IDENTIFICATION OF IMPROVED STRATIGIES FOR PROCESSING FINE COAL

by

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ABSTRACT

In modern coal preparation plants, solid-solid and solid-liquid separation processes used to treat fine coal are least efficient and most costly operations. For example, field studies indicate that the froth flotation process, which is normally used to treat minus (-0.2 mm) fine coal, often recovers less than 65 to 70% of the organic matter in this size range. Fine coal separation processes are also inherently less effective in removing pyrite than that of coarse coal separations. Moreover, while fines may represent 10% or less of the total run-of-mine feed, this size fraction often contains one-third or more of the total moisture in the delivered product. In order to address these issues, several multistage coal processing circuits were set up and experimentally tested to demonstrate the potential improvements in fine coal upgrading that may be realistically achievable using an “optimized” fine coal processing flowsheet. On the basis of results obtained from this research, engineering criteria was also developed that may be used to identify optimum circuit configurations for the processing different fine coal streams.

In the current study, several fine coal cleaning alternatives were evaluated in laboratory, bench-scale and pilot-scale test programs. Fine coal processes compared in the first phase of this work included spirals, water-only cyclones, teeter-bed separators and froth flotation. The performance of each technology was compared based on separation efficiencies derived from combustible rejection versus ash rejection plots. The resulting data was used to identify size ranges most appropriate for the various alternative processes. As a follow-up to this effort, a

second phase of pilot-scale and in-plant testing was conducted to identify new types of spiral circuit configurations that improve fine coal separations. The experimental data from this effort indicates that a four-stage spiral with second- and fourth-stage middlings recycle offered the best option for improved separation efficiency, clean coal yield and combustible recovery. The newly developed spiral circuitry was capable of increasing cumulative clean coal yield by 1.9 % at the same clean coal ash as compared to that of achieved using existing conventional compound spiral technology. Moreover, the experimental results also proved that slurry repluping after two turns is not effective in improving separation performance of spiral circuits.

The third phase of work conducted in this study focused on the development of methods for improving the partitioning of pyrite within fine coal circuits. The investigation, which included both laboratory and pilot-scale test programs, indicated that density-based separations are generally effective in reducing sulfur due to the large density difference between pyrite and coal. On the other hand, the data also showed that sulfur rejections obtained in froth flotation are often poor due to the natural floatability of pyrite. Unfortunately, engineering analyses showed that pyrite removal from the flotation feed using density separators would be impractical due to the large volumetric flow of slurry that would need to be treated. On the other hand, further analyses indicated that the preferential partitioning of pyrite to the underflow streams of classifying cyclones and fine wire sieves could be exploited to concentrate pyrite into low-volume secondary streams that could be treated in a cost effective manner to remove pyrite prior to flotation. Therefore, on the basis of results obtained from this experimental study, a combined flotation-spiral circuitry was developed for enhanced ash and sulfur rejections from fine coal circuits.

Finally, the fourth phase of work conducted as part of this investigation focused on evaluating a new mechanical, non-thermal dewatering process called Nano Drying Technology (NDT™). Experimental results obtained from bench-scale testing showed that the NDT™ system can effectively dewater fine clean coal products from more than 30% surface moisture to single-digit moisture values. Test data obtained using a pilot-scale NDT™ plant further validated this capability using a continuous prototype facility. It was also observed that, unlike existing fine coal dewatering processes, the performance of the NDT™ system is not constrained by particle size.

DEDICATION

For Ammi and Abbu…

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CHAPTER 1 - INTRODUCTION

1.1 Motivation

Coal is one of the most abundantly available energy sources in the world and is found almost in every country. The top five largest proven reserves of coal are in the United States, Russia, China, Australia and India, respectively. Table 1.1 shows the distribution of proven coal reserves. Currently, there are over 860 billion tonnes of proven coal reserves. In 2010, world coal consumption grew by 7.6% and now coal accounts for 29.6% of world total energy, 40% of world electricity and 66% of world steel production (BP, 2011).

The United States leads the world with a little over 237 billion short tons of recoverable coal reserves, i.e., approximately 27.6% of the total world coal reserves. It is estimated that at the current production rate of 984.6 million tonnes per year (USEIA, 2010), the U.S. reserves would last for 240 years. Coal is the largest single fuel used for electricity generation in the U.S. and accounts for 42% of electric power generation. Since 2000, about 90% of all the coal consumed in U.S. has been used for electric power generation as shown by Figure 1.1.

Run-of-mine coal often contains inorganic impurities in the form of mineral matter. The mineral matter consists of noncombustible materials such as shale, slate and clay. These unwanted contaminants reduce the coal heating value, leave behind an undesirable ash residue, and increase the transporting cost of coal. These impurities can also alter the suitability of coal for the manufacture of metallurgical coke or generation of petrochemicals and synthetic fuels.

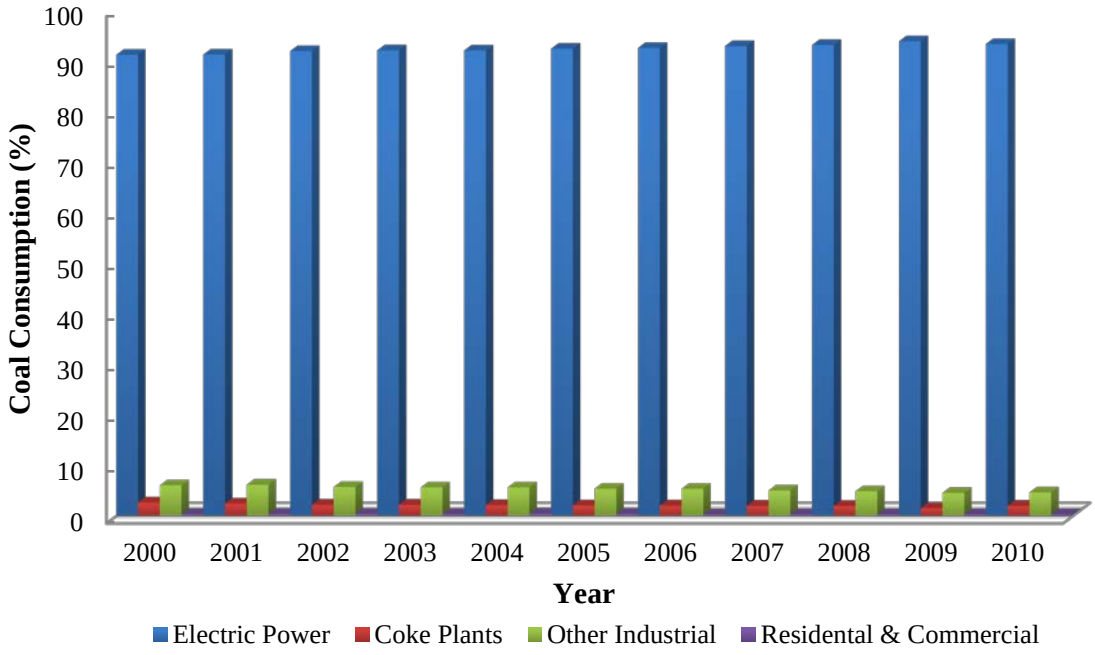


Figure 1.1 Coal consumption by sectors from 2000 to 2010 (US EIA, 2011).

Excess surface moisture also reduces the heating value of coal, leads to severe handling and freezing problems and increases the overall transportation costs of coal to consumer sites (Kaytaz et al., 1994). Therefore, strict limitations on the heating value, ash and moisture contents of purchased coal are imposed in coal purchasing agreements.

Coal processing is an important step to satisfy the run-of-mine coal quality specifications as per end-user demand. Coal processing also removes impurities such as sulfur and trace elements like mercury, thus cleaned coal is more environmentally friendly. In short, coal processing increases the heating value, lowers the transport cost, reduces the particulate emissions and improves the marketability of the run-of-mine coal. There are 286 coal processing plants in the United States, which cleaned approximately 67% (660 million short tons per year) of the total coal consumed in the United States (Coal Age, 2010).

Table 1.1 Proved Reserves at end of 2010 in million tons (BP, 2011).

Country	Anthracite & bituminous	Sub-bituminous & lignite	Total	Percentage of Total
US	108501	128794	237295	27.6%
Canada	3474	3108	6582	0.8%
Mexico	860	351	1211	0.1%
Total North America	**112835**	**132253**	**245088**	**28.5%**
Brazil	-	4559	4559	0.5%
Colombia	6366	380	6746	0.8%
Venezuela	479	-	479	0.1%
Other S. & Cent. America	45	679	724	0.1%
Total S. & Cent. America	**6890**	**5618**	**12508**	**1.5%**
Bulgaria	2	2364	2366	0.3%
Czech Republic	192	908	1100	0.1%
Germany	99	40600	40699	4.7%
Greece	-	3020	3020	0.4%
Hungary	13	1647	1660	0.2%
Kazakhstan	21500	12100	33600	3.9%
Poland	4338	1371	5709	0.7%
Romania	10	281	291	< 0.05%
Russian Federation	49088	107922	157010	18.2%
Spain	200	330	530	0.1%
Turkey	529	1814	2343	0.3%
Ukraine	15351	18522	33873	3.9%
United Kingdom	228	-	228	< 0.05%
Other Europe & Eurasia	1440	20735	22175	2.6%
Total Europe & Eurasia	**92990**	**211614**	**304604**	**35.4%**
South Africa	30156	-	30156	3.5%
Zimbabwe	502	-	502	0.1%
Other Africa	860	174	1034	0.1%
Middle East	1203	-	1203	0.1%
Total Middle East & Africa	**32721**	**174**	**32895**	**3.8%**
Australia	37100	39300	76400	8.9%
China	62200	52300	114500	13.3%
India	56100	4500	60600	7.0%
Indonesia	1520	4009	5529	0.6%
Japan	340	10	350	< 0.05%
New Zealand	33	538	571	0.1%
North Korea	300	300	600	0.1%
Pakistan	-	2070	2070	0.2%
South Korea	-	126	126	< 0.05%
Thailand	-	1239	1239	0.1%
Vietnam	150	-	150	< 0.05%
Other Asia Pacific	1582	2125	3707	0.4%
Total Asia Pacific	**159326**	**106517**	**265843**	**30.9%**
Total World	**404762**	**456176**	**860938**	**100.0%**

Coal processing consists of a series of sequential unit operations for coal particle sizing, cleaning and dewatering. This sequence of operations is called a circuit. Coal processing operations are usually designed in multistage circuits to cater to different particle size fractions. In the United States, modern plants may include as many as four separate processing circuits for treating the coarse (+ 10 mm), small (10 x 1 mm), fine (1 x 0.15 mm) and ultrafine (-0.15 mm) coal feed material (Luttrell et al., 2007). Figure 1.2 shows a typical flowsheet for a modern coal processing facility operated in United States.

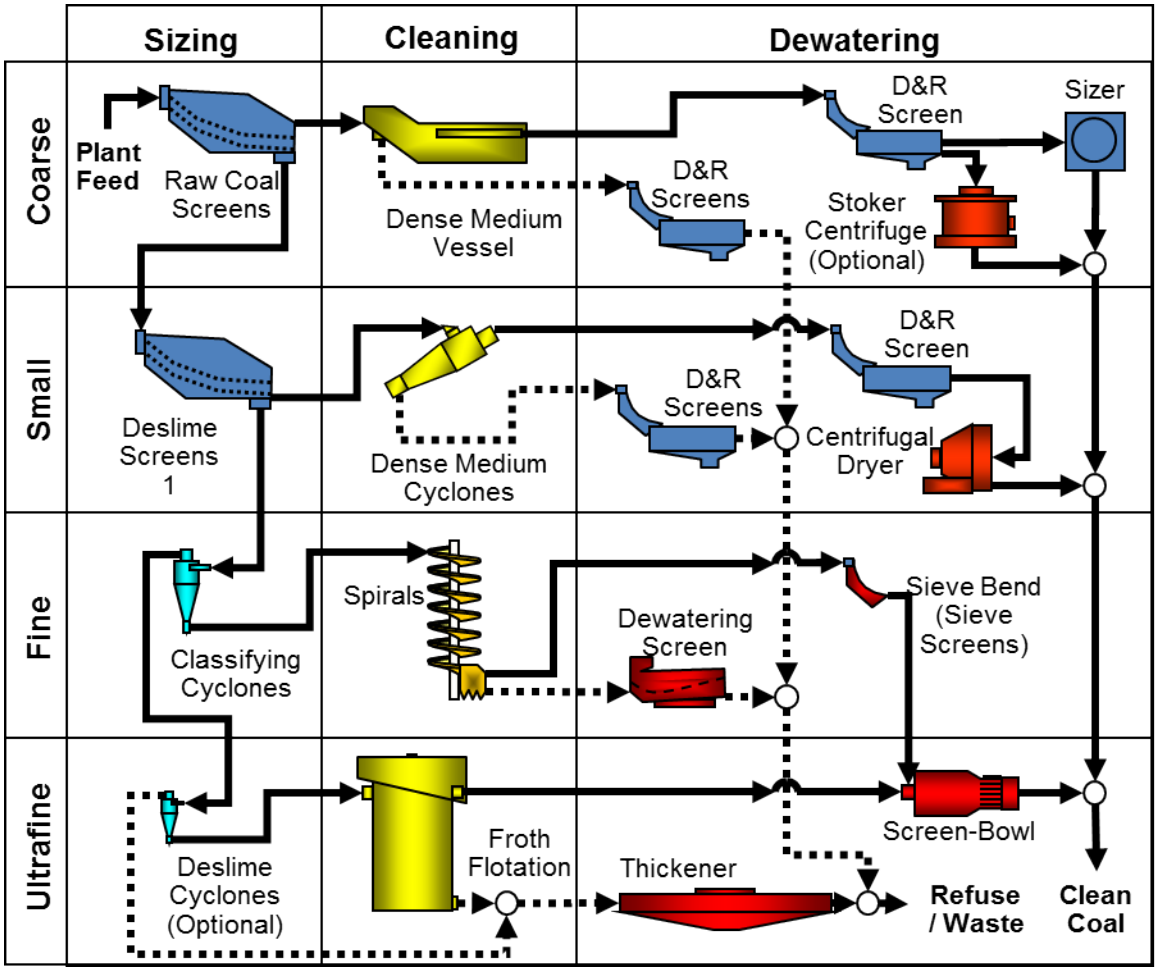


Figure 1.2 A modern coal processing plant flowsheet (Luttrell, 2012).

Although not shown in Figure 1.2, coal processing usually starts with crushing, i.e., run-of-mine coal lumps that are too large to pass through the processing plant are crushed down to an appropriate size. The crushed coal is then separated into appropriate size fractions as coarse, small, fine and ultrafine. Screens are employed for sizing coarser particles, while combinations of sieves and classifying cyclones are used for sizing finer particles. Figure 1.3 shows coal particles sizing equipment for various size ranges.

The objective of coal processing is to separate impurities from valuable carbonaceous material. In order to remove these impurities, modern coal processing plants incorporate a number of solid-solid separation methods such as dense medium vessels, water-only cyclones, teeter bed separators, coal spirals and froth flotation. Figure 1.3 shows the effectiveness of different types of conventional coal cleaning separators relative to the coal particles sizes.

The final step of coal preparation is solid-liquid separation, or dewatering, which removes unwanted surface moisture and produces a relatively dry concentrate. Dewatering methods are broadly classified in to three main groups: sedimentation, filtration and thermal drying (Wills & Napier-Munn, 2006). Primarily screens are used to remove excess moisture from coarser (+5 mm) coal particles. Finer particles, which used to have higher moisture contents than that of coarser ones due to their greater surface area, are dewatered using centrifugal methods or filtration systems (Luttrell et al., 2007). Figure 1.3 shows several different types of mechanical dewatering methods for different ranges of particle sizes.

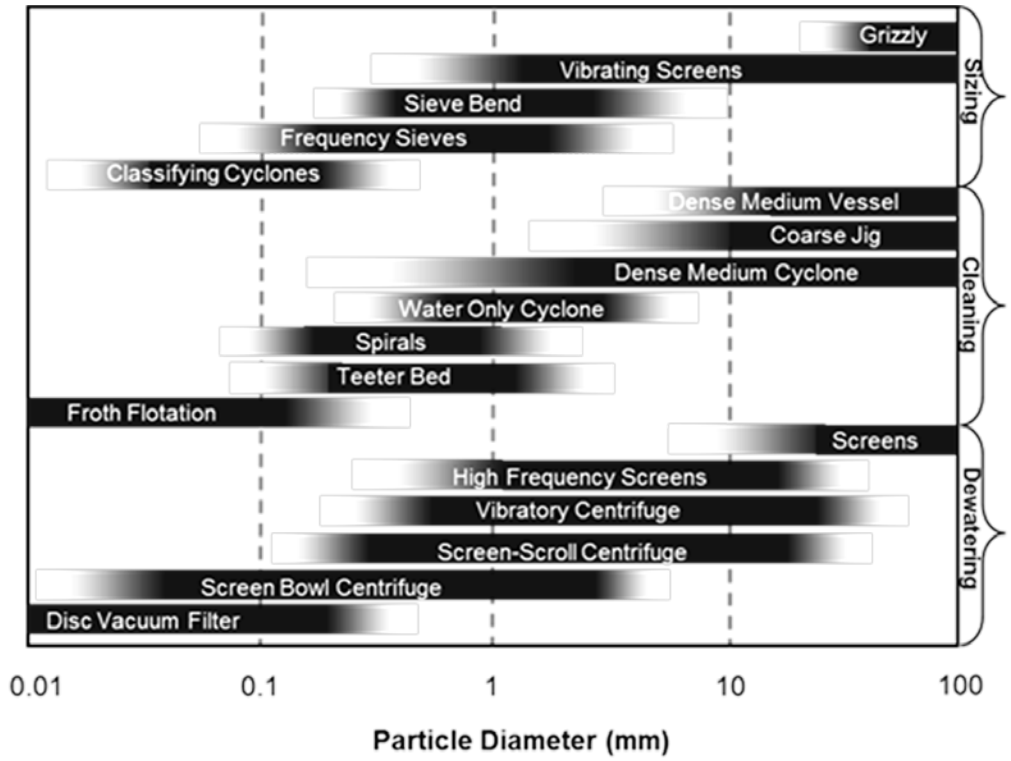


Figure 1.3 Range of coal particle sizes that can be effectively treated by conventional coal processing methods (Luttrell, 2012).

1.2 Problem Statement

The solid-solid and solid-liquid separation processes used to treat fine (-1 mm) coal are the least efficient and most costly operations used in modern coal processing facilities (Figure 1.4). Field studies indicate that the froth flotation process, which is normally used to recover coal finer than 0.1-0.2 mm, often recover less than 65 to 70% of the organic matter in this size range. Moreover, this surface based separation process is inherently less effective in removing pyrite than density based separation processes used to treat coarse coal. The lower particle size that can be effectively treated by water based density separators is severely limited by the low mass of small particles. Moreover, fines often represent 10 percent or less of the total run-of-mine feed. However, this size fraction may contain one third or more of the total moisture of the delivered

product. The inefficient removal of moisture lowers the heating value, increases the transportation cost and can create handling and/or freezing problems for the cleaned coal.

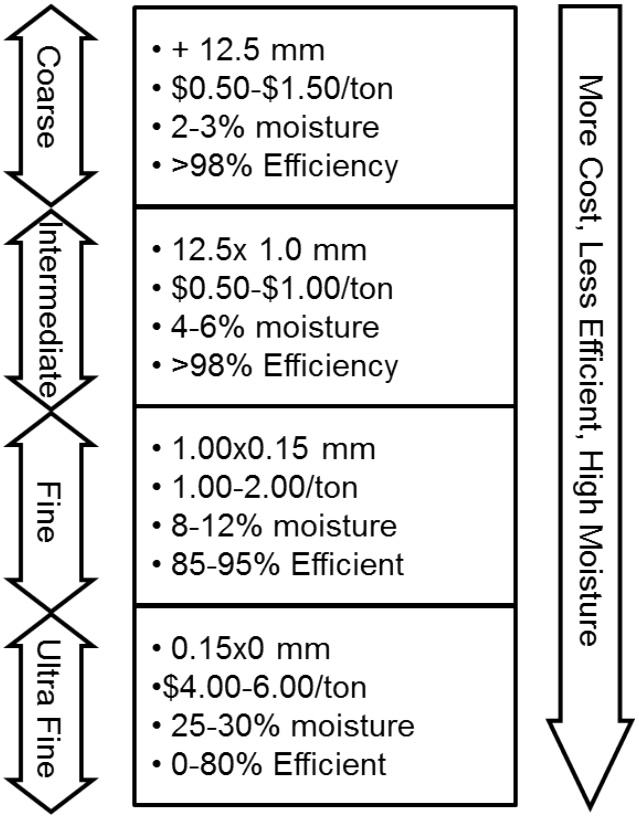


Figure 1.4 Problems in fine coal cleaning (Bethell, 2010). Used under fair use, 2012.

A significant problem associated with the cleaning and dewatering of the coal fines is the lack of standard flowsheet for fine coal processing. Coarser coal fractions are almost exclusively cleaned in modern processing plants using dense medium separation processes (Figure 1.3). These operations are considered to be very efficient and cost effective. In contrast with these coarse coal cleaning operations, a wide variety of commercially viable flowsheet configurations exist for cleaning fine coal smaller than 1 mm (Honaker et al., 2007). These circuits may include various combinations of water-based density separators such as spirals or water-only cyclones as

well as various types of surface-based separators such as conventional or column flotation machines. In many cases, the separation processes are used in multistage circuits and are integrated with various types of classification operations either before or after the cleaning step. In addition to technical and economic reasons, operator preferences and vendor biases also appear to contribute to the large variations that are observed in how fine coal is cleaned and dewatered. As a result, a standard “optimum” flowsheet for fine coal processing, which can be flexible and adaptable to accommodate changes in feed coal characteristics, does not exist at this time.

1.3 Research Objectives

The objective of this research is to develop an engineering criterion that can be used to identify optimum circuit configurations for the processing of fine coal streams. This dissertation describes several potential improvements in fine coal processing circuitry. Several multistage circuits, including laboratory, bench-scale, pilot scale-and in-plant test circuits, were set up and tested to demonstrate the potential improvements in fine coal recovery that may be realistically achievable using an “optimized” fine coal processing flowsheet. This research work also focused on the development, testing and evaluation of a modified compound spiral to treat fine coal feedstocks. A new combined flotation-spiral circuitry for desulfurization of high sulfur fine coal was also developed and experimentally tested. Finally, this research work also evaluated an innovative fine coal dewatering technique called Nano Drying Technology (NDT™). This innovative process is capable of physically removing moisture from fine coal at ambient temperature using molecular sieve technology.

1.4 Contributions

The key contributions of this research and development work are as follows:

- Developed an improved fine coal processing circuitry based on feed size characteristics.
- Developed an expanded stage compound spiral circuit (4-3-4-3 turn spiral circuit with second and fourth stage middlings recycle).
- Developed a new and innovative enhanced fine coal sulfur rejection circuit using combined spiral-flotation circuitry.
- Evaluated the effectiveness of a new low-temperature fine coal drying process.

1.5 Dissertation Organization

This dissertation is composed of seven chapters. The first chapter *"Chapter 1 - Introduction"* provides an introduction to the research topic, a detailed problem statement and a listing of research objectives. The second chapter *"Chapter 2 - Literature Review"* is a brief report on current status of research on fine coal processing. Specifically, this chapter describes in detail the research and developments in coal spiral technology (i.e., history, construction, design variables and operating variables). A brief introduction of several other fine coal processing separators used in this research work is also included in the literature review.

The next four chapters focus on the experimental testing and engineering evaluation of various new approaches for fine coal cleaning and dewatering. The first of these chapters "*Chapter 3 - Performance Comparison of Fine Coal Cleaning Alternatives"* discusses all the laboratory-scale and pilot-scale test results obtained from the detailed testing of common technologies used to clean fine coal (i.e., spirals, teeter bed separators, water-only cyclones and froth flotation). The resultant data suggest, for the particular coal investigated in this study, that the most effective processes for each size range were generally (i) froth flotation for feeds finer

than about 0.3 mm, (ii) spirals for feeds sized to 1 x 0.3 mm, and (iii) teeter-bed systems (particularly the HydroFloat™ technology) for feeds larger than 1 mm. Water-only cyclones are not recommended as stand-alone units due to the potential for high coal losses when secondary back-up units are not available within the plant circuitry.

The next chapter "*Chapter 4 - Engineering Development of Expanded Stage Compound Spiral"* provides results of field tests conducted with a prototype compound spiral that was modified to improve coal recovery and enhance the selectivity of fine coal processing. Detailed in-plant experimental tests results, along with separation performance data comparisons, are presented in this chapter for five different spiral circuit configurations. The performance comparison indicates that, amongst all the spiral circuits tested, a modified compound spiral with more cleaning stages and partial middlings recycle is the best option for improved separation efficiency, clean coal yield and combustible recovery. Preliminary calculations indicate that this new modified spiral circuit is capable of increasing the clean coal yield by 1.9%, while maintaining the same ash contents as achieved by existing compound spiral circuits.

This spiral technology research was further expanded in the next chapter *"Chapter 5 - Enhanced Sulfur Rejection Using Combined Spiral Flotation Circuits"* to investigate new methods for improving fine coal desulfurization. Specifically, this chapter discusses the experimental set up, test results, and technical evaluation of an innovative combined spiral-flotation circuitry. This chapter also describes in detail the study conducted to evaluate the partitioning of pyrite within fine coal circuits. The sulfur and ash separation performances of different fine coal cleaning alternatives were also presented and compared. On the basis of this study, a spiral followed by a froth flotation cleaning process is recommended for the cleaning of high sulfur ultrafine (minus 0.25 mm) coal feeds. This chapter describes the rationale for the

design of this new fine coal cleaning circuit and finally a generic flowsheet is also proposed for any coal preparation plant treating high sulfur ultrafine coal feeds.

The next chapter "*Chapter 6 - Engineering Development of Micro Sieve Drying Process"* discusses the theoretical basis for an innovative fine coal drying process. Experimental results obtained from bench- and pilot-scale testing of this novel approach to fine coal dewatering are also presented and discussed in this chapter. The results obtained from the experimental work indicates that the NDT™ system can effectively dewater fine (1 mm x 0) coal from slightly more than 30% surface moisture to single-digit values. Test data obtained using a pilot-scale NDT™ plant further validated this capability using a continuous prototype facility. The data presented in this chapter also showed that the performance of the NDT™ system is not dictated or constrained by particle size, i.e., it works equally well on 1 mm x 0 coal as it does on 325 mesh x 0 coal.

The seventh and final chapter of the dissertation "*Chapter 7 – Summary and Conclusions*" provides an overall summary of the findings, conclusions and recommendations resulting from this research and development study.

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CHAPTER 2 - REVIEW OF LITERATURE

2.1 Fine Coal Processing

Coal loss during fine (-1 mm) coal processing is perhaps the greatest among all other size fractions. For example, froth flotation processes typically recover only 60-80% of the organic matter contained in fine coal feeds (Bethell, 1998). A study conducted by Cavallaro et al. (1991) indicates that the reserves of low-ash coal in the central Appalachian region could be nearly doubled by efficiently cleaning at a particle topsize of 1 mm (Figure 2.1). Moreover, surface-based separation processes, such as froth flotation, which are generally used to treat fine (0.15 x 0.044 mm) coal, are less effective in removing pyritic sulfur than density-based processes used to treat the coarser sizes of coal (Adel and Wang, 2005). Therefore, fine coal desulfurization is often poor in many coal processing facilities treating high sulfur run-of-mine coal seams.

Field studies indicate that the yield and quality of clean coal products from fine coal circuitry may be significantly increased by improving the efficiency obtained for particle size separations at 150- and 45-µm. Unfortunately, screens used for sizing fine particles, and particularly those finer than 0.5 mm, tend to blind easily, wear quickly and suffer from low throughput and poor efficiency (Mohanty, 2003). Another problem associated with fine coal screening

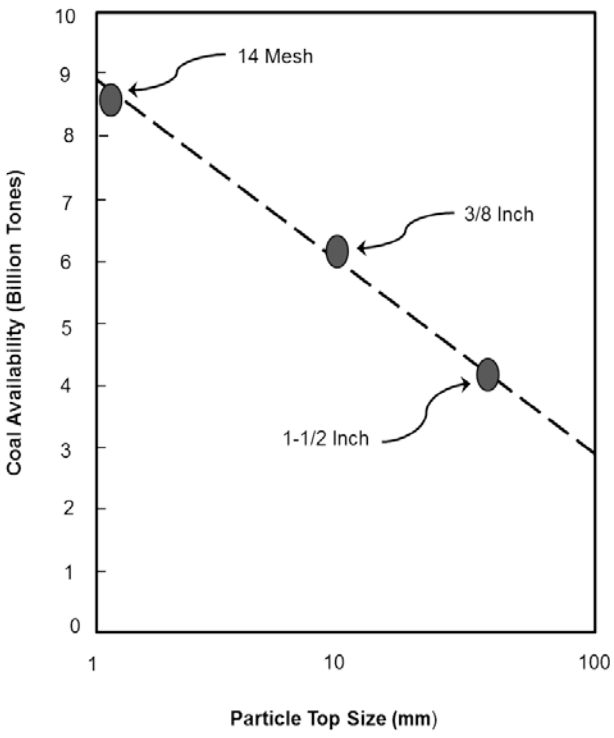


Figure 2.1 Effect of decreasing top size on coal availability (Cavallero et al., 1991**).***
Used under fair use, 2012.

is the inefficient removal of ultrafine mineral sediments, such as high-ash clay particles, from fine coal feeds (Mohanty et al., 2002). Moreover, fine (-1 mm) coal particles may represent as little as 10% of the total run-of-mine coal, but often contain one-third or more of the total moisture in the final coal product. Existing fine coal dewatering processes, such as filtration, centrifuges and thermal drying, are expensive and consume large amounts of energy (Osborne, 1988; Le Roux et al., 2005). The lack of an efficient, inexpensive and safe drying process is one of the primary reasons that about 2 billion tons of fine coal was discarded by the United States coal preparation plants into waste impoundments (Orr, 2002).

2.2 Spirals

2.2.1 *Spiral Technology*

A spiral is composed of a helical channel of modified semicircular cross-section wound around central column. These are flowing film concentrators and have been found varied applications in coal and mineral processing industry. Generally, a feed pulp containing between 15 to 45% solids by weight and in the size range of 3 mm to 75 μm is introduced at the top end of spiral trough. The pulp then gradually flows spirally downwards and, during this motion, the particles tend to stratify into different streams depending upon their particle size and specific gravity. Separation is achieved by the combined action of stratification, film sizing and centrifugal/gravitational forces. Finally, adjustable splitters and/or cutters are used to divert the separated particles into clean, middlings and refuse streams (Davies et al., 1991; Wills and Napier-Munn, 2006). Figure 2.2 is a schematic cross-section of a coal spiral trough. In addition, coal spirals have been successfully used for the treatment of iron ore, chromite, heavy mineral sand deposits.

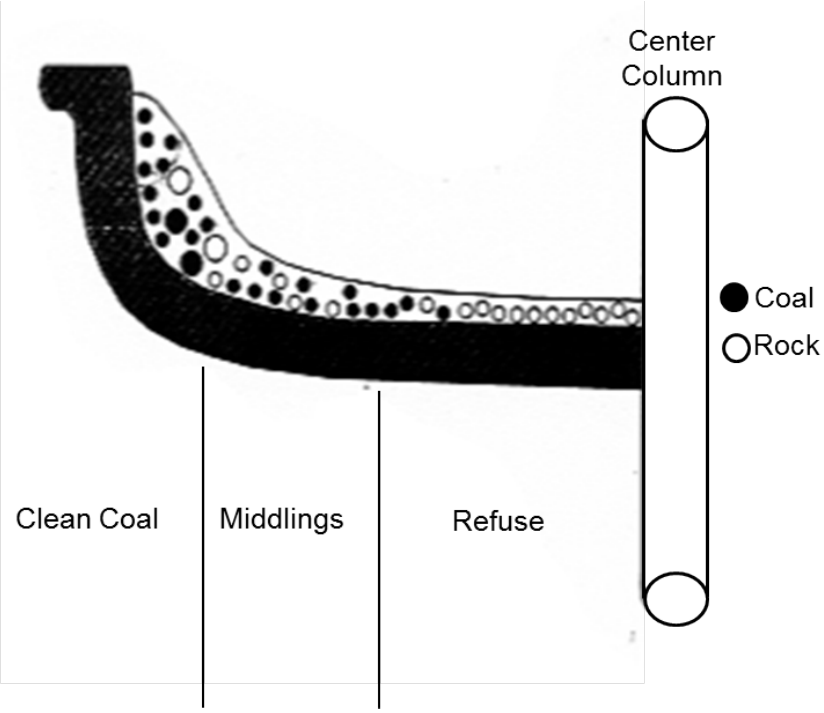


Figure 2.2 Cross-section of flow through a spiral trough.

Spirals are considered as one of the simplest, most effective and lowest cost fine (1 x 0.15 mm) coal processing technology (Kohmuench, 2000). Coal cleaning using spiral concentrators was started back in 1947 when Hudson Coal Company installed 48 spirals to clean fine anthracite coal in eastern Pennsylvania. During the 1950s, a number of researchers tried to use spirals to clean fine bituminous coal, but their attempts were not successful (Denin & Wilson, 1948). Finally, since first introducing design changes in the 1980s that made spirals larger (which improve throughput capacity) and lighter (due to fiberglass and urethane construction), spiral separators have become one of the most popular fine coal cleaning separators. Apart from their simplicity, coal spirals have many other advantages such as low capital and operating cost, simple to operate, no moving parts, no regent requirements, stable cut point with size, good clean coal recovery and high reject ash levels. On the flip side, spirals have low throughput capacity

compared to other water-based separators such as water-only cyclones. Spirals also operate with a relatively high specific gravity cut point and can treat only a very limited feed size range (MacHunter et al., 2003; Luttrell et al., 2003).

2.2.2 ***Historical Development***

The concept of separation by spirals dates back to 1943 when Humphreys Mineral Industries introduced their first spiral for concentrating mineral ores. These early units were used to upgrade a wide variety of ores including gold, silver, tin, ilmenite, rutile, zircon, monazite, iron, barite, fluorspar, mica and phosphate (Davies et al., 1991; Leonard, 1991). For many years following the introduction of the first units, spirals tended to be used only for comparatively easy separations. However, subsequent research and development by different spiral manufacturers around the world led to much wider use of spirals in mineral processing applications and eventually to their adoption for the coal cleaning (Richard et al., 1985).

The early spirals utilized relatively simple profiles and were designed with a single start and 4-6 turns. These units were constructed from semicircular sections that were bolted together. One of the disadvantages of early spiral separators is that they were constructed from cast iron and weighed about one tonne each. In Australia, sand miners used truck tire sections that were cut and reattached together to form a spiral instead of using excessively heavy spirals. In 1947, spirals made from asbestos reinforced concrete were introduced for rutile and zircon extraction. The decade of 1950 marked a major advance in spiral technology when Ernst Reichert used fiberglass as a construction material for spirals. The use of fiberglass made it possible to made light weight, non -corrosive continuous helices and allowed two or three helices to be mounted on one central column (Davies et al., 1991, Hunter et al., 1985). Another development in the subsequent spirals is the replacement of rotating disc cutters for concentrate removal with the

concentrate cut from the pulp stream by finger-type splitters. All early designs used wash-water channels to overcome the sanding/beaching problem of inner trough section. In late 1970s and early 1980s, Australian researchers came up with modified spiral geometry that resulted in complete wash-waterless light-weight spirals (Richards & Palmer, 1997). The most recent breed of spiral is made of fiberglass spray-coated with polyurethane (Das et al., 2007).

2.2.3 ***Particle Separation Mechanism***

While spirals are conceptually very simple in terms of design, the particle separation mechanism that occurs along the flow path is relatively complex. Feed slurry introduced at the top of the spiral gradually flows downward under gravity through the spiral trough. Within the rotating flowing film, coal particles are subjected to gravitational, centrifugal and Bagnold forces (Bagnold, 1954; Kapur and Meloy, 1999). The combined action of these forces causes lighter particles to move towards the outer wall and the denser particles move to the central column.

The particle separation mechanism on spirals has been a continuous source of confusion in the literature. Some researchers believe that there are two basic types of fluid flow along a spiral trough, which are (i) a primary axially downward flow and (ii) a secondary cross channel flow (Figure 2.3). The hydraulic phenomenon responsible for both of these flows has been explained by a number of researches (Holland-Batt, 1990, 1992, 1994, 1998; Richards and Palmer, 1997; Kapur and Meloy, 1998). According to Holland-Batt (1990), the interaction between the fluid flow and the particles results in separation of particles of different densities. On one hand, light particles are carried in the cross flow from the inner region of the trough towards the outer region and settle at the bottom of the channel. In this case, light particles are picked up and carried down by the primary flow, which eventually transport the particles out of the separator. On the other hand, dense particles in the outer region quickly fall to the bottom of

the channel and are carried towards the inner region by the cross flow. These dense particles are too heavy to be picked up and carried back into the outer region. Hence, dense remain in the inner region and are carried by the primary flow down the separator (Holland-Batt, 1989).

Richards and Palmer (1997) divided the cross section of the spiral trough into three zones as shown in Figure 2.3. The inner zone is occupied by a bed of slow moving heavy particles. In the outer region, or recovery zone, heavy particles must settle into lower layers in order to be transported towards the center of the spirals. The intermediate transition zone contains composite "middlings" particles and is located between the inner and outer zones (Richards and Palmer, 1997).

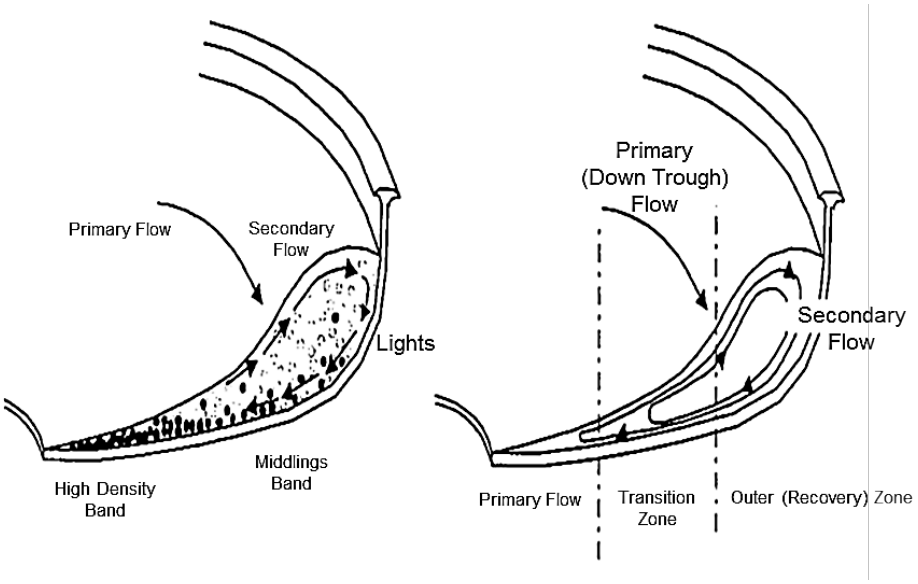


Figure 2.3 Separation mechanism and primary and secondary flow pattern on a spiral trough (Richards & Palmer, 1997). Used under fair use, 2012.

According to Luttrell et al. (2007), the above mentioned description of particle separation fails to recognize two counter-rotating flows that actually present across the spiral profile. These

two rotating flows converge along a line of separation as shown by Figure 2.4. The clockwise flow in the lower rotation zone is responsible for moving lighter particles towards the outer wall of the spiral. Heavier particles contained in this flowing stream settle down and are carried inward towards to the inner side of the spiral trough. The clockwise rotation is responsible for providing a dense concentrate that is relatively free of light particles. In contrast, the counter clockwise flow in the upper rotating section stratifies particles along the outer wall according to density. Unfortunately, some denser particles in the upper flow zone settle against the wall and are trapped there by rising current of the counter clockwise flow. Studies indicate that these entrapped high density particles rarely cross from the upper to the lower flow zones and eventually report with the low density product regardless of density. To eliminate these entrapped particles, Luttrell et al. (2000) recommends recleaning of primary low-density product using a secondary stage of spirals.

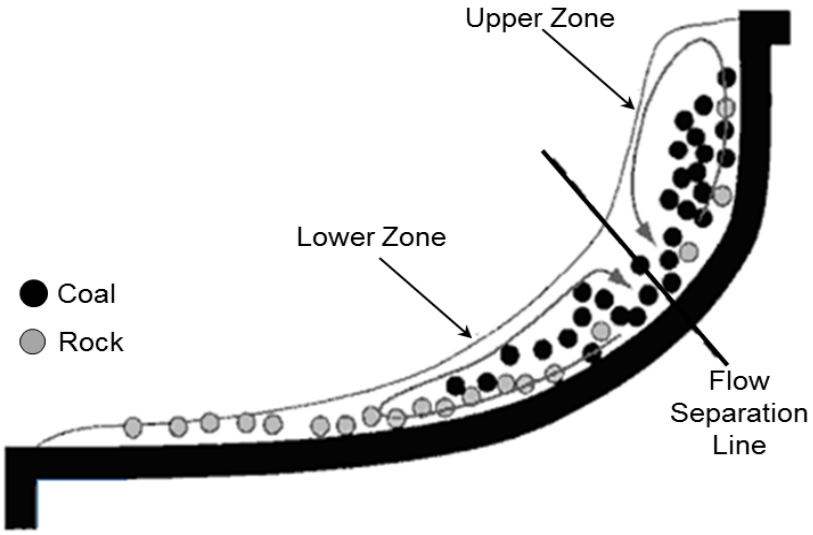


Figure 2.4 Separation regions across a spiral profile (Luttrell et al., 2007). Used under fair use, 2012.

2.2.4 ***Particle Separation Forces***

The forces responsible for particle separation within a spiral trough have been studied by a number of researchers (Atasoy and Spottiswood, 1995; Kapur and Meloy, 1999; Atasoy, 1987; Holland-Batt and Holtham, 1992; Luttrell et al., 2000). Forces involved in the particle separation within the spiral trough include hindered settling, interstitial trickling, centrifugal, frictional, gravitational, drag and Bagnold forces (Bagnold, 1954; Kapur and Meloy, 1999). Among these, the Bagnold force is distinctive. Data that shows its existence during particle separation within a spiral trough was first shown by Holtham in 1992. He concluded that Bagnold forces arises due to increase in inter particle interaction at high pulp densities and at high shear rates. It was also found that Bagnold forces weaken at a solid percentage below about 50% (Holtham, 1992). The Bagnold force is a dispersive force that is directly proportional to the shear rate and square of the particle diameter. The Bagnold force varies along the depth of the flowing film and, depending on its magnitude, causes particles to move upward or downward in the flowing film. Studies show that Bagnold forces are in effect within the inner region of spiral, where particles are in bed-load motion and the percentage solids are more than 50% (Atasoy and Spottiswood, 1995). Kapur and Meloy (1999) concluded that amongst all the forces acting on a particle, no single force dominates the others and, hence, separations are based on differences in the rate of change of all these individual forces with respect to particle size, shape, density and radial position.

2.2.5 ***Spiral Design Parameters***

Spiral design is critical to effective separation performance and has been the subject of both experimental and computational studies over the last three decades (Kapor and Meloy, 1998; Holland-Batt, 1989; Holtham, 1990; Stokes, 2000). Primary spiral design parameters include spiral pitch, diameter, trough slope, length and profile. Secondary design parameters

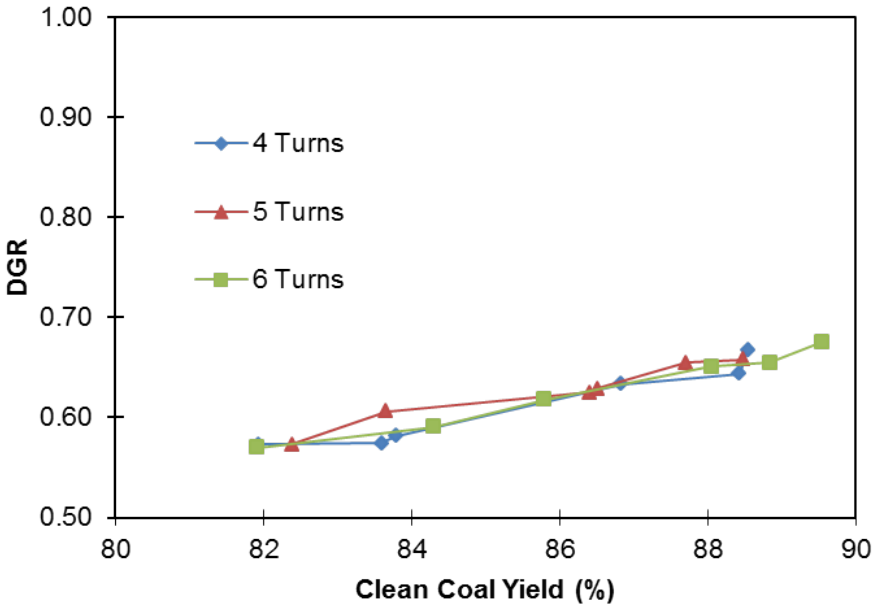
include wash-water configurations, feed box arrangements, splitters locations, repulper locations and construction materials. The design process consists of a number of interactive stages and usually starts with the scale-up, followed by volute shape determination, and finally with a sanding analysis (Davies et al., 1991; Holland-Batt,1990). Some of the key design variables are described in greater detail in the following sections.

Pitch and Diameter: The ideal pitch of a spiral trough for a particular feed type is one that ensures particle fluidity. In general, the pitch is steeper for heavy high-density feed material and is shallower for light particles (Davies et al., 1991). The diameter of a spiral depends upon the capacity and the separation size. For a given separation size, the capacity of a spiral is a function of trough area and it decreases with the particle size (Hollan-Batt, 1985). Due to the low density and low unit value of coal, spirals used in coal applications have a lower pitch and a larger diameter than mineral spirals (Luttrell et al., 2007).

Profile: Profile is a very important design parameter for spirals. In particular, the shape of the inner and flatter section of a spiral controls the migration of high density particles towards central column. The inner profile terminates and curves steeply upward at the outer side as a vertical water-retaining wall. The profile is generally designed to give a targeted relative density of separation, but in practice the profile often represents a compromise between fluidity and selectivity. Davies (1991) also considered the number and method of product stream divisions and overall pulp capacity as important parameters that influence the profile design. Optimizing studies of profile shape, with a focus of material handling aspects, were conducted by Holland-Batt (1995). This work discussed various profile shapes and concluded that trough shape has a profound effect on the nature of fluid flow phenomena and, hence, on the separation efficiency as well. This study concluded that, for a given pitch, one shape will produce excellent metallurgy

but poor material handling behavior, while other shapes may excel at transporting solids but perform poorly in terms of separation (Holland-Batt, 1995).

Flow length: In addition to pitch and profile, spiral length is a critical parameter that has been thoroughly investigated by a number of researchers (Davies, 1991; Kohmuench, 2000; Wildon and MacHunter; 1997; Atasoy and Spottiswood, 1995). Length, which reflects the total distance over which slurry travels as it passed down a spiral, is normally referenced by the number of complete 360° turns utilized by the spiral design. This parameter should not be confused with spiral height, which varies depending on the pitch employed. The aim of these studies was to optimize, and perhaps standardize, the required number of turns on a spiral for an efficient separation process for different ores. In early 1960's, Australian coal spirals employed as few as two full turns, while modern spirals employ as many as seven turns or more to achieve the required separation. In general, a minimum of five to six turns are recommended to achieve maximum separation efficiency (Holland-Batt, 1995). Other research (Weldon and MacHunter, 1997) has suggested that four turns are optimum for most spiral applications and that acceptable separations can be achieved using even shorter two or three turn spirals, depending on the density distribution of the feed particles (Figure 2.5). According to Atasoy and Spottiswood (1995), the optimum length of a coal spiral is a function of feed size. Shorter spirals are more effective for separation of coarse particles, while longer spirals are better for fine particles.



(DGR = Clean Ash/Feed Ash)

Figure 2.5 Plot for optimum number of spiral turns (*showing 4*, 5 and 6 turn coal spirals) (Wildon & MacHunter, 1997). Used under fair use, 2012.

Repulping: The installation of repulpers along the spiral length generally improves the separation efficiency of mineral spirals. The repulpers reinitiate the separation process by capturing, mixing and reintroducing the high velocity slurry stream with the relatively sluggish middling stream. The idea of repulping was introduced based on work originally done by Holland-Batt in 1995. According to this study, spiral fluid flow reaches steady-state after only two turns, while mineral recovery slowly continues for up to four or more turns. As a result, repulpers are generally installed after three or four turns when high density products are removed through central column. Several spiral manufacturers have introduced designs that have successfully incorporated repulping (MacHunter et al., 2003). The effectiveness of repulping in coal applications has drawn mixed opinions. In his PhD dissertation, Kohmuench (2000) argued that although repulping in coal spirals reduces gravity cut point but is found to be less effective in improving separation efficiency because the relatively low specific gravity of coal particles

requires more turns to be effectively separated. Holland-Batt (1995) also stated that repulping can destroy a partial separation occurring with finer material and thus can decrease the separation efficiency. Similarly, Atasoy and Spottiswood (1995) noted that if a mineral spiral treating 4.0 SG solids requires only one turn for an effective separation, then it can be expected that a coal spiral will need approximately five or six turns to achieve a good separation.

Construction Materials: The earliest spiral was manufactured from cast iron. This practice remained unchanged until the 1950's when fiberglass was introduced as a construction material for the spiral structure by Ernst Reichert. Until the late 1970's, rubber was used as a lining material for spiral trough and for feed and product boxes. Rubber lining was generally effective, but expensive and difficult to apply to complex shapes. In 1980's, sprayed polyurethane was introduced as a lining material. Finally, in 1988, the first mono-polymer spiral was commercially introduced, which is available in either ceramic or polyurethane. The major advantages of the mono polymer spiral construction include improved wettability and fluidity and superior resistance to reagents and to acid and spark attacks. Today, reverse casting is now well established for the construction of spirals, which made it possible to accurately fabricate feed and product boxes, splitters, repulpers and other components of the distribution and laundering system in heavy duty sections (MacHunter et al., 2003).

Feed Box: The spiral feed box is used to introduce the slurry to the spiral trough in a direction parallel to the walls of the trough. Ideally, the feed box should be hydraulically designed to provide equilibrium of the flow pattern as early as possible without splashing or surging. It is also generally accepted that the design of the feed box should facilitate the distribution of solids evenly throughout the slurry (Holland-Batt, 1995). More recently, however, some researchers have proposed that selective segregation and distribution of larger particles

towards the inside of the trough may be desirable to reduce unwanted entrapment of dense particles in the high velocity flow region (Luttrell, 2012).

Product Splitters: In order to make appropriate low-density, middling and high-density products, spirals are fitted with two adjustable splitters at the discharge end of the spiral. There are several different types of splitters such as small finger splitters, banana splitters and slide splitters. Splitters located at the end of the last turn are normally of the pivoting-blade type. These splitters are placed either on the trough surface or, in some cases, may be embedded in or positioned exterior to the trough surface. The splitters may be positioned in parallel or offset slightly to permit total elimination of either the middlings or concentrated products. Multiple start spirals are linked through a common shaft to control the same splitter positioning. Some mineral spirals are also equipped with one or more auxiliary splitters to remove separated solids (Holland-Batt, 1995).

For spiral applications in the coal industry, two splitters are used to separate coal, middlings and refuse products. Generally, the outer splitter nearer the wall is capable of making a density cut between 1.55 and 2.0 SG, while the inner splitter nearer the support pole can make a density cut 1.8 and 2.4 SG (Mikhail et al., 1988). In order to maintain efficiency, a constant density cut amongst the entire spiral bank should be targeted, which requires the position of the splitters to be the same for all the spiral units (Luttrell, 2007). Typically, the outer splitter should be placed to provide an acceptable clean coal product quality, which typically requires a position of approximately 3 inches from outside wall. Likewise, the inner splitter should be placed to provide a reject product that is acceptable for discard, which normally requires a splitter position of approximately 10.5 inches from outside wall. The middlings product resulting from these positions can be diverted to the clean product, refuse stream or recycled back to feed. Some

spirals have an additional primary refuse splitter, called a cutter, located after three or four turns. The purpose of the cutter is to remove high density refuse as soon as possible so as to improve separation efficiency and increase refuse loading capacity.

Ancillary Components: In order to collect products from main and auxiliary splitters, some form of product receivers are also associated with the spiral assembly. Their designs vary depending upon the manufacturer and model of spiral. The main characteristics of product receivers include satisfactory performance in terms of wear resistance, avoidance of splashing of products and suitable material handling characteristics (Holland-Batt, 1995). Spirals are usually installed in multiple banks and the necessary ancillaries required for these banks include a frame to support the spiral bank, main distributors to split feed pulp equally amongst each start and launders to transport the concentrate, middling and tailing flows. Spiral banks are fed via an overhead feed distributor which ideally distributes the feed slurry equally and homogenously to every spiral unit in the bank.

2.2.6 ***Conventional and Compound Spirals***

There are a number of spiral manufacturer around the world. Some manufacturers incorporate proprietary features into their conventional single-stage spirals and claim that design improves the separation performance. Studies conducted by Honaker and Wang (1991) evaluated the separation performance of four conventional single-stage spirals made by different manufacturers. This investigation concluded that there is a little difference in the separation performance among all these spiral designs (Figure 2.6). Therefore, it is not surprising that most manufacturers have instead focused much of their R&D efforts on the development of compound spiral designs. Compound spirals incorporate two stages of spiral processing in a single spiral assembly. Typically, compound spirals consist of three or four turns of primary spirals

immediately followed by three or four turns of secondary spirals. The refuse from both primary and secondary turns is rejected, while the clean and middlings of primary spirals are remixed in a repulping box before fed to the secondary turns (Luttrell et al., 2003). Compound spirals are capable of separating at a density between 1.68 to 1.85 SG and providing an Ecart probability from 0.16 to 0.18 (Bethell and Arnold, 2003). Apart from a lower cut density, other advantages of a compound spiral unit include no need for interstage pumping from primary to secondary spirals, higher recovery as compared with that of conventional spirals and reduced floor space when the compound spirals are stacked in banks (Weldon et al., 1997).

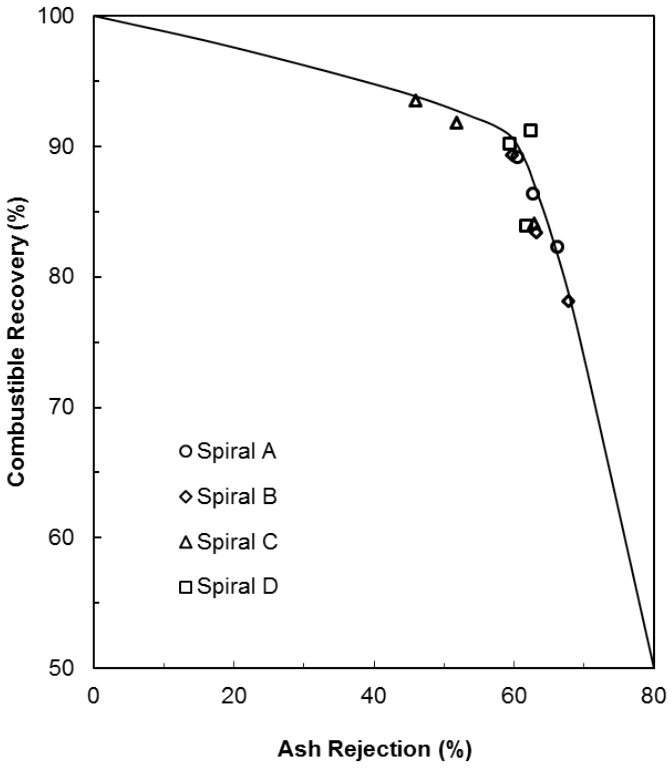


Figure 2.6 Performance comparisons amongst different conventional spiral design (Honaker & Wang, 1991). **Used under fair use, 2012.**

2.2.7 ***Spiral Operating Variables***

The separating performance of spirals is greatly influenced by a number of operating variables that are under the control of the plant operators. In coal preparation plants, spiral circuits are not often run at their maximum separation efficiency because of poor feed sizing, incorrect splitter settings, inappropriate solid and volumetric flow rates and uneven feed distribution (Luttrell et al., 2000). Therefore, to avoid these issues, a brief discussion of how these operating variables influence spiral performance is provided in the following sections.

Particle Size: There have been conflicting opinions about the optimum particle size range for coal spiral circuitry. For coal applications, some early researchers were of the view that the appropriate coal feed size for spirals is 3 x 0.1 mm (Kapur and Meloy, 1999; Davis et al., 1991), while others suggest that a feed size as broad as 3 x 0.05 mm can be effectively treated by this technology (Holland-Batt, 1992). Another point of view (Luttrell et al., 2007) is that coal particles coarser than 1 mm or finer than 0.2 mm are not cleaned as effectively in spirals and should instead be upgraded by dense medium processes (for plus 1 mm) and froth flotation (for minus 0.2 mm).

Slurry Flow Rate: For an efficient separation, spirals should be provided with an adequate and stable slurry flow rate. The optimum slurry flow rate varies according to the spiral diameter. Typically, for most of the industrial units, the optimum flow rate is between 30-40 gallons per minute (GPM) per start for a particle size range of 1 x 0.15 mm (Luttrell et al., 2007). A volumetric flow rate on higher side is maintained for a coarser feeds, while a lower slurry flow rate is required for a finer feeds (Honaker et al., 2006). At a constant tonnage of dry solids, a lower flow rate may result in sanding or beaching problems along the spiral trough. A higher flow can also cause high density particles to report with the water, which reduces the quality of

the low density product by lowering the separation efficiency and increasing the density cut point (Kohmuench, 2000).

Atasoy and Spottiswood (1995) studied the effect of residence time on the separation performance of spirals. They concluded that the residence time has a mixed effect on the separation efficiency of the particles of different densities and size classes. For example, residence time does not play a significant role in the separation of low-density coarse (3.35 x 1.7 mm) coal particles. In contrast, increased residence time has an unfavorable effect on higher density (SG > 1.45) particles of the same size class because they tend to move towards the clean coal stream with time.

Solids Feed Rate: Recent research (Luttrell et al., 2003; 2007) indicates that the density cut point (SG_{50}) and Ecart Probable (Ep) increases sharply with an increase in the dry solids feed rate to a spiral. As shown in Figure 2.7(a), a decrease in the solids feed rate improves the product quality (lowers the clean coal ash content), but decreases the recovery of product solids (reduces the recovery of combustible organic matter). An increase in dry solids feed rate to more than 3 tonnes per hour per spiral start seriously impacts the separation efficiency (Holland-Batt, 1994; Li et al., 1993). Contrary to this, some spiral manufacturers claim that their spiral designs can handle a feed rate as high as 4.5 tonne per hour per start without impacting the separation efficiency (Luttrell, 2012).

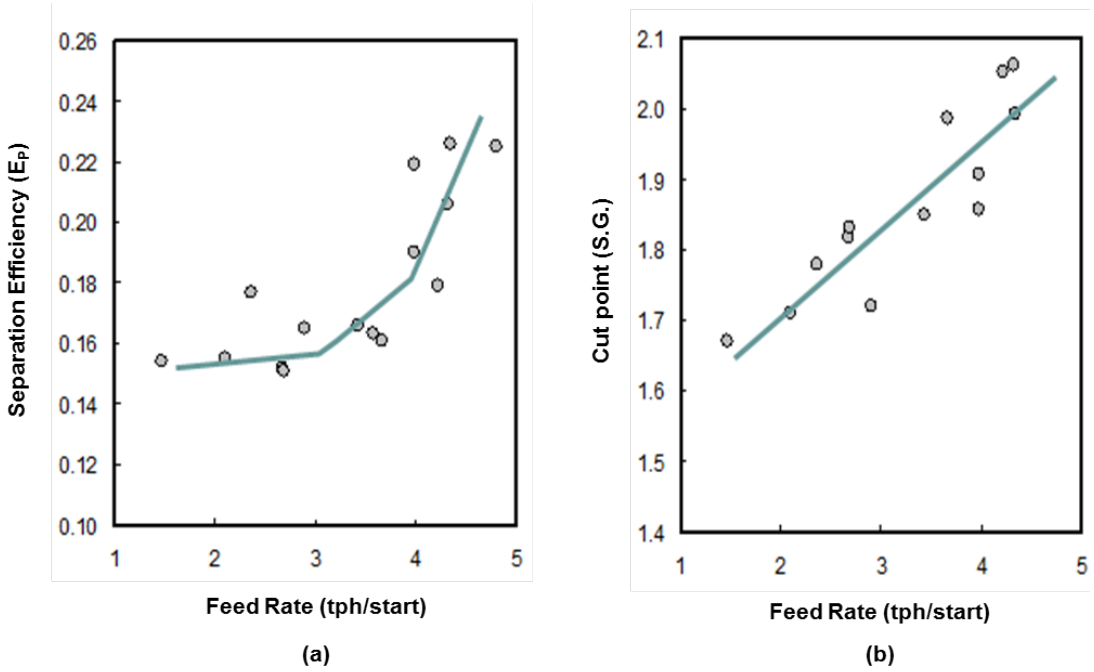


Figure 2.7 Effect of dry feed rate on spiral performance (a) on gravity cut-point, (b) on separation efficiency (Luttrell et al., 2003). Used under fair use, 2012.

Feed Solids Content: At constant feed percent solids, an increase in the feed rate increases the volumetric flow of slurry down the spiral. This increases the centrifugal force exerted on the particles, forcing more material to report to the low density product that, in turn, results in a higher density cut point (Mikhail et al., 1988). As shown in Figure 2.6(b), a similar relationship between dry feed rate and cutpoint was also reported by Luttrell (2003). If the dry tonnage is fixed, then an increase in the feed solids content decreases the slurry flow rate and lowers the specific gravity cut point. For coal applications, this action decreases combustible recovery and improves clean coal ash (Luttrell et al., 2003). Mikhail (1988) is of the point of view that feed rate may actually have a greater effect on separation cut point than even splitter position.

Feed Distribution: The maximum yield from a spiral circuit can only be realized when the same density cut point is maintained throughout the spiral circuitry. Unfortunately, one of the common problems faced by coal spirals operated in industrial plants is poor feed distribution. This problem can create differences in density cut points among different spiral units in a bank and, in extreme cases, can lead to other operational issues such as beaching and sanding. Poor feed distribution may also block the feed distributor port, which ultimately causes variations in the slurry flow rates (Luttrell et al., 2003, 2007).

2.2.8 ***Spiral Flow Modeling***

Although spiral concentrators are considered to be a mature technology, there is still room for incremental improvements in design. The most likely approach for realizing these design improvements is through the phenomenological modeling of the fluid flow patterns and particle interactions that occur during spiral separations. Such fundamental modeling requires the knowledge of operating variables (e.g., volumetric and dry solid feed rates), spiral design (e.g., pitch, diameter and trough shape) and particle properties (e.g., density, size and shape).

A number of researchers have developed spiral models based on mechanistic phenomena (Holland-Batt, 1989; Atasoy and Spottiswood, 1995; Glass et al., 1999; Holland-Batt and Holtham, 1992). These models have been used to predict the motion of particles in the flowing film over the spiral trough surface. The first such model was developed by Holland-Batt (1989). The model was capable of predicting the dynamics of fluid regimes and estimating particle distributions across the spiral trough after separation. This model uses the Manning equation to describe the primary flow in the inner region and the free vortex equation for the outer region flow (Holland-Batt, 1989). This model is computationally intensive and its output is not directly suitable for industrial process simulations (Li et al., 1995). The modeling work done by Holland-

Batt was further extended by researchers at JKMRC and their model was capable of predicting operational performance for a given set of feed characteristics and splitter settings.

More recently, advances in computational fluid dynamics (CFD) and discrete element modeling (DEM) of particle-particle interactions should ultimately help to completely investigate the separation process and to design a better spiral geometry. During the last two decades, CFD modeling in three dimensions has been used to simulate spiral flows (Holtham, 1990; Jancar et al., 1995; Matthews et al., 1996). The concept of turbulence has also been incorporated into the spiral modeling (Matthews et al., 1997). One of the most recent and most advanced models for predicting particle partitioning during spiral separations was developed by Das et al. (2007). This modified coal spiral model was based on three principal components, i.e., spiral geometry modeling, fluid flow analysis and equilibrium force balancing for moving particles. This model successfully predicted the radial equilibrium distribution of particles with respect to specific gravity and particle size (Das et al., 2007). Nevertheless, while spiral models have provided much insight related to the mechanics of particle separation, the ability of these fundamental models to predict actual spiral performance for arbitrary applications remains a difficult task. Consequently, there is a room for a more realistic analysis that would provide a truly quantitative multiphase hydrodynamic description of spiral separations (Glass et al., 1999, Das et al., 2007).

Based on insight provided by fundamental modeling, Holland-Batt (1992) came up with idea of rotating spirals. This research proposed that separation efficiency can be improved by rotating the downward volumetric flow. It was argued that, in rotating spirals, one or more additional forces were acting on the flowing film of particles, which results in a better separation process. It was found that separation efficiency of fine feed particles increases from a spiral flow

that rotated over itself but, unfortunately, little or no improvement was found for the coarser feed particles (Holland-Batt, 1992).

2.2.9 ***Spiral Circuitry***

Until 1990, little work has been done in the area of optimizing spiral circuitry. This situation changed rapidly in the 1990's with the introduction of the compound spiral. The compound spiral is essentially a two-stage middlings reclean circuit that operates along one central spiral column (MacNamara et al., 1995, 1996), i.e., a short primary and short secondary spiral are positioned on the same central tube. After the first stage, the primary reject is removed through the central column and the primary clean and middlings are repulped and retreated on the secondary spiral. Advantages of this design include lower density cut points, reduced floor space, elimination of interstage pumping, and improved recovery (Weldon et al., 1997).

According to Bethell (2003), common spiral circuit configurations are as follows:

- Single stage spiral circuit without recycle.
- Spirals circuitry with middlings only recycles.
- Spiral circuit with clean coal only recycles.
- Spiral circuit configuration having both clean coal and middlings recycle.

Luttrell et al. (1998) used a linear circuit analysis technique to identify the optimum spiral circuitry for compound spirals. They studied the following four different spiral circuit configurations:

- Single stage spiral circuit.
- Conventional rougher-cleaner circuit without recycle.
- Modified rougher cleaner circuitry with middlings recycle.
- Rougher with middlings only recleaning.

Out of the above listed spiral circuits, the modified rougher-cleaner circuit offered the best option for improved performance, while maintaining a reasonable circuit load. In the modified rougher-cleaner spiral circuit, middlings particles from the cleaner spiral are recycled back to the feed of rougher spiral as shown by Figure 2.8. This circuitry not only improves the separation efficiency, but also reduces the density cut point (Luttrell et al., 1998). Essentially all of the compound spirals employed within the coal industry now use this two-stage configuation to reduce the entrappment of dense particles in the high velocity flow region and to improve the sharpness of separation via the recycling of the middlings product back to the feed stream.

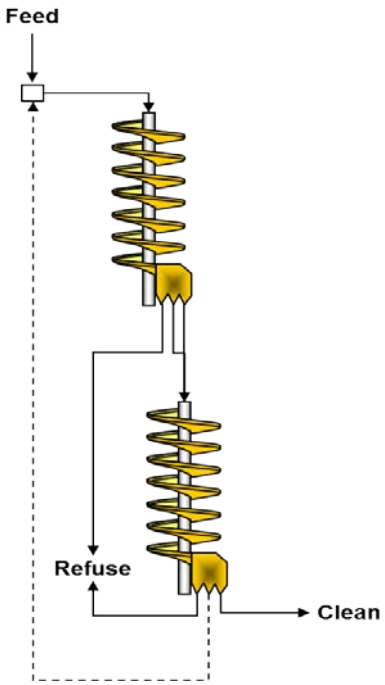


Figure 2.8 Modified rougher-cleaner spiral circuit with middlings recycle (Luttrell et al., 1999). Used under fair use. 2012.

2.2.10 ***Spirals for Ultrafine Coal Processing***

A recent development related to the use of spirals is the introduction of ultrafine (0.15 x 0.044 mm) coal spiral circuits. In these circuits, deslimed ultrafine coal slurry is introduced to a conventional spiral at a reduced dry solids feed rate of 0.45 to 0.50 t/hr/start and lower feed percent solids of 10 to 12% by weight. These ultrafine coal spirals are reported to achieve a cut point of 1.8 SG and an E_p value of 0.20. Moreover, the ash contents were reduced from 17.35% to 9.84% and total sulfur from 3.56% to 3.0%. This spiral circuit was designed specifically to treat oxidized ultrafine coal feed, which is difficult to upgrade by surface-based froth flotation

processes (Honaker et al., 2006). So far, the results suggest that this proprietary circuitry has the potential to be effectively used to treat well liberated low ash ultrafine coal with high pyrite contents, but may not suitable for poor feeds having high proportions of middlings or clay particles (Luttrell et al., 2007).

2.2.11 ***Spirals for High Sulfur Coal Processing***

Spirals are particularly well suited to reduce the sulfur contents of the final product in coal applications (Zeilinger, 1976). Tavares and Sampaio (1990) reported that a standard LD-9 spiral reduced the clean coal sulfur content to 2.2% from 4.2%. While spirals commonly provide a reject stream that is rich in sulfur, the absolute removal of sulfur from the clean coal product is typically rather low in industrial operations. One obvious reason for this is that spirals can only remove mineral, or pyritic, sulfur and not the organic sulfur associated with the carbonaceous fraction of the coal. The poorer rejection may also be because spirals are mainly configured for coal recovery rather than for pyrite removal (Kawarta et al., 2001).

On one hand hydrophobic coal pyrite particles (Oxidized pyrite particles are often hydrophobic) or partially liberated pyrites often behaves in flotation like pure coal particles and tend to report to the froth. On other hand spirals exploit the difference between specific gravities of coal and rock forming minerals, thus the same hydrophobic pyrite particles can be rejected by spirals because of their relatively high density. A two stage spiral in a rougher cleaner circuit arrangement was found to improve the coal pyrite rejection by approximately 10% compared to a single stage spiral (Kawarta et al., 2001). Tavares and Sampaio (1990) were showed that the sharpness and density of separation increase with the increase in particle size.

2.3 Teeter-Bed Separators

2.3.1 *Introduction*

Teeter-bed separators are hydraulic classifiers that have long been recognized as low-cost and high capacity devices for both classification and density separation. A teeter-bed separator is used for separating particles by size and/or density using a fluidized bed. A schematic diagram of a typical teeter-bed separator is shown in Figure 2.9. Recently, many coal preparation plants in the United States and in Australia have started to use teeter-bed technology as an alternative to spiral separators for fine coal cleaning (Sarkar et al., 2008). Teeter-bed separators are based on hindered settling and were originally used for particle size classification. However, if the feed size distribution is within acceptable limits, these classifiers can be effectively used for the concentration of particles based on differences in density (Bethell, 1988).

Teeter-bed separators have been manufactured since 1934. It was not until the early 1960's, however, that this unit was for the first time used for coal recovery from waste piles and tailings ponds (Drummond et al., 2002). Originally, teeter-bed separators primarily exploited differences in coal particle size distributions for upgrading, but later developments in the technology has now made it possible to separate particles primarily on the basis of density differences. Recently, a new type of teeter-bed separators known as the reflux classifier has been introduced to the coal and mineral industries. The reflux classifier technology has been reported to achieve density cut points as low as 1.35 SG, while maintaining good separation efficiencies that exceed those typically reported for coal spirals (Galvin et al., 2010).

2.3.2 ***Particle Settling Theory***

A solid particle falling under the influence of gravity in a viscous fluid is acted upon by three forces, i.e., a downwards acting force of gravity, an upward acting buoyancy force due to fluid displacement and an upward drag force acting in the direction of fluid flow. According to Taggart (1945), the free settling of particles predominates if the percentage of solids by weight is less than 15%. However, with an increase in the proportion of solid in the pulp, the settling rate of solid particles began to decrease in response to an increase in the interstitial fluid velocity. This condition, which is known as hindered settling, lower the settling rate compared to free settling conditions. Littler (1986) states that hindered settling starts when the concentration of solids in the pulp is about 20%. Under hindered settling conditions, a modified Newton's law can be used to determine the approximate falling rate of the particles (Wills and Napier-Munn, 2006). Mathematically, this condition can be represented by:

$$v = k[d(Ds - Dp)]^{1/2} \qquad [2.1]$$

where, v is the falling velocity of particles, k is the settling constant, d is the diameter of the falling particle, D_S is the particle density D_S and D_P is the pulp density. The hindered settling phenomenon minimizes particle size classification and enhances density classification. The hindered settling ratio between two different falling particles is always greater than the free settling ratio.

With the increase in number of settling particles, a condition called "quicksand" is reached. Under this condition, each particle is covered only by a thin layer of water and the solids are in a state of "full teeter." Every particle is free to move, but cannot do so without colliding with other particles, so the particles tend to remain in place such that the mass of

particles acts like as a viscous pulp. This condition of fluidization can be intentionally produced in classifiers and sorting columns by selecting proper rates for the addition of fluidization water. Such hindered settling columns are called teeter-bed separators, which are distinct from other hydraulic classifiers that generally operate with fluidized beds having lower solids contents.

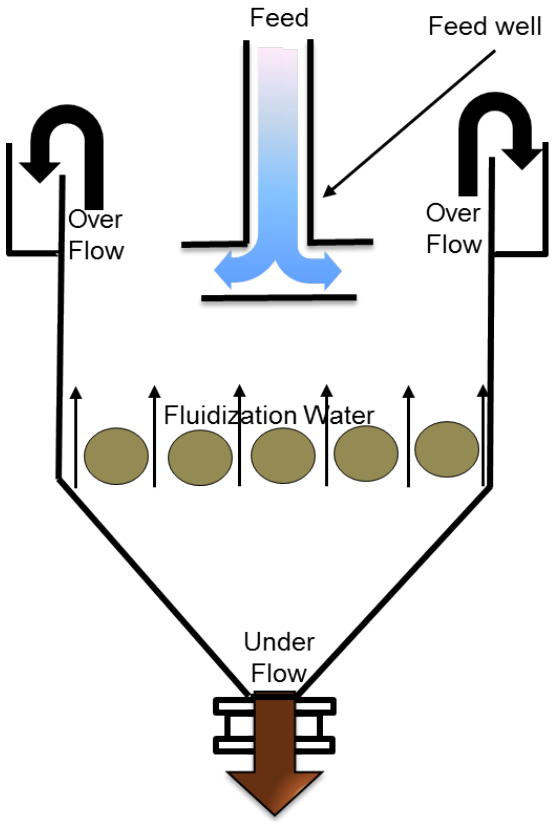


Figure 2.9 Schematic diagram of a generic teeter-bed separator.

Teeter-bed separators essentially consist of a vessel in which feed particles settle against an upward flow of water. These hindered settling particles form a teeter- or fluidized-bed within the device. Generally, slow settling particles move upward with the fluid flow and report to the top of the fluidized bed, while fast settling particles move to the bottom of the teeter-bed and are

discharged as underflow. Since the size and density of the feed particles are not uniform, particles are generally segregated according to their mass within the teeter-bed (Luttrell et al., 2006). The upward flow of fluidization water can be adjusted in such a way that the teeter-bed is mainly composed of “near-density” particles suspended within the separator. The height of the fluidized bed is normally controlled by on-line adjustment of the underflow rate using an actuated valve. A transducer monitors the bed pressure and controls the valve opening and underflow rate based on a specified set point value. Once steady-state conditions are reached, small and light feed particles float upward along the rising current of water and report to the overflow, while relatively coarse and denser particles sink and report to the under flow product.

Since their invention, teeter-bed separators have gone through significant advances in the fundamental technology. As a result, there are many different classifying units, other than a teeter-bed, that fall under this category of separator. These include Floatex density separators, AllFlux separators, CrossFlow™ separators, HydroFloat™ separators and Reflux classifiers.

2.3.3 ***CrossFlow Separator***

In order to maintain a high efficiency, non-turbulent conditions must exist within a teeter-bed separator (Heiskanen, 1993). In a conventional teeter-bed, changes in flow patterns may exist due to the introduction of feed into the teeter-bed chamber. This flow disruption can result in the unwanted misplacement of particles. In order to overcome this problem, a modified teeter bed known as the CrossFlow separator was designed the Eriez Manufacturing group. Figure 2.10 shows a conceptual diagram of a CrossFlow separator. As shown in this illustration, feed slurry enters from the side of the CrossFlow unit and flows quiescently across the top of the teeter-bed. This unique feed arrangement avoids turbulence normally associated with systems in which feed slurry is injected below the pulp surface and into the center of the teeter-bed.

Pilot-scale studies indicate that CrossFlow units offer improved separation efficiency when compared to conventional teeter-bed classifiers. Comparative testing of a full-scale 200 tph CrossFlow unit in a coal preparation plant showed that the product ash was reduced from 18% to 10%, while maintaining a combustible recovery and organic efficiency of 95% and 97%, respectively (Kohmuench et al., 2006).

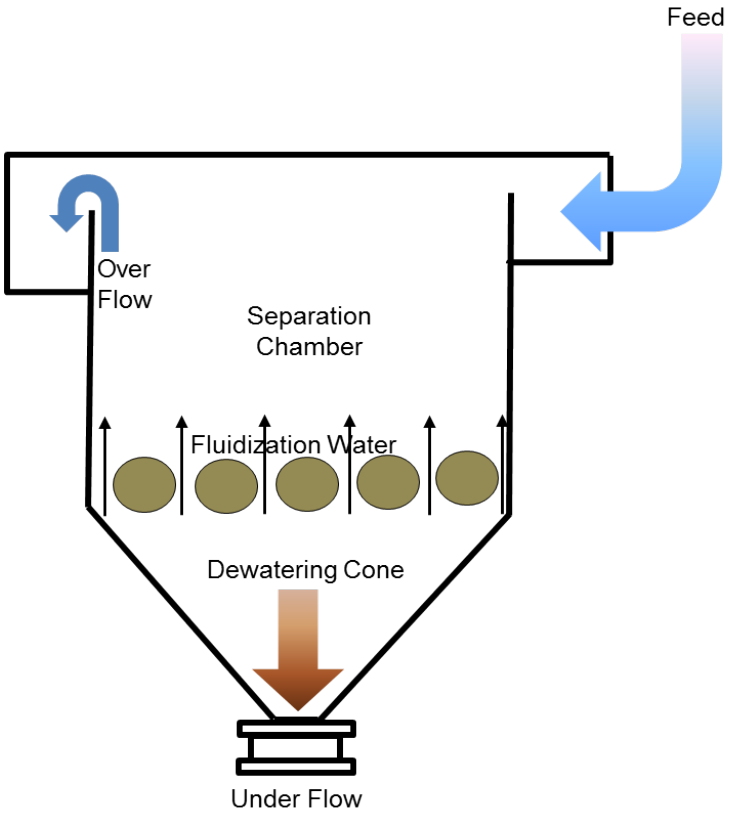


Figure 2.10 Schematic of cross flow separator.

2.3.4 *HydroFloat Separator*

Teeter-bed separators work well for upgrading coal provided that the particles are in a relatively narrow size range and the particle density difference is within acceptable limits (Mankosa et al., 1995). The problem with teeter-bed separators is that low-density coarse particles tend to be misplaced to the high-density underflow. Low-density coarse particles, which

are too heavy to be carried by the rising teeter water and too light to penetrate the fluidized bed, accumulate at the top of the teeter-bed. Eventually, more and more particles build up at the surface of the bed, which forces some low-density coarse particles to enter the teeter bed. Ultimately, these particles report to underflow along with the high-density particles. This problem can be partially corrected by increasing the velocity of the fluidization water, but higher velocities of can cause the misplacement of high-density fine particles. As a result, conventional teeter-bed separators are inefficient when treating feed streams with a wide particle size distribution and/or a narrow density distribution. To overcome this shortcoming, the HydroFloat separator was developed by the Eriez Manufacturing group.

Figure 2.11 shows a conceptual diagram of HydroFloat separator. The HydroFloat is essentially a teeter-bed separator into which small air bubbles are also introduced into the fluidization water. If required, frothers and collectors may also be added to the teeter water aid in bubble production and to render the desired mineral surfaces hydrophobic. The air bubbles attach to hydrophobic particles within the teeter bed, which effectively reduce their density. Unlike froth flotation, these bubble-particle aggregates have insufficient buoyancy to rise on their own, but due to the attached bubbles, are light enough to rise to the top of the top of the teeter bed and eventually report to the overflow launder. As a result, the HydroFloat combines the high capacity of a teeter bed with the flexibility of a froth flotation process. The HydroFloat offers many added advantages such as enhanced bubble particle contacting, better control of particle residence time, lower cell turbulence and reduced air consumption (Mankosa, et al., 1999, 2003).

HydroFloat separators have been successfully used in phosphate and fine coal processing operations (Barbee, 2007; Kohmuench et al., 2003; Mankosa et al., 2003). As shown in Figure 2.12, comparative testing of a HydroFloat separator on a deslimed coal (2 x 0.15 mm) provided

an increase in clean coal recovery by nearly 20% over the conventional teeter-bed separator (Mankosa et al., 1999). Similarly good results have also been achieved for applications involving the concentration of potash and phosphate.

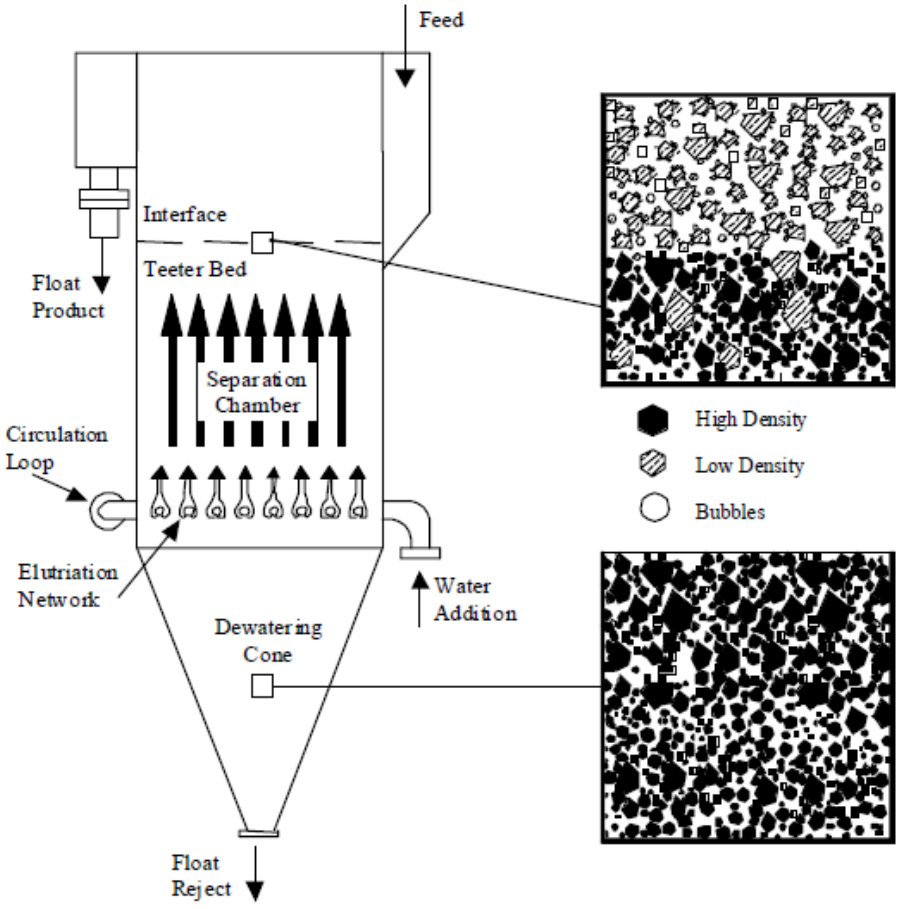


Figure 2.11 Conceptual Diagram of Hydro-Float Separator (Kohmuench et al., 2003). Used under fair use, 2012.

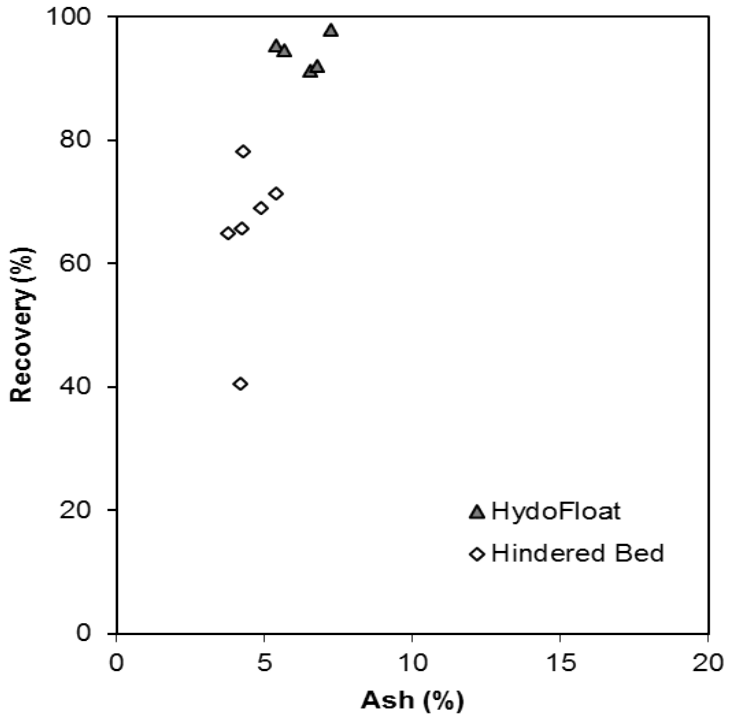


Figure 2.12 Test result obtained using 2 x 0.15 mm spiral feed from central Appalachia (Mankosa et al., 1999). Used under fair use, 2012.

2.3.5 ***Reflux Classifiers***

A reflux classifier is a teeter-bed separator that incorporates closely spaced parallel inclined plates that accelerate particle movement (Figure 2.13). In terms of functionality, the inclined plates are analogous to the inclined plates used in lamella thickener technology. For density separations, the inclined plates help to suppress the effects of particle size and enhance the separation of particles based on differences in relative density (Nguyentranlam and Galvin, 2004). A full-scale reflux classifier operated at flow rate of 16 tph of dry solids per square meter of cross-sectional area treating fine (2 x 0.25 mm) coal achieved an overall density cut point of about 1.7 SG and an E_P value to 0.15 (Galvin et al., 2004). Reflux classifier has also been used as a dry fine coal cleaner in which air was used as the fluidizing medium.

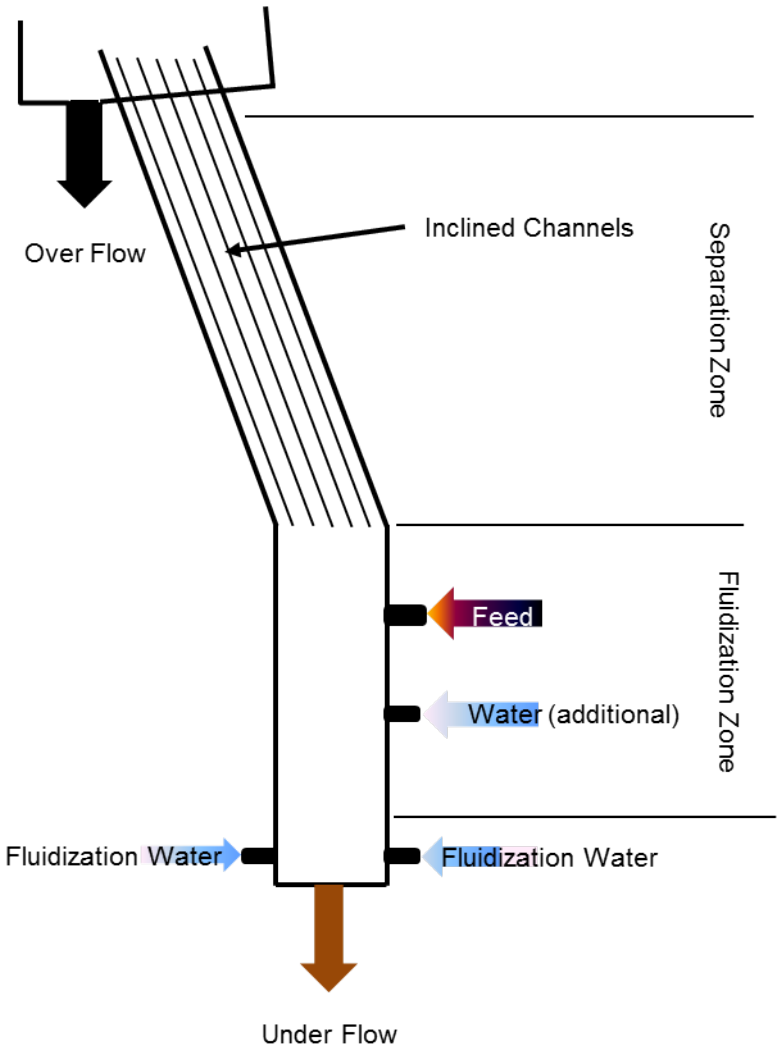


Figure 2.13 Schematic representation of a reflux classifier.

In a recent investigation, it was concluded that 7 mm inclined channels provide the optimum overall separation performance for a feed size of 2 x 0.25 mm (Walton et al., 2010). However, reflux classifiers have been applied successfully to process relatively coarse (8 x 0 mm) coal particles. Pilot-scale studies showed that the E_P value approached 0.03 for a topsize of 4 mm. When the particle size drops below 2 mm, the reflux classifier provides better efficiencies (lower E_P values) than dense medium cyclones (Galvin et al., 2010). It was also found that it is

possible to effectively separate small coal particles on the basis of density, with minimal size effects, by using a vibrated reflux classifier having air sand dense medium. An overall E_P value of 0.07 was achieved by dry processing coal (8 x 0 mm) in a semi-batch laboratory test using a reflux classifier (Macpherson and Galvin, 2010; Macpherson et al., 2011).

2.4 Water-Only Cyclones

2.4.1 Water-Only Cyclone Description

A water-only cyclone (WOC) is a gravity-based separator that has been used in the coal industry since the 1950's. The major advantage of a water-only cyclone over a dense medium cyclone is that it does not require any external feed medium (Kim and Kalima, 1998; Patil et al., 2007). On the other hand, water-only cyclone units are limited in terms of topsize to applications involving only fine (<3 mm) coal feeds (Weyher and Lovell, 1969; Gottfried, 1978). A typical water-only cyclone is a variant of hydrocyclone technology. The separator consists of a tapered conical vessel that is open at its apex and joined from the top to a cylindrical section that incorporates a tangential feed inlet (see Figure 2.14). The tangential inlet creates a rotating flow within the unit that induces centrifugal forces that enhance the settling of larger and denser particles to the cyclone wall and downward out the apex. A plate is fitted to the top of the cylindrical section and an axially mounted overflow pipe passes through this plate. The overflow pipe is extended into the body of the cyclone by a short removable section that is called a vortex finder. The vortex finder prevents the short-circuiting of feed directly to the overflow. Smaller and lighter particles are transported by the rotating flow to the center of the cyclone and up and out through the vortex finder.

When feed is introduced tangentially under pressure to a water-only cyclone, the movements of the particles inside the cyclone slow down because of the wide conical bottom.

This phenomenon creates a crowding of particles at the conical bottom. The crowded mass of particles assists in developing hindered settling conditions and eventually in the formation of a dense bed of particles. Thus, the separation process is based on the hindered settling velocity of particles in a centrifugal field. The lighter particles are unable to penetrate the bed of higher density material and thus report through the vortex finder and report as overflow, while denser particles are discharged as underflow from the apex (Flintoff et al., 1987).

Figure 2.14 shows a schematic comparison between a classifying cyclone and a water-only cyclone. Unlike conventional classifying cyclones, water-only cyclone units have a wide conical angle and a long vortex finder that extends along the length of the cylindrical body. Water-only cyclones utilize cone angles up to 120° and more, while classifying cyclones designed for particle sizing commonly use cone angles of 10° to 20°. 2007. The larger cone

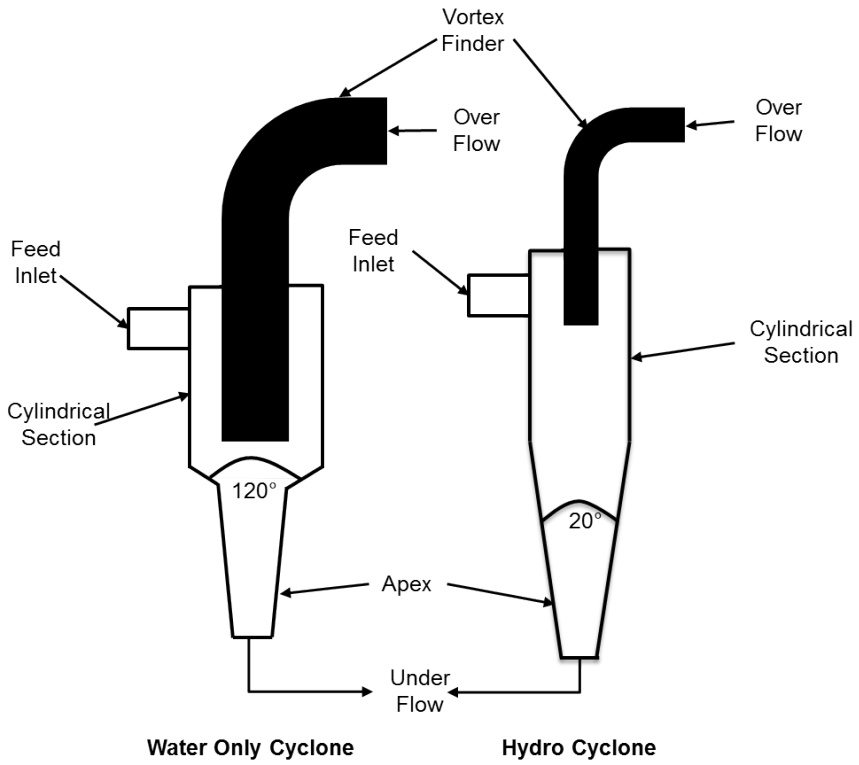


Figure 2.14 Comparison between classifying and water-only cyclone.

angle enhances the effect of particle density and minimizes particle size effects during the separation. The longer vortex finder helps to ensure that complete partitioning has occurred along the cyclone body prior to splitting of the dense and light products to underflow and overflow, respectively.

2.4.1 *Water-Only Cyclone Performance*

A wide variety of design and operating variables influence the separation performance of water-only cyclones. Suresh et al. (1990) studied the effect of different design and operating variables on the distribution of water reporting to the underflow and overflow streams from water-only cyclones. According to their study, the water split from a water-only cyclone is independent of vortex finder length and diameter, cone angle, solid concentration, feed flow rate

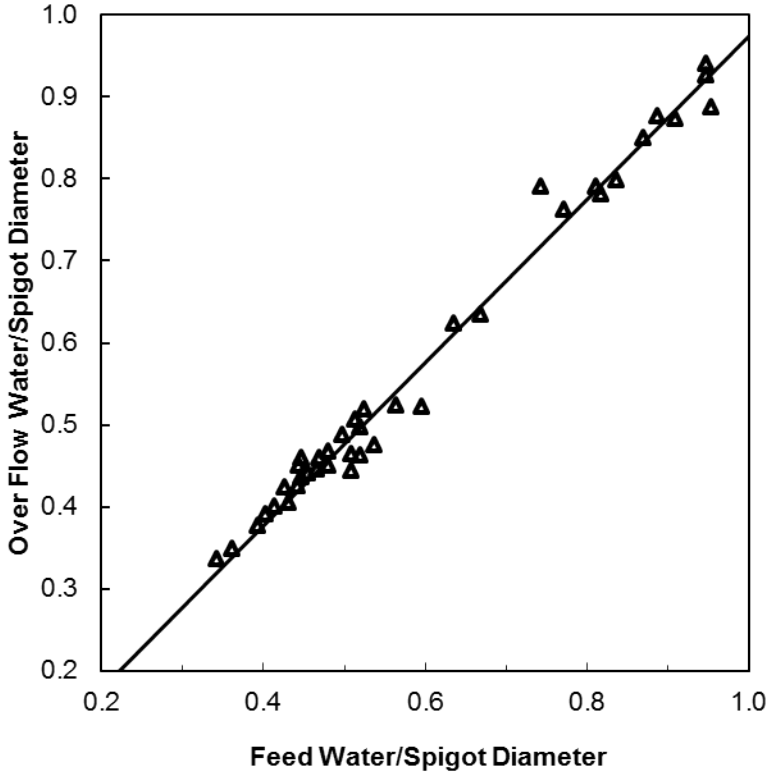


Figure 2.15 Relationship between feed water flow rate and rate of over flow water (Suresh et al., 1990). Used under fair use, 2012.

and on the size and specific gravity of feed particles. As shown in Figure 2.15, they proposed a "generalized water distribution plot" that serves as a characteristic plot for the water split from water-only cyclones. The slope of the plot represents the percentage of feed water reporting to the overflow.

In a similar study, Majumder et al. (2011) studied the effects of various design and operating variables on the separation efficiency of water-only cyclones used for fine (0.5 mm x 0) coal cleaning. This study revealed that vortex finder length, vortex finder diameter and cone angle directly control the average residence time of coal particles inside the water-only cyclone. It was also concluded that vortex finder diameter is the most sensitive variable among all the variables studied.

In an earlier study, Kim and Klima (1998) suggested that for proper operation, the cone angle of a water-only cyclone should be greater than 45°. However, too wide an angle (e.g., 180°) reduces cyclone efficiency. At concentrations higher than 20% solids, the bypass of dense particles to the overflow increases and, hence, reduces the separation performance. Cyclone efficiency can also be enhanced through the use of multistage water-only cyclone circuitry. Simulations performed by Kim and Klima (1998) indicated that a three-stage recirculating overflow/underflow circuit can achieve ferrosilicon recoveries of 97% and quartz rejections of 95%.

The separation performance of a water-only cyclone is not only affected by its geometry, but also depends upon the operating variables. Water-only cyclones are effectively used to process coal streams finer than 1 mm, but coal feed up to 20 mm upper size have also been tried on cyclones. Water only cyclones are most effective for a size fraction of 0.5 mm to 0.15 mm. Particle size fractions finer than 0.15 mm will report to over flow irrespective of their density.

Moreover, specific gravity cutpoint decreases sharply with increasing particle size, as indicated by the data shown in Figure 2.16 (Luttrell, 2011).

Another problem associated with a water-only cyclone is the unwanted bypass of low-density particles to the underflow. The bypassing results in a lower yield and poorer quality of the final clean coal product. The problem of bypassing can be somewhat reduced using a two-stage water-only cyclone circuit. Different combinations are possible for two stage water-only cyclone circuitry and the final choice depends on the objective to be achieved. For example, in order to improve the overall product quality, the overflow should be sent for recleaning. Likewise, to improve the clean coal yield, the underflow must be scavenged using a second stage of cyclones (Bull et al., 1987).

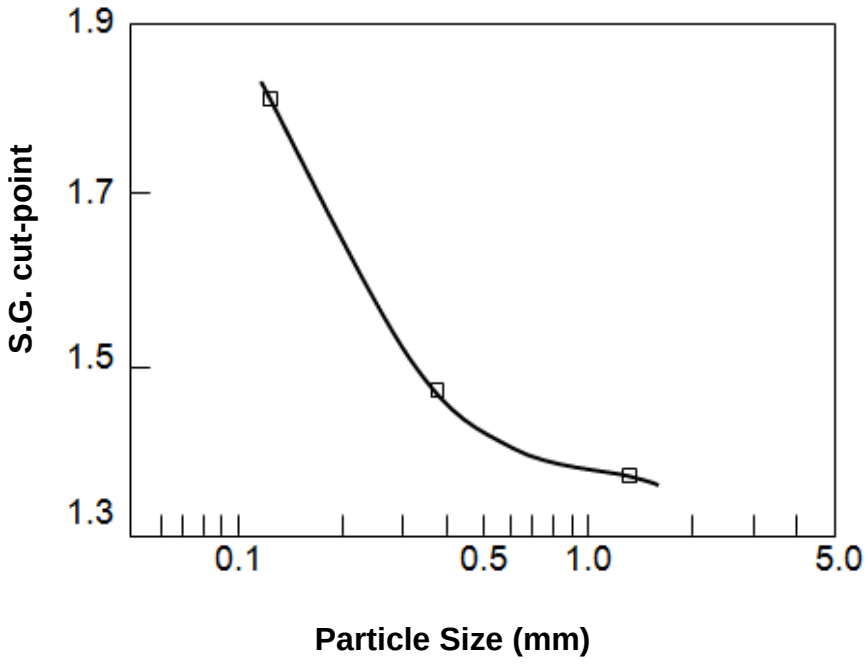


Figure 2.16 Effect of particle size on the specific gravity cut-point of the water-only cyclone (Luttrell et al., 2011). Used under fair use, 2012.

Bethell and Moorhead (2003) also studied the water-only cyclone/spiral circuitry to clean fine (1 x 0 mm) coal. This study indicated that water-only cyclone and spiral circuits are flexible and can be configured to operate at a high separating density to maximize carbon recovery or may also be configured to operate at a low separating density to maximize coal quality. In order to avoid excessive recycling rates that may occur in such circuitry, they proposed that the circuit must either be configured with no recycle or with only a spiral middlings recycle. In the case of treating finer feeds consisting of 0.6 mm top size, spiral middlings as well as clean coal can be recycled without any fear of excessive recycling rates. However, recycling of both the spiral clean coal and middlings must be restricted to circuitry where the water-only cyclone separating density is sufficiently high to keep the recycle rate acceptable.

2.5 Froth Flotation

Conventional density-based separation processes are inefficient when used to upgrade coal particles finer than about 100 mesh (0.15 mm). Thus, for this size range, froth flotation has become the most commonly used coal processing technique. Flotation is a physico-chemical separation process that utilizes differences in the surface “wettability” of coal and unwanted rock/refuse particles. Figure 2.17 is a schematic diagram of a typical conventional flotation cell. During operation, hydrophobic coal particles attach to air bubbles and are carried to the surface and collected as concentrate, while hydrophilic particles remain in the aerated pulp and are eventually discharged as tailings. A conventional, or mechanical, flotation cell consists of an agitator and tank. The agitator keeps coal particles suspended and disperses the air bubbles throughout the pulp. The agitation also provides turbulence within the pulp that promotes collisions and attachment of hydrophobic particles to the air bubbles.

The concept of flotation can be traced back in 1869 when William Haynes patented a process called bulk-oil flotation for separating sulfide and gangue minerals using oil (Somasundaran, 2006). The first successful commercial flotation process for mineral sulfides was invented by Francis Elmore in 1898. The modern froth flotation process was invented in the early 1900s in Australia by C. V. Potter and, around the same time, by G. D. Delprat (Lynch et al., 2007). Since then, the flotation process has been applied to a wide variety of materials concentration systems ranging from paper recycling to coal and mineral preparation.

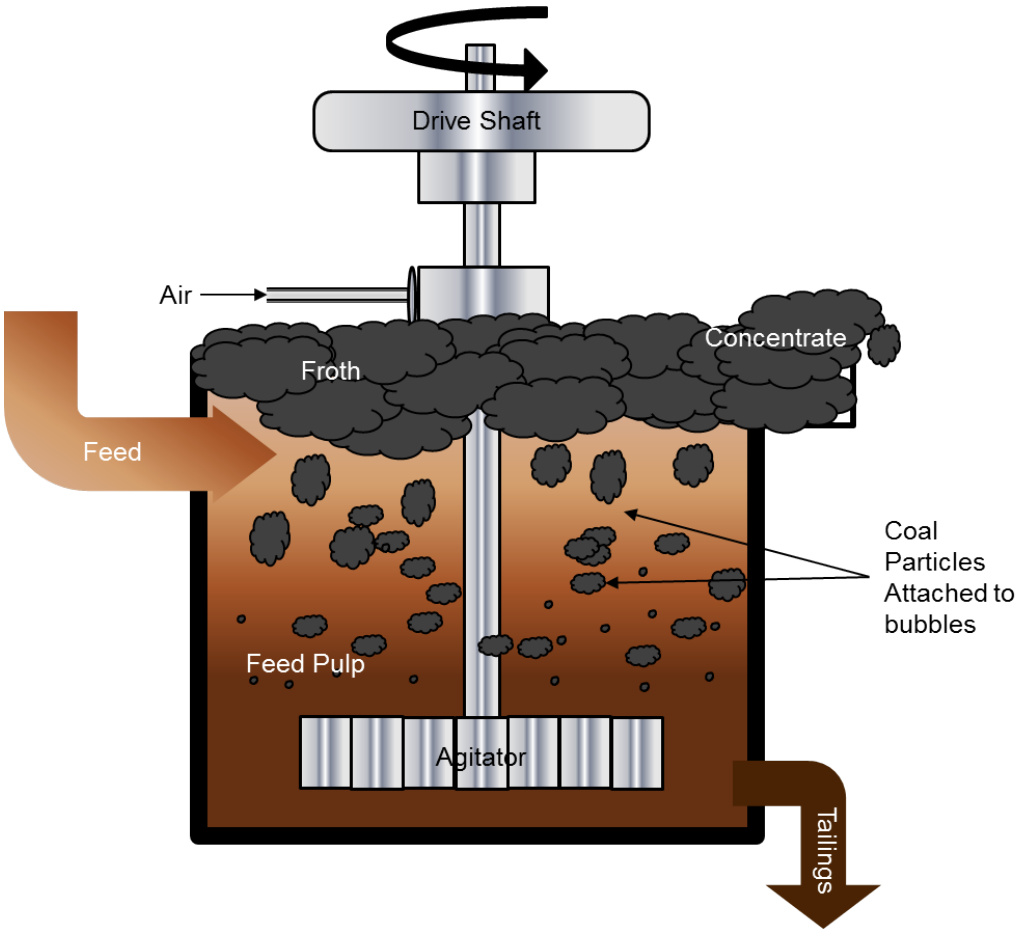


Figure 2.17 Schematic diagram of a conventional flotation cell.

Flotation is a complex process that involves three phase flow and has been thoroughly discussed by many authors (King, 1982; Schulze, 1984; Fuerstenau et al., 1985; Harris et al., 2002; Rao, 2004). The process starts with the selective attachment of particles to air bubbles. The bubble-particle aggregate rises into a froth phase due to buoyancy forces. Some of large particles may be detached from the bubbles before reaching the froth. The entrainment of particles in the water phase that reports to the froth may also occur. Unlike the selective process of flotation, entrainment is not a selective and is detrimental to the grade of the froth product.

Column flotation is an important development in the froth flotation process. A column cell consists of a long vertical cylinder into which air is added at the bottom. These cells are not agitated by any mechanical means. Feed slurry, which is introduced at approximately two-thirds of the way up along the column height, travels downwards through the column against rising air bubbles. The selectivity in column flotation is enhanced via the use of water sprays that rinse entrained mineral matter from the froth concentrate. Figure 2.18 is a schematic diagram that compares the distribution of water in a conventional and column cell. Ideally, none of the water from the feed slurry ever reports in the froth concentrate in column flotation. The column technology was developed as an alternative approach to conventional flotation cells used in cleaner circuits of mineral plants. Columns also have become increasingly popular for the upgrading of ultrafine coal particles (Finch, 1995). There are now many types of column flotation cells commercially available (Finch and Dobby, 1991; Jena et al., 2008). Two of the technologies most commonly used in the coal industry include the Microcel column developed at Virginia Tech and the CoalPro column developed by Canadian Process Technologies (CPT).

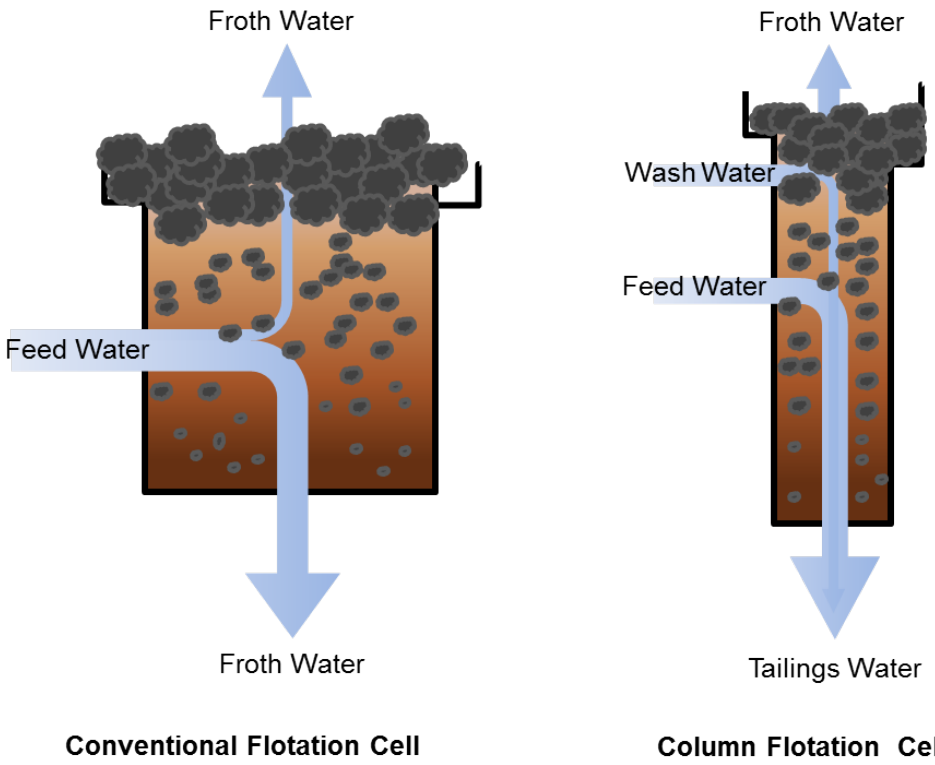


Figure 2.18 Comparison of how feed water reports to the froth between a conventional flotation cell and a column flotation cells.

2.5.1 ***Properties of floatable minerals***

Depending upon the surface characteristics, solid particles can be classified as either polar or non-polar. Polar solids have strong covalent or ionic surface bonding and are naturally hydrophilic, while non-polar solids have relatively weak molecular bonding and held together by van der Waals forces. Non-polar surfaces do not readily attract water molecules and, therefore, are hydrophobic in nature. Consequently, hydrophobic mineral particles have the ability to attach themselves to the air bubbles via the formation of stable three-phase contact. The hydrophobicity of a non-polar mineral is directly proportional to contact angle, i.e., minerals with greater contact angle have a higher attraction for air than for water. Non-polar minerals such as coal, graphite,

sulfur, diamond and talc naturally have high floatability and have high contact angles between 60° and 90° (Woods, 1994; Wills and Napier-Munn, 2006).

2.5.2 ***Flotation Reagents***

It is theoretically possible to float non-polar hydrophobic minerals such as coal without the aid of chemicals. However, the flotation process generally requires reagents be added to promote bubble formation and enhance kinetics. These reagents can be classified as collectors, frothers and modifiers (or regulators). Collectors are organic compounds that create or enhance the hydrophobicity of selected particles so as to facilitate bubble-particle attachment. Frothers are added to stabilize the formation of bubbles in the mineral pulp. Frothers also help to maintain a stable froth that increases flotation kinetics and allows for the selective drainage of entrained gangue minerals (Barbian, 2005; Melo and Laskowski, 2005). Modifiers, or regulators, are often used in the flotation industry to control or modify the action of collectors. These reagents can be generally classified as activators, depressants and pH modifiers. Activators are typically inorganic substances that alter the chemical nature of the selected mineral surfaces and help to make these particles hydrophobic due to the action of collectors (Zhou and Chander, 1991). Depressants are used to increase the selectivity of the flotation process. Depressants prevent the flotation on unwanted minerals by suppressing hydrophobicity. The selective separation that occurs during flotation is also dependent on a delicate balance between the concentrations of the reagents and the pulp pH (Buckley and Woods 1997; Raston et al., 2001; Wills and Napier-Munn, 2006). Most industrial coal flotation systems operate over pH values between 6.5 and 8.

2.5.3 ***Release Analysis***

Flotation is not a density-based separation process, thus traditional washibility analysis involving the density partitioning of particles cannot be directly applied to the flotation process. In order to characterize the ideal flotation separation process, a method called “release analysis” is frequently used by the industry. This technique was developed by Dell (1953) as the equivalent in froth flotation to float-sink analysis in gravity concentration. In Dell’s release analysis procedure, all the floatables particles are initially separated from non-floatable particles by repetitive recleaning of the froth product (see Figure 2.19). After removing all of the non-floatable particles, the remaining froth concentrate is repulped and then sequentially recovered in small increments under conditions of steadily increasing flotation intensity. In most cases, the flotation intensity is usually controlled by adjusting aeration rate and impeller speed. This procedure typically produces a series of incremental froth products that range from highest purity (recovered in the first increment) to lowest purity (recovered in the last increment).

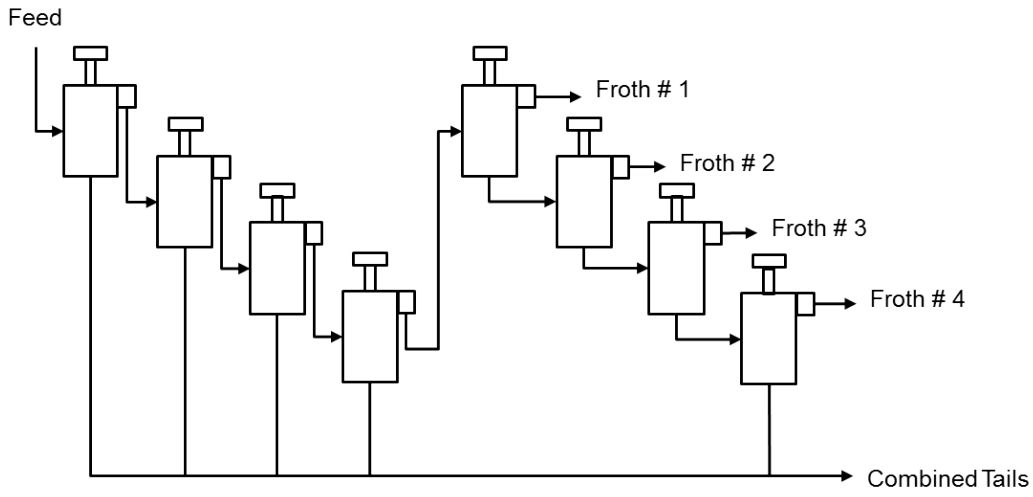


Figure 2.19 A typical release analysis test.

2.5.4 *Coal Flotation*

Froth flotation is generally used in coal preparation for upgrading the finest fractions of coal in size ranges below about 100 mesh (0.15 mm). Coal particles are naturally hydrophobic and require little addition of collector, although petrochemical products such as kerosene or diesel oil are often added to enhance the hydrophobicity. Frother dosages are usually high to keep the froth mobile (Wills and Napier-Munn, 2006). Coal floatability can be affected by maceral type, mineral content and surface oxidation. Problems associated with the flotation of oxidized coal include poor recovery, high ash contents of clean coal and higher reagent doses. Moreover, mixing oxidized coal with a good coal may hurt the floatability of the good coal as well (Luttrell, 2011). Pyrite laden coal also adds more complexities to the flotation process (Kawarta, 2001).

Although most modern U.S. plants only treat coal feeds finer than about 0.15 mm, some installations do exist in which particle sizes as large as 0.6 mm are effectively upgraded by this process. Unfortunately, the exact relationship between coal particle size and the flotation rate is difficult to understand. In most cases, the flotation rate initially increases with particle size, reaches a maximum plateau value, and then decreases afterwards with a further increase in the coal particle size (Taweel, 1986). The poor floatability of coarser coal particles may be due to higher detachments rates resulting from the increased mass of larger particles (Lynch et al., 1981). Mineral particles attached to the coal, which are commonly referred to as slime coatings, can also decrease the floatability of the associated coal particles.

Coal flotation circuits are relatively simple and typically only require roughing and scavenging circuits, although roughing circuits are usually sufficient in most industrial operations. Generally, two types of fine flotation circuits are currently in use by the U.S. coal

preparation industry: conventional 0.15 mm x 0 circuits and deslime 0.15 x 0.045 mm circuits. Typically, classifying cyclones are also incorporated into the flotation circuit to make a cut at 0.15 mm for conventional circuits or at 0.15 mm and 0.045 mm for deslimed circuits. In deslime circuits; the minus 0.045 mm material is discarded waste. It is because increased amounts of coal fines overloaded the carrying capacity of flotation cells and cause the loss of coarser particles form the bubbles due to preferential loading of the finer sizes. Phillips I., Dennis. (1998). To produce higher quality froth products, froth washing is often necessary and this can also be achieved using Jameson cells and flotation columns (Nicol, 2000). Although the design and operation of column flotation cells is more complex as compared with that of conventional flotation cells, the steady decline in high-grade feedstocks will likely force operators to utilize this technology in order to meet increasingly stringent customer demands (Yoon et al., 1997; Kohmuench et al., 2007).

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CHAPTER 3 PERFORMANCE COMPARISON OF FINE COAL CLEANING ALTERNATIVES

3.1 Abstract

While dense medium processes have largely become the standard approach for treating coarse coal, the types of unit operations used to upgrade fine (<1 mm) coal continues to vary substantially from plant to plant and across different geographic regions. In light of this disparity, an experimental study was undertaken to compare the separation performance of some of the unit operations commonly used to upgrade fine coal streams. Processes examined in this pilot-scale study included spirals, water-only cyclones, teeter-bed separators and froth flotation. Each cleaning technology was tested on the coal feed from the same source. To fairly compare each process, size-by-size separation efficiencies were determined for each process from characteristic recovery/rejection curves. The resulting data was used to identify size ranges most appropriate for the various alternative processes.

3.2 Introduction

Modern coal preparation facilities incorporate a wide variety of solid-solid separation processes for coal upgrading. Dense medium processes, which include dense medium vessels and dense medium cyclones, have become the preferred method for treating coarse coal in most new plants (Figure 3.1). The widespread acceptance of dense medium technology can be attributed to its large capacity, high efficiency and operational flexibility. In contrast, a variety of commercially viable flowsheet configurations exist for treating coal finer than 1 mm (Honaker et al., 2007). These circuit configurations may include various combinations of water-based density separators such as spirals and water-only cyclones as well as various types of surface-

based separators such as conventional or column flotation machines. In many cases, the separation processes are used in multi-stage circuits and are integrated with various types of classification processes (either before or after the cleaning step) in an attempt to improve cleaning performance (Bethell and Arnold, 2003). Differences in circuit layouts are typically justified by flowsheet designers based on both technical and financial considerations, which attempt to balance the need to accommodate a specific raw coal size distribution or washability against any undesirable increase in capital, operating or maintenance costs. Operator preferences and vendor biases also appear to contribute to the large variations that are observed in how fine coal is cleaned. As a result, a standardized “optimum” flowsheet for fine coal processing does not exist at this time.

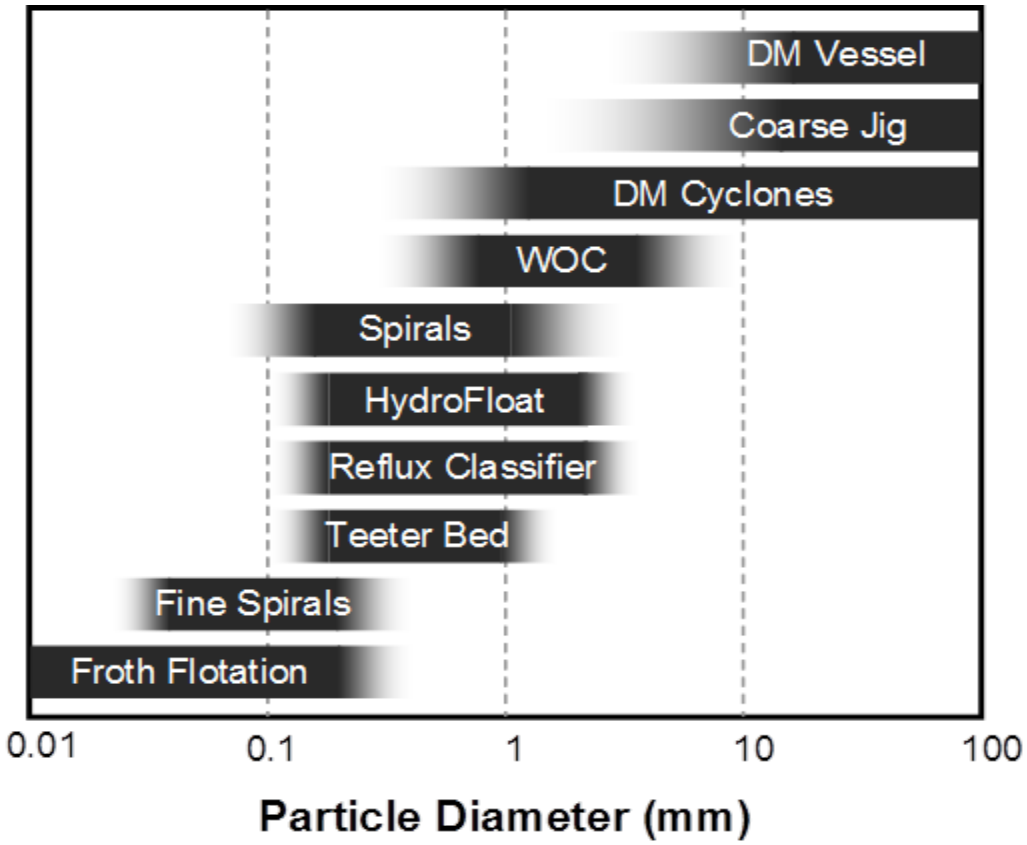


Figure 3.1 Approximate effective size ranges for different coal cleaning processes.

In the current work, a pilot-scale test program was undertaken to evaluate many of the common solid-solid separation processes used for fine coal upgrading. Processes examined in this experimental investigation included compound spirals, water-only cyclones, teeter-bed (hydraulic) separators and froth flotation. For a fair comparison, each process was experimentally tested on the same feed. The performance of each process was evaluated by comparing size-by-size separation efficiencies, which reflect the trade-off between combustible recovery and ash rejection. Based on this data, generic guidelines have been developed that can be used by plant designers to layout the “optimum” circuit for fine coal processing.

3.3 Separation Efficiency

One of the difficulties associated with the comparison of fine coal cleaning processes is the selection of a suitable performance indicator. For example, experimental test data often consist of paired groups of values such as clean coal yield and clean coal ash. A cleaning process that gives both a higher yield and a lower ash is obviously the best choice. On the other hand, the choice of which process is superior is not so obvious when one unit provides a higher yield while the other gives a lower ash. Ideally, these paired data sets need to be reduced down to a single numerical performance indicator that can simultaneously indicate how effectively carbonaceous matter is recovered versus how efficiency the ash (or other quality indicator) was rejected from the feed. An indicator such as organic efficiency is well suited to this purpose for density-based separation processes, but requires extensive float-sink analysis that may be cost prohibitive and inappropriate for very fine particles unless special methods are employed (i.e., centrifugal float-sink testing). Likewise, an arbitrary performance measure, such as the clean coal yield minus the clean coal ash, is also undesirable since it has no real physical meaning, no fixed upper or lower limits, and no definable relationship with an ideal separation.

The problem of assessing the performance of a separator using a single indicator has been addressed in the literature (Stevens and Collins, 1961; Schultz, 1970; Salama, 2001). According to these studies, the separation efficiency for a process should be defined as the theoretical percentage of feed material that passes through an ideal separation. Mathematically, the separation efficiency can be calculated as the recovery of desirable material in a given product minus the recovery of undesirable material in the same product. For the case of coal, the separation efficiency (E) can be obtained from:

$$E = R - (100 - J) = R + J - 100 \quad [3.1]$$

in which R is the combustible recovery and J is the ash rejection. R represents the percentage of combustible matter present in the feed that reports to clean coal, while J represents the percentage of ash present in the feed that reports to reject. These two important performance indicators can be calculated from the ash contents of the feed (f), clean coal (c) and refuse (r) streams using:

$$R = 100\frac{(f-r)(100-c)}{(c-r)(100-f)} \quad [3.2]$$

$$J = 100\frac{(f-c)r}{(r-c)f} \quad [3.3]$$

Combining Eqs. [3.1]-[3.3] yields:

$$E = 100\frac{r-f}{r-c}\left[\frac{100-c}{100-f} - \frac{c}{f}\right] \quad [3.4]$$

The leftmost term (i.e., 100[r-f]/[r-c]) in this expression is the total mass yield of clean coal, while the terms (100-c)/(100-f) and (c/f) represent the concentration ratios of combustibles and ash, respectively. Therefore, for the case of coal, the separation efficiency is comprised of the clean coal yield times the difference in the concentration ratio between combustibles and ash.

The important relationship defined by Eq. [3.4] can be plotted graphically as shown in Figure 3.2. A simple splitter, which gives no selective separation, is represented in this plot by a diagonal line passing between the top-left corner (i.e., 100% recovery and 0% ash rejection) and bottom-right corner (i.e., 0% recovery and 100% ash rejection). In contrast, a perfect separation is represented by the single point in the top-right corner of the plot (i.e., 100% combustible recovery and 100% ash rejection). These two boundaries represent separation efficiencies of 0%

and 100%, respectively. Other separation efficiency values are represented by lines parallel to the diagonal as defined by Eq. [3.1]. The data points plotted in Figure 3.1 represent real-world results obtained from testing of a fine coal separator over a wide range of possible operating conditions. For comparison, data obtained from float-sink analysis of the feed is also shown. Performance data plotted in this manner typically fall along knee-shaped curves passing between endpoints of 100% recovery and 100% ash rejection. Each point along the curve can be represented by a single value of separation efficiency, which reflects the degree of trade-off between recovering combustibles and rejecting ash. The optimum separation efficiency is obtained for those combinations of operating conditions that give data points in the right-upper most elbow of the performance curve.

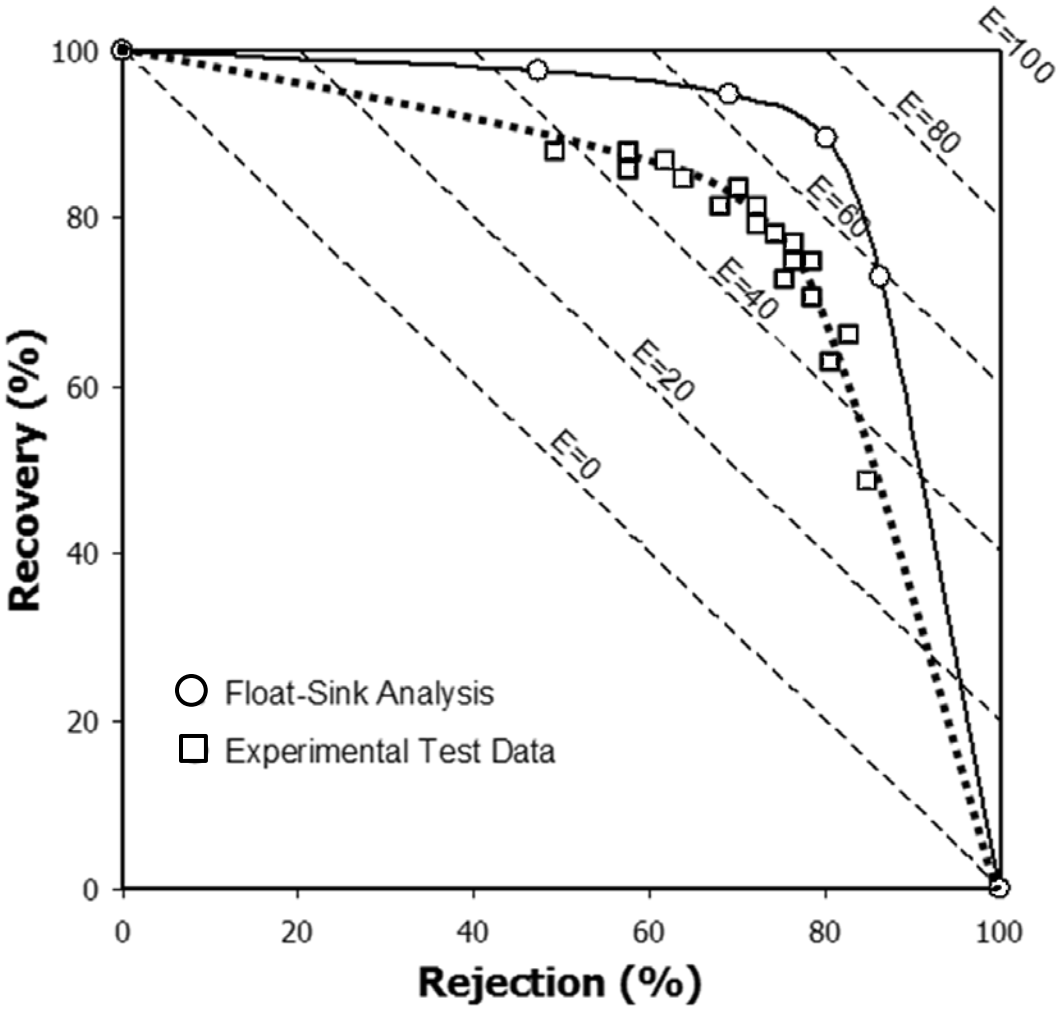


Figure 3.2 Example illustrating the relationship between combustible recovery, ash rejection and separation efficiency.

The characteristic recovery-rejection curve is also very useful for estimating the qualities of clean coal and refuse that may be expected in response to small variations in feed coal quality. For example, once the characteristic recovery-rejection curve has been identified, new clean coal (c*) and refuse (r*) ash percentages for an anticipated new feed ash (f*) can be calculated for any pair of recovery (R) and rejection (J) values along the performance curve using:

$$c^* = \frac{100}{\left(\frac{R}{100-J}\right)\left(\frac{100}{f^*}-1\right)+1} \quad [3.5]$$

$$r^* = \frac{100}{\left(\frac{100-R}{J}\right)\left(\frac{100}{f^*}-1\right)+1} \quad [3.6]$$

This ability is particularly useful when comparing different sets of experimental data for which the feed ash has changed slightly. Without this normalization step, it is difficult to distinguish whether a superior yield-ash point is due to a true enhancement in separation performance or just an artifact of a lower feed ash content.

3.4 Experimental

A pilot-scale test circuit was constructed for the purpose of evaluating several different fine coal cleaning processes. Unit operations examined in the experimental program included a two-stage compound spiral, teeter-bed separator, HydroFloat separator, water-only cyclone and froth flotation cell. Specifics related to the working features of the teeter-bed separator and HydroFloat separators have been discussed elsewhere in the literature (Kohmuench et al., 2001, 2002). A simplified schematic of the closed-loop test circuit is shown in Figure 3.3.

During testing, a coal slurry mixture was prepared by adding water and dry coal of the desired particle size into a 2-m diameter feed sump. For most tests, the feed coal consisted of nominal 1 x 0.15 mm solids, although coarser splits containing either 2.3 x 1 mm or 2.3 x 0.15 mm were also used in selected tests. The particle mixture was held in suspension using a 25-cm diameter blade mixer. Slurry from the sump was pumped at a controlled rate using a variable-speed centrifugal pump equipped with a 35-cm diameter impeller. If necessary to maintain adequate particle suspension and slurry mixing, some portion of the slurry was returned back to the sump via a bypass valve. Feed slurry from the pump was passed up to an upper level floor to each unit operation being testing.

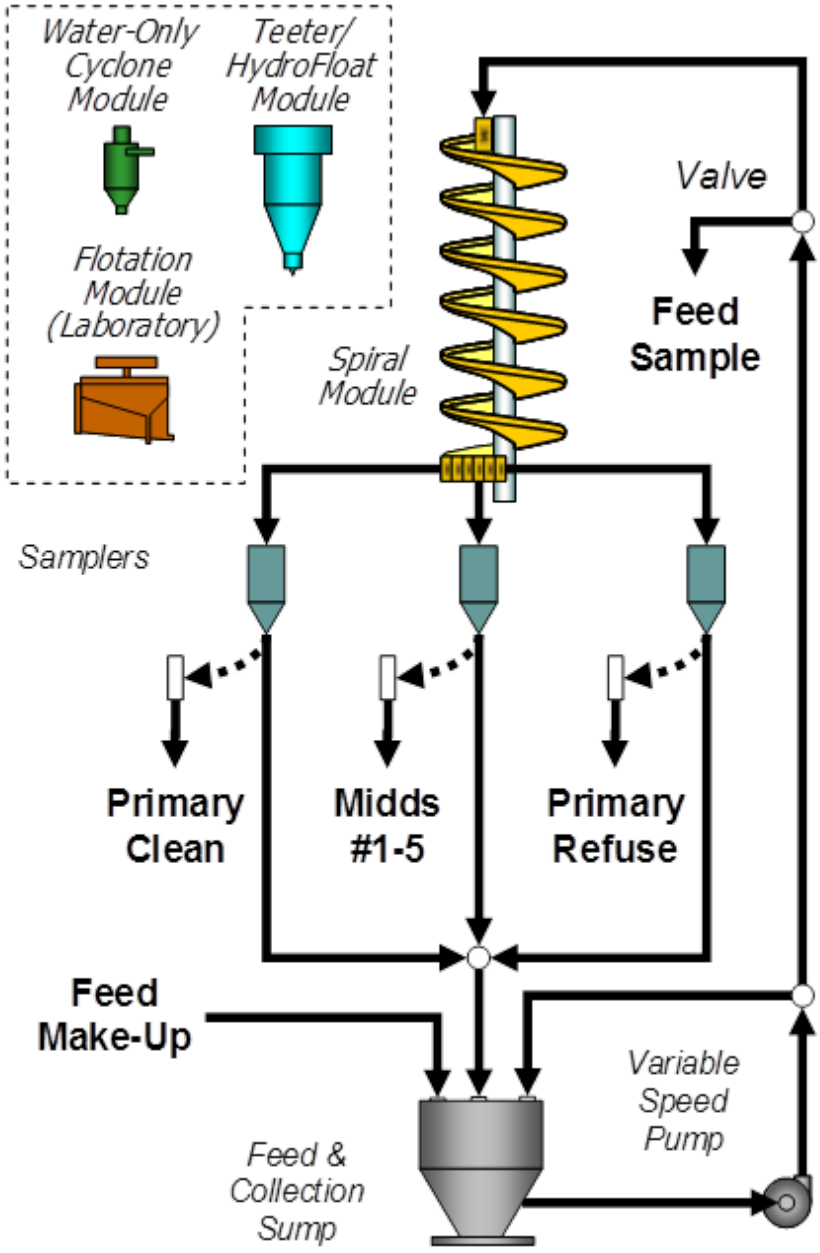


Figure 3.3 Schematic of the pilot-scale experimental setup.

A sample port was provided in the vertical feed line so that a representative feed sample could be collected. After passing through the cleaning unit, timed samples of the products were

collected by diverting the full flow of the product streams into sample containers. For most of the test units, the collected products included timed samples of clean coal and refuse. However, the two-stage compound spiral included a product box partitioned to collect six different samples across the profile of the second stage spiral as well as an upper draw-off point for the collection of primary refuse from the first stage spiral. This configuration made it possible to simultaneously collect timed samples of clean coal, refuse and five different middlings products so that complete recovery-rejection curves could be generated for each spiral test run. After collecting and weighing the slurry samples, the solids were filtered, dried, weighted and analyzed for ash content. The experimental data were then evaluated using a spreadsheet-based mass balance routine to ensure that reliable data had indeed been obtained for each test run (Luttrell, 2004).

3.5 Experimental Results

3.5.1 *Spiral Testing*

Spiral testing was conducted using a two-stage compound spiral (Multotec SX7). The unit was operated in accordance with recommended guidelines reported in the literature (Luttrell et al., 2003; 2007). As indicated previously, the 1-m diameter commercial-scale unit was equipped with a partitioned collection box so that seven products could be simultaneously collected across the spiral profile. Figure 3.4 shows the size-by-size recovery-rejection curves obtained using the spiral under standard operating conditions of 8.6 m^3/hr (38 GPM) and 2.5 t/hr (2.8 TPH). The data is re-plotted in Figure 3.5 to better illustrate the cumulative effect of splitter position across the second stage spiral profile on separation efficiency. Position “P1” represents the cleanest product taken at the outer most position across the spiral profile, while “P6” represents the high ash reject product taken at the inner most position near the center support

tube for the spiral. For most industrial separations, the clean coal product is normally a combination of products “P1” and “P2” with products “P3” and higher added/rejected sequentially as required to meet product grade specifications.

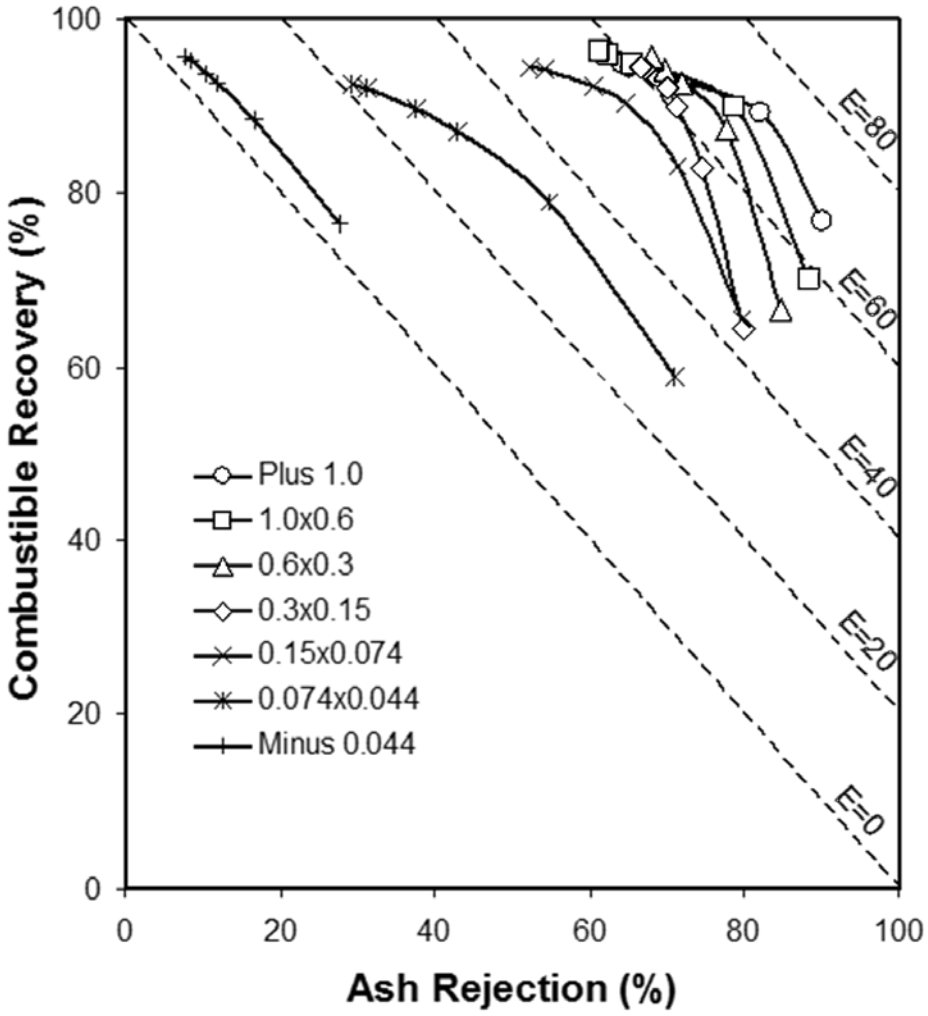


Figure 3.4 Size-by-size separation curves for a spiral operated at standard recommended slurry flow and dry solids tonnage rates.

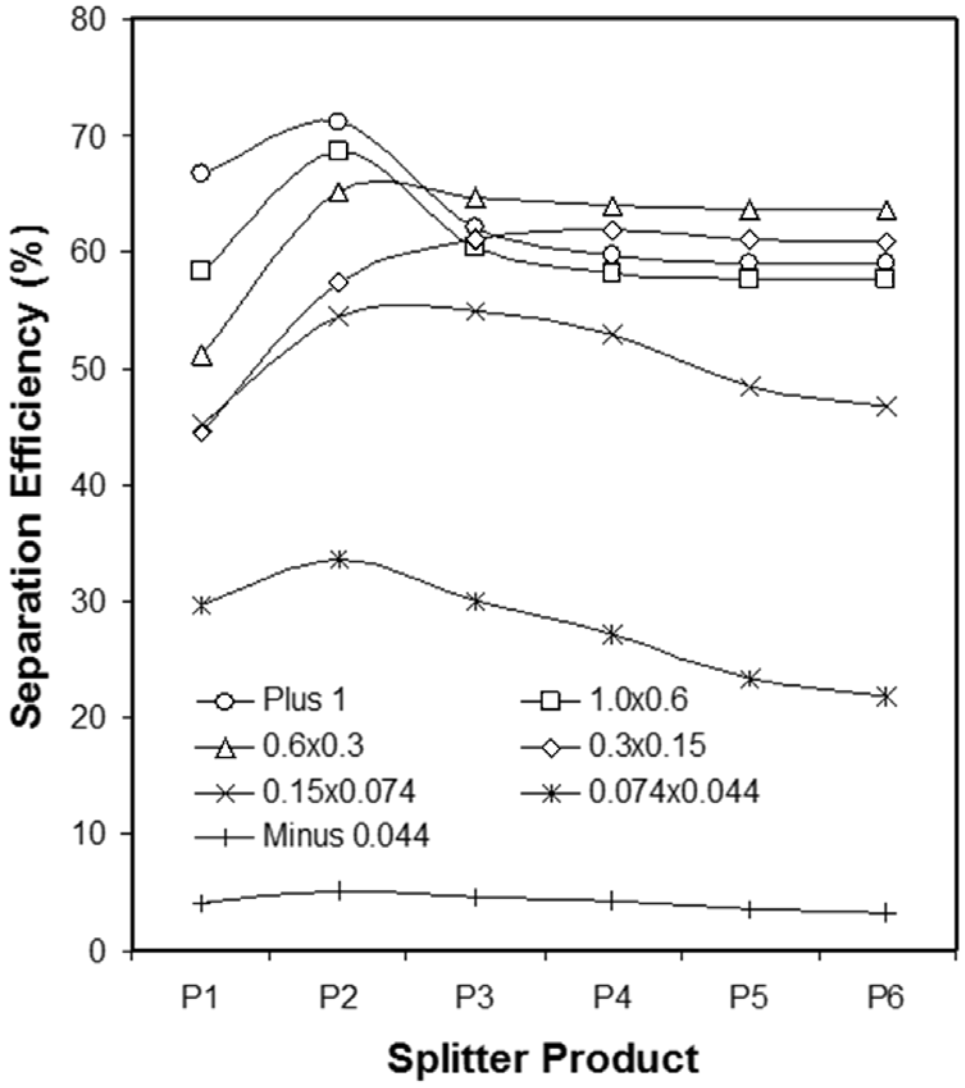


Figure 3.5 Size-by-size separation efficiency versus splitter position for a spiral separator operated at standard recommended slurry flow and dry solids tonnage rates.

The performance data plotted in Figure 3.4 and Figure 3.5 indicate that high levels of separation were achieved for size classes greater than 0.3 mm (50 mesh) for the combined products of “P1” and “P2”. A significant drop-off in performance occurs for all size classes less than 0.15 mm (100 mesh), and a substantial deterioration is noted for solids finer than 0.074 mm

(200 mesh). These results were not unexpected since spirals are typically utilized to upgrade coal feeds in the 1 x 0.15 mm size range. It is also interesting to note that the separation efficiency for the 0.3 x 0.15 mm size class is comparatively low for products collected from splitter positions “P2” and lower, but improves substantially as middlings products “P3” and “P4” are added to the combined clean coal product (Figure 3.5). The high separation efficiency is largely driven by the very high combustible recovery obtained for this size fraction when collecting products “P1” through “P4”.

Figure 3.6 shows the size-by-size effect on separation efficiency of reducing the spiral volumetric feed flow rate to only 5.7 m^3/hr (25 GPM). When compared to the plot (Figure 3.5) for the higher flow rate of 8.6 m^3/hr (38 GPM), the reduction in flow resulted in substantial decreases in the separation efficiency of solids in the plus 1 and 1 x 0.6 mm size classes reporting to the middlings and reject streams (“P3” through “P6”). Close examination of the experimental data indicated that the efficiency reduction was due to the loss of coarser coal particles resulting from that shift of volumetric flow to a lower point in the spiral trough. In other words, the lower flow rate reduced the density cutpoint for the coarser solids to a value lower value. A similar large decline in separation efficiency was not observed for coarser solids in the clean products represented by products “P1” and “P2”, although a small reduction in separation efficiency did occur. Only slight changes in separation efficiency were observed for solids of intermediate size ranges of 0.6 x 0.3 mm and 0.3 x 0.15 mm. On the other hand, the lower flow rate resulted in significant increases in separation efficiency for finer solids in the 0.15 x 0.074 mm and 0.074 x 0.044 mm size fractions. As such, the data suggests that lower flow rates are preferred for the separation of finer solids (<0.15 mm), while larger flow rates are preferred for the upgrading of coarser solids (>0.3 mm). However, since most coal feeds to spirals are

typically shifted to the coarser end of the size distribution, it is recommended that most plants be operated at higher flow rates of 8.6 to 8.8 m^3/hr (38-40 GPM) to avoid efficiency losses.

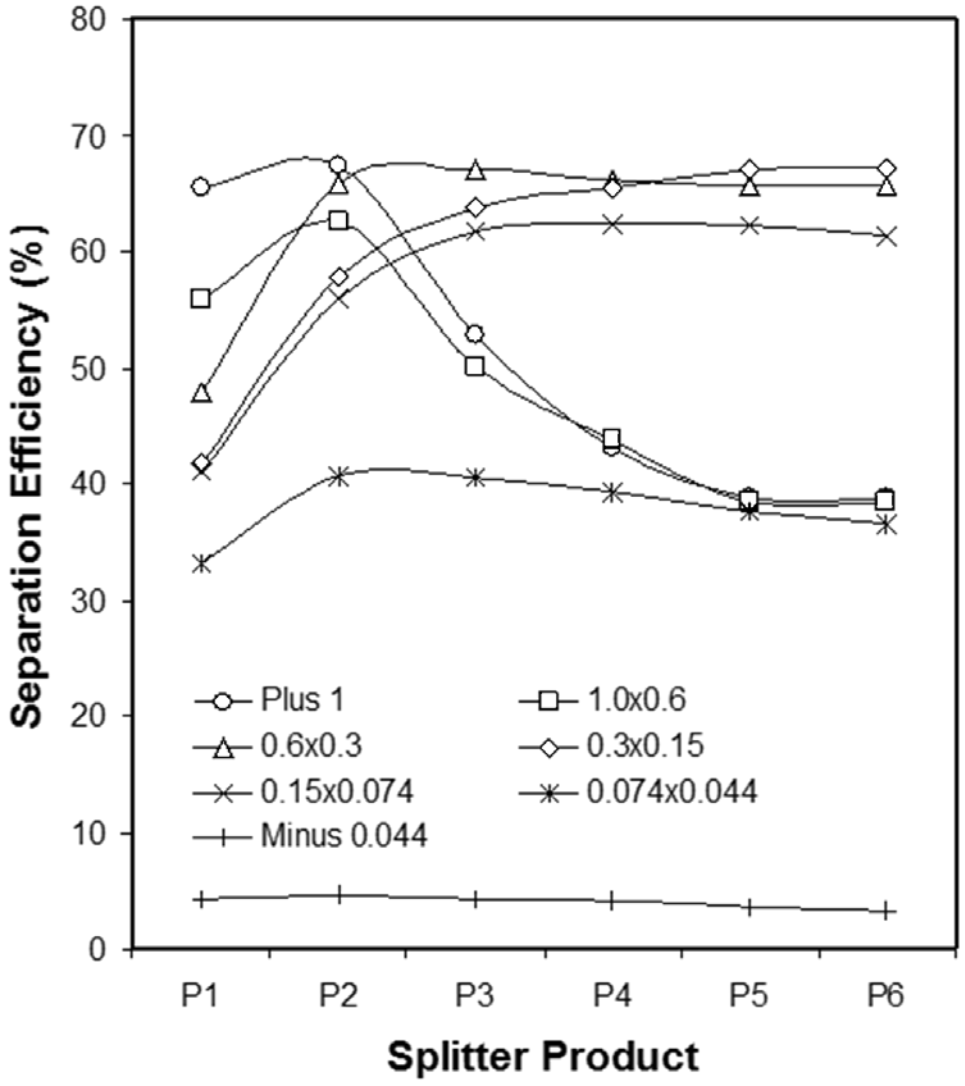


Figure 3.6 Size-by-size separation efficiency versus splitter position for a spiral separator operated under a low volumetric slurry flow rate.

3.5.2 *Water-Only Cyclone Testing*

Figure 3.7 and Figure 3.8 show the size-by-size separation performance of the water-only cyclone evaluated in the pilot-scale tests. In this particular case, the water-only cyclone was operated at three different feed solids contents ranging from a low of 8% to a high of 15%. In general, poorer separation efficiencies were observed for the water-only cyclone across all size fractions when compared to the spiral separation curves. One explanation for the lower separation efficiencies was that the geometry of the water-only cyclone was not ideally optimized for the type of feed coal used in the pilot-scale test program. On the other hand, the experimental data from this test program and others reported in the literature do indicate that high separation efficiencies are more difficult to maintain using this technology. The data show large variations in separation efficiency across each size fraction, suggesting that the density cutpoint for each size fraction declines sharply as particle size increases. This notable difference in performance is probably a major contributing factor in the historical shift in operator preferences from water-only cyclones to spirals over the last several decades in the U.S. coal preparation industry. Still, acceptable separation efficiencies in the range of 35-40% were achieved for the coarsest size fractions (>0.6 mm) when operating at the water-only cyclone at the highest feed solids content of 15%. It should be noted, however, that the efficiency declined sharply as the feed solids content dropped from 15% solids to 12% and further to 8% solids. This finding was not unexpected since the reduction in feed solids content shifted the operation of the cyclone from that of a density-based separator to that of a particle size separator (i.e., classifying cyclone). As such, the data collected under the current test program suggest that water-only cyclones should not be operated as a standalone process due to the inability of this process to simultaneously maintain good separation efficiencies across all size fractions. In addition, to

avoid coal losses and/or poor clean coal qualities, great care should be used to ensure that an optimum feed solids content is maintained at all times when water-only cyclones are backed up in multi-stage cleaning circuits with other separation technologies such as spirals.

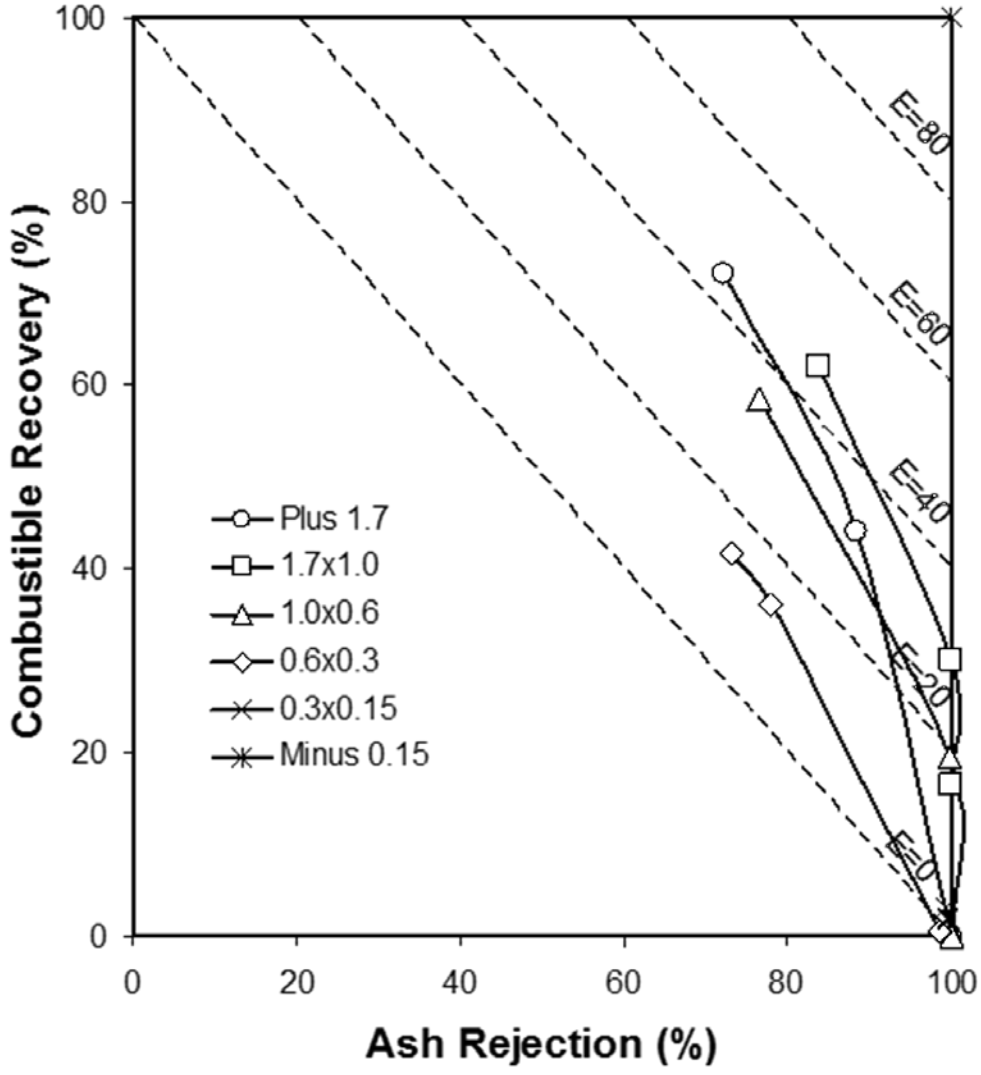


Figure 3.7 Size-by-size separation curves for a water-only cyclone operated at different feed solid contents.

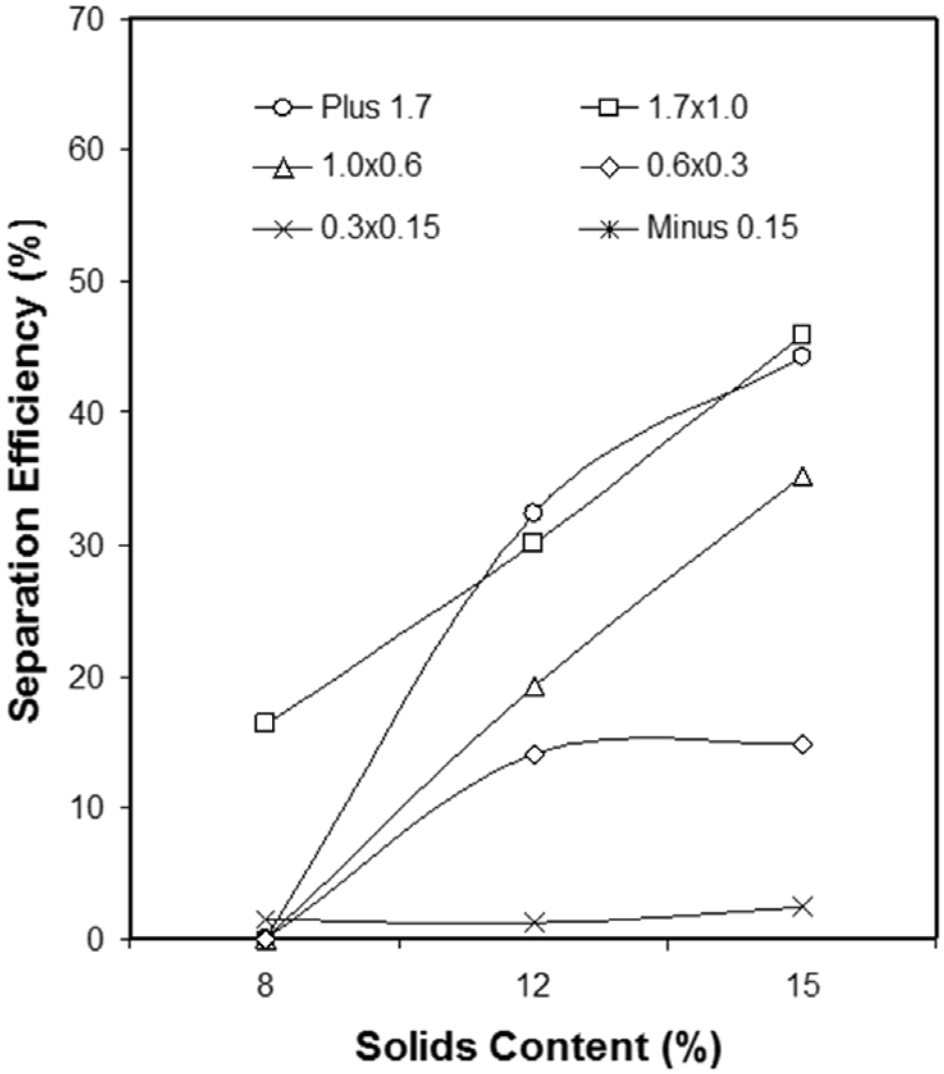


Figure 3.8 Size-by-size separation efficiency versus feed solids content for a water-only cyclone.

3.5.3 ***Teeter-Bed and HydroFloat Testing***

The size-by-size separation performance obtained from the comparative testing of two types of teeter-bed separators is plotted in Figure 3.9 and Figure 3.10. Teeter-bed separators use elutriation water injected through a series of distribution pipes in the bottom of the unit to create a fluidized “teeter bed” of suspended particles. The small interstices within the bed create high

interstitial liquid velocities that resist the penetration of the slow settling particles. As a result, small/light particles accumulate in the upper section of the separator and are eventually carried over the top of the device into a collection launder. Large/heavy particles, which settle at a rate faster than the upward current of rising water, eventually pass through the fluidized bed and are discharged out one or more restricted ports through the bottom of the separator. The HydroFloat is a special type of teeter-bed separator in which small air bubbles are also injected to avoid the loss of larger high-mass particles to the underflow, which is not uncommon for teeter-bed separators. In the current test program, the teeter-bed units were tested at three different elutriation water rates. Only the best set of test data is shown for the standard teeter-bed unit. Each unit was configured to run under operational conditions as recommended by the equipment manufacturer.

The data plotted in Figure 3.10 shows that the standard teeter-bed separator was capable of providing high separation efficiencies above 60% for size classes larger than 0.6 mm. In fact, the solids contained in the 1.7 x 0.6 mm size fraction where cleaned at a separation efficiency of about 74%, which exceeded the separation efficiencies obtained using the spiral technology. The separation efficiencies were generally further improved when using the HydroFloat technology. In particular, the separation efficiency of the coarsest material in the plus 1.7 mm fraction increased from about 64% to nearly 82% using the HydroFloat separator, while the separation efficiency for the 1.7 x 1.0 mm fraction increased from 74% to just over 80%. The data suggest that the injection of air into the teeter-bed reduced the likelihood that coarser high-mass particles would report to the underflow stream and be rejected, i.e., it increased the density cutpoint for the coarser size fractions. Relatively little difference in separation efficiency was noted between the two technologies for particles contained in the 1 x 0.6 mm size fraction. Surprisingly, the

HydroFloat also provided substantially higher separation efficiencies for finer solids contained in the 0.6 x 0.3 mm size fraction. The reason for the 10-15 point increase in separation efficiency for this size fraction is currently not well understood. Finally, very poor separation efficiencies were observed for both technologies for particles smaller than about 0.3 mm. Solids in these fine size classes are too small to pass through the fluidized bed of suspended solids, and report to the overflow regardless of quality.

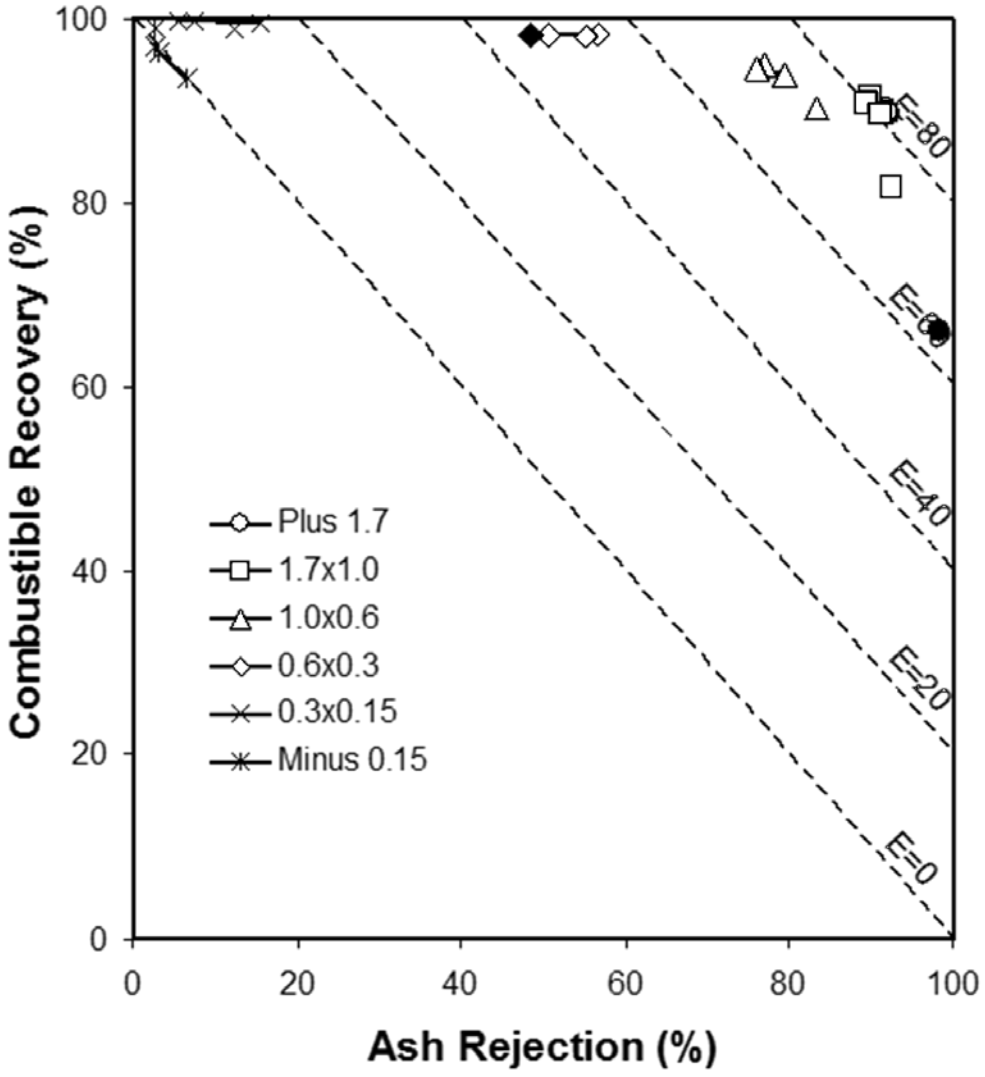


Figure 3.9 Size-by-size separation curves for a conventional teeter-bed separator (filled symbols) and HydroFloat separator (open symbols) run at different dry solids feed rates.

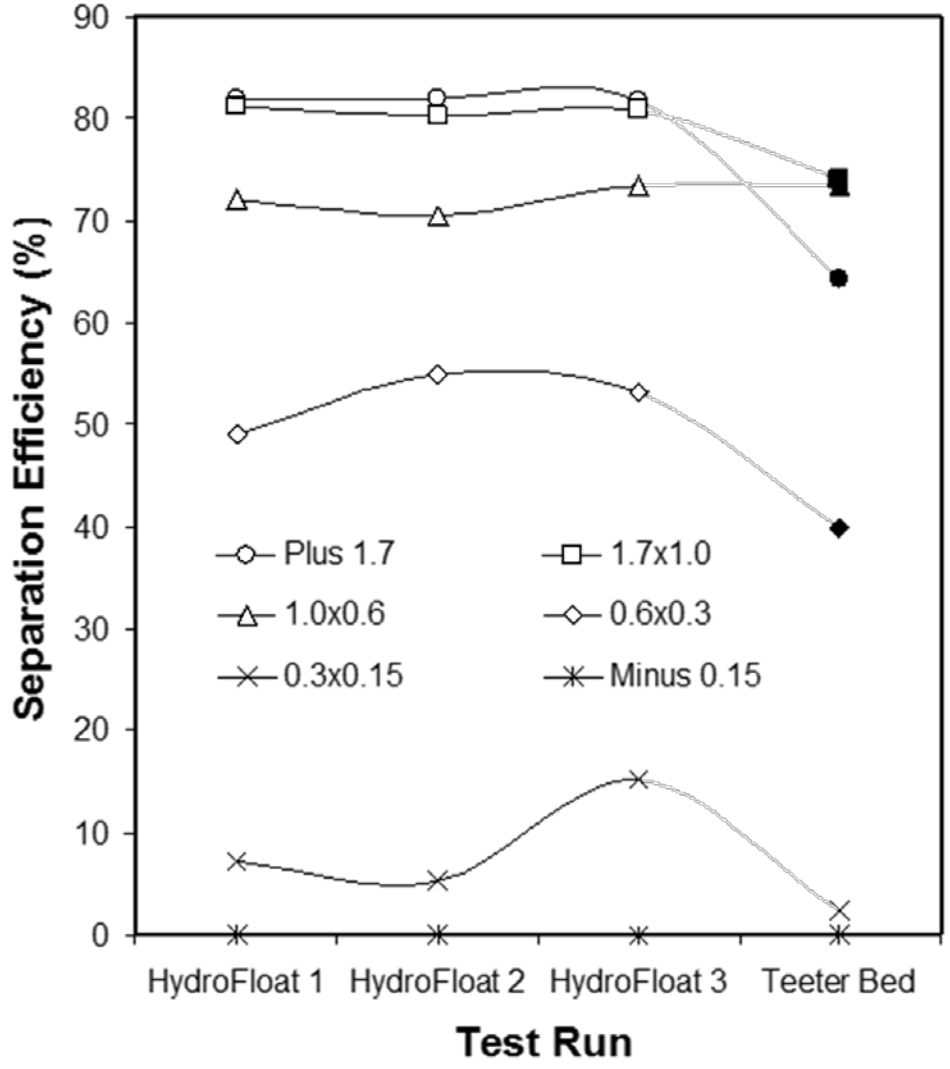


Figure 3.10 Size-by-size separation efficiency for a conventional teeter-bed separator (filled symbols) and HydroFloat separator (open symbols) run at different dry solids feed rates.

3.5.4 ***Froth Flotation Testing***

The last set of size-by-size performance data was obtained using a laboratory froth flotation machine (Denver Model D-12). The tests were conducted using a 2-liter laboratory cell using 20 ppm of MIBC frother and 15 ppm of diesel fuel collector. For flotation times of 1

minute or greater, the test data surprisingly indicate that very good separation efficiencies of near 70% could be obtained for particles in the coarse size ranges of 1 x 0.6 mm and 0.6 x 0.3 mm. For all other size classes, somewhat lower separation efficiencies of 60-64% were obtained. Unfortunately, practical experience suggests that the high separation efficiencies obtained in the laboratory tests for particles larger than 0.6 mm would probably not be possible in a full-scale industrial application (Moxon et al., 1988; Laskowski et al., 2007). Larger cells used in industrial applications are typically unable to recover larger particles due to froth transport problems. On the other hand, experience indicates that laboratory performance data obtained for particles finer than 0.3 mm can typically be duplicated in industrial scale machines. Therefore, the data obtained for particles larger than 0.3 mm from the laboratory tests should be substantially discounted (perhaps by 30-50%) when compared to the other data reported in this study.

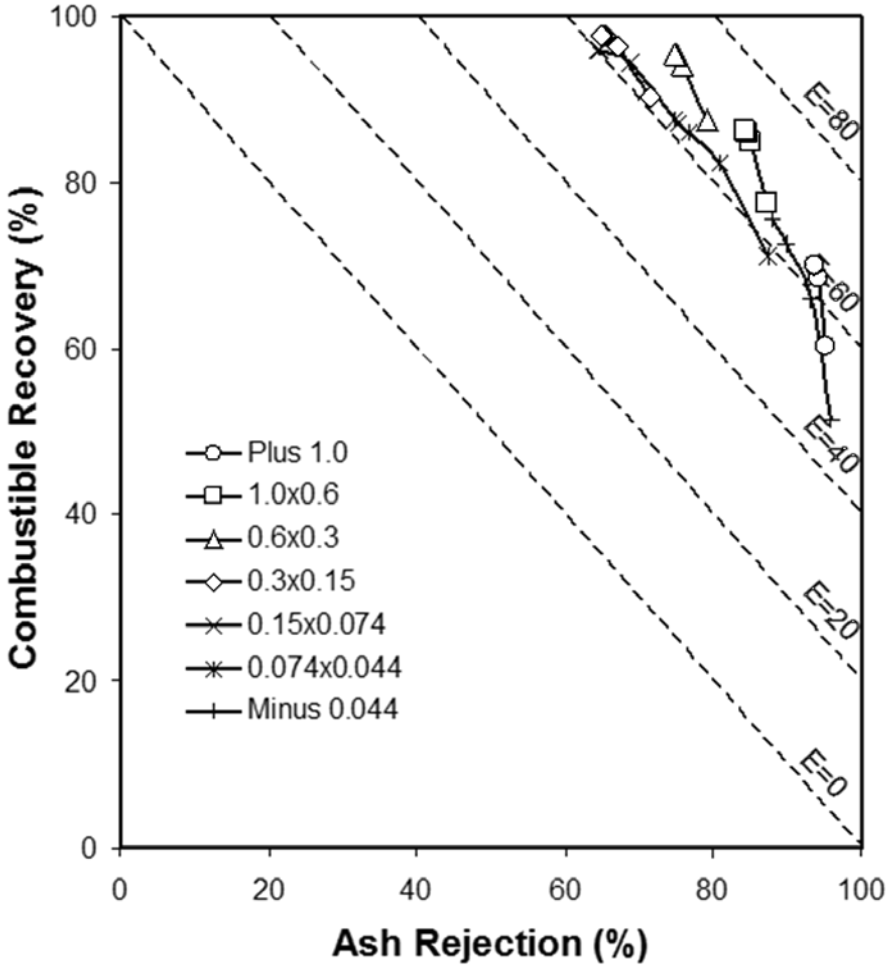


Figure 3.11 Size-by-size characteristic separation curves for a timed kinetics test run with a laboratory froth flotation machine (15 ppm collector and 20 ppm frother).

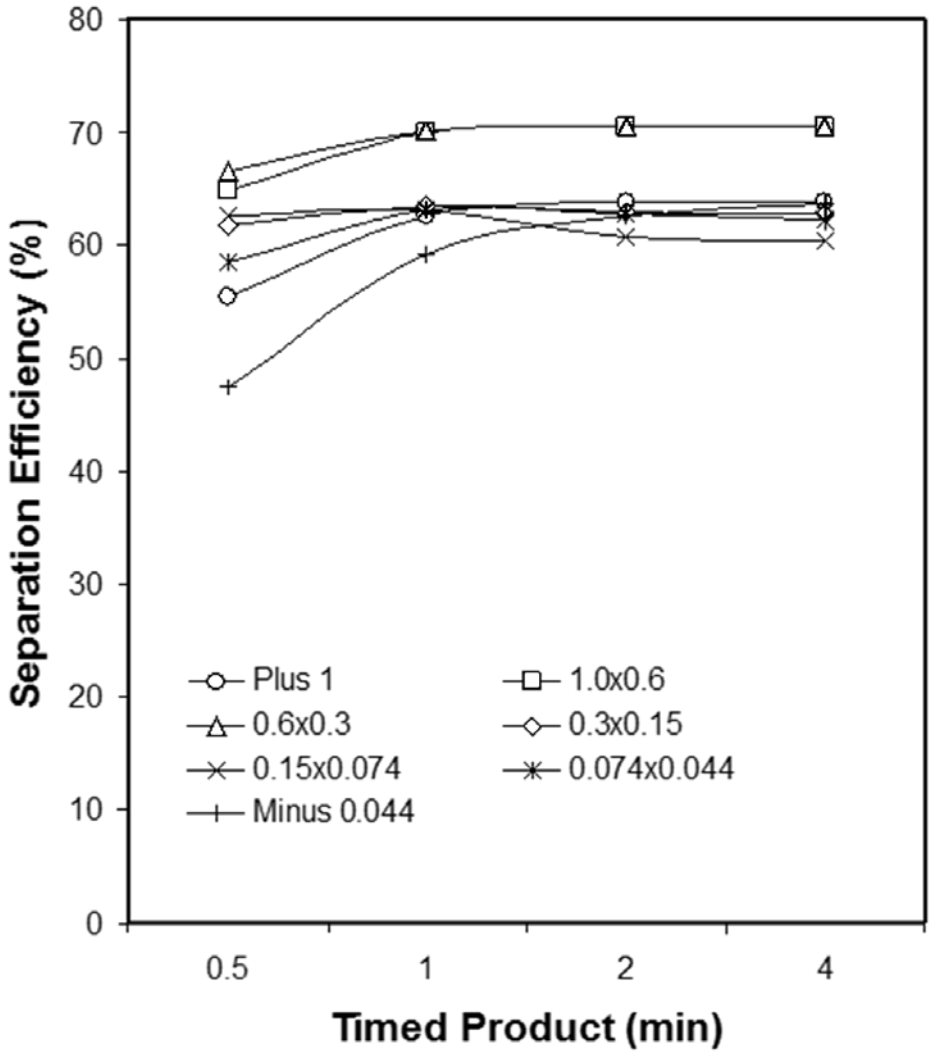


Figure 3.12 Size-by-size separation efficiency for a timed kinetics test run with a laboratory froth flotation machine (15 ppm collector and 20 ppm frother).

3.6 Discussion

Figure 3.13 compares the size-by-size separation efficiencies of the different fine coal cleaning processes evaluated in this study. The separation efficiencies were selected from the various experimental test runs and operational conditions to represent the "best" levels of performance believed to be realistically attainable for each technology operated as a single-stage

unit. The feed size distribution evaluated in each unit ranged from a top size of 2.3 mm down to a bottom size of zero. It should also be noted that two sets of spiral data are included in the comparison plot for feed top sizes of 2.3 and 1.0 mm, respectively. This step was necessary since the removal of 2.3 x 1.0 mm solids from the spiral feed was found to provide a significantly improved separation efficiency curve that needed to be considered in the process comparison.

Several interesting observations can be made from the comparative performance data. For example, the data show that several different processes appear to be capable of providing good separation efficiencies for particles larger than 0.6 mm. These units include spirals, teeter-bed and HydroFloat separators. Of these, the HydroFloat tended to be the most robust at maintaining the separation efficiency as the particle size increased into the plus 1.7 mm size range. The injection and attachment of small air bubbles to the coarser coal particles avoided the decline in recovery and corresponding reduction in separation efficiency that occurred in the standard teeter-bed separator operated without air injection. Unfortunately, the performance of the teeter-bed units (standard and HydroFloat) dropped sharply from about 70-75% down to 45-55% for the 0.6 x 0.3 mm size class and down to unacceptably low values of less than 20% for the 0.3 x 0.15 mm size class. Particles finer than 0.3 mm are simply too small to overcome the interstitial velocity of fluid in the teeter-bed and report to overflow regardless of quality. In contrast, the spiral tended to maintain a reasonably good separation efficiency in the range of 55-60% for the size class as small as 0.3 x 0.15 mm. As such, spirals appear to be a very good choice for treating feeds with a large proportion of solids in the 1 x 0.6 mm and 0.6 x 0.3 mm size ranges.

As should be expected, the experimental results also demonstrated that froth flotation should be the preferred technology for upgrading particles finer than 0.3 mm and the only realistically viable process for upgrading particles finer than 0.15 mm. Above a critical particle

size of about 0.3 mm, flotation performance diminishes due to the inability of commercial machines to effectively recovery larger particles as a result of issues associated with pulp-froth transport. Interestingly, spiral separators appear to be almost as good as flotation for the 0.3 x 0.15 mm size fraction, so the decision as to whether to treat this size class by flotation or by spirals would partially depend on site specific considerations such as the inherent floatability characteristics of the feed coal. For example, flotation may be the most attractive approach for treating the 0.3 x 0.15 mm fraction for a high-rank easily floated coal, while spirals may be a much better choice if the feed material in this size fraction responds poorly to flotation due to poor floatability as a result of factors such as weathering and surface oxidation. With the exception of spirals, none of the other density-based processes examined in this study provided separation efficiencies higher than about 15-20% for particles smaller than 0.3 mm. As such, these processes are not recommended for this size range or for feeds containing a large portion of solids in this size range.

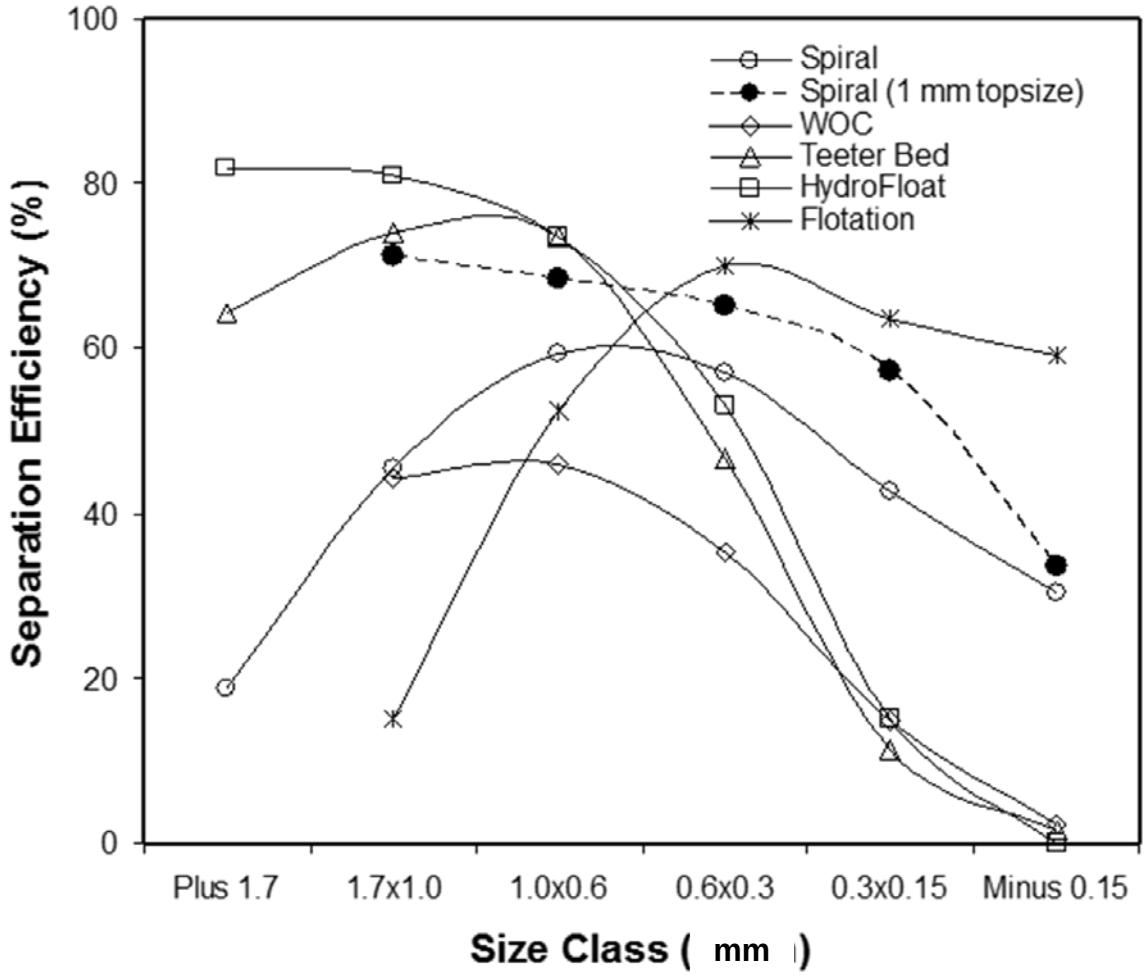


Figure 3.13 Comparison of size-by-size separation efficiencies for different fine coal cleaning processes. (Note: Flotation performance de-rated to reflect industrial capabilities for coarser size fractions).

3.7 Conclusions

Several alternative processes for cleaning fine coal were evaluated in laboratory-, bench- and pilot-scale test programs. For fairly comparison, each process was tested on the coal feed from the same source and the performance of each technology was compared based on separation efficiencies derived from combustible rejection versus ash rejection plots. The resultant data suggest, for the particular coal investigated in this study, that the most effective

processes for each size range were generally (i) froth flotation for feeds finer than about 0.3 mm, (ii) spirals for feeds sized to 1 x 0.3 mm, and (iii) teeter-bed systems (particularly the HydroFloat technology) for feeds larger than 1 mm. Water-only cyclones are not recommended as stand-alone units due to the potential for high coal losses when secondary back-up units are not available within the plant circuitry. The data also illustrate the importance of addressing site-specific factors during the design of optimal circuits, such as variations in feed characteristics (e.g., size distribution, coal washability, coal oxidation, etc.) and operator preferences (e.g., equipment and O&M costs, personnel capabilities/skills, maintenance requirements, etc.).

3.8 References

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CHAPTER 4 ENGINEERING DEVELOPMENT OF THE EXPANDED STAGE COMPOUND SPIRAL CIRCUIT

4.1 Abstract

An in-plant experimental study was performed to evaluate the separation performance of five different spiral circuit configurations. The spiral circuit feed consisted of nominal 1 x 0.15 mm particles from the underflow of a bank of classifying cyclones. The experimental data obtained from the in-plant study was mass balanced using spreadsheet-based routines, evaluated and compared for separation efficiency, clean coal yield, organic efficiency and combustible recovery. On the basis of this investigation, it was determined that the best performance could be achieved using a new four-stage circuit in which the clean coal passes through all four stages, high-ash refuse is removed after each of the four stages, and middlings from the second and final stages are recycled back to the original feed. This circuit provided the best separation efficiency, cumulative clean coal yield and combustible recovery among all the other spiral circuits tested. At the same clean coal ash, the new spiral circuit increased the cumulative clean coal yield by 1.9 % as compared to that achieved using the existing two-stage compound spiral currently installed at the plant. The experimental work also proved that the repluping after two turns of spirals is not effective in improving separation performance.

4.2 Introduction

The past two decades has witnessed widespread use of spirals to clean fine (1 x 0.15 mm) coal. Modern coal preparation plants incorporate spiral separators in a variety of different circuit configurations. The literature contains numerous studies that have examined the effects of spiral design variables (such as spiral construction, spiral pitch and diameter, and spiral length) and

spiral operating variables (such as feed percent solids, dry feed rate and volumetric flow rate) on the spiral separation efficiency. Unfortunately, comparatively little research has been conducted to optimize spiral circuitry in relation to separation efficiency. Perhaps the first studies on coal spiral circuitry were started in 1992 when Holland-Batt came up with the idea of rotating spirals. This research proposed that separation efficiency could be improved by rotating the downward volumetric flow on the spiral trough. In rotating spirals, one or more additional forces were acting on the flowing film of particles, which results in a better separation process (Holland-Batt, 1992). It was found that separation efficiency of fine feed particles increases from a spiral flow that rotated over itself but, unfortunately, little or no improvement was found for the coarser feed particles (Kohmuench, 2000).

During the late 1990's, researchers at Virginia Tech utilized the linear circuit analysis technique to improve the separation efficiency of a spiral circuit. They concluded that a reduced gravity cut point and improved separation efficiency could be achieved with a rougher-cleaner spiral circuitry (Figure 4.1), provided that the middlings were recycled back to the spiral circuit feed (Luttrell et al., 1998). The invention of the compound spiral was another important milestone in the coal spiral circuitry. The compound spiral is essentially a two-stage spiral where a short primary spiral and a short secondary spiral are mounted around the same central column. After initial separation on primary spiral, reject is removed through a primary refuse cutter and the remaining slurry is captured, remixed and reintroduced on the following secondary spiral. Finally, after a recleaning stage on secondary spiral, the products are collected as clean coal, middlings and secondary refuse by diverting the flow through appropriate product splitters. Both primary and secondary refuse are discarded, while the middlings are discarded, added to the cleaned coal product, or recycled back with the original spiral feed, depending on the spiral

circuit configurations and/or specifications of product quality. Apart from a good separation efficiency and a lower cut point, other advantages of compound spiral circuitry includes no need for interstage pumping from the primary to secondary spirals, higher recovery as compared with to that of conventional spirals and reduced floor space requirements since compound spirals are stacked in banks (MacNamara et al., 1995; Weldon et al., 1997).

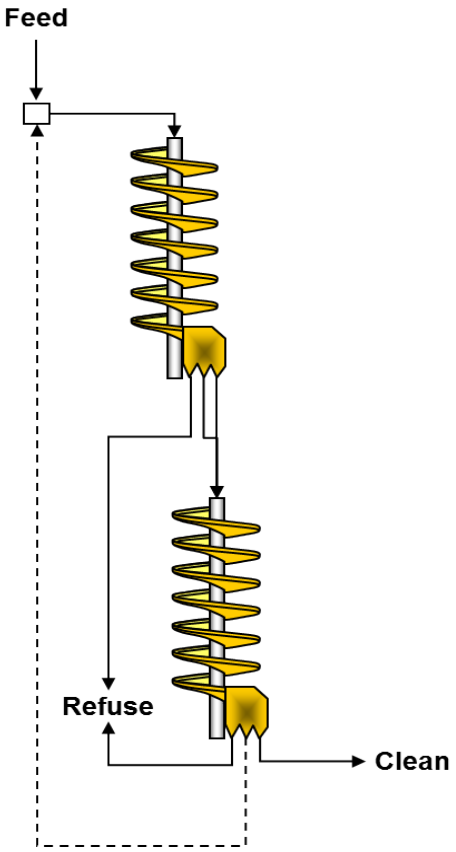


Figure 4.1 Rougher cleaner spiral circuitry (Luttrell et al., 1999).
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4.2.1 *Previous Work*

For the past several years, considerable experimental work focused on improving fine coal cleaning circuitry has been conducted by researchers at Virginia Tech. Some of the

processes investigated during this time included compound spirals, water-only cyclones, teeter bed separators and froth flotation. The compound spiral work utilized a modular test rig that was equipped with a specially designed product collection box. This arrangement made it possible to collect six different product samples simultaneously across the profile of second stage spiral. Figure 4.2 shows the positions of these fixed location splitters relative to their distance from the central support column. Product “SC1” represents the cleanest product taken at the outer most position across of the secondary spiral, whereas “ST2” represents the highest ash product taken at the inner most position near the central column.

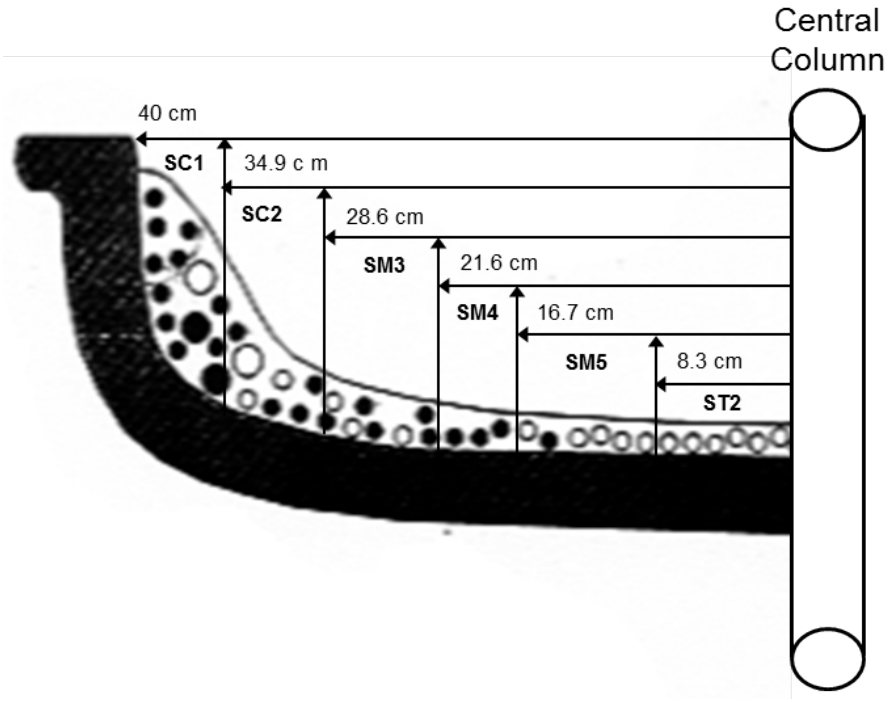


Figure 4.2 Schematic diagram showing products splitter positions from central column of a compound spiral.

Figure 4.3 provides actual separation efficiency curves for one of the experiments conducted using the compound spiral test rig. The data shows that the separation efficiency at splitter position “SC1” is substantially lower than the separation efficiency for the same size class at splitter position “SC2”. A dashed oval shape is drawn in Figure 4.3 to show this unexpected decrease in the separation efficiency at position “SC1”. In other words, the clean coal product collected at position “SC1” contained more misplaced rock particles than the product collected at position “SC2”. This work verified that some unwanted high-ash particles of rock are trapped in the outer high velocity flow region of a spiral separator.

To improve the separation performance of a spiral circuit, five different full-scale spiral units were installed, experimentally tested and compared in an industrial coal preparation plant. The separation performance of each spiral circuit was evaluated by comparing size-by-size separation efficiencies, cumulative clean coal yields, organic efficiencies and combustible recoveries. This article describes the layout of all five spiral circuits, provides details related to the experimental test program, and summarizes the test results obtained from the comparative evaluation of the separation performance of all the experimentally tested spiral circuits.

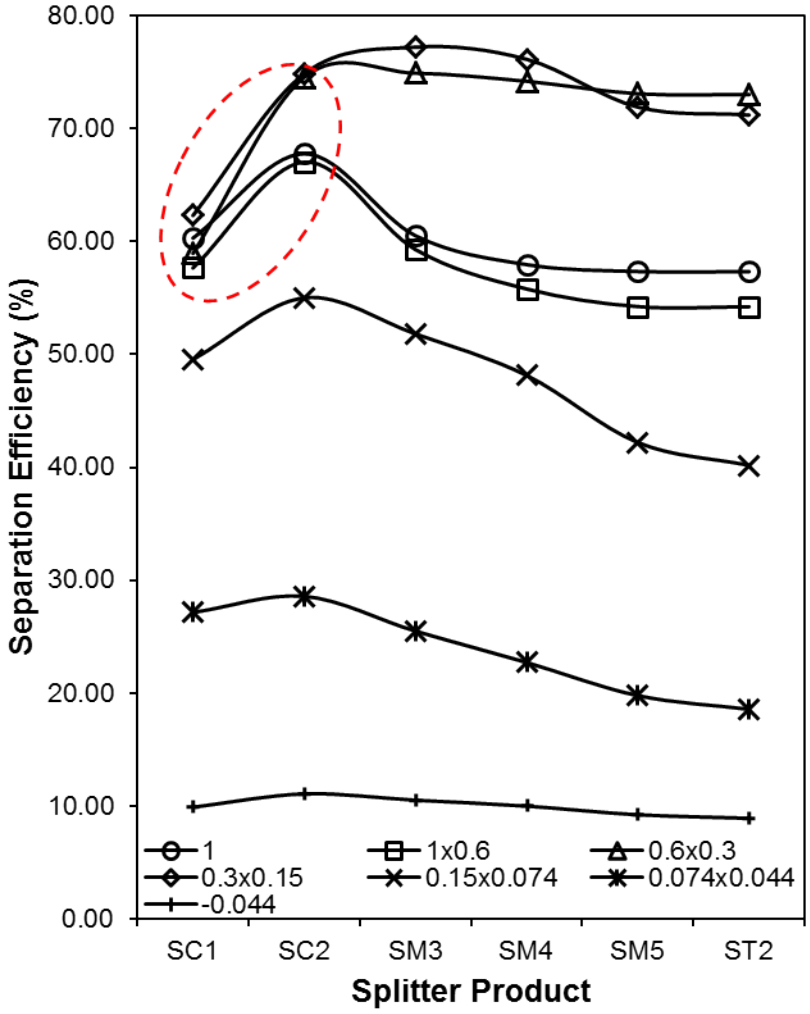


Figure 4.3 Size by size separation efficiency at different splitter positions for a compound spiral.

4.3 Experimental

4.3.1 *Site Description*

The Cardinal coal preparation plant (Figure 4.4), which is located near the town of Sharples in Logan County, West Virginia, was selected for the experimental testing program. This plant has the latest technology for automated operations and control systems, which includes a microprocessor-based controller, automatic batch load-out systems, and a nuclear



Figure 4.4 Cardinal Preparation Plant, WV.

online ash analyzer. The plant incorporates three identical 700 TPH capacity modules. The coal feed consists of high-quality bituminous coal mined from nearby areas. A double-deck banana screen sizes the run-of-mine feed coal at 12 mm on the top deck and then at 1 mm on the bottom deck. The coarse feed goes to dense medium vessels and dense medium cyclones for density separation. The fine (-1 mm) coal processing circuit consists of classifying cyclones, spirals, flotation columns and screenbowl centrifuges. The spiral circuit, which was the focus of the current investigation, is fed with fine (1 x 0.15 mm) coal from a bank of 15-inch diameter classifying cyclones. The cyclone underflow passes into a distributor that simultaneously feeds six sets of triple-start compound spirals. The middlings from the spiral circuit is recycled back to the spiral feed (Figure 4.5). Column flotation is used to process deslimed (0.15 x 0.044 mm) feed coal, while the ultrafines (0.044 mm x 0) is discarded as waste. Finally, the combined deslimed spiral and column flotation concentrates are mixed together and dewatered using several 42 x 144-inch screenbowl centrifuges (Bethell and DeHart, 2006).

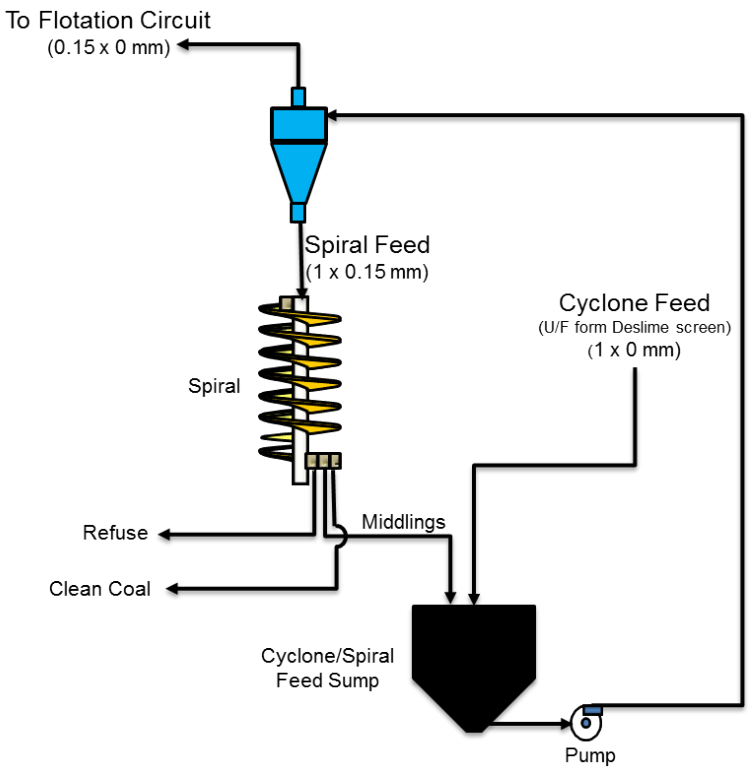


Figure 4.5 Spiral circuitry to process fine (1 x 0.15 mm) coal (Cardinal Plant).

4.3.2 ***Material***

All the spiral circuit configurations were tested using commercial scale (1 m diameter) compound spirals (Multotec SX7). The test rig incorporated a four-turn primary rougher spiral followed by a three-turn secondary cleaner spiral wound around a common central column. After four turns, the primary refuse was discharged through a refuse cutter and the remaining slurry was remixed through an auxiliary repulping box. The unit was also equipped with a partitioned product collection box so that all the seven products across the profile of the secondary spiral could be collected simultaneously. Figure 4.6 shows the Multotec SX7 compound spiral and product collection arrangement. The position and distance of product splitters measured from the central column are the same as shown previously in Figure 4.2.

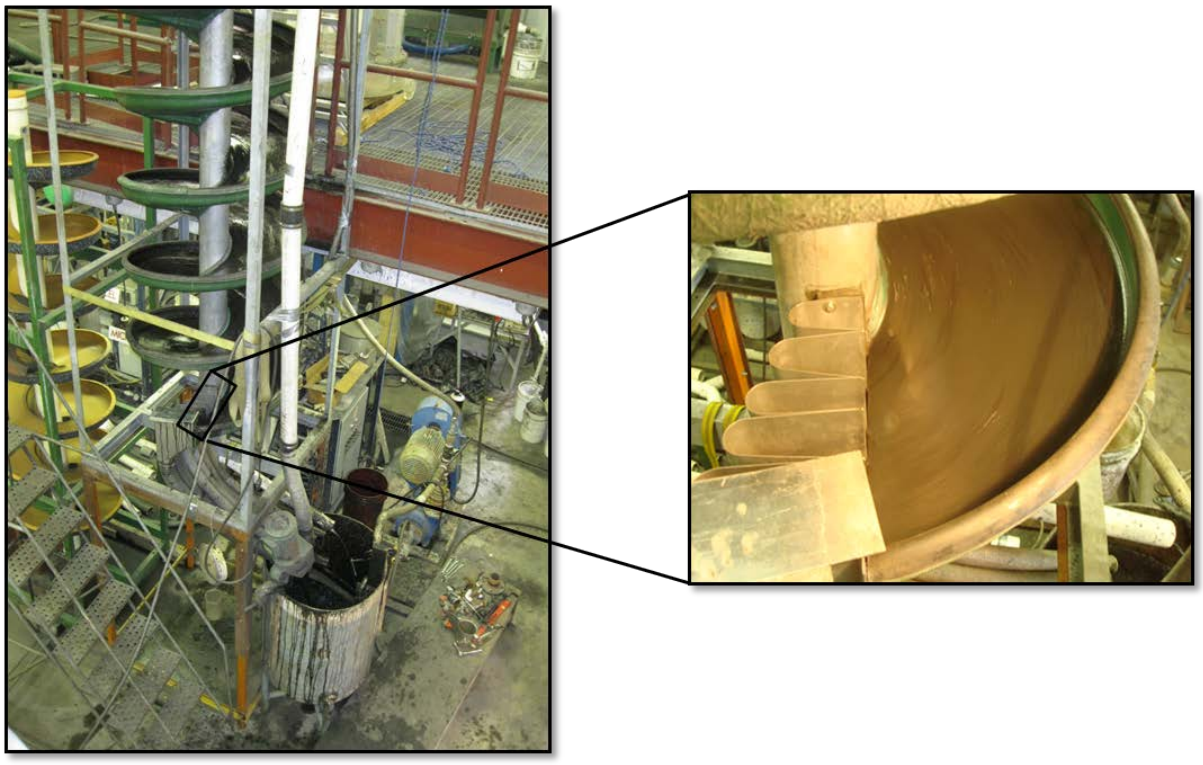


Figure 4.6 Compound spiral and its product collection arrangement.

4.3.3 ***Spiral Circuitry Notation***

To eliminate confusion associated with descriptions of complex spiral circuitry, a new and easy way of describing spiral configurations was developed and adopted in this study. The notation "1_{CTM}" consists of numbers and letters arranged in a specific order to describe a complete spiral circuit configuration. In this notation, the main number indicates the spiral number in the circuit, whereas separation products from a particular spiral are represented by the subscripts associated with that spiral number. The subscripts consist of three distinct alphabets and/or numbers. The first subscript represents the clean product, the second describes the tailings and the third designates the middling products of the spiral associated with these subscripts. An alphabetical subscript indicates that a particular product stream (clean, tailings middling) is

leaving the spiral circuit. A numbered subscript represents an internal stream and it also indicates the spiral number where the product stream (clean, tailings middlings) reports. The use of the value “0” in the subscripts indicates that no such stream exists. For example, consider the simple notation of “1_{CT0}”. In this case, the number “1” means that circuit consists of a single spiral unit. The subscripts C, T, and 0 represent the clean, tailings and middlings streams, respectively. Moreover, these subscripts also indicate that two products (clean and tailings) leave the spiral circuit and there is no middlings stream produced by the circuit.

Using this notation system, a standard compound spiral circuit (without middlings recycle back to the original feed) is represented by “$1_{2T0} + 2_{CTM}$”. The information that can be inferred from this notation is as follows.

- The spiral circuit consists of two spiral units.
- The designation “1_{2T0}” represents the first-stage spiral and “2_{CTM}” represents the second-stage spiral.
- The number “2” associated with the first-stage spiral indicates that the clean stream produced by this spiral is an internal stream that reports to the second-stage spiral.
- The letter “T” associated with the first-stage spiral indicates that the tailings leave the spiral circuit as an external product stream.
- The number “0” indicates that no middlings stream is produced by the first-stage spiral.
- The subscripts C, T and M associated with the second-stage spiral indicates that three product streams are produced by this spiral and leave the circuit as clean, tailings and middlings, respectively.

4.3.4 *Experimental Circuit Configurations*

An extensive experimental testing program was carried out on five different spiral circuit configurations using full-scale spirals. All the experiments were performed using standard spiral operating conditions, i.e., a volumetric slurry flow rate of 38-40 GPM and a dry solids feed rate of about 2.5-2.7 TPH per start. Table 4.1 shows the operating conditions for all experiments.

Table 4.1 Summary of the design and operating parameters.

Spiral Circuit Number	Design and Operating Parameters for all Spiral Circuits						
	Spiral Circuit Notation	Number of Spirals	Number of Turns Per Spiral	Feed Ash (%)	Feed Rate (TPH)	Feed Solids (%)	Feed Volume (GPM)
1	$1_{2T0}+2_{CT1}$	2	4-3	39.9	2.52	24.1	37.9
2	$1_{2T0}+2_{3T0}+3_{4T0}+4_{CT1}$	4	4-3-4-3	42.1	2.66	24.2	39.2
3	$1_{2T0}+2_{3T1}+3_{4T0}+4_{CT1}$	4	4-3-4-3	37.8	2.47	24.0	37.7
4	$1_{2T0}+2_{3T0}+3_{CT1}$	3	3-4-3	39.6	2.53	24.0	38.2
5	$1_{2T0}+2_{3T0}+3_{CT1}$	3	2-2-4	40.2	2.68	24.4	39.8

4.3.4.1 Spiral Circuit 1 ($1_{2T0}+2_{CT1}$ Circuitry)

First experimental run was carried out on the existing spiral circuitry used at the Cardinal coal preparation plant. The $1_{2T0}+2_{CT1}$ spiral circuitry employed a 4 turn primary spiral followed by a 3 turn secondary spiral, both connected to the same central column. An auxiliary repulping box along with a refuse cutter was installed at the fourth turn of first spiral. The refuse cutter was set to a distance of 9 inches measured from the outside of the central column. Feed slurry was introduced at the top of the first spiral unit and, after four turns, primary refuse was separated using a refuse cutter that passed the refuse down through the central column. The remaining slurry was remixed using a repulping box installed following the three-turn spiral unit. After passing the secondary spiral, six timed product samples were collected simultaneously with the

help of a specially-designed product collection box (Figures 4.2 and 4.6). The combined products SC1 and SC2 were clean products, while PT1 and PT2 were the tailings and SM3, SM4 and SM5 were the middlings. Clean coal form the second spiral was the final clean product, while refuse from both spirals were combined and rejected. Middlings from the second spiral was recycled back to the spiral feed. Figure 4.7(a) is a schematic illustration of this spiral circuit. The purpose of testing this circuit was to determine the separation performance of the existing compound spiral and to compare its separation efficiency with that of other four spiral circuits.

4.3.4.2 Spiral Circuit 2 (1_{2T0}+2_{3T0}+3_{4T0}+4_{CT1} Circuitry)

The second spiral circuit consisted of four short spirals that employed a $1_{2T0} + 2_{3T0} + 3_{4T0} + 4_{CT1}$ circuitry. The first and third spirals were four-turn spirals, whereas the other spirals in the circuit had three turns each. Figure 4.7(b) shows the flowsheet of this circuit. As shown, feed was introduced at the top of the first spiral, which flowed by gravity through the rest of the spiral circuit. At each spiral unit, refuse was separated and taken out of the circuit, while the remaining slurry was repulped before being fed to the next spiral. The clean coal stream collected from the fourth and final spiral was taken as the final clean product and the combined refuse from all the four spirals taken as the discard stream. The middlings from the fourth spiral were recycled back to the first spiral feed.

4.3.4.3 Spiral Circuit 3 (1_{2T0}+2_{3T1}+3_{4T0}+4_{CT1} Circuitry)

The third set of spiral experiments were conducted using a $1_{2T0} + 2_{3T1} + 3_{4T0} + 4_{CT1}$ spiral circuit (see Figure 4.7(c)). This circuitry was similar to the second spiral circuit in terms of the number and turns per spiral. The only difference between the two circuits was the separation of the second spiral middlings stream in this circuit. After passing the first spiral, refuse was

removed and the clean was repulped and retreated on the second spiral. The second spiral produced three distinct products, i.e., clean, refuse and middlings, by using appropriate product splitters. The second refuse was removed and clean was remixed with an auxiliary repulper and fed to the third spiral. Middlings from second spiral was permitted to flow by gravity back to the feed sump of the spiral circuit. Refuse from the third spiral unit was also separated and taken out of the circuit, while the clean stream was remixed before being fed to the fourth stage spiral. The final clean product was collected after the fourth spiral. The refuse products from all the four spirals were combined and discarded. Middlings from the fourth spiral were combined with the second spiral middlings and both were recycled back to the feed of spiral circuit. The purpose of testing this circuit was to assess the effect of recycling second stage spiral middlings on the overall separation efficiency of the second spiral circuit.

4.3.4.4 Spiral Circuit 4 (1_{2T0}+2_{3T0}+3_{CT1} Circuitry)

The fourth set of experiment runs was performed using a circuit that consisted of three short spirals. This 1_{2T0} + 2_{3T0} + 3_{CT1} circuitry used 3, 4 and 3 turns per spiral, respectively. The circuit layout is shown in Figure 4.8(a). The first spiral was fed fresh spiral circuit feed and the first and second spiral clean was remixed and repulped before being fed to the next spiral unit. The final clean product was produced by the third spiral unit, while the refuse from all of the three spirals were combined and discarded. The third spiral middling was sent back to the spiral circuit feed sump.

4.3.4.5 Spiral Circuit 5 (1_{2T0}+2_{3T0}+3_{CT1} Circuitry)

Finally, the fifth experiment was performed using a 1_{2T0} + 2_{3T0} + 3_{CT1} spiral circuit. Figure 4.8(b) shows the flowsheet for this spiral circuit. Both circuit configurations used in experiment numbers 4 and 5 were identical in terms of their layout, but differed in terms of the number of turns per spiral. Both circuits consisted of three spirals, but the fifth circuit had only two turns per spiral for the first two spiral units. Three turns were used on the third spiral of this circuit. Slurry feed was introduced at the top of the first spiral and, after passing the first spiral, refuse was separated and the remaining slurry was remixed and retreated on the second spiral unit. Again, the second spiral refuse was separated and the remaining slurry was repulped and rewashed on the third spiral unit. Clean product from the third spiral was taken as final clean product and the middlings were recycled back to the feed of spiral circuit. Refuse streams from all the three individual spiral units were discarded. The purpose of testing spiral circuits number 4 and 5 were to determine the optimum number of turns before repulping the slurry.

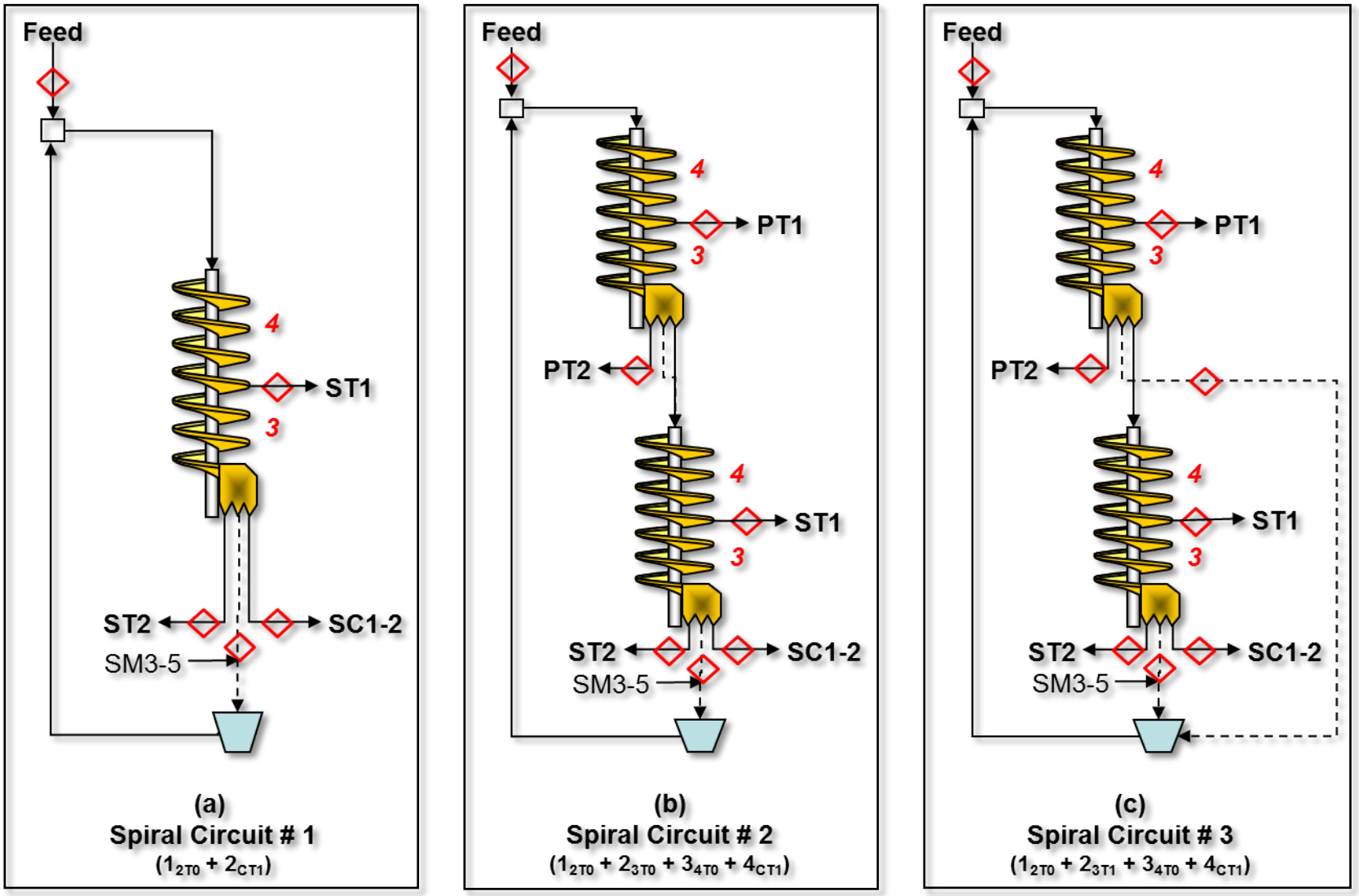


Figure 4.7 Schematic diagrams of different spiral circuitries experimentally tested at Cardinal preparation plant.

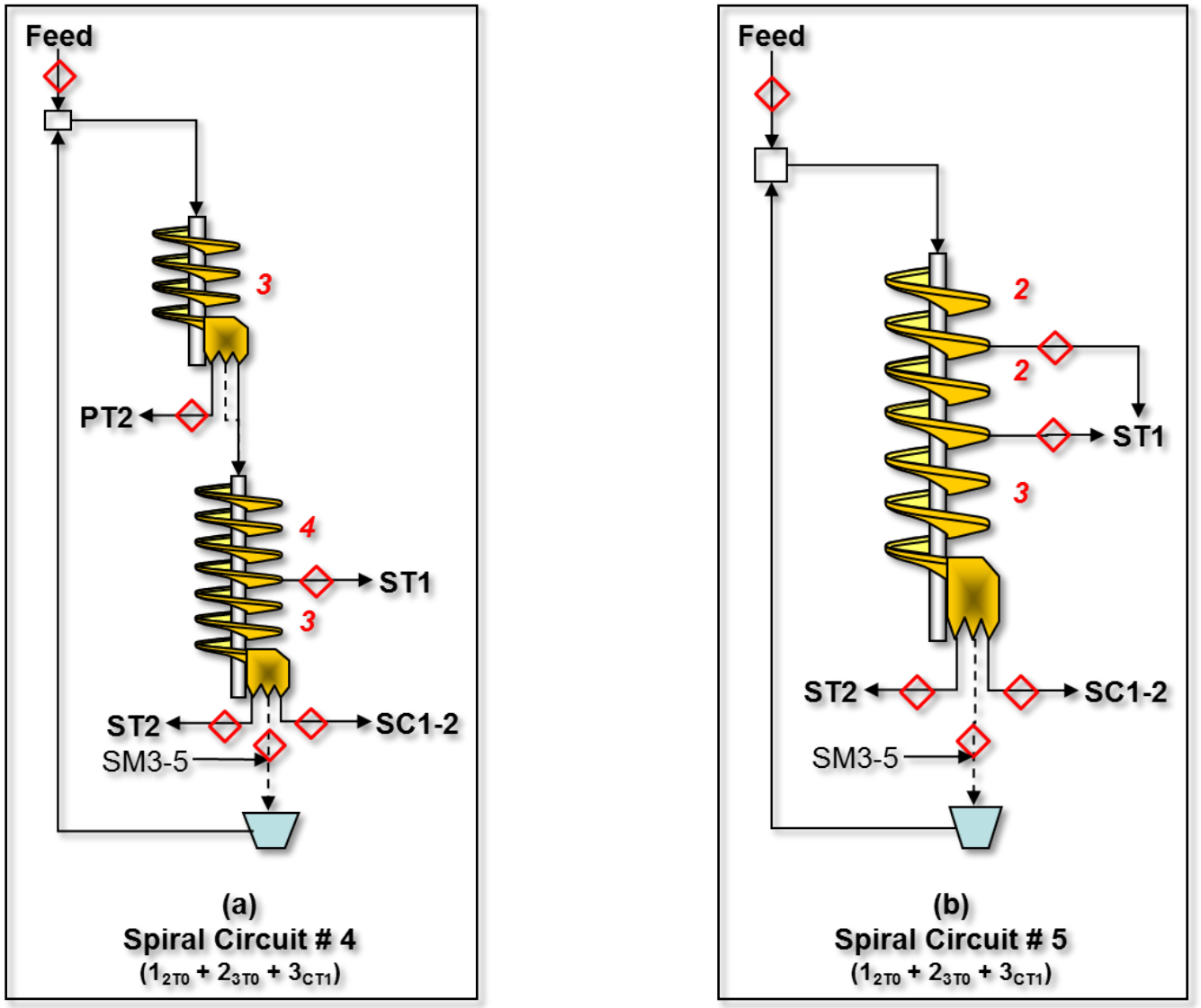


Figure 4.8 Schematic diagrams of different spiral circuitries experimentally tested at Cardinal preparation plant.

4.3.5 ***Procedure***

For all testing work, the coal feed consisted of nominal 1 x 0.15 mm size particles. As shown in Figure 4.5, the minus 1 mm fraction of raw coal that passes through the raw coal deslime screen was pumped to a bank of 15-inch diameter raw coal classifying cyclones. The cyclone underflow (1 x 0.15 mm) was directed to the spiral feed sump where it was diluted to the correct percentage of solids before being fed to the spiral circuitry. The spirals feed slurry was first introduced to a distributor that over flowed into six sets of triple-start compound spirals. One feed line from the distributor was used to feed the experimental spiral circuits used in this study. A sampling port was also provided in the feed line so that a representative feed sample could be collected. After passing through the spiral circuit the slurry stream was diverted into appropriate sample containers and timed samples of all the products were collected. A total of 46 samples were collected during this test program (i.e., 8 samples form first test, 10 from second test, 11 from third test, 9 from fourth test and 8 samples from fifth test). Sampling points are shown by diamond symbols in Figure 4.7 and Figure 4.8. After weighting the feed and product slurry samples, the products were subjected to wet-sieve analysis. Each sample was partitioned into seven distinct size classes, i.e., +1 mm, 1 x 0.6 mm, 0.6 x 0.3 mm, 0.3 x 0.15 mm, 0.15 x 0.074 mm, 0.074 x 0.044 mm and -0.044 mm. Solids from each size class were filtered, dried, weighted and analyzed for ash contents. During the whole experimental testing program, a total of 322 (46 x 7) coal samples were collected, prepared and analyzed. ASTM standards were followed throughout the experimental, sampling and ash analysis work.

Table 4.1 shows the design and operating parameters used in the spiral testing experiments. The test data obtained from the research work, which included feed rate, percent solids, volume flow rate, particle sizing and ash analyses, was adjusted using a spreadsheet based

mass balance routine. Variations in the coal feed characteristics made it difficult to calculate and compare the performance of different spiral circuits. To overcome this problem, all the calculations such as separation efficiency, overall yield, combustible recovery and organic efficiencies were performed on balanced and normalized data.

4.4 Results and Discussion

4.4.1 *Separation Efficiency*

In the current research work, separation efficiency curves are used to compare the cleaning performances of the various spiral circuits examined in this study. The concept of separation efficiency has been discussed by many authors and is defined as the theoretical percentage of feed material that passes through an ideal separation (Stevenes and Collins, 1961; Schultz, 1970; Salama, 2001). As described earlier, a separator that results in a zero percent selective separation is represented in recovery rejection plots by a dashed diagonal line passing between the top-left corner and bottom-right corner (Figure 4.9 to Figure 4.13). In other words, the separation efficiency line joins the 100% recovery and 0% ash rejection point with the 0% combustible recovery and 100% ash rejection point. Likewise, a perfect separation is represented by a single point on the top-right corner of the plot where both the combustible recovery and ash rejection is 100%. In fact, these two boundaries represent the separation efficiencies of 0% and 100%, respectively. Other separation efficiency values are represented by the lines parallel to the diagonal as shown dashed parallel lines in the recovery rejection plots. Each point along the curve can be represented by a single value of separation efficiency, which reflects the trade-off between recovering combustibles and rejecting ash. The optimum separation efficiency is obtained for those combinations of operating conditions that give data points in the right-upper most elbow of the performance curve.

4.4.2 *Comparison of Separation Efficiencies*

Figures 4.9 to 4.13 represent the size-by-size recovery rejection curves for all the five tested spiral circuits. In general, similar trends have been found in separation efficiencies for all of these spiral circuit configurations. The main points to be noted include:

- In each circuit, the highest separation efficiency was achieved by a coal feed in the size range of 0.6 x 0.150 mm.
- The separation performance starts decreasing for feed particle sizes either greater than 0.6 mm or less than 0.150 mm.
- A significant deterioration in the performance is noted for the coal particles finer than 0.074 mm.
- The maximum separation efficiency for all feed size classes was achieved by spiral circuit two (i.e., $1_{2T0} + 2_{3T0} + 3_{4T0} + 4_{CT1}$) and spiral circuit three ($1_{2T0} + 2_{3T1} + 3_{4T0} + 4_{CT1}$), followed by spiral circuit one ($1_{2T0} + 2_{CT0}$), spiral circuit four ($1_{2T0} + 2_{3T0} + 3_{CT1}$) and spiral circuit five ($1_{2T0} + 2_{3T0} + 3_{CT1}$), respectively.
- For a coal feed in the size range of 0.6 x 0.15 mm, both spiral circuit two ($1_{2T0} + 2_{3T0} + 3_{4T0} + 4_{CT1}$) and spiral circuit three ($1_{2T0} + 2_{3T1} + 3_{4T0} + 4_{CT1}$) were capable of achieving a separation efficiency of at least 80%.
- The maximum separation efficiency for both spiral circuit one ($1_{2T0} + 2_{CT0}$) and spiral circuit four ($1_{2T0} + 2_{3T0} + 3_{CT1}$) was nearly identical at approximately 77%.
- For the same feed of size class of 0.6 x 0.150 mm, spiral circuit five ($1_{2T0} + 2_{3T0} + 3_{CT1}$) was the least efficient in terms of separation efficiency (approximately 70%).
- The separation efficiency for coal feeds in the size range of +1 mm and 1 x 0.6 mm was the highest (approximately 70 to 72%) in the second, third and fourth spiral circuits,

followed by spiral circuit one (approximately 68 to 72%) and spiral circuit five (approximately 65%).

- Spiral circuit two ($1_{2T0} + 2_{3T0} + 3_{4T0} + 4_{CT1}$) and spiral circuit three ($1_{2T0} + 2_{3T1} + 3_{4T0} + 4_{CT1}$) were the only circuits that were capable of achieving a high separation efficiency of 63 to 65% for coal feeds in the particle size range of 0.150 x 0.074 mm.

A comparative study for the results plotted in Figures 4.9 to 4.13 indicate that, under the same operating conditions, separation efficiency of a spiral circuit depends on:

- the number of cleaning stages in a spiral circuit,
- the number of turns per spiral before repulping, and
- the recycling of middling streams.

These results suggest that highest separation efficiency for all feed size classes can be achieved either by spiral circuit two ($1_{2T0} + 2_{3T0} + 3_{4T0} + 4_{CT1}$) or spiral circuit three ($1_{2T0} + 2_{3T}1 + 3_{4T0} + 4_{CT1}$). It was also concluded from the comparison between separation efficiencies of spiral circuit four ($1_{2T0} + 2_{3T0} + 3_{CT1}$) and spiral circuit five ($1_{2T0} + 2_{3T0} + 3_{CT1}$) that repulping after just two turns was insufficient to achieve a good separation efficiency and at least three turns were required before repulping to maintain a high separation performance.

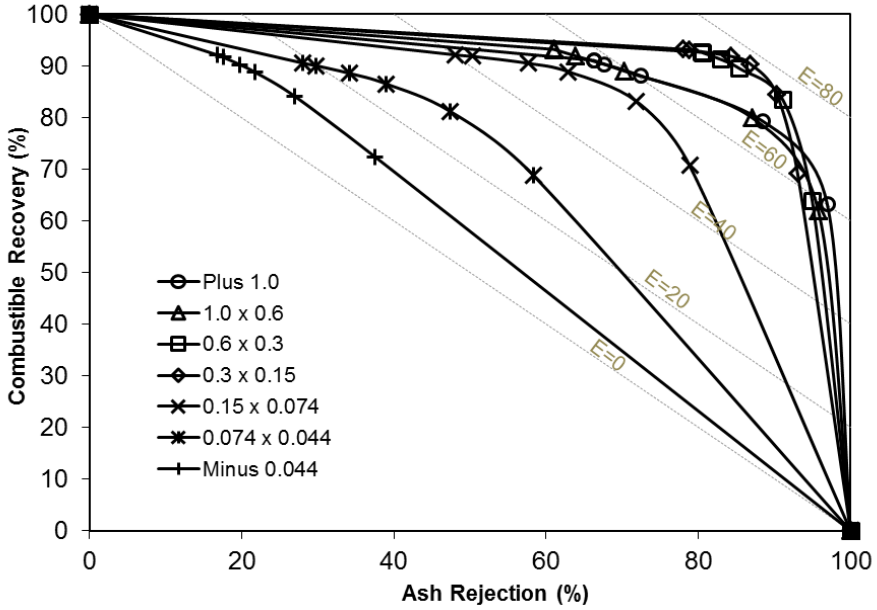


Figure 4.9 Size-by-size separation curves for spiral circuit 1 (1_{2T0}+2_{CT1}).

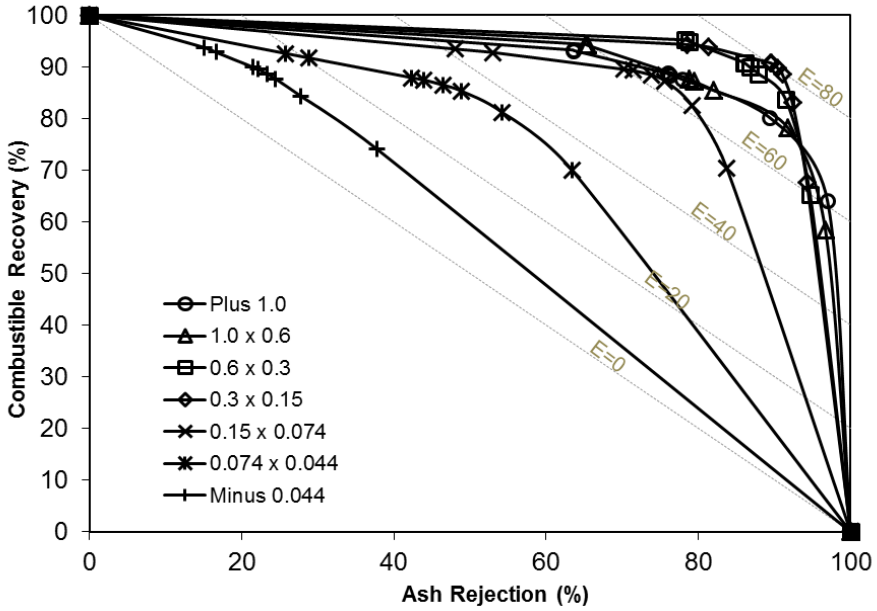


Figure 4.10 Size-by-size separation curves for spiral circuit 2 (1_{2T0}+2_{3T0}+3_{4T0}+4_{CT1}).

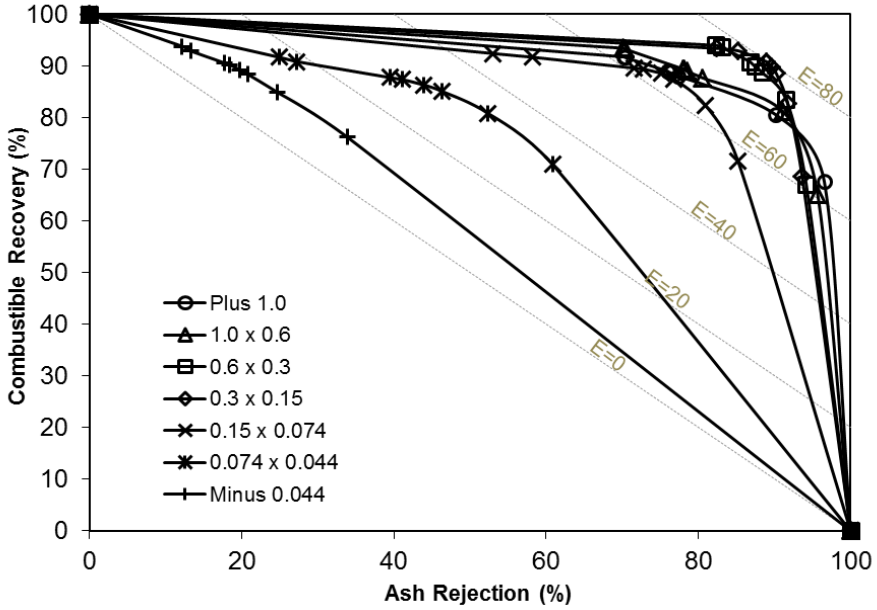


Figure 4.11 Size-by-size separation curves for spiral circuit 3 (1_{2T0}+2_{3T1}+3_{4T0}+4_{CT1}).

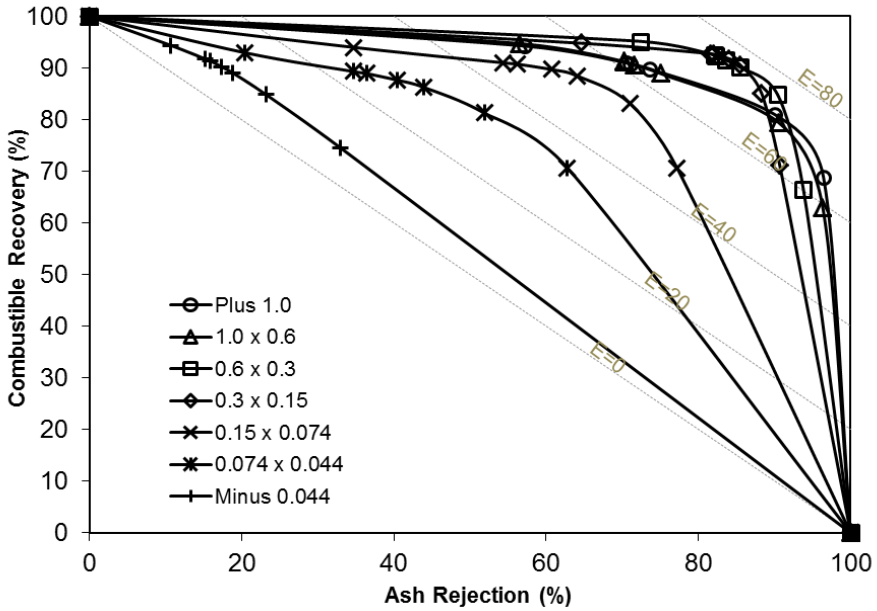


Figure 4.12 Size-by-size separation curves for spiral circuit 4 (1_{2T0}+2_{3T0}+3_{CT1}).

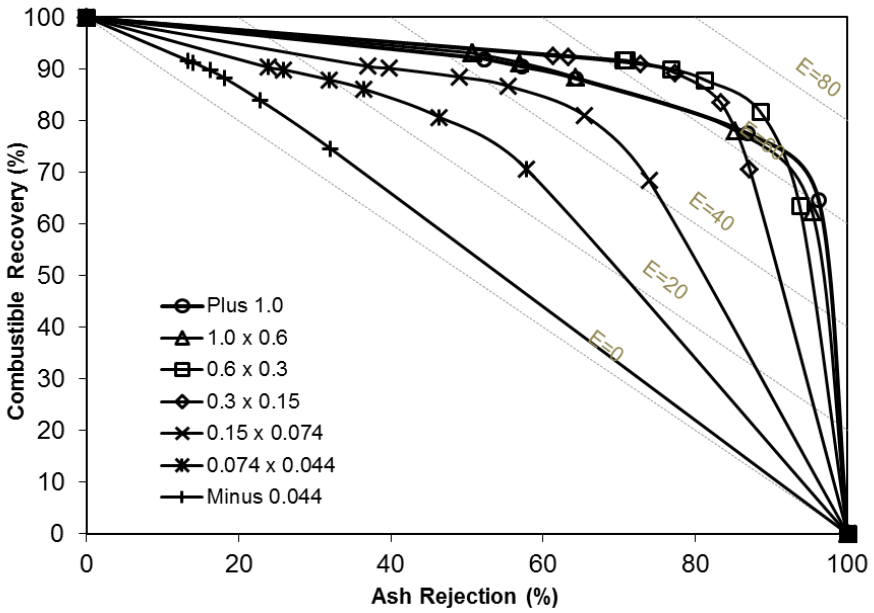


Figure 4.13 Size-by-size separation curves for spiral circuit 4 (1_{2T0}+2_{3T0}+3_{CT1}).

4.4.3 ***Separation Across the Trough***

Figure 4.14 illustrates the effect of product splitter positions on the separation performance of each spiral circuit. The product "SC1" represents the cleanest stream taken at the outer most position across the spiral profile, whereas "ST2" denotes the high-ash reject taken at the inner most position near the central column of the spiral. (Figure 4.2 shows the position of different product splitters relative to the central column of the spiral.) As shown, product ash contents gradually increase from the splitter position "SC1" to the splitter position at "ST2". In the current research work, the combined products of SC1 and SC2 represent the final clean coal, SM3, SM4 and SM5 are combined to make the middlings product, and ST2 represents the high-ash reject product. Figure 4.14 compares the overall separation efficiencies for all the five spiral circuits at same splitter positions.

It is interesting to note that in all spiral circuit configurations shown in Figure 4.14, the overall separation efficiency for the products collected at splitter position “SC1” was lower than that obtained for position “SC2”. In other words, the proportion of misplaced rock particles in the cleaner product “SC1” is more than the same in the product “SC2”.

One possible explanation for this trend may be that the ultrafine high-ash particles (minus 0.074 mm) in the spiral feed usually tends to report with the water. The data obtained by the size-by-size product analysis at different splitter positions indicates that, on average, the proportion of high-ash ultrafine particles (minus 0.074 mm particles containing 64.4% ash) in the “SC1” clean product was 16.97% compared with that of 9.91% in the product collected at the “SC2” splitter position. Thus, the apparently lower separation efficiency at splitter position “SC1” seems to be mainly attributed to the presence of a higher percentage of ultrafine high-ash particles. However, when the size-by-size separation efficiencies were plotted against different splitter positions in Figure 4.15, the data show a similar trend for all of the coarser size fractions (+1 mm, 1 x 0.6 mm, 0.6 x 0.3 mm and 0.3 x 0.150 mm) as well.

The trend of high separation efficiency at splitter position “SC2” can better be explained using the separation mechanism presented by Luttrell et al. (2007). This work identified two counter-rotating flows across the spiral profile that converges along an imaginary line of separation (Figure 4.16). The counter-clockwise flow in the lower rotation zone moves the lighter particles towards the outer wall of the spiral and the heavier particles settle down and are carried to the inner side of the spiral for rejection. Clockwise rotation is responsible for providing a good refuse product that was relatively free of coal, while the counter-clockwise flow in the upper rotating section stratifies the pure coal particles along the outer wall. Dense rock particles that are entrapped in the upper zone tend to settle against the wall and are pinned there by the

upward counter-clockwise flow (Luttrell et al., 2000, 2007). Eventually, these entrapped high-density particles report with the clean coal and, as such, are probably responsible for lower separation efficiency at splitter position “SC1”.

Particle separation behavior across the spiral trough has been a continuous source of confusion in the literature. A number of researchers have tried to explain the particle separation mechanism including Holland-Batt (1990, 1992, 1994, and 1998), Richards and Palmer (1997), Kapur and Meloy (1998) and Luttrell et al. (1998). Figure 4.16 helps to understand the flow pattern and particle behavior across the spiral trough. In this figure, separation efficiency data has been plotted against the distance from outer wall of the spiral trough. The plot was then superimposed on the schematic diagram showing the particle separation and slurry flow patterns across the spiral trough. The highest separation efficiency at the splitter position “SC2” and lower separation efficiencies on either side of the “SC2” provide striking evidence for the presence of two counter-rotating flows. As shown in Figure 4.16, the dashed line (at a distance of 8.65 cm measured from inside of the outer wall of the spiral trough) that passes through the peaks of the separation efficiency curves is the line of separation which marks the boundary between the counter-rotating flows on the spiral trough.

Frequent repulping of the feed slurry deteriorates the overall and size-by-size separation efficiencies of spiral circuit 5 as shown in Figure 4.14 and Figure 4.15(E) respectively. A close examination of the size-by-size separation efficiency curves shown in Figure 4.15(E) indicates that the repulping after two turns helps the entrapped coarser (+1 and 1 x 0.6 mm) particles to escape from the upper zone of high velocity flow. However, frequent repulping of slurry does not provide the time necessary for the particles to segregate themselves into proper reject or clean coal streams and, hence, results in a lower overall separation efficiency of the spiral circuit.

In conclusion, product splitter position "SC2" provides the highest overall separation efficiency across the spiral profile and the spiral circuit three (1_{2T0} + 2_{3T1} + 3_{4T0} + 4_{CT1}) offers the best overall separation performance amongst other experimentally tested spiral circuits.

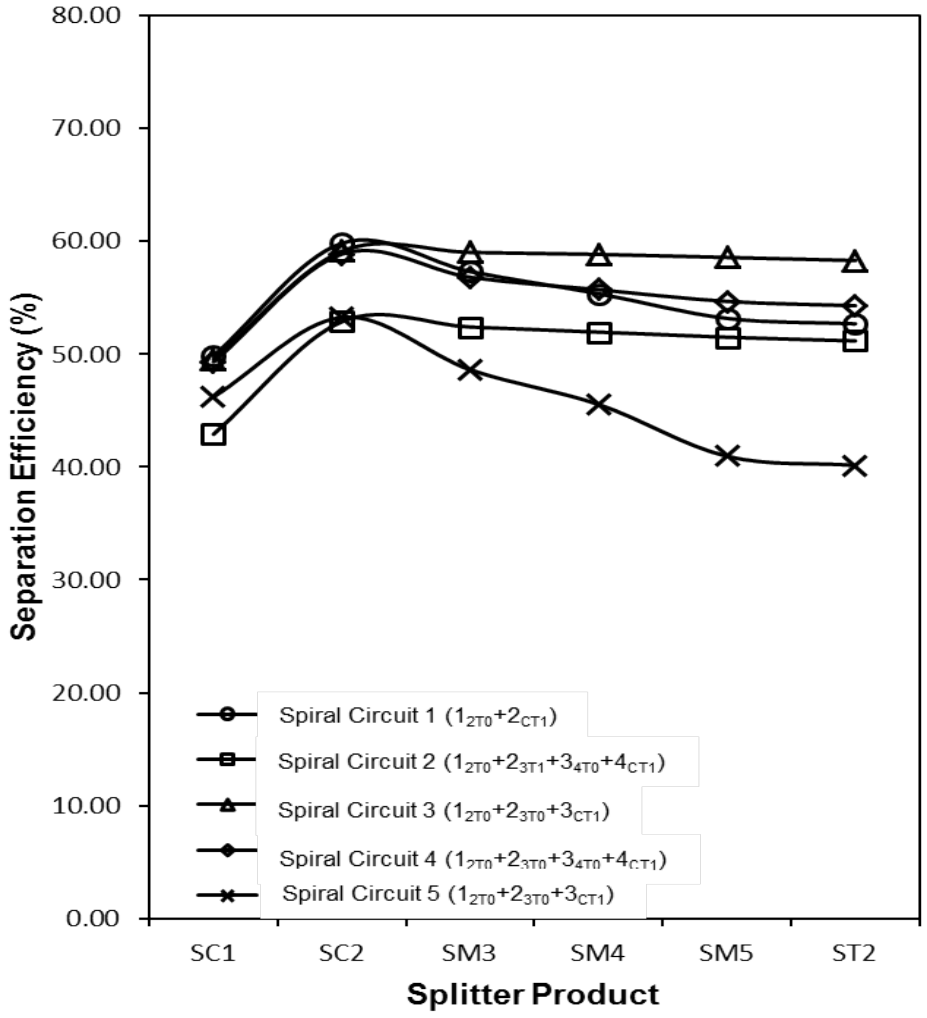
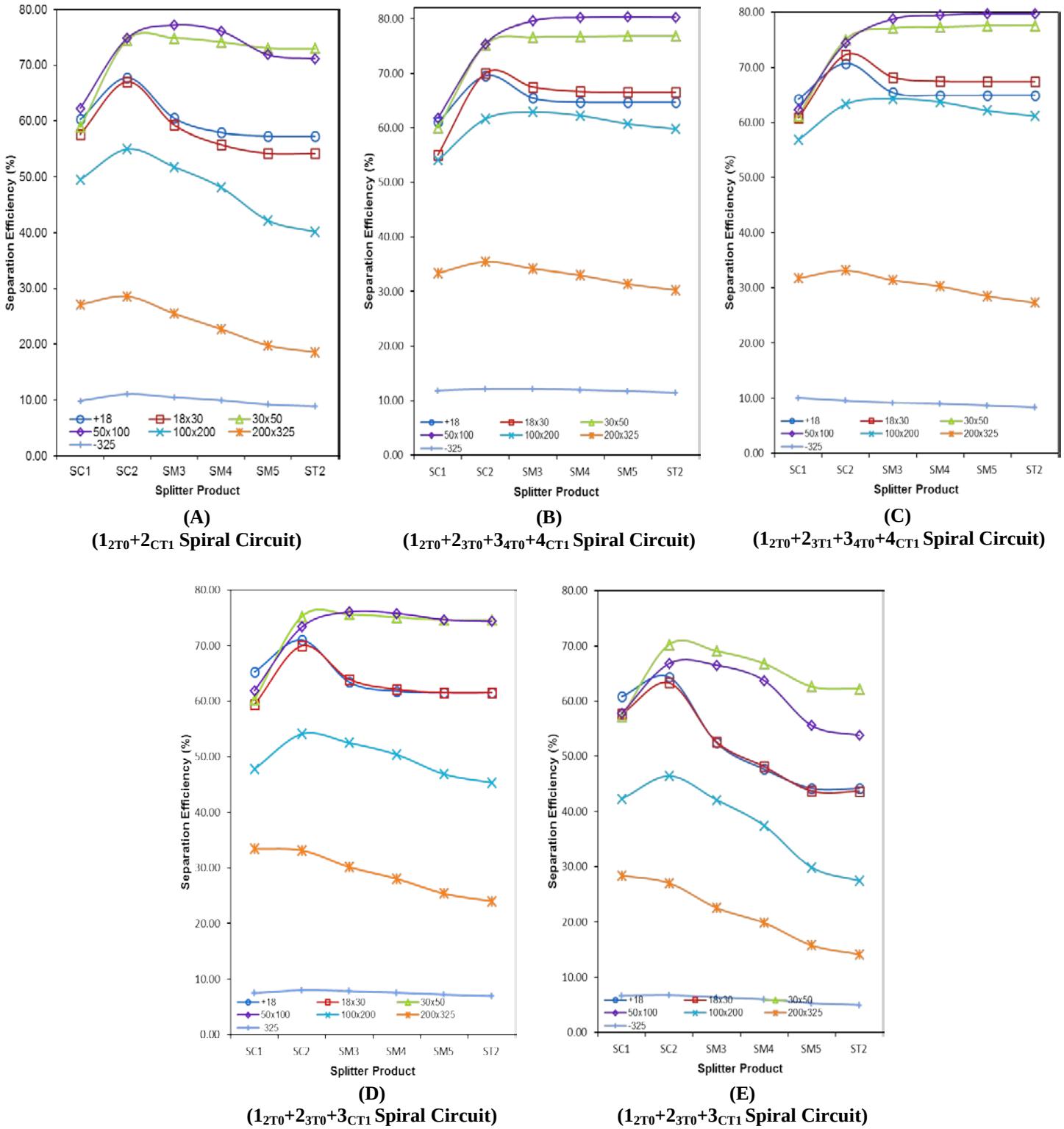


Figure 4.14 Separation efficiency at different splitters positions for spiral circuit configurations.



(A)
(1_{2T0}+2_{CT1} Spiral Circuit)

(B)
(1_{2T0}+2_{3T0}+3_{4T0}+4_{CT1} Spiral Circuit)

(C)
(1_{2T0}+2_{3T1}+3_{4T0}+4_{CT1} Spiral Circuit)

(D)
(1_{2T0}+2_{3T0}+3_{CT1} Spiral Circuit)

(E)
(1_{2T0}+2_{3T0}+3_{CT1} Spiral Circuit)

Figure 4.15 Size-by-size separation efficiency at different splitters positions.

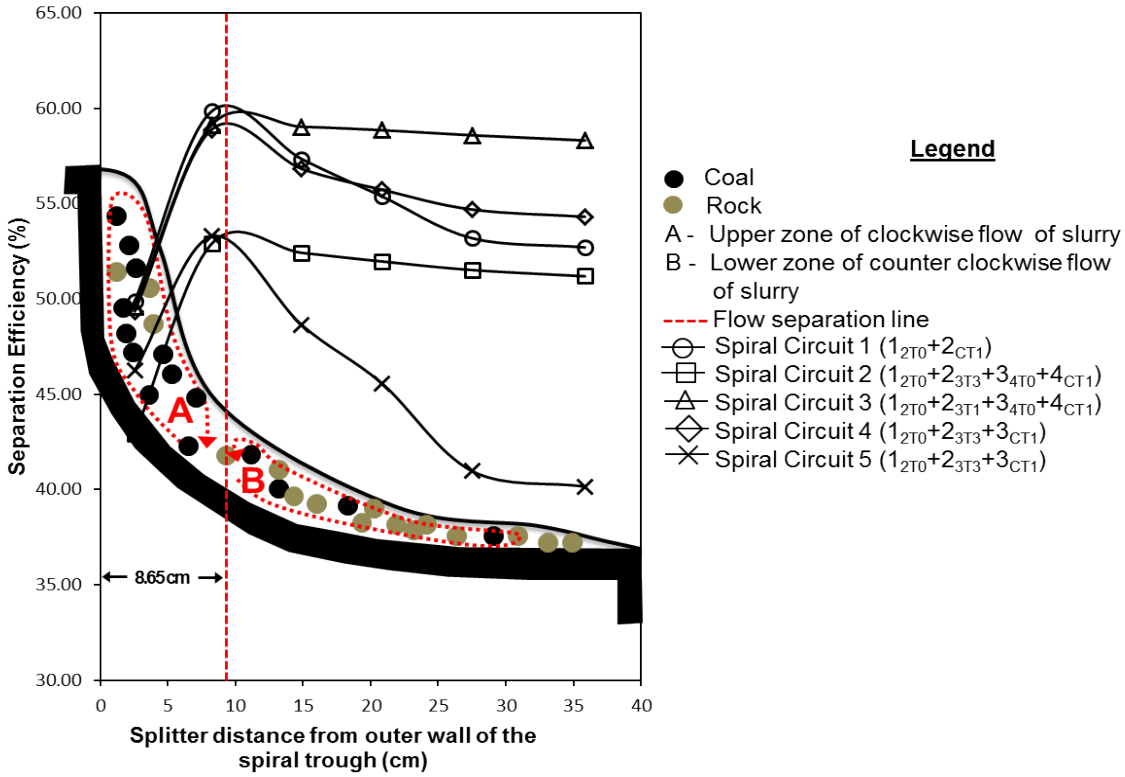


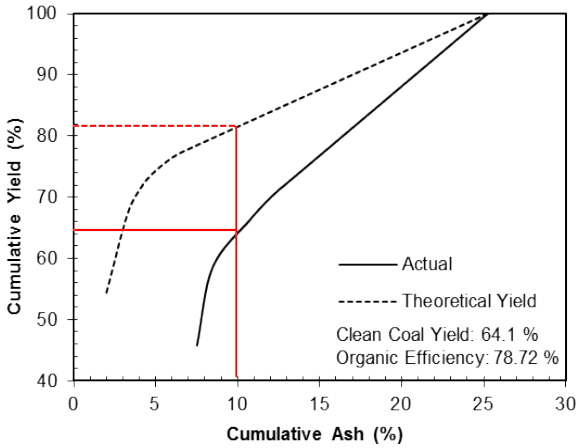
Figure 4.16 Particle separation mechanisms across a spiral profile and the position of separation line between the two counter flows.

4.4.4 *Clean Coal Yield and Organic Efficiencies*

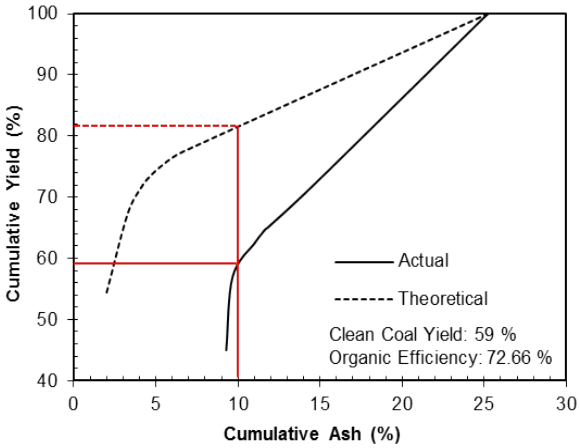
Figure 4.17 compares the clean coal yield and organic efficiencies achieved by each spiral circuit. Actual yield and ash curves for spiral circuits were plotted and then compared with the maximum possible yield based on feed washibility data. As shown in Figure 4.17, the yield and organic efficiency for all spiral circuits were compared at a constant clean coal ash of 10%. Table 4.2 shows the summary of size-by-size and overall clean coal yield data for each spiral circuit.

Figure 4.17 indicates that at a 10% clean coal ash, spiral circuit one (1_{2T0} + 2_{CT1}) was capable of achieving an overall clean coal yield and organic efficiency of 64.1% and 78.7%, respectively. However, with an increase in the number of cleaning stages, the overall clean coal

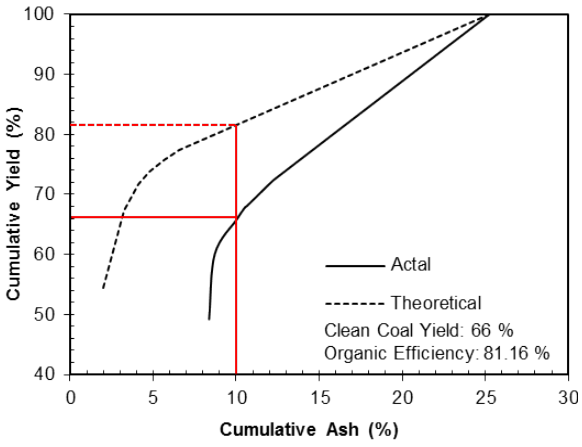
yield dropped significantly to 59% as shown by Figure 4.17(B). The best overall performance was achieved by spiral circuit three ($1_{2T0} + 2_{3T1} + 3_{4T0} + 4_{CT1}$) with a clean coal yield of 66% and an organic efficiency of 81.2%. As stated previously, the only difference between spiral circuit two and spiral circuit three was that the second middlings stream in spiral circuit three was also recleaned along with the final stage middlings of the last spiral. Surprisingly, the clean coal yield and organic efficiency achieved by the spiral circuit four ($1_{2T0} + 2_{3T0} + 3_{CT1}$) was nearly the same as that of achieved by spiral circuit one ($1_{2T0} + 2_{CT1}$). Finally, the data in Figure 4.17(E) shows that among all the tested spiral circuits, spiral circuit five ($1_{2T0}+2_{3T0}+3_{CT1}$) performed the poorest in terms of clean coal yield and organic efficiency. The overall yield and organic efficiency obtained from this circuit was 56.2 % and 70.8%, respectively. Figure 4.8 provided previously showed that spiral circuit five ($1_{2T0} + 2_{3T0} + 3_{CT1}$) incorporated auxiliary repupers after every two turns for the first two cleaning stages. Thus, it is concluded that repulping after two turns actually destroyed the separation process and caused in a lower separation efficiency, a lower clean coal yield and lower organic efficiency and as shown by Figure 4.17(E).



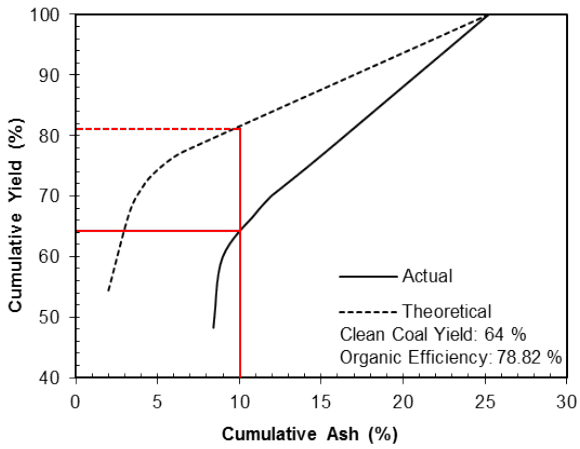
(A) Spiral circuit 1 (1_{2T0}+2_{CT1})



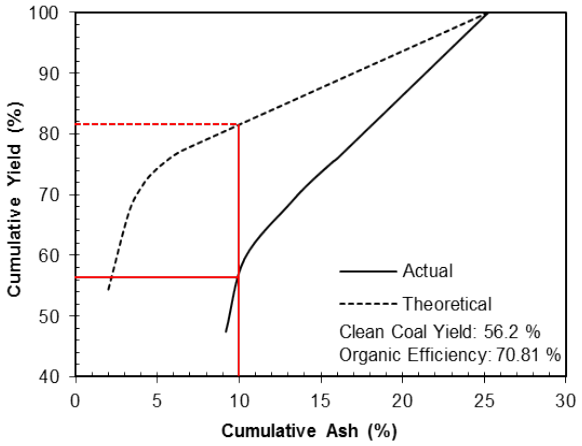
(B) Spiral circuit 2 (1_{2T0}+2_{3T0}+3_{4T0}+4_{CT1})



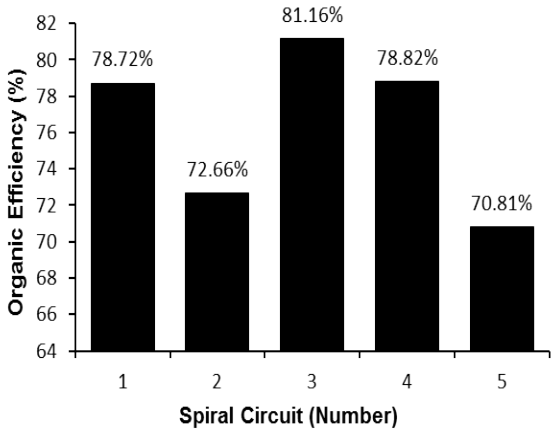
(c) Spiral circuit 3 (1_{2T0}+2_{3T1}+3_{4T0}+4_{CT1})



(D) Spiral circuit 4 (1_{2T0}+2_{3T0}+3_{CT1})



(E) Spiral circuit 5 (1_{2T0}+2_{3T0}+3_{CT1})



(F) Organic efficiencies for all spiral circuits

Figure 4.17 Comparison of spiral circuits (Yield and Organic efficiencies).

Spiral circuit three ($1_{2T0} + 2_{3T1} + 3_{4T0} + 4_{CT1}$) not only provided the overall best performance, but also proved to be superior in all the individual feed size classes as well. Figure 4.18 shows the clean coal yield and ash curves for individual size classes for the five spiral circuits.

Size-by-size clean coal yield and organic efficiencies at a clean ash of 10% are tabulated in Table 4.2 and Table 4.3 respectively. In both of these data tables, the highest clean coal yield and organic efficiencies are highlighted in bold letters. In each spiral circuit, the lowest values for clean coal yield and organic efficiency was obtained for a feed size of plus 1 mm and the highest clean coal yield was obtained when treating the 0.3 x 0.150 mm size fraction. The interesting point here is that in each spiral circuit, cumulative clean coal yield and organic efficiencies improved with the decrease in feed size up to 0.150 mm.

Finally, as shown in Table 4.2, spiral circuit three ($1_{2T0} + 2_{3T1} + 3_{4T0} + 4_{CT1}$) provided an overall yield of 66%, while at the same clean coal ash of 10%, an overall yield value of 64% was provided by the existing compound spiral circuit, i.e., spiral circuit one ($1_{2T0} + 2_{CT1}$). In other words, spiral circuit three ($1_{2T0} + 2_{3T1} + 3_{4T0} + 4_{CT1}$) increased the yield by 1.9%, while maintaining the same clean coal ash of 10% achieved by the existing spiral circuit. For example, in a 100 tph spiral circuit, this net increase in the yield can be translated into a dollar value of $751,830 per year (i.e., 1.9 ton/hr x $65.95/ton x 6,000 hrs/yr).

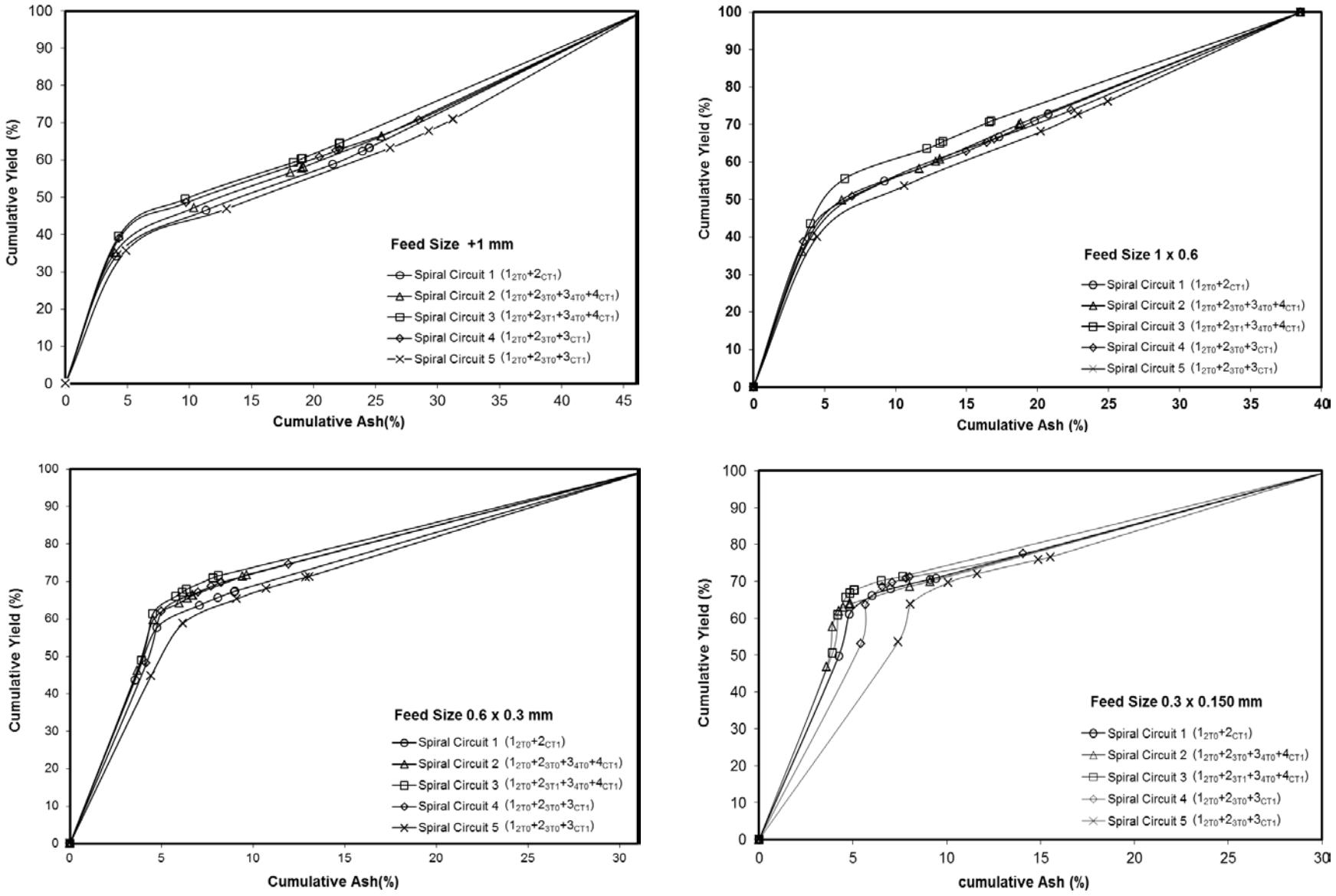


Figure 4.18 Comparison of spiral circuits (size by size cumulative yield versus clean coal ash).

Table 4.2 Summary of size by size cumulative yield at 10% of product ash.

Spiral Circuits	Cumulative yield (%) for different size classes (mm)				
	+ 1	**1 x 0.6**	**0.6 x 0.3**	**0.3 x 0.15**	**Overall**
$1_{2T0}+2_{CT1}$	44.2	55.1	67	70.4	64.1
$1_{2T0}+2_{3T0}+3_{4T0}+4_{CT1}$	46.2	54.8	70.3	70	59.0
$1_{2T0}+2_{3T1}+3_{4T0}+4_{CT1}$	**49.8**	**60**	**72.2**	**73.9**	**66.0**
$1_{2T0}+2_{3T0}+3_{CT1}$	48.4	54.8	70.3	72	64
$1_{2T0}+2_{3T0}+3_{CT1}$	43.1	51.8	64.9	68.4	56.2

Table 4.3 Summary of size-by-size organic efficiencies at 10% product ash.

Spiral Circuits	Organic efficiency (%) for different size classes (mm)				
	+ 1	**1 x 0.6**	**0.6 x 0.3**	**0.3 x 0.15**	**Over All**
$1_{2T0}+2_{CT1}$	74.63	81.71	88.84	91.29	78.72
$1_{2T0}+2_{3T0}+3_{4T0}+4_{CT1}$	77.61	82.56	92.03	90.94	72.66
$1_{2T0}+2_{3T1}+3_{4T0}+4_{CT1}$	**82.24**	**87.32**	**93.17**	**93.76**	**81.16**
$1_{2T0}+2_{3T0}+3_{CT1}$	80.45	81.22	91.69	91.76	78.62
$1_{2T0}+2_{3T0}+3_{CT1}$	72.24	77.68	87.70	88.94	70.81

4.4.5 *Combustible Recovery*

Figure 4.19 shows the size-by-size combustible recovery and ash curves for the five experimentally tested spiral circuits. The data shows that spiral circuit three (1_{2T0} + 2_{3T1} + 3_{4T0} + 4_{CT1}) offered the best combustible recovery in all size classes, while the lowest combustible recovery was obtained by using the spiral circuit five (1_{2T0} + 2_{3T0} + 3_{CT1}). Table 4.4 compares the size-by-size and overall combustible recovery at 10% clean coal ash for the experiments conducted on each of the five spiral circuits. Spiral circuit one (1_{2T0} + 2_{CT1}) and spiral circuit four (1_{2T0} + 2_{3T0} + 3_{CT1}) were found to have same overall combustible recovery, but differed in combustible recoveries for individual feed size classes. As indicated by Figure 4.19, spiral

circuit three not only gives the highest overall combustible recovery, but also provides the best combustible recoveries for all individual size classes as well.

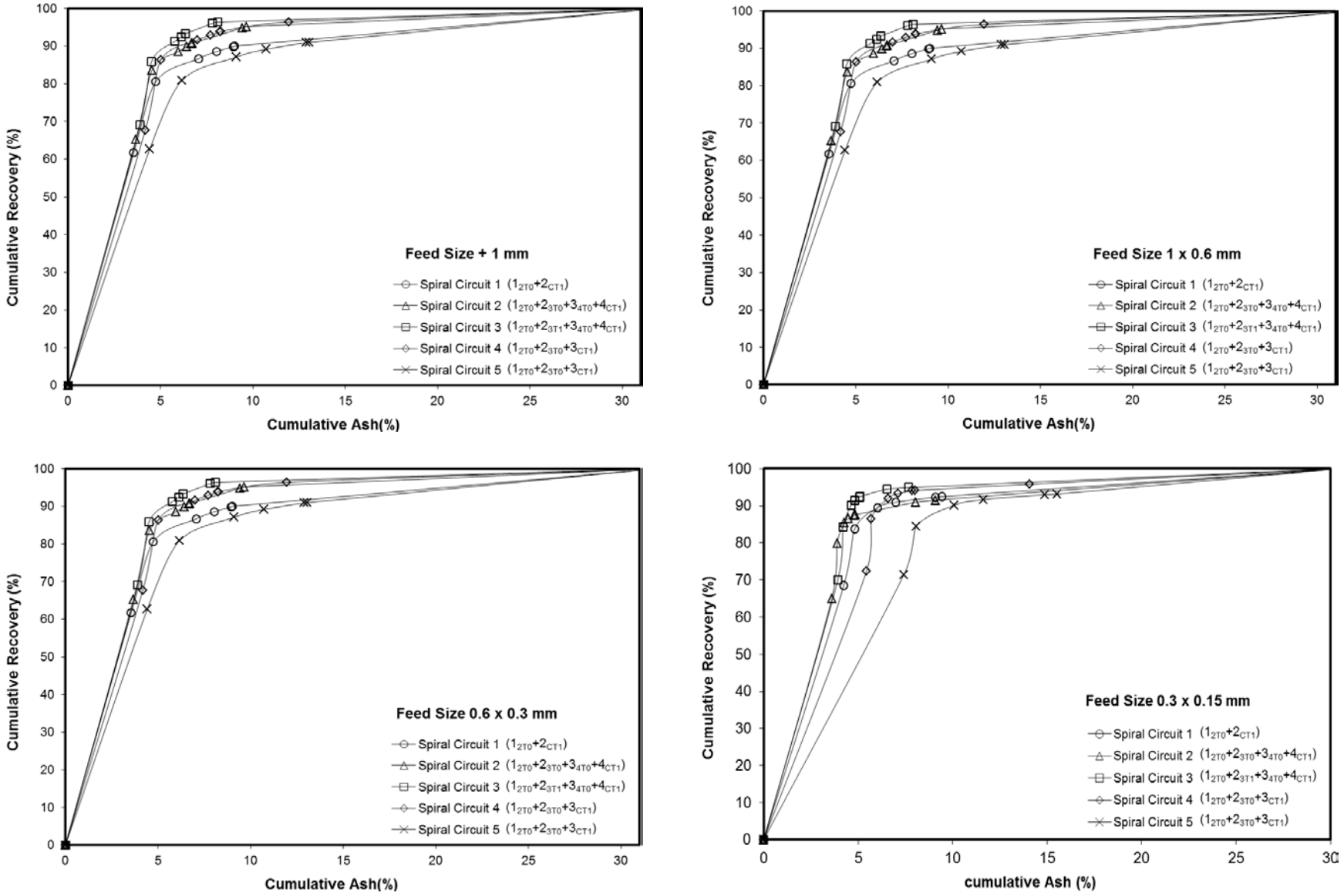


Figure 4.19 Comparison of spiral circuits (size by size combustible recovery versus clean coal ash).

Table 4.4 Comparison of spiral circuits (Summary of size by size combustible recovery at the 10 % of clean coal ash).

Spiral Circuits	Combustible recovery (%) for different size classes (mm)				
	+ 1	**1 x 0.6**	**0.6 x 0.3**	**0.3 x 0.15**	**Overall**
$\mathbf{1_{2T0}+2_{CT1}}$	75.6	81.9	90.1	92.1	77.1
$\mathbf{1_{2T0}+2_{3T0}+3_{4T0}+4_{CT1}}$	79.2	82.5	95	91.5	71.5
$\mathbf{1_{2T0}+2_{3T1}+3_{4T0}+4_{CT1}}$	**84**	**89.1**	**96.8**	**95.1**	**79.6**
$\mathbf{1_{2T0}+2_{3T0}+3_{CT1}}$	82	80.9	95	94	77.1
$\mathbf{1_{2T0}+2_{3T0}+3_{CT1}}$	74.1	77	88	89	68.5

4.4.6 *Spline Curves*

To show the incremental changes in clean coal yield and combustible recovery, spline curves were fit to the experimental data so as to improve numerical comparisons. The size-by-size coal yield and combustible recovery spline curves are shown in Figure 4.20 and Figure 4.21, respectively. These figures show the size-by-size data for the products collected at splitter positions “SC1”, “SC2” and “SM3”. In the plots, dashed circles show the actual points for clean coal yield and recovery for the products collected splitter position “SC1”. The important item to note here is that spiral circuit three (1_{2T0} + $2_{3T}1$ + 3_{4T0} + 4_{CT1}) is capable of producing both coking and thermal coal products. For example, the low ash (less than 5%) clean coal product collected at splitter position “SC1” in spiral circuit three can be sent to a coking plant, while the combined products collected at splitter positions “SC2” and “SM3” can still meet the ash requirements for coal products used for power generations (Figure 4.20 and Figure 4.21). Moreover, it can be clearly seen in the spline curves that amongst all the experimentally tested spiral circuits, spiral circuit three provides the maximum clean coal yield and recovery at any selected clean coal ash.

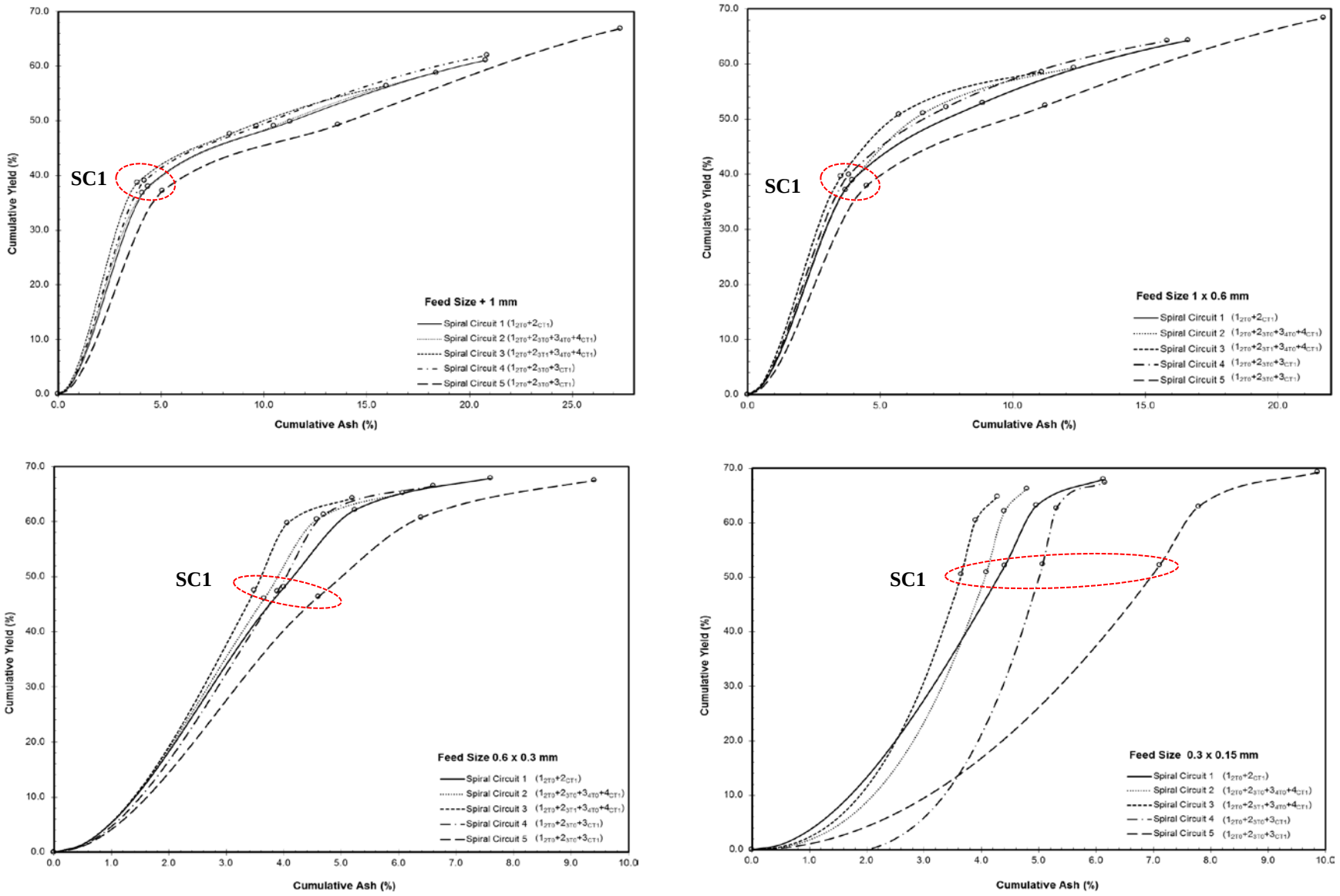


Figure 4.20 Comparison of spiral circuits (spline curves yield versus clean coal ash).

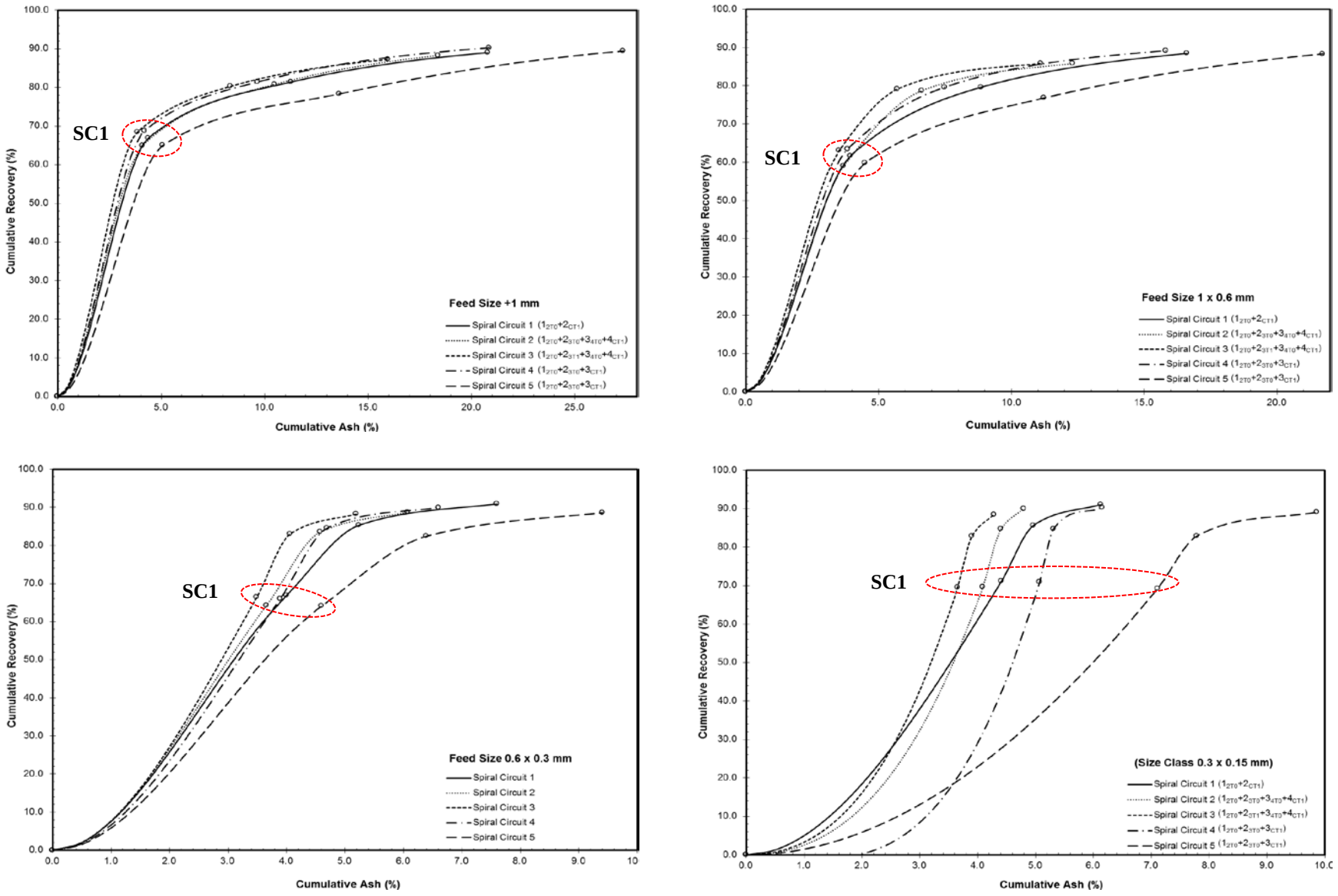


Figure 4.21 Comparison of spiral circuits (spline curves recovery versus clean coal ash).

4.5 Conclusions

A full-scale experimental study on five different spiral circuits was conducted at an industrial coal preparation plant. The results suggest that a four-stage spiral described by the shorthand notation "1_{2T0} + 2_{3T1} + 3_{4T0} + 4_{CT1}" offered the best option for improved separation efficiency, clean coal yield and combustible recovery. Preliminary calculations indicate that this spiral circuit is capable of increasing clean coal yield by 1.9%, while maintaining the same ash contents as achieved by the existing two-stage compound spiral circuitry (1_{2T0} + 2_{CT1}) currently installed in the plant. Moreover, spline curves fit through the experimental data indicate that the new four-stage spiral circuit, when used with appropriate product splitter settings, can simultaneously produce both low-ash coking coal and high-ash thermal coal products. Finally, the data also suggest that repulping after two turns in a coal spiral circuit does not provide sufficient residence time for good separations of coal and rock. On the other hand, repulping after three or more turns is recommended to improve spiral separation performance.

4.6 References

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CHAPTER 5 ENHANCED SULFUR REJECTION USING COMBINED SPIRALS FLOTATION CIRCUITS

5.1 Abstract

A detailed study was conducted to evaluate the partitioning of pyrite within fine coal circuits. The investigation, which included both laboratory and pilot-scale test programs, indicated that density-based separations are generally effective in reducing sulfur due to the large density difference between pyrite and coal. On the other hand, the data also showed that sulfur rejections obtained in froth flotation are often poor due to the natural floatability of pyrite. Unfortunately, engineering analyses showed that pyrite removal from the flotation feed using density separators would be impractical due to the large volumetric flow of slurry that would need to be treated. On the other hand, further analyses indicated that the preferential partitioning of pyrite to the underflow streams of classifying cyclones and fine wire sieves could be exploited to concentrate pyrite into low-volume secondary streams that could be treated in a cost effective manner to remove pyrite prior to flotation. On the basis of this study, an enhanced sulfur rejection circuit was designed and implemented on an industrial scale in the Illinois coal basin. This paper describes the rationale for the design of this new fine coal cleaning circuit and presents the data obtained from the full-scale sampling program.

5.2 Introduction

There has been an increasing worldwide interest to reduce overall atmospheric levels of sulfur dioxide, the primary precursor to acid rain. Environmental legislation to reduce sulfur emissions to the atmosphere have been already in place in many countries and are under consideration in most of other countries. In United States, the Clean Coal Act amended in 1990

puts strict restrictions and set targets for overall sulfur dioxide emissions to the atmosphere. Coal when burned produces pollutants such as sulfur oxides, nitrogen oxides and particulate matter. The total United States SO2 emissions from coal utilization are approximately 15.9 million tons per year. This level includes emissions arising from power generation of 10.9 million tons per year. By 2014, the EPA aims to reduce SO2 emissions from coal fired power plants by 71 percent from 2005 levels (US-EPA, 2012). To meet the air pollution standards, many coal fired power plants in United States are switching from high sulfur eastern and midwestern coal feedstocks to low sulfur western coals. However, the coal from western regions has increased the transportation cost for those power plants operated in eastern and midwestern regions.

Sulfur contents and type in coals are highly variable and depends upon the depositional environment of the coal. Total sulfur contents in coal may vary from a low of 0.5% sulfur to as high as 11% (Monticello and Finnerty, 1985).There are a number of technologies available throughout the coal life cycle that can be used to reduce the sulfur in coal. These include (Cavallaro et al., 1991; Ohtsuka, 2009):

- Physical removal of sulfur from coal before combustion
- Magnetic and electrostatic separation of sulfur form coal
- Chemical cleaning of high sulfur coals
- Biological cleaning of high sulfur coals
- Conversion of high sulfur coals to a low sulfur clean fuel by gasification or liquefaction process
- Blending of high sulfur coals with low sulfur coal feeds
- In bed desulfurization
- Flue gas desulfurization

- Wet scrubbers

In the past, coal cleaning operations focused only on reducing the percentage of ash forming minerals from coal and not necessarily targeted to reduce the sulfur contents. However, the past decade witnessed a continuous increase in the research and development of physical sulfur removal processes using coal beneficiation methods (Celik and Yildirin, 2000; Kawatra and Eisele, 2001; Rubiera et al., 1997; Mohanty et al., 2008; Shah et al., 2001; Mbamba et al., 2012). As a result of these studies, it appears that a significant amount of sulfur can be removed from high sulfur coals during coal processing operations. Moreover, removal of sulfur from high sulfur coal during processing operations offered many added advantages such as reducing the load on flue gas scrubbers, reduced transportation cost and simultaneous removal of ash and sulfur bearing minerals from coal.

Physical coal processing methods generally exploit either the difference between specific gravities or surface properties of coal and rock forming minerals. In the United States, modern coal preparation plants may include as many as four separate processing circuits for cleaning the coarse (+10 mm), small (10 x 1 mm), fine (1 x 0.15 mm) and ultrafine (-0.15 mm) coal feeds.. Coarse and small coal fractions are almost exclusively cleaned using dense medium separation processes. A wide variety of viable cleaning circuit configurations exist to treat fine (-1 mm) coal, such as water-based density separators (spirals or water-only cyclones) as well as various types of surface-based separators (conventional or column flotation processes) (Luttrell et al., 2007).

An important problem associated with the cleaning of high sulfur coal is the inferior sulfur rejection performance of fine coal cleaning circuitry (Mohanty et al., 2008). On one hand, density separation devices can reduce clean coal sulfur levels within the limits set by the

washibility characteristics of high sulfur fine coal and the limit imposed by the specific gravity cut point associated with the fine coal cleaning method. On the other hand, froth flotation faces another challenge of recovering a significant amount of pyrite when treating high sulfur ultrafine coal. Although coal pyrite particles are well liberated at particle sizes down to nominal flotation feed sizes (minus 0.150 mm), unwanted mineral matter often tends to report to the clean coal product of a flotation cell due to entrainment and the unpredictable hydrophobic nature of coal pyrite (Kawatra and Eisele, 2001). Thus, froth flotation, which otherwise provides excellent ash separation performance, often performs poorly in in terms of sulfur rejection. As a matter of fact, in a number of laboratory flotation experiments conducted during current research work, sulfur contents of the froth product were often found to be higher in sulfur than the flotation feed.

In order to address the challenge posed by high sulfur fine coal, several research studies have been conducted in an attempt to solve this problem (Honaker et al., 1995; Luttrell et al., 1995; Mcalister, 1998; Mohanty and Honaker, 1999; Celik and Yildirin, 2000; Shah et al., 2001; Kawatra and Eisele, 2001; Rubiera et al., 1997; Mohanty et al., 2008; Mbamba et al., 2012). Most of these studies examined and compared the coal pyrite separation performance of individual fine coal cleaning technology. For example, Mohanty and Honaker (1995, 1999) found that for a feed size of 0.6 x 0.045 mm, sulfur rejection performance of enhanced gravity separators was better as compared to that of a flotation process. Kawatra and Eisele (2001) conducted a detailed investigation of coal desulfurization using different coal preparation methods. Unfortunately, pyrite recovery of the fine coal circuits typically employed in coal processing facility is not as efficient as their ash removing efficiency. In fact, there is no standardized method that exists in the coal preparation industry for sulfur removal. Thus, there is

a need for an efficient, economical and industrially acceptable method for pyrite removal from high sulfur fine coal.

Hydrophobic coal pyrite particles (partially oxidized pyrite particles are often hydrophobic) or partially liberated pyrite often behave as floatable particles and report to the froth product. The same pyrite particles can be rejected by a density based separator because of their relatively high density. Unfortunately, density separators are not effective in rejection ultrafine particles such as clays, which contribute significantly to raising the ash content and lowering the heating value of the final product. In conclusion, it has been found that different types of fine coal separators are effective in removing a particular type of mineral. Thus, a combination of two different fine coal separation processes often gives better ash and pyrite separation efficiency as compared to that of multiple stages of a single type of separation process (Kawatra and Eisele, 2001).

In view of this fact, an extensive laboratory and pilot-scale experimental study was conducted at Virginia Tech to identify optimum methods for simultaneously increasing ash and sulfur rejections from fine coal. The objective of this investigation was to evaluate the coal pyrite separation performance of each fine coal separation process used in this study and to design a fine coal circuitry that gives highest performance for both ash and pyrite rejection. Unit operations examined in this study included a water-only cyclone, two stage compound spiral and froth flotation cell. On the basis of experimental findings, an enhanced sulfur rejection fine coal circuitry was developed. The new circuitry combined both density-based (spirals) and surface-based (flotation) separation processes. It was found that the combined spiral and flotation circuit, when properly located behind various types of sizing and classification units, achieved the highest ash and sulfur rejection performance amongst all individual unit tested.

5.3 Experimental

5.3.1 *Plant Description*

Figure 5.1 shows a generic flowsheet of a coal processing plant being investigated in this research. It is located in midwestern region of United States and used to treat 3" x 0 mm coal feed. The plant feed is fed to a double deck banana screen which is used as a combined raw coal and deslime screen, cutting at 1/2 inch on the top deck and 1 mm on the bottom deck. The coarse (3" x 1 mm) size fraction reports to a bank of dense medium cyclones for density separation. Undersize (minus 1 mm) of raw coal banana deslime screen is classified at a cut size of 0.150 mm by using a bank of 15 inch diameter raw coal classifying cyclones. Underflow from raw coal classifying cyclones (1 x 0.150 mm) flows to a bank of triple start compound spirals. Clean from spirals reports to clean coal sieve bend screens. Undersize (0.35 x 0) of clean coal sieve bend along with raw coal classifying overflow reports to a bank of deslime cyclones. Finally, froth flotation is used to clean deslimed fine coal (0.150 x 0.044 mm) stream. Combined deslimed spiral and flotation concentrate is dewatered by screen bowl centrifuges. A single thickener is used to treat plant fine tailings. Thickener underflow is pumped to an impoundment and the coarse refuse is hauled to a coarse refuse area. Prior to this study, the plant management had expressed concerns regarding the poor sulfur rejections achieved in the fine coal circuitry.

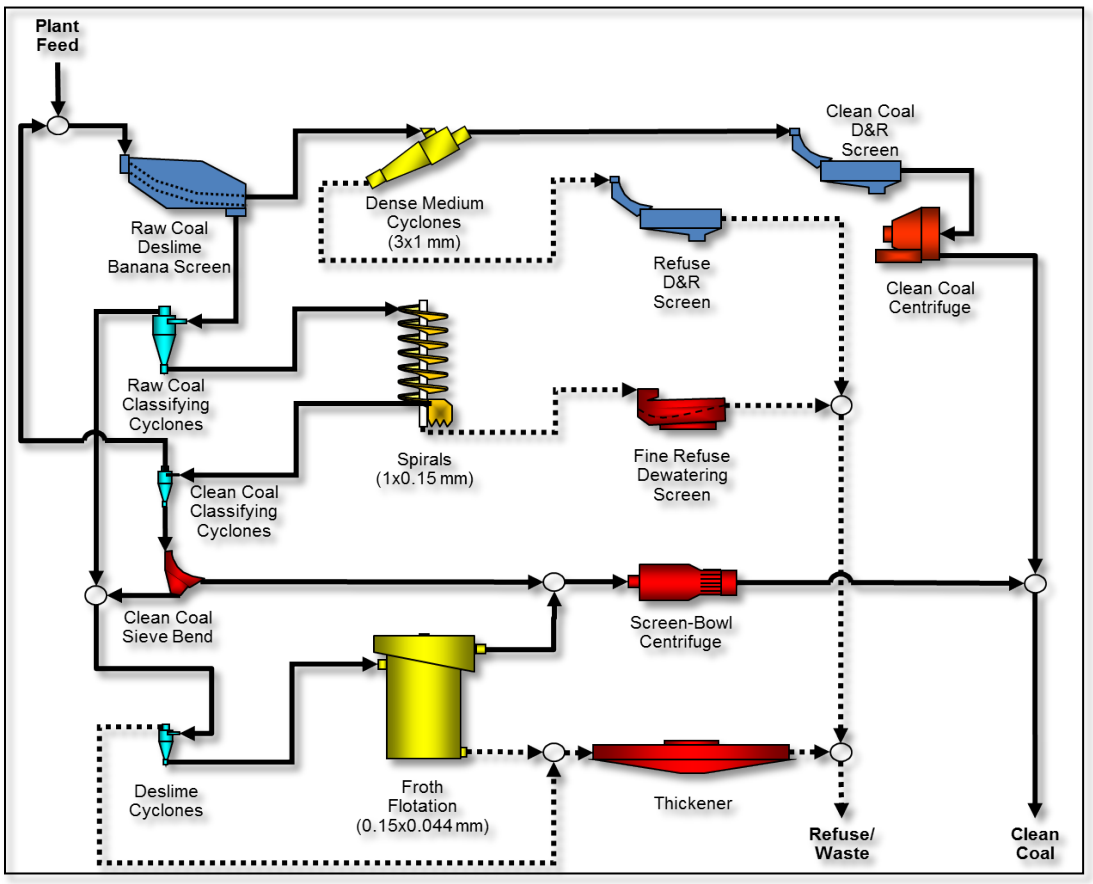


Figure 5.1 Generic flowsheet of a coal preparation plant investigated in this study.

5.3.2 *Feed Sample Characteristics*

The problem faced by the coal preparation circuit shown in Figure 5.1 was that sulfur tends to concentrate in the ultrafine (0.150 x 0.044 mm) clean coal product of flotation circuit. In order to quantify the sulfur percentage in the flotation circuit feed, initially two feed streams (overflow of raw coal classifying cyclone and undersize of clean coal sieve bend) were sampled and analyzed for their ash and sulfur contents. A comparison of the total sulfur contents of the two streams indicates that the main source of sulfur in the flotation circuit was the underflow stream of clean coal sieve bend. Table 5.1 shows size-by-size ash and sulfur data for clean coal sieve bend under size streams.

Table 5.1 Size by size average ash and sulfur analysis for the undersize stream of clean coal sieve bend.

Feed Size (mm)	Feed Fraction (%)	Feed Ash (%)	Feed Sulfur (%)
Plus 0.25	4.59	11.54	3.14
0.25 x 0.15	21.52	9.52	3.05
0.15 x 0.075	29.29	21.49	4.01
0.075 x 0.044	11.13	55.34	8.56
Minus 0.044	33.46	74.07	7.83
Total	100	39.82	5.55

Thus, the high sulfur ultrafine clean coal sieve undersize stream was selected as the feed slurry for this pilot-scale investigation. In order to normalize the fluctuations in the feed characteristics, a total of six barrels of coal slurry samples were collected over a period of 24 hours. Table 5.1 shows that the average total sulfur content of the collected feed sample was 5.5%, thus this coal sample can be classified as a high sulfur coal. Table 5.1 also illustrates another interesting aspect of the fine coal feed, i.e., the majority of the ash and sulfur is concentrated in the finer fractions of the feed.

5.3.3 ***Procedure***

Following fine coal cleaning circuitries were experimentally tested for their sulfur and ash separation performance:

- Spirals only circuit
- Water only cyclone circuit
- Froth flotation circuit
- Combined spirals and flotation circuit

Figure 5.2 provides a schematic of pilot-scale circuitry. As mentioned earlier, coal slurry from undersize clean coal sieve bend screen was used to prepare feed coal slurry of desired percent solids into a 240 gallon capacity feed sump. For all the experimental tests, coal feed consisted of 0.25 x 0.044 mm sized particles. During spiral and water-only cyclone testing, the slurry was held in suspension using a 25 cm diameter blade mixer. Slurry from the sump was pumped at a controlled rate using a variable-speed centrifugal pump equipped with a 35-cm diameter impeller. Feed slurry from the pump was passed up to an upper level floor to each unit operation being testing. A sample port was provided in the vertical feed line so that a representative feed sample could be collected. After passing through the cleaning unit, timed samples of the products were collected by diverting the full flow of the product streams into sample containers. For water-only cyclone tests, the collected products included timed samples of overflow and underflow products. Likewise, the two-stage compound spiral included a product box partitioned to collect six different samples across the profile of the second stage spiral as well as an upper draw-off point for the collection of primary refuse from the first stage spiral. This configuration made it possible to simultaneously collect timed samples of clean coal, refuse and five different middlings products so that complete recovery-rejection curves could be generated for each spiral test run. For the flotation evaluation, timed kinetic tests and release analysis tests were conducted on the same feed coal. In the combined spiral-flotation circuit, spiral clean coal product was used as feed to the froth flotation cell. After collecting and weighing the slurry samples, the solids were filtered, dried, weighted and analyzed for size-by-size sulfur and ash contents. The experimental data were then evaluated using a spreadsheet-

based mass balance routine to ensure that reliable data had indeed been obtained for each test run.

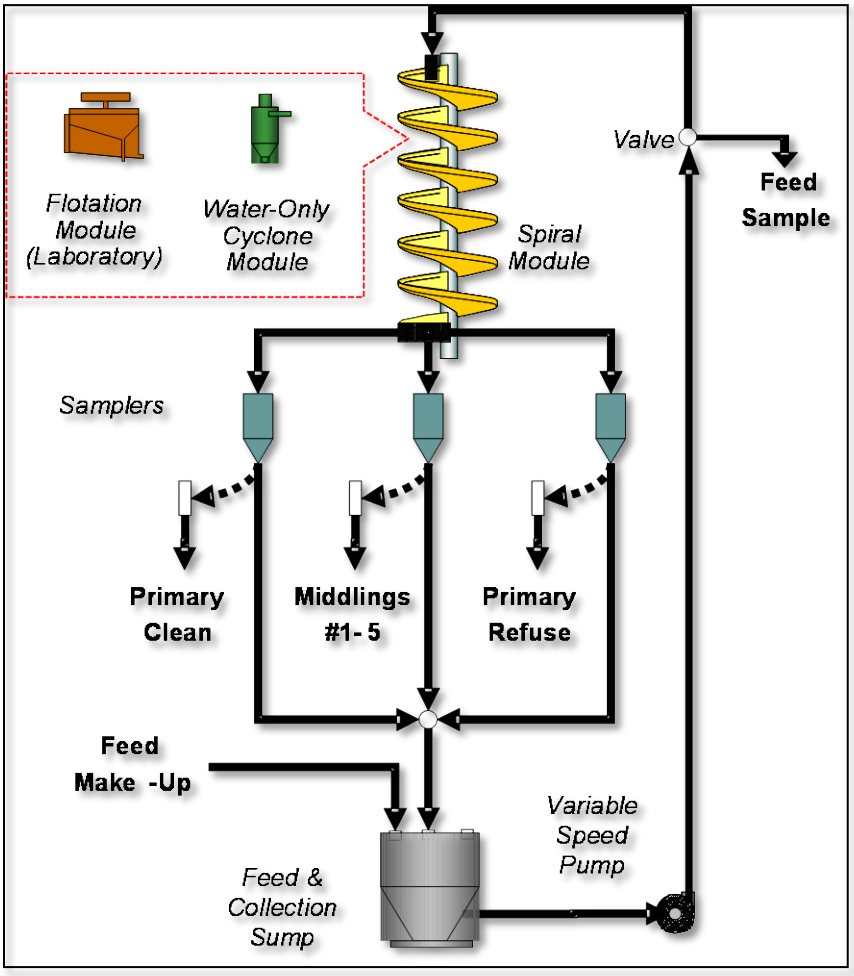


Figure 5.2 Schematic of pilot scale experimental set up.

5.4 Experimental Results

5.4.1 *Spirals Circuit*

A two-stage compound spiral (Multotec SX7) was used in spiral-only circuit testing. The Multotec SX7 is a commercial-scale compound spiral unit. The spiral-only circuit essentially consists of a seven turn compound spiral. After four turns of primary spiral, the primary refuse was removed and the remaining slurry was remixed and separated on the following three turn secondary spiral unit. The secondary spiral was equipped with a partitioned collection box so that seven products could be simultaneously collected across the spiral profile.

Figure ***5.3*** shows the schematic diagram of the product splitters and their distances from the central column of the spiral.

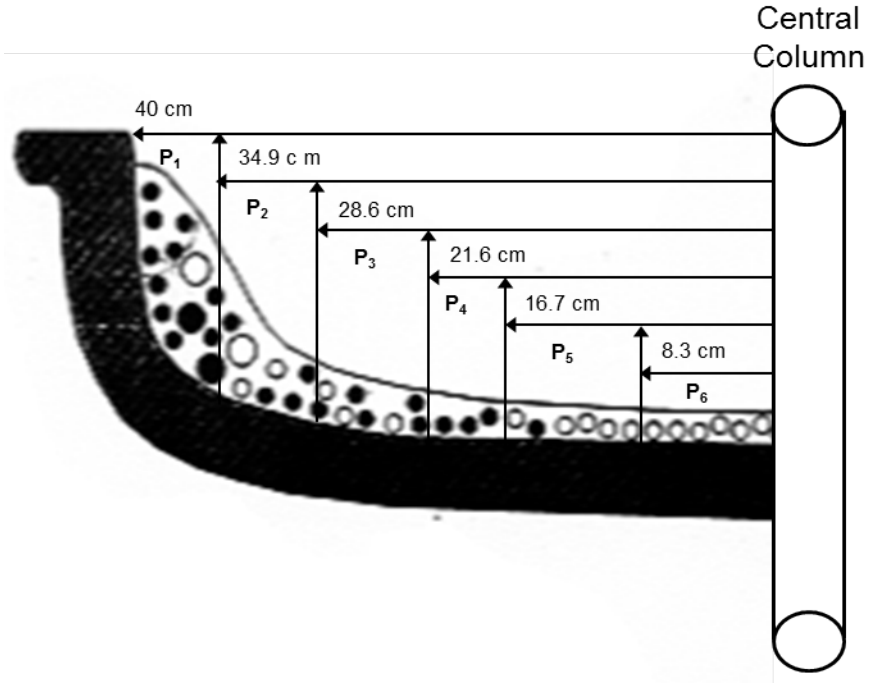


Figure 5.3 Schematic showing the position of spiral product splitters from central column.

Product collected at splitter position “P1” represents the cleanest product taken at the outer most position across the spiral profile, while “P6” represents the high density reject product taken at the inner most position near the center support tube for the spiral. Primary spiral refuse “P7” was separated by the primary refuse cutter and collected through the central column. Throughout this research study, combined products of “P1” and “P2” comprise the clean coal while products from “P3” to “P5” are the middlings. The combined products collected at splitter position of “P6” and “P7” are the spiral circuit reject. Table 5.2 shows the operating parameters for different spiral tests used in this study. These parameters were selected in accordance with the recommendations and guidelines provided by Honaker for cleaning of ultrafine coal using spirals (Honaker et al., 2007). Spiral test 1 was conducted using a relative high mass feed rate (1.04 TPH/start), feed percent solids (19.72%), and volumetric feed rate (19.43 GPM) whereas spiral test 5 was conducted on lowest values of these operating parameters. Operating parameters for other spiral tests were in between these two extremes.

Table 5.2 Operating parameters for spiral only circuits.

Spiral Test (Number)	Feed Rate (TPH)	Feed Solids (%)	Feed Volume (GPM)
1	1.04	19.72	19.43
2	1.46	19.73	27.35
3	0.80	12.44	24.48
4	0.65	12.20	20.21
5	0.46	12.15	14.56

Figure 5.4 and Figure 5.5 elucidate the cumulative effect of splitter positions across the spiral profile on ash and sulfur separation efficiencies. Spirals are typically utilized to clean 1 x

0.15 mm coal feed. Thus, coal spirals used to treat ultrafine (0.25 x 0 mm) coal yield poorer ash and sulfur separation efficiencies as indicated by the plots. Other important points to be noted in the figures are as follows.

- Maximum ash and sulfur separation efficiencies were approximately 17% and 27%, respectively.
- Among all the tests, the maximum ash and sulfur separation efficiencies were achieved during spiral test 1.
- At the same splitter position, sulfur separation efficiencies for each spiral test are better when compared to the corresponding ash separation efficiencies for the same spiral test.
- The specific gravity of sulfur-bearing particles is higher as compared to that of ash-bearing particles. Consequently, better sulfur separation performance may be due to the high specific gravity of ultrafine sulfur, which helps these particles to segregate themselves into reject streams.
- An interesting point to note is that both ash and sulfur separation efficiencies for all spiral tests are minimum for the product collected at splitter position “P1”. In other words, product “P1” contains a relatively high percentage of misplaced particles.
- For all the spiral tests, both the ash and sulfur separation efficiencies are comparatively low for the products collected at splitter position “P1”.
- For all the spiral tests, both ash and sulfur separation efficiencies improve when products from splitter positions “P2”, “P3” and “P4” are added to the clean product of “P1”.

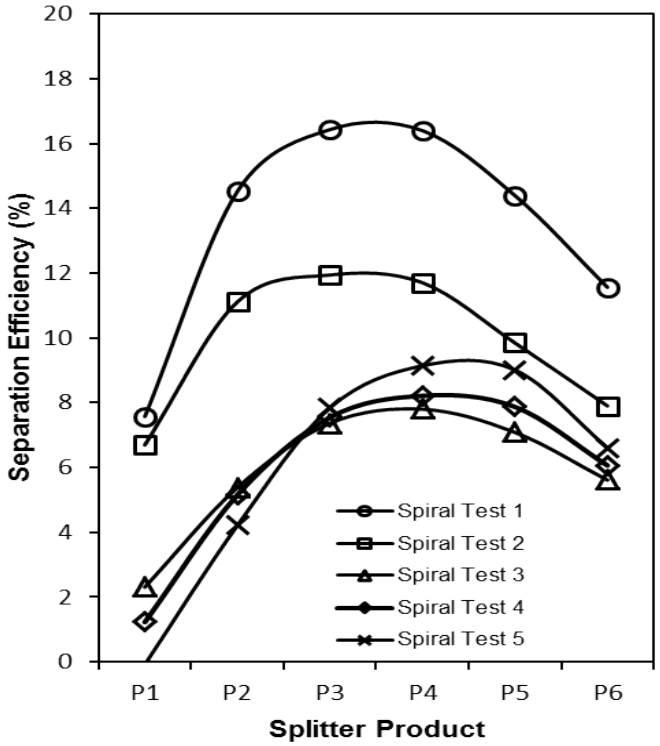


Figure 5.4 Size-by-size separation efficiency (ash) across the spiral profile.

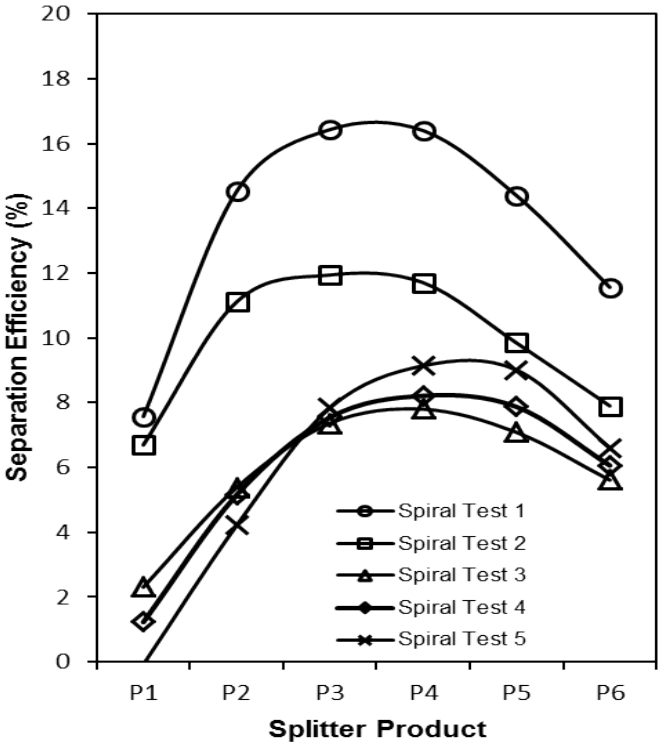


Figure 5.5 Size-by-size separation efficiency (ash) across the spiral profile.

Table 5.3 shows the size-by-size ash and sulfur reductions achieved by all spiral tests. In order to have a fair performance analysis, all the spiral tests are compared at the same feed assays. The data presented in Table 5.3 indicates that significant ash and total sulfur reductions were achieved for all feed sizes except the minus 0.044 mm size class. For the plus 0.075 mm feed coal, higher percentage reductions in product ash were noticed as compared to the minus 0.075 mm size class. In fact, feed size classes above 0.044 mm shows substantial decreases in percent sulfur values for the products.

Overall separation performance achieved by different spiral circuit is presented in Table 5.4. The highest combustible recovery of 83.7% was achieved during the second spiral test, while the highest sulfur and ash rejection was obtained during the first test run. For the overall coal feed (0.25 x 0 mm), a maximum of 36.60% of the ash and 45.72% of the sulfur was rejected (Table 5.4, Spiral test 1), while 50.77% ash and 49.85% sulfur rejection was obtained for the plus 0.044 mm coal (Table 5.5, Spiral test 1). Because of its poor separation performance, the minus 0.044 mm product size fractions were screened and removed.

The data provided in Table 5.5 represents the assays obtained from 0.25 x 0.044 mm feed size fractions for all individual spiral tests. A comparison between Table 5.4 and Table 5.5 indicates that significant improvements in separation performance were achieved by removing minus 0.044 mm size particles. For example, the combustible recovery of the 0.25 x 0.044 feed size fraction for spiral test 1 improved by 7.97% when compared to the combustible recovery achieved for a feed size of 0.25 x 0 mm for the same spiral test. Similarly, the clean coal ash and sulfur values were reduced by 20.26% and 5.26%, respectively. Thus, to achieve an acceptable sulfur rejection, the minus 0.044 size fraction needs to be removed from spiral feeds.

Table 5.3 Size-by-size separation performance achieved by pilot scale testing of spiral only circuits on high sulfur minus 0.250 mm coal .

Spiral Test (Number)	Particle size (mm)	Feed		Product		Tailings	
		Ash (%)	Sulfur (%)	Ash (%)	Sulfur (%)	Ash (%)	Sulfur (%)
1	+ 0.250	11.54	3.14	6.28	2.81	60.84	6.12
	0.250 x 0.150	9.52	3.05	7.15	2.83	36.03	5.32
	0.150 x 0.075	21.59	4.01	13.65	2.98	53.17	8.49
	0.075 x 0.044	55.34	8.56	44.16	4.81	73.48	16.21
	- 0.044	74.07	7.83	73.24	6.31	77.66	16.46
2	+ 0.250	11.54	3.14	5.36	2.67	57.37	6.69
	0.250 x 0.150	9.52	3.05	8.10	2.91	36.22	5.34
	0.150 x 0.075	21.59	4.01	15.80	3.22	52.49	8.73
	0.075 x 0.044	55.34	8.56	49.07	6.18	71.26	16.15
	- 0.044	74.07	7.83	74.08	7.69	75.24	10.73
3	+ 0.250	11.54	3.14	5.83	2.69	50.09	6.25
	0.250 x 0.150	9.52	3.05	7.43	2.84	27.51	4.66
	0.150 x 0.075	21.59	4.01	17.83	3.50	44.66	7.15
	0.075 x 0.044	55.34	8.56	47.02	5.84	75.10	15.99
	- 0.044	74.07	7.83	74.20	6.31	75.09	18.04
4	+ 0.250	11.54	3.14	6.81	2.91	41.50	4.08
	0.250 x 0.150	9.52	3.05	7.28	2.82	29.86	5.34
	0.150 x 0.075	21.59	4.01	15.56	3.36	50.11	7.38
	0.075 x 0.044	55.34	8.56	46.29	5.83	77.44	16.23
	- 0.044	74.07	7.83	73.77	7.69	76.09	16.11
5	+ 0.250	11.54	3.14	7.20	2.83	35.11	4.73
	0.250 x 0.150	9.52	3.05	7.02	2.89	24.19	4.07
	0.150 x 0.075	21.59	4.01	15.55	3.45	50.82	6.68
	0.075 x 0.044	55.34	8.56	45.85	5.90	73.94	14.39
	- 0.044	74.07	7.83	74.00	6.31	75.43	15.70

Table 5.4 Results obtained from spiral only circuits on high sulfur minus 0.25 mm coal (Feed ash = 39.82%, Feed sulfur = 5.55%).

Spiral Test (Number)	Ash		Sulfur		Ash Rejection (%)	Sulfur Rejection (%)	Cumulative Yield (%)	Combustible Recovery (%)
	Product (%)	Tailings (%)	Product (%)	Tailings (%)				
1	35.00	65.48	4.18	12.91	36.60	45.72	72.14	77.92
2	36.46	64.05	4.91	11.17	27.36	29.80	79.32	83.75
3	38.16	56.31	4.71	11.72	25.42	34.01	77.81	79.96
4	38.17	56.39	4.81	11.04	28.40	35.18	74.70	76.75
5	38.32	55.18	4.72	10.47	35.10	42.64	67.43	69.11

Table 5.5 Results obtained from spiral only circuits on high sulfur 0.25 x 0.044 mm coal (Feed ash = 39.82%, Feed sulfur = 5.55%).

Spiral Test (Number)	Ash		Sulfur		Ash Rejection (%)	Sulfur Rejection (%)	Cumulative Yield (%)	Combustible Recovery (%)
	Product (%)	Tailings (%)	Product (%)	Tailings (%)				
1	27.91	91.81	3.96	13.36	50.77	49.85	70.23	84.13
2	31.64	89.76	4.37	13.78	38.04	38.57	77.97	88.57
3	32.79	81.24	4.57	11.62	38.46	38.51	74.73	83.46
4	31.11	84.78	4.51	11.45	44.67	42.48	70.82	81.06
5	31.14	80.56	4.59	10.21	50.05	47.21	63.88	73.09

Figure 5.6 through Figure 5.10 provide size-by-size combustible recovery and ash rejection curves for all the spiral tests. The data in these figures indicates that:

- In each spiral test, the highest separation efficiency (ash) was achieved for the plus 0.25 mm feed size fraction.
- Coarser (plus 0.25) feed particles show better separation efficiency at a higher volumetric flow rate (Figure 5.7).

- Almost no separation was found in all experiments for the minus 0.044 mm feed size classes.
- Maximum separation for a feed size fraction of 0.25 x 0.044 mm was achieved for a solid feed rate of 1 tph, at a volumetric flow rate of 20 gpm and at 20% of feed solids.

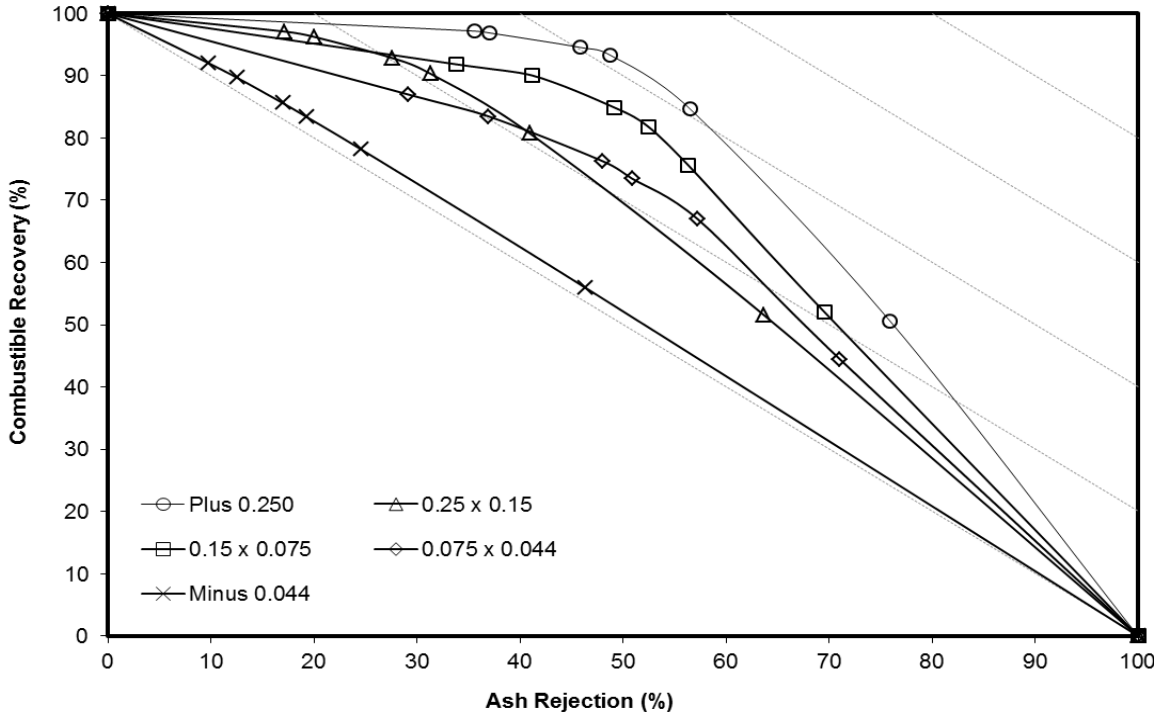


Figure 5.6 Size-by-size separation (ash) curves for spiral test 1.

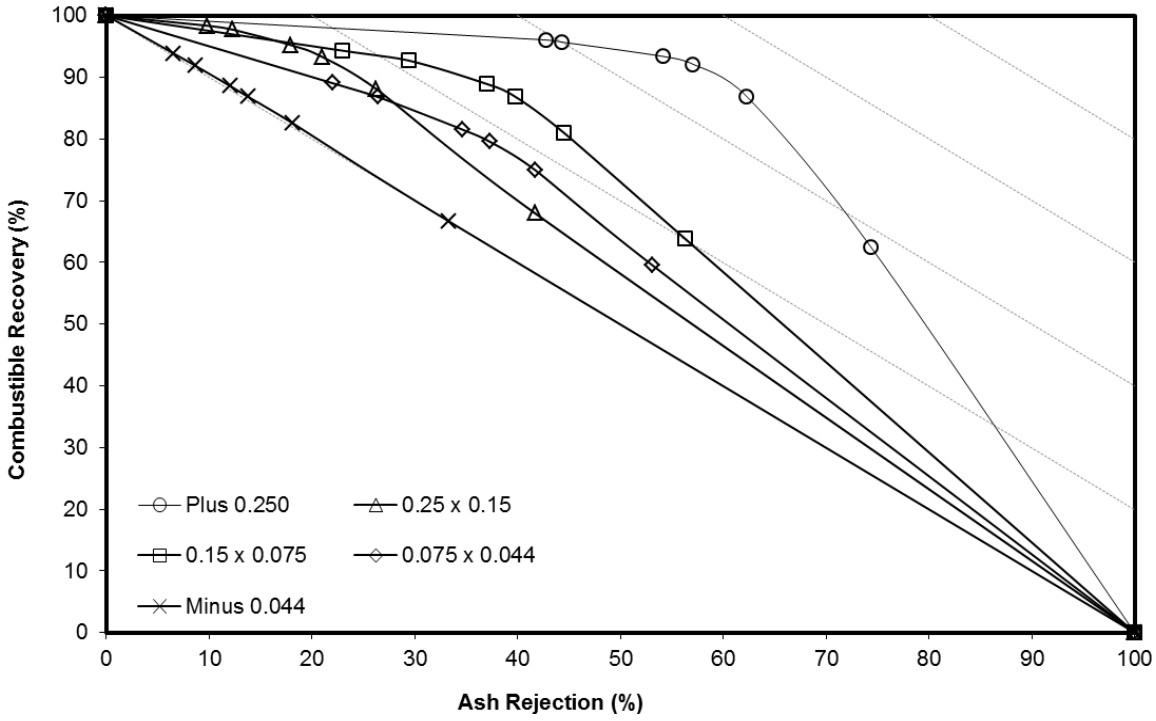


Figure 5.7 Size-by-size separation (ash) curves for spiral test 2.

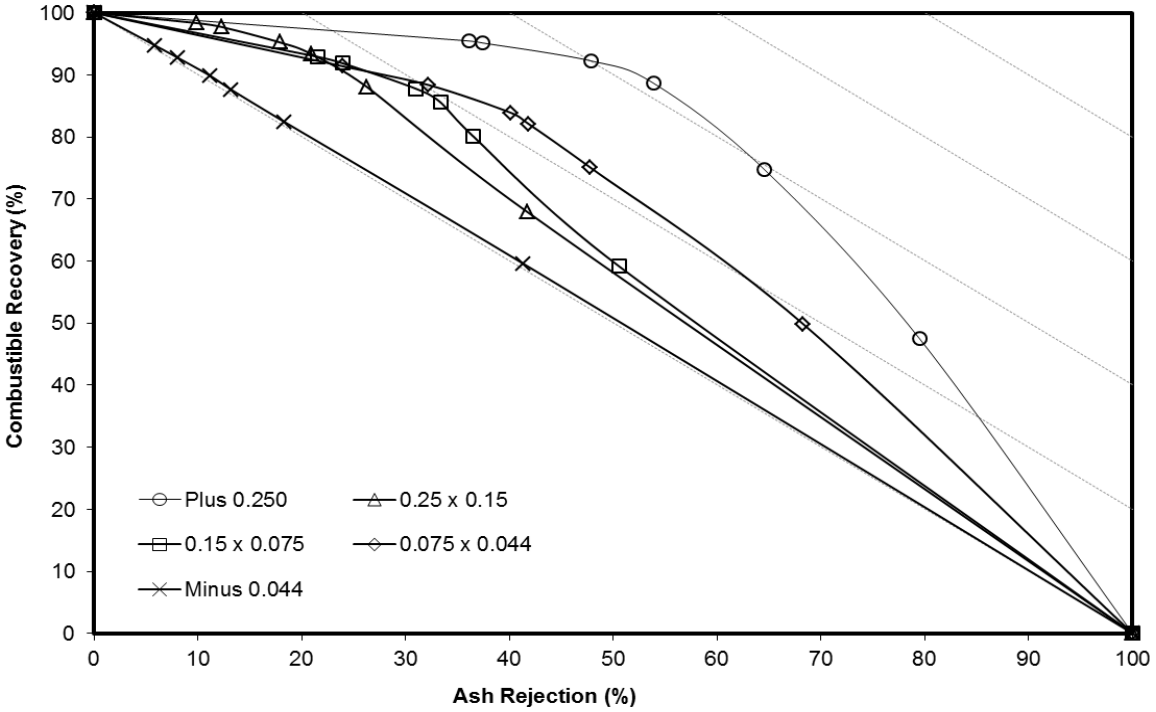


Figure 5.8 Size-by-size separation (ash) curves for spiral test 3.

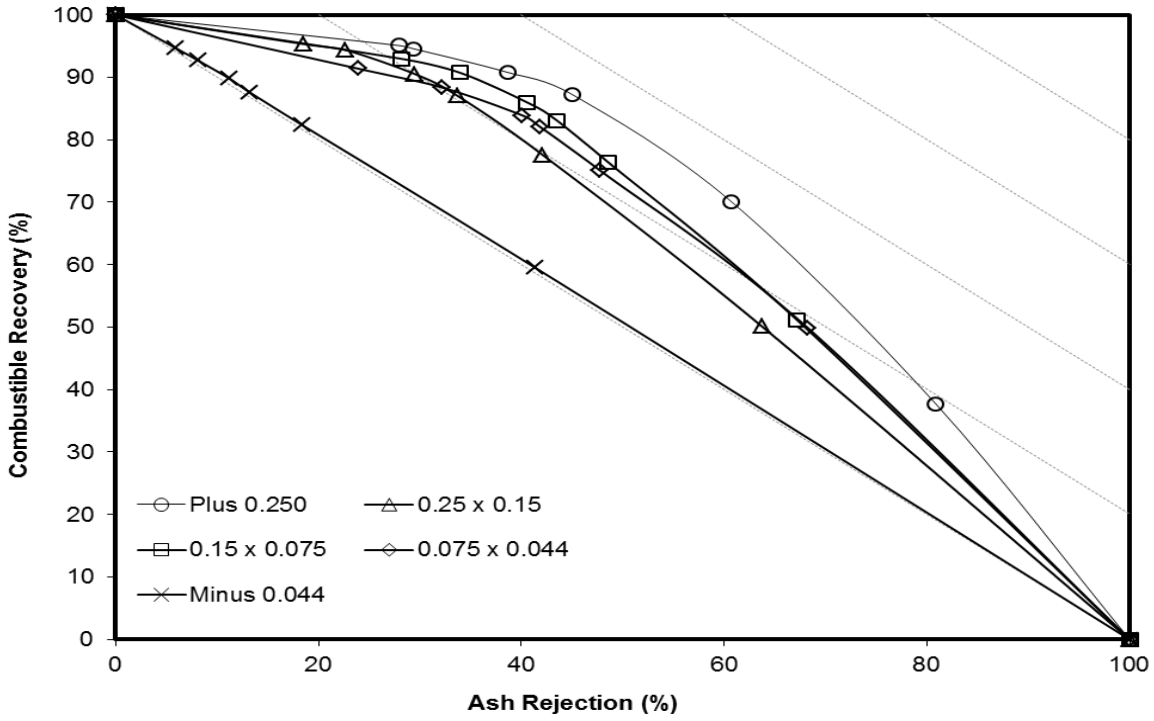


Figure 5.9 Size-by-size separation (ash) curves for spiral test 4.

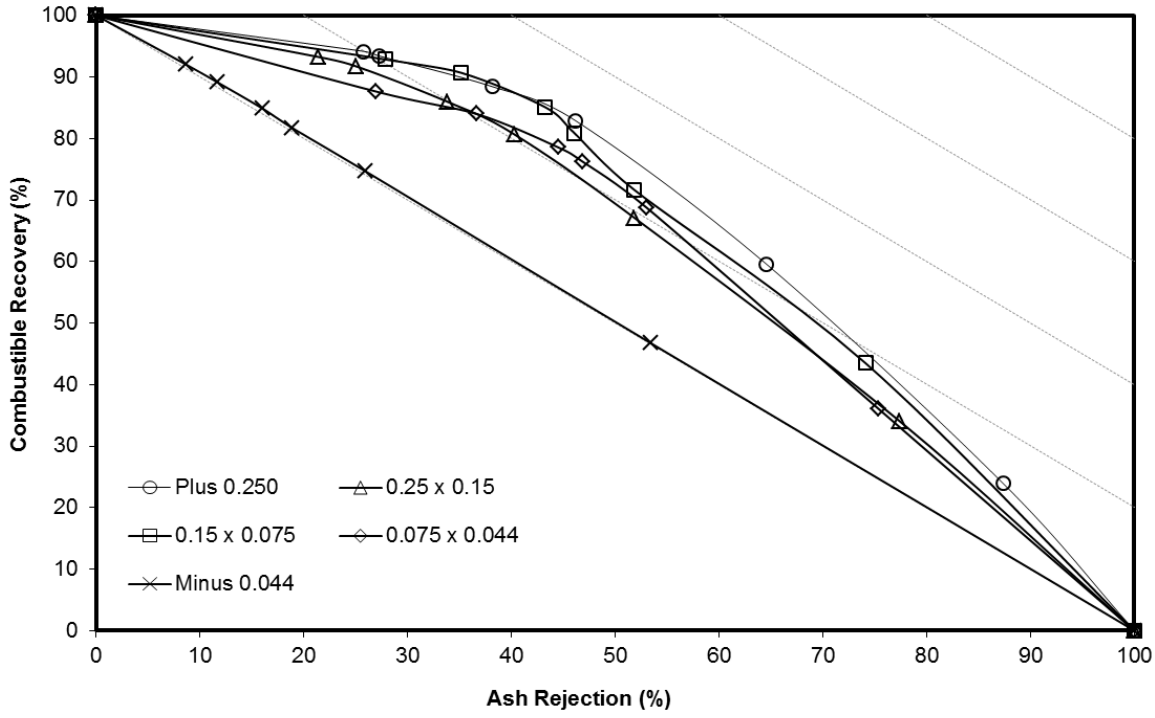


Figure 5.10 Size-by-size separation (ash) curves for spiral test 5.

Figure 5.11 through Figure 5.15 represent the size-by-size combustible recovery and sulfur rejection curves for all the spiral tests. The important point to note is that unlike the ash separation efficiencies, good sulfur separation efficiencies were obtained for the ultrafine (minus 0.15 mm) coals. Moreover, the sulfur separation efficiencies for minus 0.15 mm coal feed are better when compared to that of the plus 0.15 mm coal feed (Figure 5.11). The plots also show that spirals perform better in terms of sulfur rejection as compared to ash rejection for minus 0.15 coal feeds. Other points to be noted from the Figure 5.11 to Figure 5.15 are as follows.

- The maximum separation efficiency of sulfur was obtained by maintaining medium feed flow rates (i.e., 1 tph and 20 gpm).
- In contrast with the ash separation efficiency (Figures 5.6 to 5.10), plus 0.25 mm coal feeds perform less well in terms of sulfur separation performance.
- The maximum sulfur separation efficiency was obtained for the 0.075 x 0.044 mm feed size fraction, followed by the 0.15 x 0.075 mm feed size fractions.
- Even the minus 0.044 mm feed size fraction shows some degree of sulfur separation.

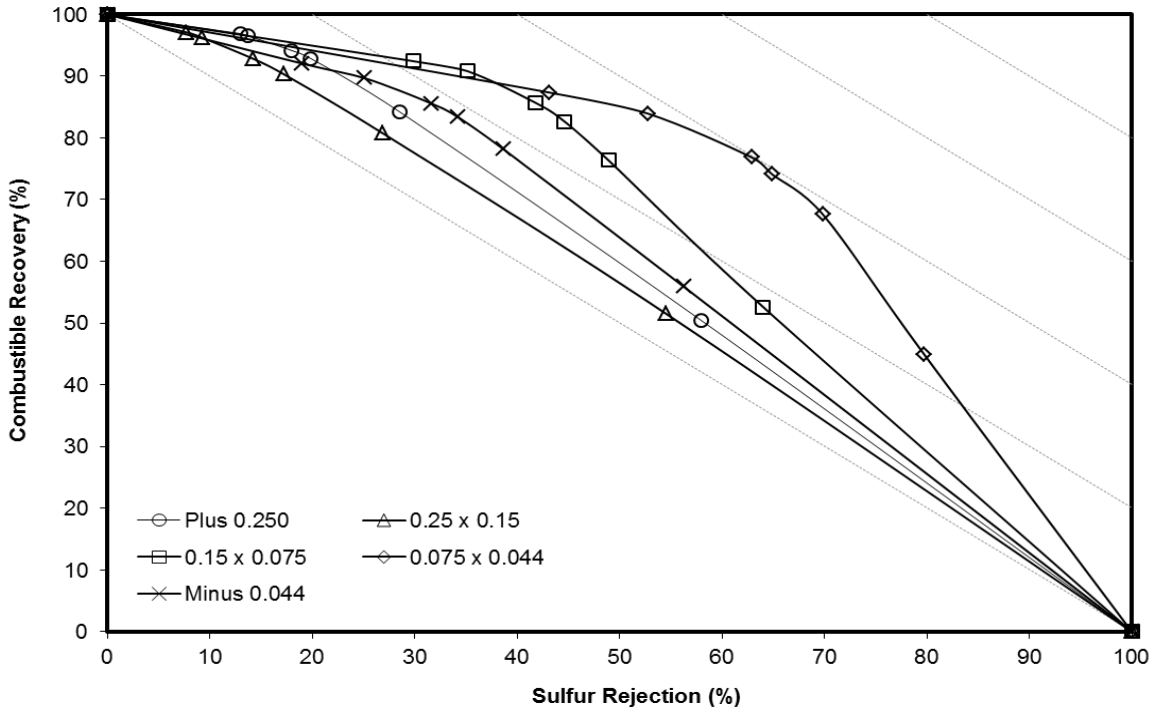


Figure 5.11 Size-by-size separation (sulfur) curves for spiral test 1.

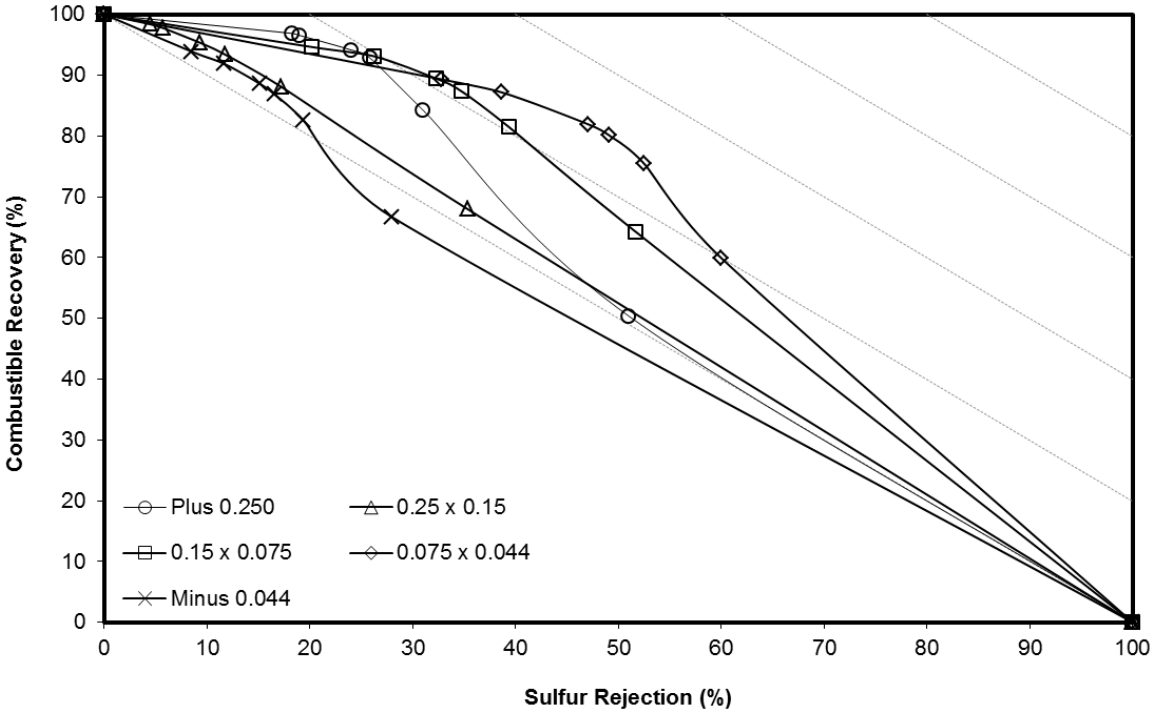


Figure 5.12 Size-by-size separation (sulfur) curves for spiral test 2.

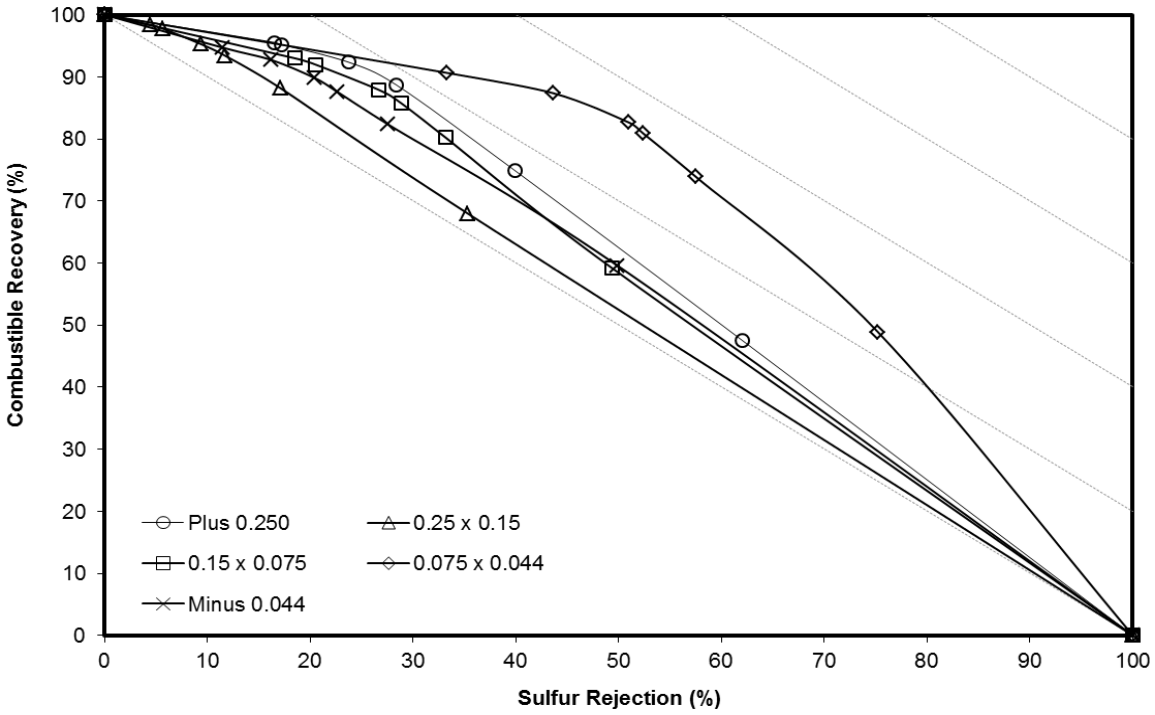


Figure 5.13 Size-by-size separation (sulfur) curves for spiral test 3.

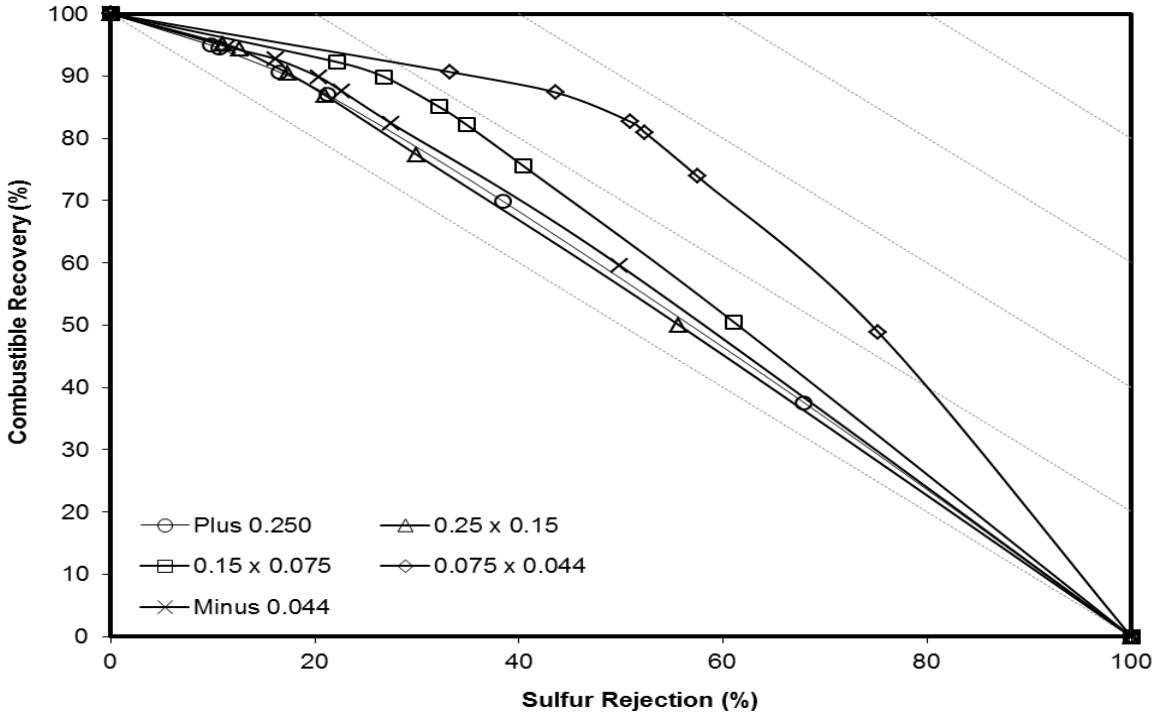


Figure 5.14 Size-by-size separation (sulfur) curves for spiral test 4.

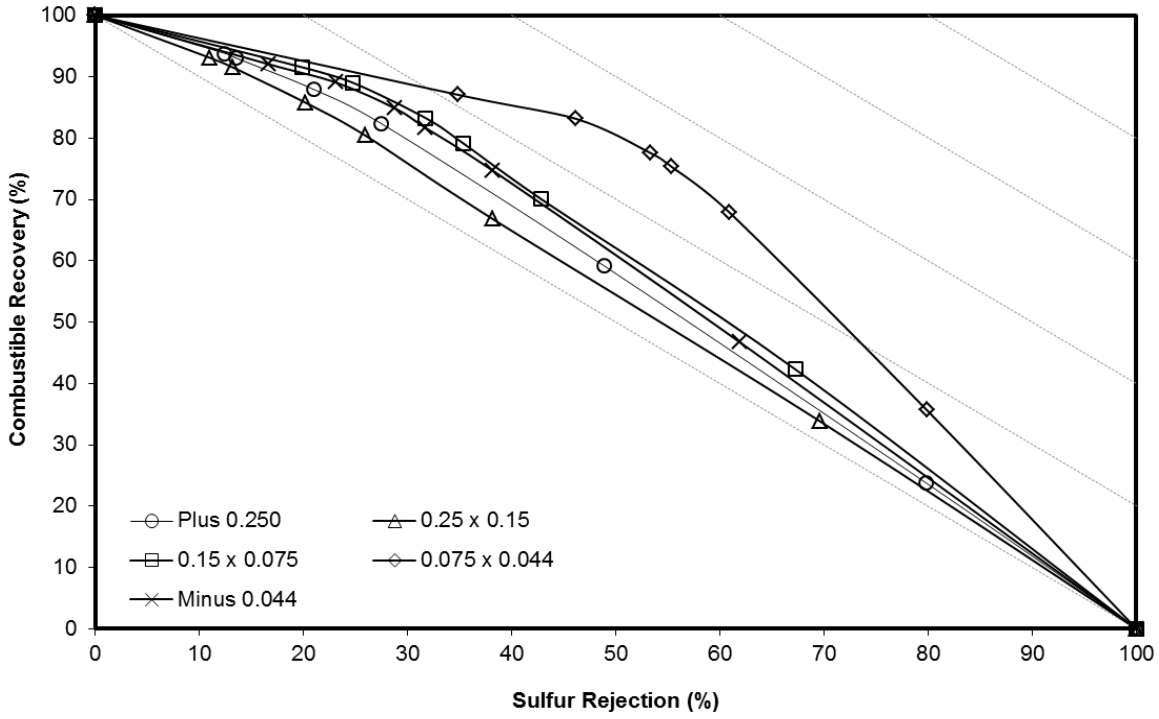


Figure 5.15 Size-by-size separation (sulfur) curves for spiral test 5.

5.4.2 *Water Only Cyclone Circuit*

In this pilot-scale research study, the water-only cyclone was operated at three different feed percent solids, i.e., low (9%), medium (12%) and high (15%). Table 5.6 shows the ash and total sulfur rejections achieved by water-only cyclone for the 0.25 x 0 mm coal feed. Although the water-only cyclone shows high sulfur rejection capability, this unit was unfortunately unable to provide an acceptable overall cumulative yield. As such, the data in the table indicates that 89.53% of the sulfur was rejected by the water-only cyclone operated at a low feed solid content of 9%. However, the cumulative yield and combustible recovery achieved during the same water-only cyclone test were only 21.78% and 15.06%, respectively. Thus, the low yield values indicate that the water-only cyclone is probably not attractive as a stand-alone unit for coal deashing and desulfurization.

Table 5.6 Ash and total sulfur reductions achieved from the treatment of high sulfur 0.25 coals by water-only cyclone (Feed ash = 39.82%, Feed sulfur = 5.55%).

WOC Test (Number)	Feed Solids (%)	Ash		Sulfur		Ash Rejection (%)	Sulfur Rejection (%)	Cumulative Yield (%)	Combustible Recovery (%)
		Product (%)	Tailings (%)	Product (%)	Tailings (%)				
1	9	59.51	36.44	2.72	6.47	68.74	89.53	21.78	15.06
2	12	60.87	35.01	2.80	6.22	68.16	68.16	21.18	13.92
3	15	61.86	34.98	2.60	6.39	71.46	71.46	18.42	11.70

Figure 5.16 and Figure 5.17 summarize the size-by-size ash and sulfur separation performance, respectively, for the water-only cyclone tests. In general, very poor ash separation efficiencies were obtained for all feed size fractions. Sulfur separation efficiencies for the same feed size are comparatively better than those of ash separation efficiencies at the same feed percent solids (Figure 5.17). Interestingly, amongst all coal feed size fractions, the minus 0.044 mm coals attained maximum sulfur separation efficiency (25 to 30%). Poor separation of both ash and sulfur results may be because the water-only cyclones are optimized to treat coal feed in the size range of 3 x 1 mm.

Figure 5.18 graphically represents the size-by-size sulfur separation efficiencies versus different feed percent solids of the water-only cyclone circuit. It shows that separation performance of each size class increases with increase in feed percent solids and as such minimum sulfur separation was obtained at 9% feed solids, while maximum separation was achieved when the water-only cyclone was operated at 15% feed solids. In conclusion, the water-only cyclone, when used to clean fine (minus 0.15 mm) high sulfur coal, tends to reject the majority of the sulfur-bearing particles into the underflow reject stream, but the very low combustible recovery of the unit made it impractical for cleaning ultrafine high sulfur coals.

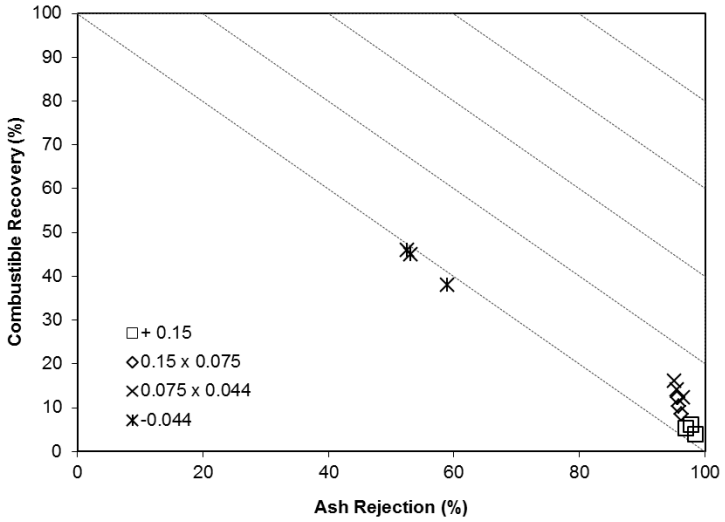


Figure 5.16 Size-by-size ash separation performance curves for a water-only cyclone circuit at different feed percent solids.

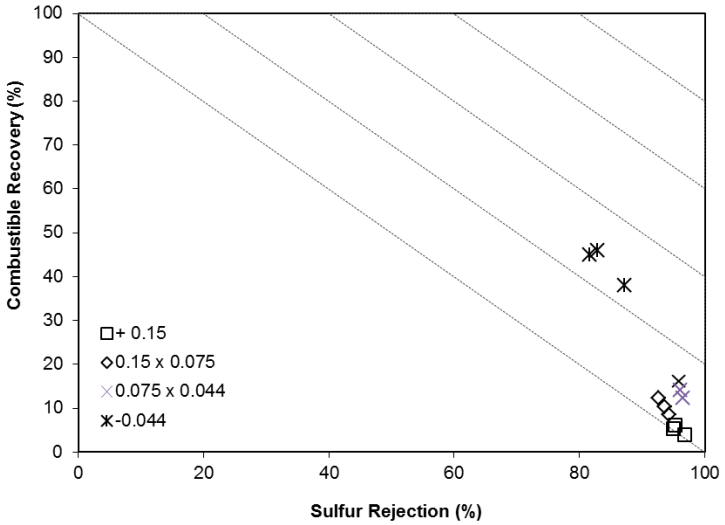


Figure 5.17 Size-by-size sulfur separation performance curves for a water-only cyclone circuit at different feed percent solids.

5.4.3 *Froth Flotation Circuit*

Froth flotation has proved to be an effective process for cleaning fine (minus 0.15 mm) coals. In this research study, both release analysis and timed flotation tests were carried out using a laboratory froth flotation machine (Denver Model D-12). The frother was Dowfroth 200 and the fuel oil was used as a collector. In order to find out the natural floatability of the clean coal product, flotation tests were also performed without the addition of any collector. In total, four different flotation tests were carried out as shown by Table 5.7. The results show that, at a comparatively lower yield of 49.75%, good ash and sulfur rejections were achieved by the flotation circuit. The highest yield (66.32%) and combustible recovery (92.34%) corresponds to the lowest ash (68.27%) and sulfur (32.83%) rejections.

Table 5.7 Ash and total sulfur reductions achieved by froth flotation circuit on high sulfur minus 0.25 coal feed. (Feed ash = 42.62%, Feed sulfur = 5.92%).

Flotation Test (Type)	Ash		Sulfur		Ash Rejection (%)	Sulfur Rejection (%)	Cumulative Yield (%)	Combustible Recovery (%)
	Product (%)	Tailings (%)	Product (%)	Tailings (%)				
Release	14.85	70.40	5.64	6.31	82.72	53.07	49.75	74.01
Release*	14.80	84.26	5.28	6.48	78.88	44.61	60.39	89.19
Kinetic	19.55	82.94	5.84	6.27	70.62	37.83	63.83	89.27
Kinetic*	20.54	87.01	6.03	5.80	68.27	32.83	66.32	92.34

*Flotation tests with frother only

Size-by-size ash and sulfur separation performances achieved by the flotation-only tests are shown in Figure 5.18 through Figure 5.22. The feed size fraction of 0.250 x 0.150 mm showed the least ash separation efficiency, while the plus 0.25 mm coals showed a comparatively

better ash separation. Reasonable sulfur separation efficiencies were achieved for the minus 0.075 mm coals. A close observation of the separation efficiencies of ash and sulfur versus time plots (Figure 5.22) indicate that good separation efficiencies were generally achieved in these experiments.

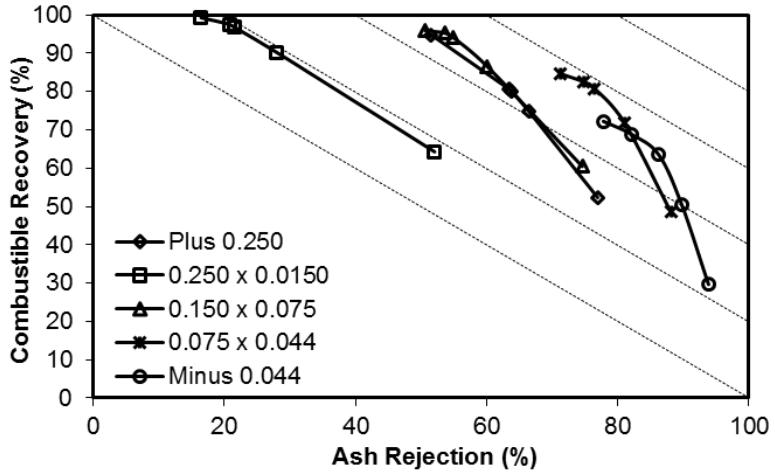


Figure 5.18 Size-by-size ash separation curves for timed kinetic test (flotation).

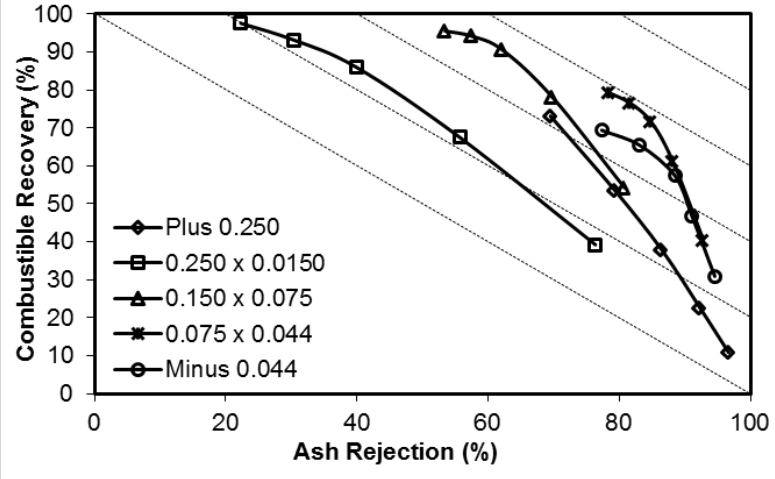


Figure 5.19 Size-by-size ash separation curves for timed kinetic test (Flotation with frother only).

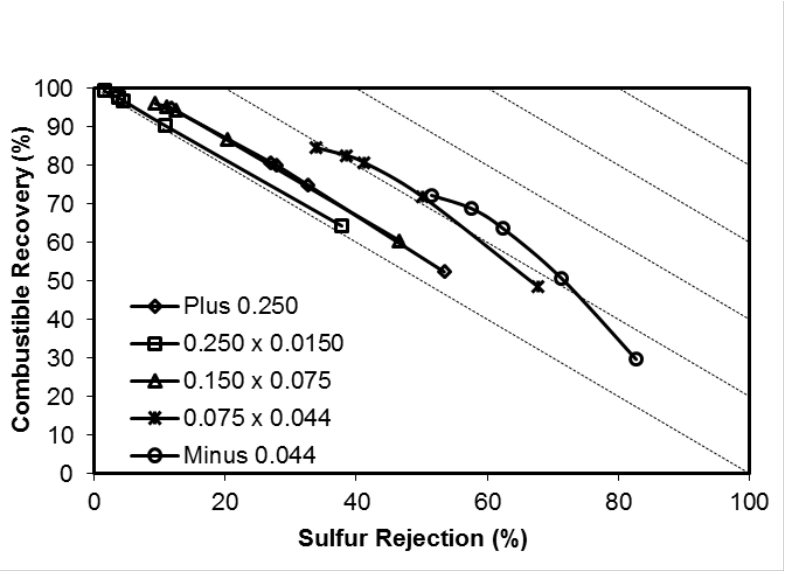


Figure 5.20 Size-by-size sulfur separation curves for timed kinetic test (Flotation).

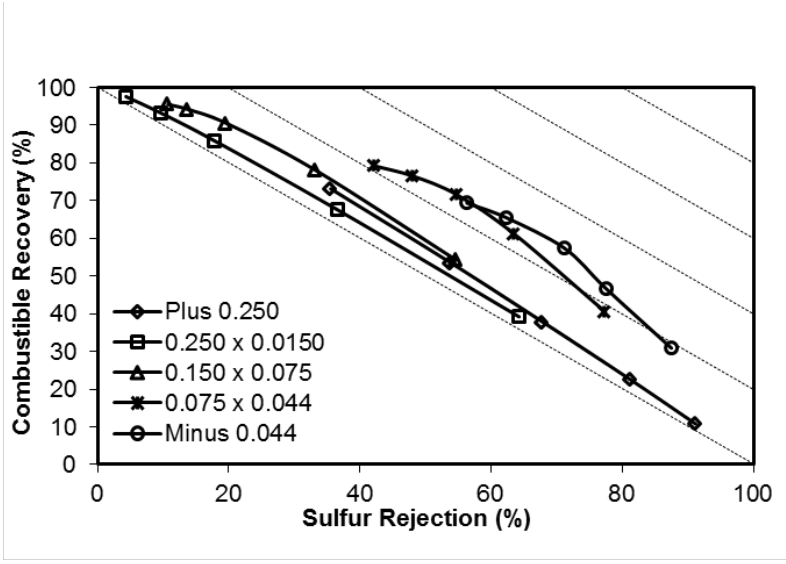
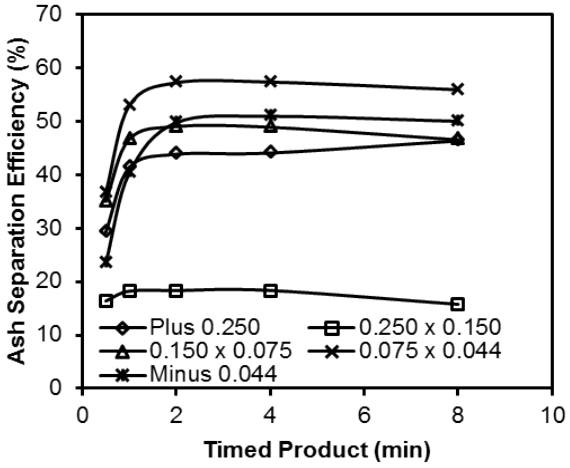
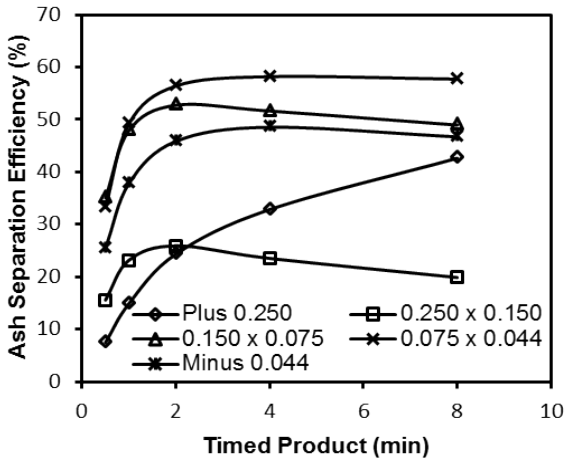


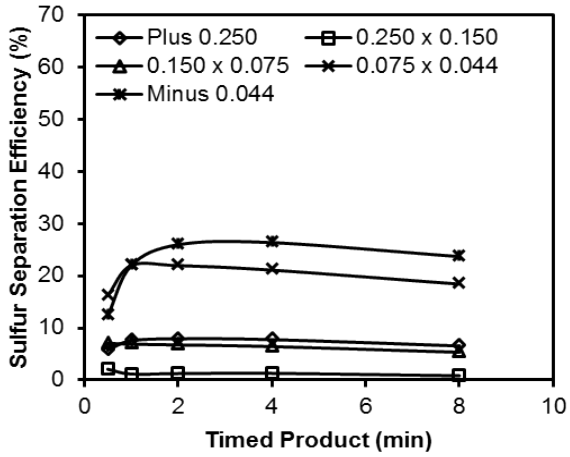
Figure 5.21 Size-by-size sulfur separation curves for timed kinetic test (Flotation with frother only).



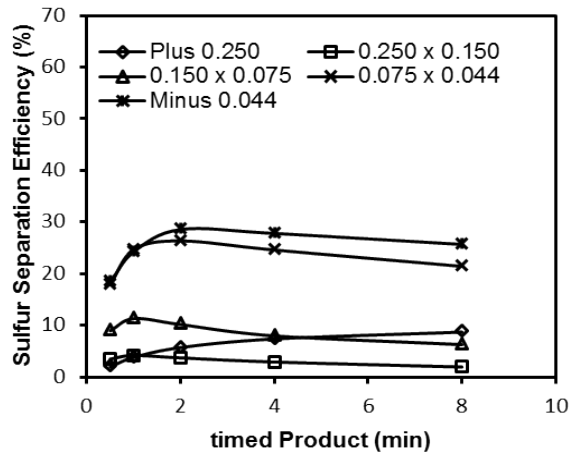
(A)
Size-by-size separation efficiencies for timed kinetic test (Flotation).



(B)
Size-by-size ash separation efficiencies for timed kinetic test (Flotation with frother only).



(C)
Size-by-size sulfur separation efficiencies for timed kinetic test (Flotation).



(D)
Size-by-size sulfur separation efficiencies for timed kinetic test (Flotation with frother only).

Figure 5.22 Size-by-Size ash and sulfur separation efficiencies for flotation only circuit .

5.4.4 *Combined Spirals and Flotation Circuit*

Analysis of the sulfur separation performance achieved by each individual technology tested in this study indicates that either the sulfur contents in the final clean coal concentrate remains high (spiral or flotation-only circuits) or the combustible recovery of the clean coal remains too low for an economical separation process (water-only cyclone circuit). However, the data also suggests that the retreatment of spiral clean coal by a forth flotation process might provide an improved sulfur rejection performance for ultrafine high-sulfur coal. Therefore, to prove the concept, additional flotation experiments were conducted on the spiral clean product. Initially, the high sulfur ultrafine coal feed sample was treated on a spiral. Afterwards, the spiral clean product was retreated by the froth flotation process. Spiral refuse was rejected, while the middlings were recycled back to the spiral feed. Ash and sulfur reductions achieved by the combined spiral-flotation circuitry are illustrated as a schematic flow diagram in Figure 5.23.

An interesting point to be noted in Figure 5.23 is that the sulfur percentage of the final product/froth concentrate (4.13%) is higher than that of flotation feed/spiral clean (4.1%). It may be due to the fact that spirals tend to (i) remove only fully liberated high-density ultrafine pyrite particles and (ii) concentrate both the partially liberated pyrite particles and the chemically bond organic sulfur present in the coal feed. Moreover, as indicated by Figure 5.22, the froth flotation process is not as efficient in removing sulfur-bearing minerals from coal as it is in removing ash-bearing minerals. Therefore, froth flotation appears to concentrate the sulfur in the final clean coal by removing more particles of ash-forming minerals than particles of coal pyrite.

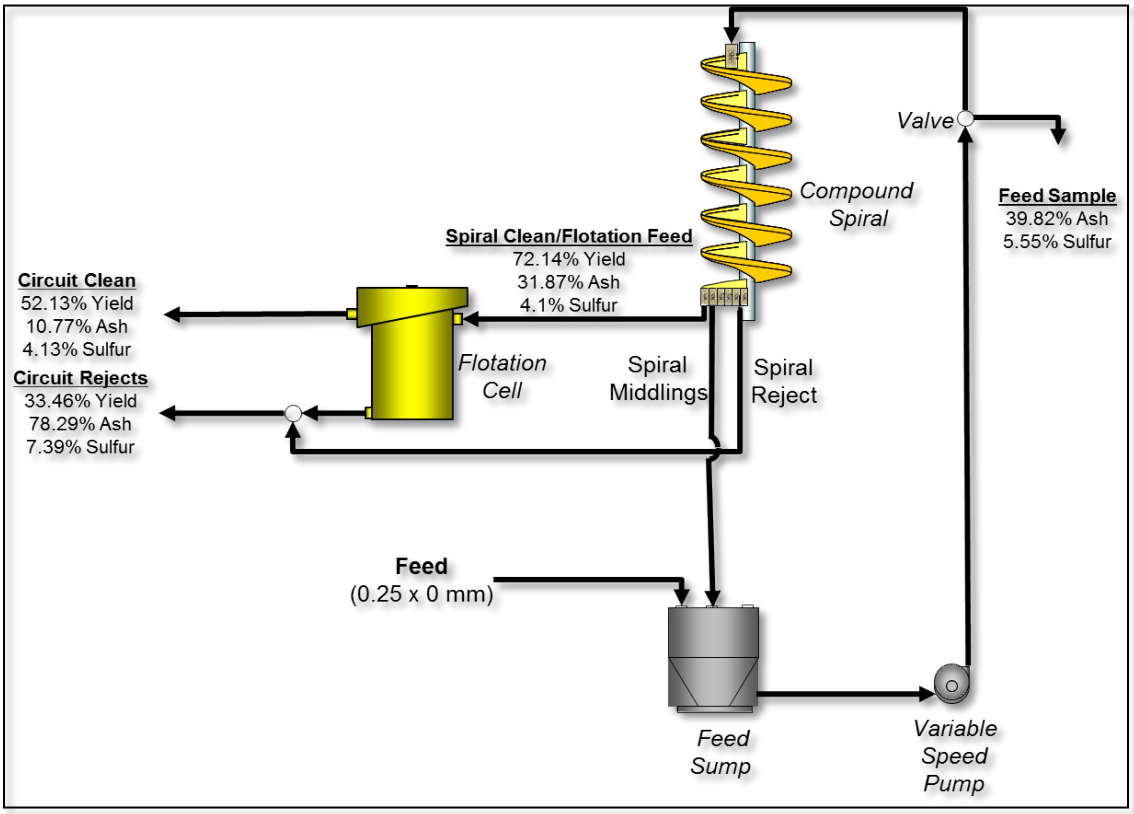


Figure 5.23 Schematic of combined spiral – froth flotation circuit showing the circuit feed and product assays.

5.5 Discussion

Table 5.8 shows the overall comparison of the separation performance achieved by different fine coal cleaning circuits on high sulfur fine coal feeds. The data shown in the table was selected from various experimental test runs and it represents the best level of performance achieved by each technology/circuit. The data indicates that the spiral-only circuit produced a relatively low sulfur (4.18%) and high ash (35%) clean coal. Thus, the spiral-only circuit gives a better sulfur rejection (45.72%), but was unable to reduce the clean coal ash to an acceptable minimum level. On one hand, the lowest clean coal sulfur (2.60%) was achieved by the water-only cyclone technology, but it also provided the lowest combustible recovery of only 11.70%,

which is clearly unacceptable. Although the flotation-only run provided good ash and sulfur rejections, the clean coal yield and combustible recovery provided by the same circuit were lower as compared to that of the spiral-only and combined spiral-flotation circuits. Amongst all the coal cleaning alternatives tested during this work, the combined spiral-flotation circuitry produces a coal with a lowest ash (10.77%) and sulfur (4.13%) at a reasonable combustible recovery of 77.29%. In fact, a detailed comparison of the results (Table 5.8) indicates that the combined spiral-flotation circuitry is superior in producing a low-ash and low-sulfur clean coal product at a comparatively higher clean coal yield.

Table 5.8 Comparison of ash and total sulfur reductions achieved by different fine coal cleaning circuits on high sulfur minus 0.25 coal feed.

		Spiral	WOC	Flotation	Spiral + FF*
Feed	Ash (%)	39.82	39.93	42.76	39.82
	Sulfur (%)	5.55	5.69	5.98	5.55
Clean Coal	Yield (%)	72.14	18.42	49.75	52.13
	Recovery (%)	77.92	11.70	74.01	77.29
	Ash (%)	35.0	61.86	14.85	10.77
	Sulfur (%)	4.18	2.60	5.64	4.13
Reject	Yield (%)	13.45	81.58	50.25	33.46
	Ash (%)	65.48	34.98	70.40	78.29
	Sulfur (%)	10.32	6.39	6.31	7.39
	Ash Rejection (%)	36.60	71.46	82.72	65.79
	Sulfur Rejection (%)	45.72	91.59	53.07	44.54

*Combined spiral and flotation circuit

The superiority of the combined spiral-flotation circuit is slightly masked by the fact that the ash and sulfur contents of the flotation only circuit feed were slightly higher than those of for

the combined circuit feed. Thus, for a fair comparison, the performance of each circuit was also compared based on separation efficiencies. The separation efficiencies were derived from combustible recoveries versus ash/sulfur rejection plots.

Figure 5.24 and Figure 5.25 compares the size-by-size sulfur and ash separation efficiencies of different fine coal cleaning alternatives evaluated in this research. The separation efficiencies shown in these figures represent the best level of performance achieved by each coal cleaning circuit used in this study. The combined spiral and flotation circuit was able to provide the lowest clean coal sulfur contents over the entire range of particle sizes (Figure 5.24). Although the sulfur separation efficiencies achieved by the spiral only circuit were nearly comparable to the combined spiral-flotation circuit for the minus 0.15 mm feed coal. But the ash separation efficiencies of spiral only circuit for the same feed sizes were less than that of achieved by the combined spiral and flotation circuit (Figure 5.25). Ash separation efficiencies of both flotation only and combined spiral and flotation circuits were the same for a feed size of 0.15 x 0.0.75 mm and for minus 0.075 mm coals flotation is the only process to achieve highest ash separation performance (Figure 5.25). Amongst all the coal cleaning circuit experimentally tested, the lowest ash and sulfur separation efficiencies were achieved by water-only cyclone across all particle sizes. In conclusion, the combined spiral-flotation circuit is capable of maintaining high sulfur and ash separation efficiencies across all particle size studied.

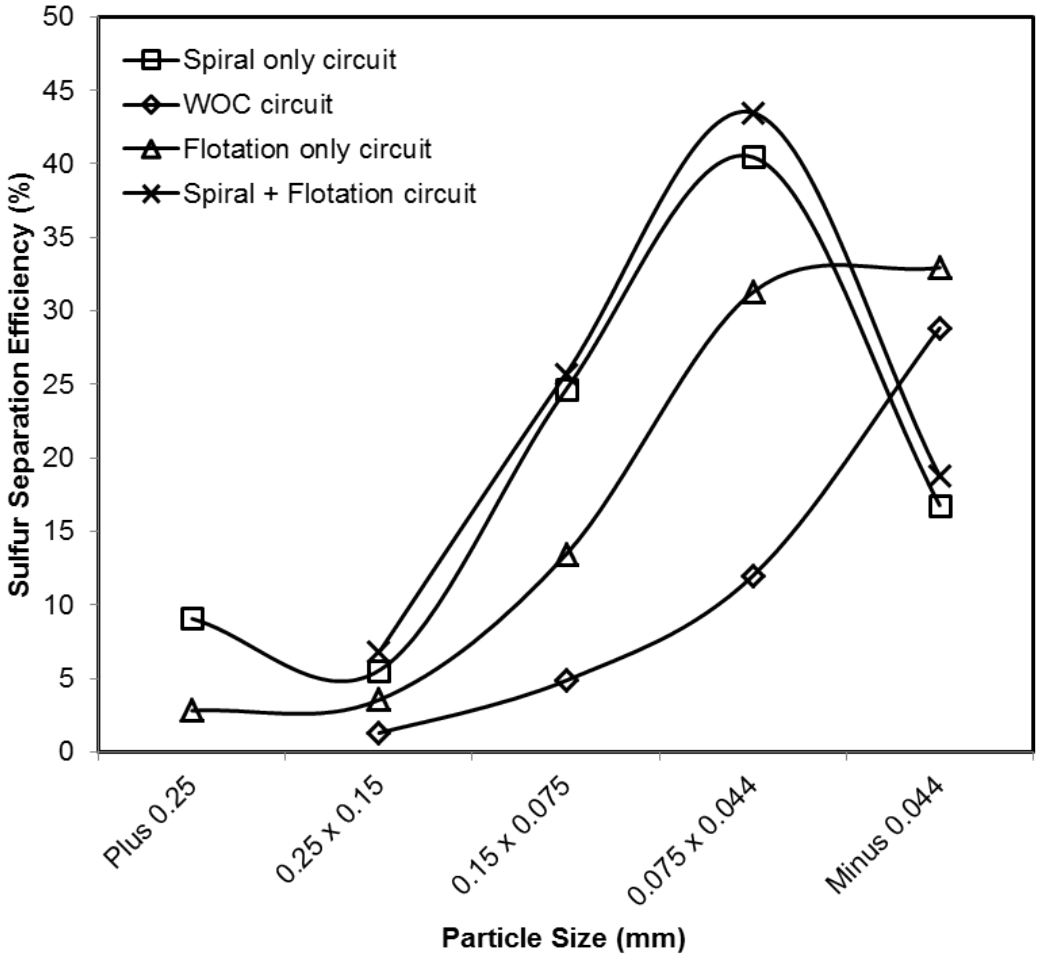


Figure 5.24 Comparison of size-by-size separation efficiencies (Sulfur) for different fine coal cleaning process.

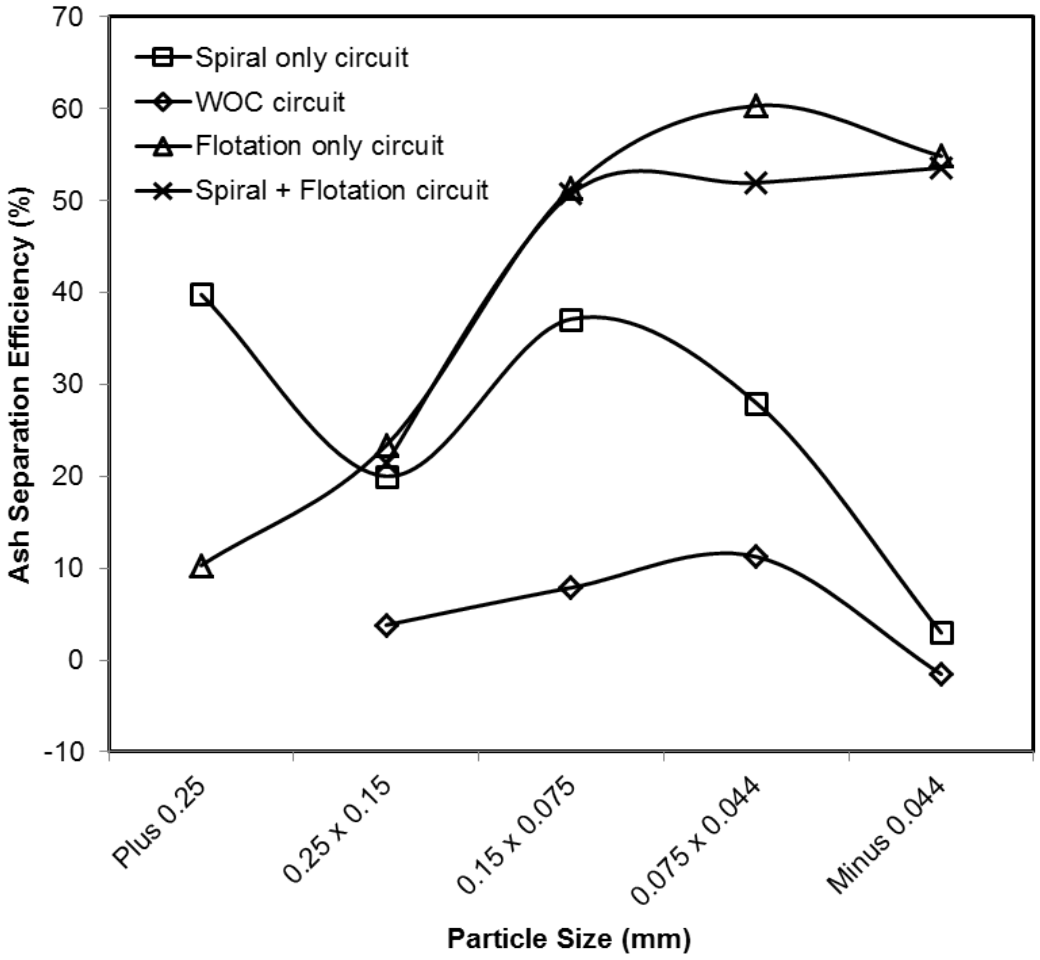


Figure 5.25 Comparison of size-by-size separation efficiencies (Ash) for different fine coal cleaning process.

5.6 Suggested Plant Flowsheet

Based on the aforementioned experimental findings, a new combined spiral-flotation circuit is recommended to effectively clean the ultrafine (minus 0.25 mm) high-sulfur coals. A new flowsheet is also suggested to treat high-sulfur ultrafine coal feeds for the preparation plant studied for this investigation. Figure 5.26 represents the generic proposed flowsheet to treat high sulfur ultrafine coals. The modified circuitry includes a combined spiral-flotation circuit to treat clean coal sieve undersize high sulfur ultrafine coals. The minus 0.25 mm spiral clean which coal passes through the clean coal sieve bend screen contains high amount of sulfur (nearly 6 % for

the plant under consideration) is rewashed on a bank of fine coal spirals. Fine coal spirals are capable of separating high density ultrafine sulfur particles. Refuse from the fine coal spirals is discharged into the thickener while the middlings are recycled back to the fine coal spiral feed sump (not shown in the figure). The clean from fine spirals is then pumped to the bank of classifying cyclones to remove particles finer than 0.044 mm. Finally, deslime fine spiral clean joins the flotation feed to remove the remaining ultrafine ash particles. The most important feature of this combined spiral-flotation circuit is that the combined circuitry not only improves the ash separation efficiency, but also improves the sulfur separations while maintaining high combustible recoveries.

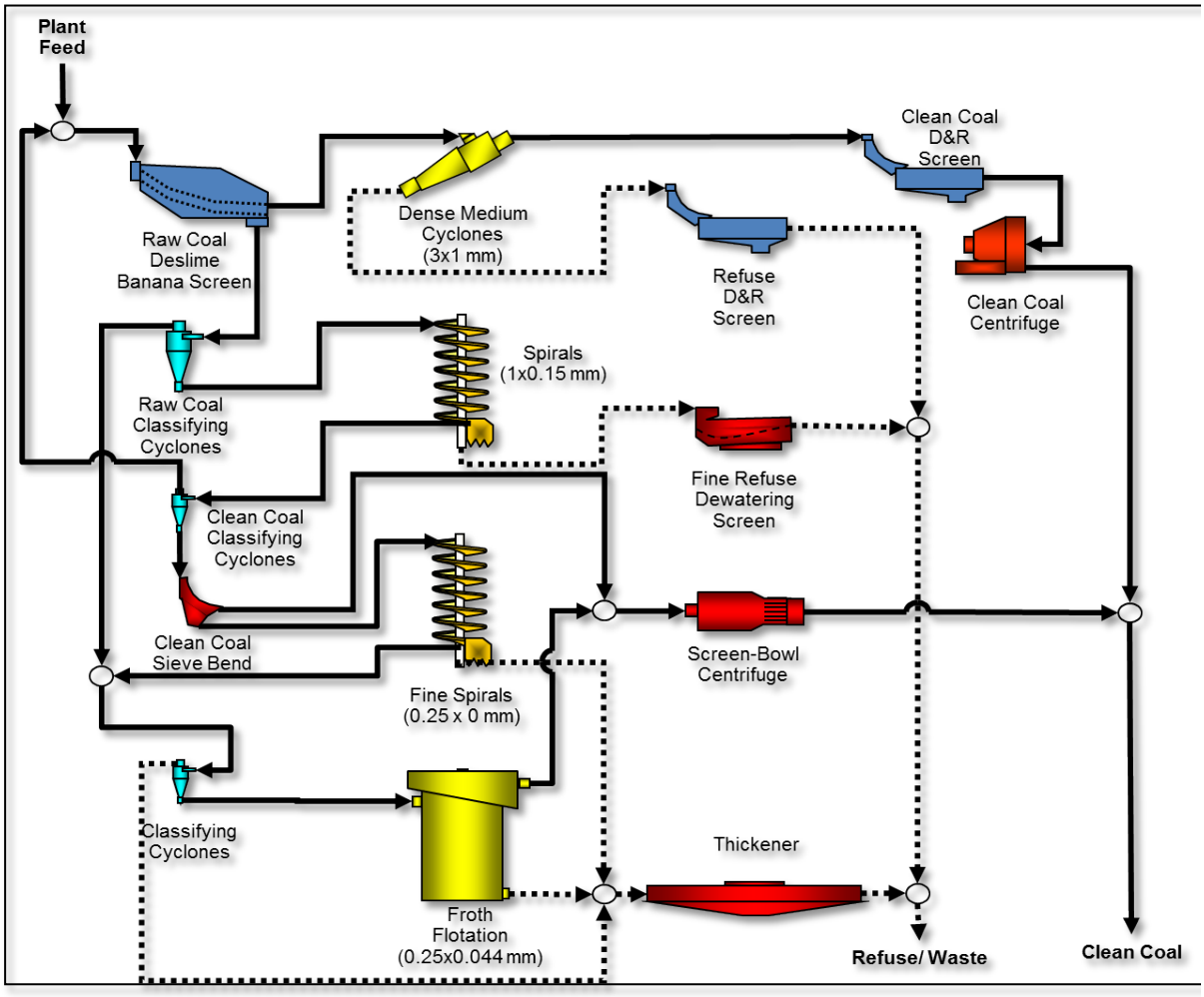


Figure 5.26 Generic upgraded flowsheet for treating high sulfur ultrafine (minus 0.25 mm) coal feed.

5.7 Summary and Conclusion

Different fine coal cleaning circuits were experimentally evaluated and compared for their sulfur and ash separation performance. The performance comparison was made on the basis of clean coal yield, clean coal sulfur, clean coal ash and on the sulfur and ash separation performance achieved by each fine coal cleaning circuit. Results indicate that a combined sieve screen-spiral-flotation circuitry significantly increases the rejection of both ash and sulfur beyond which can be achieved by using spiral, water-only cyclone or flotation circuit alone.

Spiral-only circuitry, when used to treat high sulfur ultrafine coal, provides good sulfur separation efficiencies, but its clean product contains a high (35%) percentage of ash-forming minerals. The water-only cyclone achieved high ash and sulfur rejections of 71.46% and 91.59%, respectively. However, due to a poor clean coal yield of 18.42%, the separation efficiencies of the water-only cyclone across all particles sizes tested remains very low. Finally, although the froth flotation process provides the highest ash separation efficiencies for minus 0.15 mm coal, the process fails to achieve the same levels of superior performance in terms of sulfur separation.

Based on the experimental data obtained from this research, a combined sieve screen, spiral separator followed by a froth flotation process is recommended for the cleaning of high-sulfur ultrafine (minus 0.25 mm) coal feeds. It is concluded that significant reductions both in ash and sulfur contents of clean coal are possible by the combined sieve screen-spiral-flotation circuitry, while maintaining a reasonable clean coal yield. Finally, a flowsheet is also proposed for any coal preparation plant treating high sulfur ultrafine coal feeds.

5.8 Recommendations for Future Work

The main objective of this experimental work is to prove the concept that a combined sieve screen, spiral and froth flotation circuit can practically achieve better sulfur separation efficiency as compared to that of spirals, water-only cyclones or froth flotation only circuits. Throughout the experimental work the same minus 0.25 mm high sulfur ultrafine coal feed used. In order to estimate the exact improvements in ash and sulfur rejections offered by the combined spiral and froth flotation circuit, it may be worth examining to experimentally test the same combined circuit using ultrafine deslime (0.25 x 0.044 mm) high sulfur coal feed.

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CHAPTER 6 ENGINEERING DEVELOPMENT OF THE MICROSIEVE DRYING PROCESS

6.1 Abstract

The removal of moisture from fine coal has been a longstanding problem in the coal preparation industry. While coal fines often represent as little as 10% of the total run-of-mine feed, this size fraction may contain more than a third of the total moisture in the final marketed product. Existing thermal dryers can effectively reduce moisture; however, these massive units require very large capital expenditures and have become a target of increased environmental scrutiny. Likewise, existing mechanical equipment for fine coal dewatering tend to produce unacceptably high moistures that often cannot be tolerated on existing coal contracts. In light of these issues, a mechanical, non-thermal patent-pending dewatering process has been developed by NDT™. This article (i) reviews the working features of this novel process, (ii) presents experimental results obtained from recent laboratory and pilot-scale test programs, and (iii) discusses the potential advantages of the process over existing thermal drying and mechanical dewatering systems.

6.2 Introduction

Essentially all coal supply agreements impose strict limitations on the amount of moisture contained in the shipped product. Residual moisture lowers heating value, increases transportation costs and can create downstream handling/freezing problems for customers. To meet the moisture specification, a variety of solid-liquid separation processes are used in modern coal preparation plants. Available methods for reducing surface moisture can be broadly

classified into three main groups: sedimentation, filtration and thermal drying (Wills and Napier-Mun, 2006). Sedimentation methods make use of static or induced centrifugal forces to separate solids from water based on differential settling/compaction, while filtration methods trap particles against a mesh or porous medium to separate solids from water. Equipment such as vibrating screening systems and various types of centrifugal dryers (stoker, screen-scroll and vibratory centrifuges) are commonly used to dewater coarser coal particles. Finer coal particles (<0.5-1 mm topsize) are typically dewatered using more complex dewatering equipment such as screenbowl centrifuges and various types of vacuum disc and belt filters (Luttrell et al., 2007). Unfortunately, existing fine coal dewatering processes are inefficient in terms of moisture reduction, solids recovery and/or energy consumption (Osborne, 1988; Le Roux et al., 2005; Keles, 2010).

It is widely recognized that the moisture content attainable by mechanical dewatering systems is strongly dependent on coal particle size. For example, Figure 6.1 shows the approximate lower limit on moisture than can be attained using mechanical coal dewatering equipment.The inverse relationship between particle size and moisture content should be expected due to the sharp increase in surface area as particle topsize is reduced. The finest coal fraction can account for as little as a few percent by weight of the total run-of-mine coal, but may represent one-third or more of the total moisture in the final coal product. In some industrial operations, fine (<100-200 micron) or ultrafine (<40-50 micron) coal particles may be intentially removed by classification circuits and discarded at the plant site to avoid an unacceptably high product moisture. This loss represents a waste of valuable coal resources and a potential environmental liability when discarded into waste impoundments (Orr, 2002).

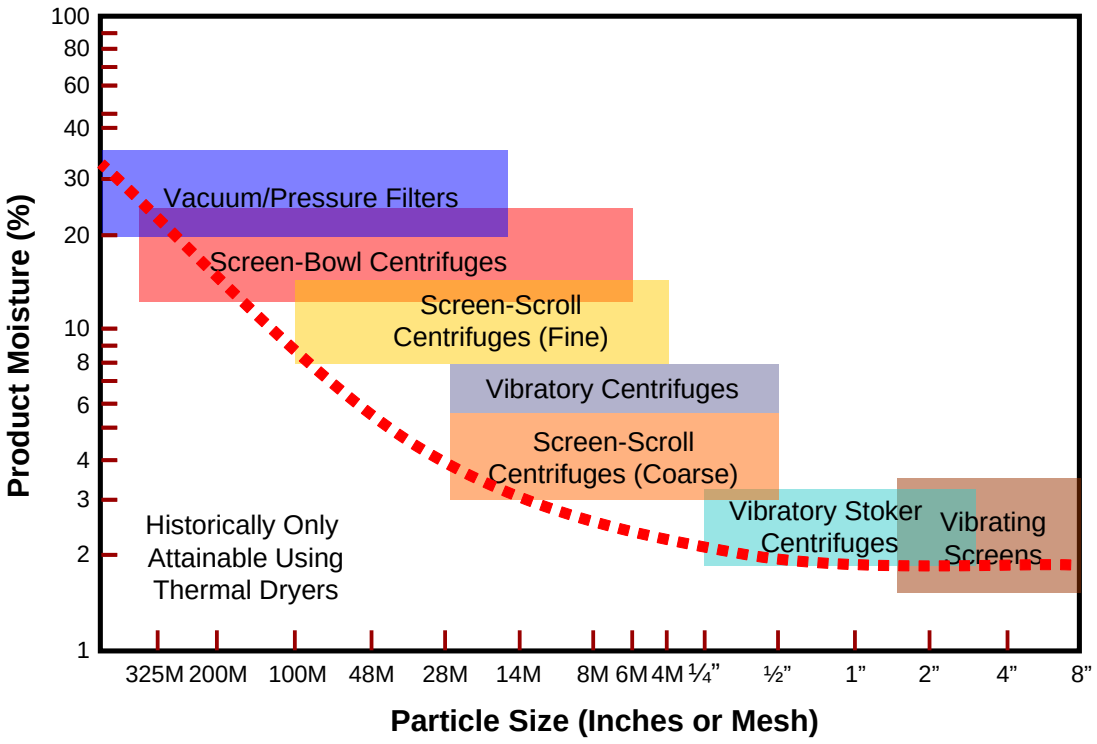


Figure 6.1 Comparison of dewatering alternatives for different particle size ranges.

Historically, thermal dryers have been utilized in the coal prepration industry to reduce clean coal moisture to single-digit values whenever mechanical dewatering processes were incapable of meeting contract specifications. The most popular design is the fluidized bed dryer, which uses coal, oil or gas as the fuel source to heat the incoming air stream. The amount of fuel required depends on the amount of water that must be evaporated which, in turn, depends on the amount of coal fed to the dryer and the percentage of water in the dewatered product (Miller, 1998). When operating correctly, thermal dryers can reduce the clean coal moisture to less than 6% by weight (Meenan, 2005). Unfortunately, thermal dryers involve a substantial investment of upfront capital funds when installed and large annual costs for equipment maintenance and repair throughout their lifespan. Operating costs for thermal dryers have also greatly increased in recent years in response to higher fuel and labor costs. Thermal dryers can also suffer from emission

problems associated with fugitive dust and poor opacity. In fact, the opacity standard for coal dryers was recently reduced from 20% to 10% as a result of a recent legislative action. Emissions of nitrous oxides, sulfur dioxide, volatile organic compounds (VOCs) and particulate matter may also present issues for some sites seeking operating permits. Moreover, thermal drying of combustible particles of coal can present safety hazards resulting from accidental fires or dust and gas explosions.

The development of an innovative, efficient and low cost technology for removing moisture from fine coal is an important need for the coal preparation industry. In light of this need, a novel non-thermal, mechanical dewatering process has been developed by NDT™ for the coal preparation industry. In the current study, an experimental test program was undertaken to evaluate the dewatering performance of the NDT™ process. This article provides a brief description of the new patent-pending dewatering technology and presents experimental results obtained from recent bench- and pilot-scale test programs.

6.3 Nano Drying Technology

The NDT™ drying system uses molecular sieves to wick water away from wet fine coal particles and does not require crushing or additional finer sizing of the wet coal to dry it. These molecular sieves are a form of nano-technology based particles, which are typically used for extracting moisture from airborne, aerosol and liquid environments. There are also known techniques for combining molecular sieves with solids, but no previous techniques included regeneration of the molecular seives. Molecular sieves contain pores of a precise and uniform size, typically in the range of 3 to 10 angstroms (Ramakrishna, Ma and Matsuura, 2011). These pores are large enough to draw in and absorb water molecules, but small enough to prevent any of the fine coal particles from entering the sieves. Some molecular sieves can adsorb up to 42%

of their weight in water (Bland et al., 2011). Molecular sieves are used in the drying process because these are re-usable after the absorbed water is removed from the sieves by heating.

Molecular sieves often consist of alumino silicate minerals, clays, porous glasses, micro-porous charcoals, zeolites, active carbon or synthetic compounds that have open structures through or into which small molecules such as nitrogen and water can diffuse (Breck, 1964). When the molecular sieves are mixed with wet coal fines, these sieves quickly draw water away from the wet solids. In order to maximize surface contact between molecular sieves and coal particles, the mixture is contacted/mixed/agitated for a short period of time. After contacting, the molecular sieves are recovered from the dry coal by simple screening since the sieves are substantially larger in size than the topsize of the dried coal particles. Once the separation occurs, the remaining coal particles have a substantially reduced moisture content, which can reach low single-digit values regardless of coal particle size. The molecular sieves are then regenerated by removing the trapped moisture and are recycled back through the process. It is important to note that the regeneration occurs after the deeply dewatered coal particles have been removed (i.e., no portion of the coal is ever subjected to heating). Consequently, this process is considered by the inventors to be an advanced dewatering process and not a thermal drying process, which offers many advantages in terms of operational cost and environmental compliance.

6.4 Bench-Scale Testing

6.4.1 *Experimental Procedure*

A bench-scale experimental test program was performed to evaluate the performance of the process of the NDT™ system in removing water from fine coal. For all experimental tests, the wet feed sample consisted of either 0.6 mm or 0.15 mm topsize clean metallurgical coal (filter cake) collected from an industrial plant.

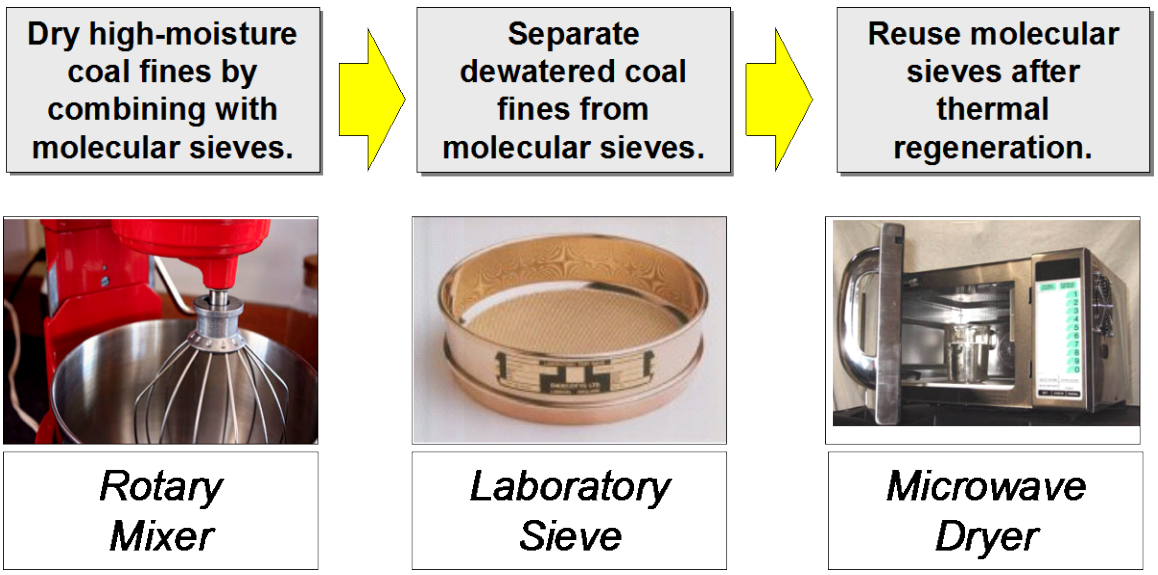


Figure 6.2 Schematic diagram of the bench-scale NDT™ process.

During testing, a weighted sample of as-received fine feed coal was mixed with a predetermined weight of molecular sieves. The mixture was then contacted together in a small bench-scale rotary mixer for a defined period of time (Figure 6.2). After contacting, the mixture of molecular sieves and coal fines was separated by using a laboratory sieve. The dewatered coal particles passed through the sieve and were collected as an underflow product, whereas the molecular sieves were retained on top of the sieve and were collected as an overflow product. Once separated, the coal particles and molecular sieves were individually weighed and the reduction in the percentage moisture of the coal sample was calculated. The last step in the experimental procedure was drying the molecular sieves. To speed the regeneration process, a microwave oven was used to evaporate the moisture held in the pores of the molecular sieves. The regenerated molecular sieves were then reused in the testing program. No significant

Table 6.1 Overview of parametric tests conducted using the NDT™ process.

Experimental Group	Experimental Design Type	Particle Top-size	Media Type (Size)	Batches/Group (Number)	Tests/Batch (Number)
A	Exploratory	0.6 mm	I	5	8
B	Central Composite	0.6 mm	I	1	39
C	Central Composite	0.6 mm	I	1	39
D	Uniform Grid	0.15 mm	II	4	12
E	Central Composite	0.15 mm	II	1	52

difference was observed in the effectiveness of the moisture removal using either newly manufactured or regenerated molecular sieves.

Five independent "groups" of statistically designed bench-scale experiments were performed using the patent-pending process developed by NDT™ (Table 6.1). The type (size) of molecular sieves and weight of coal sample was kept constant for each experimental group, while the weight of molecular sieves and time of contact were varied over a range of predetermined values as dictated by the statistical parametric test matrix. Duplicate test runs (a minimum of 3 to 4) were conducted at each test point to assess the degree of variability and level of reproducibility in the test data. The first group of tests (Group A) were comprised of exploratory tests designed to identify the suitable ranges of experimental conditions for testing. This group of test runs involved the processing of 5 batches of sample with 8 experimental test runs per batch. Groups B and C consisted of two sets of central composite designs of 39 tests each (15 central point tests). These groups were identical except for the range of variables examined. Groups D and E were conducted using a different type (size) of molecular sieve. The test matrix for Group D consisted of a uniform grid with 4 batches of experiments involving 12 test runs each, while Group E consisted of a central composite design encompassing a single

batch of 52 test runs (20 central point tests). After completing each test matrix, the data were evaluated using standard statistical techniques.

6.4.2 ***Results and Discussion***

A target moisture of 9% was selected with a range of 8 to 10% as the operating parameter for the process of the NDT™ system . When 100 mesh x 0 product coal gets below 8% moisture, dust problems become a concern and, if dried further, then explosion hazards must be considered. If the moisture is more than 10%, then the potential benefits of adding this size mateial to the clean coal are reduced. Therefore, the tests were designed to determine whether the process of the NDT™ system could produce a 9% moisture product with a 95% confidence level. The central points for Groups B, C and E were specifically selected and each central composite design was statistically configured to see if this 95% confidence level could be obtained for a 9% product moisture. It should be noted that maximum drying tests conducted during the bench- and pilot-scale testing showed that moisture levels in the 1.5 to 2.5% range could be easily produced if desired. Table 6.2 shows the overall performance of the NDT™ process in terms of average moisture contents of products for each batch/group. The data indicates that the technology can readily provide single-digit moistures over a wide range of operating conditions. In fact, moisture values in excess of 10% were only obtained when using very short contact times or when low weight fractions of molecular sieves were utilized. To fully demonstrate the impact of these factors, one group of tests from type I (i.e., Group B) and one group of tests from type II (Group E) were selected for further discussion in this publication. Figure 3 shows the central composite text matrix used in the Group B test programon the 0.6 mm x 0 feed

Table 6.2 Summary of performance data obtained using the NDTTM process.

	Group A		Group B		Group C		Group D		Group E	
Particle Top-Size	0.6 mm		0.6 mm		0.6 mm		0.15 mm		0.15 mm	
Feed Moisture	22.6±0.07%		21.9±0.11%		21.2±0.12%		27.6±0.70%		26.2±0.19%	
Batch Number	Product Moisture (%)	Contact Time (Min)	Product Moisture (%)	Contact Time (Min)	Product Moisture (%)	Contact Time (Min)	Product Moisture (%)	Contact Time (Min)	Product Moisture (%)	Contact Time (Min)
1	10.44	2	9.84	2.6	9.53	3	12.84	2	10.25	2.1
2	9.19	3	10.25	3	9.42	3.6	12.30	2	10.46	2.5
3	8.26	4	8.45	3	8.94	3.6	12.01	2	10.95	2.5
4	7.67	5	9.61	4	9.34	4.6	12.11	3	9.55	3.5
5	5.02	5	8.90	4	8.74	4.6	11.89	3	8.43	3.5
6	2.50	5	7.57	4	8.12	4.6	11.20	3	8.74	3.5
7	--	--	8.85	5	8.76	5.6	10.78	4	8.81	4.5
8	--	--	7.48	5	7.39	5.6	10.87	4	6.88	4.5
9	--	--	8.18	5.4	7.43	6	10.22	4	6.38	4.9
10	--	--	--	--	--	--	8.91	5	--	--
11	--	--	--	--	--	--	8.34	5	--	--
12	--	--	--	--	--	--	7.81	5	--	--

A total of 39 individual test runs were performed in this group using type I media. The tests included 9 different combinations of experiments based on contact time and media factor. The media factor is a dimensionless number representing the relative amounts of coal and molecular sieves used in the test run (i.e., a larger media factor represents a greater addition of feed coal relative to seive weight, while a smaller number represents less coal relative to sieve weight). The central test conducted at 4 minutes of contact time and media factor of approximately 0.3 was randomly repeated 15 times throughout the test matrix to evaluate the statistical reproducibility of the process. Also, each of the satellite tests conducted around the central test was performed in triplicate to further evaluate the data reproducibility and to assist in the identification of statistical outliers.

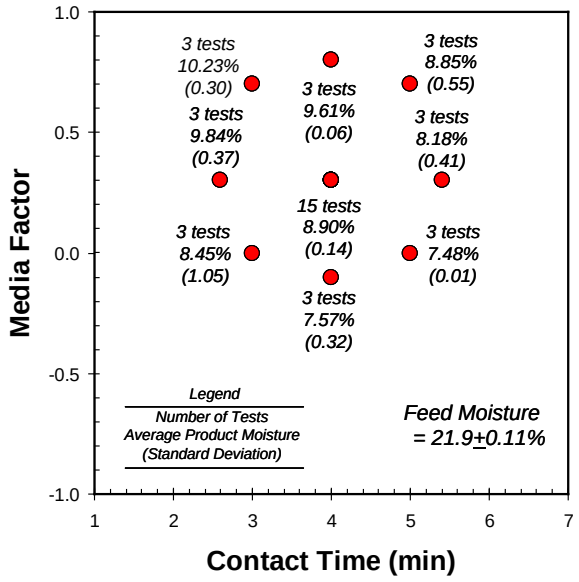


Figure 6.3 Parametric test matrix and performance data for Group B (0.6 mm x 0 size feed)

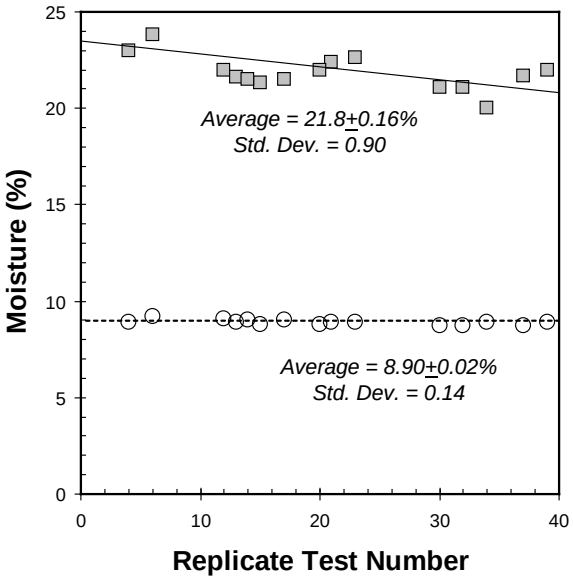


Figure 6.4 Replicate tests conducted at the central test condition for Group B (0.6 mm x 0 size feed)

All test runs performed in Group B utilized a constant sample weight of as-received feed coal. The average moisture content of the feed coal samples used in this group of tests was 21.9±0.11%.

As shown in Figure 6.3, all but one of the test runs conducted for the Group B test matrix gave single-digit moistures in the final 0.6 mm x 0 product. The product moistures decreased with either an increase in contact time or a decrease in media factor (i.e., less coal per unit weight of sieve media). The standard deviations for each set of conditions varied from a low of 0.01 to a high of 1.05, which indicated that the data was generally reproducible. In fact, as shown in Figure 6.4, the 15 replicate tests conducted at the central point of the test matrix (i.e., 4 minute contact time and 0.3 media factor) showed little variability in the product moisture despite significant variations in the feed moisture. The average moisture content for the feed sample

used in the 15 central point tests was 21.8±0.16% with a standard deviation of 0.90. After contacting with the molecular sieves, the product moisture dropped to a average value of 8.90±0.02% with a standard deviation of 0.14. The very small confidence interval and low standard deviation values associated with the data obtained for the dewatered product indicates that a high degree of reproducibility can be achieved using the bench-scale version of the process of the NDT™ system.

A similar trend in moisture removal was observed for the tests conducted for Group E having a topsize of 0.15 mm. These experiments were conducted using type II molecular sieves over a similar range of contact times and a lower range of media factors. Each satellite test conducted around the central test point was repeated 4 times to assist in identifying outliers and evaluating reproducibility. The central test point, which involved a contact time of 3.5 minutes and media factor of -0.63, was repeated 20 times in random order throughout the test matrix. For this particular group of tests, the average moisture contents of the as-received 0.15 mm x 0 feed was 26.2±0.10%. After contacting with the molecular sieves, the 0.15 mm x 0 product moistures were reduced to single-digit values for all tests conducted at contact times of 3.5 minutes or longer (see Figure 6.5). The lowest product moisture content of 6.38% was achieved for the longest contact time of 4.9 minutes. Tests conducted with contact times less than 3.5 minutes did not achieve single-digit mositures, but at 10.2-10.9% moisture were not far from breaking this meaningful barrier.

One noteworthy difference in the Group E test series was the greater degree of scatter in the experimental data. Standard deviation values greater than 1 were observed for the vast majority of the test points and a value as high as 4.67 was obtained for one of the satellite tests.

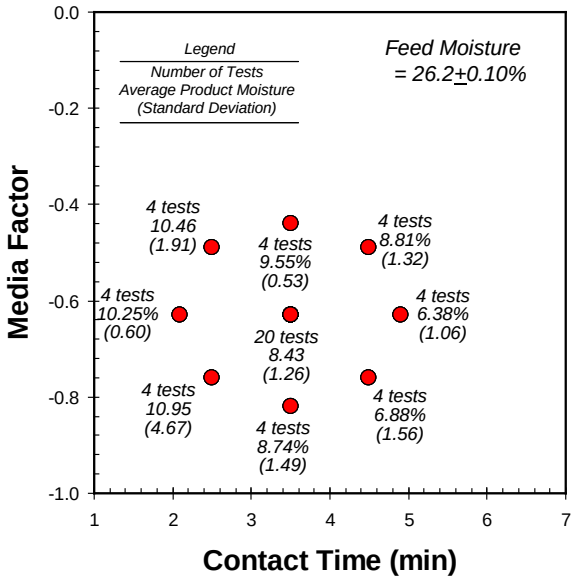


Figure 6.5 Parametric test matrix and performance data for Group E (0.15 mm x 0 feed).

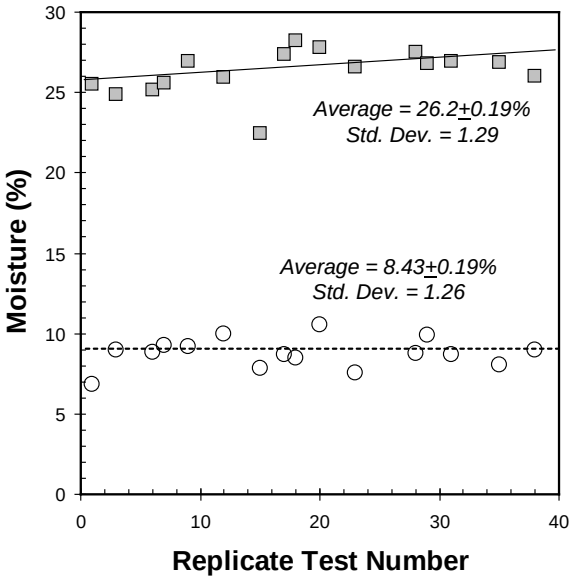


Figure 6.6 Replicate tests conducted at the central test condition for Group E (0.15 mm x 0 feed).

The increased data scatter was clearly observed in the 20 replicate tests conducted at the central test point (see Figure 6.6). The confidence interval of ±0.19 obtained for the Group E set of replicate tests was considerably larger than the ±0.02 value obtained for the Group B tests. Because the moisture of the feed was not determined before each bench-scale test, the standard deviations for both the feed and product moistures would be expected to agree, which in fact they do (i.e., 1.29 standard deviation for the feed moisture and 1.26 standard deviation for the product moisture). A refinment for future testing would be to determine the moisture of each feed sample, then calculate the correct media ratio before conducting the bench-scale test. This is in fact how the pilot-plant tests described below were conducted.

6.5 Pilot-Scale Demonstration

In light of promising bench-scale data, a decision was made to construct a pilot-scale NDT™ plant to demonstrate the capabilities of this new patent-pending technology in continous mode. While the small scale testing validated the basic system, numerous additional proprietary refinements were developed by NDT™ for operating on a larger scale. The flowsheet for the facility is shown in Figure 6.7.

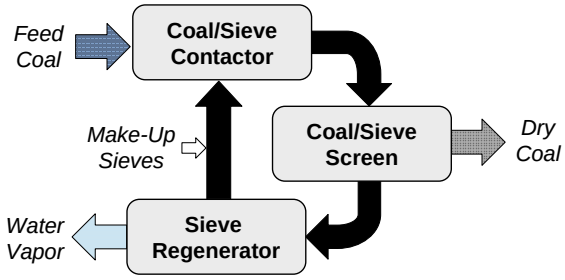


Figure 6.7 Simplified flowsheet for the pilot-scale NDT™ processing facility.

The completed facility, which was largely assembled using off-the-shelf components, was designed with an effective throughput capacity of 1,000 pounds per hour (0.5 TPH). The self-contained facility included unit operations for handling, contacting and separating the coal and media. An advanced gas-fired dryer was used to regenerate the molecular sieves such that the entire process operated in a closed-circuit loop. The prototype facility was designed, constructed and successfully commissioned over a period of approximately 10 months. During this time, shakedown tests were completed and the process circuit was refined, modifed and optimized using proprietary optimization techniques to provide a demonstration facility that operated smoothly and efficiently.

Table 6.3 provides an overview of test results obtained with various coals using the pilot-scale NDT™ facility. As shown, the prototype facility successfully achieved single-digit product moistures for a wide range of feed coal applications. Engineering criteria developed from bench-scale testing, such as contacting (retention) times and coal-to-sieve loadings, were also validated using the pilot-scale plant. More importantly, the pilot-scale test runs successfully demonstrated that the molecular sieves could be regenerated and recyled back through the process without incuring significant losses due to media degredation and at a lower heating/evaporation cost than traditional thermal drying.

Table 6.3 Examples of pilot-scale NDT™ test results.

Coal Source	Particle Size Class	Capacity (lb/hr)	Feed Moisture (%)	Product Moisture (%)
A	1 mm	1,600	17.88	7.63
B	1 mm	1,200	10.41	5.38
	1 mm	1,200	10.41	7.13
	1 mm	1,200	10.41	6.84
C	0.15 mm	600	27.28	2.52
	0.15 mm	550	27.28	7.46
D	0.15 mm	1,000	31.83	3.18
	0.15 mm	1,000	31.83	5.86
	0.15 mm	1,000	31.83	8.27

6.6 Discussion

The removal of unwanted moisture from fine coal has historically been considered one of the most challenging technical problems in the coal preparation industry. The process of the NDT™ system was developed specifically to address this issue by providing (i) effective moisture removals, (ii) efficient energy utilization and (iii) enhanced environmental

performance. Experimental data collected from both bench- and pilot-scale operations show that single-digit moisture values can be readily achieved from fine coal feeds containing 30% moisture or more. The process is highly flexible in that the product moisture can be "dialed in" by varying contacting time and coal-to-seive media loadings. Also, unlike existing mechanical processes, the product moisture from the NDT™ system is largely independent of the particle size distribution of the feed stream.

The removal of moisture in the process of the NDT™ system occurs at ambient temperature. As such, the coal particles are never subjected to high temperatures, which greatly reduces the emissons of criteria pollutants that are normally associated with conventional coaldrying systems.

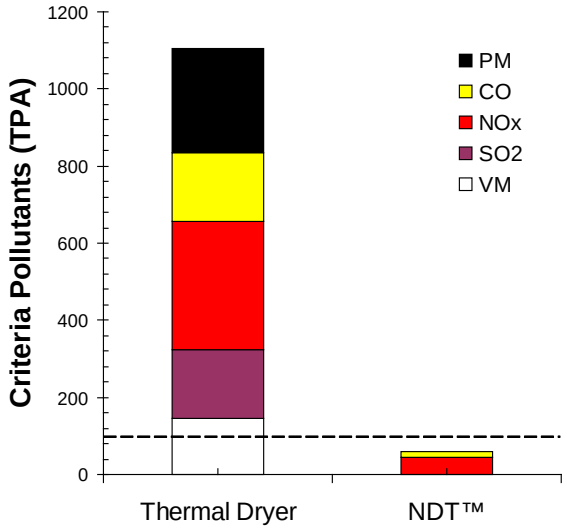


Figure 6.8 Comparison of air emissions for thermal drying and the NDTTM process.

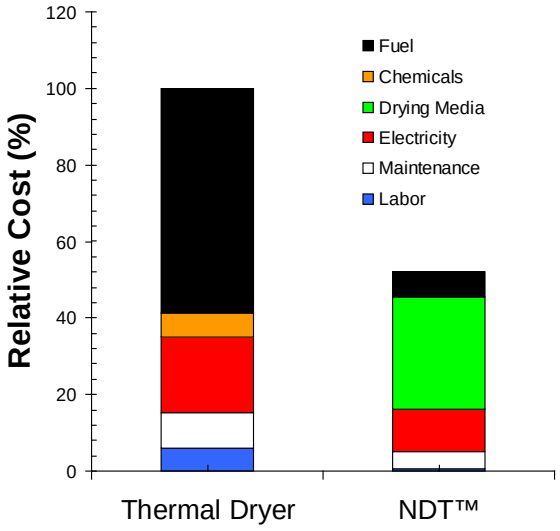


Figure 6.9 Comparison of relative costs for thermal drying and the NDTTM process.

Recent estimates by an environmental consulting group indicate that emission reductions as large as 90% or more when compared to a thermal dryer are possible using the NDT™ system. The emission projections from one such case study is shown in Figure 6.8. In this case, emissions of volatile matter (VM), sulfur dioxide (SO2) and particulate matter (PM) would be essentially elimiated (>99% reduction) using the NDT process. Projected emissions of carbon dioxide (CO2) and nitrous oxides (NOx) would be reduced by 91% and 84%, respectively. It is particularly important to note that the projected total emissions of 59.4 tons per annum (TPA) of criteria pollutants is likely to be less than the threshold value that would trigger the need for a Title V Air Quality permit in many states. For example, no such permit would be required in West Virginia since the threshold value is 100 TPA of criteria pollutants. The process of the NDT™ system also generates no other by-products that could potentially be released into the environment.

Finally, it should be noted that the NDT™ drying system is very efficient in terms of energy utilization. Since only the molecular sieves are dried, the drying step can be fully optimized in the absence of coal-imposed contraints associated with dryer temperature levels, gas-solid contacting systems, and coal dust explosions. As such, the system provides the highest possible energy efficiency at the lowest possible fuel cost. Since the process treats only the fine coal fraction, which is generally between 10 to 15% of the total clean coal product (and not the entire clean coal product treated by conventional thermal dryers), the required footprint for the facility is only a fraction of that demanded by a large-scale coal thermal dryer. Also, due to fewer operational complexities, significant cost savings are also expected for ancillary items such as electricity, chemicals, maintenance and labor. Cost estimates conducted in cooperation with a commercial engineering firm are plotted in Figure 6.9. Although such economic

calculations tend to be site specific, the costing figures for this site do suggest a relative operating cost of less than half of that required to operate a conventional thermal dryer.

6.7 Conclusions

The removal of surface moisture from fine coal has been a longstanding problem in the coal industry. To address this need, an innovative process based on nano-technology has been developed. Bench-scale studies indicate that the Nano Drying Technology (NDT™) proprietary system provides an effective method for coal drying. The NDT™ system can effectively dewater fine (1 mm x 0) coal from slightly more than 30% surface moisture to single-digit values. Test data obtained using a pilot-scale NDT™ plant further validated this impressive capability using a continous prototoype facility. It was also observed that, unlike existing fine coal dewatering processes, the performance of the NDT™ system is not dictated or constrained by particle size, i.e., it works equally well on 1 mm x 0 coal as it does on 325 mesh x 0 coal. The process of the NDT™ system overcomes problems associated with other techniques for fine coal drying since dewatering occurs at ambinent temperature and low airflow. Only the molecular sieves have to be dried, which reduces energy. Moreover, this process produces no damaging contaminants and has a very small installed footprint and environmental impact.

6.8 References

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CHAPTER 7 SUMMARY AND CONCLUSIONS

To improve the separation efficiency of fine coal cleaning circuits, several series of laboratory-scale, pilot-scale and field tests were conducted using different fine coal cleaning technologies/circuits. Based on the results obtained from this work, engineering criteria based on feed size characteristics and sulfur contents was developed to identify optimum circuit configurations for the processing different fine coal streams.

In the first phase of work, different laboratory and pilot scale test circuits (using spirals, water only cyclones, teeter bed separators, hydroFloat and froth flotation) were constructed for the purpose of conducting a detailed experimental study on the separation efficiency of fine coal cleaning processes. The results obtained from the study were then used to identify optimum coal particle size ranges for maximum separation efficiencies for different fine coal cleaning technologies. The data obtained from this work indicates that the most effective processes for each size range were generally (i) froth flotation for feeds finer than about 0.3 mm, (ii) spirals for feeds sized to 1 x 0.3 mm, and (iii) teeter-bed systems (particularly the HydroFloat™ technology) for feeds larger than 1 mm. Water-only cyclones were not found to be effective as stand-alone units due to the potential for high coal losses when secondary back-up units are not available within the plant circuitry.

In the second phase of work, pilot-scale and in-plant testing was conducted to identify new types of spiral circuit configurations that improve fine coal separations. Five different spiral circuits were constructed and experimentally tested at the pilot-scale to evaluate their separation performances. The experimental data thus obtained indicates that a four-stage spiral with second-

and fourth-stage middlings recycle offered the best option for improved separation efficiency, clean coal yield and combustible recovery. The newly developed spiral circuitry was capable of increasing cumulative clean coal yield by 1.9 % at the same clean coal ash as compared to that achieved using existing conventional compound spiral technology. Repluping of coal slurry after two turns proved to be ineffective in improving the separation performance of spiral circuits.

In the third phase of work, various methods were investigated for improving the rejection of both ash-bearing minerals and sulfur-bearing pyrite from fine coal cleaning circuits. The experimental findings from both laboratory and pilot-scale tests indicated that density-based separations are generally effective in reducing fine coal sulfur due to the large density difference between pyrite and coal. The data also showed that sulfur rejections obtained in flotation-only circuits were often poor due to the natural floatability of pyrite. Unfortunately, engineering analyses showed that pyrite removal from the flotation feed using density separators would be impractical due to the large volumetric flow of slurry that would need to be treated. On the other hand, further analyses indicated that the preferential partitioning of pyrite to the underflow streams of classifying cyclones and fine wire sieves could be exploited to concentrate pyrite into low-volume secondary streams that could be treated in a cost effective manner to remove pyrite prior to flotation. Therefore, on the basis of results obtained from this experimental study, a combined sieve screen-flotation-spiral circuitry was developed for enhanced ash and sulfur rejections from fine coal circuits.

In the fourth and final phase of work, experimental tests were carried out to investigate a new mechanical, non-thermal dewatering process called Nano Drying Technology (NDT™). Results obtained from bench-scale testing showed that the NDT™ system can effectively dewater fine (1 x 0 mm) clean coal products from more than 30% surface moisture to single-digit

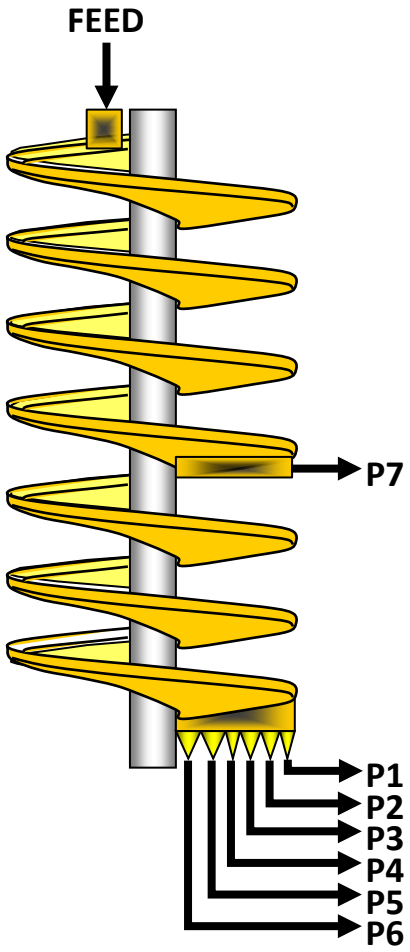
moisture values. Test data obtained using a pilot-scale NDT™ plant further validated this capability using a continuous prototype facility. It was also observed that, unlike existing fine coal dewatering processes, the performance of the NDT™ system is not constrained by particle size.

APPENDIX A – Spiral Circuit Results (Nominal Feed Size, 1 x 0.15 mm)

SPIRAL DATA ANALYSIS

Description: Run 1 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	0.831	14.8	19.12	21.55
P2	0.285	26.0	3.25	4.08
P3	0.116	29.2	1.12	1.43
P4	0.036	29.6	0.34	0.43
P5	0.025	20.0	0.40	0.46
P6	0.004	9.6	0.14	0.15
P7	0.330	49.9	1.33	1.94
Total	1.628	20.2	25.72	30.04

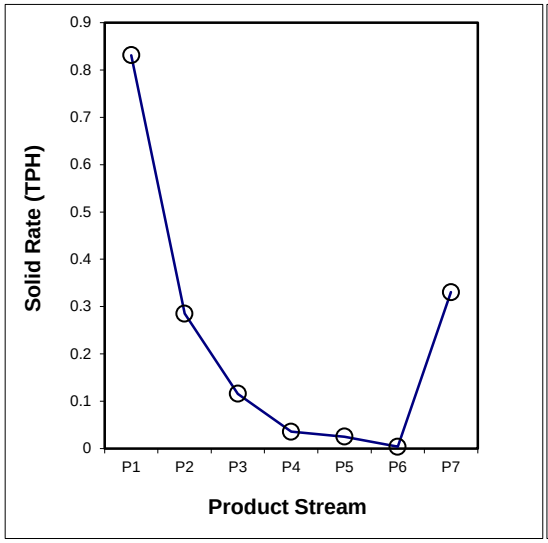
SPIRAL DATA ANALYSIS

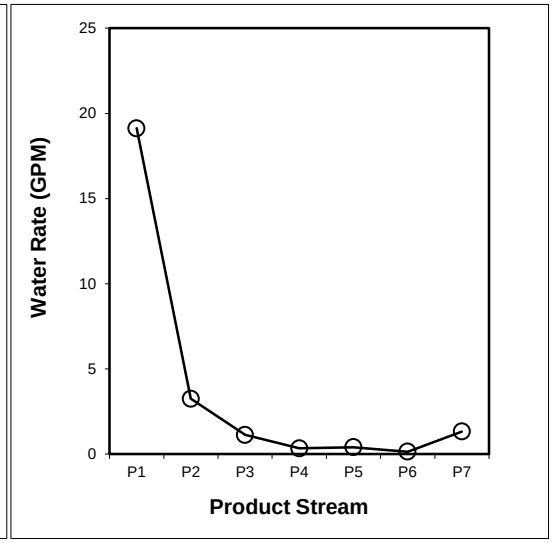
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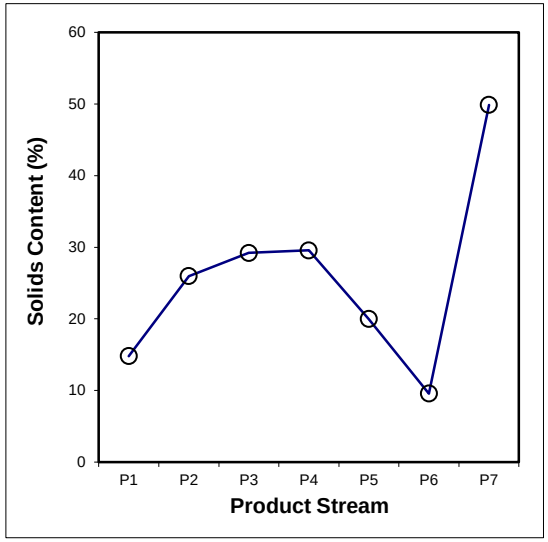
Comments: 1 x 0.15 mm Nominal Particle Size

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	5	8094	835.59	5.612	3429.6	2381.2	0.831	51.07	14.81
P2	10	3058	214.66	1.099	3108.3	2388.7	0.285	17.53	25.97
P3	15	1622	78.59	0.397	2839.7	2400.8	0.116	7.13	29.21
P4	40	1330	76.81	0.121	2575.8	2215.0	0.036	2.20	29.58
P5	40	1398.95	95.23	0.126	2732.5	2478.8	0.025	1.54	19.98
P6	120	1335.27	94.83	0.040	2419.1	2303.4	0.004	0.23	9.58
P7	10	1833.71	94.98	0.663	3267.7	2434.4	0.330	20.30	49.86
Total (Calc)	--	--	--	8.057	--	--	1.628	100.00	20.20
Total (Head)	0.61	1333.39	95.97	8.057	2524.0	2274.0	1.628	--	20.20







SPIRAL DATA ANALYSIS

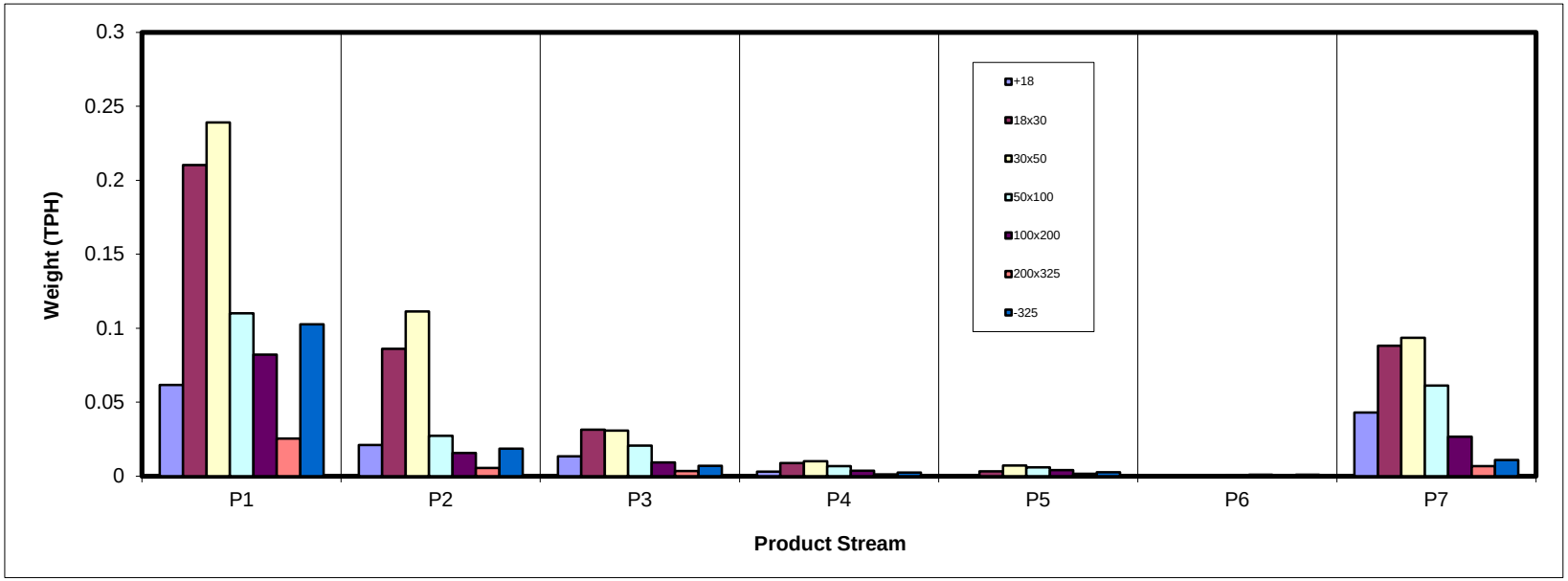
Description: Run 1 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.062	0.021	0.013	0.003	0.001	0.000	0.043		0.143
18x30	0.210	0.086	0.031	0.009	0.003	0.000	0.088		0.428
30x50	0.239	0.111	0.031	0.010	0.007	0.000	0.094		0.492
50x100	0.110	0.027	0.021	0.007	0.006	0.001	0.061		0.233
100x200	0.082	0.016	0.009	0.004	0.004	0.001	0.027		0.142
200x325	0.025	0.006	0.004	0.001	0.002	0.001	0.007		0.044
-325	0.103	0.019	0.007	0.002	0.003	0.001	0.011		0.145
Total (Calc)	0.831	0.285	0.116	0.036	0.025	0.004	0.330		1.628



SPIRAL DATA ANALYSIS

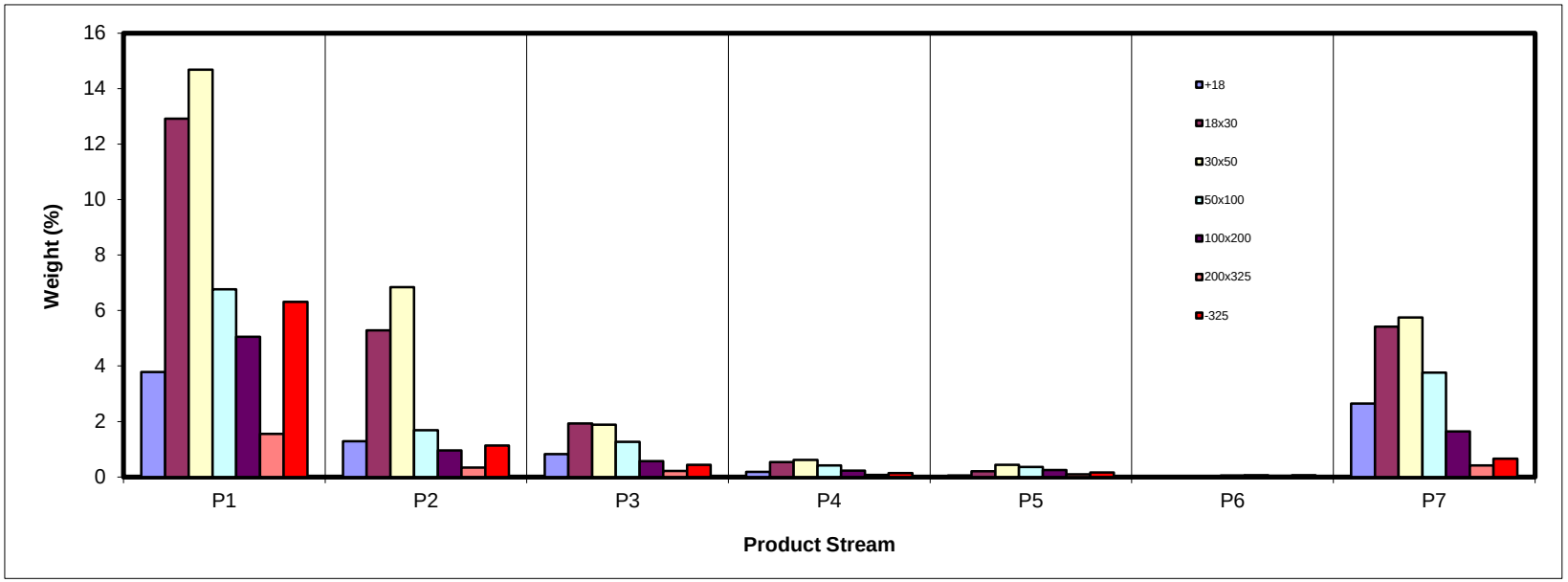
Description: Run 1 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	3.79	1.29	0.83	0.19	0.05	0.00	2.65		8.79
18x30	12.92	5.28	1.93	0.54	0.20	0.00	5.42		26.29
30x50	14.69	6.84	1.88	0.61	0.44	0.03	5.75		30.24
50x100	6.77	1.68	1.27	0.41	0.36	0.05	3.76		14.30
100x200	5.05	0.96	0.57	0.22	0.25	0.06	1.64		8.75
200x325	1.56	0.34	0.22	0.08	0.09	0.04	0.42		2.73
-325	6.31	1.14	0.43	0.14	0.16	0.06	0.66		8.90
Total (Calc)	51.07	17.53	7.13	2.20	1.54	0.23	20.30		100.00



SPIRAL DATA ANALYSIS

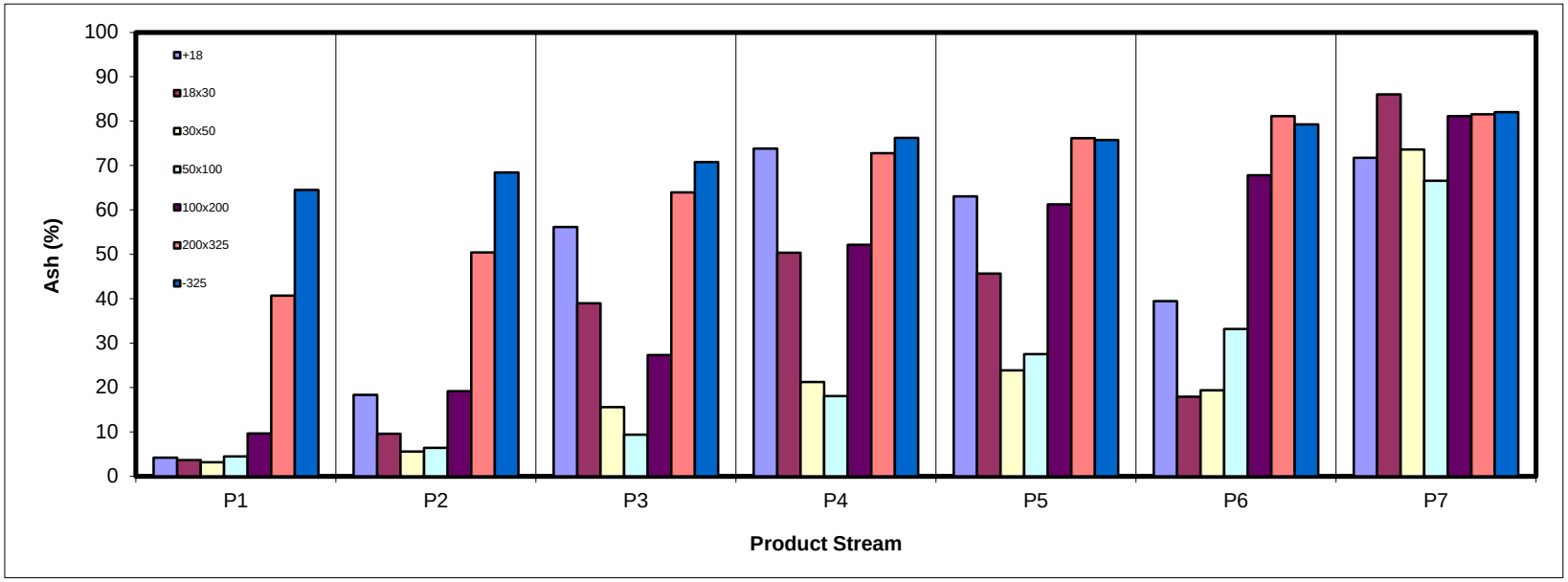
Description: Run 1 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	4.18	18.33	56.16	73.82	63.04	39.44	71.73		33.30
18x30	3.64	9.58	38.95	50.34	45.69	17.93	86.00		25.68
30x50	3.16	5.60	15.55	21.23	23.86	19.36	73.59		18.56
50x100	4.45	6.40	9.35	18.04	27.55	33.16	66.59		22.54
100x200	9.62	19.14	27.33	52.14	61.26	67.85	81.10		28.14
200x325	40.73	50.44	63.96	72.75	76.15	81.15	81.52		52.62
-325	64.49	68.42	70.78	76.21	75.76	79.29	82.01		67.09
Total (Calc)	12.89	13.50	31.26	40.81	43.11	59.66	76.40		28.39



SPIRAL DATA ANALYSIS

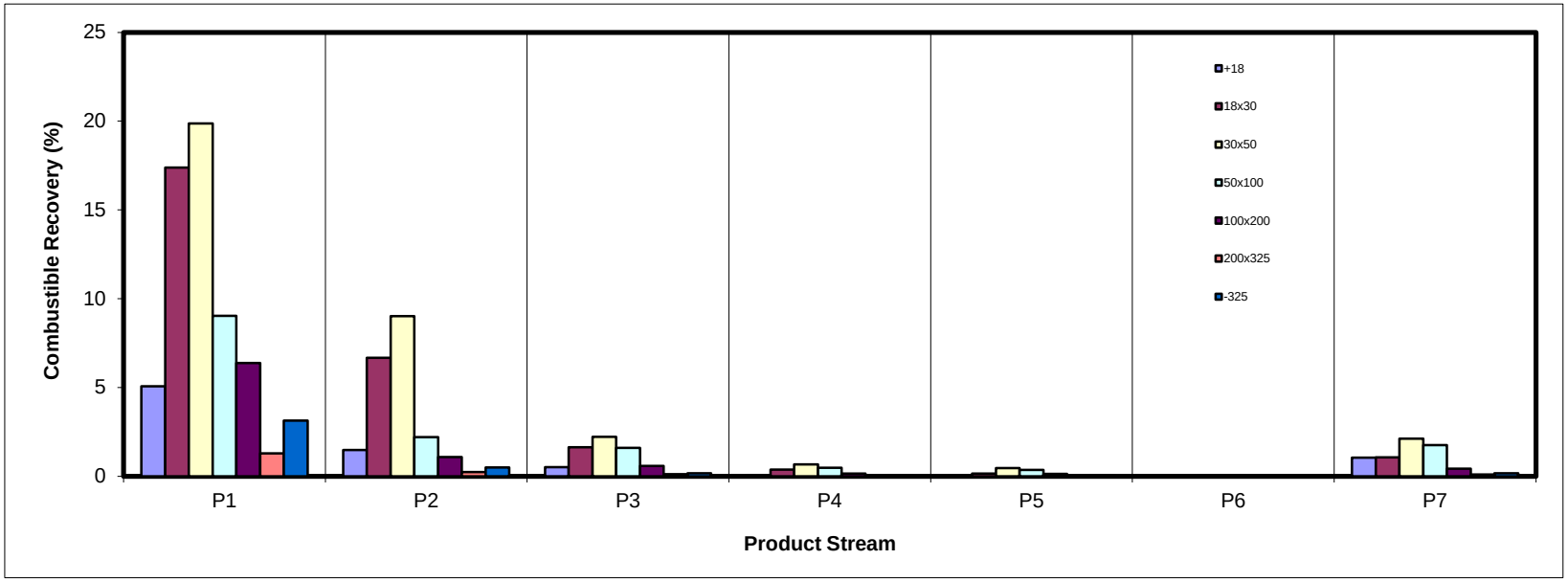
Description: Run 1 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	5.07	1.47	0.51	0.07	0.02	0.00	1.04		8.18
18x30	17.38	6.67	1.64	0.37	0.15	0.00	1.06		27.28
30x50	19.86	9.02	2.22	0.68	0.47	0.03	2.12		34.40
50x100	9.03	2.20	1.60	0.47	0.36	0.04	1.76		15.46
100x200	6.37	1.08	0.58	0.15	0.13	0.03	0.43		8.77
200x325	1.29	0.24	0.11	0.03	0.03	0.01	0.11		1.81
-325	3.13	0.50	0.18	0.05	0.05	0.02	0.17		4.09
Total (Calc)	62.12	21.17	6.84	1.82	1.23	0.13	6.69		100.00



SPIRAL DATA ANALYSIS

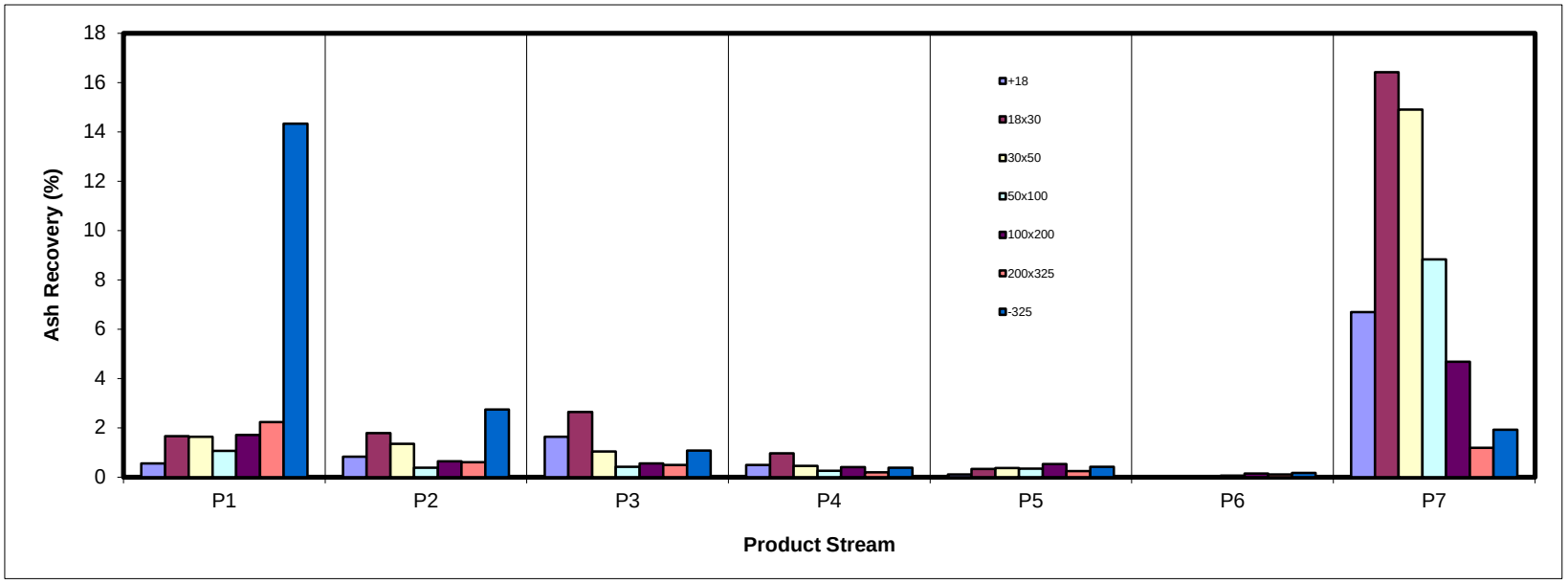
Description: Run 1 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.56	0.83	1.64	0.49	0.10	0.00	6.69		10.31
18x30	1.66	1.78	2.64	0.96	0.33	0.00	16.42		23.79
30x50	1.63	1.35	1.03	0.46	0.37	0.02	14.91		19.77
50x100	1.06	0.38	0.42	0.26	0.35	0.05	8.83		11.35
100x200	1.71	0.65	0.55	0.41	0.54	0.14	4.68		8.67
200x325	2.23	0.61	0.49	0.20	0.25	0.10	1.19		5.07
-325	14.33	2.74	1.08	0.39	0.42	0.17	1.92		21.04
Total (Calc)	23.19	8.33	7.85	3.16	2.35	0.49	54.63		100.00



SPIRAL DATA ANALYSIS

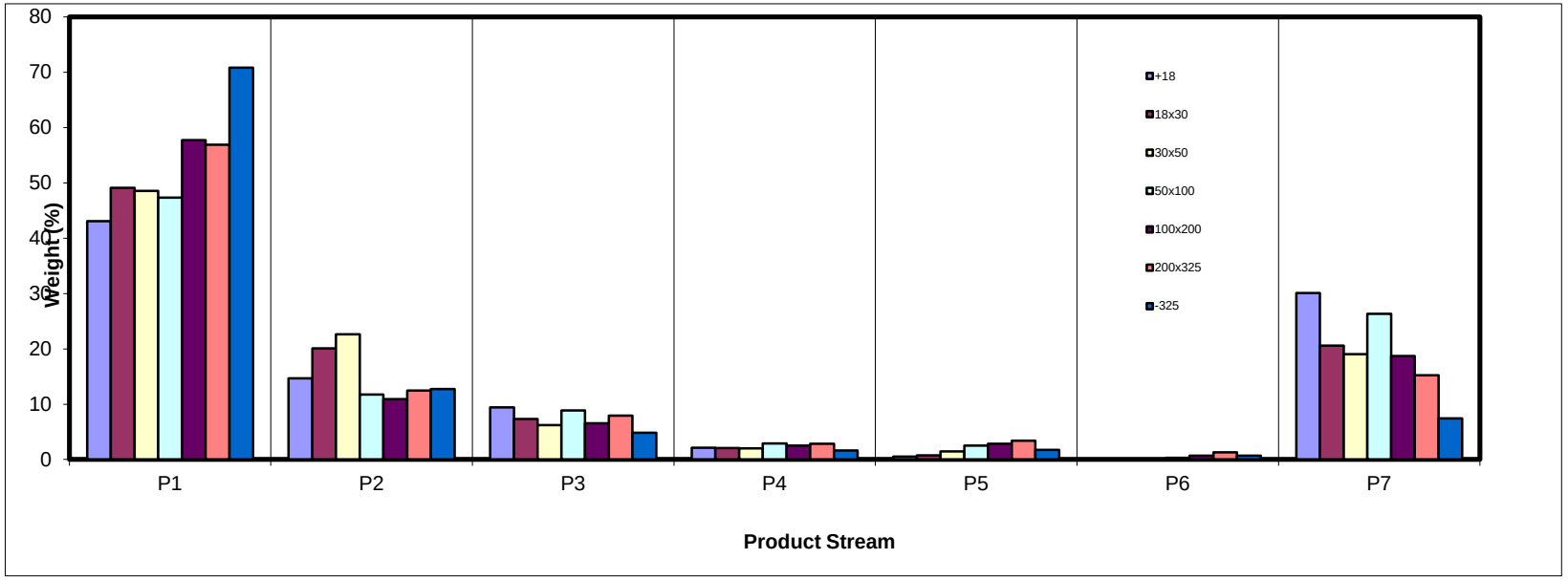
Description: Run 1 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	43.10	14.69	9.41	2.13	0.52	0.03	30.12		100.00
18x30	49.13	20.09	7.33	2.06	0.77	0.01	20.61		100.00
30x50	48.56	22.62	6.23	2.03	1.46	0.08	19.02		100.00
50x100	47.34	11.75	8.86	2.88	2.51	0.32	26.33		100.00
100x200	57.74	10.94	6.54	2.54	2.84	0.69	18.72		100.00
200x325	56.89	12.46	7.93	2.83	3.37	1.31	15.20		100.00
-325	70.87	12.77	4.86	1.62	1.75	0.68	7.45		100.00
Total (Calc)	51.07	17.53	7.13	2.20	1.54	0.23	20.30		100.00



SPIRAL DATA ANALYSIS

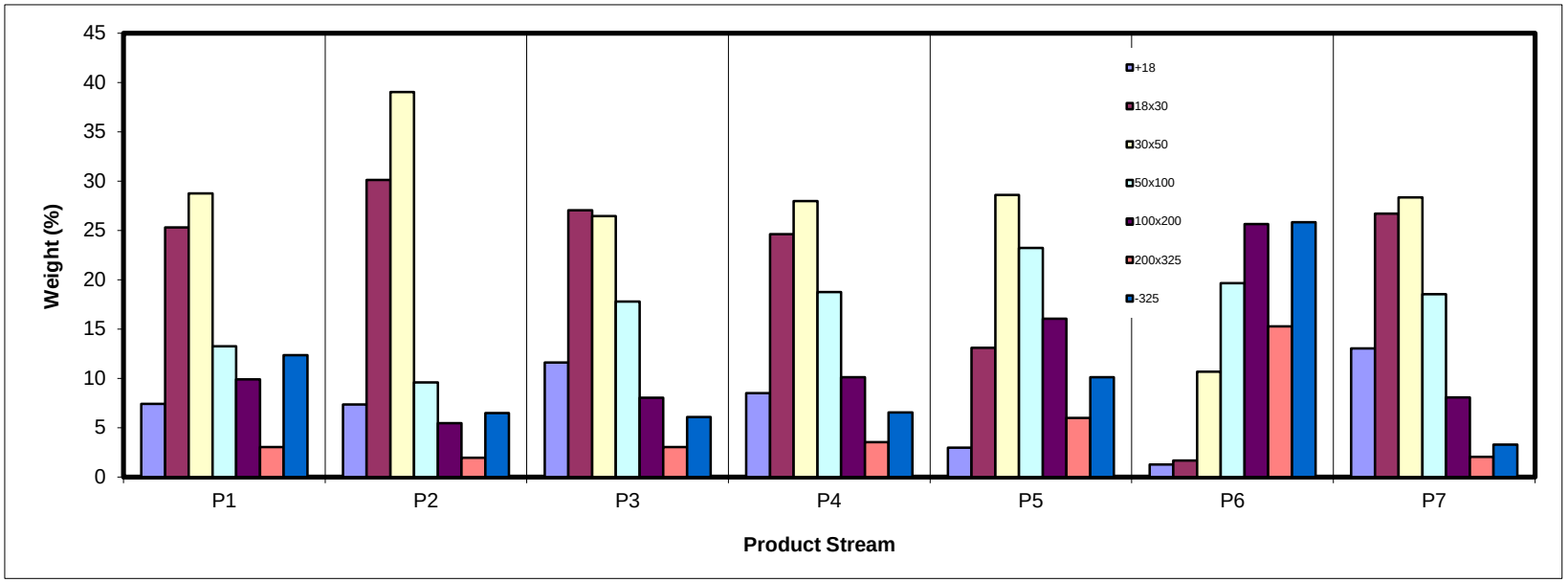
Description: Run 1 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	7.41	7.36	11.60	8.51	2.98	1.27	13.04		8.79
18x30	25.29	30.13	27.03	24.61	13.08	1.67	26.70		26.29
30x50	28.76	39.03	26.44	27.96	28.59	10.66	28.33		30.24
50x100	13.25	9.59	17.78	18.75	23.21	19.64	18.55		14.30
100x200	9.89	5.46	8.03	10.10	16.06	25.64	8.06		8.75
200x325	3.05	1.94	3.04	3.52	5.97	15.27	2.05		2.73
-325	12.35	6.48	6.07	6.55	10.10	25.84	3.27		8.90
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

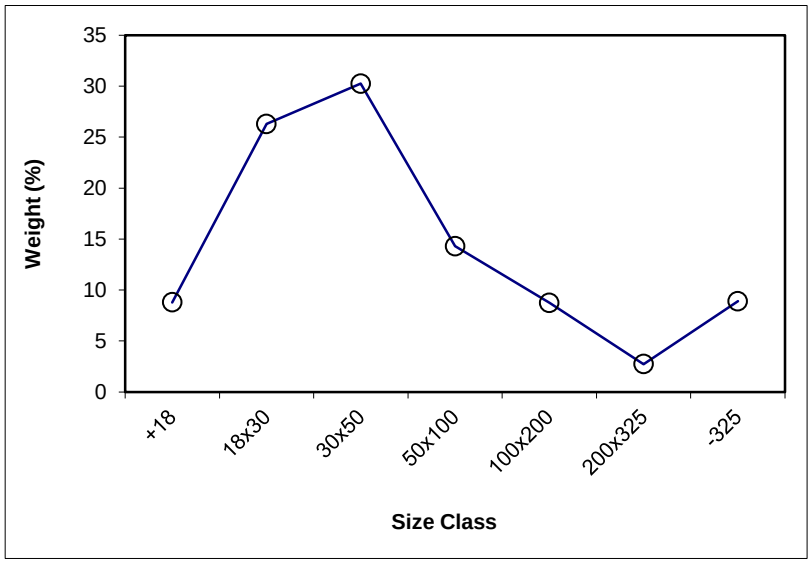
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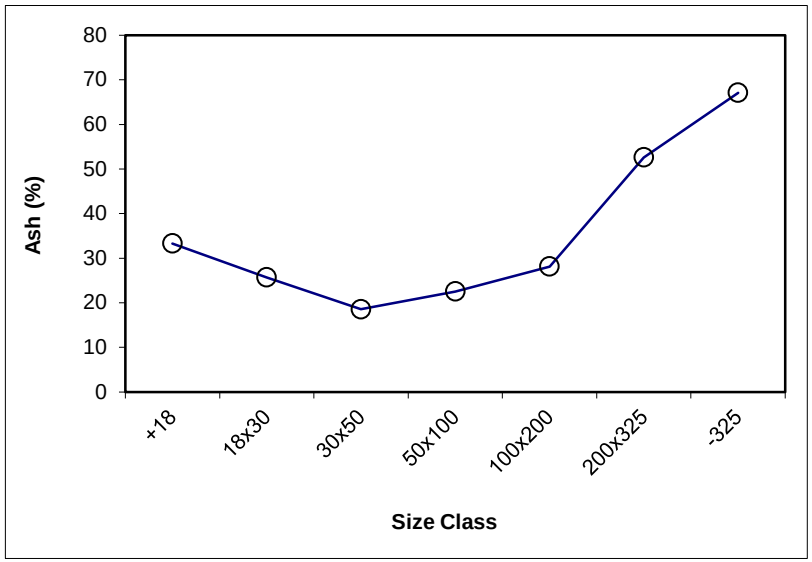
Comments: 1 x 0.15 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	482.1	460.2	21.96	8.79	33.30	8.79	33.30	100.00	28.39
18x30	496.8	431.0	65.72	26.29	25.68	35.08	27.59	91.21	27.91
30x50	429.8	354.2	75.61	30.24	18.56	65.32	23.41	64.92	28.81
50x100	433.0	397.3	35.74	14.30	22.54	79.62	23.25	34.68	37.76
100x200	349.1	327.2	21.86	8.75	28.14	88.36	23.74	20.38	48.44
200x325	304.8	298.0	6.83	2.73	52.62	91.10	24.60	11.64	63.69
-325	28.3	6.1	22.26	8.90	67.09	100.00	28.39	8.90	67.09
Total (Calc)	--	--	249.99	100.00	28.39	--	--	--	--





SPIRAL DATA ANALYSIS

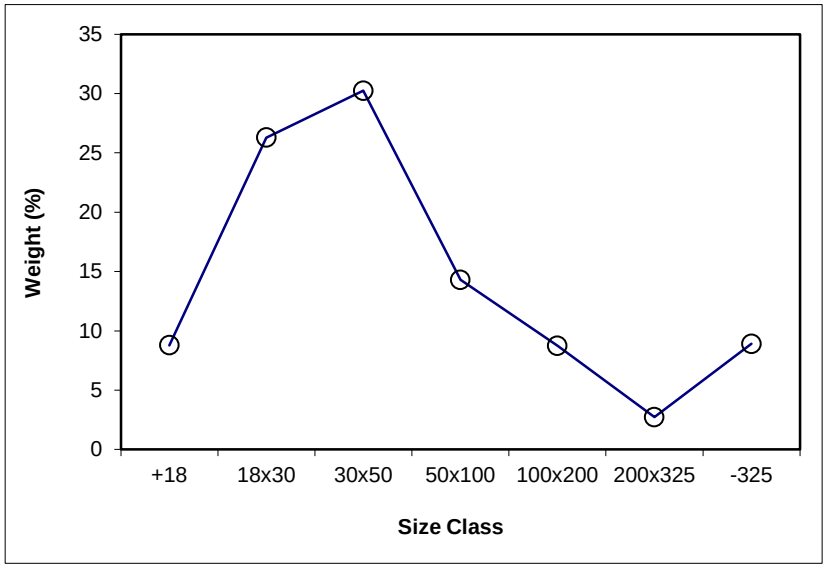
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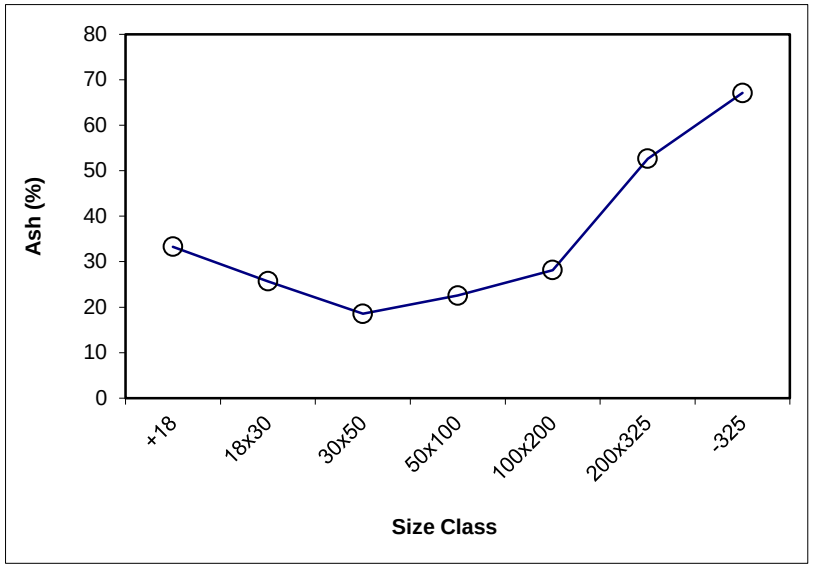
Comments: 1 x 0.15 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	8.79	33.30	8.79	33.30	100.00	28.39			
18x30	26.29	25.68	35.08	27.59	91.21	27.91	x	26.29	25.68
30x50	30.24	18.56	65.32	23.41	64.92	28.81	x	30.24	18.56
50x100	14.30	22.54	79.62	23.25	34.68	37.76	x	14.30	22.54
100x200	8.75	28.14	88.36	23.74	20.38	48.44	x	8.75	28.14
200x325	2.73	52.62	91.10	24.60	11.64	63.69	x	2.73	52.62
-325	8.90	67.09	100.00	28.39	8.90	67.09			
Total (Calc)	100.00	28.39	--	--	--	--	--	82.31	23.67





SPIRAL DATA ANALYSIS

Description: Run 1 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 51.07

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	440.38	362.7	77.73	7.41	4.18	7.41	4.18	100.00	12.89
18x30	646.57	381.4	265.16	25.29	3.64	32.71	3.77	92.59	13.58
30x50	675.42	374.0	301.47	28.76	3.16	61.46	3.48	67.29	17.32
50x100	532.18	393.3	138.93	13.25	4.45	74.71	3.65	38.54	27.89
100x200	588.85	485.2	103.66	9.89	9.62	84.60	4.35	25.29	40.17
200x325	410.54	378.6	31.93	3.05	40.73	87.65	5.61	15.40	59.79
-325	135.69	6.2	129.51	12.35	64.49	100.00	12.89	12.35	64.49
Total (Calc)	--	--	1048.39	100.00	12.89	--	--	--	--

Product P2 Feed Weight (%): 17.53

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	408.5	355.5	52.99	7.36	18.33	7.36	18.33	100.00	13.50
18x30	659.0	442.2	216.83	30.13	9.58	37.49	11.30	92.64	13.11
30x50	720.5	439.6	280.91	39.03	5.60	76.53	8.39	62.51	14.82
50x100	477.9	408.9	68.98	9.59	6.40	86.12	8.17	23.47	30.14
100x200	388.9	349.7	39.27	5.46	19.14	91.57	8.82	13.88	46.54
200x325	400.7	386.7	13.99	1.94	50.44	93.52	9.69	8.43	64.27
-325	52.8	6.1	46.66	6.48	68.42	100.00	13.50	6.48	68.42
Total (Calc)	--	--	719.63	100.00	13.50	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 1 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 7.13

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	511.1	460.2	50.90	11.60	56.16	11.60	56.16	100.00	31.26
18x30	566.7	448.1	118.61	27.03	38.95	38.63	44.12	88.40	27.99
30x50	528.6	412.5	116.05	26.44	15.55	65.07	32.51	61.37	23.16
50x100	429.6	351.6	78.05	17.78	9.35	82.86	27.54	34.93	28.92
100x200	426.6	391.4	35.22	8.03	27.33	90.88	27.52	17.14	49.23
200x325	344.3	331.0	13.35	3.04	63.96	93.93	28.70	9.12	68.51
-325	32.7	6.1	26.66	6.07	70.78	100.00	31.26	6.07	70.78
Total (Calc)	--	--	438.83	100.00	31.26	--	--	--	--

Product P4 Feed Weight (%): 2.20

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	431.9	401.2	30.70	8.51	73.82	8.51	73.82	100.00	40.81
18x30	519.8	431.0	88.80	24.61	50.34	33.12	56.37	91.49	37.74
30x50	455.1	354.2	100.89	27.96	21.23	61.08	40.28	66.88	33.10
50x100	464.9	397.3	67.66	18.75	18.04	79.83	35.06	38.92	41.62
100x200	363.7	327.2	36.45	10.10	52.14	89.93	36.98	20.17	63.55
200x325	310.7	298.0	12.70	3.52	72.75	93.45	38.33	10.07	75.00
-325	29.7	6.1	23.63	6.55	76.21	100.00	40.81	6.55	76.21
Total (Calc)	--	--	360.82	100.00	40.81	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 1 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 1.54

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	467.7	460.2	7.56	2.98	63.04	2.98	63.04	100.00	43.11
18x30	414.6	381.4	33.19	13.08	45.69	16.07	48.91	97.02	42.50
30x50	446.5	374.0	72.52	28.59	23.86	44.66	32.88	83.93	42.00
50x100	452.1	393.3	58.88	23.21	27.55	67.87	31.05	55.34	51.37
100x200	525.9	485.2	40.73	16.06	61.26	83.93	36.83	32.13	68.59
200x325	393.8	378.6	15.14	5.97	76.15	89.90	39.44	16.07	75.91
-325	31.8	6.2	25.63	10.10	75.76	100.00	43.11	10.10	75.76
Total (Calc)	--	--	253.66	100.00	43.11	--	--	--	--

Product P6 Feed Weight (%): 0.23

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	364.1	362.6	1.47	1.27	39.44	1.27	39.44	100.00	59.66
18x30	450.1	448.1	1.94	1.67	17.93	2.94	27.21	98.73	59.92
30x50	424.9	412.5	12.34	10.66	19.36	13.61	21.05	97.06	60.64
50x100	374.3	351.6	22.73	19.64	33.16	33.25	28.20	86.39	65.74
100x200	421.1	391.4	29.67	25.64	67.85	58.89	45.47	66.75	75.32
200x325	348.7	331.0	17.67	15.27	81.15	74.16	52.81	41.11	79.98
-325	36.1	6.2	29.91	25.84	79.29	100.00	59.66	25.84	79.29
Total (Calc)	--	--	115.73	100.00	59.66	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 1 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 20.30

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	509.8	401.2	108.66	13.04	71.73	13.04	71.73	100.00	76.40
18x30	664.7	442.2	222.49	26.70	86.00	39.74	81.31	86.96	77.11
30x50	675.7	439.6	236.12	28.33	73.59	68.07	78.10	60.26	73.17
50x100	563.5	408.9	154.54	18.55	66.59	86.62	75.63	31.93	72.79
100x200	416.9	349.7	67.20	8.06	81.10	94.68	76.10	13.38	81.38
200x325	403.8	386.7	17.06	2.05	81.52	96.73	76.21	5.32	81.82
-325	33.3	6.1	27.25	3.27	82.01	100.00	76.40	3.27	82.01
Total (Calc)	--	--	833.31	100.00	76.40	--	--	--	--

SPIRAL DATA ANALYSIS

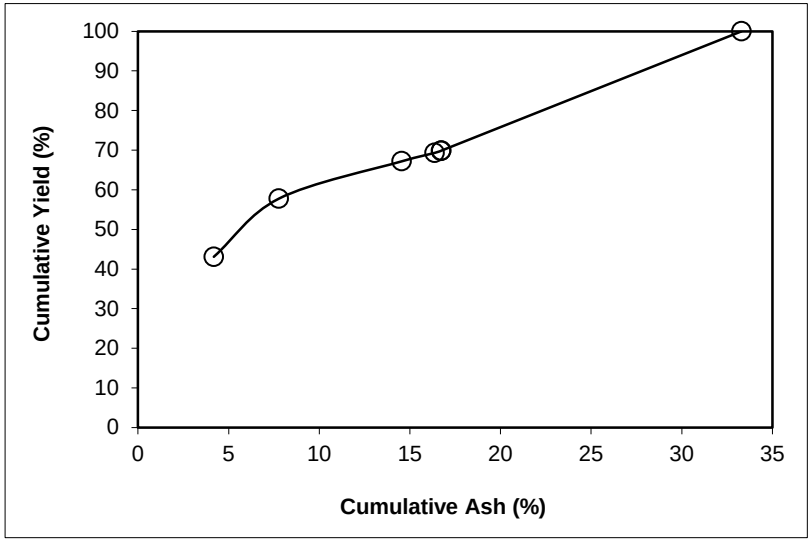
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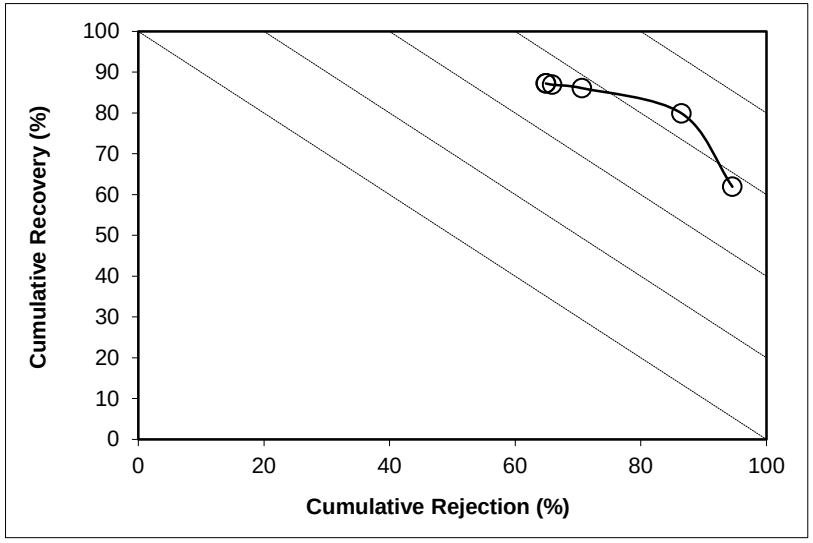
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 8.79

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	43.10	4.18	43.10	4.18	61.91	56.90	55.35	94.59	56.49
P2	14.69	18.33	57.79	7.78	79.89	42.21	68.23	86.50	66.39
P3	9.41	56.16	67.19	14.55	86.08	32.81	71.69	70.63	56.71
P4	2.13	73.82	69.32	16.37	86.91	30.68	71.54	65.92	52.83
P5	0.52	63.04	69.84	16.72	87.20	30.16	71.69	64.92	52.13
P6	0.03	39.44	69.88	16.73	87.23	30.12	71.73	64.88	52.12
P7	30.12	71.73	100.00	33.30	100.00	0.00			
Total (Calc)	100.00	33.30	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

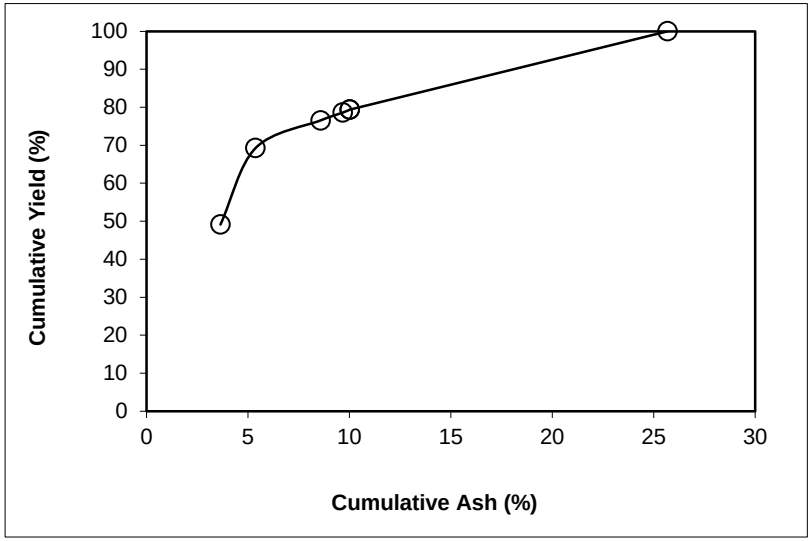
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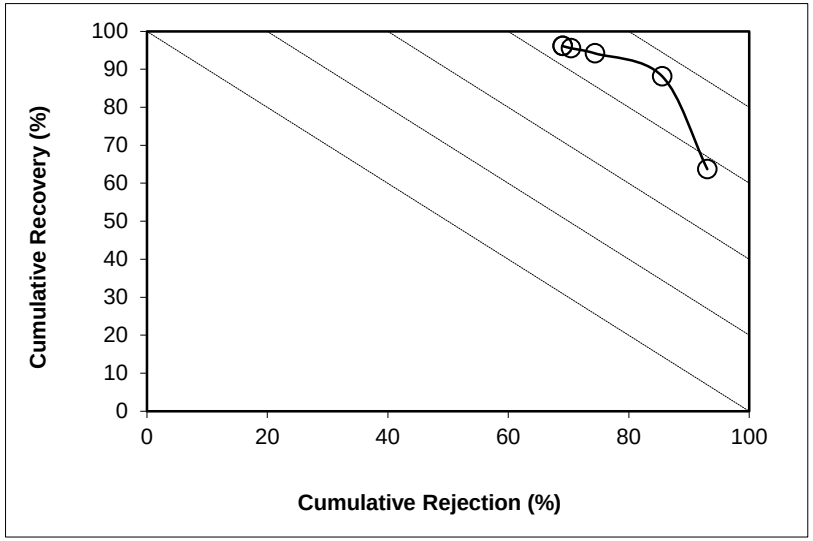
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 26.29

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	49.13	3.64	49.13	3.64	63.70	50.87	46.97	93.03	56.73
P2	20.09	9.58	69.22	5.36	88.15	30.78	71.38	85.54	73.69
P3	7.33	38.95	76.55	8.58	94.16	23.45	81.51	74.43	68.59
P4	2.06	50.34	78.60	9.67	95.54	21.40	84.50	70.40	65.94
P5	0.77	45.69	79.37	10.02	96.10	20.63	85.95	69.03	65.13
P6	0.01	17.93	79.39	10.02	96.12	20.61	86.00	69.02	65.14
P7	20.61	86.00	100.00	25.68	100.00	0.00			
Total (Calc)	100.00	25.68	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

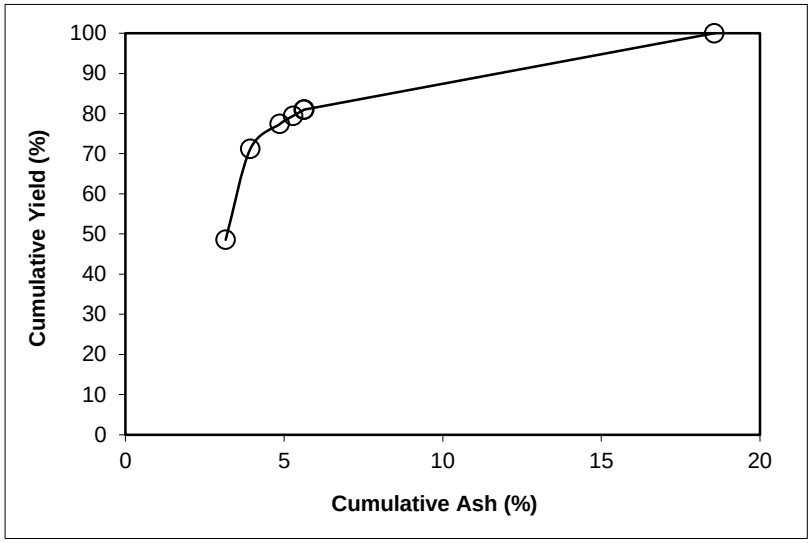
Description: Run 1 - Intermediate Spiral Test

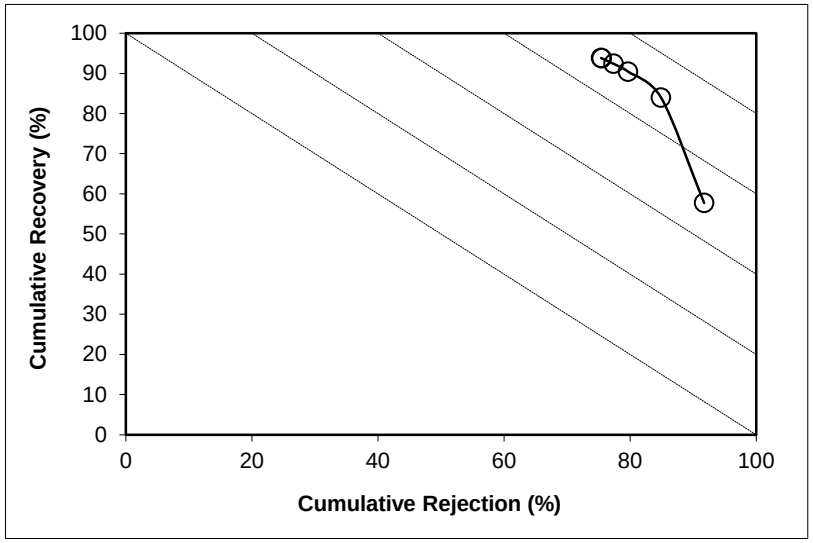
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 30.24

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	48.56	3.16	48.56	3.16	57.74	51.44	33.09	91.74	49.48
P2	22.62	5.60	71.18	3.93	83.96	28.82	54.68	84.92	68.88
P3	6.23	15.55	77.41	4.87	90.42	22.59	65.47	79.69	70.11
P4	2.03	21.23	79.44	5.29	92.39	20.56	69.84	77.37	69.76
P5	1.46	23.86	80.90	5.62	93.75	19.10	73.35	75.49	69.24
P6	0.08	19.36	80.98	5.64	93.83	19.02	73.59	75.41	69.24
P7	19.02	73.59	100.00	18.56	100.00	0.00			
Total (Calc)	100.00	18.56	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

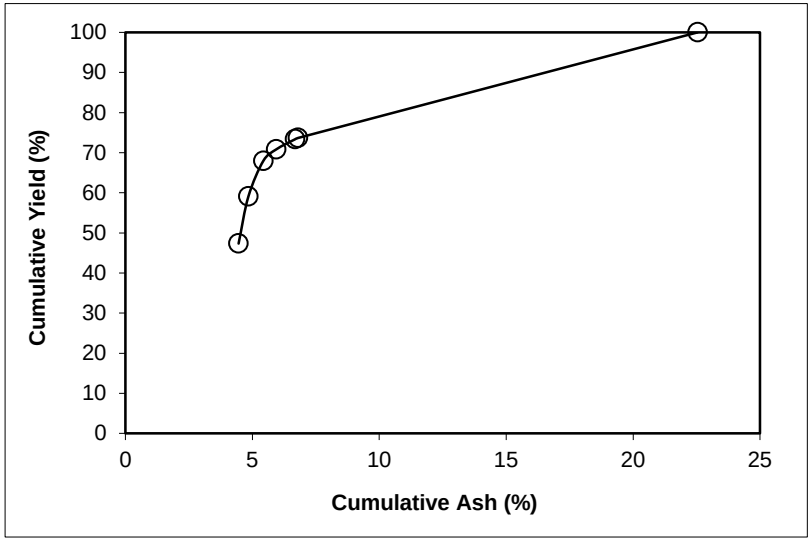
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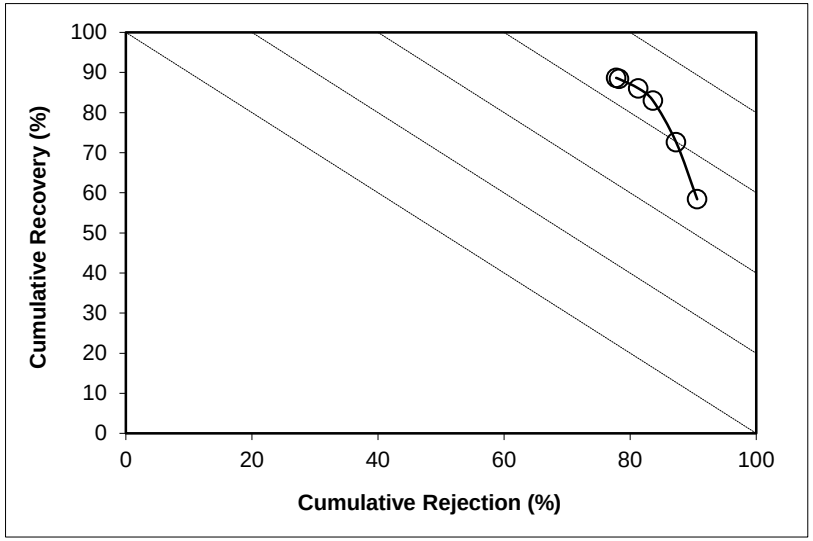
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 14.30

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	47.34	4.45	47.34	4.45	58.39	52.66	38.80	90.64	49.04
P2	11.75	6.40	59.09	4.84	72.60	40.91	48.11	87.31	59.90
P3	8.86	9.35	67.96	5.43	82.97	32.04	58.83	83.63	66.60
P4	2.88	18.04	70.84	5.94	86.02	29.16	62.86	81.32	67.34
P5	2.51	27.55	73.35	6.68	88.37	26.65	66.19	78.26	66.62
P6	0.32	33.16	73.67	6.80	88.64	26.33	66.59	77.78	66.43
P7	26.33	66.59	100.00	22.54	100.00	0.00			
Total (Calc)	100.00	22.54	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

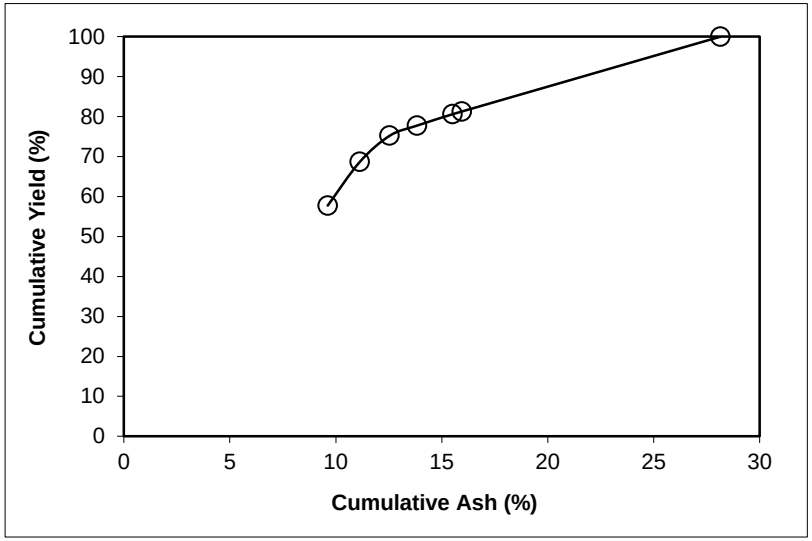
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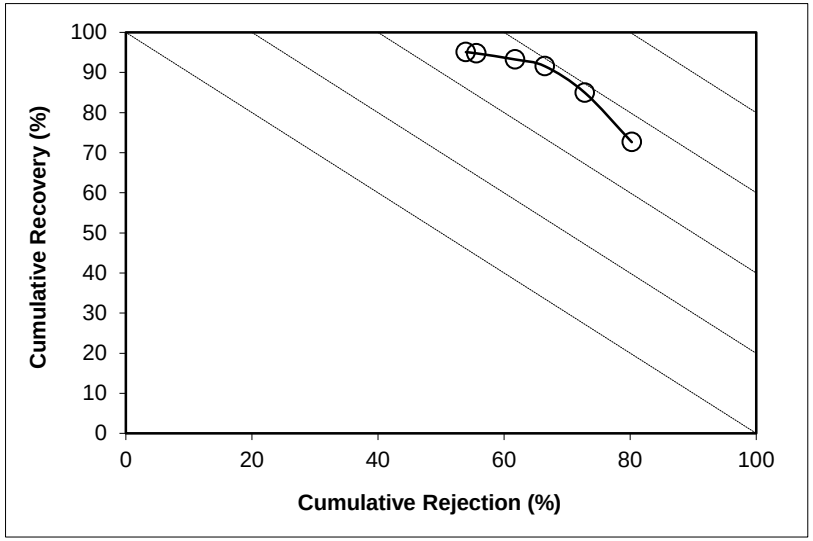
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 8.75

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	57.74	9.62	57.74	9.62	72.63	42.26	53.45	80.27	52.90
P2	10.94	19.14	68.68	11.13	84.94	31.32	65.43	72.83	57.76
P3	6.54	27.33	75.22	12.54	91.55	24.78	75.49	66.47	58.02
P4	2.54	52.14	77.76	13.83	93.24	22.24	78.16	61.77	55.01
P5	2.84	61.26	80.60	15.50	94.77	19.40	80.63	55.60	50.37
P6	0.69	67.85	81.28	15.95	95.08	18.72	81.10	53.94	49.01
P7	18.72	81.10	100.00	28.14	100.00	0.00			
Total (Calc)	100.00	28.14	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

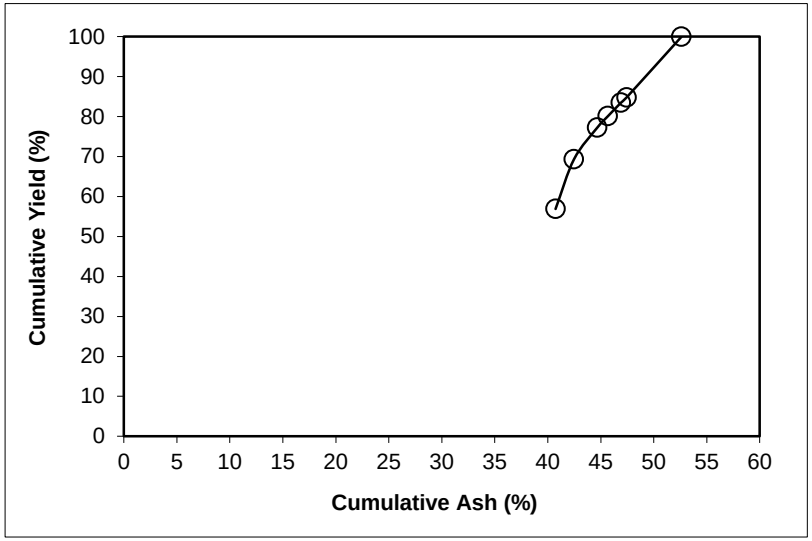
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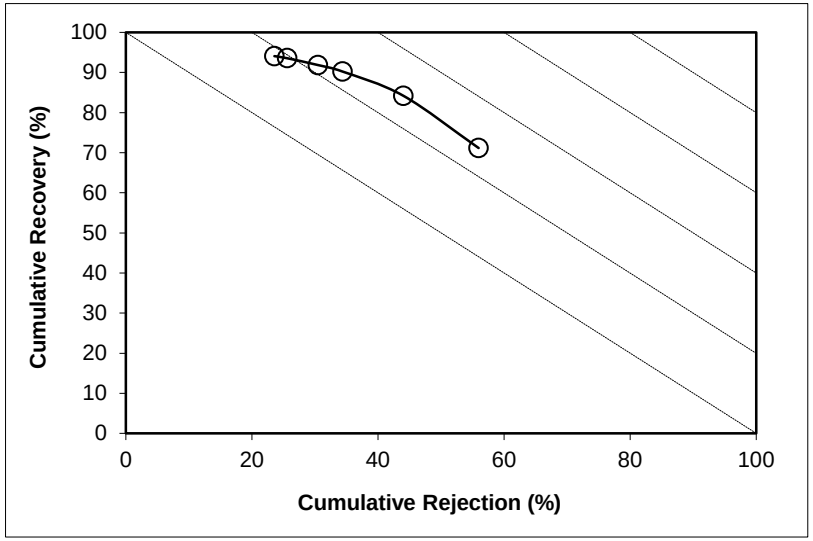
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 2.73

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	56.89	40.73	56.89	40.73	71.16	43.11	68.30	55.96	27.12
P2	12.46	50.44	69.35	42.47	84.20	30.65	75.56	44.01	28.21
P3	7.93	63.96	77.28	44.68	90.23	22.72	79.61	34.37	24.60
P4	2.83	72.75	80.11	45.67	91.85	19.89	80.59	30.46	22.31
P5	3.37	76.15	83.49	46.90	93.55	16.51	81.49	25.58	19.13
P6	1.31	81.15	84.80	47.43	94.07	15.20	81.52	23.55	17.63
P7	15.20	81.52	100.00	52.62	100.00	0.00			
Total (Calc)	100.00	52.62	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

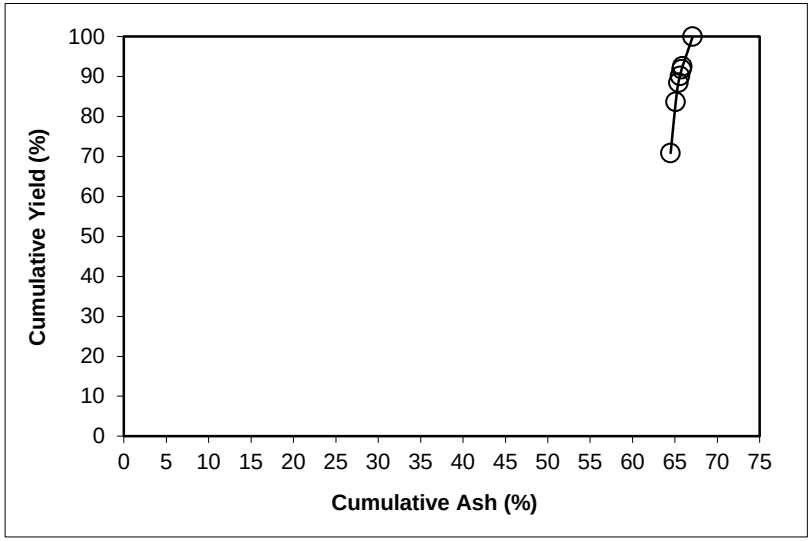
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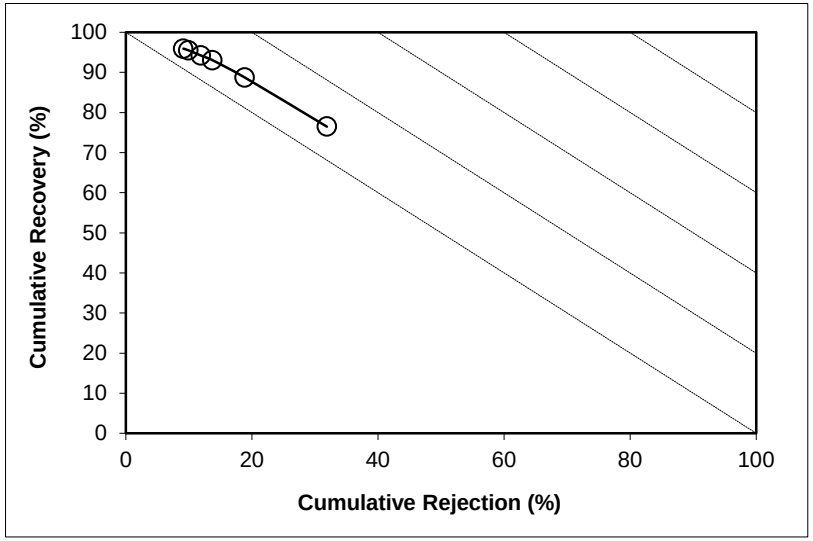
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 8.90

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	70.87	64.49	70.87	64.49	76.47	29.13	73.42	31.88	8.35
P2	12.77	68.42	83.63	65.09	88.72	16.37	77.32	18.86	7.58
P3	4.86	70.78	88.49	65.40	93.04	11.51	80.08	13.73	6.77
P4	1.62	76.21	90.11	65.59	94.20	9.89	80.71	11.90	6.10
P5	1.75	75.76	91.86	65.79	95.50	8.14	81.78	9.92	5.41
P6	0.68	79.29	92.55	65.89	95.92	7.45	82.01	9.11	5.04
P7	7.45	82.01	100.00	67.09	100.00	0.00			
Total (Calc)	100.00	67.09	--	--	--	--	--	--	--





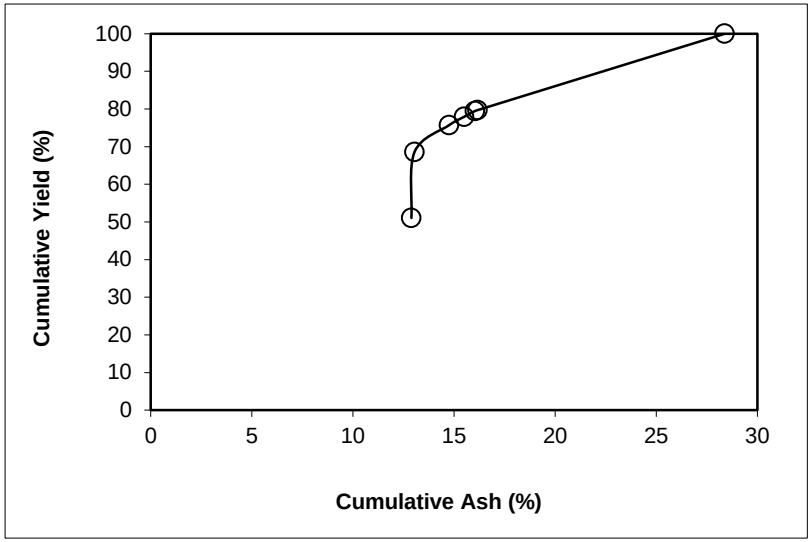
SPIRAL DATA ANALYSIS

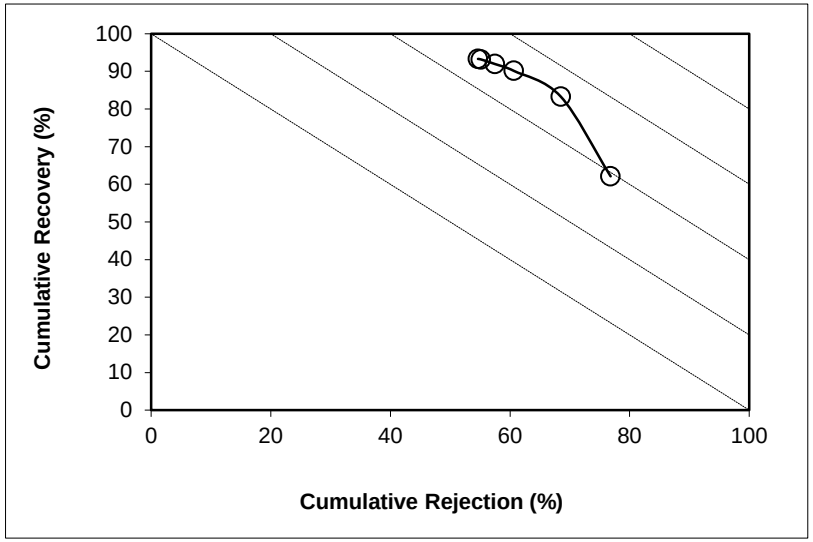
Description: Run 1 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	51.07	12.89	51.07	12.89	62.12	48.93	44.56	76.81	38.94
P2	17.53	13.50	68.60	13.04	83.30	31.40	61.90	68.48	51.78
P3	7.13	31.26	75.73	14.76	90.14	24.27	70.90	60.63	50.77
P4	2.20	40.81	77.92	15.49	91.95	22.08	73.90	57.47	49.43
P5	1.54	43.11	79.47	16.03	93.18	20.53	76.21	55.13	48.31
P6	0.23	59.66	79.70	16.16	93.31	20.30	76.40	54.63	47.95
P7	20.30	76.40	100.00	28.39	100.00	0.00			
Total (Calc)	100.00	28.39	--	--	--	--	--	--	--

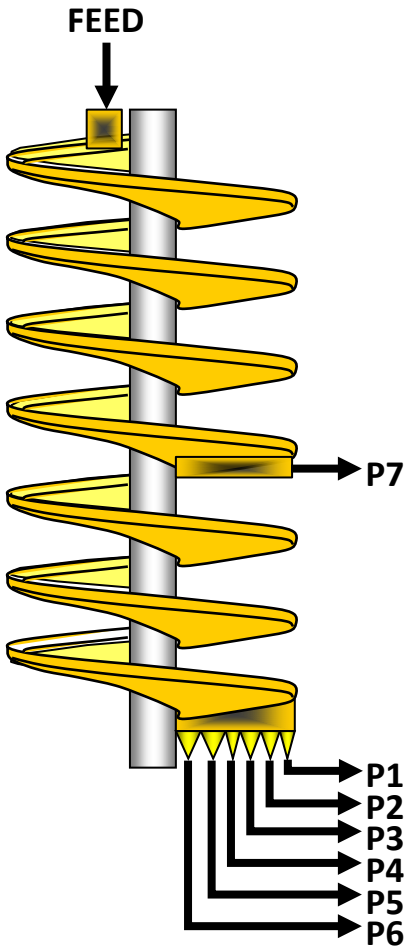




SPIRAL DATA ANALYSIS

Description: Run 2 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	1.295	19.7	21.16	24.89
P2	0.357	27.3	3.81	4.84
P3	0.138	32.0	1.18	1.53
P4	0.041	31.8	0.35	0.45
P5	0.035	23.4	0.45	0.54
P6	0.005	11.9	0.14	0.15
P7	0.362	52.0	1.33	1.97
Total	2.232	23.9	28.42	34.38

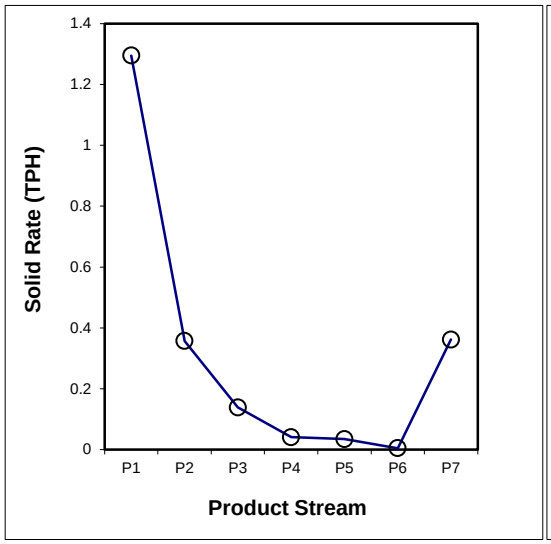
SPIRAL DATA ANALYSIS

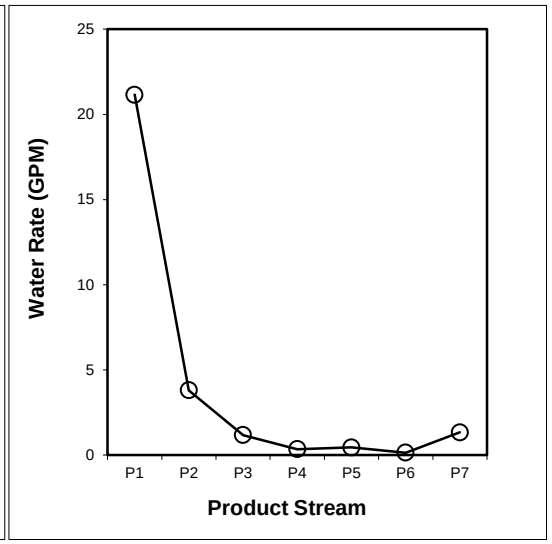
Description: Run 2 - Intermediate Spiral Test

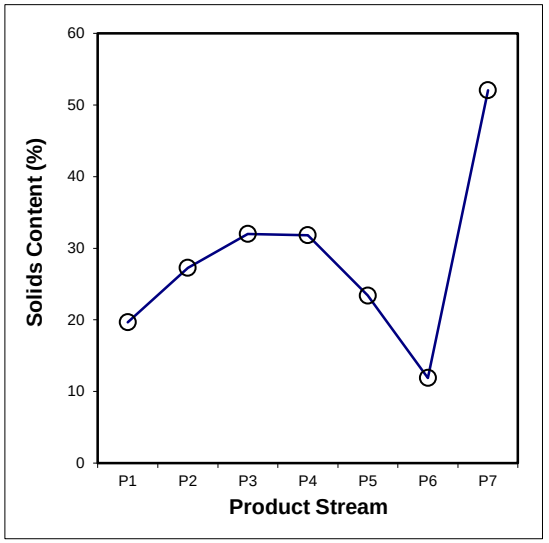
Comments: 1 x 0.15 mm Nominal Particle Size

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	5	9300.00	866.74	6.584	4114.8	2481.6	1.295	58.02	19.67
P2	5	1761.35	86.29	1.309	2470.6	2020.4	0.357	15.99	27.27
P3	10	1200.91	95.01	0.433	2609.7	2260.6	0.138	6.20	31.99
P4	40	1403.31	94.18	0.128	2917.0	2506.0	0.041	1.83	31.83
P5	30	1230.38	94.54	0.148	2973.2	2711.1	0.035	1.55	23.40
P6	90	1020.88	95.11	0.040	2122.6	2014.0	0.005	0.21	11.90
P7	10	1849.97	93.16	0.695	3171.4	2259.4	0.362	16.20	52.05
Total (Calc)	--	--	--	9.337	--	--	2.232	100.00	23.91
Total (Head)	0.53	1350.8	96.26	9.337	3011.1	2711.2	2.232	--	23.91







SPIRAL DATA ANALYSIS

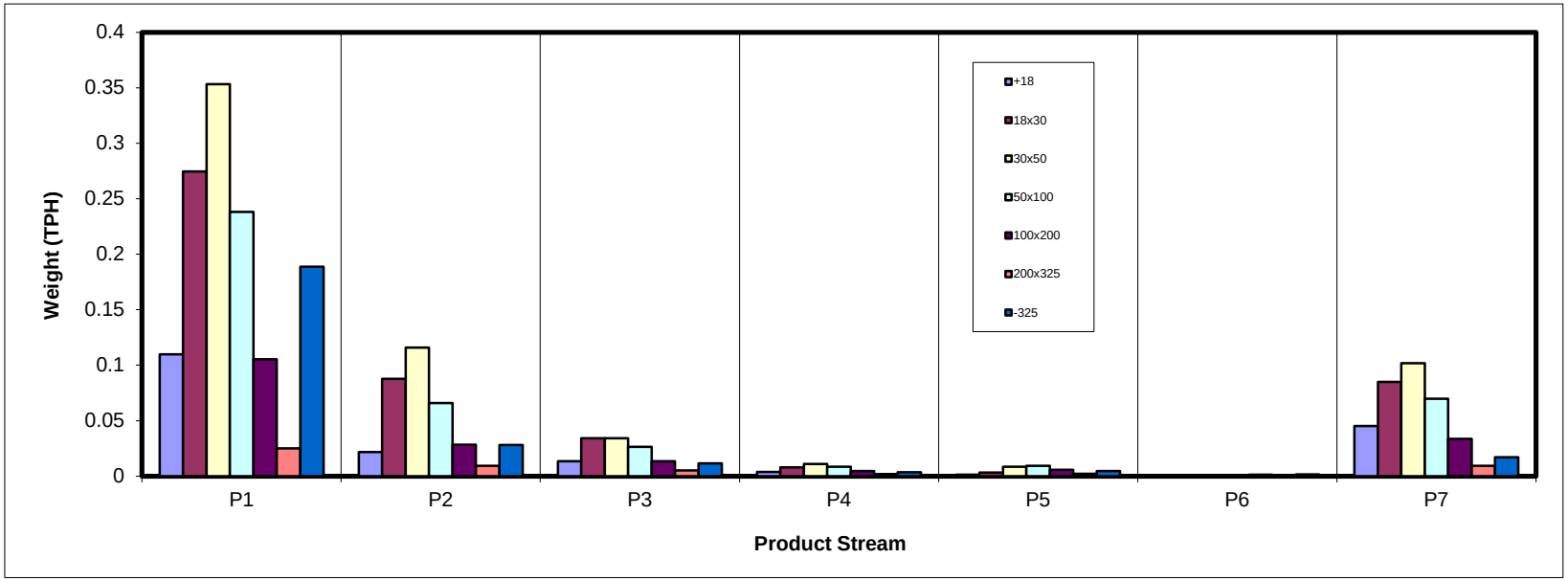
Description: Run 2 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.110	0.022	0.013	0.004	0.001	0.000	0.045		0.195
18x30	0.275	0.088	0.034	0.008	0.003	0.000	0.085		0.492
30x50	0.353	0.116	0.034	0.011	0.009	0.001	0.102		0.625
50x100	0.238	0.066	0.026	0.008	0.009	0.001	0.070		0.419
100x200	0.105	0.028	0.013	0.005	0.006	0.001	0.034		0.192
200x325	0.025	0.009	0.005	0.002	0.002	0.001	0.009		0.053
-325	0.189	0.028	0.011	0.004	0.005	0.002	0.017		0.255
Total (Calc)	1.295	0.357	0.138	0.041	0.035	0.005	0.362		2.232



SPIRAL DATA ANALYSIS

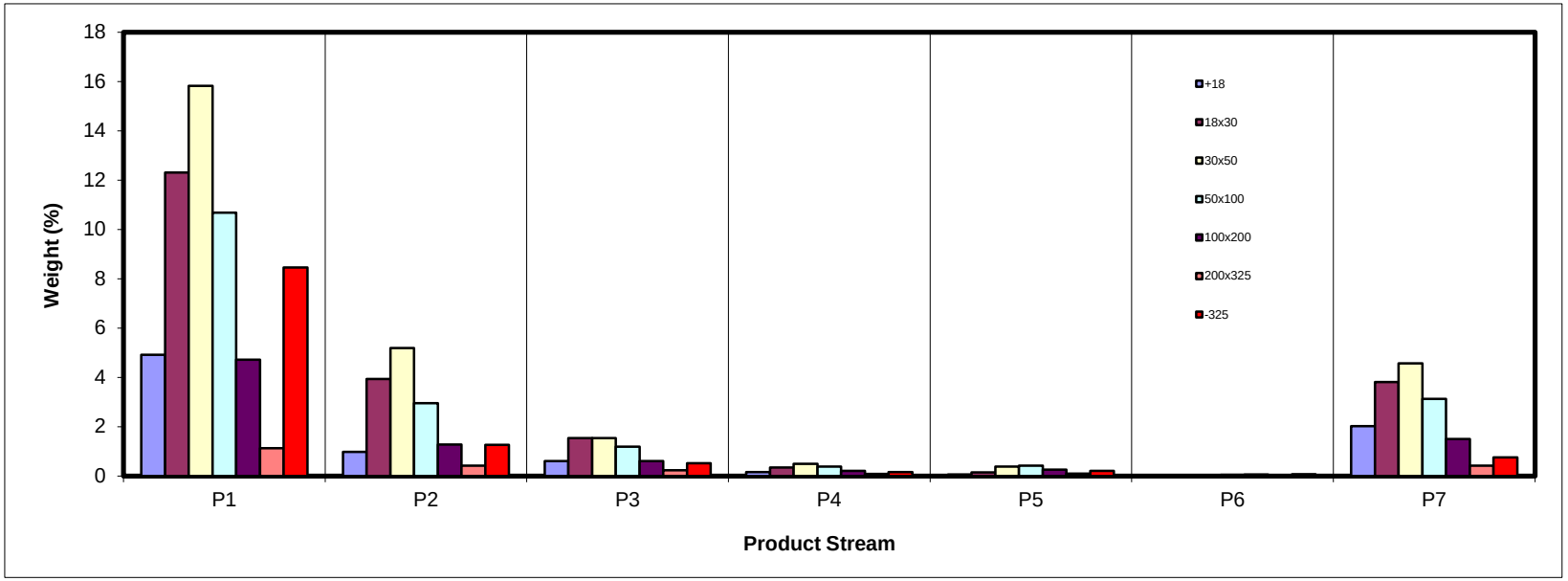
Description: Run 2 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	4.92	0.98	0.60	0.16	0.05	0.00	2.02		8.74
18x30	12.30	3.93	1.53	0.35	0.14	0.00	3.81		22.06
30x50	15.83	5.19	1.53	0.49	0.38	0.03	4.56		28.01
50x100	10.67	2.95	1.18	0.38	0.42	0.04	3.13		18.77
100x200	4.71	1.27	0.60	0.21	0.26	0.05	1.50		8.61
200x325	1.12	0.42	0.23	0.08	0.10	0.02	0.42		2.40
-325	8.46	1.26	0.51	0.16	0.20	0.07	0.76		11.41
Total (Calc)	58.02	15.99	6.20	1.83	1.55	0.21	16.20		100.00



SPIRAL DATA ANALYSIS

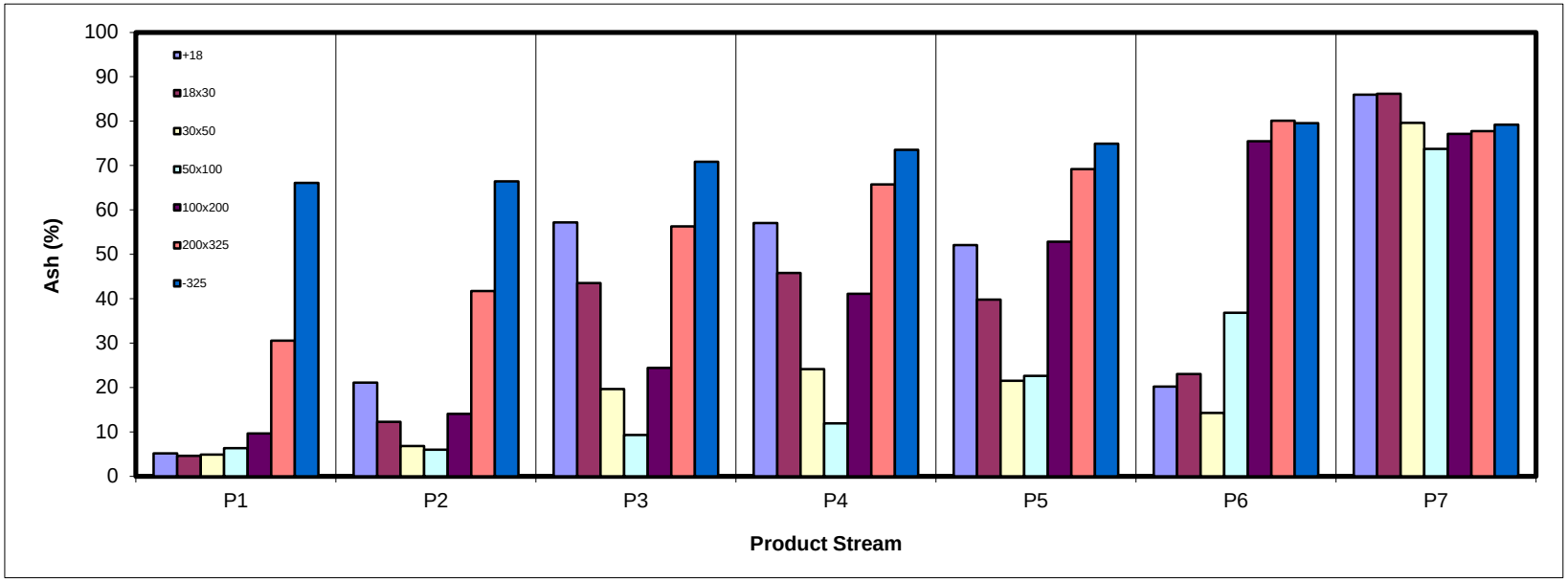
Description: Run 2 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	5.15	21.11	57.20	57.05	52.11	20.19	85.97		30.50
18x30	4.58	12.29	43.51	45.79	39.77	23.00	86.14		23.61
30x50	4.87	6.79	19.68	24.13	21.52	14.28	79.60		18.78
50x100	6.32	6.00	9.30	11.92	22.64	36.81	73.75		18.24
100x200	9.64	14.06	24.43	41.14	52.86	75.50	77.13		25.56
200x325	30.56	41.74	56.32	65.77	69.22	80.07	77.77		46.57
-325	66.08	66.42	70.83	73.57	74.93	79.55	79.21		67.54
Total (Calc)	14.91	15.05	33.32	36.82	39.70	61.77	80.51		27.58



SPIRAL DATA ANALYSIS

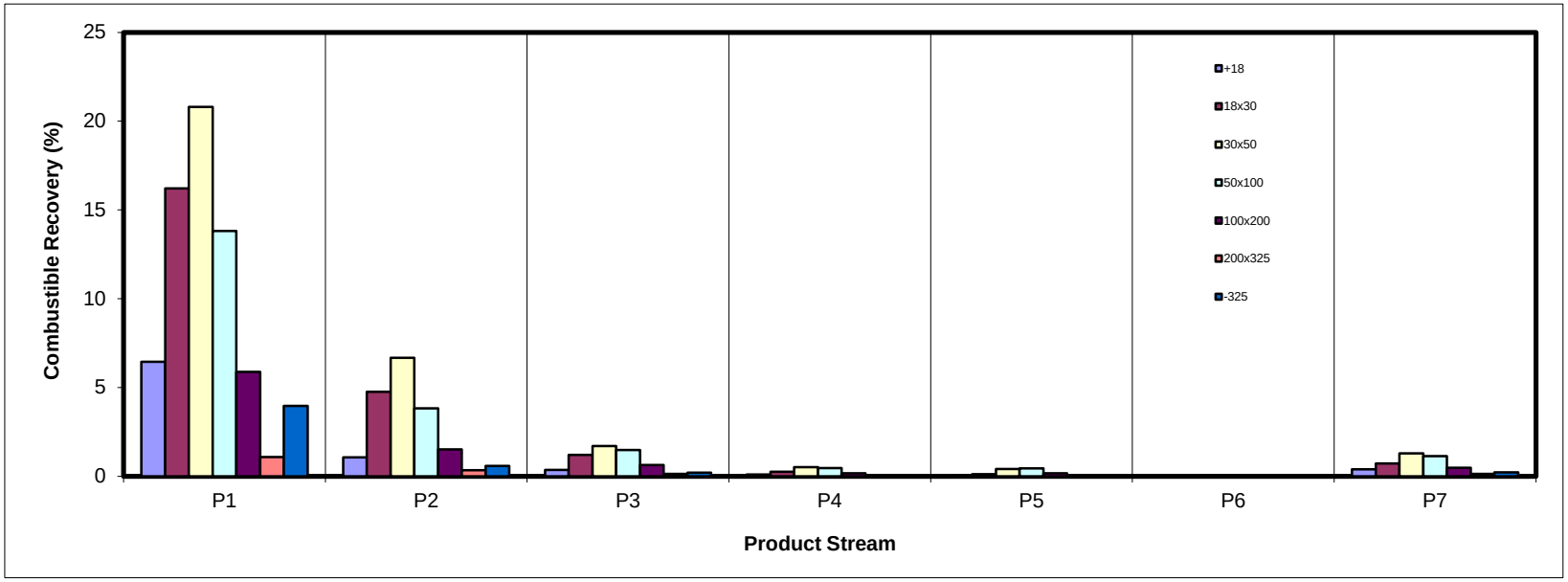
Description: Run 2 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	6.44	1.06	0.36	0.10	0.03	0.00	0.39		8.38
18x30	16.21	4.76	1.20	0.26	0.12	0.00	0.73		23.27
30x50	20.79	6.68	1.70	0.51	0.42	0.03	1.29		31.41
50x100	13.81	3.83	1.48	0.46	0.45	0.03	1.13		21.20
100x200	5.88	1.51	0.63	0.17	0.17	0.02	0.47		8.85
200x325	1.08	0.34	0.14	0.04	0.04	0.01	0.13		1.77
-325	3.96	0.58	0.21	0.06	0.07	0.02	0.22		5.12
Total (Calc)	68.17	18.76	5.71	1.59	1.29	0.11	4.36		100.00



SPIRAL DATA ANALYSIS

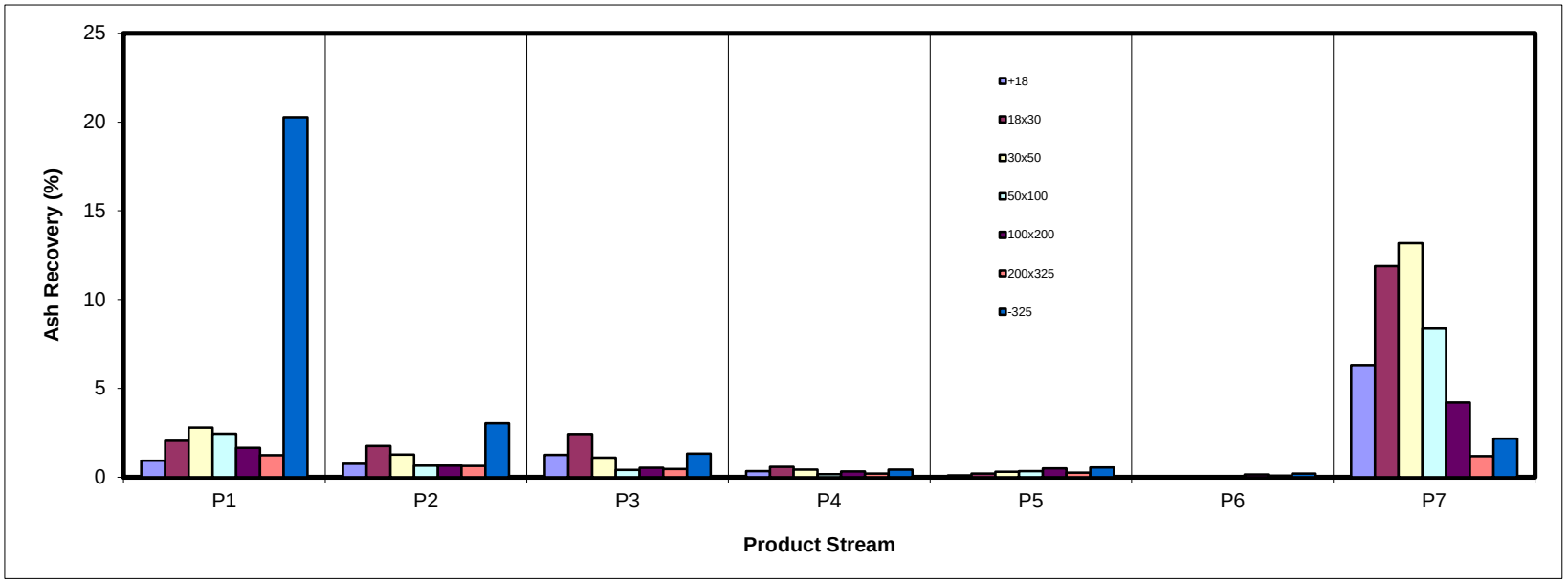
Description: Run 2 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.92	0.75	1.25	0.34	0.10	0.00	6.31		9.66
18x30	2.04	1.75	2.42	0.58	0.20	0.00	11.89		18.88
30x50	2.79	1.28	1.09	0.43	0.30	0.01	13.17		19.07
50x100	2.45	0.64	0.40	0.16	0.34	0.05	8.37		12.41
100x200	1.65	0.65	0.54	0.31	0.49	0.14	4.20		7.98
200x325	1.24	0.64	0.47	0.20	0.25	0.07	1.18		4.05
-325	20.26	3.03	1.32	0.42	0.55	0.20	2.17		27.95
Total (Calc)	31.35	8.72	7.49	2.44	2.23	0.48	47.28		100.00



SPIRAL DATA ANALYSIS

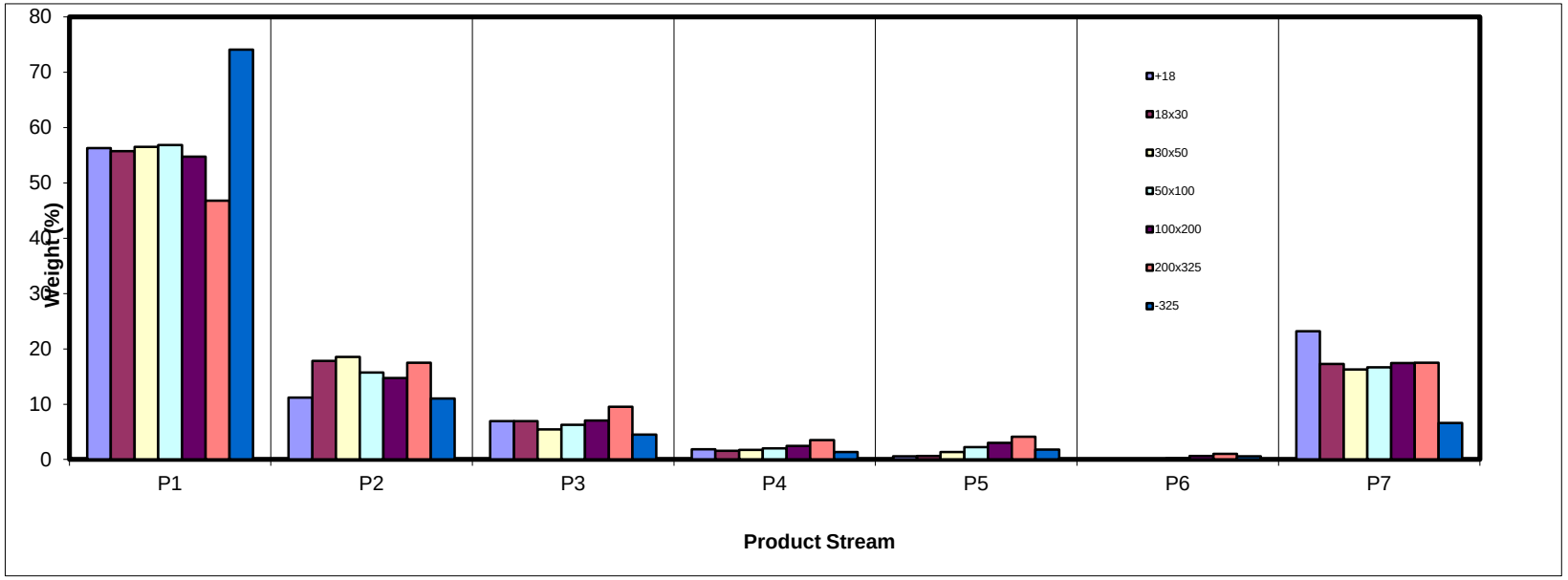
Description: Run 2 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	56.29	11.17	6.92	1.86	0.59	0.01	23.16		100.00
18x30	55.76	17.80	6.96	1.58	0.63	0.02	17.25		100.00
30x50	56.51	18.53	5.47	1.74	1.37	0.09	16.29		100.00
50x100	56.86	15.73	6.30	2.00	2.22	0.21	16.67		100.00
100x200	54.77	14.75	7.02	2.44	2.98	0.61	17.44		100.00
200x325	46.80	17.52	9.53	3.53	4.11	1.03	17.48		100.00
-325	74.10	11.01	4.51	1.38	1.79	0.59	6.63		100.00
Total (Calc)	58.02	15.99	6.20	1.83	1.55	0.21	16.20		100.00



SPIRAL DATA ANALYSIS

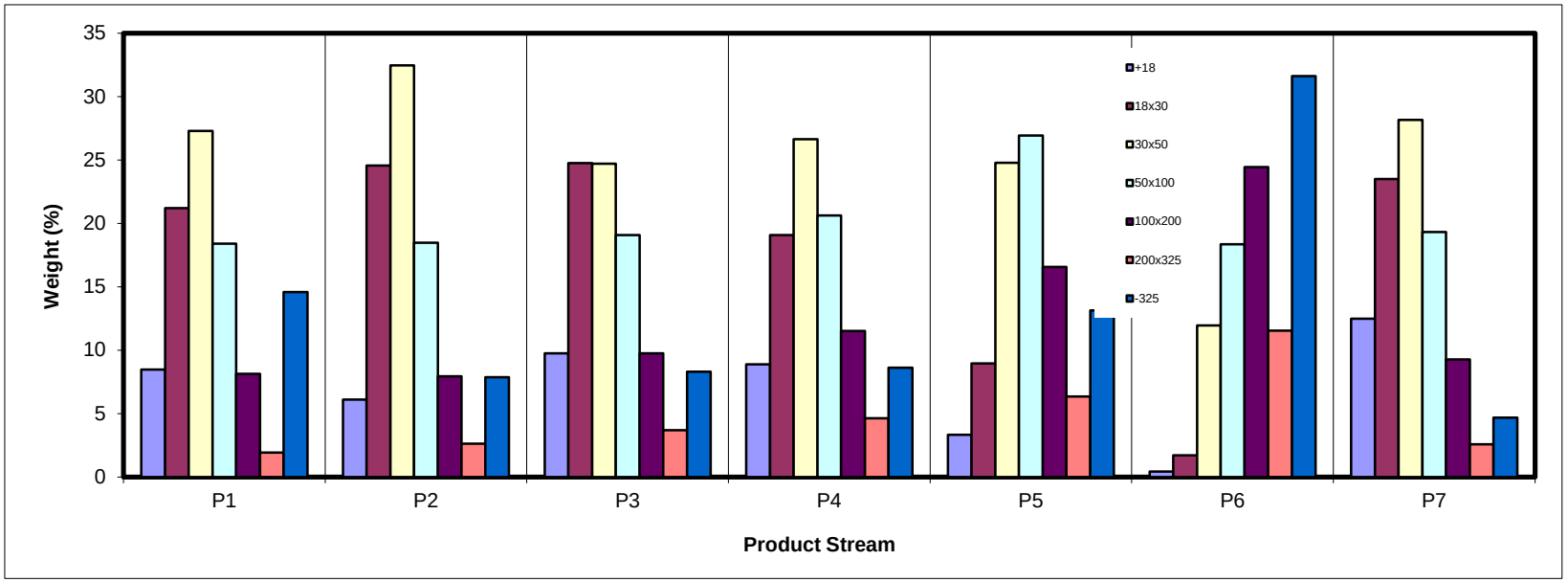
Description: Run 2 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	8.48	6.10	9.75	8.88	3.32	0.42	12.49		8.74
18x30	21.20	24.56	24.75	19.08	8.96	1.70	23.49		22.06
30x50	27.28	32.45	24.70	26.65	24.77	11.94	28.17		28.01
50x100	18.40	18.47	19.07	20.62	26.92	18.36	19.32		18.77
100x200	8.13	7.94	9.74	11.50	16.55	24.44	9.26		8.61
200x325	1.93	2.62	3.68	4.64	6.34	11.53	2.59		2.40
-325	14.58	7.86	8.30	8.62	13.14	31.61	4.67		11.41
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

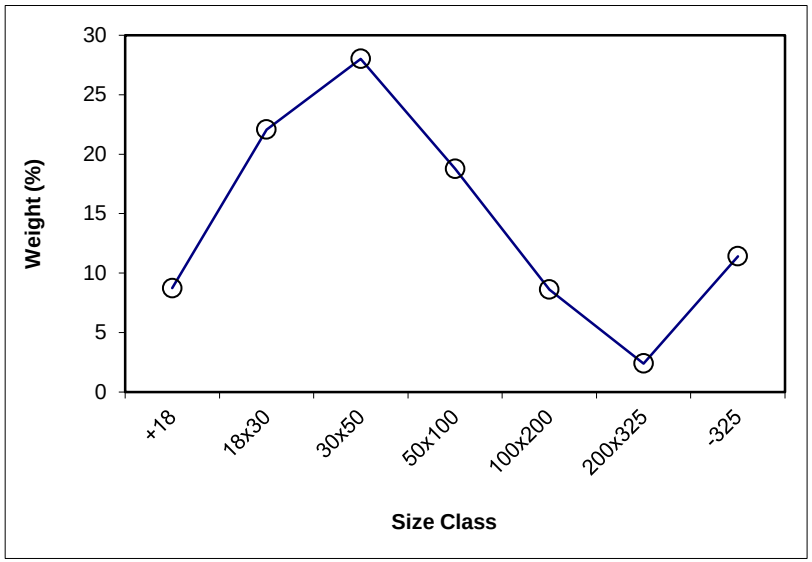
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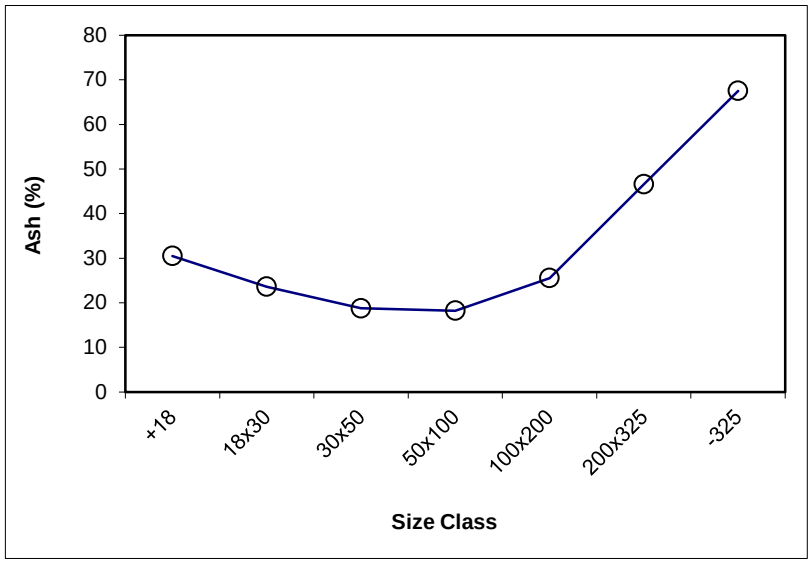
Comments: 1 x 0.15 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	690.9	664.7	26.20	8.74	30.50	8.74	30.50	100.00	27.58
18x30	514.3	448.1	66.17	22.06	23.61	30.80	25.56	91.26	27.30
30x50	508.9	424.9	84.02	28.01	18.78	58.81	22.33	69.20	28.48
50x100	453.5	397.2	56.31	18.77	18.24	77.58	21.34	41.19	35.08
100x200	417.2	391.3	25.82	8.61	25.56	86.19	21.76	22.42	49.18
200x325	385.8	378.6	7.19	2.40	46.57	88.59	22.43	13.81	63.90
-325	40.5	6.3	34.24	11.41	67.54	100.00	27.58	11.41	67.54
Total (Calc)	--	--	299.94	100.00	27.58	--	--	--	--





SPIRAL DATA ANALYSIS

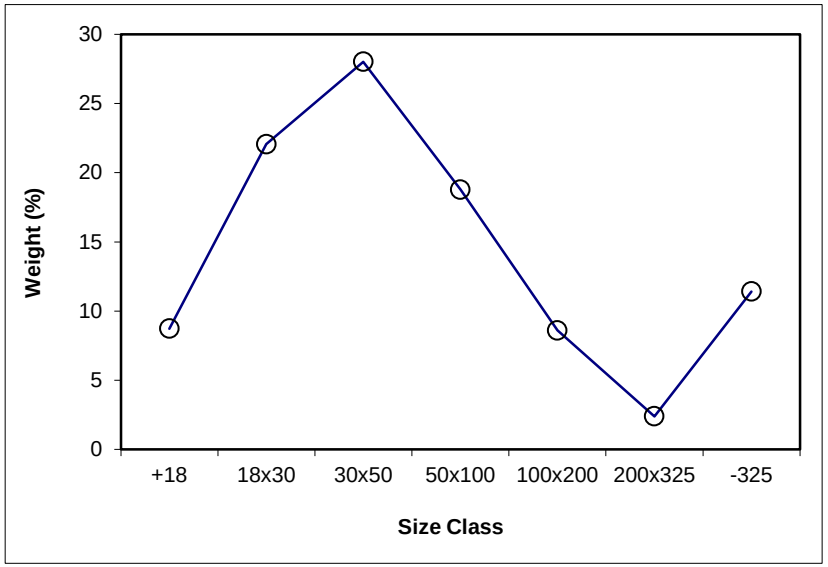
Description: Run 2 - Intermediate Spiral Test

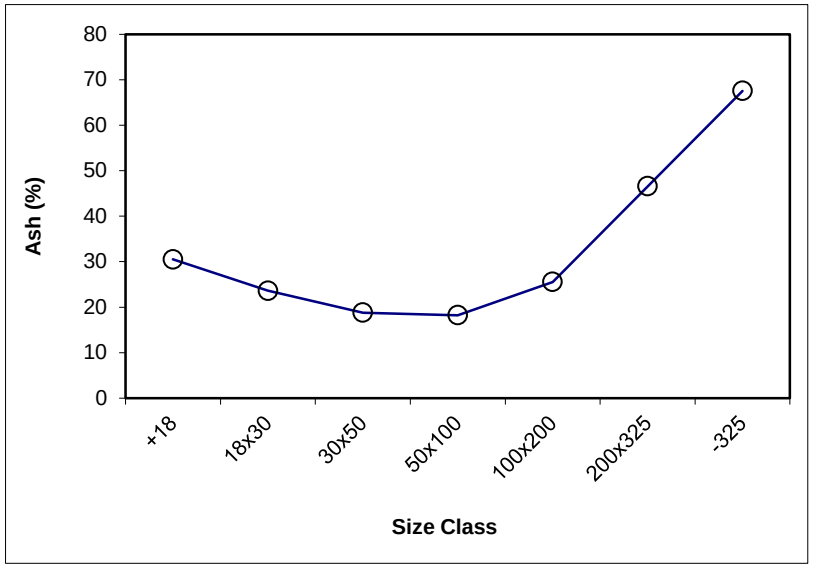
Comments: 1 x 0.15 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	8.74	30.50	8.74	30.50	100.00	27.58			
18x30	22.06	23.61	30.80	25.56	91.26	27.30	x	22.06	23.61
30x50	28.01	18.78	58.81	22.33	69.20	28.48	x	28.01	18.78
50x100	18.77	18.24	77.58	21.34	41.19	35.08	x	18.77	18.24
100x200	8.61	25.56	86.19	21.76	22.42	49.18	x	8.61	25.56
200x325	2.40	46.57	88.59	22.43	13.81	63.90	x	2.40	46.57
-325	11.41	67.54	100.00	27.58	11.41	67.54			
Total (Calc)	100.00	27.58	--	--	--	--	--	79.85	21.55





SPIRAL DATA ANALYSIS

Description: Run 2 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 58.02

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	598.58	460.1	138.44	8.48	5.15	8.48	5.15	100.00	14.91
18x30	788.47	442.2	346.32	21.20	4.58	29.68	4.74	91.52	15.81
30x50	858.13	412.5	445.60	27.28	4.87	56.96	4.80	70.32	19.20
50x100	709.24	408.8	300.49	18.40	6.32	75.36	5.17	43.04	28.28
100x200	482.33	349.6	132.70	8.13	9.64	83.49	5.61	24.64	44.68
200x325	433.89	402.3	31.58	1.93	30.56	85.42	6.17	16.51	61.92
-325	244.22	6.1	238.09	14.58	66.08	100.00	14.91	14.58	66.08
Total (Calc)	--	--	1633.21	100.00	14.91	--	--	--	--

Product P2 Feed Weight (%): 15.99

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	428.7	401.2	27.48	6.10	21.11	6.10	21.11	100.00	15.05
18x30	480.6	370.0	110.57	24.56	12.29	30.66	14.04	93.90	14.65
30x50	482.4	336.3	146.11	32.45	6.79	63.12	10.31	69.34	15.49
50x100	391.0	307.8	83.14	18.47	6.00	81.58	9.34	36.88	23.15
100x200	330.2	294.5	35.73	7.94	14.06	89.52	9.75	18.42	40.34
200x325	309.8	298.0	11.82	2.62	41.74	92.14	10.67	10.48	60.24
-325	48.0	12.6	35.37	7.86	66.42	100.00	15.05	7.86	66.42
Total (Calc)	--	--	450.21	100.00	15.05	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 2 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 6.20

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	435.2	401.2	34.04	9.75	57.20	9.75	57.20	100.00	33.32
18x30	478.4	392.0	86.40	24.75	43.51	34.50	47.38	90.25	30.74
30x50	440.4	354.2	86.24	24.70	19.68	59.20	35.82	65.50	25.91
50x100	459.6	393.0	66.58	19.07	9.30	78.27	29.36	40.80	29.68
100x200	361.2	327.2	34.02	9.74	24.43	88.01	28.81	21.73	47.56
200x325	399.6	386.7	12.86	3.68	56.32	91.70	29.92	11.99	66.37
-325	35.3	6.3	28.99	8.30	70.83	100.00	33.32	8.30	70.83
Total (Calc)	--	--	349.13	100.00	33.32	--	--	--	--

Product P4 Feed Weight (%): 1.83

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	683.1	646.6	36.52	8.88	57.05	8.88	57.05	100.00	36.82
18x30	470.4	392.0	78.42	19.08	45.79	27.97	49.37	91.12	34.85
30x50	463.7	354.2	109.52	26.65	24.13	54.61	37.05	72.03	31.95
50x100	477.8	393.0	84.75	20.62	11.92	75.23	30.16	45.39	36.54
100x200	374.5	327.2	47.28	11.50	41.14	86.74	31.62	24.77	57.05
200x325	405.8	386.7	19.07	4.64	65.77	91.38	33.35	13.26	70.84
-325	41.8	6.3	35.45	8.62	73.57	100.00	36.82	8.62	73.57
Total (Calc)	--	--	411.01	100.00	36.82	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 2 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 1.55

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	673.4	664.7	8.69	3.32	52.11	3.32	52.11	100.00	39.70
18x30	471.6	448.1	23.47	8.96	39.77	12.28	43.11	96.68	39.28
30x50	489.8	424.9	64.91	24.77	21.52	37.05	28.67	87.72	39.22
50x100	467.8	397.2	70.54	26.92	22.64	63.97	26.13	62.95	46.19
100x200	434.7	391.3	43.37	16.55	52.86	80.52	31.63	36.03	63.79
200x325	395.2	378.6	16.62	6.34	69.22	86.86	34.37	19.48	73.07
-325	40.7	6.3	34.43	13.14	74.93	100.00	39.70	13.14	74.93
Total (Calc)	--	--	262.03	100.00	39.70	--	--	--	--

Product P6 Feed Weight (%): 0.21

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	401.7	401.2	0.46	0.42	20.19	0.42	20.19	100.00	61.77
18x30	371.9	370.0	1.84	1.70	23.00	2.12	22.44	99.58	61.95
30x50	349.2	336.3	12.96	11.94	14.28	14.06	15.51	97.88	62.62
50x100	327.7	307.8	19.93	18.36	36.81	32.42	27.57	85.94	69.34
100x200	321.0	294.5	26.53	24.44	75.50	56.85	48.17	67.58	78.17
200x325	310.5	298.0	12.52	11.53	80.07	68.39	53.55	43.15	79.69
-325	40.5	6.2	34.32	31.61	79.55	100.00	61.77	31.61	79.55
Total (Calc)	--	--	108.56	100.00	61.77	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 2 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 16.20

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	760.5	646.6	113.94	12.49	85.97	12.49	85.97	100.00	80.51
18x30	584.3	370.0	214.28	23.49	86.14	35.99	86.08	87.51	79.73
30x50	593.2	336.3	256.94	28.17	79.60	64.16	83.23	64.01	77.37
50x100	484.1	307.8	176.25	19.32	73.75	83.48	81.04	35.84	75.63
100x200	379.0	294.5	84.50	9.26	77.13	92.75	80.65	16.52	77.82
200x325	321.6	298.0	23.58	2.59	77.77	95.33	80.57	7.25	78.70
-325	48.8	6.2	42.59	4.67	79.21	100.00	80.51	4.67	79.21
Total (Calc)	--	--	912.08	100.00	80.51	--	--	--	--

SPIRAL DATA ANALYSIS

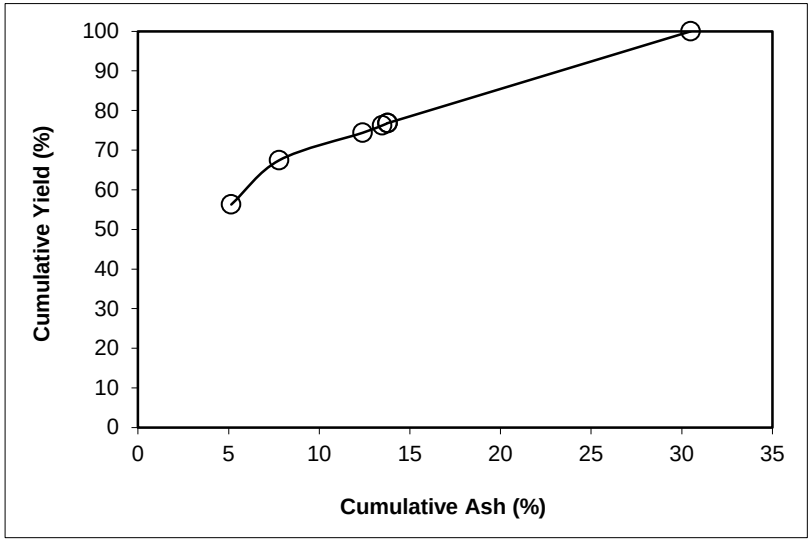
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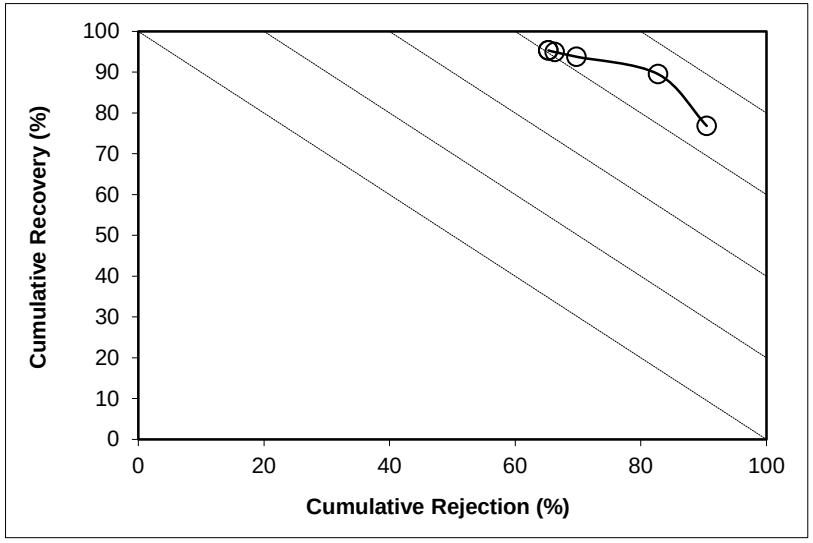
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 8.74

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	56.29	5.15	56.29	5.15	76.82	43.71	63.14	90.50	67.31
P2	11.17	21.11	67.46	7.79	89.50	32.54	77.57	82.76	72.26
P3	6.92	57.20	74.38	12.39	93.76	25.62	83.07	69.78	63.54
P4	1.86	57.05	76.24	13.48	94.91	23.76	85.10	66.31	61.22
P5	0.59	52.11	76.83	13.77	95.31	23.17	85.94	65.30	60.62
P6	0.01	20.19	76.84	13.77	95.32	23.16	85.97	65.30	60.62
P7	23.16	85.97	100.00	30.50	100.00	0.00			
Total (Calc)	100.00	30.50	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

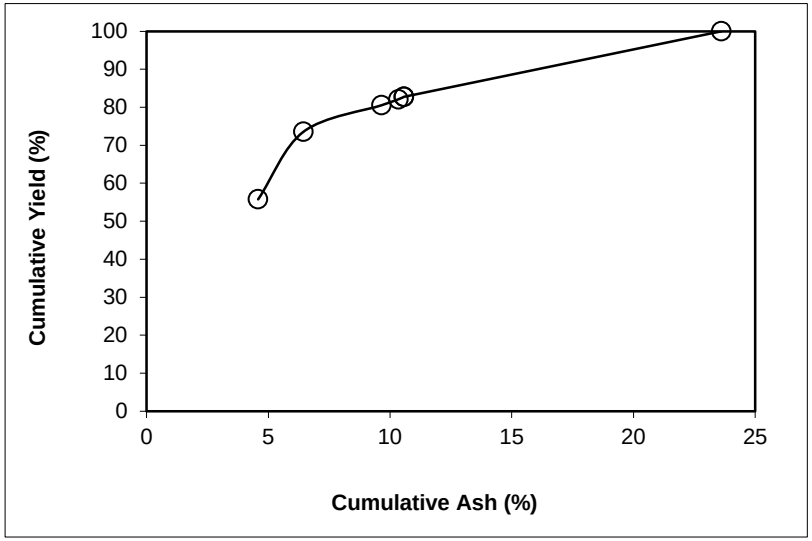
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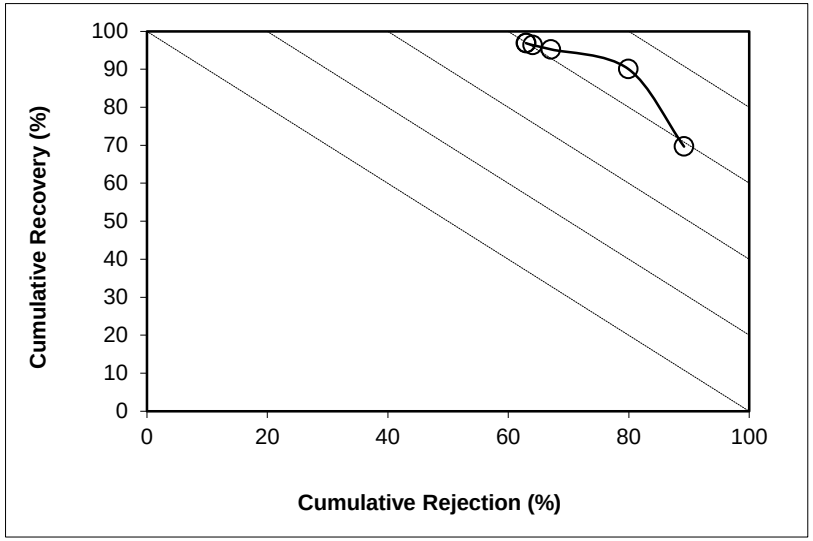
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 22.06

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	55.76	4.58	55.76	4.58	69.65	44.24	47.59	89.17	58.82
P2	17.80	12.29	73.57	6.45	90.09	26.43	71.37	79.91	70.00
P3	6.96	43.51	80.52	9.65	95.24	19.48	81.32	67.09	62.33
P4	1.58	45.79	82.10	10.34	96.36	17.90	84.45	64.03	60.38
P5	0.63	39.77	82.73	10.57	96.85	17.27	86.08	62.97	59.82
P6	0.02	23.00	82.75	10.57	96.87	17.25	86.14	62.95	59.82
P7	17.25	86.14	100.00	23.61	100.00	0.00			
Total (Calc)	100.00	23.61	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

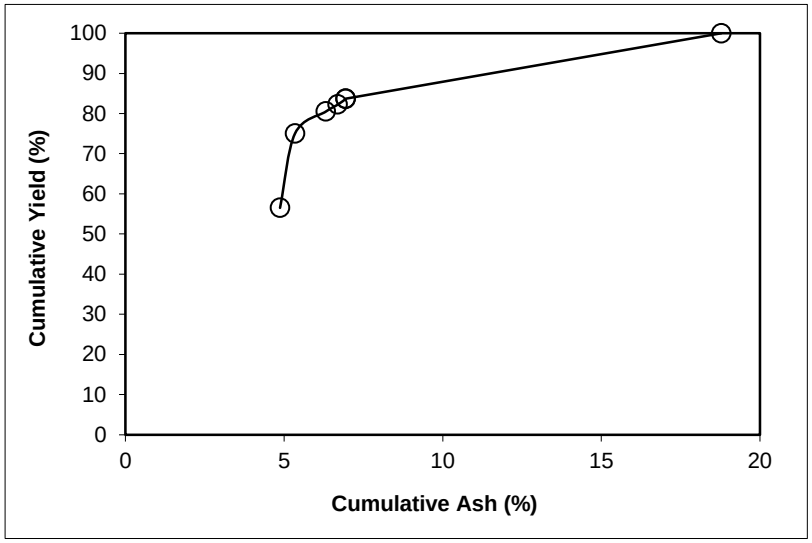
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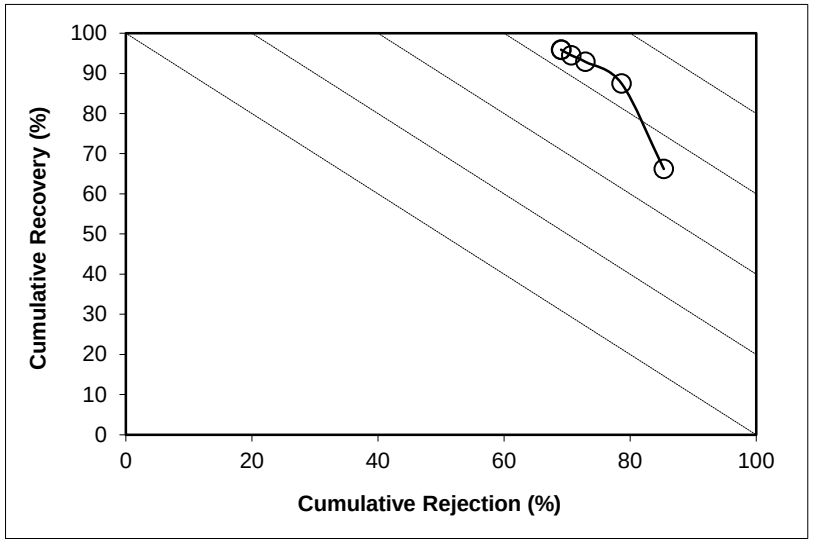
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 28.01

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	56.51	4.87	56.51	4.87	66.19	43.49	36.86	85.35	51.54
P2	18.53	6.79	75.04	5.34	87.46	24.96	59.18	78.65	66.11
P3	5.47	19.68	80.51	6.32	92.86	19.49	70.26	72.92	65.78
P4	1.74	24.13	82.24	6.69	94.49	17.76	74.77	70.69	65.18
P5	1.37	21.52	83.62	6.94	95.81	16.38	79.23	69.12	64.93
P6	0.09	14.28	83.71	6.94	95.91	16.29	79.60	69.05	64.96
P7	16.29	79.60	100.00	18.78	100.00	0.00			
Total (Calc)	100.00	18.78	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

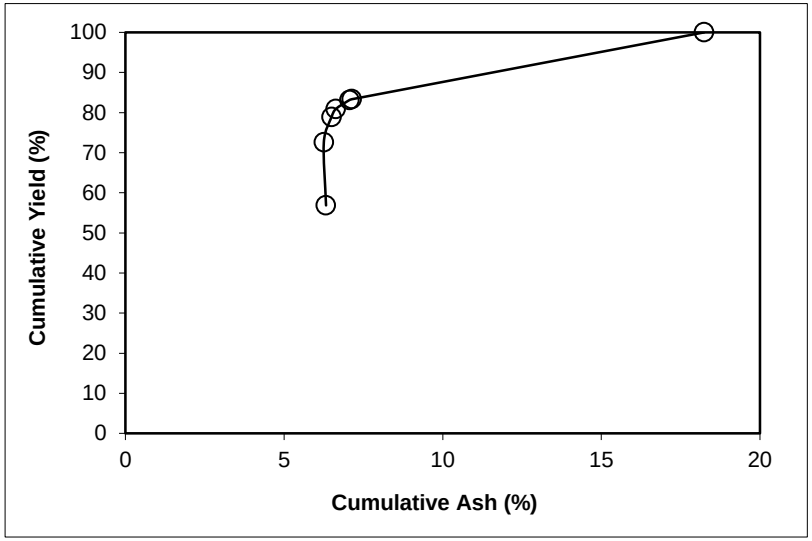
Description: Run 2 - Intermediate Spiral Test

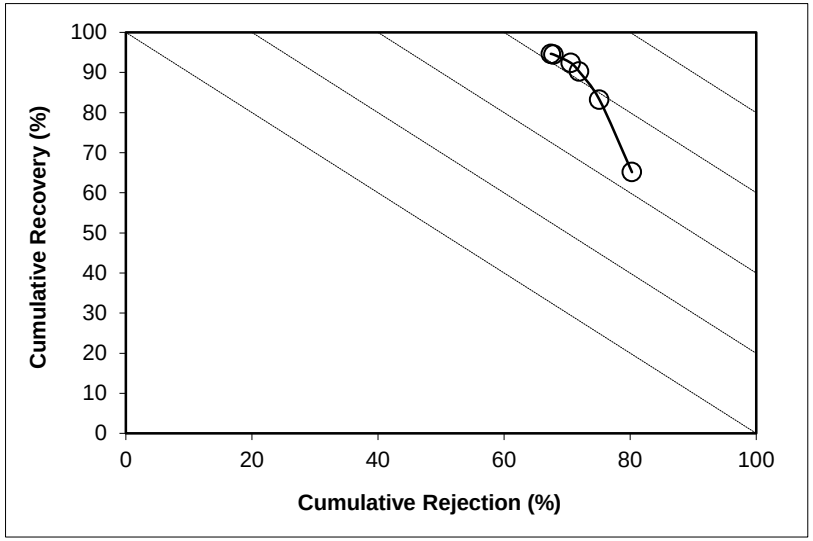
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 18.77

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	56.86	6.32	56.86	6.32	65.15	43.14	33.95	80.30	45.44
P2	15.73	6.00	72.59	6.25	83.23	27.41	49.99	75.13	58.36
P3	6.30	9.30	78.89	6.49	90.22	21.11	62.13	71.91	62.13
P4	2.00	11.92	80.89	6.63	92.38	19.11	67.40	70.60	62.98
P5	2.22	22.64	83.12	7.06	94.48	16.88	73.29	67.84	62.33
P6	0.21	36.81	83.33	7.13	94.65	16.67	73.75	67.42	62.07
P7	16.67	73.75	100.00	18.24	100.00	0.00			
Total (Calc)	100.00	18.24	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

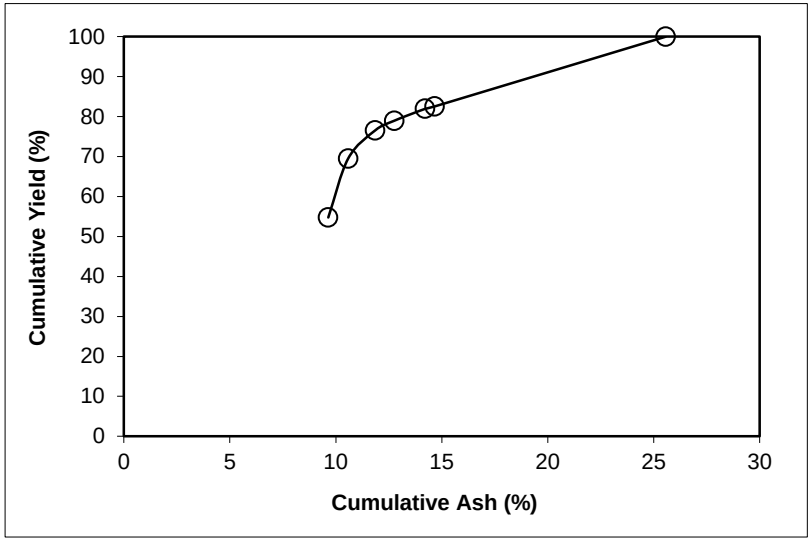
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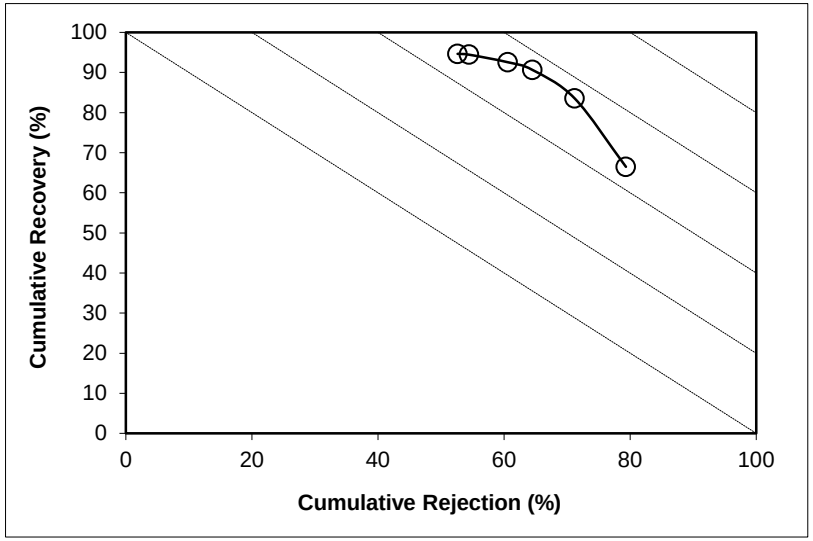
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 8.61

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	54.77	9.64	54.77	9.64	66.48	45.23	44.83	79.34	45.81
P2	14.75	14.06	69.51	10.58	83.50	30.49	59.71	71.22	54.72
P3	7.02	24.43	76.53	11.85	90.63	23.47	70.26	64.51	55.14
P4	2.44	41.14	78.97	12.76	92.55	21.03	73.64	60.59	53.14
P5	2.98	52.86	81.96	14.22	94.44	18.04	77.08	54.42	48.86
P6	0.61	75.50	82.56	14.67	94.64	17.44	77.13	52.62	47.26
P7	17.44	77.13	100.00	25.56	100.00	0.00			
Total (Calc)	100.00	25.56	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

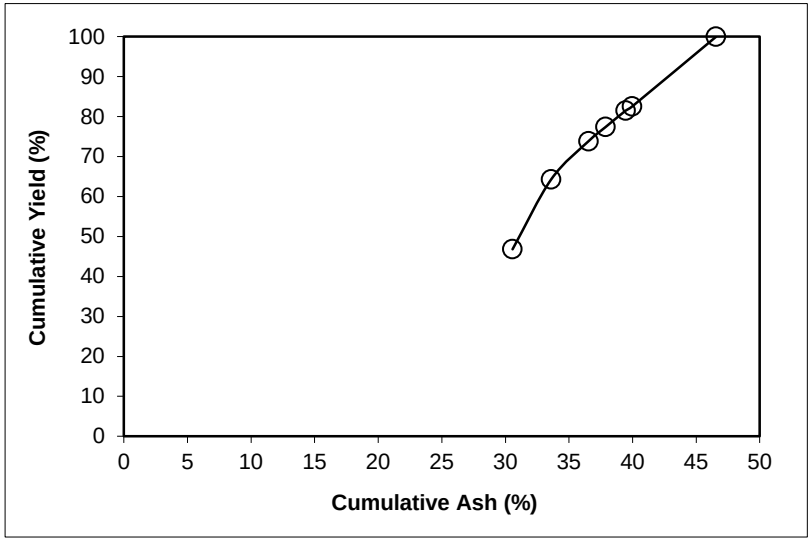
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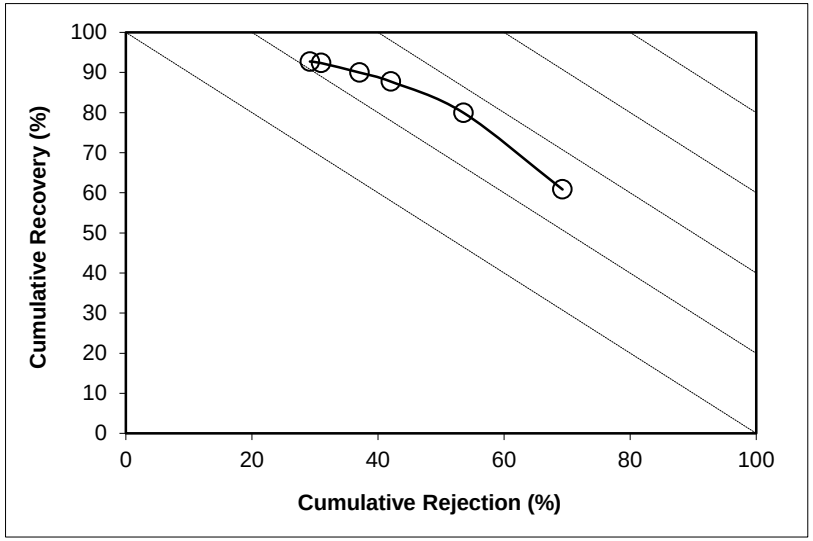
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 2.40

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	46.80	30.56	46.80	30.56	60.82	53.20	60.65	69.28	30.11
P2	17.52	41.74	64.32	33.60	79.92	35.68	69.93	53.58	33.51
P3	9.53	56.32	73.85	36.54	87.72	26.15	74.90	42.05	29.77
P4	3.53	65.77	77.39	37.87	89.98	22.61	76.32	37.06	27.04
P5	4.11	69.22	81.49	39.45	92.34	18.51	77.90	30.96	23.30
P6	1.03	80.07	82.52	39.96	92.73	17.48	77.77	29.19	21.91
P7	17.48	77.77	100.00	46.57	100.00	0.00			
Total (Calc)	100.00	46.57	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

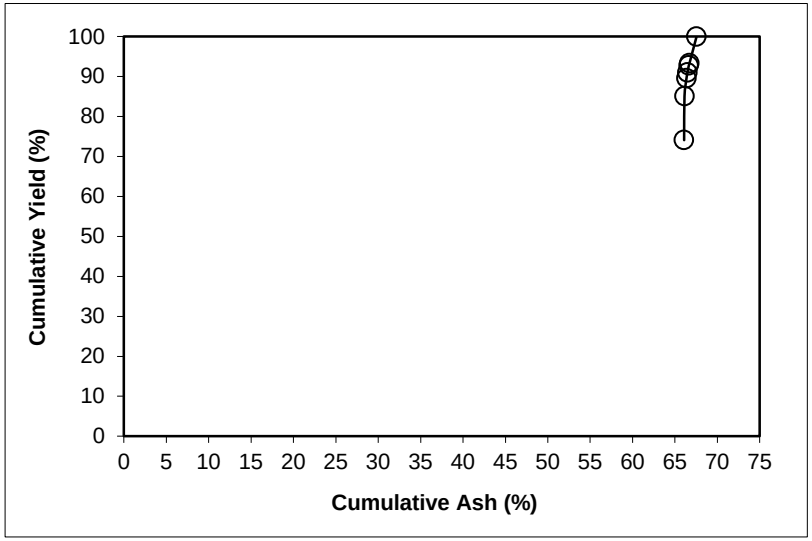
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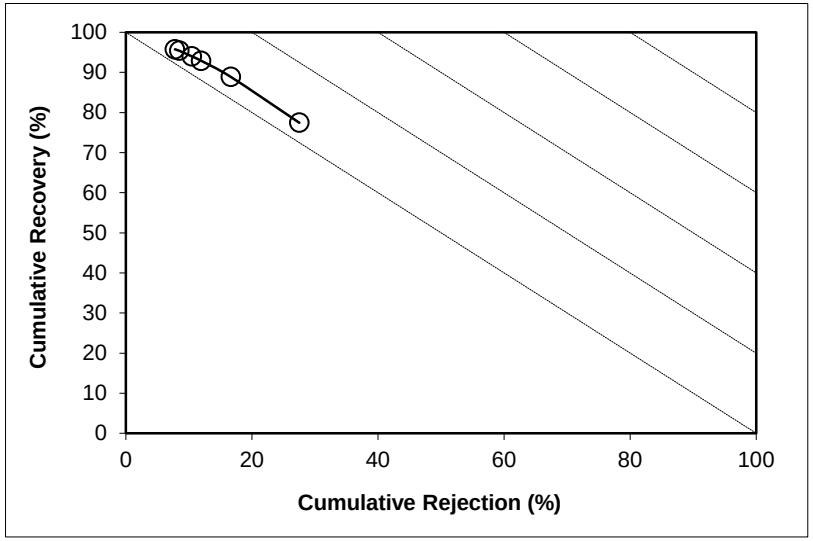
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 11.41

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	74.10	66.08	74.10	66.08	77.44	25.90	71.73	27.51	4.95
P2	11.01	66.42	85.10	66.12	88.83	14.90	75.65	16.69	5.51
P3	4.51	70.83	89.61	66.36	92.88	10.39	77.75	11.95	4.83
P4	1.38	73.57	90.99	66.47	94.00	9.01	78.38	10.45	4.45
P5	1.79	74.93	92.78	66.63	95.38	7.22	79.24	8.47	3.85
P6	0.59	79.55	93.37	66.71	95.76	6.63	79.21	7.77	3.53
P7	6.63	79.21	100.00	67.54	100.00	0.00			
Total (Calc)	100.00	67.54	--	--	--	--	--	--	--





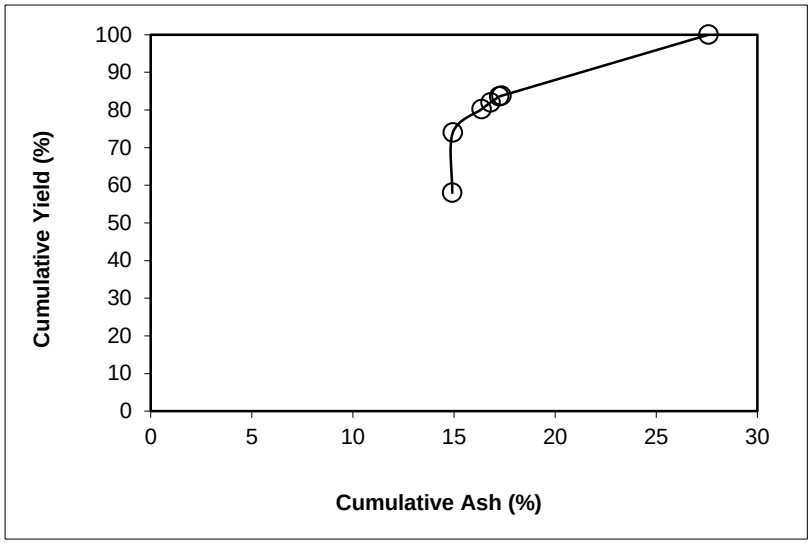
SPIRAL DATA ANALYSIS

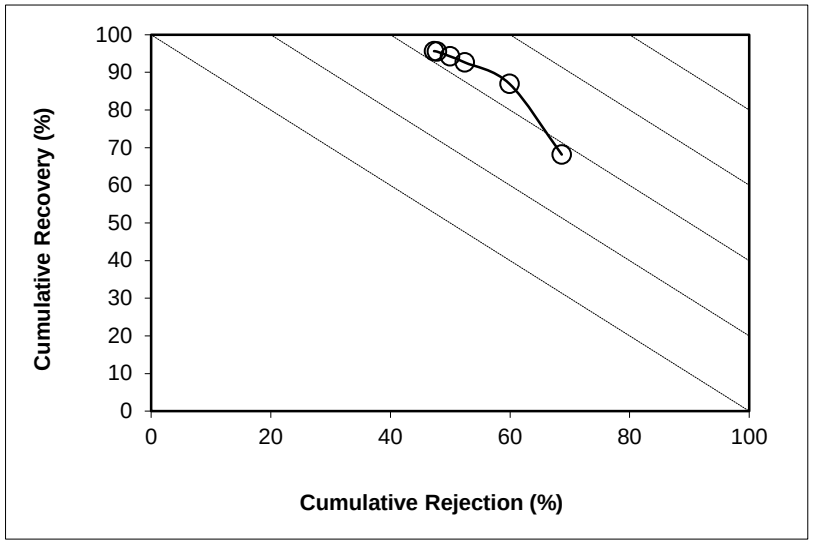
Description: Run 2 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	58.02	14.91	58.02	14.91	68.17	41.98	45.10	68.65	36.82
P2	15.99	15.05	74.01	14.94	86.93	25.99	63.59	59.92	46.85
P3	6.20	33.32	80.21	16.36	92.64	19.79	73.08	52.43	45.07
P4	1.83	36.82	82.03	16.81	94.23	17.97	76.76	50.00	44.23
P5	1.55	39.70	83.59	17.24	95.53	16.41	80.26	47.76	43.29
P6	0.21	61.77	83.80	17.35	95.64	16.20	80.51	47.28	42.92
P7	16.20	80.51	100.00	27.58	100.00	0.00			
Total (Calc)	100.00	27.58	--	--	--	--	--	--	--

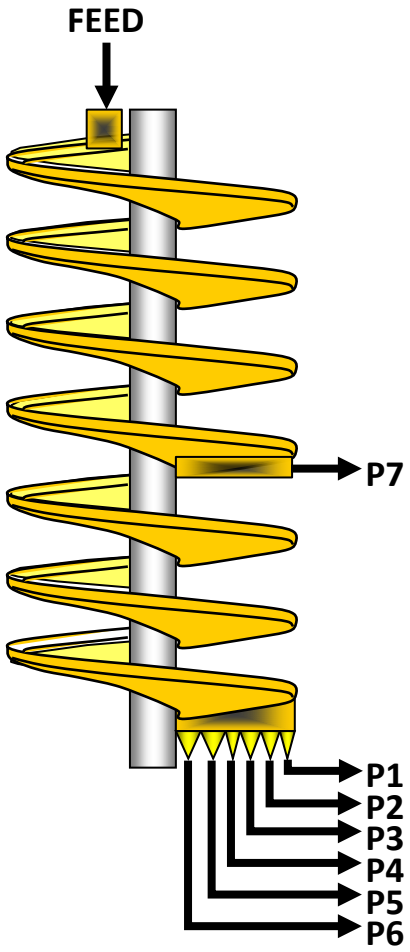




SPIRAL DATA ANALYSIS

Description: Run 3 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	0.484	14.4	11.47	12.86
P2	0.247	25.3	2.93	3.65
P3	0.102	28.7	1.01	1.28
P4	0.037	25.0	0.44	0.53
P5	0.043	32.3	0.36	0.47
P6	0.017	41.1	0.10	0.13
P7	0.141	41.2	0.80	1.06
Total	1.071	20.0	17.12	19.97

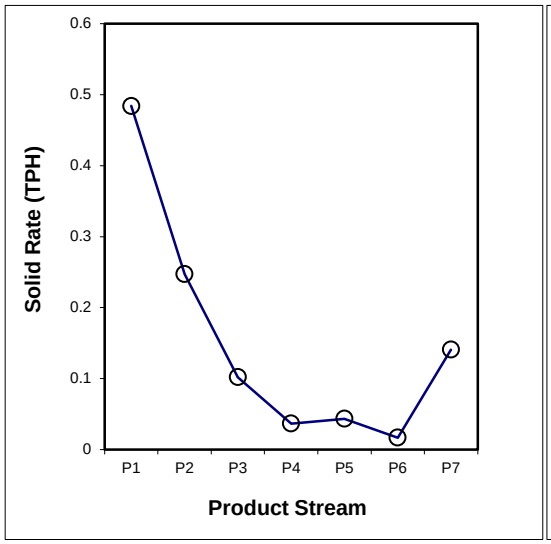
SPIRAL DATA ANALYSIS

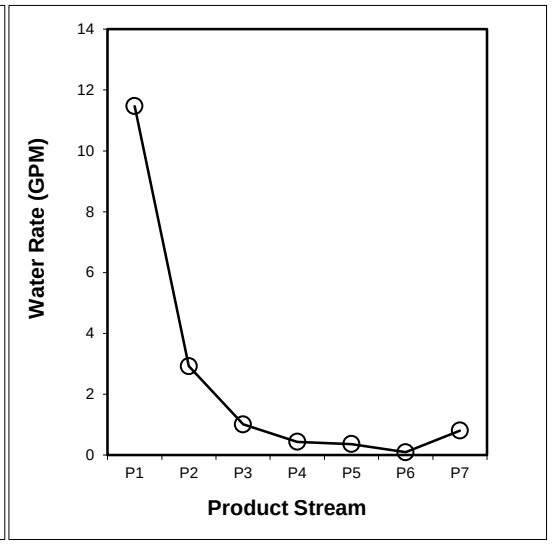
Description: Run 3 - Intermediate Spiral Test

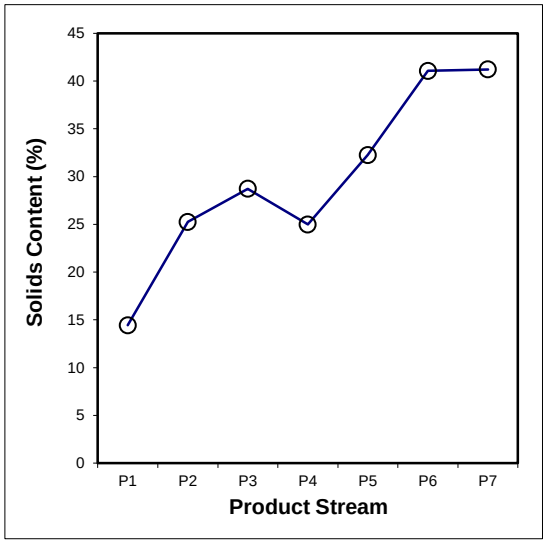
Comments: 1 x 0.15 mm Nominal Particle Size

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	5	4476.00	182.92	3.352	3075.5	2465.2	0.484	45.19	14.44
P2	5	1350.07	96.10	0.979	3169.3	2857.5	0.247	23.09	25.25
P3	10	1004.44	96.23	0.355	2517.1	2259.7	0.102	9.53	28.72
P4	20	845.17	97.16	0.146	3073.2	2888.7	0.037	3.41	25.00
P5	20	785.25	97.03	0.135	2479.8	2260.6	0.043	4.06	32.26
P6	90	1034.36	97.81	0.041	2886.4	2506.7	0.017	1.56	41.06
P7	15	1391.71	92.72	0.342	3047.7	2514.7	0.141	13.16	41.22
Total (Calc)	--	--	--	5.350	--	--	1.071	100.00	20.02
Total (Head)	1.64	2446.57	232.51	5.350	2457.3	2014.2	1.071	--	20.02







SPIRAL DATA ANALYSIS

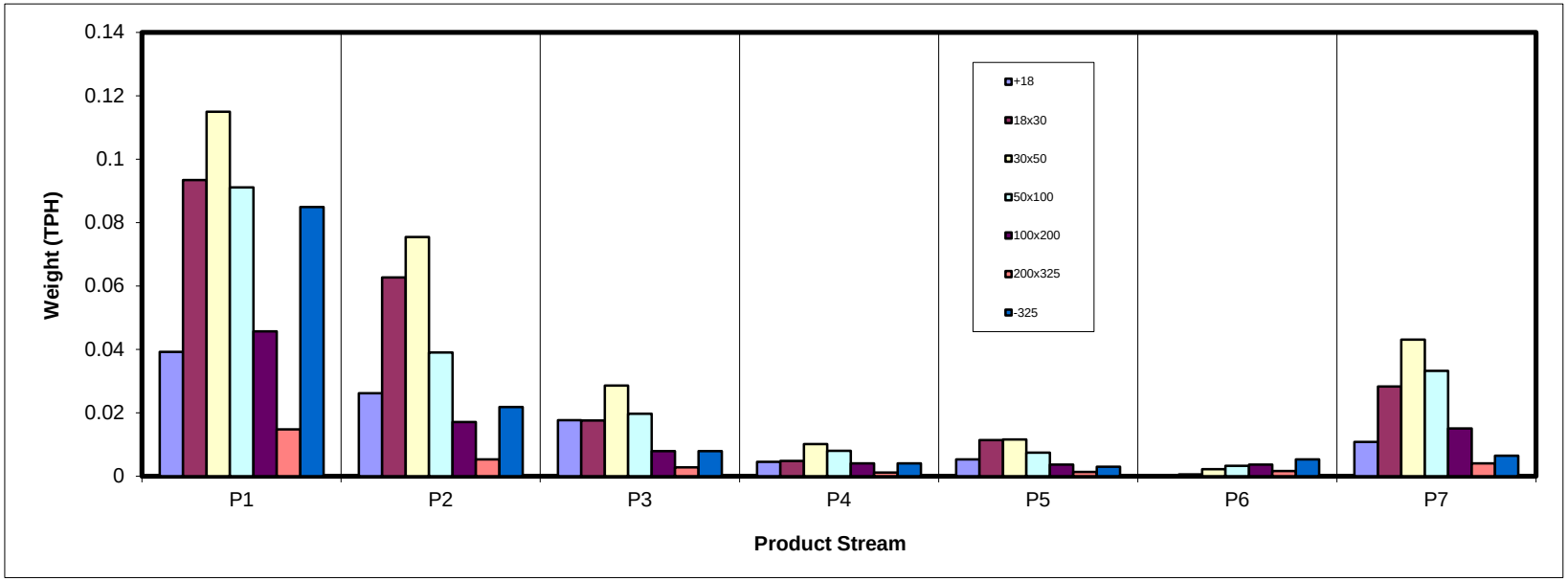
Description: Run 3 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.039	0.026	0.018	0.005	0.005	0.000	0.011		0.104
18x30	0.093	0.063	0.018	0.005	0.011	0.001	0.028		0.219
30x50	0.115	0.075	0.029	0.010	0.012	0.002	0.043		0.286
50x100	0.091	0.039	0.020	0.008	0.007	0.003	0.033		0.202
100x200	0.046	0.017	0.008	0.004	0.004	0.004	0.015		0.097
200x325	0.015	0.005	0.003	0.001	0.001	0.002	0.004		0.031
-325	0.085	0.022	0.008	0.004	0.003	0.005	0.006		0.133
Total (Calc)	0.484	0.247	0.102	0.037	0.043	0.017	0.141		1.071



SPIRAL DATA ANALYSIS

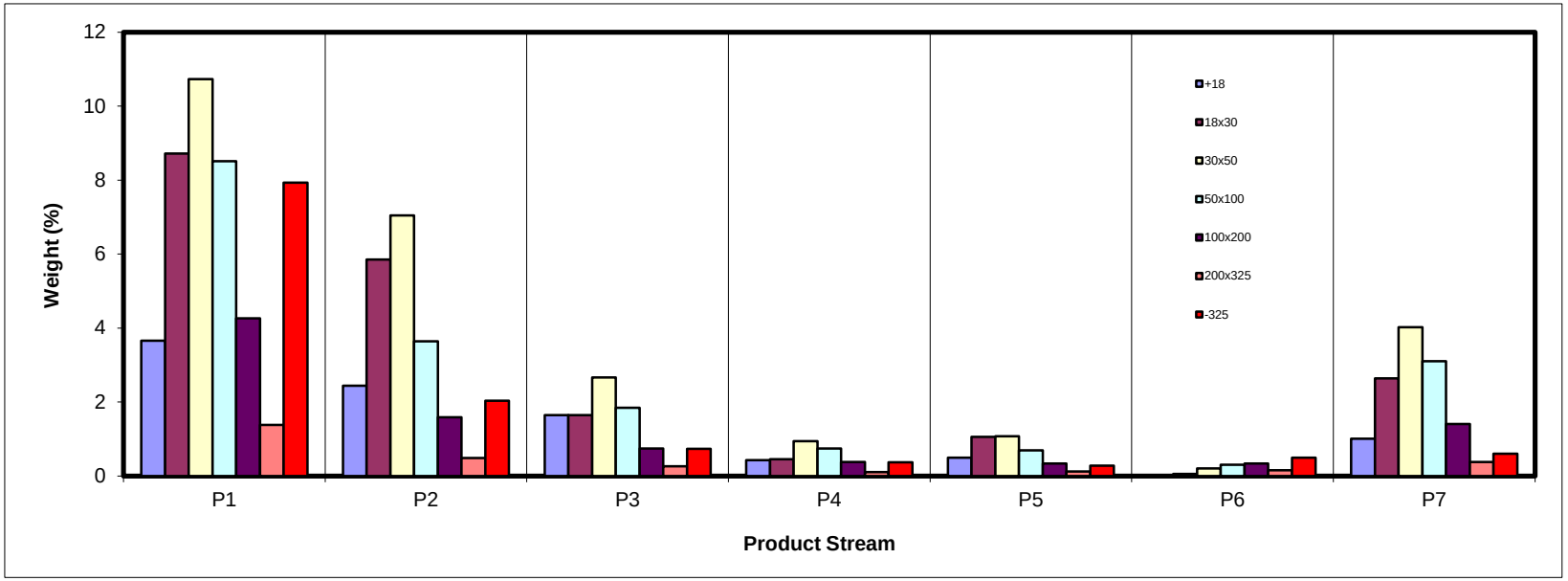
Description: Run 3 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	3.66	2.44	1.65	0.42	0.49	0.01	1.01		9.68
18x30	8.72	5.85	1.64	0.45	1.06	0.05	2.64		20.41
30x50	10.73	7.04	2.67	0.94	1.08	0.21	4.02		26.69
50x100	8.51	3.64	1.84	0.74	0.69	0.30	3.10		18.83
100x200	4.26	1.59	0.74	0.38	0.34	0.34	1.41		9.05
200x325	1.38	0.49	0.26	0.10	0.12	0.15	0.37		2.88
-325	7.93	2.03	0.74	0.37	0.28	0.50	0.60		12.45
Total (Calc)	45.19	23.09	9.53	3.41	4.06	1.56	13.16		100.00



SPIRAL DATA ANALYSIS

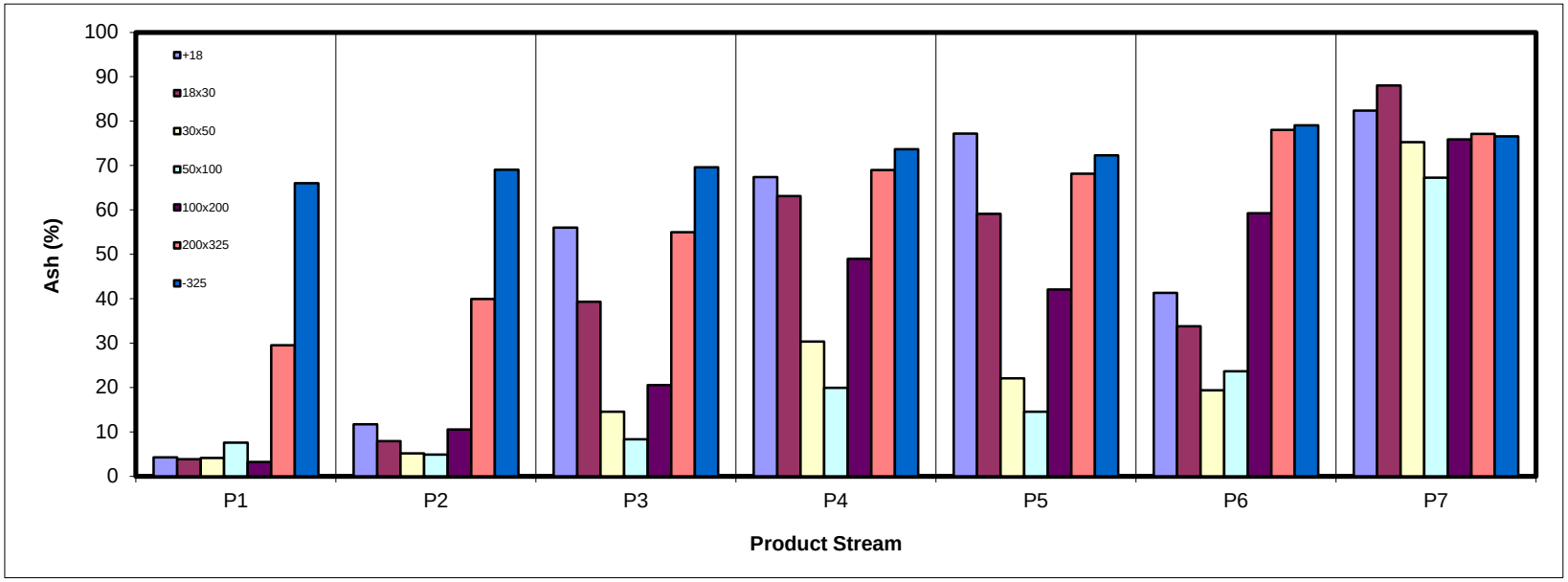
Description: Run 3 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	4.25	11.74	56.00	67.37	77.22	41.30	82.40		29.60
18x30	3.87	7.91	39.31	63.11	59.10	33.79	88.00		23.01
30x50	4.13	5.16	14.56	30.33	22.08	19.38	75.28		17.93
50x100	7.57	4.90	8.36	19.91	14.52	23.67	67.25		17.96
100x200	3.22	10.57	20.54	48.95	42.04	59.24	75.85		22.66
200x325	29.50	39.92	54.97	69.00	68.13	78.05	77.11		45.39
-325	66.02	69.04	69.64	73.69	72.30	79.05	76.59		68.13
Total (Calc)	16.28	13.25	30.61	44.97	43.63	54.15	76.66		27.57



SPIRAL DATA ANALYSIS

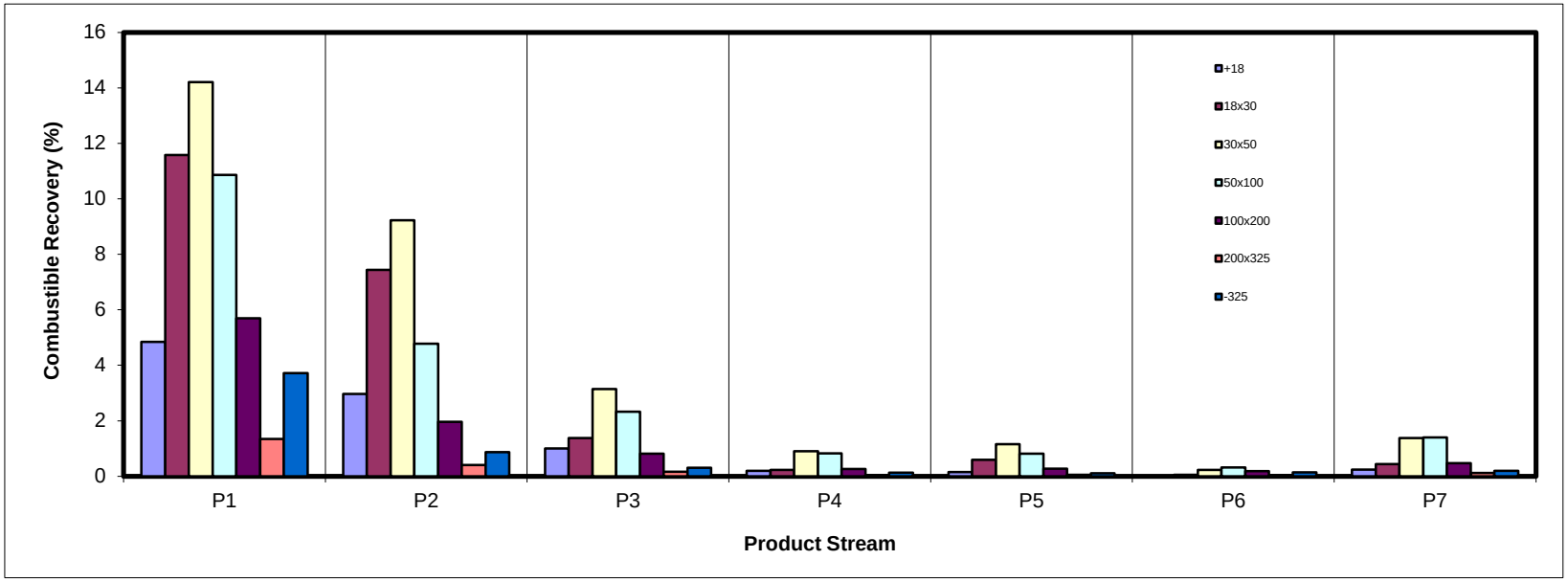
Description: Run 3 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	4.84	2.97	1.00	0.19	0.15	0.01	0.25		9.41
18x30	11.57	7.44	1.38	0.23	0.60	0.05	0.44		21.70
30x50	14.21	9.22	3.15	0.91	1.16	0.23	1.37		30.24
50x100	10.86	4.78	2.33	0.82	0.82	0.32	1.40		21.33
100x200	5.69	1.96	0.81	0.27	0.27	0.19	0.47		9.66
200x325	1.34	0.41	0.16	0.04	0.05	0.05	0.12		2.17
-325	3.72	0.87	0.31	0.14	0.11	0.14	0.19		5.48
Total (Calc)	52.23	27.65	9.13	2.59	3.16	0.99	4.24		100.00



SPIRAL DATA ANALYSIS

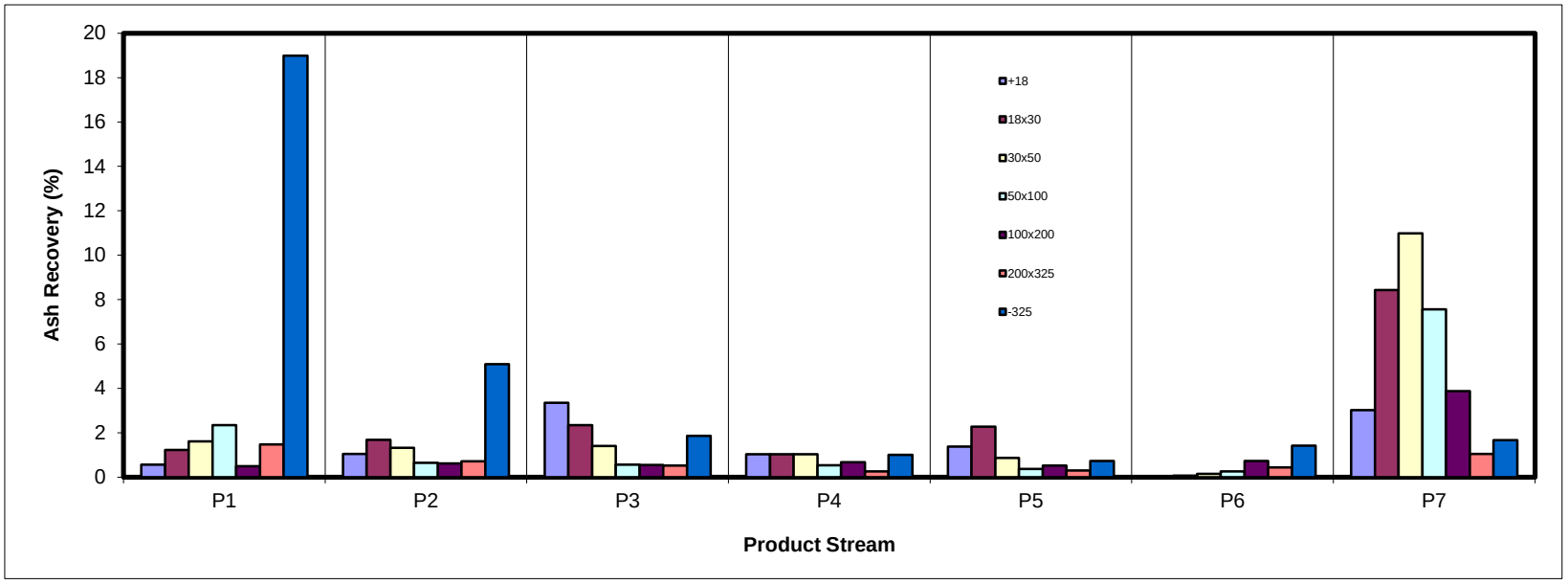
Description: Run 3 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.56	1.04	3.35	1.04	1.38	0.02	3.02		10.40
18x30	1.22	1.68	2.34	1.03	2.27	0.06	8.43		17.03
30x50	1.61	1.32	1.41	1.04	0.86	0.15	10.98		17.36
50x100	2.34	0.65	0.56	0.54	0.36	0.26	7.56		12.27
100x200	0.50	0.61	0.55	0.67	0.52	0.72	3.87		7.44
200x325	1.48	0.71	0.52	0.26	0.30	0.44	1.05		4.74
-325	18.99	5.09	1.86	1.00	0.73	1.42	1.67		30.76
Total (Calc)	26.69	11.09	10.58	5.57	6.42	3.07	36.58		100.00



SPIRAL DATA ANALYSIS

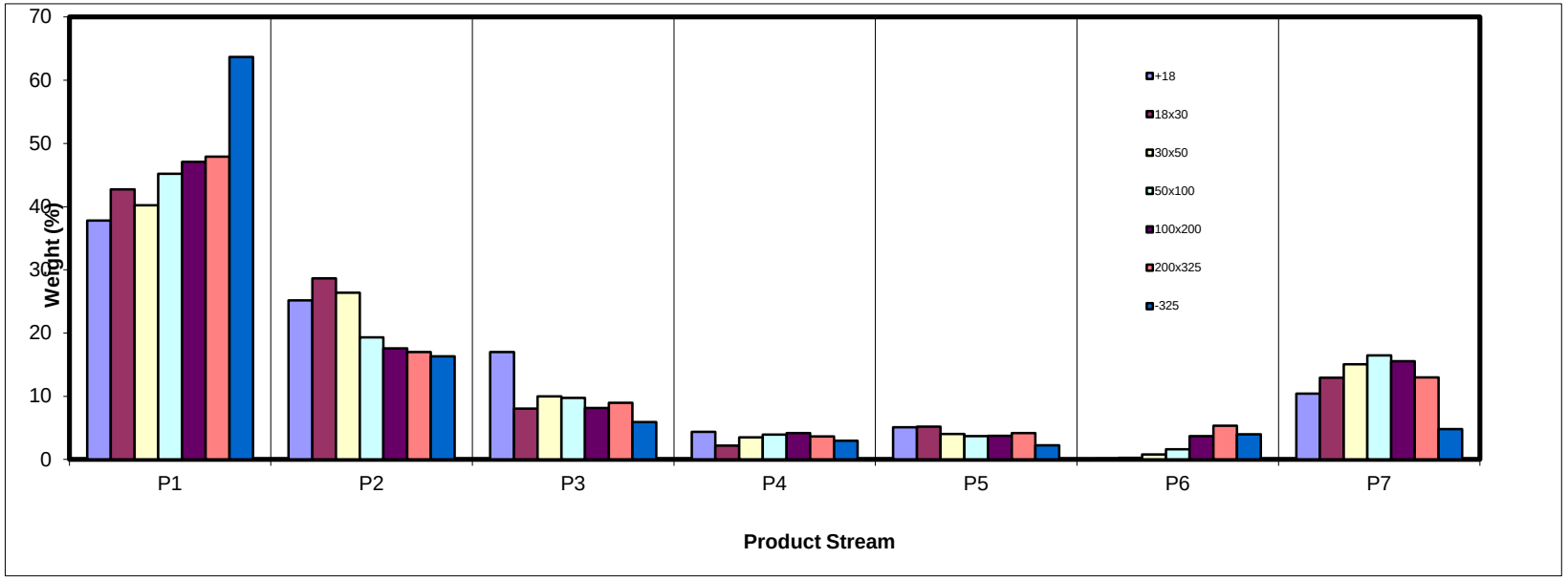
Description: Run 3 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	37.80	25.18	17.01	4.38	5.08	0.13	10.43		100.00
18x30	42.71	28.65	8.05	2.20	5.19	0.26	12.93		100.00
30x50	40.21	26.39	10.00	3.53	4.03	0.78	15.07		100.00
50x100	45.19	19.34	9.77	3.95	3.67	1.62	16.47		100.00
100x200	47.08	17.57	8.17	4.18	3.75	3.70	15.54		100.00
200x325	47.89	16.99	8.97	3.64	4.16	5.35	12.99		100.00
-325	63.70	16.34	5.93	3.00	2.24	3.98	4.82		100.00
Total (Calc)	45.19	23.09	9.53	3.41	4.06	1.56	13.16		100.00



SPIRAL DATA ANALYSIS

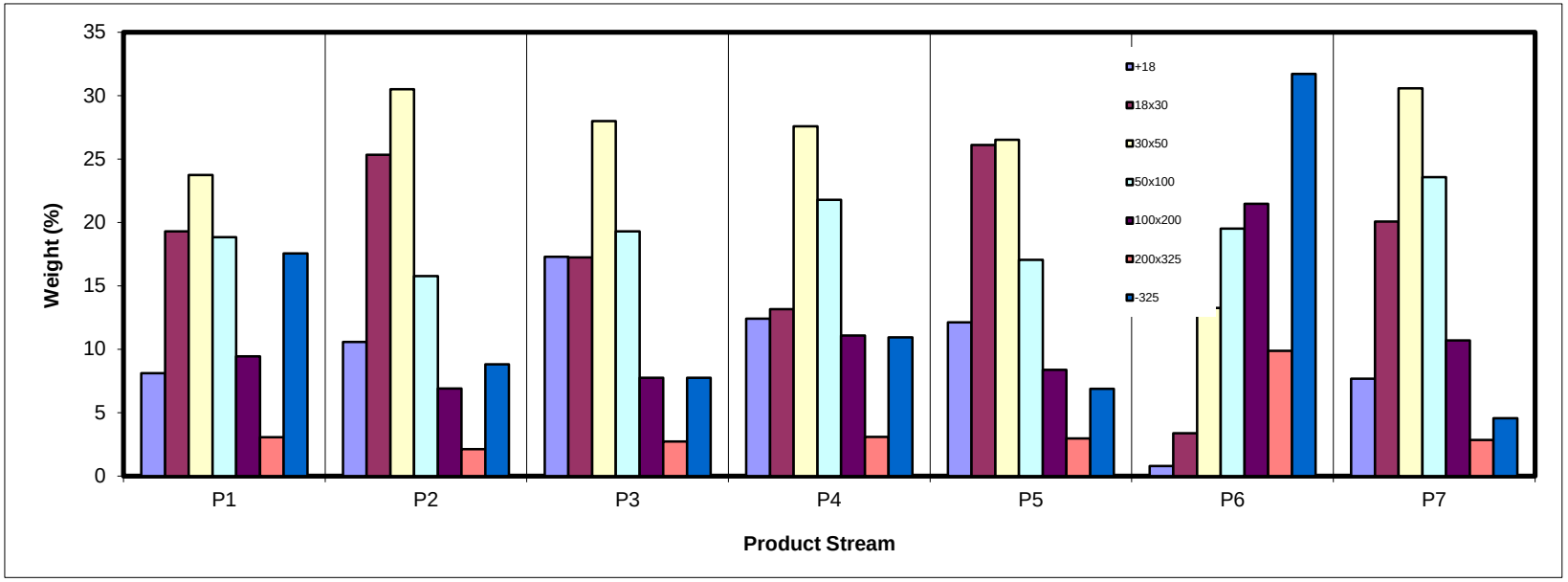
Description: Run 3 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	8.10	10.56	17.28	12.42	12.13	0.80	7.68		9.68
18x30	19.29	25.34	17.23	13.17	26.12	3.38	20.07		20.41
30x50	23.75	30.51	27.99	27.57	26.51	13.26	30.58		26.69
50x100	18.83	15.77	19.30	21.77	17.06	19.51	23.57		18.83
100x200	9.43	6.89	7.75	11.08	8.37	21.46	10.69		9.05
200x325	3.05	2.12	2.71	3.07	2.95	9.87	2.84		2.88
-325	17.55	8.81	7.74	10.92	6.87	31.72	4.56		12.45
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

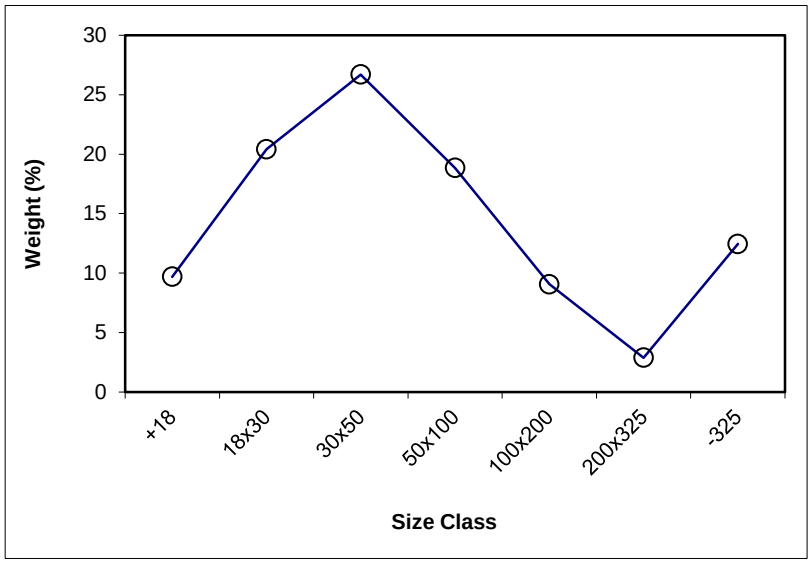
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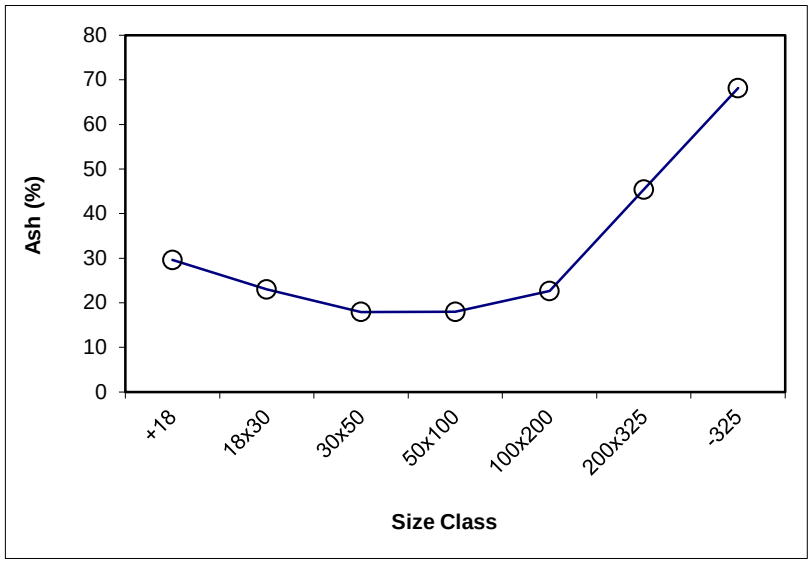
Comments: 1 x 0.15 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	444.1	401.2	42.92	9.68	29.60	9.68	29.60	100.00	27.57
18x30	460.5	370.0	90.47	20.41	23.01	30.10	25.13	90.32	27.35
30x50	454.6	336.3	118.29	26.69	17.93	56.79	21.75	69.90	28.62
50x100	391.3	307.8	83.47	18.83	17.96	75.62	20.80	43.21	35.22
100x200	334.6	294.5	40.11	9.05	22.66	84.67	21.00	24.38	48.56
200x325	310.8	298.0	12.76	2.88	45.39	87.55	21.80	15.33	63.85
-325	61.5	6.3	55.17	12.45	68.13	100.00	27.57	12.45	68.13
Total (Calc)	--	--	443.20	100.00	27.57	--	--	--	--





SPIRAL DATA ANALYSIS

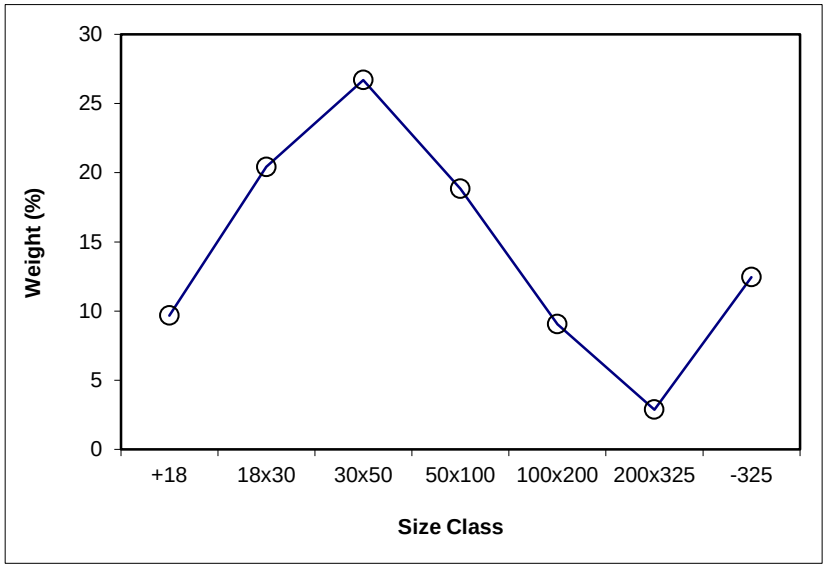
Description: Run 3 - Intermediate Spiral Test

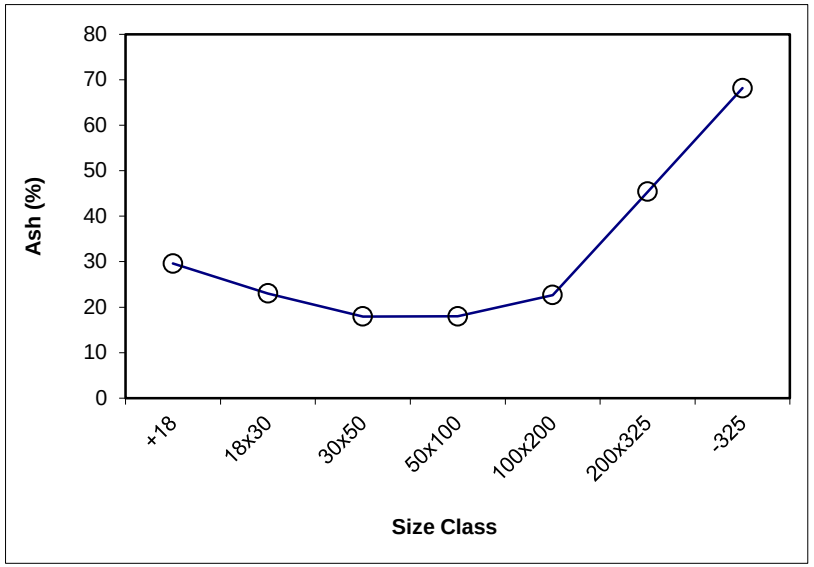
Comments: 1 x 0.15 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	9.68	29.60	9.68	29.60	100.00	27.57			
18x30	20.41	23.01	30.10	25.13	90.32	27.35	x	20.41	23.01
30x50	26.69	17.93	56.79	21.75	69.90	28.62	x	26.69	17.93
50x100	18.83	17.96	75.62	20.80	43.21	35.22	x	18.83	17.96
100x200	9.05	22.66	84.67	21.00	24.38	48.56	x	9.05	22.66
200x325	2.88	45.39	87.55	21.80	15.33	63.85	x	2.88	45.39
-325	12.45	68.13	100.00	27.57	12.45	68.13			
Total (Calc)	100.00	27.57	--	--	--	--	--	77.87	20.83





SPIRAL DATA ANALYSIS

Description: Run 3 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 45.19

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	509.58	460.1	49.44	8.10	4.25	8.10	4.25	100.00	16.28
18x30	559.91	442.2	117.76	19.29	3.87	27.40	3.98	91.90	17.34
30x50	557.47	412.5	144.94	23.75	4.13	51.14	4.05	72.60	20.92
50x100	523.68	408.8	114.93	18.83	7.57	69.97	5.00	48.86	29.09
100x200	407.17	349.6	57.54	9.43	3.22	79.40	4.78	30.03	42.59
200x325	404.50	385.9	18.62	3.05	29.50	82.45	5.70	20.60	60.61
-325	113.22	6.1	107.08	17.55	66.02	100.00	16.28	17.55	66.02
Total (Calc)	--	--	610.31	100.00	16.28	--	--	--	--

Product P2 Feed Weight (%): 23.09

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	844.0	811.1	32.93	10.56	11.74	10.56	11.74	100.00	13.25
18x30	527.1	448.1	78.99	25.34	7.91	35.90	9.03	89.44	13.43
30x50	520.0	424.9	95.14	30.51	5.16	66.41	7.26	64.10	15.61
50x100	446.4	397.2	49.18	15.77	4.90	82.18	6.80	33.59	25.09
100x200	412.8	391.3	21.48	6.89	10.57	89.07	7.10	17.82	42.97
200x325	385.2	378.6	6.61	2.12	39.92	91.19	7.86	10.93	63.39
-325	33.7	6.3	27.47	8.81	69.04	100.00	13.25	8.81	69.04
Total (Calc)	--	--	311.79	100.00	13.25	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 3 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 9.53

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	691.1	646.6	44.49	17.28	56.00	17.28	56.00	100.00	30.61
18x30	414.4	370.0	44.36	17.23	39.31	34.51	47.67	82.72	25.31
30x50	408.3	336.3	72.06	27.99	14.56	62.50	32.84	65.49	21.62
50x100	357.5	307.8	49.69	19.30	8.36	81.80	27.06	37.50	26.89
100x200	314.8	294.8	19.96	7.75	20.54	89.55	26.50	18.20	46.54
200x325	305.0	298.0	6.98	2.71	54.97	92.26	27.34	10.45	65.83
-325	26.1	6.1	19.92	7.74	69.64	100.00	30.61	7.74	69.64
Total (Calc)	--	--	257.46	100.00	30.61	--	--	--	--

Product P4 Feed Weight (%): 3.41

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	890.0	867.1	22.90	12.42	67.37	12.42	67.37	100.00	44.97
18x30	466.4	442.2	24.29	13.17	63.11	25.58	65.18	87.58	41.79
30x50	463.4	412.5	50.85	27.57	30.33	53.15	47.11	74.42	38.02
50x100	448.9	408.8	40.16	21.77	19.91	74.92	39.20	46.85	42.54
100x200	370.1	349.6	20.44	11.08	48.95	86.00	40.46	25.08	62.19
200x325	408.0	402.3	5.66	3.07	69.00	89.08	41.44	14.00	72.66
-325	26.5	6.3	20.15	10.92	73.69	100.00	44.97	10.92	73.69
Total (Calc)	--	--	184.45	100.00	44.97	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 3 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 4.06

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	427.8	401.2	26.58	12.13	77.22	12.13	77.22	100.00	43.63
18x30	449.2	392.0	57.24	26.12	59.10	38.24	64.85	87.87	38.99
30x50	412.3	354.2	58.10	26.51	22.08	64.75	47.34	61.76	30.49
50x100	430.4	393.0	37.38	17.06	14.52	81.81	40.50	35.25	36.81
100x200	345.6	327.2	18.34	8.37	42.04	90.18	40.64	18.19	57.71
200x325	393.2	386.7	6.47	2.95	68.13	93.13	41.51	9.82	71.05
-325	21.4	6.4	15.06	6.87	72.30	100.00	43.63	6.87	72.30
Total (Calc)	--	--	219.19	100.00	43.63	--	--	--	--

Product P6 Feed Weight (%): 1.56

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	463.2	460.1	3.03	0.80	41.30	0.80	41.30	100.00	54.15
18x30	461.0	448.1	12.82	3.38	33.79	4.18	35.23	99.20	54.25
30x50	475.3	424.9	50.36	13.26	19.38	17.44	23.17	95.82	54.97
50x100	471.3	397.2	74.08	19.51	23.67	36.95	23.43	82.56	60.69
100x200	472.8	391.3	81.49	21.46	59.24	58.41	36.59	63.05	72.15
200x325	416.1	378.6	37.47	9.87	78.05	68.28	42.58	41.59	78.81
-325	126.8	6.4	120.43	31.72	79.05	100.00	54.15	31.72	79.05
Total (Calc)	--	--	379.68	100.00	54.15	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 3 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 13.16

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	696.4	655.5	40.91	7.68	82.40	7.68	82.40	100.00	76.66
18x30	498.9	392.0	106.97	20.07	88.00	27.75	86.45	92.32	76.18
30x50	517.1	354.2	162.97	30.58	75.28	58.32	80.59	72.25	72.90
50x100	518.7	393.0	125.65	23.57	67.25	81.90	76.75	41.68	71.15
100x200	384.2	327.2	56.99	10.69	75.85	92.59	76.65	18.10	76.24
200x325	401.9	386.7	15.16	2.84	77.11	95.44	76.66	7.41	76.79
-325	30.4	6.1	24.33	4.56	76.59	100.00	76.66	4.56	76.59
Total (Calc)	--	--	532.99	100.00	76.66	--	--	--	--

SPIRAL DATA ANALYSIS

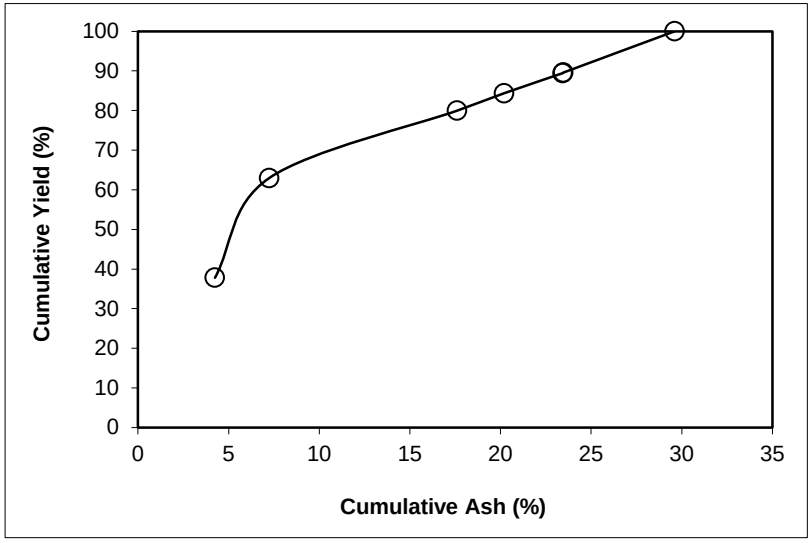
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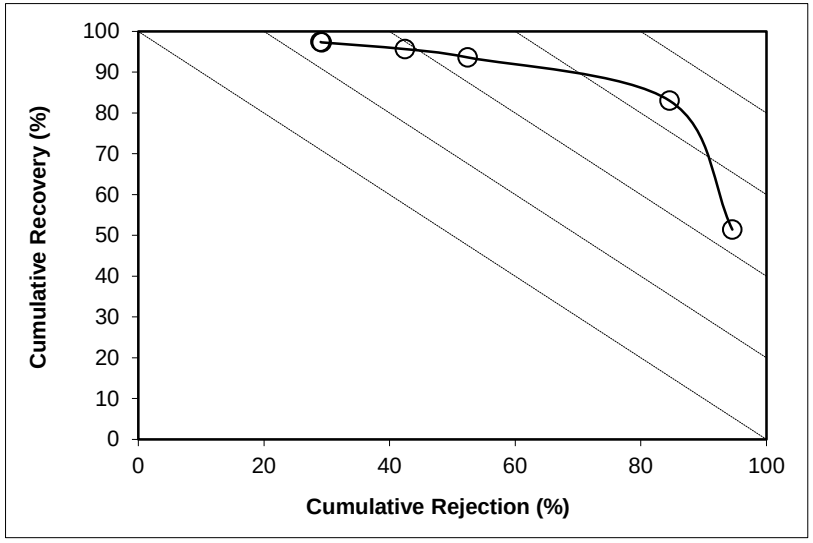
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 9.68

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	37.80	4.25	37.80	4.25	51.42	62.20	45.02	94.58	45.99
P2	25.18	11.74	62.98	7.24	82.98	37.02	67.64	84.59	67.57
P3	17.01	56.00	79.98	17.61	93.61	20.02	77.53	52.42	46.03
P4	4.38	67.37	84.36	20.19	95.64	15.64	80.38	42.46	38.10
P5	5.08	77.22	89.44	23.43	97.29	10.56	81.90	29.20	26.49
P6	0.13	41.30	89.57	23.46	97.39	10.43	82.40	29.02	26.42
P7	10.43	82.40	100.00	29.60	100.00	0.00			
Total (Calc)	100.00	29.60	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

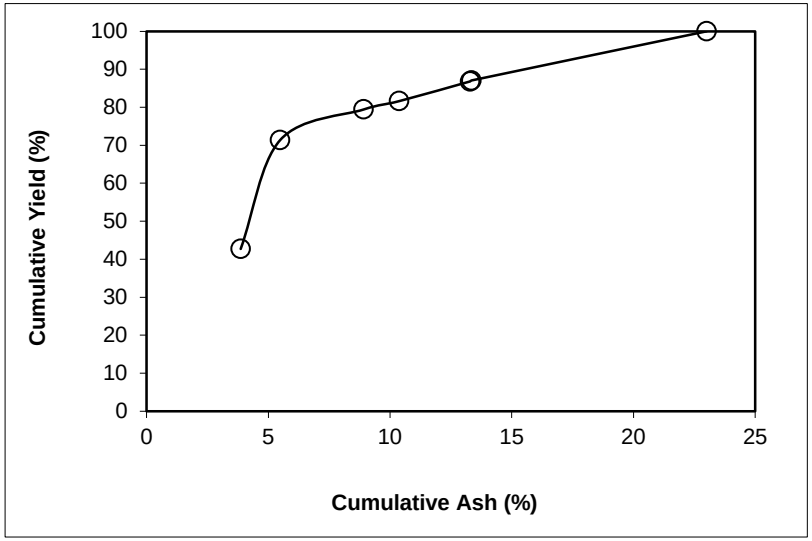
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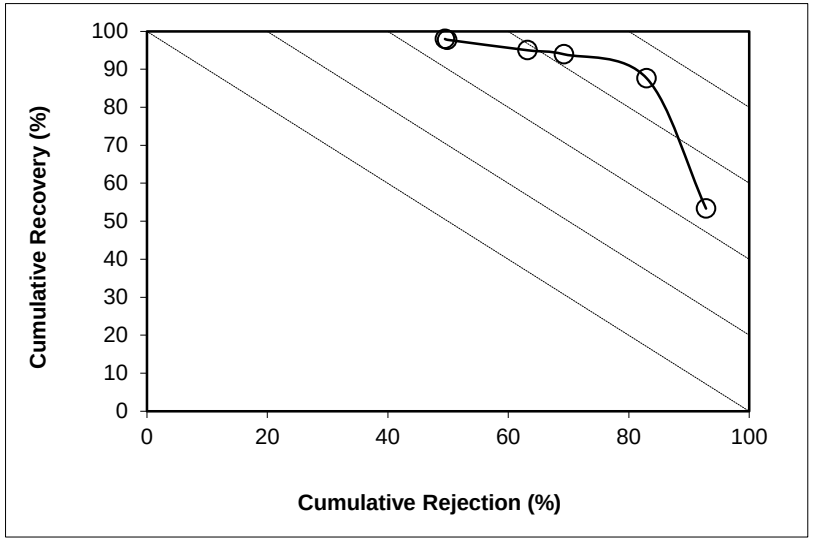
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 20.41

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	42.71	3.87	42.71	3.87	53.33	57.29	37.28	92.82	46.16
P2	28.65	7.91	71.37	5.49	87.61	28.63	66.68	82.98	70.58
P3	8.05	39.31	79.41	8.91	93.95	20.59	77.37	69.23	63.18
P4	2.20	63.11	81.62	10.38	95.00	18.38	79.08	63.19	58.19
P5	5.19	59.10	86.81	13.29	97.76	13.19	86.94	49.85	47.62
P6	0.26	33.79	87.07	13.35	97.98	12.93	88.00	49.47	47.46
P7	12.93	88.00	100.00	23.01	100.00	0.00			
Total (Calc)	100.00	23.01	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

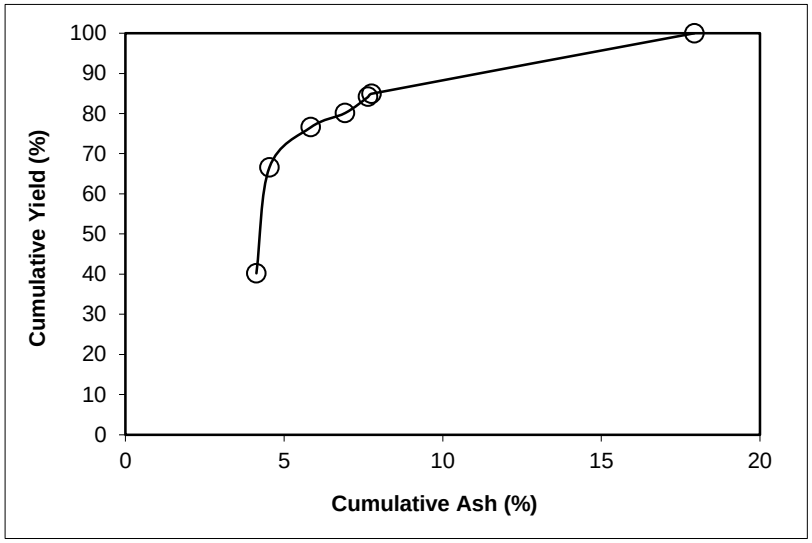
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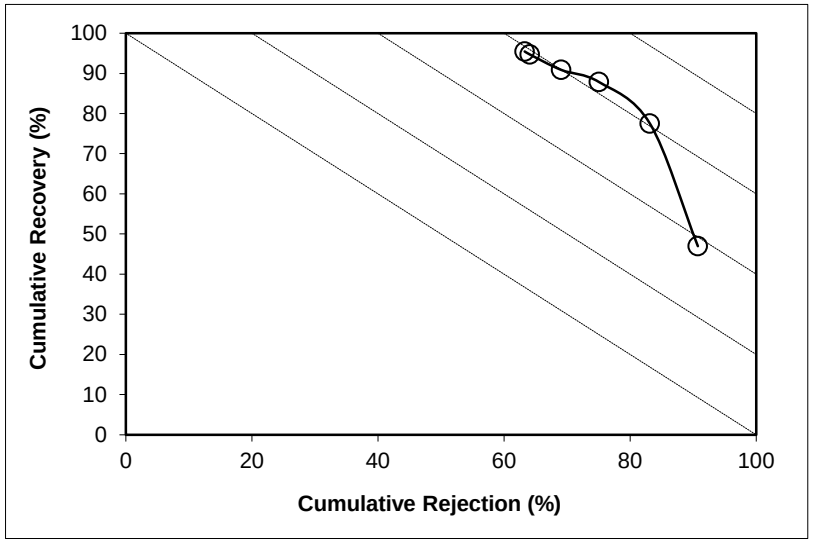
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 26.69

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	40.21	4.13	40.21	4.13	46.97	59.79	27.22	90.75	37.72
P2	26.39	5.16	66.60	4.54	77.47	33.40	44.64	83.15	60.62
P3	10.00	14.56	76.60	5.84	87.88	23.40	57.49	75.03	62.91
P4	3.53	30.33	80.12	6.92	90.87	19.88	62.31	69.07	59.94
P5	4.03	22.08	84.15	7.65	94.70	15.85	72.54	64.11	58.80
P6	0.78	19.38	84.93	7.76	95.46	15.07	75.28	63.27	58.73
P7	15.07	75.28	100.00	17.93	100.00	0.00			
Total (Calc)	100.00	17.93	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

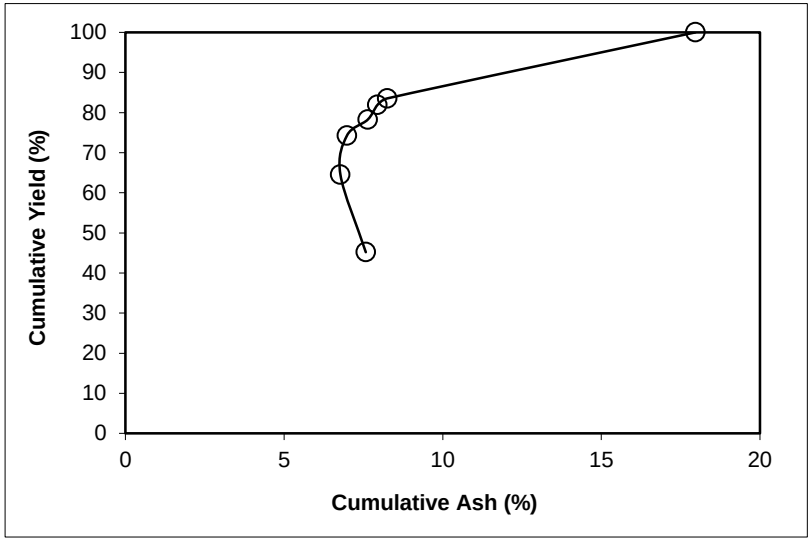
Description: Run 3 - Intermediate Spiral Test

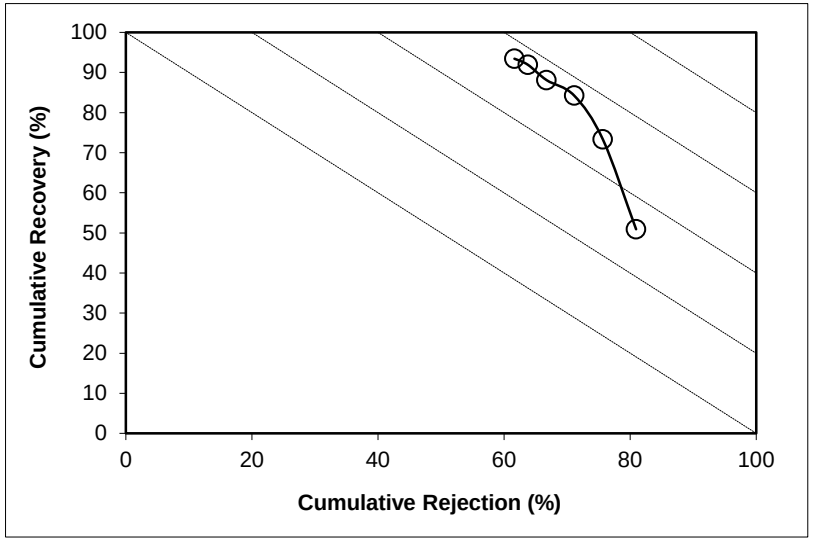
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 18.83

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	45.19	7.57	45.19	7.57	50.91	54.81	26.53	80.95	31.86
P2	19.34	4.90	64.52	6.77	73.33	35.48	38.32	75.67	49.00
P3	9.77	8.36	74.29	6.98	84.24	25.71	49.70	71.13	55.36
P4	3.95	19.91	78.24	7.63	88.09	21.76	55.10	66.75	54.84
P5	3.67	14.52	81.91	7.94	91.92	18.09	63.35	63.78	55.70
P6	1.62	23.67	83.53	8.25	93.43	16.47	67.25	61.65	55.07
P7	16.47	67.25	100.00	17.96	100.00	0.00			
Total (Calc)	100.00	17.96	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

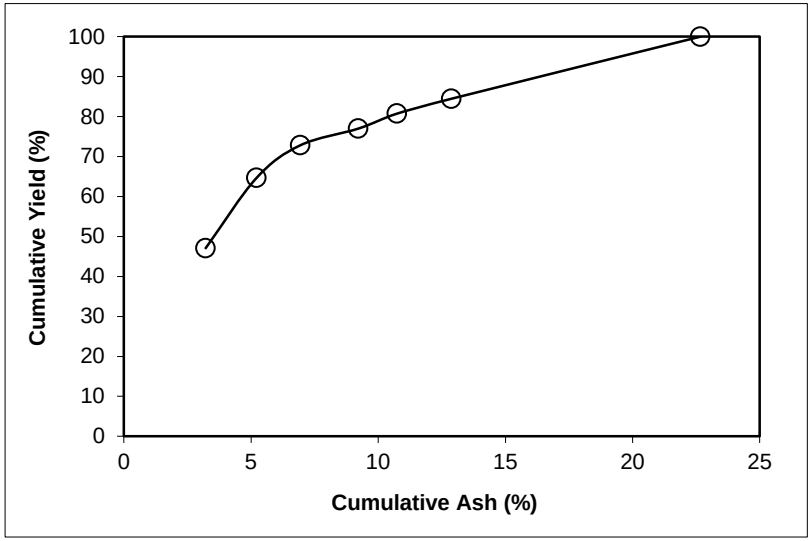
Description: Run 3 - Intermediate Spiral Test

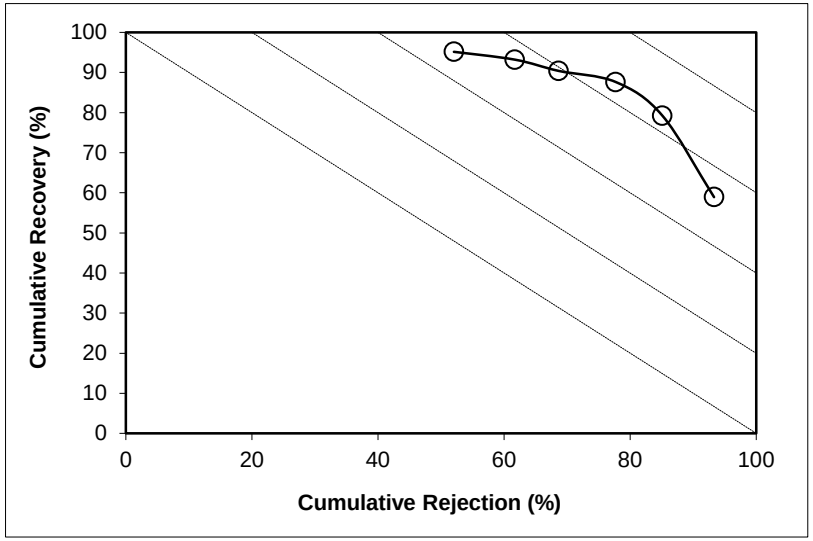
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 9.05

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	47.08	3.22	47.08	3.22	58.91	52.92	39.95	93.32	52.23
P2	17.57	10.57	64.65	5.22	79.24	35.35	54.56	85.12	64.35
P3	8.17	20.54	72.82	6.93	87.62	27.18	64.78	77.71	65.34
P4	4.18	48.95	77.00	9.22	90.38	23.00	67.66	68.68	59.07
P5	3.75	42.04	80.75	10.74	93.20	19.25	72.66	61.72	54.91
P6	3.70	59.24	84.46	12.87	95.15	15.54	75.85	52.04	47.18
P7	15.54	75.85	100.00	22.66	100.00	0.00			
Total (Calc)	100.00	22.66	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

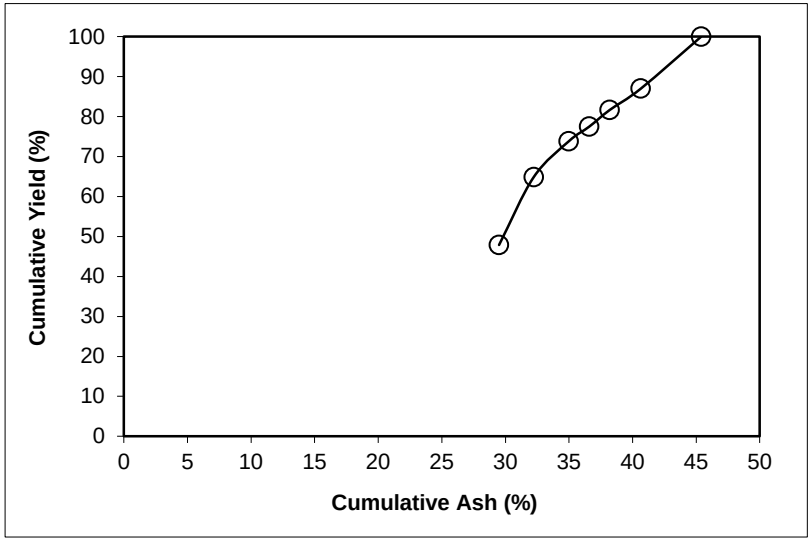
Description: Run 3 - Intermediate Spiral Test

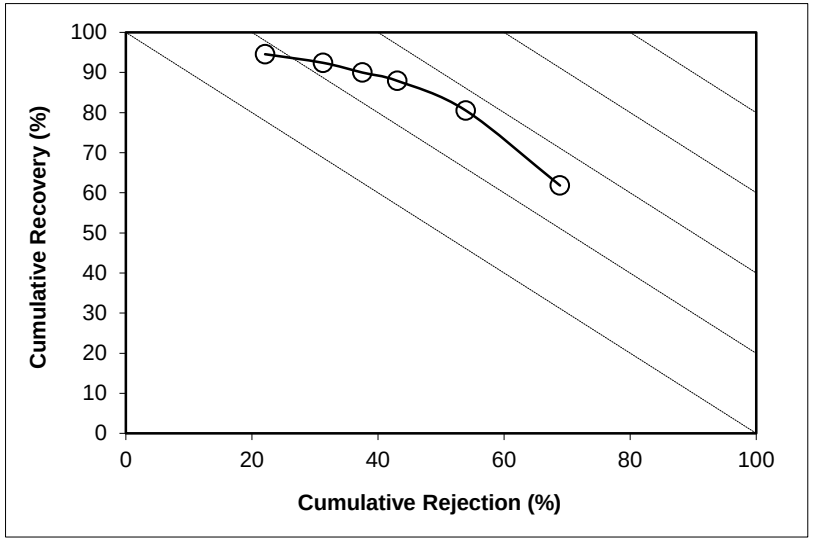
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 2.88

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	47.89	29.50	47.89	29.50	61.82	52.11	59.98	68.87	30.69
P2	16.99	39.92	64.88	32.23	80.51	35.12	69.69	53.93	34.44
P3	8.97	54.97	73.85	34.99	87.91	26.15	74.74	43.06	30.97
P4	3.64	69.00	77.49	36.59	89.97	22.51	75.67	37.53	27.50
P5	4.16	68.13	81.65	38.20	92.40	18.35	77.39	31.28	23.69
P6	5.35	78.05	87.01	40.65	94.55	12.99	77.11	22.08	16.63
P7	12.99	77.11	100.00	45.39	100.00	0.00			
Total (Calc)	100.00	45.39	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

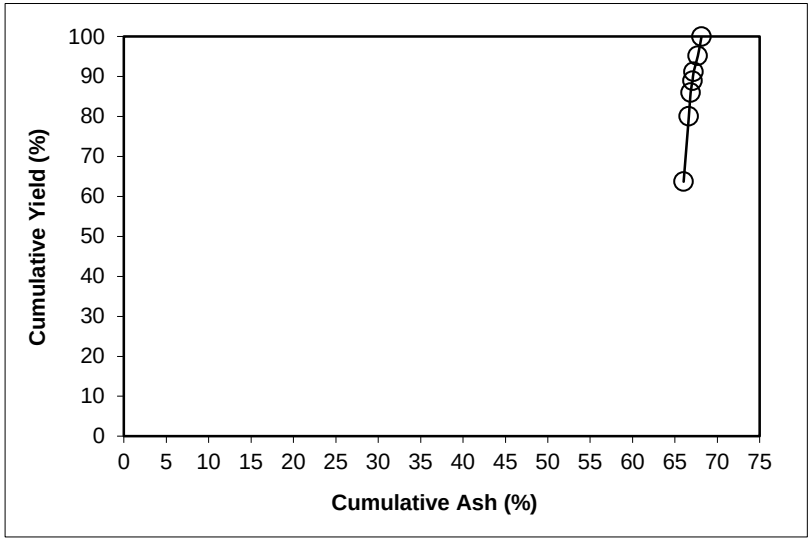
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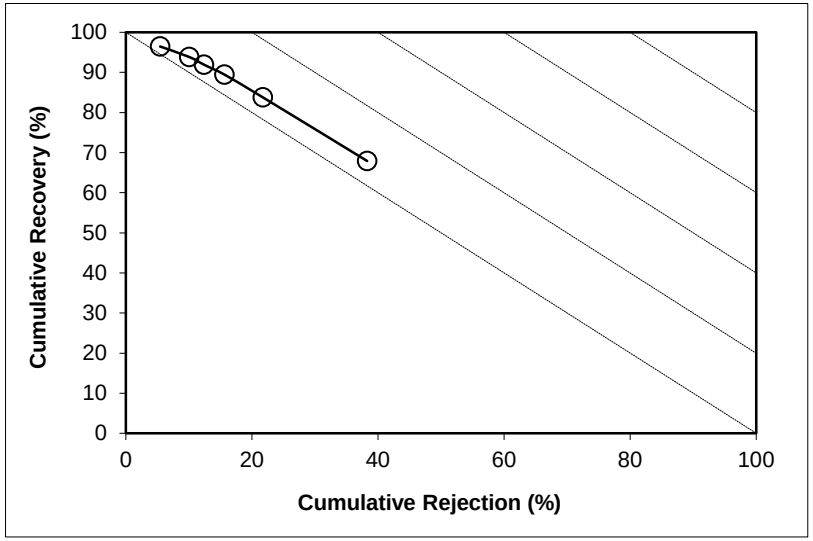
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 12.45

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	63.70	66.02	63.70	66.02	67.91	36.30	71.82	38.27	6.18
P2	16.34	69.04	80.03	66.64	83.78	19.97	74.10	21.72	5.49
P3	5.93	69.64	85.96	66.84	89.42	14.04	75.98	15.66	5.08
P4	3.00	73.69	88.96	67.07	91.89	11.04	76.60	12.42	4.31
P5	2.24	72.30	91.20	67.20	93.84	8.80	77.70	10.04	3.88
P6	3.98	79.05	95.18	67.70	96.46	4.82	76.59	5.42	1.88
P7	4.82	76.59	100.00	68.13	100.00	0.00			
Total (Calc)	100.00	68.13	--	--	--	--	--	--	--





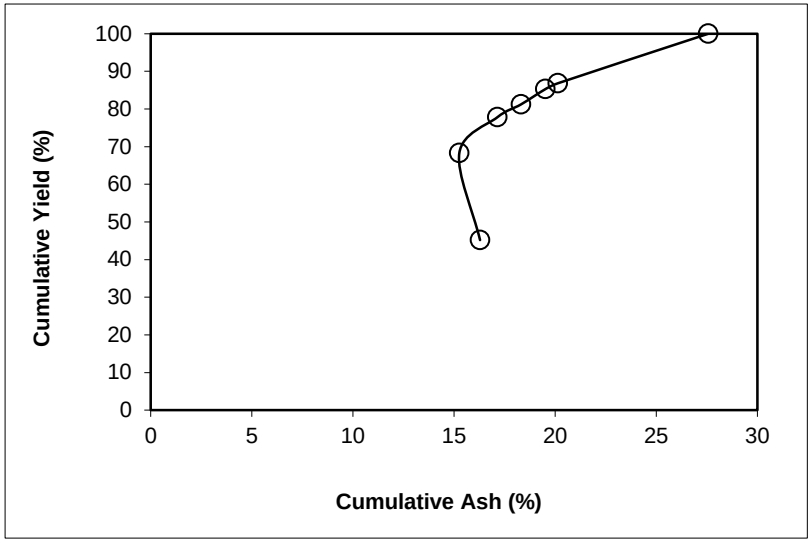
SPIRAL DATA ANALYSIS

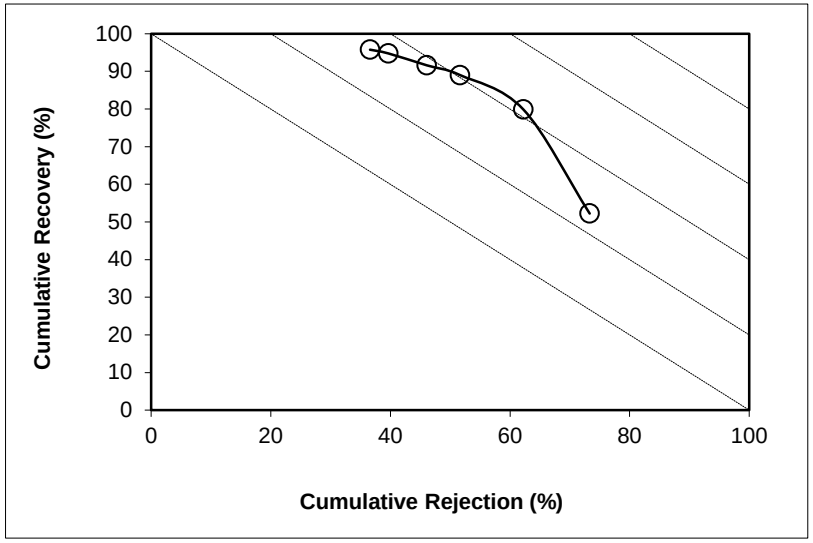
Description: Run 3 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	45.19	16.28	45.19	16.28	52.23	54.81	36.88	73.31	25.55
P2	23.09	13.25	68.28	15.26	79.89	31.72	54.08	62.22	42.10
P3	9.53	30.61	77.81	17.14	89.02	22.19	64.16	51.63	40.65
P4	3.41	44.97	81.23	18.31	91.61	18.77	67.65	46.07	37.68
P5	4.06	43.63	85.28	19.51	94.77	14.72	74.27	39.65	34.42
P6	1.56	54.15	86.84	20.13	95.76	13.16	76.66	36.58	32.34
P7	13.16	76.66	100.00	27.57	100.00	0.00			
Total (Calc)	100.00	27.57	--	--	--	--	--	--	--

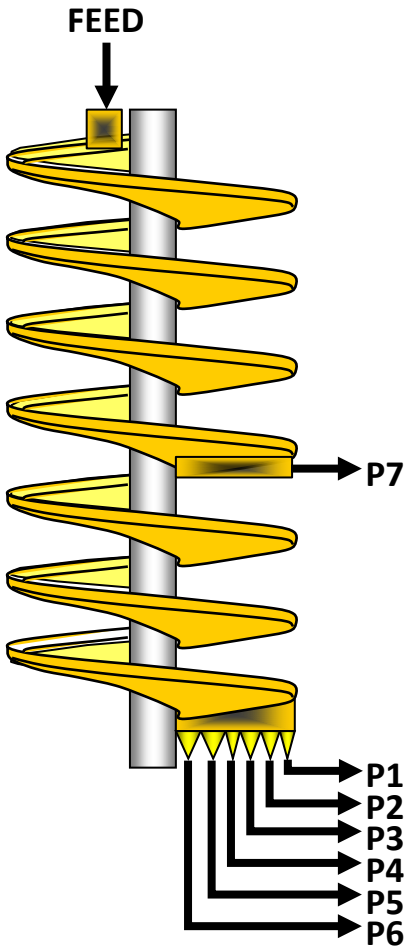




SPIRAL DATA ANALYSIS

Description: Run 4 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	1.064	16.3	21.79	24.85
P2	0.307	27.2	3.29	4.17
P3	0.114	30.3	1.05	1.34
P4	0.062	58.3	0.18	0.32
P5	0.023	18.7	0.40	0.45
P6	0.004	9.3	0.14	0.15
P7	0.351	47.6	1.54	2.22
Total	1.925	21.3	28.39	33.50

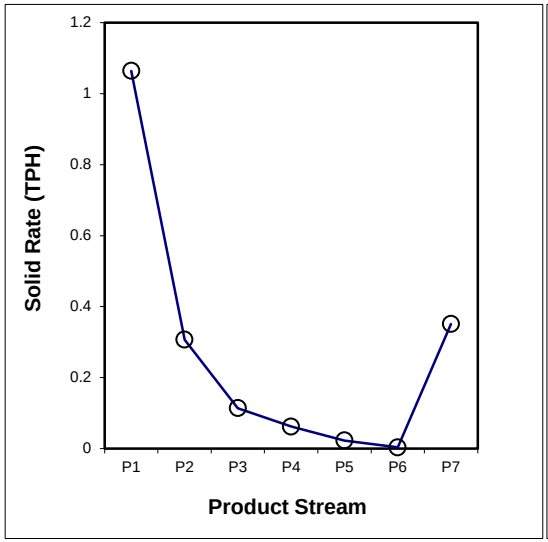
SPIRAL DATA ANALYSIS

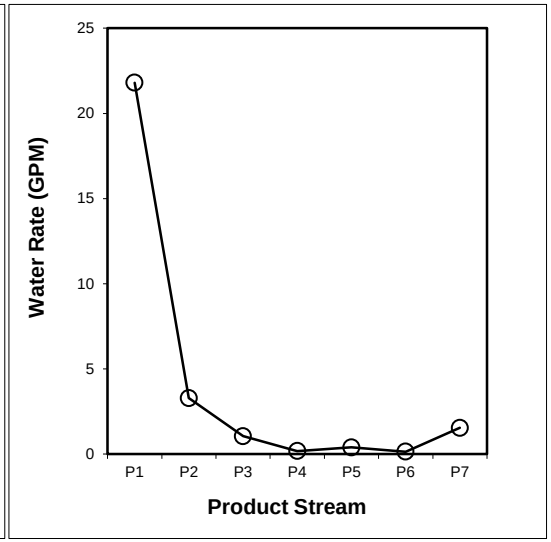
Description: Run 4 - Intermediate Spiral Test

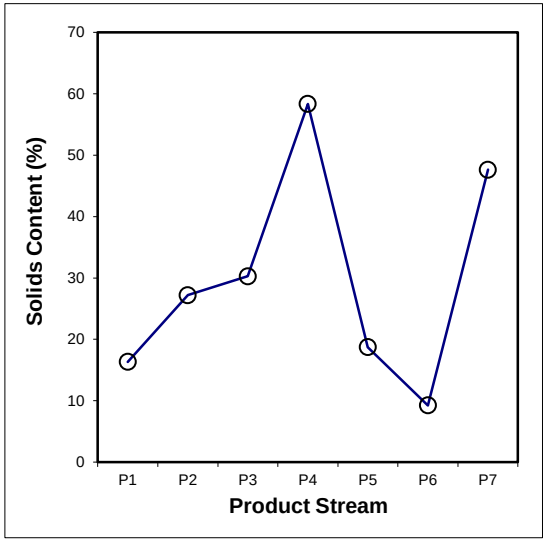
Comments: 1 x 0.15 mm Nominal Particle Size

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	3	5831.00	836.06	6.513	2819.4	2014.1	1.064	55.30	16.34
P2	5	1655.65	212.92	1.129	2706.5	2319.5	0.307	15.94	27.19
P3	10	1056.48	93.21	0.376	3012.7	2725.4	0.114	5.92	30.26
P4	25	858.36	178.51	0.106	2856.5	2465.4	0.062	3.22	58.33
P5	25	872.26	91.20	0.122	2158.0	2013.9	0.023	1.19	18.72
P6	90	997.97	95.43	0.039	2547.4	2465.1	0.004	0.19	9.25
P7	10	2135.22	229.35	0.737	3742.9	2857.5	0.351	18.24	47.62
Total (Calc)	--	--	--	9.023	--	--	1.925	100.00	21.33
Total (Head)	0.97	2446.57	232.51	9.023	2486.4	2014.2	1.925	--	21.33







SPIRAL DATA ANALYSIS

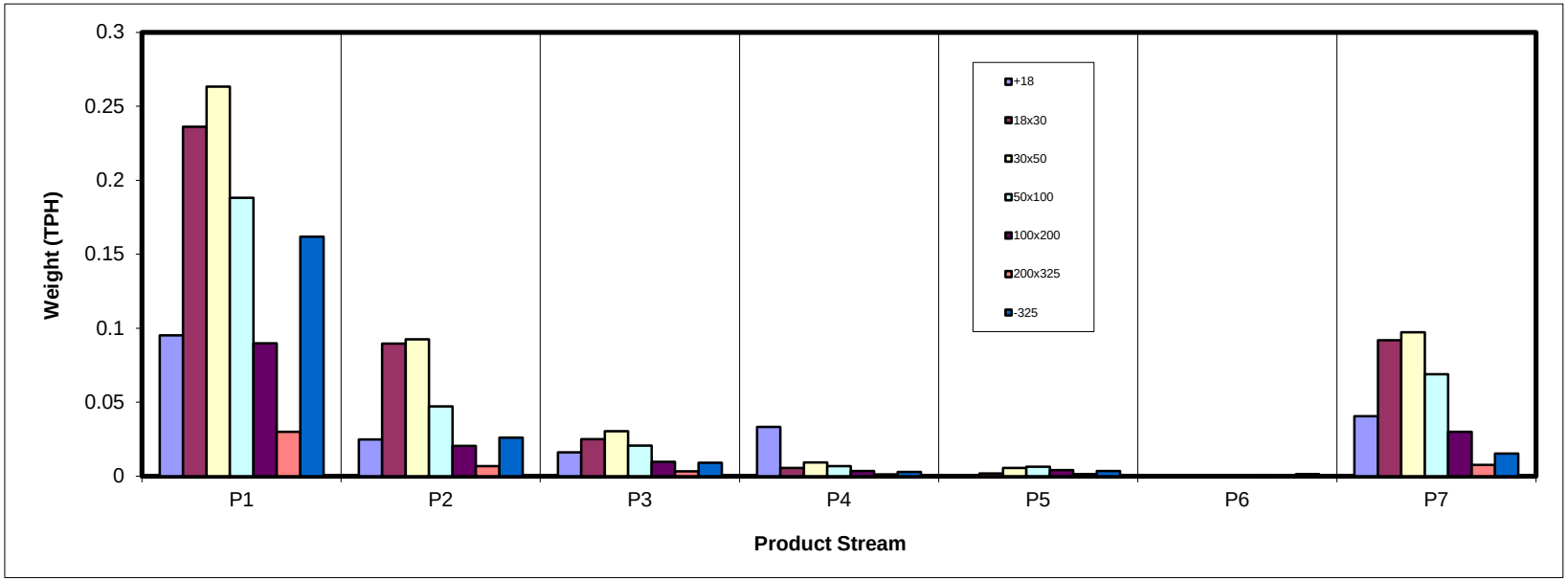
Description: Run 4 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.095	0.025	0.016	0.033	0.000	0.000	0.040		0.210
18x30	0.236	0.089	0.025	0.005	0.002	0.000	0.092		0.450
30x50	0.263	0.092	0.030	0.009	0.006	0.000	0.097		0.498
50x100	0.188	0.047	0.021	0.007	0.006	0.001	0.069		0.339
100x200	0.090	0.020	0.010	0.003	0.004	0.001	0.030		0.158
200x325	0.030	0.007	0.003	0.001	0.001	0.000	0.008		0.051
-325	0.162	0.026	0.009	0.003	0.003	0.001	0.015		0.220
Total (Calc)	1.064	0.307	0.114	0.062	0.023	0.004	0.351		1.925



SPIRAL DATA ANALYSIS

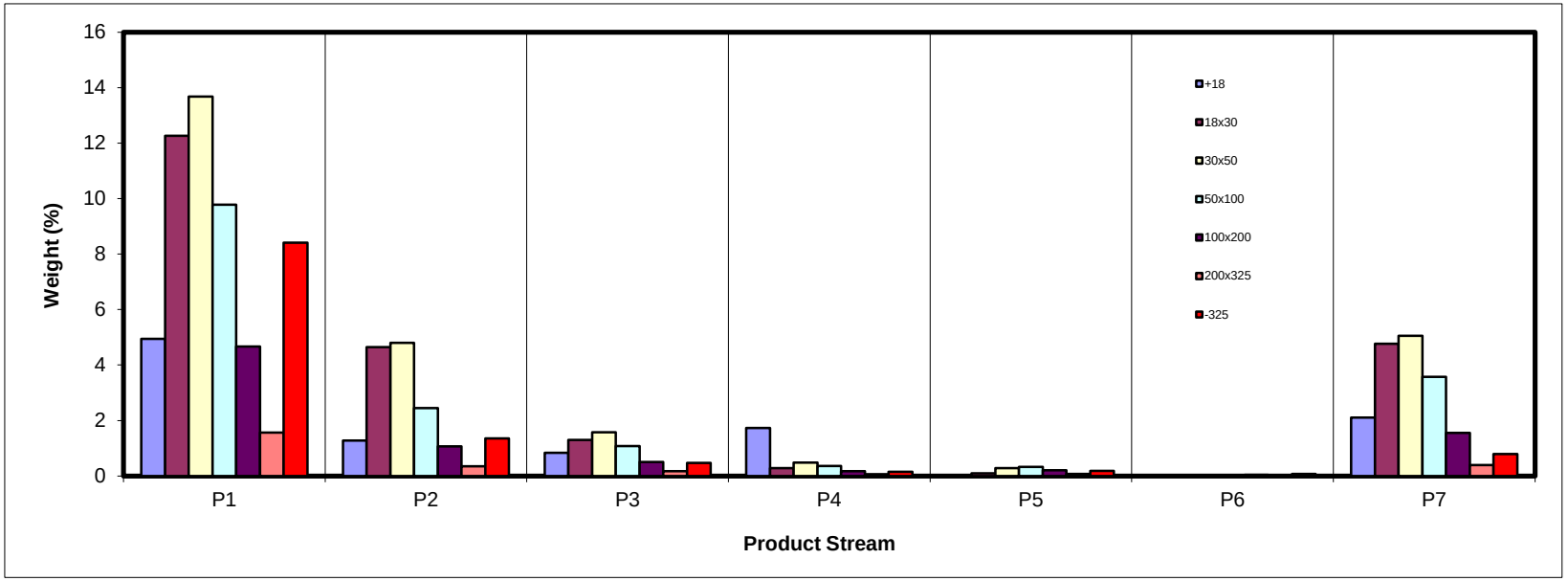
Description: Run 4 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	4.95	1.28	0.83	1.73	0.02	0.00	2.10		10.90
18x30	12.27	4.65	1.29	0.28	0.09	0.00	4.77		23.36
30x50	13.68	4.80	1.58	0.48	0.29	0.02	5.05		25.89
50x100	9.78	2.44	1.08	0.35	0.33	0.03	3.57		17.59
100x200	4.66	1.06	0.50	0.18	0.21	0.04	1.55		8.20
200x325	1.56	0.35	0.17	0.06	0.07	0.02	0.40		2.63
-325	8.41	1.36	0.47	0.15	0.18	0.07	0.79		11.42
Total (Calc)	55.30	15.94	5.92	3.22	1.19	0.19	18.24		100.00



SPIRAL DATA ANALYSIS

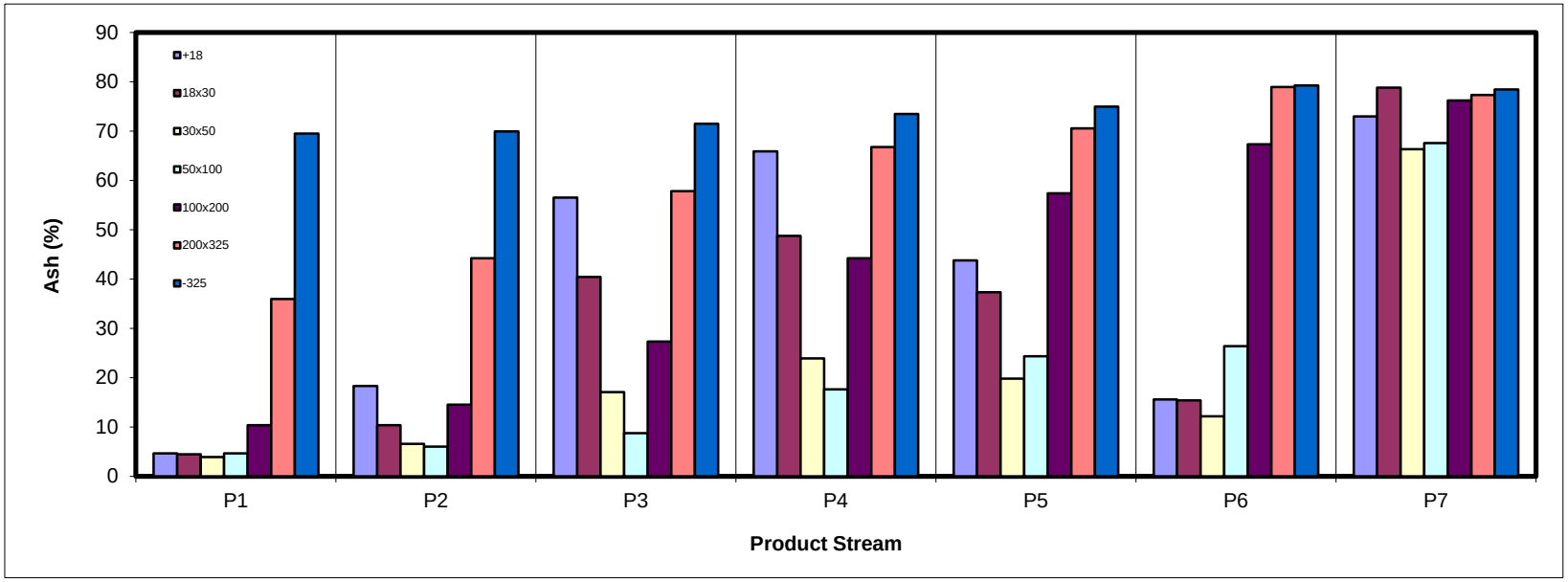
Description: Run 4 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	4.67	18.33	56.50	65.88	43.77	15.57	72.98		33.14
18x30	4.43	10.38	40.41	48.72	37.33	15.38	78.80		23.46
30x50	3.87	6.55	17.06	23.87	19.80	12.13	66.30		17.91
50x100	4.66	5.99	8.74	17.61	24.31	26.40	67.58		18.55
100x200	10.36	14.52	27.29	44.18	57.35	67.33	76.19		26.60
200x325	35.91	44.23	57.79	66.75	70.54	78.90	77.30		46.74
-325	69.51	69.92	71.44	73.46	74.94	79.21	78.42		70.45
Total (Calc)	15.64	15.27	32.54	52.03	40.85	59.74	72.20		28.45



SPIRAL DATA ANALYSIS

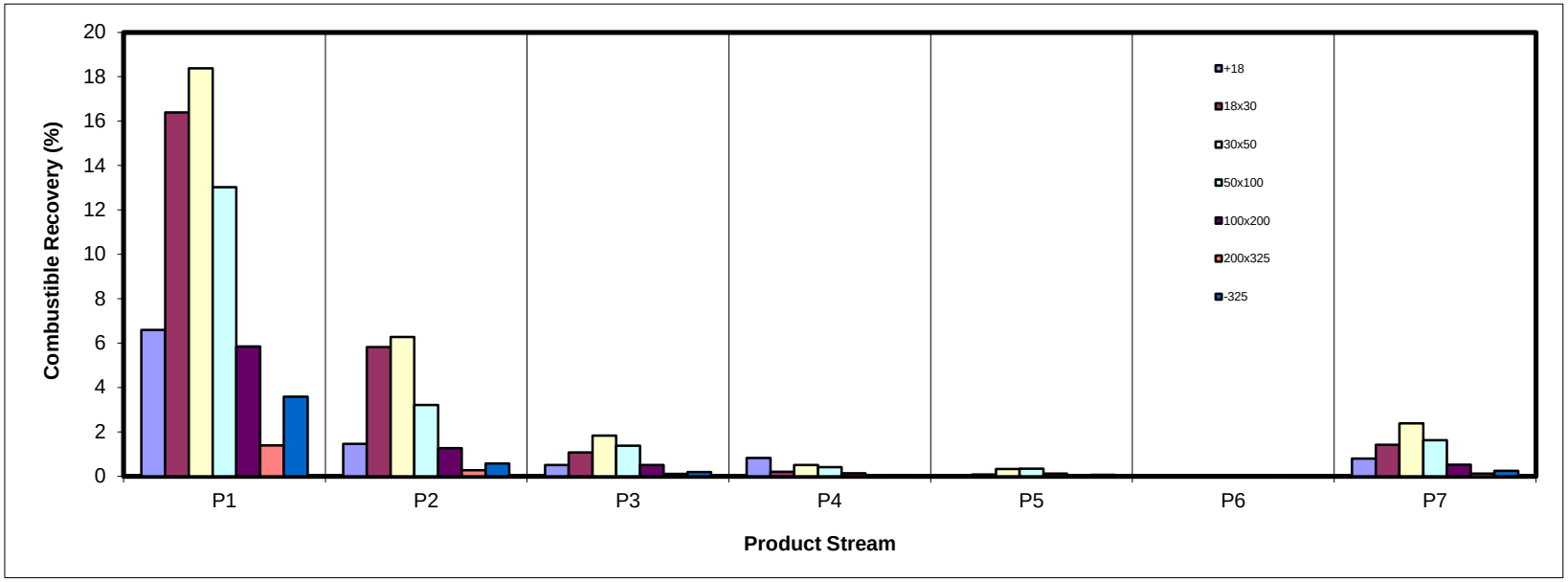
Description: Run 4 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	6.59	1.46	0.51	0.82	0.01	0.00	0.79		10.19
18x30	16.39	5.82	1.08	0.20	0.08	0.00	1.41		24.99
30x50	18.37	6.27	1.83	0.51	0.32	0.02	2.38		29.71
50x100	13.03	3.21	1.37	0.41	0.35	0.03	1.62		20.02
100x200	5.84	1.27	0.51	0.14	0.12	0.02	0.52		8.42
200x325	1.40	0.27	0.10	0.03	0.03	0.01	0.13		1.96
-325	3.58	0.57	0.19	0.05	0.06	0.02	0.24		4.72
Total (Calc)	65.20	18.88	5.58	2.16	0.98	0.11	7.09		100.00



SPIRAL DATA ANALYSIS

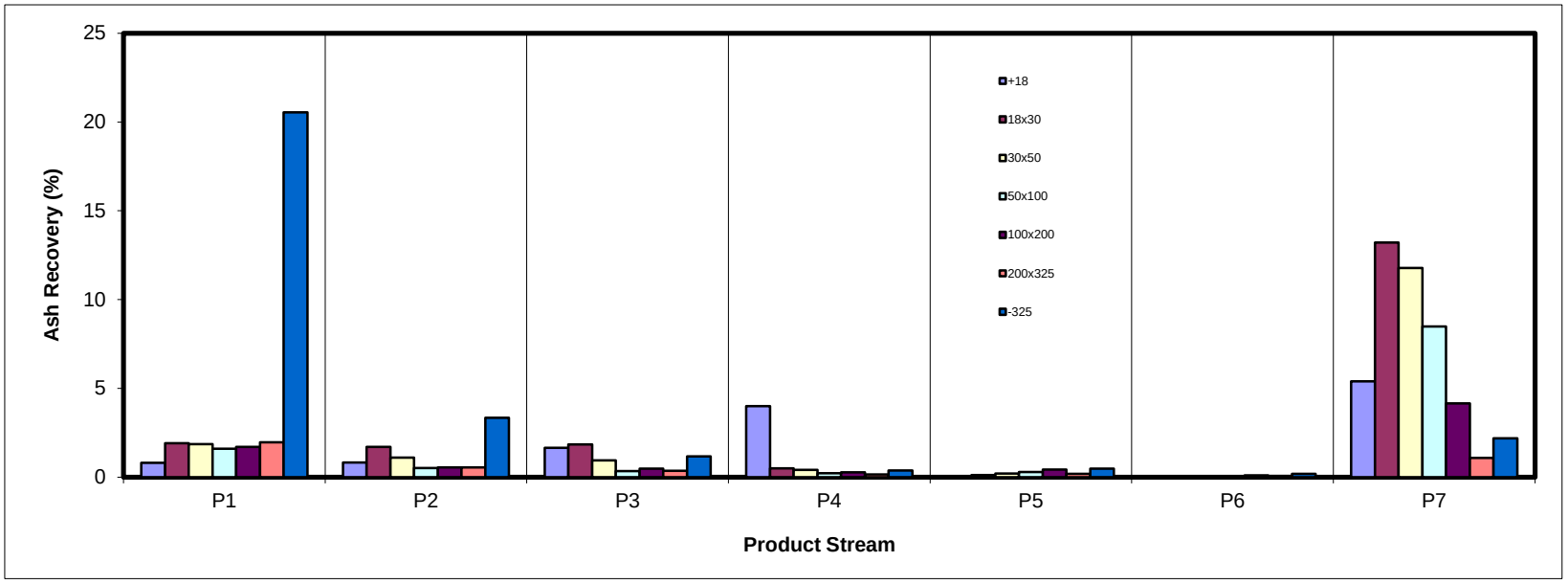
Description: Run 4 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.81	0.83	1.65	3.99	0.02	0.00	5.39		12.70
18x30	1.91	1.70	1.84	0.49	0.12	0.00	13.21		19.26
30x50	1.86	1.11	0.95	0.40	0.20	0.01	11.77		16.29
50x100	1.60	0.51	0.33	0.22	0.28	0.03	8.49		11.47
100x200	1.70	0.54	0.48	0.27	0.42	0.10	4.16		7.67
200x325	1.97	0.54	0.35	0.14	0.18	0.07	1.08		4.32
-325	20.55	3.33	1.17	0.38	0.48	0.19	2.18		28.28
Total (Calc)	30.40	8.56	6.77	5.89	1.70	0.40	46.28		100.00



SPIRAL DATA ANALYSIS

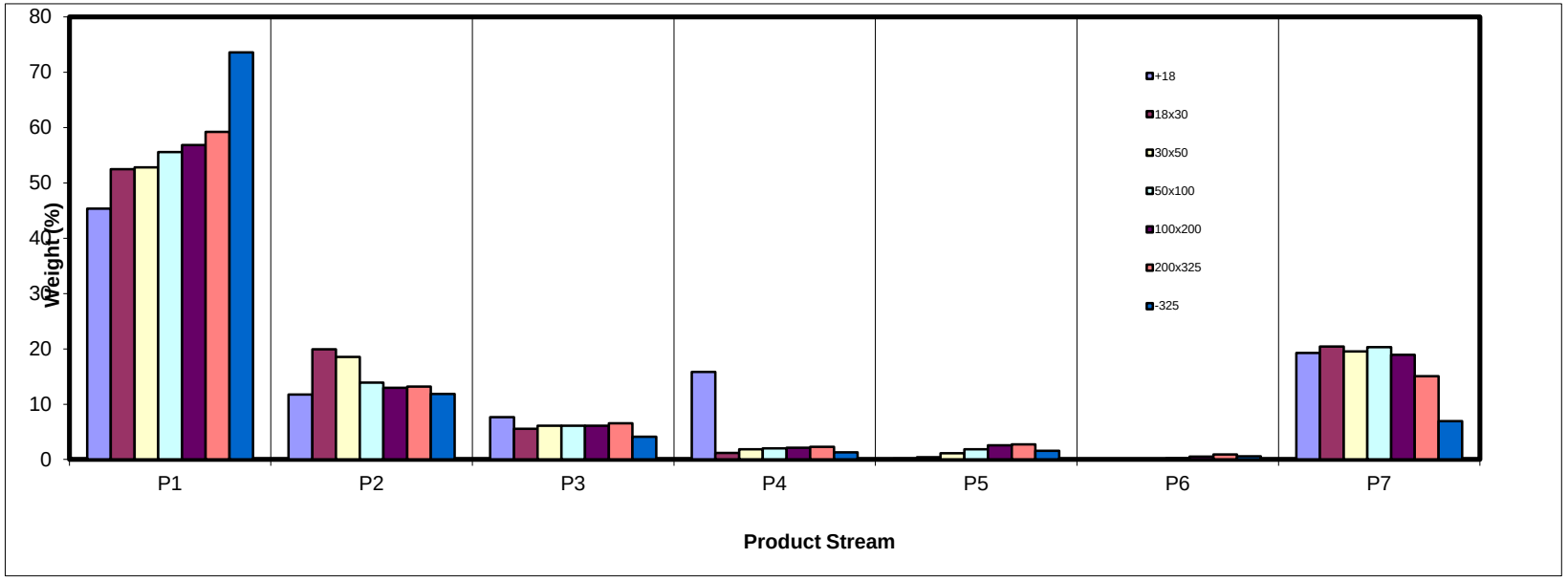
Description: Run 4 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	45.36	11.75	7.64	15.82	0.14	0.01	19.28		100.00
18x30	52.51	19.91	5.54	1.21	0.40	0.01	20.42		100.00
30x50	52.83	18.55	6.09	1.84	1.11	0.07	19.51		100.00
50x100	55.59	13.90	6.12	2.02	1.87	0.18	20.33		100.00
100x200	56.85	12.94	6.08	2.14	2.55	0.52	18.92		100.00
200x325	59.22	13.21	6.52	2.32	2.75	0.90	15.08		100.00
-325	73.63	11.88	4.09	1.28	1.59	0.59	6.94		100.00
Total (Calc)	55.30	15.94	5.92	3.22	1.19	0.19	18.24		100.00



SPIRAL DATA ANALYSIS

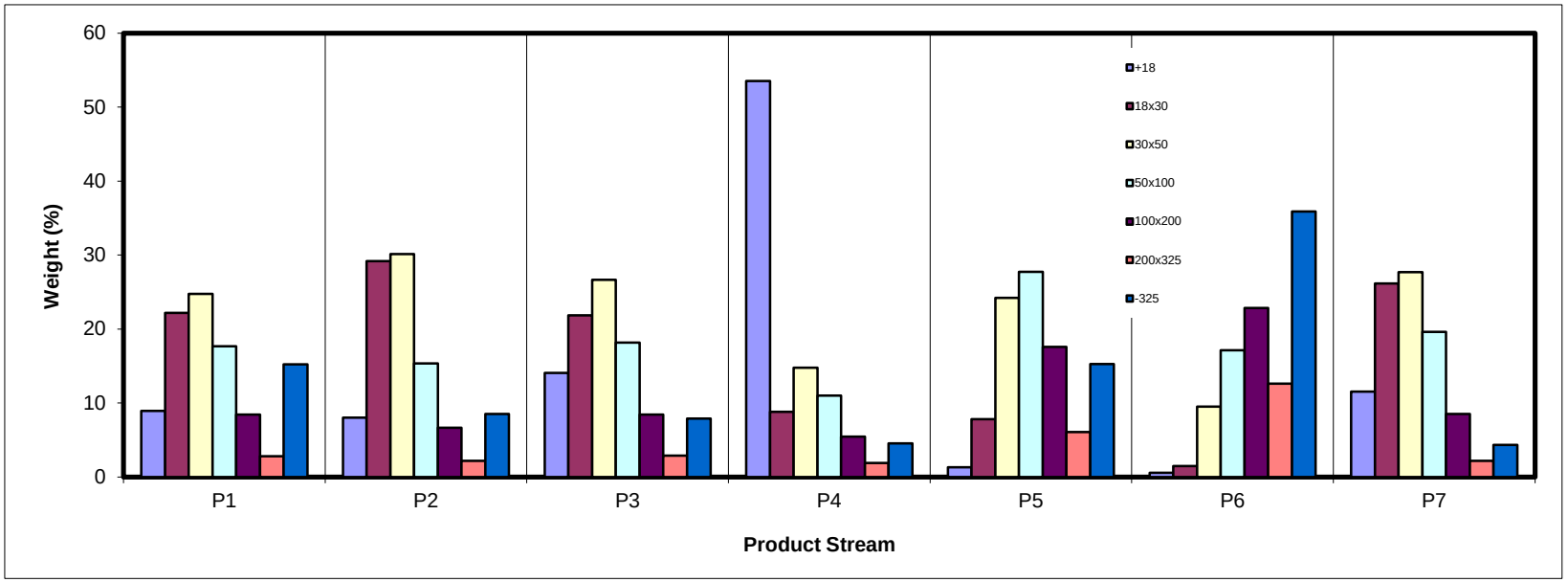
Description: Run 4 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	8.94	8.04	14.08	53.54	1.30	0.55	11.52		10.90
18x30	22.18	29.16	21.86	8.79	7.81	1.46	26.15		23.36
30x50	24.73	30.12	26.65	14.77	24.21	9.52	27.69		25.89
50x100	17.68	15.33	18.18	11.00	27.72	17.14	19.60		17.59
100x200	8.43	6.66	8.43	5.45	17.59	22.83	8.51		8.20
200x325	2.82	2.18	2.90	1.89	6.09	12.61	2.18		2.63
-325	15.21	8.51	7.90	4.56	15.28	35.89	4.34		11.42
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

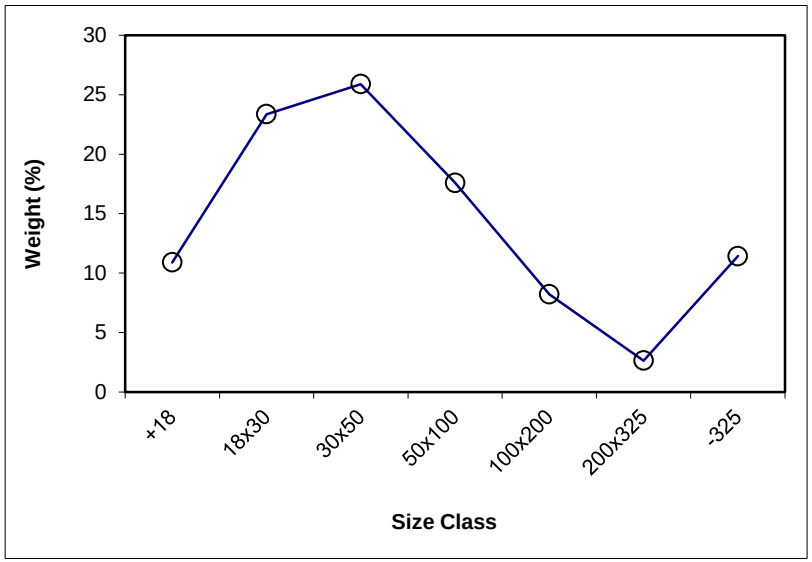
Description: Run 4 - Intermediate Spiral Test

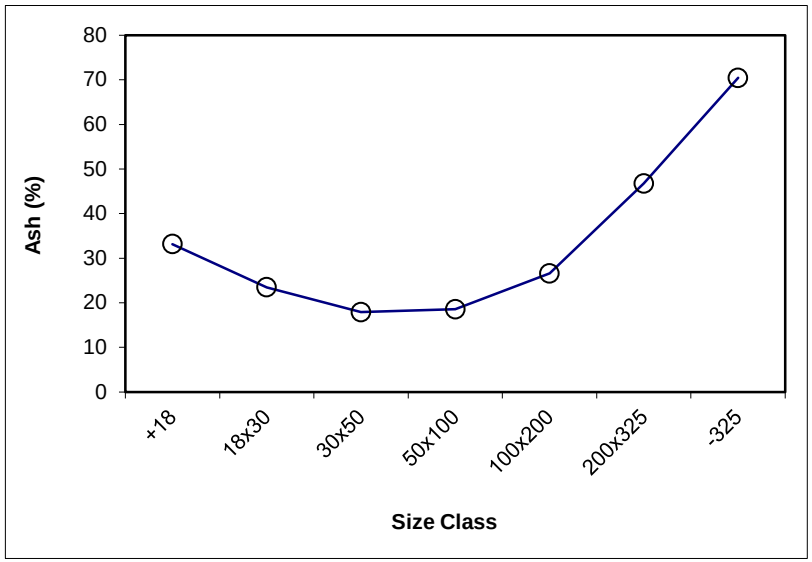
Comments: 1 x 0.15 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	452.7	401.2	51.50	10.90	33.14	10.90	33.14	100.00	28.45
18x30	480.4	370.0	110.32	23.36	23.46	34.26	26.54	89.10	27.88
30x50	458.5	336.3	122.27	25.89	17.91	60.15	22.83	65.74	29.45
50x100	390.9	307.8	83.07	17.59	18.55	77.74	21.86	39.85	36.95
100x200	333.2	294.5	38.75	8.20	26.60	85.95	22.31	22.26	51.48
200x325	310.4	298.0	12.43	2.63	46.74	88.58	23.04	14.05	66.01
-325	60.3	6.3	53.95	11.42	70.45	100.00	28.45	11.42	70.45
Total (Calc)	--	--	472.28	100.00	28.45	--	--	--	--





SPIRAL DATA ANALYSIS

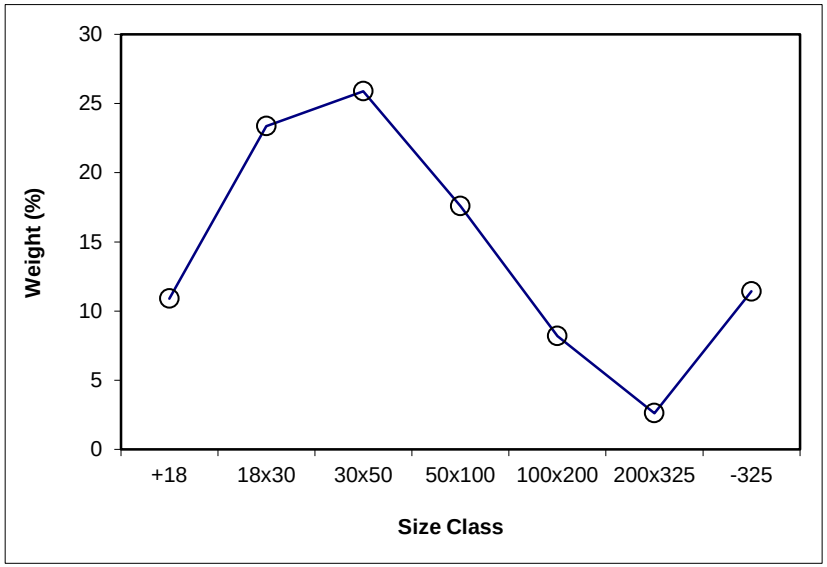
Description: Run 4 - Intermediate Spiral Test

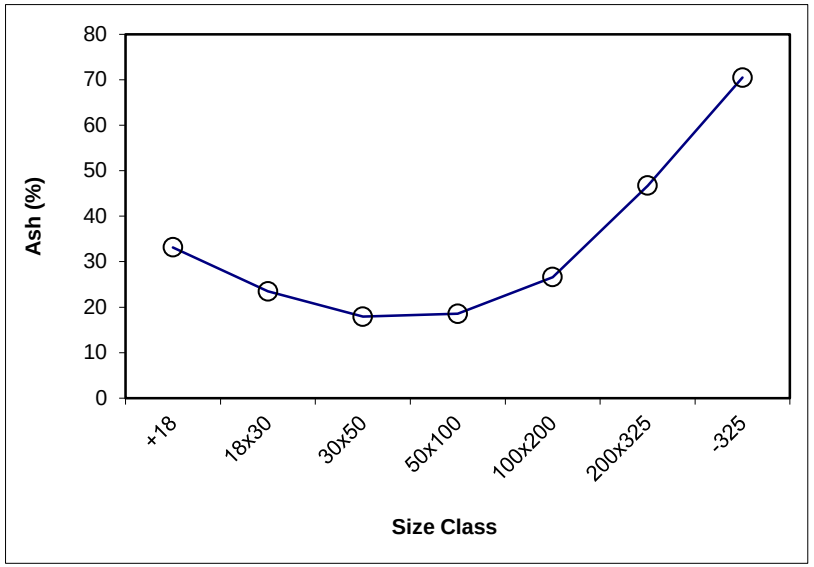
Comments: 1 x 0.15 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	10.90	33.14	10.90	33.14	100.00	28.45			
18x30	23.36	23.46	34.26	26.54	89.10	27.88	x	23.36	23.46
30x50	25.89	17.91	60.15	22.83	65.74	29.45	x	25.89	17.91
50x100	17.59	18.55	77.74	21.86	39.85	36.95	x	17.59	18.55
100x200	8.20	26.60	85.95	22.31	22.26	51.48	x	8.20	26.60
200x325	2.63	46.74	88.58	23.04	14.05	66.01	x	2.63	46.74
-325	11.42	70.45	100.00	28.45	11.42	70.45			
Total (Calc)	100.00	28.45	--	--	--	--	--	77.67	21.62





SPIRAL DATA ANALYSIS

Description: Run 4 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 55.30

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	473.23	401.2	72.03	8.94	4.67	8.94	4.67	100.00	15.64
18x30	548.69	370.0	178.65	22.18	4.43	31.13	4.50	91.06	16.72
30x50	535.46	336.3	199.18	24.73	3.87	55.86	4.22	68.87	20.67
50x100	450.21	307.8	142.40	17.68	4.66	73.54	4.33	44.14	30.09
100x200	362.41	294.5	67.92	8.43	10.36	81.97	4.95	26.46	47.08
200x325	320.68	298.0	22.69	2.82	35.91	84.79	5.98	18.03	64.26
-325	128.77	6.3	122.48	15.21	69.51	100.00	15.64	15.21	69.51
Total (Calc)	--	--	805.35	100.00	15.64	--	--	--	--

Product P2 Feed Weight (%): 15.94

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	491.2	460.1	31.11	8.04	18.33	8.04	18.33	100.00	15.27
18x30	504.8	392.0	112.86	29.16	10.38	37.20	12.10	91.96	15.01
30x50	470.7	354.2	116.56	30.12	6.55	67.32	9.62	62.80	17.15
50x100	452.4	393.0	59.33	15.33	5.99	82.65	8.94	32.68	26.93
100x200	353.0	327.2	25.77	6.66	14.52	89.31	9.36	17.35	45.43
200x325	395.1	386.7	8.43	2.18	44.23	91.49	10.19	10.69	64.69
-325	39.2	6.3	32.93	8.51	69.92	100.00	15.27	8.51	69.92
Total (Calc)	--	--	386.99	100.00	15.27	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 4 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 5.92

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	906.6	866.1	40.46	14.08	56.50	14.08	56.50	100.00	32.54
18x30	454.8	392.0	62.81	21.86	40.41	35.94	46.71	85.92	28.62
30x50	430.7	354.2	76.56	26.65	17.06	62.59	34.09	64.06	24.59
50x100	445.3	393.0	52.24	18.18	8.74	80.77	28.38	37.41	29.96
100x200	351.4	327.2	24.22	8.43	27.29	89.20	28.28	19.23	50.02
200x325	395.0	386.7	8.33	2.90	57.79	92.10	29.21	10.80	67.77
-325	28.9	6.2	22.69	7.90	71.44	100.00	32.54	7.90	71.44
Total (Calc)	--	--	287.32	100.00	32.54	--	--	--	--

Product P4 Feed Weight (%): 3.22

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	669.5	460.1	209.36	53.54	65.88	53.54	65.88	100.00	52.03
18x30	476.5	442.2	34.38	8.79	48.72	62.33	63.46	46.46	36.08
30x50	470.3	412.5	57.76	14.77	23.87	77.10	55.87	37.67	33.13
50x100	451.8	408.8	43.02	11.00	17.61	88.10	51.10	22.90	39.10
100x200	370.9	349.6	21.31	5.45	44.18	93.55	50.69	11.90	58.98
200x325	393.3	385.9	7.40	1.89	66.75	95.44	51.01	6.45	71.49
-325	24.1	6.3	17.81	4.56	73.46	100.00	52.03	4.56	73.46
Total (Calc)	--	--	391.05	100.00	52.03	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 4 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 1.19

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	403.1	401.2	1.87	1.30	43.77	1.30	43.77	100.00	40.85
18x30	381.3	370.0	11.26	7.81	37.33	9.11	38.24	98.70	40.81
30x50	371.2	336.3	34.89	24.21	19.80	33.32	24.84	90.89	41.11
50x100	347.8	307.8	39.95	27.72	24.31	61.04	24.60	66.68	48.85
100x200	319.8	294.5	25.36	17.59	57.35	78.63	31.93	38.96	66.31
200x325	306.8	298.0	8.77	6.09	70.54	84.72	34.70	21.37	73.69
-325	28.1	6.1	22.02	15.28	74.94	100.00	40.85	15.28	74.94
Total (Calc)	--	--	144.12	100.00	40.85	--	--	--	--

Product P6 Feed Weight (%): 0.19

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	460.6	460.1	0.46	0.55	15.57	0.55	15.57	100.00	59.74
18x30	443.3	442.2	1.20	1.46	15.38	2.01	15.43	99.45	59.98
30x50	420.4	412.5	7.83	9.52	12.13	11.53	12.70	97.99	60.65
50x100	422.8	408.8	14.09	17.14	26.40	28.67	20.89	88.47	65.87
100x200	368.4	349.6	18.77	22.83	67.33	51.50	41.48	71.33	75.35
200x325	396.2	385.9	10.37	12.61	78.90	64.11	48.84	48.50	79.13
-325	35.6	6.1	29.52	35.89	79.21	100.00	59.74	35.89	79.21
Total (Calc)	--	--	82.24	100.00	59.74	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 4 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 18.24

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	913.1	811.1	102.05	11.52	72.98	11.52	72.98	100.00	72.20
18x30	679.7	448.1	231.56	26.15	78.80	37.68	77.02	88.48	72.10
30x50	670.1	424.9	245.23	27.69	66.30	65.37	72.48	62.32	69.28
50x100	570.8	397.2	173.55	19.60	67.58	84.97	71.35	34.63	71.67
100x200	466.7	391.3	75.35	8.51	76.19	93.48	71.79	15.03	76.99
200x325	397.9	378.6	19.27	2.18	77.30	95.66	71.91	6.52	78.04
-325	44.7	6.2	38.47	4.34	78.42	100.00	72.20	4.34	78.42
Total (Calc)	--	--	885.46	100.00	72.20	--	--	--	--

SPIRAL DATA ANALYSIS

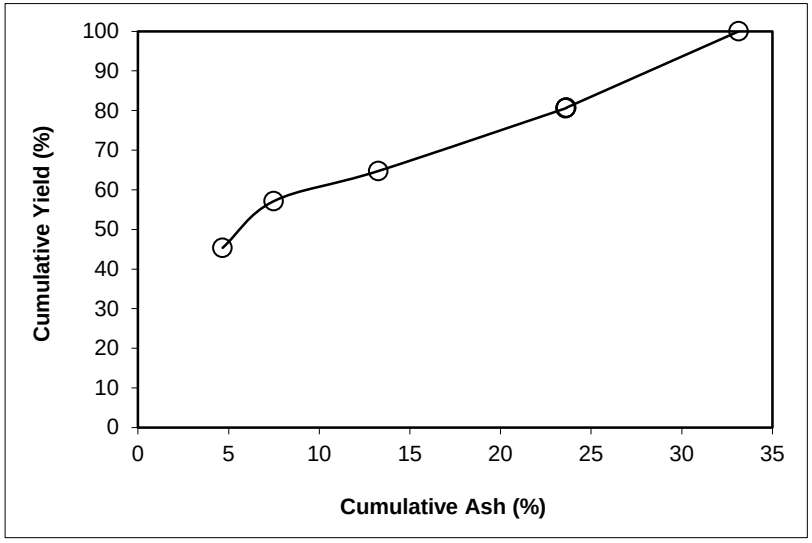
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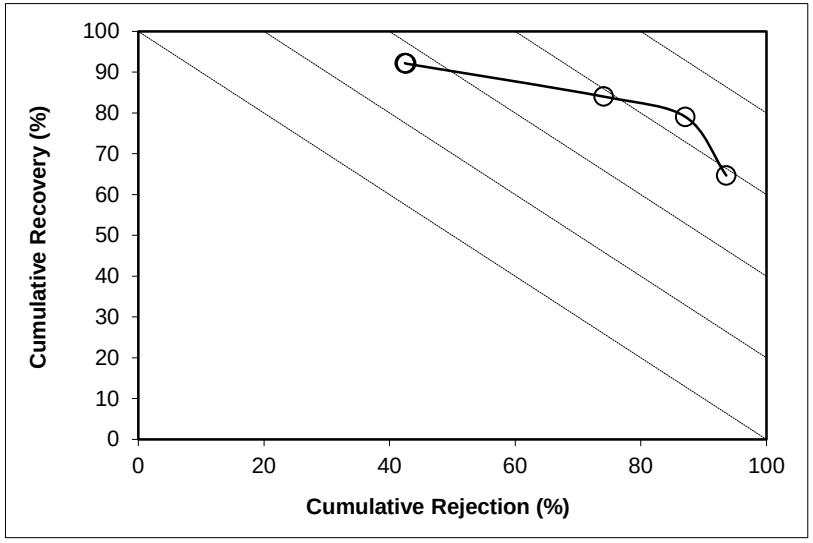
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 10.90

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	45.36	4.67	45.36	4.67	64.67	54.64	56.78	93.61	58.28
P2	11.75	18.33	57.11	7.48	79.03	42.89	67.31	87.11	66.14
P3	7.64	56.50	64.75	13.27	84.00	35.25	69.66	74.08	58.09
P4	15.82	65.88	80.57	23.60	92.08	19.43	72.74	42.64	34.72
P5	0.14	43.77	80.71	23.63	92.20	19.29	72.95	42.45	34.65
P6	0.01	15.57	80.72	23.63	92.21	19.28	72.98	42.45	34.66
P7	19.28	72.98	100.00	33.14	100.00	0.00			
Total (Calc)	100.00	33.14	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

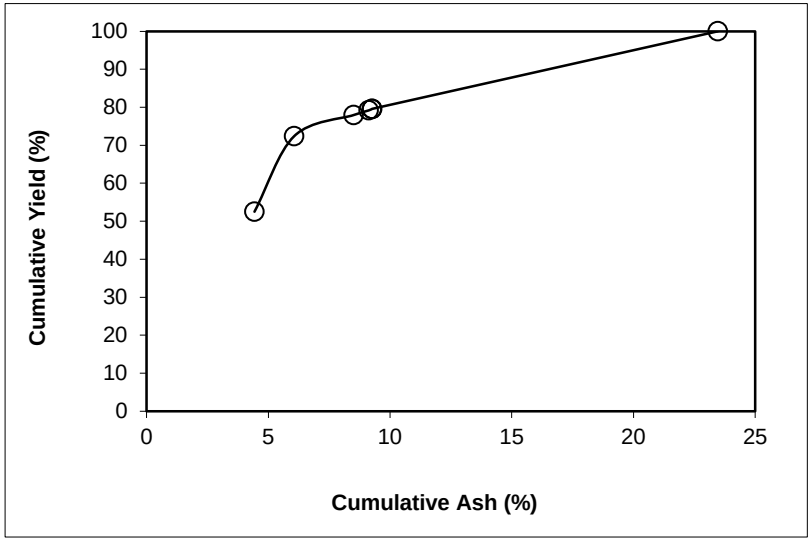
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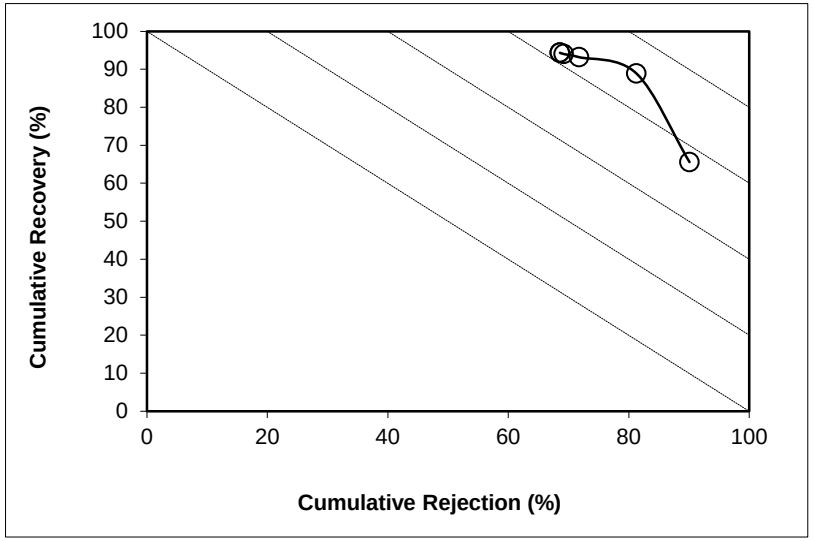
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 23.36

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	52.51	4.43	52.51	4.43	65.57	47.49	44.51	90.08	55.65
P2	19.91	10.38	72.42	6.07	88.88	27.58	69.14	81.27	70.15
P3	5.54	40.41	77.96	8.51	93.19	22.04	76.36	71.73	64.93
P4	1.21	48.72	79.17	9.12	94.01	20.83	77.97	69.22	63.22
P5	0.40	37.33	79.57	9.26	94.33	20.43	78.76	68.58	62.92
P6	0.01	15.38	79.58	9.27	94.34	20.42	78.80	68.58	62.92
P7	20.42	78.80	100.00	23.46	100.00	0.00			
Total (Calc)	100.00	23.46	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

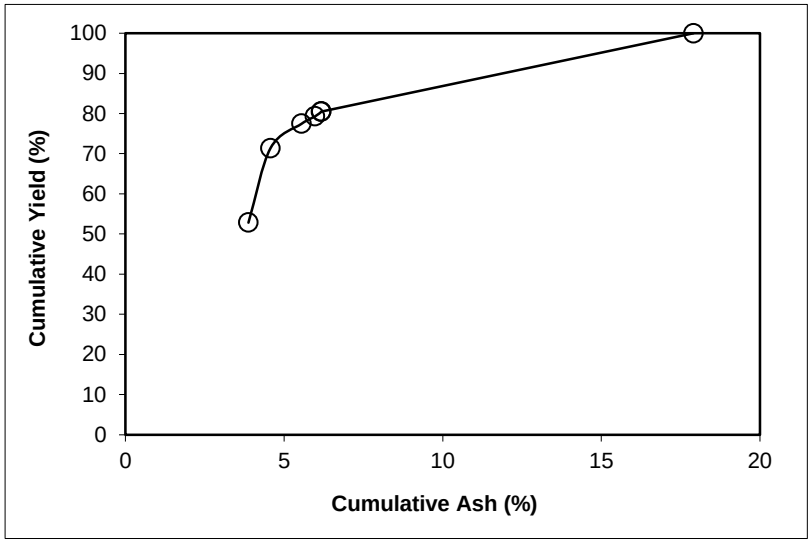
Description: Run 4 - Intermediate Spiral Test

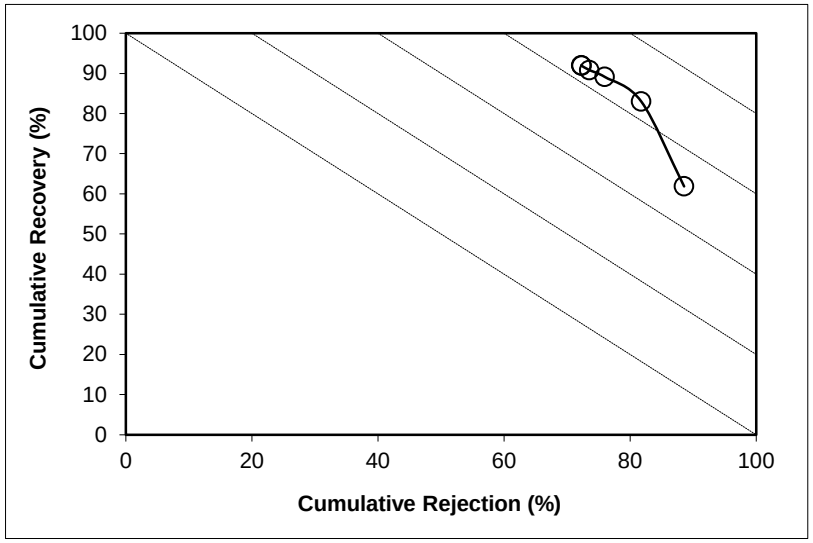
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 25.89

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	52.83	3.87	52.83	3.87	61.86	47.17	33.62	88.57	50.43
P2	18.55	6.55	71.38	4.57	82.97	28.62	51.16	81.78	64.75
P3	6.09	17.06	77.47	5.55	89.13	22.53	60.38	75.98	65.10
P4	1.84	23.87	79.31	5.98	90.83	20.69	63.62	73.53	64.36
P5	1.11	19.80	80.42	6.17	91.92	19.58	66.11	72.30	64.21
P6	0.07	12.13	80.49	6.17	91.99	19.51	66.30	72.25	64.24
P7	19.51	66.30	100.00	17.91	100.00	0.00			
Total (Calc)	100.00	17.91	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

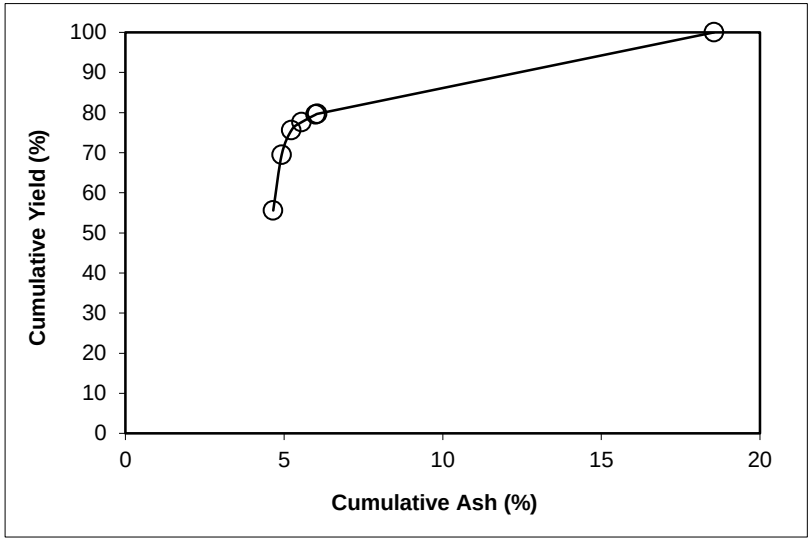
Description: Run 4 - Intermediate Spiral Test

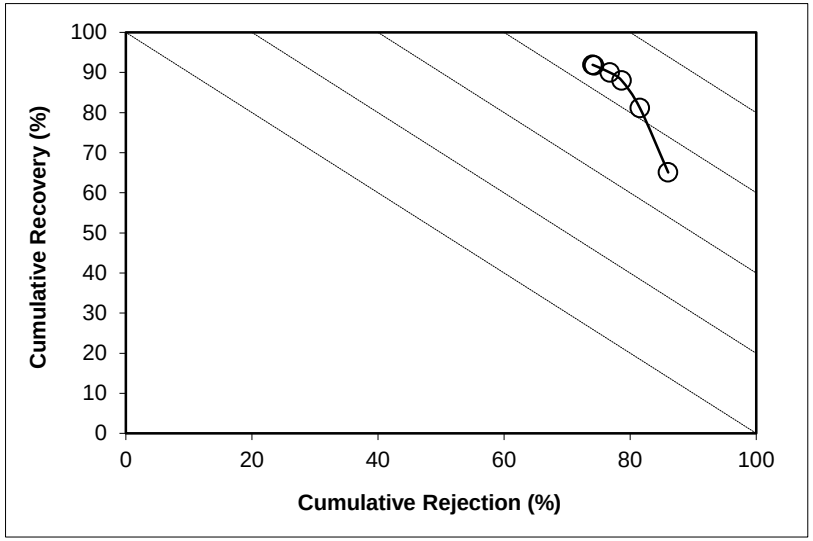
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 17.59

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	55.59	4.66	55.59	4.66	65.07	44.41	35.94	86.05	51.12
P2	13.90	5.99	69.49	4.92	81.11	30.51	49.58	81.56	62.67
P3	6.12	8.74	75.60	5.23	87.97	24.40	59.82	78.68	66.65
P4	2.02	17.61	77.62	5.55	90.01	22.38	63.63	76.76	66.77
P5	1.87	24.31	79.49	5.99	91.74	20.51	67.21	74.31	66.06
P6	0.18	26.40	79.67	6.04	91.91	20.33	67.58	74.05	65.96
P7	20.33	67.58	100.00	18.55	100.00	0.00			
Total (Calc)	100.00	18.55	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

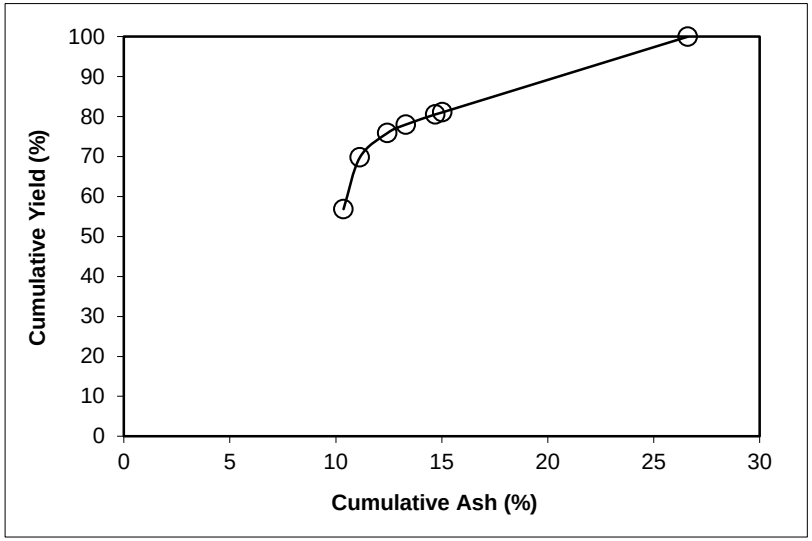
Description: Run 4 - Intermediate Spiral Test

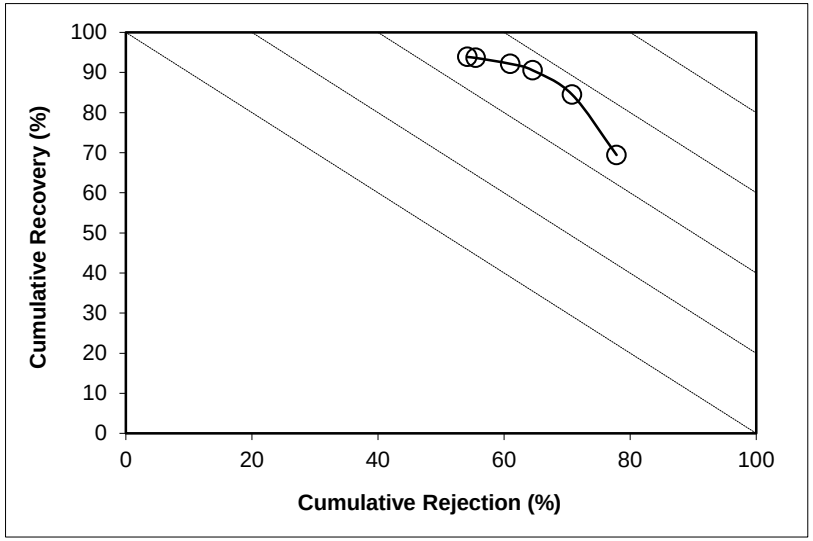
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 8.20

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	56.85	10.36	56.85	10.36	69.43	43.15	48.00	77.85	47.28
P2	12.94	14.52	69.79	11.13	84.50	30.21	62.33	70.79	55.29
P3	6.08	27.29	75.87	12.43	90.52	24.13	71.17	64.55	55.07
P4	2.14	44.18	78.01	13.30	92.15	21.99	73.79	61.00	53.15
P5	2.55	57.35	80.56	14.69	93.63	19.44	75.95	55.51	49.14
P6	0.52	67.33	81.08	15.03	93.86	18.92	76.19	54.18	48.04
P7	18.92	76.19	100.00	26.60	100.00	0.00			
Total (Calc)	100.00	26.60	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

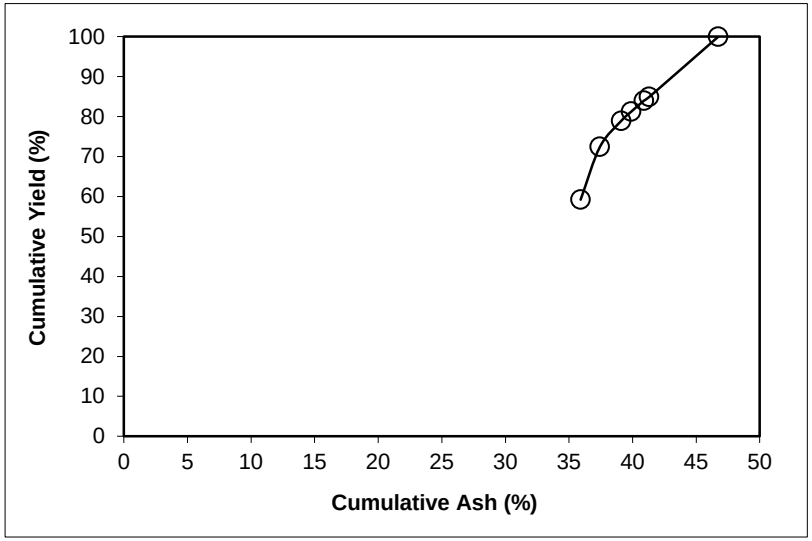
Description: Run 4 - Intermediate Spiral Test

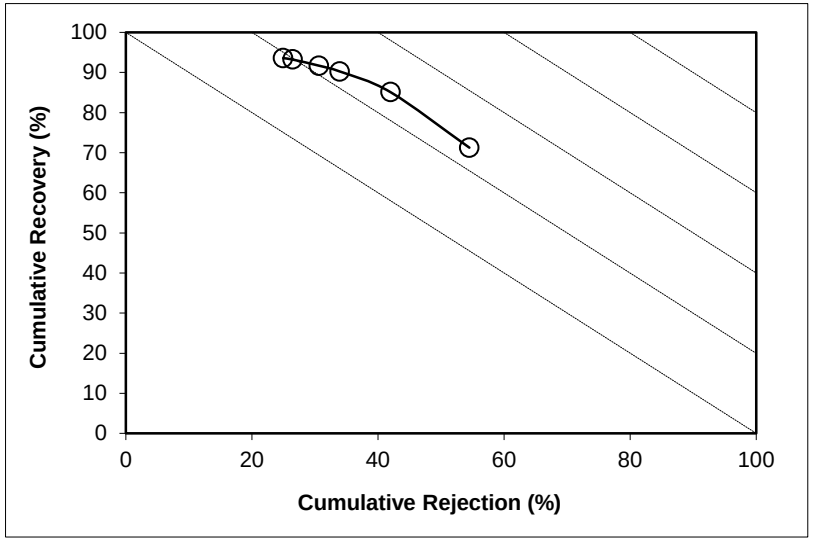
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 2.63

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	59.22	35.91	59.22	35.91	71.25	40.78	62.45	54.49	25.75
P2	13.21	44.23	72.43	37.43	85.08	27.57	71.18	41.99	27.07
P3	6.52	57.79	78.95	39.11	90.25	21.05	75.33	33.93	24.18
P4	2.32	66.75	81.27	39.90	91.70	18.73	76.39	30.62	22.32
P5	2.75	70.54	84.01	40.90	93.21	15.99	77.39	26.47	19.69
P6	0.90	78.90	84.92	41.31	93.57	15.08	77.30	24.95	18.52
P7	15.08	77.30	100.00	46.74	100.00	0.00			
Total (Calc)	100.00	46.74	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

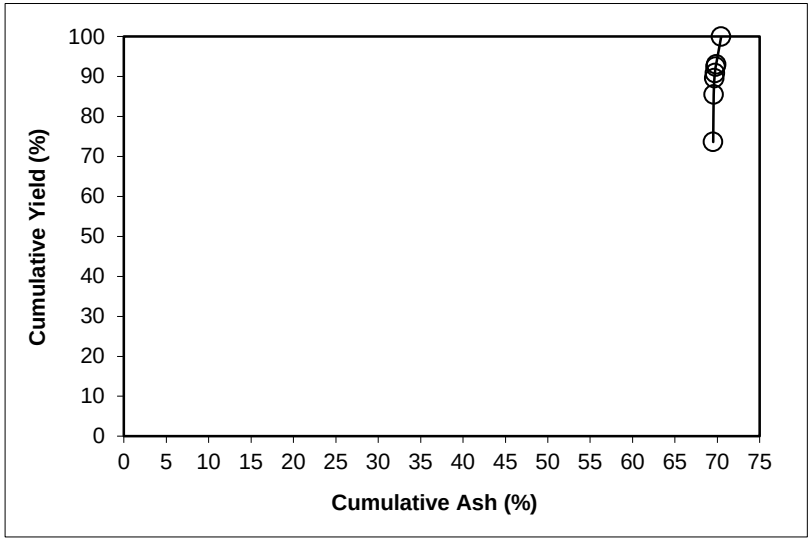
Description: Run 4 - Intermediate Spiral Test

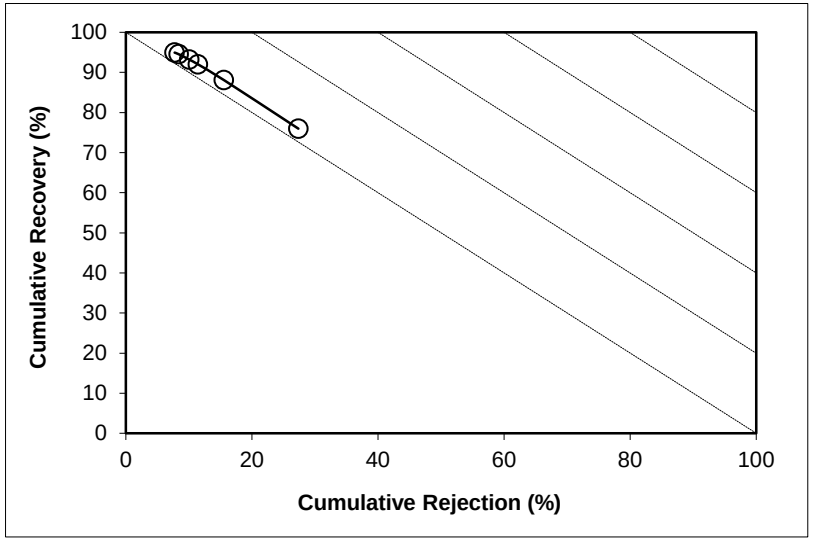
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 11.42

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	73.63	69.51	73.63	69.51	75.97	26.37	73.08	27.35	3.33
P2	11.88	69.92	85.51	69.57	88.06	14.49	75.66	15.57	3.63
P3	4.09	71.44	89.60	69.65	92.02	10.40	77.32	11.42	3.43
P4	1.28	73.46	90.88	69.70	93.17	9.12	77.86	10.08	3.25
P5	1.59	74.94	92.47	69.79	94.52	7.53	78.48	8.39	2.90
P6	0.59	79.21	93.06	69.85	94.93	6.94	78.42	7.72	2.66
P7	6.94	78.42	100.00	70.45	100.00	0.00			
Total (Calc)	100.00	70.45	--	--	--	--	--	--	--





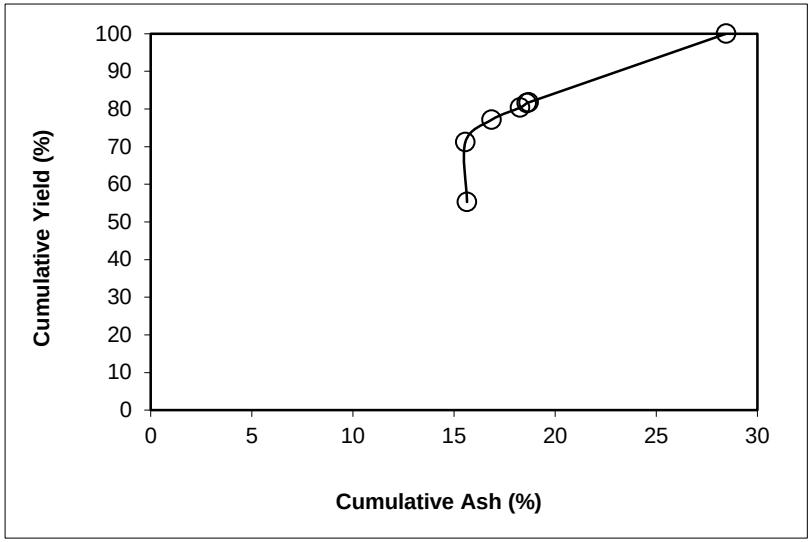
SPIRAL DATA ANALYSIS

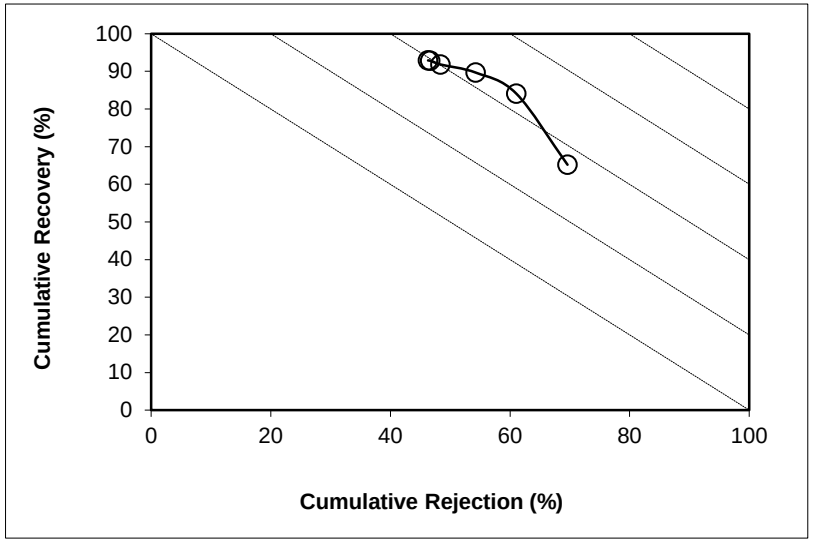
Description: Run 4 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	55.30	15.64	55.30	15.64	65.20	44.70	44.30	69.60	34.81
P2	15.94	15.27	71.24	15.56	84.08	28.76	60.40	61.05	45.13
P3	5.92	32.54	77.16	16.86	89.66	22.84	67.62	54.28	43.94
P4	3.22	52.03	80.38	18.27	91.82	19.62	70.18	48.38	40.21
P5	1.19	40.85	81.57	18.60	92.81	18.43	72.07	46.68	39.48
P6	0.19	59.74	81.76	18.69	92.91	18.24	72.20	46.28	39.20
P7	18.24	72.20	100.00	28.45	100.00	0.00			
Total (Calc)	100.00	28.45	--	--	--	--	--	--	--

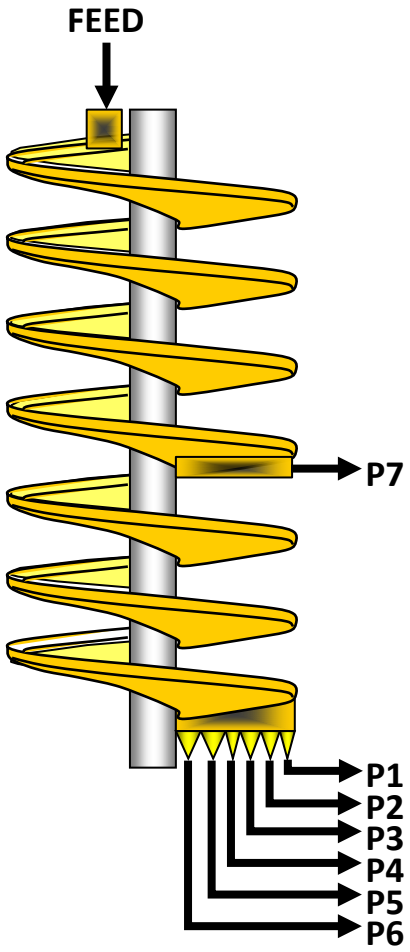




SPIRAL DATA ANALYSIS

Description: Run 5 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	2.619	28.6	26.21	33.66
P2	0.448	31.8	3.85	5.10
P3	0.169	34.7	1.27	1.70
P4	0.051	36.4	0.36	0.49
P5	0.062	32.0	0.53	0.68
P6	0.012	20.0	0.19	0.21
P7	0.583	48.9	2.44	3.56
Total	3.943	31.2	34.84	45.41

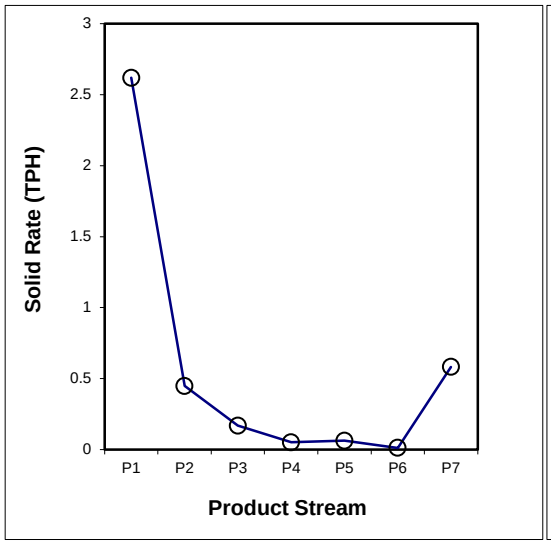
SPIRAL DATA ANALYSIS

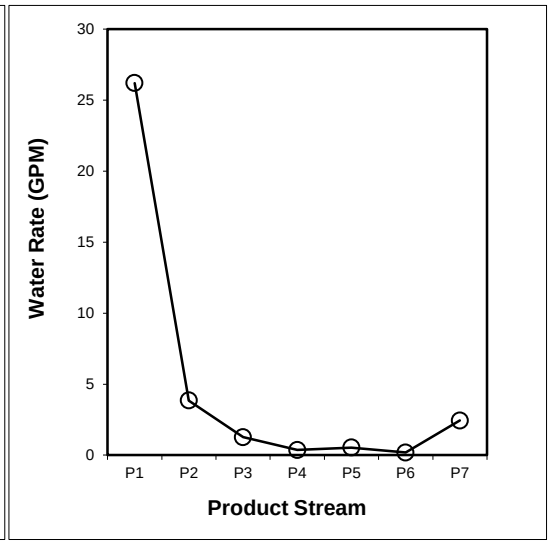
Description: Run 5 - Intermediate Spiral Test

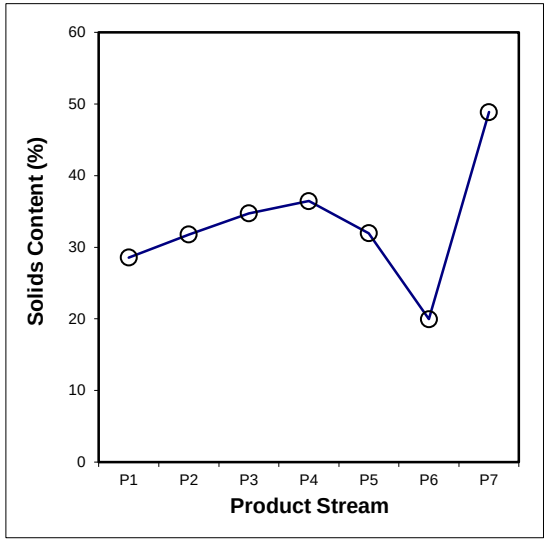
Comments: 1 x 0.15 mm Nominal Particle Size

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	5	12591.00	853.49	9.171	5328.0	2025.2	2.619	66.41	28.56
P2	5	1899.81	97.05	1.410	3487.4	2922.6	0.448	11.36	31.77
P3	10	1338.54	96.33	0.486	2686.0	2260.6	0.169	4.28	34.72
P4	25	996.93	95.35	0.141	2789.4	2465.3	0.051	1.30	36.44
P5	20	1090.85	96.03	0.195	3048.8	2735.3	0.062	1.58	31.95
P6	80	1278.39	86.61	0.058	3067.1	2832.7	0.012	0.29	19.96
P7	5	1608.81	93.32	1.192	2748.9	2014.1	0.583	14.78	48.86
Total (Calc)	--	--	--	12.653	--	--	3.943	100.00	31.17
Total (Head)	0.48	1636.25	96.98	12.653	2552.8	2073.1	3.943	--	31.17







SPIRAL DATA ANALYSIS

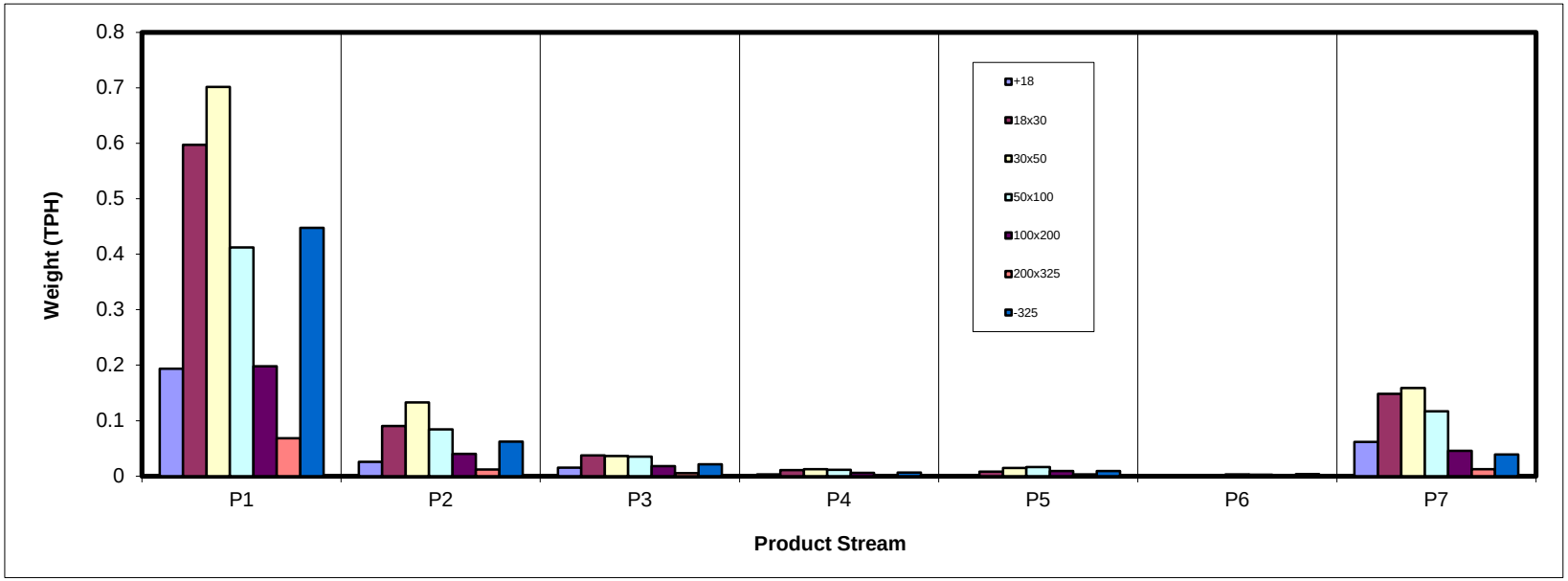
Description: Run 5 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.194	0.025	0.015	0.003	0.002	0.000	0.062		0.301
18x30	0.597	0.090	0.038	0.011	0.008	0.000	0.148		0.892
30x50	0.702	0.133	0.036	0.012	0.015	0.001	0.159		1.058
50x100	0.412	0.084	0.035	0.011	0.016	0.003	0.117		0.679
100x200	0.198	0.040	0.018	0.006	0.009	0.003	0.046		0.319
200x325	0.068	0.012	0.005	0.002	0.003	0.001	0.012		0.104
-325	0.448	0.062	0.021	0.006	0.009	0.004	0.039		0.590
Total (Calc)	2.619	0.448	0.169	0.051	0.062	0.012	0.583		3.943



SPIRAL DATA ANALYSIS

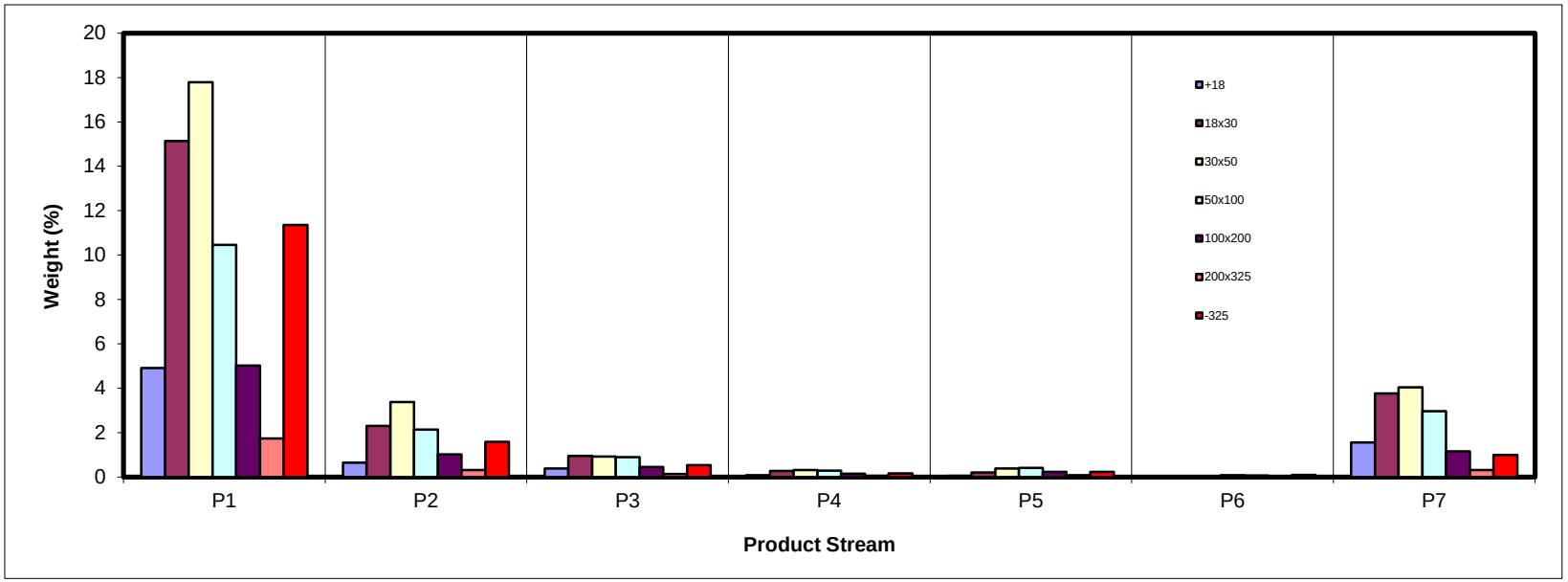
Description: Run 5 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	4.91	0.65	0.38	0.08	0.05	0.00	1.56		7.63
18x30	15.14	2.29	0.95	0.27	0.21	0.00	3.76		22.63
30x50	17.79	3.37	0.92	0.32	0.38	0.03	4.03		26.84
50x100	10.46	2.14	0.89	0.28	0.41	0.08	2.96		17.22
100x200	5.02	1.02	0.46	0.15	0.23	0.06	1.16		8.10
200x325	1.73	0.31	0.14	0.05	0.08	0.03	0.31		2.64
-325	11.36	1.58	0.54	0.16	0.23	0.09	0.99		14.95
Total (Calc)	66.41	11.36	4.28	1.30	1.58	0.29	14.78		100.00



SPIRAL DATA ANALYSIS

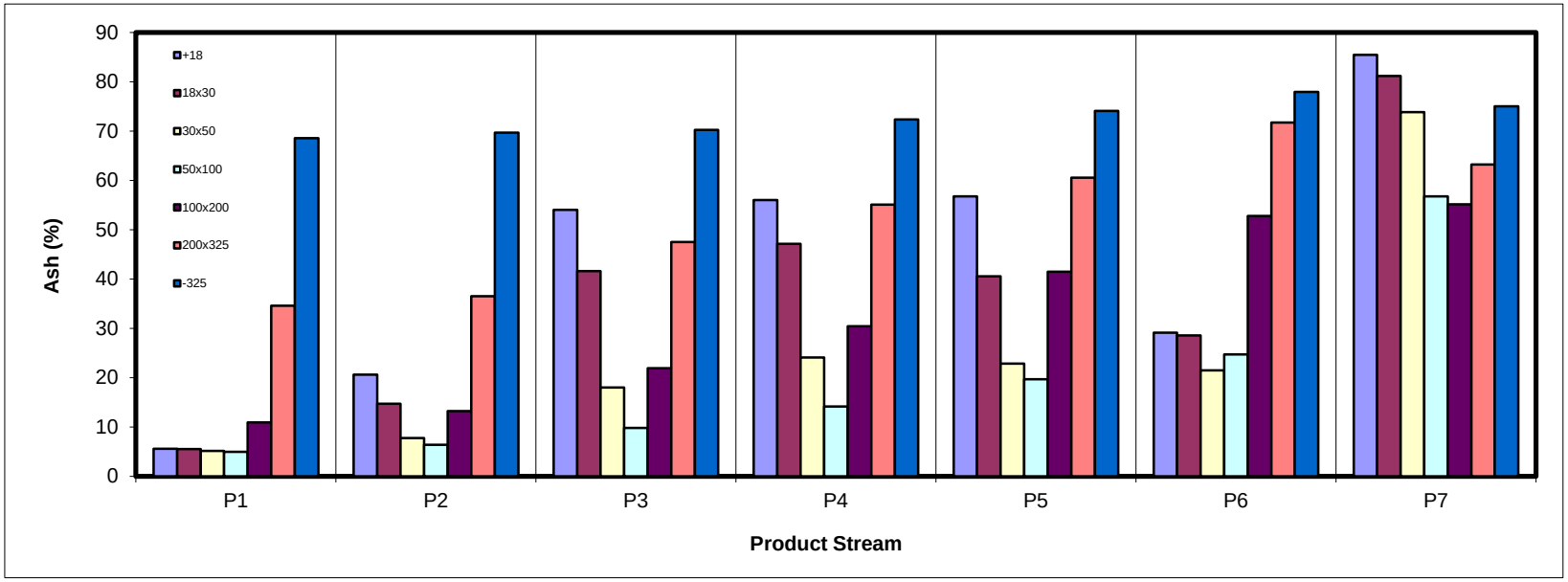
Description: Run 5 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	5.56	20.59	54.02	55.98	56.77	29.13	85.42		26.43
18x30	5.51	14.72	41.61	47.10	40.53	28.56	81.13		21.35
30x50	5.14	7.77	18.02	24.05	22.83	21.48	73.85		16.73
50x100	4.95	6.38	9.79	14.16	19.65	24.71	56.73		14.86
100x200	10.93	13.20	21.91	30.44	41.47	52.78	55.16		19.72
200x325	34.57	36.53	47.46	55.07	60.56	71.74	63.21		40.35
-325	68.57	69.63	70.21	72.35	74.10	77.90	74.98		69.35
Total (Calc)	17.28	19.52	32.71	36.45	37.43	50.80	71.88		26.93



SPIRAL DATA ANALYSIS

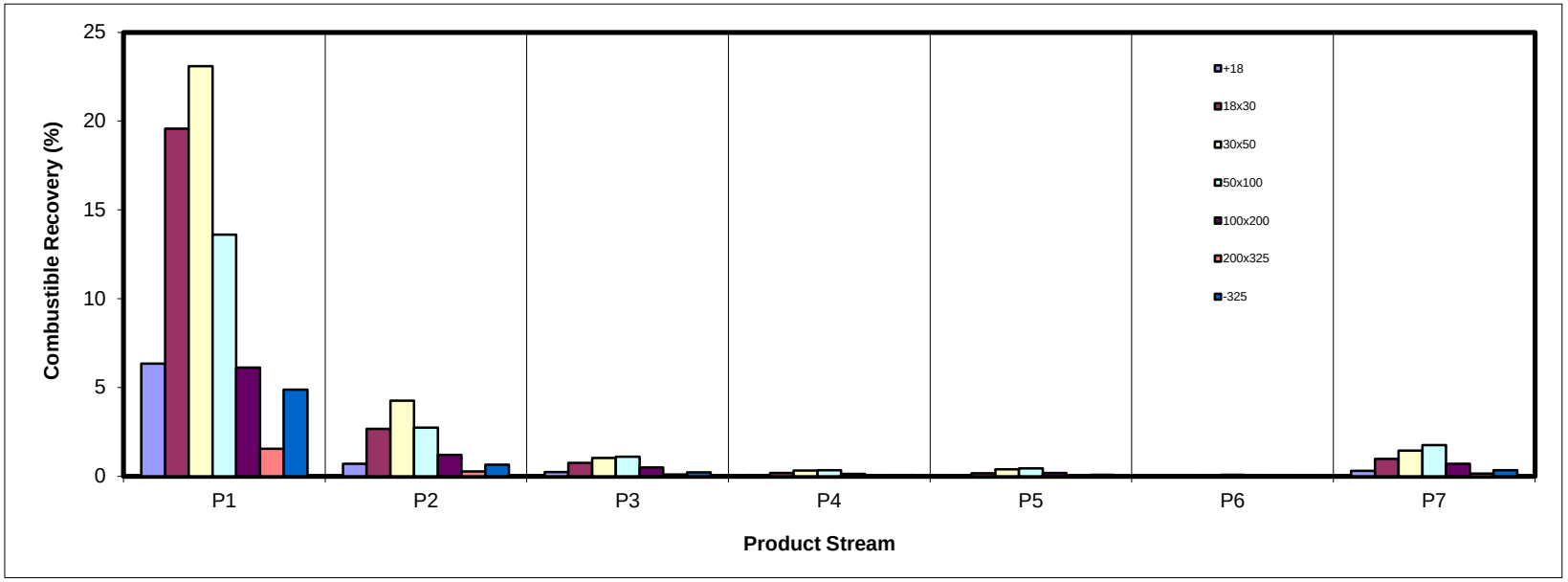
Description: Run 5 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	6.35	0.70	0.24	0.05	0.03	0.00	0.31		7.68
18x30	19.58	2.68	0.76	0.19	0.17	0.00	0.97		24.35
30x50	23.09	4.25	1.04	0.33	0.40	0.03	1.44		30.58
50x100	13.60	2.74	1.09	0.33	0.45	0.08	1.75		20.06
100x200	6.12	1.21	0.49	0.14	0.19	0.04	0.71		8.89
200x325	1.55	0.27	0.10	0.03	0.04	0.01	0.16		2.16
-325	4.88	0.66	0.22	0.06	0.08	0.03	0.34		6.27
Total (Calc)	75.19	12.51	3.94	1.13	1.35	0.20	5.69		100.00



SPIRAL DATA ANALYSIS

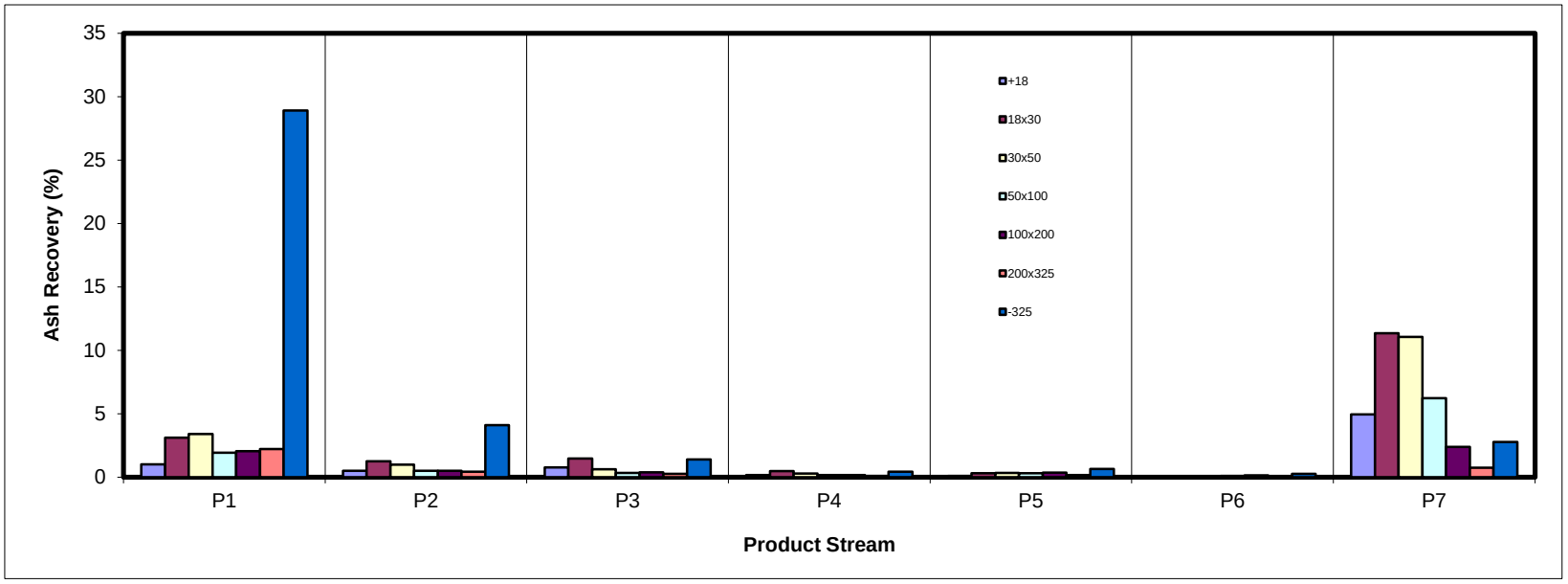
Description: Run 5 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	1.01	0.49	0.77	0.16	0.10	0.00	4.95		7.49
18x30	3.10	1.25	1.47	0.47	0.31	0.00	11.34		17.94
30x50	3.40	0.97	0.62	0.28	0.32	0.02	11.06		16.68
50x100	1.92	0.51	0.32	0.15	0.30	0.08	6.23		9.50
100x200	2.04	0.50	0.37	0.17	0.36	0.13	2.37		5.93
200x325	2.22	0.42	0.24	0.10	0.17	0.07	0.73		3.96
-325	28.92	4.09	1.40	0.44	0.64	0.26	2.76		38.50
Total (Calc)	42.61	8.23	5.20	1.76	2.19	0.56	39.45		100.00



SPIRAL DATA ANALYSIS

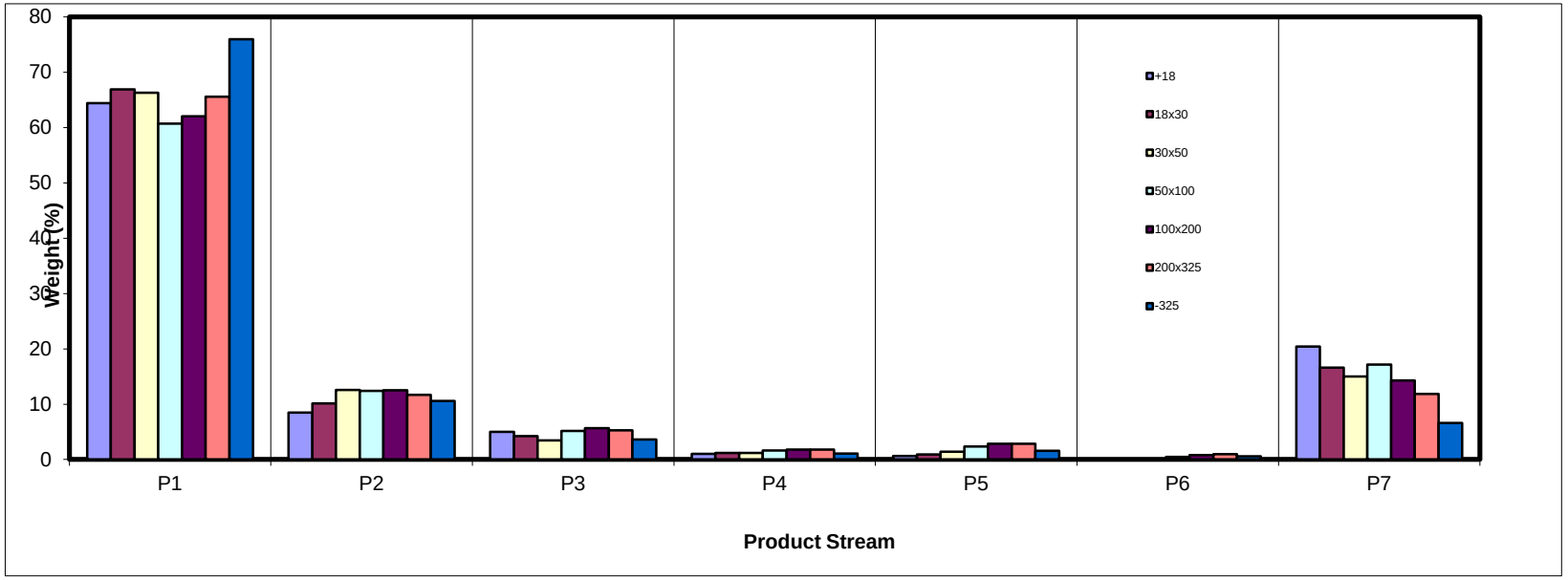
Description: Run 5 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	64.40	8.47	5.02	1.03	0.61	0.02	20.44		100.00
18x30	66.91	10.14	4.20	1.19	0.91	0.02	16.63		100.00
30x50	66.28	12.56	3.44	1.18	1.40	0.11	15.03		100.00
50x100	60.74	12.44	5.15	1.65	2.37	0.48	17.18		100.00
100x200	62.05	12.54	5.64	1.80	2.86	0.79	14.31		100.00
200x325	65.58	11.67	5.26	1.79	2.87	0.98	11.85		100.00
-325	75.96	10.58	3.59	1.09	1.55	0.60	6.63		100.00
Total (Calc)	66.41	11.36	4.28	1.30	1.58	0.29	14.78		100.00



SPIRAL DATA ANALYSIS

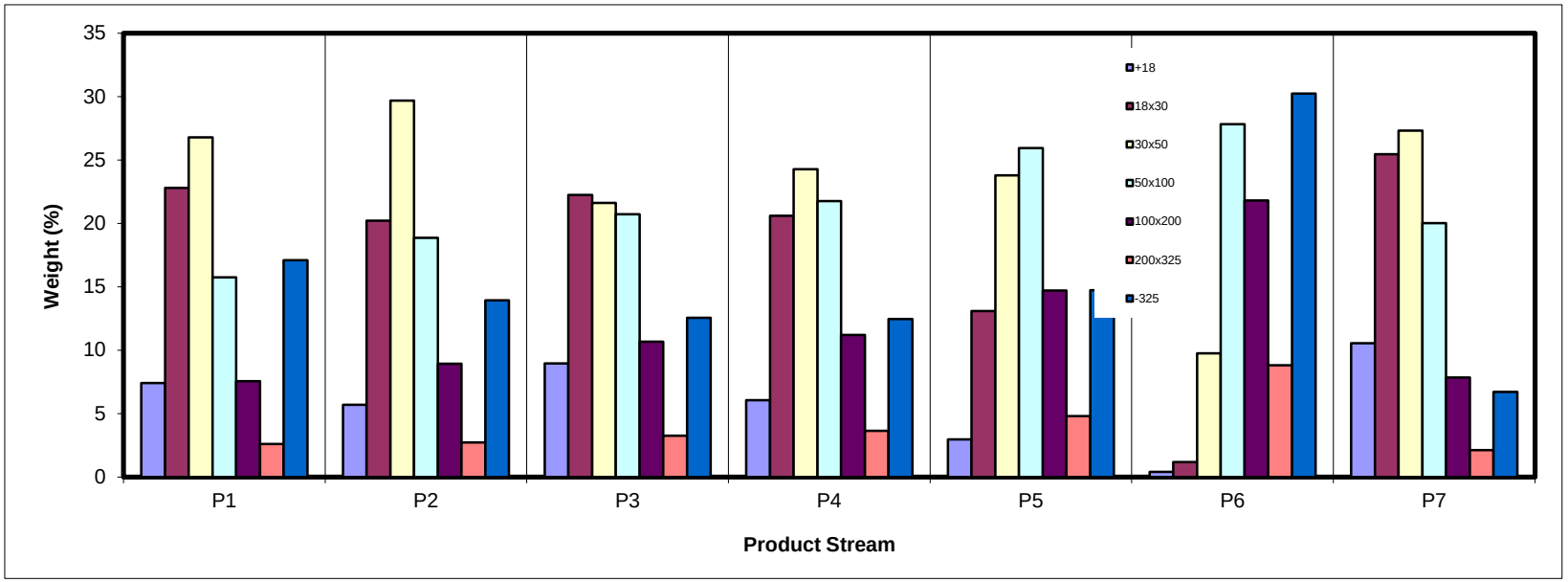
Description: Run 5 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	7.40	5.69	8.96	6.05	2.96	0.41	10.56		7.63
18x30	22.80	20.20	22.24	20.61	13.08	1.18	25.46		22.63
30x50	26.79	29.67	21.61	24.27	23.79	9.74	27.30		26.84
50x100	15.75	18.85	20.71	21.76	25.93	27.83	20.01		17.22
100x200	7.56	8.94	10.68	11.21	14.71	21.82	7.84		8.10
200x325	2.61	2.72	3.25	3.63	4.80	8.80	2.12		2.64
-325	17.10	13.93	12.55	12.47	14.72	30.23	6.71		14.95
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

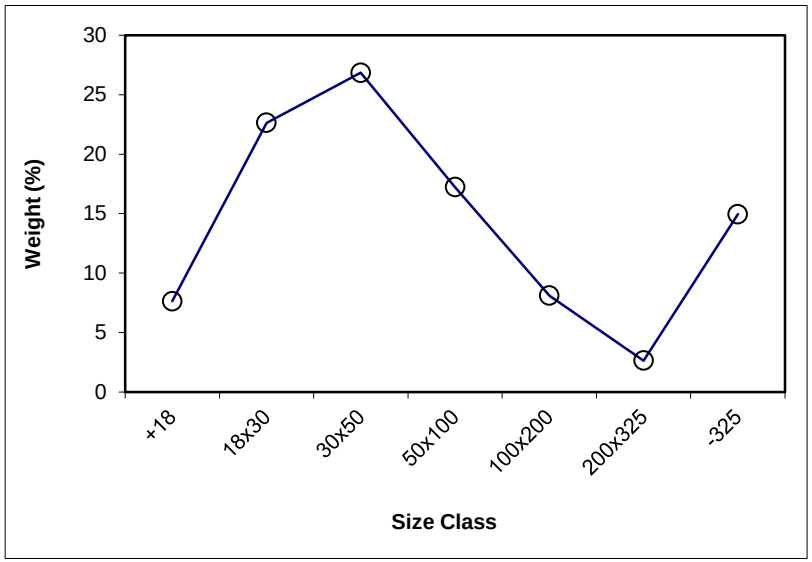
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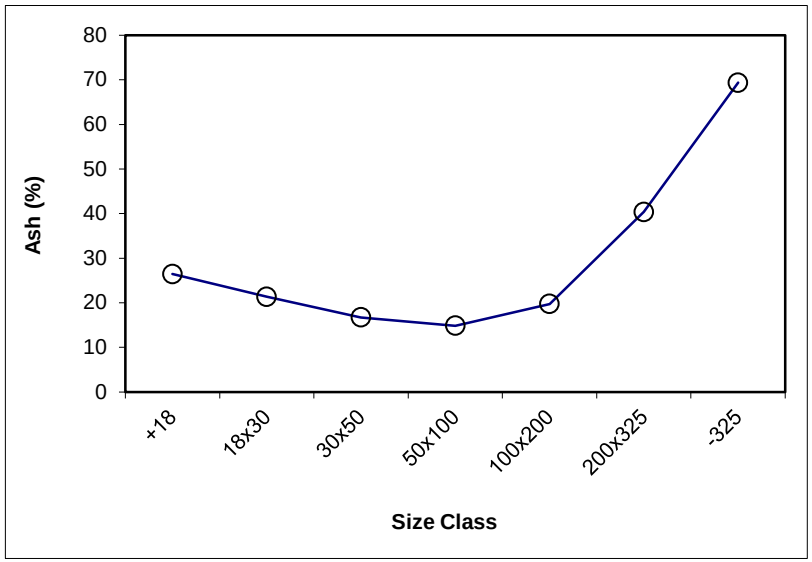
Comments: 1 x 0.15 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	496.7	460.1	36.61	7.63	26.43	7.63	26.43	100.00	26.93
18x30	478.6	370.0	108.55	22.63	21.35	30.26	22.63	92.37	26.97
30x50	465.0	336.3	128.75	26.84	16.73	57.10	19.86	69.74	28.79
50x100	390.4	307.8	82.59	17.22	14.86	74.31	18.70	42.90	36.33
100x200	333.3	294.5	38.83	8.10	19.72	82.41	18.80	25.69	50.72
200x325	310.7	298.0	12.68	2.64	40.35	85.05	19.47	17.59	64.99
-325	78.0	6.3	71.71	14.95	69.35	100.00	26.93	14.95	69.35
Total (Calc)	--	--	479.72	100.00	26.93	--	--	--	--





SPIRAL DATA ANALYSIS

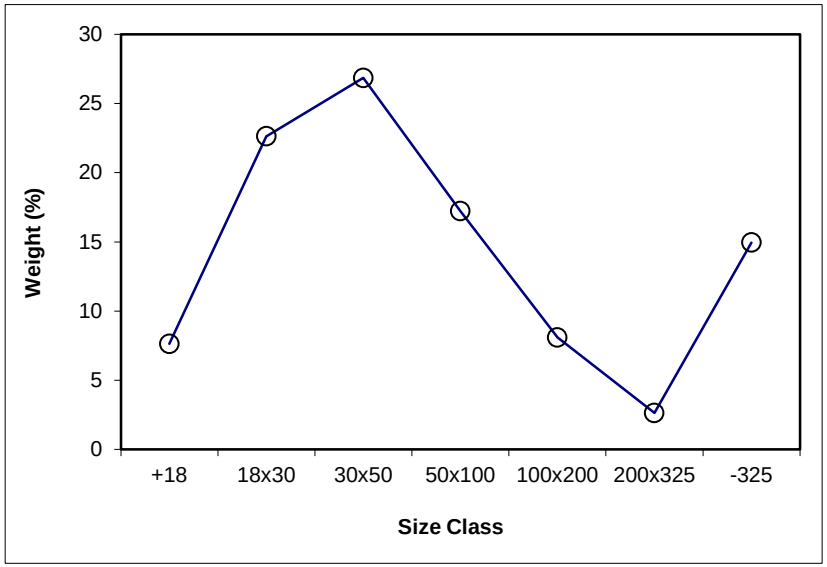
Description: Run 5 - Intermediate Spiral Test

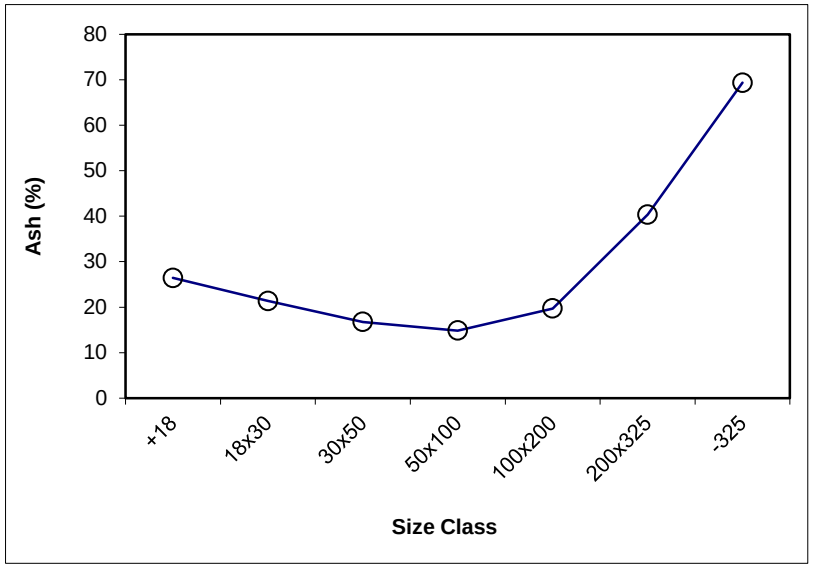
Comments: 1 x 0.15 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	7.63	26.43	7.63	26.43	100.00	26.93			
18x30	22.63	21.35	30.26	22.63	92.37	26.97	x	22.63	21.35
30x50	26.84	16.73	57.10	19.86	69.74	28.79	x	26.84	16.73
50x100	17.22	14.86	74.31	18.70	42.90	36.33	x	17.22	14.86
100x200	8.10	19.72	82.41	18.80	25.69	50.72	x	8.10	19.72
200x325	2.64	40.35	85.05	19.47	17.59	64.99	x	2.64	40.35
-325	14.95	69.35	100.00	26.93	14.95	69.35			
Total (Calc)	100.00	26.93	--	--	--	--	--	77.42	18.79





SPIRAL DATA ANALYSIS

Description: Run 5 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 66.41

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	645.60	401.2	244.40	7.40	5.56	7.40	5.56	100.00	17.28
18x30	1123.03	370.0	752.99	22.80	5.51	30.20	5.52	92.60	18.21
30x50	1220.96	336.3	884.68	26.79	5.14	56.99	5.34	69.80	22.36
50x100	827.83	307.8	520.02	15.75	4.95	72.73	5.26	43.01	33.08
100x200	544.26	294.5	249.77	7.56	10.93	80.29	5.79	27.27	49.33
200x325	384.16	298.0	86.17	2.61	34.57	82.90	6.70	19.71	64.07
-325	582.14	17.4	564.71	17.10	68.57	100.00	17.28	17.10	68.57
Total (Calc)	--	--	3302.74	100.00	17.28	--	--	--	--

Product P2 Feed Weight (%): 11.36

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	908.2	876.1	32.14	5.69	20.59	5.69	20.59	100.00	19.52
18x30	562.2	448.1	114.10	20.20	14.72	25.89	16.01	94.31	19.46
30x50	592.5	424.9	167.58	29.67	7.77	55.56	11.61	74.11	20.75
50x100	503.7	397.2	106.47	18.85	6.38	74.41	10.28	44.44	29.42
100x200	441.8	391.3	50.49	8.94	13.20	83.35	10.59	25.59	46.40
200x325	393.9	378.6	15.34	2.72	36.53	86.07	11.41	16.65	64.23
-325	85.0	6.4	78.67	13.93	69.63	100.00	19.52	13.93	69.63
Total (Calc)	--	--	564.79	100.00	19.52	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 5 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 4.28

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	439.3	401.2	38.13	8.96	54.02	8.96	54.02	100.00	32.71
18x30	486.6	392.0	94.62	22.24	41.61	31.20	45.18	91.04	30.61
30x50	446.1	354.2	91.94	21.61	18.02	52.81	34.07	68.80	27.06
50x100	481.2	393.0	88.13	20.71	9.79	73.52	27.23	47.19	31.20
100x200	372.7	327.2	45.44	10.68	21.91	84.20	26.55	26.48	47.94
200x325	400.5	386.7	13.82	3.25	47.46	87.45	27.33	15.80	65.53
-325	59.7	6.3	53.41	12.55	70.21	100.00	32.71	12.55	70.21
Total (Calc)	--	--	425.49	100.00	32.71	--	--	--	--

Product P4 Feed Weight (%): 1.30

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	479.8	460.1	19.62	6.05	55.98	6.05	55.98	100.00	36.45
18x30	508.9	442.2	66.79	20.61	47.10	26.66	49.12	93.95	35.19
30x50	491.2	412.5	78.68	24.27	24.05	50.94	37.17	73.34	31.84
50x100	479.3	408.8	70.53	21.76	14.16	72.70	30.28	49.06	35.69
100x200	386.0	349.6	36.33	11.21	30.44	83.91	30.31	27.30	52.85
200x325	397.6	385.9	11.76	3.63	55.07	87.53	31.33	16.09	68.45
-325	46.6	6.2	40.41	12.47	72.35	100.00	36.45	12.47	72.35
Total (Calc)	--	--	324.12	100.00	36.45	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 5 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 1.58

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	885.4	876.1	9.29	2.96	56.77	2.96	56.77	100.00	37.43
18x30	432.9	392.0	41.00	13.08	40.53	16.04	43.53	97.04	36.84
30x50	428.8	354.2	74.60	23.79	22.83	39.83	31.17	83.96	36.26
50x100	474.3	393.0	81.30	25.93	19.65	65.76	26.63	60.17	41.58
100x200	373.3	327.2	46.12	14.71	41.47	80.47	29.34	34.24	58.18
200x325	401.8	386.7	15.06	4.80	60.56	85.28	31.10	19.53	70.77
-325	52.3	6.2	46.16	14.72	74.10	100.00	37.43	14.72	74.10
Total (Calc)	--	--	313.54	100.00	37.43	--	--	--	--

Product P6 Feed Weight (%): 0.29

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	828.3	827.4	0.95	0.41	29.13	0.41	29.13	100.00	50.80
18x30	444.9	442.2	2.76	1.18	28.56	1.58	28.71	99.59	50.89
30x50	435.4	412.5	22.83	9.74	21.48	11.32	22.49	98.42	51.16
50x100	474.0	408.8	65.23	27.83	24.71	39.15	24.07	88.68	54.42
100x200	400.8	349.6	51.14	21.82	52.78	60.97	34.34	60.85	68.00
200x325	406.5	385.9	20.62	8.80	71.74	69.77	39.06	39.03	76.51
-325	77.2	6.4	70.87	30.23	77.90	100.00	50.80	30.23	77.90
Total (Calc)	--	--	234.41	100.00	50.80	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 5 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P7 Feed Weight (%): 14.78

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	478.8	401.2	77.58	10.56	85.42	10.56	85.42	100.00	71.88
18x30	557.1	370.0	187.11	25.46	81.13	36.02	82.39	89.44	70.29
30x50	536.9	336.3	200.62	27.30	73.85	63.32	78.71	63.98	65.97
50x100	454.9	307.8	147.07	20.01	56.73	83.34	73.43	36.68	60.10
100x200	352.1	294.5	57.59	7.84	55.16	91.17	71.86	16.66	64.16
200x325	313.6	298.0	15.57	2.12	63.21	93.29	71.66	8.83	72.16
-325	55.6	6.3	49.29	6.71	74.98	100.00	71.88	6.71	74.98
Total (Calc)	--	--	734.81	100.00	71.88	--	--	--	--

SPIRAL DATA ANALYSIS

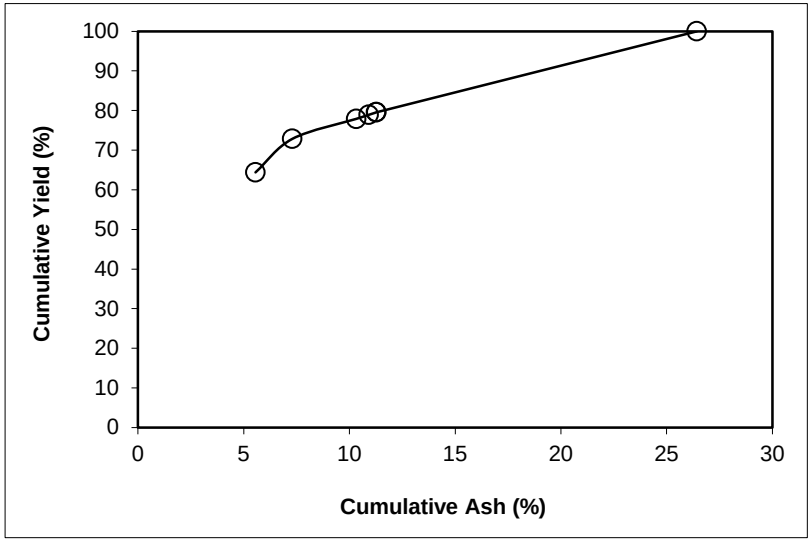
Description: Run 5 - Intermediate Spiral Test

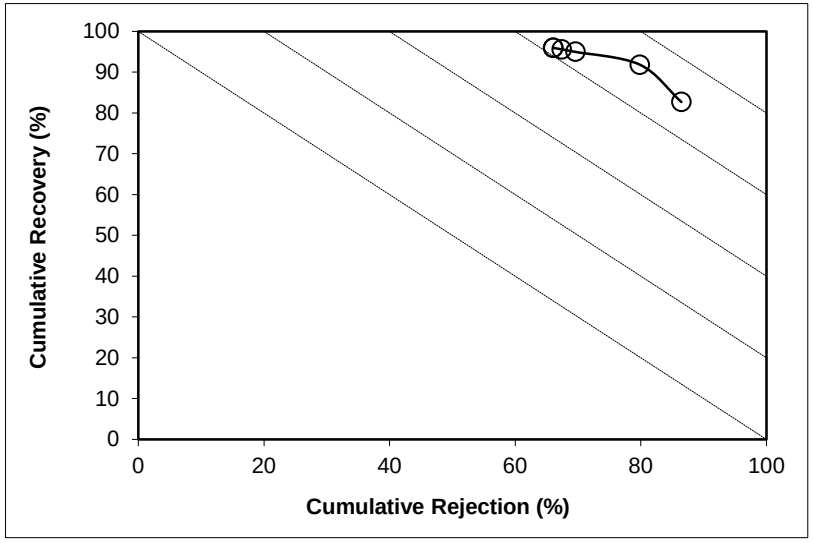
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 7.63

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	64.40	5.56	64.40	5.56	82.68	35.60	64.19	86.46	69.13
P2	8.47	20.59	72.87	7.30	91.82	27.13	77.81	79.86	71.68
P3	5.02	54.02	77.90	10.32	94.96	22.10	83.21	69.59	64.55
P4	1.03	55.98	78.93	10.92	95.58	21.07	84.55	67.40	62.98
P5	0.61	56.77	79.54	11.27	95.94	20.46	85.38	66.09	62.02
P6	0.02	29.13	79.56	11.27	95.95	20.44	85.42	66.07	62.02
P7	20.44	85.42	100.00	26.43	100.00	0.00			
Total (Calc)	100.00	26.43	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

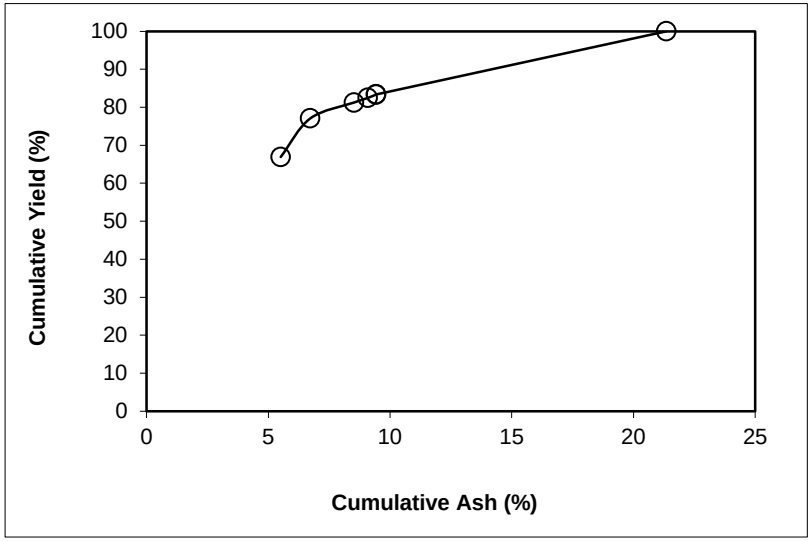
Description: Run 5 - Intermediate Spiral Test

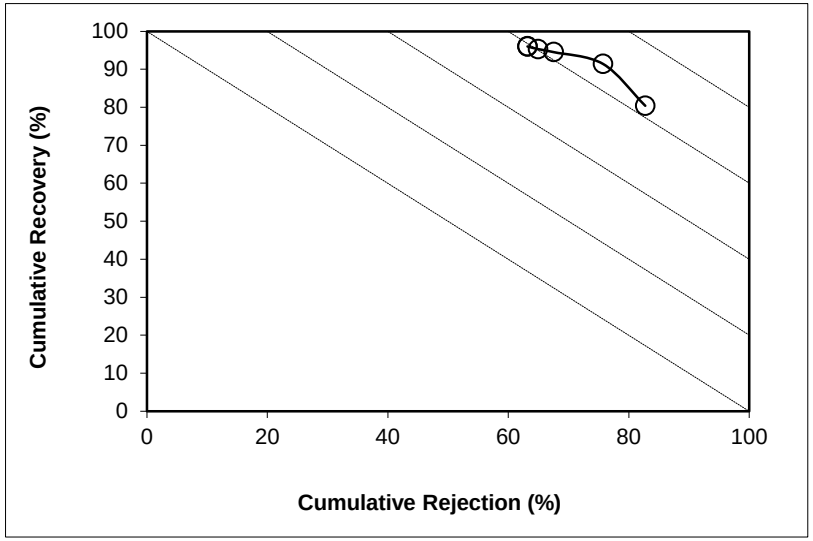
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 22.63

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	66.91	5.51	66.91	5.51	80.39	33.09	53.39	82.73	63.12
P2	10.14	14.72	77.05	6.72	91.39	22.95	70.48	75.74	67.13
P3	4.20	41.61	81.26	8.53	94.51	18.74	76.96	67.55	62.06
P4	1.19	47.10	82.45	9.08	95.31	17.55	78.98	64.93	60.24
P5	0.91	40.53	83.36	9.43	96.00	16.64	81.08	63.20	59.20
P6	0.02	28.56	83.37	9.43	96.01	16.63	81.13	63.18	59.19
P7	16.63	81.13	100.00	21.35	100.00	0.00			
Total (Calc)	100.00	21.35	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

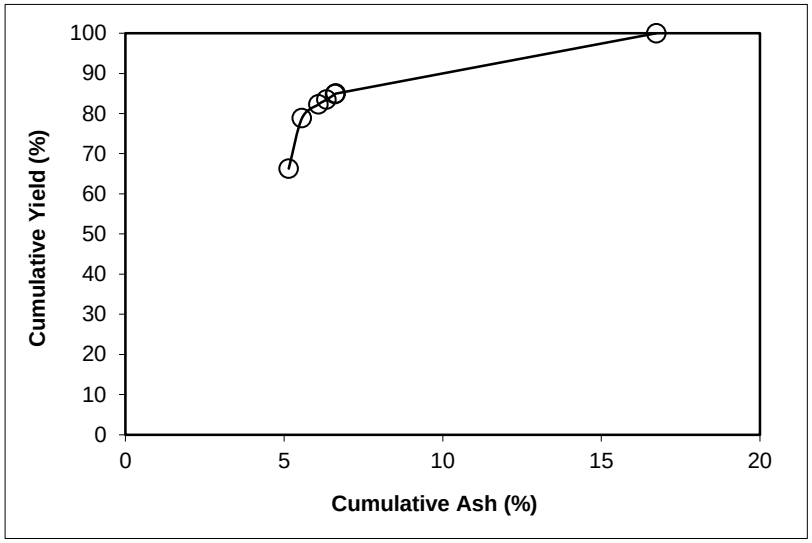
Description: Run 5 - Intermediate Spiral Test

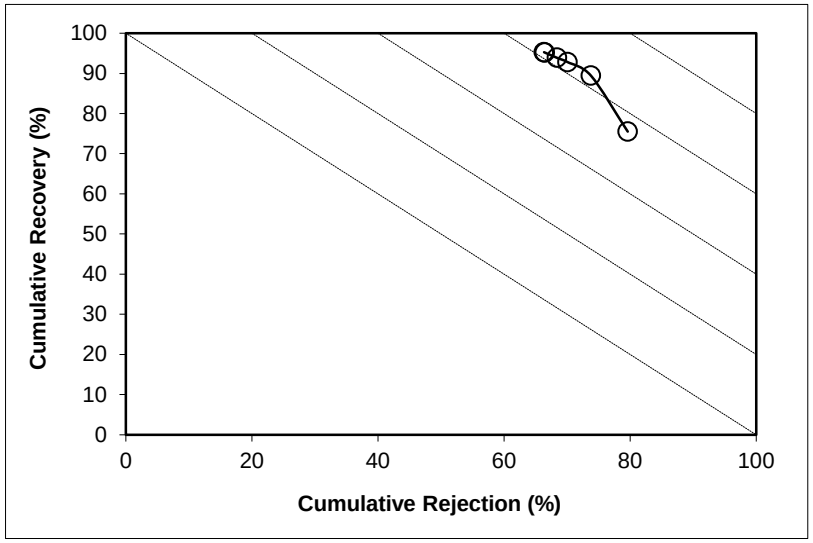
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 26.84

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	66.28	5.14	66.28	5.14	75.51	33.72	39.51	79.62	55.13
P2	12.56	7.77	78.84	5.56	89.42	21.16	58.35	73.79	63.21
P3	3.44	18.02	82.28	6.08	92.81	17.72	66.19	70.08	62.89
P4	1.18	24.05	83.46	6.34	93.88	16.54	69.20	68.39	62.27
P5	1.40	22.83	84.86	6.61	95.18	15.14	73.48	66.48	61.66
P6	0.11	21.48	84.97	6.63	95.28	15.03	73.85	66.35	61.62
P7	15.03	73.85	100.00	16.73	100.00	0.00			
Total (Calc)	100.00	16.73	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

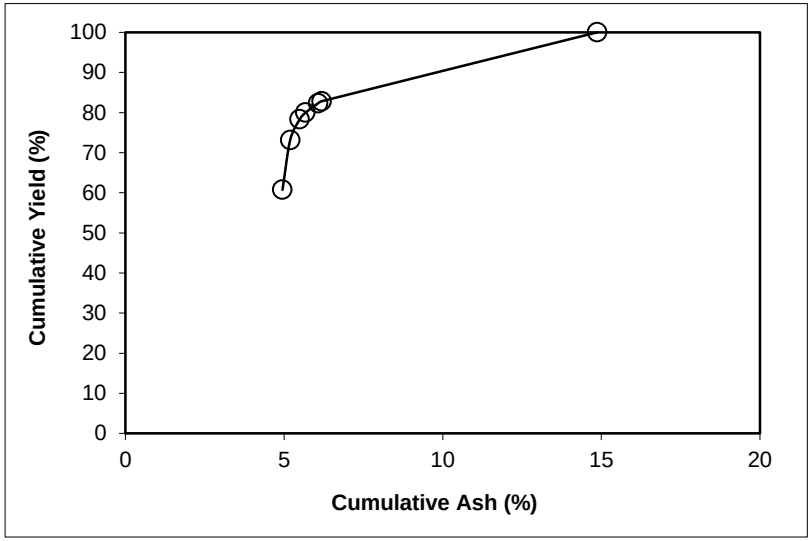
Description: Run 5 - Intermediate Spiral Test

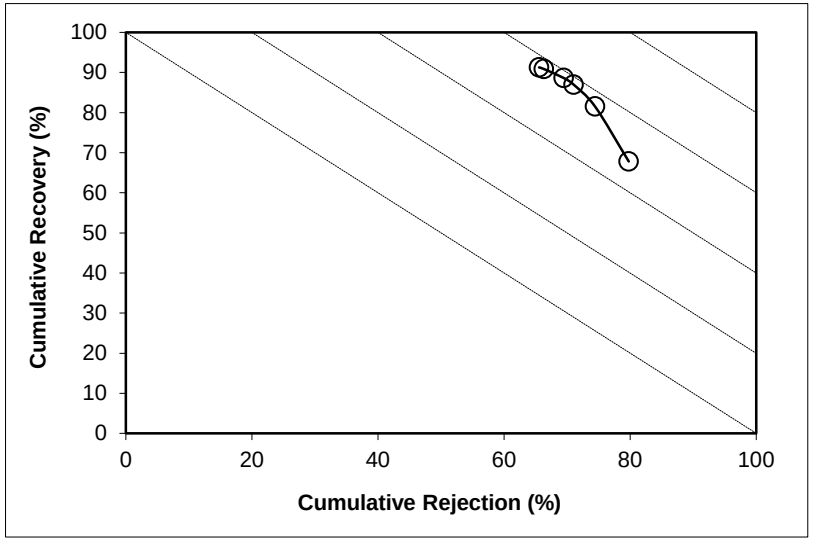
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 17.22

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	60.74	4.95	60.74	4.95	67.82	39.26	30.21	79.78	47.60
P2	12.44	6.38	73.18	5.19	81.49	26.82	41.25	74.44	55.94
P3	5.15	9.79	78.32	5.49	86.95	21.68	48.73	71.06	58.00
P4	1.65	14.16	79.97	5.67	88.61	20.03	51.57	69.49	58.09
P5	2.37	19.65	82.35	6.07	90.85	17.65	55.86	66.35	57.19
P6	0.48	24.71	82.82	6.18	91.27	17.18	56.73	65.56	56.82
P7	17.18	56.73	100.00	14.86	100.00	0.00			
Total (Calc)	100.00	14.86	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

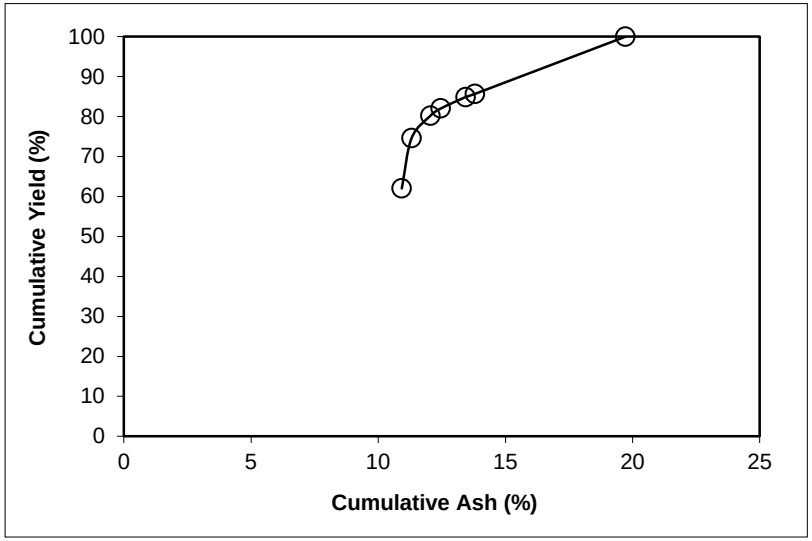
Description: Run 5 - Intermediate Spiral Test

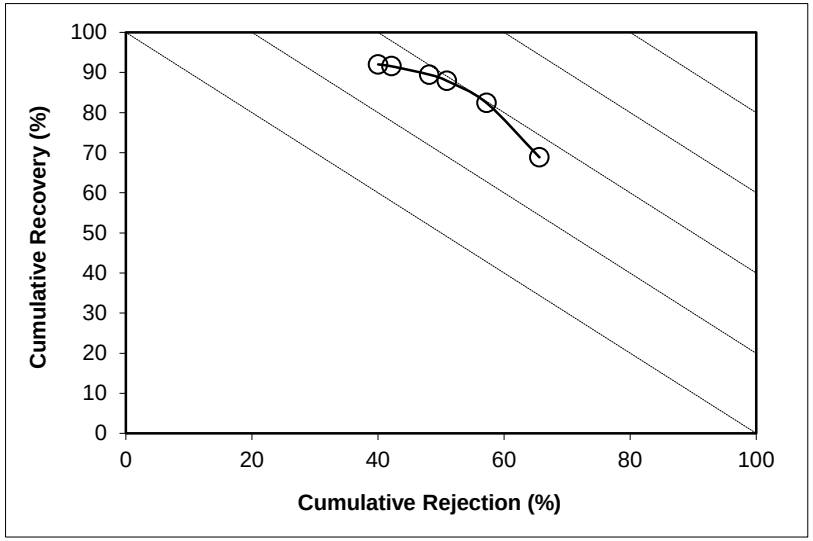
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 8.10

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	62.05	10.93	62.05	10.93	68.84	37.95	34.09	65.62	34.46
P2	12.54	13.20	74.59	11.31	82.40	25.41	44.40	57.22	39.62
P3	5.64	21.91	80.23	12.05	87.89	19.77	50.82	50.95	38.84
P4	1.80	30.44	82.04	12.46	89.45	17.96	52.87	48.16	37.62
P5	2.86	41.47	84.90	13.44	91.54	15.10	55.03	42.14	33.68
P6	0.79	52.78	85.69	13.80	92.01	14.31	55.16	40.02	32.03
P7	14.31	55.16	100.00	19.72	100.00	0.00			
Total (Calc)	100.00	19.72	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

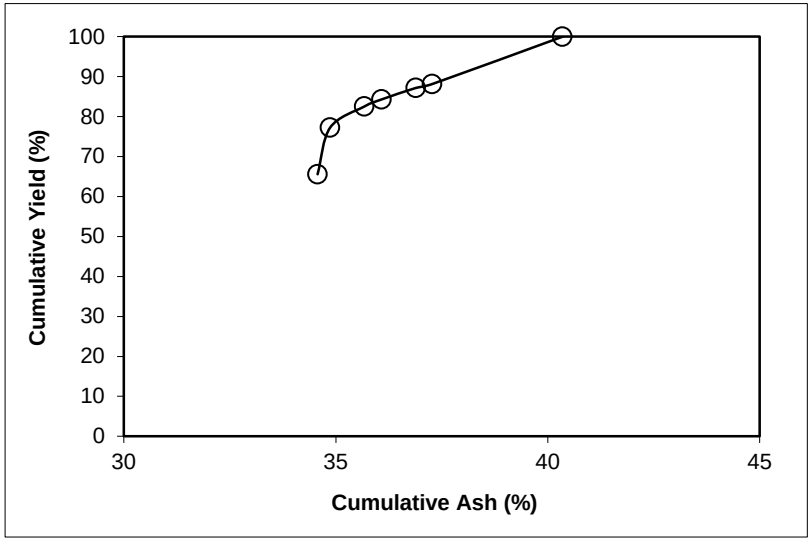
Description: Run 5 - Intermediate Spiral Test

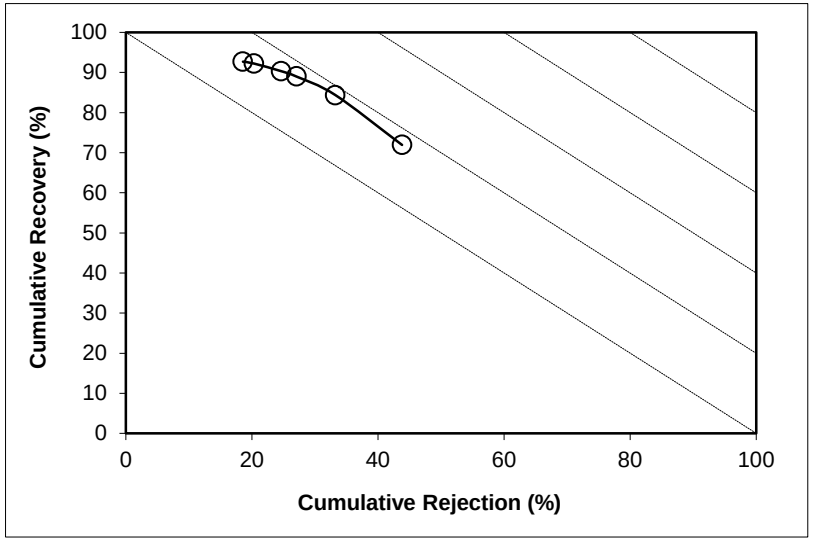
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 2.64

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	65.58	34.57	65.58	34.57	71.93	34.42	51.35	43.81	15.74
P2	11.67	36.53	77.26	34.87	84.35	22.74	58.96	33.24	17.59
P3	5.26	47.46	82.52	35.67	88.99	17.48	62.42	27.05	16.04
P4	1.79	55.07	84.31	36.08	90.33	15.69	63.26	24.61	14.94
P5	2.87	60.56	87.17	36.88	92.23	12.83	63.87	20.31	12.54
P6	0.98	71.74	88.15	37.27	92.69	11.85	63.21	18.56	11.26
P7	11.85	63.21	100.00	40.35	100.00	0.00			
Total (Calc)	100.00	40.35	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

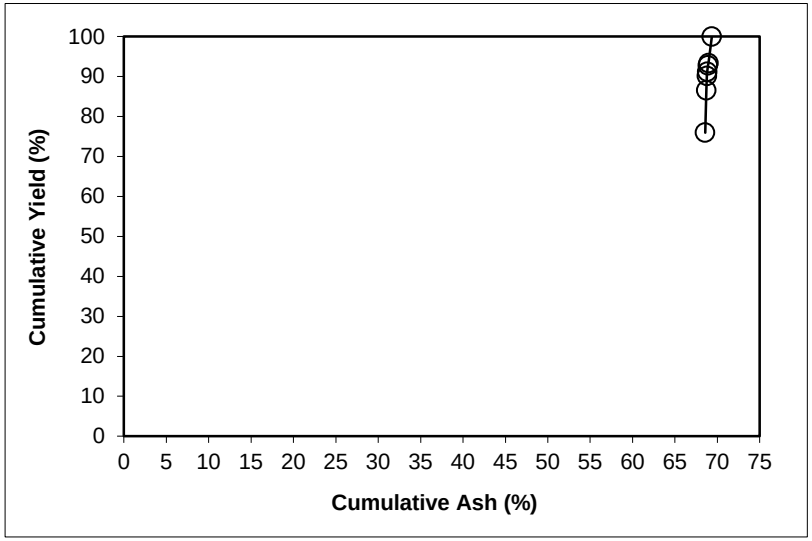
Description: Run 5 - Intermediate Spiral Test

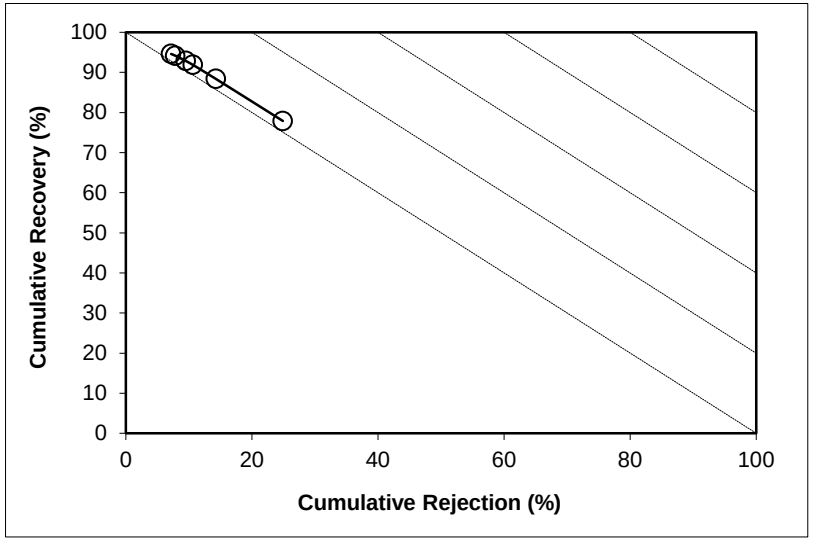
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 14.95

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	75.96	68.57	75.96	68.57	77.89	24.04	71.81	24.89	2.78
P2	10.58	69.63	86.54	68.70	88.38	13.46	73.52	14.27	2.64
P3	3.59	70.21	90.14	68.76	91.87	9.86	74.73	10.63	2.50
P4	1.09	72.35	91.22	68.80	92.85	8.78	75.02	9.50	2.34
P5	1.55	74.10	92.77	68.89	94.16	7.23	75.22	7.84	2.00
P6	0.60	77.90	93.37	68.95	94.59	6.63	74.98	7.17	1.76
P7	6.63	74.98	100.00	69.35	100.00	0.00			
Total (Calc)	100.00	69.35	--	--	--	--	--	--	--





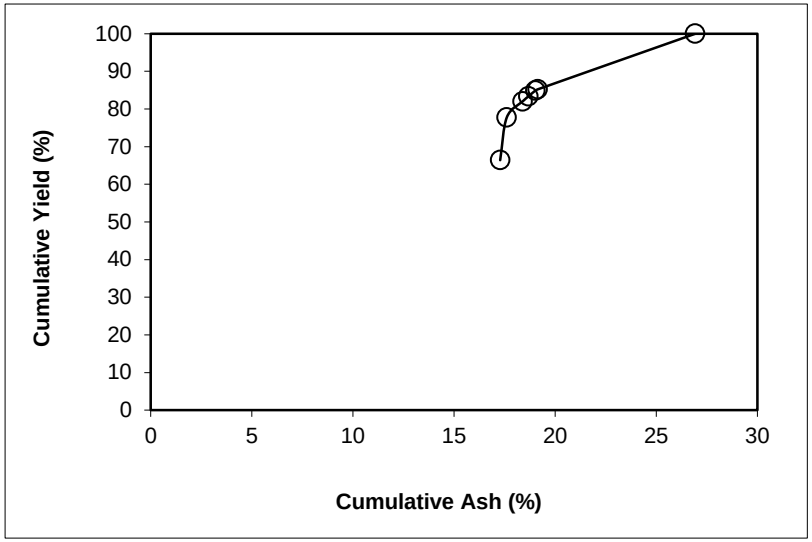
SPIRAL DATA ANALYSIS

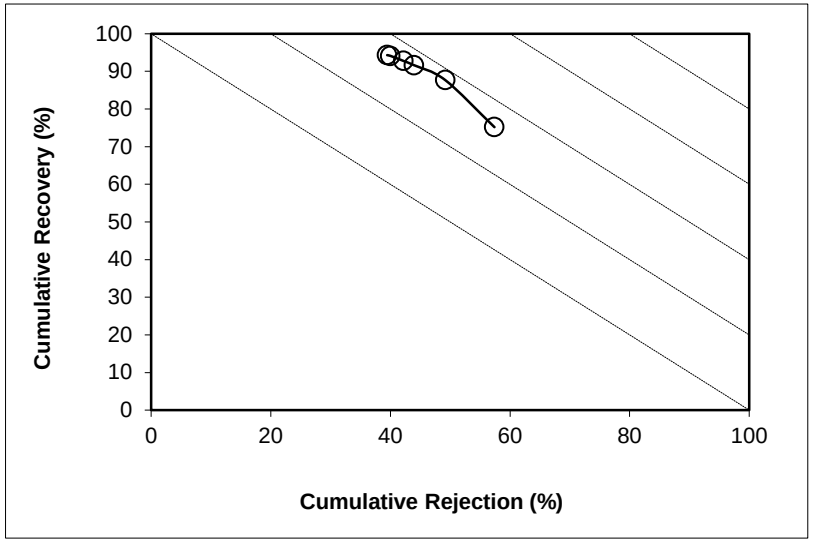
Description: Run 5 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	66.41	17.28	66.41	17.28	75.19	33.59	46.01	57.39	32.57
P2	11.36	19.52	77.77	17.60	87.69	22.23	59.54	49.15	36.85
P3	4.28	32.71	82.05	18.39	91.63	17.95	65.94	43.96	35.59
P4	1.30	36.45	83.35	18.67	92.77	16.65	68.25	42.19	34.96
P5	1.58	37.43	84.93	19.02	94.12	15.07	71.47	40.00	34.12
P6	0.29	50.80	85.22	19.13	94.31	14.78	71.88	39.45	33.76
P7	14.78	71.88	100.00	26.93	100.00	0.00			
Total (Calc)	100.00	26.93	--	--	--	--	--	--	--

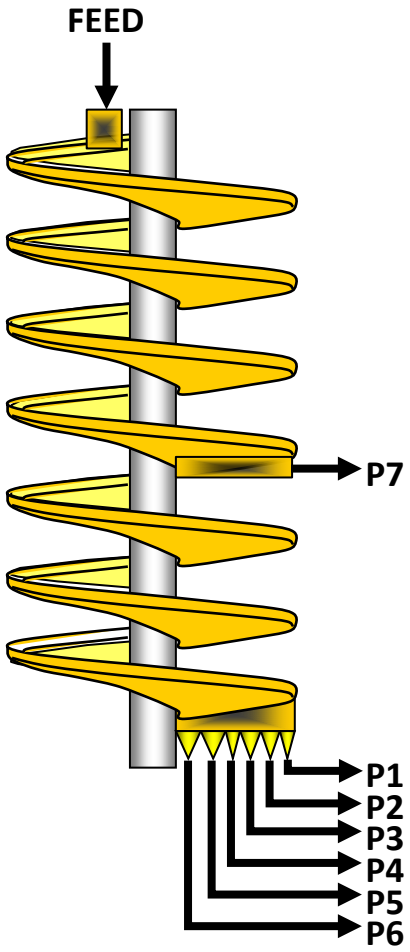




SPIRAL DATA ANALYSIS

Description: Run 6 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	1.131	28.7	11.25	14.49
P2	0.353	30.4	3.23	4.24
P3	0.149	32.6	1.24	1.63
P4	0.055	36.9	0.38	0.51
P5	0.059	31.8	0.51	0.66
P6	0.010	19.1	0.16	0.19
P7	0.317	31.3	2.79	3.39
Total	2.075	29.8	19.55	25.11

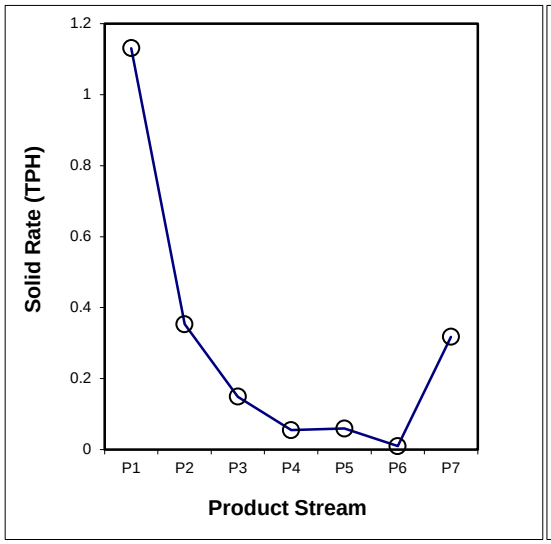
SPIRAL DATA ANALYSIS

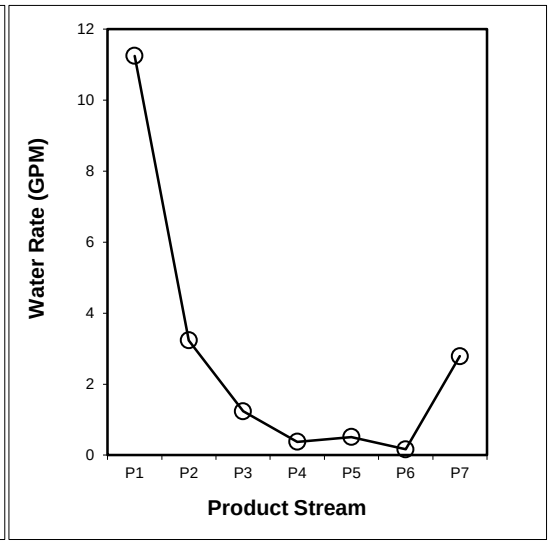
Description: Run 6 - Intermediate Spiral Test

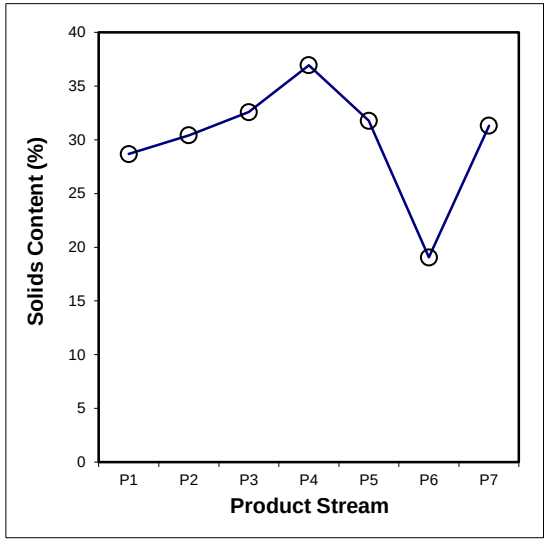
Comments: 1 x 0.15 mm Nominal Particle Size

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	5	5879.00	833.19	3.943	3932.7	2506.8	1.131	54.50	28.68
P2	5	1580.45	95.28	1.161	3132.1	2686.8	0.353	17.02	30.41
P3	10	1264.37	92.57	0.458	3111.7	2735.2	0.149	7.19	32.57
P4	20	854.92	93.02	0.149	3110.3	2832.7	0.055	2.65	36.94
P5	15	810.32	93.78	0.187	2238.8	2014.2	0.059	2.86	31.77
P6	80	1135.18	93.19	0.051	2702.4	2506.7	0.010	0.47	19.05
P7	5	1388.17	94.21	1.014	3281.6	2881.3	0.317	15.30	31.31
Total (Calc)	--	--	--	6.963	--	--	2.075	100.00	29.79
Total (Head)	0.45	891.53	96.29	6.963	2743.4	2506.5	2.075	--	29.79







SPIRAL DATA ANALYSIS

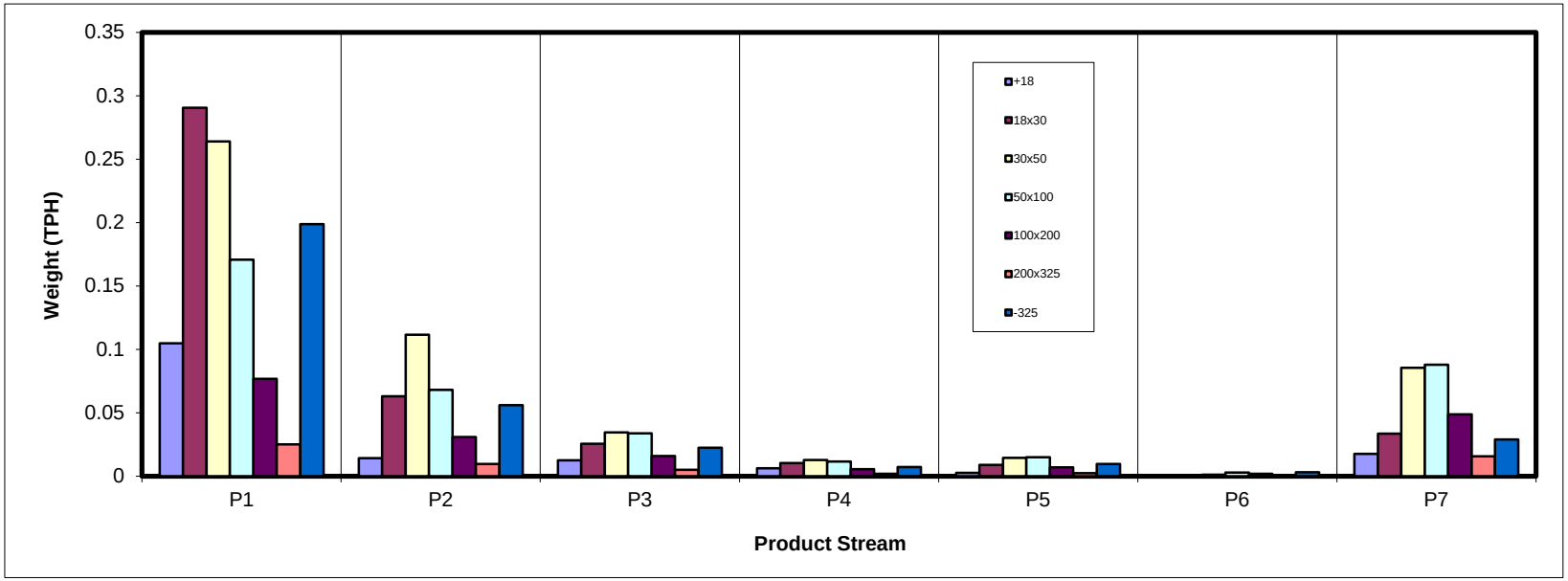
Description: Run 6 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.105	0.014	0.012	0.006	0.002	0.000	0.018		0.158
18x30	0.291	0.063	0.026	0.010	0.009	0.000	0.033		0.432
30x50	0.264	0.112	0.034	0.013	0.014	0.001	0.085		0.524
50x100	0.171	0.068	0.034	0.012	0.015	0.003	0.088		0.390
100x200	0.077	0.031	0.016	0.005	0.007	0.002	0.049		0.186
200x325	0.025	0.009	0.005	0.002	0.002	0.001	0.016		0.060
-325	0.199	0.056	0.022	0.007	0.010	0.003	0.029		0.326
Total (Calc)	1.131	0.353	0.149	0.055	0.059	0.010	0.317		2.075



SPIRAL DATA ANALYSIS

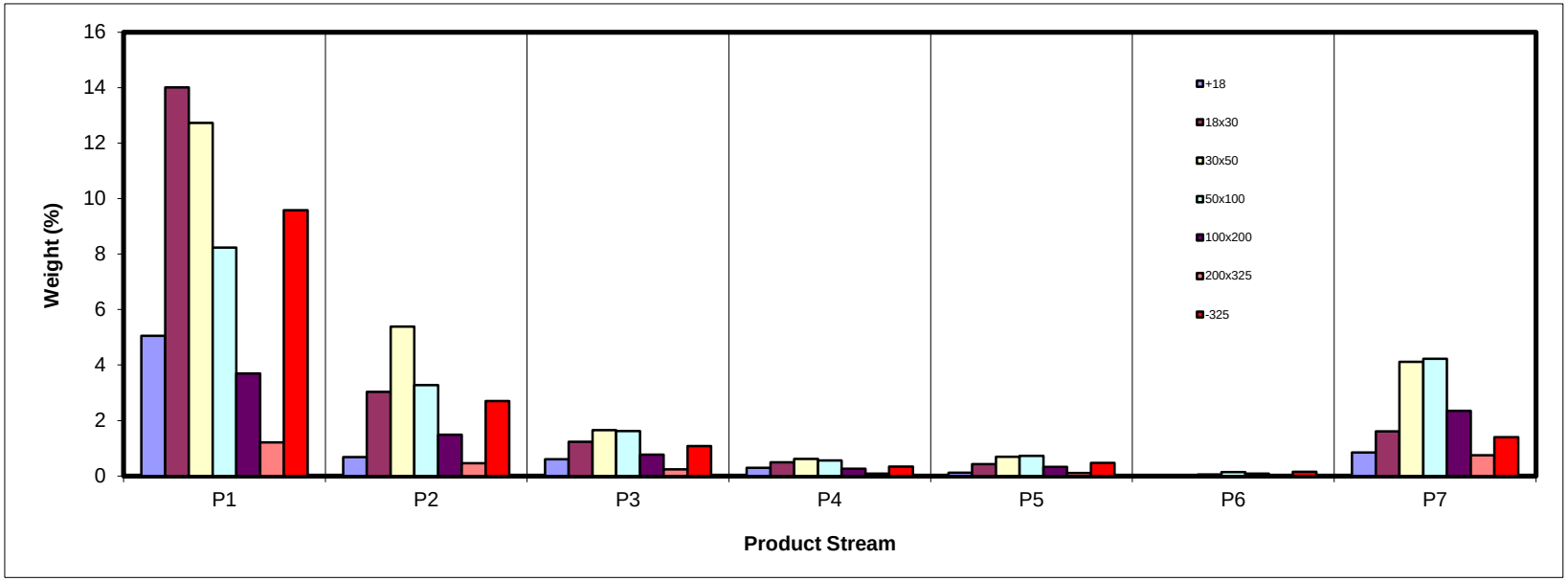
Description: Run 6 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	5.05	0.68	0.60	0.29	0.12	0.00	0.85		7.60
18x30	14.01	3.03	1.23	0.50	0.43	0.01	1.61		20.81
30x50	12.73	5.38	1.66	0.62	0.69	0.05	4.12		25.24
50x100	8.23	3.28	1.62	0.55	0.72	0.14	4.23		18.78
100x200	3.70	1.49	0.77	0.26	0.33	0.08	2.35		8.98
200x325	1.21	0.46	0.24	0.09	0.11	0.03	0.75		2.88
-325	9.58	2.70	1.08	0.34	0.47	0.15	1.39		15.71
Total (Calc)	54.50	17.02	7.19	2.65	2.86	0.47	15.30		100.00



SPIRAL DATA ANALYSIS

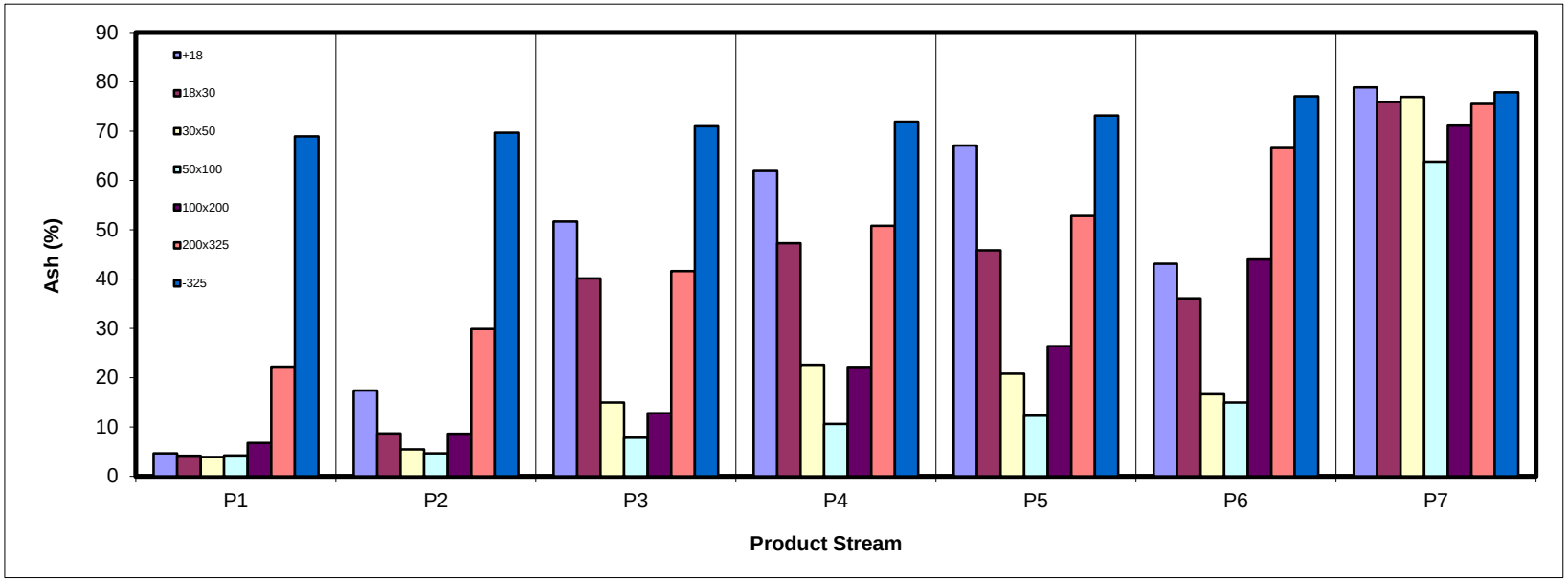
Description: Run 6 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	4.64	17.37	51.64	61.91	67.03	43.06	78.85		21.00
18x30	4.15	8.68	40.08	47.23	45.80	36.05	75.86		14.38
30x50	3.88	5.44	14.93	22.58	20.76	16.66	76.94		17.80
50x100	4.22	4.63	7.80	10.59	12.30	14.98	63.77		18.59
100x200	6.78	8.64	12.78	22.17	26.36	43.97	71.09		25.97
200x325	22.24	29.89	41.58	50.81	52.77	66.54	75.52		41.42
-325	68.93	69.63	70.97	71.90	73.12	77.03	77.84		70.25
Total (Calc)	16.11	17.45	29.73	36.30	34.66	44.32	72.40		27.13



SPIRAL DATA ANALYSIS

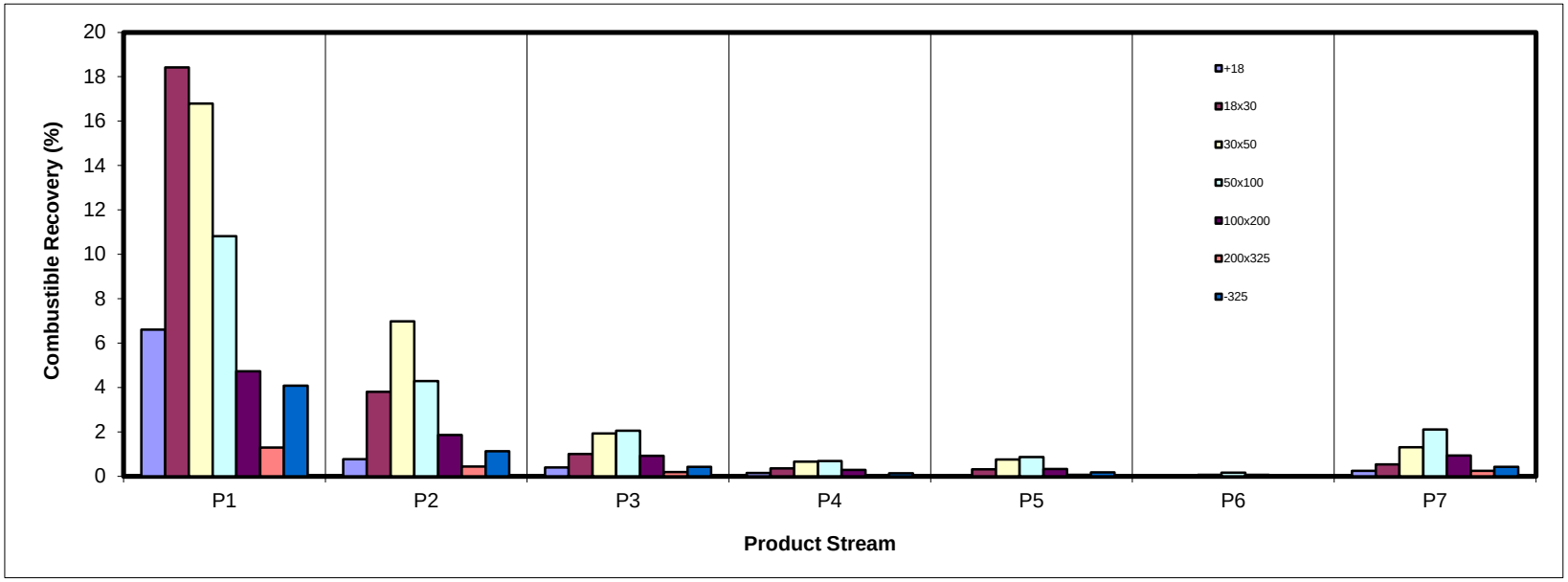
Description: Run 6 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	6.61	0.78	0.40	0.15	0.05	0.00	0.25		8.24
18x30	18.42	3.80	1.01	0.36	0.32	0.01	0.53		24.45
30x50	16.79	6.98	1.93	0.65	0.75	0.06	1.30		28.48
50x100	10.82	4.29	2.05	0.68	0.87	0.16	2.10		20.98
100x200	4.73	1.87	0.92	0.28	0.33	0.07	0.93		9.12
200x325	1.29	0.44	0.19	0.06	0.07	0.01	0.25		2.32
-325	4.09	1.12	0.43	0.13	0.17	0.05	0.42		6.41
Total (Calc)	62.74	19.28	6.94	2.32	2.57	0.36	5.80		100.00



SPIRAL DATA ANALYSIS

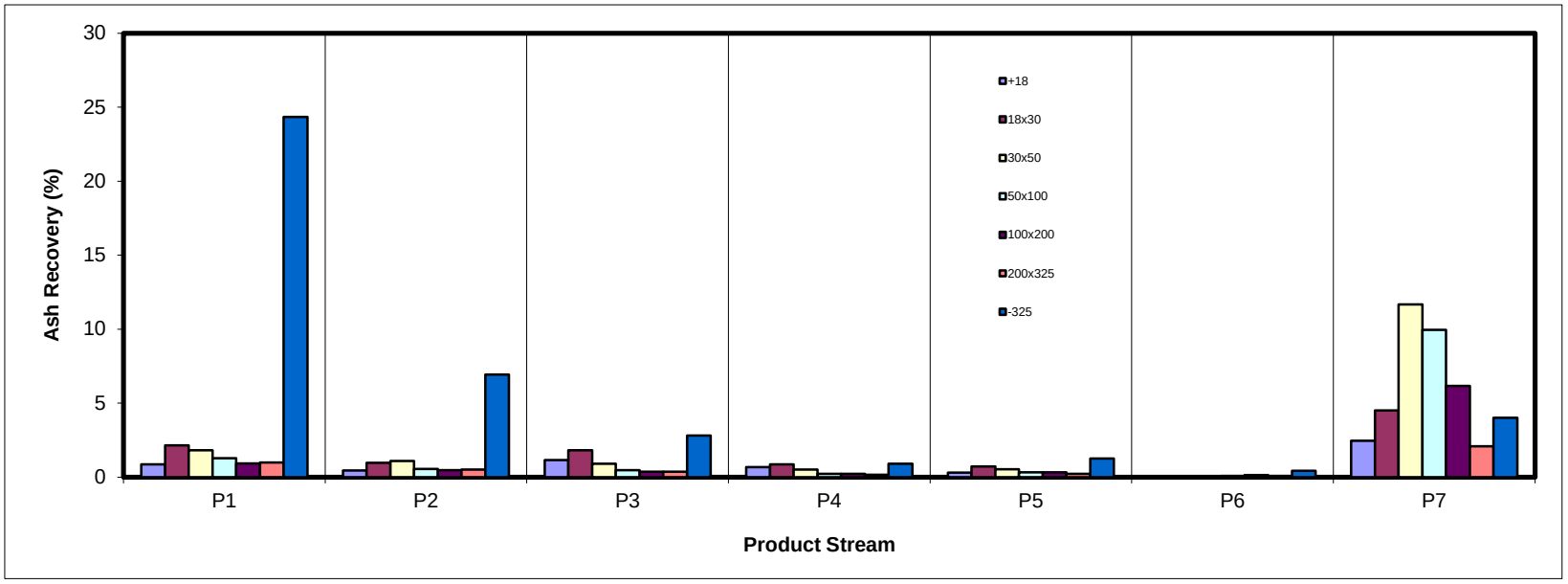
Description: Run 6 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.86	0.44	1.14	0.67	0.29	0.00	2.47		5.88
18x30	2.14	0.97	1.82	0.87	0.72	0.01	4.50		11.03
30x50	1.82	1.08	0.91	0.51	0.53	0.03	11.67		16.56
50x100	1.28	0.56	0.47	0.22	0.33	0.08	9.94		12.87
100x200	0.92	0.47	0.36	0.21	0.32	0.14	6.16		8.59
200x325	0.99	0.50	0.37	0.16	0.21	0.07	2.09		4.40
-325	24.34	6.92	2.82	0.91	1.25	0.43	4.00		40.67
Total (Calc)	32.36	10.95	7.88	3.55	3.65	0.76	40.84		100.00



SPIRAL DATA ANALYSIS

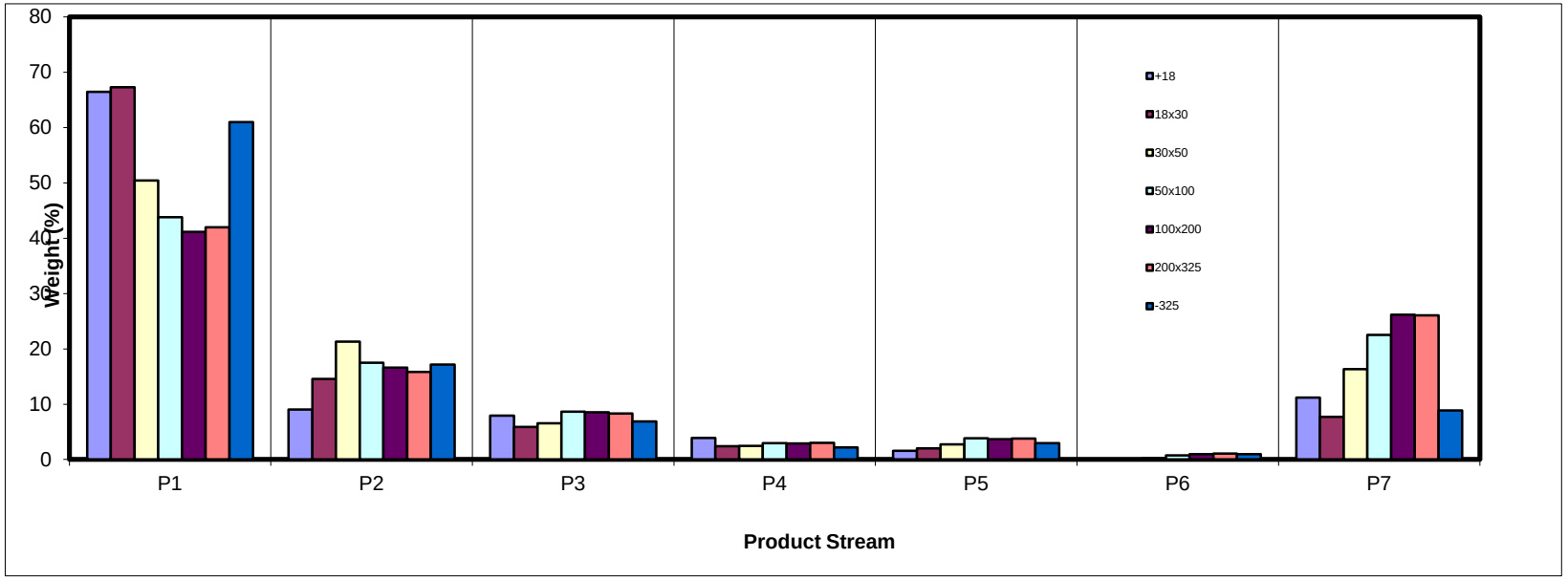
Description: Run 6 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	66.45	9.01	7.91	3.87	1.57	0.02	11.17		100.00
18x30	67.31	14.57	5.91	2.39	2.04	0.05	7.74		100.00
30x50	50.42	21.31	6.56	2.44	2.75	0.21	16.31		100.00
50x100	43.83	17.47	8.65	2.95	3.84	0.73	22.53		100.00
100x200	41.16	16.58	8.54	2.92	3.66	0.95	26.19		100.00
200x325	41.98	15.83	8.31	3.01	3.76	1.05	26.07		100.00
-325	60.99	17.18	6.86	2.18	2.96	0.96	8.87		100.00
Total (Calc)	54.50	17.02	7.19	2.65	2.86	0.47	15.30		100.00



SPIRAL DATA ANALYSIS

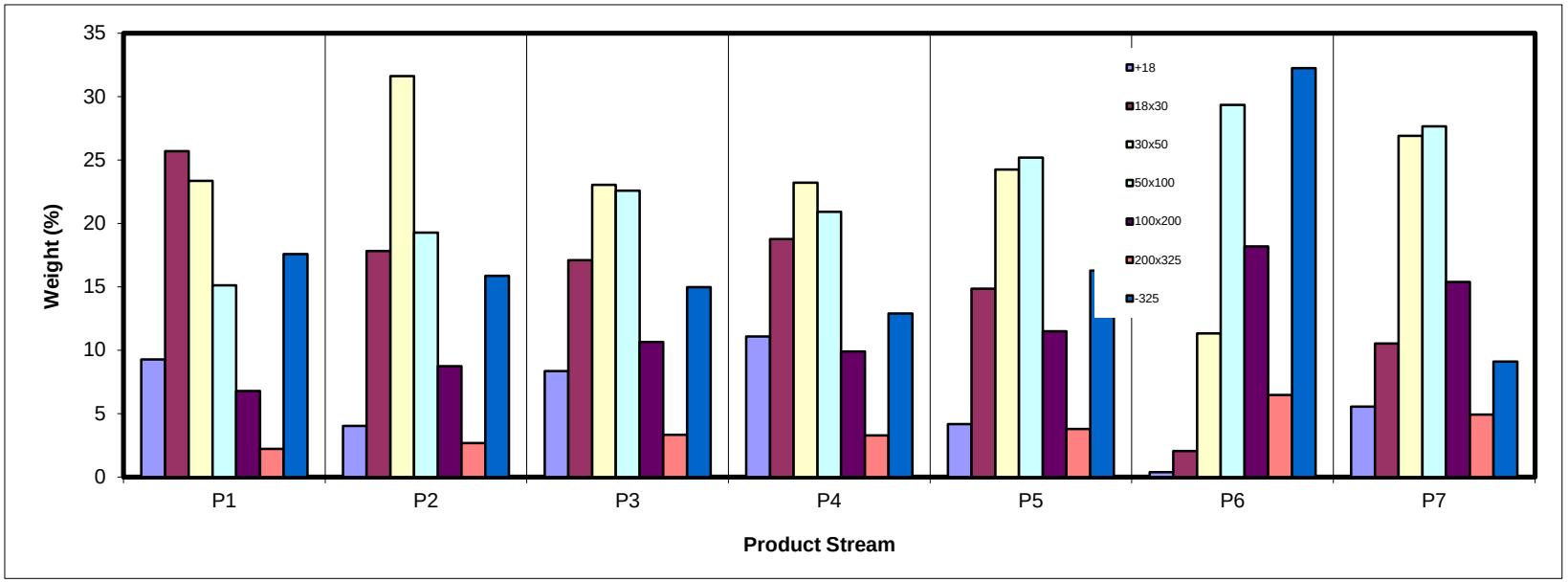
Description: Run 6 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	9.26	4.02	8.36	11.09	4.17	0.38	5.54		7.60
18x30	25.70	17.82	17.09	18.76	14.86	2.05	10.52		20.81
30x50	23.35	31.61	23.03	23.20	24.24	11.32	26.90		25.24
50x100	15.10	19.27	22.57	20.90	25.18	29.34	27.65		18.78
100x200	6.78	8.75	10.65	9.90	11.48	18.18	15.37		8.98
200x325	2.22	2.68	3.33	3.27	3.79	6.47	4.91		2.88
-325	17.58	15.85	14.97	12.90	16.27	32.24	9.11		15.71
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

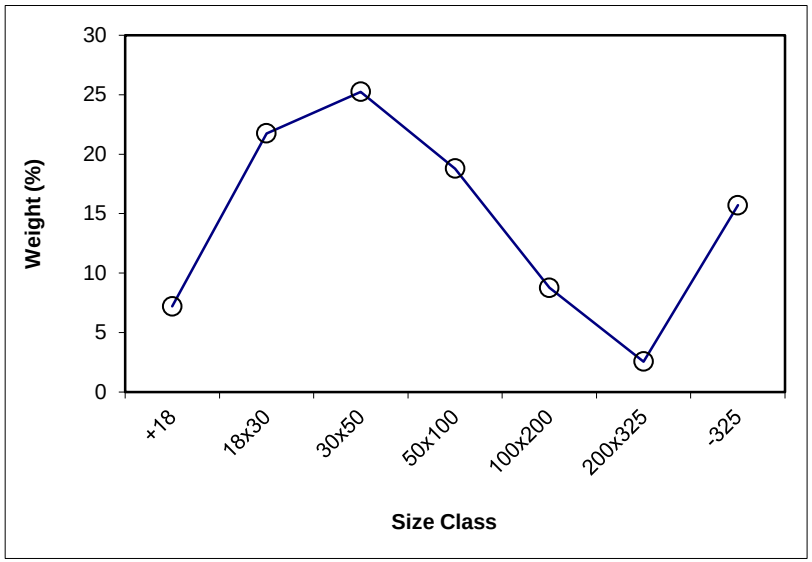
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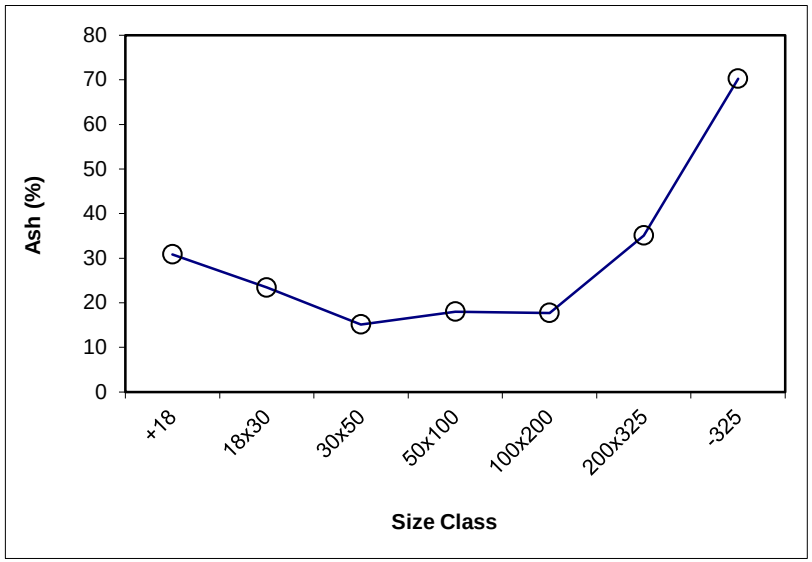
Comments: 1 x 0.15 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	477.2	460.1	17.06	7.20	30.85	7.20	30.85	100.00	28.00
18x30	499.7	448.1	51.53	21.75	23.42	28.95	25.27	92.80	27.78
30x50	484.7	424.9	59.81	25.24	15.15	54.19	20.56	71.05	29.12
50x100	441.7	397.2	44.49	18.78	17.99	72.97	19.90	45.81	36.81
100x200	412.1	391.3	20.76	8.76	17.72	81.74	19.66	27.03	49.89
200x325	384.7	378.6	6.06	2.56	35.08	84.29	20.13	18.26	65.33
-325	43.4	6.1	37.22	15.71	70.25	100.00	28.00	15.71	70.25
Total (Calc)	--	--	236.94	100.00	28.00	--	--	--	--





SPIRAL DATA ANALYSIS

Description: Run 6 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 54.50

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	592.24	460.1	132.10	9.26	4.64	9.26	4.64	100.00	16.11
18x30	814.62	448.1	366.49	25.70	4.15	34.97	4.28	90.74	17.28
30x50	757.89	424.9	332.99	23.35	3.88	58.32	4.12	65.03	22.47
50x100	612.58	397.2	215.35	15.10	4.22	73.42	4.14	41.68	32.89
100x200	488.02	391.3	96.68	6.78	6.78	80.20	4.37	26.58	49.18
200x325	410.26	378.6	31.66	2.22	22.24	82.42	4.85	19.80	63.69
-325	257.09	6.4	250.67	17.58	68.93	100.00	16.11	17.58	68.93
Total (Calc)	--	--	1425.93	100.00	16.11	--	--	--	--

Product P2 Feed Weight (%): 17.02

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	845.3	827.4	17.91	4.02	17.37	4.02	17.37	100.00	17.45
18x30	471.3	392.0	79.34	17.82	8.68	21.84	10.29	95.98	17.46
30x50	494.9	354.2	140.77	31.61	5.44	53.45	7.42	78.16	19.46
50x100	478.9	393.0	85.83	19.27	4.63	72.72	6.68	46.55	28.97
100x200	366.2	327.2	38.95	8.75	8.64	81.47	6.89	27.28	46.17
200x325	398.6	386.7	11.94	2.68	29.89	84.15	7.62	18.53	63.88
-325	76.9	6.3	70.59	15.85	69.63	100.00	17.45	15.85	69.63
Total (Calc)	--	--	445.35	100.00	17.45	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 6 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 7.19

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	907.5	876.1	31.46	8.36	51.64	8.36	51.64	100.00	29.73
18x30	456.3	392.0	64.35	17.09	40.08	25.45	43.87	91.64	27.73
30x50	440.9	354.2	86.71	23.03	14.93	48.48	30.12	74.55	24.91
50x100	478.0	393.0	84.99	22.57	7.80	71.05	23.03	51.52	29.36
100x200	367.3	327.2	40.11	10.65	12.78	81.70	21.70	28.95	46.18
200x325	399.2	386.7	12.53	3.33	41.58	85.03	22.47	18.30	65.62
-325	62.5	6.1	56.35	14.97	70.97	100.00	29.73	14.97	70.97
Total (Calc)	--	--	376.49	100.00	29.73	--	--	--	--

Product P4 Feed Weight (%): 2.65

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	858.2	827.4	30.79	11.09	61.91	11.09	61.91	100.00	36.30
18x30	494.2	442.2	52.08	18.76	47.23	29.84	52.69	88.91	33.11
30x50	476.9	412.5	64.41	23.20	22.58	53.04	39.52	70.16	29.33
50x100	466.8	408.8	58.04	20.90	10.59	73.94	31.34	46.96	32.66
100x200	377.1	349.6	27.48	9.90	22.17	83.84	30.26	26.06	50.37
200x325	394.9	385.9	9.07	3.27	50.81	87.10	31.03	16.16	67.64
-325	42.1	6.3	35.81	12.90	71.90	100.00	36.30	12.90	71.90
Total (Calc)	--	--	277.68	100.00	36.30	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 6 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 2.86

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	410.6	401.2	9.36	4.17	67.03	4.17	67.03	100.00	34.66
18x30	403.4	370.0	33.36	14.86	45.80	19.03	50.45	95.83	33.25
30x50	390.7	336.3	54.43	24.24	20.76	43.27	33.82	80.97	30.94
50x100	364.4	307.8	56.55	25.18	12.30	68.45	25.90	56.73	35.30
100x200	320.3	294.5	25.78	11.48	26.36	79.93	25.97	31.55	53.65
200x325	306.5	298.0	8.52	3.79	52.77	83.73	27.18	20.07	69.27
-325	43.0	6.4	36.54	16.27	73.12	100.00	34.66	16.27	73.12
Total (Calc)	--	--	224.53	100.00	34.66	--	--	--	--

Product P6 Feed Weight (%): 0.47

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	460.9	460.1	0.75	0.38	43.06	0.38	43.06	100.00	44.32
18x30	452.1	448.1	4.02	2.05	36.05	2.44	37.16	99.62	44.33
30x50	447.1	424.9	22.15	11.32	16.66	13.76	20.29	97.56	44.50
50x100	454.6	397.2	57.41	29.34	14.98	43.11	16.68	86.24	48.16
100x200	426.9	391.3	35.57	18.18	43.97	61.29	24.77	56.89	65.27
200x325	391.3	378.6	12.66	6.47	66.54	67.76	28.76	38.71	75.27
-325	69.5	6.4	63.07	32.24	77.03	100.00	44.32	32.24	77.03
Total (Calc)	--	--	195.64	100.00	44.32	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 6 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 15.30

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	898.3	876.1	22.20	5.54	78.85	5.54	78.85	100.00	72.40
18x30	484.3	442.2	42.12	10.52	75.86	16.06	76.89	94.46	72.02
30x50	520.3	412.5	107.72	26.90	76.94	42.97	76.92	83.94	71.54
50x100	519.4	408.8	110.69	27.65	63.77	70.61	71.77	57.03	69.00
100x200	411.2	349.6	61.53	15.37	71.09	85.98	71.65	29.39	73.92
200x325	405.5	385.9	19.66	4.91	75.52	90.89	71.86	14.02	77.03
-325	42.7	6.2	36.47	9.11	77.84	100.00	72.40	9.11	77.84
Total (Calc)	--	--	400.40	100.00	72.40	--	--	--	--

SPIRAL DATA ANALYSIS

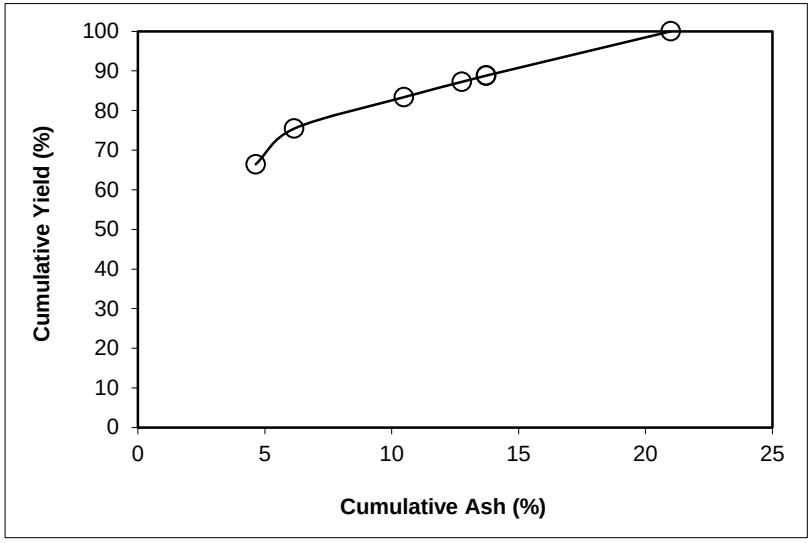
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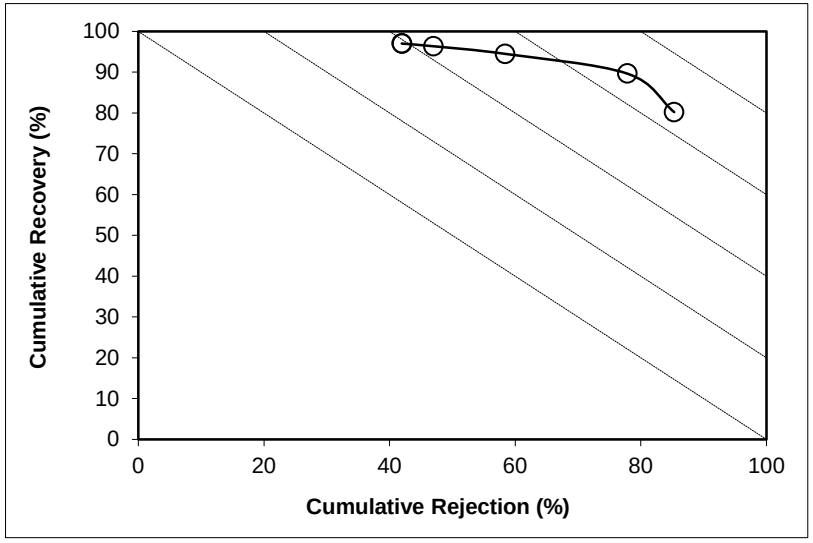
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 7.60

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	66.45	4.64	66.45	4.64	80.20	33.55	53.39	85.31	65.52
P2	9.01	17.37	75.46	6.16	89.63	24.54	66.62	77.86	67.49
P3	7.91	51.64	83.37	10.48	94.47	16.63	73.74	58.40	52.87
P4	3.87	61.91	87.24	12.76	96.34	12.76	77.33	46.98	43.32
P5	1.57	67.03	88.81	13.72	96.99	11.19	78.78	41.98	38.97
P6	0.02	43.06	88.83	13.73	97.01	11.17	78.85	41.93	38.94
P7	11.17	78.85	100.00	21.00	100.00	0.00			
Total (Calc)	100.00	21.00	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

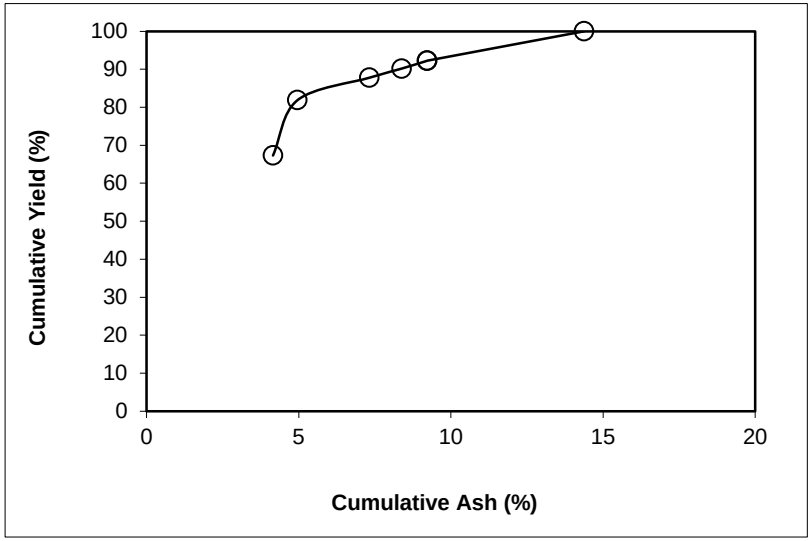
Description: Run 6 - Intermediate Spiral Test

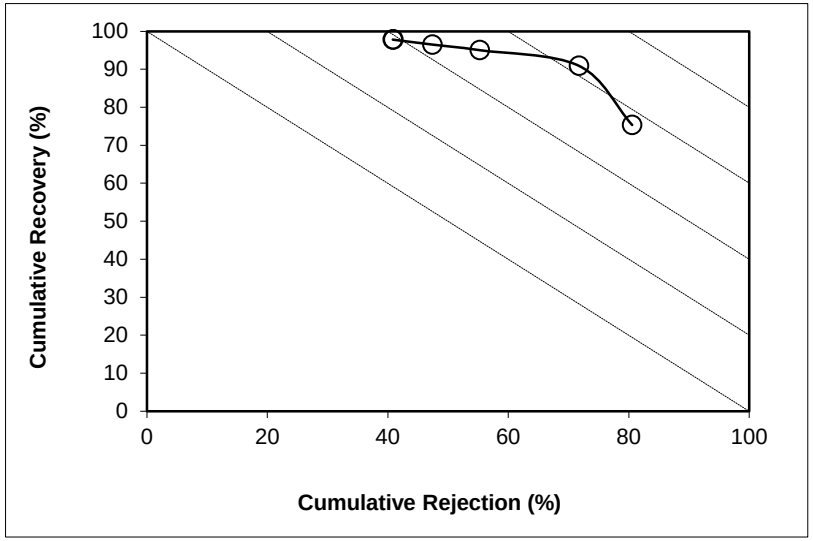
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 20.81

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	67.31	4.15	67.31	4.15	75.34	32.69	35.43	80.55	55.90
P2	14.57	8.68	81.88	4.96	90.88	18.12	56.93	71.75	62.64
P3	5.91	40.08	87.79	7.32	95.02	12.21	65.08	55.28	50.30
P4	2.39	47.23	90.18	8.38	96.49	9.82	69.42	47.43	43.92
P5	2.04	45.80	92.22	9.21	97.78	7.78	75.62	40.92	38.71
P6	0.05	36.05	92.26	9.22	97.82	7.74	75.86	40.81	38.63
P7	7.74	75.86	100.00	14.38	100.00	0.00			
Total (Calc)	100.00	14.38	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

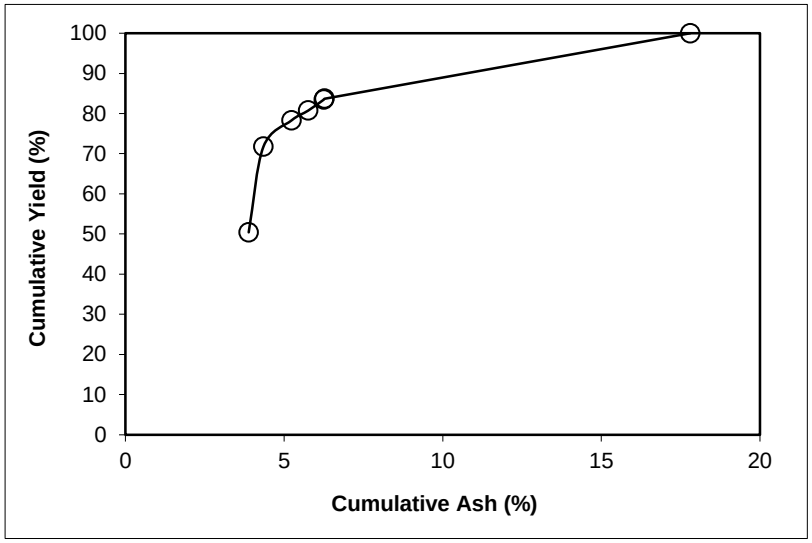
Description: Run 6 - Intermediate Spiral Test

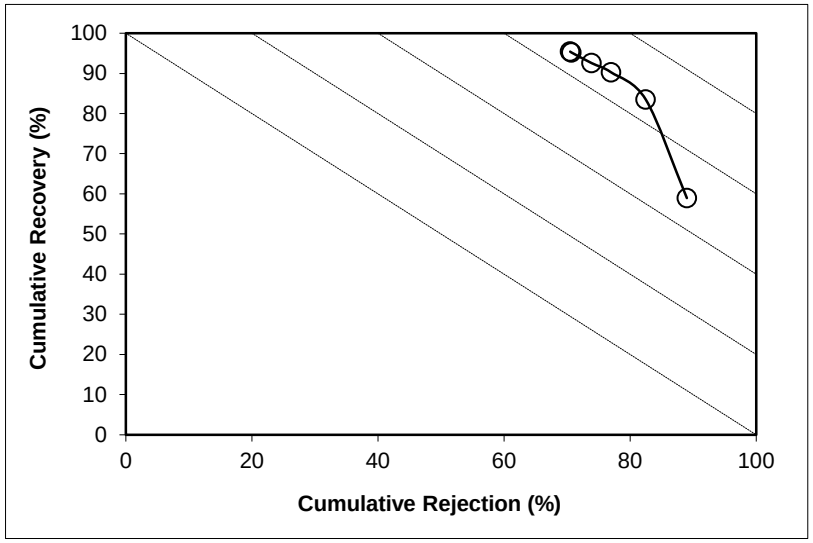
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 25.24

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	50.42	3.88	50.42	3.88	58.96	49.58	31.96	89.00	47.96
P2	21.31	5.44	71.73	4.35	83.47	28.27	51.95	82.49	65.96
P3	6.56	14.93	78.30	5.23	90.27	21.70	63.14	76.98	67.25
P4	2.44	22.58	80.73	5.76	92.56	19.27	68.27	73.89	66.45
P5	2.75	20.76	83.48	6.25	95.21	16.52	76.17	70.69	65.90
P6	0.21	16.66	83.69	6.28	95.42	16.31	76.94	70.49	65.92
P7	16.31	76.94	100.00	17.80	100.00	0.00			
Total (Calc)	100.00	17.80	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

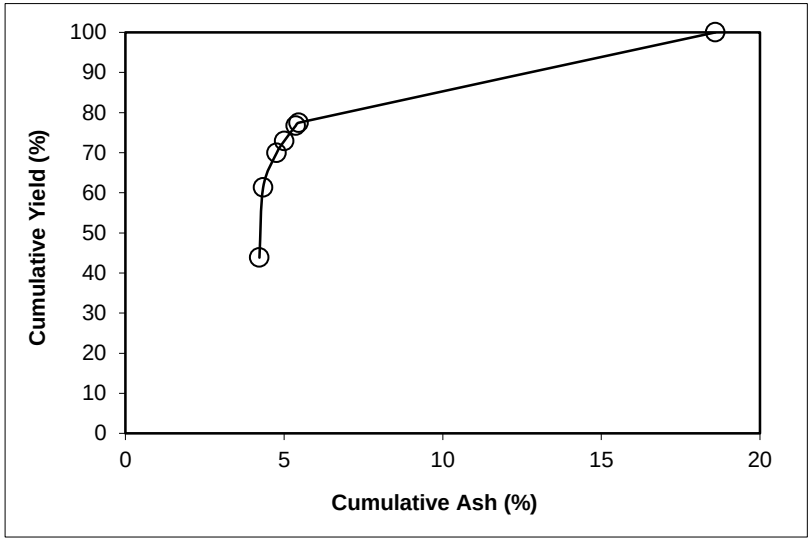
Description: Run 6 - Intermediate Spiral Test

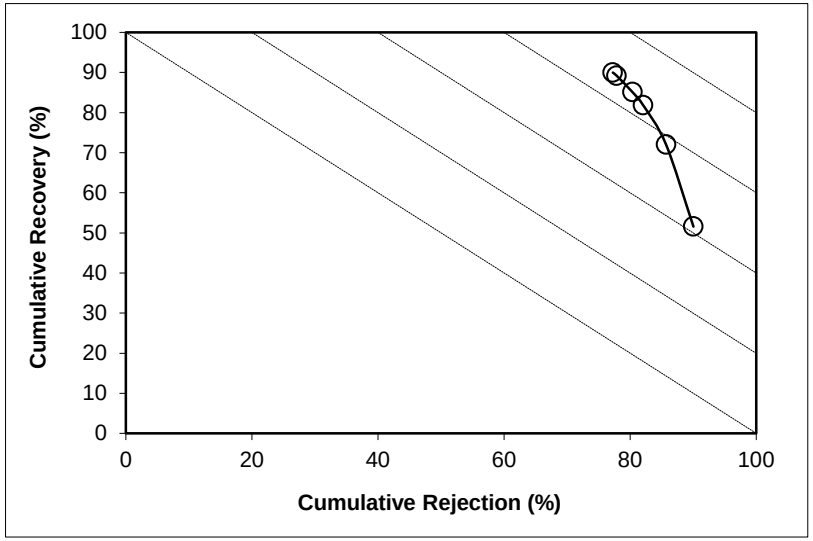
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 18.78

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	43.83	4.22	43.83	4.22	51.57	56.17	29.81	90.05	41.62
P2	17.47	4.63	61.30	4.34	72.04	38.70	41.18	85.70	57.74
P3	8.65	7.80	69.95	4.77	81.83	30.05	50.78	82.07	63.90
P4	2.95	10.59	72.90	5.00	85.08	27.10	55.17	80.39	65.46
P5	3.84	12.30	76.74	5.37	89.21	23.26	62.23	77.85	67.06
P6	0.73	14.98	77.47	5.46	89.97	22.53	63.77	77.26	67.23
P7	22.53	63.77	100.00	18.59	100.00	0.00			
Total (Calc)	100.00	18.59	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

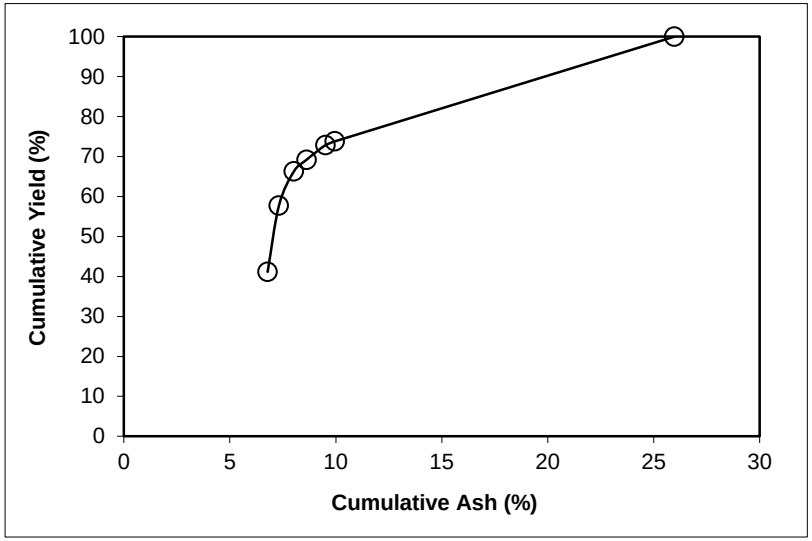
Description: Run 6 - Intermediate Spiral Test

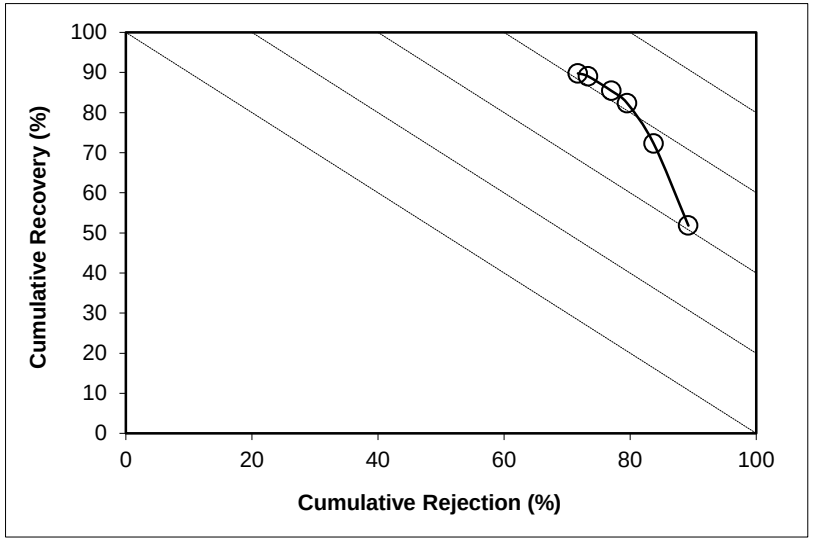
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 8.98

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	41.16	6.78	41.16	6.78	51.82	58.84	39.38	89.25	41.07
P2	16.58	8.64	57.74	7.32	72.29	42.26	51.45	83.73	56.02
P3	8.54	12.78	66.28	8.02	82.34	33.72	61.24	79.53	61.87
P4	2.92	22.17	69.20	8.62	85.42	30.80	64.94	77.03	62.45
P5	3.66	26.36	72.86	9.51	89.06	27.14	70.14	73.32	62.37
P6	0.95	43.97	73.81	9.95	89.77	26.19	71.09	71.72	61.49
P7	26.19	71.09	100.00	25.97	100.00	0.00			
Total (Calc)	100.00	25.97	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

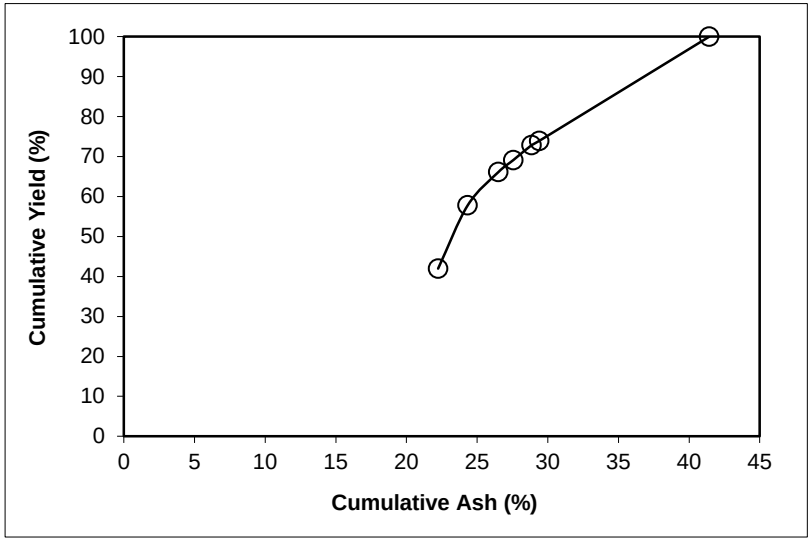
Description: Run 6 - Intermediate Spiral Test

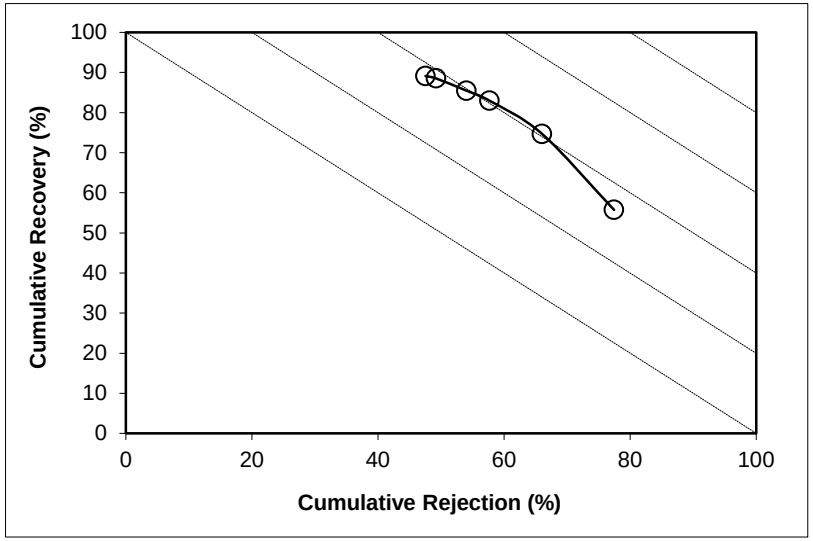
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 2.88

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	41.98	22.24	41.98	22.24	55.72	58.02	55.29	77.46	33.18
P2	15.83	29.89	57.81	24.33	74.67	42.19	64.83	66.04	40.71
P3	8.31	41.58	66.11	26.50	82.95	33.89	70.52	57.70	40.65
P4	3.01	50.81	69.12	27.56	85.47	30.88	72.44	54.01	39.49
P5	3.76	52.77	72.88	28.86	88.51	27.12	75.17	49.22	37.73
P6	1.05	66.54	73.93	29.39	89.11	26.07	75.52	47.53	36.64
P7	26.07	75.52	100.00	41.42	100.00	0.00			
Total (Calc)	100.00	41.42	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

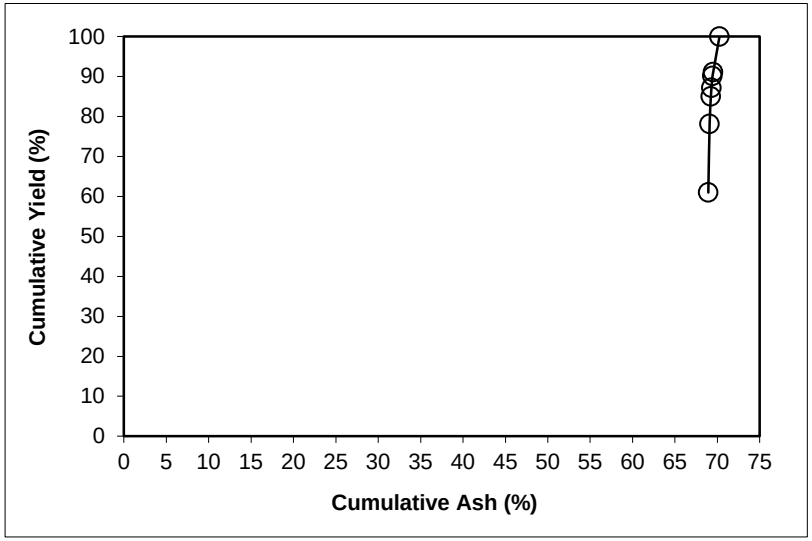
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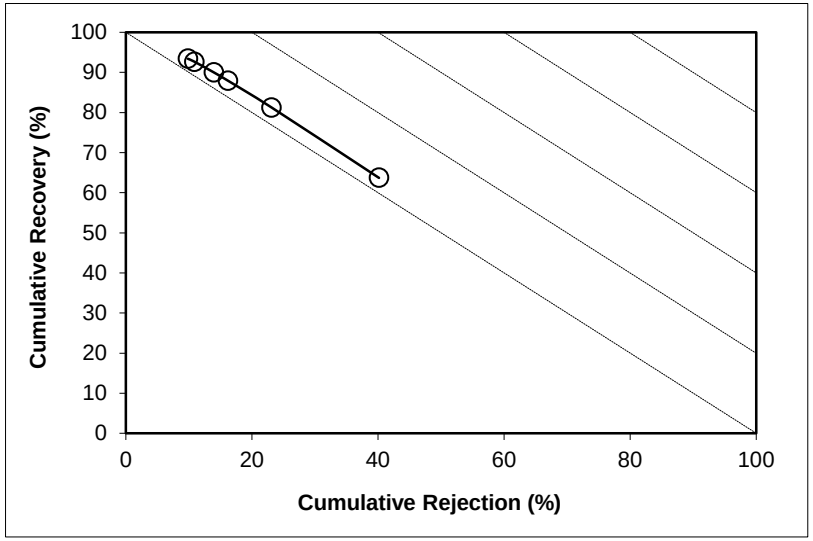
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 15.71

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	60.99	68.93	60.99	68.93	63.69	39.01	72.31	40.15	3.85
P2	17.18	69.63	78.17	69.08	81.23	21.83	74.41	23.12	4.35
P3	6.86	70.97	85.03	69.24	87.92	14.97	75.99	16.20	4.11
P4	2.18	71.90	87.20	69.30	89.97	12.80	76.69	13.97	3.94
P5	2.96	73.12	90.17	69.43	92.65	9.83	77.76	10.88	3.54
P6	0.96	77.03	91.13	69.51	93.39	8.87	77.84	9.83	3.22
P7	8.87	77.84	100.00	70.25	100.00	0.00			
Total (Calc)	100.00	70.25	--	--	--	--	--	--	--





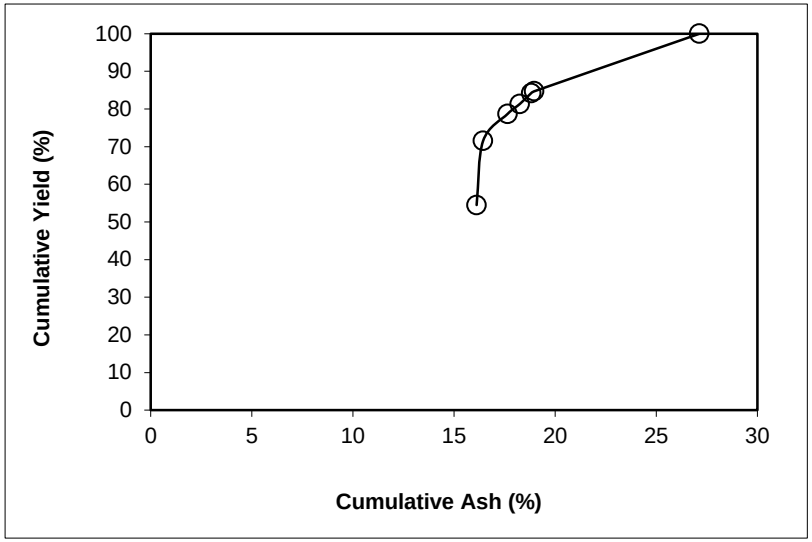
SPIRAL DATA ANALYSIS

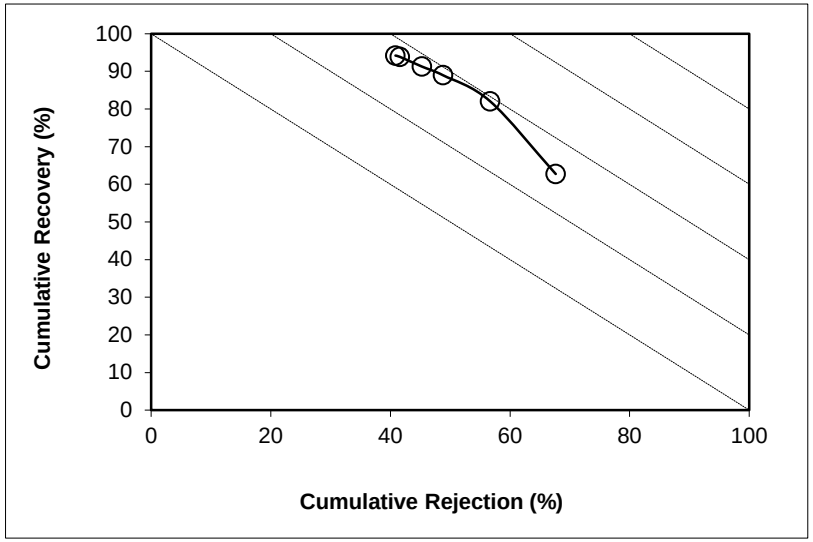
Description: Run 6 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	54.50	16.11	54.50	16.11	62.74	45.50	40.33	67.64	30.38
P2	17.02	17.45	71.52	16.43	82.02	28.48	54.01	56.69	38.71
P3	7.19	29.73	78.72	17.65	88.96	21.28	62.21	48.80	37.76
P4	2.65	36.30	81.37	18.26	91.28	18.63	65.90	45.25	36.53
P5	2.86	34.66	84.23	18.81	93.85	15.77	71.57	41.60	35.45
P6	0.47	44.32	84.70	18.95	94.20	15.30	72.40	40.84	35.04
P7	15.30	72.40	100.00	27.13	100.00	0.00			
Total (Calc)	100.00	27.13	--	--	--	--	--	--	--

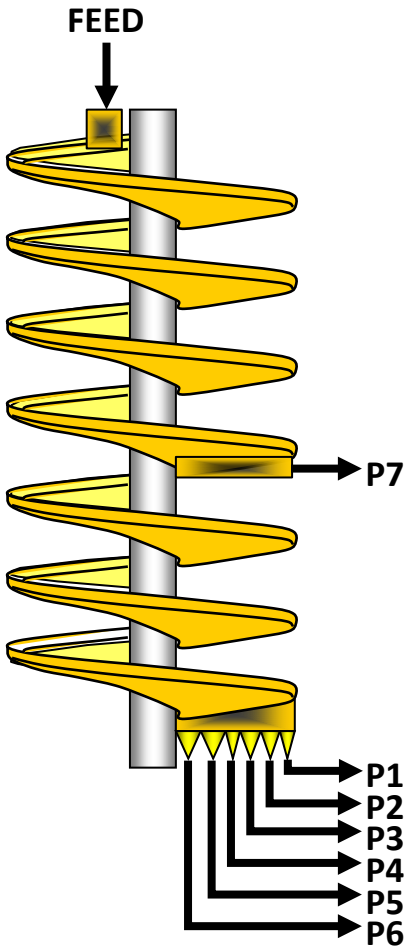




SPIRAL DATA ANALYSIS

Description: Run 7 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	2.795	32.8	22.86	31.08
P2	0.472	48.3	2.03	3.38
P3	0.124	38.3	0.80	1.12
P4	0.085	34.7	0.64	0.87
P5	0.066	33.8	0.52	0.69
P6	0.011	19.2	0.19	0.21
P7	0.564	34.3	4.33	5.50
Total	4.117	34.4	31.35	42.85

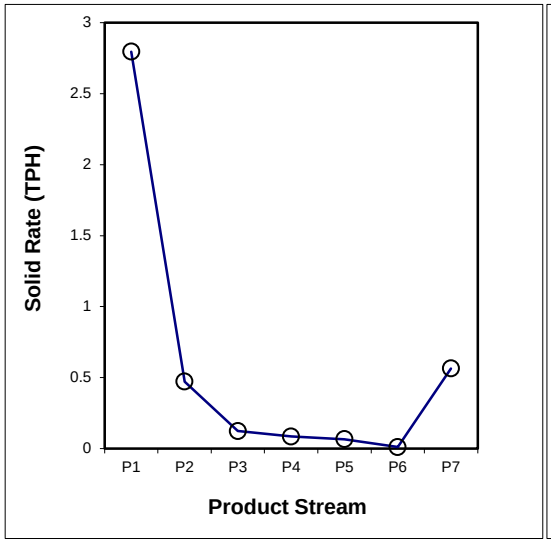
SPIRAL DATA ANALYSIS

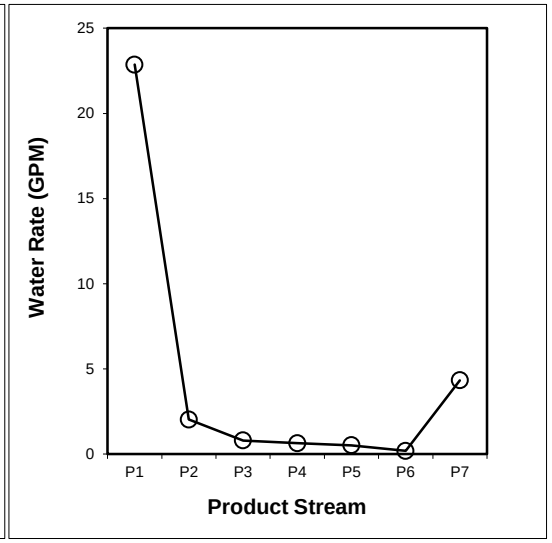
Description: Run 7 - Intermediate Spiral Test

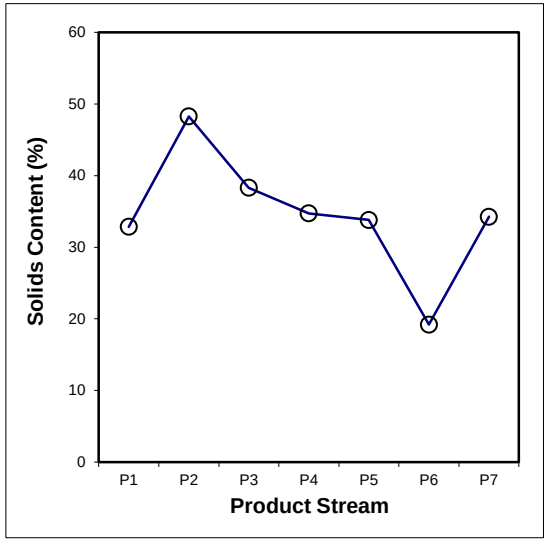
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	5	11773.00	874.00	8.510	4953.1	1427.8	2.795	67.90	32.85
P2	5	1346.21	96.01	0.979	2397.6	1802.0	0.472	11.47	48.25
P3	10	917.73	93.30	0.323	2457.4	2145.8	0.124	3.00	38.30
P4	20	1347.73	94.08	0.245	1851.1	1421.6	0.085	2.07	34.73
P5	25	1341.31	97.56	0.195	2151.2	1736.6	0.066	1.60	33.80
P6	70	1127.14	100.82	0.057	1996.4	1802.3	0.011	0.27	19.20
P7	5	2187.08	96.47	1.646	2447.7	1736.8	0.564	13.69	34.25
Total (Calc)	--	--	--	11.954	--	--	4.117	100.00	34.44
Total (Head)	0.50	1593.31	98.91	11.954	2449.0	1934.4	4.117	--	34.44







SPIRAL DATA ANALYSIS

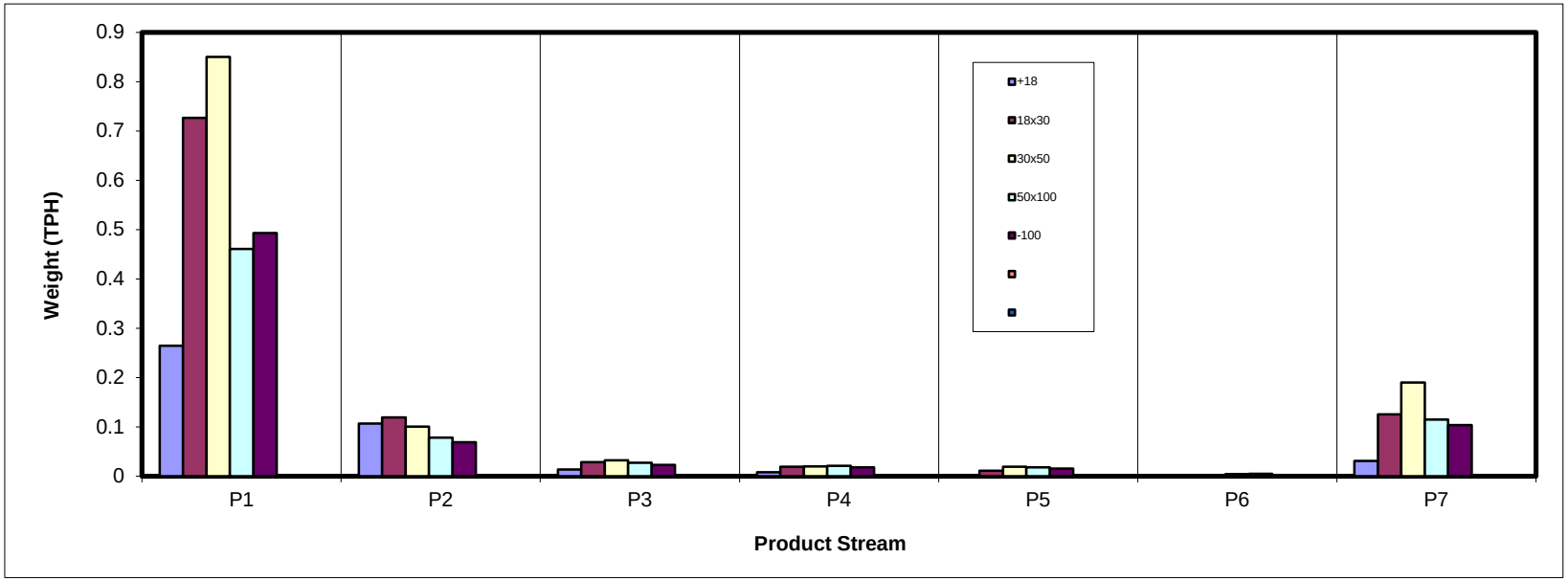
Description: Run 7 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.265	0.106	0.014	0.008	0.002	0.000	0.031		0.426
18x30	0.727	0.119	0.028	0.019	0.011	0.000	0.126		1.030
30x50	0.850	0.100	0.032	0.020	0.019	0.002	0.190		1.213
50x100	0.461	0.078	0.027	0.021	0.018	0.004	0.115		0.723
-100	0.493	0.069	0.023	0.018	0.015	0.004	0.103		0.725
Total (Calc)	2.795	0.472	0.124	0.085	0.066	0.011	0.564		4.117



SPIRAL DATA ANALYSIS

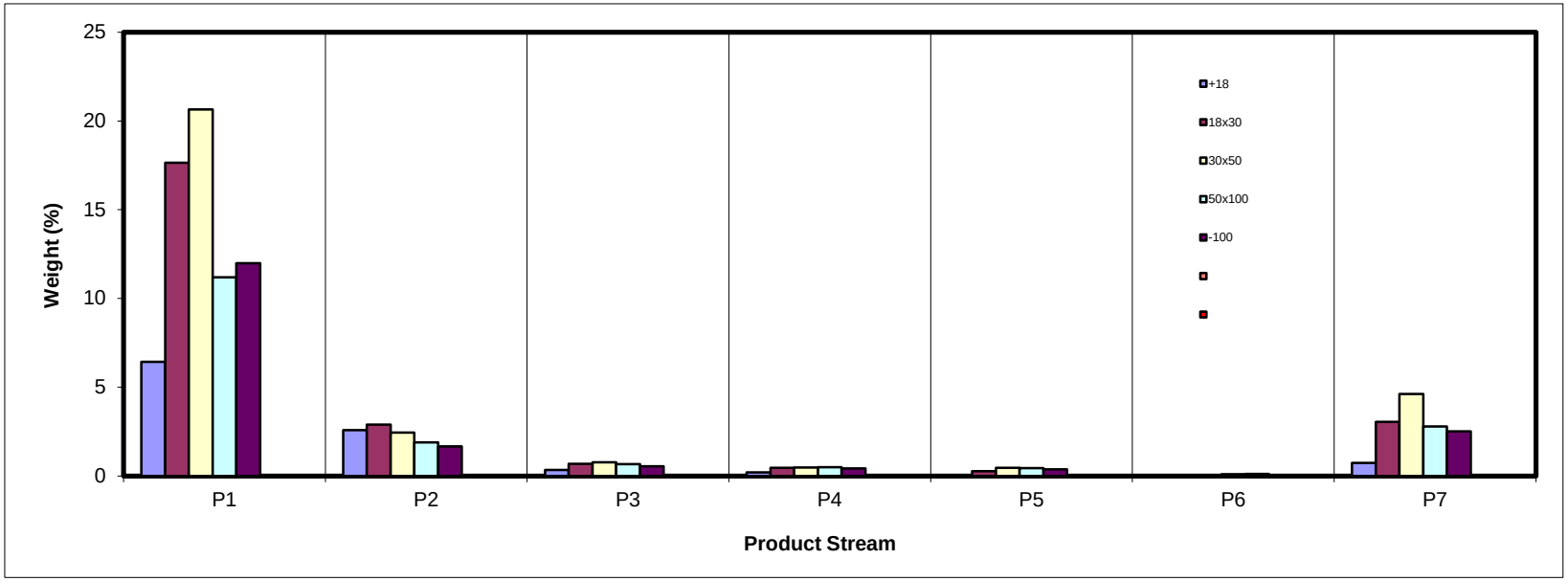
Description: Run 7 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	6.43	2.58	0.33	0.20	0.05	0.00	0.74		10.34
18x30	17.65	2.89	0.68	0.46	0.27	0.01	3.05		25.02
30x50	20.65	2.44	0.77	0.48	0.46	0.05	4.61		29.47
50x100	11.19	1.90	0.66	0.50	0.44	0.10	2.78		17.57
-100	11.98	1.66	0.55	0.43	0.37	0.11	2.51		17.61
Total (Calc)	67.90	11.47	3.00	2.07	1.60	0.27	13.69		100.00



SPIRAL DATA ANALYSIS

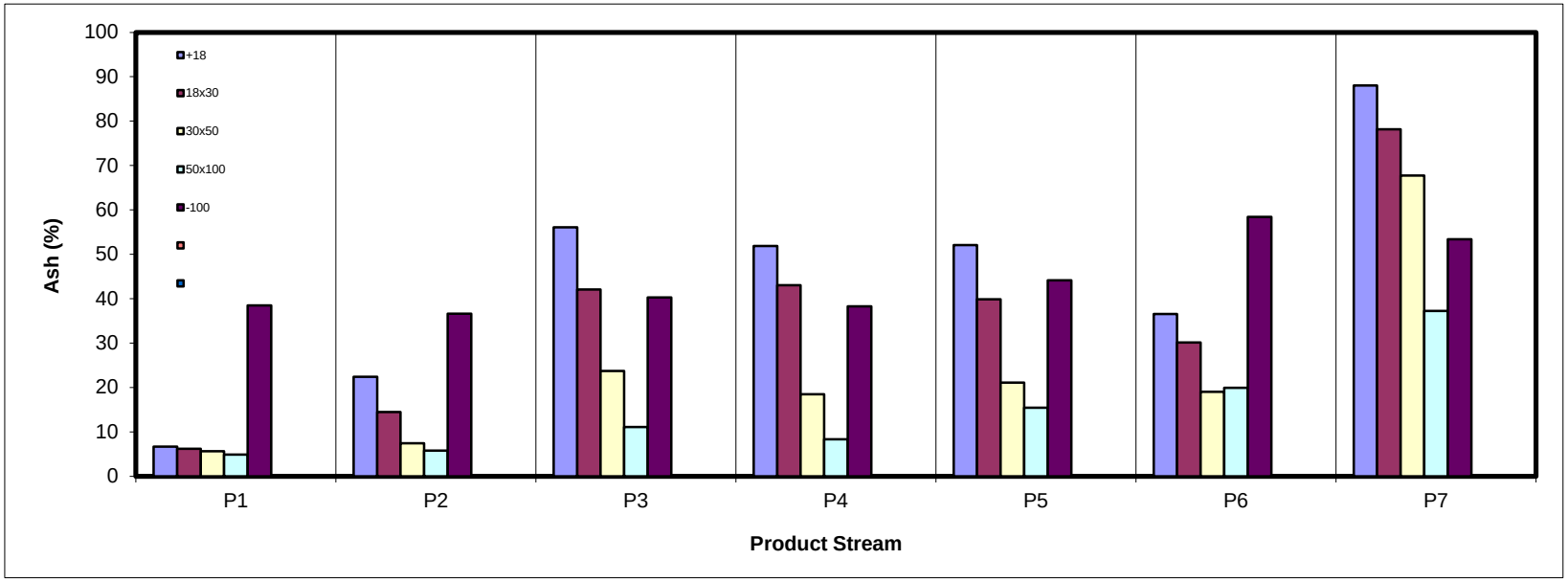
Description: Run 7 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	6.68	22.44	56.07	51.84	52.07	36.56	88.02		19.14
18x30	6.21	14.45	42.09	43.01	39.88	30.14	78.17		17.97
30x50	5.67	7.44	23.73	18.49	21.13	19.00	67.72		16.48
50x100	4.85	5.76	11.12	8.35	15.43	19.94	37.27		10.77
-100	38.49	36.60	40.26	38.26	44.18	58.41	53.42		40.73
Total (Calc)	11.56	16.54	31.78	28.76	29.11	35.63	62.34		20.39



SPIRAL DATA ANALYSIS

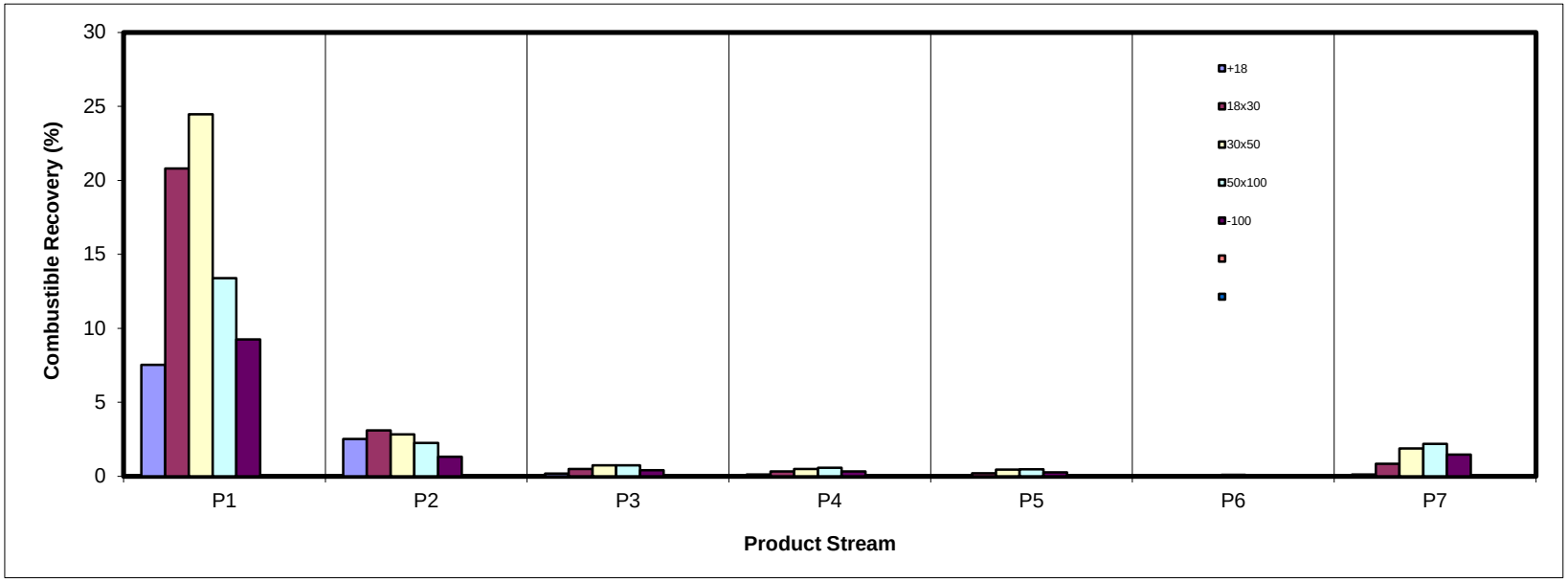
Description: Run 7 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	7.54	2.52	0.18	0.12	0.03	0.00	0.11		10.50
18x30	20.79	3.11	0.50	0.33	0.20	0.01	0.84		25.78
30x50	24.47	2.83	0.74	0.49	0.46	0.05	1.87		30.92
50x100	13.38	2.24	0.73	0.58	0.47	0.11	2.19		19.70
-100	9.26	1.33	0.42	0.33	0.26	0.06	1.47		13.11
Total (Calc)	75.43	12.03	2.57	1.85	1.42	0.22	6.48		100.00



SPIRAL DATA ANALYSIS

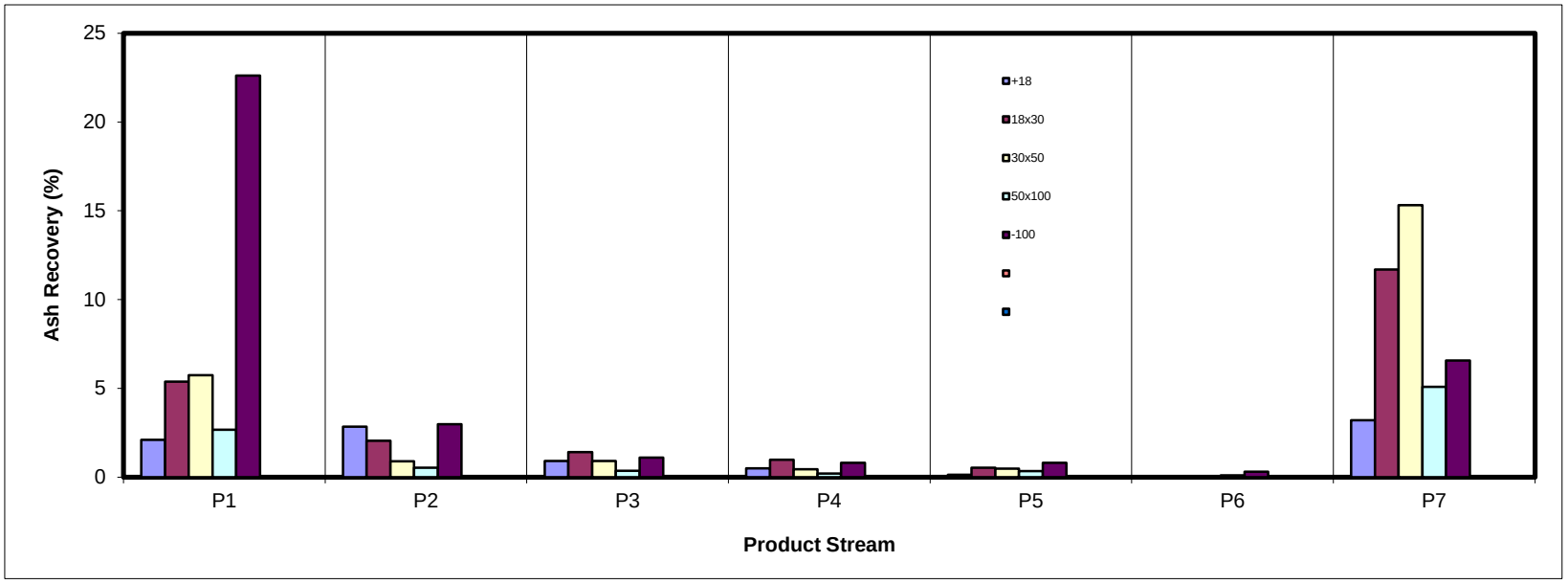
Description: Run 7 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	2.11	2.84	0.91	0.50	0.14	0.00	3.20		9.70
18x30	5.37	2.05	1.41	0.97	0.53	0.01	11.69		22.04
30x50	5.74	0.89	0.90	0.44	0.48	0.04	15.32		23.81
50x100	2.66	0.54	0.36	0.20	0.33	0.10	5.08		9.28
-100	22.61	2.99	1.09	0.80	0.80	0.31	6.57		35.17
Total (Calc)	38.49	9.30	4.68	2.92	2.28	0.47	41.86		100.00



SPIRAL DATA ANALYSIS

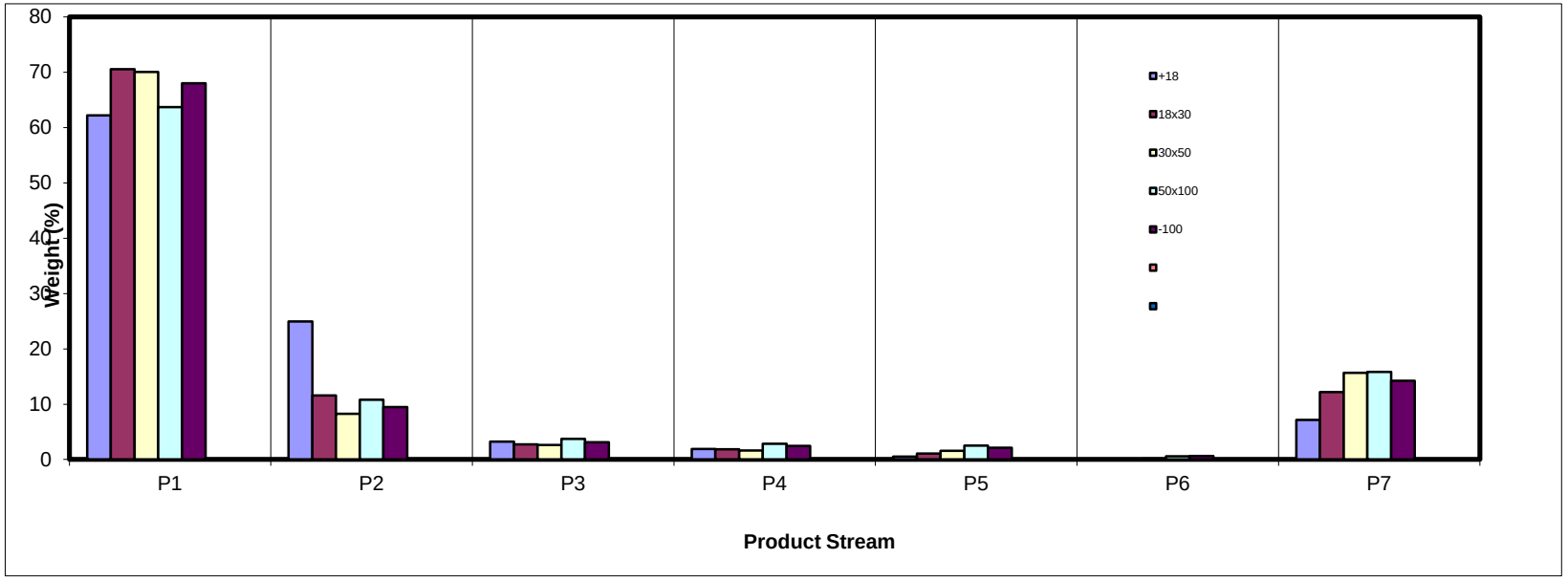
Description: Run 7 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	62.20	24.98	3.21	1.90	0.51	0.01	7.18		100.00
18x30	70.55	11.57	2.74	1.84	1.08	0.03	12.19		100.00
30x50	70.08	8.27	2.63	1.64	1.58	0.16	15.66		100.00
50x100	63.70	10.78	3.74	2.84	2.50	0.60	15.83		100.00
-100	68.03	9.45	3.14	2.43	2.10	0.61	14.24		100.00
Total (Calc)	67.90	11.47	3.00	2.07	1.60	0.27	13.69		100.00



SPIRAL DATA ANALYSIS

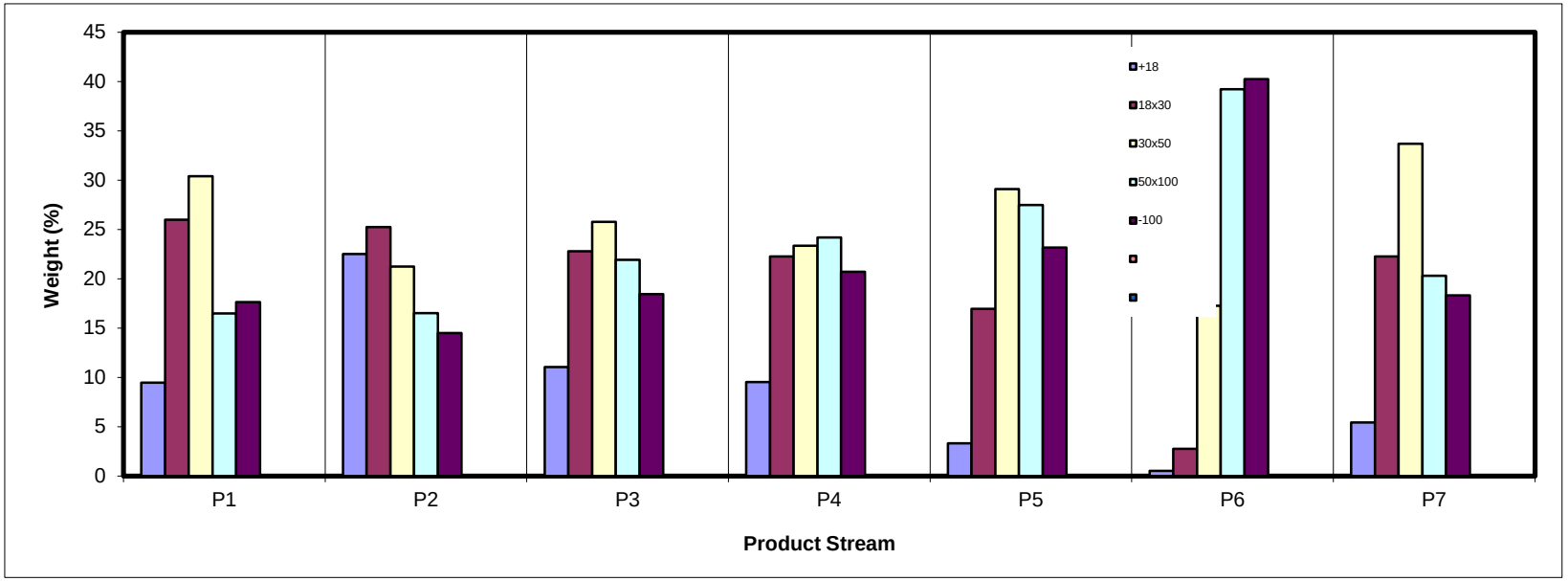
Description: Run 7 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	9.47	22.51	11.06	9.51	3.33	0.53	5.42		10.34
18x30	25.99	25.23	22.80	22.27	16.94	2.76	22.27		25.02
30x50	30.41	21.24	25.78	23.36	29.10	17.25	33.69		29.47
50x100	16.49	16.52	21.92	24.17	27.48	39.21	20.32		17.57
-100	17.64	14.51	18.44	20.70	23.16	40.25	18.31		17.61
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

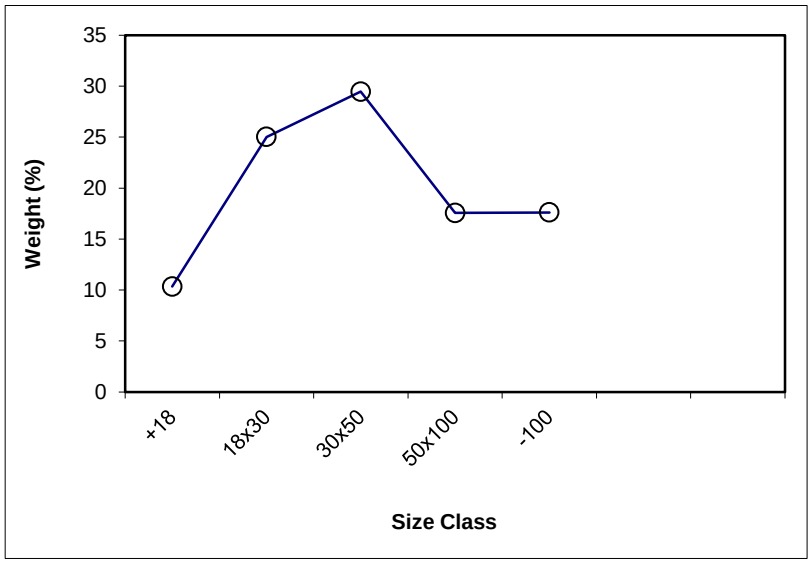
Description: Run 7 - Intermediate Spiral Test

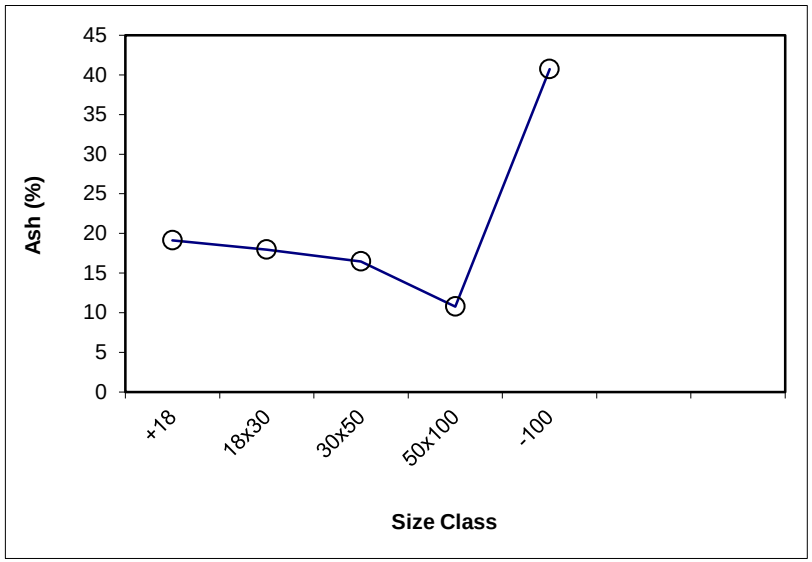
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	717.9	664.7	53.20	10.34	19.14	10.34	19.14	100.00	20.39
18x30	570.9	442.2	128.74	25.02	17.97	35.35	18.31	89.66	20.54
30x50	564.2	412.5	151.65	29.47	16.48	64.82	17.48	64.65	21.53
50x100	499.2	408.8	90.43	17.57	10.77	82.39	16.05	35.18	25.76
-100	96.9	6.3	90.62	17.61	40.73	100.00	20.39	17.61	40.73
Total (Calc)	--	--	514.63	100.00	20.39	--	--	--	--





SPIRAL DATA ANALYSIS

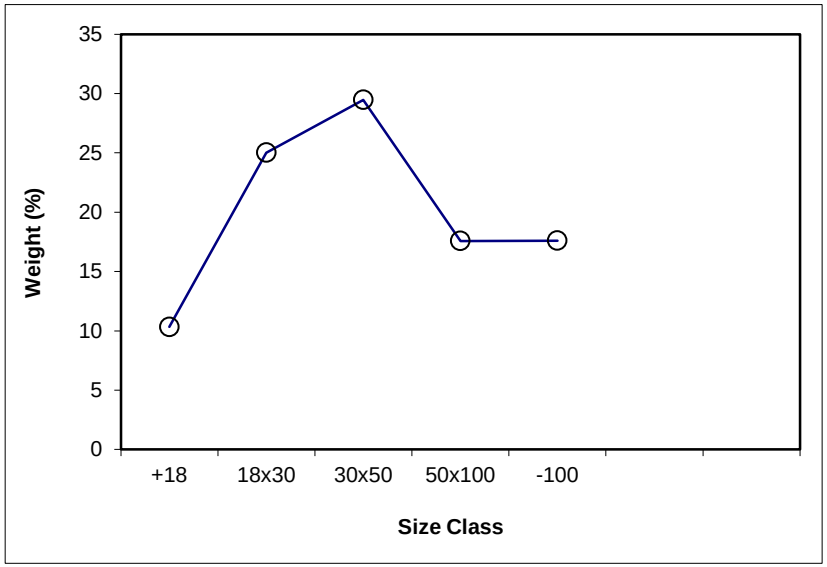
Description: Run 7 - Intermediate Spiral Test

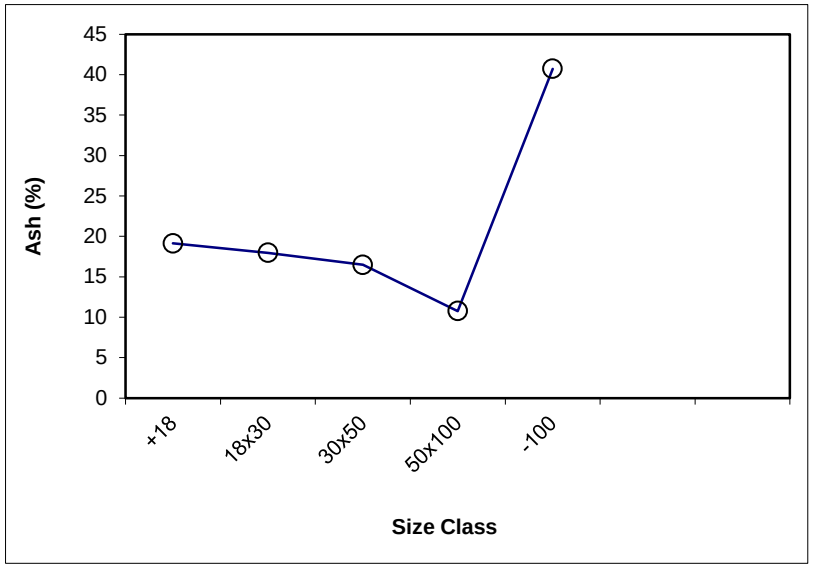
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	10.34	19.14	10.34	19.14	100.00	20.39			
18x30	25.02	17.97	35.35	18.31	89.66	20.54	x	25.02	17.97
30x50	29.47	16.48	64.82	17.48	64.65	21.53	x	29.47	16.48
50x100	17.57	10.77	82.39	16.05	35.18	25.76	x	17.57	10.77
-100	17.61	40.73	100.00	20.39	17.61	40.73			
Total (Calc)	100.00	20.39	--	--	--	--	--	72.05	15.60





SPIRAL DATA ANALYSIS

Description: Run 7 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 67.90

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	734.99	401.2	333.79	9.47	6.68	9.47	6.68	100.00	11.56
18x30	1286.37	370.0	916.33	25.99	6.21	35.46	6.33	90.53	12.07
30x50	1408.35	336.3	1072.07	30.41	5.67	65.87	6.03	64.54	14.43
50x100	888.97	307.8	581.16	16.49	4.85	82.36	5.79	34.13	22.24
-100	634.41	12.5	621.90	17.64	38.49	100.00	11.56	17.64	38.49
Total (Calc)	--	--	3525.25	100.00	11.56	--	--	--	--

Product P2 Feed Weight (%): 11.47

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	790.9	656.8	134.08	22.51	22.44	22.51	22.44	100.00	16.54
18x30	542.2	392.0	150.25	25.23	14.45	47.74	18.22	77.49	14.82
30x50	480.6	354.2	126.50	21.24	7.44	68.97	14.90	52.26	15.00
50x100	491.4	393.0	98.39	16.52	5.76	85.49	13.13	31.03	20.18
-100	92.5	6.1	86.41	14.51	36.60	100.00	16.54	14.51	36.60
Total (Calc)	--	--	595.63	100.00	16.54	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 7 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 3.00

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	910.5	876.1	34.46	11.06	56.07	11.06	56.07	100.00	31.78
18x30	513.2	442.2	71.07	22.80	42.09	33.86	46.66	88.94	28.76
30x50	492.9	412.5	80.36	25.78	23.73	59.64	36.75	66.14	24.16
50x100	477.1	408.8	68.33	21.92	11.12	81.56	29.86	40.36	24.43
-100	63.7	6.3	57.46	18.44	40.26	100.00	31.78	18.44	40.26
Total (Calc)	--	--	311.67	100.00	31.78	--	--	--	--

Product P4 Feed Weight (%): 2.07

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	442.0	401.2	40.84	9.51	51.84	9.51	51.84	100.00	28.76
18x30	465.7	370.0	95.62	22.27	43.01	31.77	45.65	90.49	26.34
30x50	436.6	336.3	100.31	23.36	18.49	55.13	34.14	68.23	20.90
50x100	411.6	307.8	103.82	24.17	8.35	79.30	26.28	44.87	22.15
-100	95.1	6.3	88.88	20.70	38.26	100.00	28.76	20.70	38.26
Total (Calc)	--	--	429.46	100.00	28.76	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 7 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 1.60

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	473.9	460.1	13.79	3.33	52.07	3.33	52.07	100.00	29.11
18x30	518.4	448.1	70.23	16.94	39.88	20.26	41.88	96.67	28.32
30x50	545.6	424.9	120.65	29.10	21.13	49.36	29.65	79.74	25.86
50x100	511.2	397.2	113.96	27.48	15.43	76.84	24.56	50.64	28.58
-100	102.2	6.2	96.03	23.16	44.18	100.00	29.11	23.16	44.18
Total (Calc)	--	--	414.67	100.00	29.11	--	--	--	--

Product P6 Feed Weight (%): 0.27

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	657.9	656.8	1.02	0.53	36.56	0.53	36.56	100.00	35.63
18x30	397.3	392.0	5.37	2.76	30.14	3.29	31.17	99.47	35.63
30x50	387.6	354.2	33.49	17.25	19.00	20.54	20.95	96.71	35.78
50x100	469.1	393.0	76.12	39.21	19.94	59.75	20.29	79.46	39.43
-100	84.4	6.3	78.14	40.25	58.41	100.00	35.63	40.25	58.41
Total (Calc)	--	--	194.13	100.00	35.63	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 7 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 13.69

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	498.7	460.1	38.53	5.42	88.02	5.42	88.02	100.00	62.34
18x30	606.4	448.1	158.31	22.27	78.17	27.69	80.10	94.58	60.87
30x50	664.4	424.9	239.51	33.69	67.72	61.38	73.31	72.31	55.54
50x100	541.7	397.2	144.43	20.32	37.27	81.69	64.34	38.62	44.92
-100	136.5	6.4	130.13	18.31	53.42	100.00	62.34	18.31	53.42
Total (Calc)	--	--	710.91	100.00	62.34	--	--	--	--

SPIRAL DATA ANALYSIS

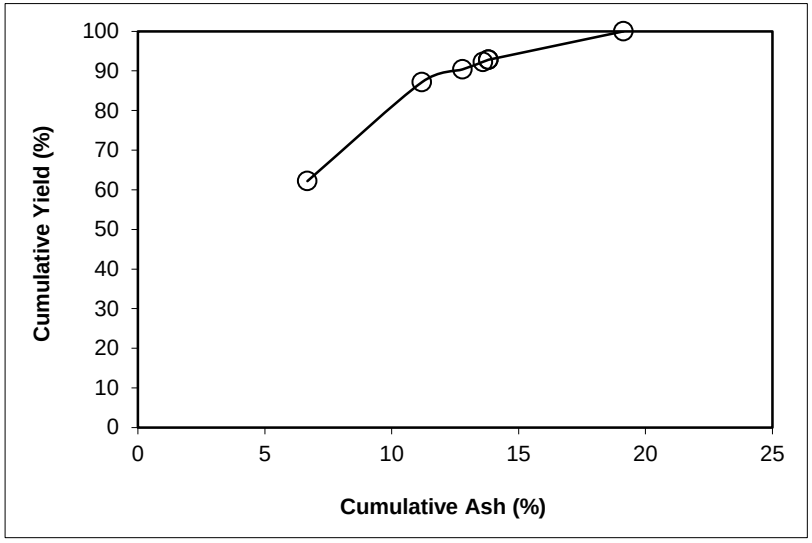
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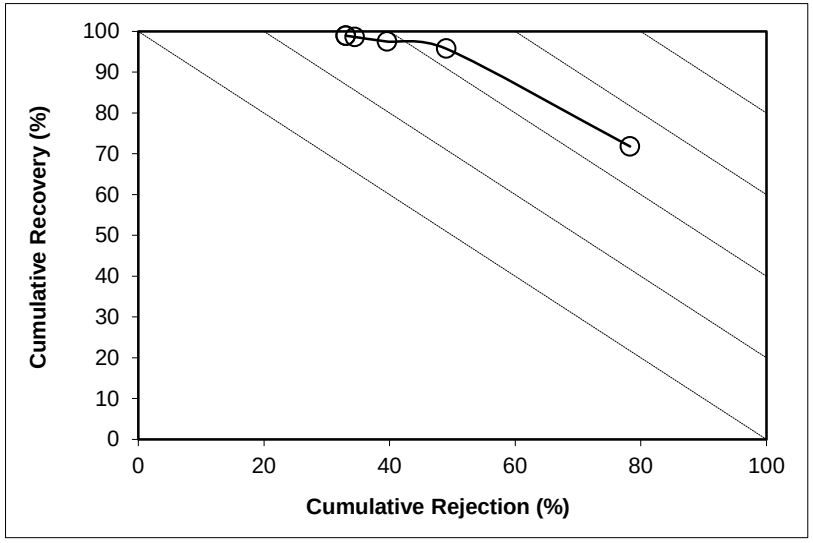
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 10.34

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	62.20	6.68	62.20	6.68	71.78	37.80	39.64	78.30	50.08
P2	24.98	22.44	87.18	11.19	95.74	12.82	73.15	49.01	44.75
P3	3.21	56.07	90.39	12.79	97.49	9.61	78.86	39.60	37.09
P4	1.90	51.84	92.29	13.59	98.62	7.71	85.53	34.45	33.07
P5	0.51	52.07	92.81	13.81	98.93	7.19	87.93	33.05	31.98
P6	0.01	36.56	92.82	13.81	98.94	7.18	88.02	33.02	31.96
P7	7.18	88.02	100.00	19.14	100.00	0.00			
Total (Calc)	100.00	19.14	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

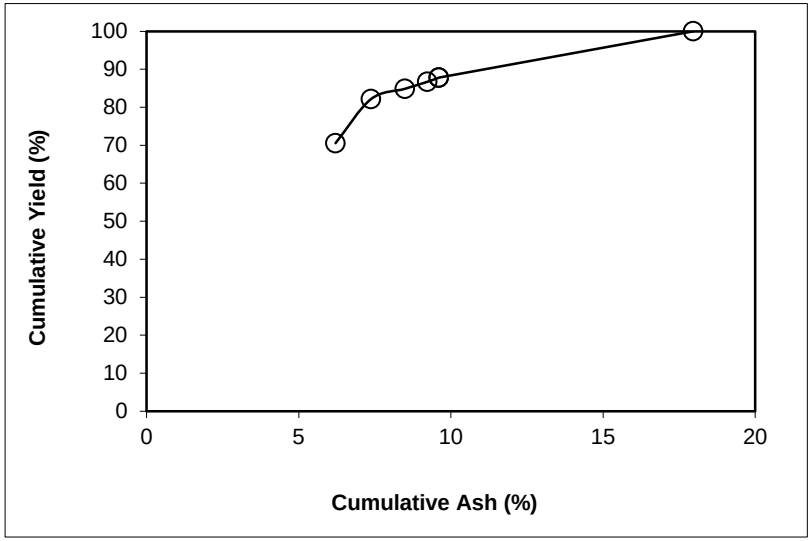
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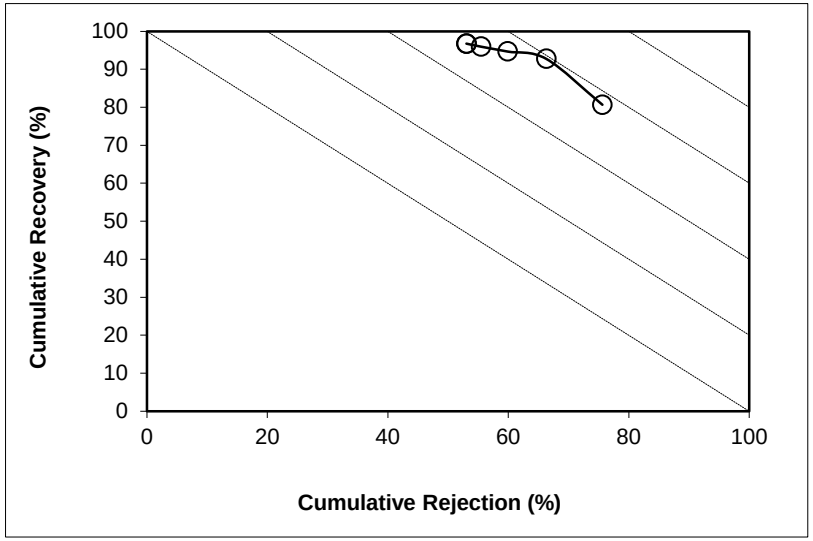
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 25.02

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	70.55	6.21	70.55	6.21	80.66	29.45	46.13	75.61	56.28
P2	11.57	14.45	82.12	7.37	92.73	17.88	66.64	66.31	59.04
P3	2.74	42.09	84.86	8.49	94.66	15.14	71.07	59.90	54.56
P4	1.84	43.01	86.70	9.22	95.94	13.30	74.95	55.49	51.43
P5	1.08	39.88	87.78	9.60	96.73	12.22	78.06	53.09	49.82
P6	0.03	30.14	87.81	9.61	96.76	12.19	78.17	53.04	49.80
P7	12.19	78.17	100.00	17.97	100.00	0.00			
Total (Calc)	100.00	17.97	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

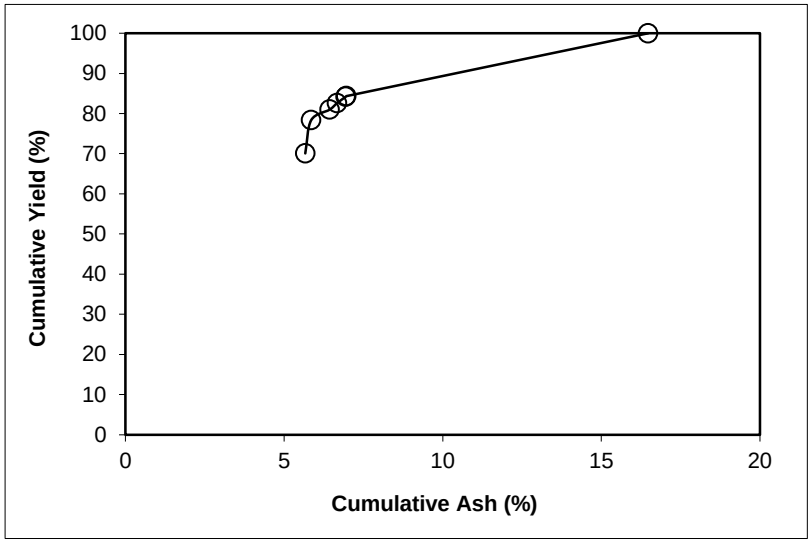
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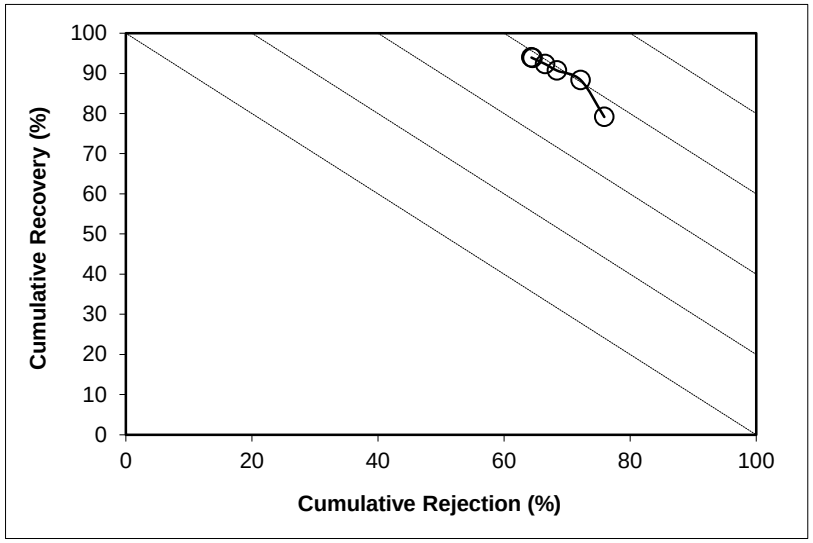
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 29.47

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	70.08	5.67	70.08	5.67	79.15	29.92	41.79	75.90	55.05
P2	8.27	7.44	78.35	5.85	88.31	21.65	54.91	72.17	60.48
P3	2.63	23.73	80.97	6.43	90.71	19.03	59.22	68.39	59.10
P4	1.64	18.49	82.61	6.67	92.31	17.39	63.06	66.55	58.86
P5	1.58	21.13	84.19	6.94	93.80	15.81	67.24	64.53	58.33
P6	0.16	19.00	84.34	6.96	93.95	15.66	67.72	64.35	58.30
P7	15.66	67.72	100.00	16.48	100.00	0.00			
Total (Calc)	100.00	16.48	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

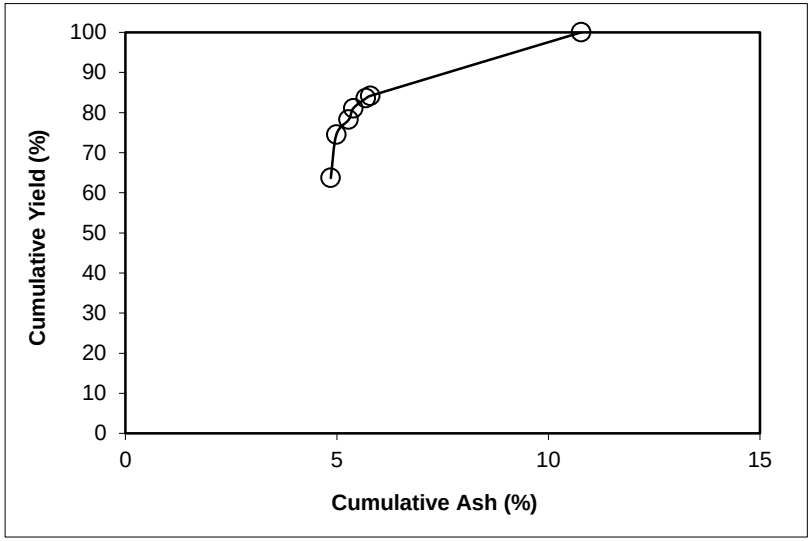
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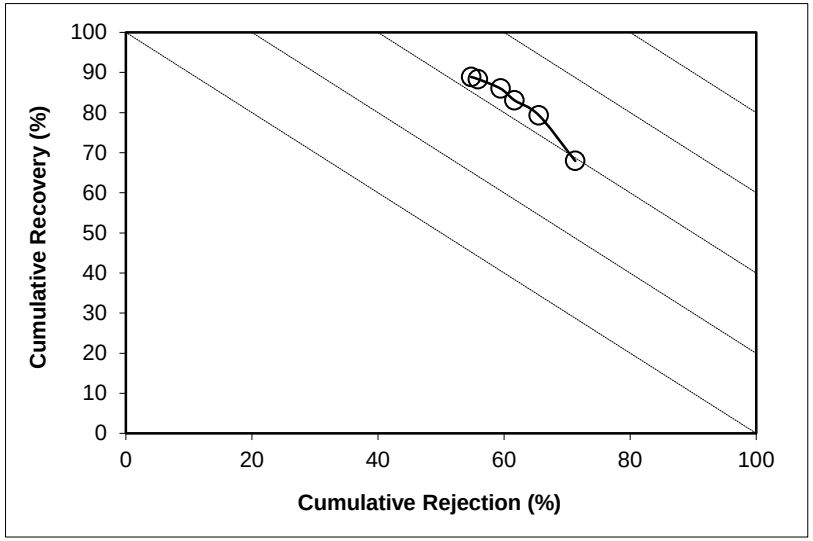
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 17.57

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	63.70	4.85	63.70	4.85	67.93	36.30	21.16	71.30	39.22
P2	10.78	5.76	74.49	4.98	79.32	25.51	27.66	65.53	44.85
P3	3.74	11.12	78.23	5.28	83.05	21.77	30.51	61.67	44.71
P4	2.84	8.35	81.07	5.39	85.97	18.93	33.84	59.46	45.43
P5	2.50	15.43	83.57	5.69	88.34	16.43	36.64	55.88	44.22
P6	0.60	19.94	84.17	5.79	88.87	15.83	37.27	54.78	43.65
P7	15.83	37.27	100.00	10.77	100.00	0.00			
Total (Calc)	100.00	10.77	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

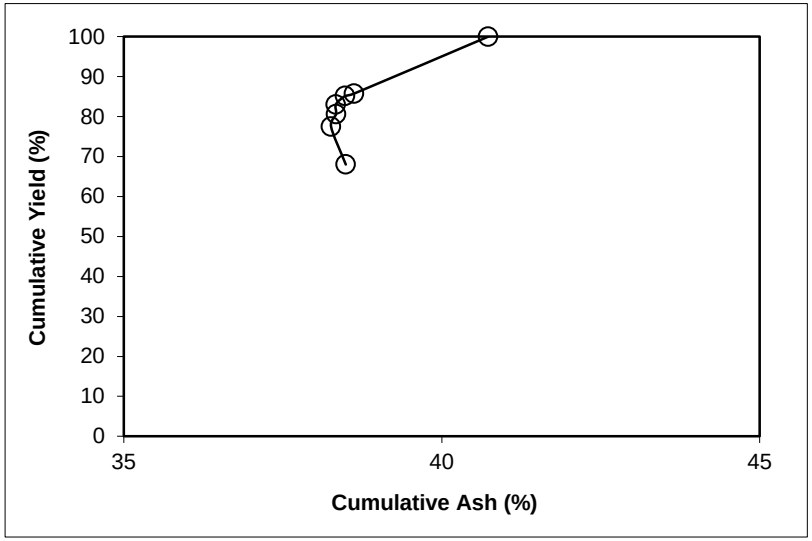
Description: Run 7 - Intermediate Spiral Test

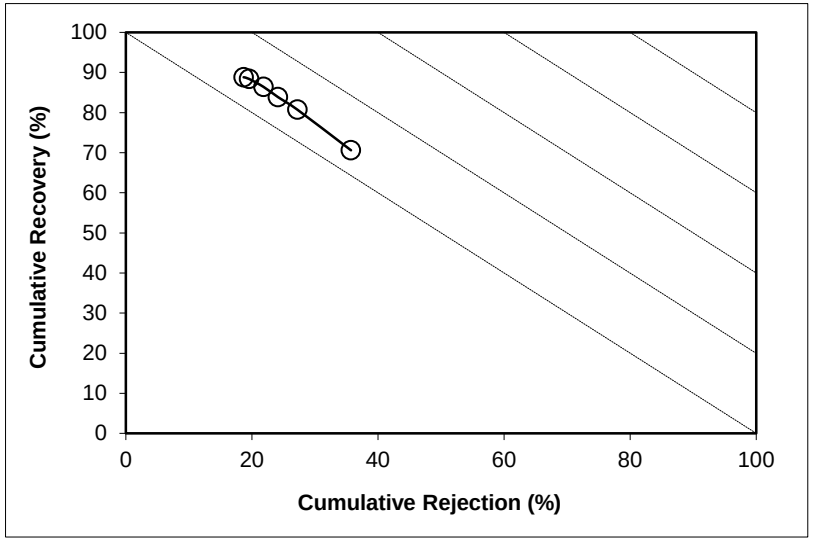
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: -100 Feed Weight (%): 17.61

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	68.03	38.49	68.03	38.49	70.60	31.97	45.49	35.71	6.31
P2	9.45	36.60	77.48	38.26	80.71	22.52	49.22	27.22	7.92
P3	3.14	40.26	80.62	38.34	83.87	19.38	50.67	24.11	7.98
P4	2.43	38.26	83.05	38.33	86.41	16.95	52.45	21.83	8.23
P5	2.10	44.18	85.15	38.48	88.39	14.85	53.63	19.55	7.93
P6	0.61	58.41	85.76	38.62	88.81	14.24	53.42	18.67	7.49
P7	14.24	53.42	100.00	40.73	100.00	0.00			
Total (Calc)	100.00	40.73	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

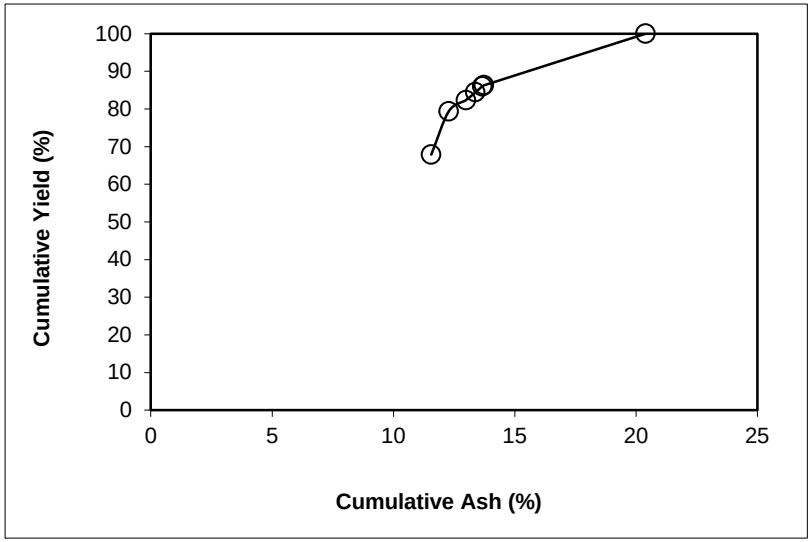
Description: Run 7 - Intermediate Spiral Test

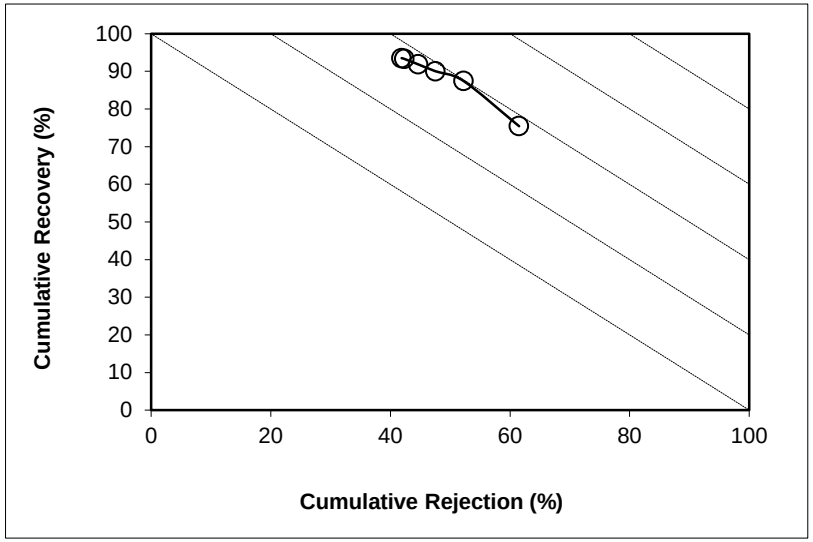
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	67.90	11.56	67.90	11.56	75.43	32.10	39.07	61.51	36.94
P2	11.47	16.54	79.37	12.28	87.46	20.63	51.61	52.21	39.67
P3	3.00	31.78	82.37	12.99	90.03	17.63	54.99	47.53	37.56
P4	2.07	28.76	84.44	13.38	91.88	15.56	58.47	44.61	36.50
P5	1.60	29.11	86.04	13.67	93.31	13.96	61.83	42.33	35.64
P6	0.27	35.63	86.31	13.74	93.52	13.69	62.34	41.86	35.39
P7	13.69	62.34	100.00	20.39	100.00	0.00			
Total (Calc)	100.00	20.39	--	--	--	--	--	--	--

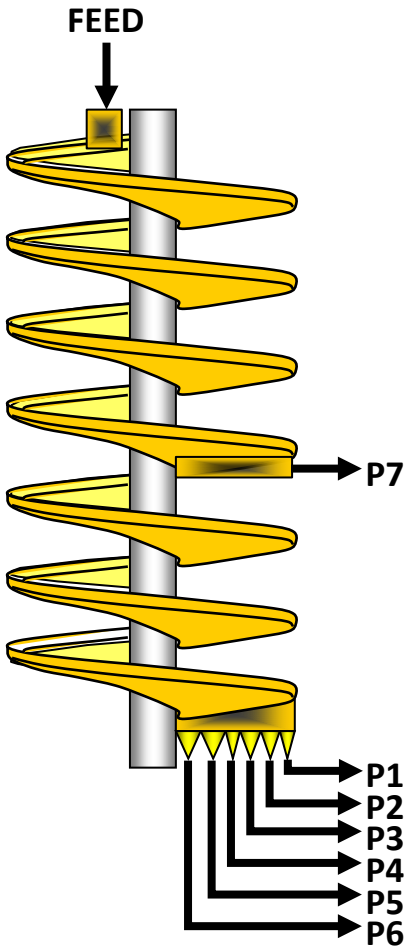




SPIRAL DATA ANALYSIS

Description: Run 8 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	2.289	27.2	24.55	31.28
P2	0.423	30.6	3.84	5.07
P3	0.155	33.4	1.23	1.64
P4	0.052	35.9	0.37	0.51
P5	0.050	28.6	0.50	0.63
P6	0.008	14.9	0.18	0.20
P7	0.463	48.5	1.97	2.89
Total	3.439	29.7	32.63	42.21

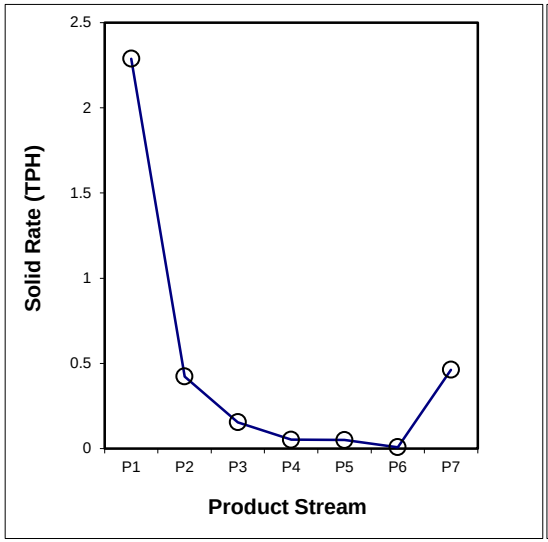
SPIRAL DATA ANALYSIS

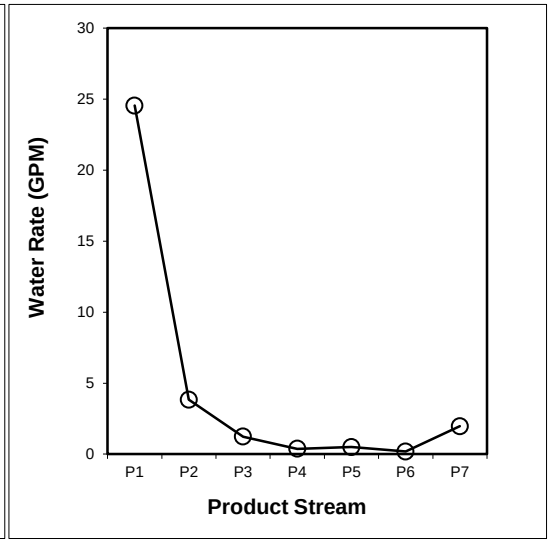
Description: Run 8 - Intermediate Spiral Test

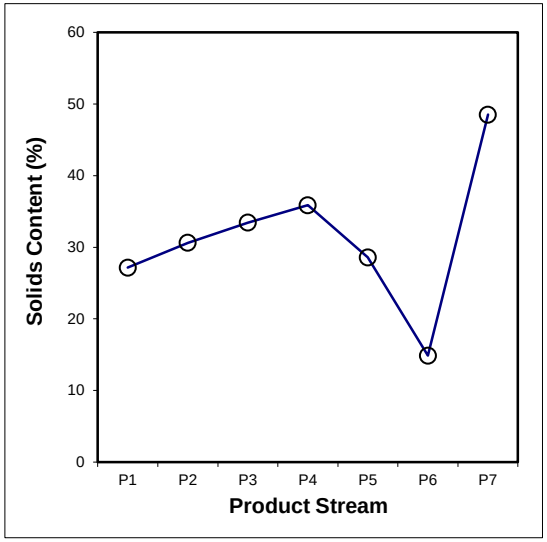
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	5	11987.00	1205.00	8.426	6044.0	3157.8	2.289	66.55	27.16
P2	5	1862.34	94.33	1.383	2270.5	1736.8	0.423	12.31	30.61
P3	10	1274.43	92.98	0.462	2324.3	1934.5	0.155	4.49	33.44
P4	25	1020.14	92.75	0.145	2284.4	1956.3	0.052	1.51	35.86
P5	25	1208.12	90.44	0.175	2052.0	1736.8	0.050	1.45	28.59
P6	70	1034.80	94.40	0.052	1559.6	1421.7	0.008	0.23	14.88
P7	5	1308.28	93.58	0.955	2518.3	1934.5	0.463	13.46	48.50
Total (Calc)	--	--	--	11.597	--	--	3.439	100.00	29.65
Total (Head)	0.46	1448.37	94.44	11.597	2357.8	1956.3	3.439	--	29.65







SPIRAL DATA ANALYSIS

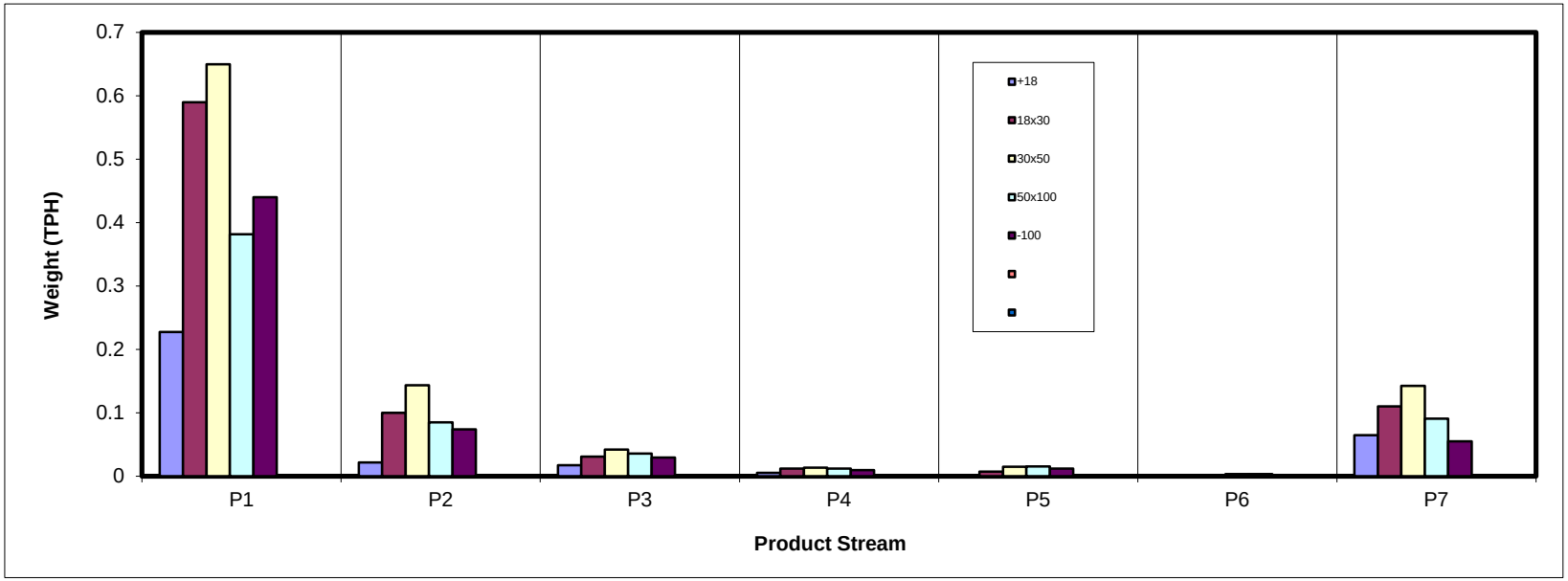
Description: Run 8 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.228	0.022	0.017	0.005	0.001	0.000	0.065		0.337
18x30	0.590	0.100	0.031	0.012	0.007	0.000	0.110		0.850
30x50	0.649	0.143	0.042	0.014	0.015	0.001	0.143		1.006
50x100	0.382	0.085	0.035	0.012	0.015	0.003	0.091		0.623
-100	0.440	0.074	0.029	0.010	0.012	0.003	0.055		0.623
Total (Calc)	2.289	0.423	0.155	0.052	0.050	0.008	0.463		3.439



SPIRAL DATA ANALYSIS

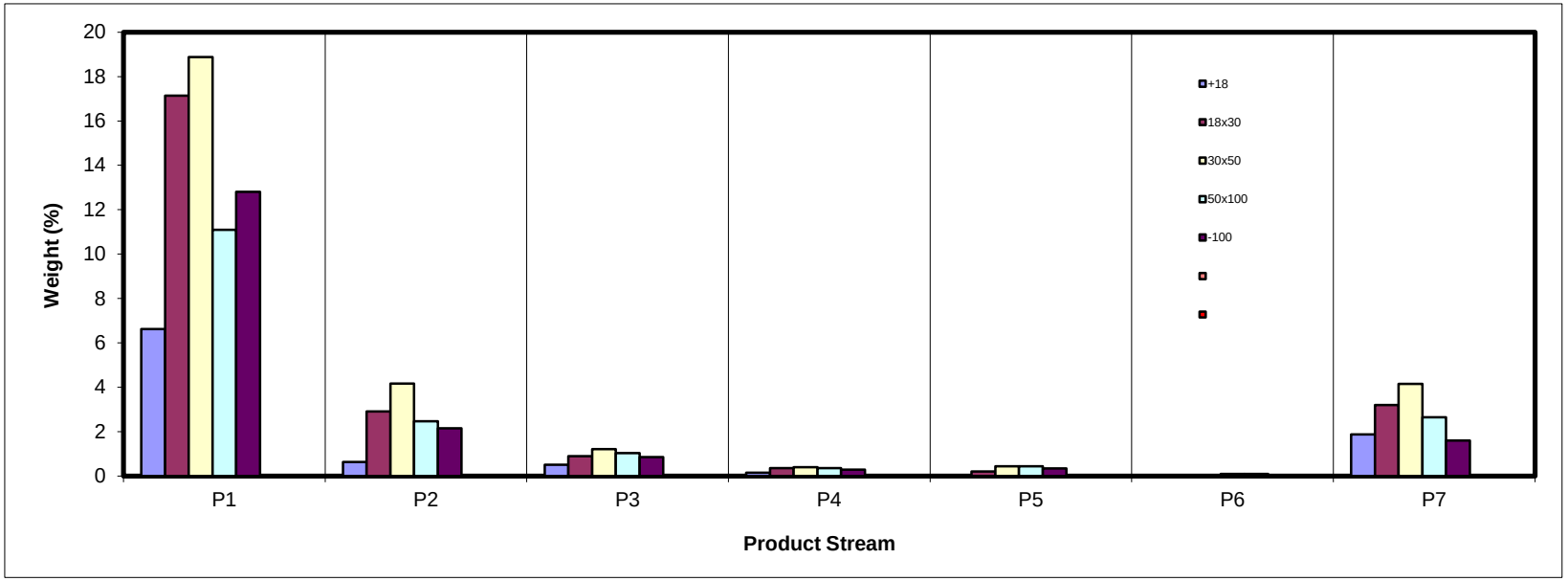
Description: Run 8 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	6.62	0.63	0.50	0.15	0.04	0.00	1.88		9.81
18x30	17.15	2.91	0.89	0.35	0.20	0.01	3.20		24.71
30x50	18.88	4.16	1.21	0.39	0.43	0.04	4.15		29.26
50x100	11.10	2.47	1.03	0.35	0.44	0.09	2.64		18.11
-100	12.80	2.15	0.86	0.28	0.34	0.10	1.59		18.11
Total (Calc)	66.55	12.31	4.49	1.51	1.45	0.23	13.46		100.00



SPIRAL DATA ANALYSIS

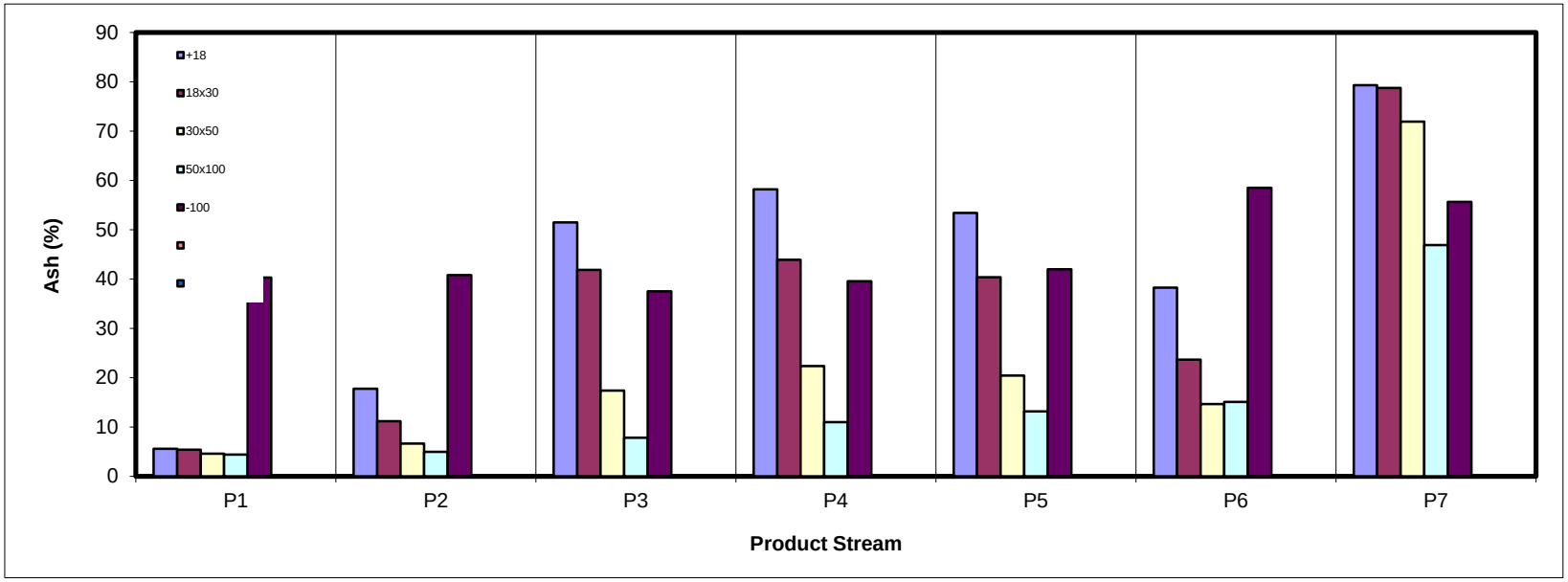
Description: Run 8 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	5.57	17.74	51.47	58.15	53.39	38.26	79.27		23.78
18x30	5.40	11.15	41.85	43.88	40.34	23.62	78.73		17.74
30x50	4.56	6.64	17.37	22.36	20.40	14.64	71.87		15.41
50x100	4.39	4.98	7.82	10.99	13.12	15.09	46.85		11.24
-100	40.29	40.80	37.52	39.54	41.98	58.50	55.62		41.69
Total (Calc)	11.72	13.89	27.70	31.29	26.91	33.77	67.70		20.81



SPIRAL DATA ANALYSIS

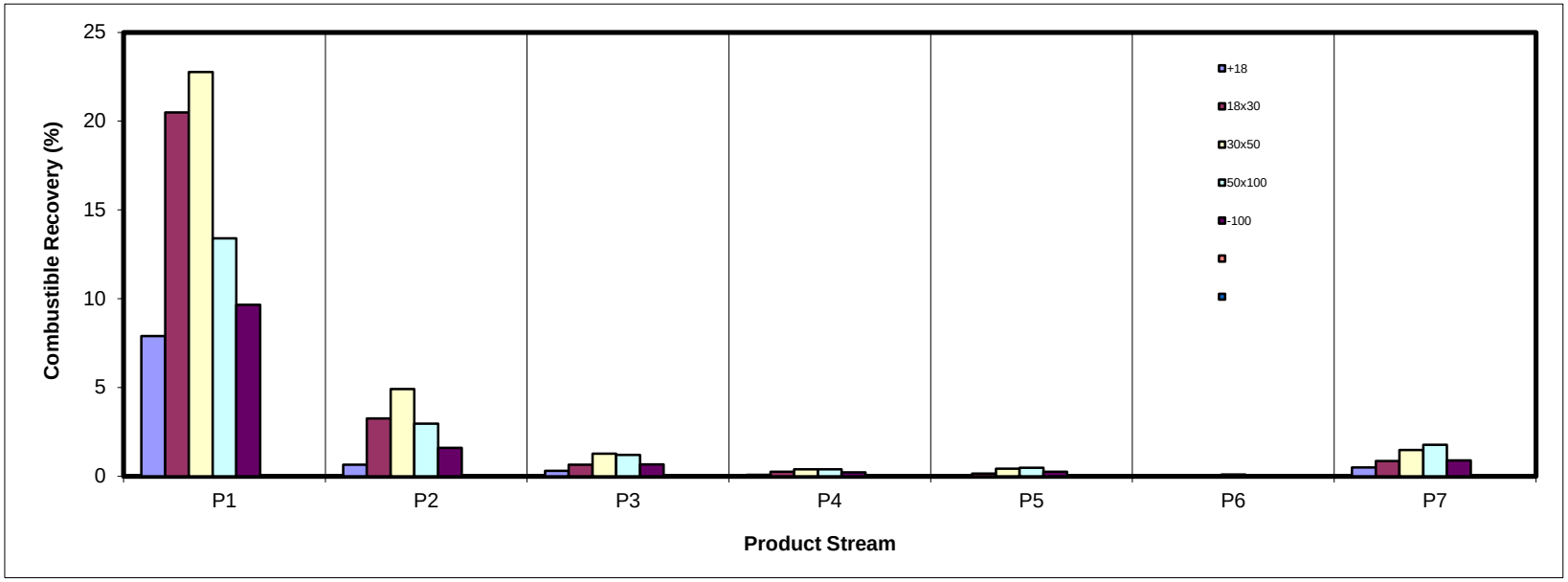
Description: Run 8 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	7.89	0.65	0.31	0.08	0.02	0.00	0.49		9.44
18x30	20.48	3.26	0.65	0.25	0.15	0.01	0.86		25.66
30x50	22.76	4.90	1.27	0.39	0.43	0.04	1.47		31.26
50x100	13.40	2.96	1.20	0.39	0.48	0.09	1.77		20.30
-100	9.65	1.60	0.67	0.21	0.25	0.05	0.89		13.34
Total (Calc)	74.18	13.38	4.10	1.31	1.34	0.19	5.49		100.00



SPIRAL DATA ANALYSIS

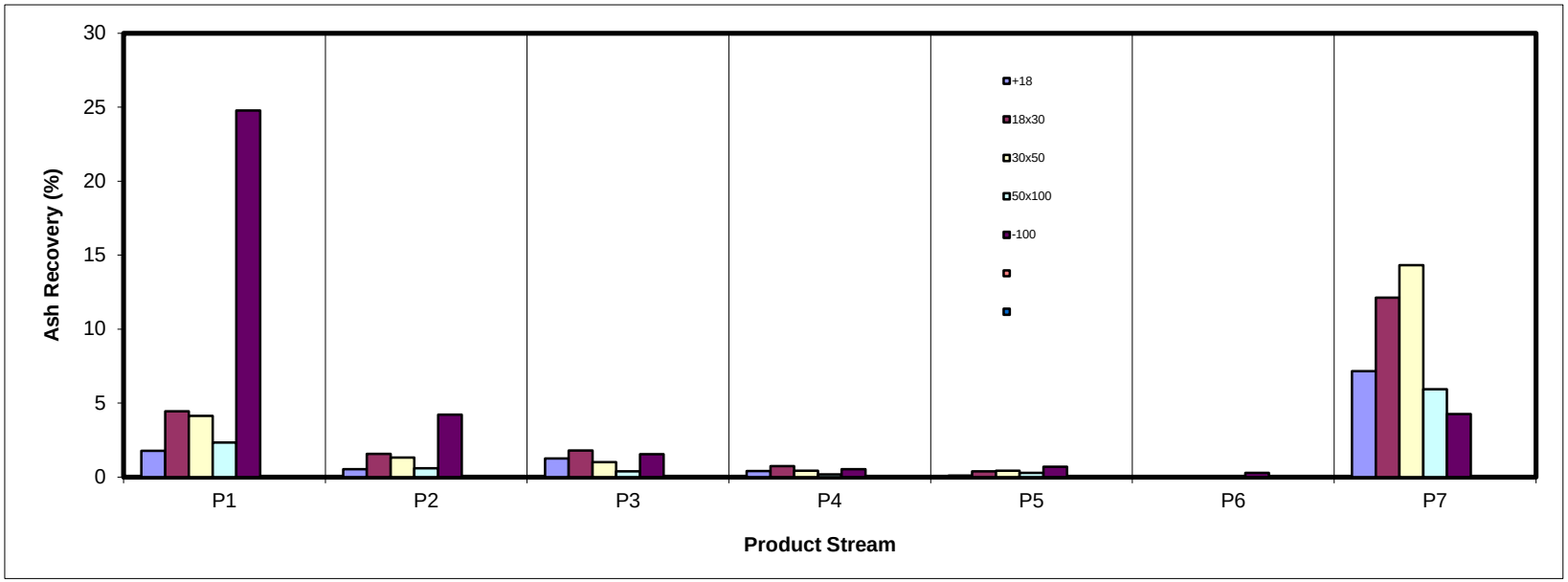
Description: Run 8 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	1.77	0.53	1.25	0.41	0.09	0.00	7.15		11.21
18x30	4.45	1.56	1.79	0.73	0.39	0.01	12.12		21.06
30x50	4.14	1.33	1.01	0.42	0.42	0.03	14.32		21.67
50x100	2.34	0.59	0.39	0.18	0.28	0.06	5.94		9.78
-100	24.78	4.21	1.54	0.53	0.69	0.27	4.26		36.28
Total (Calc)	37.48	8.21	5.98	2.27	1.88	0.37	43.80		100.00



SPIRAL DATA ANALYSIS

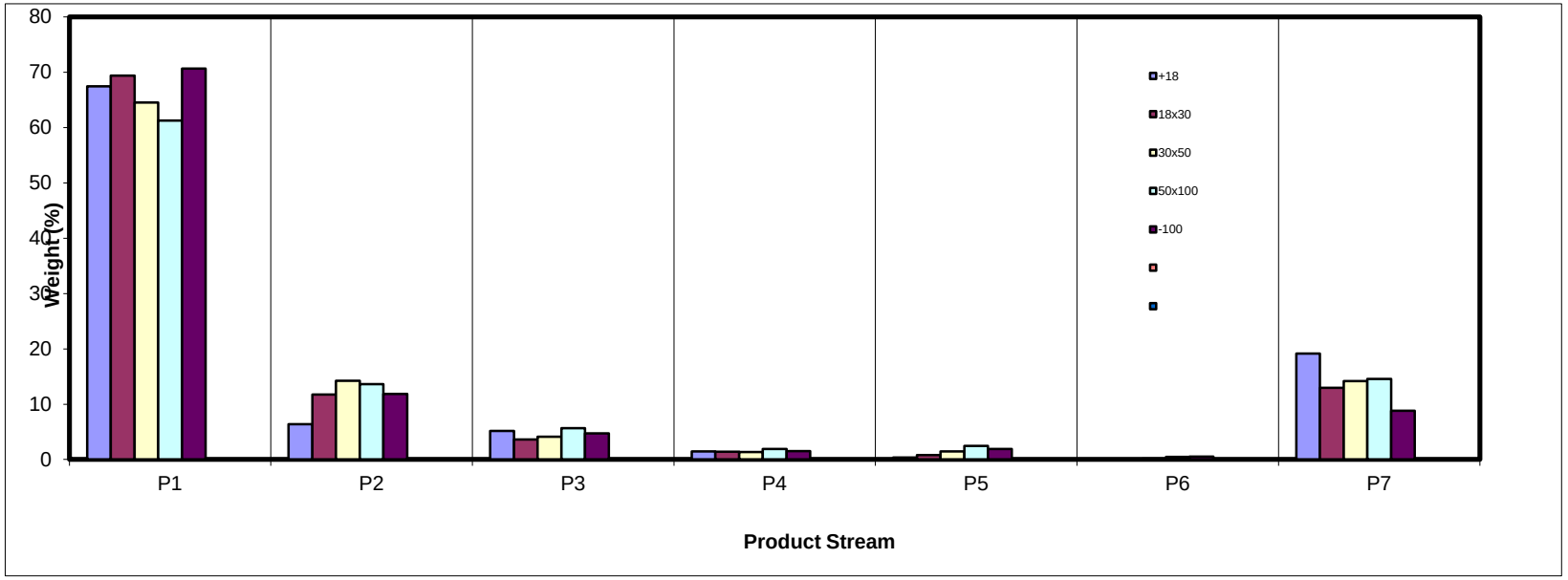
Description: Run 8 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	67.47	6.38	5.14	1.48	0.37	0.01	19.15		100.00
18x30	69.40	11.77	3.61	1.41	0.82	0.02	12.97		100.00
30x50	64.53	14.22	4.14	1.35	1.47	0.13	14.17		100.00
50x100	61.29	13.62	5.69	1.92	2.43	0.48	14.57		100.00
-100	70.67	11.84	4.72	1.53	1.90	0.53	8.80		100.00
Total (Calc)	66.55	12.31	4.49	1.51	1.45	0.23	13.46		100.00



SPIRAL DATA ANALYSIS

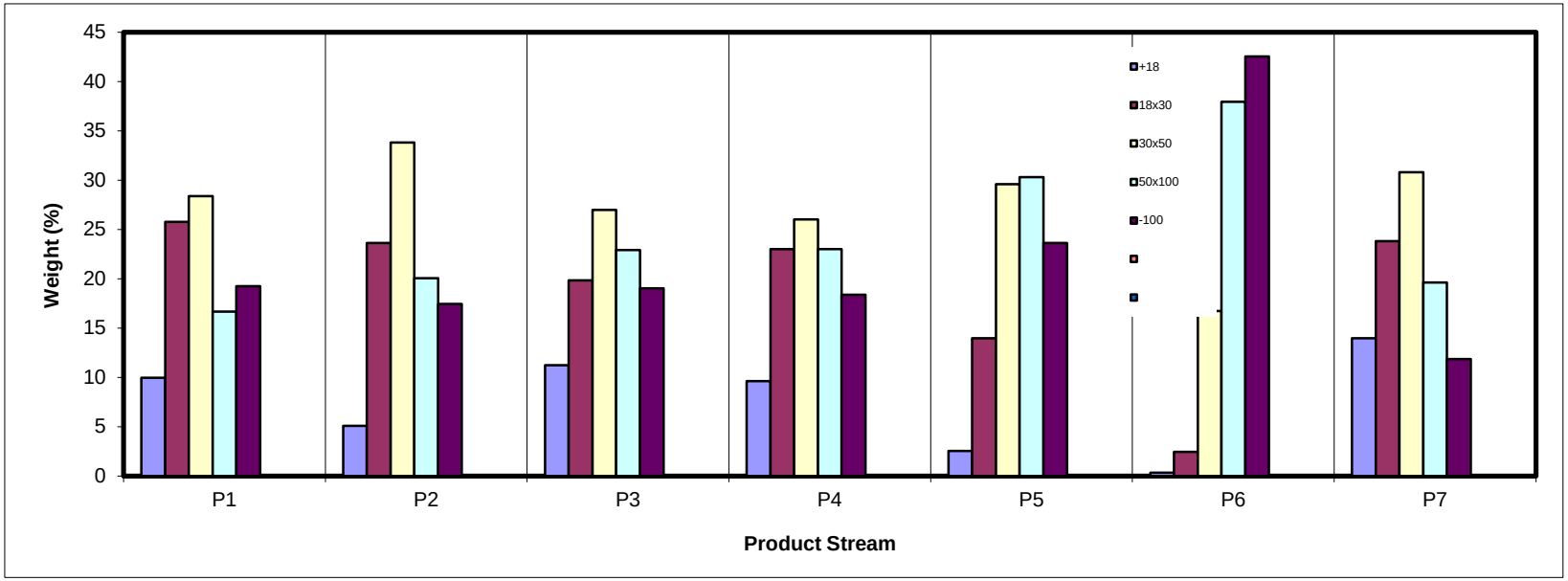
Description: Run 8 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	9.94	5.09	11.23	9.60	2.52	0.33	13.95		9.81
18x30	25.77	23.63	19.83	23.01	13.95	2.45	23.80		24.71
30x50	28.38	33.81	26.98	26.03	29.60	16.74	30.80		29.26
50x100	16.68	20.04	22.92	23.00	30.30	37.94	19.61		18.11
-100	19.23	17.43	19.04	18.37	23.63	42.54	11.84		18.11
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

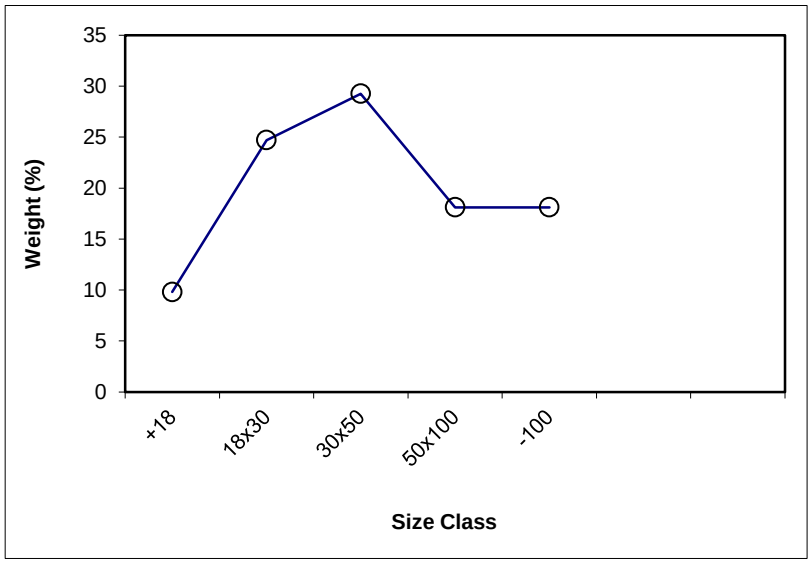
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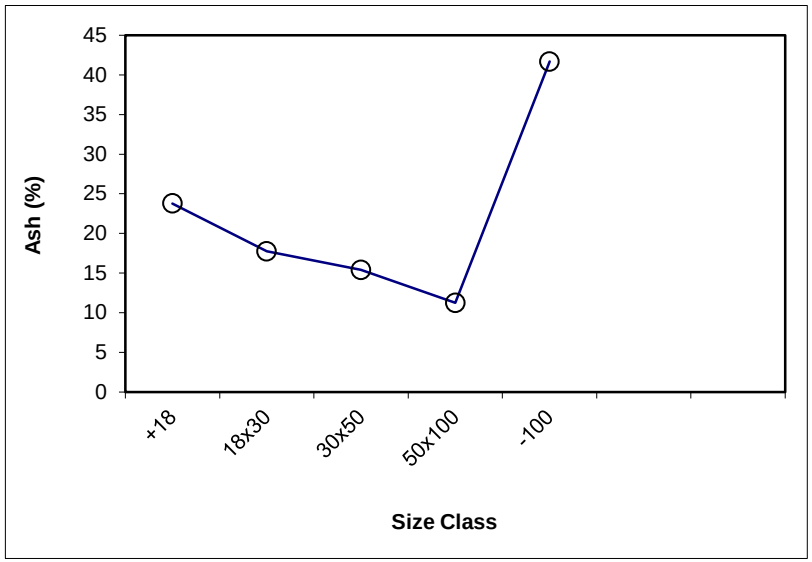
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	850.4	811.1	39.38	9.81	23.78	9.81	23.78	100.00	20.81
18x30	491.1	392.0	99.19	24.71	17.74	34.51	19.45	90.19	20.49
30x50	471.6	354.2	117.50	29.26	15.41	63.78	17.60	65.49	21.52
50x100	465.7	393.0	72.71	18.11	11.24	81.89	16.19	36.22	26.47
-100	78.9	6.2	72.72	18.11	41.69	100.00	20.81	18.11	41.69
Total (Calc)	--	--	401.50	100.00	20.81	--	--	--	--





SPIRAL DATA ANALYSIS

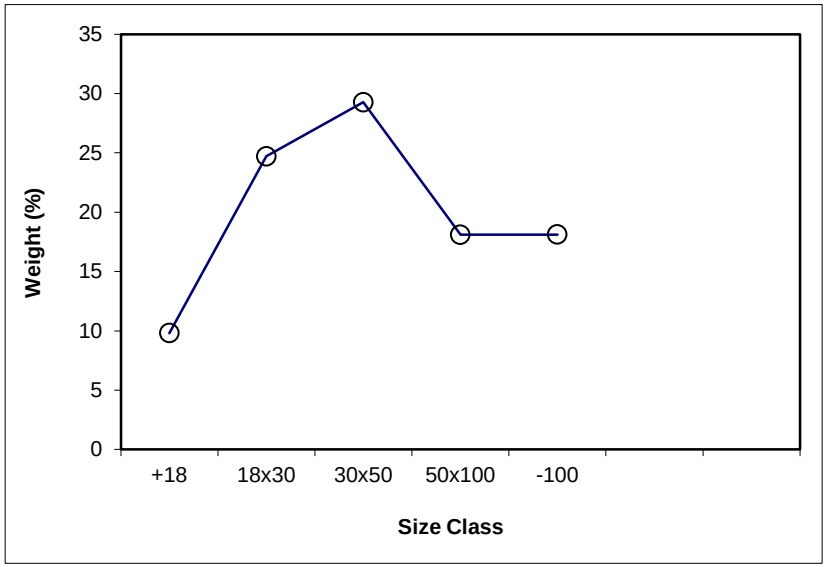
Description: Run 8 - Intermediate Spiral Test

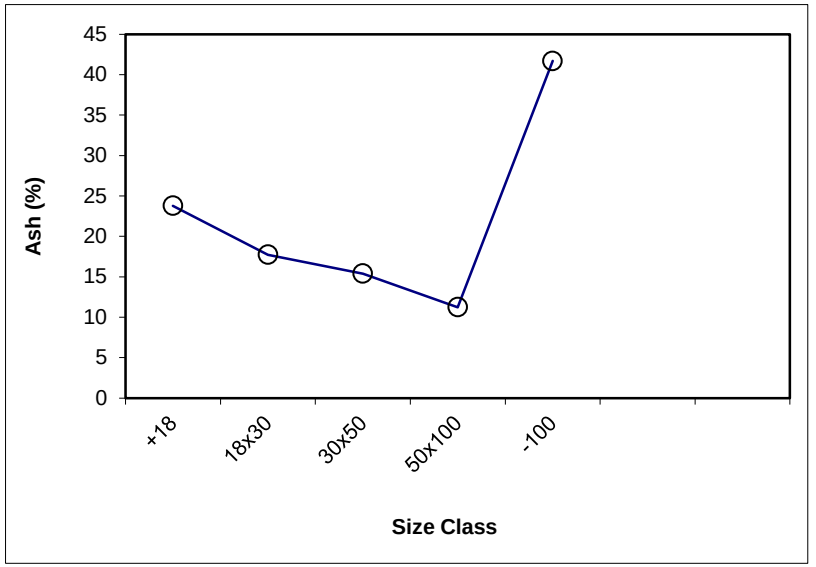
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	9.81	23.78	9.81	23.78	100.00	20.81			
18x30	24.71	17.74	34.51	19.45	90.19	20.49	x	24.71	17.74
30x50	29.26	15.41	63.78	17.60	65.49	21.52	x	29.26	15.41
50x100	18.11	11.24	81.89	16.19	36.22	26.47	x	18.11	11.24
-100	18.11	41.69	100.00	20.81	18.11	41.69			
Total (Calc)	100.00	20.81	--	--	--	--	--	72.08	15.16





SPIRAL DATA ANALYSIS

Description: Run 8 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 66.55

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	1148.36	861.3	287.02	9.94	5.57	9.94	5.57	100.00	11.72
18x30	1555.86	812.2	743.67	25.77	5.40	35.71	5.45	90.06	12.40
30x50	1567.85	748.8	819.04	28.38	4.56	64.09	5.06	64.29	15.20
50x100	1204.09	722.7	481.35	16.68	4.39	80.77	4.92	35.91	23.62
-100	567.85	12.7	555.12	19.23	40.29	100.00	11.72	19.23	40.29
Total (Calc)	--	--	2886.20	100.00	11.72	--	--	--	--

Product P2 Feed Weight (%): 12.31

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	487.3	460.1	27.15	5.09	17.74	5.09	17.74	100.00	13.89
18x30	574.2	448.1	126.11	23.63	11.15	28.72	12.32	94.91	13.69
30x50	605.3	424.9	180.44	33.81	6.64	62.52	9.25	71.28	14.53
50x100	504.2	397.2	106.98	20.04	4.98	82.57	8.21	37.48	21.64
-100	99.4	6.4	93.04	17.43	40.80	100.00	13.89	17.43	40.80
Total (Calc)	--	--	533.71	100.00	13.89	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 8 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 4.49

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	708.4	664.7	43.76	11.23	51.47	11.23	51.47	100.00	27.70
18x30	519.4	442.2	77.29	19.83	41.85	31.06	45.33	88.77	24.70
30x50	517.7	412.5	105.17	26.98	17.37	58.04	32.33	68.94	19.76
50x100	498.1	408.8	89.34	22.92	7.82	80.96	25.39	41.96	21.30
-100	80.6	6.4	74.19	19.04	37.52	100.00	27.70	19.04	37.52
Total (Calc)	--	--	389.76	100.00	27.70	--	--	--	--

Product P4 Feed Weight (%): 1.51

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	842.6	811.1	31.50	9.60	58.15	9.60	58.15	100.00	31.29
18x30	467.4	392.0	75.49	23.01	43.88	32.61	48.08	90.40	28.44
30x50	439.5	354.2	85.39	26.03	22.36	58.64	36.66	67.39	23.16
50x100	468.5	393.0	75.45	23.00	10.99	81.63	29.43	41.36	23.67
-100	66.4	6.1	60.26	18.37	39.54	100.00	31.29	18.37	39.54
Total (Calc)	--	--	328.09	100.00	31.29	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 8 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 1.45

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	468.1	460.1	7.94	2.52	53.39	2.52	53.39	100.00	26.91
18x30	492.1	448.1	43.96	13.95	40.34	16.47	42.34	97.48	26.22
30x50	518.2	424.9	93.28	29.60	20.40	46.07	28.24	83.53	23.86
50x100	492.7	397.2	95.49	30.30	13.12	76.37	22.24	53.93	25.77
-100	80.9	6.4	74.47	23.63	41.98	100.00	26.91	23.63	41.98
Total (Calc)	--	--	315.14	100.00	26.91	--	--	--	--

Product P6 Feed Weight (%): 0.23

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	401.7	401.2	0.46	0.33	38.26	0.33	38.26	100.00	33.77
18x30	373.4	370.0	3.38	2.45	23.62	2.78	25.36	99.67	33.75
30x50	359.4	336.3	23.07	16.74	14.64	19.52	16.17	97.22	34.01
50x100	360.1	307.8	52.30	37.94	15.09	57.46	15.45	80.48	38.03
-100	65.0	6.4	58.64	42.54	58.50	100.00	33.77	42.54	58.50
Total (Calc)	--	--	137.85	100.00	33.77	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 8 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 13.46

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	746.1	664.7	81.45	13.95	79.27	13.95	79.27	100.00	67.70
18x30	581.1	442.2	138.95	23.80	78.73	37.75	78.93	86.05	65.83
30x50	592.3	412.5	179.81	30.80	71.87	68.55	75.76	62.25	60.90
50x100	523.2	408.8	114.47	19.61	46.85	88.16	69.33	31.45	50.15
-100	75.5	6.4	69.14	11.84	55.62	100.00	67.70	11.84	55.62
Total (Calc)	--	--	583.82	100.00	67.70	--	--	--	--

SPIRAL DATA ANALYSIS

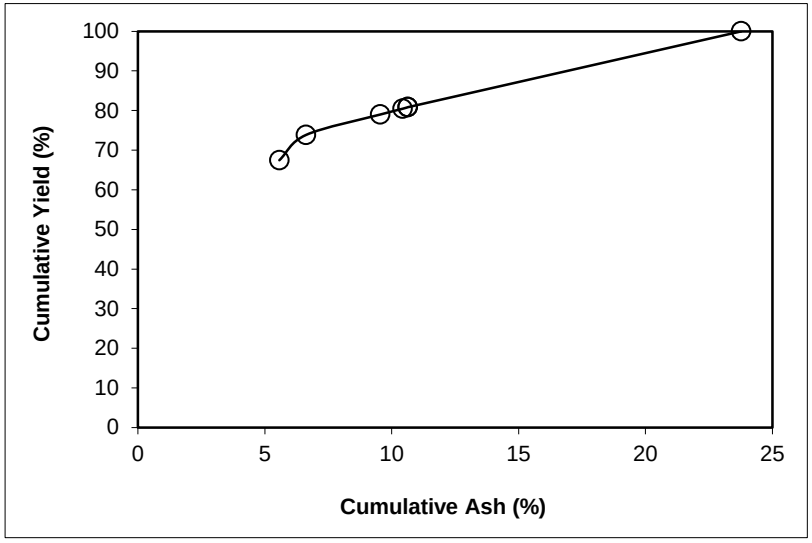
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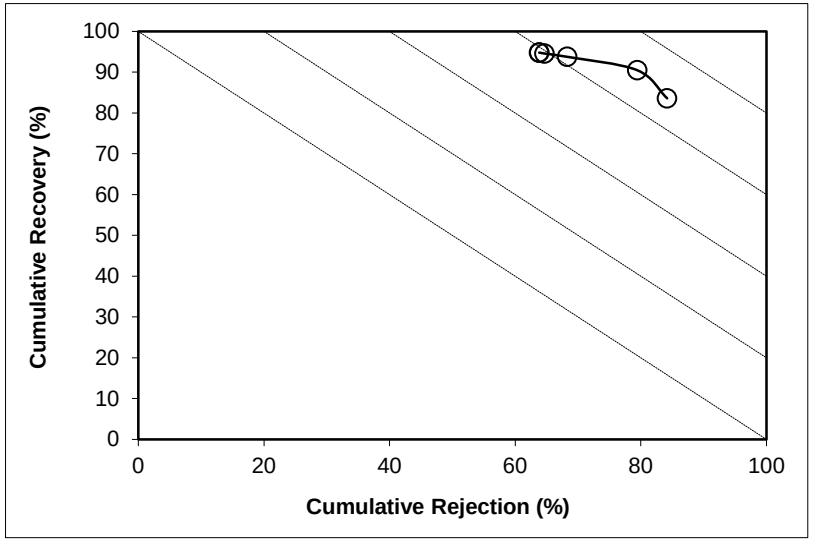
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 9.81

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	67.47	5.57	67.47	5.57	83.58	32.53	61.53	84.19	67.77
P2	6.38	17.74	73.85	6.62	90.47	26.15	72.22	79.43	69.90
P3	5.14	51.47	78.99	9.54	93.74	21.01	77.30	68.30	62.04
P4	1.48	58.15	80.47	10.44	94.56	19.53	78.75	64.68	59.23
P5	0.37	53.39	80.85	10.64	94.79	19.15	79.25	63.84	58.62
P6	0.01	38.26	80.85	10.64	94.79	19.15	79.27	63.83	58.62
P7	19.15	79.27	100.00	23.78	100.00	0.00			
Total (Calc)	100.00	23.78	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

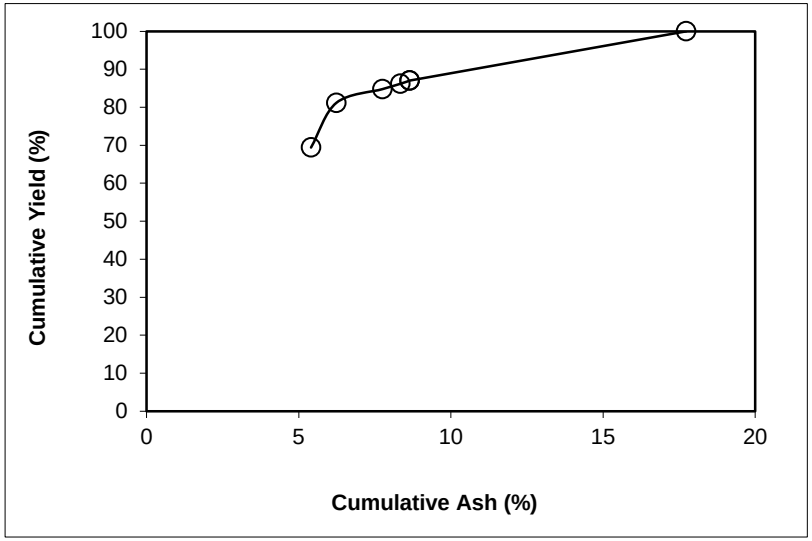
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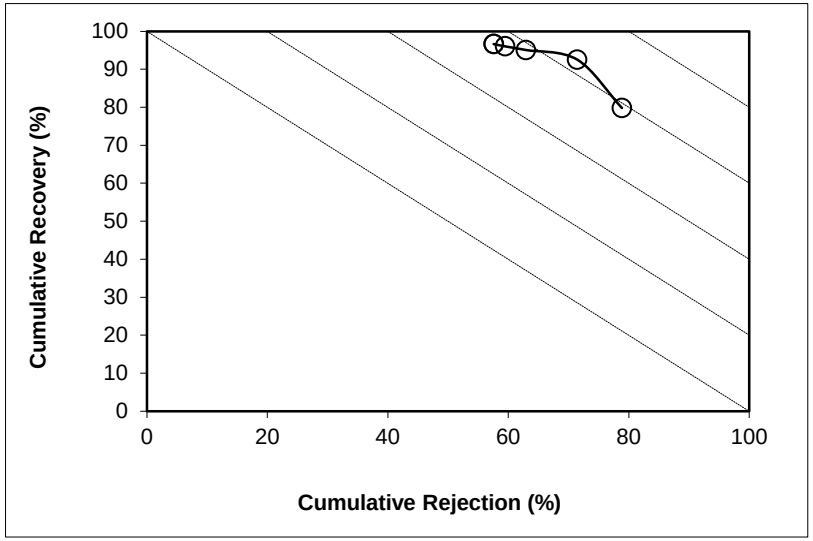
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 24.71

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	69.40	5.40	69.40	5.40	79.81	30.60	45.71	78.85	58.66
P2	11.77	11.15	81.17	6.24	92.52	18.83	67.32	71.46	63.98
P3	3.61	41.85	84.78	7.75	95.07	15.22	73.35	62.94	58.01
P4	1.41	43.88	86.19	8.34	96.03	13.81	76.36	59.46	55.49
P5	0.82	40.34	87.01	8.64	96.63	12.99	78.63	57.59	54.22
P6	0.02	23.62	87.03	8.65	96.65	12.97	78.73	57.56	54.21
P7	12.97	78.73	100.00	17.74	100.00	0.00			
Total (Calc)	100.00	17.74	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

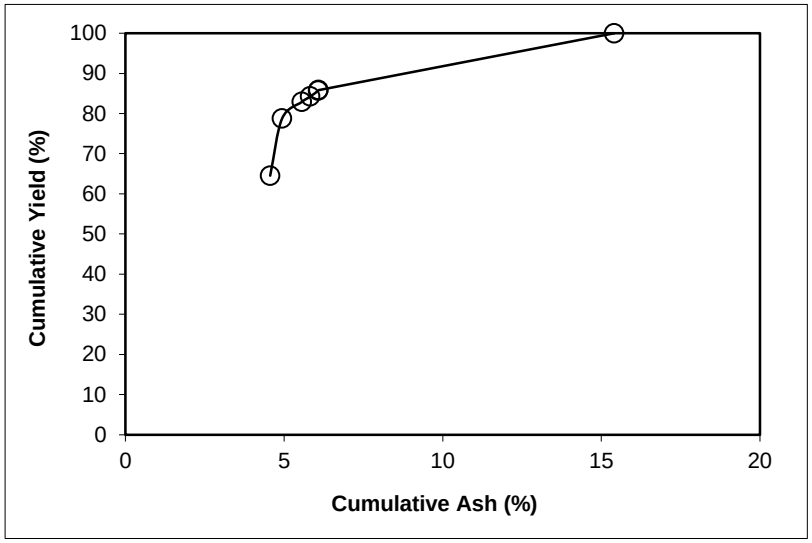
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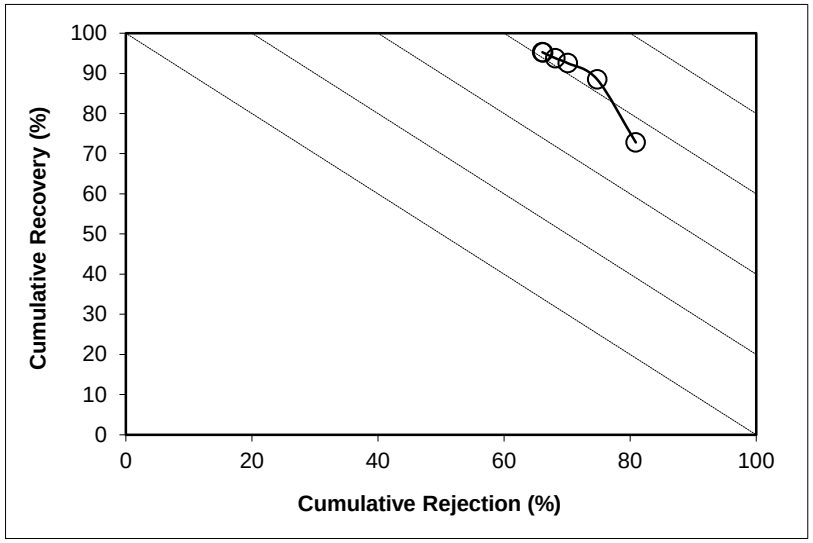
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 29.26

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	64.53	4.56	64.53	4.56	72.80	35.47	35.14	80.90	53.71
P2	14.22	6.64	78.75	4.93	88.49	21.25	54.20	74.78	63.27
P3	4.14	17.37	82.89	5.56	92.54	17.11	63.12	70.11	62.65
P4	1.35	22.36	84.23	5.82	93.78	15.77	66.60	68.16	61.93
P5	1.47	20.40	85.70	6.07	95.16	14.30	71.35	66.21	61.37
P6	0.13	14.64	85.83	6.09	95.29	14.17	71.87	66.09	61.38
P7	14.17	71.87	100.00	15.41	100.00	0.00			
Total (Calc)	100.00	15.41	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

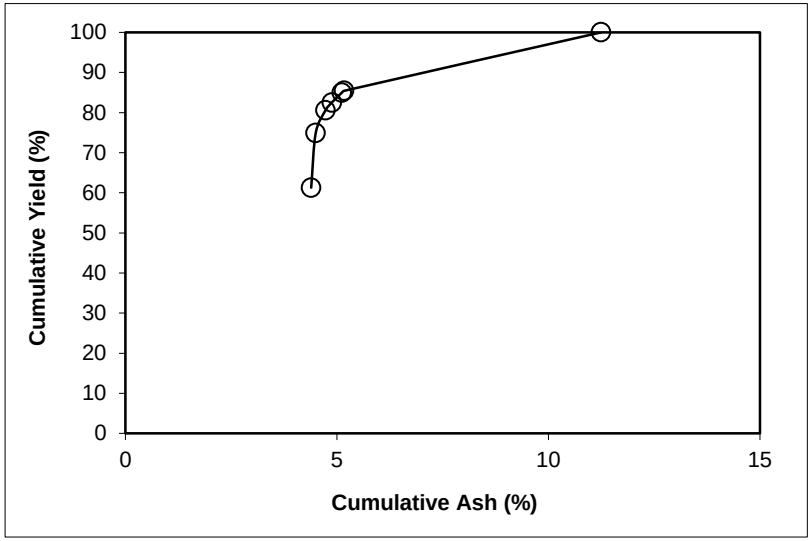
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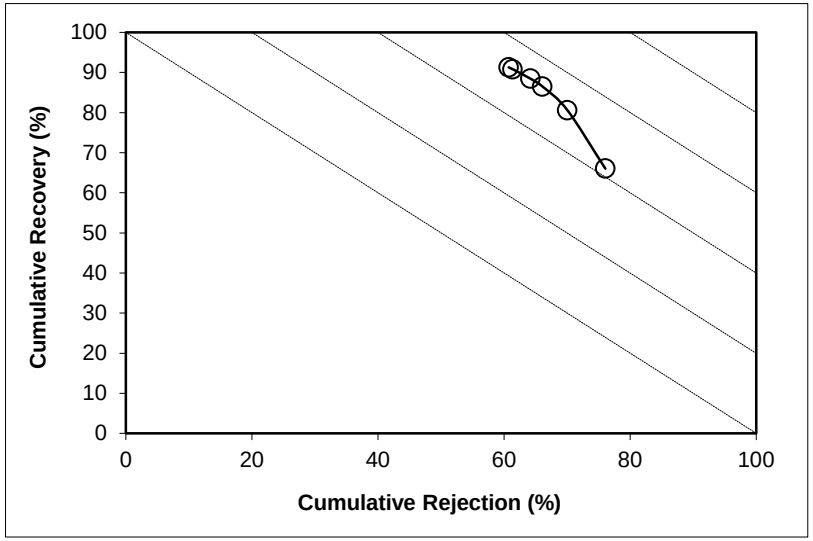
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 18.11

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	61.29	4.39	61.29	4.39	66.02	38.71	22.09	76.07	42.09
P2	13.62	4.98	74.91	4.50	80.60	25.09	31.39	70.04	50.65
P3	5.69	7.82	80.60	4.73	86.51	19.40	38.29	66.09	52.60
P4	1.92	10.99	82.52	4.88	88.44	17.48	41.29	64.21	52.64
P5	2.43	13.12	84.95	5.11	90.82	15.05	45.84	61.37	52.19
P6	0.48	15.09	85.43	5.17	91.27	14.57	46.85	60.73	52.00
P7	14.57	46.85	100.00	11.24	100.00	0.00			
Total (Calc)	100.00	11.24	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

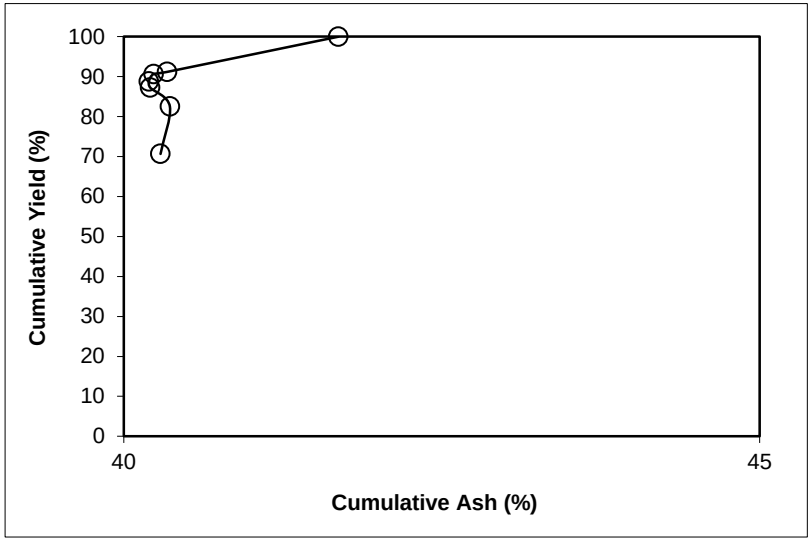
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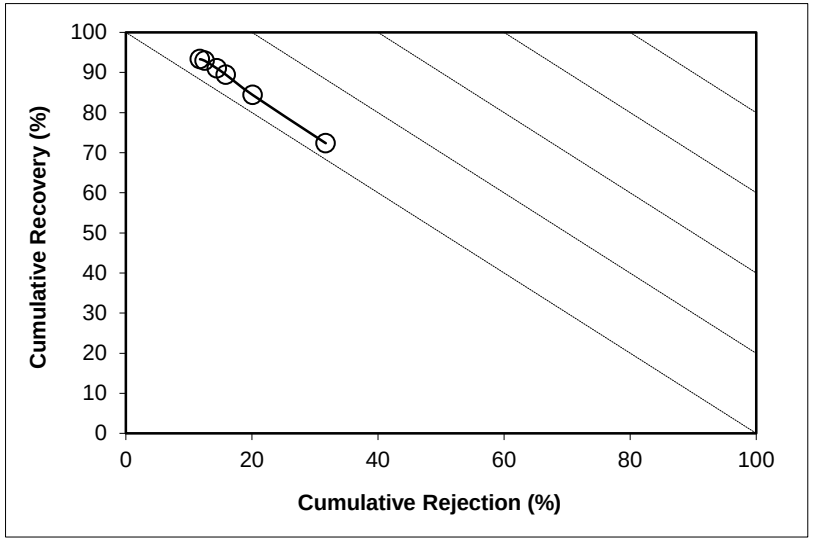
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: -100 Feed Weight (%): 18.11

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	70.67	40.29	70.67	40.29	72.36	29.33	45.05	31.70	4.06
P2	11.84	40.80	82.51	40.36	84.39	17.49	47.93	20.11	4.49
P3	4.72	37.52	87.23	40.21	89.45	12.77	51.78	15.86	5.30
P4	1.53	39.54	88.77	40.20	91.04	11.23	53.46	14.40	5.44
P5	1.90	41.98	90.67	40.23	92.92	9.33	55.79	12.49	5.42
P6	0.53	58.50	91.20	40.34	93.30	8.80	55.62	11.74	5.05
P7	8.80	55.62	100.00	41.69	100.00	0.00			
Total (Calc)	100.00	41.69	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

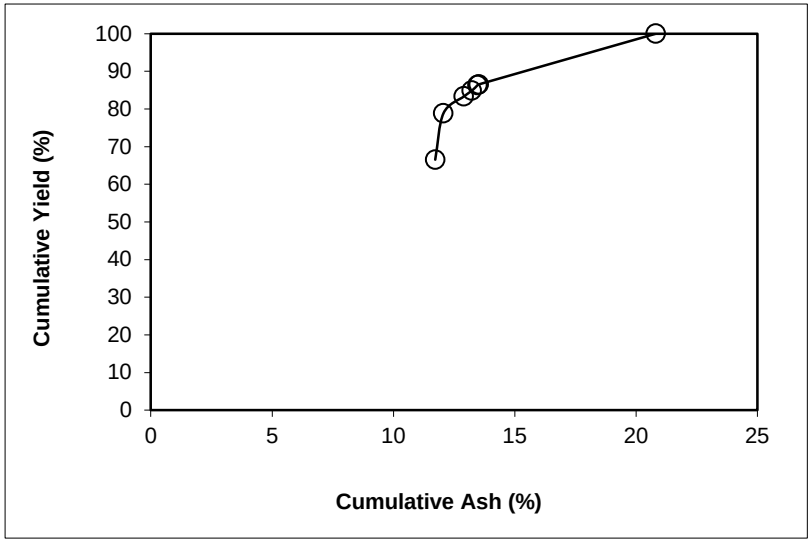
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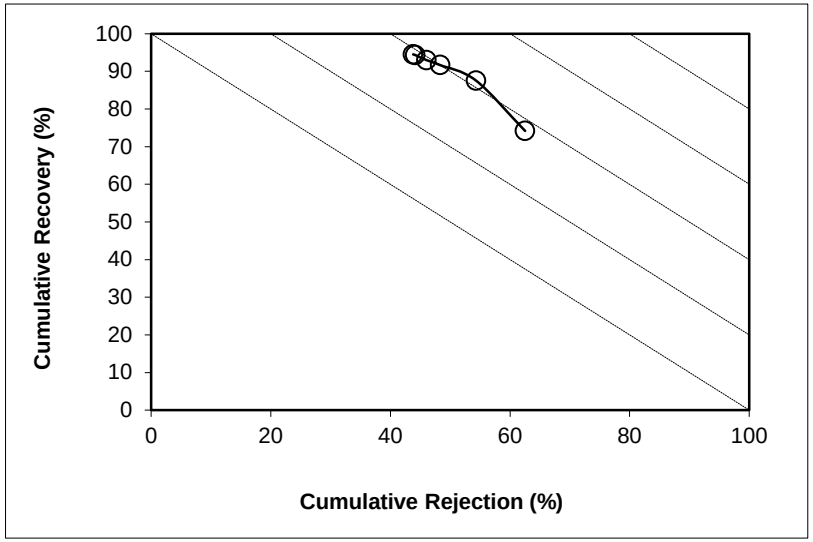
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	66.55	11.72	66.55	11.72	74.18	33.45	38.89	62.52	36.70
P2	12.31	13.89	78.85	12.06	87.56	21.15	53.43	54.30	41.87
P3	4.49	27.70	83.35	12.90	91.67	16.65	60.37	48.32	39.99
P4	1.51	31.29	84.86	13.23	92.98	15.14	63.28	46.04	39.02
P5	1.45	26.91	86.31	13.46	94.32	13.69	67.14	44.17	38.49
P6	0.23	33.77	86.54	13.51	94.51	13.46	67.70	43.80	38.31
P7	13.46	67.70	100.00	20.81	100.00	0.00			
Total (Calc)	100.00	20.81	--	--	--	--	--	--	--

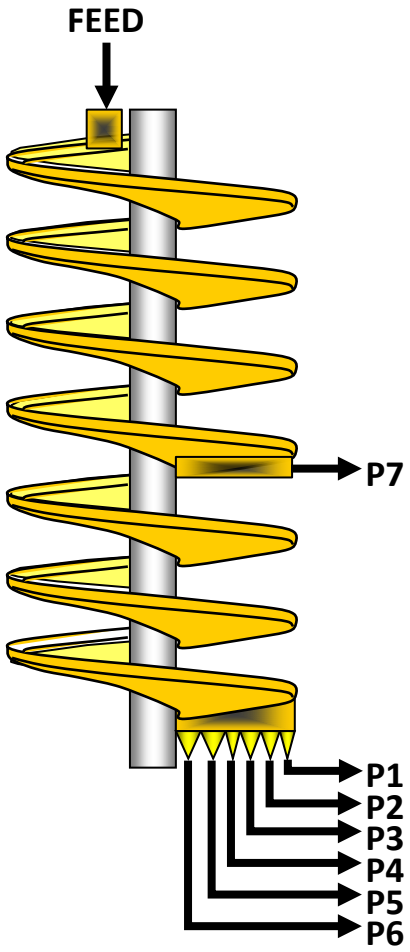




SPIRAL DATA ANALYSIS

Description: Run 9 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	1.480	20.6	22.80	27.13
P2	0.362	28.2	3.69	4.75
P3	0.139	31.7	1.20	1.57
P4	0.050	35.9	0.36	0.49
P5	0.039	22.3	0.54	0.65
P6	0.006	11.2	0.18	0.19
P7	0.245	42.0	1.35	1.82
Total	2.322	23.6	30.12	36.60

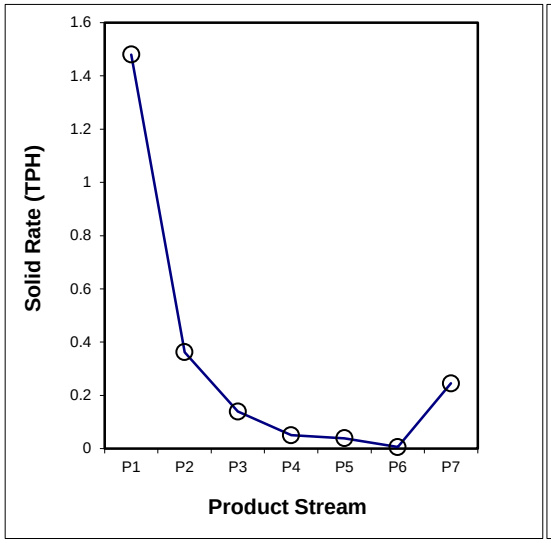
SPIRAL DATA ANALYSIS

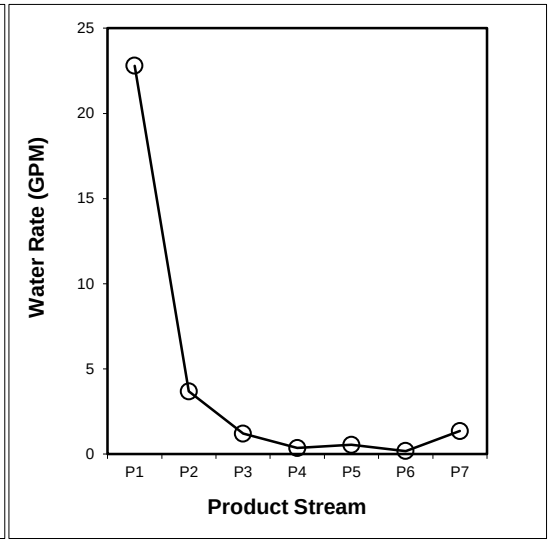
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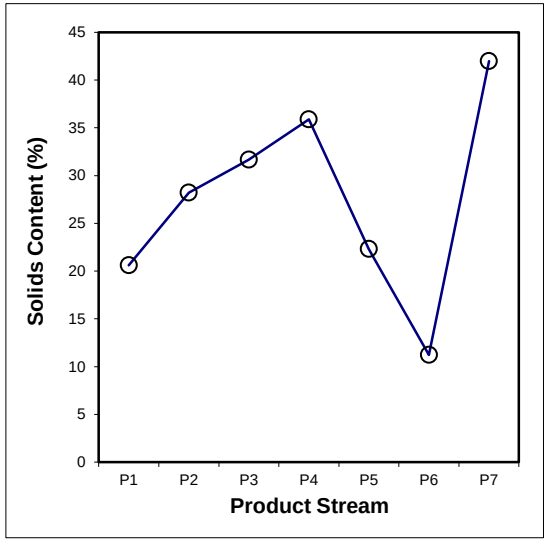
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	5	10320.00	1123.00	7.179	5024.3	3158.0	1.480	63.74	20.61
P2	5	1732.83	89.39	1.284	1878.7	1421.7	0.362	15.61	28.22
P3	10	1218.79	95.13	0.440	2285.9	1934.3	0.139	6.00	31.68
P4	25	990.38	94.22	0.140	2274.4	1956.7	0.050	2.17	35.90
P5	25	1213.45	92.76	0.175	1983.5	1736.8	0.039	1.69	22.32
P6	70	981.68	92.68	0.050	1520.1	1421.7	0.006	0.24	11.24
P7	5	819.66	84.95	0.583	2243.2	1934.3	0.245	10.55	41.99
Total (Calc)	--	--	--	9.852	--	--	2.322	100.00	23.57
Total (Head)	0.51	1357.4	93.98	9.852	2254.4	1956.6	2.322	--	23.57







SPIRAL DATA ANALYSIS

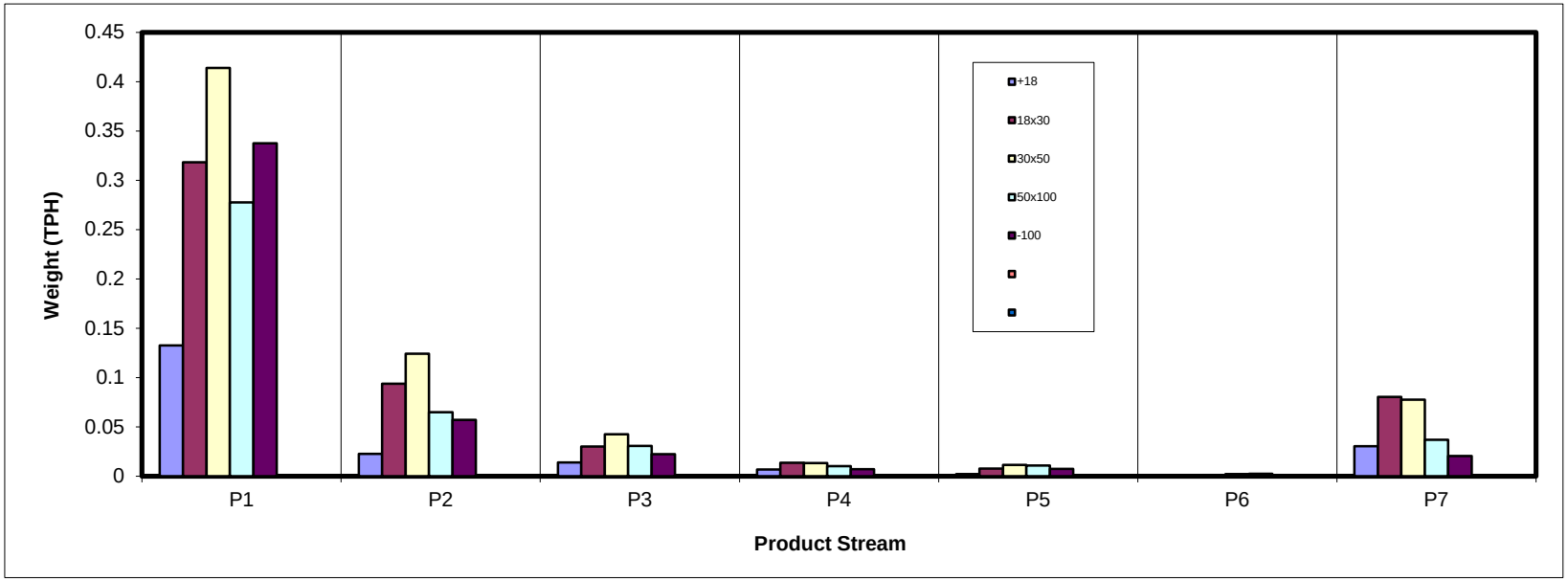
Description: Run 9 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.133	0.023	0.014	0.007	0.002	0.000	0.030		0.208
18x30	0.318	0.094	0.030	0.013	0.008	0.000	0.080		0.543
30x50	0.414	0.124	0.042	0.013	0.011	0.001	0.077		0.684
50x100	0.278	0.065	0.031	0.010	0.011	0.002	0.037		0.433
-100	0.337	0.057	0.022	0.007	0.007	0.002	0.020		0.454
Total (Calc)	1.480	0.362	0.139	0.050	0.039	0.006	0.245		2.322



SPIRAL DATA ANALYSIS

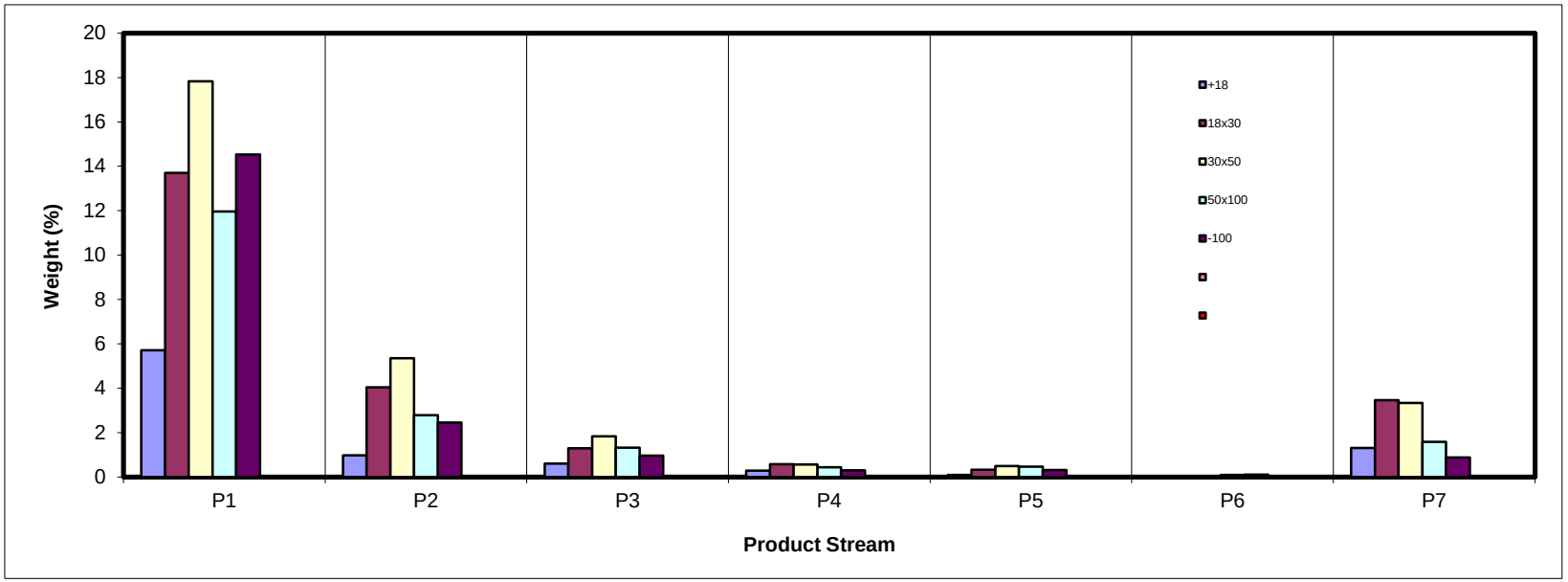
Description: Run 9 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	5.71	0.98	0.60	0.29	0.09	0.00	1.30		8.97
18x30	13.71	4.03	1.29	0.58	0.33	0.01	3.46		23.40
30x50	17.83	5.35	1.83	0.57	0.49	0.04	3.33		29.45
50x100	11.96	2.79	1.33	0.43	0.46	0.09	1.59		18.64
-100	14.54	2.46	0.96	0.30	0.31	0.10	0.88		19.55
Total (Calc)	63.74	15.61	6.00	2.17	1.69	0.24	10.55		100.00



SPIRAL DATA ANALYSIS

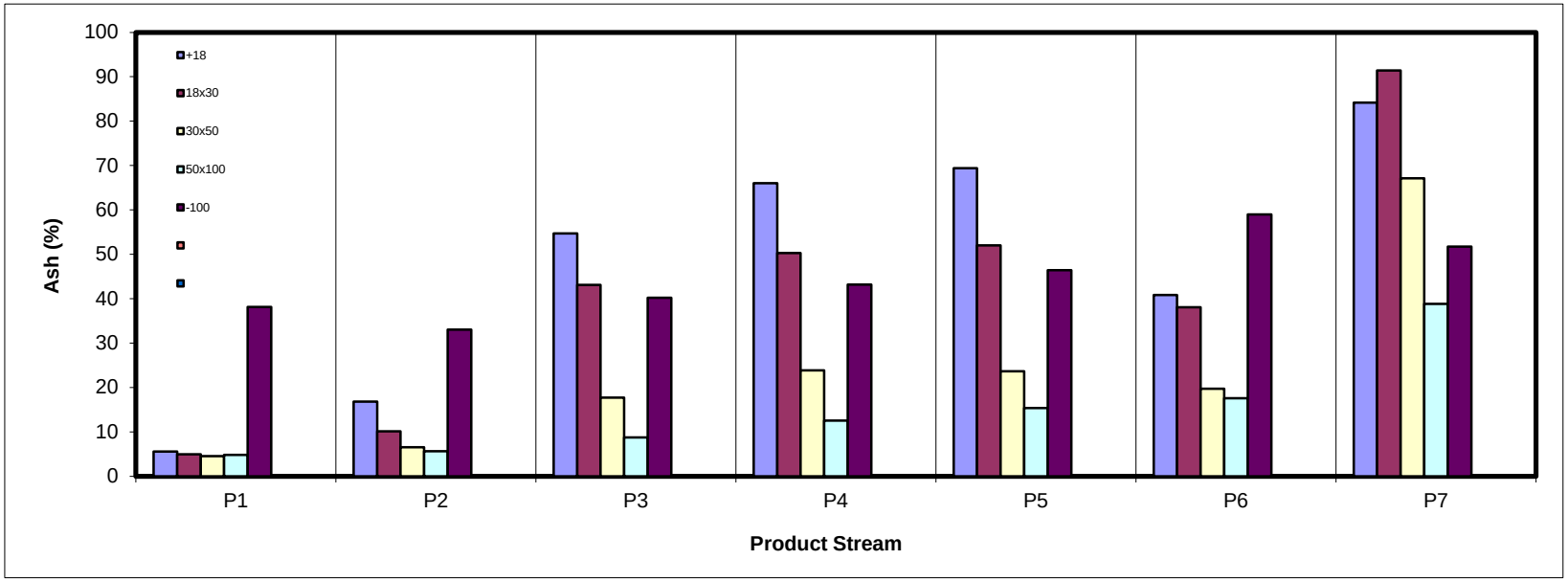
Description: Run 9 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	5.59	16.81	54.72	65.99	69.42	40.81	84.17		24.08
18x30	4.95	10.13	43.12	50.29	51.99	38.10	91.40		22.50
30x50	4.57	6.52	17.74	23.88	23.68	19.70	67.10		13.54
50x100	4.81	5.62	8.74	12.52	15.39	17.55	38.86		8.61
-100	38.15	33.00	40.22	43.16	46.42	58.96	51.74		38.53
Total (Calc)	12.44	12.11	28.49	37.00	33.59	36.04	71.64		20.55



SPIRAL DATA ANALYSIS

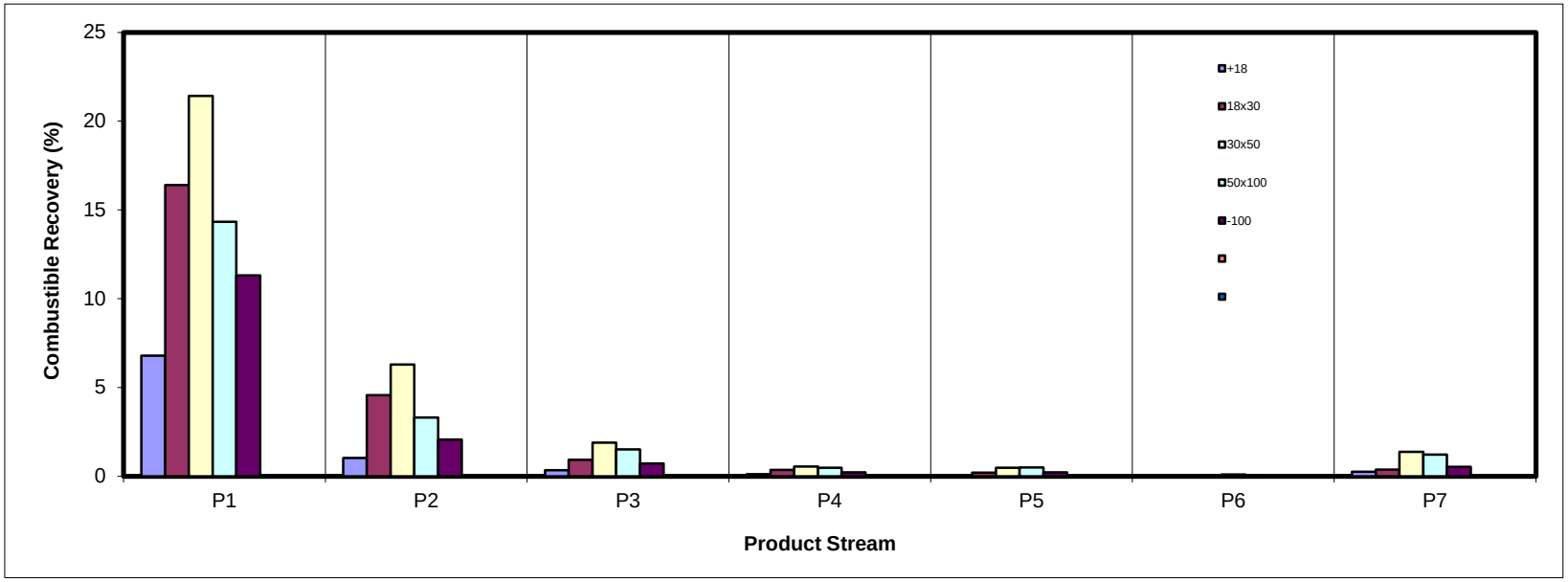
Description: Run 9 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	6.79	1.02	0.34	0.12	0.03	0.00	0.26		8.57
18x30	16.40	4.56	0.92	0.36	0.20	0.01	0.37		22.82
30x50	21.41	6.30	1.89	0.54	0.48	0.04	1.38		32.04
50x100	14.33	3.31	1.52	0.47	0.49	0.09	1.22		21.44
-100	11.32	2.07	0.73	0.22	0.21	0.05	0.53		15.12
Total (Calc)	70.24	17.27	5.40	1.72	1.41	0.19	3.77		100.00



SPIRAL DATA ANALYSIS

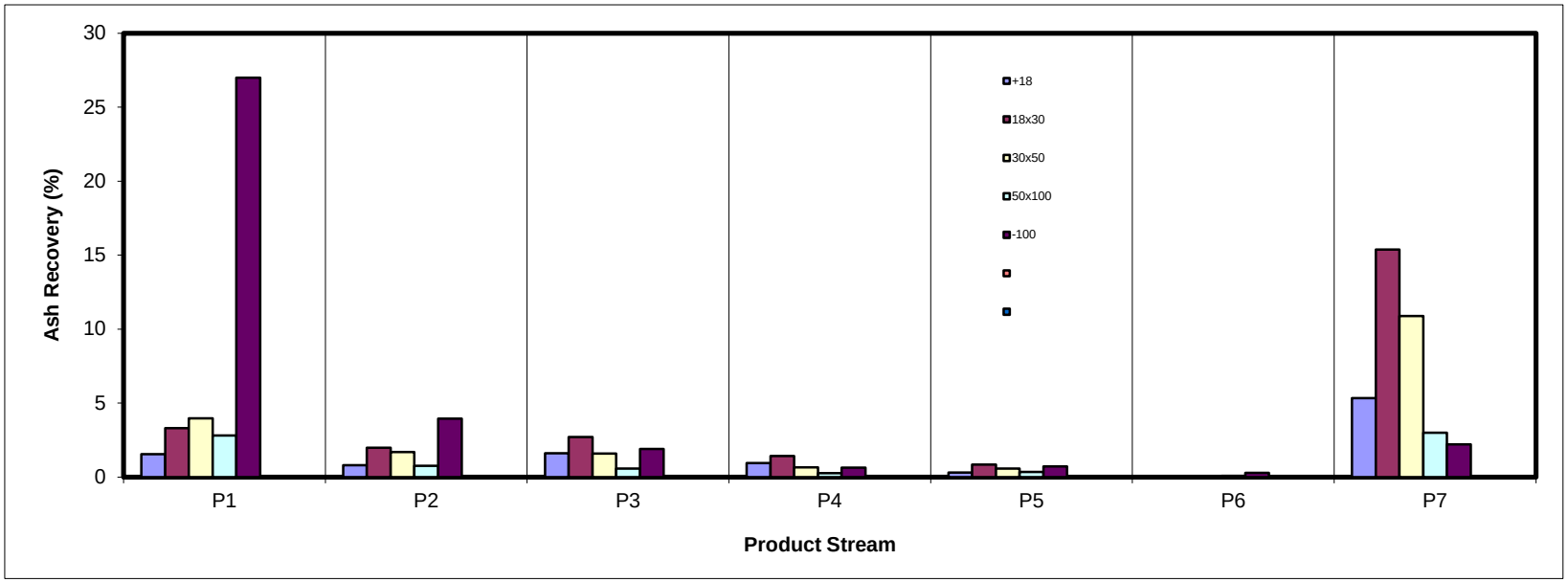
Description: Run 9 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	1.55	0.80	1.60	0.93	0.30	0.00	5.33		10.51
18x30	3.30	1.99	2.70	1.42	0.83	0.01	15.37		25.62
30x50	3.96	1.70	1.58	0.66	0.57	0.04	10.89		19.40
50x100	2.80	0.76	0.56	0.26	0.34	0.08	3.00		7.81
-100	26.99	3.95	1.89	0.64	0.71	0.29	2.21		36.66
Total (Calc)	38.60	9.20	8.33	3.91	2.75	0.42	36.79		100.00



SPIRAL DATA ANALYSIS

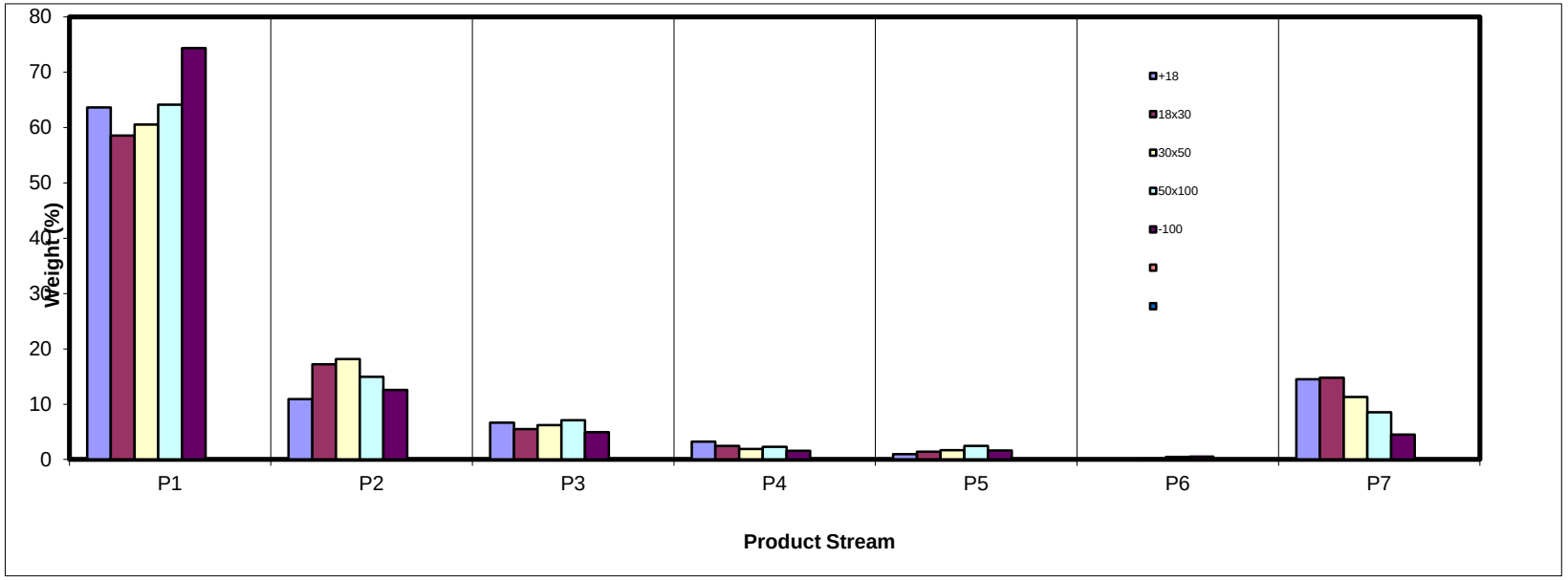
Description: Run 9 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	63.68	10.90	6.69	3.25	0.98	0.02	14.50		100.00
18x30	58.58	17.24	5.50	2.47	1.41	0.03	14.77		100.00
30x50	60.55	18.18	6.21	1.93	1.68	0.14	11.32		100.00
50x100	64.16	14.97	7.11	2.31	2.46	0.48	8.51		100.00
-100	74.35	12.57	4.93	1.55	1.61	0.51	4.48		100.00
Total (Calc)	63.74	15.61	6.00	2.17	1.69	0.24	10.55		100.00



SPIRAL DATA ANALYSIS

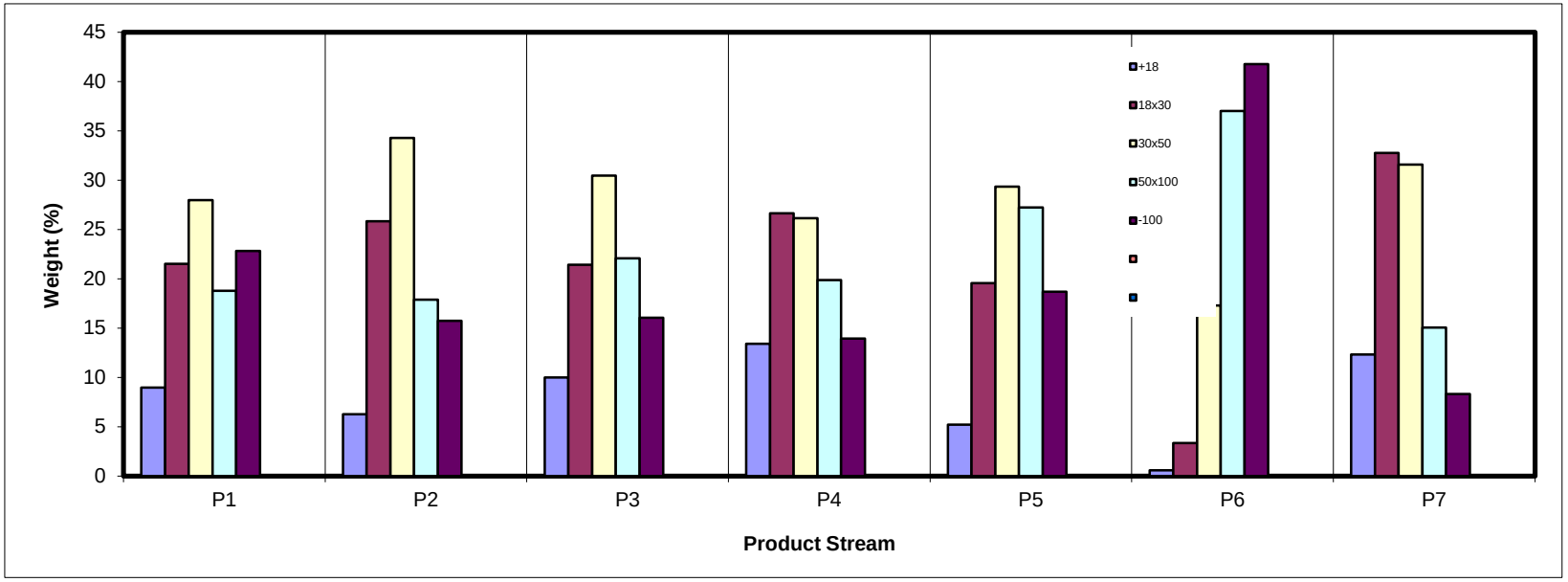
Description: Run 9 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	8.96	6.26	9.99	13.41	5.21	0.58	12.32		8.97
18x30	21.50	25.84	21.42	26.64	19.55	3.33	32.75		23.40
30x50	27.97	34.29	30.47	26.14	29.36	17.29	31.59		29.45
50x100	18.76	17.87	22.07	19.85	27.22	37.01	15.04		18.64
-100	22.80	15.74	16.06	13.95	18.67	41.78	8.30		19.55
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

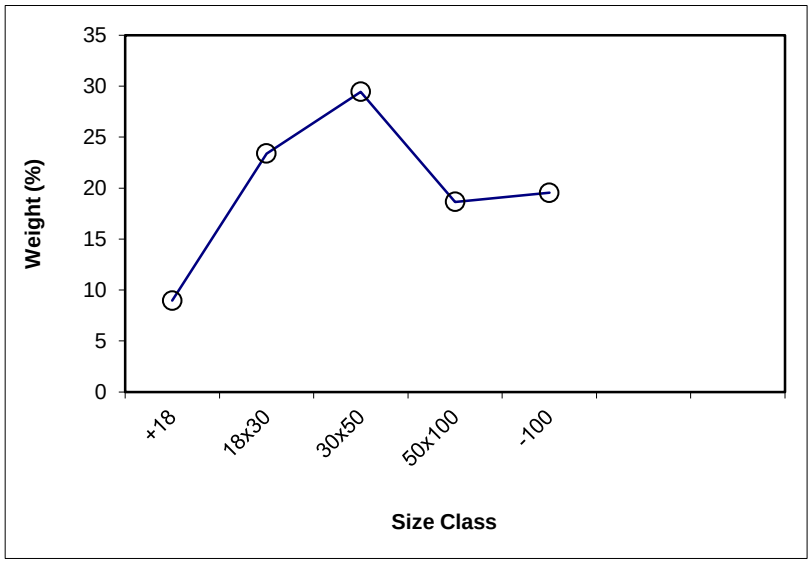
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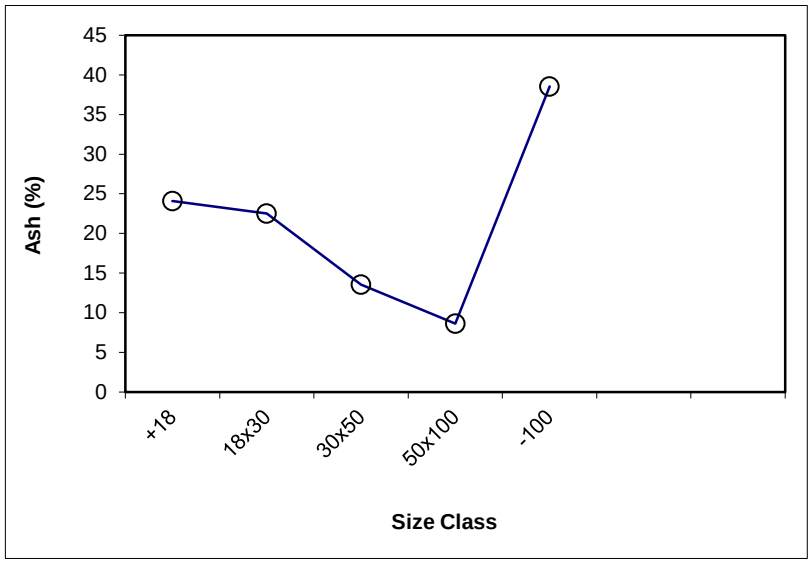
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	837.8	811.1	26.70	8.97	24.08	8.97	24.08	100.00	20.55
18x30	461.6	392.0	69.66	23.40	22.50	32.36	22.94	91.03	20.20
30x50	441.8	354.1	87.67	29.45	13.54	61.81	18.46	67.64	19.40
50x100	448.5	393.0	55.50	18.64	8.61	80.45	16.18	38.19	23.93
-100	64.6	6.4	58.21	19.55	38.53	100.00	20.55	19.55	38.53
Total (Calc)	--	--	297.74	100.00	20.55	--	--	--	--





SPIRAL DATA ANALYSIS

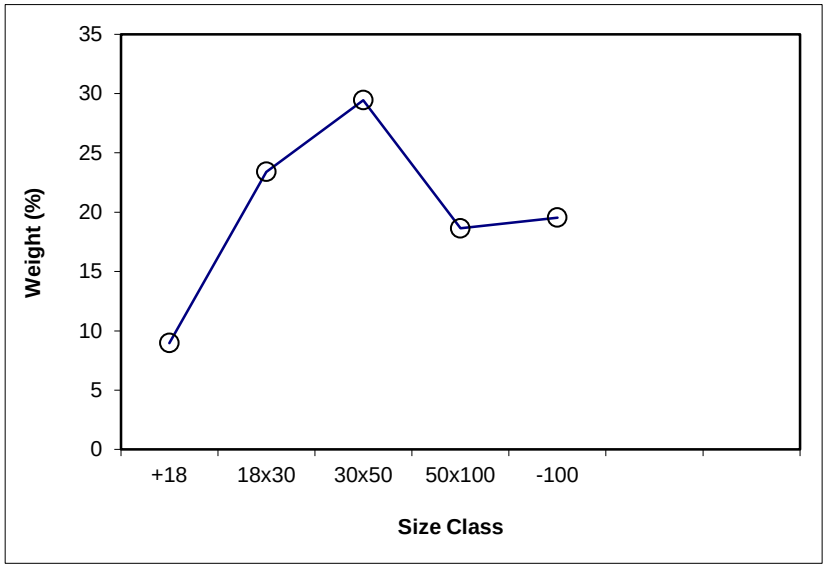
Description: Run 9 - Intermediate Spiral Test

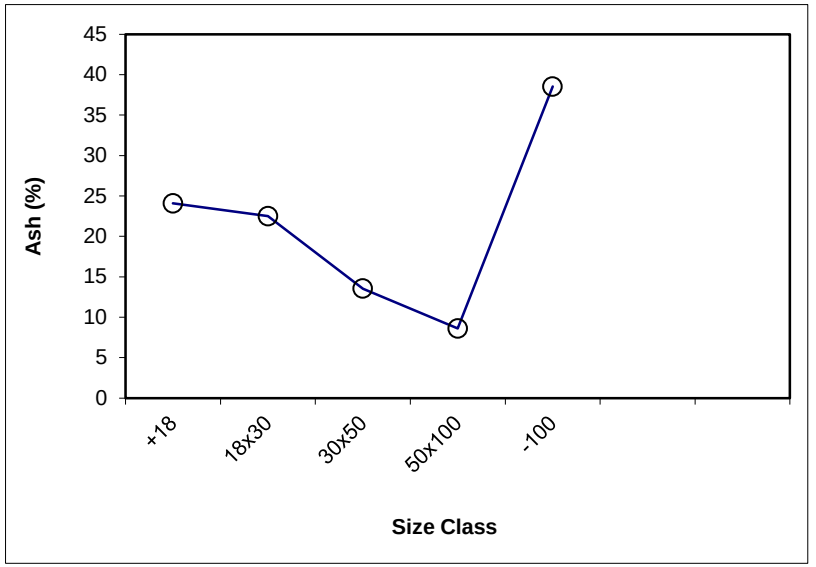
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	8.97	24.08	8.97	24.08	100.00	20.55			
18x30	23.40	22.50	32.36	22.94	91.03	20.20	x	23.40	22.50
30x50	29.45	13.54	61.81	18.46	67.64	19.40	x	29.45	13.54
50x100	18.64	8.61	80.45	16.18	38.19	23.93	x	18.64	8.61
-100	19.55	38.53	100.00	20.55	19.55	38.53			
Total (Calc)	100.00	20.55	--	--	--	--	--	71.48	15.19





SPIRAL DATA ANALYSIS

Description: Run 9 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 63.74

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	1028.53	861.3	167.19	8.96	5.59	8.96	5.59	100.00	12.44
18x30	1213.52	812.2	401.33	21.50	4.95	30.46	5.13	91.04	13.12
30x50	1270.83	748.8	522.02	27.97	4.57	58.43	4.86	69.54	15.65
50x100	1072.96	722.7	350.22	18.76	4.81	77.20	4.85	41.57	23.10
-100	438.50	12.9	425.60	22.80	38.15	100.00	12.44	22.80	38.15
Total (Calc)	--	--	1866.37	100.00	12.44	--	--	--	--

Product P2 Feed Weight (%): 15.61

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	429.8	401.2	28.61	6.26	16.81	6.26	16.81	100.00	12.11
18x30	488.1	370.0	118.10	25.84	10.13	32.10	11.44	93.74	11.79
30x50	493.0	336.3	156.71	34.29	6.52	66.39	8.90	67.90	12.42
50x100	389.5	307.8	81.69	17.87	5.62	84.26	8.20	33.61	18.44
-100	78.3	6.4	71.94	15.74	33.00	100.00	12.11	15.74	33.00
Total (Calc)	--	--	457.05	100.00	12.11	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 9 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 6.00

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	699.8	664.7	35.11	9.99	54.72	9.99	54.72	100.00	28.49
18x30	517.5	442.2	75.32	21.42	43.12	31.40	46.80	90.01	25.58
30x50	519.7	412.5	107.13	30.47	17.74	61.87	32.49	68.60	20.11
50x100	486.4	408.8	77.61	22.07	8.74	83.94	26.25	38.13	22.00
-100	62.6	6.2	56.46	16.06	40.22	100.00	28.49	16.06	40.22
Total (Calc)	--	--	351.63	100.00	28.49	--	--	--	--

Product P4 Feed Weight (%): 2.17

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	853.7	811.1	42.61	13.41	65.99	13.41	65.99	100.00	37.00
18x30	476.6	392.0	84.64	26.64	50.29	40.06	55.55	86.59	32.51
30x50	437.2	354.1	83.04	26.14	23.88	66.20	43.05	59.94	24.61
50x100	456.1	393.0	63.07	19.85	12.52	86.05	36.00	33.80	25.16
-100	50.8	6.5	44.31	13.95	43.16	100.00	37.00	13.95	43.16
Total (Calc)	--	--	317.68	100.00	37.00	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 9 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 1.69

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	473.0	460.1	12.85	5.21	69.42	5.21	69.42	100.00	33.59
18x30	496.4	448.1	48.23	19.55	51.99	24.76	55.66	94.79	31.62
30x50	497.3	424.9	72.42	29.36	23.68	54.11	38.31	75.24	26.33
50x100	464.4	397.2	67.14	27.22	15.39	81.33	30.64	45.89	28.02
-100	52.5	6.4	46.06	18.67	46.42	100.00	33.59	18.67	46.42
Total (Calc)	--	--	246.69	100.00	33.59	--	--	--	--

Product P6 Feed Weight (%): 0.24

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	401.8	401.2	0.57	0.58	40.81	0.58	40.81	100.00	36.04
18x30	373.3	370.0	3.28	3.33	38.10	3.91	38.51	99.42	36.01
30x50	353.3	336.3	17.03	17.29	19.70	21.21	23.17	96.09	35.94
50x100	344.2	307.8	36.44	37.01	17.55	58.22	19.60	78.79	39.51
-100	47.5	6.4	41.13	41.78	58.96	100.00	36.04	41.78	58.96
Total (Calc)	--	--	98.45	100.00	36.04	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 9 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 10.55

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	702.7	664.7	38.07	12.32	84.17	12.32	84.17	100.00	71.64
18x30	543.3	442.2	101.18	32.75	91.40	45.07	89.42	87.68	69.88
30x50	510.1	412.5	97.60	31.59	67.10	76.66	80.23	54.93	57.05
50x100	455.2	408.8	46.46	15.04	38.86	91.70	73.44	23.34	43.44
-100	31.8	6.2	25.65	8.30	51.74	100.00	71.64	8.30	51.74
Total (Calc)	--	--	308.95	100.00	71.64	--	--	--	--

SPIRAL DATA ANALYSIS

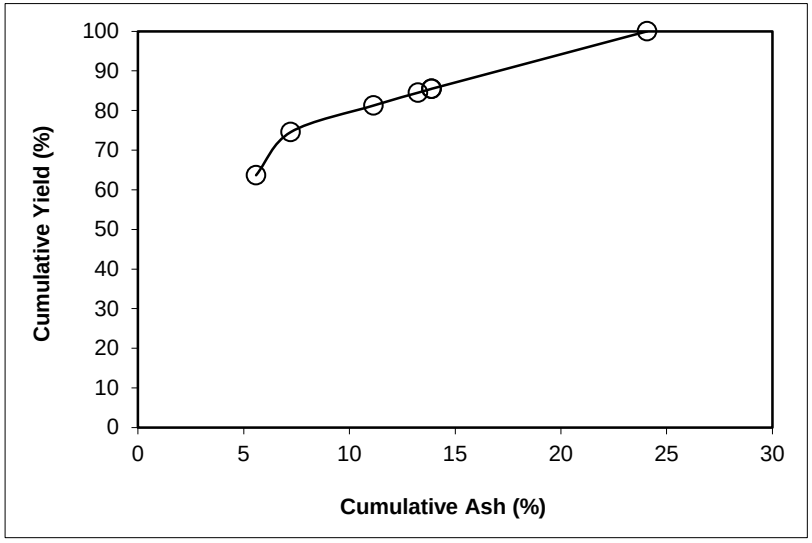
Description: Run 9 - Intermediate Spiral Test

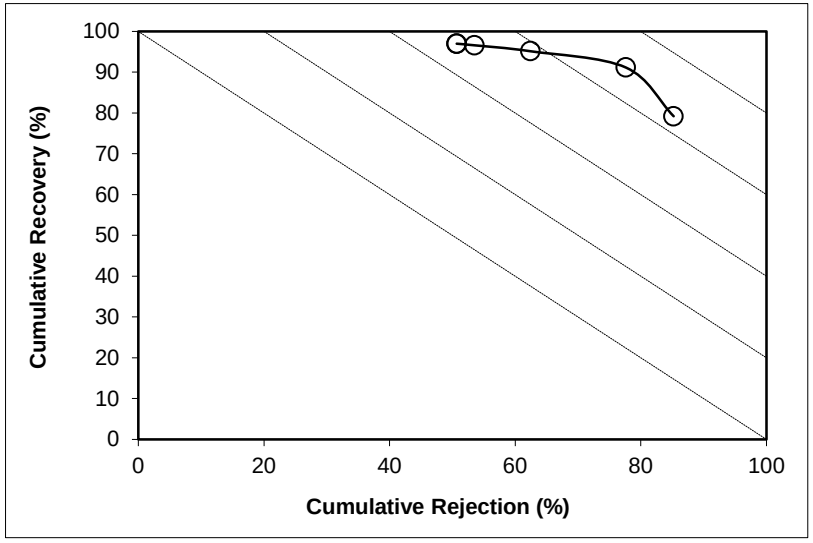
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 8.97

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	63.68	5.59	63.68	5.59	79.19	36.32	56.50	85.23	64.42
P2	10.90	16.81	74.58	7.23	91.13	25.42	73.51	77.62	68.75
P3	6.69	54.72	81.26	11.13	95.12	18.74	80.22	62.43	57.54
P4	3.25	65.99	84.51	13.24	96.57	15.49	83.20	53.53	50.10
P5	0.98	69.42	85.49	13.88	96.97	14.51	84.13	50.71	47.67
P6	0.02	40.81	85.50	13.89	96.98	14.50	84.17	50.68	47.66
P7	14.50	84.17	100.00	24.08	100.00	0.00			
Total (Calc)	100.00	24.08	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

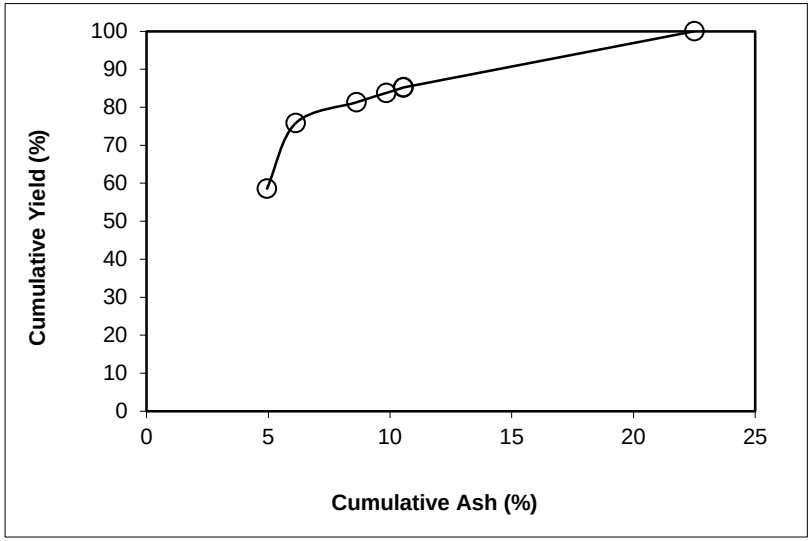
Description: Run 9 - Intermediate Spiral Test

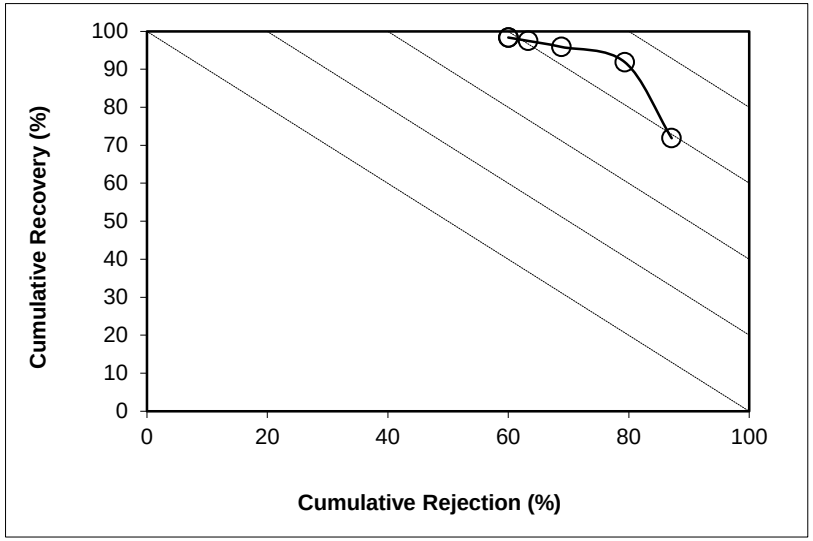
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 23.40

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	58.58	4.95	58.58	4.95	71.85	41.42	47.33	87.12	58.97
P2	17.24	10.13	75.82	6.13	91.84	24.18	73.85	79.36	71.20
P3	5.50	43.12	81.32	8.63	95.88	18.68	82.90	68.82	64.70
P4	2.47	50.29	83.79	9.86	97.46	16.21	87.86	63.30	60.76
P5	1.41	51.99	85.20	10.55	98.33	14.80	91.28	60.05	58.38
P6	0.03	38.10	85.23	10.56	98.36	14.77	91.40	59.99	58.35
P7	14.77	91.40	100.00	22.50	100.00	0.00			
Total (Calc)	100.00	22.50	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

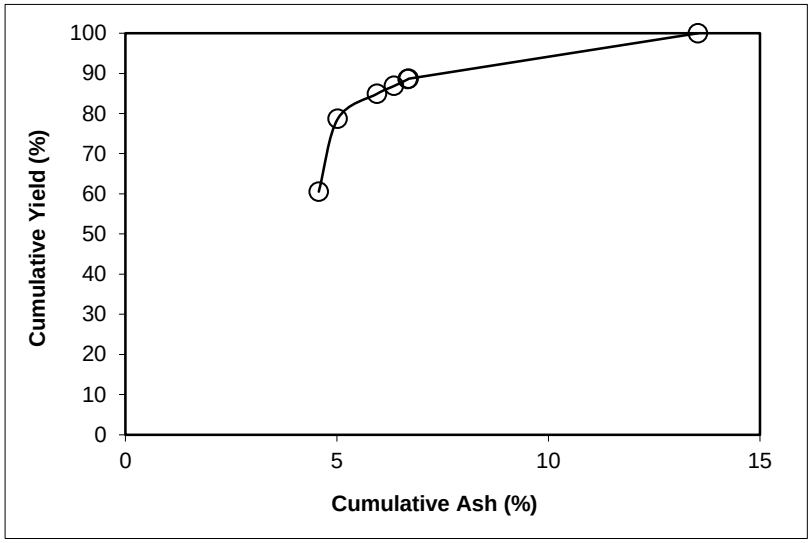
Description: Run 9 - Intermediate Spiral Test

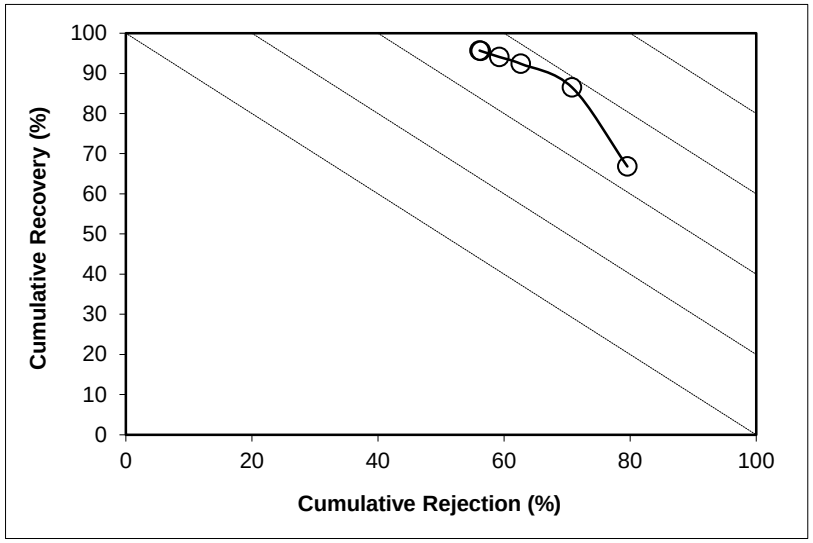
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 29.45

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	60.55	4.57	60.55	4.57	66.82	39.45	27.29	79.56	46.39
P2	18.18	6.52	78.72	5.02	86.47	21.28	45.04	70.80	57.28
P3	6.21	17.74	84.93	5.95	92.38	15.07	56.29	62.66	55.05
P4	1.93	23.88	86.86	6.35	94.08	13.14	61.04	59.26	53.34
P5	1.68	23.68	88.54	6.68	95.56	11.46	66.52	56.32	51.89
P6	0.14	19.70	88.68	6.70	95.69	11.32	67.10	56.12	51.81
P7	11.32	67.10	100.00	13.54	100.00	0.00			
Total (Calc)	100.00	13.54	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

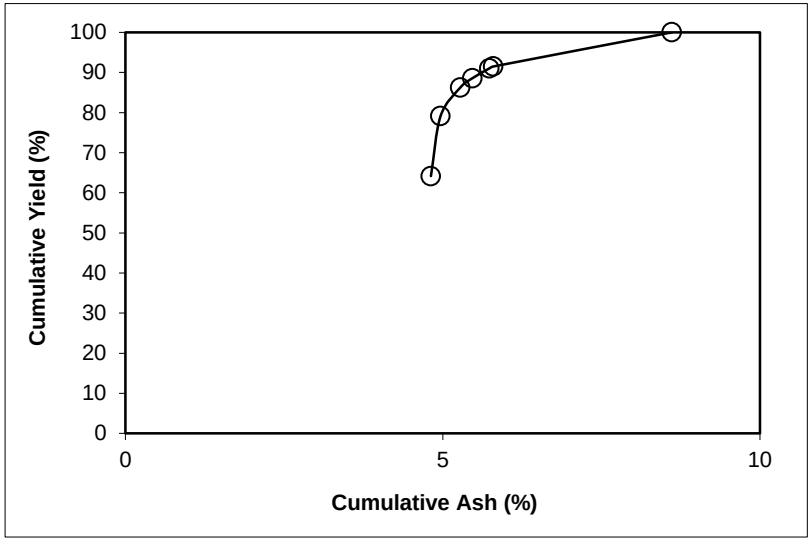
Description: Run 9 - Intermediate Spiral Test

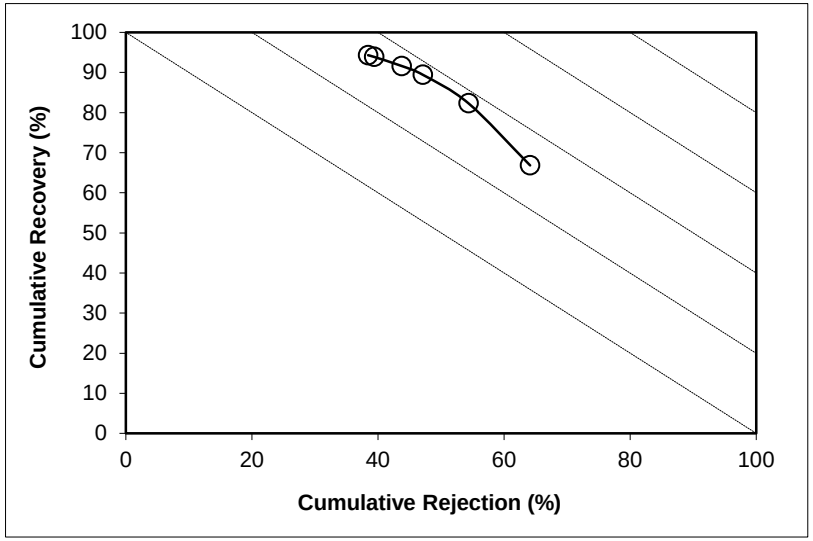
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 18.64

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	64.16	4.81	64.16	4.81	66.83	35.84	15.41	64.13	30.96
P2	14.97	5.62	79.13	4.97	82.29	20.87	22.43	54.37	36.65
P3	7.11	8.74	86.24	5.28	89.39	13.76	29.50	47.15	36.54
P4	2.31	12.52	88.55	5.47	91.60	11.45	32.93	43.79	35.39
P5	2.46	15.39	91.01	5.73	93.87	8.99	37.73	39.39	33.27
P6	0.48	17.55	91.49	5.80	94.31	8.51	38.86	38.42	32.73
P7	8.51	38.86	100.00	8.61	100.00	0.00			
Total (Calc)	100.00	8.61	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

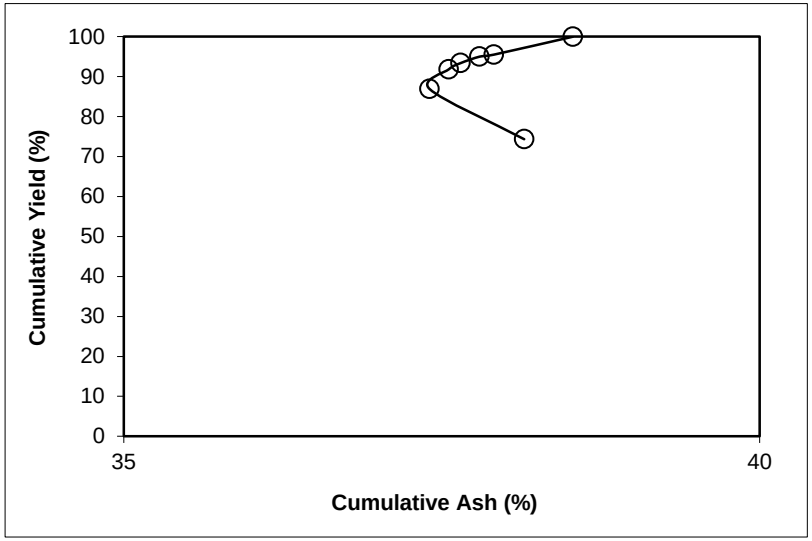
Description: Run 9 - Intermediate Spiral Test

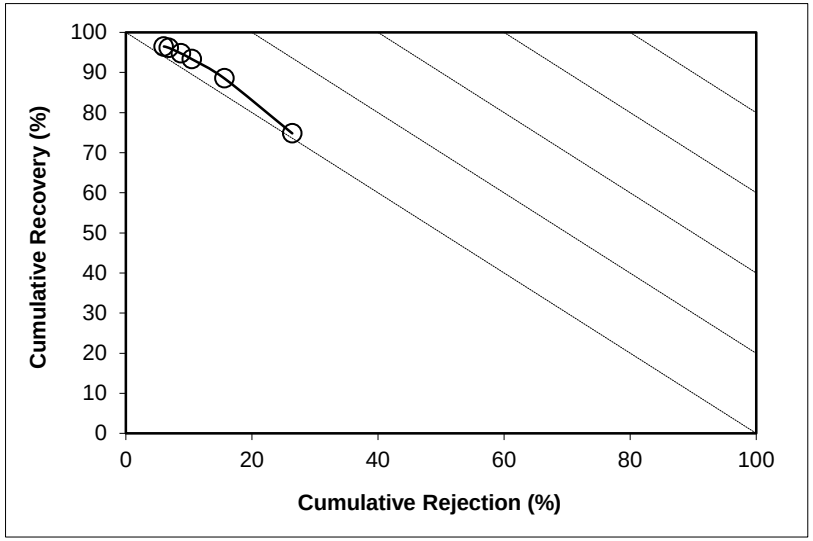
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: -100 Feed Weight (%): 19.55

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	74.35	38.15	74.35	38.15	74.81	25.65	39.64	26.39	1.20
P2	12.57	33.00	86.92	37.40	88.51	13.08	46.01	15.62	4.13
P3	4.93	40.22	91.85	37.56	93.31	8.15	49.51	10.47	3.78
P4	1.55	43.16	93.40	37.65	94.74	6.60	51.00	8.74	3.48
P5	1.61	46.42	95.01	37.80	96.14	4.99	52.48	6.80	2.94
P6	0.51	58.96	95.52	37.91	96.48	4.48	51.74	6.02	2.50
P7	4.48	51.74	100.00	38.53	100.00	0.00			
Total (Calc)	100.00	38.53	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

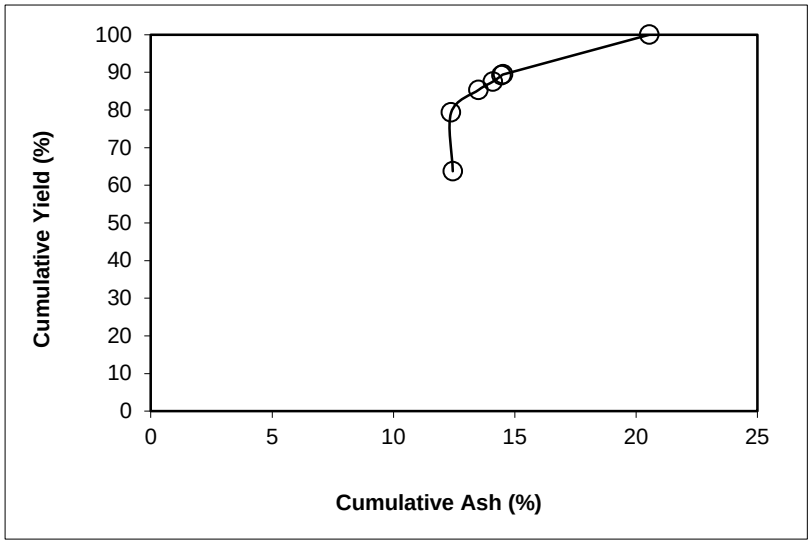
Description: Run 9 - Intermediate Spiral Test

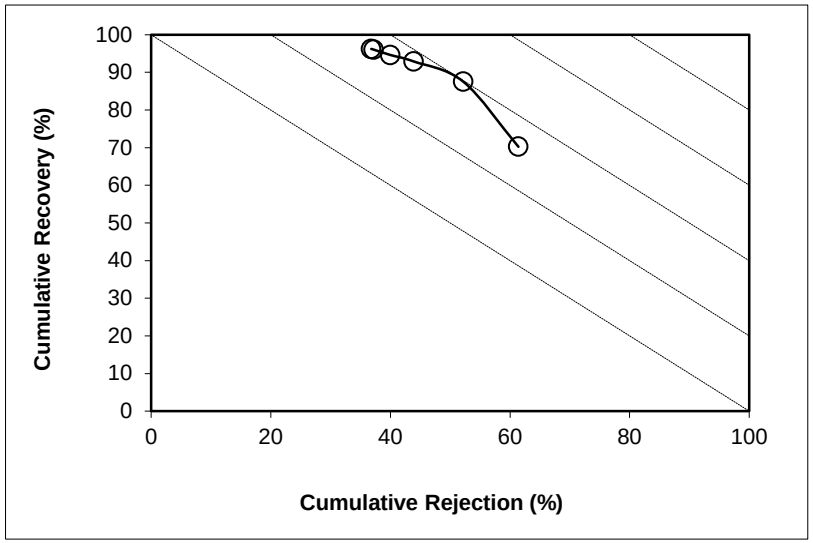
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	63.74	12.44	63.74	12.44	70.24	36.26	34.79	61.40	31.64
P2	15.61	12.11	79.35	12.38	87.51	20.65	51.94	52.20	39.71
P3	6.00	28.49	85.35	13.51	92.91	14.65	61.55	43.87	36.78
P4	2.17	37.00	87.52	14.09	94.63	12.48	65.82	39.97	34.60
P5	1.69	33.59	89.21	14.46	96.04	10.79	70.85	37.21	33.25
P6	0.24	36.04	89.45	14.52	96.23	10.55	71.64	36.79	33.02
P7	10.55	71.64	100.00	20.55	100.00	0.00			
Total (Calc)	100.00	20.55	--	--	--	--	--	--	--

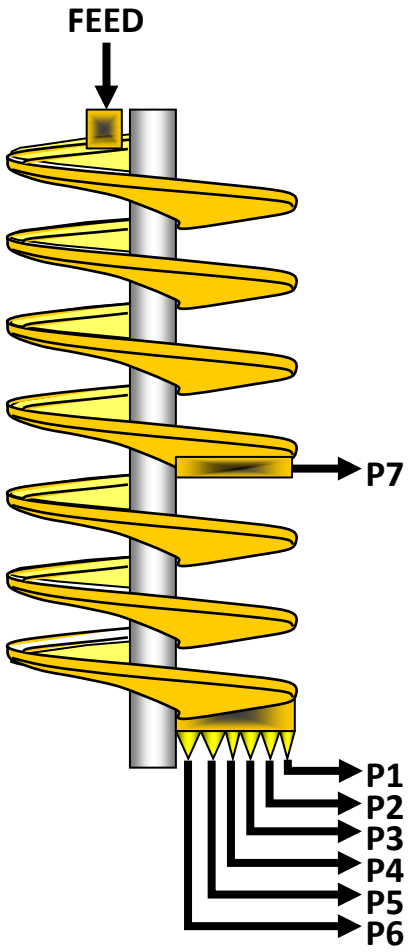




SPIRAL DATA ANALYSIS

Description: Run 10 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	1.085	17.1	21.05	24.24
P2	0.311	26.7	3.42	4.34
P3	0.121	28.9	1.19	1.52
P4	0.037	30.1	0.35	0.44
P5	0.030	21.6	0.44	0.52
P6	0.005	10.0	0.17	0.18
P7	0.295	42.2	1.62	2.20
Total	1.885	21.1	28.25	33.44

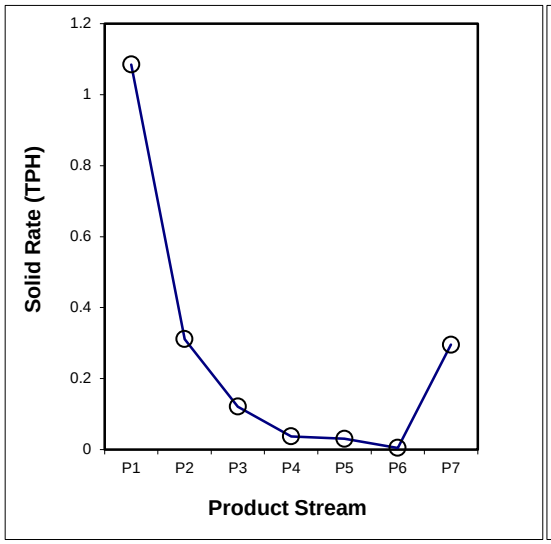
SPIRAL DATA ANALYSIS

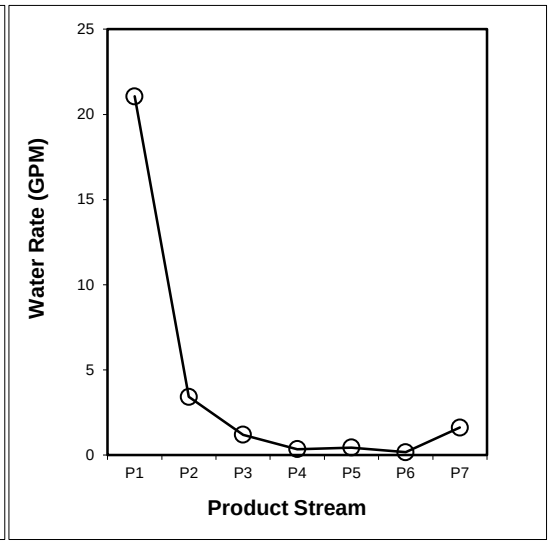
Description: Run 10 - Intermediate Spiral Test

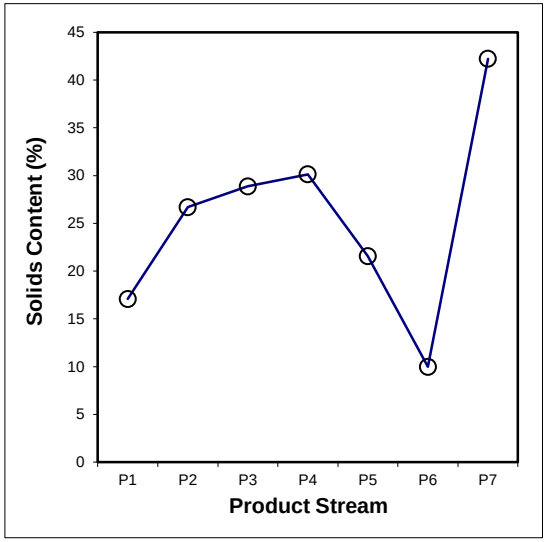
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	5	8991.50	851.50	6.349	4525.1	3156.9	1.085	57.55	17.09
P2	5	1589.79	95.80	1.167	2129.5	1736.8	0.311	16.52	26.69
P3	10	1167.45	94.32	0.420	1727.2	1421.5	0.121	6.43	28.87
P4	25	885.23	94.89	0.124	2169.3	1934.5	0.037	1.98	30.12
P5	25	990.54	92.06	0.140	2147.6	1956.6	0.030	1.61	21.56
P6	70	941.43	93.65	0.047	1820.2	1736.8	0.005	0.25	9.99
P7	5	973.78	94.01	0.700	1794.4	1421.7	0.295	15.67	42.22
Total (Calc)	--	--	--	8.947	--	--	1.885	100.00	21.07
Total (Head)	0.70	1680.86	94.08	8.947	1755.9	1421.6	1.885	--	21.07







SPIRAL DATA ANALYSIS

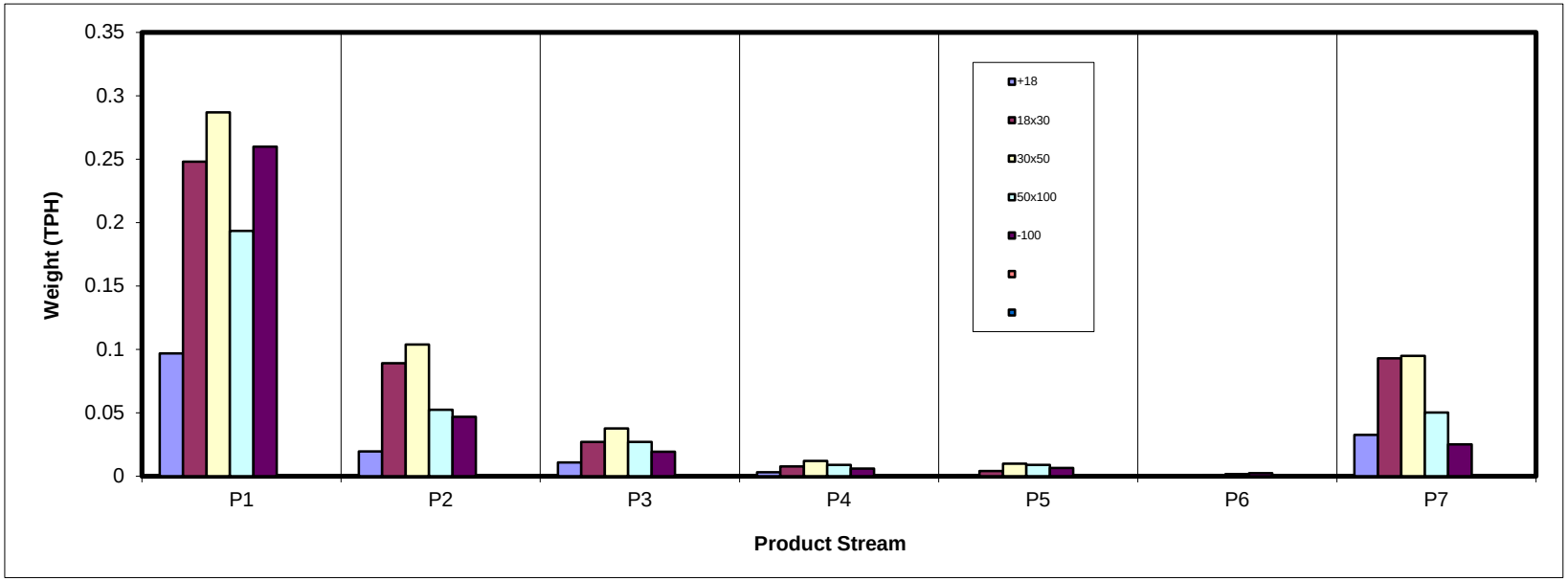
Description: Run 10 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.097	0.020	0.011	0.003	0.001	0.000	0.033		0.164
18x30	0.248	0.089	0.027	0.008	0.004	0.000	0.093		0.469
30x50	0.287	0.104	0.038	0.012	0.010	0.001	0.095		0.546
50x100	0.193	0.052	0.027	0.009	0.009	0.002	0.050		0.342
-100	0.260	0.047	0.019	0.006	0.006	0.002	0.025		0.365
Total (Calc)	1.085	0.311	0.121	0.037	0.030	0.005	0.295		1.885



SPIRAL DATA ANALYSIS

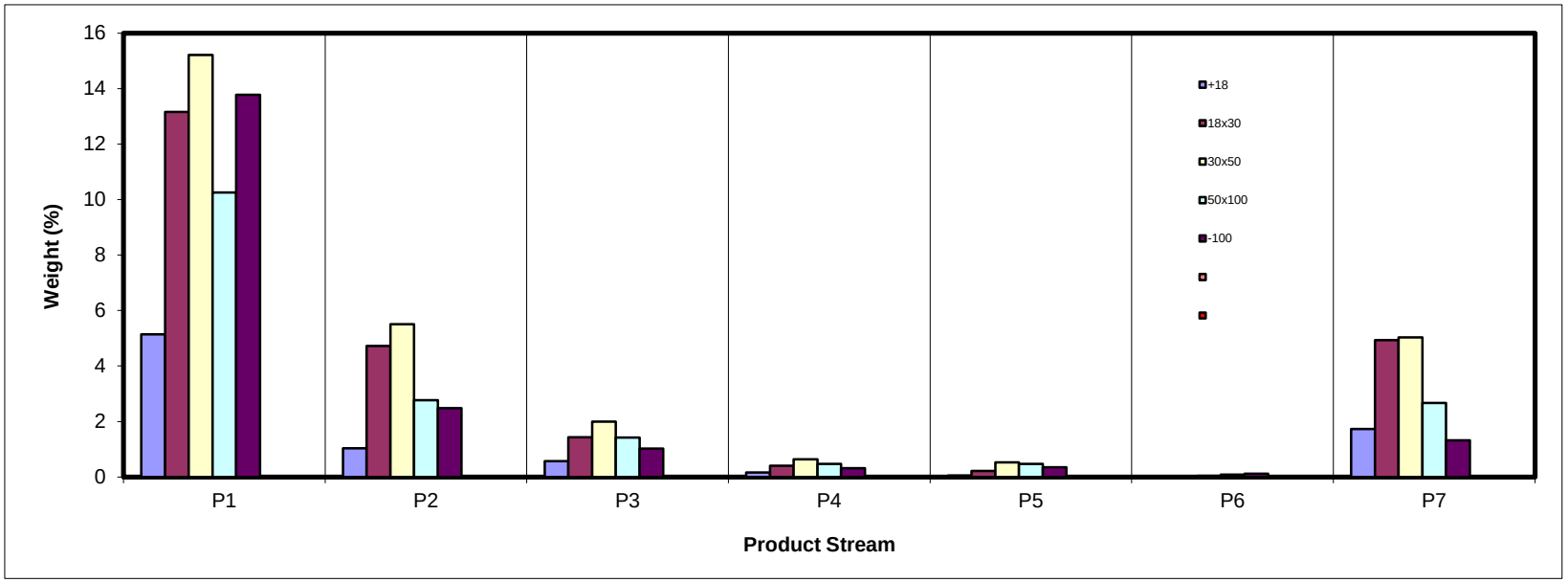
Description: Run 10 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	5.14	1.04	0.57	0.16	0.05	0.00	1.73		8.68
18x30	13.16	4.72	1.43	0.41	0.22	0.01	4.93		24.87
30x50	15.21	5.50	1.99	0.63	0.52	0.04	5.03		28.93
50x100	10.26	2.77	1.42	0.47	0.47	0.08	2.66		18.14
-100	13.78	2.48	1.02	0.31	0.34	0.12	1.32		19.37
Total (Calc)	57.55	16.52	6.43	1.98	1.61	0.25	15.67		100.00



SPIRAL DATA ANALYSIS

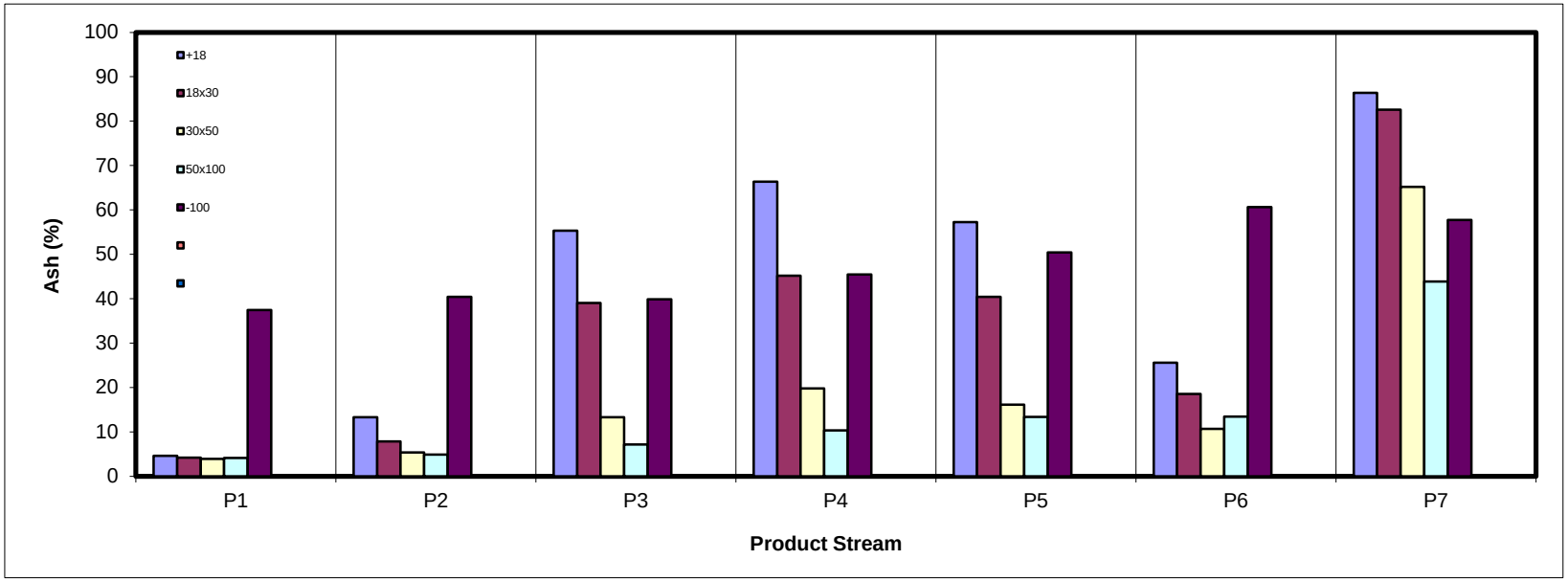
Description: Run 10 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	4.62	13.28	55.31	66.38	57.23	25.56	86.40		26.67
18x30	4.19	7.88	39.03	45.15	40.44	18.55	82.59		23.42
30x50	3.95	5.37	13.28	19.80	16.13	10.65	65.17		16.08
50x100	4.11	4.91	7.16	10.34	13.40	13.42	43.84		10.75
-100	37.46	40.41	39.86	45.48	50.42	60.63	57.75		39.85
Total (Calc)	12.12	11.77	25.57	30.53	27.22	35.30	68.74		22.46



SPIRAL DATA ANALYSIS

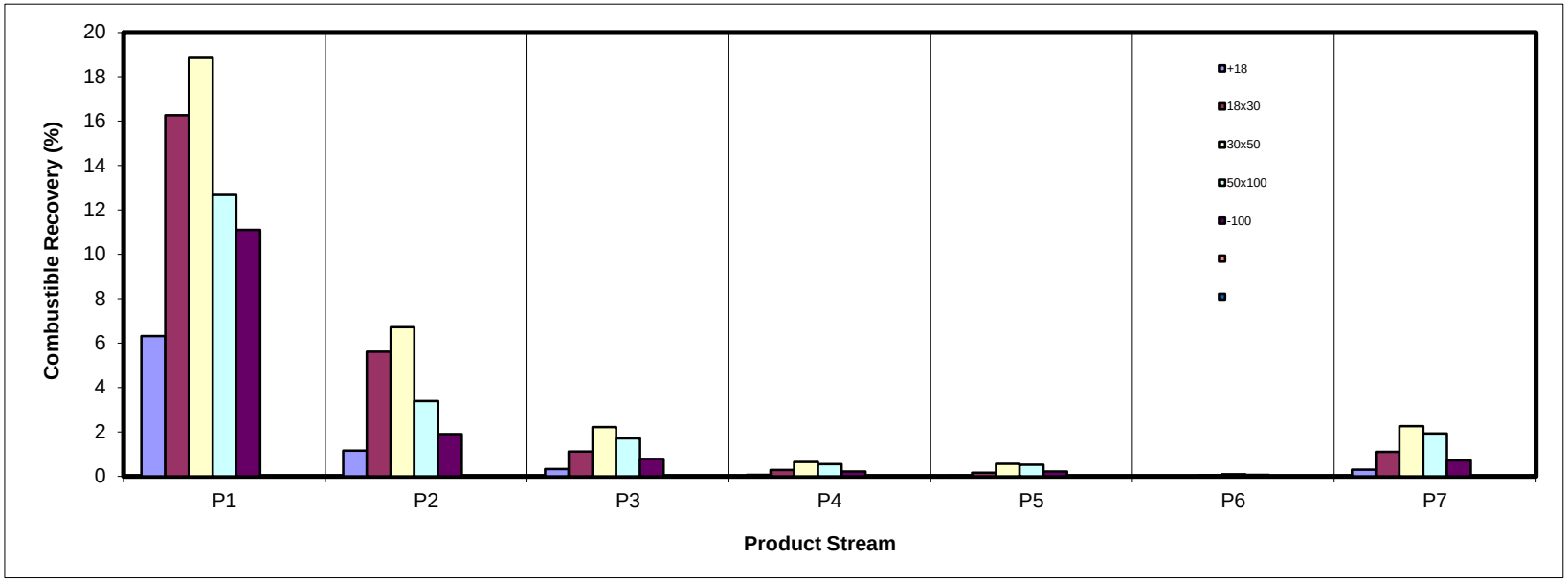
Description: Run 10 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	6.32	1.16	0.33	0.07	0.03	0.00	0.30		8.21
18x30	16.26	5.61	1.12	0.29	0.17	0.01	1.11		24.56
30x50	18.84	6.72	2.23	0.65	0.57	0.05	2.26		31.32
50x100	12.68	3.40	1.71	0.54	0.53	0.09	1.93		20.88
-100	11.11	1.91	0.79	0.22	0.22	0.06	0.72		15.03
Total (Calc)	65.22	18.80	6.17	1.77	1.51	0.21	6.32		100.00



SPIRAL DATA ANALYSIS

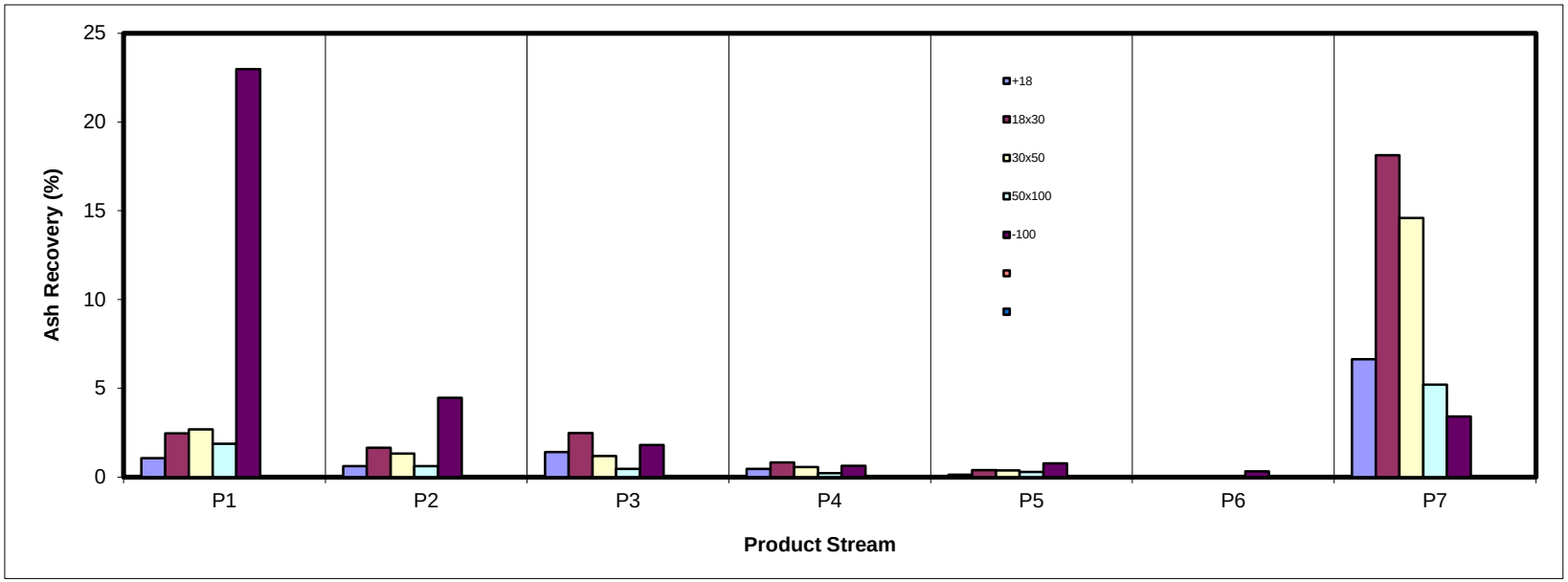
Description: Run 10 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	1.06	0.61	1.40	0.47	0.13	0.00	6.64		10.31
18x30	2.45	1.66	2.48	0.81	0.39	0.01	18.13		25.93
30x50	2.68	1.32	1.18	0.56	0.38	0.02	14.59		20.71
50x100	1.88	0.61	0.45	0.22	0.28	0.05	5.20		8.68
-100	22.98	4.46	1.81	0.63	0.77	0.32	3.40		34.37
Total (Calc)	31.04	8.66	7.32	2.69	1.95	0.39	47.96		100.00



SPIRAL DATA ANALYSIS

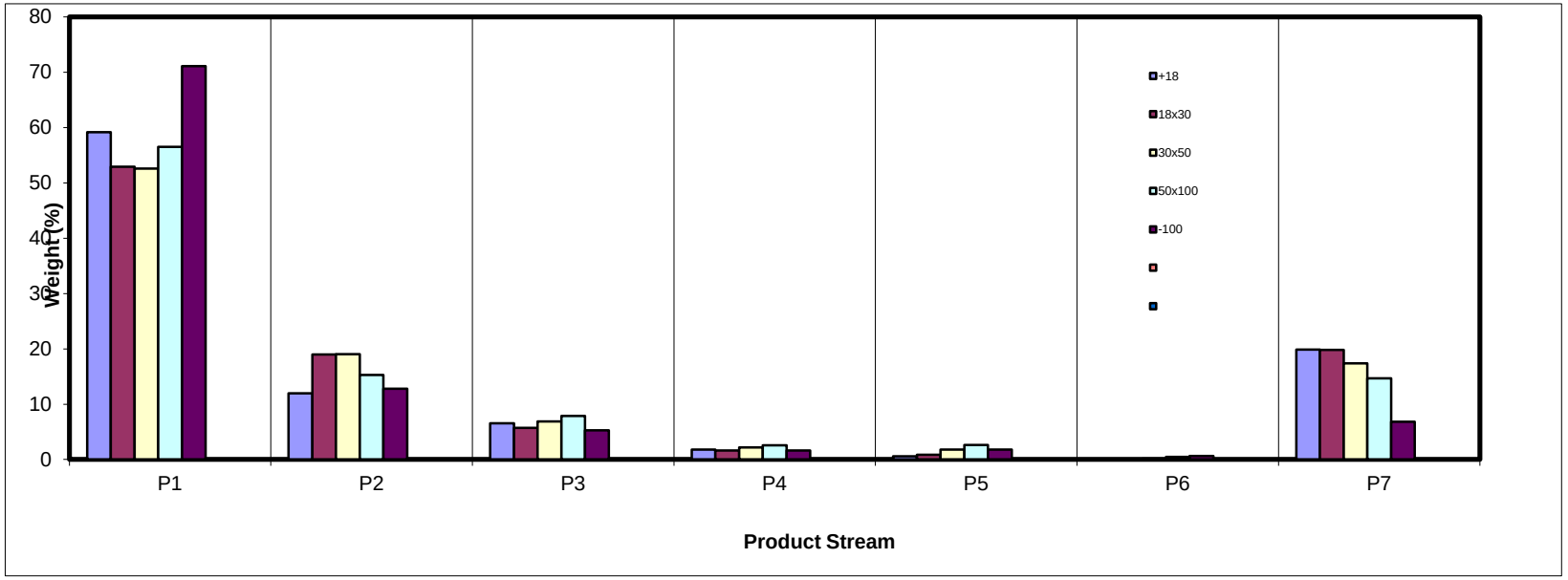
Description: Run 10 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	59.19	11.96	6.57	1.82	0.57	0.02	19.88		100.00
18x30	52.92	19.00	5.74	1.63	0.87	0.03	19.83		100.00
30x50	52.58	19.02	6.88	2.18	1.81	0.16	17.38		100.00
50x100	56.55	15.27	7.86	2.59	2.61	0.44	14.69		100.00
-100	71.11	12.81	5.25	1.61	1.78	0.61	6.83		100.00
Total (Calc)	57.55	16.52	6.43	1.98	1.61	0.25	15.67		100.00



SPIRAL DATA ANALYSIS

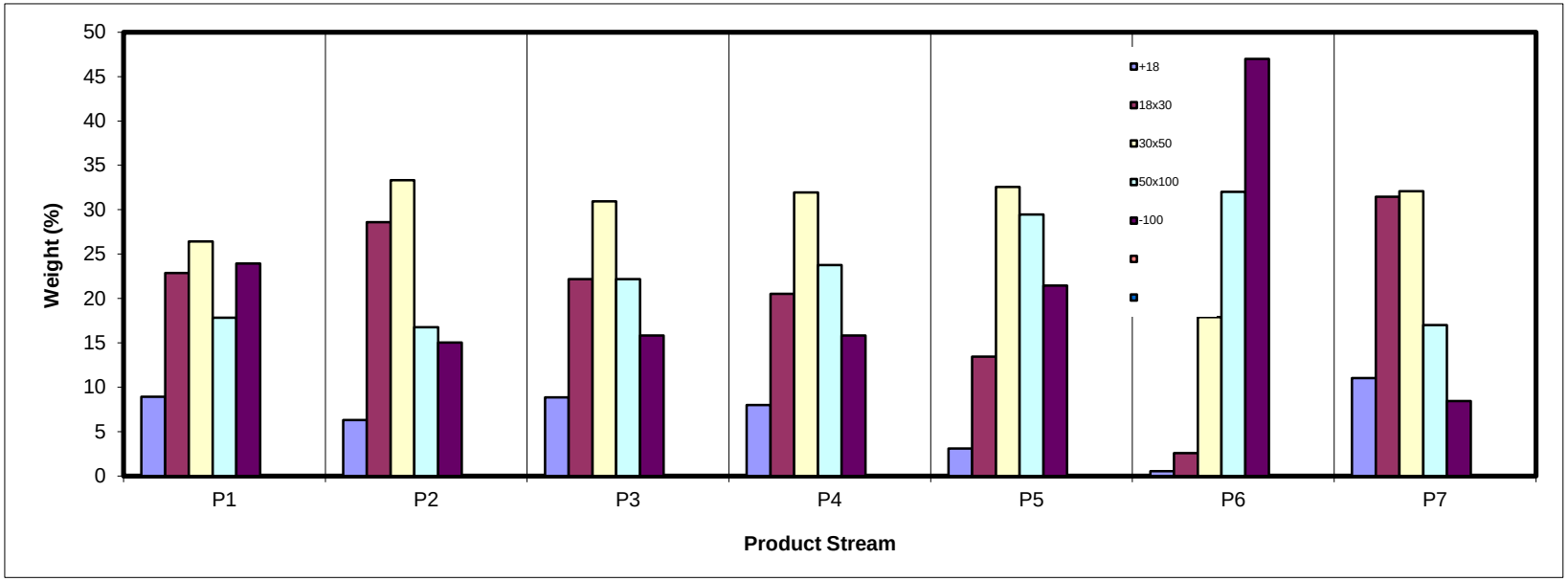
Description: Run 10 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	8.93	6.29	8.87	7.98	3.08	0.53	11.02		8.68
18x30	22.87	28.60	22.19	20.50	13.44	2.56	31.46		24.87
30x50	26.44	33.32	30.95	31.93	32.58	17.90	32.08		28.93
50x100	17.82	16.76	22.16	23.75	29.44	32.02	17.00		18.14
-100	23.94	15.02	15.83	15.83	21.46	46.98	8.44		19.37
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

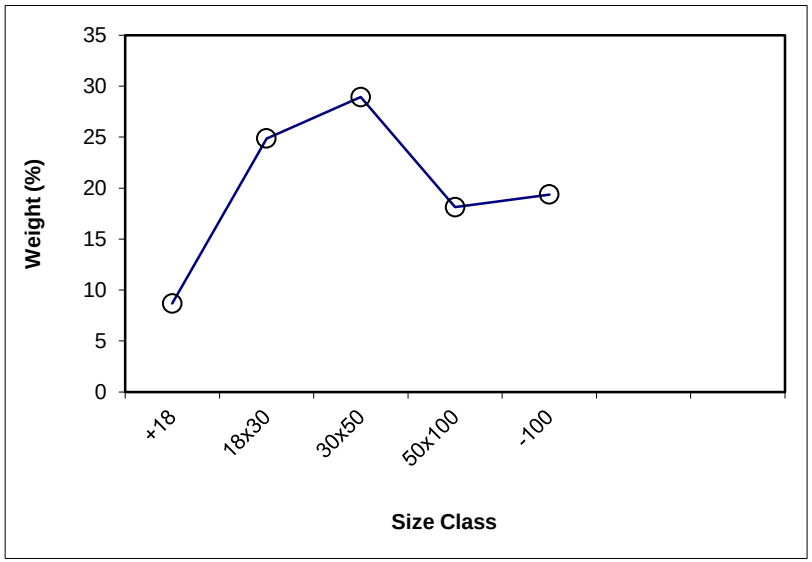
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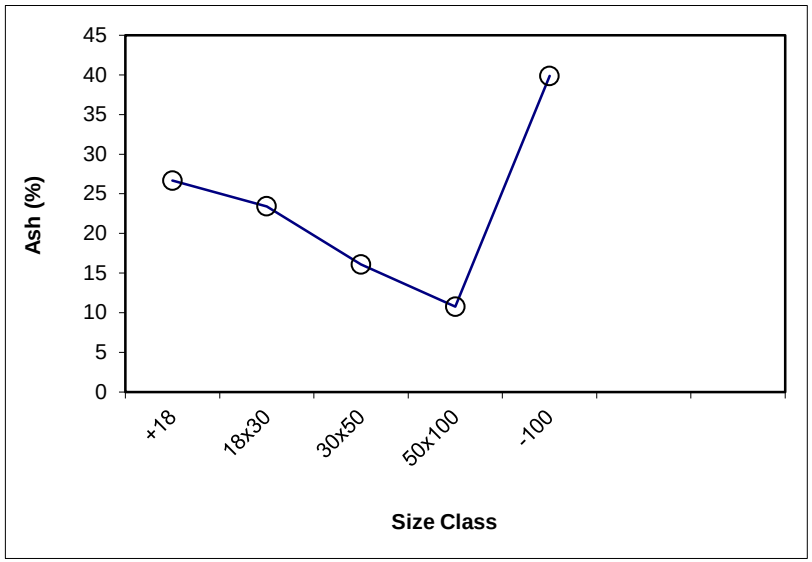
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	430.2	401.2	29.04	8.68	26.67	8.68	26.67	100.00	22.46
18x30	453.2	370.0	83.16	24.87	23.42	33.55	24.26	91.32	22.06
30x50	433.0	336.3	96.75	28.93	16.08	62.49	20.47	66.45	21.56
50x100	368.5	307.8	60.65	18.14	10.75	80.63	18.29	37.51	25.78
-100	71.0	6.2	64.79	19.37	39.85	100.00	22.46	19.37	39.85
Total (Calc)	--	--	334.38	100.00	22.46	--	--	--	--





SPIRAL DATA ANALYSIS

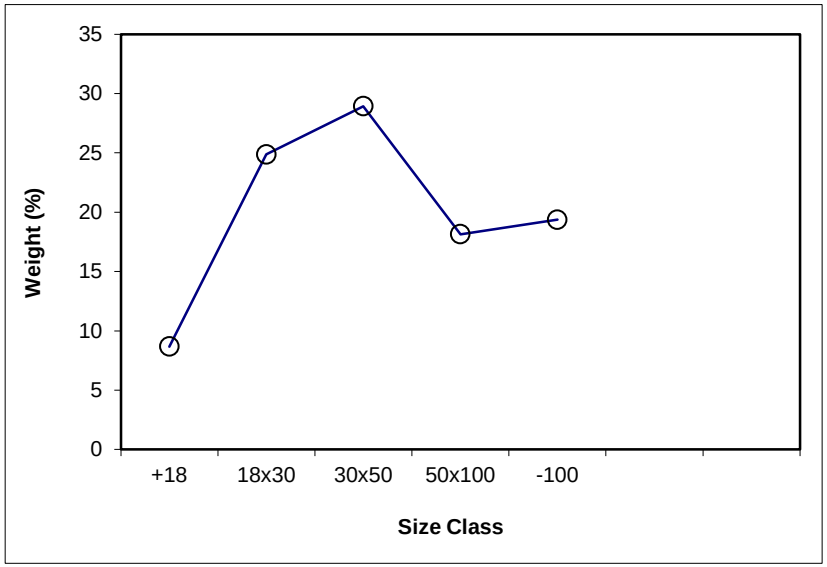
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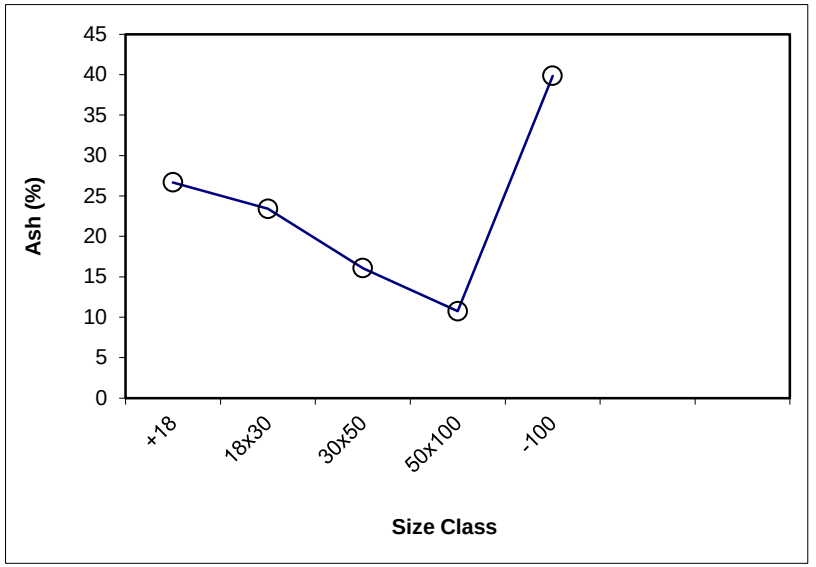
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	8.68	26.67	8.68	26.67	100.00	22.46			
18x30	24.87	23.42	33.55	24.26	91.32	22.06	x	24.87	23.42
30x50	28.93	16.08	62.49	20.47	66.45	21.56	x	28.93	16.08
50x100	18.14	10.75	80.63	18.29	37.51	25.78	x	18.14	10.75
-100	19.37	39.85	100.00	22.46	19.37	39.85			
Total (Calc)	100.00	22.46	--	--	--	--	--	71.94	17.27





SPIRAL DATA ANALYSIS

Description: Run 10 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 57.55

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	983.54	861.3	122.20	8.93	4.62	8.93	4.62	100.00	12.12
18x30	1125.09	812.2	312.90	22.87	4.19	31.80	4.31	91.07	12.85
30x50	1110.51	748.8	361.70	26.44	3.95	58.24	4.15	68.20	15.76
50x100	966.59	722.7	243.85	17.82	4.11	76.06	4.14	41.76	23.23
-100	339.41	11.8	327.57	23.94	37.46	100.00	12.12	23.94	37.46
Total (Calc)	--	--	1368.22	100.00	12.12	--	--	--	--

Product P2 Feed Weight (%): 16.52

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	484.8	460.1	24.69	6.29	13.28	6.29	13.28	100.00	11.77
18x30	560.5	448.1	112.34	28.60	7.88	34.89	8.85	93.71	11.67
30x50	555.8	424.9	130.88	33.32	5.37	68.21	7.15	65.11	13.34
50x100	463.1	397.2	65.85	16.76	4.91	84.98	6.71	31.79	21.69
-100	65.4	6.4	59.00	15.02	40.41	100.00	11.77	15.02	40.41
Total (Calc)	--	--	392.76	100.00	11.77	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 10 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 6.43

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	428.3	401.2	27.12	8.87	55.31	8.87	55.31	100.00	25.57
18x30	437.9	370.0	67.84	22.19	39.03	31.06	43.68	91.13	22.68
30x50	430.9	336.3	94.62	30.95	13.28	62.01	28.51	68.94	17.42
50x100	375.6	307.8	67.76	22.16	7.16	84.17	22.89	37.99	20.79
-100	54.5	6.2	48.39	15.83	39.86	100.00	25.57	15.83	39.86
Total (Calc)	--	--	305.72	100.00	25.57	--	--	--	--

Product P4 Feed Weight (%): 1.98

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	683.4	664.7	18.74	7.98	66.38	7.98	66.38	100.00	30.53
18x30	490.3	442.2	48.16	20.50	45.15	28.49	51.10	92.02	27.43
30x50	487.5	412.5	74.99	31.93	19.80	60.42	34.56	71.51	22.34
50x100	464.5	408.8	55.79	23.75	10.34	84.17	27.72	39.58	24.39
-100	43.6	6.4	37.18	15.83	45.48	100.00	30.53	15.83	45.48
Total (Calc)	--	--	234.86	100.00	30.53	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 10 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 1.61

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	816.9	811.1	5.88	3.08	57.23	3.08	57.23	100.00	27.22
18x30	417.6	392.0	25.67	13.44	40.44	16.52	43.57	96.92	26.26
30x50	416.4	354.1	62.22	32.58	16.13	49.10	25.36	83.48	23.98
50x100	449.3	393.0	56.24	29.44	13.40	78.54	20.88	50.90	29.00
-100	47.4	6.4	40.98	21.46	50.42	100.00	27.22	21.46	50.42
Total (Calc)	--	--	190.99	100.00	27.22	--	--	--	--

Product P6 Feed Weight (%): 0.25

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	460.6	460.1	0.45	0.53	25.56	0.53	25.56	100.00	35.30
18x30	450.3	448.1	2.14	2.56	18.55	3.10	19.76	99.47	35.35
30x50	439.8	424.9	14.93	17.90	10.65	21.00	11.99	96.90	35.80
50x100	423.9	397.2	26.71	32.02	13.42	53.02	12.86	79.00	41.50
-100	45.5	6.4	39.18	46.98	60.63	100.00	35.30	46.98	60.63
Total (Calc)	--	--	83.41	100.00	35.30	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 10 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 15.67

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	442.2	401.2	41.05	11.02	86.40	11.02	86.40	100.00	68.74
18x30	487.3	370.0	117.24	31.46	82.59	42.48	83.58	88.98	66.55
30x50	455.8	336.3	119.56	32.08	65.17	74.56	75.66	57.52	57.78
50x100	371.1	307.8	63.34	17.00	43.84	91.56	69.75	25.44	48.46
-100	37.9	6.4	31.46	8.44	57.75	100.00	68.74	8.44	57.75
Total (Calc)	--	--	372.65	100.00	68.74	--	--	--	--

SPIRAL DATA ANALYSIS

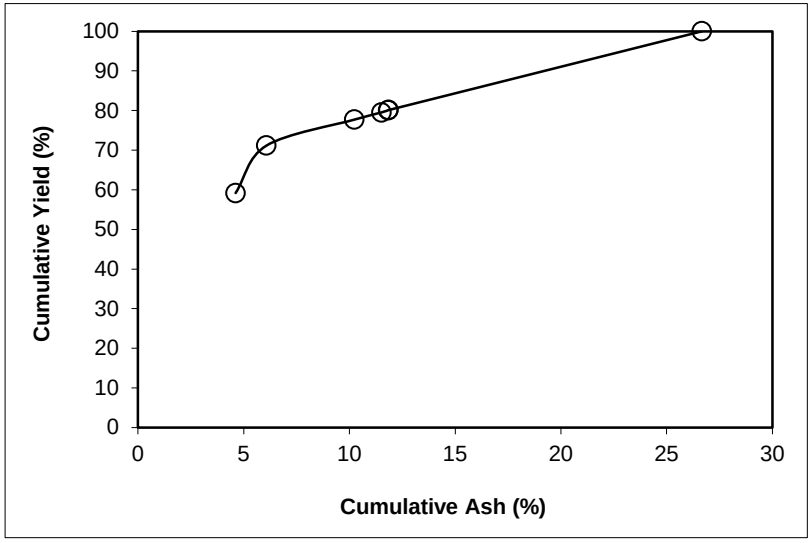
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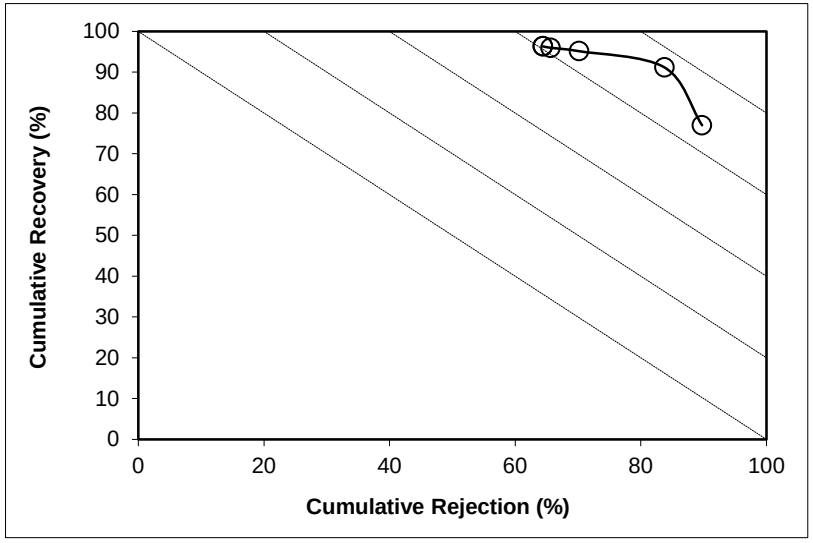
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 8.68

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	59.19	4.62	59.19	4.62	76.99	40.81	58.65	89.75	66.74
P2	11.96	13.28	71.15	6.07	91.13	28.85	77.45	83.80	74.92
P3	6.57	55.31	77.72	10.23	95.13	22.28	83.98	70.17	65.30
P4	1.82	66.38	79.53	11.52	95.96	20.47	85.54	65.65	61.62
P5	0.57	57.23	80.10	11.84	96.30	19.90	86.35	64.43	60.73
P6	0.02	25.56	80.12	11.84	96.31	19.88	86.40	64.42	60.73
P7	19.88	86.40	100.00	26.67	100.00	0.00			
Total (Calc)	100.00	26.67	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

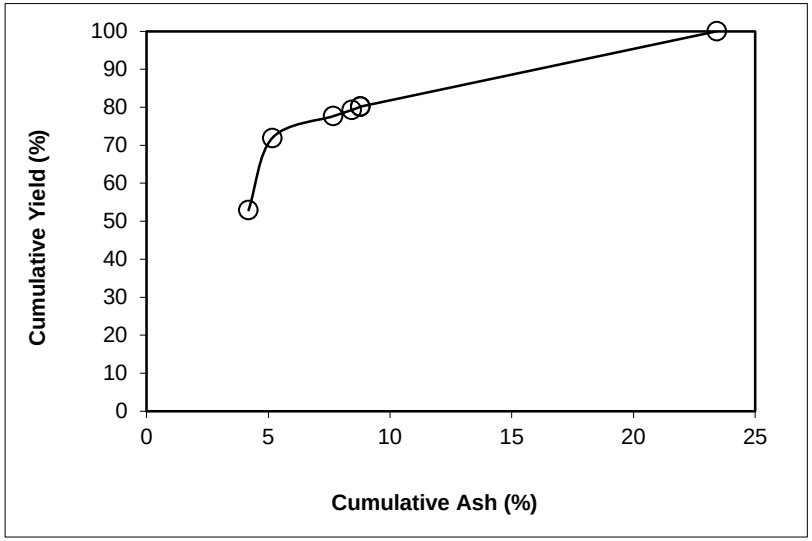
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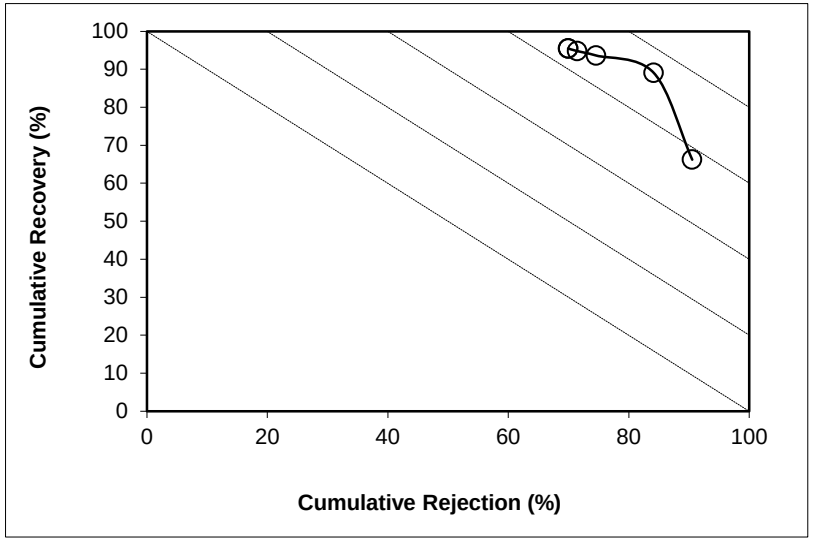
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 24.87

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	52.92	4.19	52.92	4.19	66.20	47.08	45.03	90.53	56.73
P2	19.00	7.88	71.91	5.16	89.06	28.09	70.16	84.14	73.20
P3	5.74	39.03	77.65	7.67	93.62	22.35	78.15	74.58	68.20
P4	1.63	45.15	79.28	8.44	94.79	20.72	80.74	71.44	66.23
P5	0.87	40.44	80.15	8.78	95.46	19.85	82.50	69.94	65.41
P6	0.03	18.55	80.17	8.79	95.49	19.83	82.59	69.92	65.41
P7	19.83	82.59	100.00	23.42	100.00	0.00			
Total (Calc)	100.00	23.42	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

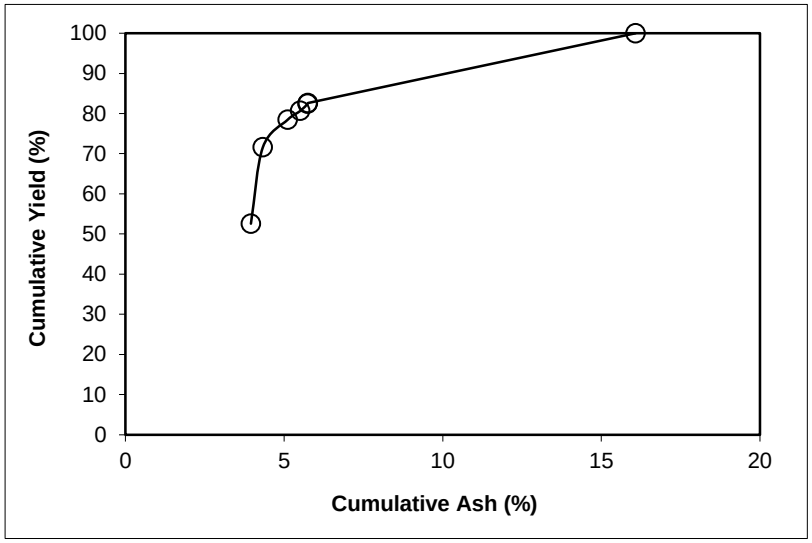
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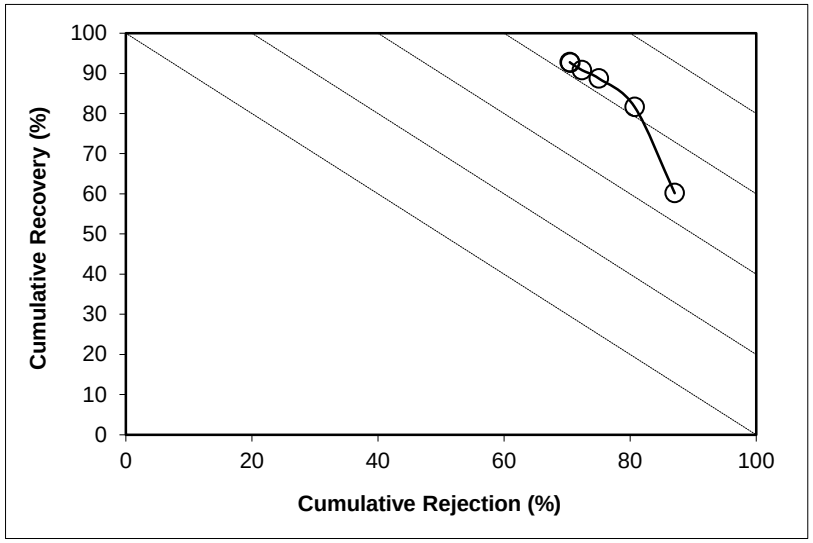
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 28.93

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	52.58	3.95	52.58	3.95	60.17	47.42	29.52	87.08	47.25
P2	19.02	5.37	71.60	4.33	81.62	28.40	45.70	80.72	62.35
P3	6.88	13.28	78.48	5.11	88.73	21.52	56.06	75.04	63.77
P4	2.18	19.80	80.66	5.51	90.81	19.34	60.15	72.36	63.17
P5	1.81	16.13	82.47	5.74	92.62	17.53	64.69	70.54	63.17
P6	0.16	10.65	82.62	5.75	92.79	17.38	65.17	70.44	63.23
P7	17.38	65.17	100.00	16.08	100.00	0.00			
Total (Calc)	100.00	16.08	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

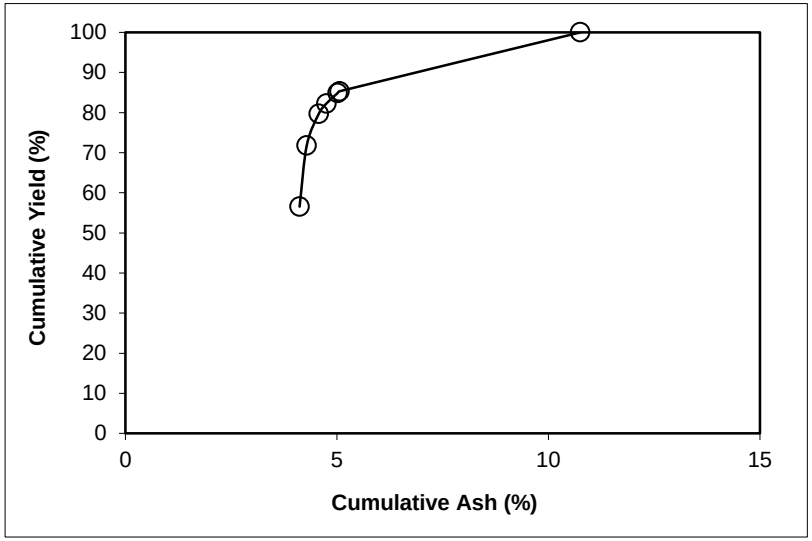
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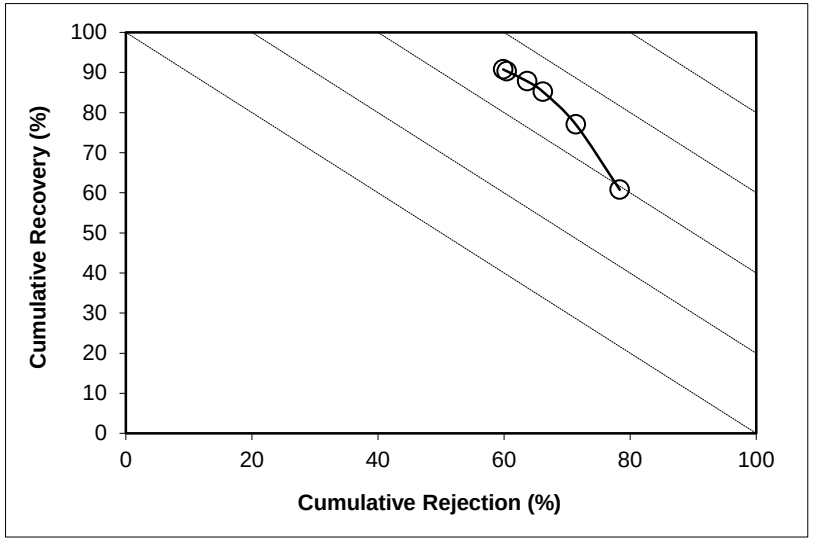
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 18.14

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	56.55	4.11	56.55	4.11	60.76	43.45	19.40	78.37	39.12
P2	15.27	4.91	71.82	4.28	77.03	28.18	27.24	71.39	48.42
P3	7.86	7.16	79.67	4.57	85.20	20.33	35.01	66.16	51.36
P4	2.59	10.34	82.26	4.75	87.80	17.74	38.60	63.67	51.47
P5	2.61	13.40	84.87	5.02	90.33	15.13	42.95	60.42	50.75
P6	0.44	13.42	85.31	5.06	90.76	14.69	43.84	59.87	50.63
P7	14.69	43.84	100.00	10.75	100.00	0.00			
Total (Calc)	100.00	10.75	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

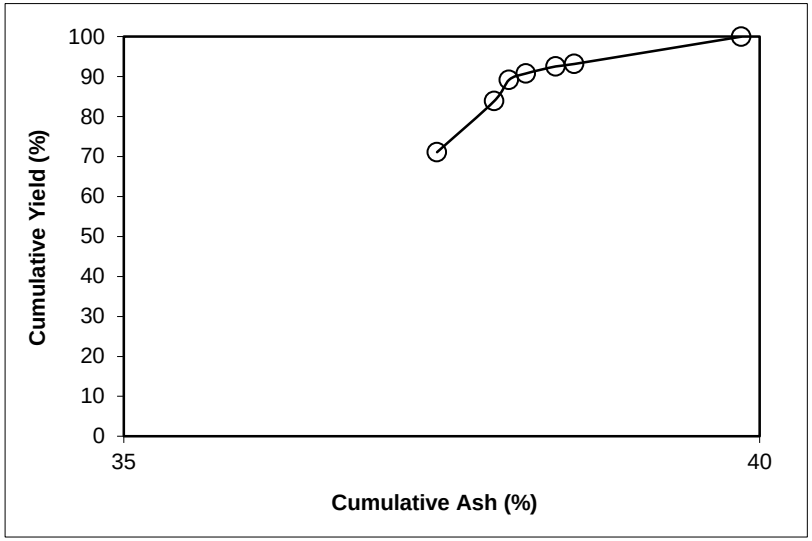
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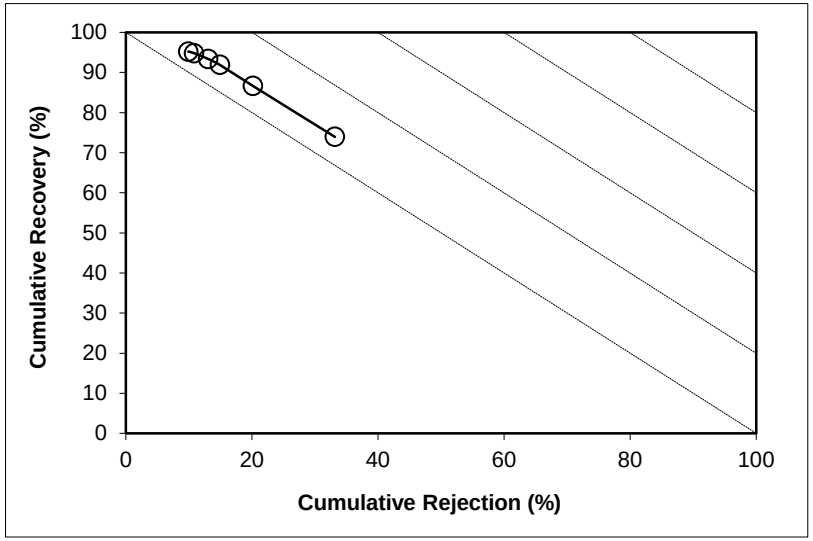
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: -100 Feed Weight (%): 19.37

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	71.11	37.46	71.11	37.46	73.93	28.89	45.74	33.16	7.09
P2	12.81	40.41	83.92	37.91	86.62	16.08	49.98	20.17	6.79
P3	5.25	39.86	89.17	38.03	91.87	10.83	54.88	14.92	6.79
P4	1.61	45.48	90.78	38.16	93.34	9.22	56.53	13.07	6.41
P5	1.78	50.42	92.56	38.40	94.80	7.44	57.99	10.82	5.63
P6	0.61	60.63	93.17	38.54	95.20	6.83	57.75	9.90	5.10
P7	6.83	57.75	100.00	39.85	100.00	0.00			
Total (Calc)	100.00	39.85	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

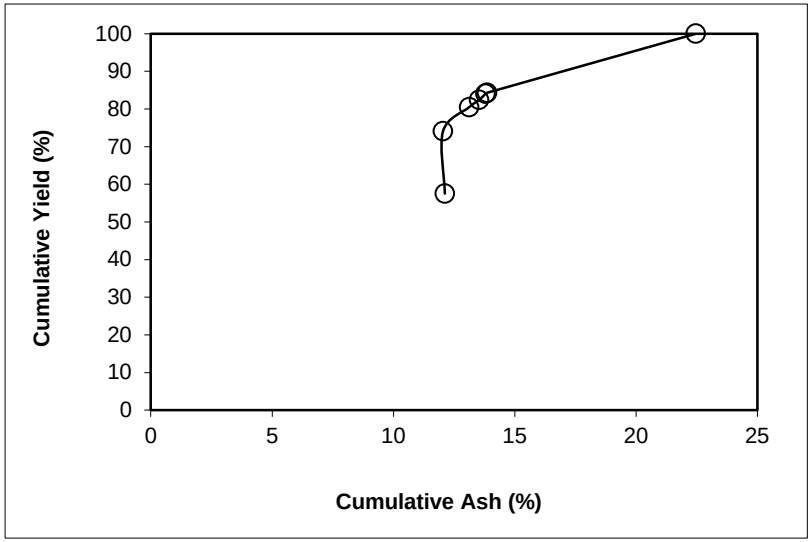
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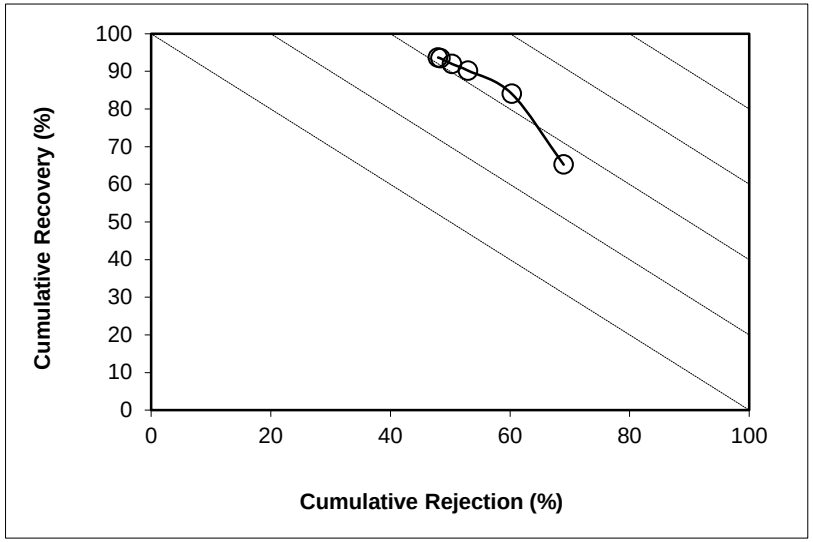
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	57.55	12.12	57.55	12.12	65.22	42.45	36.49	68.96	34.18
P2	16.52	11.77	74.06	12.04	84.02	25.94	52.23	60.30	44.32
P3	6.43	25.57	80.49	13.12	90.19	19.51	61.02	52.98	43.18
P4	1.98	30.53	82.47	13.54	91.96	17.53	64.45	50.30	42.26
P5	1.61	27.22	84.08	13.80	93.47	15.92	68.21	48.35	41.82
P6	0.25	35.30	84.33	13.86	93.68	15.67	68.74	47.96	41.64
P7	15.67	68.74	100.00	22.46	100.00	0.00			
Total (Calc)	100.00	22.46	--	--	--	--	--	--	--

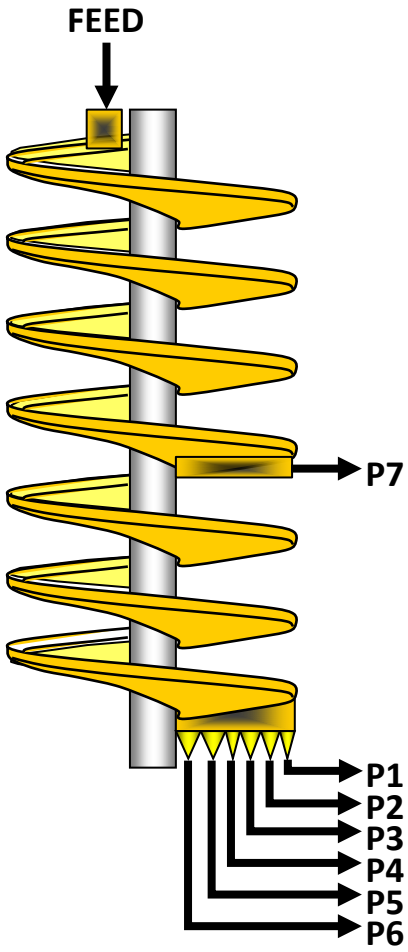




SPIRAL DATA ANALYSIS

Description: Run 19 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	1.441	18.3	25.67	29.57
P2	0.346	29.9	3.25	4.21
P3	0.134	36.7	0.92	1.26
P4	0.042	36.8	0.29	0.39
P5	0.039	27.5	0.41	0.50
P6	0.008	17.0	0.16	0.18
P7	0.354	49.3	1.46	2.16
Total	2.365	22.7	32.16	38.28

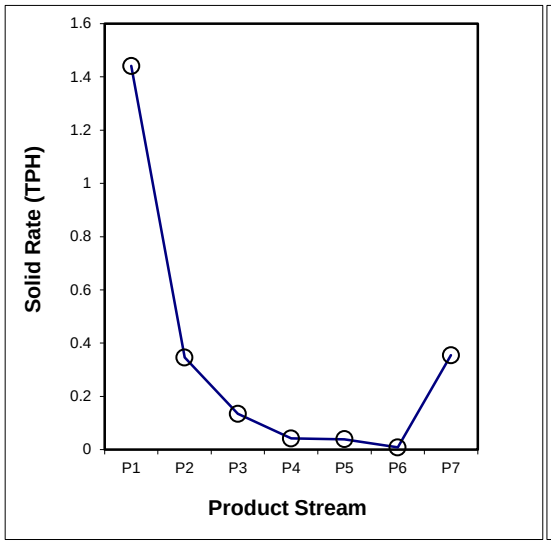
SPIRAL DATA ANALYSIS

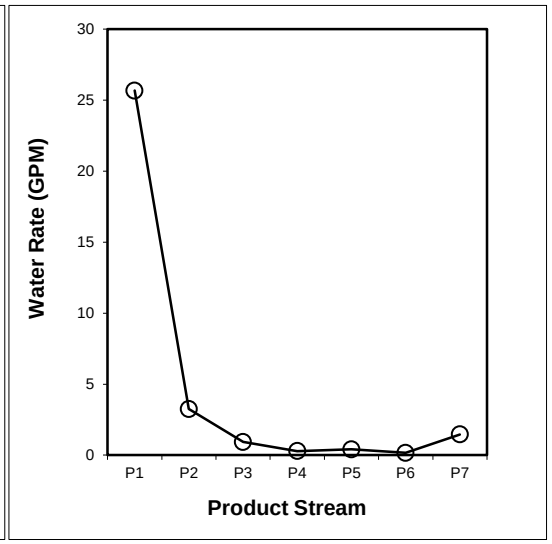
Description: Run 19 - Intermediate Spiral Test

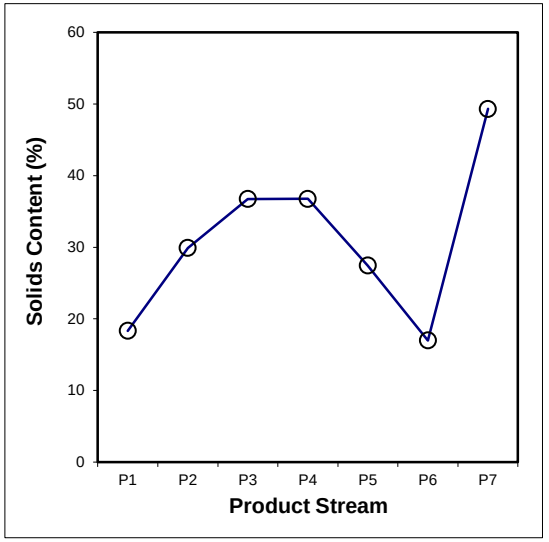
Comments: 1 x 0.15 mm Nominal Particle Size

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	3	7305.00	1269.19	7.859	3575.9	2485.3	1.441	60.95	18.34
P2	5	1576.65	95.69	1.158	3105.2	2668.6	0.346	14.64	29.90
P3	10	1029.00	95.09	0.365	2817.1	2478.8	0.134	5.67	36.73
P4	30	963.41	87.90	0.114	2331.7	2014.3	0.042	1.77	36.76
P5	20	816.11	95.32	0.141	2372.5	2177.4	0.039	1.64	27.45
P6	60	840.00	94.96	0.049	2603.8	2479.0	0.008	0.35	17.00
P7	5	1015.91	97.25	0.719	2461.3	2014.3	0.354	14.99	49.30
Total (Calc)	--	--	--	10.405	--	--	2.365	100.00	22.73
Total (Head)	0.74	2190.54	261.01	10.405	2616.1	2177.5	2.365	--	22.73







SPIRAL DATA ANALYSIS

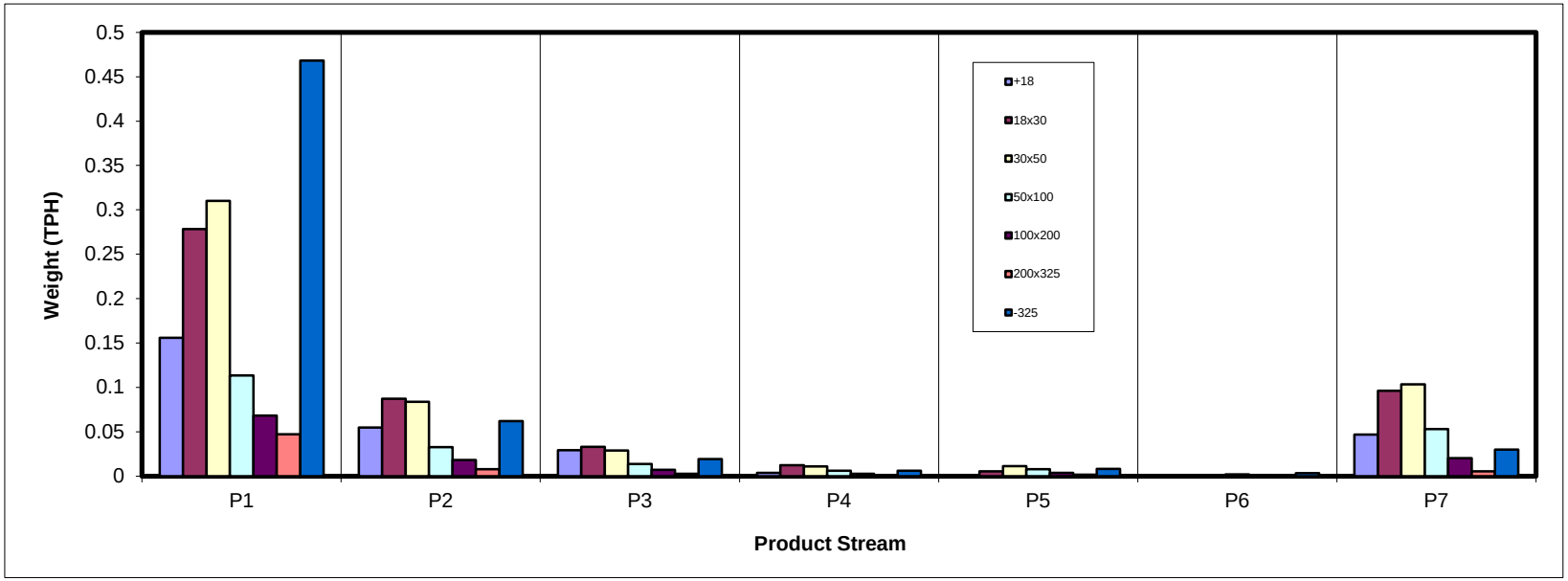
Description: Run 19 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.156	0.055	0.029	0.004	0.001	0.000	0.047		0.291
18x30	0.278	0.087	0.033	0.012	0.005	0.000	0.096		0.513
30x50	0.310	0.084	0.029	0.011	0.011	0.001	0.103		0.548
50x100	0.113	0.033	0.014	0.006	0.008	0.002	0.053		0.228
100x200	0.068	0.018	0.007	0.003	0.004	0.001	0.020		0.121
200x325	0.047	0.008	0.003	0.001	0.001	0.001	0.005		0.066
-325	0.468	0.062	0.019	0.006	0.008	0.003	0.030		0.597
Total (Calc)	1.441	0.346	0.134	0.042	0.039	0.008	0.354		2.365



SPIRAL DATA ANALYSIS

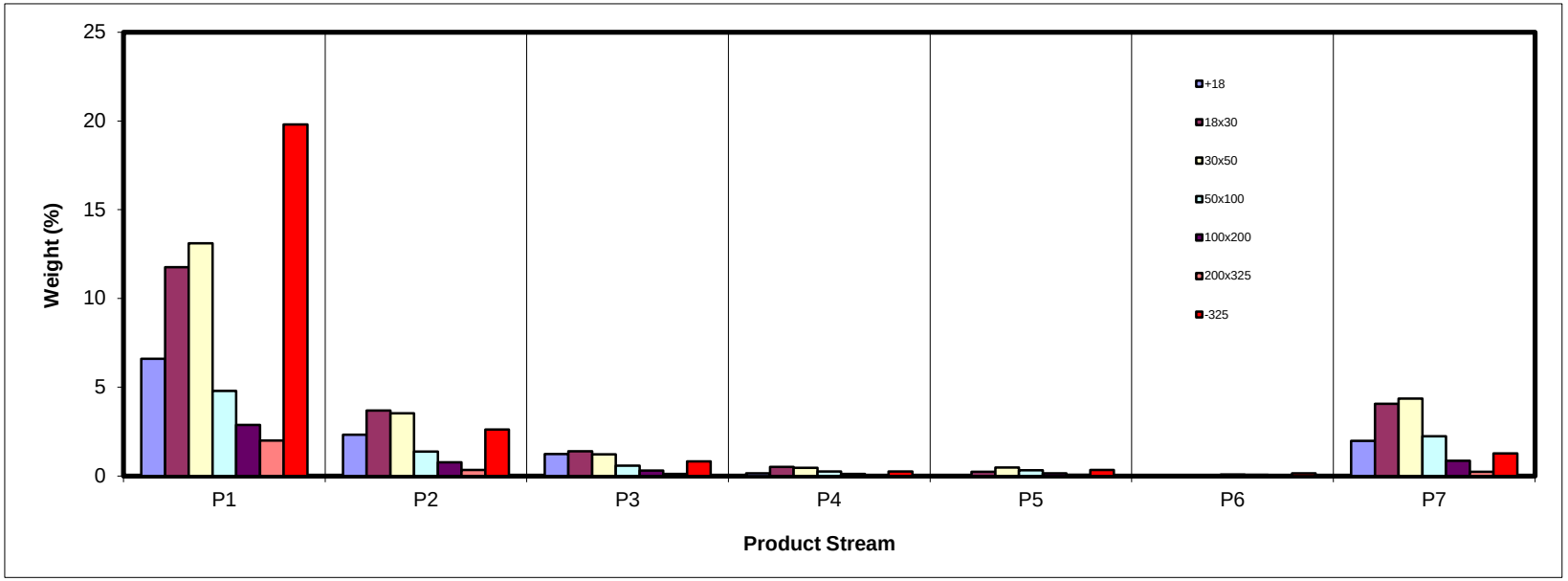
Description: Run 19 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	6.60	2.32	1.24	0.15	0.04	0.00	1.97		12.33
18x30	11.77	3.69	1.40	0.51	0.23	0.01	4.06		21.67
30x50	13.11	3.53	1.22	0.46	0.47	0.03	4.37		23.19
50x100	4.80	1.38	0.58	0.25	0.33	0.08	2.24		9.65
100x200	2.88	0.77	0.30	0.11	0.15	0.06	0.85		5.11
200x325	1.99	0.33	0.12	0.04	0.06	0.03	0.23		2.79
-325	19.80	2.62	0.82	0.25	0.34	0.14	1.27		25.25
Total (Calc)	60.95	14.64	5.67	1.77	1.64	0.35	14.99		100.00



SPIRAL DATA ANALYSIS

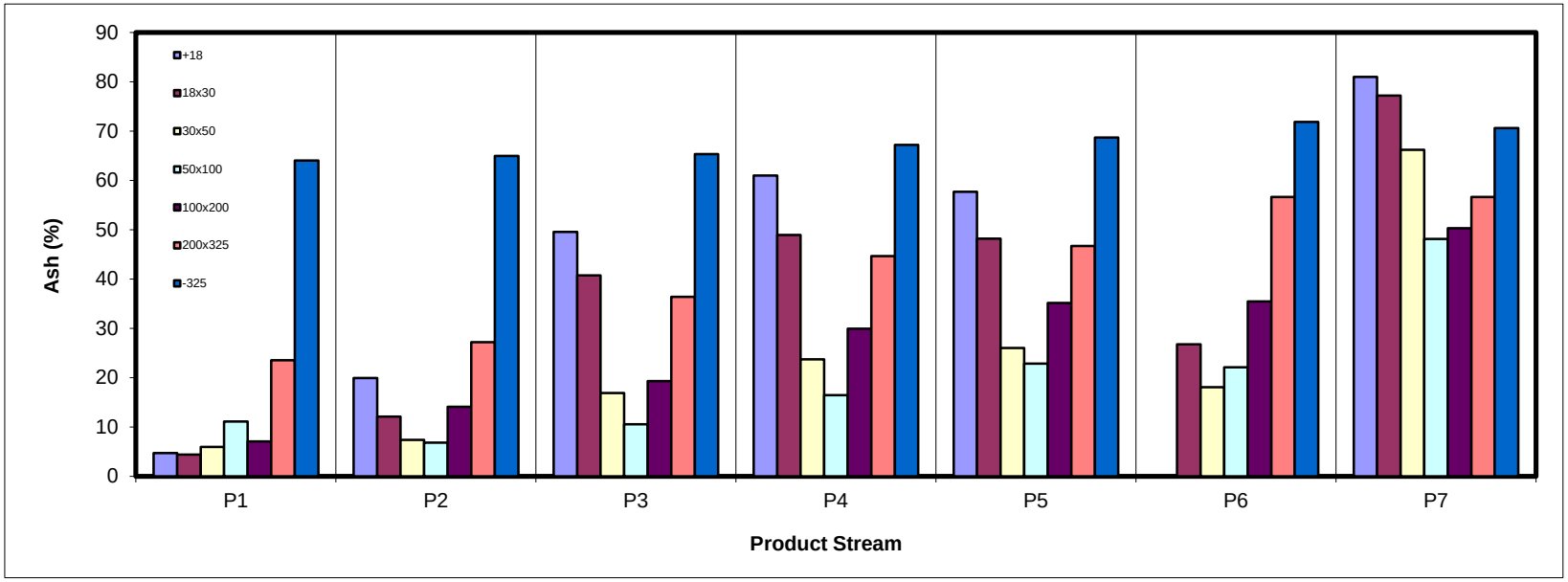
Description: Run 19 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	4.68	19.91	49.57	61.00	57.66	0.00	80.95		25.15
18x30	4.42	12.09	40.75	48.89	48.19	26.74	77.15		23.23
30x50	5.92	7.36	16.91	23.71	25.99	18.06	66.20		18.84
50x100	11.11	6.84	10.52	16.44	22.86	22.12	48.13		19.67
100x200	7.08	14.08	19.31	29.93	35.16	35.43	50.30		17.66
200x325	23.53	27.21	36.40	44.65	46.69	56.61	56.62		28.35
-325	64.00	64.93	65.29	67.18	68.66	71.82	70.59		64.61
Total (Calc)	25.40	21.59	36.77	40.23	40.02	46.96	67.74		32.41



SPIRAL DATA ANALYSIS

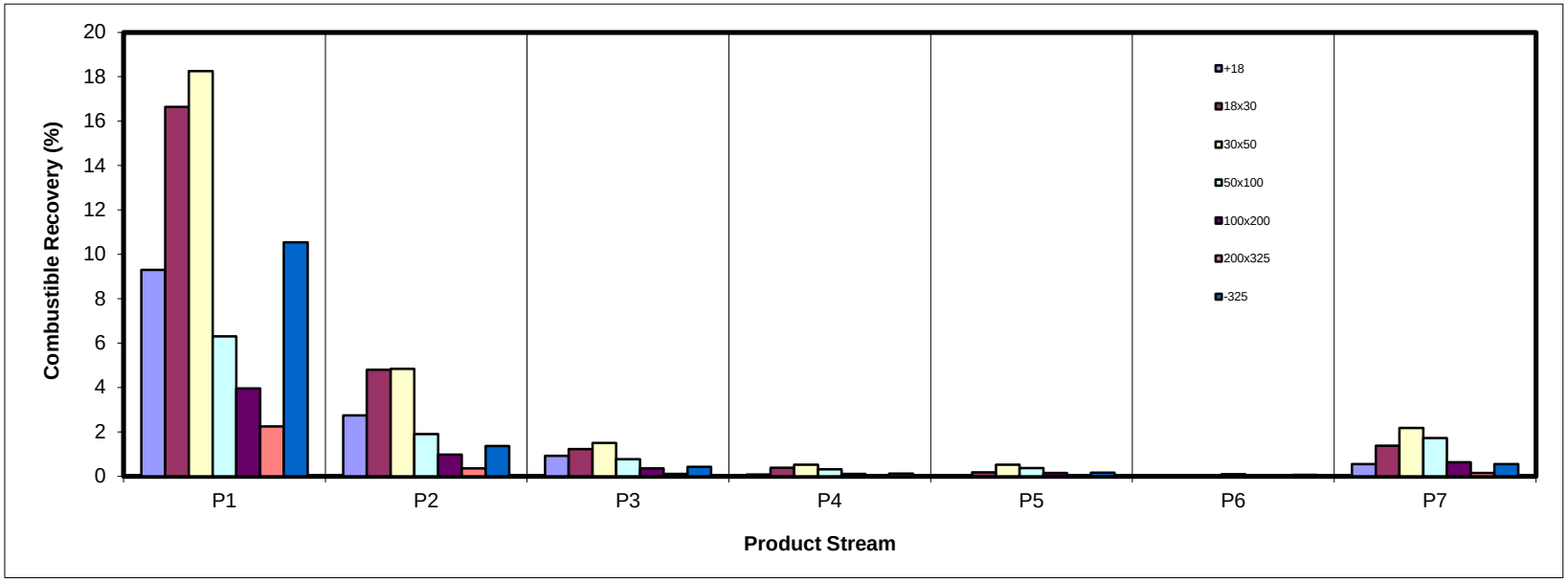
Description: Run 19 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	9.30	2.75	0.93	0.09	0.03	0.00	0.56		13.65
18x30	16.64	4.80	1.22	0.39	0.18	0.01	1.37		24.62
30x50	18.25	4.84	1.50	0.51	0.51	0.04	2.18		27.85
50x100	6.31	1.90	0.77	0.31	0.38	0.09	1.72		11.47
100x200	3.96	0.98	0.36	0.11	0.15	0.05	0.63		6.23
200x325	2.25	0.36	0.11	0.03	0.05	0.02	0.15		2.96
-325	10.55	1.36	0.42	0.12	0.16	0.06	0.55		13.22
Total (Calc)	67.26	16.98	5.31	1.57	1.45	0.27	7.15		100.00



SPIRAL DATA ANALYSIS

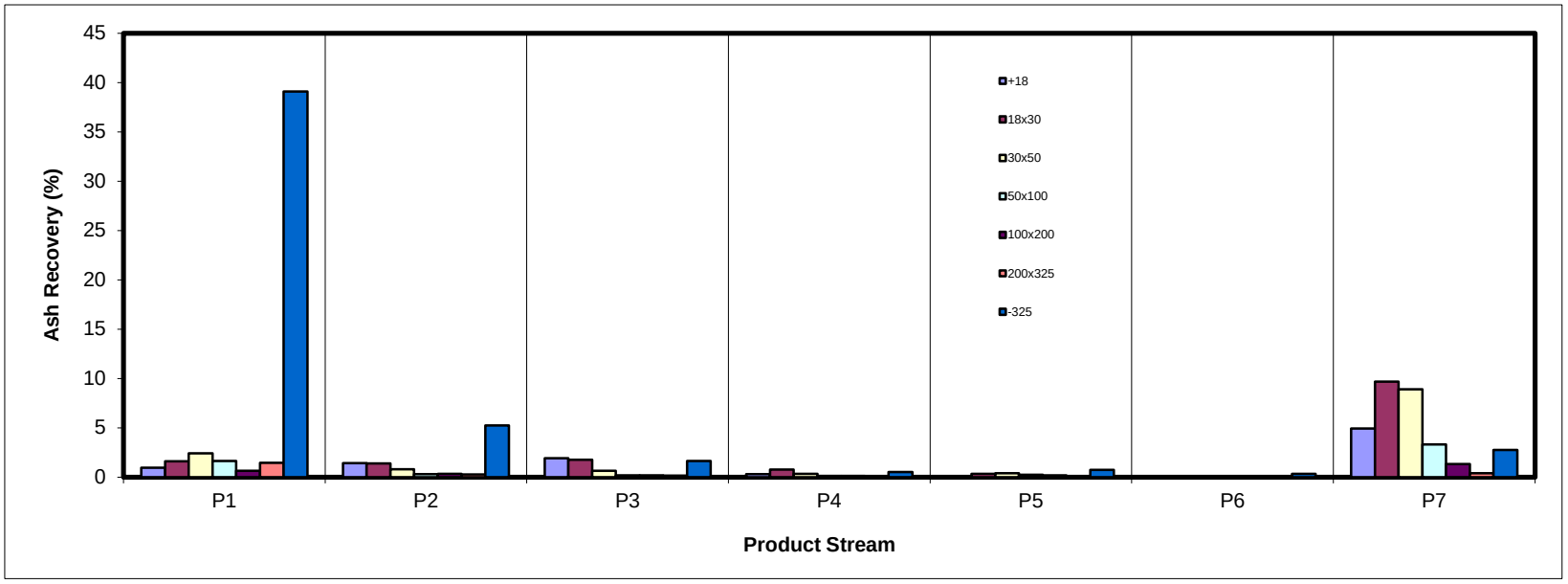
Description: Run 19 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.95	1.42	1.90	0.28	0.08	0.00	4.92		9.56
18x30	1.61	1.38	1.75	0.77	0.34	0.00	9.67		15.54
30x50	2.40	0.80	0.64	0.33	0.38	0.02	8.92		13.48
50x100	1.64	0.29	0.19	0.13	0.23	0.06	3.32		5.86
100x200	0.63	0.33	0.18	0.10	0.16	0.06	1.32		2.79
200x325	1.44	0.28	0.13	0.06	0.09	0.04	0.40		2.44
-325	39.10	5.25	1.65	0.53	0.73	0.32	2.77		50.34
Total (Calc)	47.77	9.75	6.43	2.20	2.02	0.51	31.32		100.00



SPIRAL DATA ANALYSIS

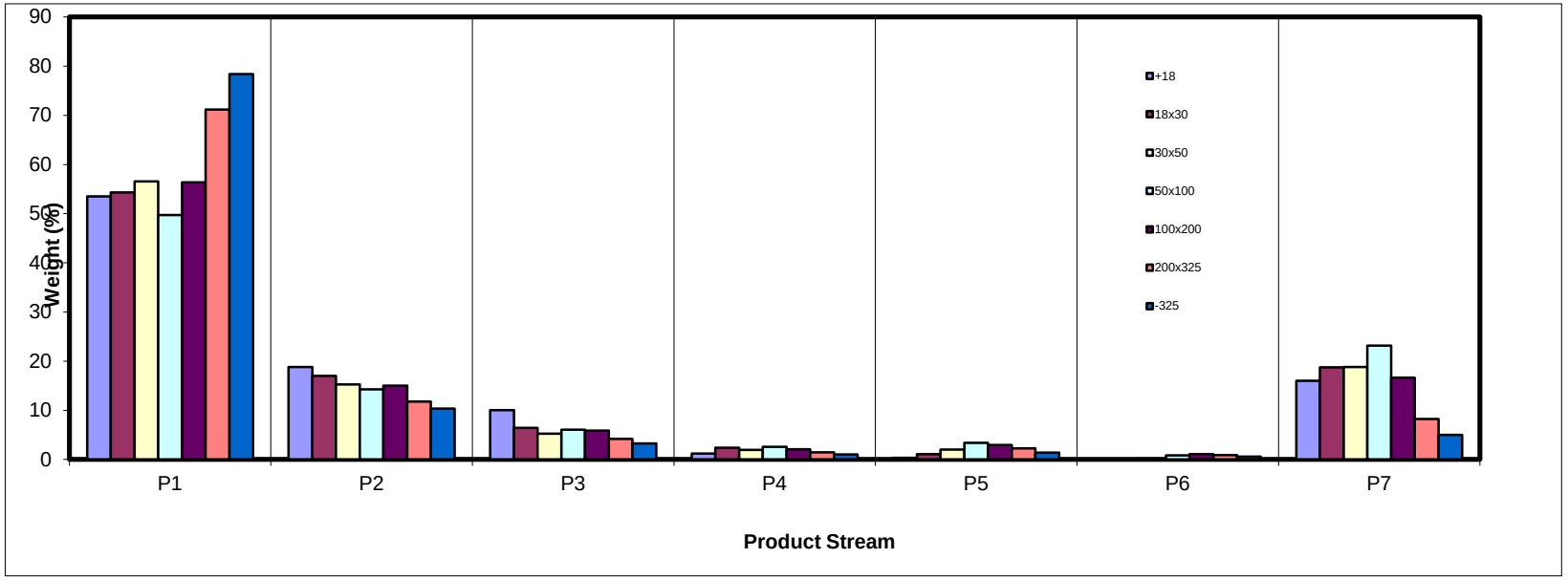
Description: Run 19 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	53.52	18.81	10.07	1.22	0.36	0.02	16.00		100.00
18x30	54.31	17.03	6.44	2.37	1.07	0.02	18.76		100.00
30x50	56.54	15.24	5.25	1.97	2.03	0.15	18.82		100.00
50x100	49.70	14.27	6.03	2.60	3.41	0.84	23.16		100.00
100x200	56.35	15.00	5.85	2.11	2.96	1.10	16.63		100.00
200x325	71.16	11.81	4.20	1.46	2.24	0.92	8.21		100.00
-325	78.41	10.37	3.24	1.01	1.37	0.57	5.03		100.00
Total (Calc)	60.95	14.64	5.67	1.77	1.64	0.35	14.99		100.00



SPIRAL DATA ANALYSIS

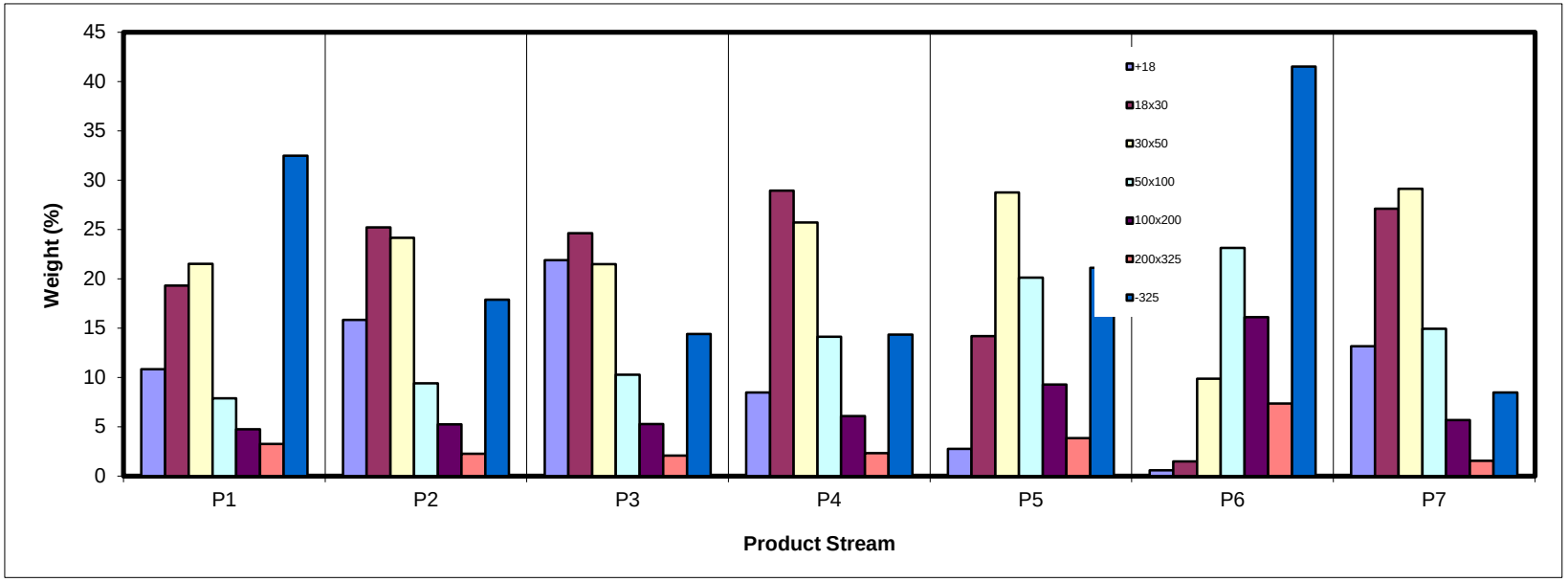
Description: Run 19 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	10.82	15.84	21.89	8.47	2.75	0.57	13.16		12.33
18x30	19.31	25.22	24.61	28.95	14.17	1.47	27.12		21.67
30x50	21.51	24.15	21.47	25.72	28.76	9.87	29.13		23.19
50x100	7.87	9.41	10.27	14.13	20.12	23.13	14.92		9.65
100x200	4.73	5.24	5.28	6.09	9.27	16.12	5.67		5.11
200x325	3.26	2.25	2.07	2.30	3.83	7.34	1.53		2.79
-325	32.49	17.89	14.41	14.34	21.10	41.50	8.48		25.25
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

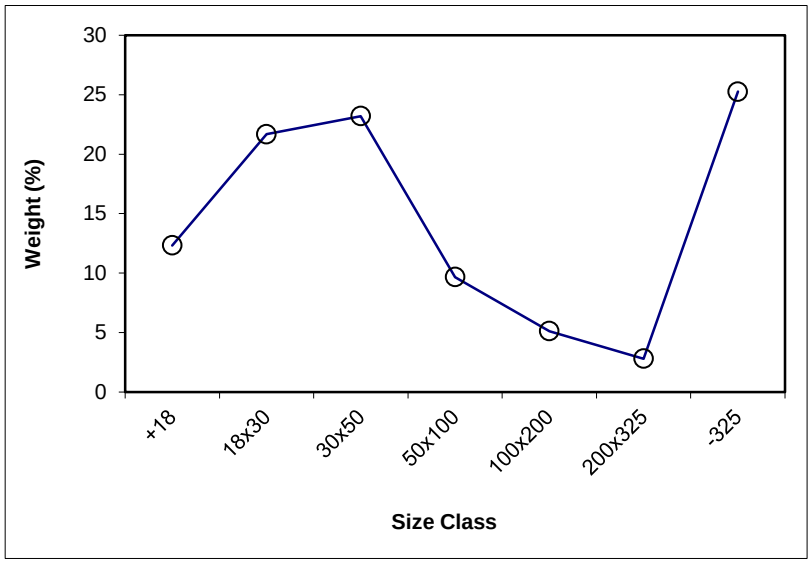
Description: Run 19 - Intermediate Spiral Test

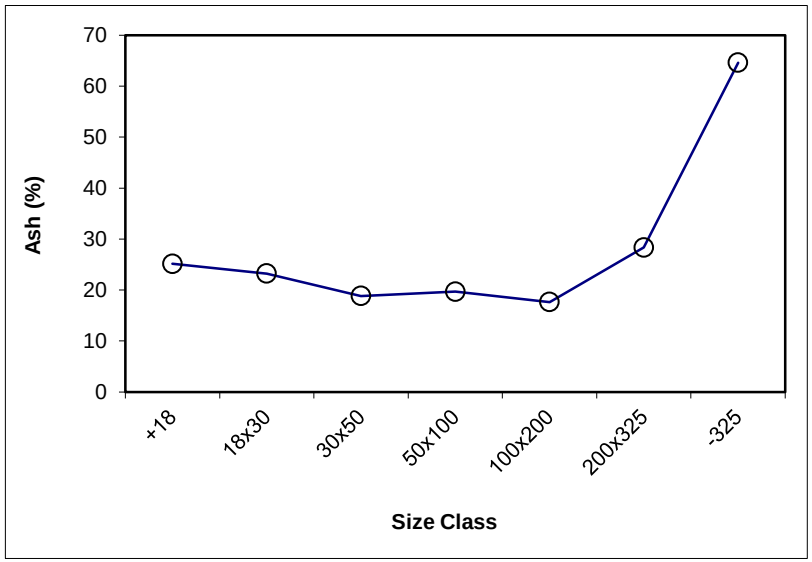
Comments: 1 x 0.15 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	433.3	379.2	54.06	12.33	25.15	12.33	25.15	100.00	32.41
18x30	487.2	392.2	95.05	21.67	23.23	34.00	23.93	87.67	33.43
30x50	456.2	354.5	101.70	23.19	18.84	57.19	21.86	66.00	36.78
50x100	409.2	366.9	42.34	9.65	19.67	66.84	21.55	42.81	46.50
100x200	369.9	347.4	22.43	5.11	17.66	71.96	21.27	33.16	54.32
200x325	343.2	331.0	12.25	2.79	28.35	74.75	21.54	28.04	61.00
-325	117.2	6.4	110.74	25.25	64.61	100.00	32.41	25.25	64.61
Total (Calc)	--	--	438.58	100.00	32.41	--	--	--	--





SPIRAL DATA ANALYSIS

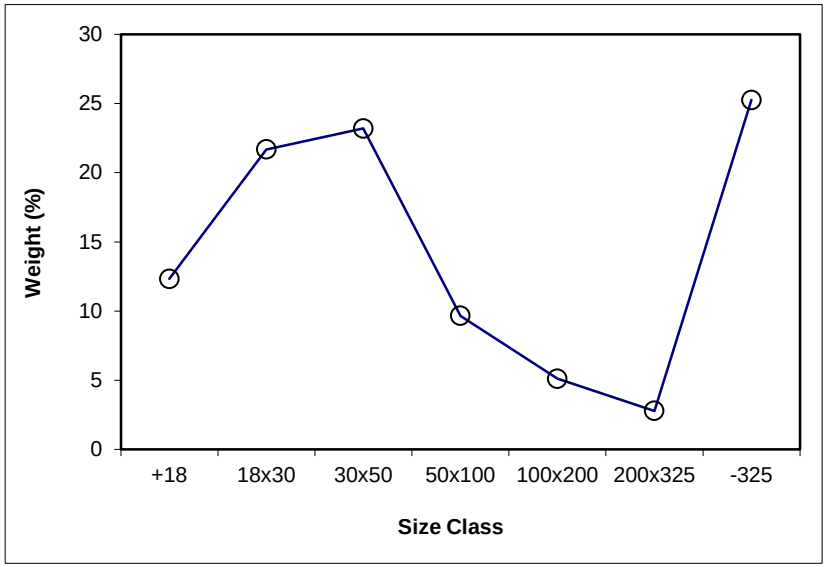
Description: Run 19 - Intermediate Spiral Test

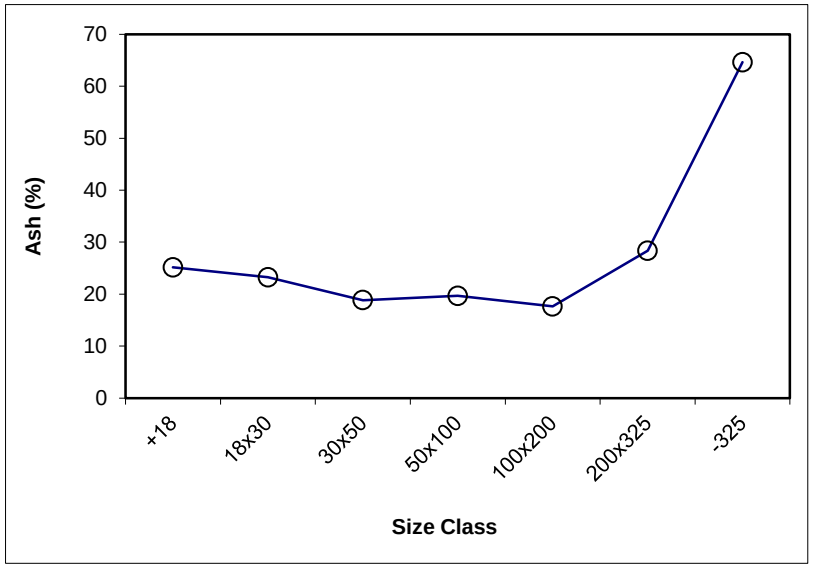
Comments: 1 x 0.15 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	12.33	25.15	12.33	25.15	100.00	32.41			
18x30	21.67	23.23	34.00	23.93	87.67	33.43	x	21.67	23.23
30x50	23.19	18.84	57.19	21.86	66.00	36.78	x	23.19	18.84
50x100	9.65	19.67	66.84	21.55	42.81	46.50	x	9.65	19.67
100x200	5.11	17.66	71.96	21.27	33.16	54.32	x	5.11	17.66
200x325	2.79	28.35	74.75	21.54	28.04	61.00	x	2.79	28.35
-325	25.25	64.61	100.00	32.41	25.25	64.61			
Total (Calc)	100.00	32.41	--	--	--	--	--	62.42	20.82





SPIRAL DATA ANALYSIS

Description: Run 19 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 60.95

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	578.18	460.1	118.04	10.82	4.68	10.82	4.68	100.00	25.40
18x30	652.76	442.2	210.61	19.31	4.42	30.14	4.51	89.18	27.92
30x50	647.15	412.5	234.62	21.51	5.92	51.65	5.10	69.86	34.42
50x100	473.55	387.7	85.86	7.87	11.11	59.52	5.89	48.35	47.09
100x200	442.92	391.3	51.58	4.73	7.08	64.25	5.98	40.48	54.09
200x325	414.16	378.6	35.56	3.26	23.53	67.51	6.83	35.75	60.31
-325	367.17	12.9	354.32	32.49	64.00	100.00	25.40	32.49	64.00
Total (Calc)	--	--	1090.61	100.00	25.40	--	--	--	--

Product P2 Feed Weight (%): 14.64

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	470.4	401.2	69.15	15.84	19.91	15.84	19.91	100.00	21.59
18x30	480.1	370.0	110.10	25.22	12.09	41.06	15.11	84.16	21.90
30x50	441.7	336.3	105.41	24.15	7.36	65.21	12.24	58.94	26.10
50x100	348.9	307.8	41.09	9.41	6.84	74.62	11.56	34.79	39.11
100x200	317.4	294.5	22.88	5.24	14.08	79.86	11.72	25.38	51.08
200x325	307.8	298.0	9.83	2.25	27.21	82.11	12.15	20.14	60.71
-325	738.9	660.8	78.09	17.89	64.93	100.00	21.59	17.89	64.93
Total (Calc)	--	--	436.57	100.00	21.59	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 19 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 5.67

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	534.2	460.1	74.04	21.89	49.57	21.89	49.57	100.00	36.77
18x30	525.4	442.2	83.26	24.61	40.75	46.50	44.90	78.11	33.19
30x50	485.2	412.5	72.65	21.47	16.91	67.97	36.06	53.50	29.71
50x100	422.4	387.7	34.74	10.27	10.52	78.24	32.71	32.03	38.29
100x200	409.2	391.3	17.85	5.28	19.31	83.52	31.86	21.76	51.40
200x325	385.6	378.6	7.00	2.07	36.40	85.59	31.97	16.48	61.67
-325	55.1	6.4	48.76	14.41	65.29	100.00	36.77	14.41	65.29
Total (Calc)	--	--	338.29	100.00	36.77	--	--	--	--

Product P4 Feed Weight (%): 1.77

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	428.1	401.2	26.90	8.47	61.00	8.47	61.00	100.00	40.23
18x30	461.9	370.0	91.90	28.95	48.89	37.42	51.63	91.53	38.30
30x50	417.9	336.3	81.64	25.72	23.71	63.14	40.26	62.58	33.40
50x100	352.7	307.8	44.85	14.13	16.44	77.27	35.90	36.86	40.17
100x200	313.8	294.5	19.33	6.09	29.93	83.36	35.47	22.73	54.92
200x325	305.3	298.0	7.31	2.30	44.65	85.66	35.71	16.64	64.07
-325	52.0	6.5	45.52	14.34	67.18	100.00	40.23	14.34	67.18
Total (Calc)	--	--	317.44	100.00	40.23	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 19 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 1.64

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	384.6	379.2	5.37	2.75	57.66	2.75	57.66	100.00	40.02
18x30	419.8	392.2	27.64	14.17	48.19	16.92	49.73	97.25	39.52
30x50	410.6	354.5	56.10	28.76	25.99	45.68	34.78	83.08	38.05
50x100	406.1	366.9	39.24	20.12	22.86	65.80	31.14	54.32	44.43
100x200	365.5	347.4	18.08	9.27	35.16	75.07	31.63	34.20	57.12
200x325	338.5	331.0	7.48	3.83	46.69	78.90	32.37	24.93	65.28
-325	47.5	6.3	41.16	21.10	68.66	100.00	40.02	21.10	68.66
Total (Calc)	--	--	195.06	100.00	40.02	--	--	--	--

Product P6 Feed Weight (%): 0.35

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	460.9	460.1	0.71	0.57	0.00	0.57	0.00	100.00	46.96
18x30	444.0	442.2	1.84	1.47	26.74	2.05	19.28	99.43	47.23
30x50	424.8	412.5	12.32	9.87	18.06	11.92	18.27	97.95	47.54
50x100	416.6	387.7	28.86	23.13	22.12	35.04	20.81	88.08	50.85
100x200	411.5	391.3	20.11	16.12	35.43	51.16	25.41	64.96	61.07
200x325	387.8	378.6	9.16	7.34	56.61	58.50	29.33	48.84	69.54
-325	58.3	6.5	51.80	41.50	71.82	100.00	46.96	41.50	71.82
Total (Calc)	--	--	124.80	100.00	46.96	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 19 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 14.99

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	460.0	401.2	58.81	13.16	80.95	13.16	80.95	100.00	67.74
18x30	491.3	370.0	121.23	27.12	77.15	40.27	78.39	86.84	65.74
30x50	466.5	336.3	130.19	29.13	66.20	69.40	73.28	59.73	60.56
50x100	374.5	307.8	66.68	14.92	48.13	84.32	68.83	30.60	55.18
100x200	319.9	294.5	25.36	5.67	50.30	89.99	67.66	15.68	61.89
200x325	304.8	298.0	6.84	1.53	56.62	91.52	67.48	10.01	68.45
-325	44.4	6.5	37.90	8.48	70.59	100.00	67.74	8.48	70.59
Total (Calc)	--	--	447.01	100.00	67.74	--	--	--	--

SPIRAL DATA ANALYSIS

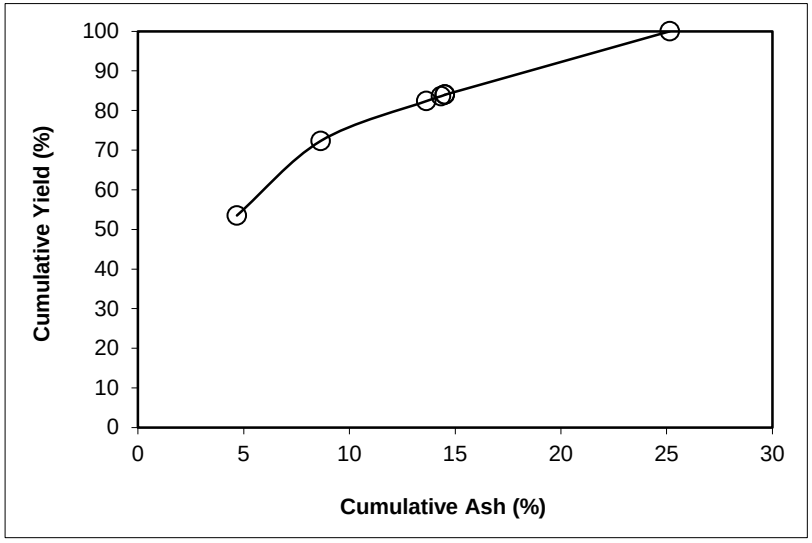
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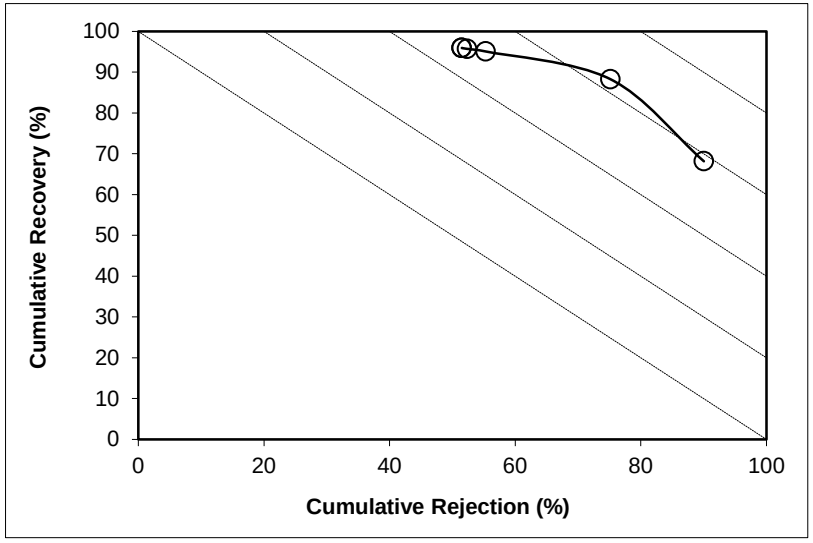
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 12.33

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	53.52	4.68	53.52	4.68	68.15	46.48	48.71	90.04	58.19
P2	18.81	19.91	72.33	8.64	88.28	27.67	68.29	75.15	63.43
P3	10.07	49.57	82.40	13.64	95.07	17.60	79.01	55.30	50.36
P4	1.22	61.00	83.62	14.33	95.70	16.38	80.35	52.34	48.04
P5	0.36	57.66	83.99	14.52	95.91	16.01	80.87	51.50	47.41
P6	0.02	0.00	84.00	14.52	95.93	16.00	80.95	51.50	47.43
P7	16.00	80.95	100.00	25.15	100.00	0.00			
Total (Calc)	100.00	25.15	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

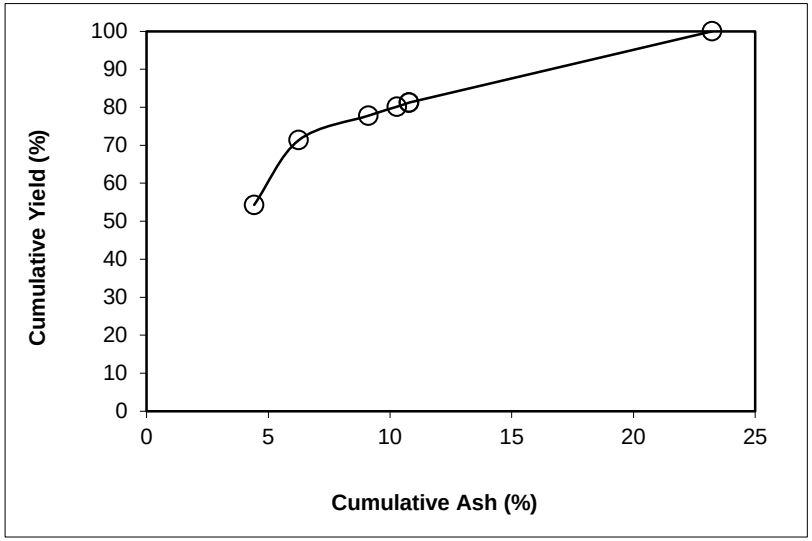
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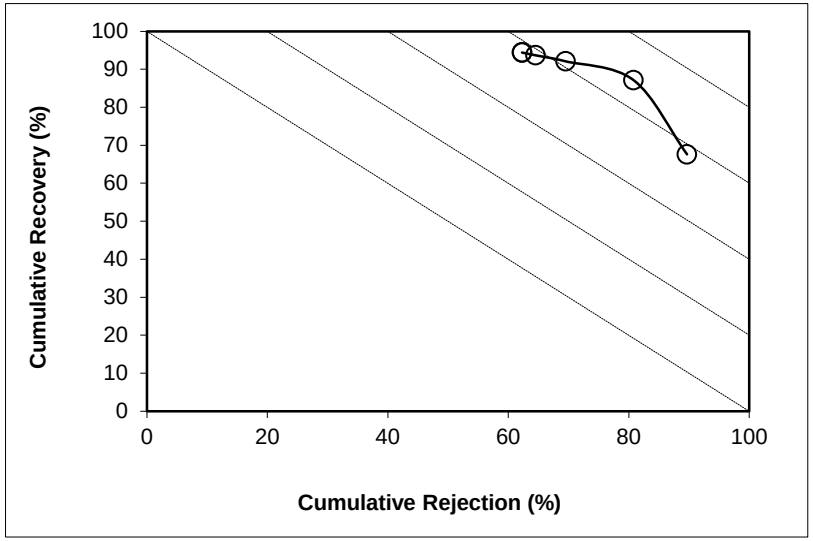
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 21.67

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	54.31	4.42	54.31	4.42	67.62	45.69	45.59	89.67	57.28
P2	17.03	12.09	71.34	6.25	87.12	28.66	65.51	80.80	67.93
P3	6.44	40.75	77.78	9.11	92.10	22.22	72.69	69.51	61.60
P4	2.37	48.89	80.15	10.28	93.67	19.85	75.53	64.52	58.19
P5	1.07	48.19	81.22	10.78	94.39	18.78	77.09	62.30	56.70
P6	0.02	26.74	81.24	10.79	94.42	18.76	77.15	62.28	56.69
P7	18.76	77.15	100.00	23.23	100.00	0.00			
Total (Calc)	100.00	23.23	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

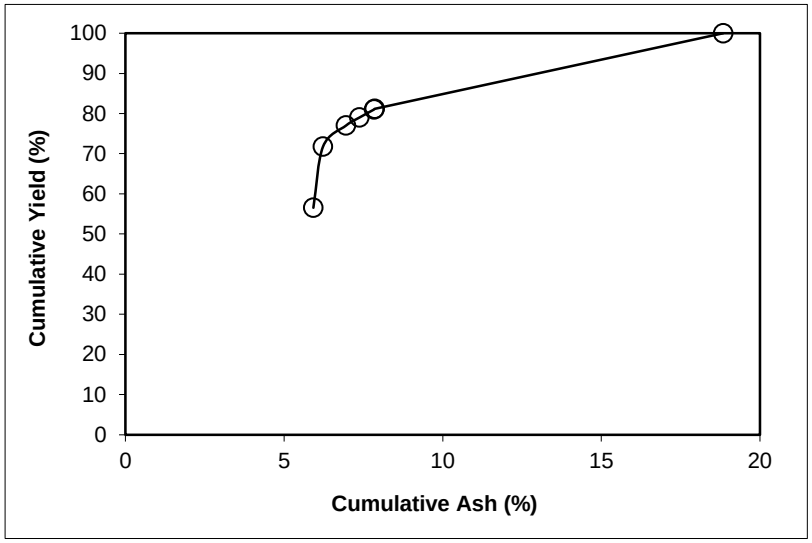
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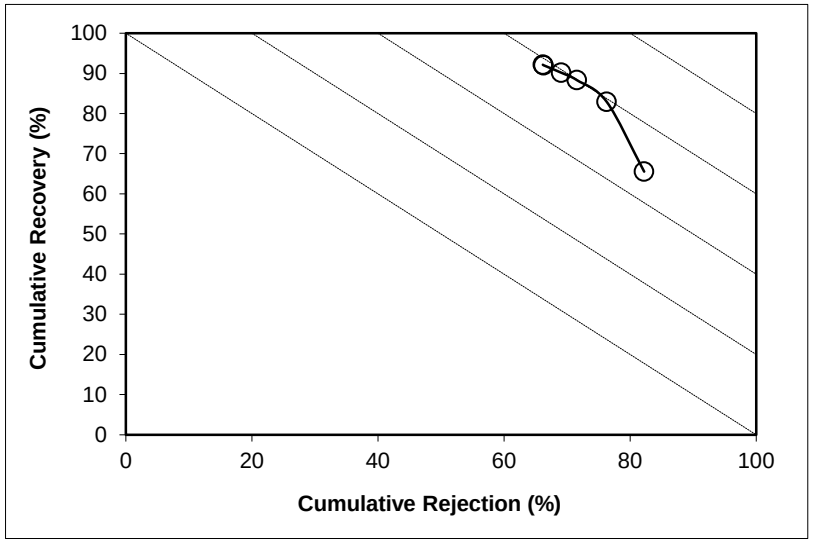
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 23.19

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	56.54	5.92	56.54	5.92	65.54	43.46	35.65	82.23	47.77
P2	15.24	7.36	71.78	6.23	82.94	28.22	50.92	76.28	59.22
P3	5.25	16.91	77.03	6.95	88.31	22.97	58.70	71.57	59.88
P4	1.97	23.71	79.00	7.37	90.16	21.00	61.98	69.09	59.25
P5	2.03	25.99	81.03	7.84	92.01	18.97	65.83	66.29	58.30
P6	0.15	18.06	81.18	7.86	92.16	18.82	66.20	66.15	58.31
P7	18.82	66.20	100.00	18.84	100.00	0.00			
Total (Calc)	100.00	18.84	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

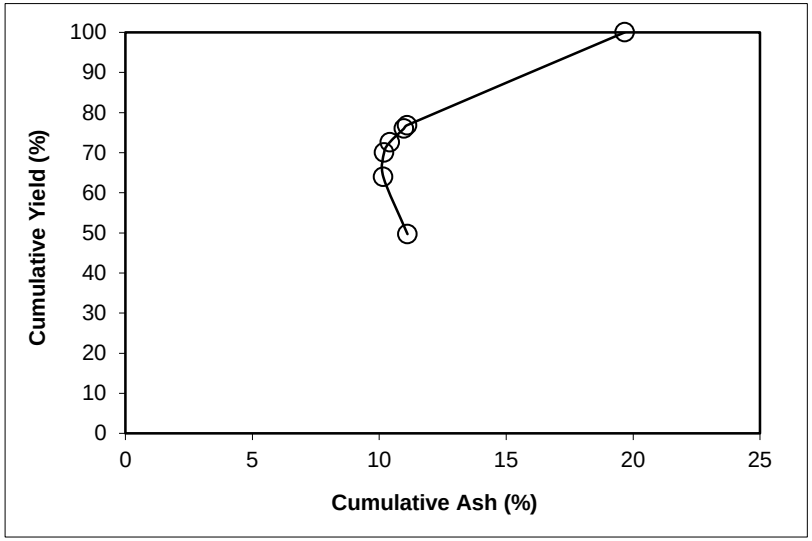
Description: Run 19 - Intermediate Spiral Test

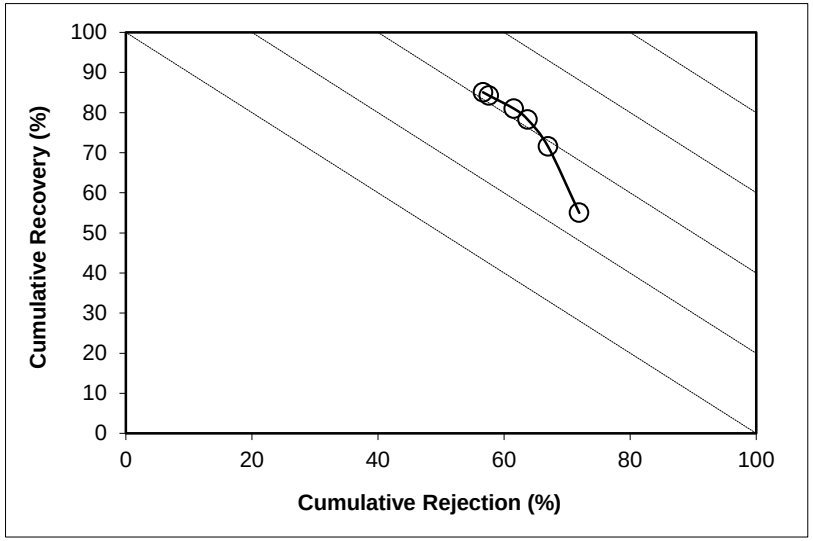
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 9.65

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	49.70	11.11	49.70	11.11	54.99	50.30	28.13	71.93	26.92
P2	14.27	6.84	63.97	10.16	71.55	36.03	36.56	66.97	38.51
P3	6.03	10.52	70.00	10.19	78.27	30.00	41.80	63.74	42.00
P4	2.60	16.44	72.60	10.41	80.97	27.40	44.20	61.57	42.54
P5	3.41	22.86	76.01	10.97	84.24	23.99	47.23	57.61	41.85
P6	0.84	22.12	76.84	11.09	85.05	23.16	48.13	56.67	41.72
P7	23.16	48.13	100.00	19.67	100.00	0.00			
Total (Calc)	100.00	19.67	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

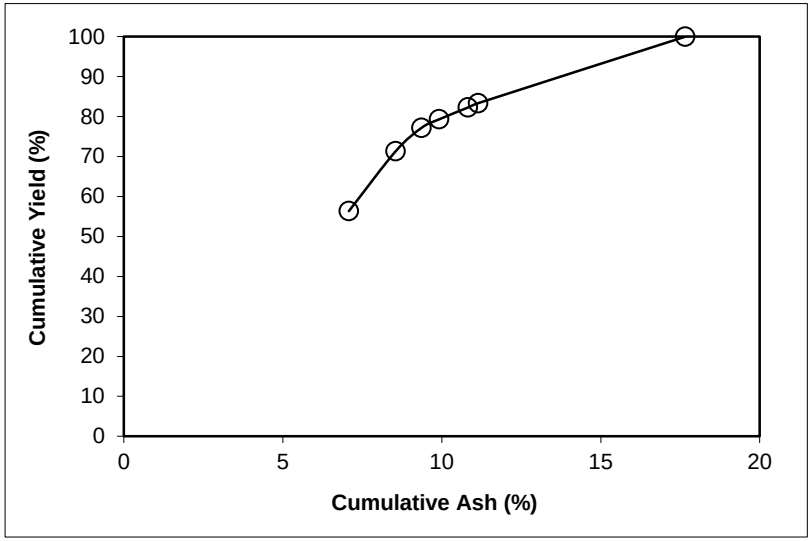
Description: Run 19 - Intermediate Spiral Test

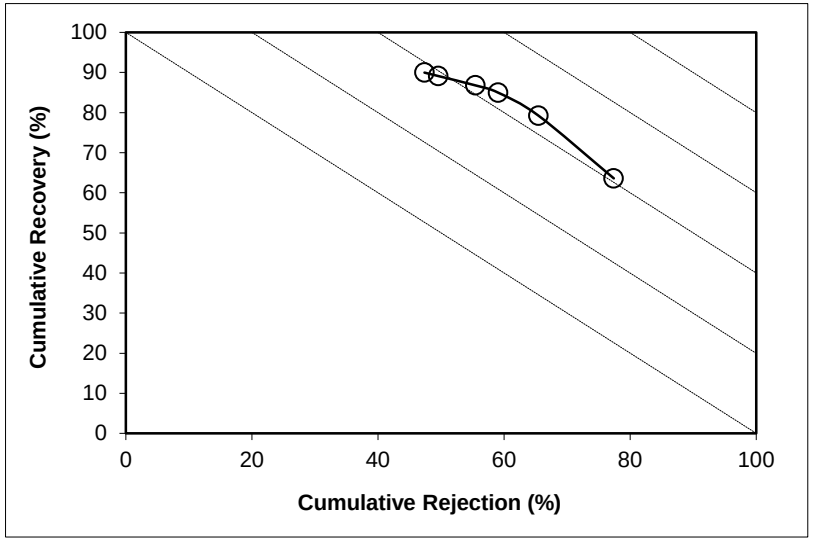
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 5.11

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	56.35	7.08	56.35	7.08	63.59	43.65	31.31	77.41	41.01
P2	15.00	14.08	71.35	8.55	79.24	28.65	40.34	65.45	44.69
P3	5.85	19.31	77.20	9.36	84.97	22.80	45.73	59.05	44.03
P4	2.11	29.93	79.31	9.91	86.77	20.69	47.34	55.47	42.24
P5	2.96	35.16	82.28	10.82	89.10	17.72	49.38	49.57	38.68
P6	1.10	35.43	83.37	11.15	89.97	16.63	50.30	47.37	37.33
P7	16.63	50.30	100.00	17.66	100.00	0.00			
Total (Calc)	100.00	17.66	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

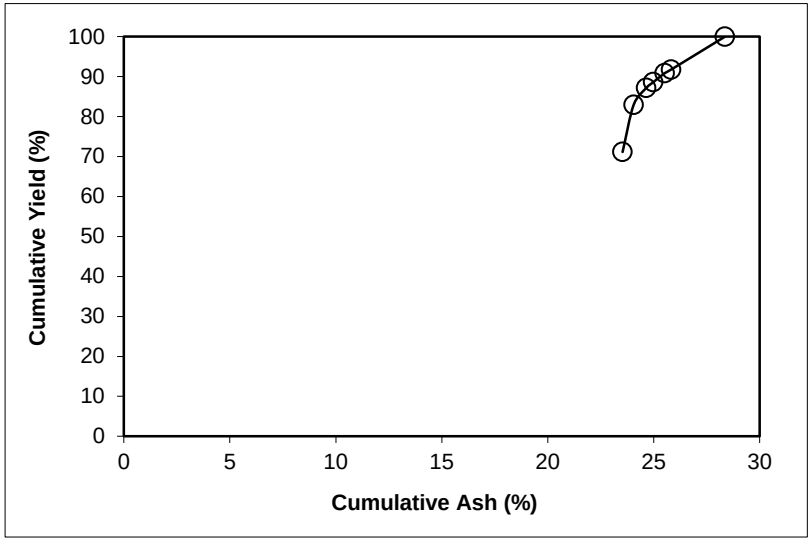
Description: Run 19 - Intermediate Spiral Test

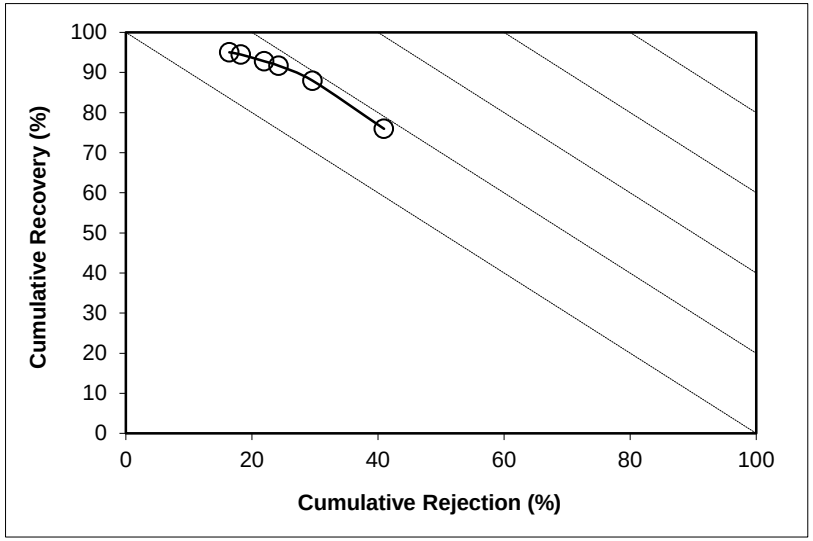
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 2.79

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	71.16	23.53	71.16	23.53	75.95	28.84	40.25	40.95	16.90
P2	11.81	27.21	82.96	24.05	87.94	17.04	49.30	29.62	17.57
P3	4.20	36.40	87.16	24.65	91.67	12.84	53.52	24.23	15.90
P4	1.46	44.65	88.63	24.98	92.80	11.37	54.66	21.93	14.73
P5	2.24	46.69	90.87	25.51	94.47	9.13	56.62	18.23	12.70
P6	0.92	56.61	91.79	25.82	95.03	8.21	56.62	16.40	11.43
P7	8.21	56.62	100.00	28.35	100.00	0.00			
Total (Calc)	100.00	28.35	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

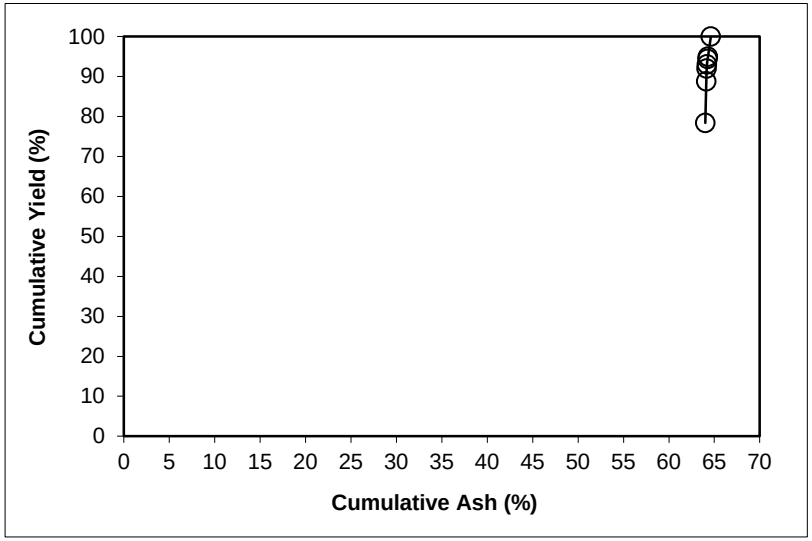
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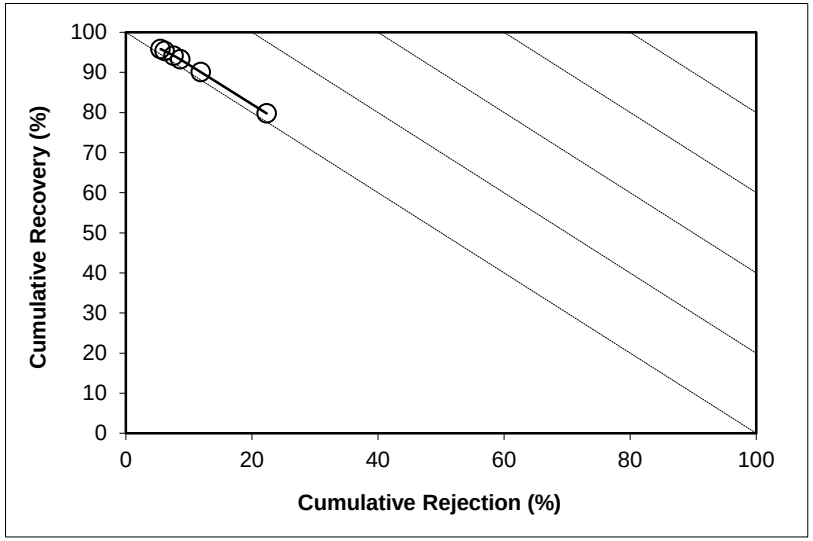
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 25.25

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	78.41	64.00	78.41	64.00	79.77	21.59	66.83	22.33	2.09
P2	10.37	64.93	88.78	64.11	90.04	11.22	68.58	11.91	1.95
P3	3.24	65.29	92.02	64.15	93.22	7.98	69.92	8.63	1.85
P4	1.01	67.18	93.03	64.19	94.15	6.97	70.31	7.59	1.74
P5	1.37	68.66	94.39	64.25	95.36	5.61	70.72	6.13	1.50
P6	0.57	71.82	94.97	64.30	95.82	5.03	70.59	5.50	1.32
P7	5.03	70.59	100.00	64.61	100.00	0.00			
Total (Calc)	100.00	64.61	--	--	--	--	--	--	--





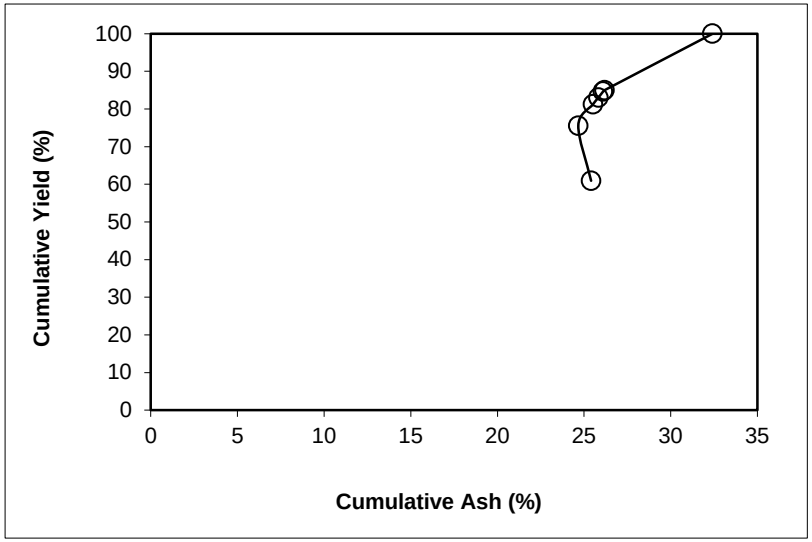
SPIRAL DATA ANALYSIS

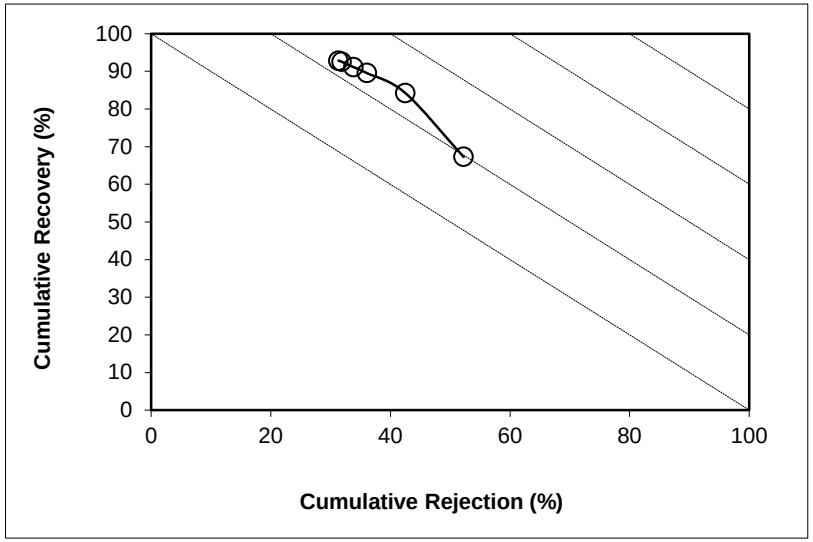
Description: Run 19 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	60.95	25.40	60.95	25.40	67.26	39.05	43.35	52.23	19.50
P2	14.64	21.59	75.58	24.67	84.25	24.42	56.40	42.48	26.73
P3	5.67	36.77	81.25	25.51	89.55	18.75	62.33	36.05	25.60
P4	1.77	40.23	83.03	25.82	91.12	16.97	64.64	33.85	24.97
P5	1.64	40.02	84.66	26.10	92.57	15.34	67.27	31.83	24.40
P6	0.35	46.96	85.01	26.18	92.85	14.99	67.74	31.32	24.17
P7	14.99	67.74	100.00	32.41	100.00	0.00			
Total (Calc)	100.00	32.41	--	--	--	--	--	--	--

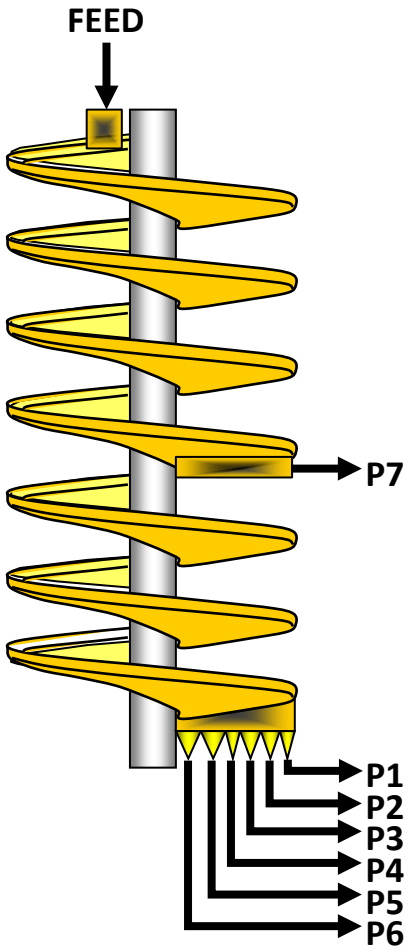




SPIRAL DATA ANALYSIS

Description: Run 20 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	1.219	14.7	28.23	31.49
P2	0.335	28.1	3.43	4.37
P3	0.115	33.6	0.91	1.20
P4	0.036	34.0	0.28	0.37
P5	0.033	25.9	0.38	0.46
P6	0.006	13.2	0.15	0.17
P7	0.235	43.5	1.22	1.69
Total	1.980	18.6	34.61	39.75

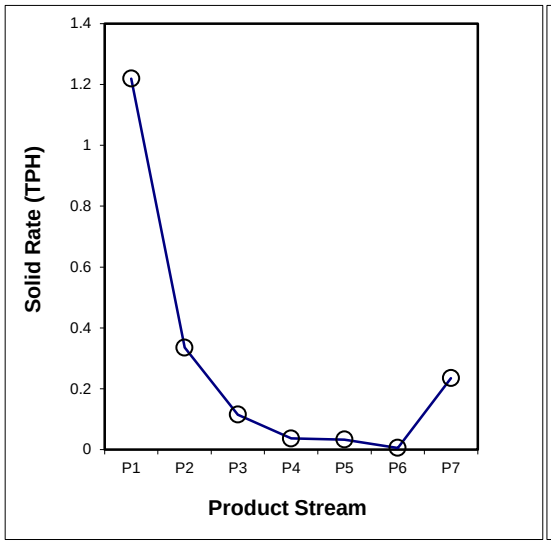
SPIRAL DATA ANALYSIS

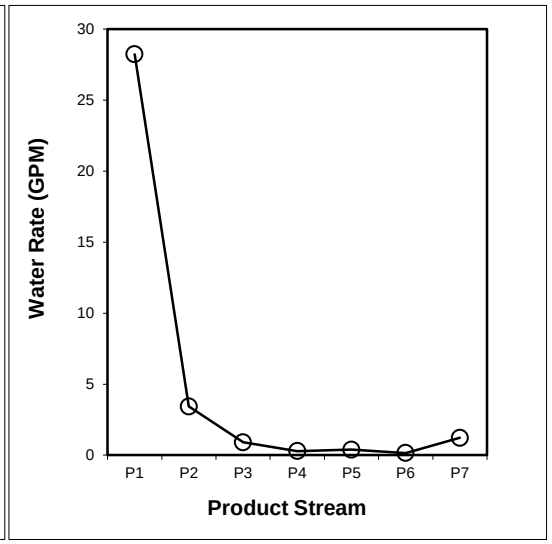
Description: Run 20 - Intermediate Spiral Test

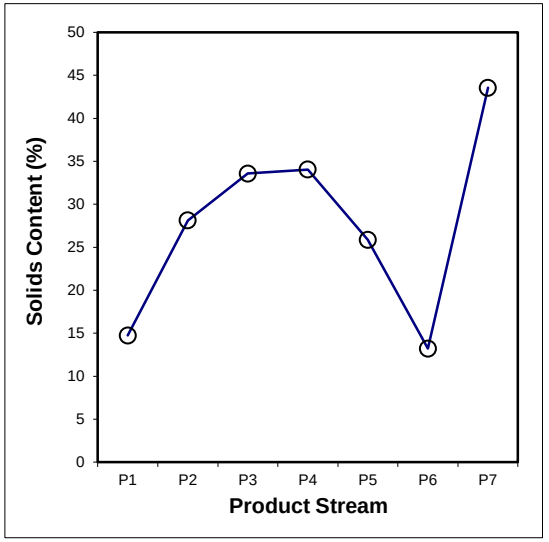
Comments: 1 x 0.15 mm Nominal Particle Size

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	3	7663.00	1305.54	8.278	3401.7	2479.0	1.219	61.59	14.73
P2	5	1622.64	96.81	1.193	2437.0	2014.1	0.335	16.94	28.12
P3	10	970.40	96.22	0.342	2467.1	2177.7	0.115	5.80	33.56
P4	30	919.83	98.63	0.107	2754.7	2479.0	0.036	1.84	34.04
P5	30	1082.68	99.33	0.128	2246.9	1996.2	0.033	1.67	25.86
P6	60	779.38	101.43	0.044	2266.0	2177.7	0.006	0.29	13.22
P7	5	786.57	98.29	0.539	2775.3	2479.1	0.235	11.86	43.54
Total (Calc)	--	--	--	10.631	--	--	1.980	100.00	18.62
Total (Head)	0.63	1979.17	281.76	10.631	2330.3	2014.2	1.980	--	18.62







SPIRAL DATA ANALYSIS

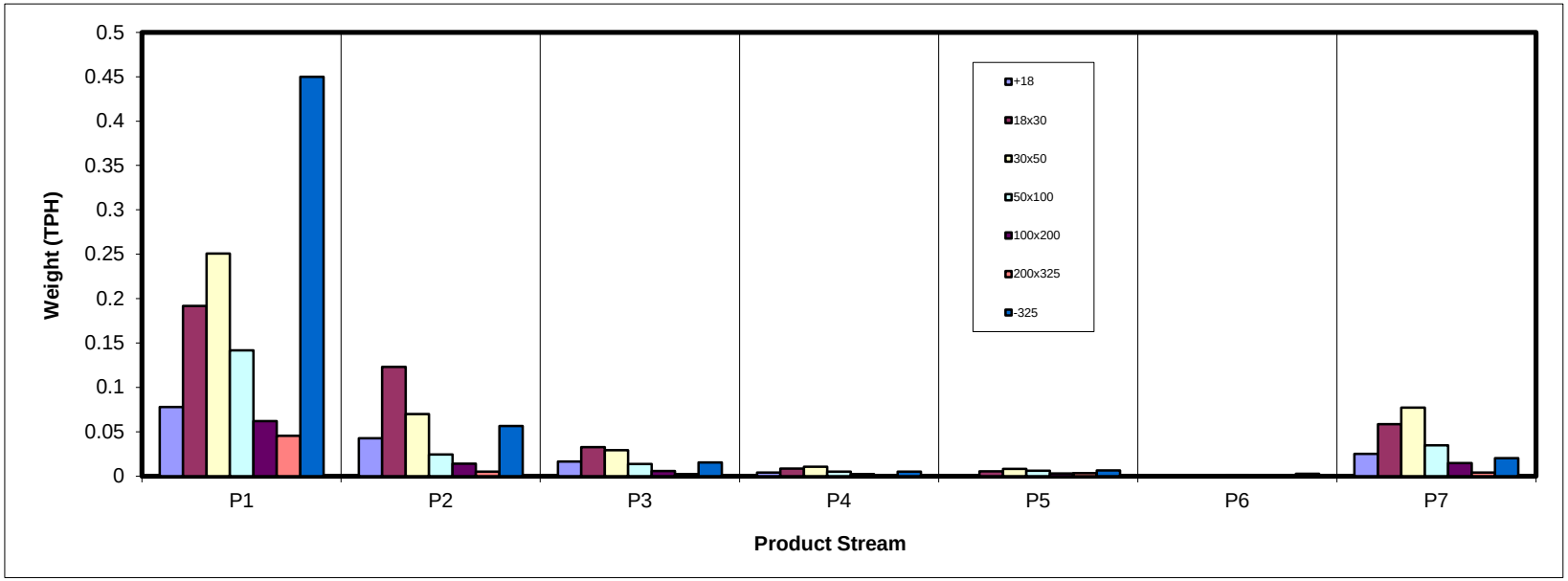
Description: Run 20 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.078	0.042	0.016	0.004	0.001	0.000	0.025		0.167
18x30	0.192	0.123	0.033	0.009	0.005	0.000	0.059		0.420
30x50	0.251	0.070	0.029	0.011	0.008	0.001	0.077		0.446
50x100	0.142	0.025	0.014	0.005	0.006	0.001	0.035		0.227
100x200	0.062	0.014	0.006	0.002	0.003	0.001	0.015		0.103
200x325	0.045	0.005	0.002	0.001	0.003	0.000	0.004		0.061
-325	0.450	0.056	0.015	0.005	0.006	0.003	0.020		0.556
Total (Calc)	1.219	0.335	0.115	0.036	0.033	0.006	0.235		1.980



SPIRAL DATA ANALYSIS

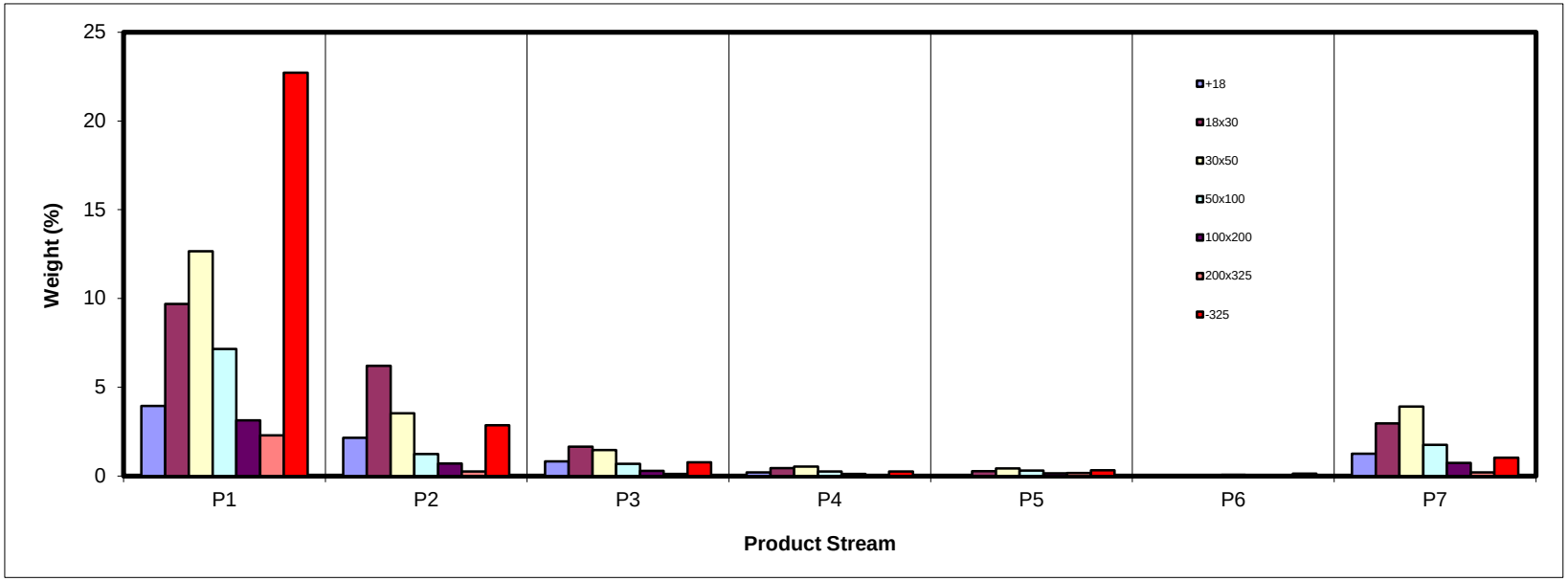
Description: Run 20 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	3.94	2.15	0.83	0.21	0.05	0.00	1.26		8.43
18x30	9.69	6.21	1.64	0.44	0.27	0.01	2.96		21.21
30x50	12.66	3.53	1.47	0.53	0.42	0.03	3.90		22.55
50x100	7.16	1.24	0.68	0.25	0.30	0.06	1.76		11.45
100x200	3.13	0.71	0.29	0.11	0.15	0.05	0.74		5.19
200x325	2.29	0.26	0.11	0.04	0.16	0.02	0.21		3.09
-325	22.72	2.85	0.77	0.26	0.32	0.13	1.02		28.08
Total (Calc)	61.59	16.94	5.80	1.84	1.67	0.29	11.86		100.00



SPIRAL DATA ANALYSIS

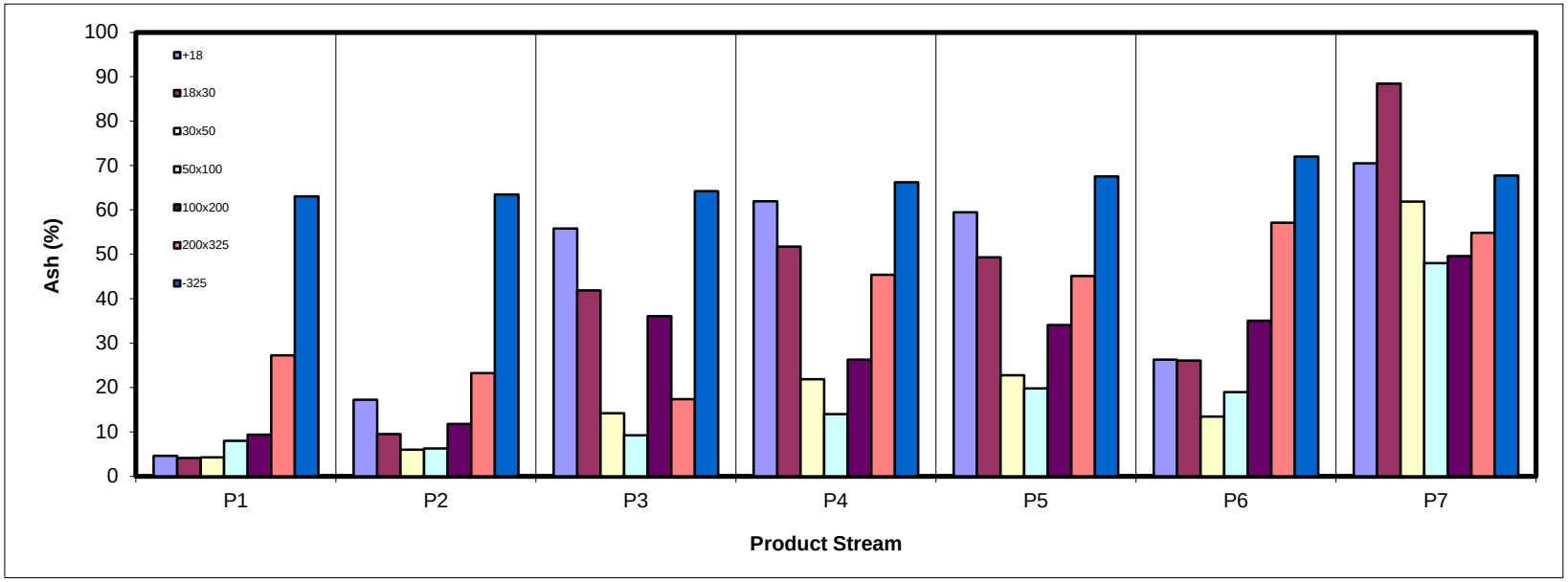
Description: Run 20 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	4.63	17.24	55.81	61.95	59.45	26.25	70.48		24.44
18x30	4.13	9.53	41.89	51.71	49.30	26.08	88.46		21.97
30x50	4.25	6.00	14.23	21.84	22.76	13.41	61.86		15.92
50x100	7.99	6.26	9.23	14.00	19.81	18.98	48.01		14.53
100x200	9.38	11.80	36.04	26.29	34.04	35.07	49.63		18.31
200x325	27.22	23.23	17.37	45.36	45.14	57.11	54.81		29.79
-325	63.08	63.45	64.25	66.21	67.56	72.00	67.72		63.44
Total (Calc)	27.51	18.91	35.23	39.32	39.46	47.42	66.98		31.66



SPIRAL DATA ANALYSIS

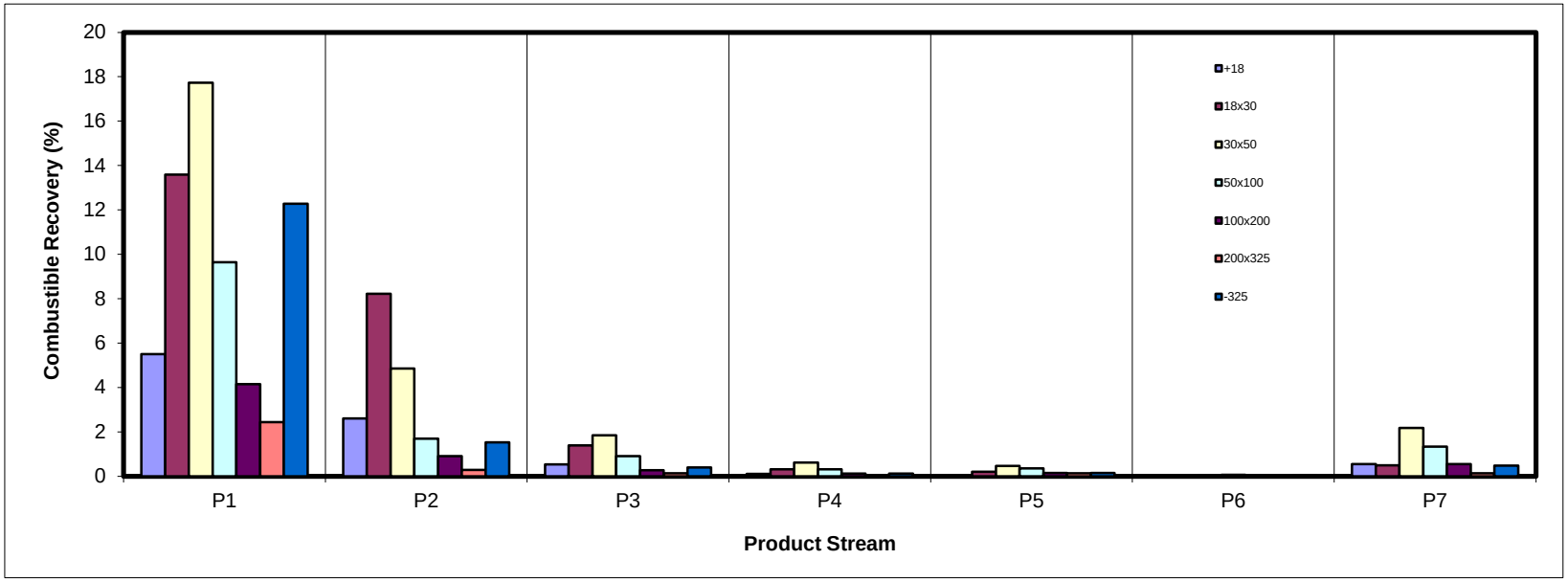
Description: Run 20 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	5.50	2.60	0.54	0.11	0.03	0.00	0.54		9.32
18x30	13.60	8.22	1.40	0.31	0.20	0.01	0.50		24.22
30x50	17.74	4.86	1.84	0.61	0.47	0.04	2.18		27.74
50x100	9.64	1.70	0.91	0.32	0.35	0.07	1.34		14.32
100x200	4.15	0.91	0.28	0.12	0.15	0.04	0.55		6.20
200x325	2.44	0.29	0.13	0.04	0.13	0.01	0.14		3.17
-325	12.28	1.52	0.40	0.13	0.15	0.05	0.48		15.02
Total (Calc)	65.33	20.10	5.49	1.63	1.48	0.23	5.73		100.00



SPIRAL DATA ANALYSIS

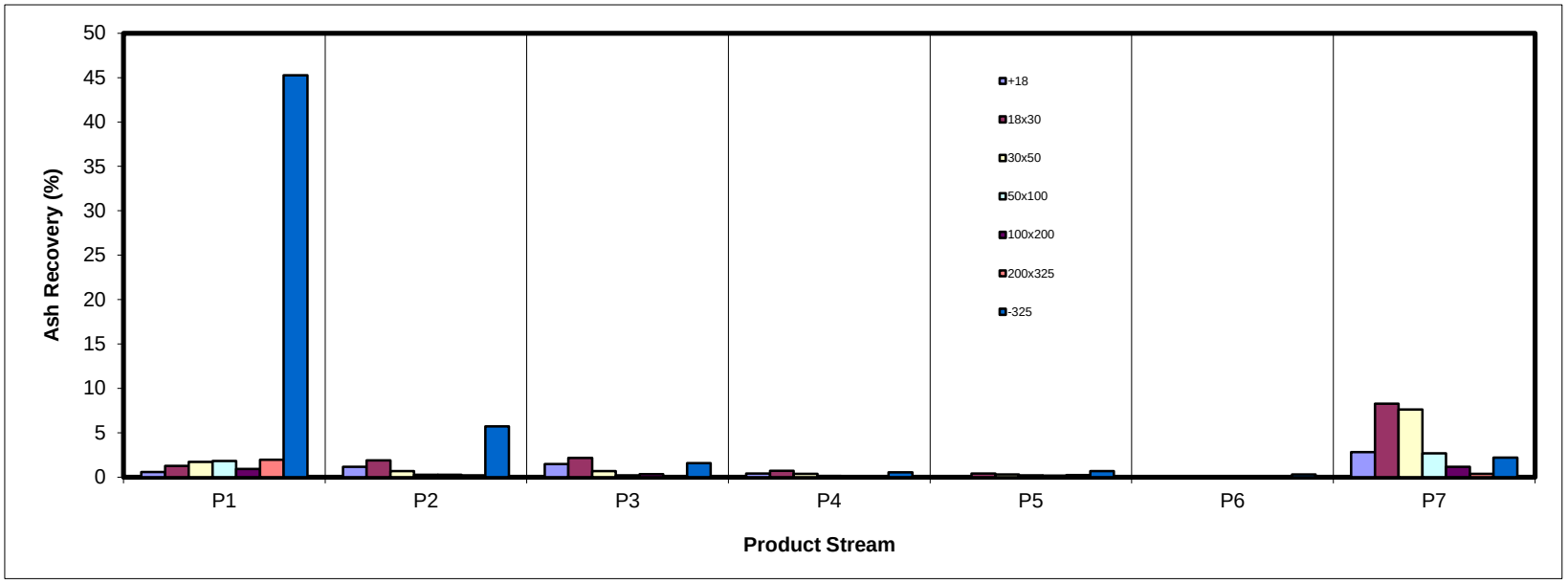
Description: Run 20 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.58	1.17	1.46	0.40	0.09	0.00	2.81		6.51
18x30	1.26	1.87	2.17	0.71	0.42	0.00	8.28		14.72
30x50	1.70	0.67	0.66	0.37	0.30	0.01	7.63		11.34
50x100	1.81	0.24	0.20	0.11	0.19	0.04	2.67		5.26
100x200	0.93	0.26	0.33	0.09	0.16	0.05	1.17		3.00
200x325	1.97	0.19	0.06	0.06	0.23	0.03	0.36		2.90
-325	45.28	5.71	1.56	0.53	0.69	0.30	2.19		56.27
Total (Calc)	53.52	10.12	6.45	2.29	2.09	0.44	25.10		100.00



SPIRAL DATA ANALYSIS

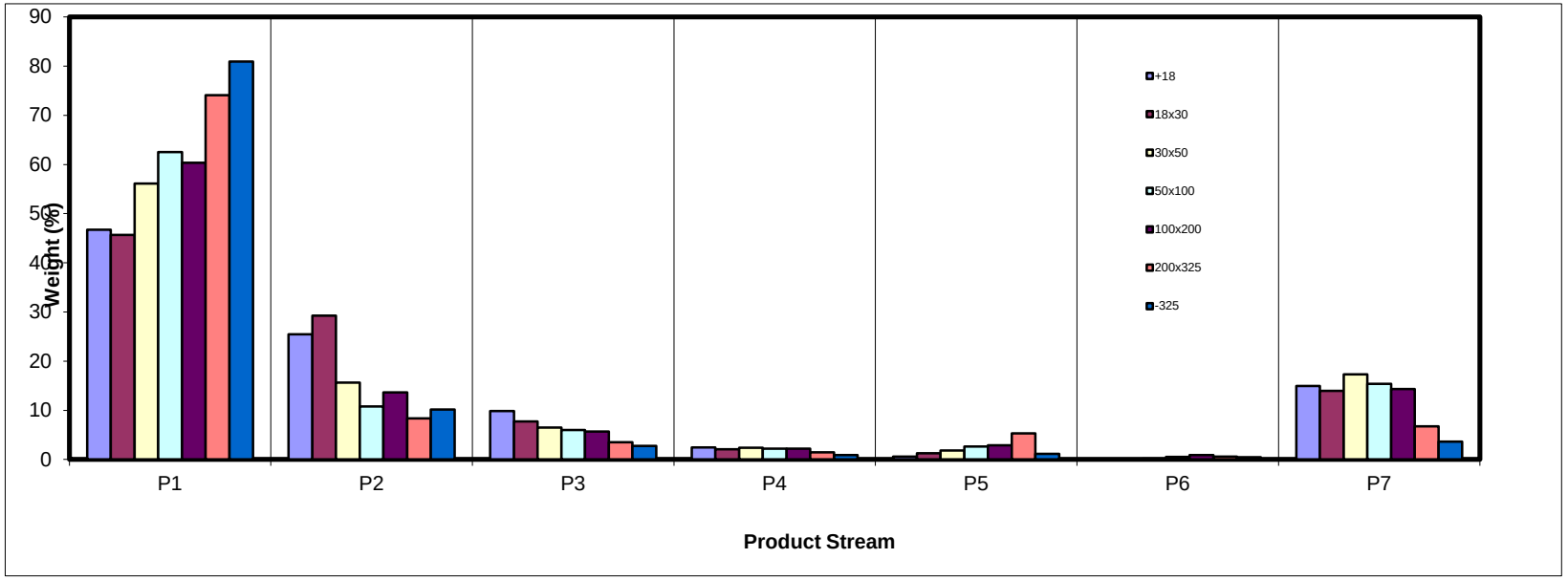
Description: Run 20 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	46.73	25.46	9.83	2.43	0.60	0.00	14.95		100.00
18x30	45.69	29.26	7.74	2.06	1.26	0.02	13.97		100.00
30x50	56.14	15.66	6.51	2.37	1.85	0.14	17.32		100.00
50x100	62.52	10.81	5.98	2.19	2.61	0.51	15.37		100.00
100x200	60.34	13.66	5.67	2.20	2.91	0.90	14.33		100.00
200x325	74.09	8.36	3.49	1.44	5.30	0.59	6.73		100.00
-325	80.92	10.15	2.74	0.91	1.16	0.48	3.65		100.00
Total (Calc)	61.59	16.94	5.80	1.84	1.67	0.29	11.86		100.00



SPIRAL DATA ANALYSIS

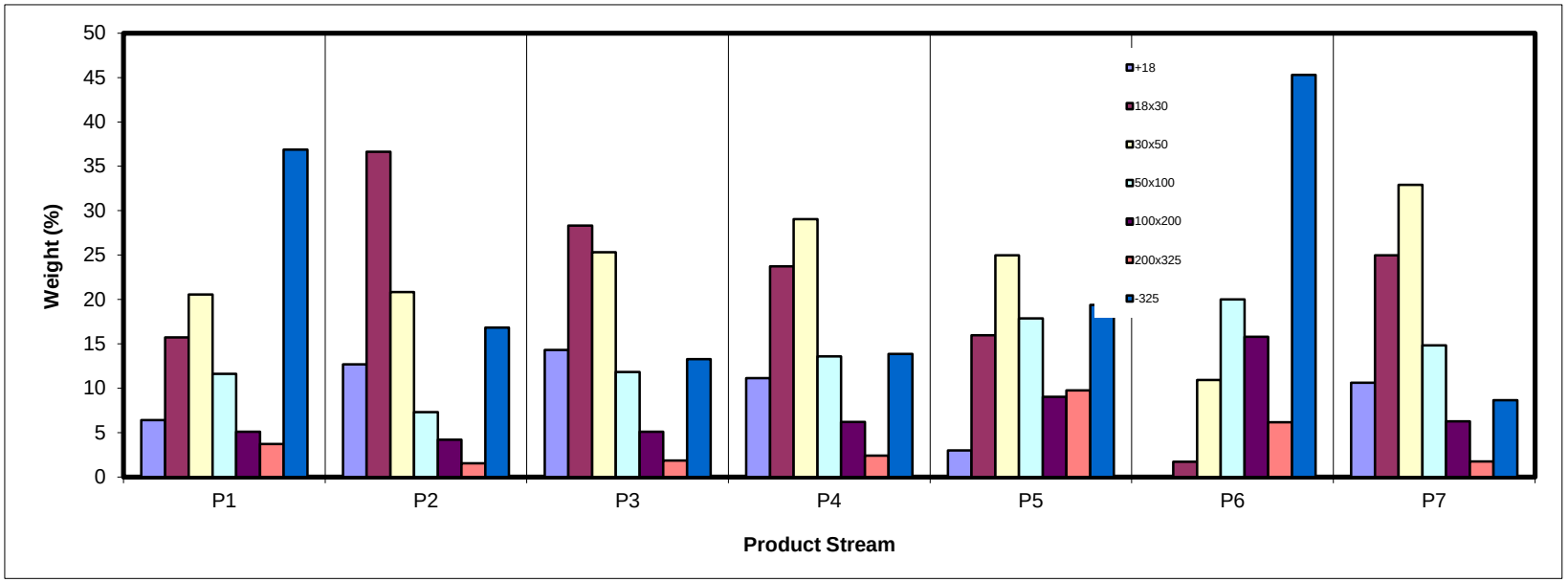
Description: Run 20 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	6.40	12.67	14.30	11.14	3.00	0.09	10.63		8.43
18x30	15.73	36.64	28.33	23.73	15.97	1.70	24.97		21.21
30x50	20.55	20.84	25.33	29.06	24.99	10.92	32.91		22.55
50x100	11.63	7.31	11.82	13.60	17.88	20.01	14.84		11.45
100x200	5.08	4.18	5.08	6.19	9.01	15.80	6.27		5.19
200x325	3.71	1.52	1.86	2.42	9.77	6.18	1.75		3.09
-325	36.89	16.82	13.28	13.86	19.39	45.30	8.64		28.08
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

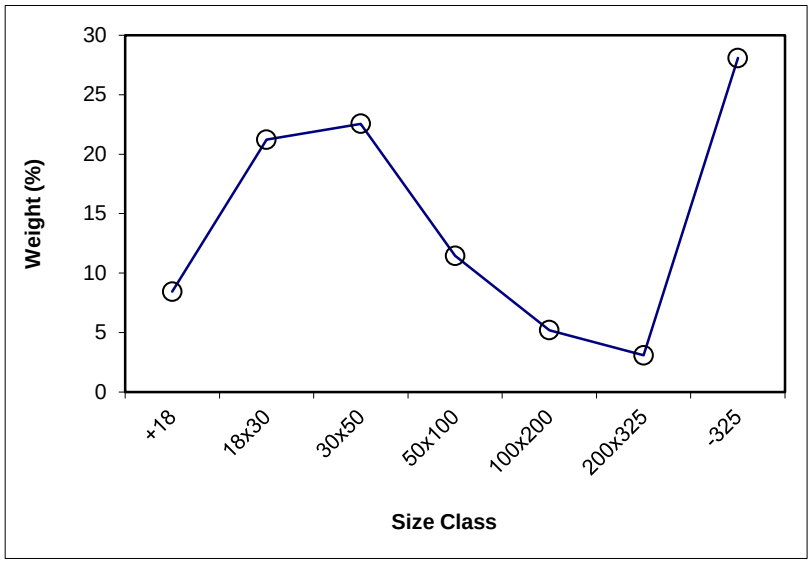
Description: Run 20 - Intermediate Spiral Test

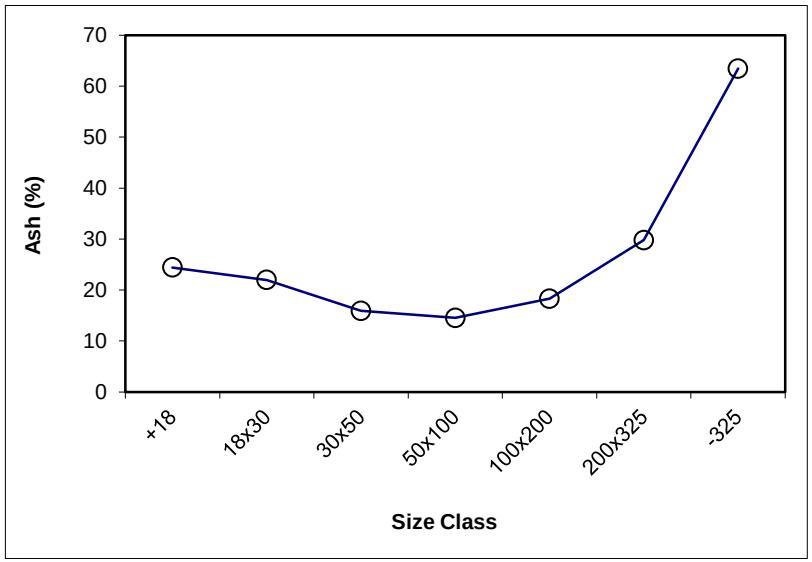
Comments: 1 x 0.15 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	427.9	401.2	26.65	8.43	24.44	8.43	24.44	100.00	31.66
18x30	437.1	370.0	67.06	21.21	21.97	29.64	22.67	91.57	32.32
30x50	407.6	336.3	71.28	22.55	15.92	52.19	19.75	70.36	35.45
50x100	344.0	307.8	36.21	11.45	14.53	63.64	18.81	47.81	44.65
100x200	310.9	294.5	16.40	5.19	18.31	68.83	18.78	36.36	54.14
200x325	307.7	298.0	9.76	3.09	29.78	71.92	19.25	31.17	60.11
-325	95.2	6.4	88.77	28.08	63.44	100.00	31.66	28.08	63.44
Total (Calc)	--	--	316.12	100.00	31.66	--	--	--	--





SPIRAL DATA ANALYSIS

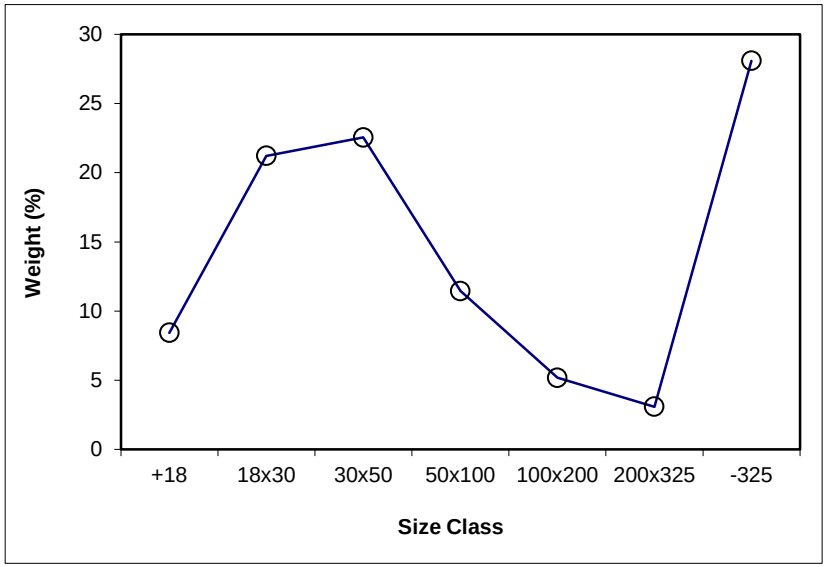
Description: Run 20 - Intermediate Spiral Test

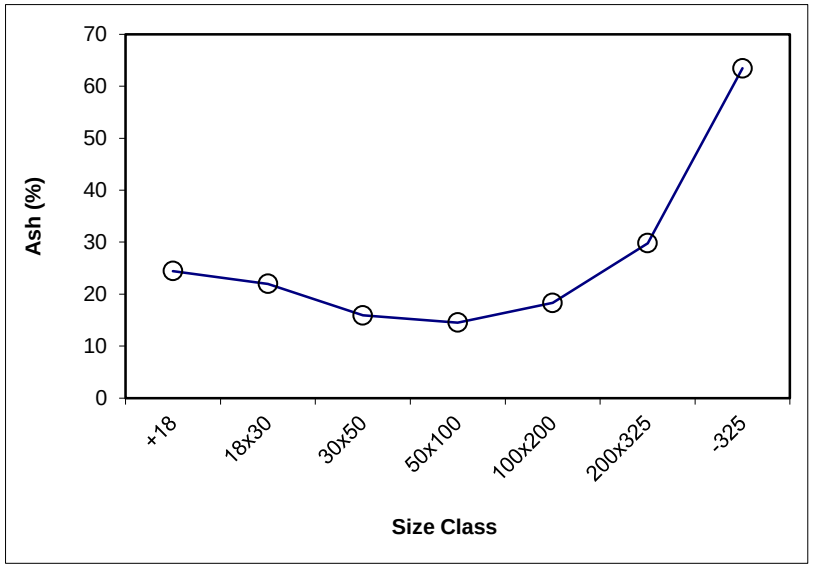
Comments: 1 x 0.15 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	8.43	24.44	8.43	24.44	100.00	31.66			
18x30	21.21	21.97	29.64	22.67	91.57	32.32	x	21.21	21.97
30x50	22.55	15.92	52.19	19.75	70.36	35.45	x	22.55	15.92
50x100	11.45	14.53	63.64	18.81	47.81	44.65	x	11.45	14.53
100x200	5.19	18.31	68.83	18.78	36.36	54.14	x	5.19	18.31
200x325	3.09	29.79	71.92	19.25	31.17	60.11	x	3.09	29.79
-325	28.08	63.44	100.00	31.66	28.08	63.44			
Total (Calc)	100.00	31.66	--	--	--	--	--	63.49	18.56





SPIRAL DATA ANALYSIS

Description: Run 20 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 61.59

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	519.18	460.1	59.04	6.40	4.63	6.40	4.63	100.00	27.51
18x30	587.34	442.2	145.19	15.73	4.13	22.13	4.27	93.60	29.07
30x50	602.17	412.5	189.64	20.55	4.25	42.68	4.26	77.87	34.11
50x100	494.97	387.7	107.28	11.63	7.99	54.31	5.06	57.32	44.82
100x200	438.23	391.3	46.89	5.08	9.38	59.39	5.43	45.69	54.19
200x325	412.85	378.6	34.25	3.71	27.22	63.11	6.71	40.61	59.80
-325	346.94	6.5	340.44	36.89	63.08	100.00	27.51	36.89	63.08
Total (Calc)	--	--	922.72	100.00	27.51	--	--	--	--

Product P2 Feed Weight (%): 16.94

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	454.8	401.2	53.59	12.67	17.24	12.67	17.24	100.00	18.91
18x30	525.0	370.0	154.99	36.64	9.53	49.31	11.51	87.33	19.15
30x50	424.4	336.3	88.17	20.84	6.00	70.16	9.88	50.69	26.10
50x100	338.7	307.8	30.93	7.31	6.26	77.47	9.54	29.84	40.14
100x200	312.2	294.5	17.69	4.18	11.80	81.65	9.65	22.53	51.14
200x325	304.4	298.0	6.45	1.52	23.23	83.18	9.90	18.35	60.11
-325	77.4	6.2	71.16	16.82	63.45	100.00	18.91	16.82	63.45
Total (Calc)	--	--	422.97	100.00	18.91	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 20 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 5.80

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	420.6	379.2	41.39	14.30	55.81	14.30	55.81	100.00	35.23
18x30	474.3	392.3	82.00	28.33	41.89	42.63	46.56	85.70	31.80
30x50	427.8	354.5	73.32	25.33	14.23	67.97	34.51	57.37	26.81
50x100	401.1	366.9	34.20	11.82	9.23	79.78	30.76	32.03	36.77
100x200	362.1	347.4	14.70	5.08	36.04	84.86	31.08	20.22	52.86
200x325	336.4	331.0	5.38	1.86	17.37	86.72	30.79	15.14	58.50
-325	44.9	6.5	38.44	13.28	64.25	100.00	35.23	13.28	64.25
Total (Calc)	--	--	289.43	100.00	35.23	--	--	--	--

Product P4 Feed Weight (%): 1.84

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	490.9	460.1	30.72	11.14	61.95	11.14	61.95	100.00	39.32
18x30	507.6	442.2	65.45	23.73	51.71	34.87	54.98	88.86	36.49
30x50	492.7	412.5	80.14	29.06	21.84	63.94	39.92	65.13	30.94
50x100	425.2	387.7	37.50	13.60	14.00	77.54	35.37	36.06	38.27
100x200	408.4	391.3	17.07	6.19	26.29	83.73	34.70	22.46	52.96
200x325	385.3	378.6	6.67	2.42	45.36	86.14	35.00	16.27	63.11
-325	44.7	6.5	38.20	13.86	66.21	100.00	39.32	13.86	66.21
Total (Calc)	--	--	275.74	100.00	39.32	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 20 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 1.67

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	408.7	401.2	7.52	3.00	59.45	3.00	59.45	100.00	39.46
18x30	410.1	370.0	40.04	15.97	49.30	18.97	50.90	97.00	38.84
30x50	398.9	336.3	62.64	24.99	22.76	43.95	34.90	81.03	36.78
50x100	352.6	307.8	44.82	17.88	19.81	61.83	30.54	56.05	43.03
100x200	317.1	294.5	22.60	9.01	34.04	70.84	30.99	38.17	53.91
200x325	304.5	280.0	24.49	9.77	45.14	80.61	32.70	29.16	60.05
-325	55.0	6.4	48.62	19.39	67.56	100.00	39.46	19.39	67.56
Total (Calc)	--	--	250.72	100.00	39.46	--	--	--	--

Product P6 Feed Weight (%): 0.29

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	379.3	379.2	0.08	0.09	26.25	0.09	26.25	100.00	47.42
18x30	393.7	392.2	1.50	1.70	26.08	1.79	26.09	99.91	47.44
30x50	364.1	354.5	9.64	10.92	13.41	12.71	15.20	98.21	47.81
50x100	384.5	366.9	17.67	20.01	18.98	32.72	17.51	87.29	52.11
100x200	361.4	347.4	13.95	15.80	35.07	48.52	23.23	67.28	61.96
200x325	336.4	331.0	5.46	6.18	57.11	54.70	27.06	51.48	70.22
-325	46.6	6.6	40.01	45.30	72.00	100.00	47.42	45.30	72.00
Total (Calc)	--	--	88.31	100.00	47.42	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 20 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 11.86

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	491.6	460.1	31.48	10.63	70.48	10.63	70.48	100.00	66.98
18x30	516.1	442.2	73.97	24.97	88.46	35.60	83.09	89.37	66.56
30x50	510.0	412.5	97.49	32.91	61.86	68.51	72.89	64.40	58.07
50x100	431.6	387.7	43.96	14.84	48.01	83.35	68.46	31.49	54.12
100x200	409.9	391.3	18.56	6.27	49.63	89.61	67.15	16.65	59.56
200x325	383.8	378.6	5.19	1.75	54.81	91.36	66.91	10.39	65.54
-325	32.2	6.6	25.59	8.64	67.72	100.00	66.98	8.64	67.72
Total (Calc)	--	--	296.22	100.00	66.98	--	--	--	--

SPIRAL DATA ANALYSIS

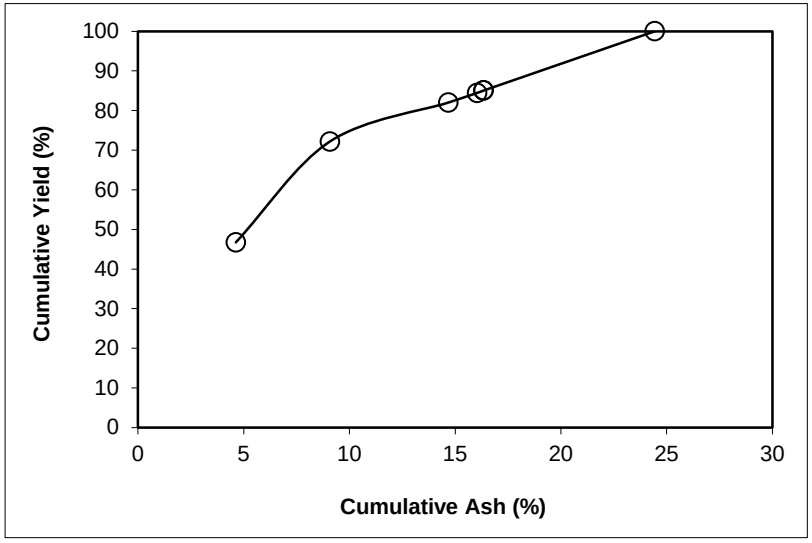
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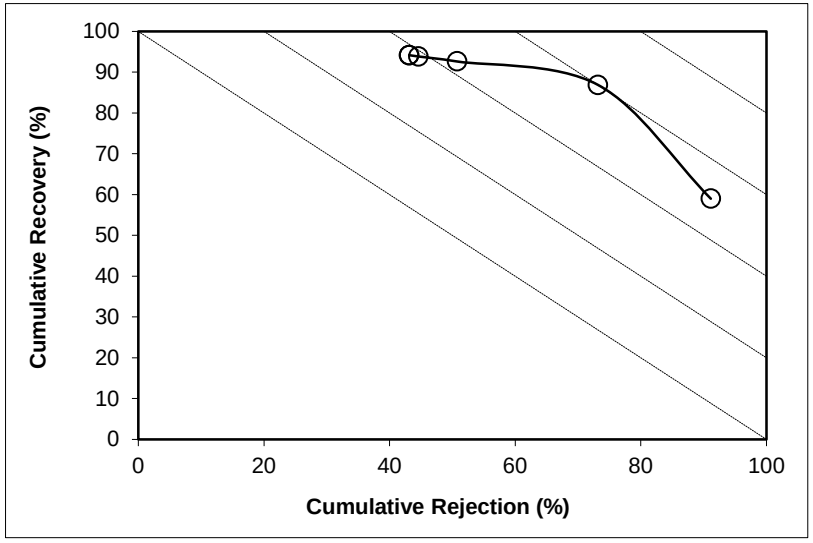
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 8.43

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	46.73	4.63	46.73	4.63	58.98	53.27	41.81	91.15	50.13
P2	25.46	17.24	72.19	9.08	86.86	27.81	64.31	73.19	60.05
P3	9.83	55.81	82.02	14.68	92.61	17.98	68.95	50.74	43.35
P4	2.43	61.95	84.45	16.04	93.84	15.55	70.05	44.57	38.41
P5	0.60	59.45	85.05	16.34	94.16	14.95	70.47	43.12	37.28
P6	0.00	26.25	85.05	16.34	94.16	14.95	70.48	43.12	37.28
P7	14.95	70.48	100.00	24.44	100.00	0.00			
Total (Calc)	100.00	24.44	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

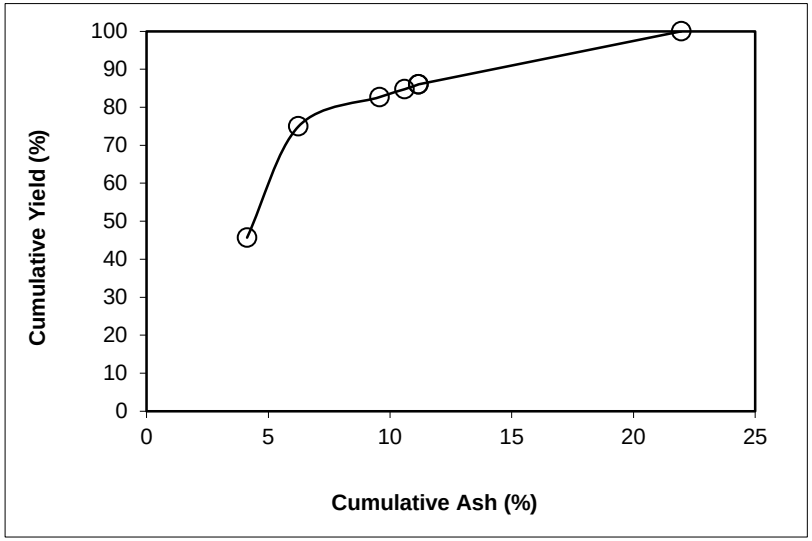
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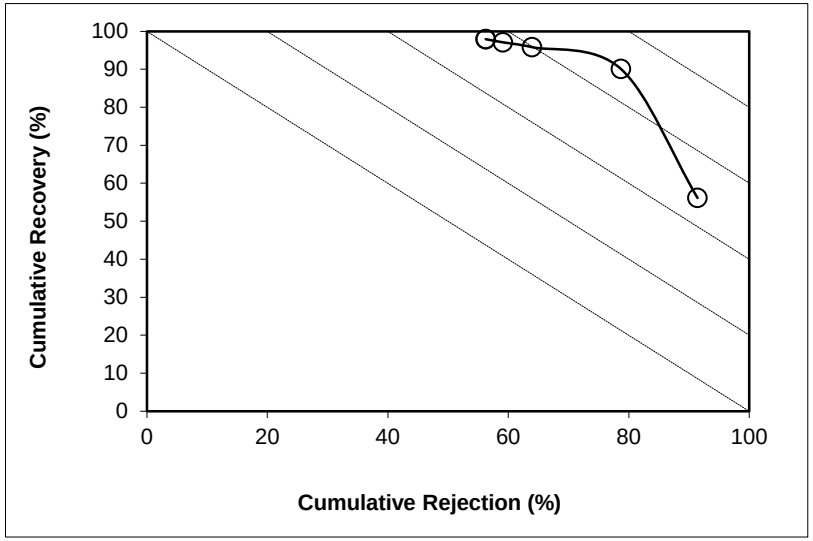
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 21.21

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	45.69	4.13	45.69	4.13	56.13	54.31	36.97	91.41	47.54
P2	29.26	9.53	74.95	6.24	90.06	25.05	69.02	78.71	68.77
P3	7.74	41.89	82.69	9.58	95.82	17.31	81.15	63.95	59.77
P4	2.06	51.71	84.75	10.60	97.09	15.25	85.13	59.10	56.20
P5	1.26	49.30	86.01	11.17	97.91	13.99	88.36	56.27	54.19
P6	0.02	26.08	86.03	11.17	97.94	13.97	88.46	56.25	54.18
P7	13.97	88.46	100.00	21.97	100.00	0.00			
Total (Calc)	100.00	21.97	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

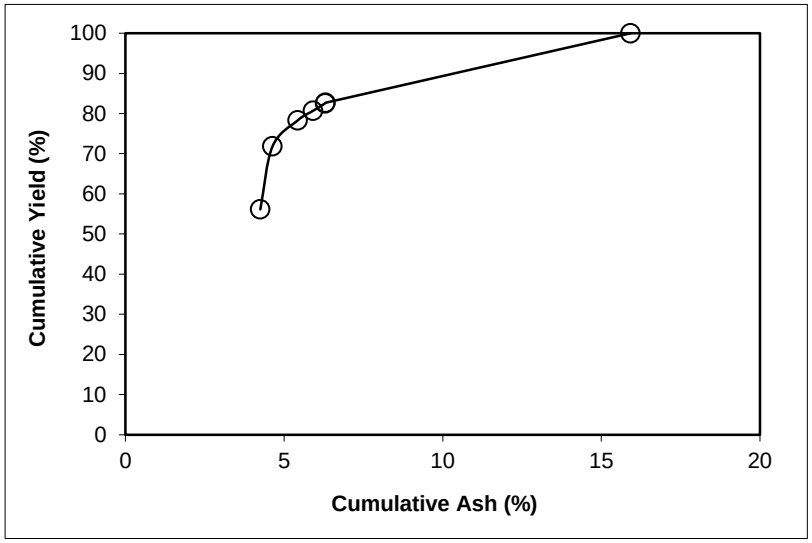
Description: Run 20 - Intermediate Spiral Test

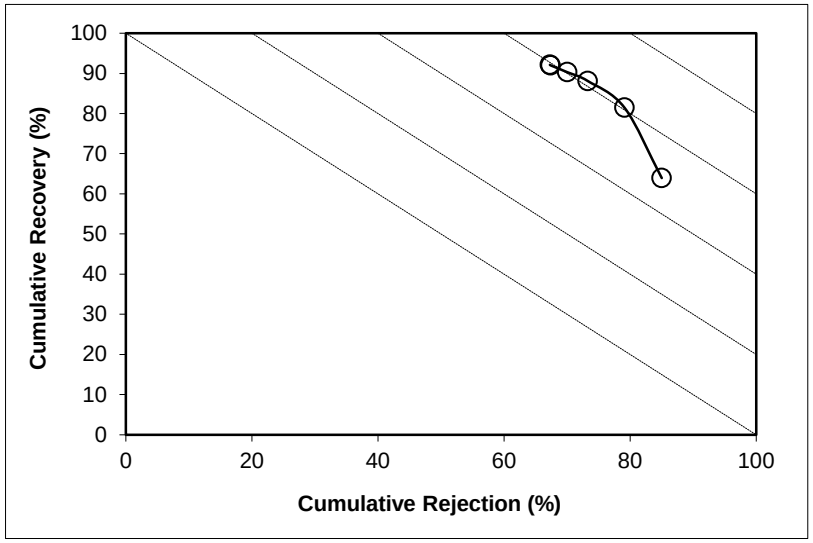
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 22.55

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	56.14	4.25	56.14	4.25	63.94	43.86	30.87	85.02	48.96
P2	15.66	6.00	71.80	4.63	81.44	28.20	44.67	79.11	60.56
P3	6.51	14.23	78.31	5.43	88.09	21.69	53.82	73.30	61.38
P4	2.37	21.84	80.69	5.91	90.29	19.31	57.75	70.04	60.34
P5	1.85	22.76	82.54	6.29	92.00	17.46	61.46	67.39	59.39
P6	0.14	13.41	82.68	6.30	92.14	17.32	61.86	67.27	59.42
P7	17.32	61.86	100.00	15.92	100.00	0.00			
Total (Calc)	100.00	15.92	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

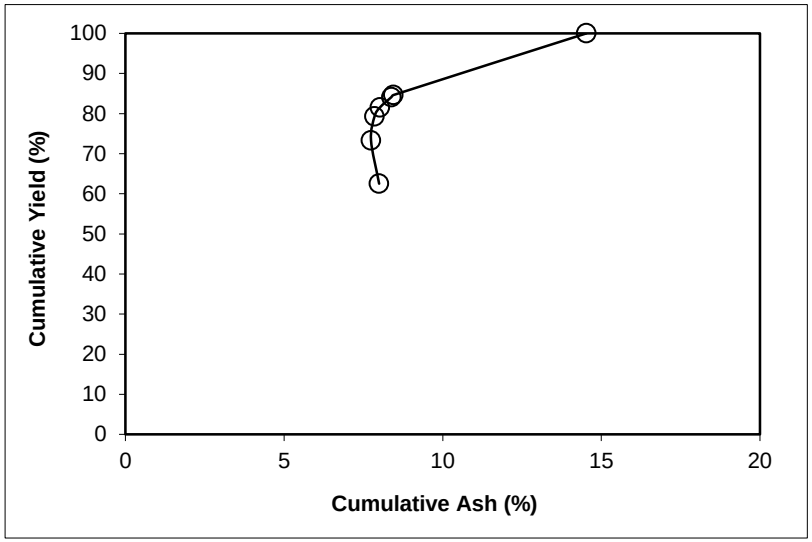
Description: Run 20 - Intermediate Spiral Test

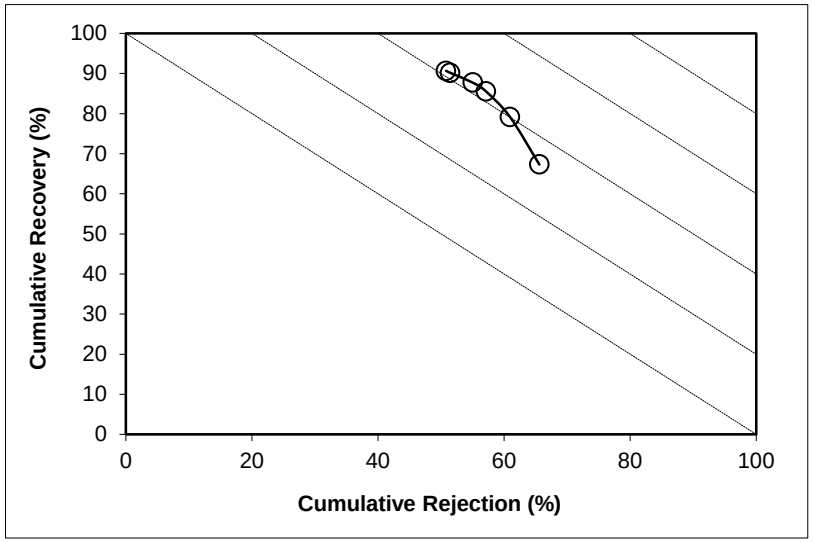
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 11.45

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	62.52	7.99	62.52	7.99	67.30	37.48	25.43	65.60	32.90
P2	10.81	6.26	73.34	7.74	79.16	26.66	33.20	60.94	40.10
P3	5.98	9.23	79.32	7.85	85.51	20.68	40.13	57.14	42.65
P4	2.19	14.00	81.50	8.02	87.71	18.50	43.22	55.03	42.74
P5	2.61	19.81	84.11	8.38	90.16	15.89	47.07	51.47	41.63
P6	0.51	18.98	84.63	8.45	90.65	15.37	48.01	50.80	41.45
P7	15.37	48.01	100.00	14.53	100.00	0.00			
Total (Calc)	100.00	14.53	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

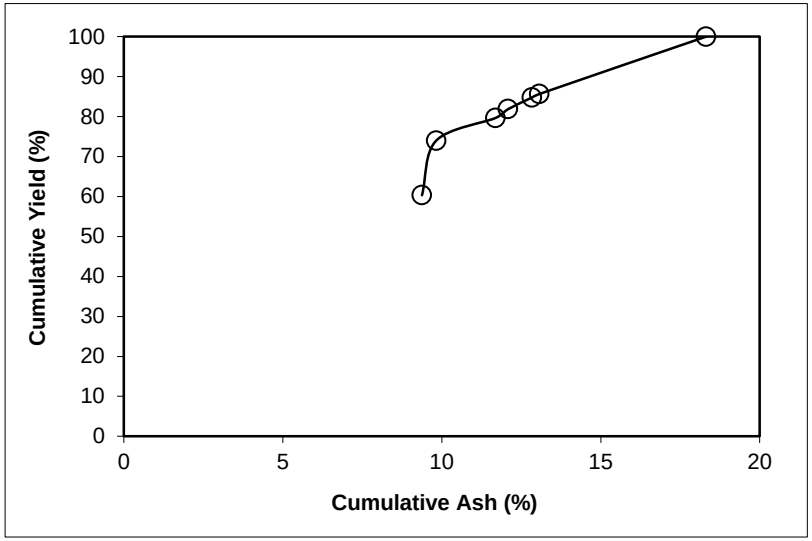
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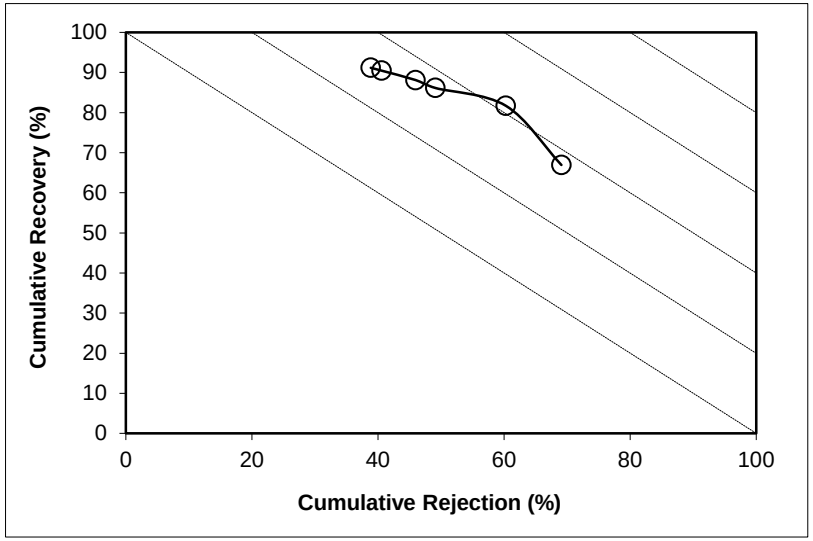
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 5.19

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	60.34	9.38	60.34	9.38	66.94	39.66	31.89	69.10	36.03
P2	13.66	11.80	74.00	9.82	81.68	26.00	42.45	60.30	41.98
P3	5.67	36.04	79.67	11.69	86.12	20.33	44.24	49.13	35.25
P4	2.20	26.29	81.87	12.08	88.10	18.13	46.41	45.97	34.08
P5	2.91	34.04	84.77	12.83	90.45	15.23	48.77	40.57	31.02
P6	0.90	35.07	85.67	13.07	91.16	14.33	49.63	38.85	30.01
P7	14.33	49.63	100.00	18.31	100.00	0.00			
Total (Calc)	100.00	18.31	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

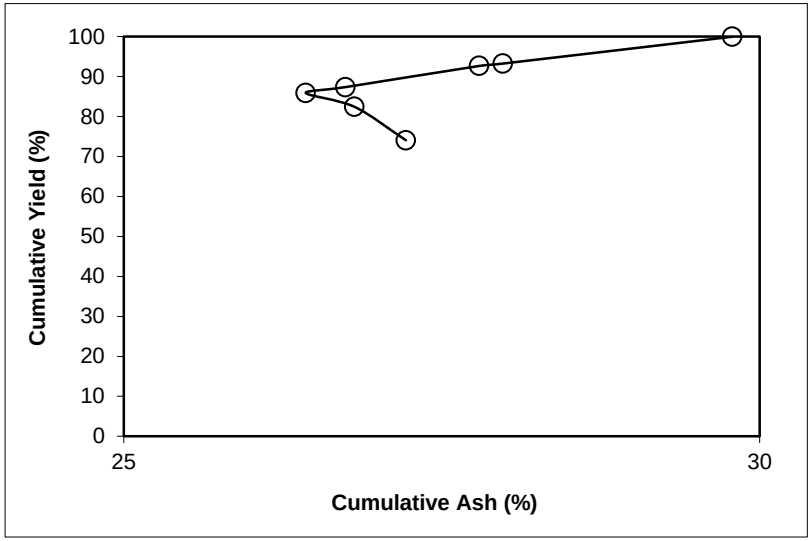
Description: Run 20 - Intermediate Spiral Test

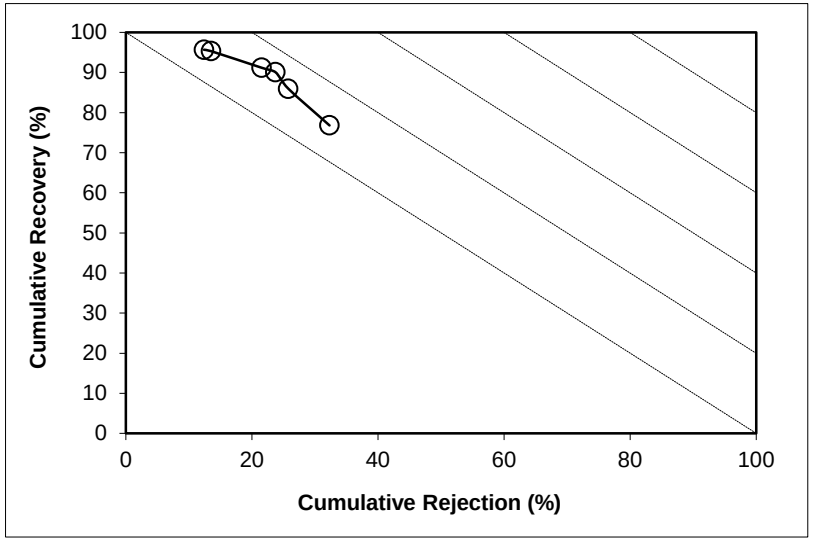
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 3.09

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	74.09	27.22	74.09	27.22	76.80	25.91	37.13	32.30	9.10
P2	8.36	23.23	82.45	26.81	85.94	17.55	43.75	25.77	11.72
P3	3.49	17.37	85.94	26.43	90.05	14.06	50.30	23.74	13.79
P4	1.44	45.36	87.38	26.74	91.17	12.62	50.86	21.54	12.71
P5	5.30	45.14	92.68	27.79	95.31	7.32	55.00	13.52	8.82
P6	0.59	57.11	93.27	27.98	95.67	6.73	54.81	12.38	8.05
P7	6.73	54.81	100.00	29.79	100.00	0.00			
Total (Calc)	100.00	29.79	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

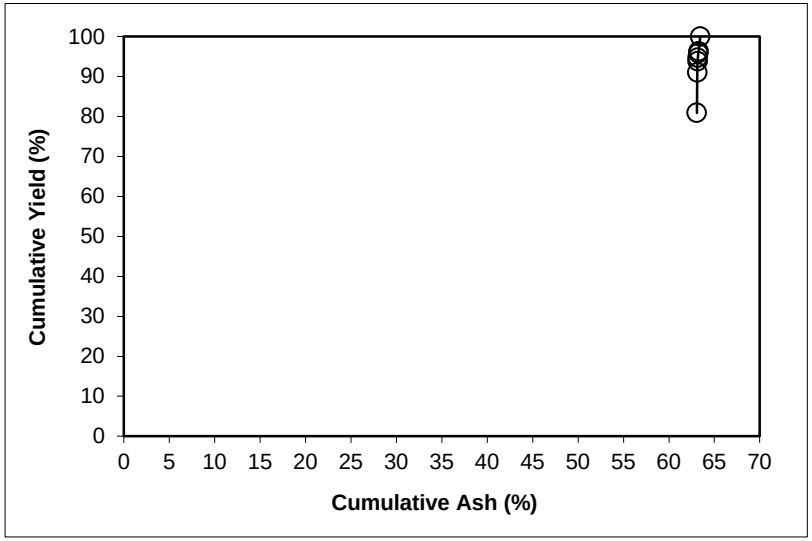
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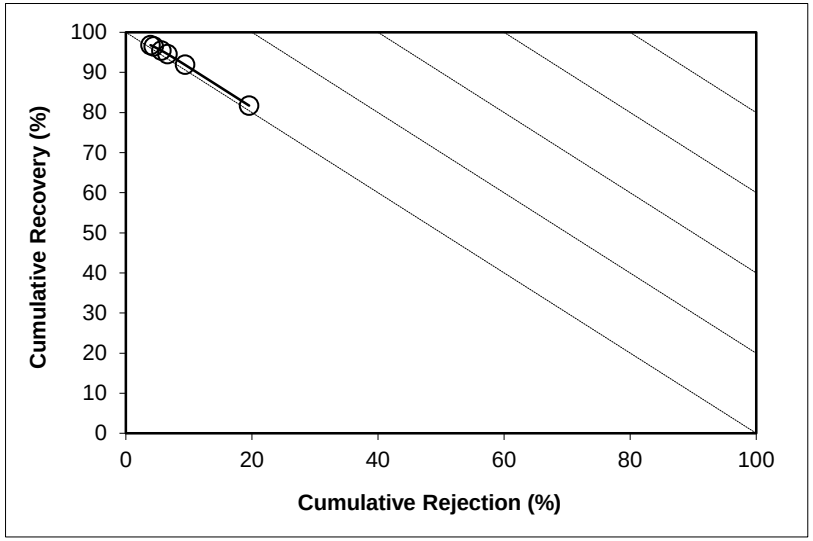
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 28.08

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	80.92	63.08	80.92	63.08	81.72	19.08	64.97	19.54	1.26
P2	10.15	63.45	91.07	63.12	91.87	8.93	66.71	9.39	1.26
P3	2.74	64.25	93.81	63.15	94.55	6.19	67.79	6.61	1.16
P4	0.91	66.21	94.72	63.18	95.39	5.28	68.07	5.67	1.05
P5	1.16	67.56	95.88	63.24	96.41	4.12	68.21	4.43	0.85
P6	0.48	72.00	96.35	63.28	96.78	3.65	67.72	3.90	0.67
P7	3.65	67.72	100.00	63.44	100.00	0.00			
Total (Calc)	100.00	63.44	--	--	--	--	--	--	--





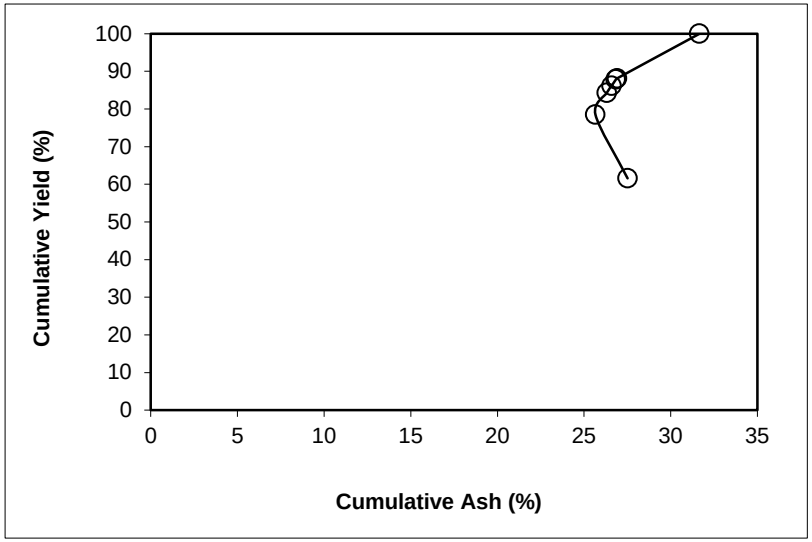
SPIRAL DATA ANALYSIS

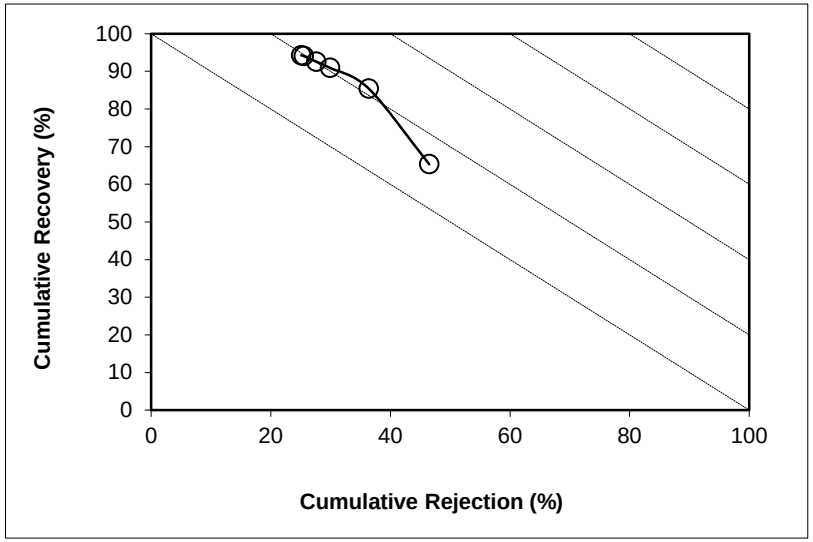
Description: Run 20 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	61.59	27.51	61.59	27.51	65.33	38.41	38.31	46.48	11.81
P2	16.94	18.91	78.53	25.65	85.43	21.47	53.62	36.36	21.80
P3	5.80	35.23	84.33	26.31	90.92	15.67	60.42	29.91	20.84
P4	1.84	39.32	86.17	26.59	92.56	13.83	63.23	27.63	20.19
P5	1.67	39.46	87.84	26.83	94.04	12.16	66.51	25.54	19.58
P6	0.29	47.42	88.14	26.90	94.27	11.86	66.98	25.10	19.37
P7	11.86	66.98	100.00	31.66	100.00	0.00			
Total (Calc)	100.00	31.66	--	--	--	--	--	--	--

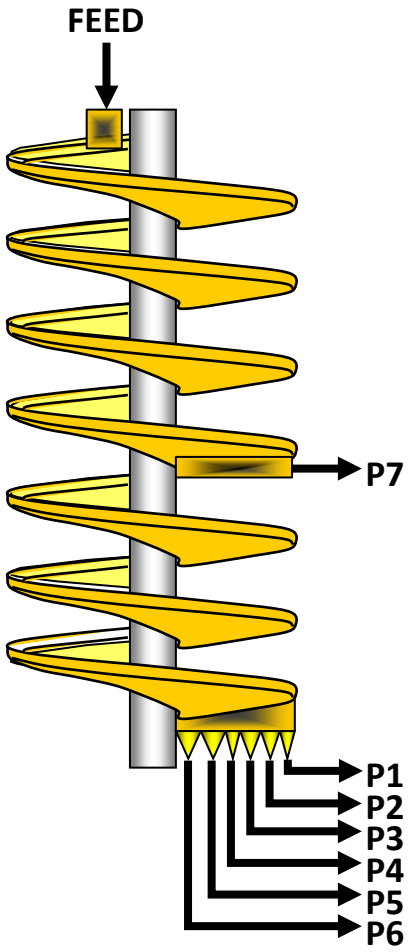




SPIRAL DATA ANALYSIS

Description: Run 21 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	1.727	30.1	16.01	20.70
P2	0.409	34.5	3.11	4.22
P3	0.151	37.6	1.00	1.39
P4	0.056	42.4	0.30	0.44
P5	0.071	38.1	0.46	0.64
P6	0.016	26.7	0.18	0.22
P7	0.277	51.6	1.04	1.61
Total	2.707	32.9	22.10	29.21

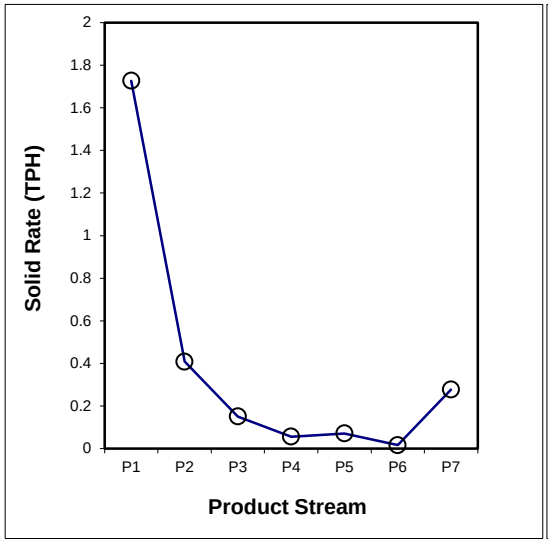
SPIRAL DATA ANALYSIS

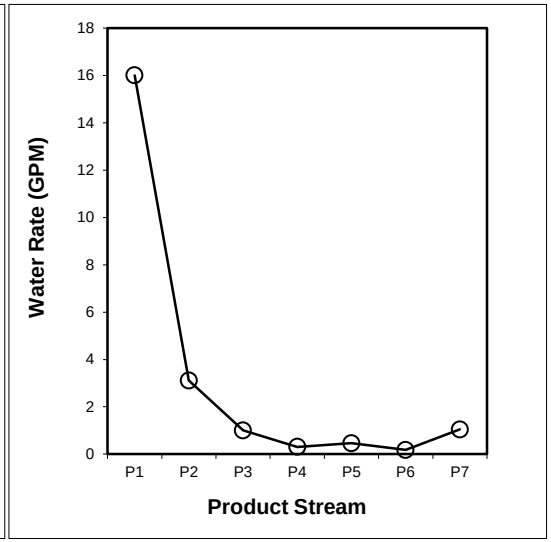
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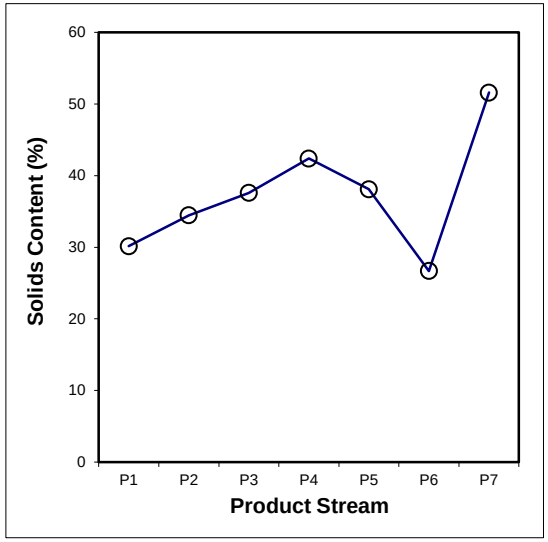
Comments: 1 x 0.15 mm Nominal Particle Size

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	3	5656.00	1258.00	5.729	3490.8	2183.8	1.727	63.80	30.15
P2	5	1614.09	97.53	1.186	2994.2	2478.8	0.409	15.10	34.46
P3	10	1114.56	87.93	0.402	2394.9	2014.1	0.151	5.58	37.59
P4	40	1447.71	96.54	0.132	2742.7	2177.5	0.056	2.07	42.38
P5	30	1527.36	97.26	0.187	2715.4	2177.7	0.071	2.63	38.10
P6	90	1484.09	98.27	0.060	2542.3	2177.7	0.016	0.59	26.68
P7	10	1465.21	98.95	0.537	2713.4	2014.4	0.277	10.24	51.59
Total (Calc)	--	--	--	8.233	--	--	2.707	100.00	32.88
Total (Head)	0.94	2201.05	259.14	8.233	3117.6	2479.0	2.707	--	32.88







SPIRAL DATA ANALYSIS

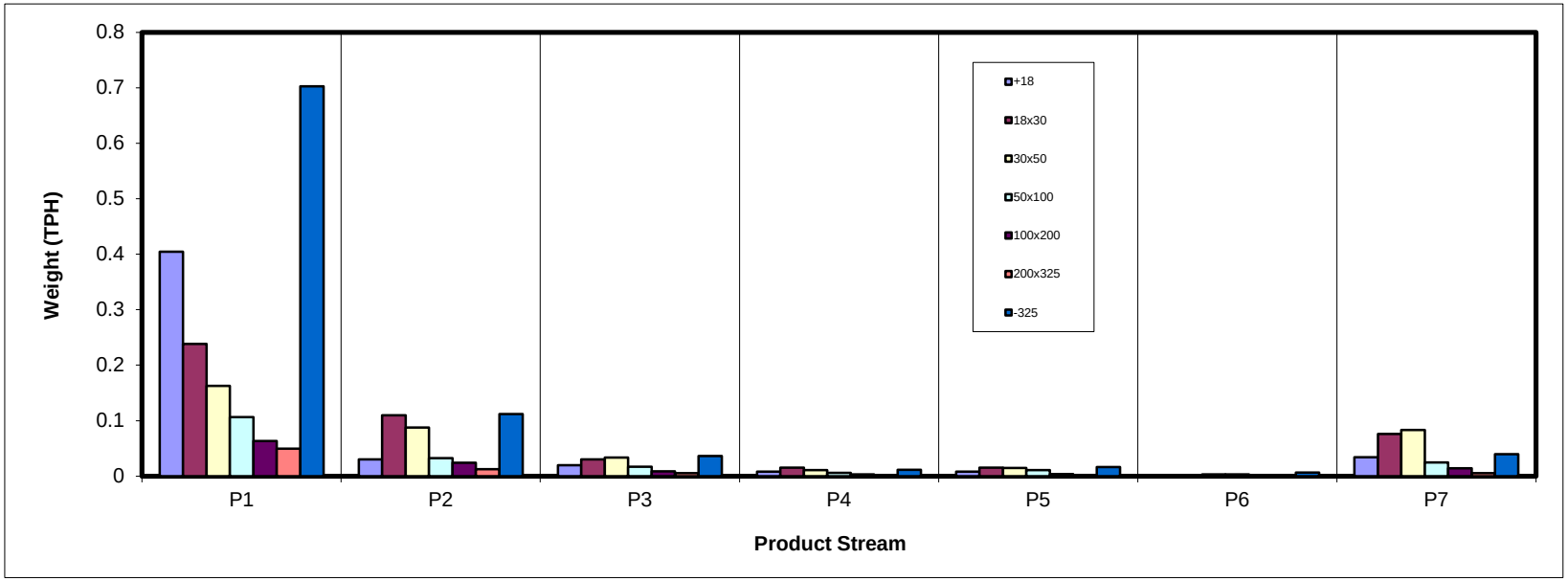
Description: Run 21 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.405	0.030	0.020	0.008	0.008	0.000	0.034		0.505
18x30	0.238	0.110	0.030	0.015	0.015	0.000	0.076		0.486
30x50	0.163	0.088	0.033	0.011	0.015	0.003	0.083		0.396
50x100	0.106	0.033	0.017	0.006	0.011	0.003	0.025		0.200
100x200	0.063	0.024	0.009	0.003	0.004	0.002	0.014		0.119
200x325	0.050	0.013	0.006	0.001	0.002	0.001	0.006		0.078
-325	0.703	0.112	0.036	0.011	0.016	0.007	0.040		0.925
Total (Calc)	1.727	0.409	0.151	0.056	0.071	0.016	0.277		2.707



SPIRAL DATA ANALYSIS

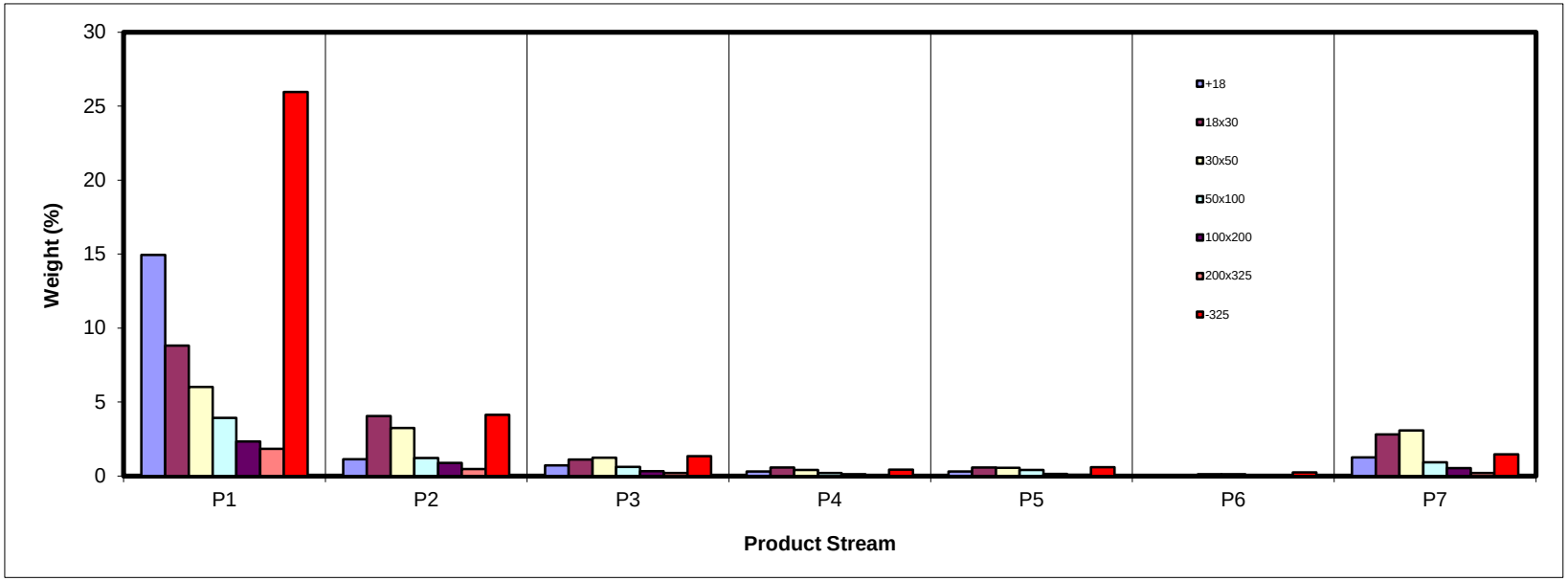
Description: Run 21 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	14.94	1.12	0.73	0.30	0.30	0.00	1.25		18.64
18x30	8.81	4.05	1.12	0.57	0.57	0.01	2.81		17.94
30x50	6.01	3.24	1.23	0.41	0.55	0.11	3.07		14.62
50x100	3.92	1.20	0.62	0.21	0.40	0.12	0.91		7.39
100x200	2.34	0.89	0.33	0.11	0.13	0.06	0.52		4.38
200x325	1.83	0.46	0.21	0.05	0.07	0.04	0.21		2.87
-325	25.95	4.13	1.35	0.42	0.60	0.24	1.47		34.16
Total (Calc)	63.80	15.10	5.58	2.07	2.63	0.59	10.24		100.00



SPIRAL DATA ANALYSIS

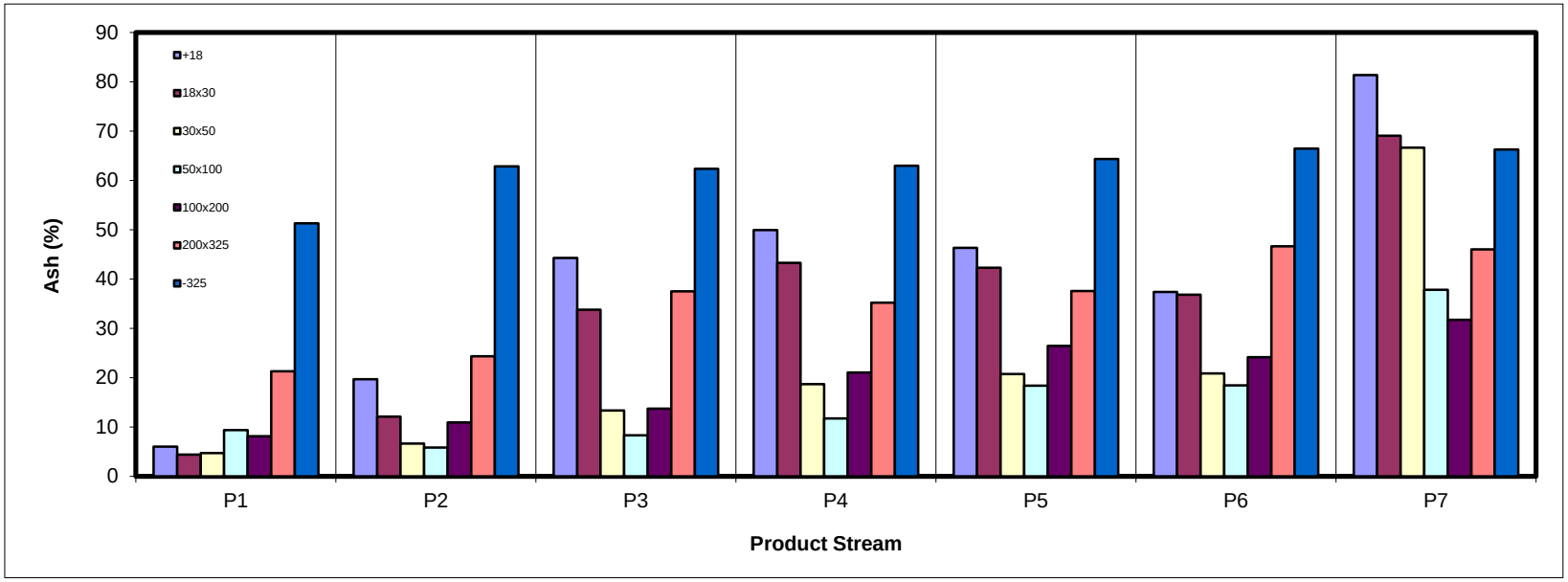
Description: Run 21 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	6.03	19.67	44.27	49.91	46.34	37.39	81.36		14.73
18x30	4.37	12.09	33.76	43.29	42.30	36.84	69.04		20.54
30x50	4.68	6.64	13.34	18.67	20.73	20.85	66.64		19.97
50x100	9.35	5.84	8.28	11.74	18.38	18.41	37.78		12.92
100x200	8.13	10.89	13.70	21.06	26.42	24.17	31.70		13.01
200x325	21.28	24.34	37.51	35.18	37.53	46.62	46.02		25.70
-325	51.26	62.81	62.31	62.98	64.32	66.45	66.24		54.22
Total (Calc)	24.79	25.17	33.62	38.90	38.63	41.43	64.25		30.13



SPIRAL DATA ANALYSIS

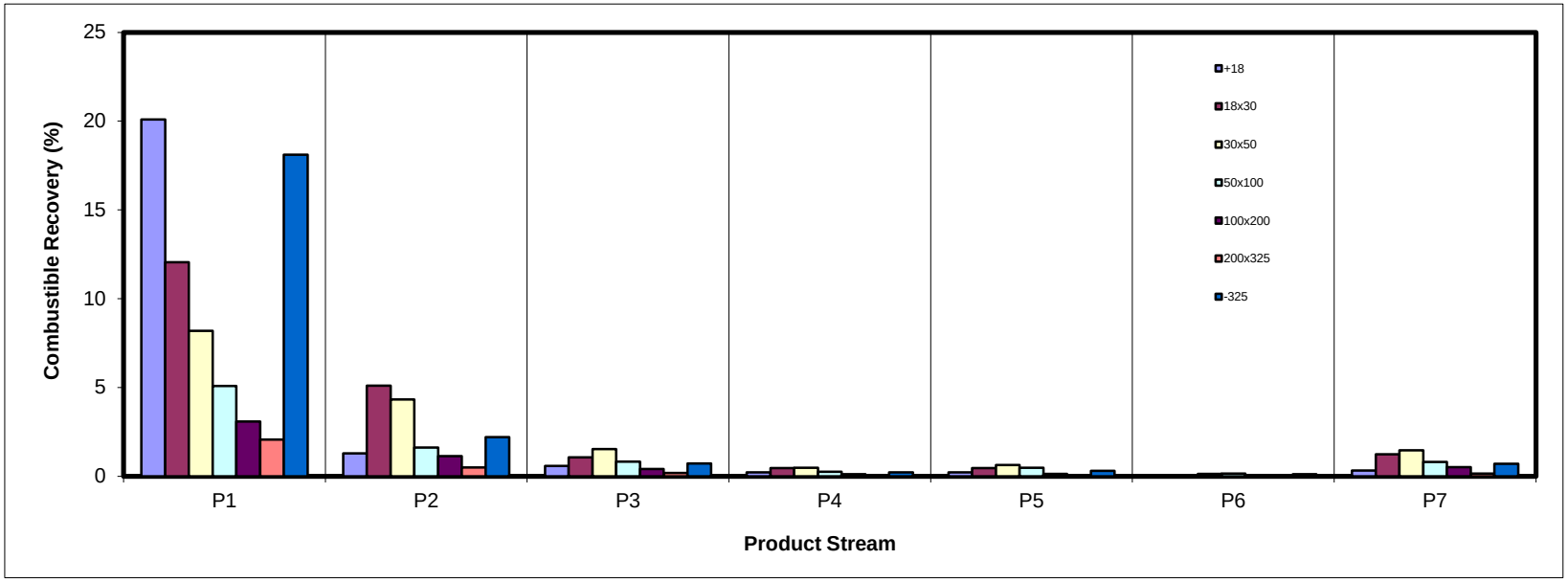
Description: Run 21 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	20.10	1.29	0.58	0.22	0.23	0.00	0.33		22.74
18x30	12.06	5.10	1.06	0.46	0.47	0.01	1.24		20.40
30x50	8.20	4.33	1.53	0.47	0.63	0.13	1.47		16.75
50x100	5.08	1.62	0.82	0.26	0.47	0.14	0.81		9.22
100x200	3.08	1.13	0.40	0.12	0.14	0.06	0.51		5.45
200x325	2.06	0.50	0.18	0.05	0.06	0.03	0.16		3.05
-325	18.11	2.20	0.73	0.22	0.31	0.12	0.71		22.39
Total (Calc)	68.68	16.17	5.30	1.81	2.31	0.50	5.24		100.00



SPIRAL DATA ANALYSIS

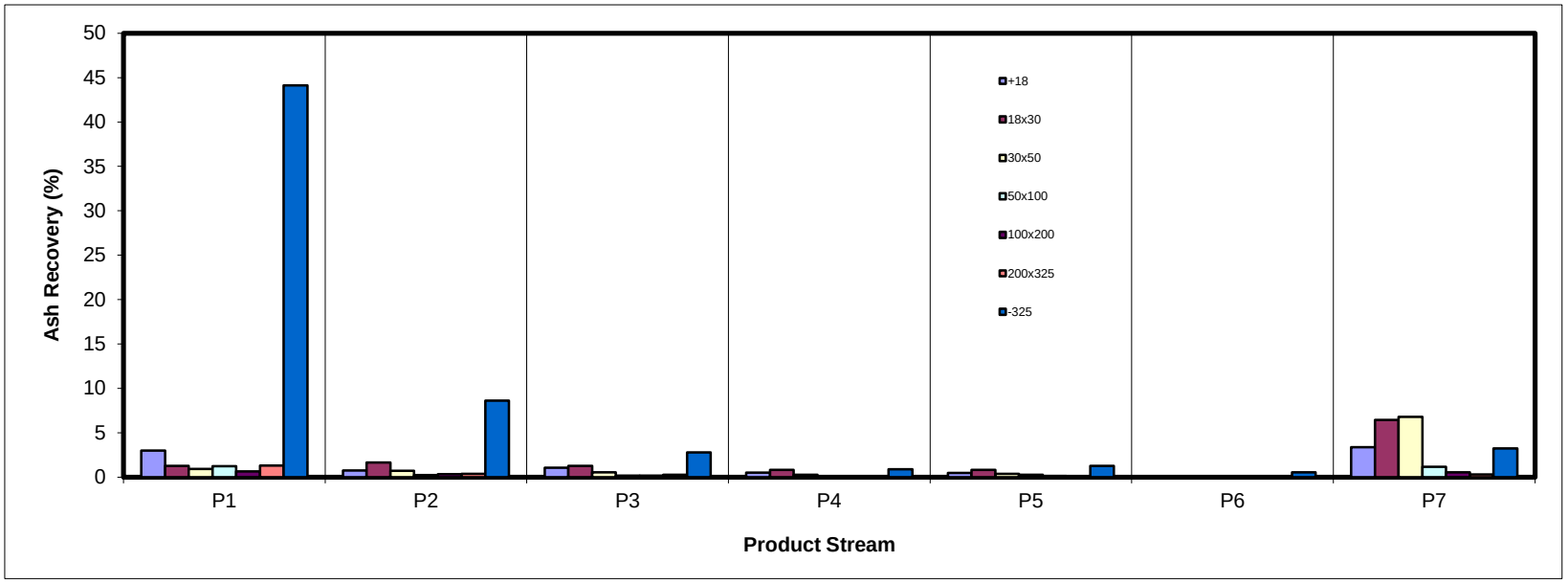
Description: Run 21 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	2.99	0.73	1.07	0.50	0.46	0.00	3.37		9.11
18x30	1.28	1.63	1.25	0.82	0.80	0.02	6.44		12.23
30x50	0.93	0.71	0.55	0.25	0.38	0.08	6.78		9.69
50x100	1.22	0.23	0.17	0.08	0.25	0.08	1.15		3.17
100x200	0.63	0.32	0.15	0.08	0.12	0.05	0.55		1.89
200x325	1.29	0.37	0.26	0.06	0.09	0.06	0.31		2.44
-325	44.14	8.61	2.78	0.88	1.28	0.54	3.23		61.46
Total (Calc)	52.49	12.61	6.22	2.67	3.36	0.82	21.83		100.00



SPIRAL DATA ANALYSIS

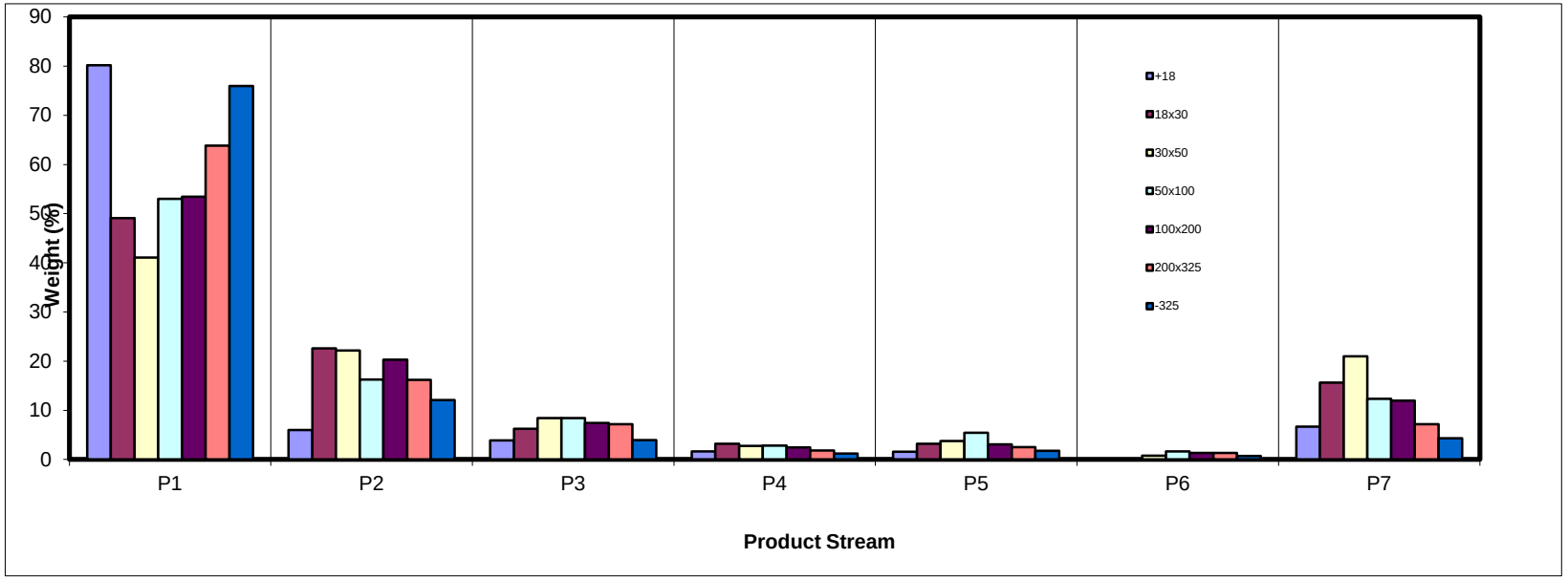
Description: Run 21 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	80.19	6.01	3.90	1.62	1.59	0.01	6.69		100.00
18x30	49.10	22.58	6.22	3.19	3.18	0.08	15.66		100.00
30x50	41.09	22.14	8.44	2.78	3.78	0.78	20.98		100.00
50x100	52.99	16.27	8.42	2.82	5.45	1.68	12.37		100.00
100x200	53.44	20.31	7.45	2.45	3.05	1.34	11.96		100.00
200x325	63.84	16.20	7.16	1.81	2.52	1.30	7.16		100.00
-325	75.97	12.09	3.94	1.24	1.75	0.71	4.30		100.00
Total (Calc)	63.80	15.10	5.58	2.07	2.63	0.59	10.24		100.00



SPIRAL DATA ANALYSIS

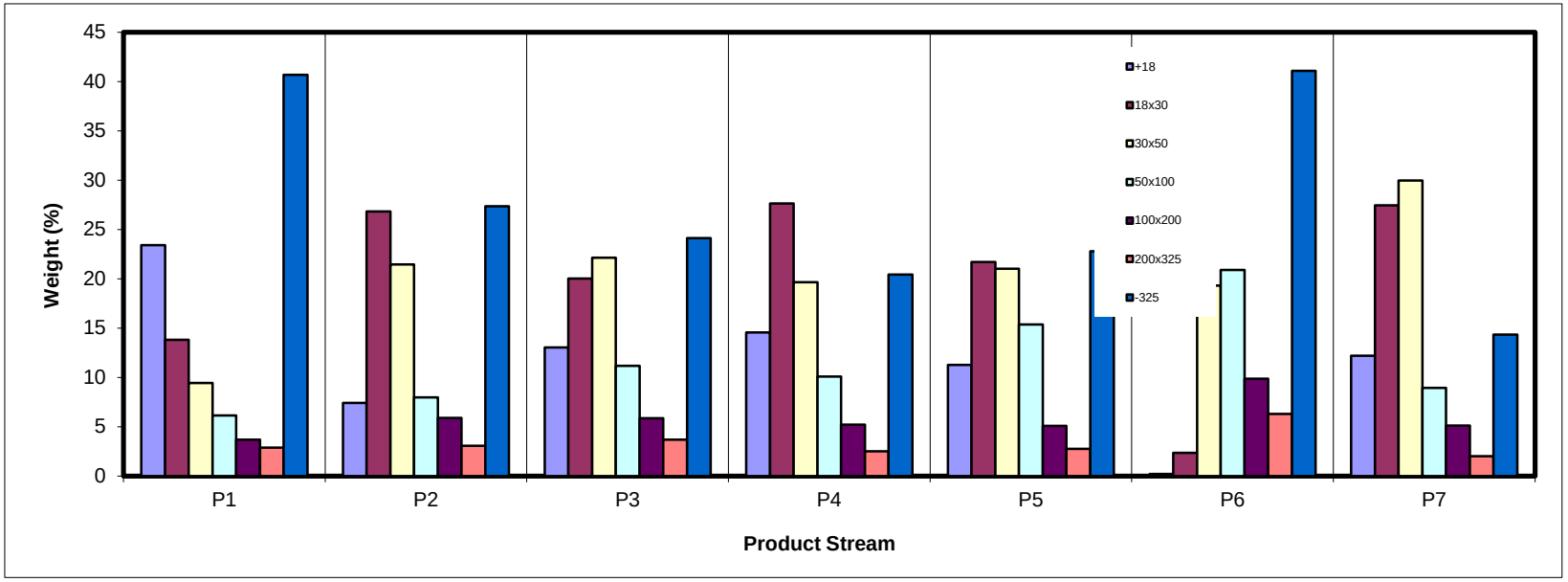
Description: Run 21 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	23.42	7.42	13.02	14.55	11.27	0.21	12.18		18.64
18x30	13.81	26.83	20.02	27.62	21.71	2.35	27.44		17.94
30x50	9.42	21.45	22.14	19.64	21.03	19.30	29.97		14.62
50x100	6.14	7.97	11.16	10.08	15.36	20.89	8.93		7.39
100x200	3.67	5.89	5.85	5.20	5.08	9.88	5.12		4.38
200x325	2.87	3.08	3.68	2.51	2.76	6.30	2.00		2.87
-325	40.68	27.36	24.13	20.41	22.79	41.07	14.35		34.16
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

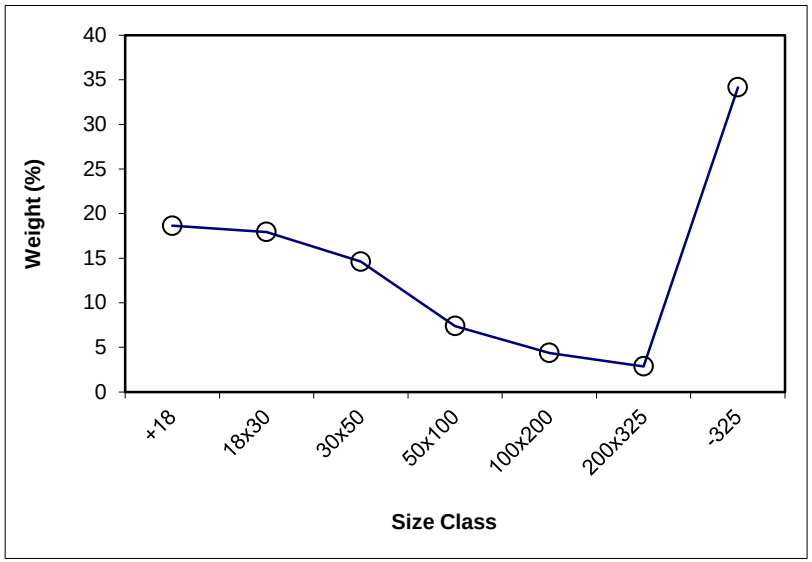
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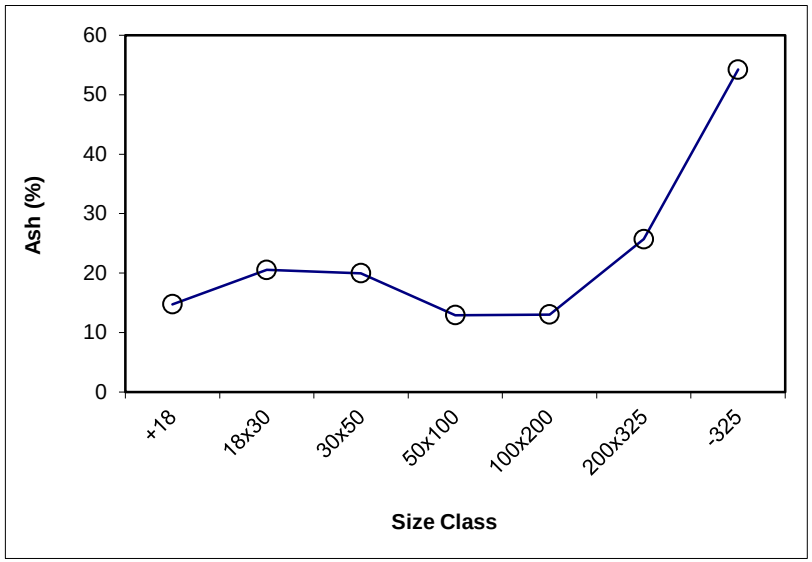
Comments: 1 x 0.15 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	579.1	460.1	119.00	18.64	14.73	18.64	14.73	100.00	30.13
18x30	556.7	442.2	114.56	17.94	20.54	36.58	17.58	81.36	33.66
30x50	505.9	412.5	93.37	14.62	19.97	51.20	18.26	63.42	37.37
50x100	434.9	387.7	47.22	7.39	12.92	58.59	17.59	48.80	42.59
100x200	419.3	391.3	27.98	4.38	13.01	62.97	17.27	41.41	47.88
200x325	396.9	378.6	18.30	2.87	25.70	65.84	17.64	37.03	52.01
-325	224.7	6.6	218.14	34.16	54.22	100.00	30.13	34.16	54.22
Total (Calc)	--	--	638.56	100.00	30.13	--	--	--	--





SPIRAL DATA ANALYSIS

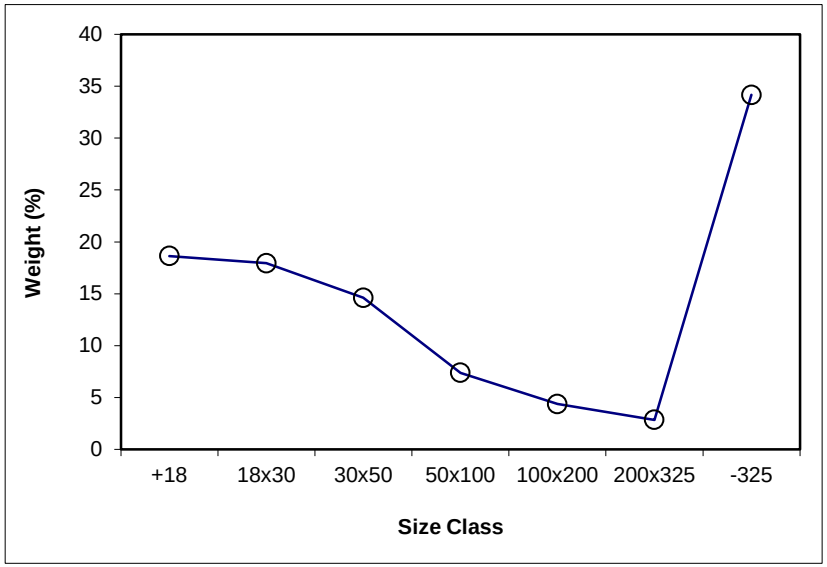
Description: Run 21 - Intermediate Spiral Test

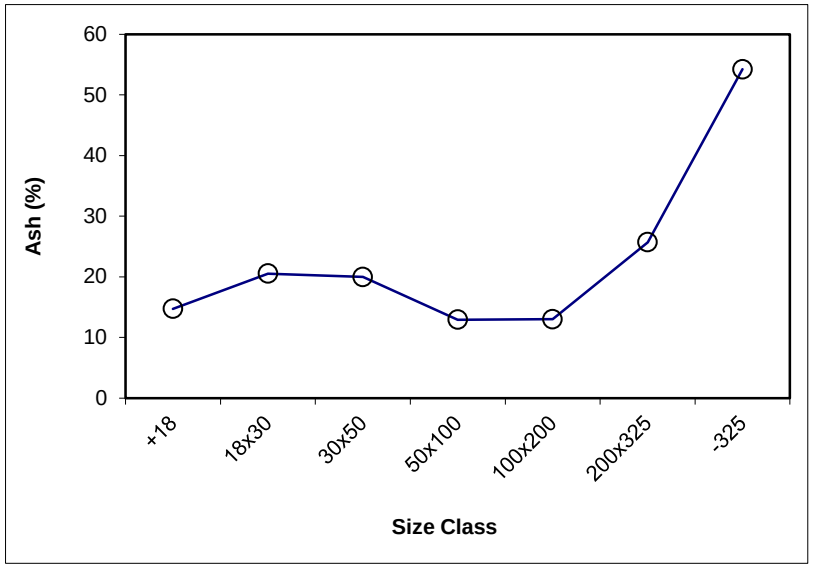
Comments: 1 x 0.15 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	18.64	14.73	18.64	14.73	100.00	30.13			
18x30	17.94	20.54	36.58	17.58	81.36	33.66	x	17.94	20.54
30x50	14.62	19.97	51.20	18.26	63.42	37.37	x	14.62	19.97
50x100	7.39	12.92	58.59	17.59	48.80	42.59	x	7.39	12.92
100x200	4.38	13.01	62.97	17.27	41.41	47.88	x	4.38	13.01
200x325	2.87	25.70	65.84	17.64	37.03	52.01	x	2.87	25.70
-325	34.16	54.22	100.00	30.13	34.16	54.22			
Total (Calc)	100.00	30.13	--	--	--	--	--	47.20	18.78





SPIRAL DATA ANALYSIS

Description: Run 21 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 63.80

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	685.33	379.2	306.12	23.42	6.03	23.42	6.03	100.00	24.79
18x30	572.71	392.3	180.45	13.81	4.37	37.23	5.42	76.58	30.53
30x50	477.53	354.5	123.08	9.42	4.68	46.65	5.27	62.77	36.28
50x100	447.13	366.9	80.27	6.14	9.35	52.79	5.74	53.35	41.86
100x200	395.40	347.4	47.96	3.67	8.13	56.46	5.90	47.21	46.08
200x325	368.45	331.0	37.47	2.87	21.28	59.32	6.64	43.54	49.28
-325	544.24	12.6	531.62	40.68	51.26	100.00	24.79	40.68	51.26
Total (Calc)	--	--	1306.96	100.00	24.79	--	--	--	--

Product P2 Feed Weight (%): 15.10

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	498.4	460.1	38.26	7.42	19.67	7.42	19.67	100.00	25.17
18x30	580.4	442.2	138.29	26.83	12.09	34.25	13.74	92.58	25.61
30x50	523.1	412.5	110.53	21.45	6.64	55.70	11.00	65.75	31.13
50x100	428.8	387.7	41.08	7.97	5.84	63.67	10.36	44.30	42.98
100x200	421.7	391.3	30.38	5.89	10.89	69.57	10.40	36.33	51.13
200x325	394.4	378.6	15.85	3.08	24.34	72.64	10.99	30.43	58.92
-325	147.3	6.3	141.01	27.36	62.81	100.00	25.17	27.36	62.81
Total (Calc)	--	--	515.41	100.00	25.17	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 21 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 5.58

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	450.8	401.2	49.58	13.02	44.27	13.02	44.27	100.00	33.62
18x30	446.3	370.0	76.23	20.02	33.76	33.04	37.90	86.98	32.02
30x50	420.6	336.3	84.31	22.14	13.34	55.18	28.05	66.96	31.50
50x100	350.3	307.8	42.51	11.16	8.28	66.34	24.72	44.82	40.48
100x200	316.8	294.5	22.28	5.85	13.70	72.19	23.83	33.66	51.15
200x325	312.0	298.0	14.00	3.68	37.51	75.87	24.49	27.81	59.03
-325	98.2	6.3	91.90	24.13	62.31	100.00	33.62	24.13	62.31
Total (Calc)	--	--	380.80	100.00	33.62	--	--	--	--

Product P4 Feed Weight (%): 2.07

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	461.4	379.2	82.22	14.55	49.91	14.55	49.91	100.00	38.90
18x30	548.4	392.3	156.10	27.62	43.29	42.16	45.58	85.45	37.02
30x50	465.5	354.5	111.01	19.64	18.67	61.80	37.02	57.84	34.03
50x100	423.8	366.9	56.97	10.08	11.74	71.88	33.48	38.20	41.93
100x200	376.8	347.4	29.37	5.20	21.06	77.08	32.64	28.12	52.75
200x325	345.2	331.0	14.19	2.51	35.18	79.59	32.72	22.92	59.94
-325	121.6	6.3	115.37	20.41	62.98	100.00	38.90	20.41	62.98
Total (Calc)	--	--	565.22	100.00	38.90	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 21 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 2.63

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	439.8	379.2	60.62	11.27	46.34	11.27	46.34	100.00	38.63
18x30	509.0	392.3	116.74	21.71	42.30	32.98	43.68	88.73	37.64
30x50	467.5	354.5	113.08	21.03	20.73	54.01	34.75	67.02	36.14
50x100	449.5	366.9	82.62	15.36	18.38	69.37	31.12	45.99	43.18
100x200	374.8	347.4	27.33	5.08	26.42	74.46	30.80	30.63	55.62
200x325	345.8	331.0	14.82	2.76	37.53	77.21	31.04	25.54	61.43
-325	129.0	6.5	122.53	22.79	64.32	100.00	38.63	22.79	64.32
Total (Calc)	--	--	537.74	100.00	38.63	--	--	--	--

Product P6 Feed Weight (%): 0.59

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	380.0	379.2	0.78	0.21	37.39	0.21	37.39	100.00	41.43
18x30	400.8	392.3	8.55	2.35	36.84	2.56	36.89	99.79	41.44
30x50	424.8	354.5	70.38	19.30	20.85	21.86	22.73	97.44	41.55
50x100	443.0	366.9	76.17	20.89	18.41	42.76	20.62	78.14	46.67
100x200	383.4	347.4	36.01	9.88	24.17	52.63	21.29	57.24	56.98
200x325	353.9	331.0	22.97	6.30	46.62	58.93	23.99	47.37	63.82
-325	156.3	6.5	149.74	41.07	66.45	100.00	41.43	41.07	66.45
Total (Calc)	--	--	364.59	100.00	41.43	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 21 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 10.24

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	486.4	401.2	85.17	12.18	81.36	12.18	81.36	100.00	64.25
18x30	561.8	370.0	191.80	27.44	69.04	39.62	72.83	87.82	61.88
30x50	545.8	336.3	209.49	29.97	66.64	69.59	70.16	60.38	58.63
50x100	370.3	307.8	62.44	8.93	37.78	78.53	66.48	30.41	50.73
100x200	330.3	294.5	35.78	5.12	31.70	83.64	64.35	21.47	56.12
200x325	312.0	298.0	14.00	2.00	46.02	85.65	63.92	16.36	63.76
-325	106.9	6.5	100.32	14.35	66.24	100.00	64.25	14.35	66.24
Total (Calc)	--	--	699.00	100.00	64.25	--	--	--	--

SPIRAL DATA ANALYSIS

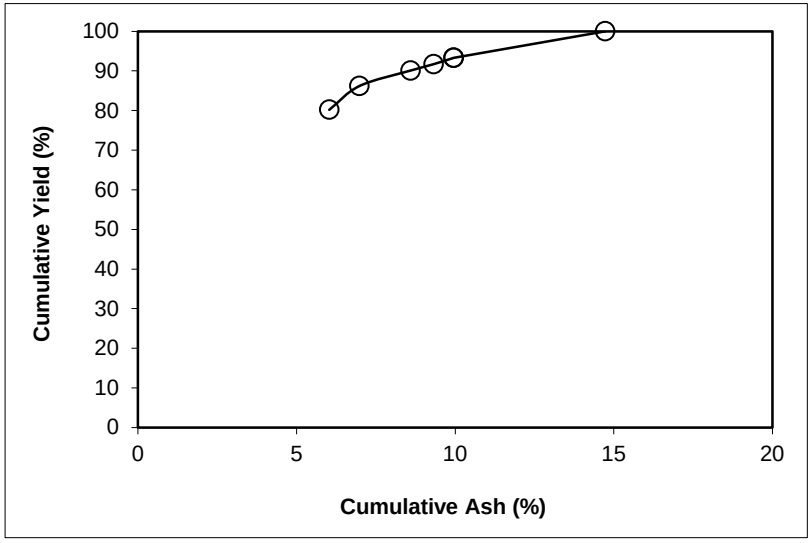
Description: Run 21 - Intermediate Spiral Test

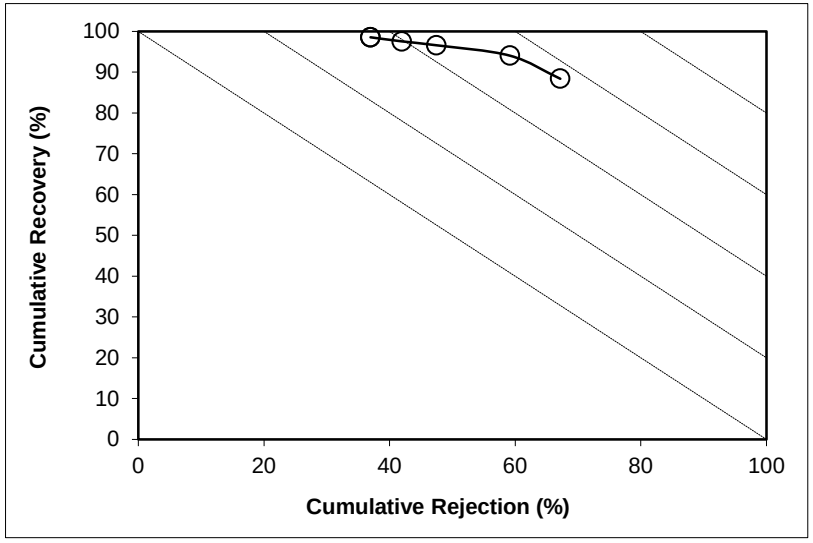
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 18.64

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	80.19	6.03	80.19	6.03	88.37	19.81	49.96	67.18	55.55
P2	6.01	19.67	86.20	6.98	94.04	13.80	63.15	59.15	53.19
P3	3.90	44.27	90.10	8.59	96.58	9.90	70.58	47.44	44.03
P4	1.62	49.91	91.71	9.32	97.53	8.29	74.61	41.97	39.50
P5	1.59	46.34	93.30	9.95	98.53	6.70	81.31	36.98	35.51
P6	0.01	37.39	93.31	9.95	98.54	6.69	81.36	36.96	35.50
P7	6.69	81.36	100.00	14.73	100.00	0.00			
Total (Calc)	100.00	14.73	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

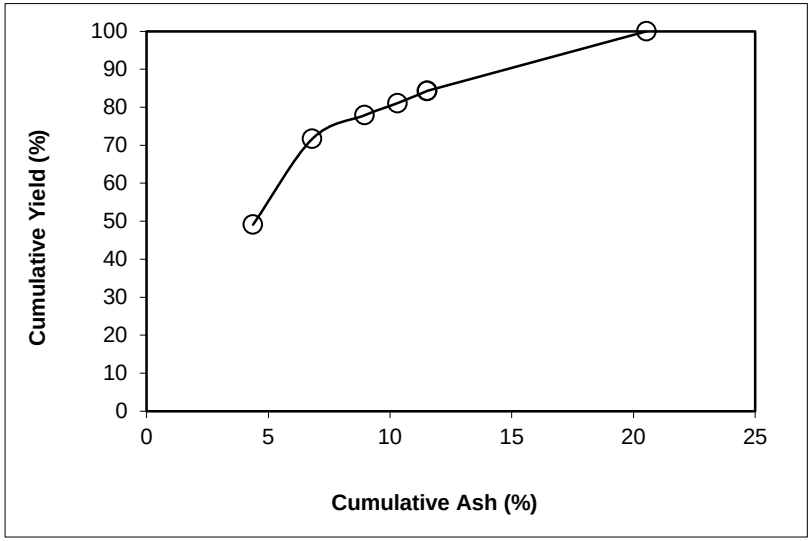
Description: Run 21 - Intermediate Spiral Test

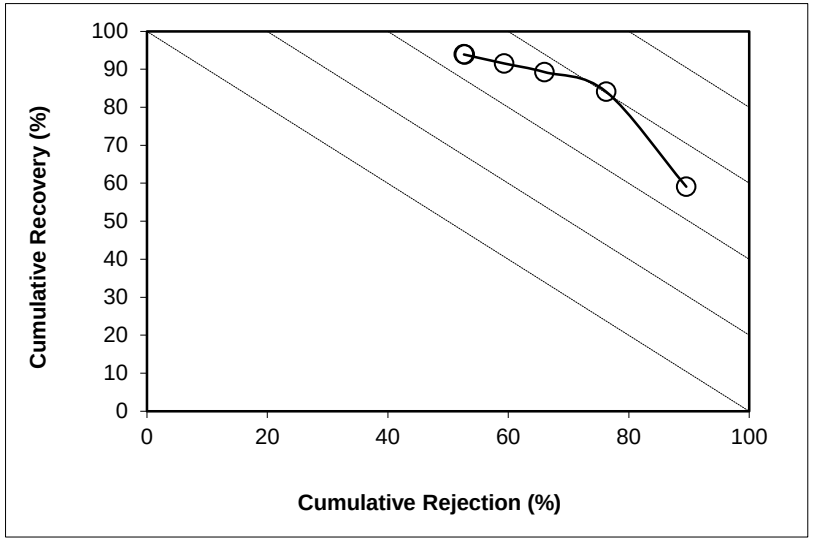
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 17.94

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	49.10	4.37	49.10	4.37	59.09	50.90	36.14	89.54	48.63
P2	22.58	12.09	71.68	6.81	84.07	28.32	55.31	76.25	60.32
P3	6.22	33.76	77.90	8.96	89.26	22.10	61.37	66.02	55.28
P4	3.19	43.29	81.09	10.31	91.53	18.91	64.42	59.31	50.84
P5	3.18	42.30	84.26	11.51	93.84	15.74	68.88	52.77	46.60
P6	0.08	36.84	84.34	11.54	93.90	15.66	69.04	52.63	46.53
P7	15.66	69.04	100.00	20.54	100.00	0.00			
Total (Calc)	100.00	20.54	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

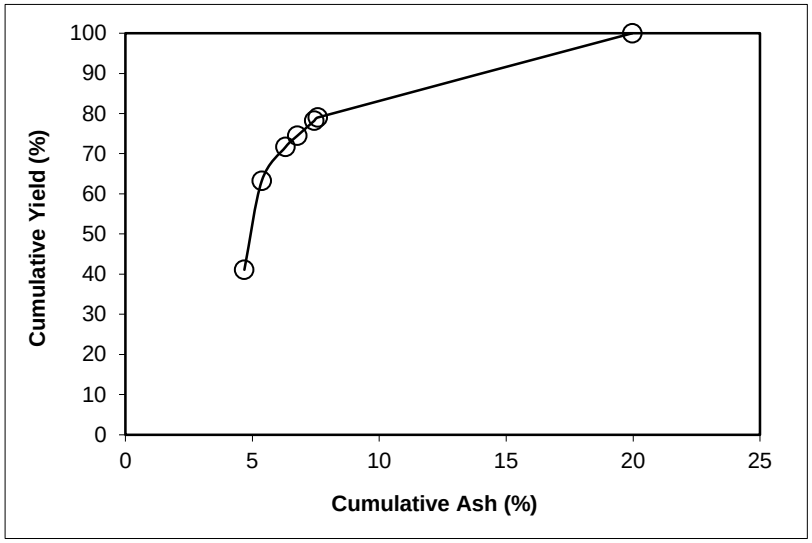
Description: Run 21 - Intermediate Spiral Test

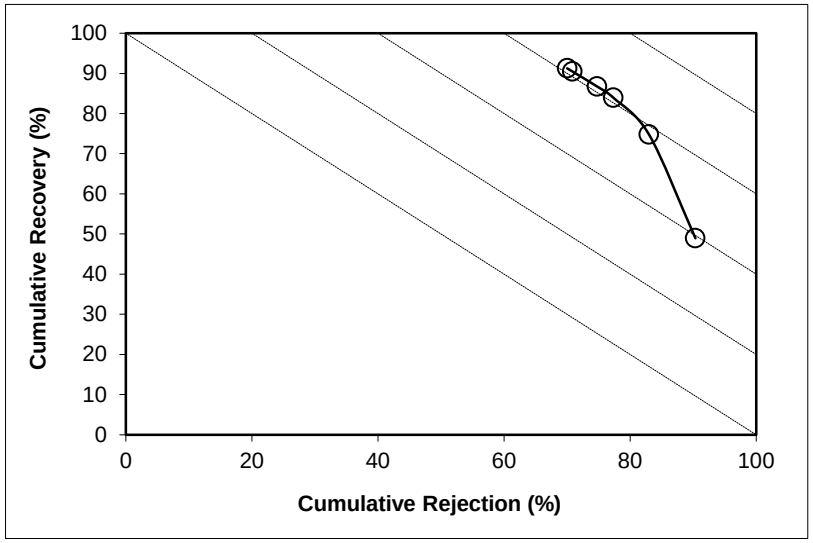
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 14.62

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	41.09	4.68	41.09	4.68	48.94	58.91	30.63	90.36	39.30
P2	22.14	6.64	63.23	5.37	74.77	36.77	45.08	83.00	57.77
P3	8.44	13.34	71.68	6.31	83.91	28.32	54.54	77.36	61.27
P4	2.78	18.67	74.46	6.77	86.74	25.54	58.45	74.76	61.50
P5	3.78	20.73	78.23	7.44	90.48	21.77	64.99	70.84	61.32
P6	0.78	20.85	79.02	7.58	91.25	20.98	66.64	70.02	61.28
P7	20.98	66.64	100.00	19.97	100.00	0.00			
Total (Calc)	100.00	19.97	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

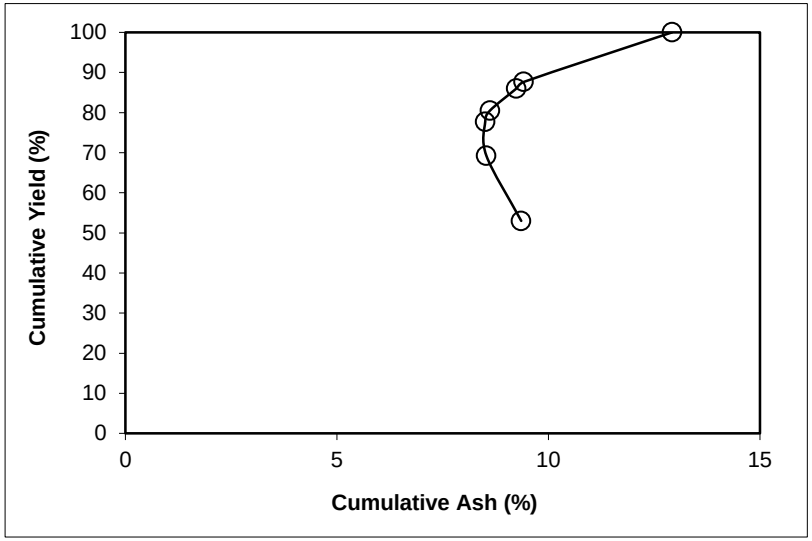
Description: Run 21 - Intermediate Spiral Test

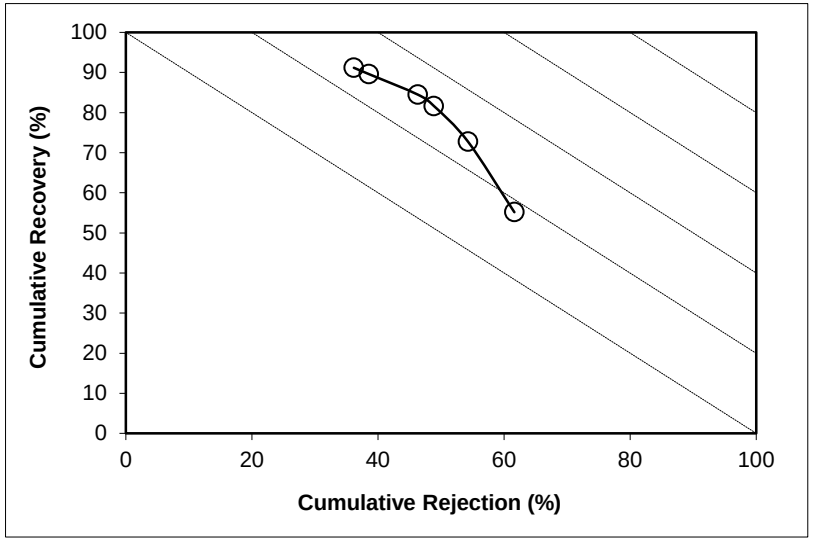
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 7.39

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	52.99	9.35	52.99	9.35	55.16	47.01	16.94	61.63	16.79
P2	16.27	5.84	69.26	8.53	72.76	30.74	22.81	54.27	27.03
P3	8.42	8.28	77.68	8.50	81.62	22.32	28.29	48.88	30.50
P4	2.82	11.74	80.50	8.62	84.48	19.50	30.69	46.31	30.79
P5	5.45	18.38	85.96	9.24	89.59	14.04	35.47	38.55	28.15
P6	1.68	18.41	87.63	9.41	91.16	12.37	37.78	36.17	27.33
P7	12.37	37.78	100.00	12.92	100.00	0.00			
Total (Calc)	100.00	12.92	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

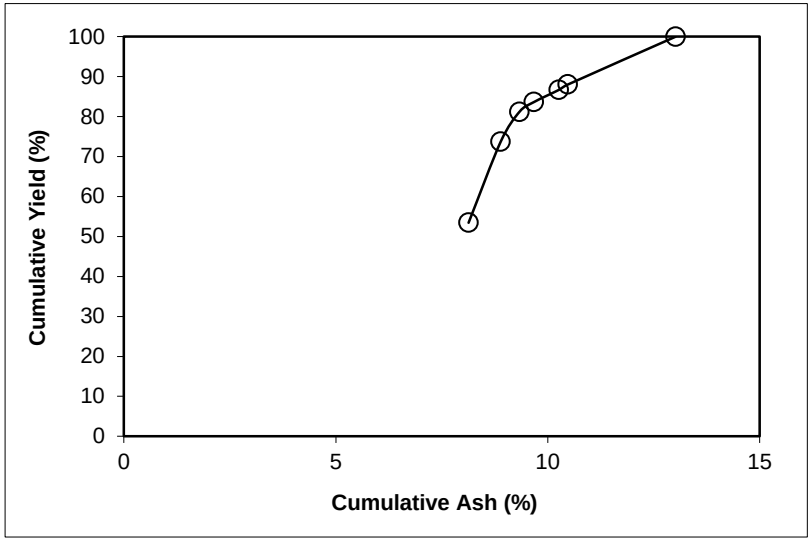
Description: Run 21 - Intermediate Spiral Test

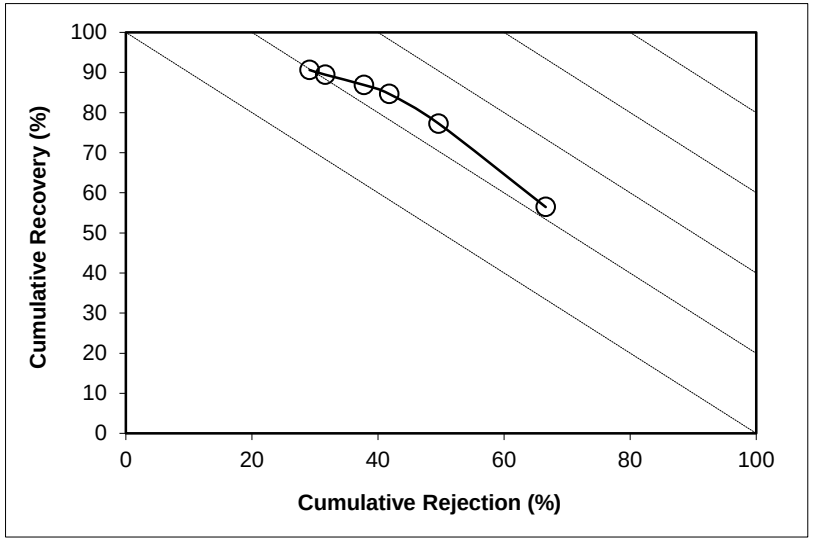
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 4.38

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	53.44	8.13	53.44	8.13	56.44	46.56	18.62	66.61	23.05
P2	20.31	10.89	73.76	8.89	77.25	26.24	24.60	49.62	26.87
P3	7.45	13.70	81.20	9.33	84.64	18.80	28.92	41.78	26.42
P4	2.45	21.06	83.66	9.68	86.87	16.34	30.10	37.80	24.67
P5	3.05	26.42	86.70	10.26	89.44	13.30	30.95	31.62	21.06
P6	1.34	24.17	88.04	10.47	90.61	11.96	31.70	29.14	19.75
P7	11.96	31.70	100.00	13.01	100.00	0.00			
Total (Calc)	100.00	13.01	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

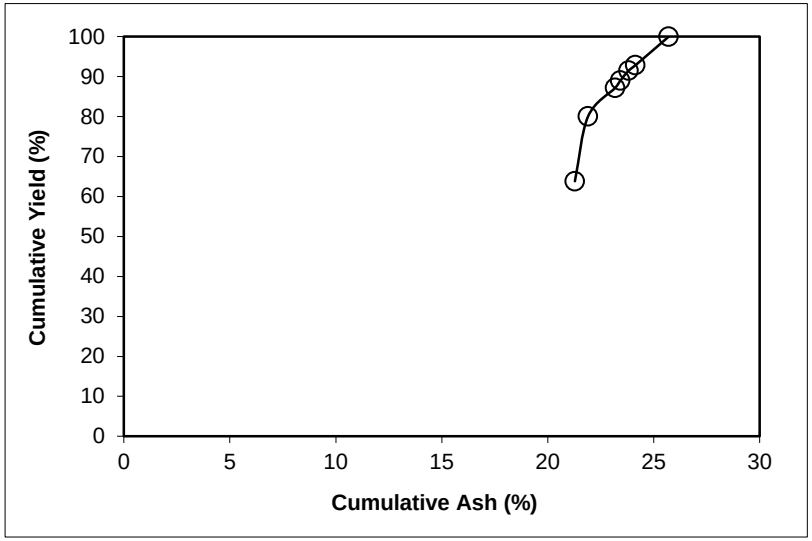
Description: Run 21 - Intermediate Spiral Test

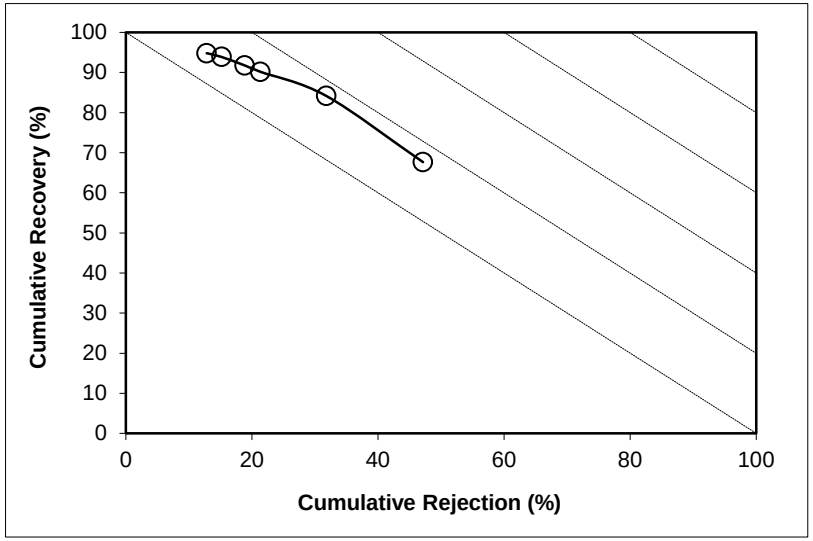
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 2.87

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	63.84	21.28	63.84	21.28	67.64	36.16	33.51	47.14	14.78
P2	16.20	24.34	80.05	21.90	84.14	19.95	40.95	31.80	15.94
P3	7.16	37.51	87.20	23.18	90.16	12.80	42.87	21.35	11.51
P4	1.81	35.18	89.02	23.42	91.74	10.98	44.14	18.87	10.61
P5	2.52	37.53	91.54	23.81	93.87	8.46	46.11	15.18	9.04
P6	1.30	46.62	92.84	24.13	94.80	7.16	46.02	12.81	7.62
P7	7.16	46.02	100.00	25.70	100.00	0.00			
Total (Calc)	100.00	25.70	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

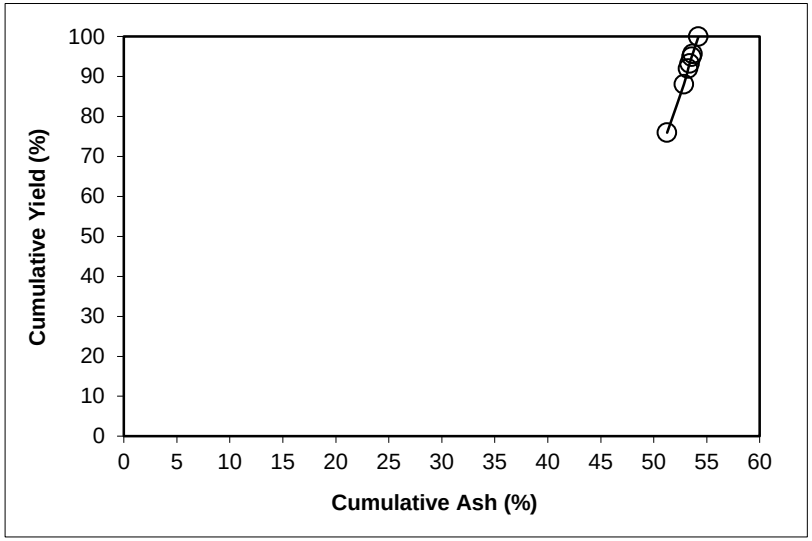
Description: Run 21 - Intermediate Spiral Test

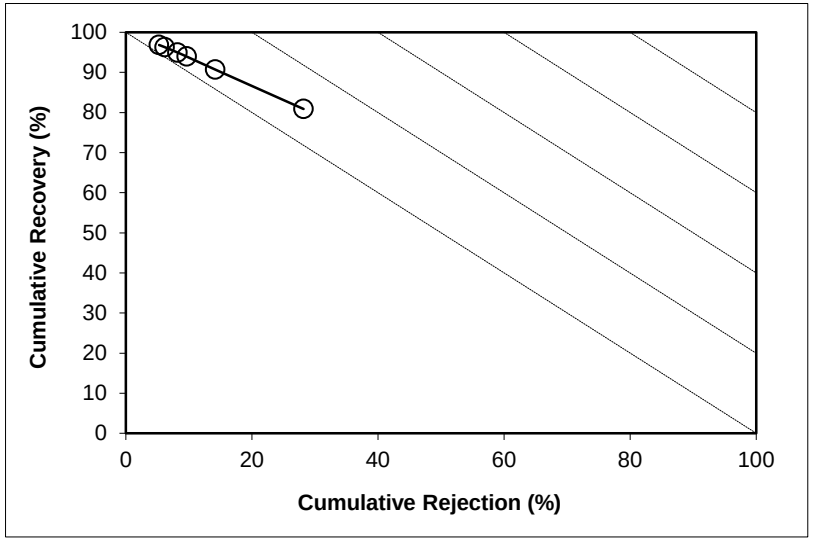
Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 34.16

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	75.97	51.26	75.97	51.26	80.88	24.03	63.57	28.18	9.05
P2	12.09	62.81	88.06	52.84	90.70	11.94	64.33	14.17	4.87
P3	3.94	62.31	92.00	53.25	93.94	8.00	65.33	9.64	3.58
P4	1.24	62.98	93.23	53.38	94.94	6.77	65.76	8.21	3.15
P5	1.75	64.32	94.99	53.58	96.31	5.01	66.27	6.13	2.43
P6	0.71	66.45	95.70	53.68	96.83	4.30	66.24	5.25	2.08
P7	4.30	66.24	100.00	54.22	100.00	0.00			
Total (Calc)	100.00	54.22	--	--	--	--	--	--	--





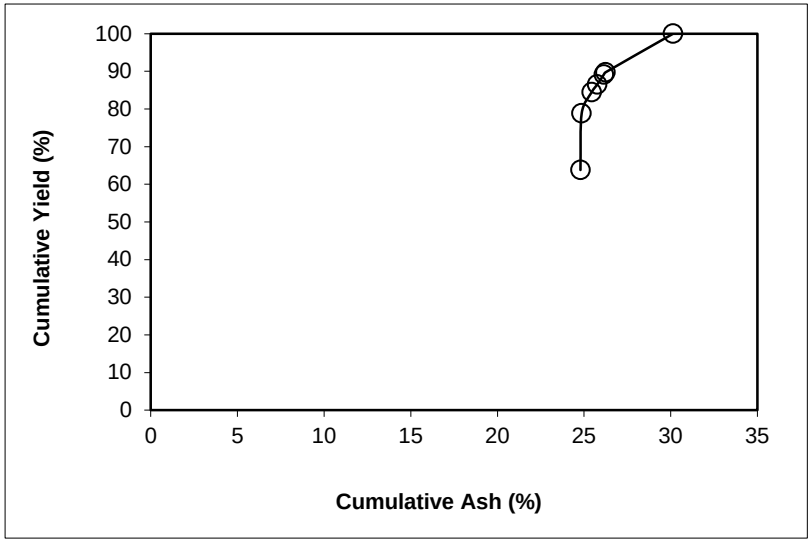
SPIRAL DATA ANALYSIS

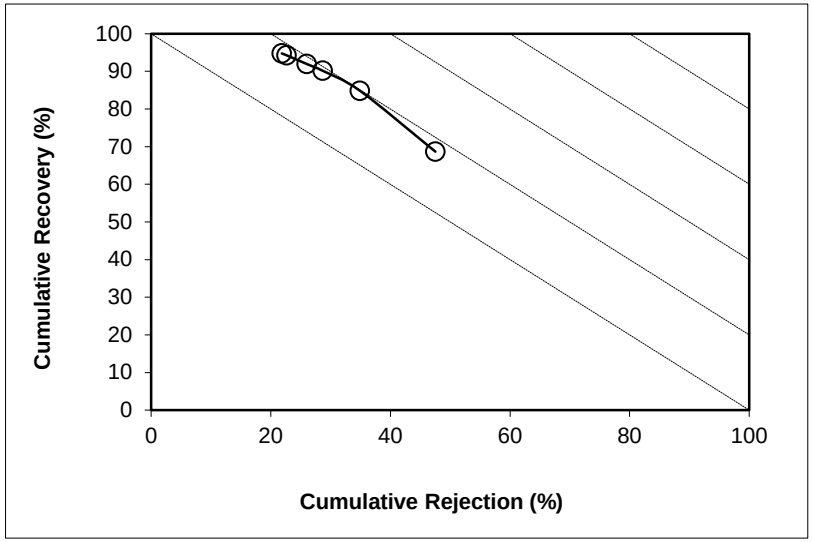
Description: Run 21 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	63.80	24.79	63.80	24.79	68.68	36.20	39.55	47.51	16.19
P2	15.10	25.17	78.90	24.86	84.85	21.10	49.84	34.90	19.75
P3	5.58	33.62	84.48	25.44	90.15	15.52	55.67	28.68	18.83
P4	2.07	38.90	86.54	25.76	91.96	13.46	58.25	26.01	17.97
P5	2.63	38.63	89.17	26.14	94.27	10.83	63.00	22.64	16.91
P6	0.59	41.43	89.76	26.24	94.76	10.24	64.25	21.83	16.59
P7	10.24	64.25	100.00	30.13	100.00	0.00			
Total (Calc)	100.00	30.13	--	--	--	--	--	--	--

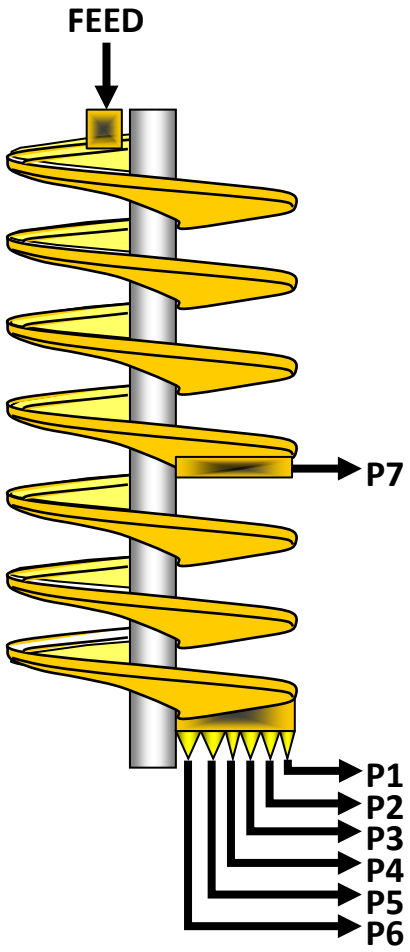




SPIRAL DATA ANALYSIS

Description: Run 26 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	2.833	34.7	21.31	29.44
P2	0.468	34.7	3.53	4.85
P3	0.149	36.7	1.03	1.42
P4	0.056	40.4	0.33	0.48
P5	0.079	37.4	0.53	0.74
P6	0.019	27.5	0.20	0.25
P7	0.276	47.3	1.23	1.85
Total	3.880	35.5	28.16	39.03

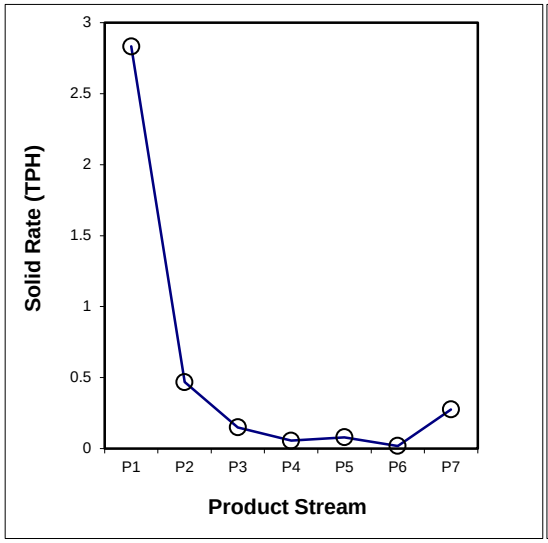
SPIRAL DATA ANALYSIS

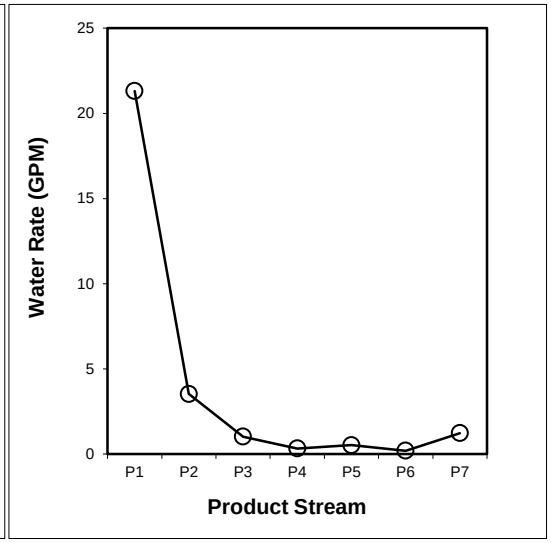
Description: Run 26 - Intermediate Spiral Test

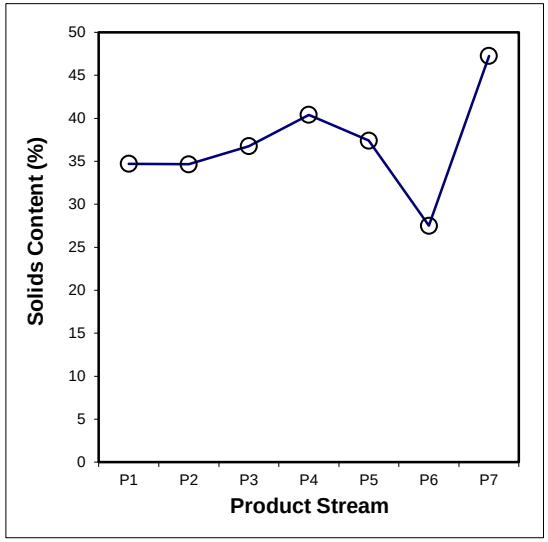
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	3	7432.00	1168.57	8.161	4322.3	2179.0	2.833	73.00	34.71
P2	5	1821.89	94.45	1.352	2747.8	2157.1	0.468	12.07	34.66
P3	10	1129.55	93.30	0.406	2854.6	2478.7	0.149	3.84	36.75
P4	30	1150.32	93.32	0.138	2435.6	2014.2	0.056	1.44	40.40
P5	30	1719.32	92.82	0.212	2756.5	2156.1	0.079	2.05	37.41
P6	60	1147.68	93.94	0.069	2764.7	2478.9	0.019	0.49	27.51
P7	10	1580.70	94.53	0.585	2711.0	2014.2	0.276	7.12	47.25
Total (Calc)	--	--	--	10.921	--	--	3.880	100.00	35.53
Total (Head)	0.59	1847.7	222.32	10.921	2734.5	2157.0	3.880	--	35.53







SPIRAL DATA ANALYSIS

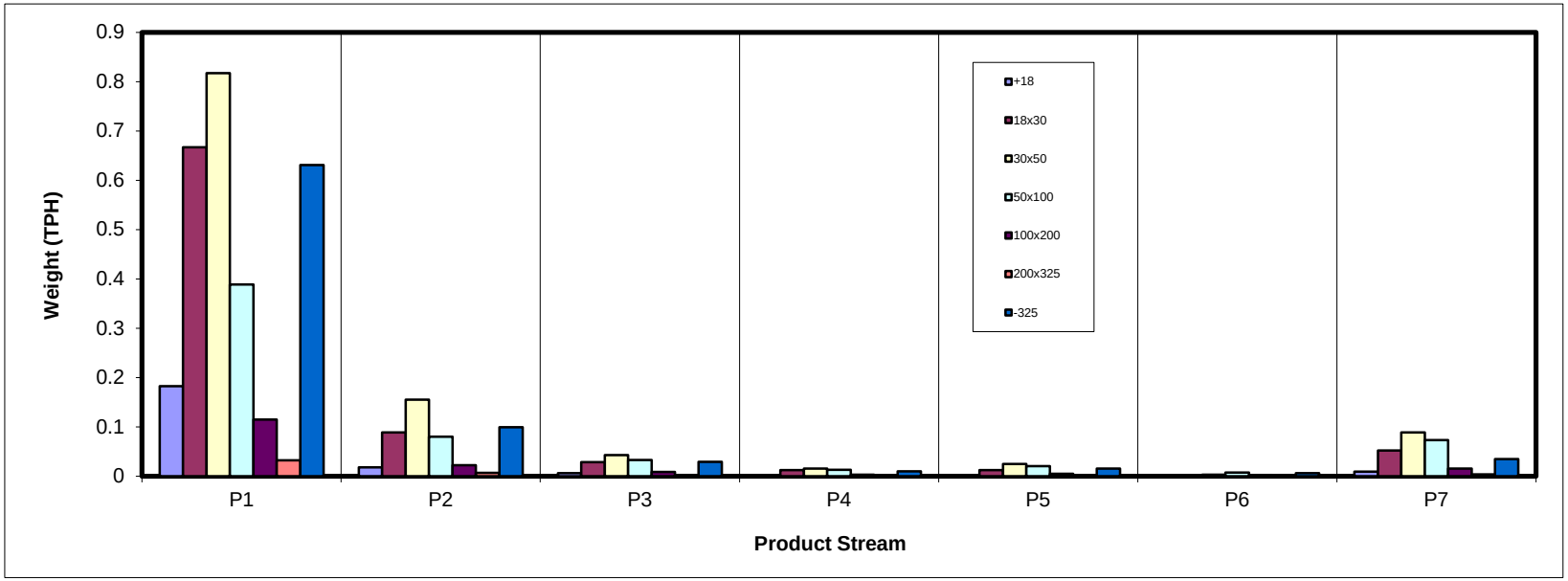
Description: Run 26 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.182	0.018	0.006	0.002	0.001	0.000	0.009		0.218
18x30	0.667	0.089	0.028	0.012	0.012	0.000	0.052		0.860
30x50	0.817	0.155	0.042	0.015	0.025	0.003	0.089		1.146
50x100	0.389	0.080	0.033	0.013	0.020	0.007	0.073		0.614
100x200	0.115	0.022	0.009	0.003	0.005	0.002	0.015		0.171
200x325	0.032	0.007	0.002	0.001	0.001	0.001	0.003		0.047
-325	0.631	0.099	0.029	0.010	0.015	0.006	0.035		0.825
Total (Calc)	2.833	0.468	0.149	0.056	0.079	0.019	0.276		3.880



SPIRAL DATA ANALYSIS

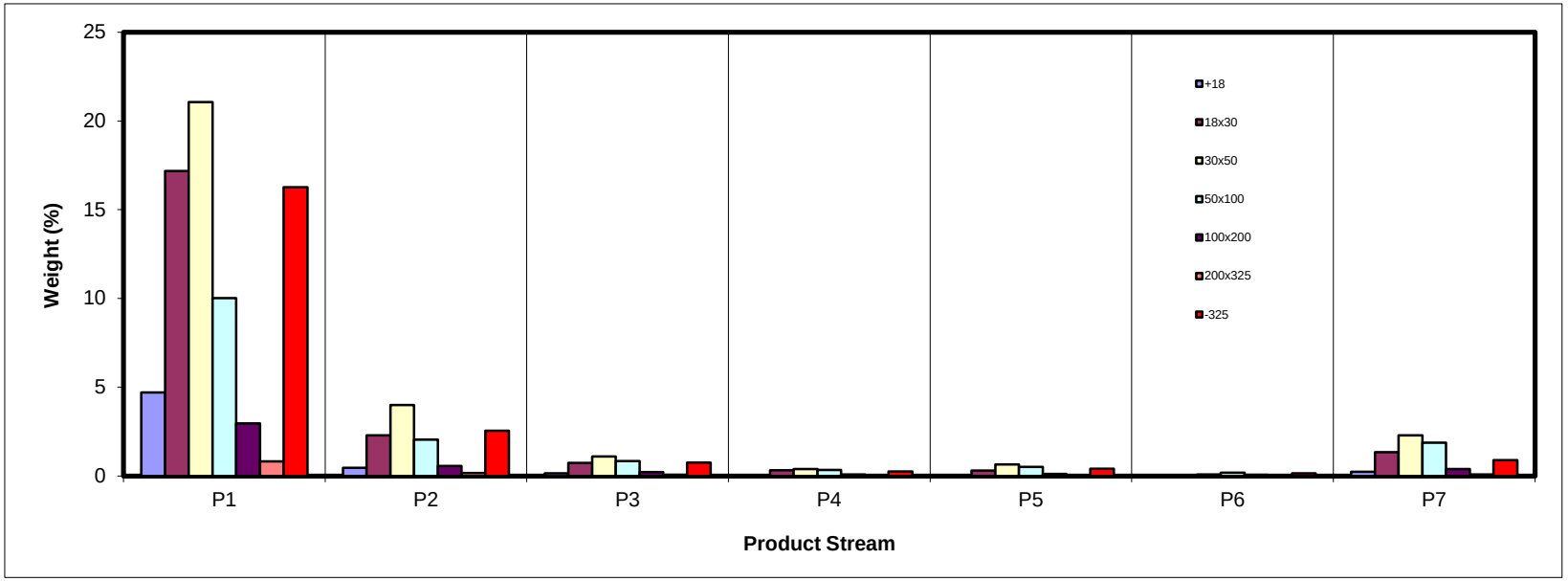
Description: Run 26 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	4.70	0.45	0.15	0.04	0.03	0.00	0.24		5.62
18x30	17.18	2.29	0.73	0.32	0.31	0.01	1.34		22.17
30x50	21.07	3.99	1.09	0.40	0.64	0.07	2.28		29.54
50x100	10.01	2.05	0.84	0.33	0.52	0.18	1.88		15.81
100x200	2.96	0.56	0.22	0.08	0.12	0.06	0.40		4.39
200x325	0.83	0.17	0.06	0.02	0.03	0.01	0.09		1.21
-325	16.26	2.55	0.75	0.25	0.40	0.15	0.89		21.25
Total (Calc)	73.00	12.07	3.84	1.44	2.05	0.49	7.12		100.00



SPIRAL DATA ANALYSIS

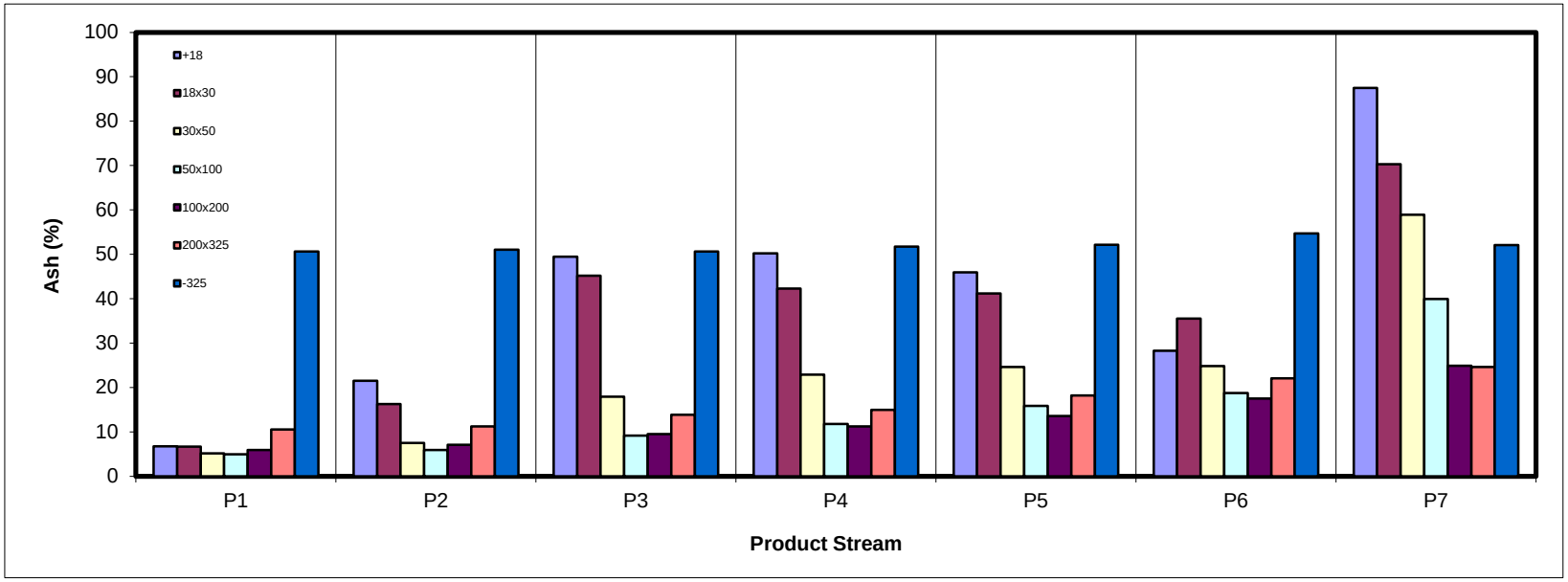
Description: Run 26 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	6.74	21.53	49.47	50.23	45.93	28.27	87.47		13.08
18x30	6.65	16.27	45.20	42.30	41.21	35.55	70.33		13.76
30x50	5.16	7.50	17.90	22.92	24.59	24.85	58.89		10.80
50x100	4.98	5.91	9.15	11.78	15.85	18.75	39.93		10.13
100x200	5.95	7.06	9.47	11.22	13.60	17.53	24.87		8.44
200x325	10.53	11.26	13.88	14.96	18.17	22.05	24.63		12.22
-325	50.62	51.06	50.64	51.72	52.13	54.73	52.10		50.80
Total (Calc)	15.80	18.66	28.23	29.59	29.87	31.08	53.84		19.89



SPIRAL DATA ANALYSIS

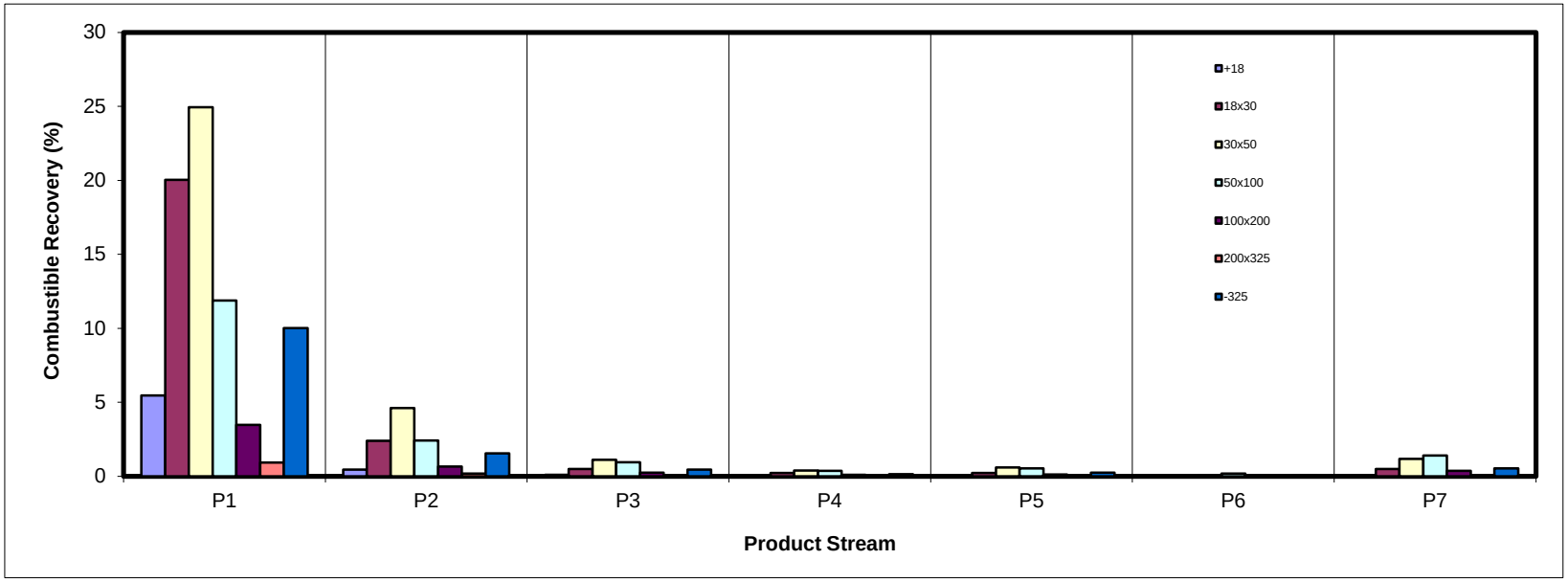
Description: Run 26 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	5.47	0.45	0.09	0.02	0.02	0.00	0.04		6.09
18x30	20.02	2.39	0.50	0.23	0.22	0.01	0.50		23.87
30x50	24.94	4.61	1.12	0.38	0.60	0.07	1.17		32.89
50x100	11.88	2.41	0.95	0.36	0.54	0.18	1.41		17.74
100x200	3.47	0.65	0.25	0.09	0.13	0.06	0.37		5.02
200x325	0.92	0.19	0.06	0.02	0.03	0.01	0.08		1.33
-325	10.02	1.56	0.46	0.15	0.24	0.09	0.53		13.05
Total (Calc)	76.73	12.26	3.44	1.26	1.79	0.42	4.10		100.00



SPIRAL DATA ANALYSIS

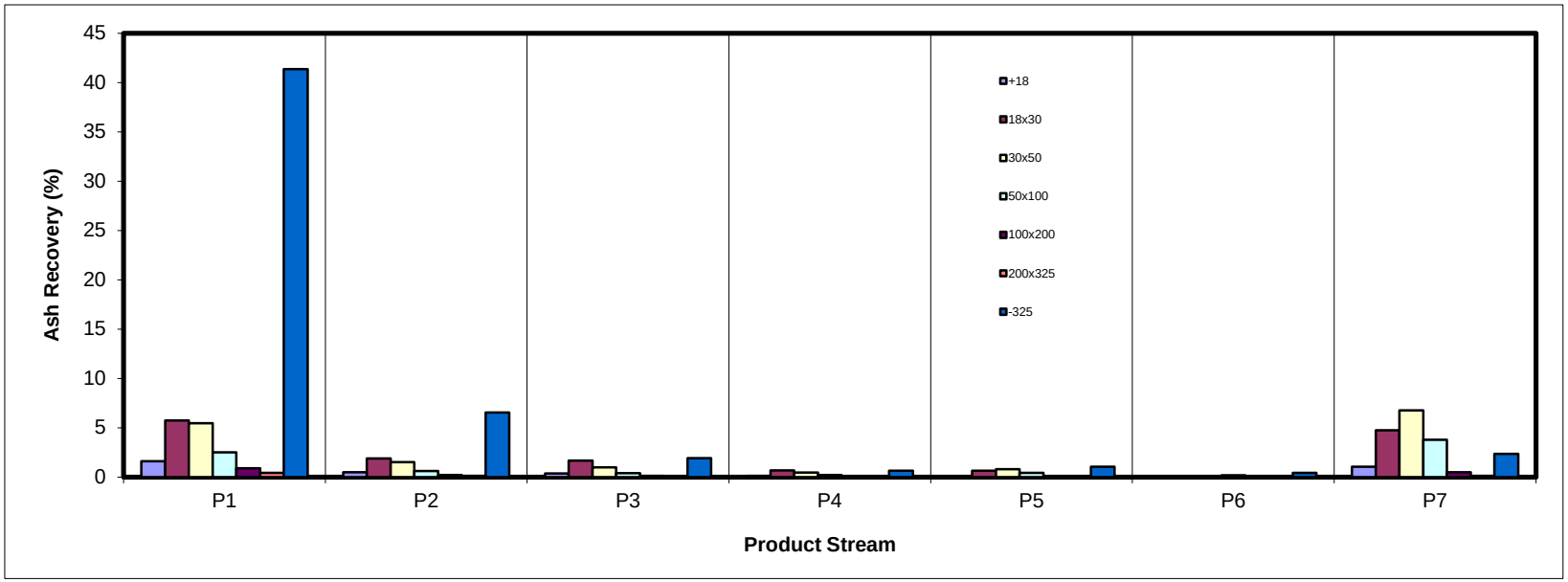
Description: Run 26 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	1.59	0.49	0.37	0.10	0.08	0.00	1.05		3.69
18x30	5.74	1.87	1.66	0.67	0.63	0.01	4.74		15.34
30x50	5.46	1.50	0.98	0.46	0.79	0.09	6.75		16.04
50x100	2.51	0.61	0.39	0.20	0.41	0.17	3.78		8.05
100x200	0.88	0.20	0.11	0.05	0.08	0.05	0.49		1.86
200x325	0.44	0.10	0.04	0.02	0.03	0.02	0.11		0.75
-325	41.37	6.54	1.90	0.65	1.05	0.42	2.34		54.27
Total (Calc)	57.99	11.32	5.45	2.14	3.07	0.76	19.27		100.00



SPIRAL DATA ANALYSIS

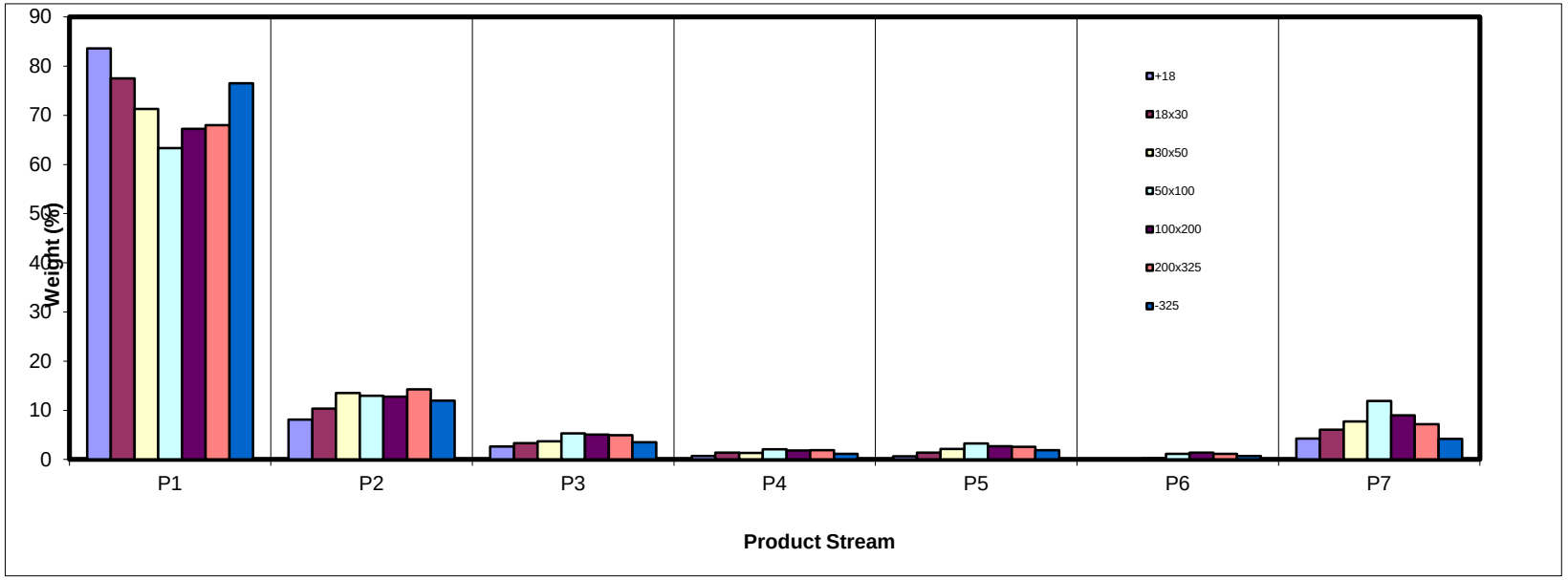
Description: Run 26 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	83.62	8.10	2.67	0.71	0.62	0.02	4.27		100.00
18x30	77.49	10.32	3.30	1.42	1.38	0.03	6.05		100.00
30x50	71.31	13.51	3.69	1.35	2.17	0.25	7.72		100.00
50x100	63.33	12.98	5.32	2.09	3.26	1.13	11.90		100.00
100x200	67.25	12.79	5.04	1.83	2.69	1.39	9.00		100.00
200x325	68.02	14.28	4.92	1.87	2.60	1.15	7.16		100.00
-325	76.52	12.00	3.51	1.17	1.88	0.71	4.20		100.00
Total (Calc)	73.00	12.07	3.84	1.44	2.05	0.49	7.12		100.00



SPIRAL DATA ANALYSIS

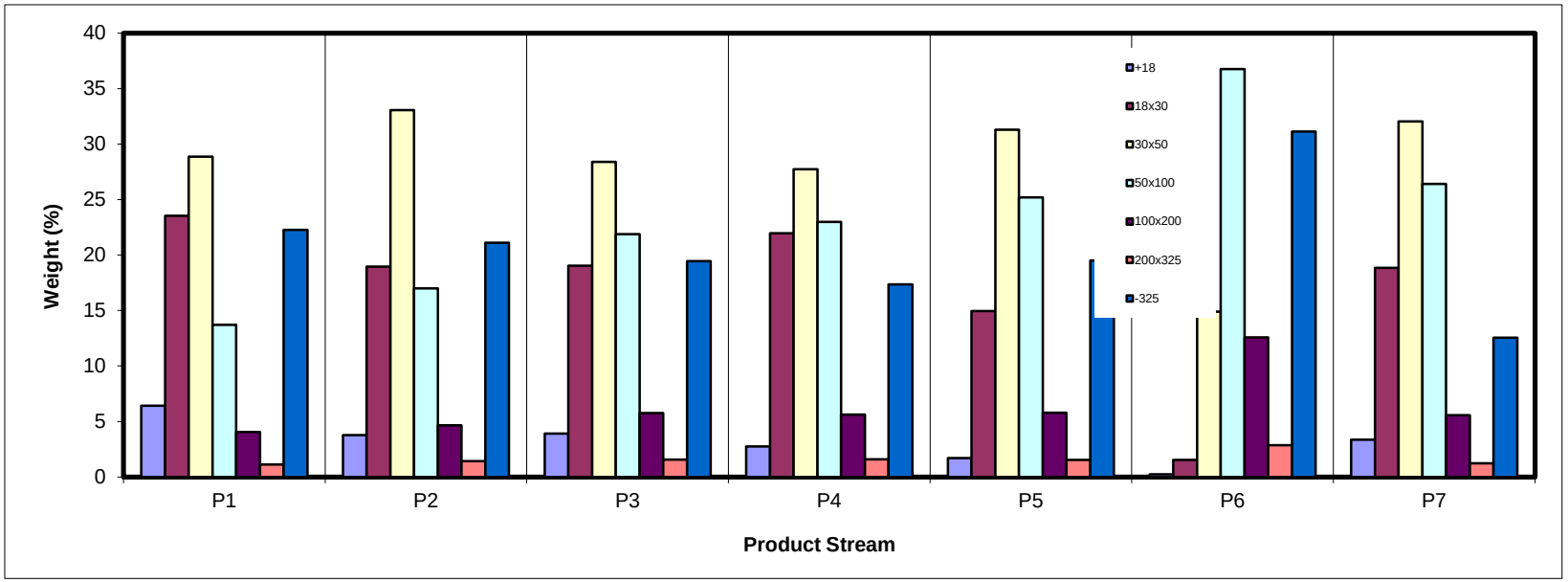
Description: Run 26 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	6.43	3.77	3.90	2.76	1.70	0.23	3.37		5.62
18x30	23.54	18.96	19.05	21.97	14.96	1.54	18.84		22.17
30x50	28.86	33.06	28.40	27.74	31.31	14.90	32.04		29.54
50x100	13.72	17.00	21.89	22.98	25.20	36.77	26.42		15.81
100x200	4.05	4.66	5.77	5.62	5.78	12.57	5.56		4.39
200x325	1.13	1.44	1.56	1.58	1.54	2.87	1.22		1.21
-325	22.27	21.12	19.44	17.36	19.50	31.13	12.55		21.25
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

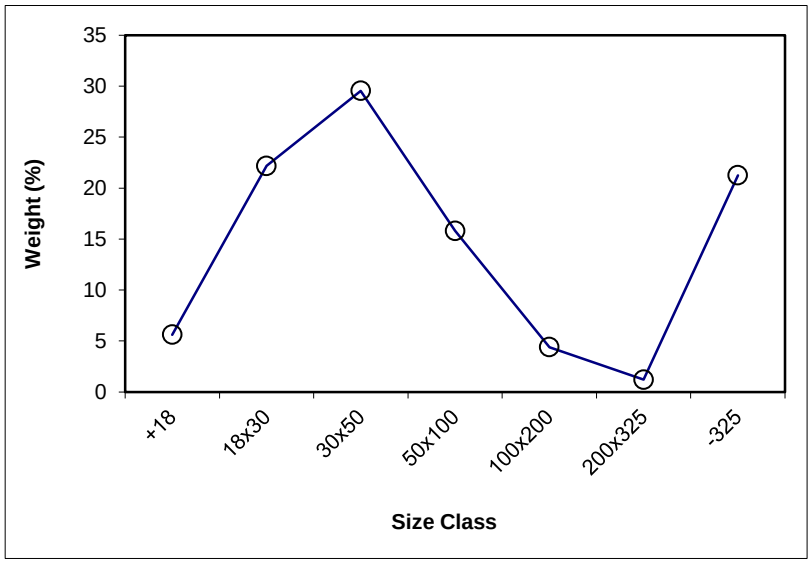
Description: Run 26 - Intermediate Spiral Test

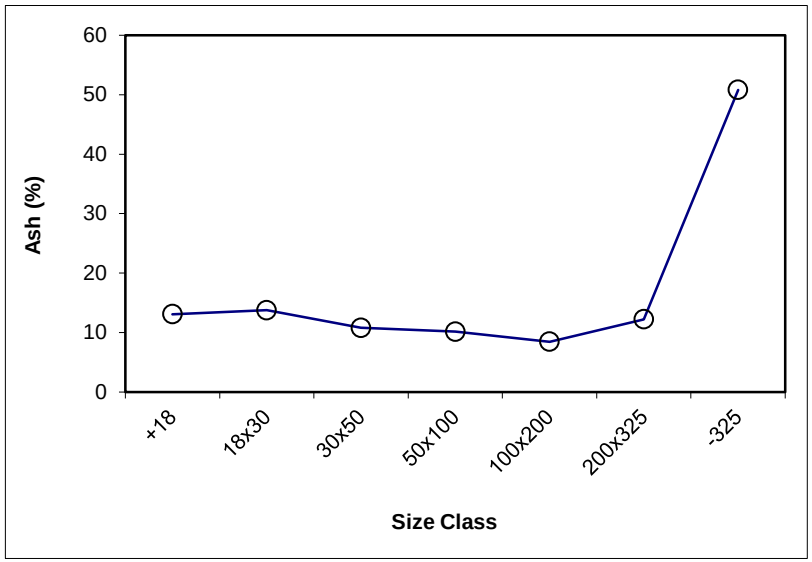
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	411.6	379.2	32.43	5.62	13.08	5.62	13.08	100.00	19.89
18x30	520.2	392.2	128.05	22.17	13.76	27.79	13.62	94.38	20.30
30x50	525.0	354.5	170.59	29.54	10.80	57.33	12.17	72.21	22.31
50x100	458.2	366.9	91.31	15.81	10.13	73.14	11.73	42.67	30.27
100x200	352.6	327.2	25.38	4.39	8.44	77.54	11.54	26.86	42.13
200x325	337.8	330.8	7.01	1.21	12.22	78.75	11.55	22.46	48.72
-325	129.0	6.3	122.71	21.25	50.80	100.00	19.89	21.25	50.80
Total (Calc)	--	--	577.49	100.00	19.89	--	--	--	--





SPIRAL DATA ANALYSIS

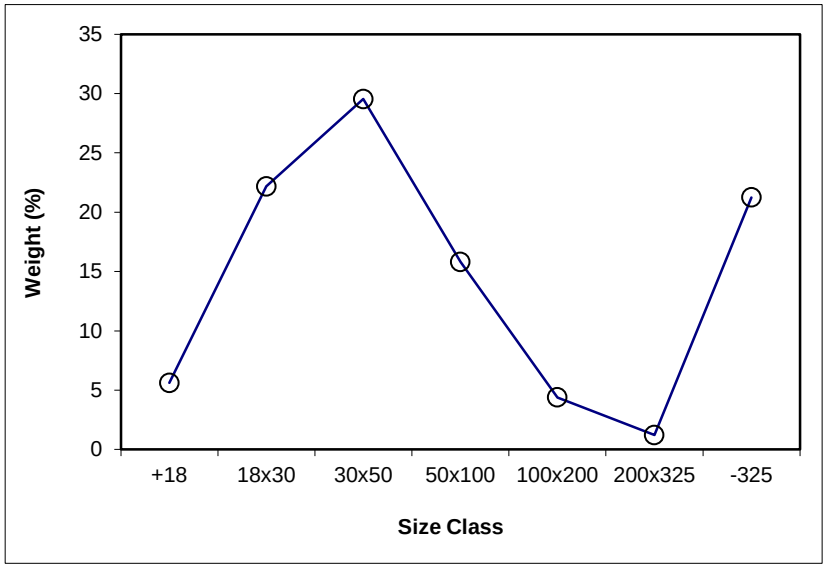
Description: Run 26 - Intermediate Spiral Test

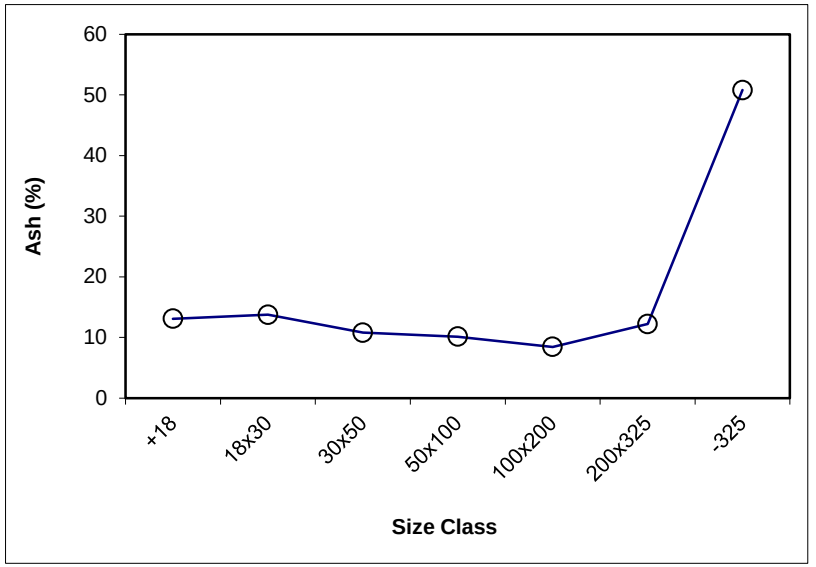
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	5.62	13.08	5.62	13.08	100.00	19.89			
18x30	22.17	13.76	27.79	13.62	94.38	20.30	x	22.17	13.76
30x50	29.54	10.80	57.33	12.17	72.21	22.31	x	29.54	10.80
50x100	15.81	10.13	73.14	11.73	42.67	30.27	x	15.81	10.13
100x200	4.39	8.44	77.54	11.54	26.86	42.13	x	4.39	8.44
200x325	1.21	12.22	78.75	11.55	22.46	48.72	x	1.21	12.22
-325	21.25	50.80	100.00	19.89	21.25	50.80			
Total (Calc)	100.00	19.89	--	--	--	--	--	73.13	11.44





SPIRAL DATA ANALYSIS

Description: Run 26 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 73.00

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	539.09	401.2	137.89	6.43	6.74	6.43	6.74	100.00	15.80
18x30	896.66	392.2	504.50	23.54	6.65	29.97	6.67	93.57	16.43
30x50	972.98	354.5	618.53	28.86	5.16	58.83	5.93	70.03	19.71
50x100	660.86	366.9	294.00	13.72	4.98	72.55	5.75	41.17	29.92
100x200	413.98	327.2	86.76	4.05	5.95	76.59	5.76	27.45	42.38
200x325	355.07	330.8	24.26	1.13	10.53	77.73	5.83	23.41	48.68
-325	483.66	6.3	477.41	22.27	50.62	100.00	15.80	22.27	50.62
Total (Calc)	--	--	2143.35	100.00	15.80	--	--	--	--

Product P2 Feed Weight (%): 12.07

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	401.5	379.2	22.26	3.77	21.53	3.77	21.53	100.00	18.66
18x30	504.1	392.2	111.99	18.96	16.27	22.73	17.14	96.23	18.54
30x50	549.7	354.5	195.29	33.06	7.50	55.79	11.43	77.27	19.10
50x100	467.3	366.9	100.44	17.00	5.91	72.79	10.14	44.21	27.77
100x200	354.7	327.2	27.50	4.66	7.06	77.44	9.96	27.21	41.43
200x325	339.3	330.8	8.49	1.44	11.26	78.88	9.98	22.56	48.53
-325	131.1	6.4	124.76	21.12	51.06	100.00	18.66	21.12	51.06
Total (Calc)	--	--	590.74	100.00	18.66	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 26 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 3.84

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	474.8	460.1	14.66	3.90	49.47	3.90	49.47	100.00	28.23
18x30	513.8	442.2	71.61	19.05	45.20	22.95	45.93	96.10	27.37
30x50	519.3	412.5	106.76	28.40	17.90	51.35	30.42	77.05	22.96
50x100	470.0	387.7	82.28	21.89	9.15	73.23	24.07	48.65	25.92
100x200	413.0	391.3	21.67	5.77	9.47	79.00	23.00	26.77	39.63
200x325	384.5	378.6	5.85	1.56	13.88	80.56	22.82	21.00	47.91
-325	79.3	6.2	73.10	19.44	50.64	100.00	28.23	19.44	50.64
Total (Calc)	--	--	375.93	100.00	28.23	--	--	--	--

Product P4 Feed Weight (%): 1.44

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	412.8	401.2	11.63	2.76	50.23	2.76	50.23	100.00	29.59
18x30	462.6	370.0	92.57	21.97	42.30	24.72	43.18	97.24	29.00
30x50	453.2	336.3	116.90	27.74	22.92	52.46	32.47	75.28	25.12
50x100	404.6	307.8	96.83	22.98	11.78	75.44	26.17	47.54	26.41
100x200	318.2	294.5	23.67	5.62	11.22	81.06	25.13	24.56	40.10
200x325	304.7	298.0	6.66	1.58	14.96	82.64	24.94	18.94	48.65
-325	79.5	6.4	73.18	17.36	51.72	100.00	29.59	17.36	51.72
Total (Calc)	--	--	421.43	100.00	29.59	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 26 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 2.05

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	389.4	379.2	10.23	1.70	45.93	1.70	45.93	100.00	29.87
18x30	482.0	392.2	89.86	14.96	41.21	16.67	41.69	98.30	29.59
30x50	542.4	354.5	187.99	31.31	24.59	47.97	30.53	83.33	27.51
50x100	518.2	366.9	151.30	25.20	15.85	73.17	25.47	52.03	29.27
100x200	362.0	327.2	34.73	5.78	13.60	78.95	24.60	26.83	41.87
200x325	340.1	330.8	9.27	1.54	18.17	80.50	24.48	21.05	49.64
-325	122.5	5.3	117.12	19.50	52.13	100.00	29.87	19.50	52.13
Total (Calc)	--	--	600.50	100.00	29.87	--	--	--	--

Product P6 Feed Weight (%): 0.49

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	460.8	460.1	0.65	0.23	28.27	0.23	28.27	100.00	31.08
18x30	446.6	442.2	4.40	1.54	35.55	1.77	34.61	99.77	31.09
30x50	455.1	412.5	42.58	14.90	24.85	16.67	25.89	98.23	31.02
50x100	492.8	387.7	105.10	36.77	18.75	53.44	20.98	83.33	32.12
100x200	427.3	391.3	35.93	12.57	17.53	66.01	20.32	46.56	42.68
200x325	386.8	378.6	8.19	2.87	22.05	68.87	20.39	33.99	51.98
-325	95.4	6.4	88.97	31.13	54.73	100.00	31.08	31.13	54.73
Total (Calc)	--	--	285.83	100.00	31.08	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 26 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 7.12

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	424.7	401.2	23.48	3.37	87.47	3.37	87.47	100.00	53.84
18x30	501.3	370.0	131.30	18.84	70.33	22.21	72.93	96.63	52.66
30x50	559.5	336.3	223.24	32.04	58.89	54.25	64.64	77.79	48.39
50x100	491.9	307.8	184.10	26.42	39.93	80.68	56.54	45.75	41.03
100x200	333.2	294.5	38.72	5.56	24.87	86.23	54.50	19.32	42.53
200x325	306.5	298.0	8.51	1.22	24.63	87.45	54.09	13.77	49.66
-325	93.8	6.4	87.42	12.55	52.10	100.00	53.84	12.55	52.10
Total (Calc)	--	--	696.77	100.00	53.84	--	--	--	--

SPIRAL DATA ANALYSIS

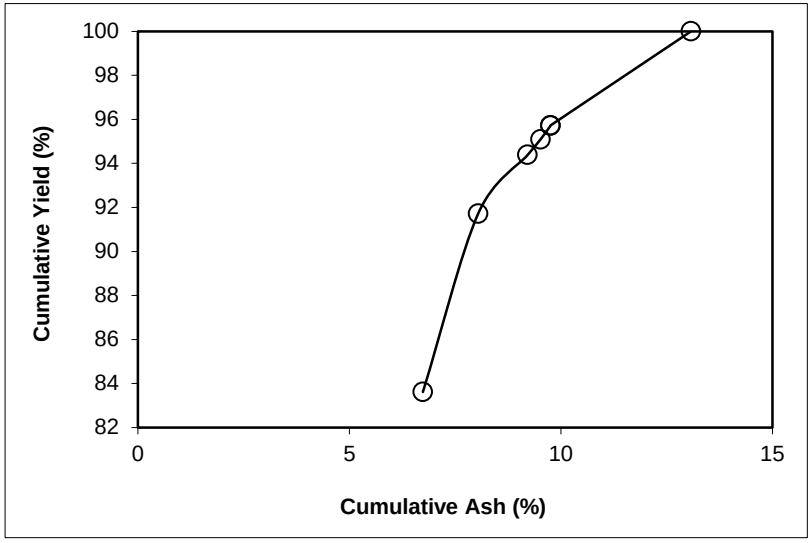
Description: Run 26 - Intermediate Spiral Test

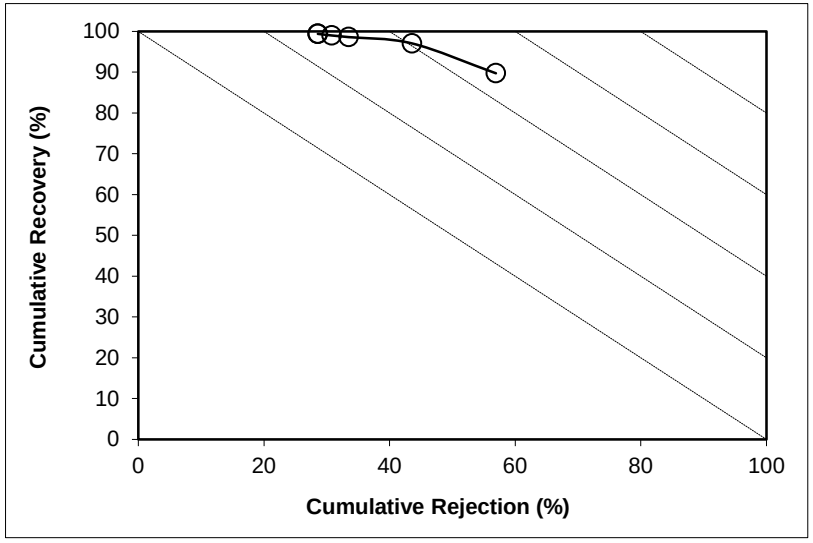
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 5.62

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	83.62	6.74	83.62	6.74	89.72	16.38	45.43	56.93	46.64
P2	8.10	21.53	91.72	8.04	97.03	8.28	68.81	43.59	40.62
P3	2.67	49.47	94.38	9.21	98.58	5.62	78.00	33.50	32.08
P4	0.71	50.23	95.09	9.52	98.98	4.91	81.99	30.79	29.77
P5	0.62	45.93	95.71	9.75	99.37	4.29	87.20	28.61	27.98
P6	0.02	28.27	95.73	9.76	99.38	4.27	87.47	28.57	27.96
P7	4.27	87.47	100.00	13.08	100.00	0.00			
Total (Calc)	100.00	13.08	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

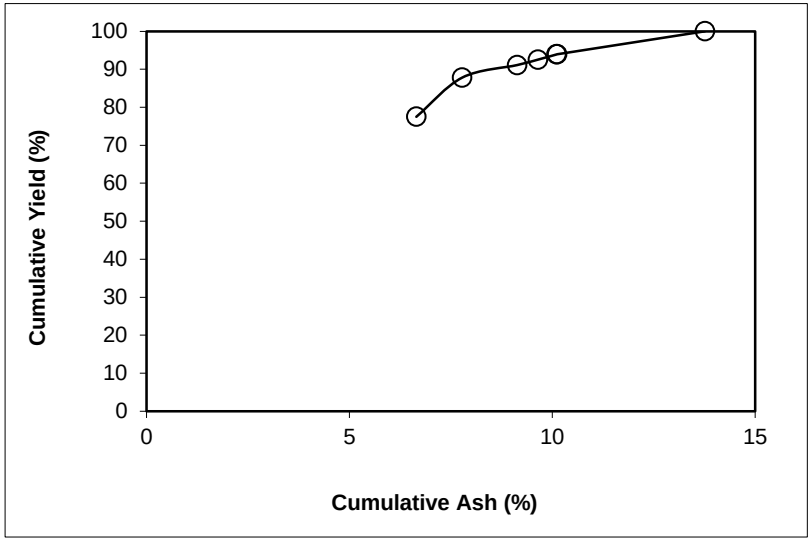
Description: Run 26 - Intermediate Spiral Test

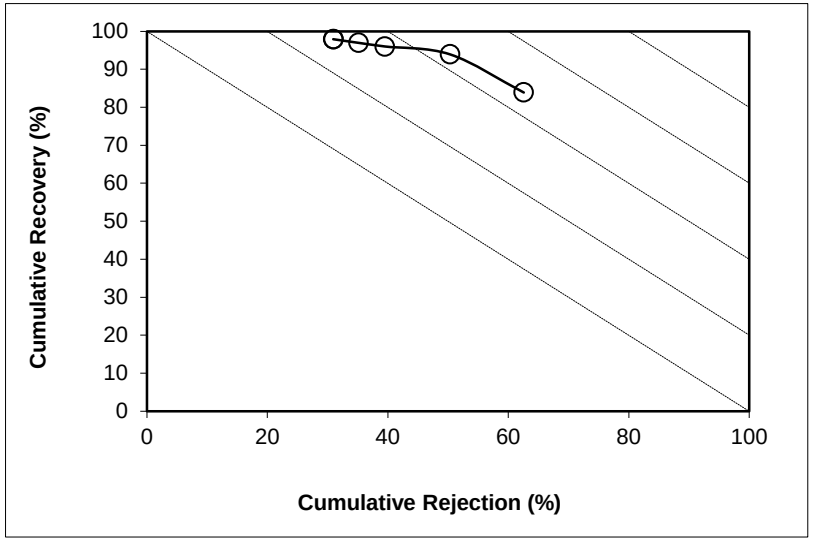
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 22.17

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	77.49	6.65	77.49	6.65	83.88	22.51	38.25	62.56	46.44
P2	10.32	16.27	87.81	7.78	93.90	12.19	56.86	50.35	44.26
P3	3.30	45.20	91.11	9.13	96.00	8.89	61.19	39.52	35.52
P4	1.42	42.30	92.54	9.64	96.95	7.46	64.78	35.14	32.10
P5	1.38	41.21	93.92	10.11	97.89	6.08	70.13	31.01	28.90
P6	0.03	35.55	93.95	10.12	97.92	6.05	70.33	30.92	28.84
P7	6.05	70.33	100.00	13.76	100.00	0.00			
Total (Calc)	100.00	13.76	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

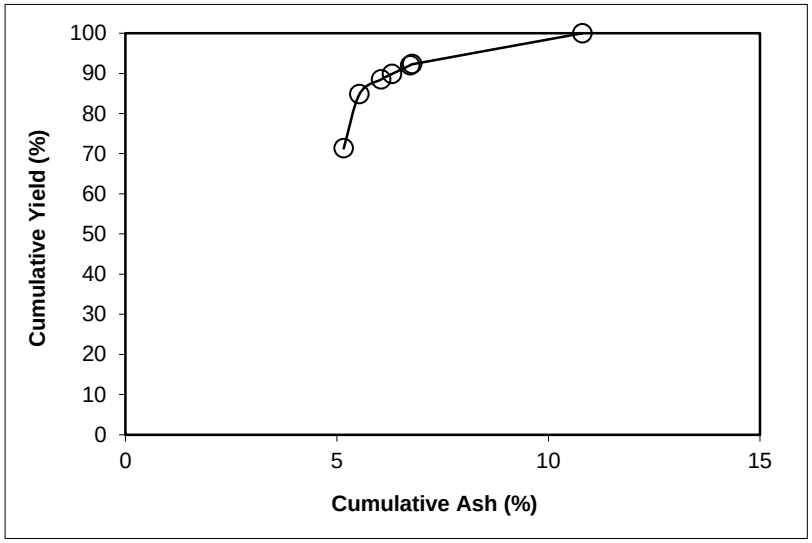
Description: Run 26 - Intermediate Spiral Test

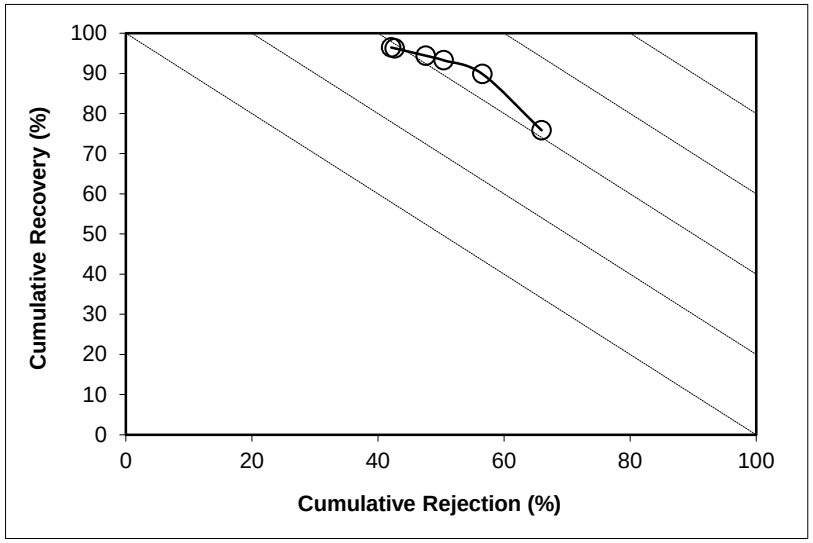
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 29.54

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	71.31	5.16	71.31	5.16	75.83	28.69	24.84	65.95	41.78
P2	13.51	7.50	84.82	5.53	89.84	15.18	40.27	56.57	46.41
P3	3.69	17.90	88.52	6.05	93.24	11.48	47.47	50.45	43.69
P4	1.35	22.92	89.87	6.30	94.40	10.13	50.73	47.59	42.00
P5	2.17	24.59	92.03	6.73	96.23	7.97	57.84	42.66	38.90
P6	0.25	24.85	92.28	6.78	96.44	7.72	58.89	42.10	38.54
P7	7.72	58.89	100.00	10.80	100.00	0.00			
Total (Calc)	100.00	10.80	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

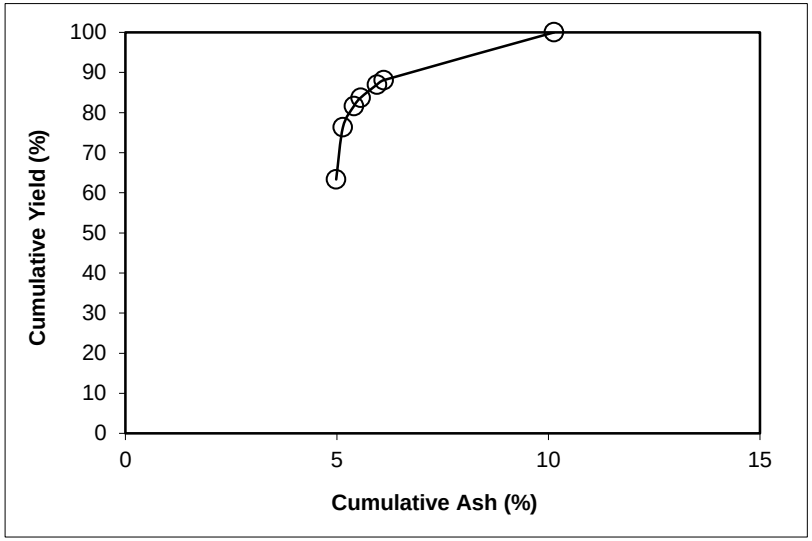
Description: Run 26 - Intermediate Spiral Test

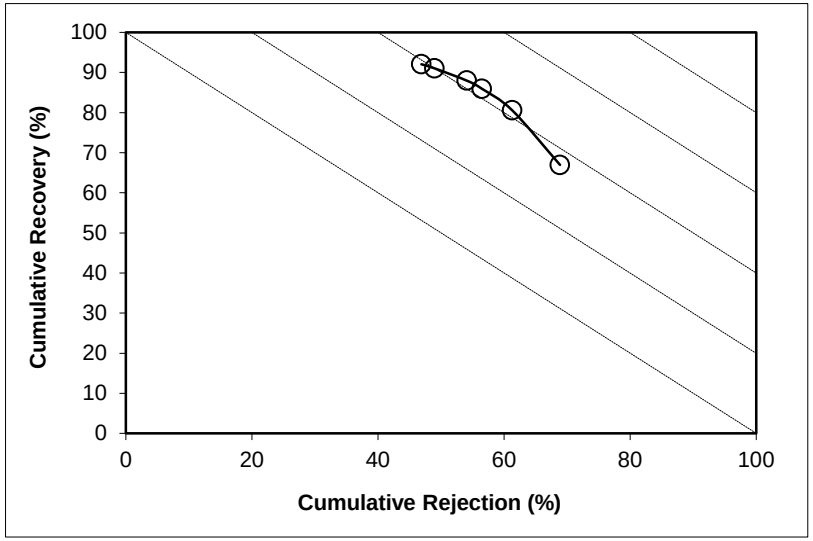
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 15.81

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	63.33	4.98	63.33	4.98	66.96	36.67	19.03	68.87	35.83
P2	12.98	5.91	76.31	5.14	80.55	23.69	26.22	61.30	41.85
P3	5.32	9.15	81.63	5.40	85.92	18.37	31.16	56.50	42.42
P4	2.09	11.78	83.71	5.56	87.97	16.29	33.64	54.07	42.04
P5	3.26	15.85	86.97	5.94	91.02	13.03	38.09	48.97	40.00
P6	1.13	18.75	88.10	6.11	92.05	11.90	39.93	46.88	38.93
P7	11.90	39.93	100.00	10.13	100.00	0.00			
Total (Calc)	100.00	10.13	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

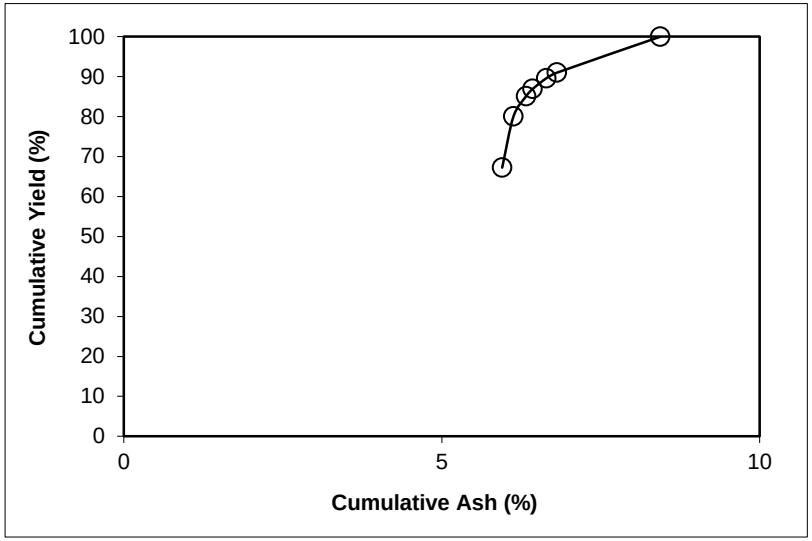
Description: Run 26 - Intermediate Spiral Test

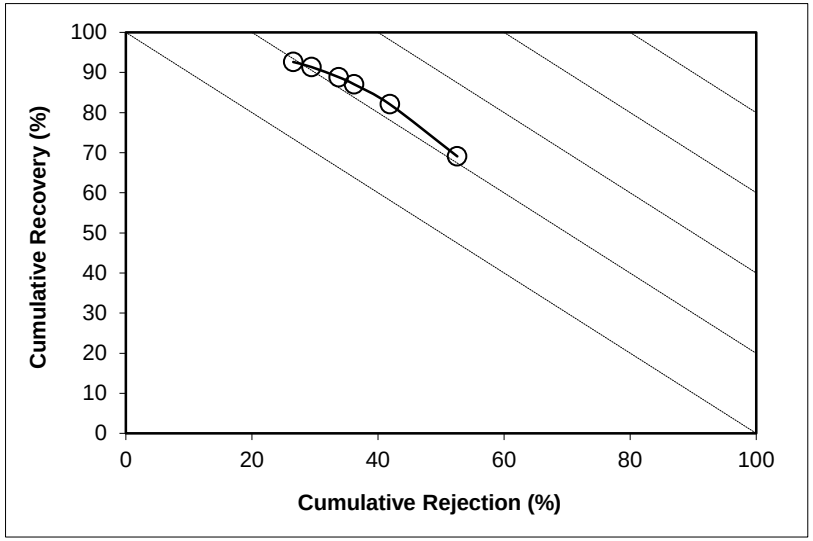
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 4.39

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	67.25	5.95	67.25	5.95	69.08	32.75	13.54	52.58	21.65
P2	12.79	7.06	80.04	6.13	82.06	19.96	17.70	41.88	23.93
P3	5.04	9.47	85.08	6.33	87.04	14.92	20.48	36.22	23.26
P4	1.83	11.22	86.91	6.43	88.82	13.09	21.77	33.78	22.59
P5	2.69	13.60	89.60	6.64	91.36	10.40	23.89	29.43	20.79
P6	1.39	17.53	91.00	6.81	92.61	9.00	24.87	26.54	19.15
P7	9.00	24.87	100.00	8.44	100.00	0.00			
Total (Calc)	100.00	8.44	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

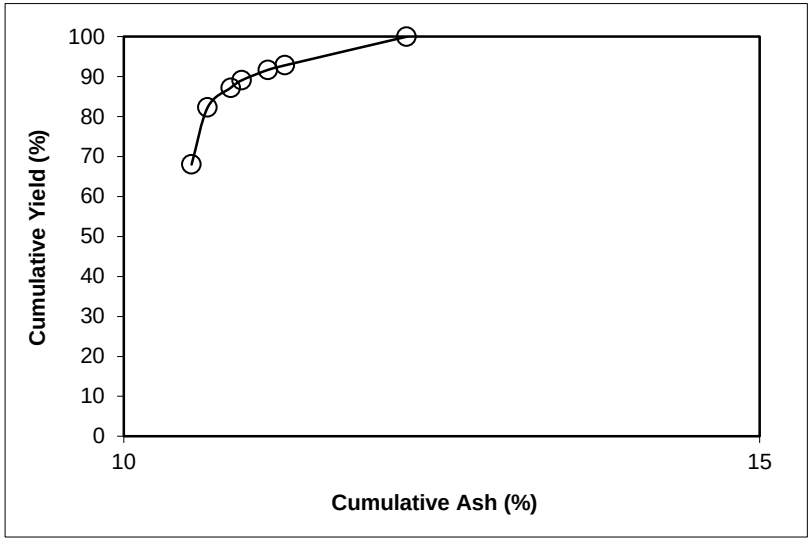
Description: Run 26 - Intermediate Spiral Test

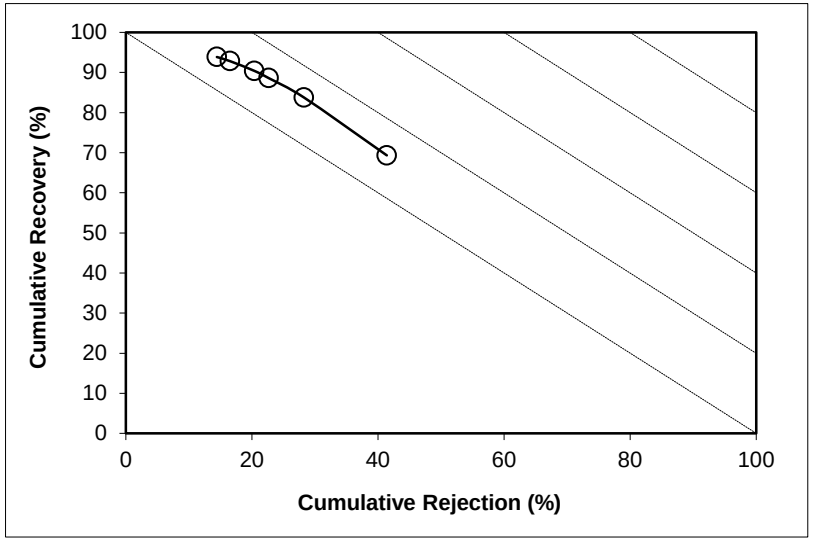
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 1.21

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	68.02	10.53	68.02	10.53	69.33	31.98	15.82	41.39	10.72
P2	14.28	11.26	82.30	10.66	83.77	17.70	19.50	28.23	12.00
P3	4.92	13.88	87.23	10.84	88.60	12.77	21.67	22.64	11.24
P4	1.87	14.96	89.09	10.93	90.41	10.91	22.82	20.36	10.77
P5	2.60	18.17	91.69	11.13	92.83	8.31	24.27	16.50	9.33
P6	1.15	22.05	92.84	11.27	93.85	7.16	24.63	14.42	8.28
P7	7.16	24.63	100.00	12.22	100.00	0.00			
Total (Calc)	100.00	12.22	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

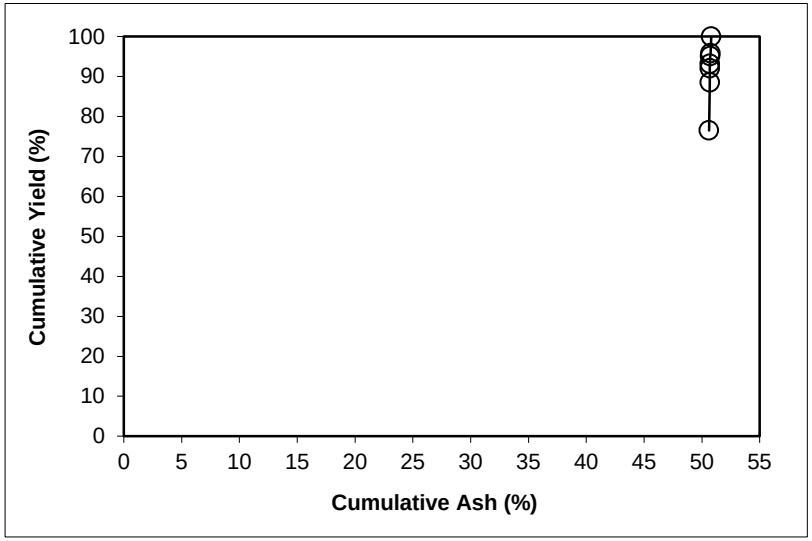
Description: Run 26 - Intermediate Spiral Test

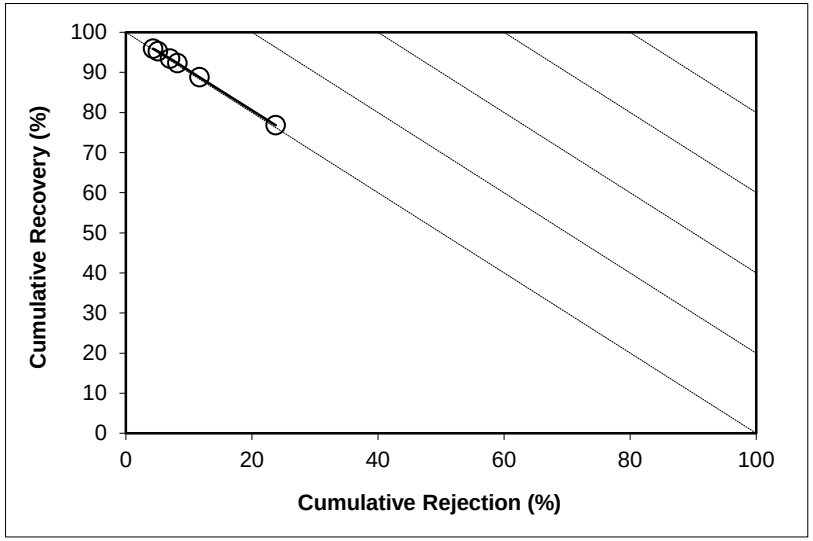
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 21.25

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	76.52	50.62	76.52	50.62	76.81	23.48	51.41	23.76	0.57
P2	12.00	51.06	88.52	50.68	88.75	11.48	51.78	11.70	0.45
P3	3.51	50.64	92.03	50.67	92.27	7.97	52.29	8.20	0.47
P4	1.17	51.72	93.21	50.69	93.42	6.79	52.38	7.01	0.43
P5	1.88	52.13	95.08	50.72	95.25	4.92	52.48	5.08	0.33
P6	0.71	54.73	95.80	50.75	95.91	4.20	52.10	4.31	0.22
P7	4.20	52.10	100.00	50.80	100.00	0.00			
Total (Calc)	100.00	50.80	--	--	--	--	--	--	--





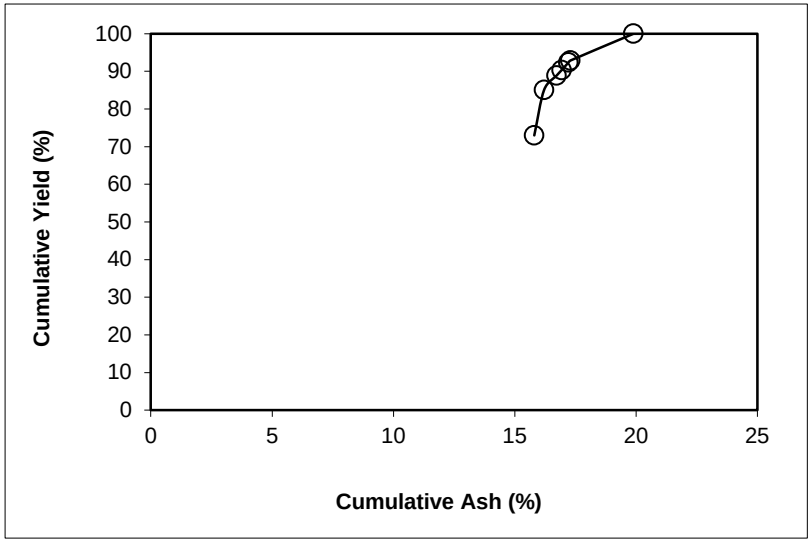
SPIRAL DATA ANALYSIS

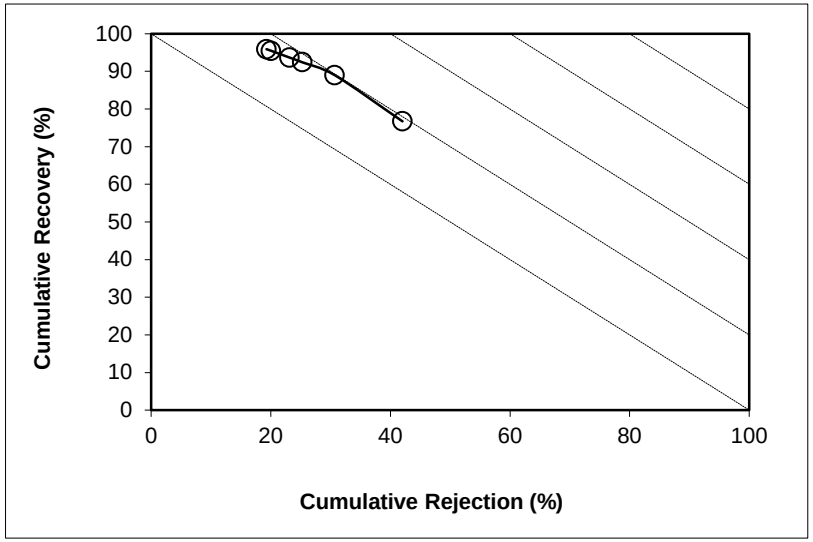
Description: Run 26 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	73.00	15.80	73.00	15.80	76.73	27.00	30.95	42.01	18.73
P2	12.07	18.66	85.07	16.21	88.99	14.93	40.89	30.69	19.67
P3	3.84	28.23	88.91	16.73	92.43	11.09	45.28	25.23	17.66
P4	1.44	29.59	90.35	16.93	93.69	9.65	47.61	23.10	16.79
P5	2.05	29.87	92.39	17.22	95.48	7.61	52.38	20.03	15.51
P6	0.49	31.08	92.88	17.29	95.90	7.12	53.84	19.27	15.16
P7	7.12	53.84	100.00	19.89	100.00	0.00			
Total (Calc)	100.00	19.89	--	--	--	--	--	--	--

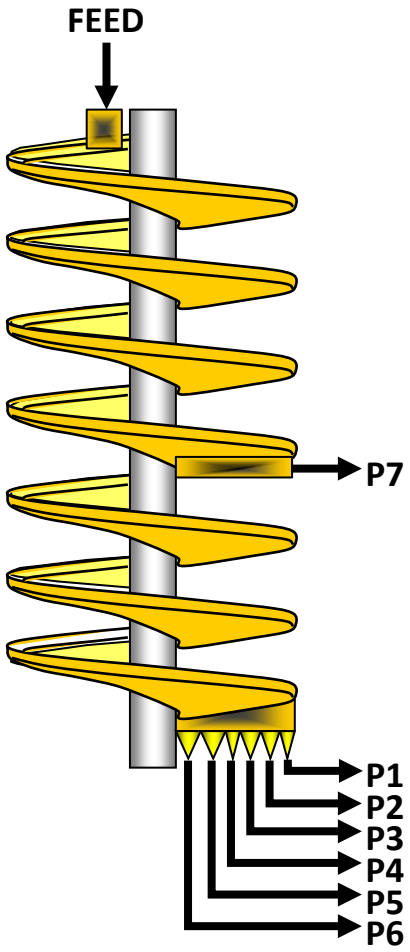




SPIRAL DATA ANALYSIS

Description: Run 27 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	1.656	25.4	19.42	24.24
P2	0.412	32.8	3.38	4.56
P3	0.171	38.6	1.09	1.53
P4	0.053	39.3	0.33	0.46
P5	0.052	30.7	0.47	0.61
P6	0.008	16.6	0.16	0.18
P7	0.428	53.4	1.49	2.30
Total	2.781	29.7	26.35	33.88

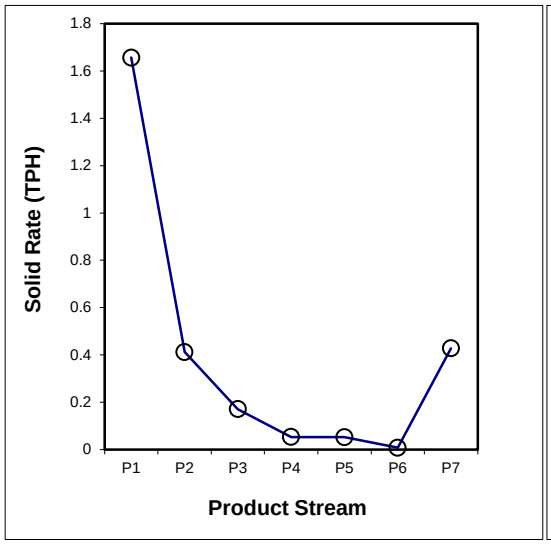
SPIRAL DATA ANALYSIS

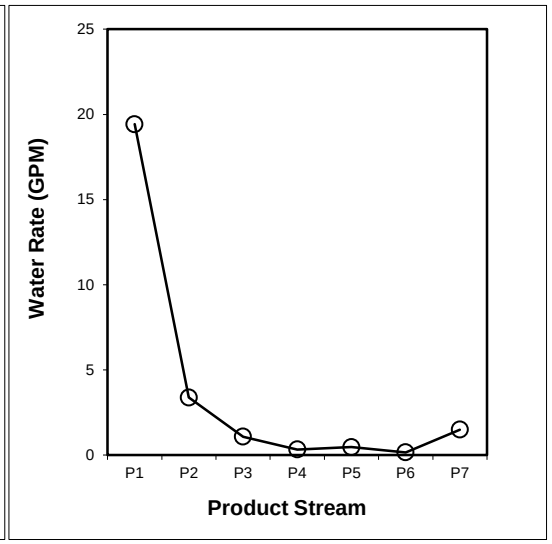
Description: Run 27 - Intermediate Spiral Test

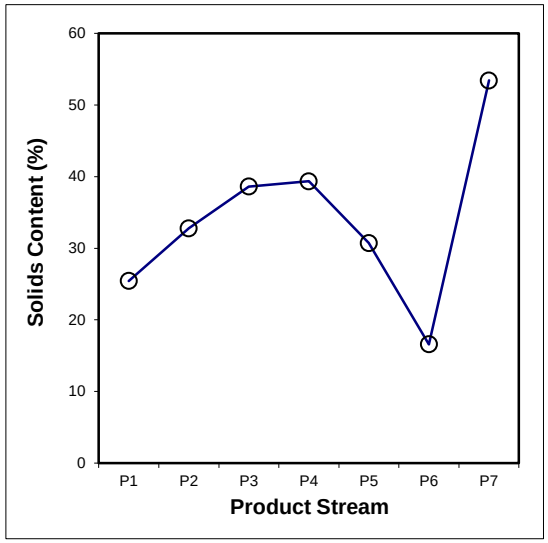
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	3	6187.00	1184.41	6.512	3732.2	2478.9	1.656	59.57	25.44
P2	5	1781.04	173.29	1.257	2675.6	2156.0	0.412	14.82	32.77
P3	10	1302.73	172.13	0.442	2586.9	2155.9	0.171	6.14	38.62
P4	25	1031.93	168.07	0.135	2348.4	2013.1	0.053	1.91	39.34
P5	30	1482.43	171.74	0.171	2874.8	2477.7	0.052	1.89	30.72
P6	60	925.10	170.85	0.049	2279.3	2156.0	0.008	0.29	16.59
P7	5	1187.64	171.79	0.801	3018.3	2478.9	0.428	15.38	53.42
Total (Calc)	--	--	--	9.368	--	--	2.781	100.00	29.69
Total (Head)	0.94	2444.51	217.07	9.368	2675.4	2014.2	2.781	--	29.69







SPIRAL DATA ANALYSIS

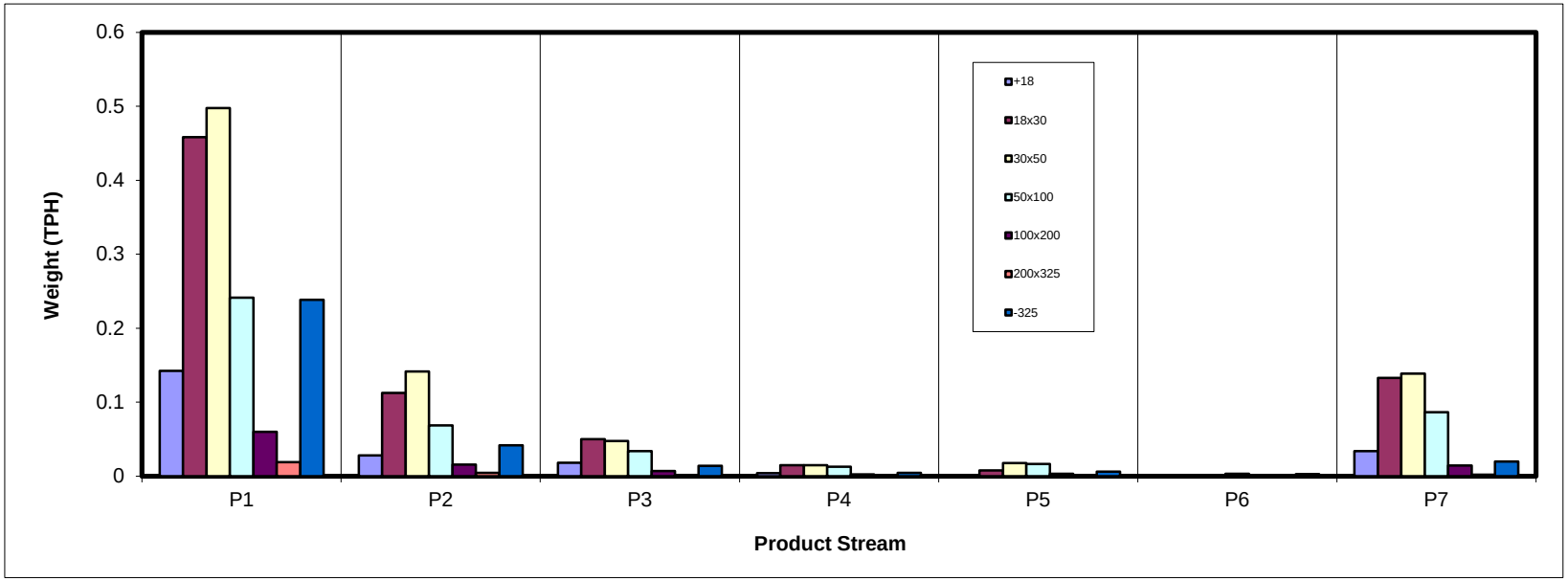
Description: Run 27 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.142	0.028	0.018	0.004	0.001	0.000	0.034		0.227
18x30	0.458	0.112	0.050	0.015	0.008	0.000	0.133		0.776
30x50	0.498	0.142	0.047	0.015	0.018	0.001	0.139		0.858
50x100	0.241	0.069	0.034	0.013	0.016	0.003	0.086		0.462
100x200	0.060	0.016	0.007	0.002	0.003	0.001	0.014		0.103
200x325	0.019	0.004	0.002	0.000	0.001	0.000	0.002		0.028
-325	0.238	0.042	0.014	0.004	0.006	0.003	0.020		0.327
Total (Calc)	1.656	0.412	0.171	0.053	0.052	0.008	0.428		2.781



SPIRAL DATA ANALYSIS

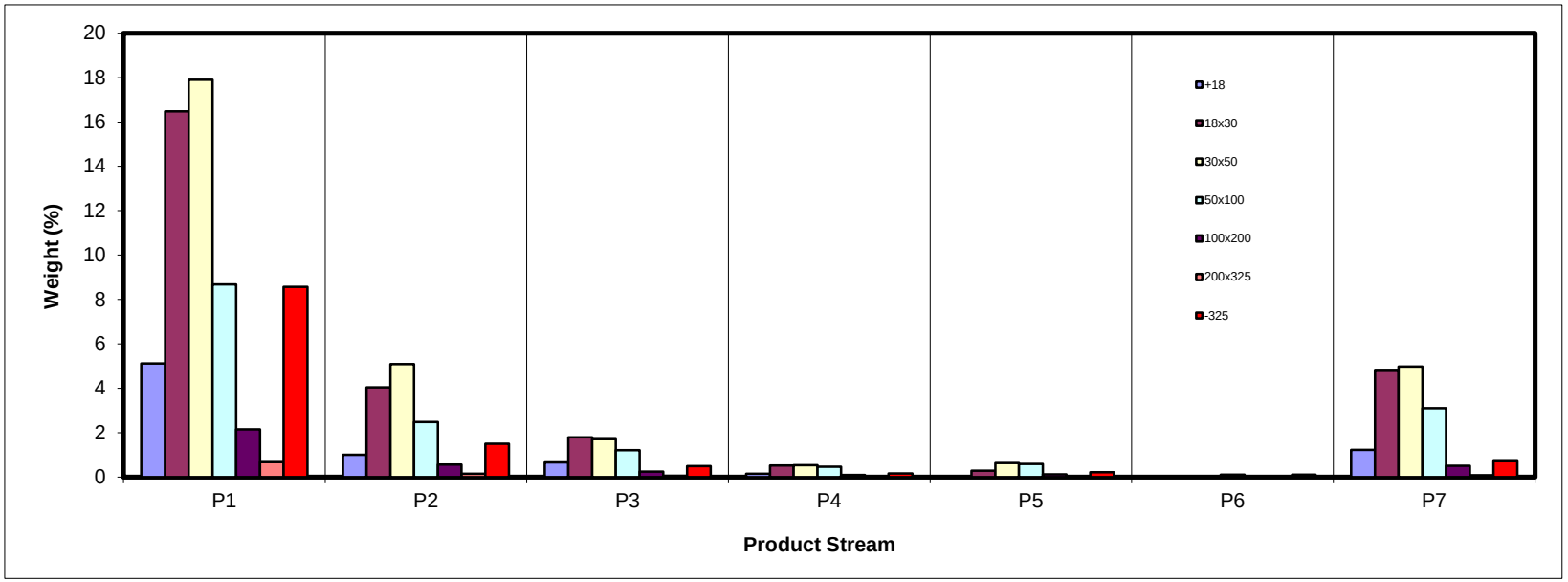
Description: Run 27 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	5.11	1.01	0.65	0.14	0.04	0.00	1.22		8.17
18x30	16.48	4.04	1.79	0.53	0.28	0.01	4.78		27.89
30x50	17.90	5.09	1.70	0.53	0.63	0.04	4.98		30.87
50x100	8.68	2.47	1.21	0.46	0.58	0.11	3.10		16.61
100x200	2.15	0.56	0.24	0.09	0.11	0.03	0.51		3.69
200x325	0.68	0.15	0.06	0.02	0.02	0.01	0.07		1.00
-325	8.57	1.49	0.50	0.16	0.22	0.10	0.71		11.76
Total (Calc)	59.57	14.82	6.14	1.91	1.89	0.29	15.38		100.00



SPIRAL DATA ANALYSIS

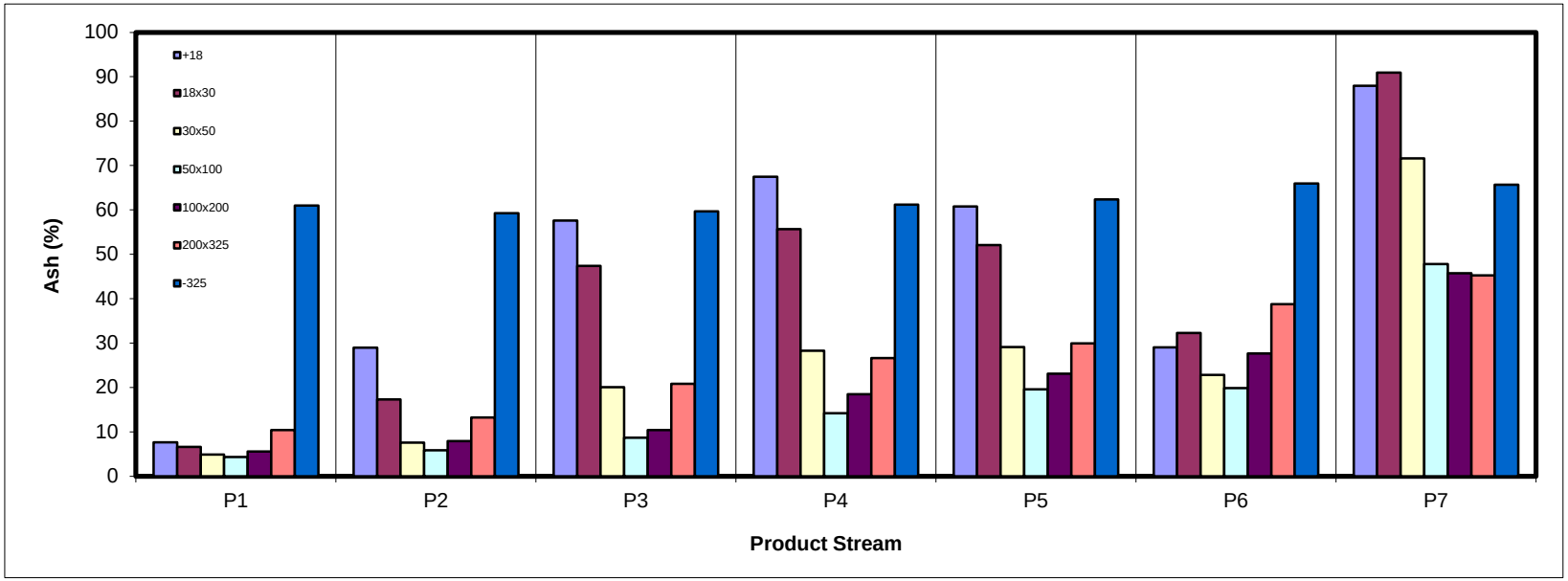
Description: Run 27 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	7.65	28.98	57.63	67.44	60.75	29.04	87.93		27.54
18x30	6.62	17.27	47.40	55.66	52.05	32.26	90.94		26.61
30x50	4.85	7.61	20.07	28.27	29.08	22.85	71.58		17.83
50x100	4.36	5.82	8.66	14.19	19.58	19.83	47.77		13.91
100x200	5.56	7.92	10.38	18.47	23.13	27.67	45.72		12.81
200x325	10.40	13.25	20.83	26.62	29.91	38.74	45.23		14.88
-325	60.99	59.24	59.65	61.20	62.38	65.93	65.71		61.07
Total (Calc)	13.68	16.67	32.60	37.52	33.75	37.83	72.83		25.29



SPIRAL DATA ANALYSIS

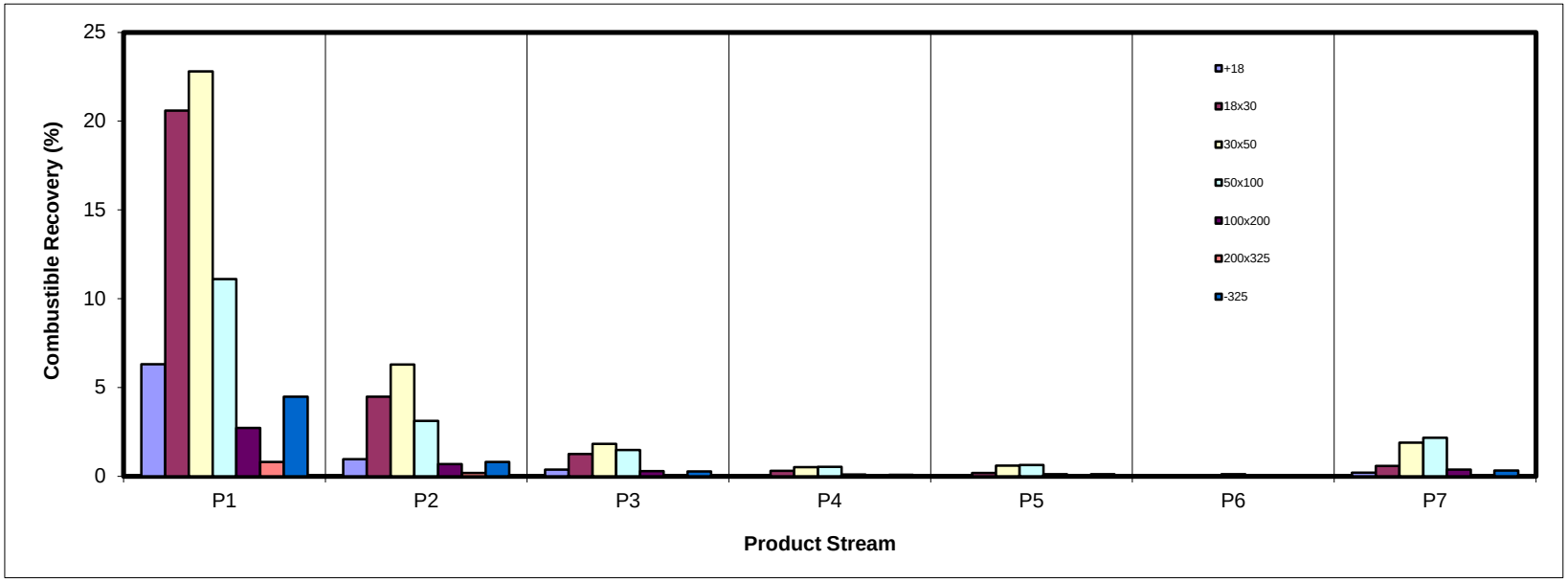
Description: Run 27 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	6.32	0.96	0.37	0.06	0.02	0.00	0.20		7.92
18x30	20.59	4.47	1.26	0.31	0.18	0.01	0.58		27.40
30x50	22.80	6.29	1.82	0.51	0.60	0.04	1.89		33.95
50x100	11.11	3.12	1.48	0.53	0.63	0.12	2.17		19.14
100x200	2.72	0.69	0.29	0.09	0.12	0.03	0.37		4.31
200x325	0.81	0.18	0.06	0.02	0.02	0.00	0.05		1.14
-325	4.48	0.81	0.27	0.08	0.11	0.05	0.33		6.13
Total (Calc)	68.82	16.53	5.54	1.60	1.67	0.24	5.59		100.00



SPIRAL DATA ANALYSIS

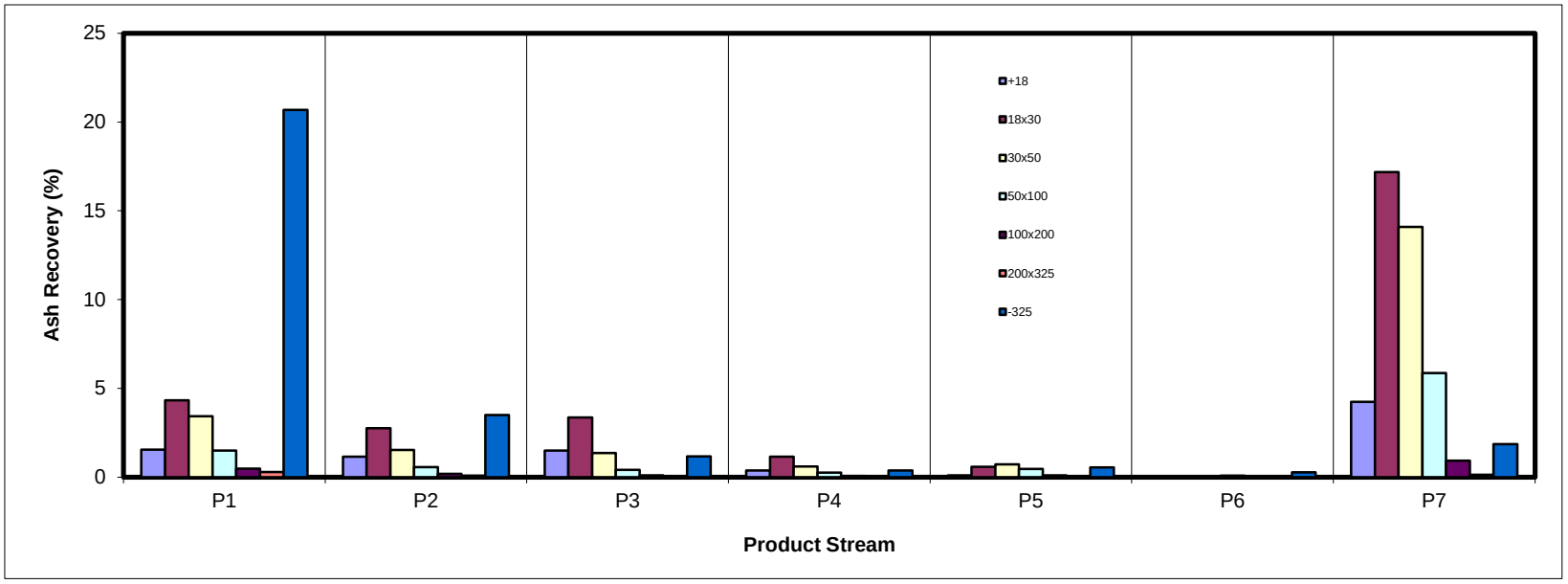
Description: Run 27 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	1.55	1.15	1.49	0.37	0.10	0.00	4.24		8.90
18x30	4.32	2.76	3.35	1.16	0.57	0.01	17.18		29.35
30x50	3.43	1.53	1.35	0.59	0.72	0.03	14.10		21.77
50x100	1.50	0.57	0.41	0.26	0.45	0.09	5.86		9.14
100x200	0.47	0.18	0.10	0.06	0.10	0.04	0.92		1.87
200x325	0.28	0.08	0.05	0.02	0.03	0.01	0.13		0.59
-325	20.68	3.50	1.17	0.38	0.54	0.27	1.85		28.39
Total (Calc)	32.22	9.77	7.92	2.84	2.52	0.44	44.30		100.00



SPIRAL DATA ANALYSIS

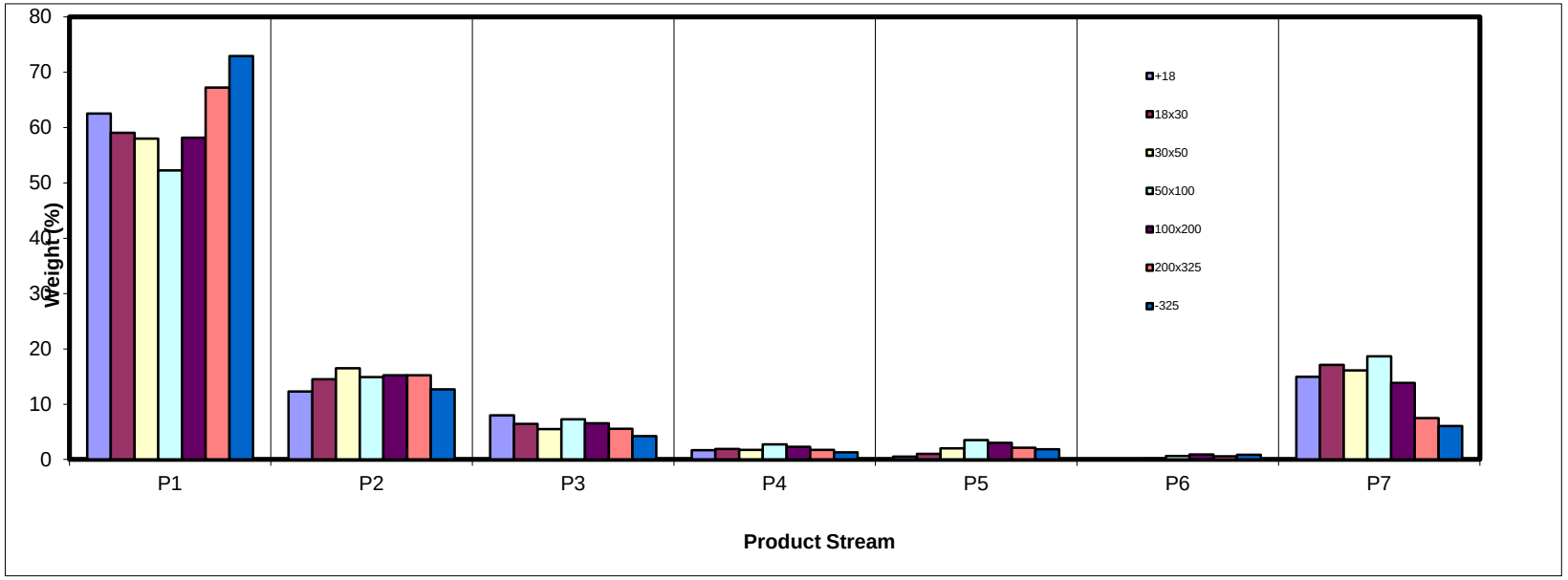
Description: Run 27 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	62.55	12.31	7.99	1.71	0.51	0.00	14.93		100.00
18x30	59.07	14.49	6.41	1.88	1.00	0.02	17.13		100.00
30x50	57.99	16.48	5.51	1.72	2.04	0.12	16.13		100.00
50x100	52.24	14.88	7.27	2.75	3.52	0.65	18.68		100.00
100x200	58.19	15.21	6.54	2.31	3.03	0.89	13.82		100.00
200x325	67.26	15.25	5.54	1.76	2.14	0.58	7.47		100.00
-325	72.94	12.71	4.23	1.32	1.87	0.87	6.07		100.00
Total (Calc)	59.57	14.82	6.14	1.91	1.89	0.29	15.38		100.00



SPIRAL DATA ANALYSIS

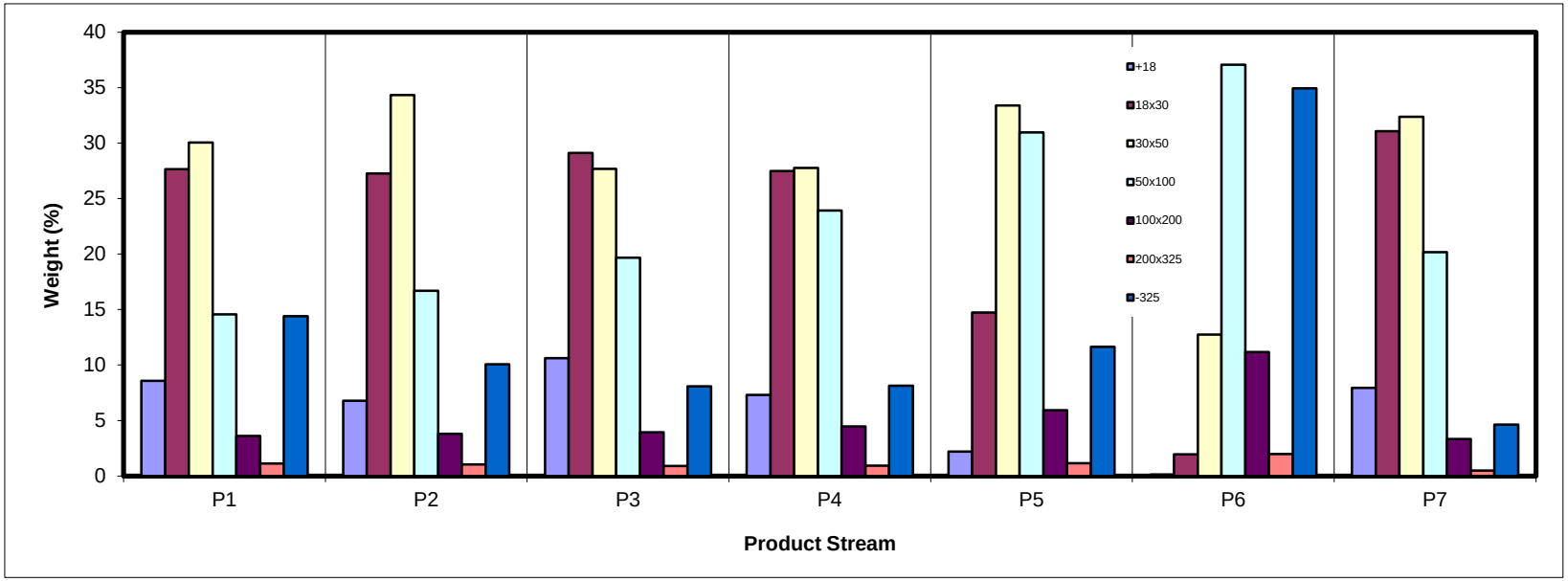
Description: Run 27 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	8.58	6.79	10.62	7.31	2.20	0.14	7.93		8.17
18x30	27.66	27.27	29.11	27.49	14.74	1.96	31.07		27.89
30x50	30.05	34.35	27.68	27.75	33.39	12.75	32.38		30.87
50x100	14.57	16.69	19.66	23.92	30.97	37.06	20.18		16.61
100x200	3.61	3.79	3.93	4.46	5.93	11.17	3.32		3.69
200x325	1.13	1.03	0.91	0.93	1.14	1.98	0.49		1.00
-325	14.39	10.08	8.09	8.14	11.63	34.94	4.64		11.76
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

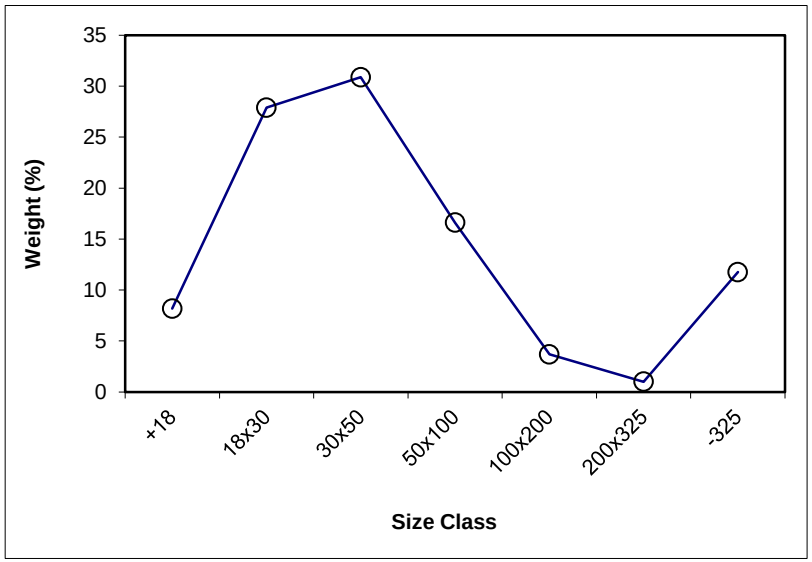
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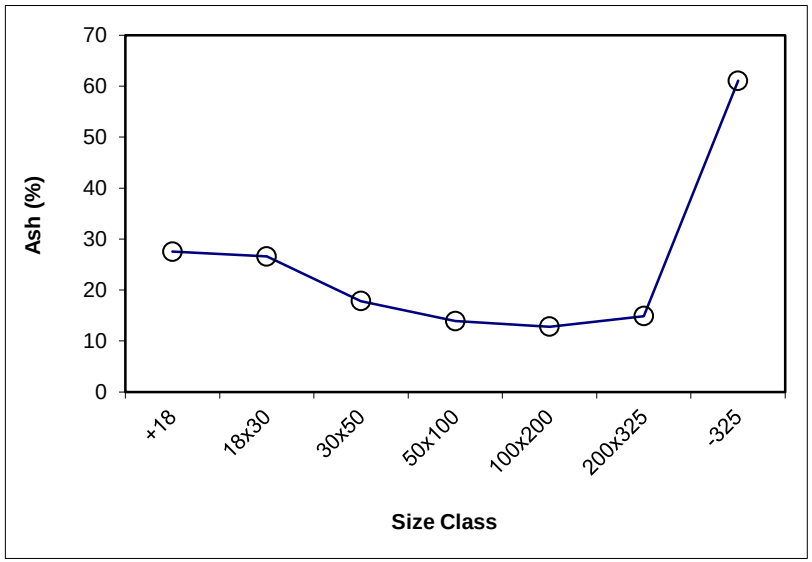
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	455.2	401.2	54.02	8.17	27.54	8.17	27.54	100.00	25.29
18x30	554.5	370.0	184.45	27.89	26.61	36.06	26.82	91.83	25.09
30x50	540.4	336.3	204.12	30.87	17.83	66.94	22.67	63.94	24.42
50x100	417.7	307.8	109.85	16.61	13.91	83.55	20.93	33.06	30.58
100x200	318.9	294.5	24.42	3.69	12.81	87.24	20.59	16.45	47.42
200x325	304.6	298.0	6.64	1.00	14.88	88.24	20.52	12.76	57.43
-325	84.1	6.4	77.73	11.76	61.07	100.00	25.29	11.76	61.07
Total (Calc)	--	--	661.23	100.00	25.29	--	--	--	--





SPIRAL DATA ANALYSIS

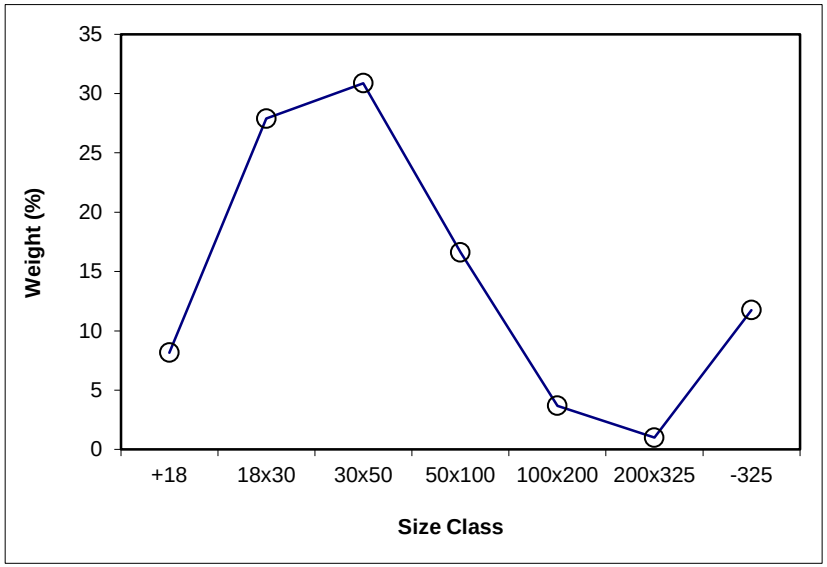
Description: Run 27 - Intermediate Spiral Test

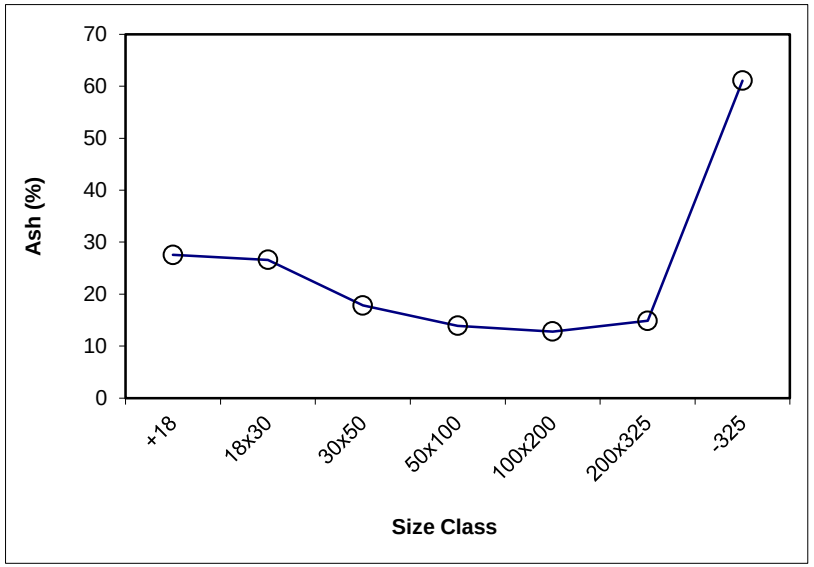
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	8.17	27.54	8.17	27.54	100.00	25.29			
18x30	27.89	26.61	36.06	26.82	91.83	25.09	x	27.89	26.61
30x50	30.87	17.83	66.94	22.67	63.94	24.42	x	30.87	17.83
50x100	16.61	13.91	83.55	20.93	33.06	30.58	x	16.61	13.91
100x200	3.69	12.81	87.24	20.59	16.45	47.42	x	3.69	12.81
200x325	1.00	14.88	88.24	20.52	12.76	57.43	x	1.00	14.88
-325	11.76	61.07	100.00	25.29	11.76	61.07			
Total (Calc)	100.00	25.29	--	--	--	--	--	80.07	19.80





SPIRAL DATA ANALYSIS

Description: Run 27 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 59.57

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	567.68	460.1	107.54	8.58	7.65	8.58	7.65	100.00	13.68
18x30	788.86	442.2	346.71	27.66	6.62	36.24	6.87	91.42	14.24
30x50	789.21	412.5	376.68	30.05	4.85	66.30	5.95	63.76	17.55
50x100	570.30	387.7	182.61	14.57	4.36	80.87	5.67	33.70	28.87
100x200	436.55	391.3	45.21	3.61	5.56	84.47	5.66	19.13	47.54
200x325	392.81	378.6	14.21	1.13	10.40	85.61	5.72	15.53	57.29
-325	186.82	6.4	180.41	14.39	60.99	100.00	13.68	14.39	60.99
Total (Calc)	--	--	1253.37	100.00	13.68	--	--	--	--

Product P2 Feed Weight (%): 14.82

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	414.5	379.2	35.27	6.79	28.98	6.79	28.98	100.00	16.67
18x30	533.9	392.2	141.71	27.27	17.27	34.06	19.60	93.21	15.77
30x50	532.9	354.5	178.46	34.35	7.61	68.41	13.58	65.94	15.15
50x100	453.6	366.9	86.72	16.69	5.82	85.09	12.06	31.59	23.36
100x200	346.9	327.2	19.70	3.79	7.92	88.89	11.88	14.91	42.99
200x325	336.2	330.8	5.37	1.03	13.25	89.92	11.90	11.11	54.96
-325	57.6	5.3	52.38	10.08	59.24	100.00	16.67	10.08	59.24
Total (Calc)	--	--	519.62	100.00	16.67	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 27 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 6.14

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	425.0	379.2	45.76	10.62	57.63	10.62	57.63	100.00	32.60
18x30	517.6	392.2	125.45	29.11	47.40	39.73	50.13	89.38	29.62
30x50	473.8	354.5	119.31	27.68	20.07	67.41	37.79	60.27	21.04
50x100	451.6	366.9	84.74	19.66	8.66	87.08	31.21	32.59	21.86
100x200	344.2	327.2	16.95	3.93	10.38	91.01	30.31	12.92	41.94
200x325	334.7	330.8	3.90	0.91	20.83	91.91	30.22	8.99	55.74
-325	40.1	5.2	34.84	8.09	59.65	100.00	32.60	8.09	59.65
Total (Calc)	--	--	430.96	100.00	32.60	--	--	--	--

Product P4 Feed Weight (%): 1.91

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	425.7	401.2	24.50	7.31	67.44	7.31	67.44	100.00	37.52
18x30	462.2	370.0	92.20	27.49	55.66	34.80	58.13	92.69	35.16
30x50	429.3	336.3	93.06	27.75	28.27	62.55	44.88	65.20	26.52
50x100	388.0	307.8	80.21	23.92	14.19	86.47	36.39	37.45	25.23
100x200	309.5	294.5	14.97	4.46	18.47	90.93	35.51	13.53	44.74
200x325	301.1	298.0	3.11	0.93	26.62	91.86	35.42	9.07	57.67
-325	32.6	5.3	27.30	8.14	61.20	100.00	37.52	8.14	61.20
Total (Calc)	--	--	335.34	100.00	37.52	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 27 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 1.89

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	468.9	460.1	8.74	2.20	60.75	2.20	60.75	100.00	33.75
18x30	500.7	442.2	58.53	14.74	52.05	16.94	53.18	97.80	33.14
30x50	545.1	412.5	132.58	33.39	29.08	50.33	37.20	83.06	29.79
50x100	510.7	387.7	122.99	30.97	19.58	81.30	30.48	49.67	30.26
100x200	414.9	391.3	23.54	5.93	23.13	87.23	29.98	18.70	47.95
200x325	383.1	378.6	4.53	1.14	29.91	88.37	29.98	12.77	59.48
-325	51.4	5.2	46.17	11.63	62.38	100.00	33.75	11.63	62.38
Total (Calc)	--	--	397.09	100.00	33.75	--	--	--	--

Product P6 Feed Weight (%): 0.29

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	379.4	379.2	0.17	0.14	29.04	0.14	29.04	100.00	37.83
18x30	394.6	392.2	2.42	1.96	32.26	2.09	32.05	99.86	37.84
30x50	370.2	354.5	15.73	12.75	22.85	14.85	24.15	97.91	37.95
50x100	412.6	366.9	45.71	37.06	19.83	51.91	21.07	85.15	40.21
100x200	341.0	327.2	13.77	11.17	27.67	63.08	22.23	48.09	55.92
200x325	333.3	330.8	2.44	1.98	38.74	65.06	22.74	36.92	64.47
-325	48.4	5.3	43.09	34.94	65.93	100.00	37.83	34.94	65.93
Total (Calc)	--	--	123.33	100.00	37.83	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 27 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 15.38

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	502.9	460.1	42.77	7.93	87.93	7.93	87.93	100.00	72.83
18x30	609.7	442.2	167.57	31.07	90.94	39.00	90.33	92.07	71.53
30x50	587.2	412.5	174.68	32.38	71.58	71.38	81.82	61.00	61.64
50x100	496.5	387.7	108.83	20.18	47.77	91.56	74.32	28.62	50.40
100x200	409.2	391.3	17.90	3.32	45.72	94.87	73.32	8.44	56.67
200x325	381.2	378.6	2.63	0.49	45.23	95.36	73.17	5.13	63.76
-325	31.4	6.4	25.02	4.64	65.71	100.00	72.83	4.64	65.71
Total (Calc)	--	--	539.40	100.00	72.83	--	--	--	--

SPIRAL DATA ANALYSIS

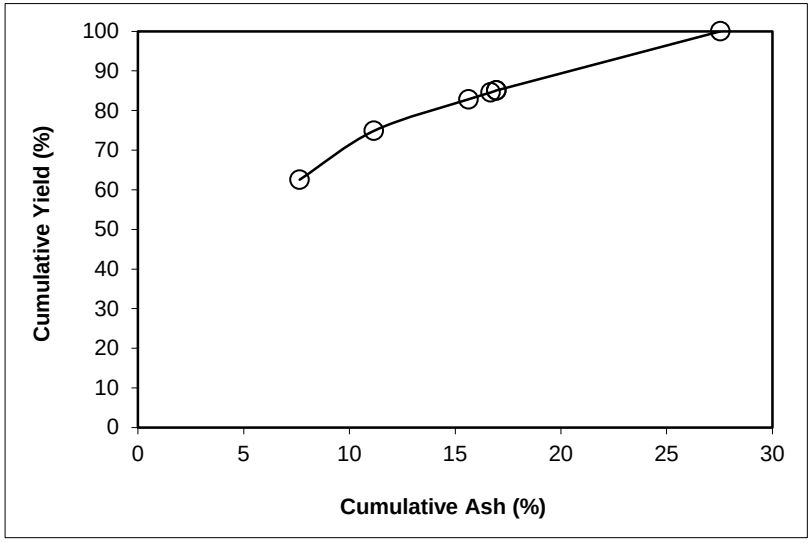
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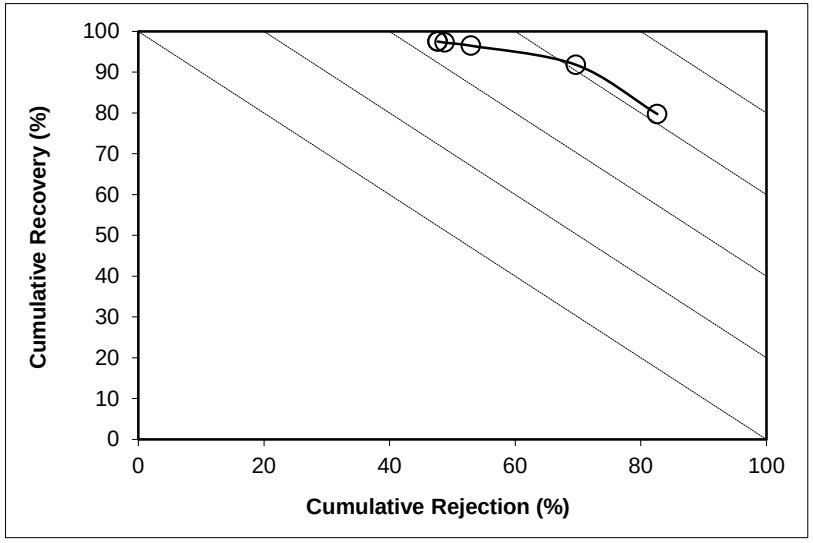
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 8.17

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	62.55	7.65	62.55	7.65	79.73	37.45	60.78	82.63	62.36
P2	12.31	28.98	74.86	11.15	91.79	25.14	76.35	69.68	61.48
P3	7.99	57.63	82.85	15.63	96.46	17.15	85.06	52.97	49.44
P4	1.71	67.44	84.56	16.68	97.23	15.44	87.01	48.78	46.02
P5	0.51	60.75	85.07	16.94	97.51	14.93	87.91	47.66	45.17
P6	0.00	29.04	85.07	16.95	97.51	14.93	87.93	47.66	45.17
P7	14.93	87.93	100.00	27.54	100.00	0.00			
Total (Calc)	100.00	27.54	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

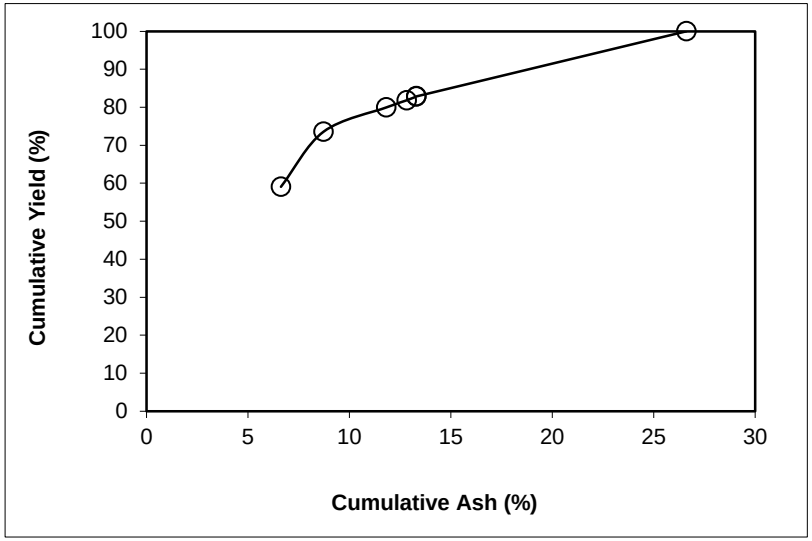
Description: Run 27 - Intermediate Spiral Test

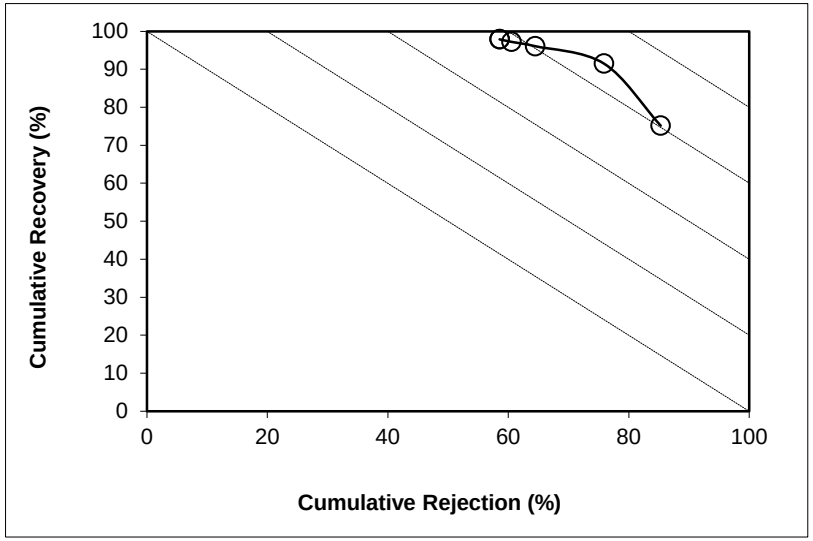
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 27.89

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	59.07	6.62	59.07	6.62	75.15	40.93	55.44	85.29	60.45
P2	14.49	17.27	73.56	8.72	91.48	26.44	76.36	75.89	67.37
P3	6.41	47.40	79.97	11.82	96.08	20.03	85.63	64.47	60.54
P4	1.88	55.66	81.85	12.83	97.22	18.15	88.74	60.52	57.74
P5	1.00	52.05	82.85	13.30	97.87	17.15	90.87	58.57	56.44
P6	0.02	32.26	82.87	13.31	97.89	17.13	90.94	58.55	56.43
P7	17.13	90.94	100.00	26.61	100.00	0.00			
Total (Calc)	100.00	26.61	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

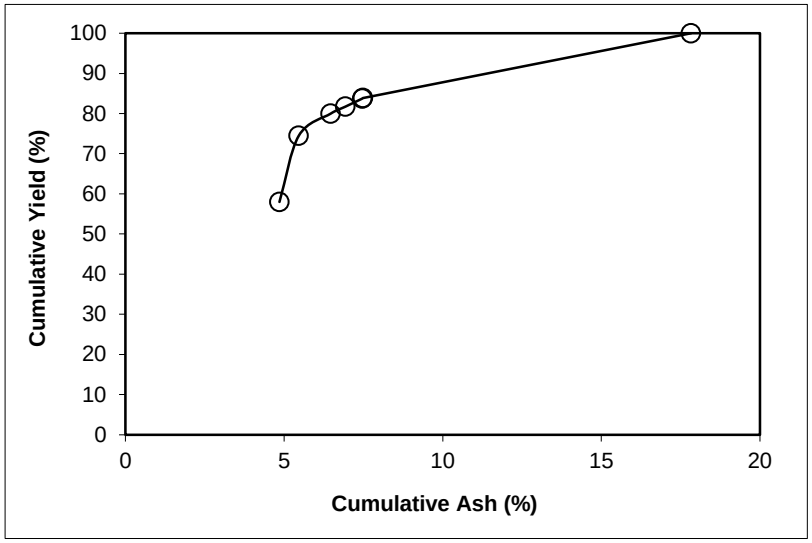
Description: Run 27 - Intermediate Spiral Test

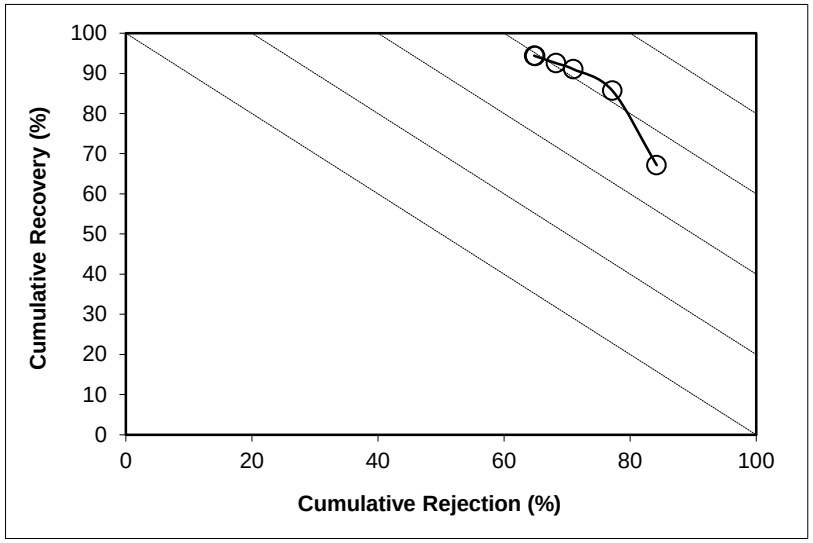
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 30.87

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	57.99	4.85	57.99	4.85	67.15	42.01	35.74	84.22	51.37
P2	16.48	7.61	74.47	5.46	85.68	25.53	53.91	77.19	62.87
P3	5.51	20.07	79.98	6.47	91.04	20.02	63.23	70.99	62.03
P4	1.72	28.27	81.70	6.93	92.54	18.30	66.51	68.26	60.80
P5	2.04	29.08	83.74	7.47	94.31	16.26	71.21	64.93	59.24
P6	0.12	22.85	83.87	7.49	94.42	16.13	71.58	64.77	59.19
P7	16.13	71.58	100.00	17.83	100.00	0.00			
Total (Calc)	100.00	17.83	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

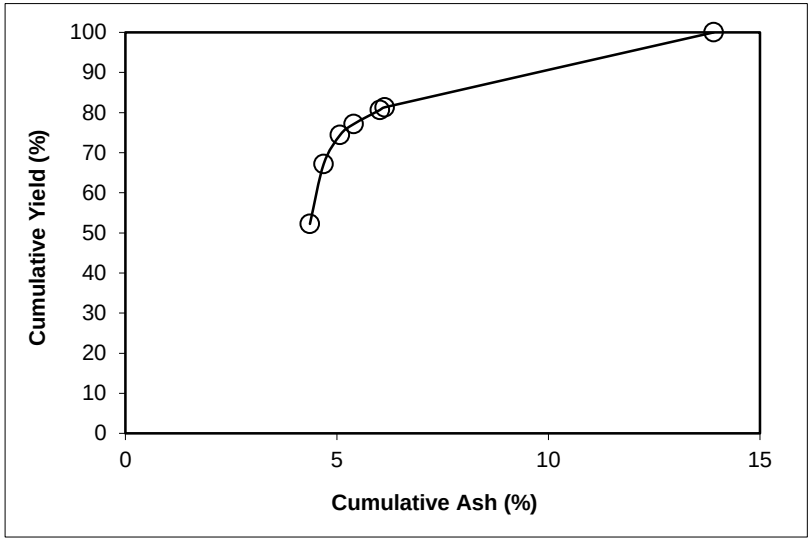
Description: Run 27 - Intermediate Spiral Test

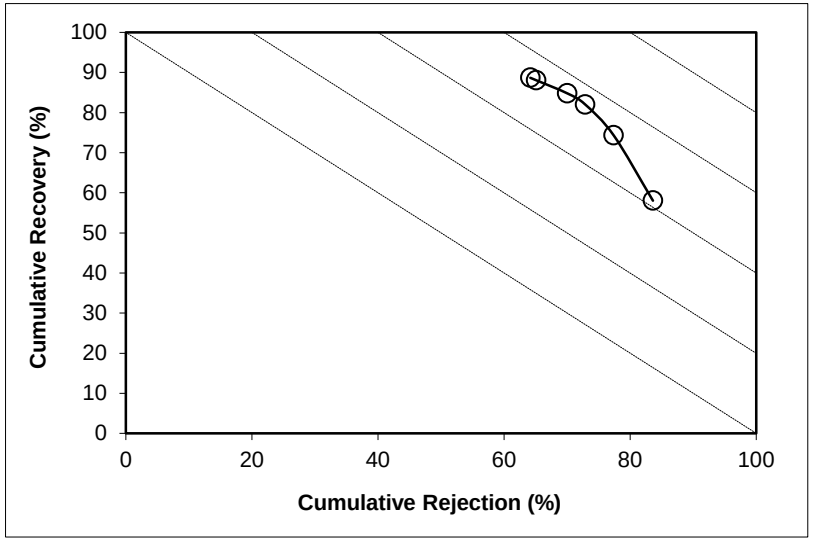
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 16.61

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	52.24	4.36	52.24	4.36	58.03	47.76	24.35	83.62	41.65
P2	14.88	5.82	67.12	4.68	74.31	32.88	32.74	77.39	51.71
P3	7.27	8.66	74.40	5.07	82.03	25.60	39.57	72.86	54.89
P4	2.75	14.19	77.15	5.40	84.77	22.85	42.63	70.05	54.83
P5	3.52	19.58	80.67	6.02	88.06	19.33	46.82	65.10	53.16
P6	0.65	19.83	81.32	6.13	88.67	18.68	47.77	64.17	52.84
P7	18.68	47.77	100.00	13.91	100.00	0.00			
Total (Calc)	100.00	13.91	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

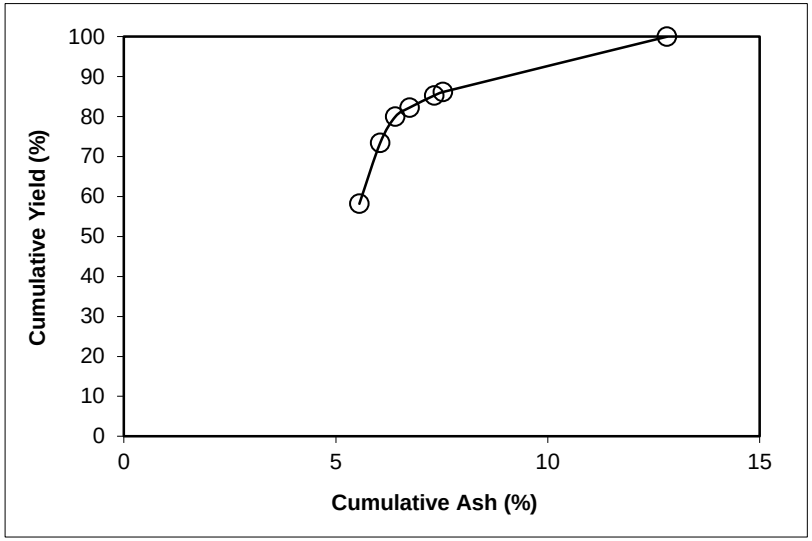
Description: Run 27 - Intermediate Spiral Test

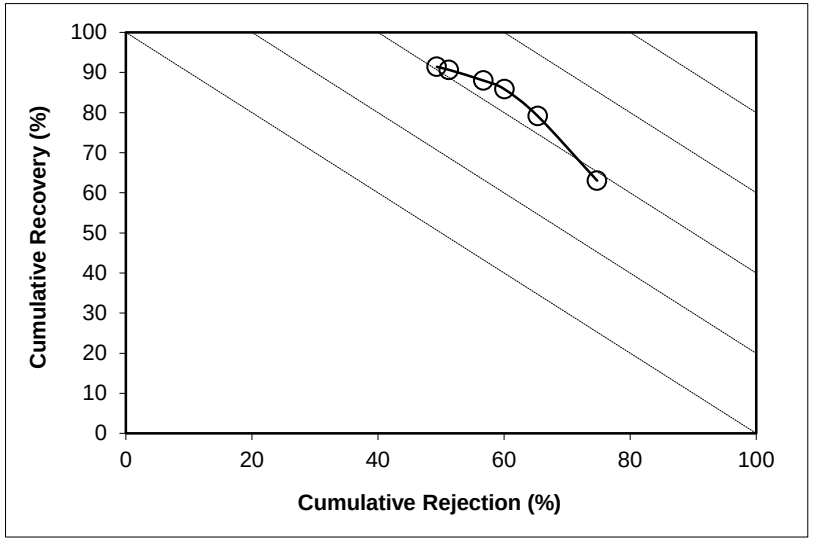
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 3.69

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	58.19	5.56	58.19	5.56	63.03	41.81	22.91	74.77	37.80
P2	15.21	7.92	73.40	6.05	79.10	26.60	31.48	65.36	44.46
P3	6.54	10.38	79.95	6.40	85.83	20.05	38.37	60.05	45.88
P4	2.31	18.47	82.26	6.74	87.99	17.74	40.96	56.72	44.71
P5	3.03	23.13	85.29	7.32	90.66	14.71	44.64	51.25	41.91
P6	0.89	27.67	86.18	7.53	91.40	13.82	45.72	49.34	40.73
P7	13.82	45.72	100.00	12.81	100.00	0.00			
Total (Calc)	100.00	12.81	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

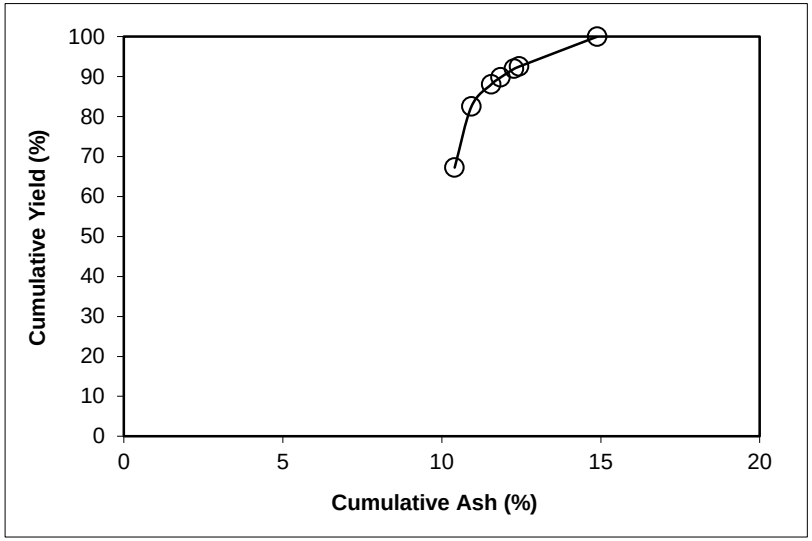
Description: Run 27 - Intermediate Spiral Test

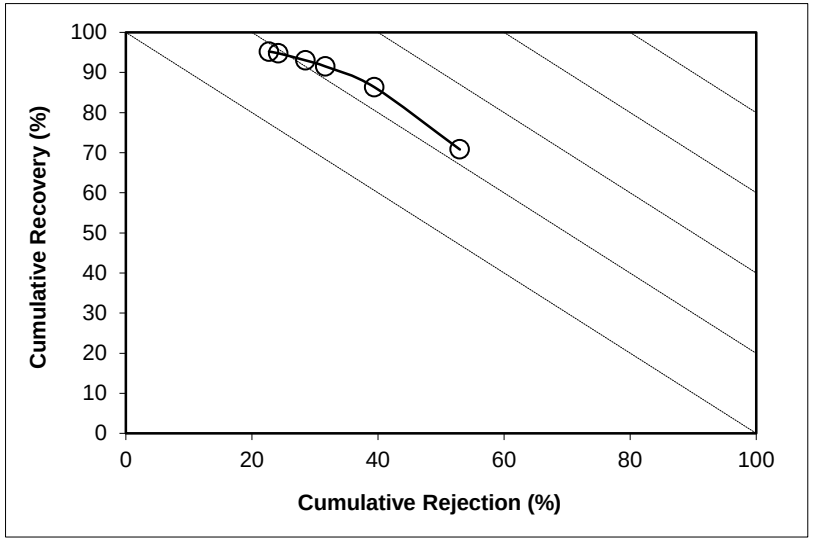
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 1.00

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	67.26	10.40	67.26	10.40	70.80	32.74	24.08	52.99	23.78
P2	15.25	13.25	82.51	10.93	86.34	17.49	33.53	39.41	25.75
P3	5.54	20.83	88.05	11.55	91.49	11.95	39.42	31.66	23.15
P4	1.76	26.62	89.81	11.85	93.01	10.19	41.64	28.50	21.52
P5	2.14	29.91	91.96	12.27	94.78	8.04	44.76	24.20	18.97
P6	0.58	38.74	92.53	12.44	95.20	7.47	45.23	22.69	17.89
P7	7.47	45.23	100.00	14.88	100.00	0.00			
Total (Calc)	100.00	14.88	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

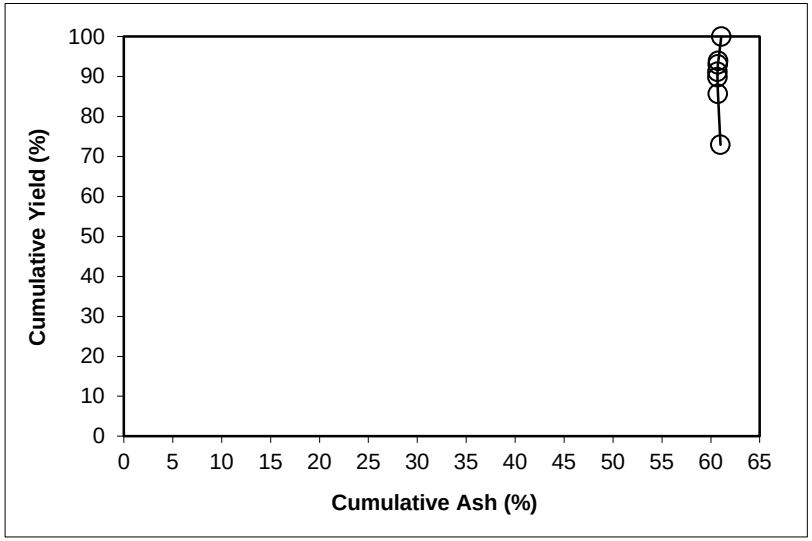
Description: Run 27 - Intermediate Spiral Test

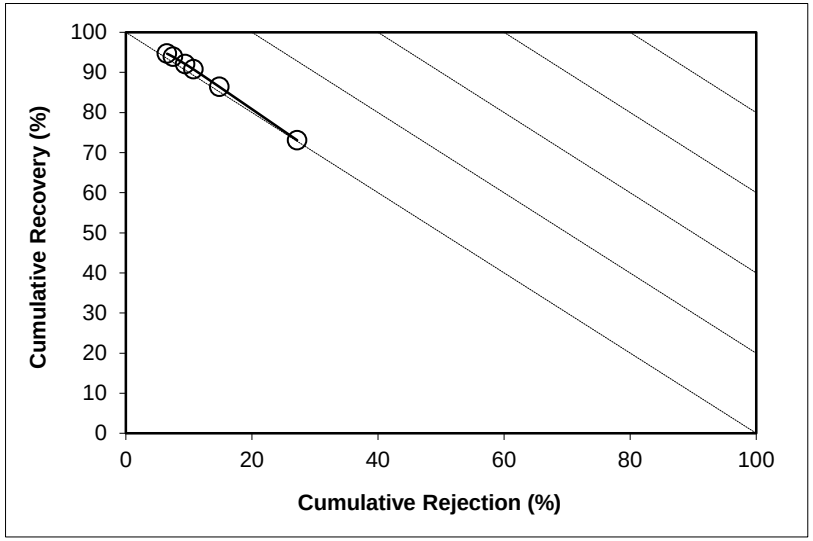
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 11.76

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	72.94	60.99	72.94	60.99	73.09	27.06	61.28	27.16	0.24
P2	12.71	59.24	85.64	60.73	86.39	14.36	63.09	14.83	1.22
P3	4.23	59.65	89.87	60.68	90.77	10.13	64.52	10.71	1.47
P4	1.32	61.20	91.19	60.68	92.09	8.81	65.02	9.38	1.47
P5	1.87	62.38	93.06	60.72	93.89	6.94	65.73	7.47	1.36
P6	0.87	65.93	93.93	60.77	94.65	6.07	65.71	6.53	1.18
P7	6.07	65.71	100.00	61.07	100.00	0.00			
Total (Calc)	100.00	61.07	--	--	--	--	--	--	--





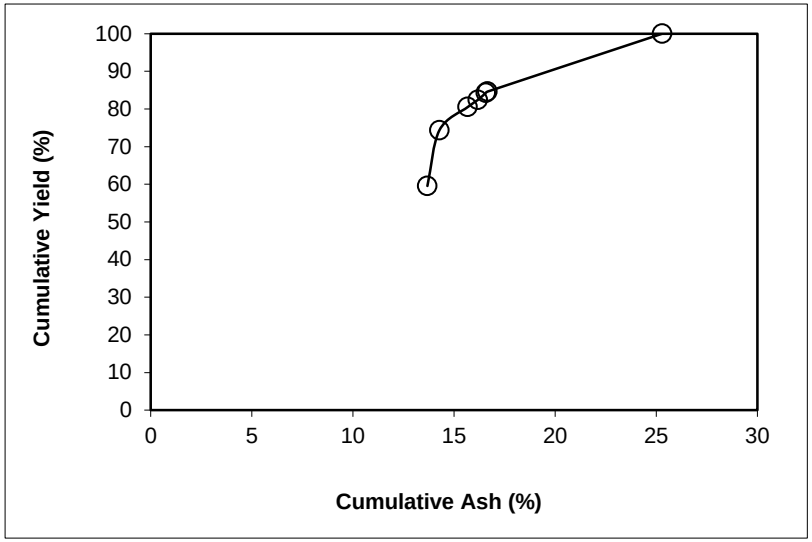
SPIRAL DATA ANALYSIS

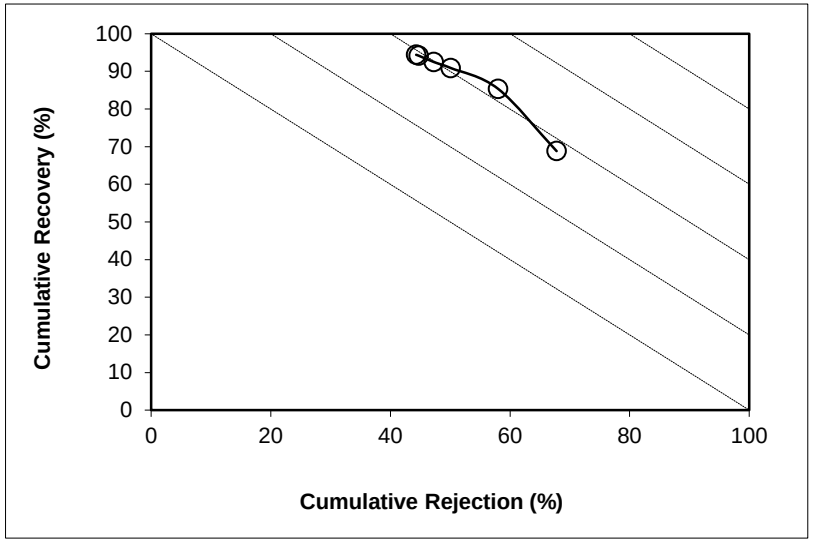
Description: Run 27 - Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	59.57	13.68	59.57	13.68	68.82	40.43	42.39	67.78	36.60
P2	14.82	16.67	74.38	14.27	85.35	25.62	57.26	58.01	43.36
P3	6.14	32.60	80.53	15.67	90.89	19.47	65.05	50.09	40.98
P4	1.91	37.52	82.44	16.18	92.49	17.56	68.04	47.25	39.74
P5	1.89	33.75	84.33	16.57	94.16	15.67	72.17	44.74	38.90
P6	0.29	37.83	84.62	16.65	94.41	15.38	72.83	44.30	38.70
P7	15.38	72.83	100.00	25.29	100.00	0.00			
Total (Calc)	100.00	25.29	--	--	--	--	--	--	--

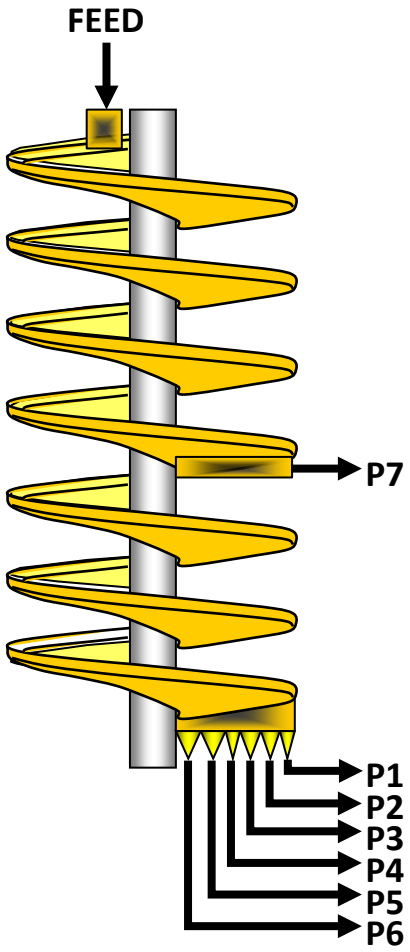




SPIRAL DATA ANALYSIS

Description: Run 37 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	2.066	27.2	22.11	28.31
P2	0.378	32.9	3.08	4.21
P3	0.137	31.5	1.19	1.57
P4	0.049	35.5	0.36	0.49
P5	0.058	31.9	0.50	0.66
P6	0.010	17.8	0.18	0.21
P7	0.272	40.3	1.61	2.25
Total	2.971	29.0	29.03	37.71

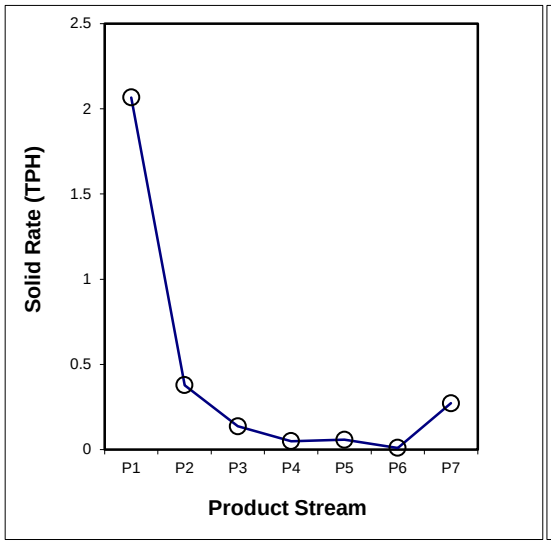
SPIRAL DATA ANALYSIS

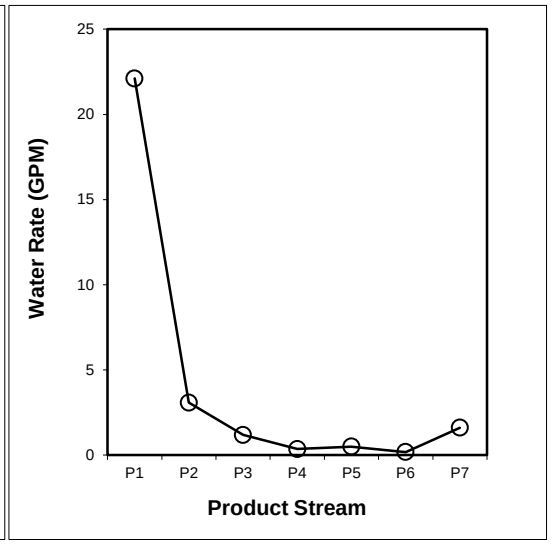
Description: Run 37 -Intermediate Spiral Test

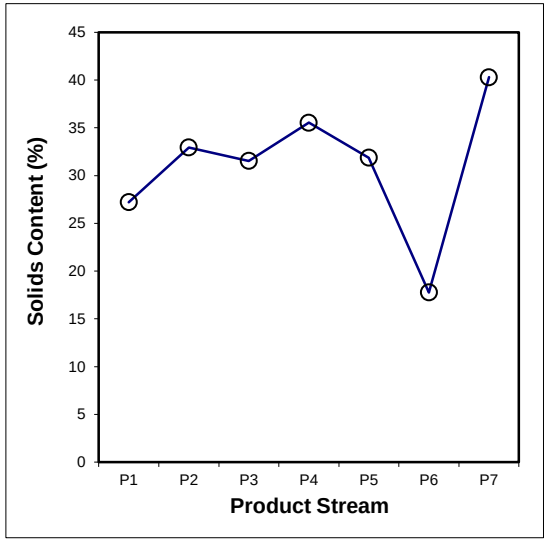
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	3	7072.50	1248.00	7.594	2991.7	1428.1	2.066	69.56	27.21
P2	3	976.75	95.53	1.148	317.9	31.7	0.378	12.73	32.94
P3	10	1205.62	96.12	0.434	376.1	31.2	0.137	4.60	31.54
P4	30	1160.48	91.87	0.139	406.0	31.4	0.049	1.67	35.54
P5	10	560.63	93.36	0.183	178.2	31.3	0.058	1.96	31.88
P6	40	657.25	94.45	0.055	122.9	24.3	0.010	0.33	17.77
P7	5	960.92	94.05	0.674	374.0	31.3	0.272	9.15	40.30
Total (Calc)	--	--	--	10.227	--	--	2.971	100.00	29.05
Total (Head)	0.50	1452.98	172.51	10.227	403.1	31.2	2.971	--	29.05







SPIRAL DATA ANALYSIS

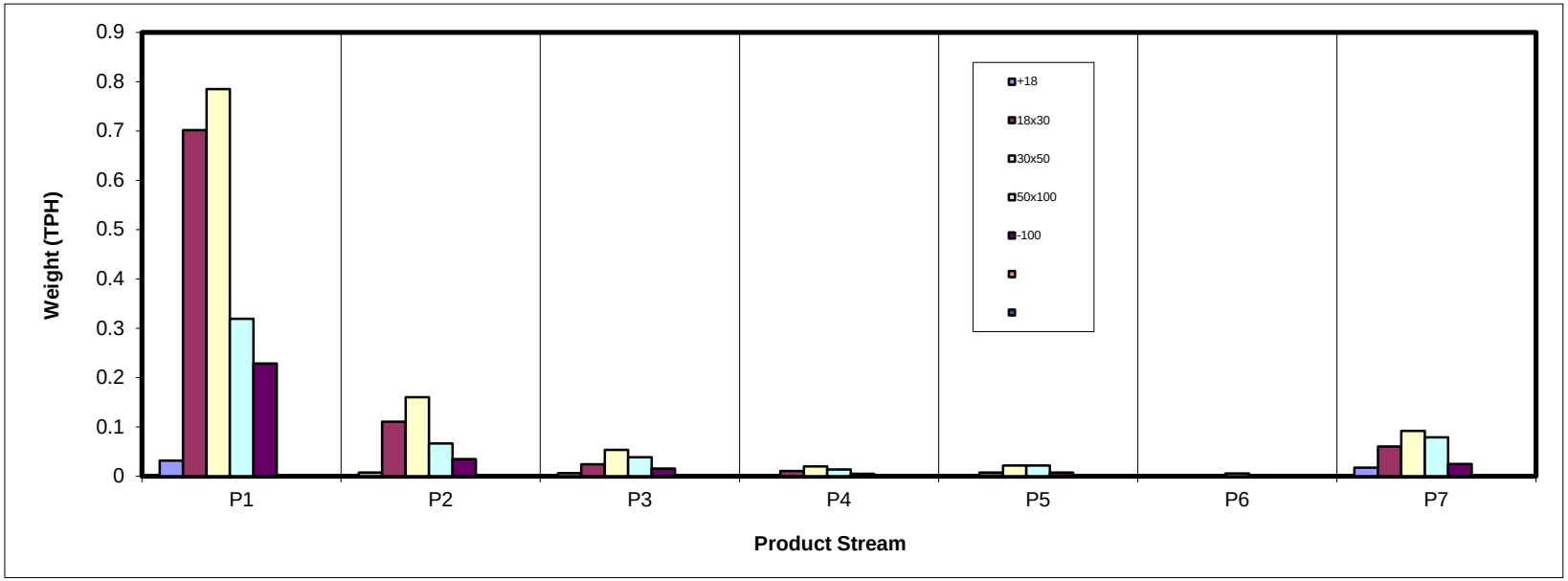
Description: Run 37 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.032	0.007	0.006	0.001	0.001	0.000	0.017		0.064
18x30	0.702	0.110	0.024	0.010	0.007	0.000	0.060		0.914
30x50	0.785	0.160	0.053	0.019	0.022	0.002	0.092		1.133
50x100	0.319	0.066	0.038	0.014	0.021	0.005	0.079		0.542
-100	0.228	0.034	0.015	0.005	0.007	0.002	0.024		0.317
Total (Calc)	2.066	0.378	0.137	0.049	0.058	0.010	0.272		2.971



SPIRAL DATA ANALYSIS

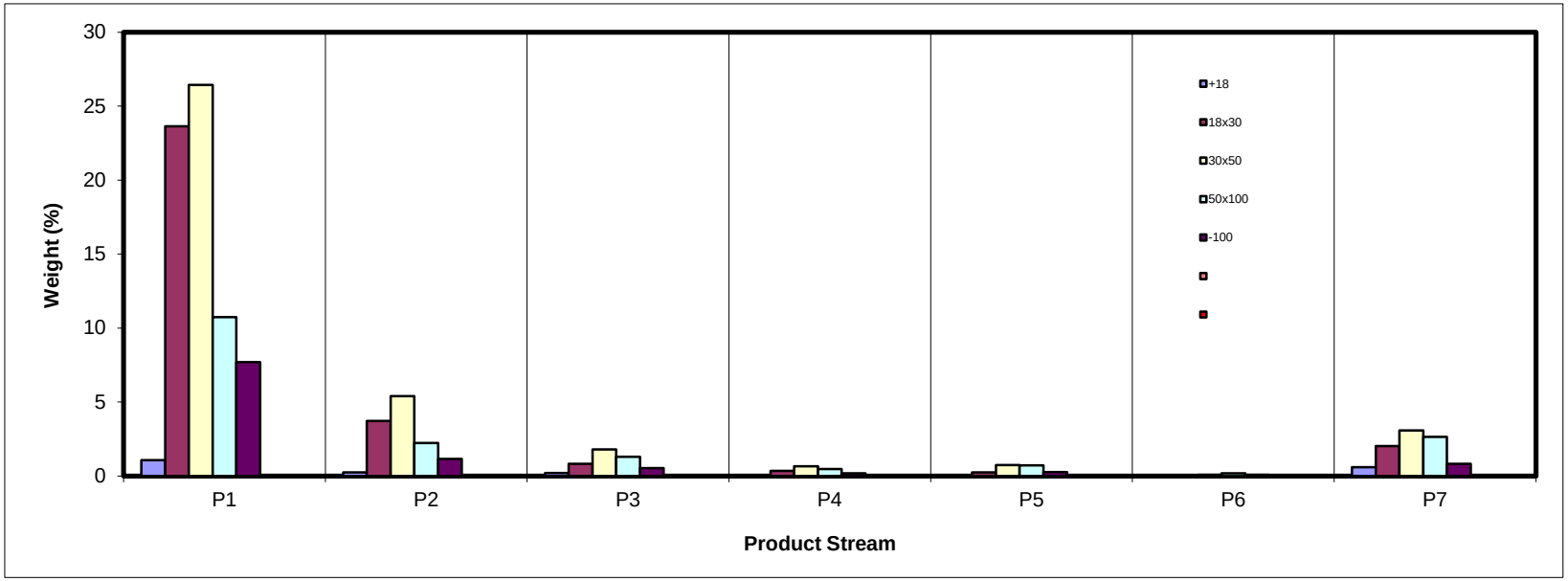
Description: Run 37 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	1.07	0.24	0.19	0.05	0.02	0.00	0.58		2.16
18x30	23.63	3.72	0.81	0.34	0.24	0.01	2.01		30.76
30x50	26.43	5.39	1.78	0.65	0.73	0.07	3.08		38.14
50x100	10.75	2.22	1.29	0.46	0.71	0.17	2.65		18.26
-100	7.69	1.16	0.52	0.17	0.25	0.08	0.82		10.68
Total (Calc)	69.56	12.73	4.60	1.67	1.96	0.33	9.15		100.00



SPIRAL DATA ANALYSIS

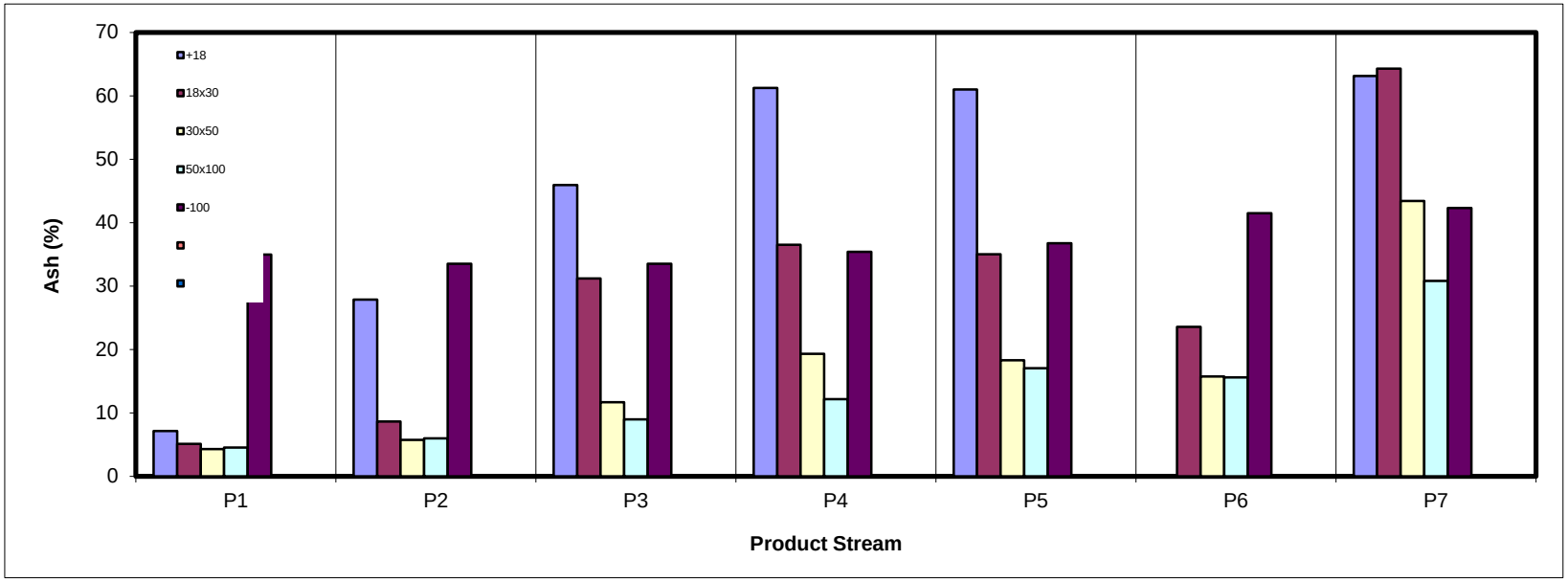
Description: Run 37 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	7.15	27.84	45.95	61.25	61.02	0.00	63.10		29.92
18x30	5.12	8.65	31.19	36.52	35.00	23.55	64.27		10.69
30x50	4.29	5.72	11.67	19.31	18.31	15.71	43.41		8.55
50x100	4.54	5.99	8.98	12.15	17.04	15.59	30.80		9.63
-100	34.95	33.50	33.49	35.41	36.77	41.47	42.28		35.38
Total (Calc)	8.05	9.57	18.25	23.67	22.82	22.17	45.51		12.73



SPIRAL DATA ANALYSIS

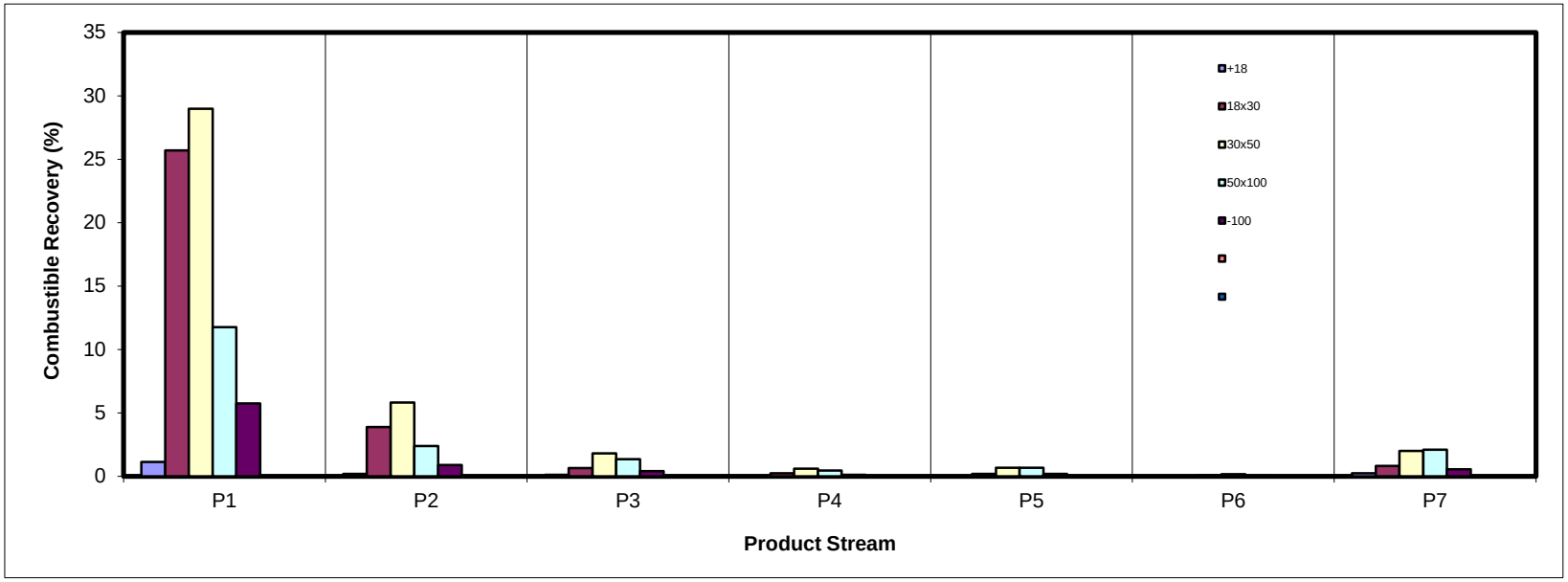
Description: Run 37 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	1.13	0.20	0.12	0.02	0.01	0.00	0.25		1.73
18x30	25.69	3.89	0.64	0.25	0.18	0.00	0.82		31.48
30x50	28.98	5.83	1.81	0.60	0.68	0.07	2.00		39.97
50x100	11.75	2.39	1.35	0.46	0.68	0.17	2.10		18.91
-100	5.73	0.88	0.40	0.12	0.18	0.05	0.54		7.91
Total (Calc)	73.30	13.20	4.31	1.46	1.73	0.29	5.71		100.00



SPIRAL DATA ANALYSIS

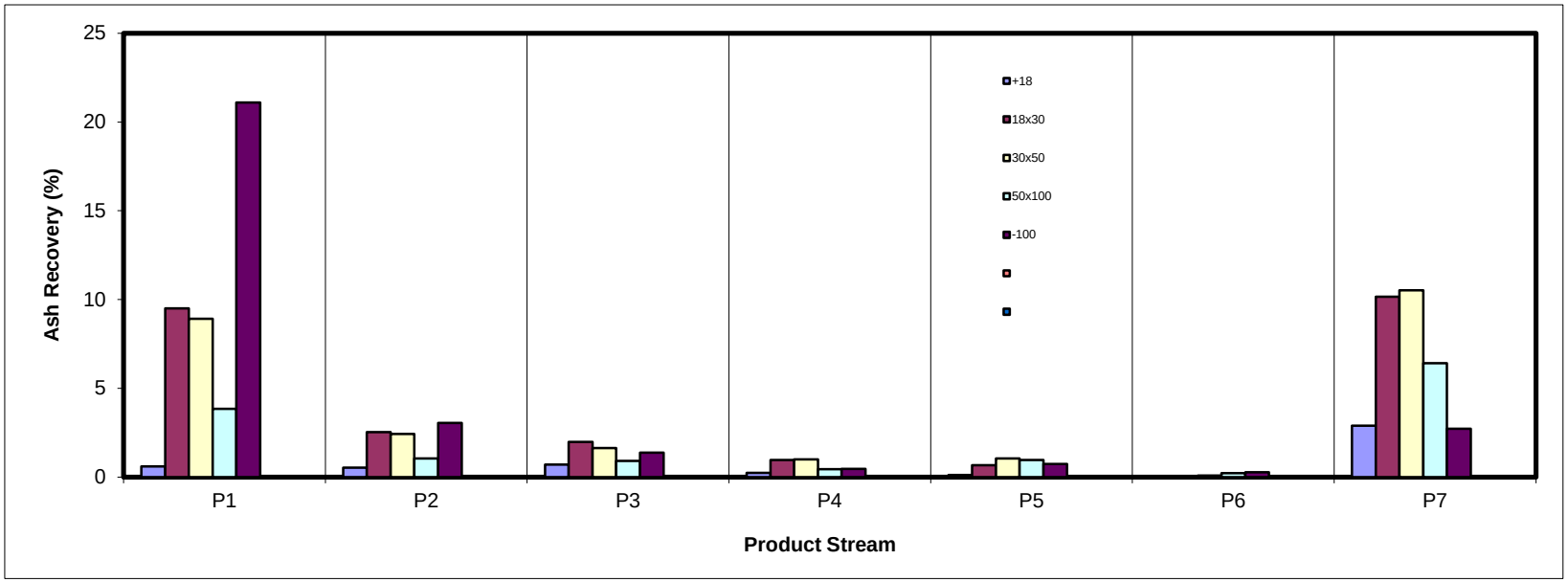
Description: Run 37 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.60	0.53	0.70	0.24	0.12	0.00	2.90		5.07
18x30	9.51	2.53	1.99	0.97	0.67	0.01	10.16		25.83
30x50	8.91	2.42	1.64	0.99	1.05	0.08	10.51		25.61
50x100	3.83	1.05	0.91	0.44	0.96	0.21	6.41		13.81
-100	21.10	3.04	1.37	0.47	0.73	0.27	2.72		29.69
Total (Calc)	43.96	9.57	6.60	3.10	3.51	0.57	32.69		100.00



SPIRAL DATA ANALYSIS

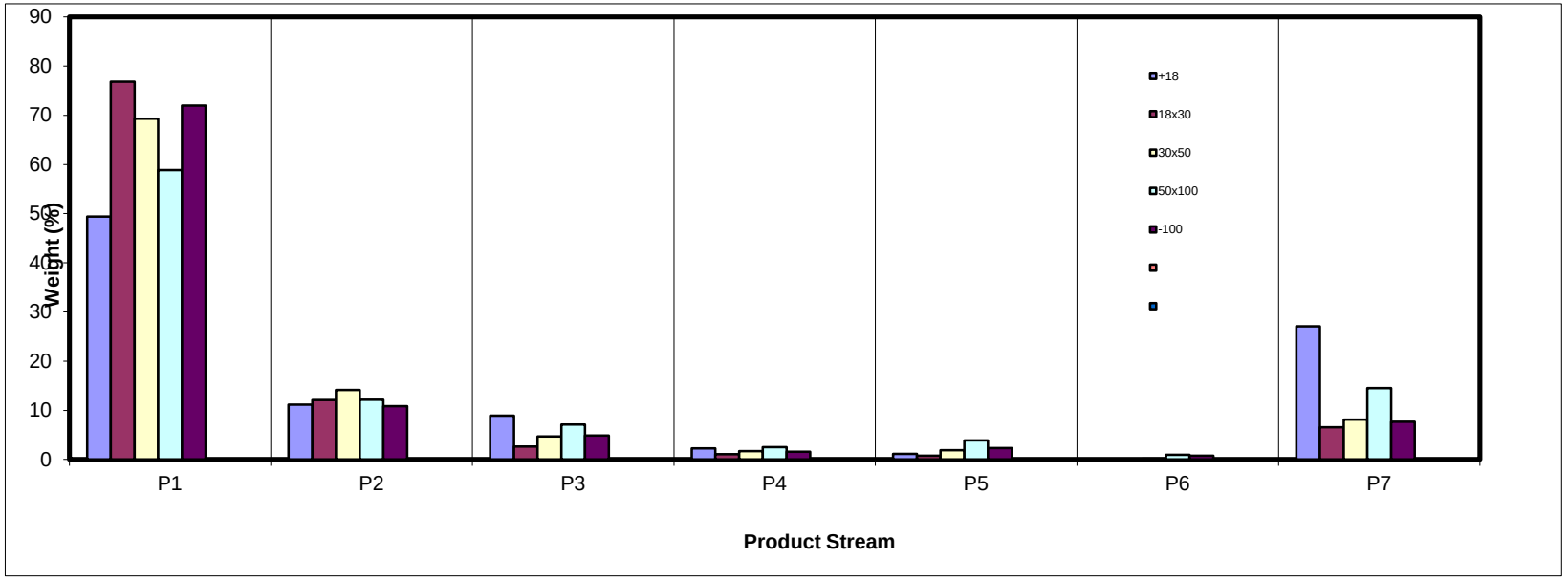
Description: Run 37 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	49.41	11.17	8.95	2.26	1.13	0.00	27.08		100.00
18x30	76.82	12.09	2.64	1.10	0.79	0.02	6.54		100.00
30x50	69.30	14.14	4.68	1.71	1.91	0.18	8.09		100.00
50x100	58.85	12.17	7.09	2.52	3.91	0.95	14.51		100.00
-100	71.96	10.83	4.86	1.57	2.36	0.76	7.65		100.00
Total (Calc)	69.56	12.73	4.60	1.67	1.96	0.33	9.15		100.00



SPIRAL DATA ANALYSIS

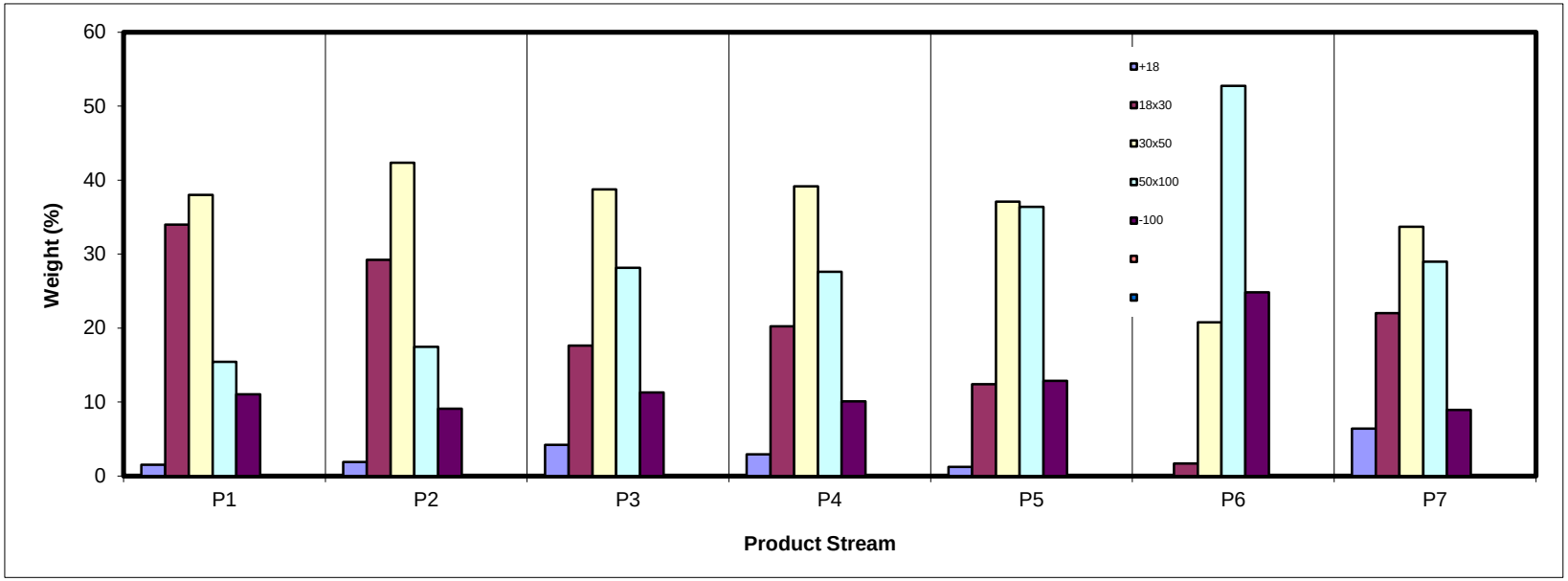
Description: Run 37 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	1.53	1.89	4.20	2.93	1.25	0.00	6.39		2.16
18x30	33.97	29.21	17.61	20.23	12.40	1.67	22.01		30.76
30x50	37.99	42.35	38.77	39.17	37.10	20.78	33.71		38.14
50x100	15.45	17.46	28.13	27.59	36.41	52.73	28.95		18.26
-100	11.05	9.09	11.29	10.07	12.84	24.82	8.94		10.68
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

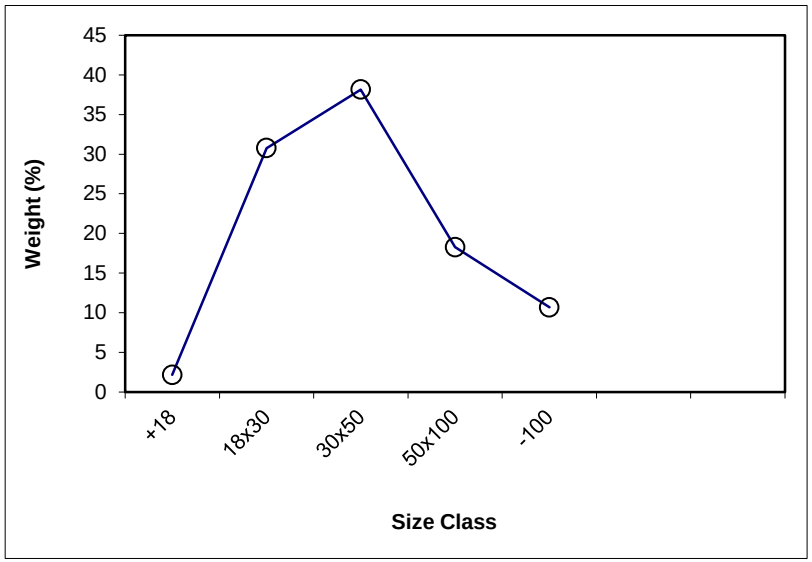
Description: Run 37 -Intermediate Spiral Test

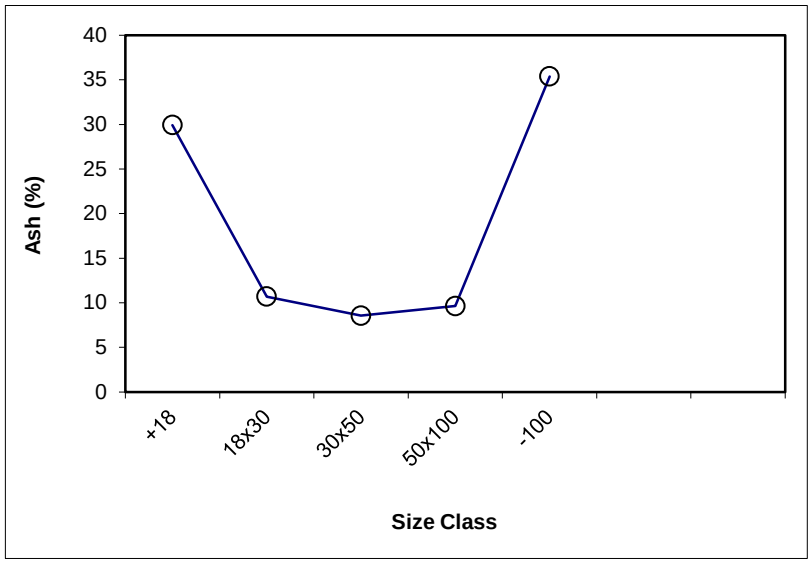
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	14.3	6.3	8.03	2.16	29.92	2.16	29.92	100.00	12.73
18x30	120.6	6.2	114.40	30.76	10.69	32.92	11.95	97.84	12.35
30x50	148.1	6.3	141.85	38.14	8.55	71.06	10.13	67.08	13.12
50x100	74.0	6.1	67.91	18.26	9.63	89.32	10.02	28.94	19.13
-100	46.0	6.3	39.74	10.68	35.38	100.00	12.73	10.68	35.38
Total (Calc)	--	--	371.93	100.00	12.73	--	--	--	--





SPIRAL DATA ANALYSIS

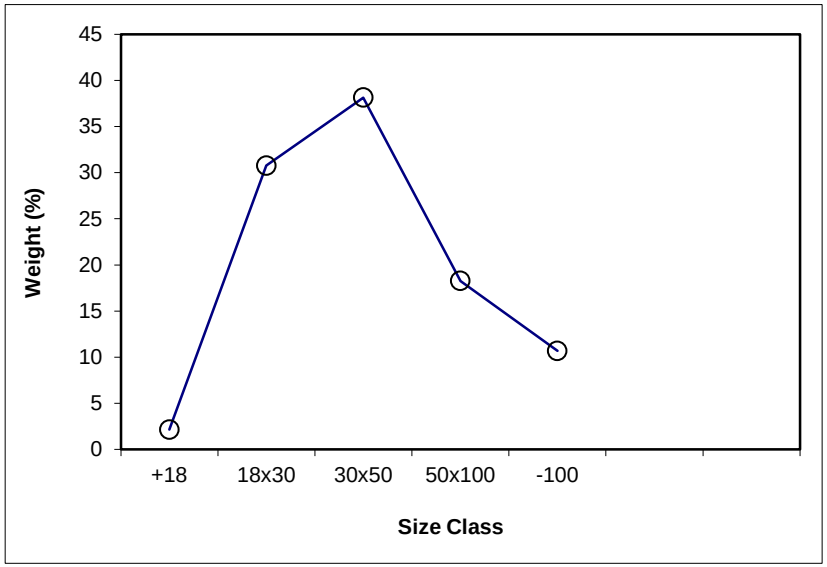
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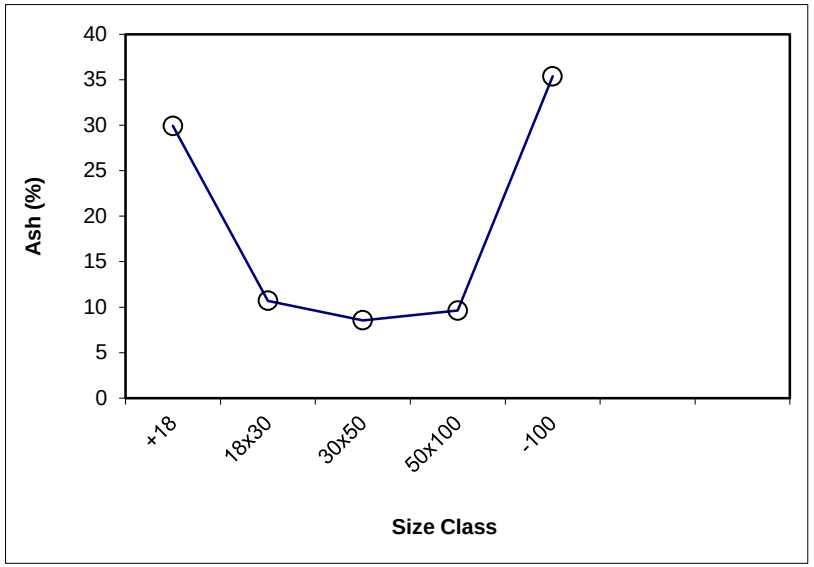
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	2.16	29.92	2.16	29.92	100.00	12.73			
18x30	30.76	10.69	32.92	11.95	97.84	12.35	x	30.76	10.69
30x50	38.14	8.55	71.06	10.13	67.08	13.12	x	38.14	8.55
50x100	18.26	9.63	89.32	10.02	28.94	19.13	x	18.26	9.63
-100	10.68	35.38	100.00	12.73	10.68	35.38			
Total (Calc)	100.00	12.73	--	--	--	--	--	87.16	9.53





SPIRAL DATA ANALYSIS

Description: Run 37 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 69.56

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	425.18	401.2	23.98	1.53	7.15	1.53	7.15	100.00	8.05
18x30	901.19	370.0	531.15	33.97	5.12	35.50	5.21	98.47	8.06
30x50	930.33	336.3	594.05	37.99	4.29	73.50	4.74	64.50	9.61
50x100	549.67	308.1	241.54	15.45	4.54	88.95	4.70	26.50	17.22
-100	185.30	12.5	172.83	11.05	34.95	100.00	8.05	11.05	34.95
Total (Calc)	--	--	1563.55	100.00	8.05	--	--	--	--

Product P2 Feed Weight (%): 12.73

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	11.7	6.3	5.42	1.89	27.84	1.89	27.84	100.00	9.57
18x30	90.0	6.4	83.61	29.21	8.65	31.10	9.81	98.11	9.21
30x50	127.6	6.4	121.22	42.35	5.72	73.46	7.45	68.90	9.45
50x100	56.2	6.3	49.97	17.46	5.99	90.91	7.17	26.54	15.41
-100	32.4	6.4	26.01	9.09	33.50	100.00	9.57	9.09	33.50
Total (Calc)	--	--	286.23	100.00	9.57	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 37 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P3

Feed Weight (%): 4.60

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	20.8	6.3	14.48	4.20	45.95	4.20	45.95	100.00	18.25
18x30	66.9	6.2	60.74	17.61	31.19	21.81	34.03	95.80	17.04
30x50	139.9	6.2	133.71	38.77	11.67	60.58	19.72	78.19	13.85
50x100	103.3	6.3	97.02	28.13	8.98	88.71	16.31	39.42	16.00
-100	45.3	6.3	38.95	11.29	33.49	100.00	18.25	11.29	33.49
Total (Calc)	--	--	344.89	100.00	18.25	--	--	--	--

Product P4

Feed Weight (%): 1.67

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	17.1	6.2	10.98	2.93	61.25	2.93	61.25	100.00	23.67
18x30	82.1	6.4	75.77	20.23	36.52	23.16	39.65	97.07	22.53
30x50	153.0	6.4	146.69	39.17	19.31	62.33	26.87	76.84	18.85
50x100	109.7	6.4	103.35	27.59	12.15	89.93	22.35	37.67	18.37
-100	43.9	6.2	37.72	10.07	35.41	100.00	23.67	10.07	35.41
Total (Calc)	--	--	374.51	100.00	23.67	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 37 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 1.96

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	8.1	6.3	1.83	1.25	61.02	1.25	61.02	100.00	22.82
18x30	24.4	6.2	18.22	12.40	35.00	13.65	37.37	98.75	22.34
30x50	60.6	6.1	54.48	37.10	18.31	50.75	23.44	86.35	20.52
50x100	59.8	6.4	53.46	36.41	17.04	87.16	20.77	49.25	22.18
-100	25.2	6.4	18.86	12.84	36.77	100.00	22.82	12.84	36.77
Total (Calc)	--	--	146.85	100.00	22.82	--	--	--	--

Product P6 Feed Weight (%): 0.33

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	0.0	0.0	0.00	0.00	0.00	0.00	0.00	100.00	22.17
18x30	7.7	6.0	1.64	1.67	23.55	1.67	23.55	100.00	22.17
30x50	26.5	6.0	20.48	20.78	15.71	22.45	16.30	98.33	22.15
50x100	58.1	6.2	51.98	52.73	15.59	75.18	15.80	77.55	23.87
-100	30.6	6.1	24.47	24.82	41.47	100.00	22.17	24.82	41.47
Total (Calc)	--	--	98.57	100.00	22.17	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 37 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 9.15

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	28.3	6.4	21.90	6.39	63.10	6.39	63.10	100.00	45.51
18x30	81.6	6.2	75.41	22.01	64.27	28.40	64.01	93.61	44.31
30x50	121.7	6.2	115.53	33.71	43.41	62.11	52.83	71.60	38.17
50x100	105.5	6.3	99.23	28.95	30.80	91.06	45.82	37.89	33.51
-100	36.9	6.3	30.63	8.94	42.28	100.00	45.51	8.94	42.28
Total (Calc)	--	--	342.70	100.00	45.51	--	--	--	--

SPIRAL DATA ANALYSIS

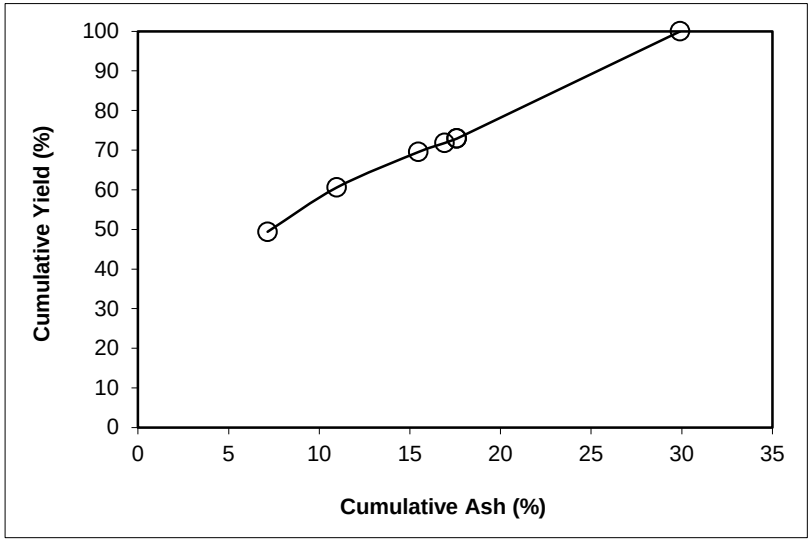
Description: Run 37 -Intermediate Spiral Test

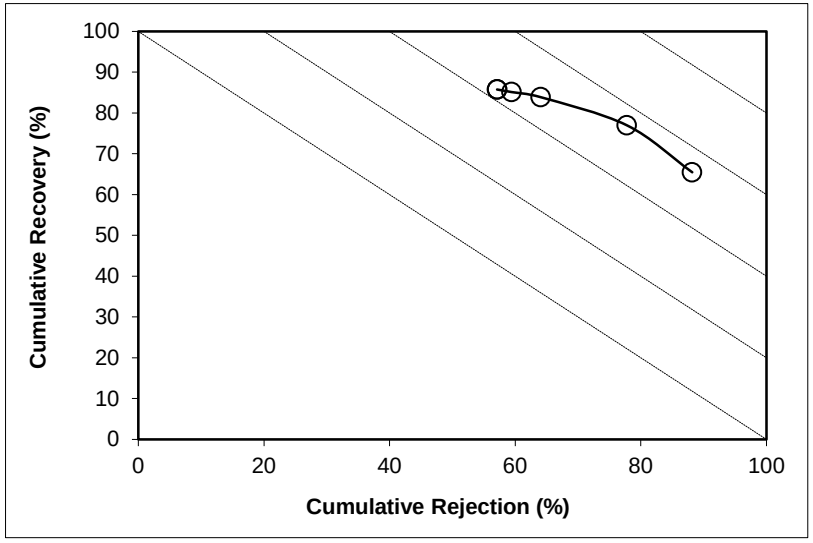
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 2.16

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	49.41	7.15	49.41	7.15	65.46	50.59	52.15	88.19	53.65
P2	11.17	27.84	60.58	10.97	76.96	39.42	59.04	77.79	54.76
P3	8.95	45.95	69.53	15.47	83.86	30.47	62.89	64.05	47.92
P4	2.26	61.25	71.79	16.91	85.12	28.21	63.02	59.42	44.53
P5	1.13	61.02	72.92	17.59	85.74	27.08	63.10	57.11	42.86
P6	0.00	0.00	72.92	17.59	85.74	27.08	63.10	57.11	42.86
P7	27.08	63.10	100.00	29.92	100.00	0.00			
Total (Calc)	100.00	29.92	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

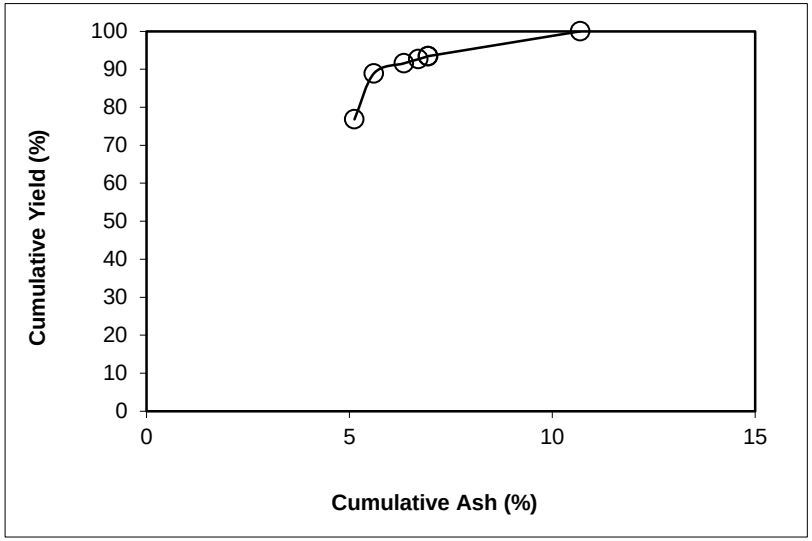
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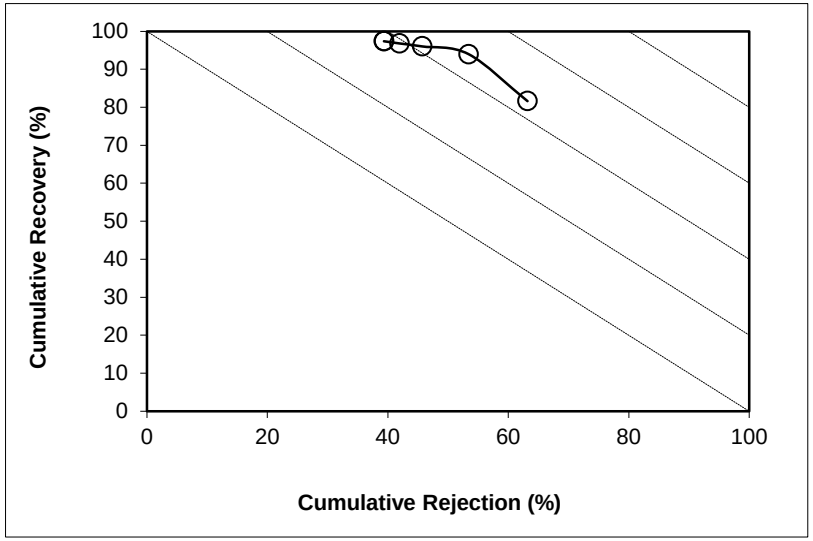
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 30.76

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	76.82	5.12	76.82	5.12	81.61	23.18	29.14	63.18	44.79
P2	12.09	8.65	88.92	5.60	93.98	11.08	51.51	53.40	47.38
P3	2.64	31.19	91.55	6.34	96.01	8.45	57.84	45.71	41.72
P4	1.10	36.52	92.65	6.70	96.79	7.35	61.02	41.97	38.76
P5	0.79	35.00	93.44	6.94	97.37	6.56	64.16	39.38	36.75
P6	0.02	23.55	93.46	6.94	97.38	6.54	64.27	39.34	36.72
P7	6.54	64.27	100.00	10.69	100.00	0.00			
Total (Calc)	100.00	10.69	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

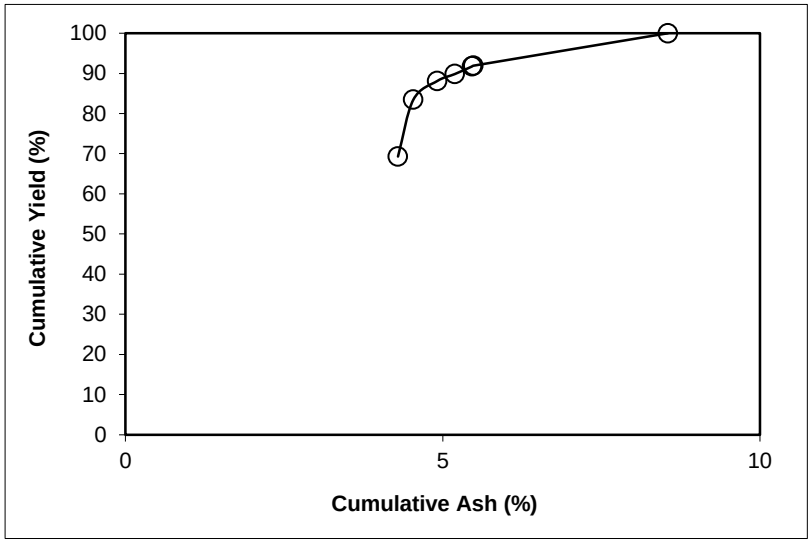
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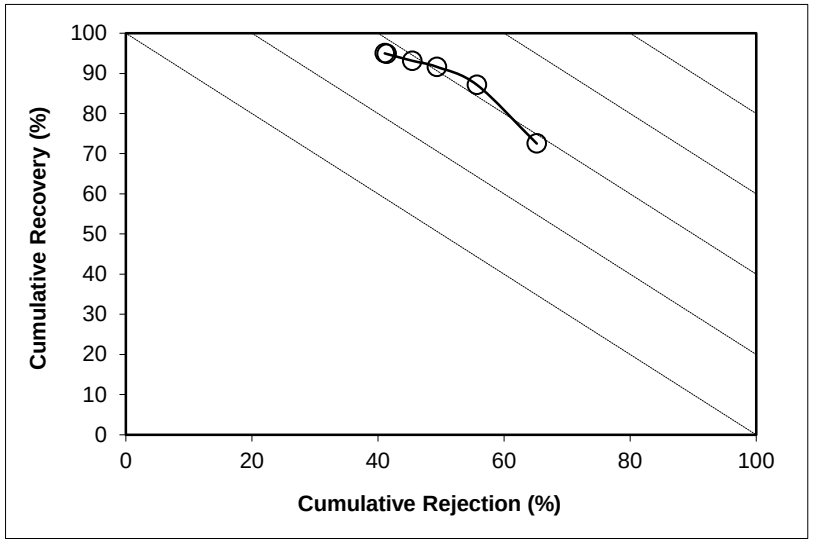
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 38.14

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	69.30	4.29	69.30	4.29	72.52	30.70	18.15	65.19	37.71
P2	14.14	5.72	83.44	4.54	87.10	16.56	28.76	55.73	42.83
P3	4.68	11.67	88.12	4.91	91.62	11.88	35.50	49.34	40.96
P4	1.71	19.31	89.83	5.19	93.13	10.17	38.22	45.48	38.60
P5	1.91	18.31	91.73	5.46	94.83	8.27	42.81	41.39	36.22
P6	0.18	15.71	91.91	5.48	95.00	8.09	43.41	41.06	36.06
P7	8.09	43.41	100.00	8.55	100.00	0.00			
Total (Calc)	100.00	8.55	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

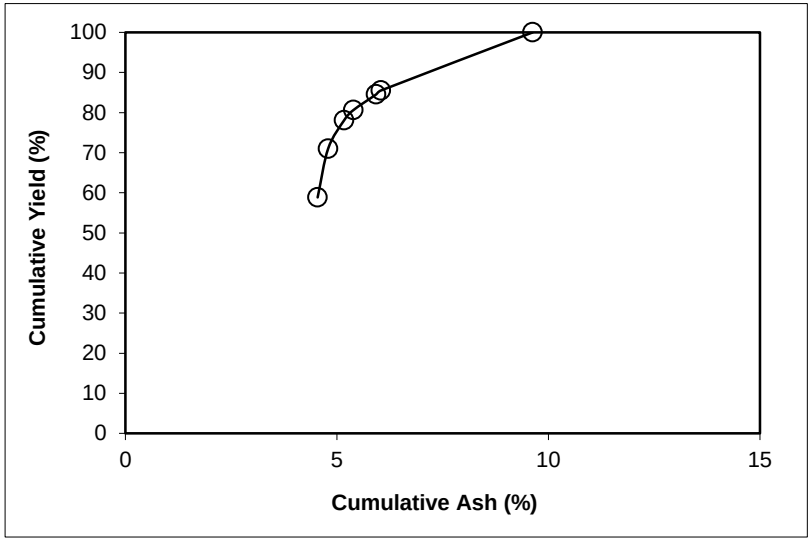
Description: Run 37 -Intermediate Spiral Test

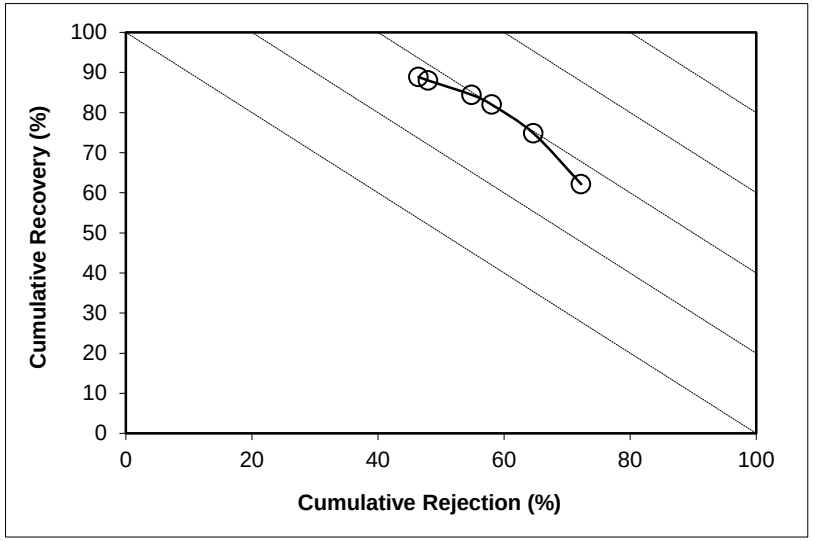
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 18.26

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	58.85	4.54	58.85	4.54	62.16	41.15	16.90	72.24	34.40
P2	12.17	5.99	71.03	4.79	74.83	28.97	21.48	64.66	39.49
P3	7.09	8.98	78.12	5.17	81.97	21.88	25.54	58.04	40.01
P4	2.52	12.15	80.64	5.39	84.42	19.36	27.28	54.86	39.28
P5	3.91	17.04	84.54	5.93	88.01	15.46	29.87	47.95	35.95
P6	0.95	15.59	85.49	6.03	88.89	14.51	30.80	46.41	35.30
P7	14.51	30.80	100.00	9.63	100.00	0.00			
Total (Calc)	100.00	9.63	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

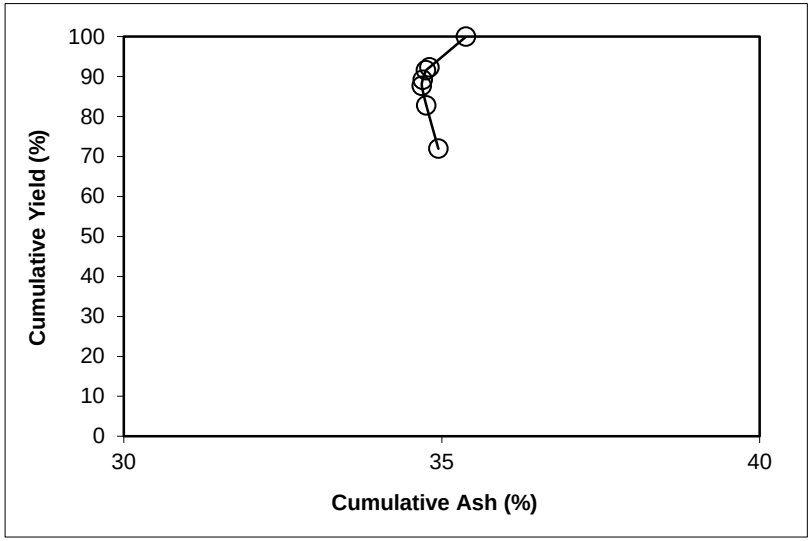
Description: Run 37 -Intermediate Spiral Test

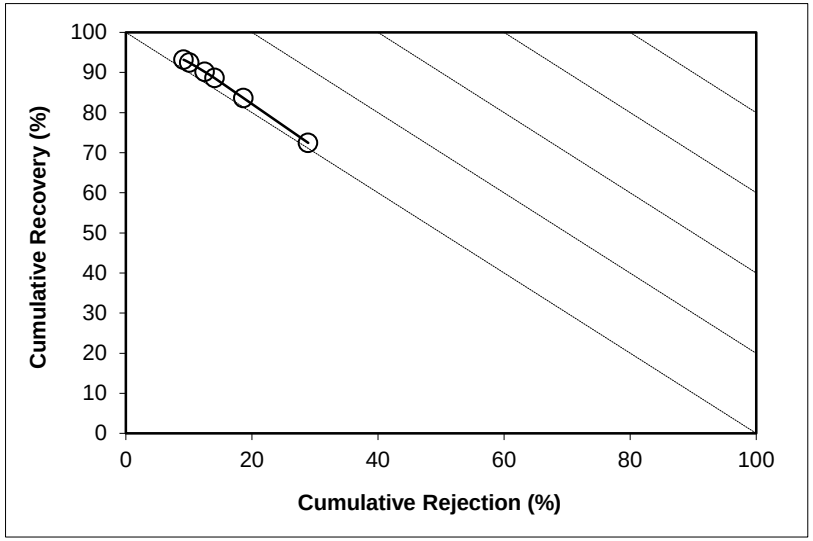
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: -100 Feed Weight (%): 10.68

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	71.96	34.95	71.96	34.95	72.45	28.04	36.49	28.92	1.37
P2	10.83	33.50	82.79	34.76	83.59	17.21	38.38	18.67	2.26
P3	4.86	33.49	87.66	34.69	88.60	12.34	40.30	14.06	2.66
P4	1.57	35.41	89.23	34.70	90.17	10.77	41.02	12.49	2.66
P5	2.36	36.77	91.58	34.75	92.47	8.42	42.21	10.04	2.51
P6	0.76	41.47	92.35	34.81	93.17	7.65	42.28	9.15	2.31
P7	7.65	42.28	100.00	35.38	100.00	0.00			
Total (Calc)	100.00	35.38	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

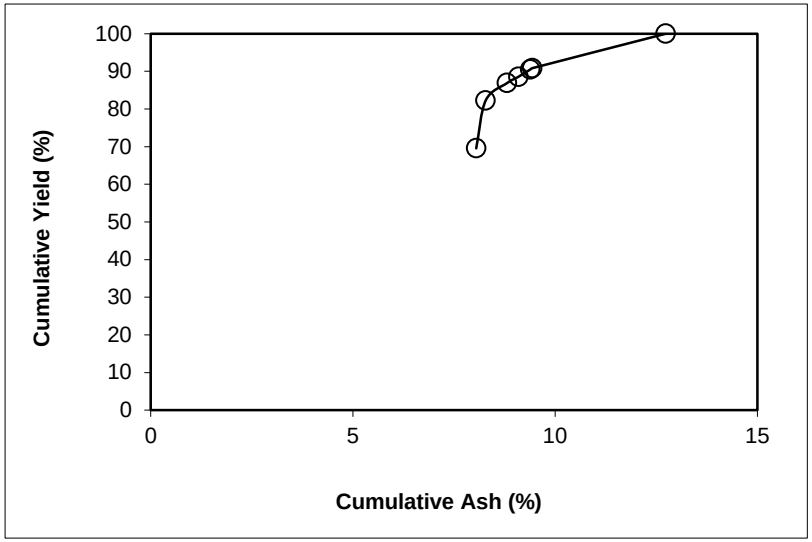
Description: Run 37 -Intermediate Spiral Test

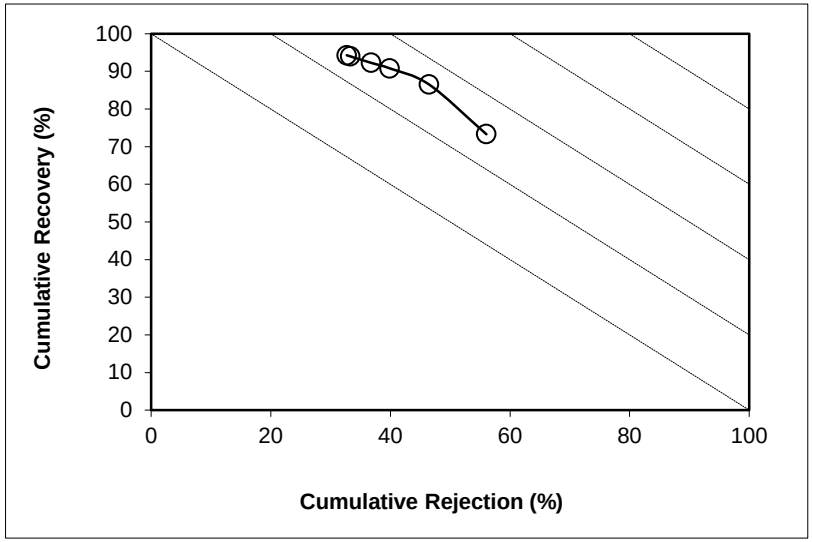
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	69.56	8.05	69.56	8.05	73.30	30.44	23.44	56.04	29.34
P2	12.73	9.57	82.29	8.28	86.49	17.71	33.42	46.48	32.97
P3	4.60	18.25	86.90	8.81	90.80	13.10	38.75	39.88	30.68
P4	1.67	23.67	88.56	9.09	92.26	11.44	40.95	36.78	29.04
P5	1.96	22.82	90.52	9.39	93.99	9.48	44.70	33.27	27.26
P6	0.33	22.17	90.85	9.43	94.29	9.15	45.51	32.69	26.98
P7	9.15	45.51	100.00	12.73	100.00	0.00			
Total (Calc)	100.00	12.73	--	--	--	--	--	--	--

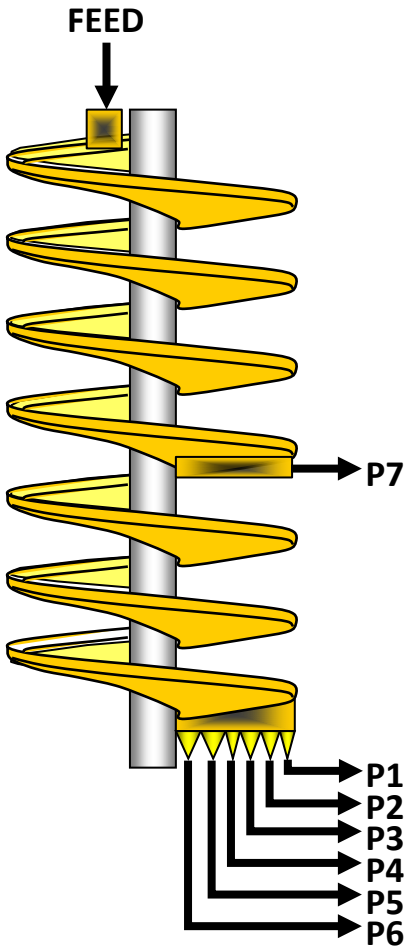




SPIRAL DATA ANALYSIS

Description: Run 38 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	1.850	23.3	24.40	29.96
P2	0.397	30.9	3.55	4.74
P3	0.123	29.6	1.17	1.52
P4	0.041	32.4	0.34	0.46
P5	0.047	28.1	0.48	0.61
P6	0.007	14.6	0.17	0.19
P7	0.186	31.3	1.64	2.08
Total	2.652	25.0	31.75	39.56

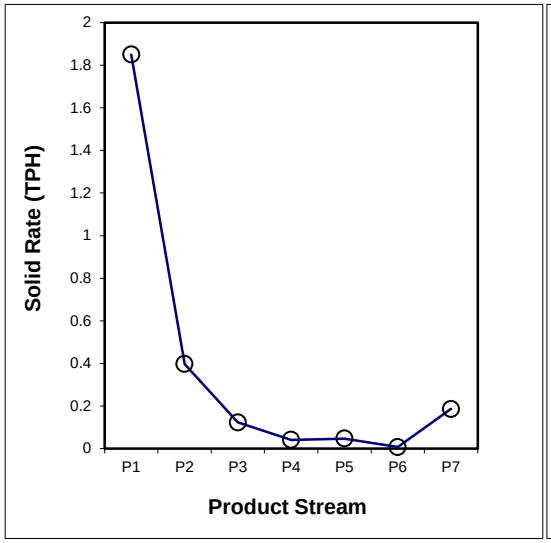
SPIRAL DATA ANALYSIS

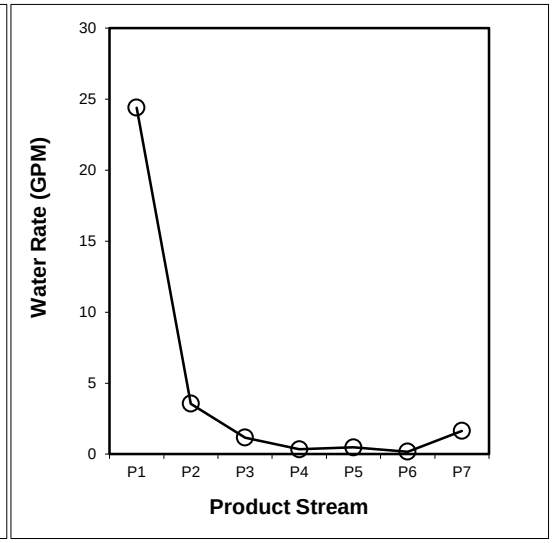
Description: Run 38 -Intermediate Spiral Test

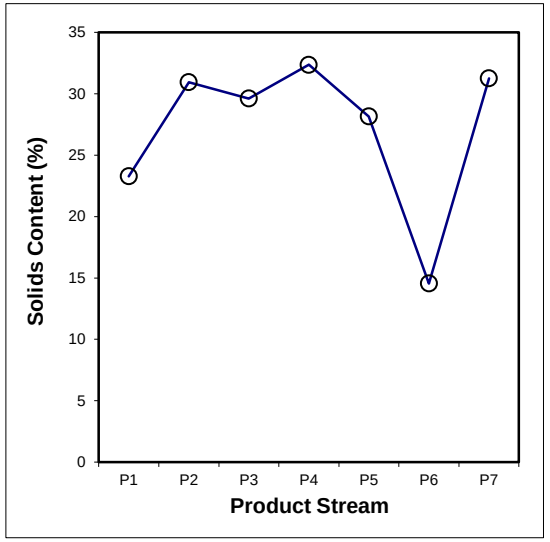
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	3	7213.50	1108.53	7.950	3060.2	1660.1	1.850	69.77	23.28
P2	3	1079.13	93.60	1.285	331.3	30.6	0.397	14.99	30.94
P3	10	1151.31	92.26	0.414	340.6	31.2	0.123	4.63	29.61
P4	30	1063.65	94.02	0.126	340.9	31.3	0.041	1.54	32.36
P5	10	524.36	96.73	0.167	150.3	31.6	0.047	1.77	28.15
P6	40	616.24	96.01	0.051	99.7	25.1	0.007	0.28	14.55
P7	5	850.14	91.56	0.596	266.0	31.1	0.186	7.02	31.25
Total (Calc)	--	--	--	10.589	--	--	2.652	100.00	25.05
Total (Head)	0.45	1371.17	169.13	10.589	332.3	31.3	2.652	--	25.05







SPIRAL DATA ANALYSIS

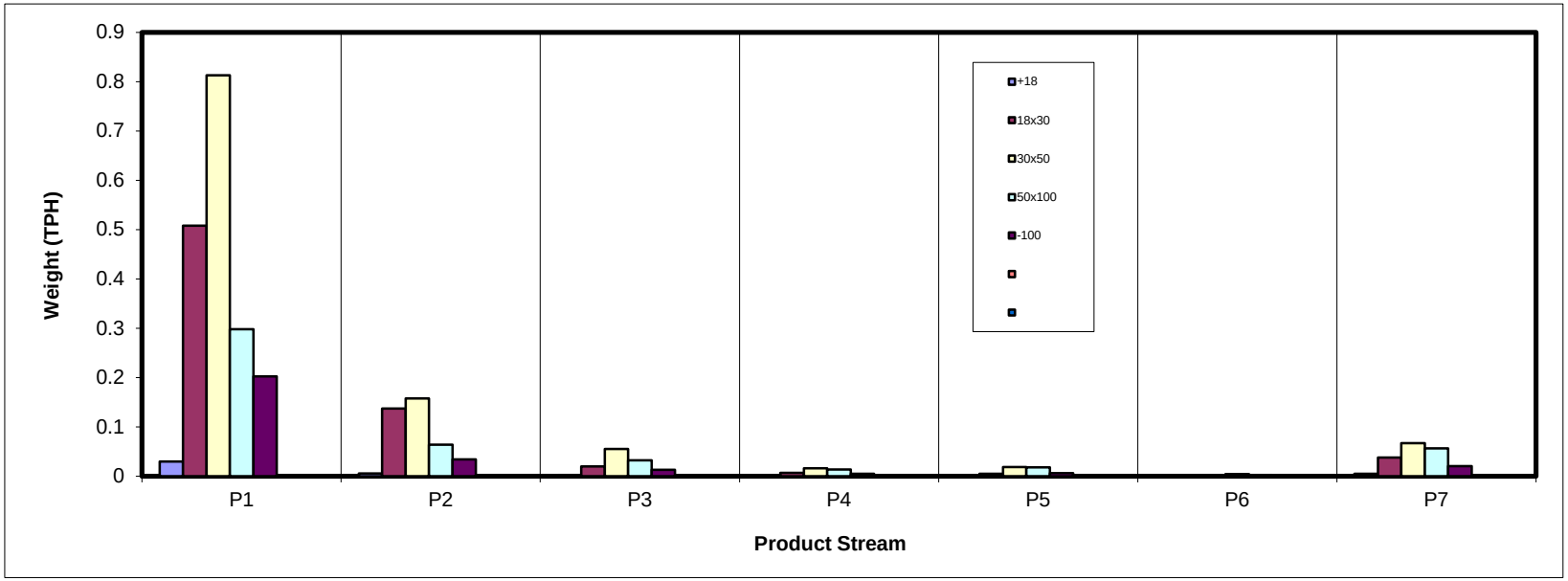
Description: Run 38 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.029	0.005	0.003	0.001	0.000	0.000	0.005		0.043
18x30	0.508	0.137	0.020	0.007	0.005	0.000	0.038		0.714
30x50	0.813	0.158	0.055	0.016	0.018	0.001	0.067		1.128
50x100	0.298	0.064	0.032	0.013	0.018	0.004	0.056		0.485
-100	0.203	0.034	0.013	0.004	0.006	0.002	0.020		0.282
Total (Calc)	1.850	0.397	0.123	0.041	0.047	0.007	0.186		2.652



SPIRAL DATA ANALYSIS

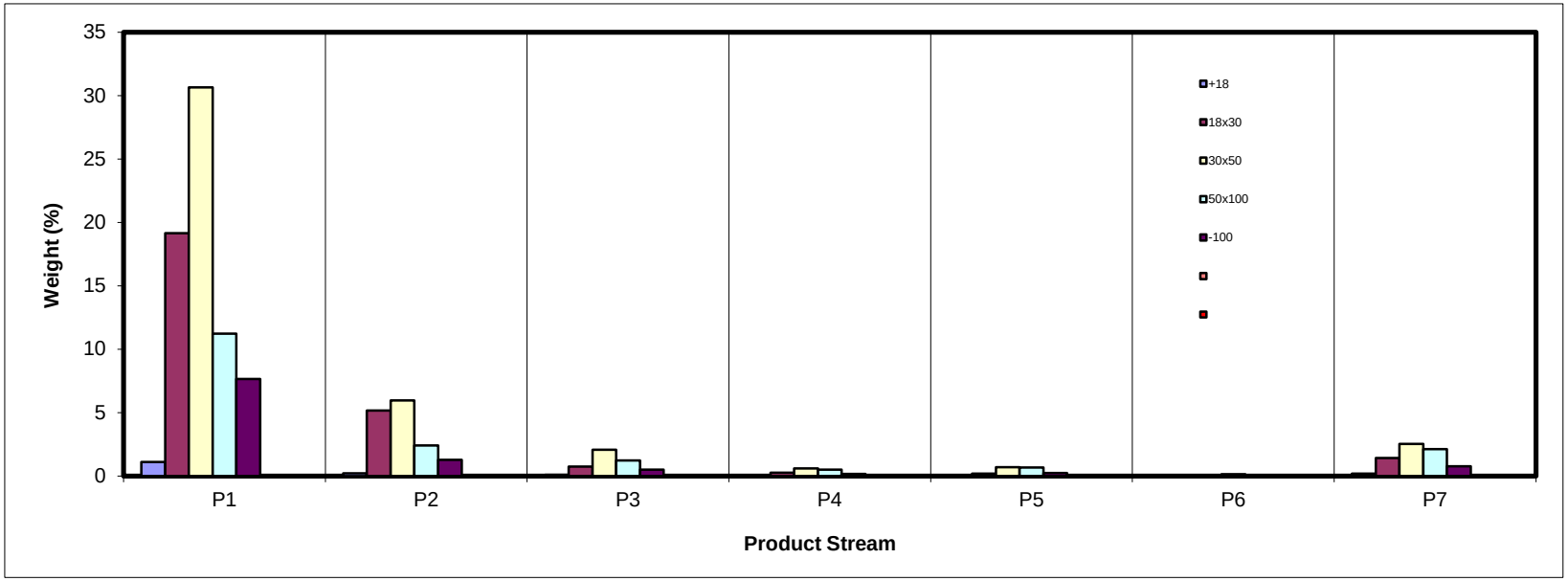
Description: Run 38 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	1.11	0.20	0.10	0.03	0.01	0.00	0.18		1.62
18x30	19.14	5.17	0.75	0.25	0.17	0.00	1.43		26.92
30x50	30.65	5.95	2.07	0.59	0.69	0.06	2.53		42.53
50x100	11.23	2.39	1.22	0.50	0.68	0.15	2.12		18.29
-100	7.64	1.28	0.49	0.17	0.23	0.07	0.77		10.64
Total (Calc)	69.77	14.99	4.63	1.54	1.77	0.28	7.02		100.00



SPIRAL DATA ANALYSIS

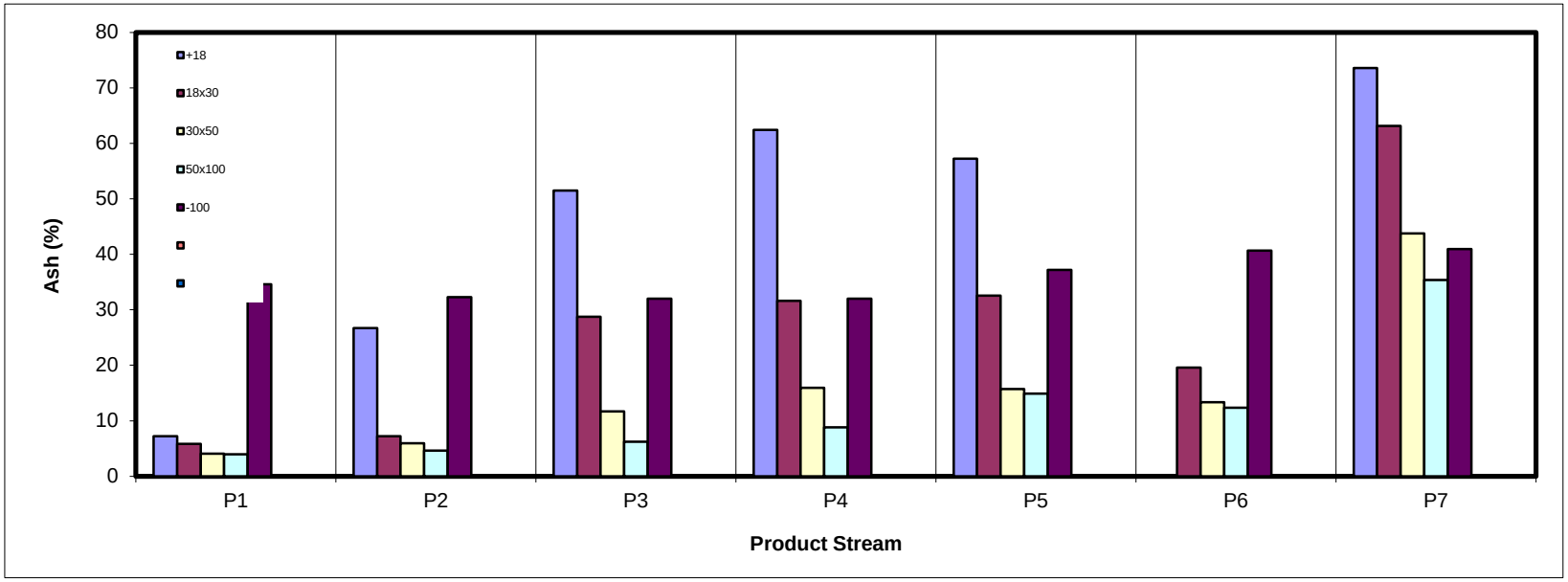
Description: Run 38 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	7.20	26.72	51.49	62.42	57.25	0.01	73.56		20.90
18x30	5.82	7.22	28.77	31.61	32.53	19.56	63.14		10.18
30x50	4.09	5.92	11.69	15.96	15.71	13.34	43.76		7.44
50x100	3.94	4.62	6.23	8.80	14.91	12.37	35.38		8.43
-100	34.61	32.30	32.03	31.98	37.19	40.64	40.96		34.72
Total (Calc)	7.93	8.68	16.01	18.71	20.04	20.06	45.64		11.48



SPIRAL DATA ANALYSIS

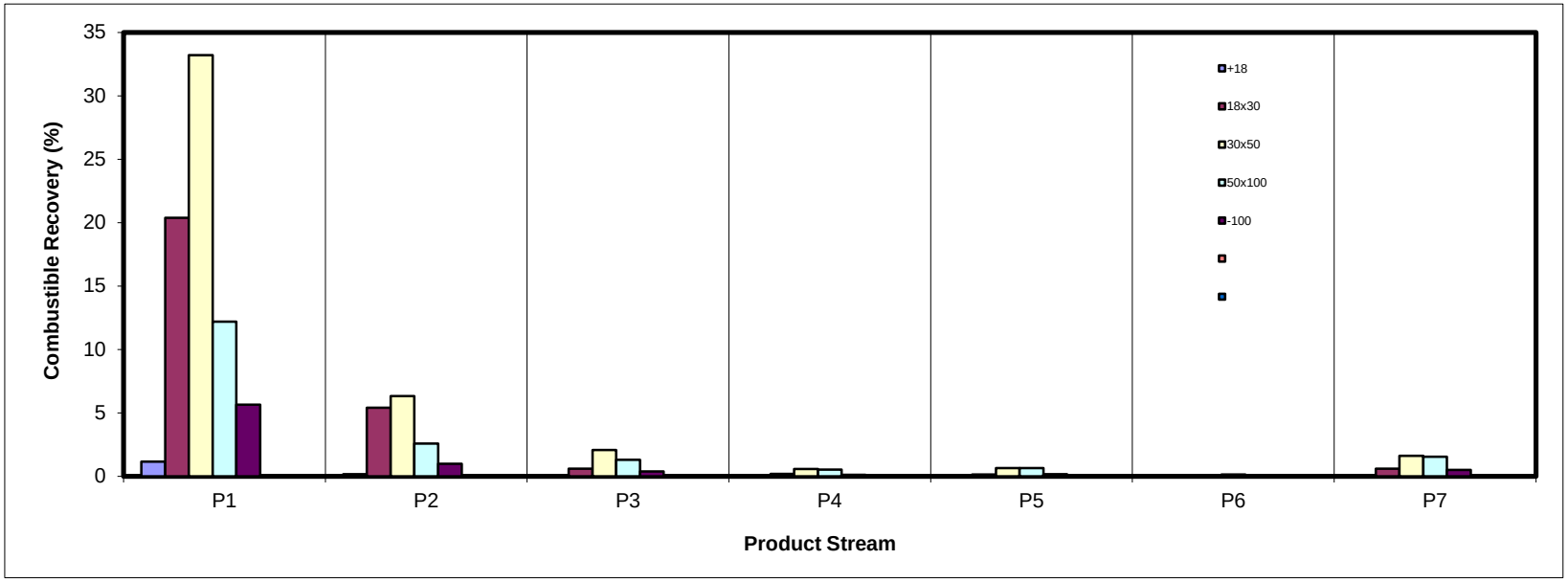
Description: Run 38 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	1.16	0.16	0.05	0.01	0.00	0.00	0.05		1.44
18x30	20.37	5.41	0.60	0.20	0.13	0.00	0.59		27.31
30x50	33.21	6.33	2.06	0.56	0.65	0.05	1.60		44.47
50x100	12.19	2.58	1.29	0.52	0.65	0.14	1.55		18.92
-100	5.64	0.98	0.38	0.13	0.16	0.05	0.51		7.85
Total (Calc)	72.57	15.46	4.39	1.42	1.60	0.25	4.31		100.00



SPIRAL DATA ANALYSIS

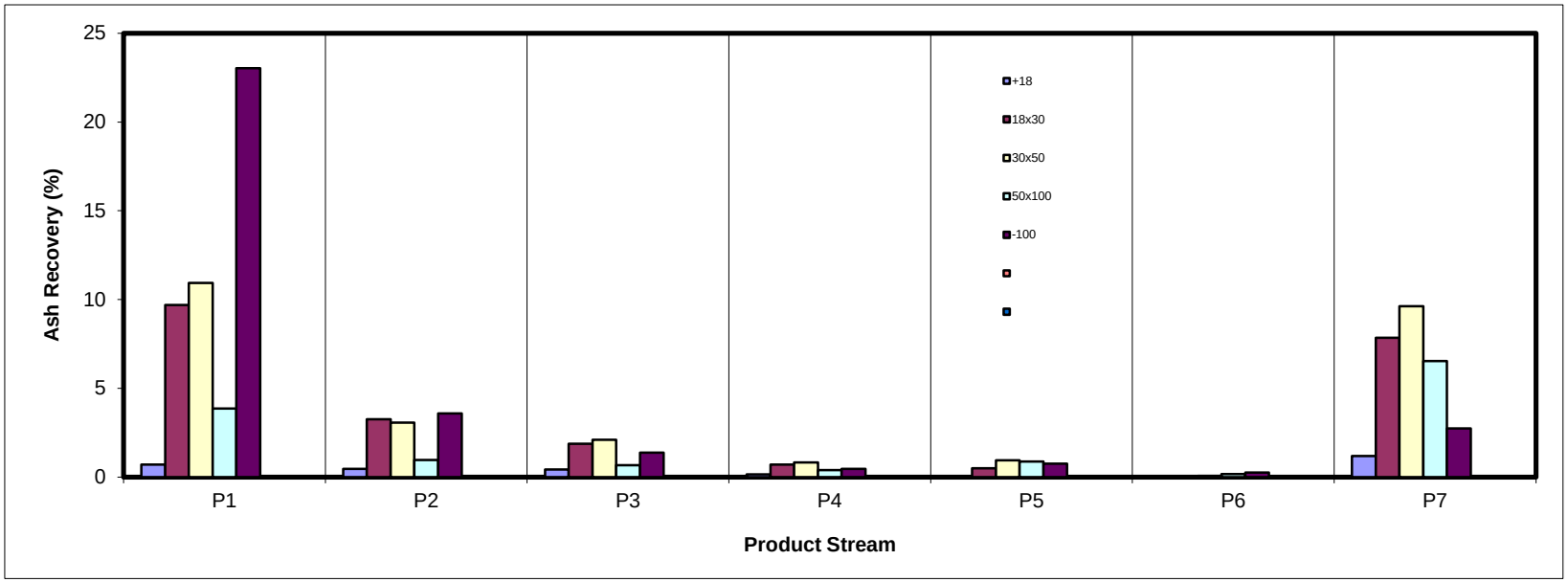
Description: Run 38 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.69	0.46	0.43	0.14	0.05	0.00	1.18		2.94
18x30	9.70	3.25	1.88	0.70	0.49	0.01	7.84		23.86
30x50	10.93	3.07	2.11	0.83	0.94	0.06	9.63		27.57
50x100	3.85	0.96	0.66	0.39	0.88	0.16	6.54		13.44
-100	23.02	3.59	1.38	0.46	0.74	0.26	2.73		32.19
Total (Calc)	48.20	11.33	6.45	2.51	3.10	0.49	27.92		100.00



SPIRAL DATA ANALYSIS

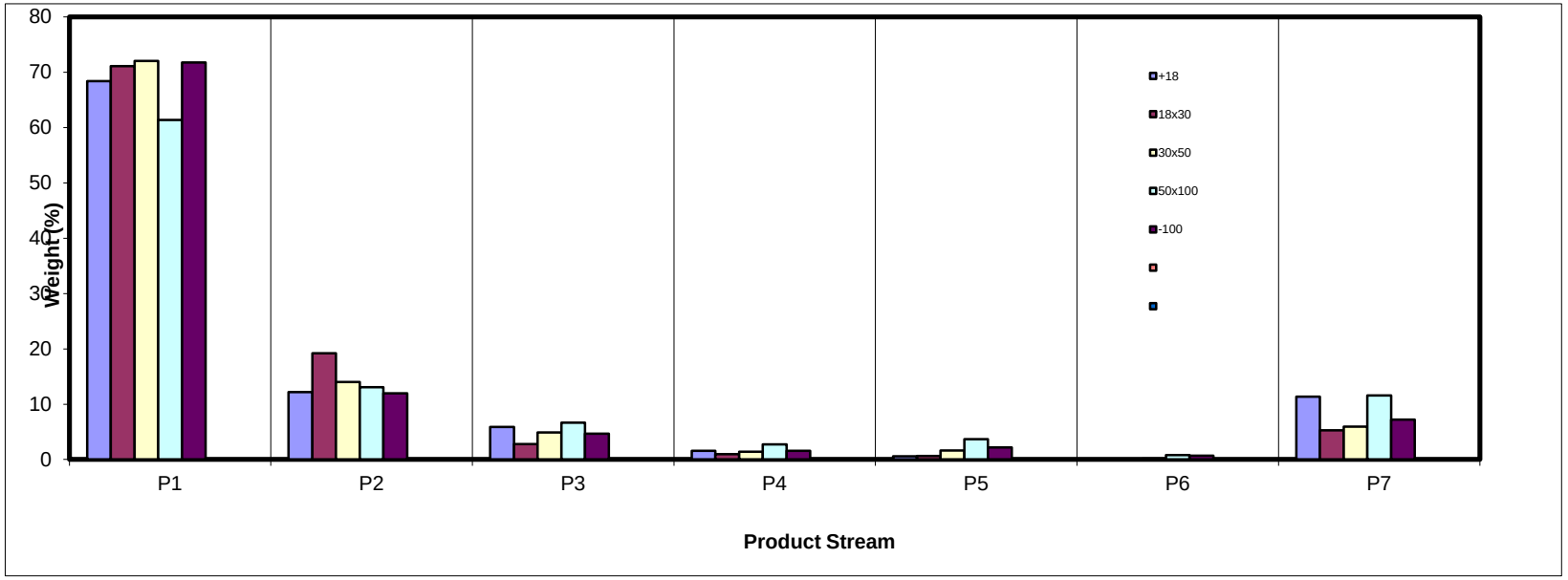
Description: Run 38 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	68.40	12.17	5.88	1.59	0.56	0.00	11.39		100.00
18x30	71.12	19.19	2.78	0.94	0.64	0.01	5.30		100.00
30x50	72.06	13.99	4.86	1.40	1.61	0.13	5.94		100.00
50x100	61.41	13.09	6.66	2.75	3.70	0.80	11.59		100.00
-100	71.77	11.99	4.64	1.56	2.16	0.68	7.20		100.00
Total (Calc)	69.77	14.99	4.63	1.54	1.77	0.28	7.02		100.00



SPIRAL DATA ANALYSIS

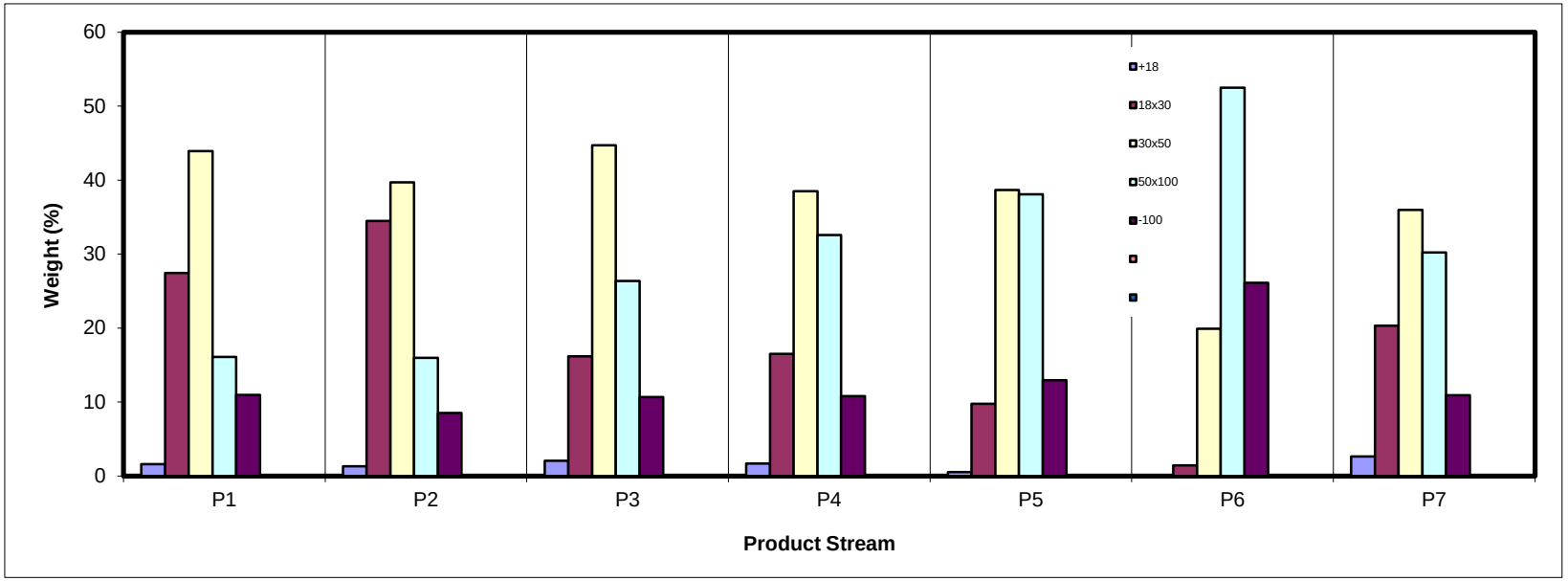
Description: Run 38 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	1.58	1.31	2.06	1.67	0.51	0.01	2.62		1.62
18x30	27.44	34.48	16.18	16.49	9.77	1.45	20.30		26.92
30x50	43.93	39.72	44.72	38.49	38.66	19.89	35.97		42.53
50x100	16.10	15.98	26.36	32.58	38.10	52.52	30.20		18.29
-100	10.95	8.52	10.68	10.78	12.95	26.13	10.91		10.64
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

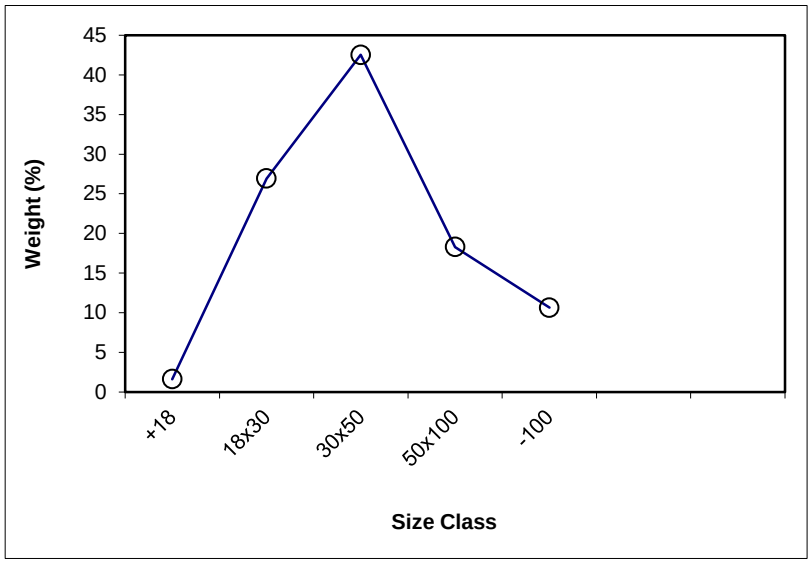
Description: Run 38 -Intermediate Spiral Test

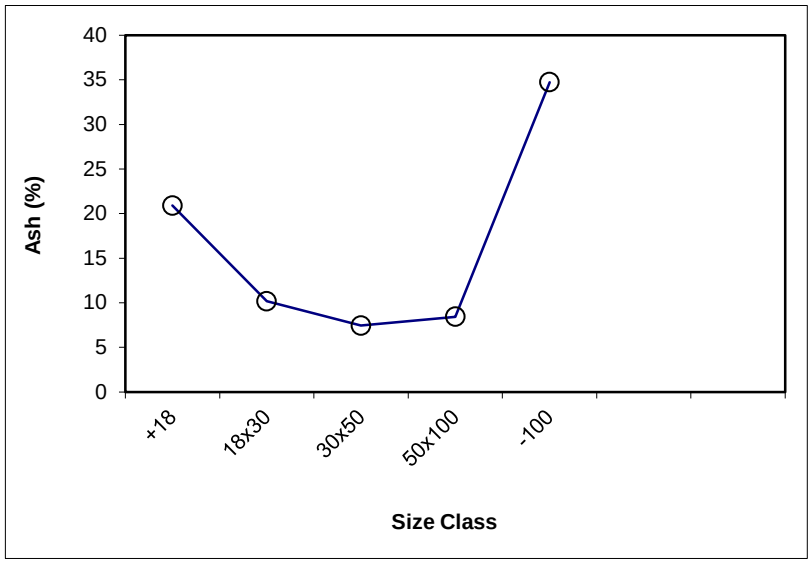
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	11.1	6.2	4.86	1.62	20.90	1.62	20.90	100.00	11.48
18x30	87.3	6.3	81.03	26.92	10.18	28.53	10.79	98.38	11.33
30x50	134.5	6.4	128.04	42.53	7.44	71.06	8.78	71.47	11.76
50x100	61.3	6.2	55.07	18.29	8.43	89.36	8.71	28.94	18.10
-100	38.2	6.2	32.04	10.64	34.72	100.00	11.48	10.64	34.72
Total (Calc)	--	--	301.05	100.00	11.48	--	--	--	--





SPIRAL DATA ANALYSIS

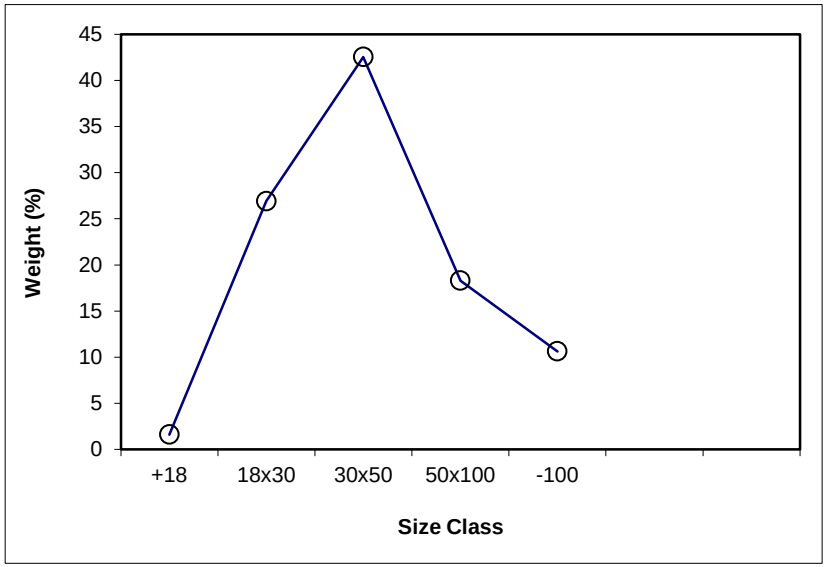
Description: Run 38 -Intermediate Spiral Test

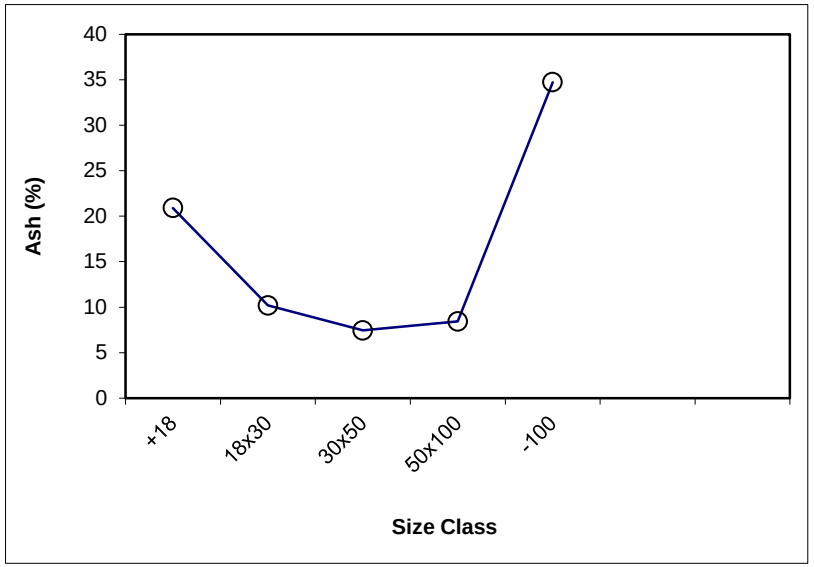
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	1.62	20.90	1.62	20.90	100.00	11.48			
18x30	26.92	10.18	28.53	10.79	98.38	11.33	x	26.92	10.18
30x50	42.53	7.44	71.06	8.78	71.47	11.76	x	42.53	7.44
50x100	18.29	8.43	89.36	8.71	28.94	18.10	x	18.29	8.43
-100	10.64	34.72	100.00	11.48	10.64	34.72			
Total (Calc)	100.00	11.48	--	--	--	--	--	87.74	8.49





SPIRAL DATA ANALYSIS

Description: Run 38 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 69.77

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	482.32	460.1	22.18	1.58	7.20	1.58	7.20	100.00	7.93
18x30	826.32	442.2	384.17	27.44	5.82	29.02	5.89	98.42	7.94
30x50	969.53	354.5	615.08	43.93	4.09	72.95	4.81	70.98	8.77
50x100	622.68	397.2	225.45	16.10	3.94	89.05	4.65	27.05	16.35
-100	159.41	6.1	153.28	10.95	34.61	100.00	7.93	10.95	34.61
Total (Calc)	--	--	1400.15	100.00	7.93	--	--	--	--

Product P2 Feed Weight (%): 14.99

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	10.2	6.3	3.95	1.31	26.72	1.31	26.72	100.00	8.68
18x30	109.7	6.1	103.68	34.48	7.22	35.79	7.94	98.69	8.44
30x50	125.5	6.0	119.44	39.72	5.92	75.51	6.88	64.21	9.10
50x100	54.1	6.1	48.05	15.98	4.62	91.48	6.48	24.49	14.25
-100	31.8	6.2	25.61	8.52	32.30	100.00	8.68	8.52	32.30
Total (Calc)	--	--	300.72	100.00	8.68	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 38 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 4.63

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	12.6	6.3	6.36	2.06	51.49	2.06	51.49	100.00	16.01
18x30	56.3	6.2	50.07	16.18	28.77	18.24	31.33	97.94	15.26
30x50	144.6	6.2	138.37	44.72	11.69	62.96	17.38	81.76	12.59
50x100	87.7	6.2	81.56	26.36	6.23	89.32	14.09	37.04	13.67
-100	39.3	6.3	33.05	10.68	32.03	100.00	16.01	10.68	32.03
Total (Calc)	--	--	309.40	100.00	16.01	--	--	--	--

Product P4 Feed Weight (%): 1.54

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	11.4	6.2	5.16	1.67	62.42	1.67	62.42	100.00	18.71
18x30	57.4	6.3	51.04	16.49	31.61	18.16	34.44	98.33	17.97
30x50	125.4	6.3	119.14	38.49	15.96	56.65	21.88	81.84	15.22
50x100	107.1	6.3	100.84	32.58	8.80	89.22	17.11	43.35	14.56
-100	39.6	6.3	33.35	10.78	31.98	100.00	18.71	10.78	31.98
Total (Calc)	--	--	309.53	100.00	18.71	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 38 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 1.77

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	7.0	6.4	0.60	0.51	57.25	0.51	57.25	100.00	20.04
18x30	17.8	6.2	11.61	9.77	32.53	10.28	33.76	99.49	19.85
30x50	52.2	6.3	45.90	38.66	15.71	48.95	19.50	89.72	18.47
50x100	51.6	6.4	45.24	38.10	14.91	87.05	17.49	51.05	20.56
-100	21.7	6.4	15.37	12.95	37.19	100.00	20.04	12.95	37.19
Total (Calc)	--	--	118.72	100.00	20.04	--	--	--	--

Product P6 Feed Weight (%): 0.28

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	0.0	0.0	0.01	0.01	0.01	0.01	0.01	100.00	20.06
18x30	7.3	6.3	1.08	1.45	19.56	1.46	19.39	99.99	20.06
30x50	21.1	6.3	14.84	19.89	13.34	21.35	13.75	98.54	20.07
50x100	45.4	6.2	39.18	52.52	12.37	73.87	12.77	78.65	21.77
-100	25.8	6.3	19.49	26.13	40.64	100.00	20.06	26.13	40.64
Total (Calc)	--	--	74.60	100.00	20.06	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 38 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 7.02

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	12.3	6.1	6.15	2.62	73.56	2.62	73.56	100.00	45.64
18x30	53.8	6.1	47.69	20.30	63.14	22.92	64.33	97.38	44.89
30x50	90.8	6.3	84.50	35.97	43.76	58.90	51.77	77.08	40.08
50x100	77.2	6.3	70.93	30.20	35.38	89.09	46.21	41.10	36.86
-100	31.9	6.3	25.62	10.91	40.96	100.00	45.64	10.91	40.96
Total (Calc)	--	--	234.89	100.00	45.64	--	--	--	--

SPIRAL DATA ANALYSIS

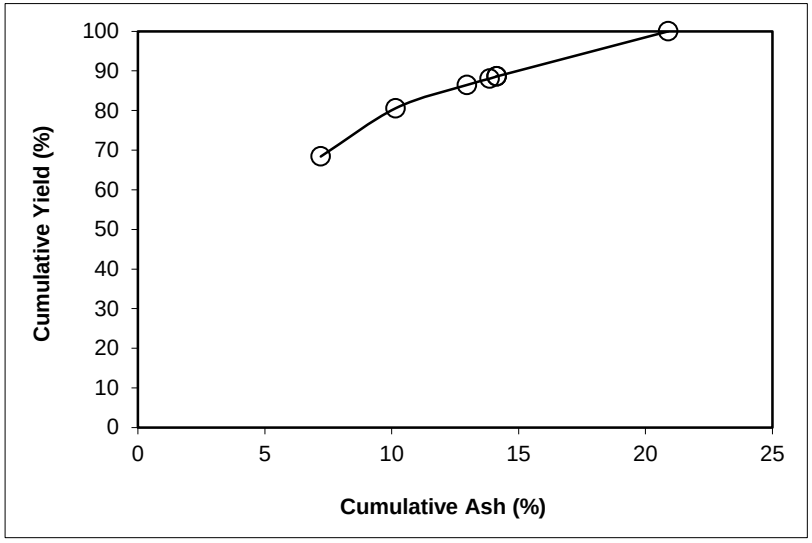
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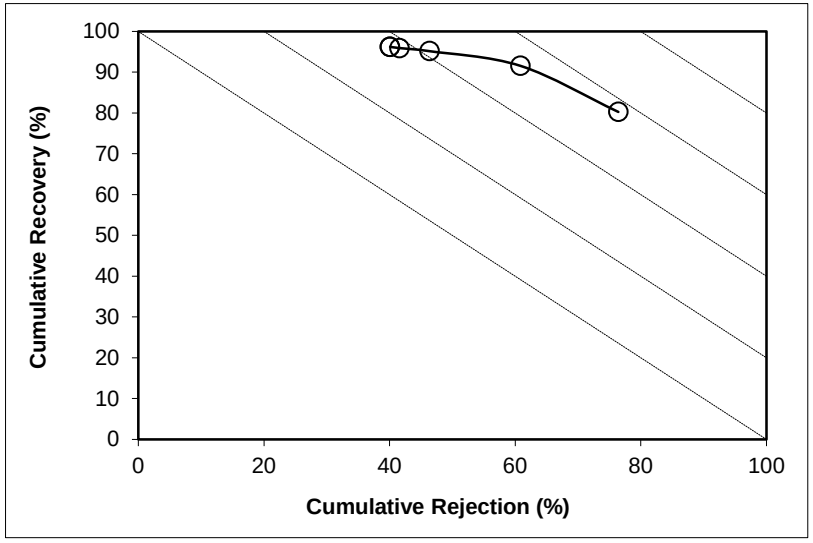
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 1.62

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	68.40	7.20	68.40	7.20	80.25	31.60	50.55	76.42	56.67
P2	12.17	26.72	80.58	10.15	91.52	19.42	65.48	60.86	52.39
P3	5.88	51.49	86.46	12.96	95.13	13.54	71.57	46.36	41.50
P4	1.59	62.42	88.05	13.86	95.89	11.95	72.79	41.61	37.50
P5	0.56	57.25	88.61	14.13	96.19	11.39	73.55	40.08	36.27
P6	0.00	0.01	88.61	14.13	96.19	11.39	73.56	40.08	36.27
P7	11.39	73.56	100.00	20.90	100.00	0.00			
Total (Calc)	100.00	20.90	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

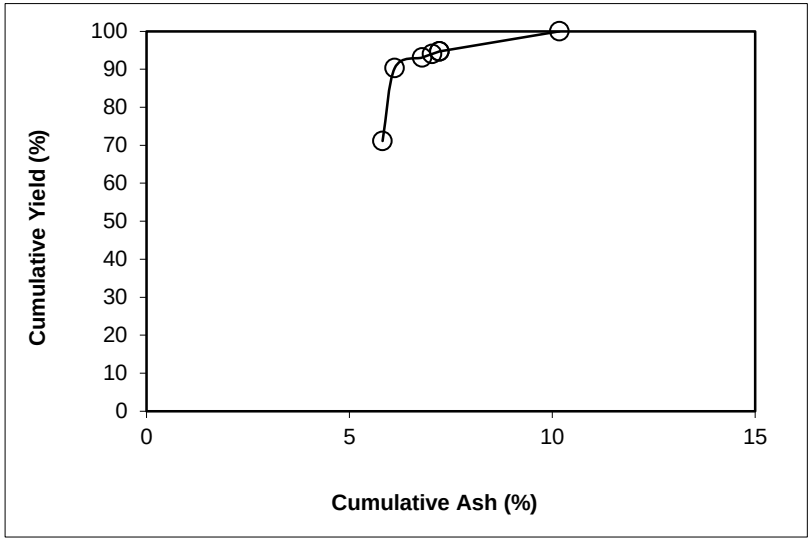
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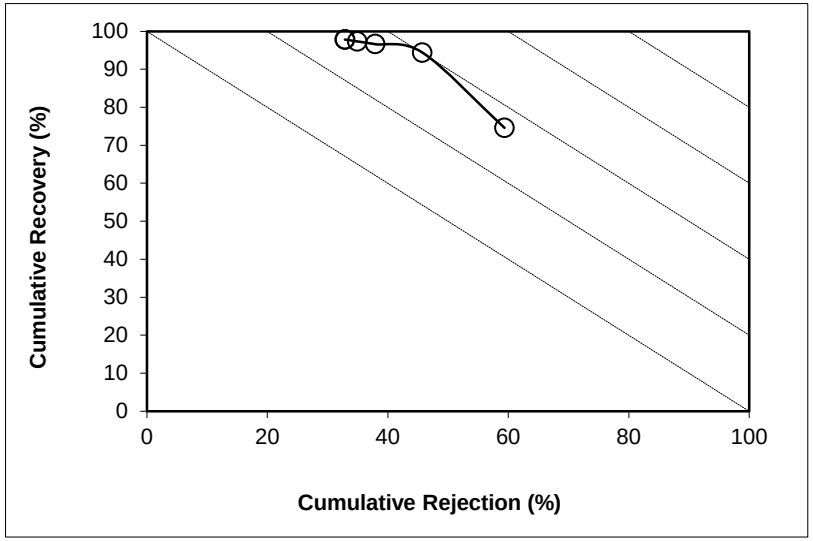
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 26.92

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	71.12	5.82	71.12	5.82	74.58	28.88	20.92	59.36	33.94
P2	19.19	7.22	90.32	6.12	94.40	9.68	48.08	45.74	40.14
P3	2.78	28.77	93.10	6.79	96.61	6.90	55.87	37.88	34.49
P4	0.94	31.61	94.04	7.04	97.33	5.96	59.71	34.95	32.27
P5	0.64	32.53	94.69	7.21	97.81	5.31	63.01	32.89	30.70
P6	0.01	19.56	94.70	7.22	97.83	5.30	63.14	32.86	30.68
P7	5.30	63.14	100.00	10.18	100.00	0.00			
Total (Calc)	100.00	10.18	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

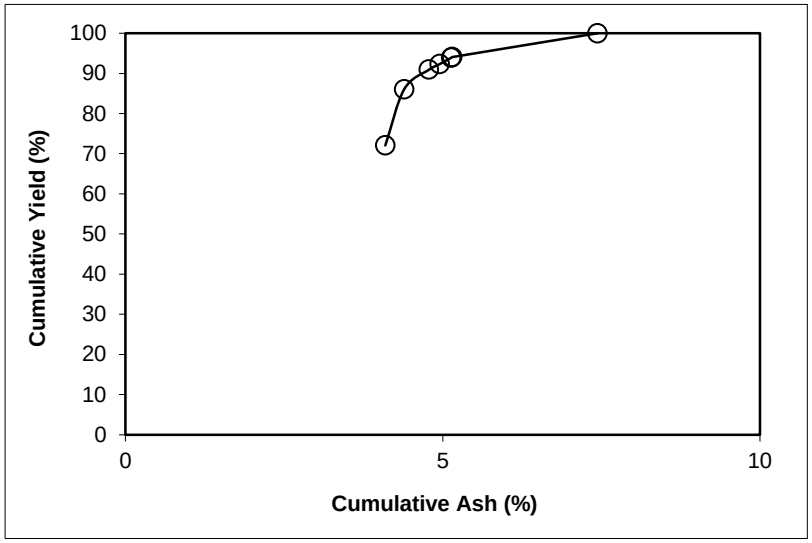
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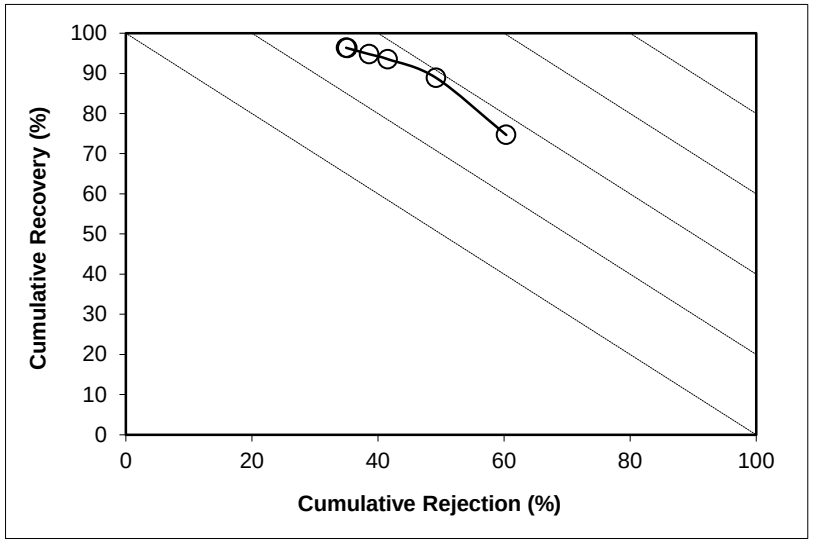
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 42.53

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	72.06	4.09	72.06	4.09	74.67	27.94	16.07	60.35	35.02
P2	13.99	5.92	86.06	4.39	88.89	13.94	26.26	49.21	38.10
P3	4.86	11.69	90.92	4.78	93.53	9.08	34.07	41.57	35.10
P4	1.40	15.96	92.32	4.95	94.80	7.68	37.36	38.57	33.37
P5	1.61	15.71	93.93	5.14	96.27	6.07	43.11	35.17	31.44
P6	0.13	13.34	94.06	5.15	96.39	5.94	43.76	34.93	31.33
P7	5.94	43.76	100.00	7.44	100.00	0.00			
Total (Calc)	100.00	7.44	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

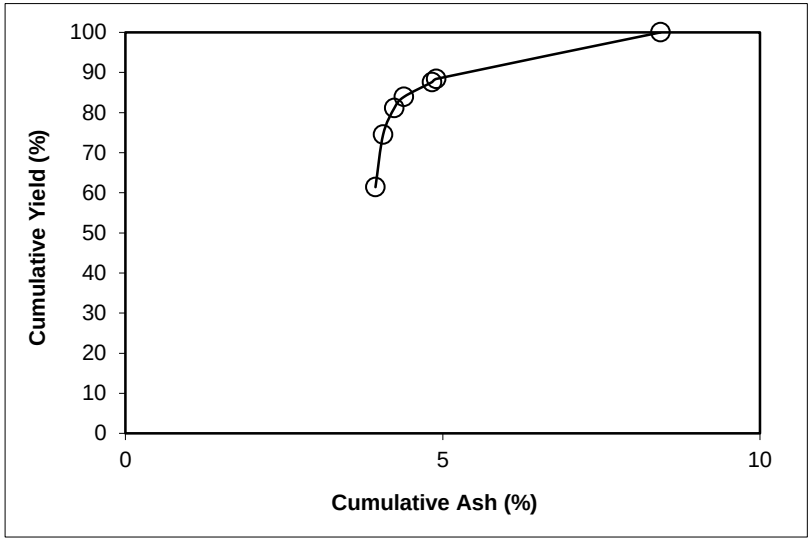
Description: Run 38 -Intermediate Spiral Test

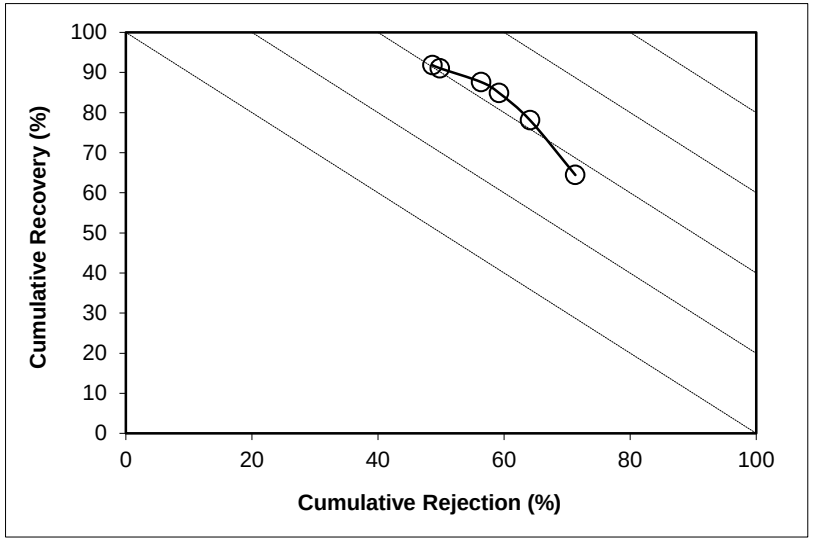
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 18.29

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	61.41	3.94	61.41	3.94	64.42	38.59	15.59	71.32	35.74
P2	13.09	4.62	74.50	4.06	78.06	25.50	21.21	64.14	42.20
P3	6.66	6.23	81.16	4.24	84.88	18.84	26.51	59.21	44.10
P4	2.75	8.80	83.91	4.39	87.62	16.09	29.53	56.35	43.96
P5	3.70	14.91	87.61	4.83	91.05	12.39	33.90	49.81	40.86
P6	0.80	12.37	88.41	4.90	91.82	11.59	35.38	48.64	40.45
P7	11.59	35.38	100.00	8.43	100.00	0.00			
Total (Calc)	100.00	8.43	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

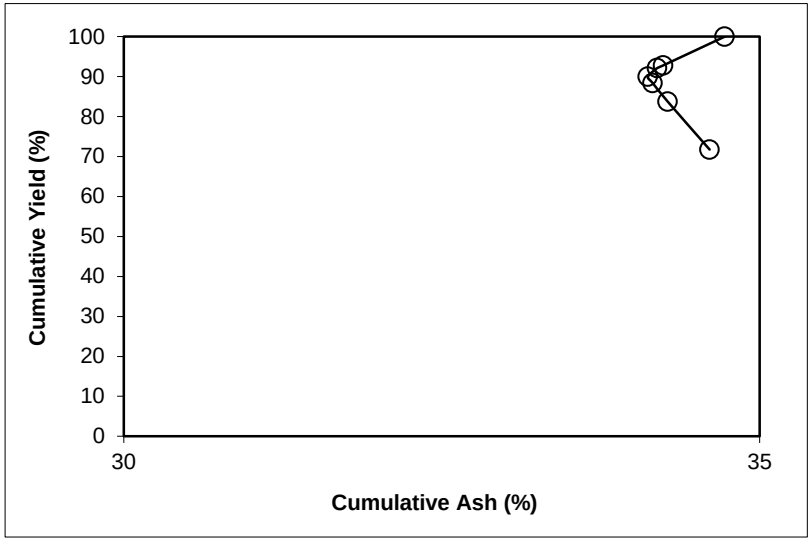
Description: Run 38 -Intermediate Spiral Test

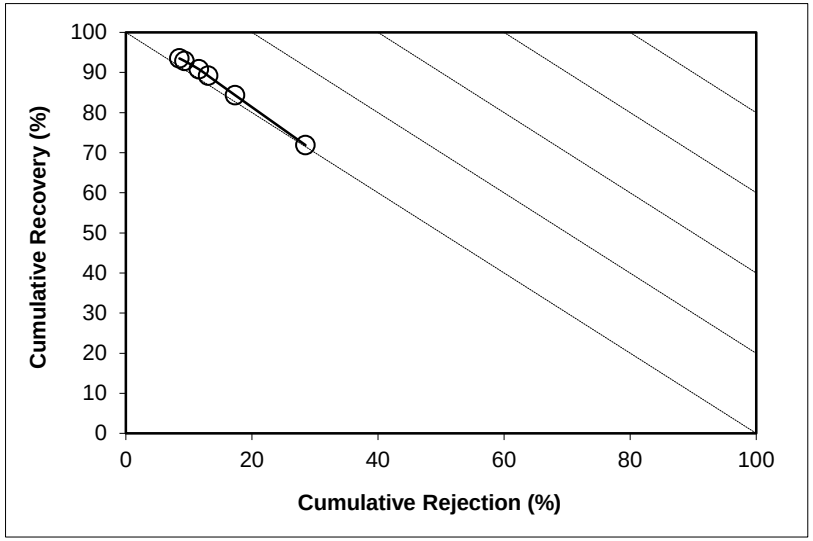
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: -100 Feed Weight (%): 10.64

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	71.77	34.61	71.77	34.61	71.90	28.23	35.02	28.48	0.37
P2	11.99	32.30	83.76	34.28	84.33	16.24	37.03	17.32	1.65
P3	4.64	32.03	88.40	34.16	89.16	11.60	39.03	13.04	2.20
P4	1.56	31.98	89.96	34.12	90.79	10.04	40.13	11.60	2.39
P5	2.16	37.19	92.12	34.19	92.87	7.88	40.93	9.29	2.16
P6	0.68	40.64	92.80	34.24	93.49	7.20	40.96	8.49	1.98
P7	7.20	40.96	100.00	34.72	100.00	0.00			
Total (Calc)	100.00	34.72	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

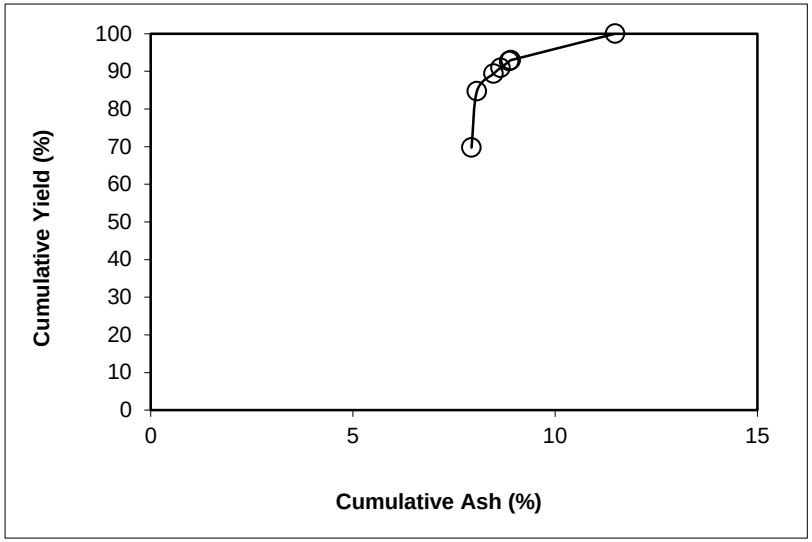
Description: Run 38 -Intermediate Spiral Test

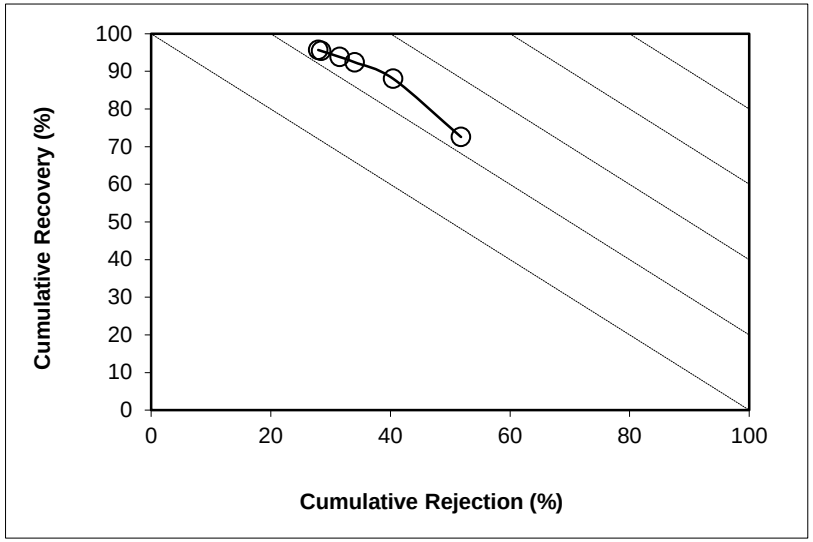
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	69.77	7.93	69.77	7.93	72.57	30.23	19.67	51.80	24.37
P2	14.99	8.68	84.76	8.06	88.03	15.24	30.48	40.47	28.49
P3	4.63	16.01	89.38	8.48	92.42	10.62	36.78	34.02	26.43
P4	1.54	18.71	90.92	8.65	93.83	9.08	39.85	31.50	25.34
P5	1.77	20.04	92.70	8.87	95.44	7.30	44.66	28.41	23.84
P6	0.28	20.06	92.98	8.90	95.69	7.02	45.64	27.92	23.61
P7	7.02	45.64	100.00	11.48	100.00	0.00			
Total (Calc)	100.00	11.48	--	--	--	--	--	--	--

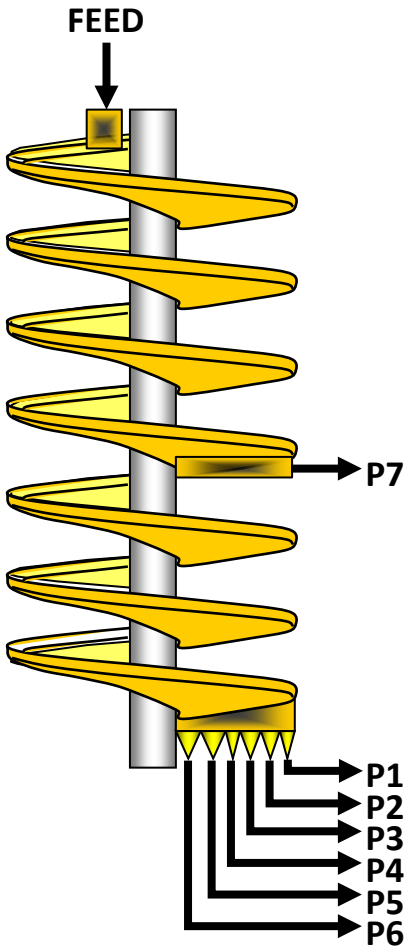




SPIRAL DATA ANALYSIS

Description: Run 39 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	1.582	20.7	24.28	29.04
P2	0.382	29.6	3.64	4.79
P3	0.119	28.7	1.18	1.52
P4	0.035	30.2	0.33	0.43
P5	0.038	23.9	0.49	0.60
P6	0.006	12.3	0.17	0.18
P7	0.186	26.0	2.11	2.60
Total	2.349	22.6	32.20	39.16

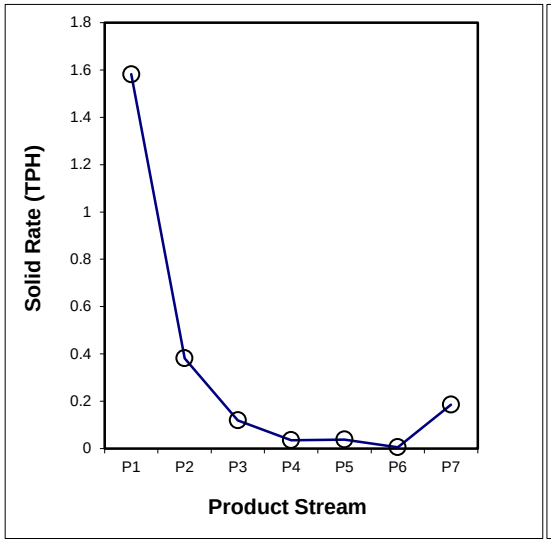
SPIRAL DATA ANALYSIS

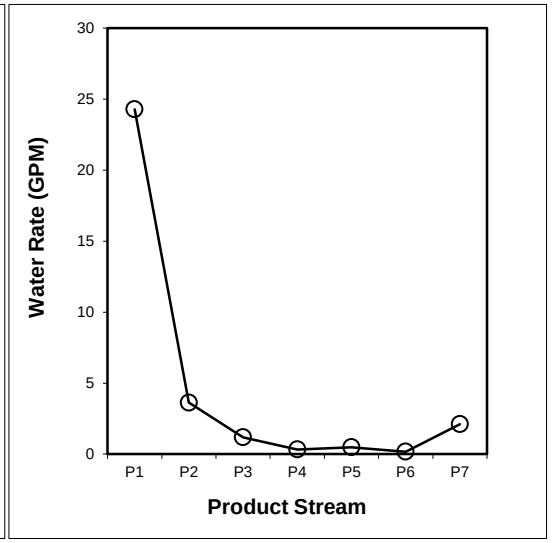
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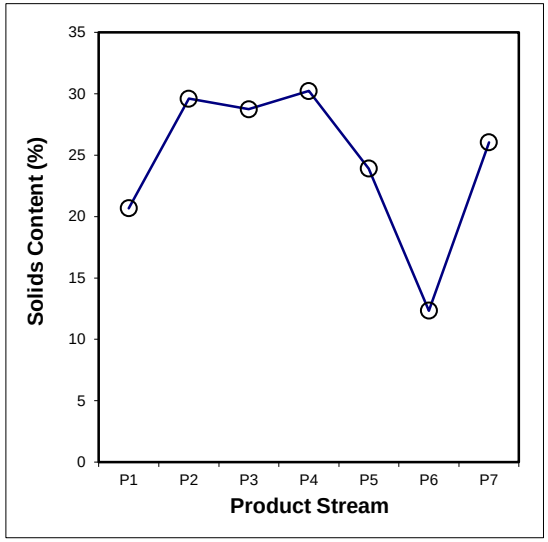
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	3	6991.00	1113.00	7.653	2397.6	1200.5	1.582	67.36	20.67
P2	3	1161.70	170.52	1.291	319.8	30.7	0.382	16.27	29.59
P3	10	1288.42	227.76	0.415	330.9	30.3	0.119	5.07	28.74
P4	30	1067.87	171.71	0.117	297.8	30.8	0.035	1.50	30.22
P5	10	626.62	215.05	0.161	127.5	30.6	0.038	1.64	23.90
P6	40	733.88	243.61	0.048	84.2	24.6	0.006	0.25	12.34
P7	5	1126.19	214.41	0.713	265.0	30.7	0.186	7.91	26.04
Total (Calc)	--	--	--	10.398	--	--	2.349	100.00	22.59
Total (Head)	0.50	1526.34	221.59	10.398	325.2	30.5	2.349	--	22.59







SPIRAL DATA ANALYSIS

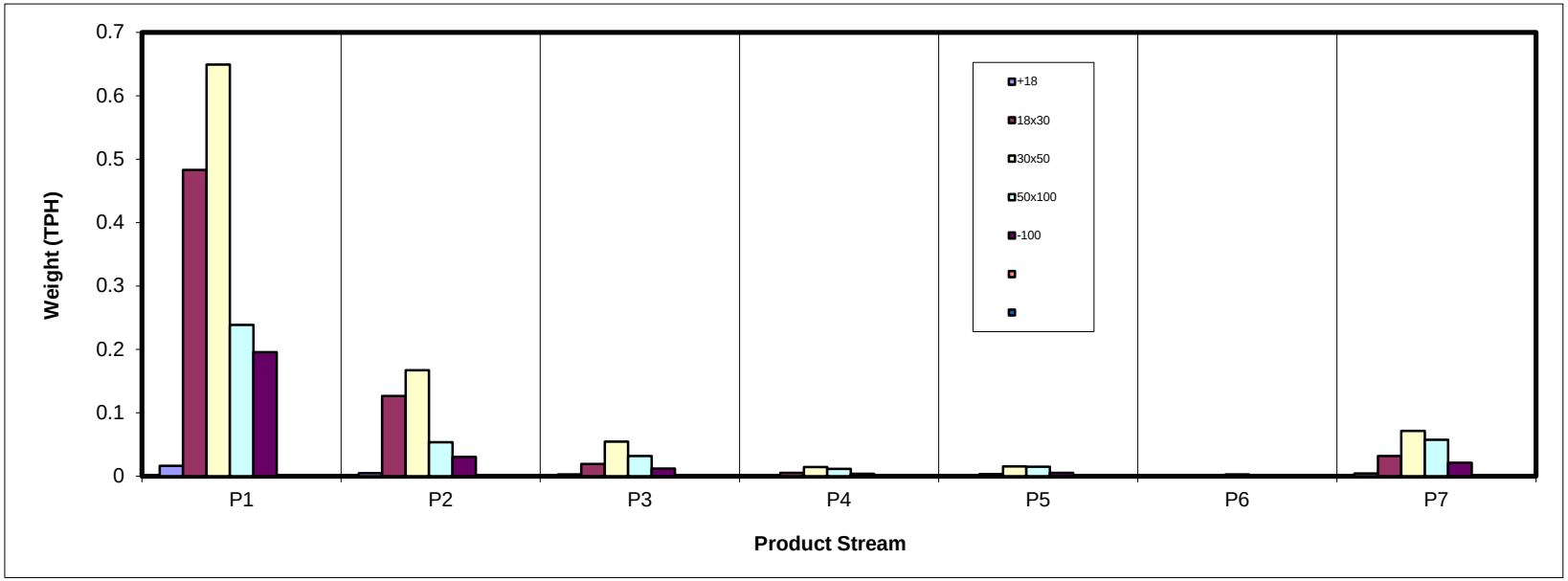
Description: Run 39 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.016	0.004	0.003	0.001	0.000	0.000	0.004		0.028
18x30	0.483	0.127	0.019	0.005	0.003	0.000	0.032		0.669
30x50	0.649	0.167	0.054	0.014	0.015	0.001	0.071		0.973
50x100	0.238	0.054	0.032	0.012	0.015	0.003	0.057		0.410
-100	0.195	0.030	0.012	0.004	0.005	0.002	0.021		0.269
Total (Calc)	1.582	0.382	0.119	0.035	0.038	0.006	0.186		2.349



SPIRAL DATA ANALYSIS

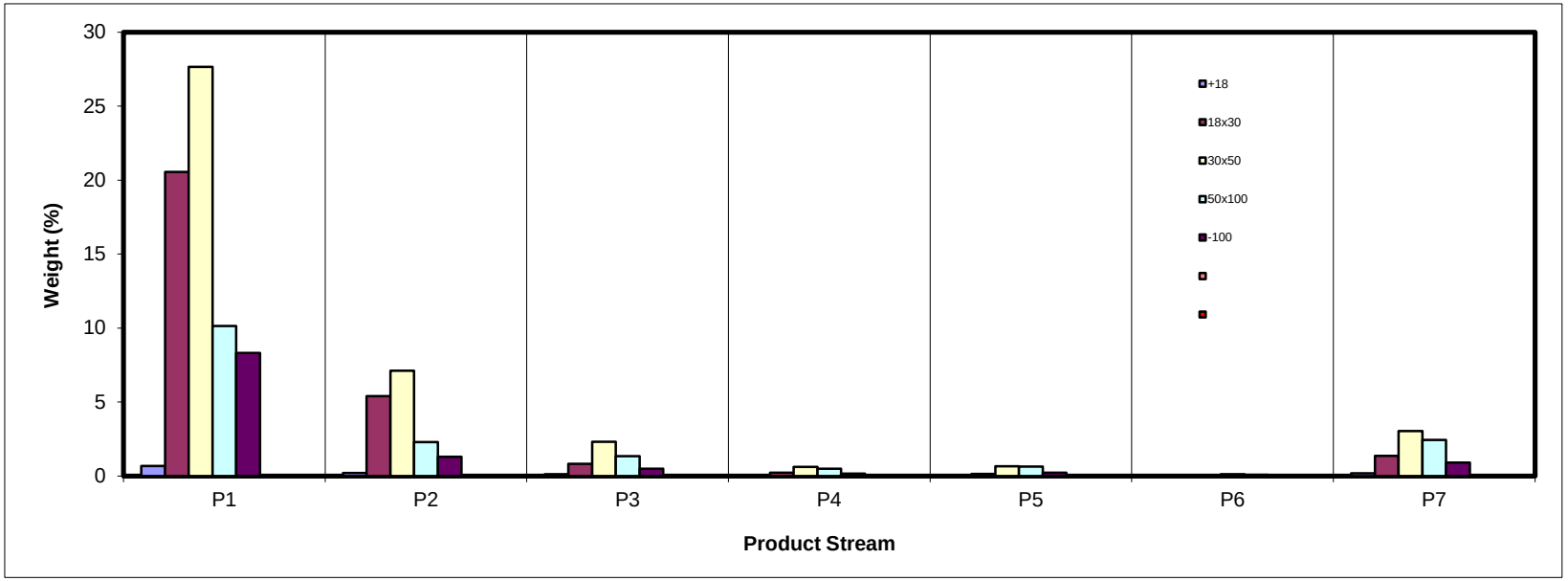
Description: Run 39 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.68	0.19	0.12	0.02	0.01	0.00	0.18		1.20
18x30	20.56	5.39	0.81	0.22	0.14	0.00	1.35		28.48
30x50	27.65	7.11	2.31	0.61	0.65	0.06	3.03		41.42
50x100	10.15	2.28	1.34	0.49	0.62	0.12	2.43		17.44
-100	8.32	1.30	0.50	0.15	0.21	0.07	0.91		11.45
Total (Calc)	67.36	16.27	5.07	1.50	1.64	0.25	7.91		100.00



SPIRAL DATA ANALYSIS

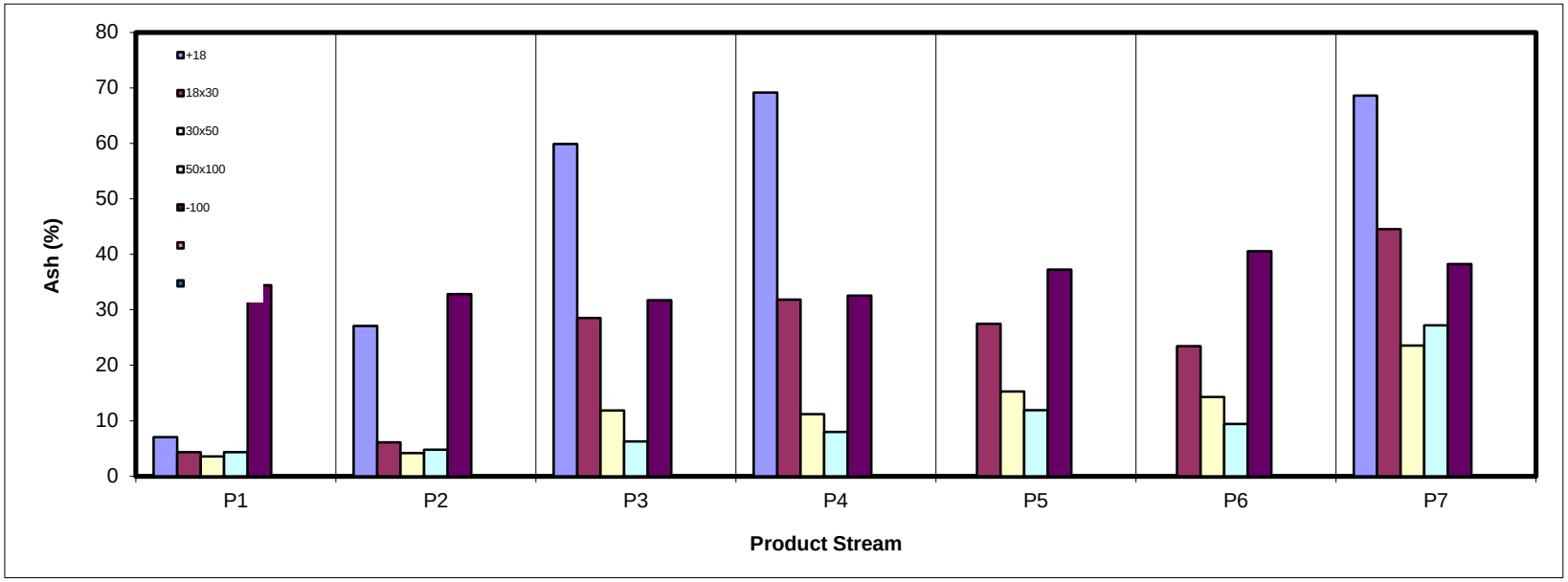
Description: Run 39 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	7.05	27.10	59.91	69.16	0.00	0.00	68.61		25.84
18x30	4.36	6.12	28.50	31.82	27.49	23.47	44.52		7.62
30x50	3.56	4.17	11.85	11.20	15.27	14.29	23.55		5.90
50x100	4.36	4.77	6.30	7.98	11.89	9.45	27.22		8.16
-100	34.46	32.85	31.72	32.54	37.26	40.55	38.27		34.52
Total (Calc)	7.78	7.45	16.07	16.27	17.83	19.07	31.00		10.30



SPIRAL DATA ANALYSIS

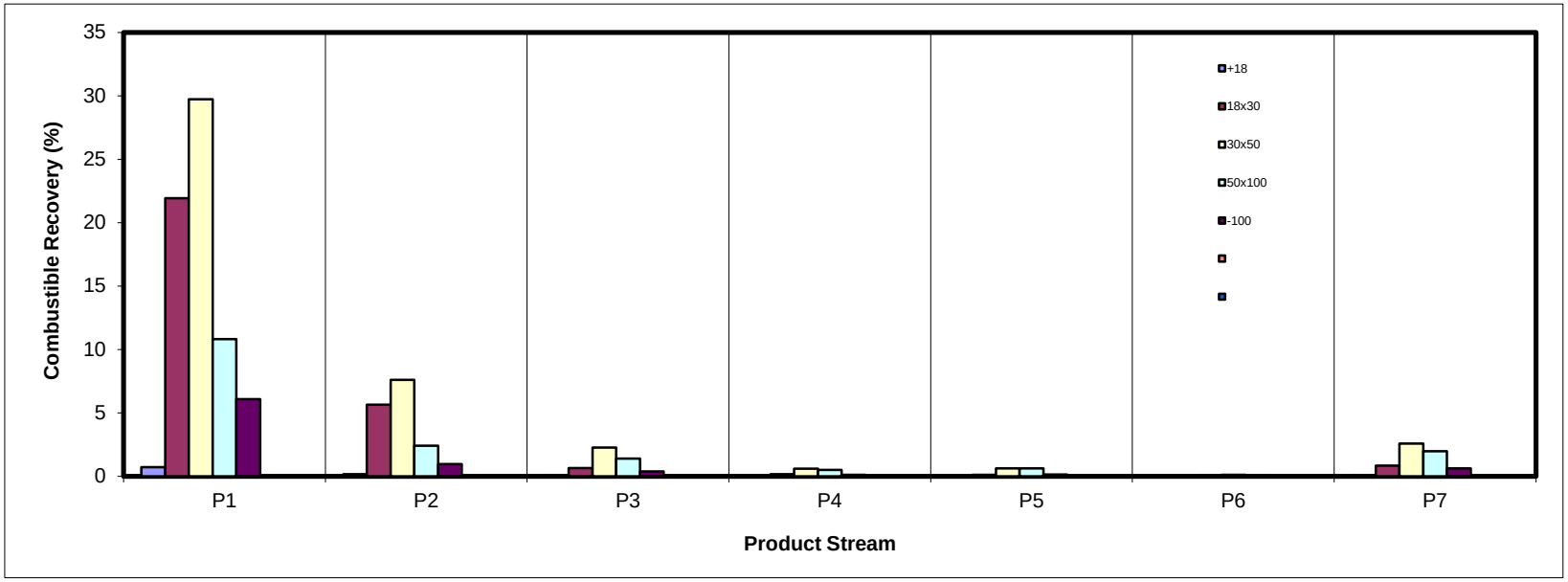
Description: Run 39 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.71	0.15	0.05	0.01	0.01	0.00	0.06		1.00
18x30	21.92	5.64	0.65	0.17	0.11	0.00	0.84		29.33
30x50	29.73	7.60	2.27	0.60	0.62	0.05	2.59		43.45
50x100	10.82	2.42	1.40	0.51	0.61	0.13	1.97		17.86
-100	6.08	0.97	0.38	0.12	0.15	0.04	0.62		8.36
Total (Calc)	69.26	16.78	4.75	1.40	1.50	0.23	6.08		100.00



SPIRAL DATA ANALYSIS

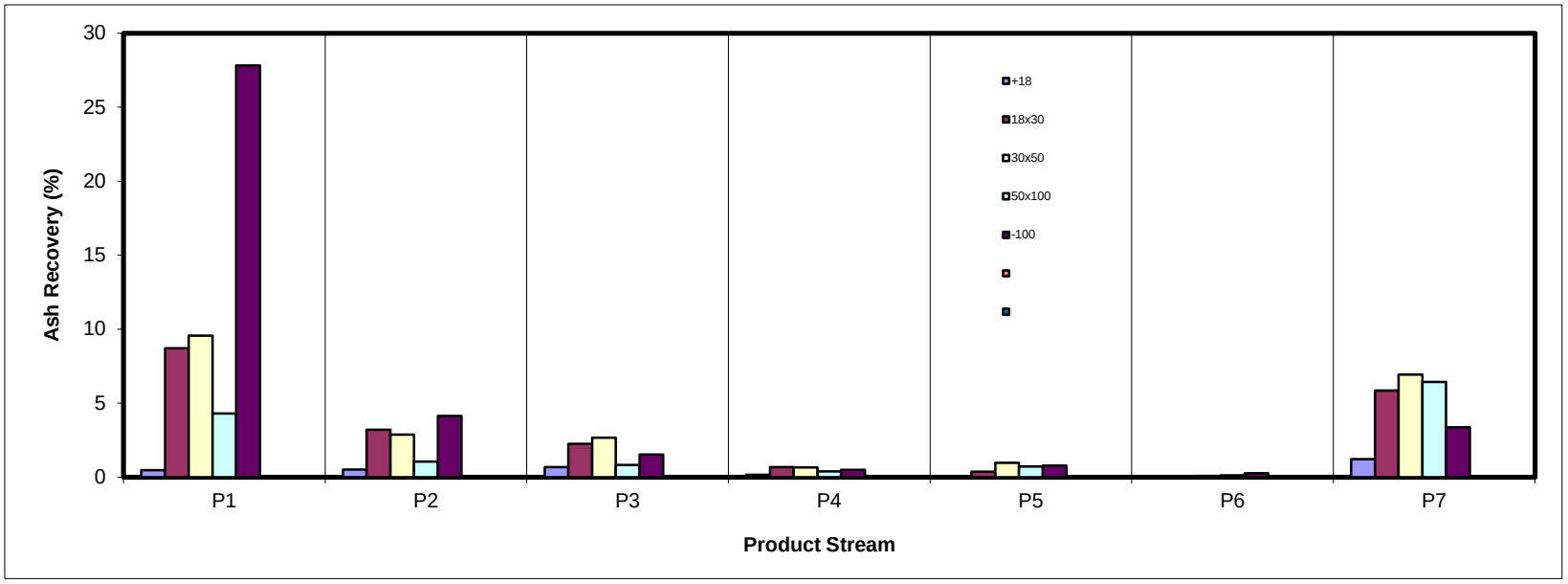
Description: Run 39 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	0.47	0.50	0.67	0.16	0.00	0.00	1.22		3.02
18x30	8.70	3.20	2.24	0.68	0.37	0.01	5.85		21.06
30x50	9.56	2.88	2.66	0.66	0.97	0.08	6.93		23.73
50x100	4.30	1.06	0.82	0.38	0.72	0.11	6.42		13.81
-100	27.82	4.14	1.53	0.49	0.77	0.26	3.36		38.37
Total (Calc)	50.85	11.77	7.92	2.37	2.83	0.47	23.80		100.00



SPIRAL DATA ANALYSIS

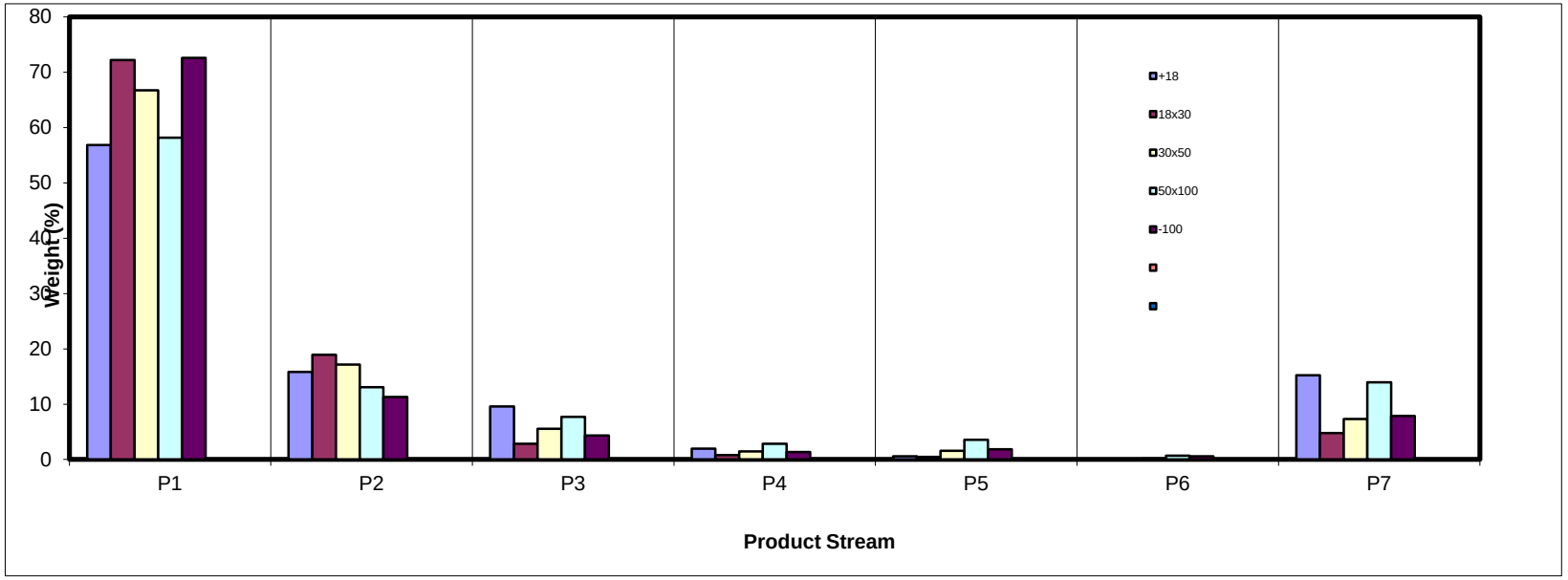
Description: Run 39 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	56.85	15.83	9.57	1.95	0.55	0.00	15.25		100.00
18x30	72.20	18.91	2.85	0.77	0.49	0.01	4.76		100.00
30x50	66.75	17.17	5.57	1.47	1.58	0.13	7.33		100.00
50x100	58.17	13.07	7.70	2.83	3.58	0.71	13.94		100.00
-100	72.63	11.33	4.33	1.35	1.86	0.59	7.90		100.00
Total (Calc)	67.36	16.27	5.07	1.50	1.64	0.25	7.91		100.00



SPIRAL DATA ANALYSIS

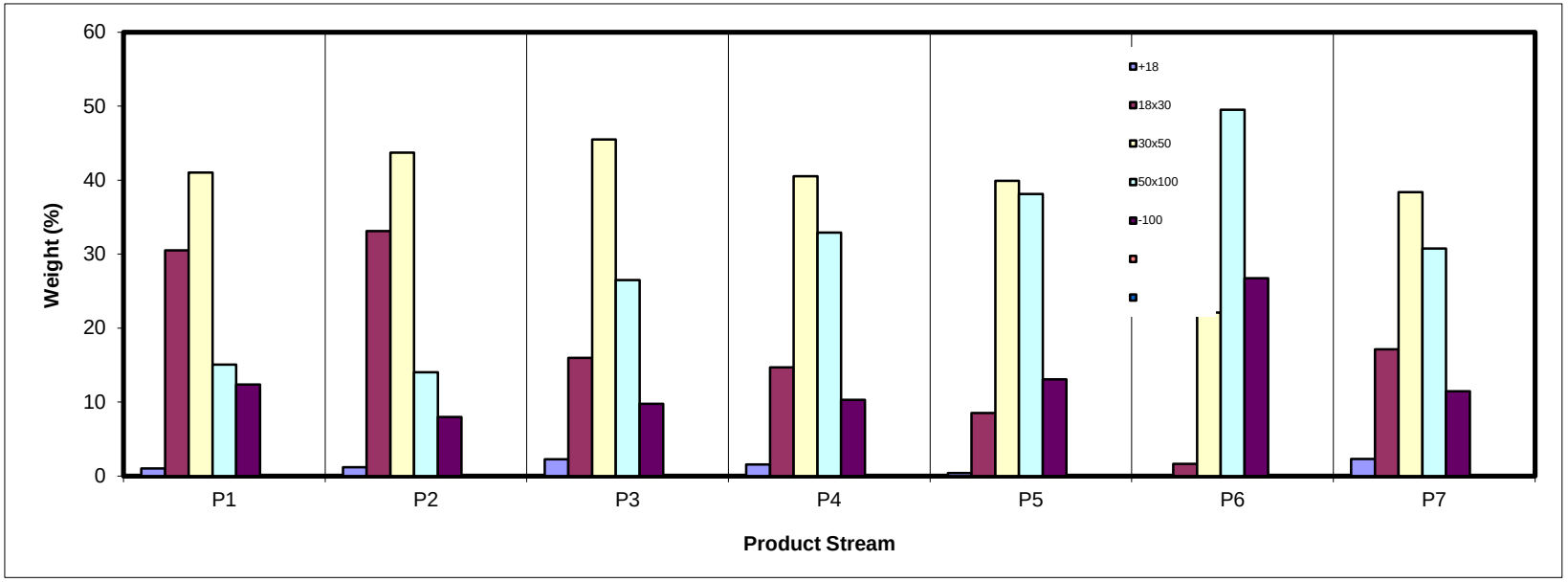
Description: Run 39 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+18	1.02	1.17	2.27	1.56	0.41	0.00	2.32		1.20
18x30	30.52	33.11	15.98	14.68	8.52	1.64	17.13		28.48
30x50	41.04	43.72	45.50	40.55	39.91	22.10	38.36		41.42
50x100	15.06	14.02	26.48	32.90	38.12	49.50	30.74		17.44
-100	12.35	7.98	9.77	10.31	13.05	26.75	11.44		11.45
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

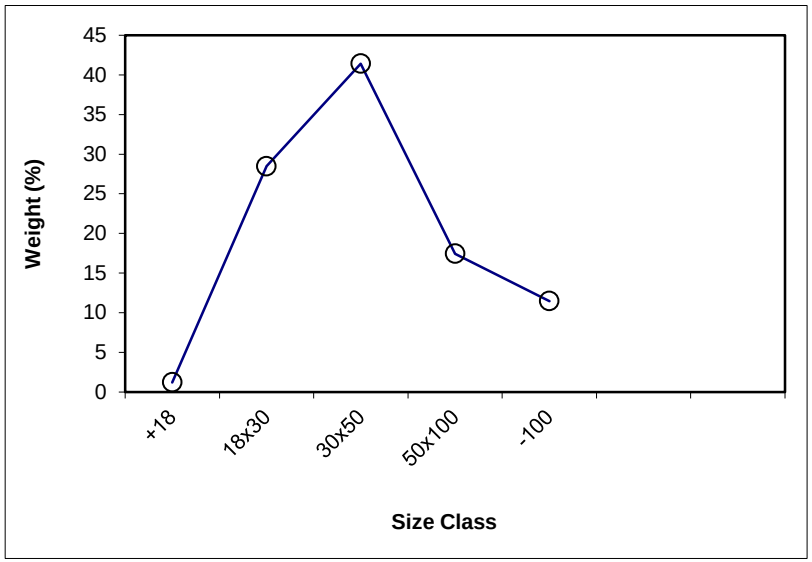
Description: Run 39 -Intermediate Spiral Test

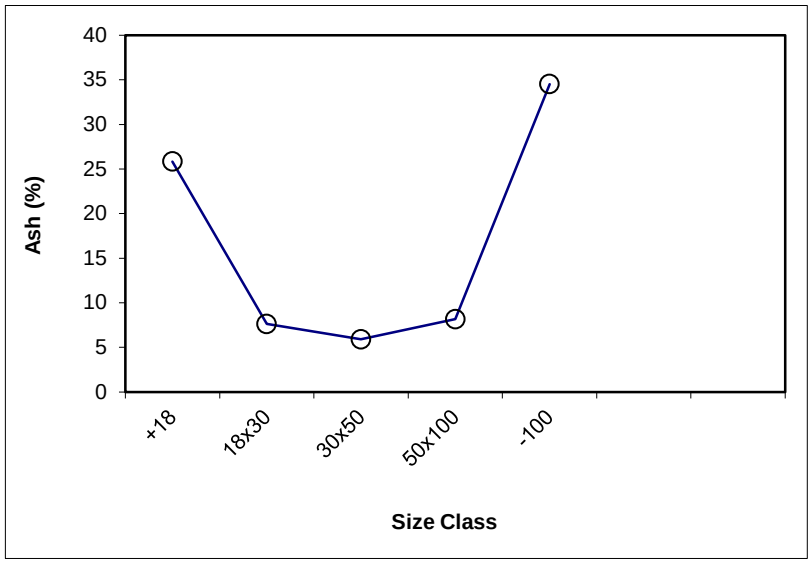
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	9.5	6.0	3.55	1.20	25.84	1.20	25.84	100.00	10.30
18x30	90.1	6.2	83.93	28.48	7.62	29.68	8.36	98.80	10.11
30x50	128.2	6.1	122.08	41.42	5.90	71.10	6.93	70.32	11.12
50x100	57.5	6.1	51.41	17.44	8.16	88.55	7.17	28.90	18.61
-100	39.8	6.1	33.76	11.45	34.52	100.00	10.30	11.45	34.52
Total (Calc)	--	--	294.72	100.00	10.30	--	--	--	--





SPIRAL DATA ANALYSIS

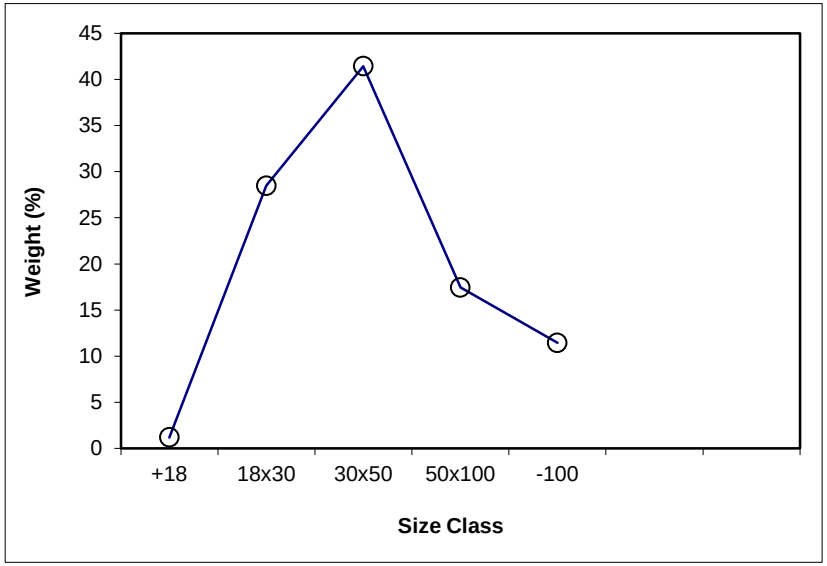
Description: Run 39 -Intermediate Spiral Test

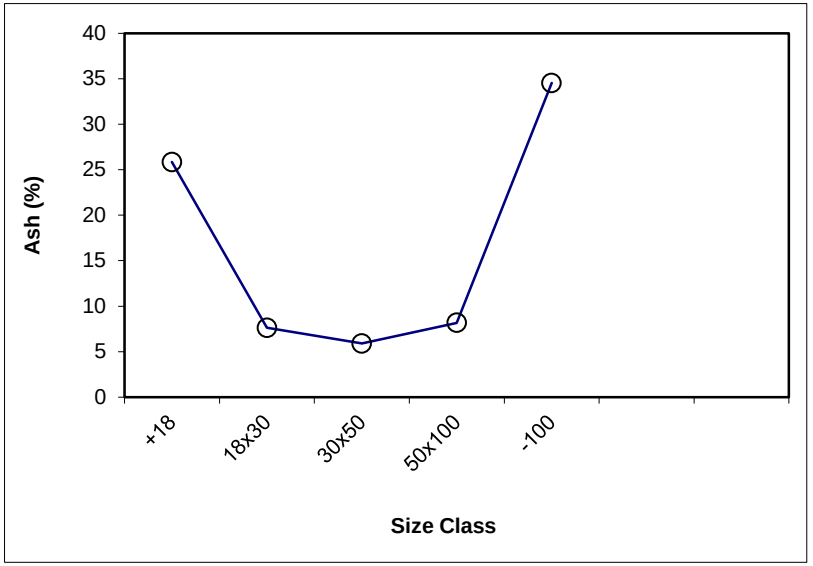
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	1.20	25.84	1.20	25.84	100.00	10.30			
18x30	28.48	7.62	29.68	8.36	98.80	10.11	x	28.48	7.62
30x50	41.42	5.90	71.10	6.93	70.32	11.12	x	41.42	5.90
50x100	17.44	8.16	88.55	7.17	28.90	18.61	x	17.44	8.16
-100	11.45	34.52	100.00	10.30	11.45	34.52			
Total (Calc)	100.00	10.30	--	--	--	--	--	87.34	6.91





SPIRAL DATA ANALYSIS

Description: Run 39 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 67.36

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	18.20	6.0	12.17	1.02	7.05	1.02	7.05	100.00	7.78
18x30	747.27	381.9	365.41	30.52	4.36	31.54	4.45	98.98	7.79
30x50	903.87	412.5	491.34	41.04	3.56	72.59	3.95	68.46	9.31
50x100	568.02	387.7	180.33	15.06	4.36	87.65	4.02	27.41	17.92
-100	160.24	12.4	147.84	12.35	34.46	100.00	7.78	12.35	34.46
Total (Calc)	--	--	1197.08	100.00	7.78	--	--	--	--

Product P2 Feed Weight (%): 16.27

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	9.4	6.1	3.39	1.17	27.10	1.17	27.10	100.00	7.45
18x30	102.0	6.3	95.72	33.11	6.12	34.28	6.84	98.83	7.22
30x50	132.6	6.2	126.41	43.72	4.17	78.01	5.34	65.72	7.78
50x100	46.6	6.1	40.53	14.02	4.77	92.02	5.25	21.99	14.95
-100	29.2	6.1	23.06	7.98	32.85	100.00	7.45	7.98	32.85
Total (Calc)	--	--	289.10	100.00	7.45	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 39 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 5.07

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	12.9	6.1	6.83	2.27	59.91	2.27	59.91	100.00	16.07
18x30	54.2	6.1	48.04	15.98	28.50	18.25	32.41	97.73	15.06
30x50	142.8	6.0	136.75	45.50	11.85	63.75	17.74	81.75	12.43
50x100	85.6	6.1	79.59	26.48	6.30	90.23	14.38	36.25	13.15
-100	35.3	6.0	29.38	9.77	31.72	100.00	16.07	9.77	31.72
Total (Calc)	--	--	300.58	100.00	16.07	--	--	--	--

Product P4 Feed Weight (%): 1.50

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	10.3	6.2	4.17	1.56	69.16	1.56	69.16	100.00	16.27
18x30	45.4	6.2	39.20	14.68	31.82	16.24	35.41	98.44	15.43
30x50	114.4	6.1	108.27	40.55	11.20	56.79	18.12	83.76	12.56
50x100	94.1	6.2	87.84	32.90	7.98	89.69	14.40	43.21	13.84
-100	33.6	6.1	27.53	10.31	32.54	100.00	16.27	10.31	32.54
Total (Calc)	--	--	267.01	100.00	16.27	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 39 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 1.64

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	6.5	6.1	0.40	0.41	0.00	0.41	0.00	100.00	17.83
18x30	14.4	6.2	8.26	8.52	27.49	8.93	26.23	99.59	17.90
30x50	44.9	6.2	38.68	39.91	15.27	48.83	17.27	91.07	17.01
50x100	43.0	6.1	36.95	38.12	11.89	86.95	14.91	51.17	18.36
-100	18.7	6.1	12.65	13.05	37.26	100.00	17.83	13.05	37.26
Total (Calc)	--	--	96.94	100.00	17.83	--	--	--	--

Product P6 Feed Weight (%): 0.25

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	0.0	0.0	0.00	0.00	0.00	0.00	0.00	100.00	19.07
18x30	7.2	6.2	0.98	1.64	23.47	1.64	23.47	100.00	19.07
30x50	19.4	6.3	13.17	22.10	14.29	23.75	14.93	98.36	19.00
50x100	35.6	6.1	29.50	49.50	9.45	73.25	11.23	76.25	20.36
-100	22.0	6.1	15.94	26.75	40.55	100.00	19.07	26.75	40.55
Total (Calc)	--	--	59.59	100.00	19.07	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 39 -Intermediate Spiral Test

Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 7.91

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	11.6	6.2	5.44	2.32	68.61	2.32	68.61	100.00	31.00
18x30	46.2	6.1	40.12	17.13	44.52	19.45	47.40	97.68	30.11
30x50	96.1	6.2	89.87	38.36	23.55	57.81	31.57	80.55	27.04
50x100	78.3	6.2	72.02	30.74	27.22	88.56	30.06	42.19	30.22
-100	32.9	6.1	26.81	11.44	38.27	100.00	31.00	11.44	38.27
Total (Calc)	--	--	234.27	100.00	31.00	--	--	--	--

SPIRAL DATA ANALYSIS

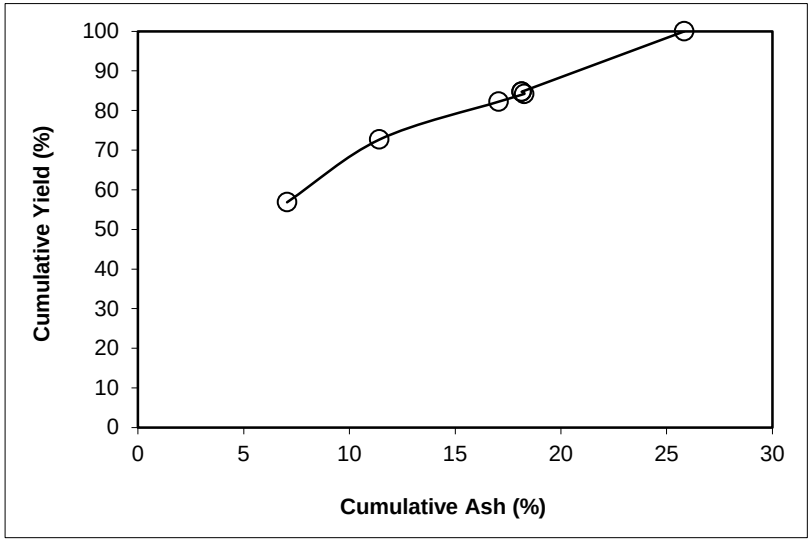
Description: Run 39 -Intermediate Spiral Test

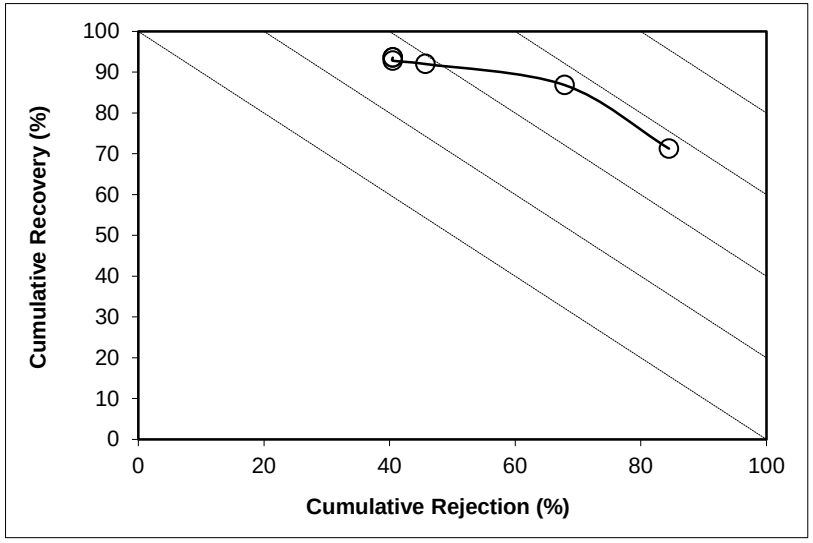
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 1.20

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	56.85	7.05	56.85	7.05	71.26	43.15	50.60	84.49	55.75
P2	15.83	27.10	72.68	11.41	86.81	27.32	64.21	67.89	54.71
P3	9.57	59.91	82.25	17.06	91.99	17.75	66.53	45.71	37.70
P4	1.95	69.16	84.19	18.26	92.80	15.81	66.20	40.50	33.29
P5	0.55	0.00	84.75	18.14	93.55	15.25	68.61	40.50	34.04
P6	0.00	0.00	84.75	18.14	93.55	15.25	68.61	40.50	34.04
P7	15.25	68.61	100.00	25.84	100.00	0.00			
Total (Calc)	100.00	25.84	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

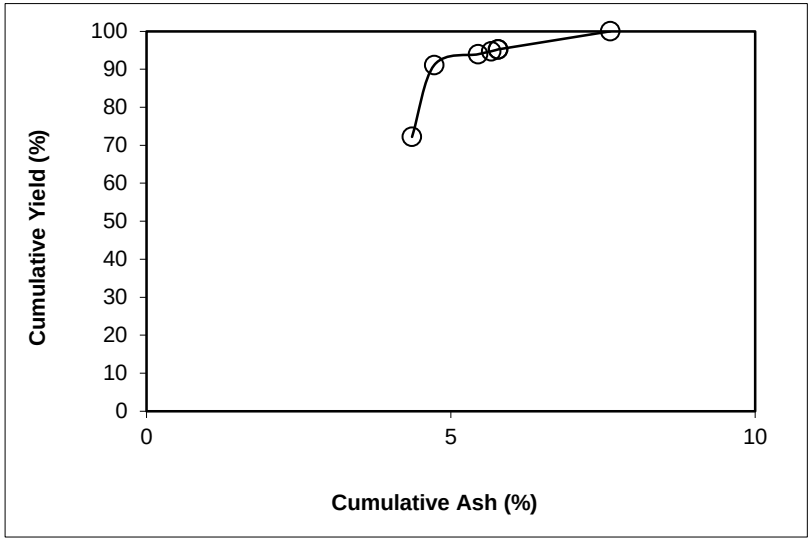
Description: Run 39 -Intermediate Spiral Test

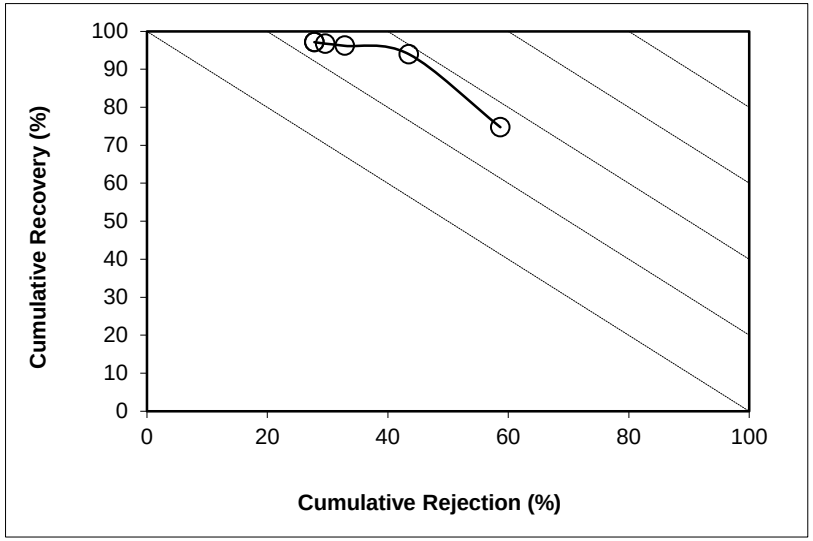
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 28.48

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	72.20	4.36	72.20	4.36	74.75	27.80	16.09	58.68	33.43
P2	18.91	6.12	91.12	4.73	93.97	8.88	37.31	43.49	37.46
P3	2.85	28.50	93.96	5.45	96.18	6.04	41.46	32.83	29.01
P4	0.77	31.82	94.74	5.66	96.75	5.26	42.88	29.60	26.35
P5	0.49	27.49	95.23	5.77	97.13	4.77	44.46	27.84	24.97
P6	0.01	23.47	95.24	5.78	97.14	4.76	44.52	27.79	24.93
P7	4.76	44.52	100.00	7.62	100.00	0.00			
Total (Calc)	100.00	7.62	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

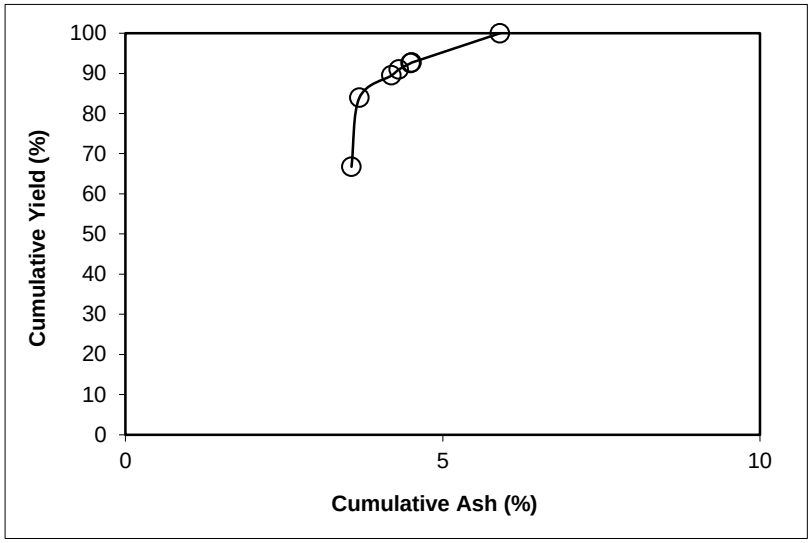
Description: Run 39 -Intermediate Spiral Test

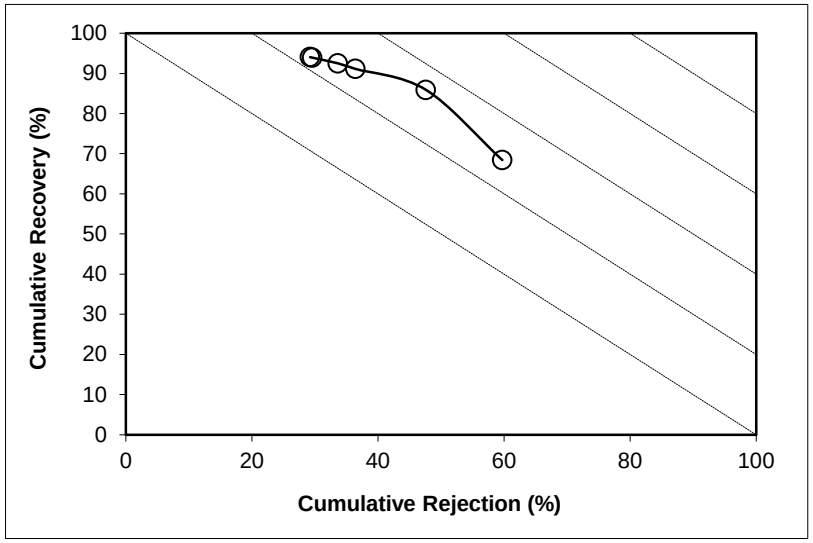
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 41.42

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	66.75	3.56	66.75	3.56	68.41	33.25	10.60	59.72	28.13
P2	17.17	4.17	83.92	3.69	85.90	16.08	17.48	47.61	33.50
P3	5.57	11.85	89.49	4.19	91.12	10.51	20.46	36.42	27.54
P4	1.47	11.20	90.96	4.31	92.51	9.04	21.97	33.63	26.13
P5	1.58	15.27	92.54	4.49	93.93	7.46	23.38	29.55	23.47
P6	0.13	14.29	92.67	4.51	94.05	7.33	23.55	29.22	23.27
P7	7.33	23.55	100.00	5.90	100.00	0.00			
Total (Calc)	100.00	5.90	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

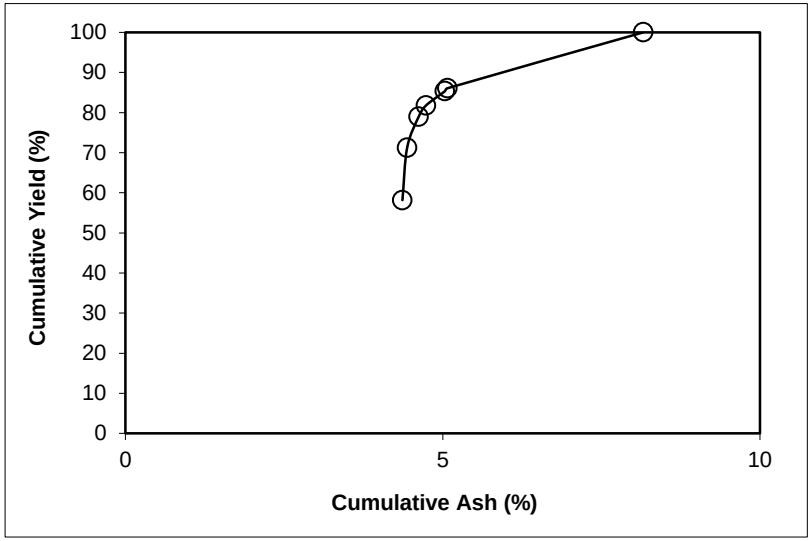
Description: Run 39 -Intermediate Spiral Test

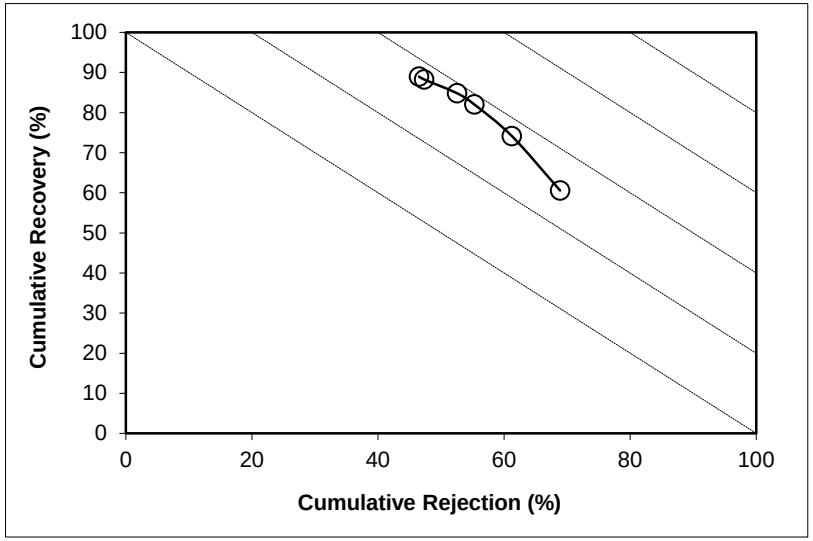
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 17.44

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	58.17	4.36	58.17	4.36	60.57	41.83	13.44	68.89	29.46
P2	13.07	4.77	71.24	4.44	74.12	28.76	17.38	61.25	35.38
P3	7.70	6.30	78.94	4.62	81.98	21.06	21.43	55.31	37.29
P4	2.83	7.98	81.77	4.74	84.82	18.23	23.52	52.54	37.36
P5	3.58	11.89	85.35	5.04	88.25	14.65	26.36	47.33	35.58
P6	0.71	9.45	86.06	5.07	88.95	13.94	27.22	46.50	35.45
P7	13.94	27.22	100.00	8.16	100.00	0.00			
Total (Calc)	100.00	8.16	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

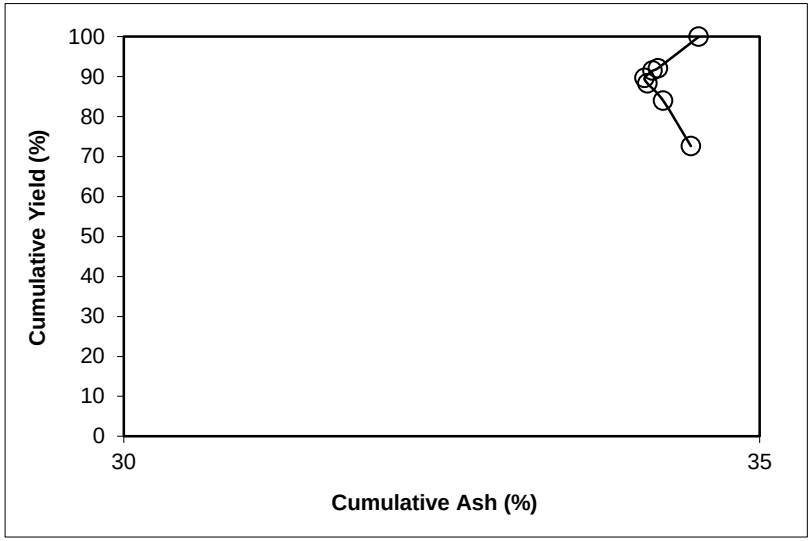
Description: Run 39 -Intermediate Spiral Test

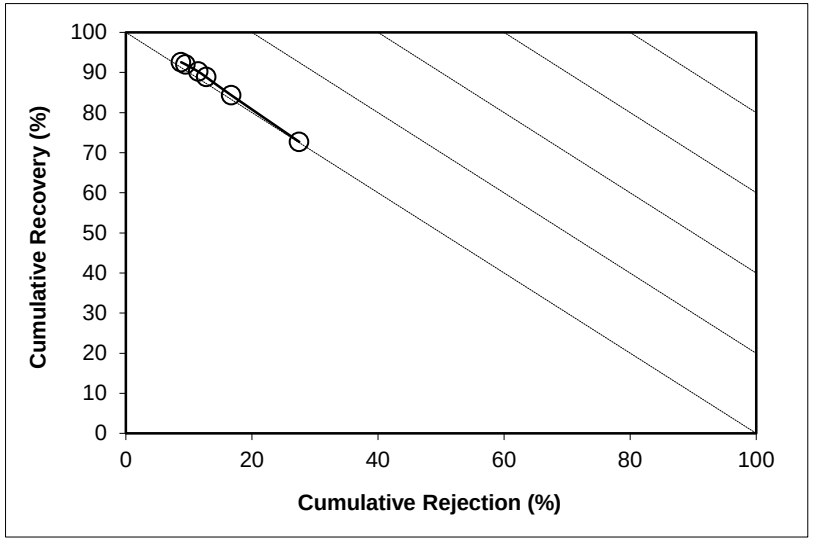
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: -100 Feed Weight (%): 11.45

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	72.63	34.46	72.63	34.46	72.70	27.37	34.69	27.50	0.20
P2	11.33	32.85	83.96	34.24	84.32	16.04	35.98	16.72	1.04
P3	4.33	31.72	88.29	34.12	88.84	11.71	37.56	12.74	1.57
P4	1.35	32.54	89.64	34.09	90.23	10.36	38.22	11.46	1.69
P5	1.86	37.26	91.51	34.16	92.02	8.49	38.43	9.45	1.47
P6	0.59	40.55	92.10	34.20	92.55	7.90	38.27	8.76	1.31
P7	7.90	38.27	100.00	34.52	100.00	0.00			
Total (Calc)	100.00	34.52	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

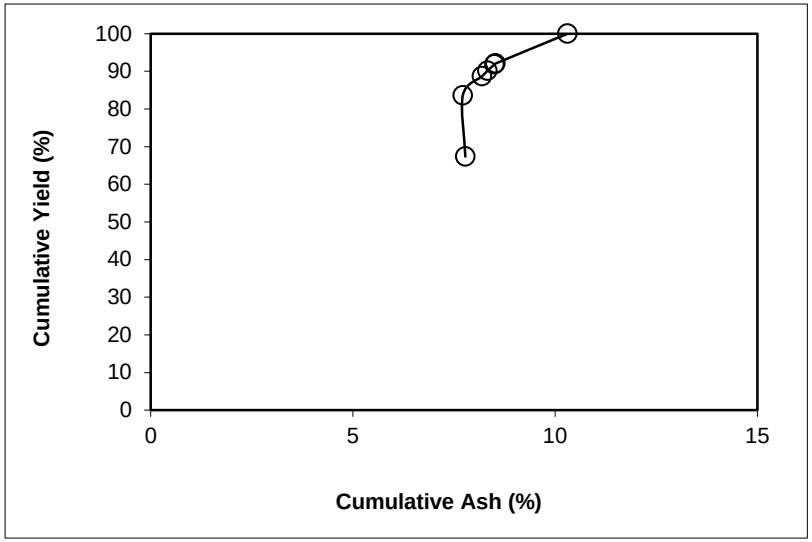
Description: Run 39 -Intermediate Spiral Test

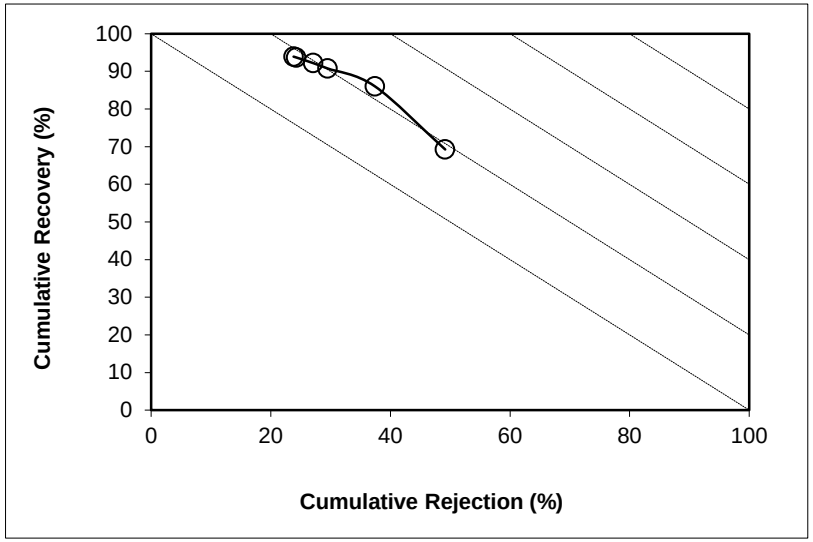
Comments: 1 x 0.15 mm Nominal Particle Size (Deslime)

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	67.36	7.78	67.36	7.78	69.26	32.64	15.51	49.15	18.41
P2	16.27	7.45	83.63	7.71	86.04	16.37	23.52	37.38	23.42
P3	5.07	16.07	88.70	8.19	90.79	11.30	26.87	29.47	20.25
P4	1.50	16.27	90.20	8.33	92.19	9.80	28.49	27.09	19.28
P5	1.64	17.83	91.84	8.50	93.69	8.16	30.63	24.26	17.95
P6	0.25	19.07	92.09	8.53	93.92	7.91	31.00	23.80	17.71
P7	7.91	31.00	100.00	10.30	100.00	0.00			
Total (Calc)	100.00	10.30	--	--	--	--	--	--	--



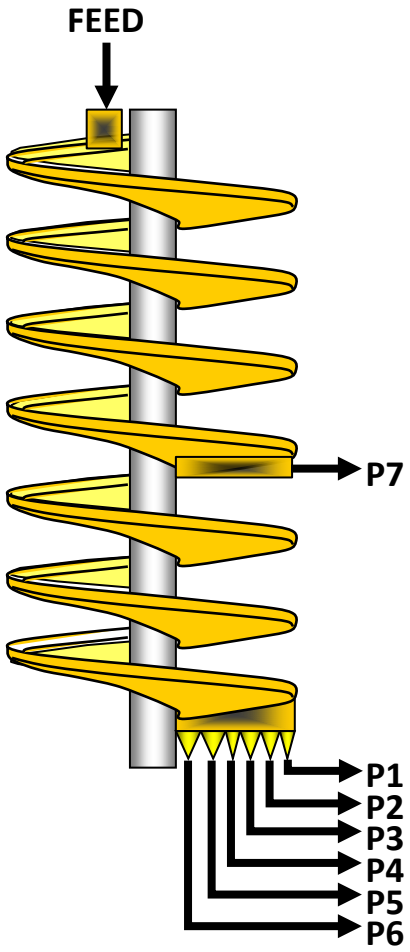


APPENDIX B – Spiral Circuit Results (Fine Coal Feed Stock, 0.15 x 0 mm)

SPIRAL DATA ANALYSIS

Description: Run 11 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	0.534	19.5	8.80	10.24
P2	0.261	20.5	4.03	4.74
P3	0.055	21.6	0.80	0.95
P4	0.026	22.7	0.35	0.42
P5	0.037	24.1	0.47	0.57
P6	0.015	24.6	0.18	0.22
P7	0.057	25.7	0.67	0.80
Total	0.985	20.5	15.30	17.93

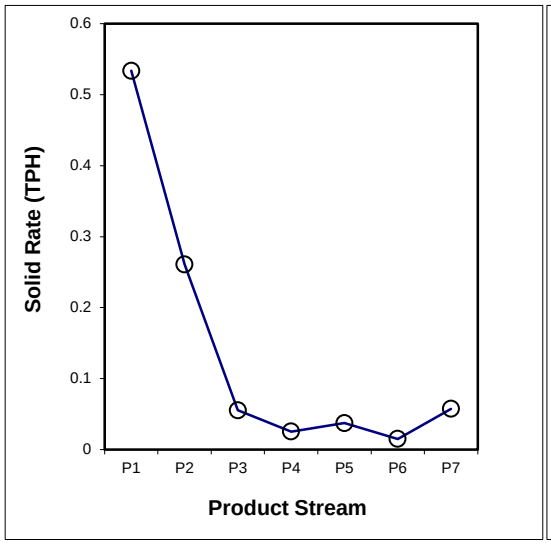
SPIRAL DATA ANALYSIS

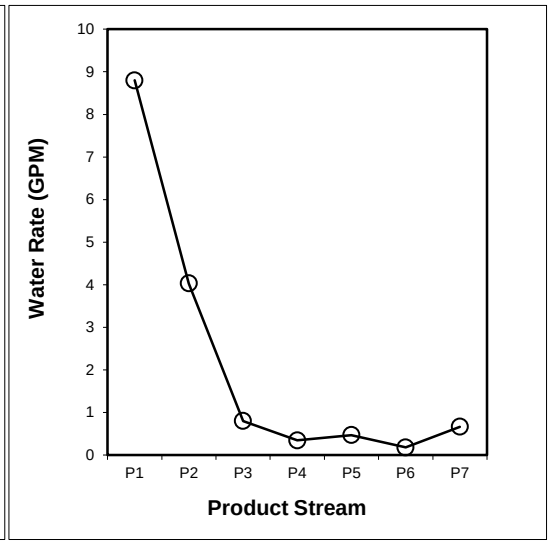
Description: Run 11 - Intermediate Spiral Test

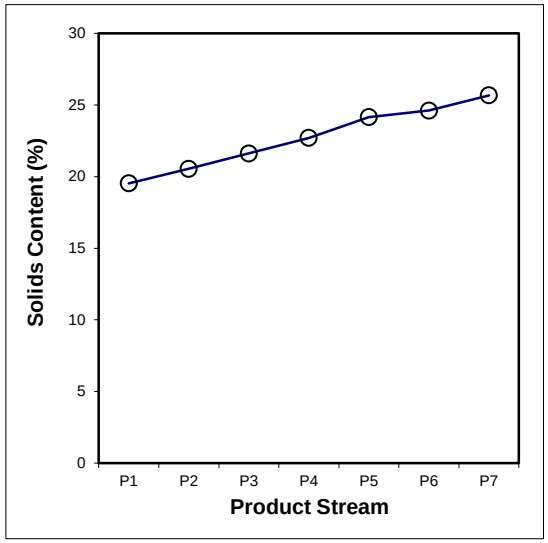
Comments: 0.15 x 0.044 mm Nominal Particle Size

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	5	4790.50	1294.00	2.733	1846.4	1173.4	0.534	54.18	19.52
P2	5	1851.76	228.77	1.269	1502.3	1173.6	0.261	26.46	20.54
P3	15	1075.70	94.16	0.256	1321.7	1112.6	0.055	5.61	21.61
P4	25	810.14	91.67	0.112	1312.0	1151.2	0.026	2.59	22.70
P5	25	1084.39	93.28	0.155	1387.6	1151.6	0.037	3.80	24.15
P6	80	1335.00	94.36	0.061	1413.5	1112.4	0.015	1.52	24.61
P7	15	954.48	95.50	0.224	1391.1	1173.6	0.057	5.84	25.67
Total (Calc)	--	--	--	4.810	--	--	0.985	100.00	20.48
Total (Head)	1.00	1395.96	183.43	4.810	1371.4	1123.2	0.985	--	20.48







SPIRAL DATA ANALYSIS

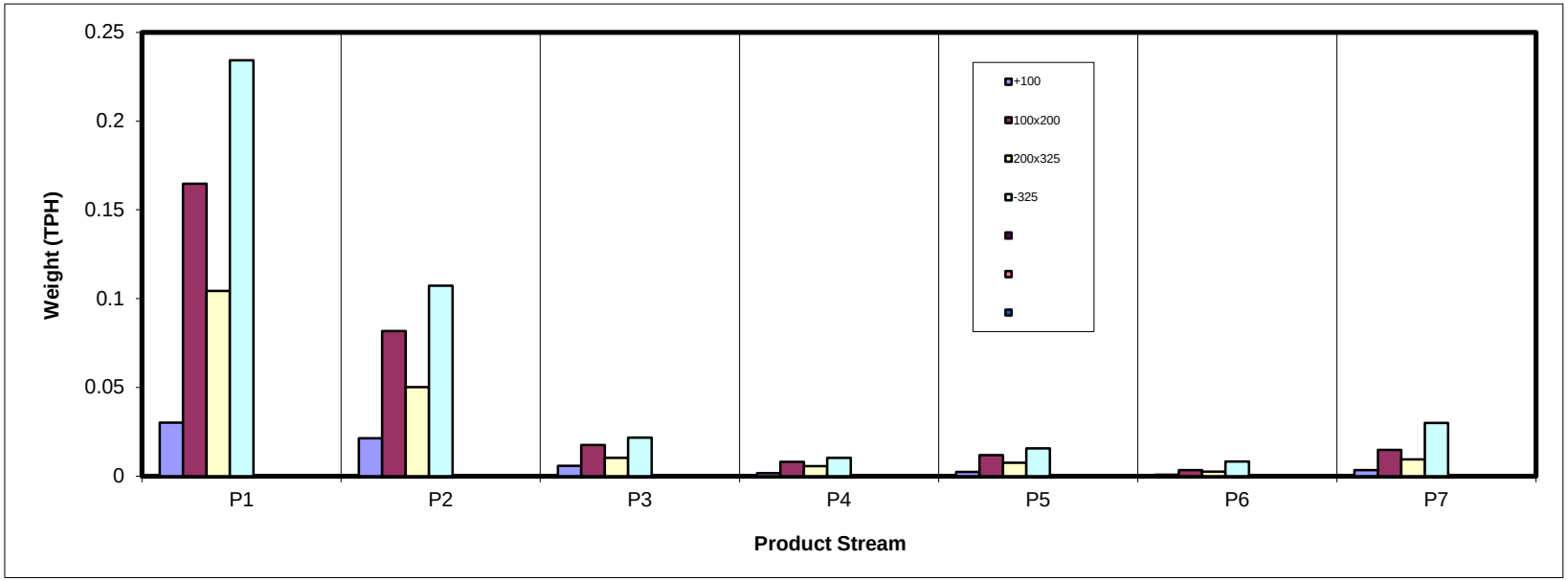
Description: Run 11 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	0.030	0.021	0.006	0.002	0.002	0.001	0.003		0.065
100x200	0.165	0.082	0.017	0.008	0.012	0.003	0.015		0.302
200x325	0.104	0.050	0.010	0.006	0.008	0.003	0.009		0.190
-325	0.234	0.107	0.022	0.010	0.016	0.008	0.030		0.427
Total (Calc)	0.534	0.261	0.055	0.026	0.037	0.015	0.057		0.985



SPIRAL DATA ANALYSIS

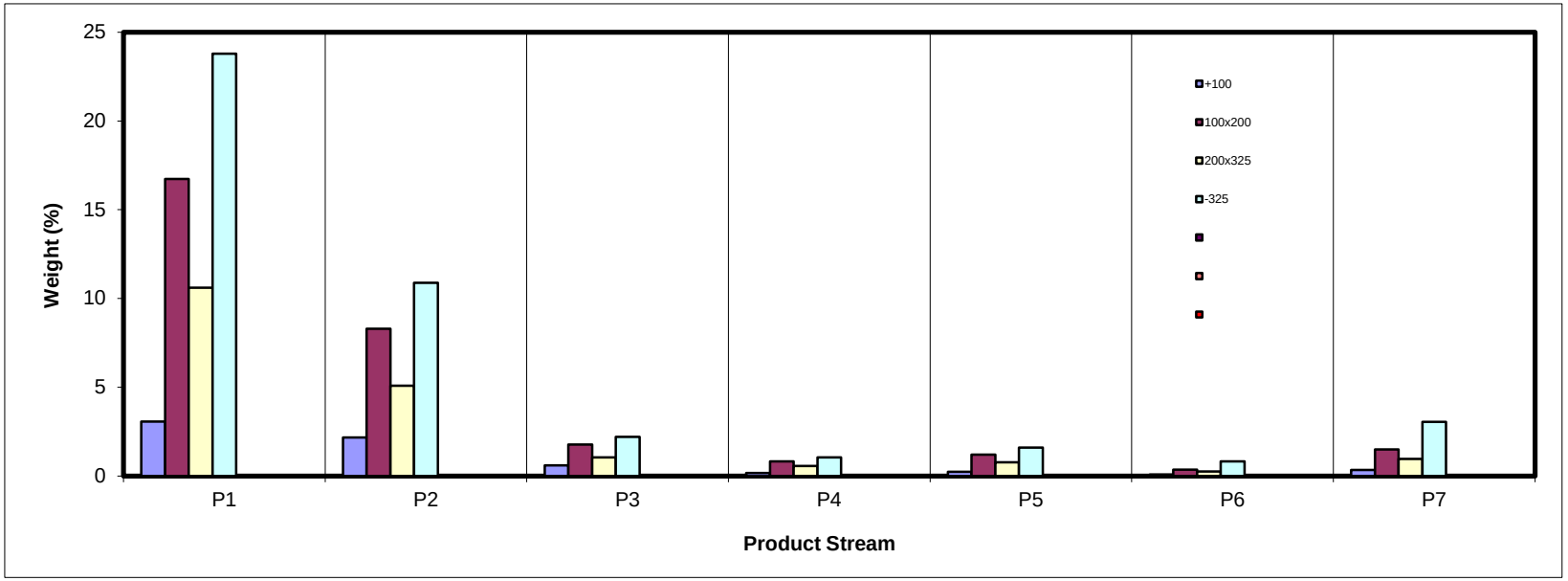
Description: Run 11 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	3.06	2.17	0.59	0.16	0.23	0.09	0.34		6.64
100x200	16.73	8.30	1.77	0.82	1.21	0.35	1.49		30.67
200x325	10.60	5.09	1.05	0.56	0.77	0.25	0.96		19.29
-325	23.79	10.89	2.20	1.04	1.59	0.83	3.04		43.38
Total (Calc)	54.18	26.45	5.61	2.59	3.80	1.52	5.84		99.98



SPIRAL DATA ANALYSIS

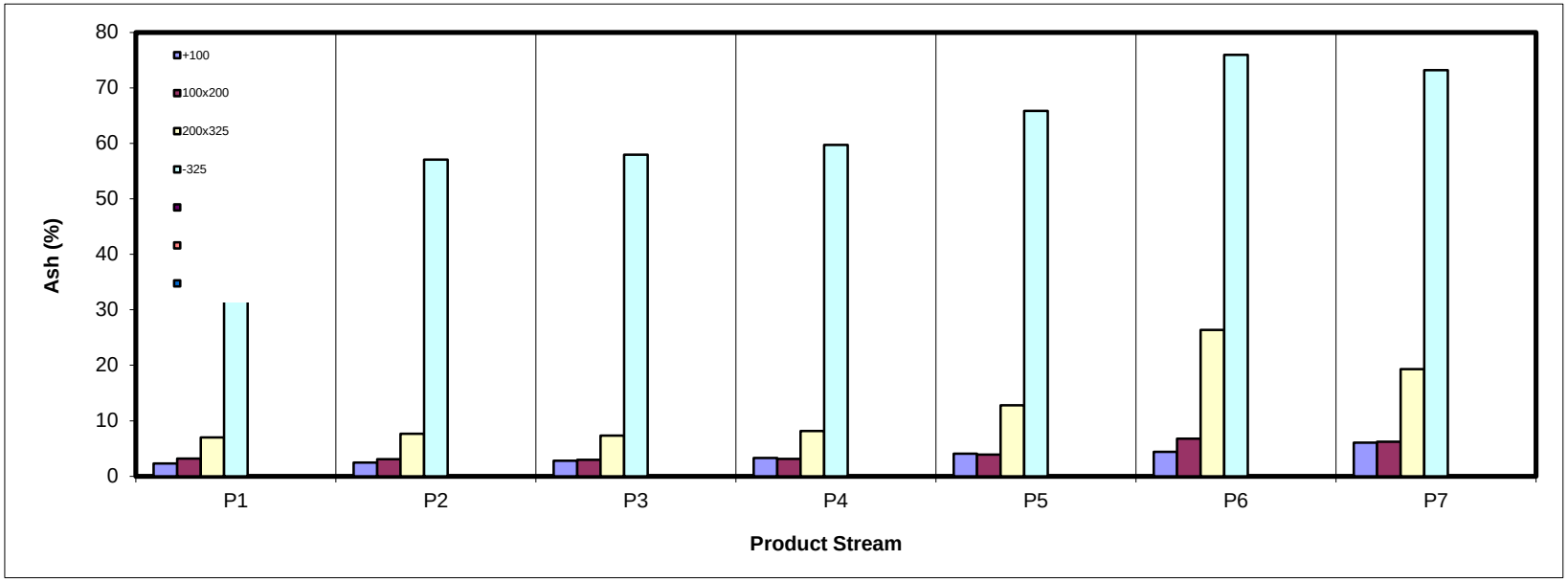
Description: Run 11 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	2.30	2.49	2.80	3.29	4.05	4.41	6.05		2.71
100x200	3.22	3.06	2.96	3.13	3.92	6.77	6.24		3.37
200x325	7.02	7.67	7.34	8.16	12.77	26.39	19.34		8.34
-325	53.80	57.06	57.94	59.70	65.85	75.94	73.21		57.19
Total (Calc)	26.12	26.13	25.32	27.01	31.64	47.69	43.29		27.64



SPIRAL DATA ANALYSIS

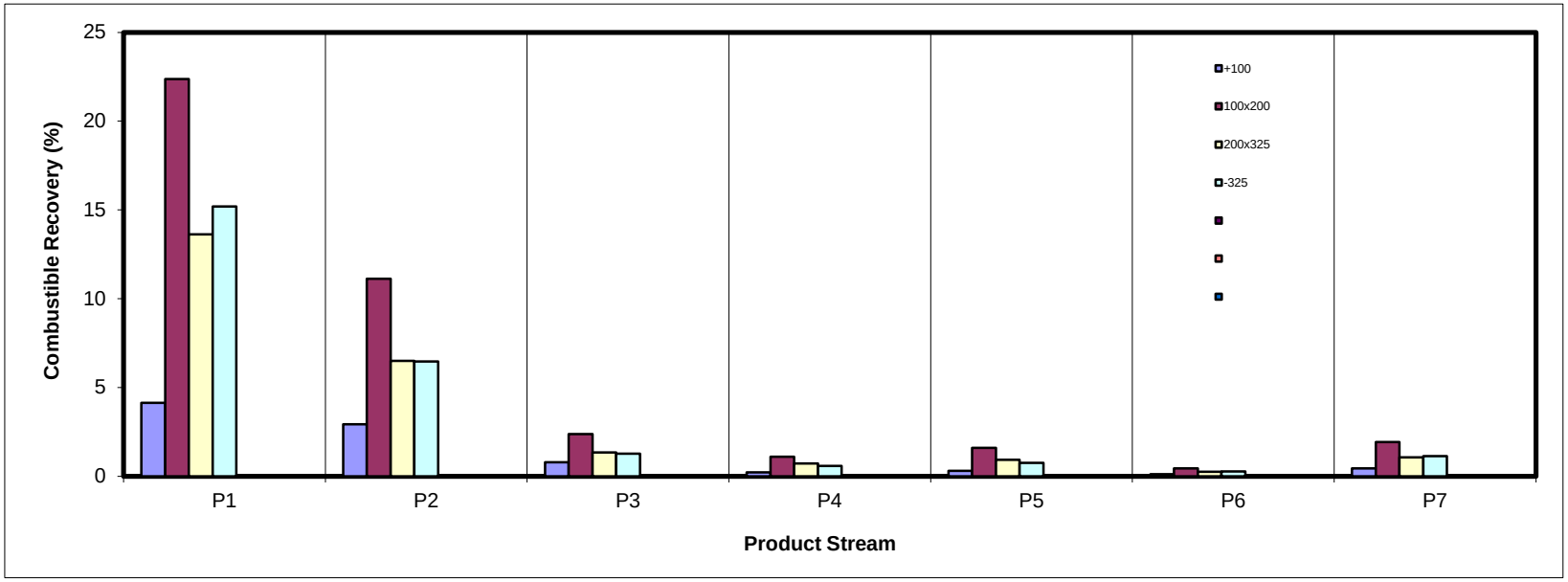
Description: Run 11 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	4.14	2.92	0.80	0.21	0.31	0.11	0.44		8.93
100x200	22.37	11.12	2.38	1.10	1.60	0.45	1.94		40.96
200x325	13.62	6.50	1.34	0.71	0.93	0.26	1.07		24.43
-325	15.19	6.46	1.28	0.58	0.75	0.28	1.13		25.66
Total (Calc)	55.32	27.00	5.79	2.61	3.59	1.10	4.57		99.98



SPIRAL DATA ANALYSIS

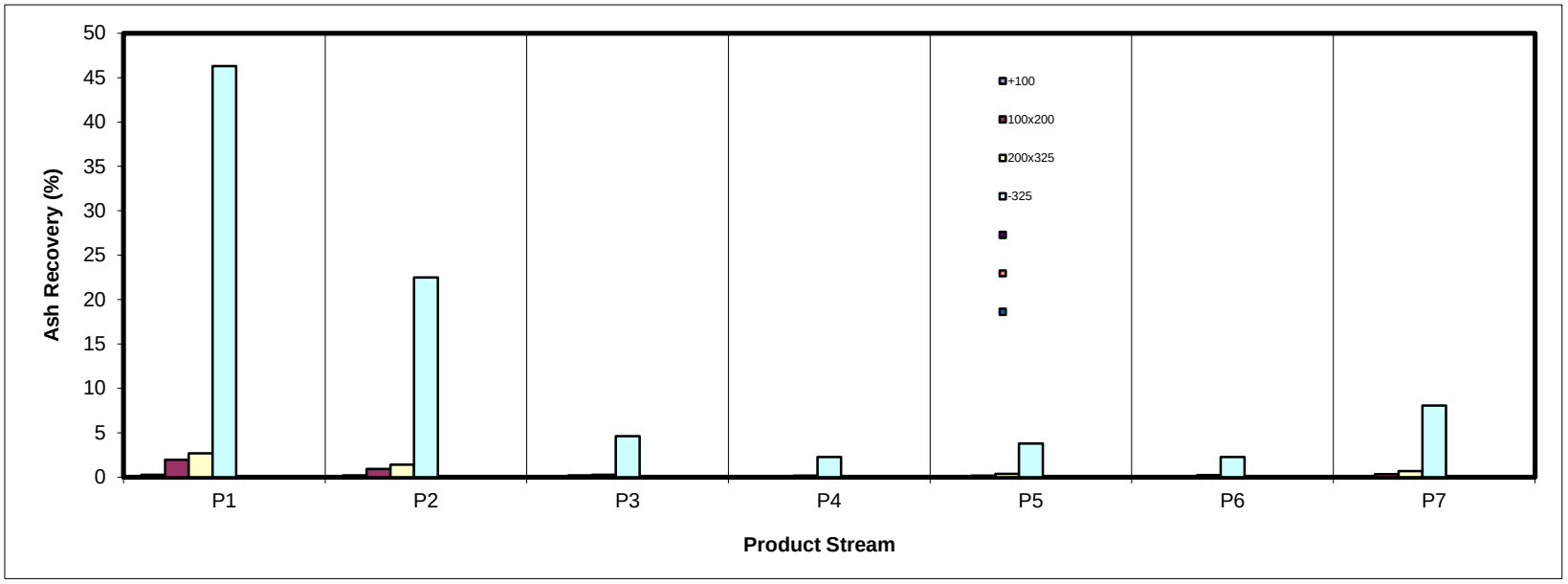
Description: Run 11 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	0.26	0.20	0.06	0.02	0.03	0.01	0.07		0.65
100x200	1.95	0.92	0.19	0.09	0.17	0.09	0.34		3.74
200x325	2.69	1.41	0.28	0.17	0.36	0.24	0.67		5.82
-325	46.31	22.48	4.61	2.25	3.79	2.27	8.06		89.77
Total (Calc)	51.20	25.00	5.14	2.53	4.35	2.61	9.14		99.98



SPIRAL DATA ANALYSIS

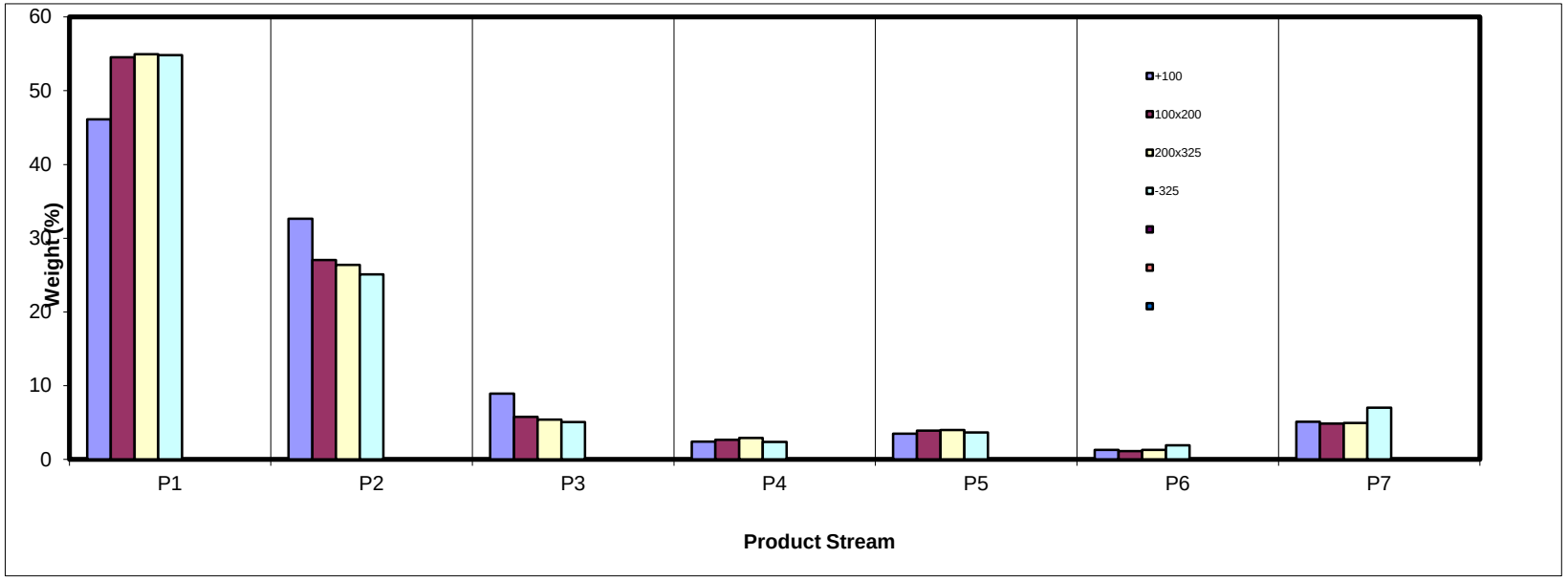
Description: Run 11 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	46.12	32.64	8.92	2.40	3.49	1.30	5.13		100.00
100x200	54.53	27.06	5.78	2.69	3.94	1.13	4.87		100.00
200x325	54.97	26.40	5.43	2.92	4.00	1.32	4.97		100.00
-325	54.84	25.10	5.07	2.40	3.67	1.91	7.01		100.00
Total (Calc)	54.19	26.45	5.61	2.59	3.80	1.52	5.84		100.00



SPIRAL DATA ANALYSIS

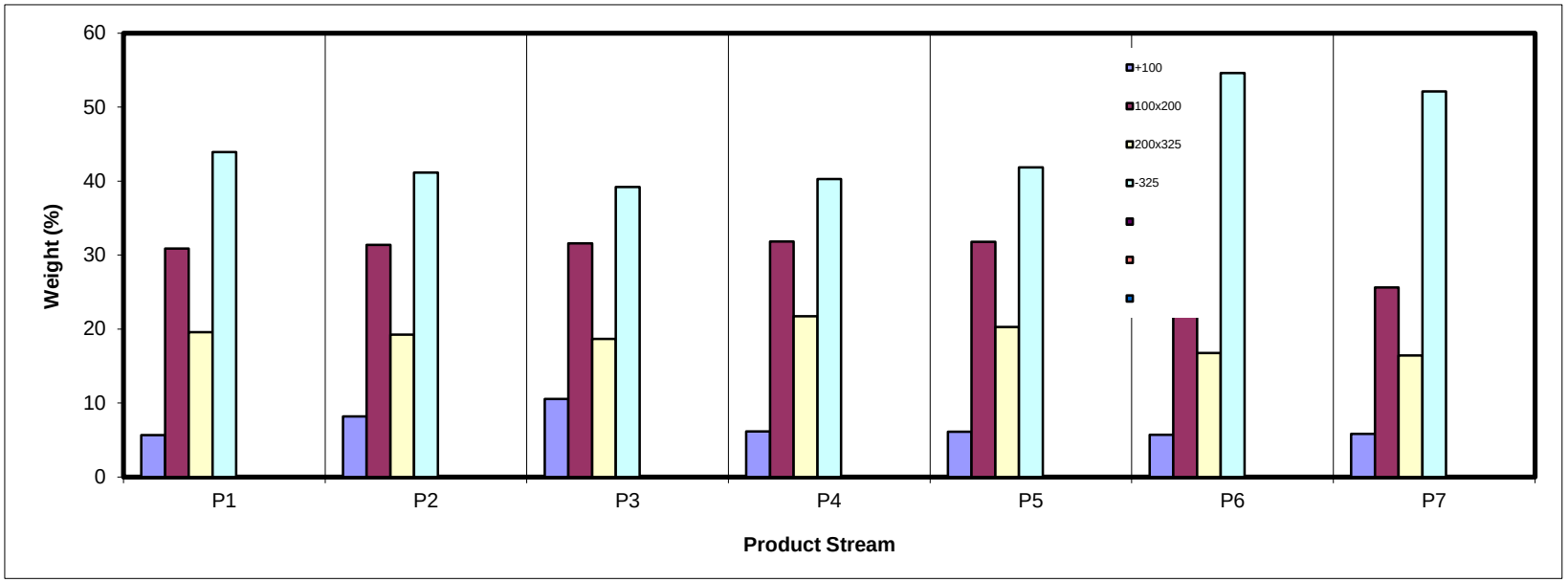
Description: Run 11 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	5.65	8.20	10.56	6.17	6.10	5.69	5.83		6.64
100x200	30.87	31.39	31.58	31.82	31.77	22.96	25.61		30.68
200x325	19.57	19.25	18.65	21.74	20.28	16.75	16.43		19.29
-325	43.91	41.17	39.21	40.26	41.86	54.59	52.12		43.39
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

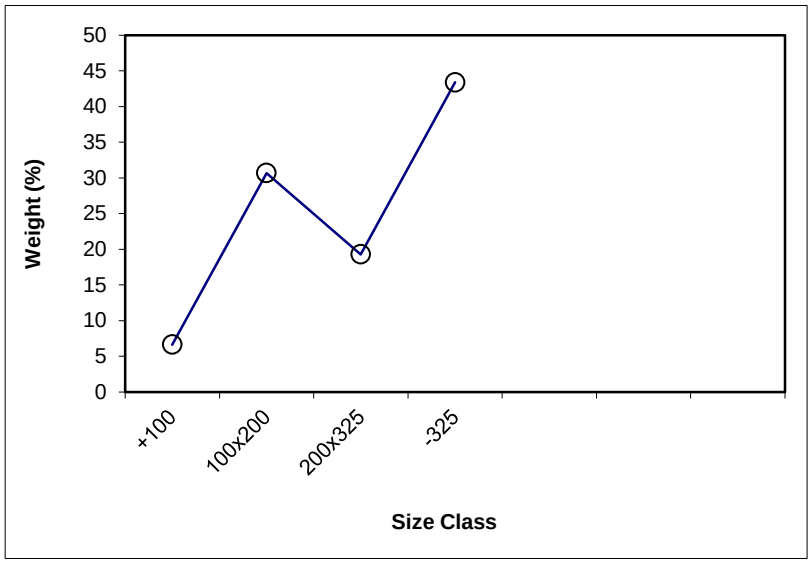
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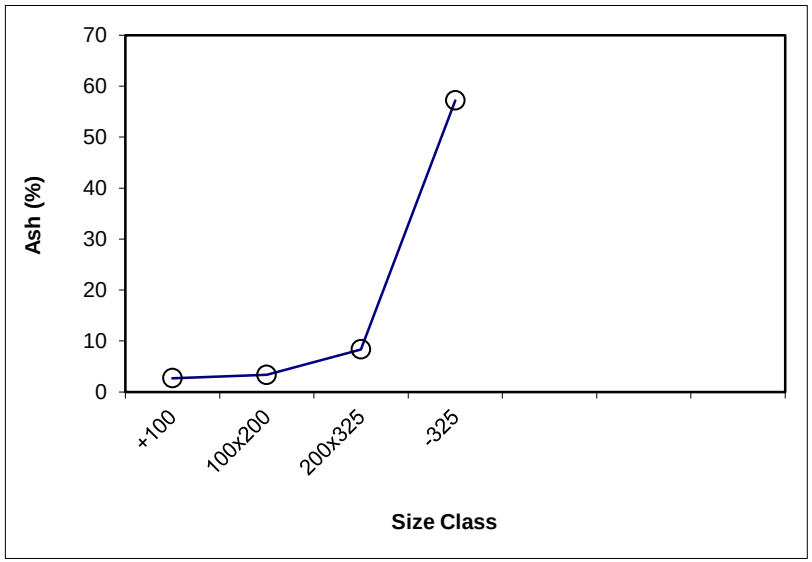
Comments: 0.15 x 0.044 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	383.4	366.9	16.49	6.64	2.71	6.64	2.71	99.98	27.64
100x200	423.6	347.4	76.17	30.67	3.37	37.32	3.25	93.34	29.41
200x325	450.6	402.7	47.89	19.29	8.34	56.60	4.99	62.67	42.16
-325	113.9	6.2	107.73	43.38	57.19	99.98	27.64	43.38	57.19
Total (Calc)	--	--	248.33	99.98	27.64	--	--	--	--





SPIRAL DATA ANALYSIS

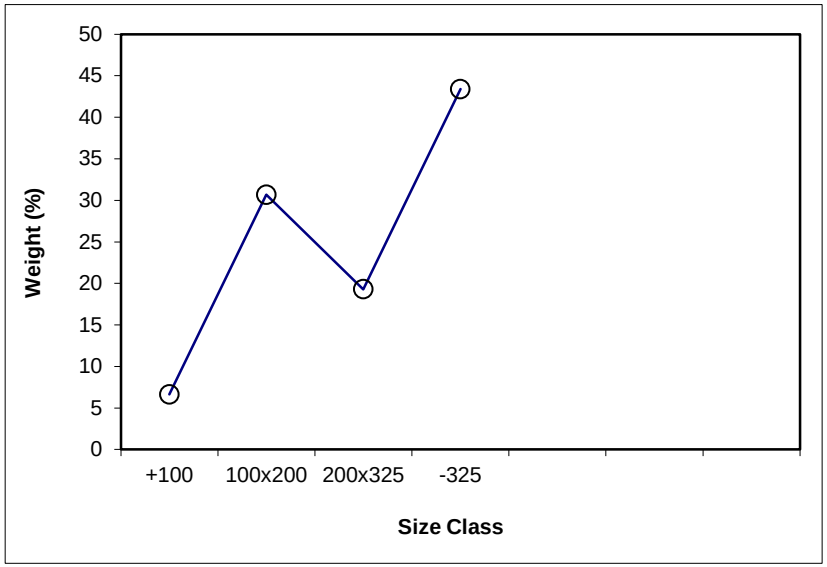
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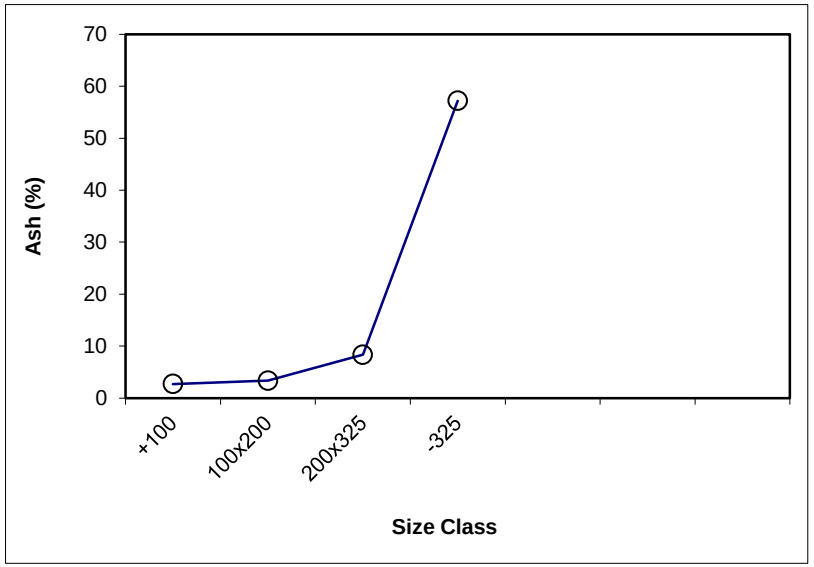
Comments: 0.15 x 0.044 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+100	6.64	2.71	6.64	2.71	99.98	27.64			
100x200	30.67	3.37	37.32	3.25	93.34	29.41	x	30.67	3.37
200x325	19.29	8.34	56.60	4.99	62.67	42.16	x	19.29	8.34
-325	43.38	57.19	99.98	27.64	43.38	57.19			
Total (Calc)	99.98	27.64	--	--	--	--	--	49.96	5.29





SPIRAL DATA ANALYSIS

Description: Run 11 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 54.18

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	435.27	397.2	38.04	5.65	2.30	5.65	2.30	100.00	26.12
100x200	599.11	391.3	207.77	30.87	3.22	36.52	3.07	94.35	27.55
200x325	510.28	378.6	131.68	19.57	7.02	56.09	4.45	63.47	39.38
-325	301.76	6.3	295.51	43.91	53.80	100.00	26.12	43.91	53.80
Total (Calc)	--	--	673.01	100.00	26.12	--	--	--	--

Product P2 Feed Weight (%): 26.46

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	424.2	397.2	26.94	8.19	2.49	8.19	2.49	99.94	26.13
100x200	494.5	391.3	103.17	31.37	3.06	39.56	2.94	91.75	28.24
200x325	441.9	378.6	63.28	19.24	7.67	58.80	4.49	60.38	41.32
-325	141.8	6.4	135.32	41.14	57.06	99.94	26.13	41.14	57.06
Total (Calc)	--	--	328.92	99.94	26.13	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 11 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 5.61

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	415.1	393.0	22.08	10.56	2.80	10.56	2.80	99.99	25.32
100x200	393.3	327.2	66.05	31.57	2.96	42.13	2.92	89.43	27.98
200x325	424.9	385.9	39.02	18.65	7.34	60.78	4.28	57.86	41.63
-325	88.5	6.4	82.01	39.21	57.94	99.99	25.32	39.21	57.94
Total (Calc)	--	--	209.18	99.99	25.32	--	--	--	--

Product P4 Feed Weight (%): 2.59

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	418.7	408.8	9.92	6.17	3.29	6.17	3.29	99.99	27.01
100x200	400.8	349.6	51.17	31.82	3.13	37.99	3.15	93.83	28.57
200x325	421.7	386.7	34.96	21.74	8.16	59.73	4.98	62.00	41.63
-325	70.9	6.2	64.74	40.26	59.70	99.99	27.01	40.26	59.70
Total (Calc)	--	--	160.81	99.99	27.01	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 11 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 3.80

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	423.1	408.8	14.39	6.10	4.05	6.10	4.05	100.00	31.64
100x200	424.6	349.6	74.98	31.77	3.92	37.87	3.94	93.90	33.44
200x325	434.6	386.7	47.85	20.28	12.77	58.14	7.02	62.13	48.53
-325	105.3	6.5	98.79	41.86	65.85	100.00	31.64	41.86	65.85
Total (Calc)	--	--	236.01	100.00	31.64	--	--	--	--

Product P6 Feed Weight (%): 1.52

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	410.2	393.0	17.14	5.69	4.41	5.69	4.41	100.00	47.69
100x200	396.4	327.2	69.15	22.96	6.77	28.65	6.30	94.31	50.30
200x325	436.3	385.9	50.45	16.75	26.39	45.41	13.71	71.35	64.31
-325	170.7	6.3	164.41	54.59	75.94	100.00	47.69	54.59	75.94
Total (Calc)	--	--	301.14	100.00	47.69	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 11 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 5.84

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	409.9	397.2	12.69	5.83	6.05	5.83	6.05	100.00	43.29
100x200	447.0	391.3	55.71	25.61	6.24	31.45	6.21	94.17	45.59
200x325	414.3	378.6	35.72	16.43	19.34	47.88	10.71	68.55	60.30
-325	119.8	6.4	113.36	52.12	73.21	100.00	43.29	52.12	73.21
Total (Calc)	--	--	217.49	100.00	43.29	--	--	--	--

SPIRAL DATA ANALYSIS

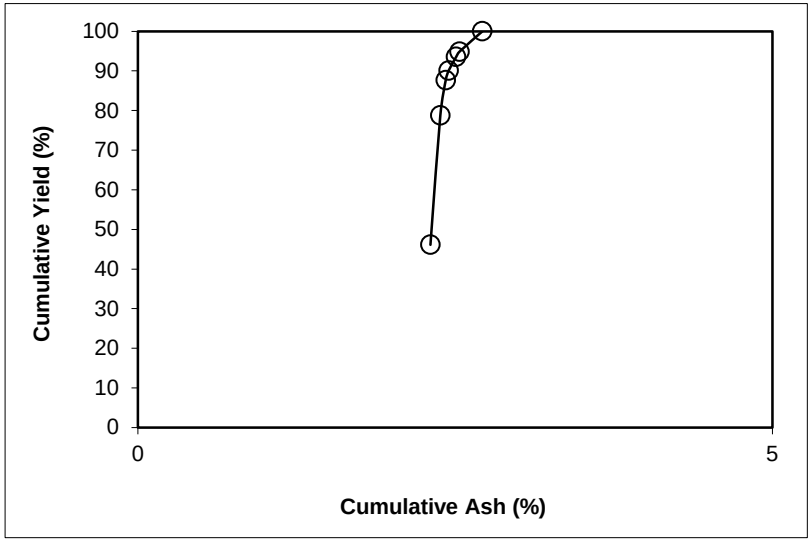
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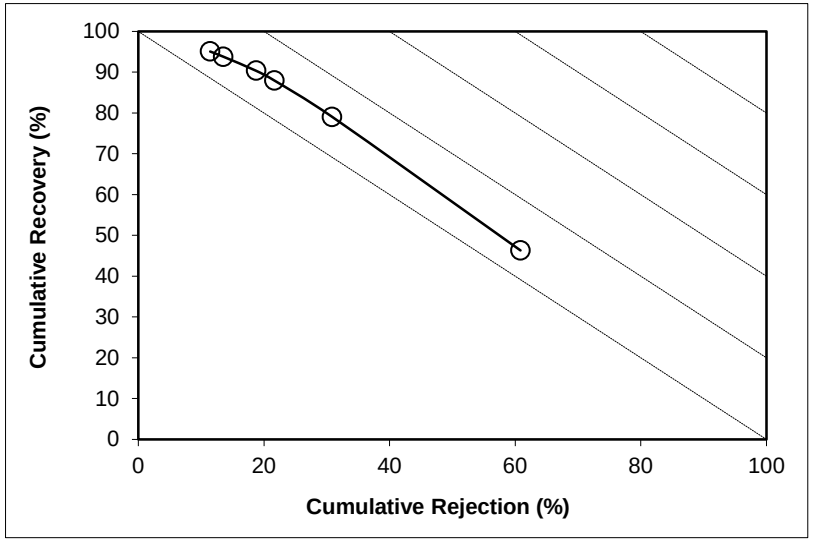
Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: +100 Feed Weight (%): 6.64

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	46.12	2.30	46.12	2.30	46.31	53.88	3.07	60.84	7.15
P2	32.64	2.49	78.76	2.38	79.03	21.24	3.94	30.86	9.89
P3	8.92	2.80	87.68	2.43	87.94	12.32	4.77	21.65	9.59
P4	2.40	3.29	90.09	2.45	90.33	9.91	5.13	18.74	9.07
P5	3.49	4.05	93.57	2.51	93.77	6.43	5.72	13.54	7.31
P6	1.30	4.41	94.87	2.53	95.05	5.13	6.05	11.43	6.48
P7	5.13	6.05	100.00	2.71	100.00	0.00			
Total (Calc)	100.00	2.71	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

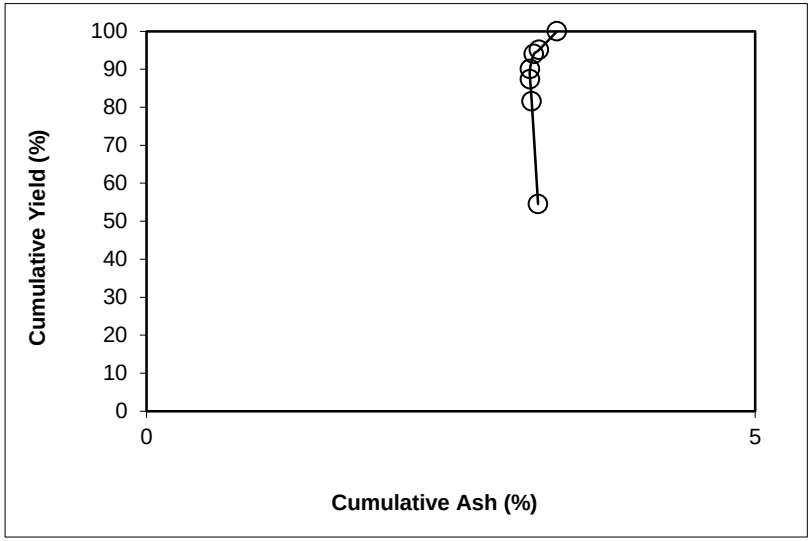
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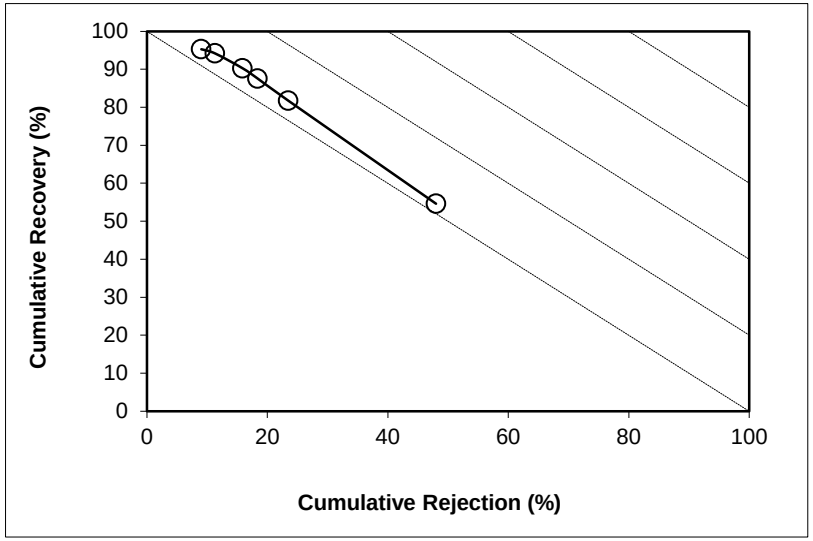
Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 30.67

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	54.53	3.22	54.53	3.22	54.62	45.47	3.56	47.99	2.61
P2	27.06	3.06	81.59	3.16	81.77	18.41	4.29	23.43	5.20
P3	5.78	2.96	87.37	3.15	87.57	12.63	4.90	18.37	5.94
P4	2.69	3.13	90.06	3.15	90.26	9.94	5.38	15.87	6.14
P5	3.94	3.92	93.99	3.18	94.18	6.01	6.34	11.30	5.48
P6	1.13	6.77	95.13	3.22	95.27	4.87	6.24	9.02	4.29
P7	4.87	6.24	100.00	3.37	100.00	0.00			
Total (Calc)	100.00	3.37	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

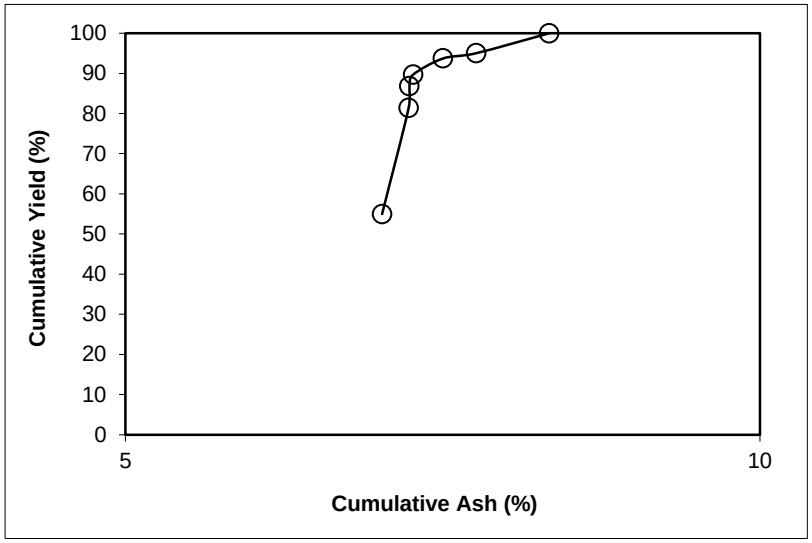
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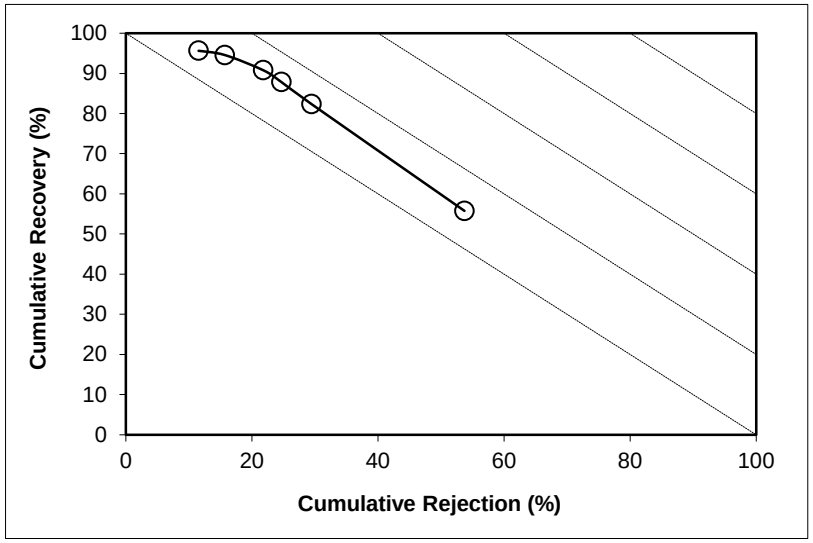
Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 19.29

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	54.97	7.02	54.97	7.02	55.76	45.03	9.95	53.71	9.47
P2	26.40	7.67	81.37	7.23	82.35	18.63	13.18	29.44	11.80
P3	5.43	7.34	86.80	7.24	87.84	13.20	15.58	24.67	12.51
P4	2.92	8.16	89.72	7.27	90.77	10.28	17.69	21.81	12.58
P5	4.00	12.77	93.71	7.50	94.57	6.29	20.81	15.69	10.26
P6	1.32	26.39	95.03	7.76	95.63	4.97	19.34	11.53	7.15
P7	4.97	19.34	100.00	8.34	100.00	0.00			
Total (Calc)	100.00	8.34	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

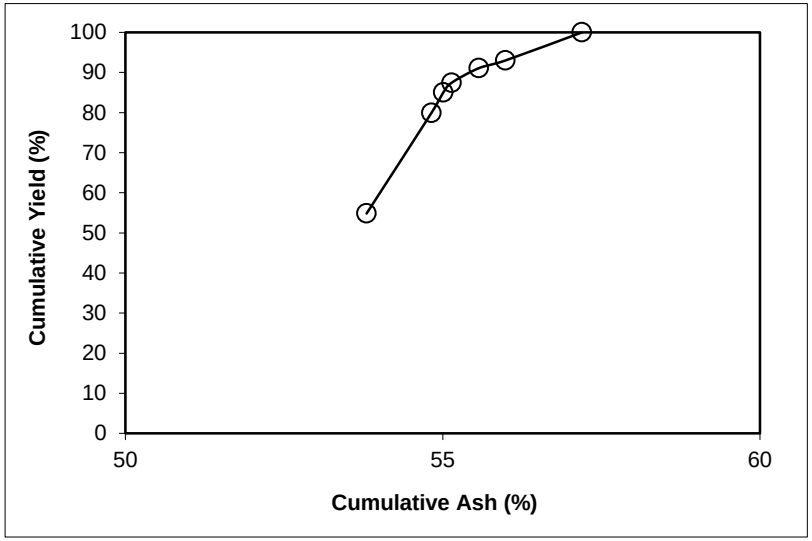
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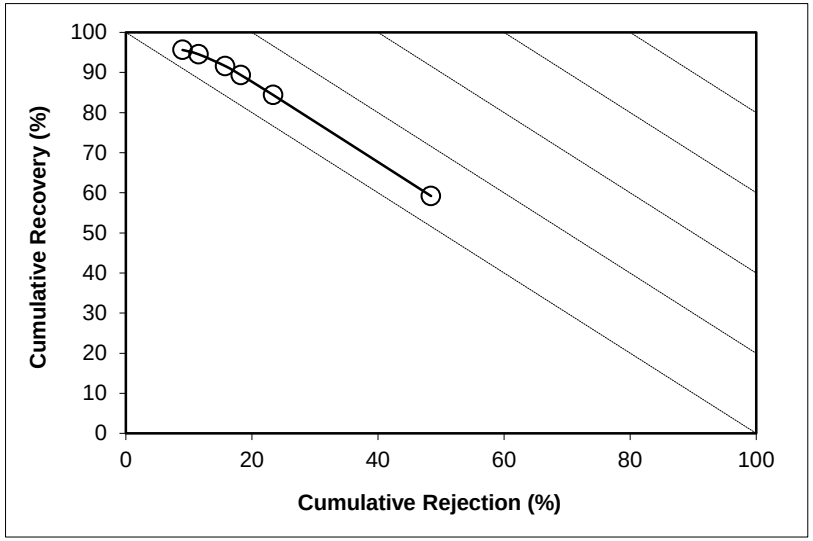
Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: -325.00 Feed Weight (%): 43.38

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	54.84	53.80	54.84	53.80	59.19	45.16	61.32	48.41	7.60
P2	25.10	57.06	79.94	54.82	84.37	20.06	66.65	23.38	7.74
P3	5.07	57.94	85.01	55.01	89.35	14.99	69.59	18.24	7.59
P4	2.40	59.70	87.41	55.14	91.61	12.59	71.48	15.73	7.34
P5	3.67	65.85	91.08	55.57	94.54	8.92	73.79	11.51	6.05
P6	1.91	75.94	92.99	55.99	95.61	7.01	73.21	8.98	4.59
P7	7.01	73.21	100.00	57.19	100.00	0.00			
Total (Calc)	100.00	57.19	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

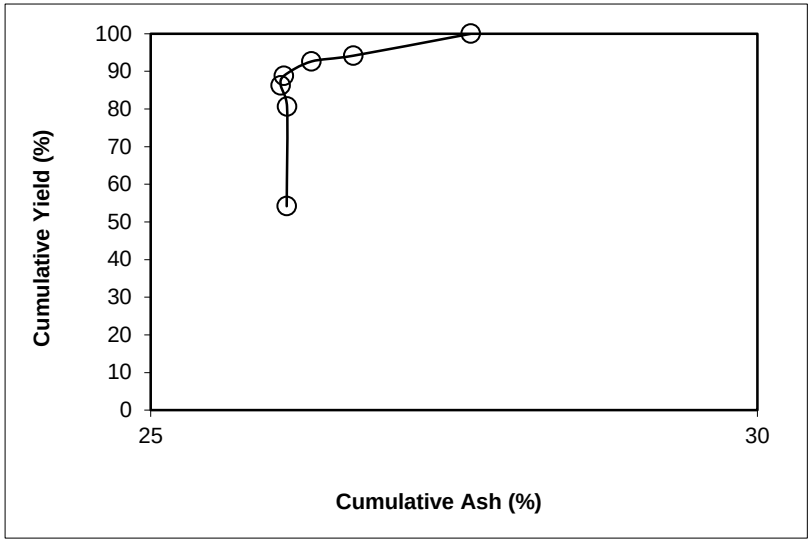
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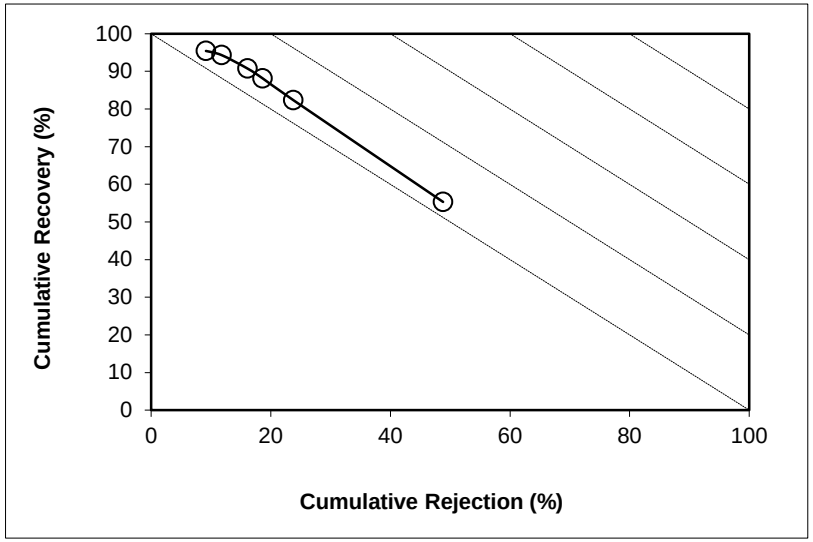
Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	54.18	26.12	54.18	26.12	55.32	45.82	29.44	48.80	4.12
P2	26.46	26.13	80.65	26.12	82.34	19.35	33.96	23.78	6.11
P3	5.61	25.32	86.26	26.07	88.13	13.74	37.49	18.64	6.77
P4	2.59	27.01	88.85	26.10	90.74	11.15	39.92	16.11	6.85
P5	3.80	31.64	92.65	26.33	94.33	7.35	44.19	11.76	6.09
P6	1.52	47.69	94.16	26.67	95.43	5.84	43.29	9.14	4.57
P7	5.84	43.29	100.00	27.64	100.00	0.00			
Total (Calc)	100.00	27.64	--	--	--	--	--	--	--

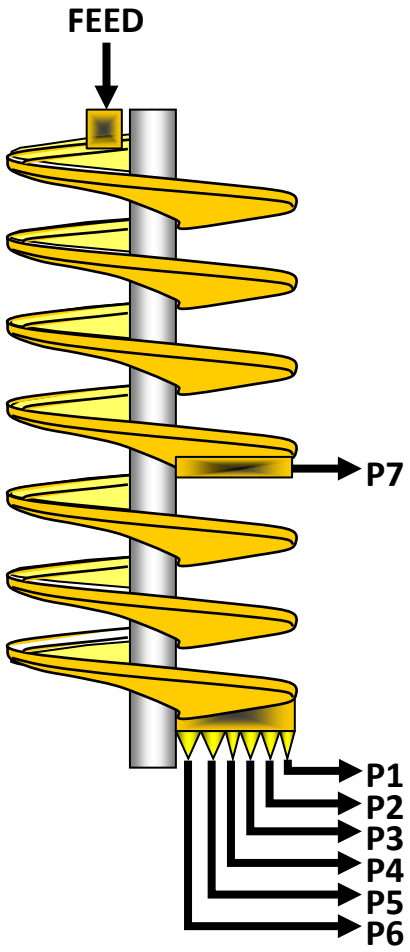




SPIRAL DATA ANALYSIS

Description: Run 12 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	0.377	13.0	10.07	11.08
P2	0.162	13.8	4.04	4.48
P3	0.032	13.0	0.86	0.95
P4	0.012	14.3	0.29	0.33
P5	0.020	16.0	0.41	0.47
P6	0.008	16.3	0.17	0.19
P7	0.029	16.3	0.59	0.66
Total	0.641	13.5	16.43	18.15

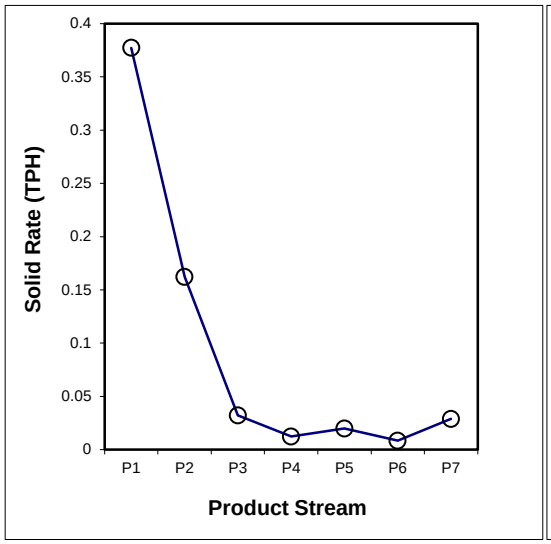
SPIRAL DATA ANALYSIS

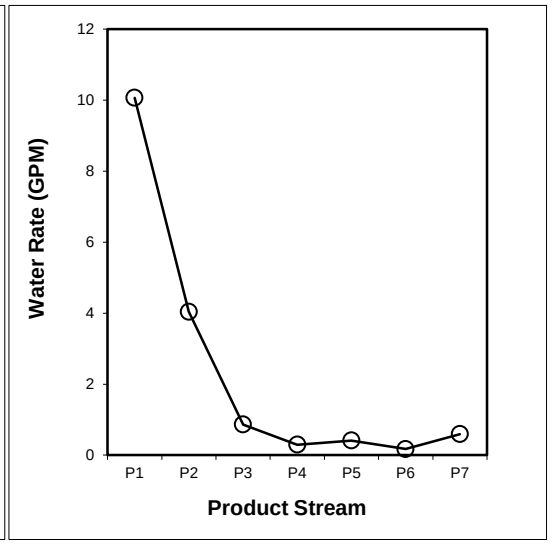
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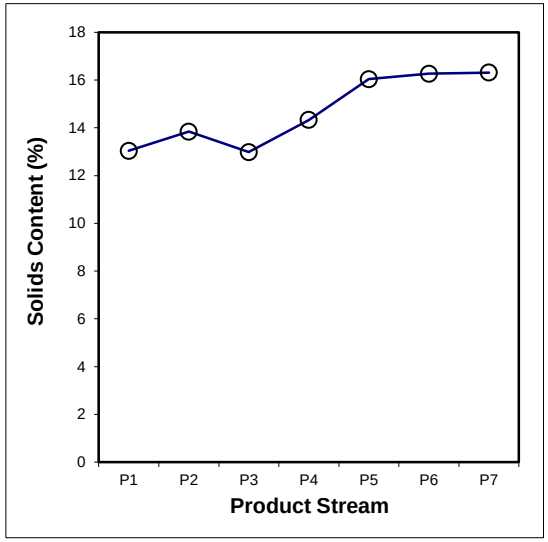
Comments: 0.15 x 0.044 mm Nominal Particle Size

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	5	5014.50	1311.00	2.894	2733.5	2257.7	0.377	58.89	13.04
P2	5	1639.56	139.74	1.172	1111.2	906.7	0.162	25.31	13.84
P3	15	1043.71	93.98	0.247	1028.2	906.8	0.032	5.01	12.98
P4	35	864.07	94.18	0.086	1260.2	1151.5	0.012	1.92	14.33
P5	25	882.13	94.83	0.123	1236.9	1112.5	0.020	3.08	16.04
P6	80	1133.76	84.41	0.051	1341.6	1173.4	0.008	1.30	16.26
P7	15	772.53	95.91	0.176	1015.4	906.6	0.029	4.49	16.31
Total (Calc)	--	--	--	4.749	--	--	0.641	100.00	13.49
Total (Head)	1.00	1422.6	223.81	4.749	1313.1	1151.4	0.641	--	13.49







SPIRAL DATA ANALYSIS

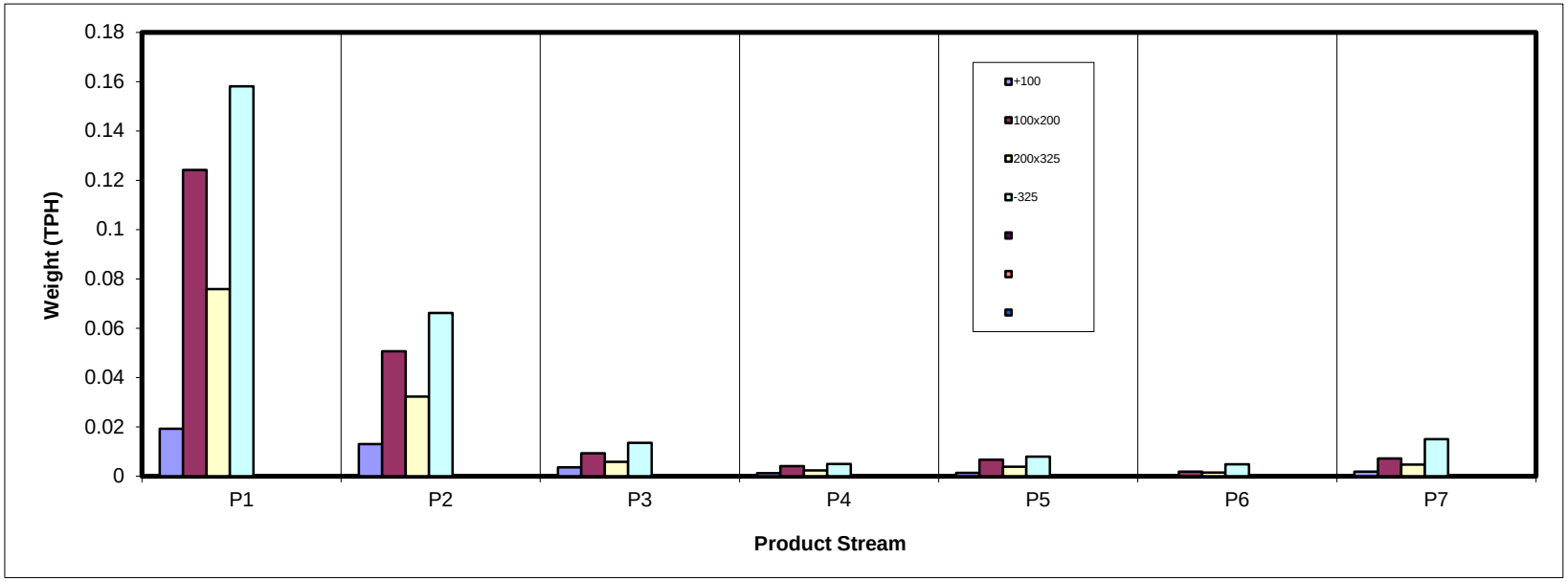
Description: Run 12 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	0.019	0.013	0.003	0.001	0.001	0.000	0.002		0.040
100x200	0.124	0.051	0.009	0.004	0.007	0.002	0.007		0.204
200x325	0.076	0.032	0.006	0.002	0.004	0.001	0.005		0.126
-325	0.158	0.066	0.014	0.005	0.008	0.005	0.015		0.270
Total (Calc)	0.377	0.162	0.032	0.012	0.020	0.008	0.029		0.641



SPIRAL DATA ANALYSIS

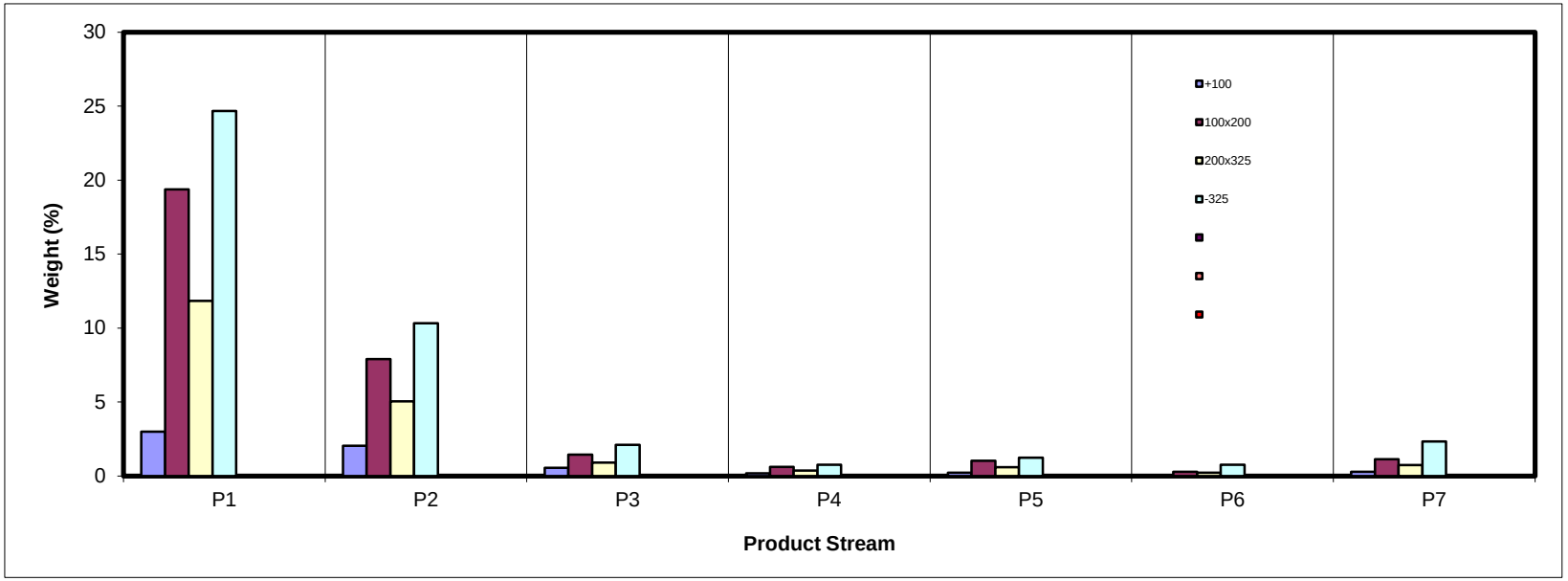
Description: Run 12 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	2.99	2.04	0.55	0.18	0.21	0.05	0.29		6.30
100x200	19.38	7.91	1.45	0.62	1.04	0.29	1.13		31.81
200x325	11.84	5.04	0.90	0.35	0.59	0.22	0.73		19.68
-325	24.68	10.32	2.11	0.76	1.24	0.75	2.34		42.20
Total (Calc)	58.89	25.31	5.01	1.92	3.08	1.30	4.49		100.00



SPIRAL DATA ANALYSIS

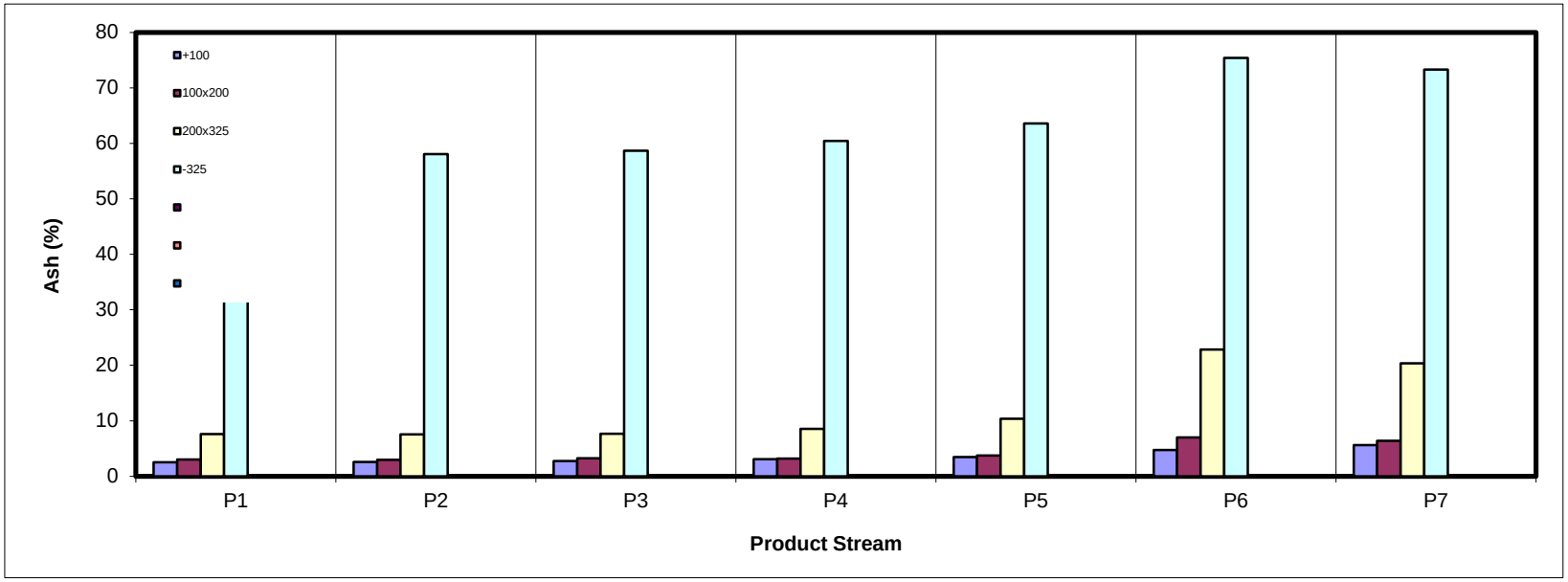
Description: Run 12 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	2.53	2.58	2.73	3.06	3.46	4.72	5.62		2.77
100x200	3.04	2.96	3.22	3.21	3.72	7.02	6.39		3.21
200x325	7.61	7.54	7.66	8.56	10.39	22.83	20.36		8.34
-325	55.63	58.05	58.64	60.42	63.58	75.41	73.30		58.02
Total (Calc)	25.97	26.31	27.31	26.92	29.08	49.10	43.47		27.32



SPIRAL DATA ANALYSIS

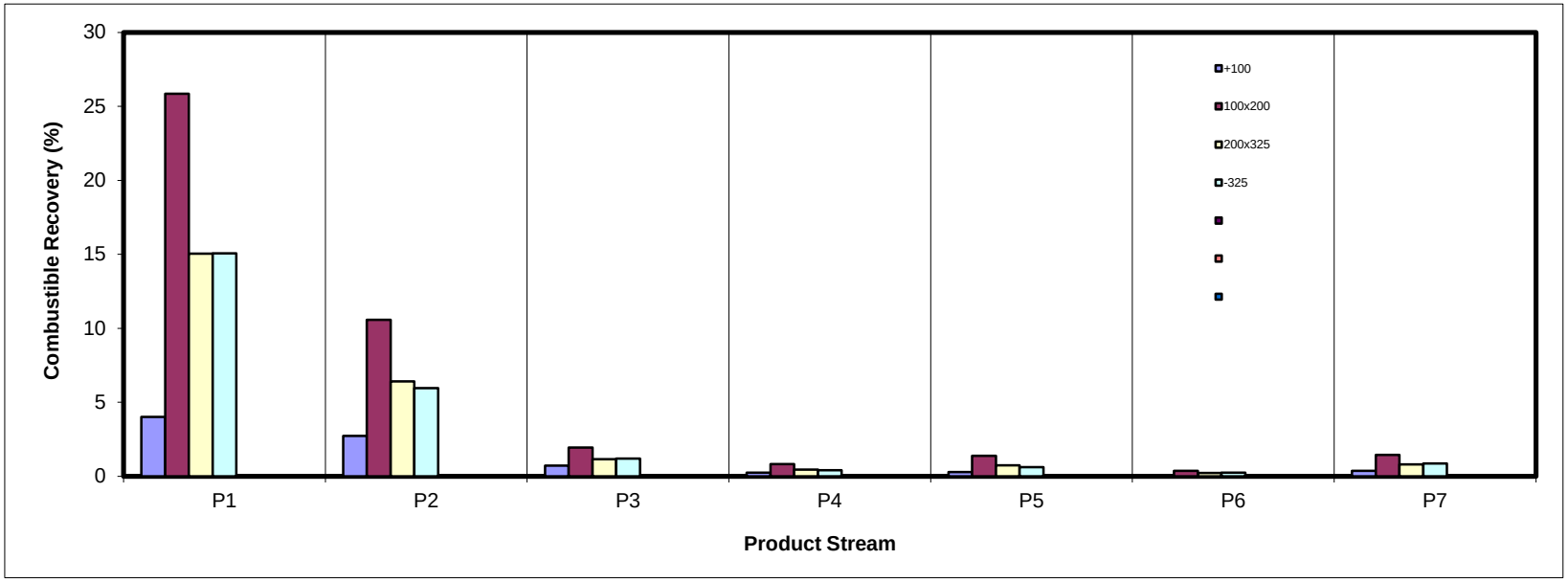
Description: Run 12 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	4.01	2.73	0.73	0.24	0.28	0.06	0.38		8.43
100x200	25.86	10.56	1.93	0.83	1.37	0.37	1.45		42.37
200x325	15.05	6.41	1.15	0.45	0.73	0.23	0.80		24.82
-325	15.07	5.96	1.20	0.42	0.62	0.25	0.86		24.38
Total (Calc)	59.98	25.66	5.01	1.93	3.01	0.91	3.49		100.00



SPIRAL DATA ANALYSIS

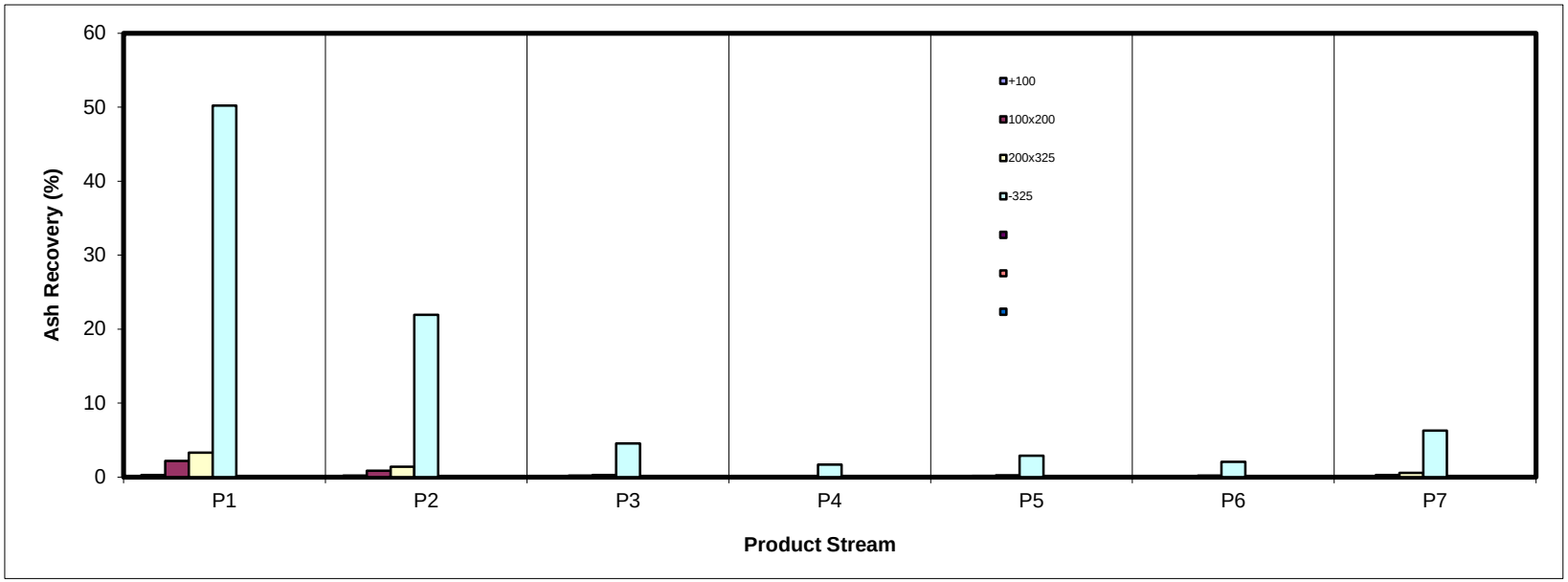
Description: Run 12 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	0.28	0.19	0.05	0.02	0.03	0.01	0.06		0.64
100x200	2.16	0.86	0.17	0.07	0.14	0.07	0.26		3.74
200x325	3.30	1.39	0.25	0.11	0.23	0.18	0.55		6.01
-325	50.24	21.93	4.53	1.69	2.88	2.07	6.27		89.62
Total (Calc)	55.97	24.37	5.01	1.89	3.28	2.34	7.14		100.00



SPIRAL DATA ANALYSIS

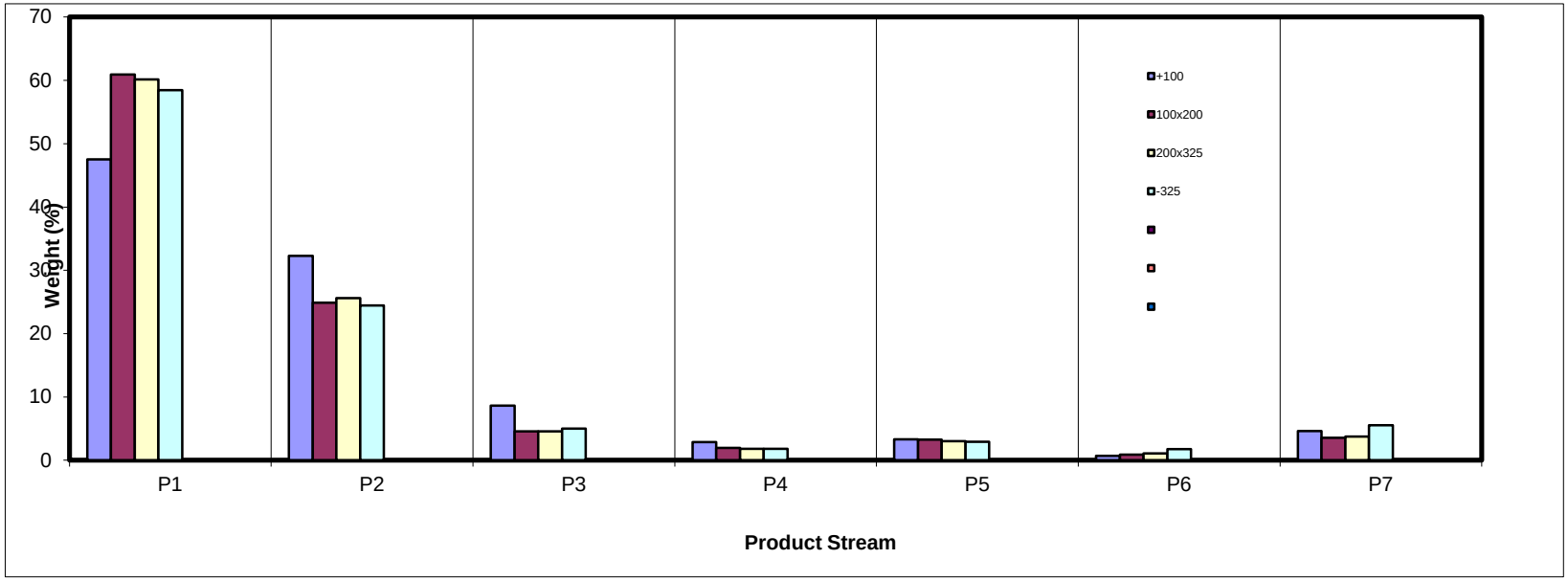
Description: Run 12 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	47.50	32.30	8.66	2.87	3.33	0.72	4.62		100.00
100x200	60.92	24.87	4.56	1.96	3.26	0.90	3.54		100.00
200x325	60.14	25.61	4.59	1.80	3.02	1.11	3.73		100.00
-325	58.47	24.46	5.00	1.81	2.94	1.78	5.54		100.00
Total (Calc)	58.89	25.31	5.01	1.92	3.08	1.30	4.49		100.00



SPIRAL DATA ANALYSIS

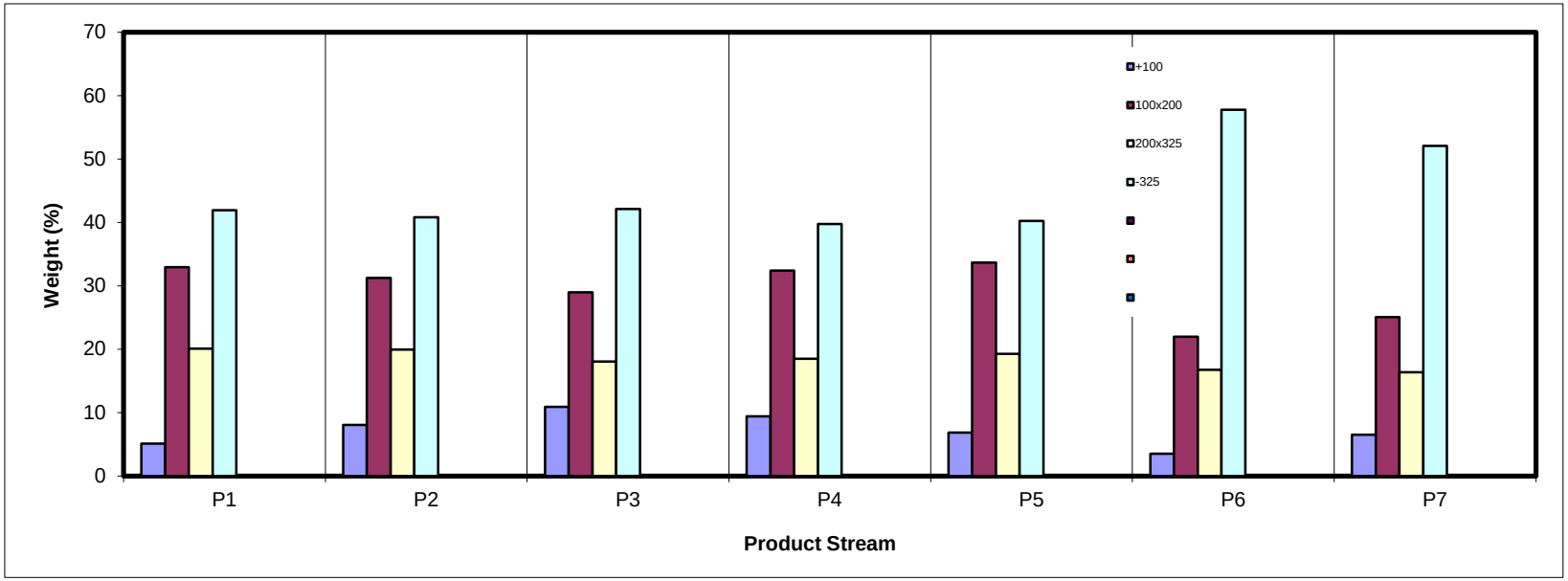
Description: Run 12 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	5.08	8.04	10.88	9.39	6.82	3.50	6.49		6.30
100x200	32.91	31.26	28.96	32.40	33.65	21.98	25.08		31.81
200x325	20.10	19.92	18.04	18.46	19.28	16.76	16.35		19.68
-325	41.90	40.79	42.12	39.74	40.25	57.77	52.08		42.20
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

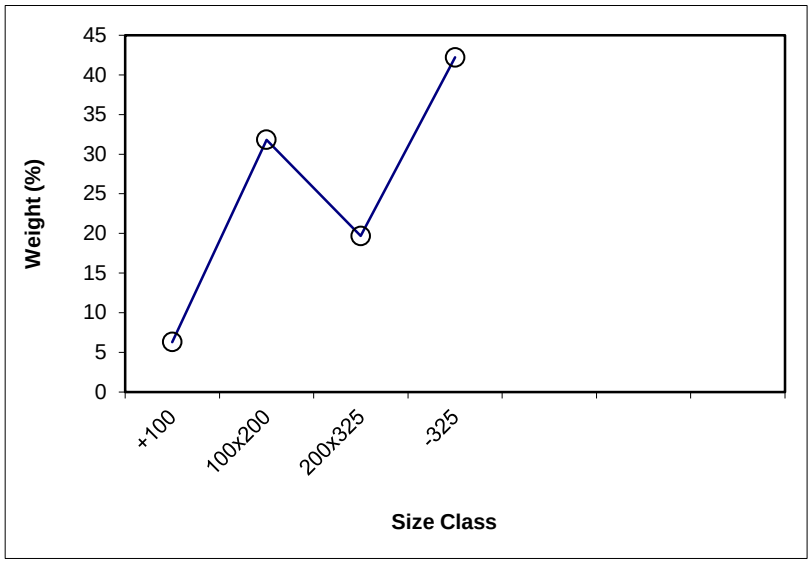
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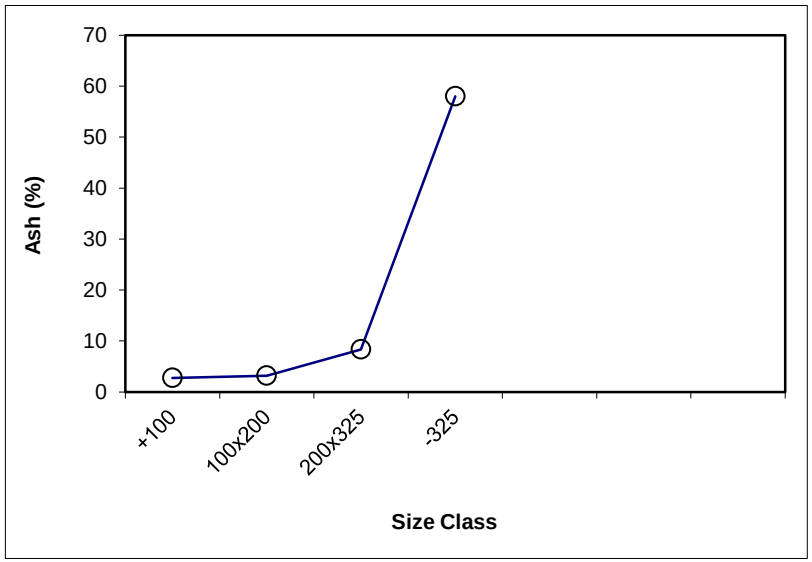
Comments: 0.15 x 0.044 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	418.9	408.8	10.19	6.30	2.77	6.30	2.77	100.00	27.32
100x200	401.1	349.6	51.45	31.81	3.21	38.11	3.14	93.70	28.97
200x325	418.5	386.7	31.83	19.68	8.34	57.80	4.91	61.89	42.22
-325	74.5	6.3	68.25	42.20	58.02	100.00	27.32	42.20	58.02
Total (Calc)	--	--	161.72	100.00	27.32	--	--	--	--





SPIRAL DATA ANALYSIS

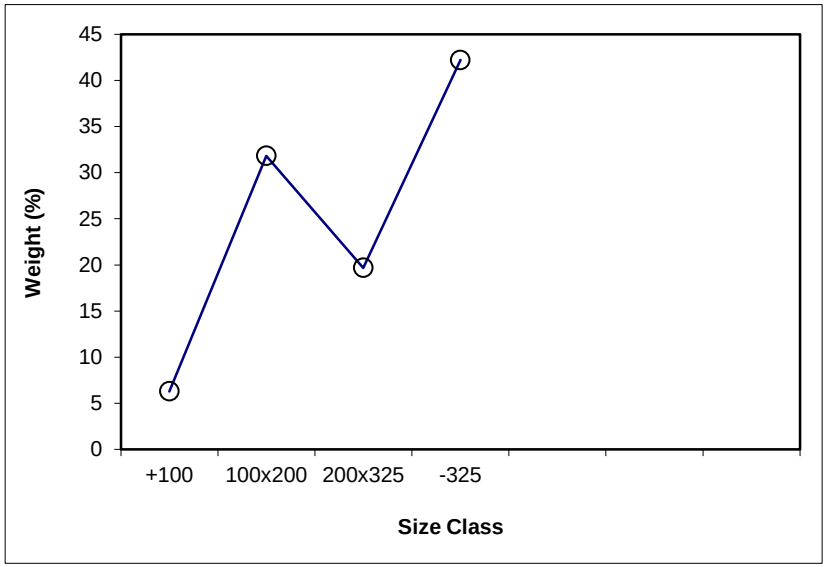
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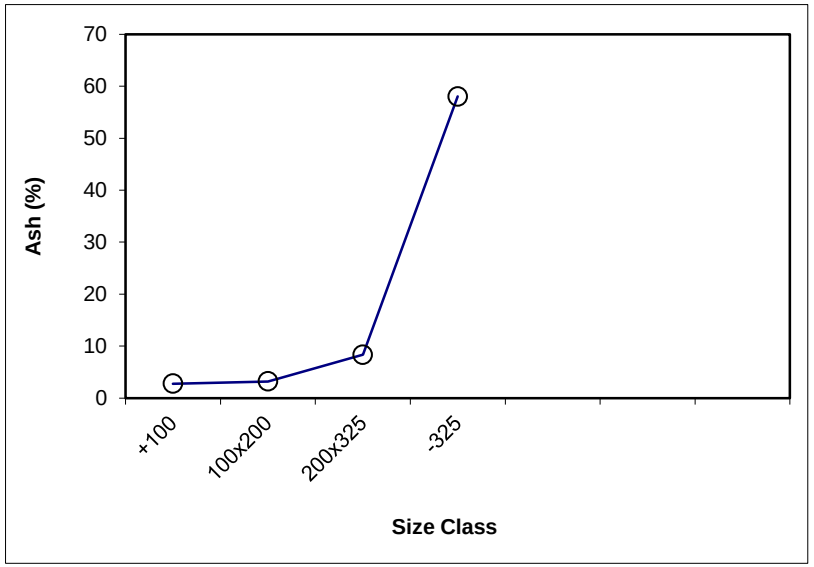
Comments: 0.15 x 0.044 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+100	6.30	2.77	6.30	2.77	100.00	27.32			
100x200	31.81	3.21	38.11	3.14	93.70	28.97	x	31.81	3.21
200x325	19.68	8.34	57.80	4.91	61.89	42.22	x	19.68	8.34
-325	42.20	58.02	100.00	27.32	42.20	58.02			
Total (Calc)	100.00	27.32	--	--	--	--	--	51.50	5.17





SPIRAL DATA ANALYSIS

Description: Run 12 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 58.89

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	825.96	801.8	24.18	5.08	2.53	5.08	2.53	100.00	25.97
100x200	833.45	676.9	156.60	32.91	3.04	37.99	2.97	94.92	27.23
200x325	868.24	772.6	95.65	20.10	7.61	58.10	4.58	62.01	40.06
-325	205.87	6.5	199.39	41.90	55.63	100.00	25.97	41.90	55.63
Total (Calc)	--	--	475.81	100.00	25.97	--	--	--	--

Product P2 Feed Weight (%): 25.31

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	324.3	307.8	16.44	8.04	2.58	8.04	2.58	100.00	26.31
100x200	358.4	294.5	63.92	31.26	2.96	39.30	2.88	91.96	28.39
200x325	338.7	298.0	40.73	19.92	7.54	59.21	4.45	60.70	41.48
-325	89.8	6.4	83.42	40.79	58.05	100.00	26.31	40.79	58.05
Total (Calc)	--	--	204.51	100.00	26.31	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 12 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 5.01

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	321.0	307.8	13.22	10.88	2.73	10.88	2.73	100.00	27.31
100x200	329.7	294.5	35.18	28.96	3.22	39.84	3.09	89.12	30.31
200x325	319.9	298.0	21.91	18.04	7.66	57.88	4.51	60.16	43.35
-325	57.6	6.5	51.17	42.12	58.64	100.00	27.31	42.12	58.64
Total (Calc)	--	--	121.48	100.00	27.31	--	--	--	--

Product P4 Feed Weight (%): 1.92

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	419.0	408.8	10.21	9.39	3.06	9.39	3.06	100.00	26.92
100x200	384.9	349.6	35.22	32.40	3.21	41.79	3.18	90.61	29.39
200x325	406.8	386.7	20.07	18.46	8.56	60.26	4.83	58.21	43.97
-325	49.6	6.4	43.21	39.74	60.42	100.00	26.92	39.74	60.42
Total (Calc)	--	--	108.71	100.00	26.92	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 12 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 3.08

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	401.5	393.0	8.49	6.82	3.46	6.82	3.46	100.00	29.08
100x200	369.1	327.2	41.87	33.65	3.72	40.47	3.68	93.18	30.96
200x325	409.9	385.9	23.99	19.28	10.39	59.75	5.84	59.53	46.35
-325	56.5	6.4	50.08	40.25	63.58	100.00	29.08	40.25	63.58
Total (Calc)	--	--	124.43	100.00	29.08	--	--	--	--

Product P6 Feed Weight (%): 1.30

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	403.1	397.2	5.88	3.50	4.72	3.50	4.72	100.00	49.10
100x200	428.3	391.3	36.97	21.98	7.02	25.48	6.71	96.50	50.71
200x325	406.8	378.6	28.18	16.76	22.83	42.23	13.11	74.52	63.59
-325	103.4	6.3	97.15	57.77	75.41	100.00	49.10	57.77	75.41
Total (Calc)	--	--	168.19	100.00	49.10	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 12 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 4.49

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	314.9	307.8	7.06	6.49	5.62	6.49	5.62	100.00	43.47
100x200	321.8	294.5	27.28	25.08	6.39	31.57	6.23	93.51	46.10
200x325	315.8	298.0	17.78	16.35	20.36	47.92	11.05	68.43	60.65
-325	63.0	6.3	56.65	52.08	73.30	100.00	43.47	52.08	73.30
Total (Calc)	--	--	108.77	100.00	43.47	--	--	--	--

SPIRAL DATA ANALYSIS

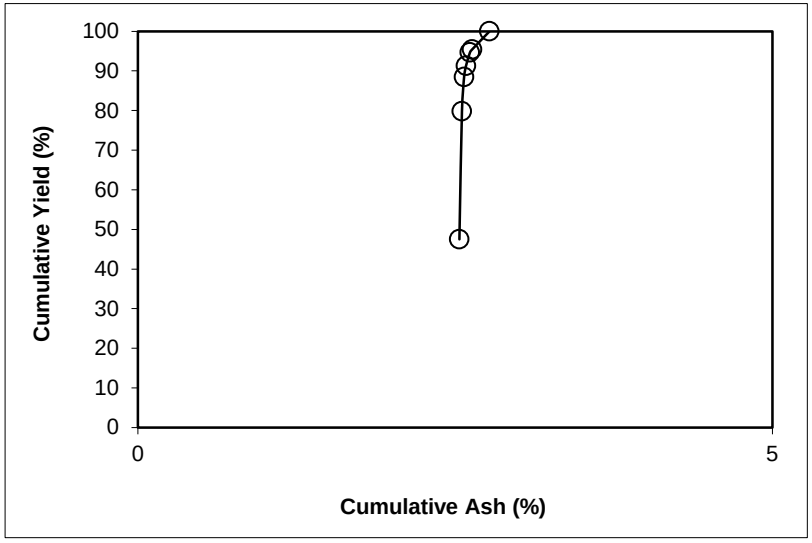
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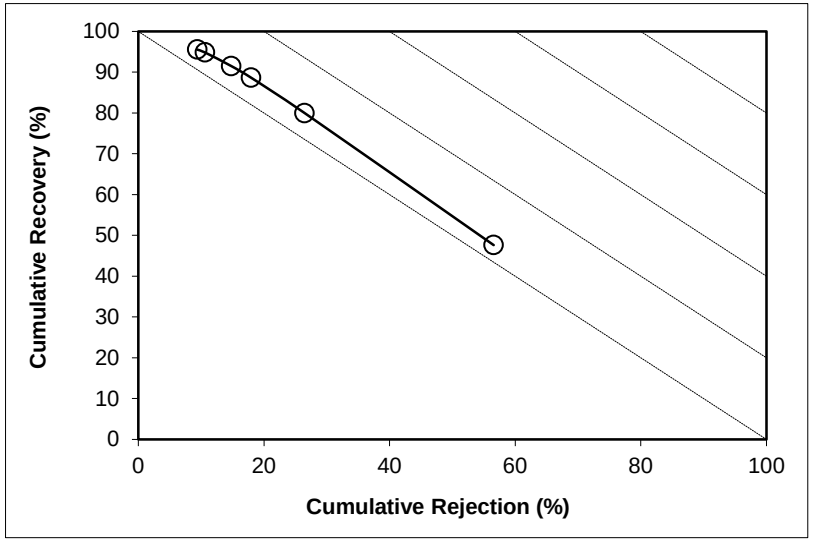
Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: +100 Feed Weight (%): 6.30

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	47.50	2.53	47.50	2.53	47.62	52.50	2.99	56.57	4.19
P2	32.30	2.58	79.80	2.55	79.98	20.20	3.63	26.46	6.44
P3	8.66	2.73	88.45	2.57	88.64	11.55	4.31	17.94	6.58
P4	2.87	3.06	91.32	2.59	91.49	8.68	4.72	14.78	6.27
P5	3.33	3.46	94.66	2.62	94.81	5.34	5.50	10.62	5.42
P6	0.72	4.72	95.38	2.63	95.51	4.62	5.62	9.39	4.90
P7	4.62	5.62	100.00	2.77	100.00	0.00			
Total (Calc)	100.00	2.77	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

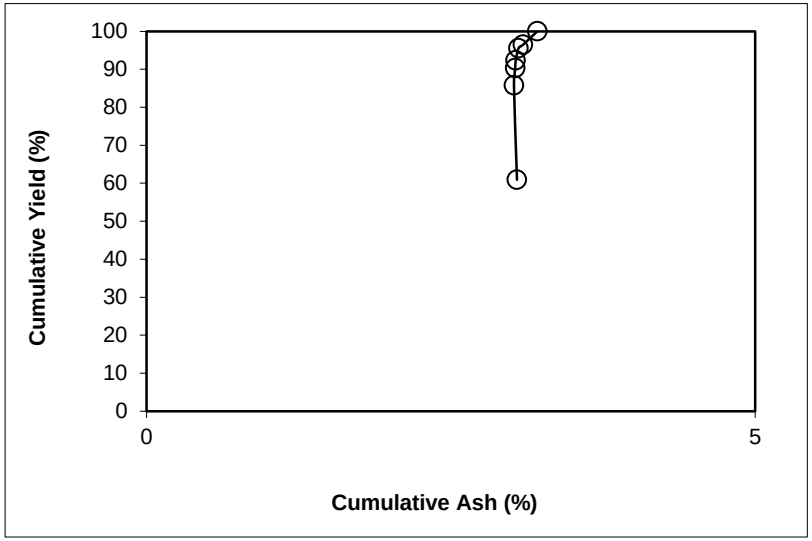
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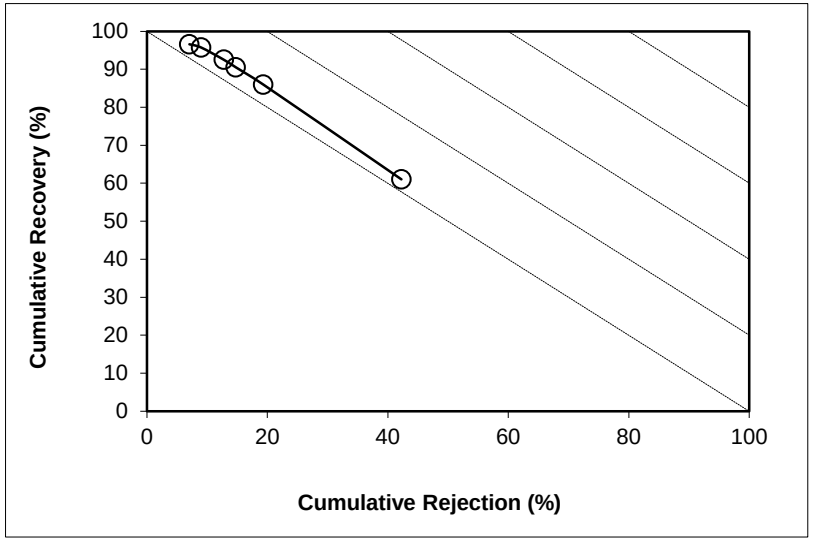
Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 31.81

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	60.92	3.04	60.92	3.04	61.02	39.08	3.47	42.24	3.27
P2	24.87	2.96	85.79	3.02	85.96	14.21	4.37	19.33	5.29
P3	4.56	3.22	90.35	3.03	90.52	9.65	4.90	14.75	5.27
P4	1.96	3.21	92.31	3.03	92.48	7.69	5.34	12.79	5.27
P5	3.26	3.72	95.56	3.06	95.72	4.44	6.52	9.01	4.73
P6	0.90	7.02	96.46	3.09	96.58	3.54	6.39	7.04	3.62
P7	3.54	6.39	100.00	3.21	100.00	0.00			
Total (Calc)	100.00	3.21	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

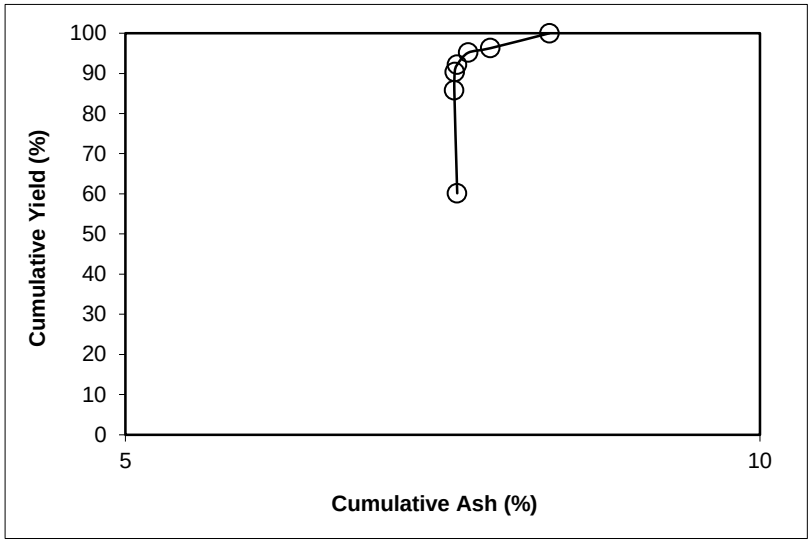
Description: Run 12 - Intermediate Spiral Test

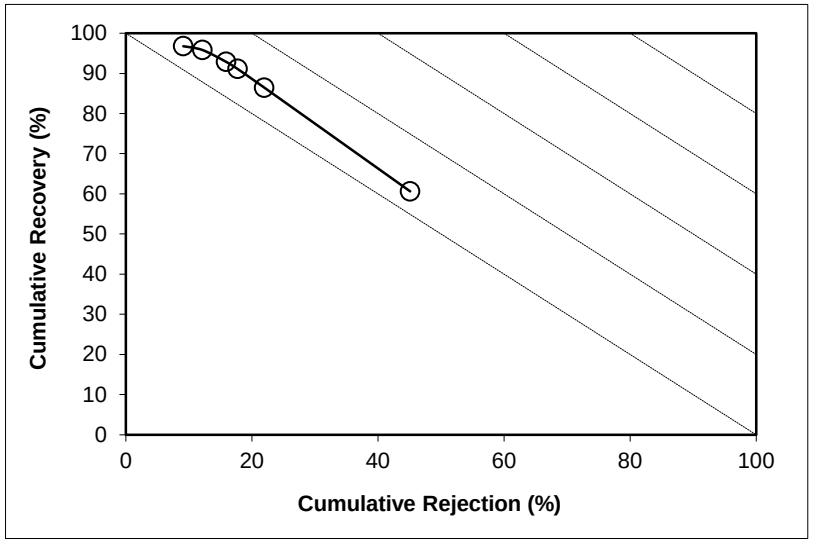
Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 19.68

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	60.14	7.61	60.14	7.61	60.62	39.86	9.44	45.10	5.72
P2	25.61	7.54	85.75	7.59	86.45	14.25	12.85	21.95	8.41
P3	4.59	7.66	90.35	7.59	91.08	9.65	15.32	17.74	8.82
P4	1.80	8.56	92.15	7.61	92.88	7.85	16.88	15.89	8.77
P5	3.02	10.39	95.17	7.70	95.83	4.83	20.93	12.13	7.96
P6	1.11	22.83	96.27	7.88	96.76	3.73	20.36	9.10	5.86
P7	3.73	20.36	100.00	8.34	100.00	0.00			
Total (Calc)	100.00	8.34	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

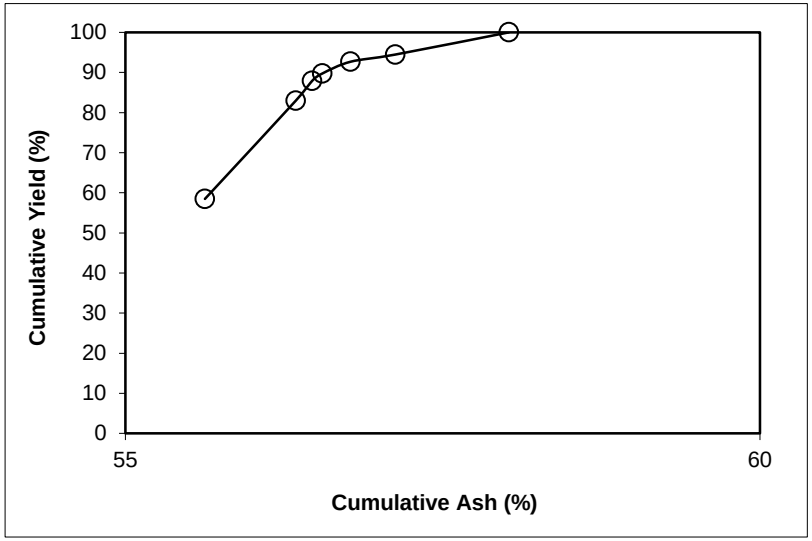
Description: Run 12 - Intermediate Spiral Test

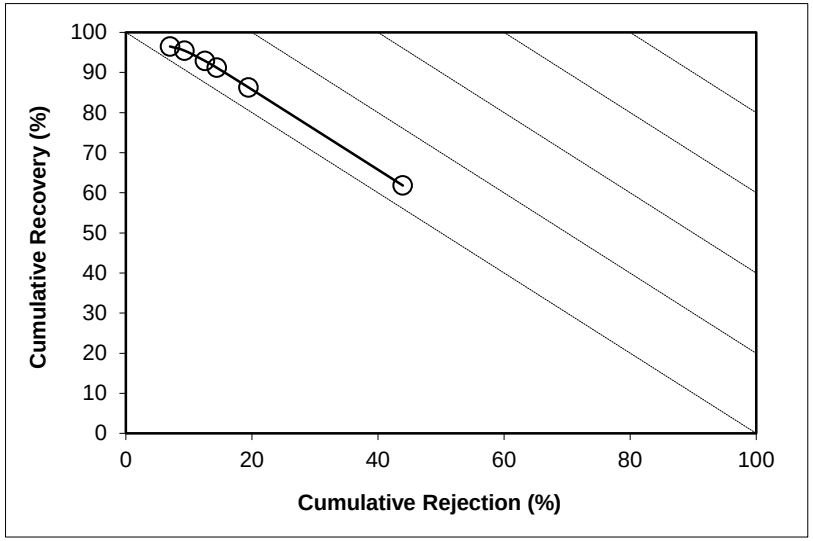
Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: -325.00 Feed Weight (%): 42.20

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	58.47	55.63	58.47	55.63	61.81	41.53	61.39	43.94	5.75
P2	24.46	58.05	82.93	56.34	86.25	17.07	66.18	19.47	5.72
P3	5.00	58.64	87.93	56.47	91.18	12.07	69.31	14.41	5.59
P4	1.81	60.42	89.74	56.55	92.89	10.26	70.88	12.53	5.41
P5	2.94	63.58	92.68	56.77	95.43	7.32	73.81	9.31	4.74
P6	1.78	75.41	94.46	57.13	96.48	5.54	73.30	7.00	3.47
P7	5.54	73.30	100.00	58.02	100.00	0.00			
Total (Calc)	100.00	58.02	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

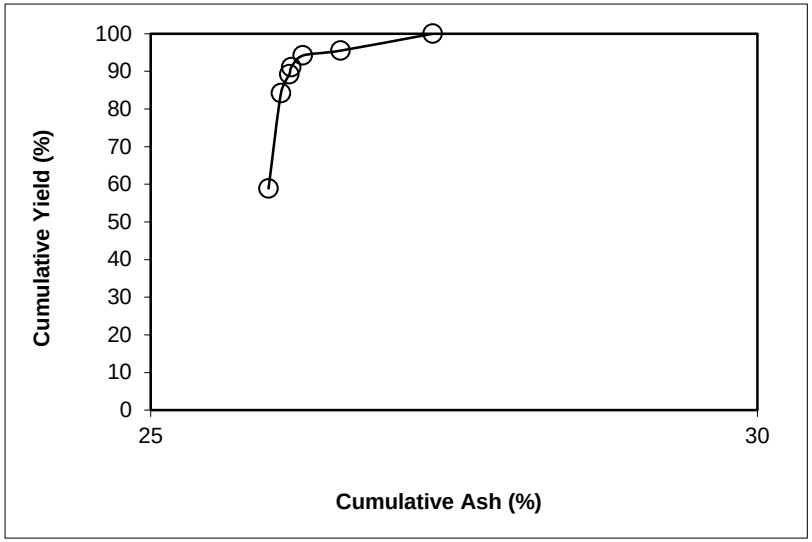
Description: Run 12 - Intermediate Spiral Test

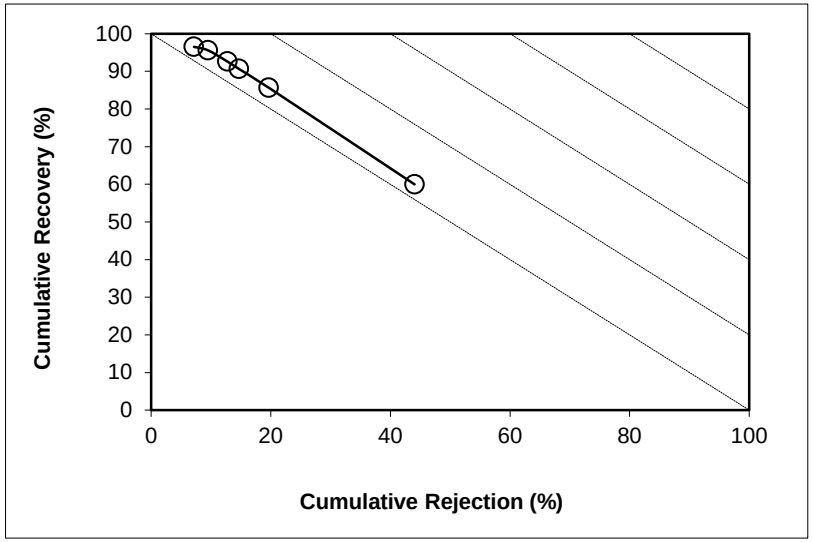
Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	58.89	25.97	58.89	25.97	59.98	41.11	29.26	44.03	4.01
P2	25.31	26.31	84.20	26.07	85.65	15.80	33.99	19.66	5.31
P3	5.01	27.31	89.21	26.14	90.66	10.79	37.09	14.65	5.31
P4	1.92	26.92	91.13	26.16	92.59	8.87	39.30	12.75	5.35
P5	3.08	29.08	94.21	26.25	95.60	5.79	44.74	9.48	5.08
P6	1.30	49.10	95.51	26.57	96.51	4.49	43.47	7.14	3.65
P7	4.49	43.47	100.00	27.32	100.00	0.00			
Total (Calc)	100.00	27.32	--	--	--	--	--	--	--

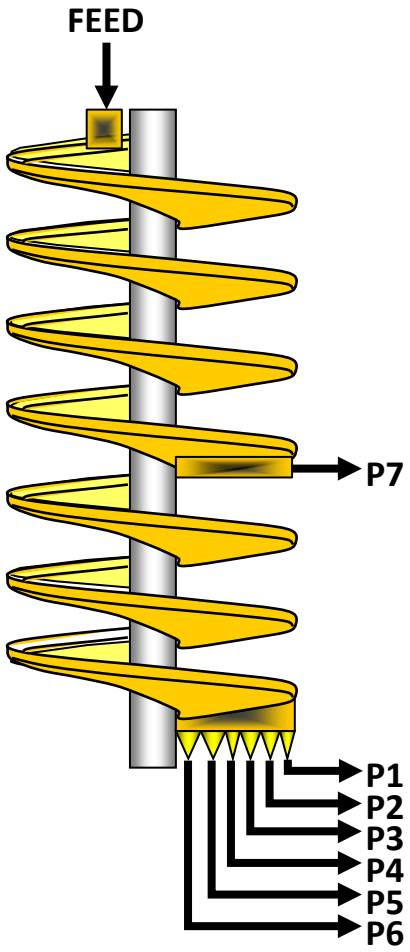




SPIRAL DATA ANALYSIS

Description: Run 13 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	0.191	7.9	8.93	9.44
P2	0.099	8.4	4.32	4.59
P3	0.017	7.4	0.87	0.92
P4	0.005	7.9	0.24	0.25
P5	0.009	8.3	0.39	0.41
P6	0.004	9.6	0.16	0.17
P7	0.013	8.6	0.57	0.60
Total	0.339	8.1	15.47	16.38

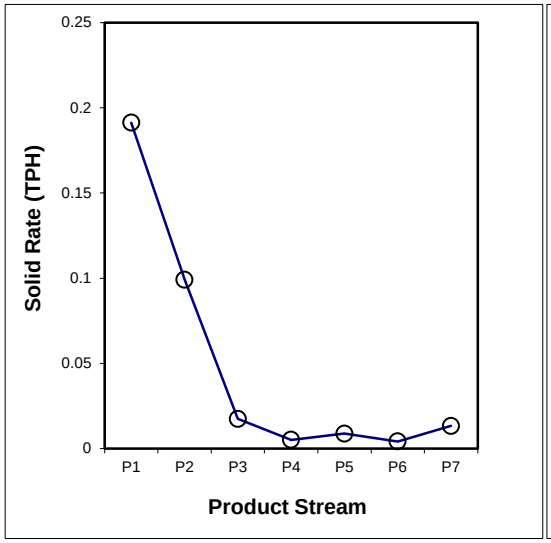
SPIRAL DATA ANALYSIS

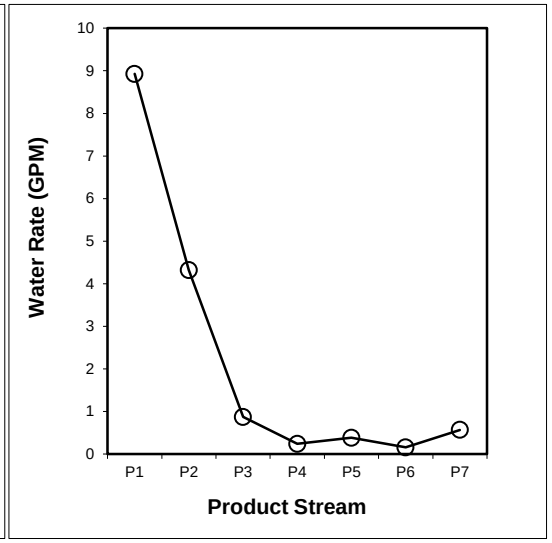
Description: Run 13 - Intermediate Spiral Test

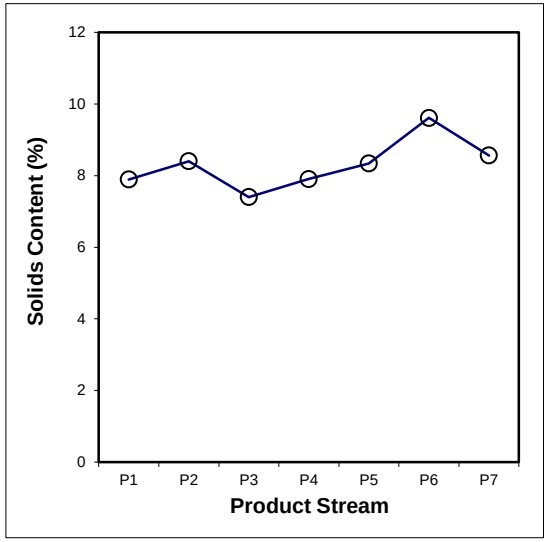
Comments: 0.15 x 0.044 mm Nominal Particle Size

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	5	4406.50	1304.50	2.423	1147.9	906.7	0.191	56.37	7.89
P2	5	1725.08	215.10	1.179	1237.6	1112.7	0.099	29.21	8.40
P3	15	1051.15	145.16	0.236	1239.7	1173.6	0.017	5.15	7.40
P4	35	781.85	199.76	0.065	952.0	906.7	0.005	1.51	7.90
P5	25	768.55	95.19	0.105	1167.8	1112.5	0.009	2.59	8.34
P6	80	998.70	96.01	0.044	1258.9	1173.4	0.004	1.25	9.61
P7	20	874.90	78.15	0.156	1218.3	1151.1	0.013	3.93	8.56
Total (Calc)	--	--	--	4.208	--	--	0.339	100.00	8.06
Total (Head)	1.28	1598.06	236.4	4.208	1233.2	1123.4	0.339	--	8.06







SPIRAL DATA ANALYSIS

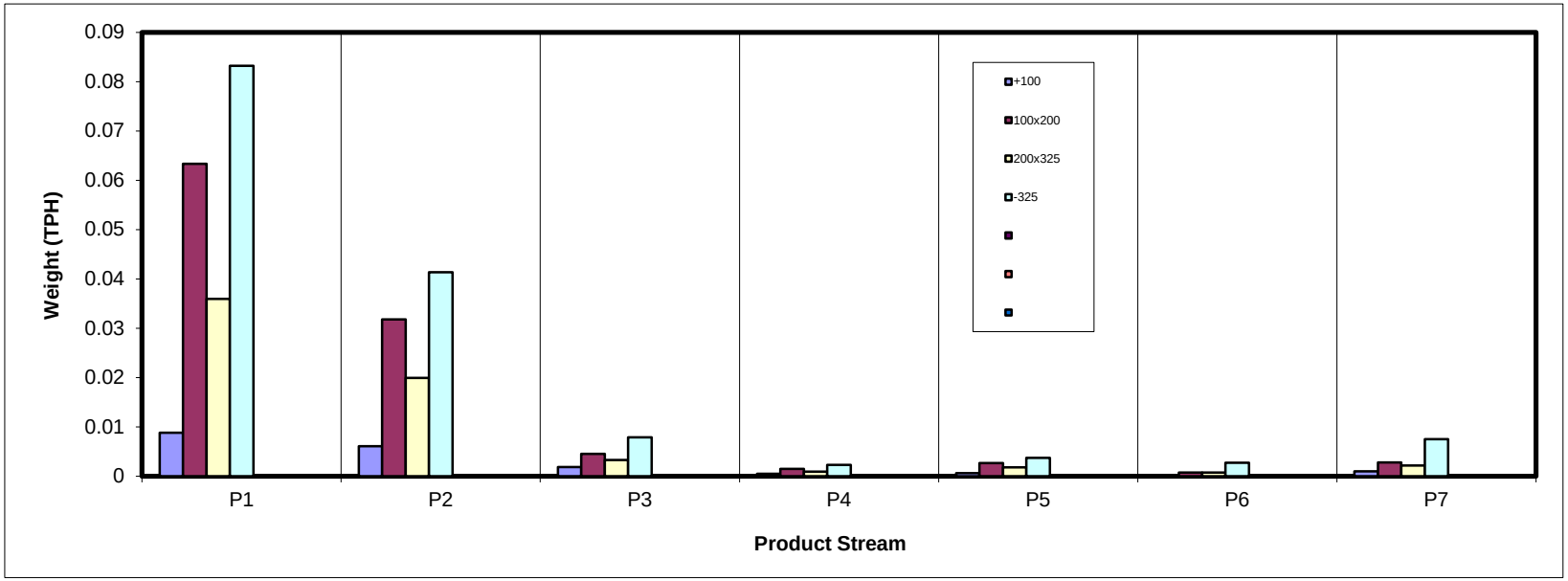
Description: Run 13 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	0.009	0.006	0.002	0.000	0.001	0.000	0.001		0.019
100x200	0.063	0.032	0.005	0.001	0.003	0.001	0.003		0.107
200x325	0.036	0.020	0.003	0.001	0.002	0.001	0.002		0.065
-325	0.083	0.041	0.008	0.002	0.004	0.003	0.007		0.149
Total (Calc)	0.191	0.099	0.017	0.005	0.009	0.004	0.013		0.339



SPIRAL DATA ANALYSIS

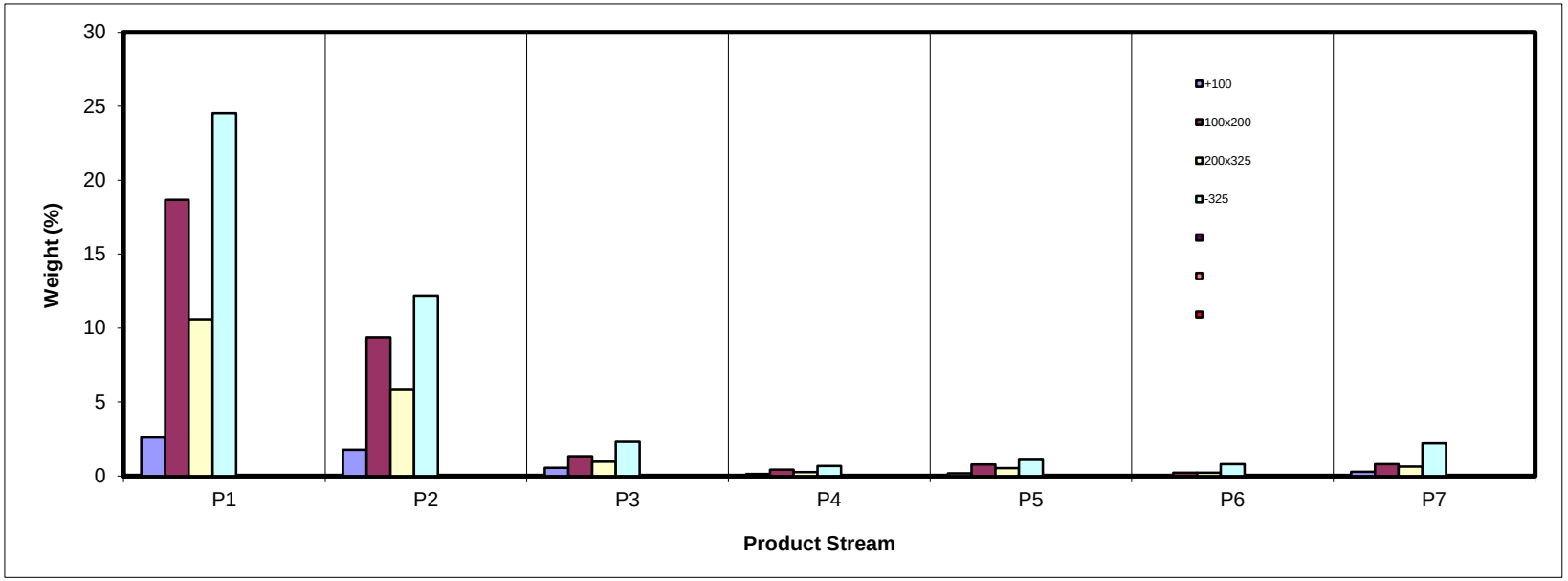
Description: Run 13 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	2.60	1.78	0.54	0.15	0.18	0.03	0.29		5.56
100x200	18.67	9.37	1.34	0.43	0.79	0.21	0.81		31.61
200x325	10.59	5.88	0.95	0.26	0.53	0.22	0.63		19.05
-325	24.52	12.19	2.31	0.67	1.09	0.79	2.20		43.78
Total (Calc)	56.37	29.21	5.15	1.51	2.59	1.25	3.93		100.00



SPIRAL DATA ANALYSIS

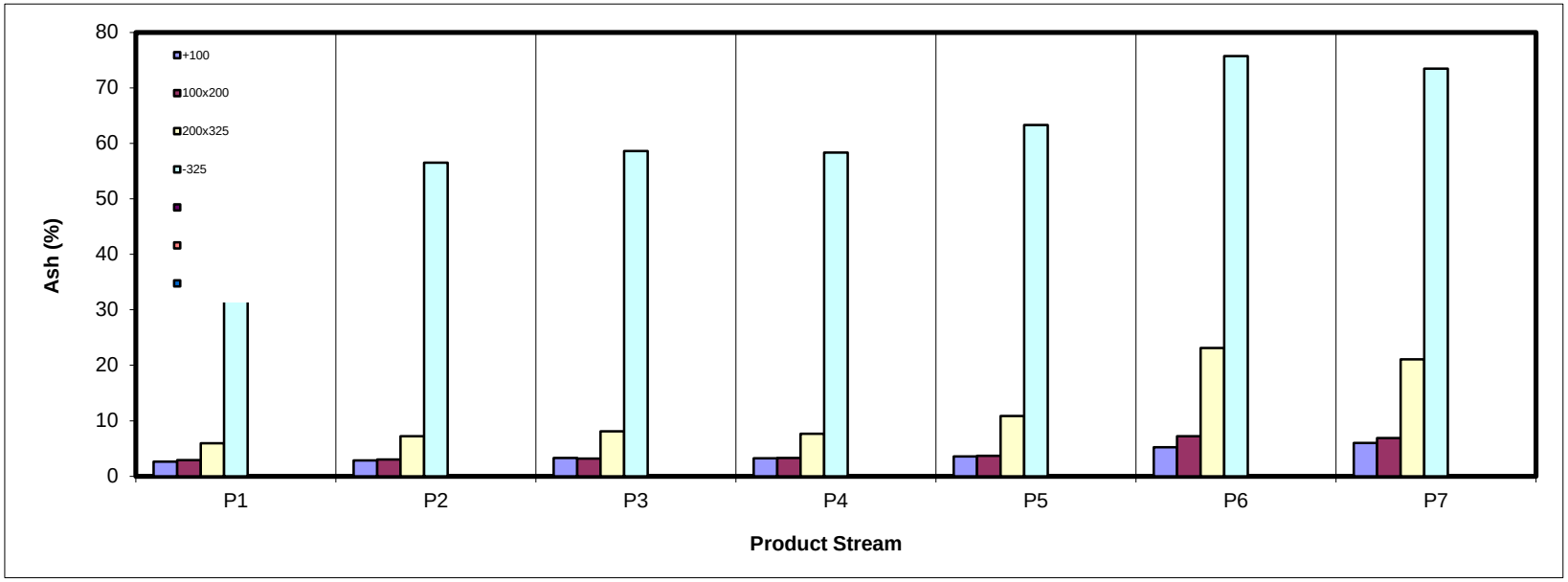
Description: Run 13 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	2.65	2.89	3.28	3.23	3.57	5.22	6.00		3.02
100x200	2.92	3.04	3.20	3.31	3.70	7.25	6.86		3.12
200x325	5.93	7.22	8.09	7.66	10.85	23.09	21.05		7.29
-325	52.78	56.51	58.60	58.35	63.28	75.71	73.45		55.93
Total (Calc)	25.16	26.18	29.02	28.58	30.18	53.27	46.45		27.03



SPIRAL DATA ANALYSIS

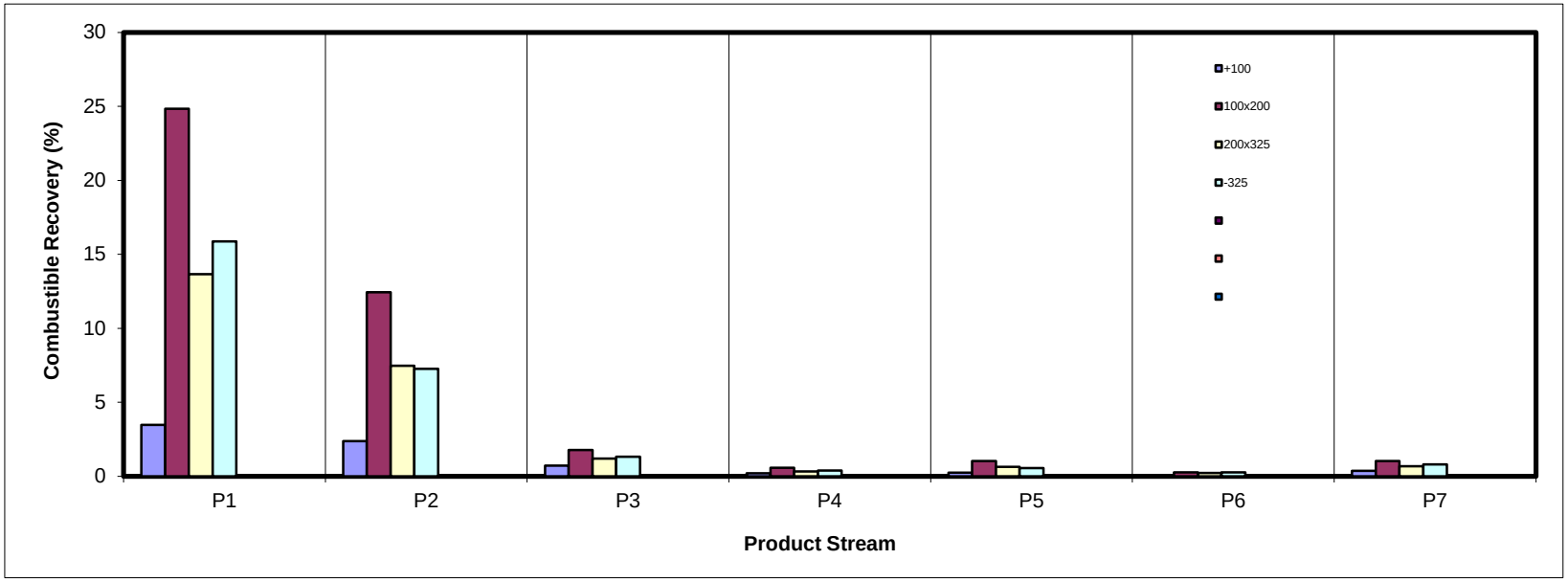
Description: Run 13 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	3.46	2.37	0.72	0.19	0.24	0.03	0.37		7.39
100x200	24.83	12.44	1.77	0.57	1.04	0.27	1.03		41.96
200x325	13.65	7.47	1.20	0.33	0.65	0.23	0.68		24.21
-325	15.87	7.26	1.31	0.38	0.55	0.26	0.80		26.44
Total (Calc)	57.81	29.55	5.00	1.48	2.47	0.80	2.88		100.00



SPIRAL DATA ANALYSIS

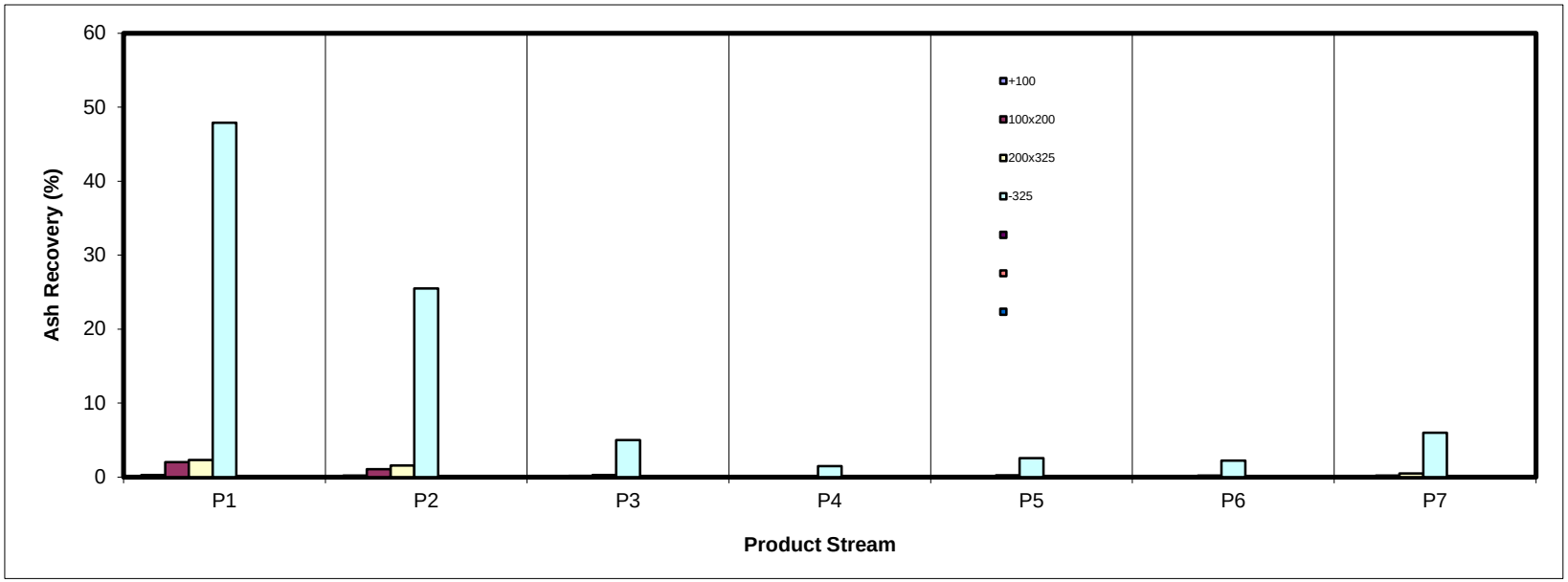
Description: Run 13 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	0.25	0.19	0.07	0.02	0.02	0.00	0.06		0.62
100x200	2.02	1.05	0.16	0.05	0.11	0.06	0.21		3.65
200x325	2.32	1.57	0.29	0.07	0.21	0.19	0.49		5.14
-325	47.89	25.48	5.01	1.46	2.54	2.21	5.99		90.59
Total (Calc)	52.48	28.29	5.52	1.60	2.89	2.46	6.75		100.00



SPIRAL DATA ANALYSIS

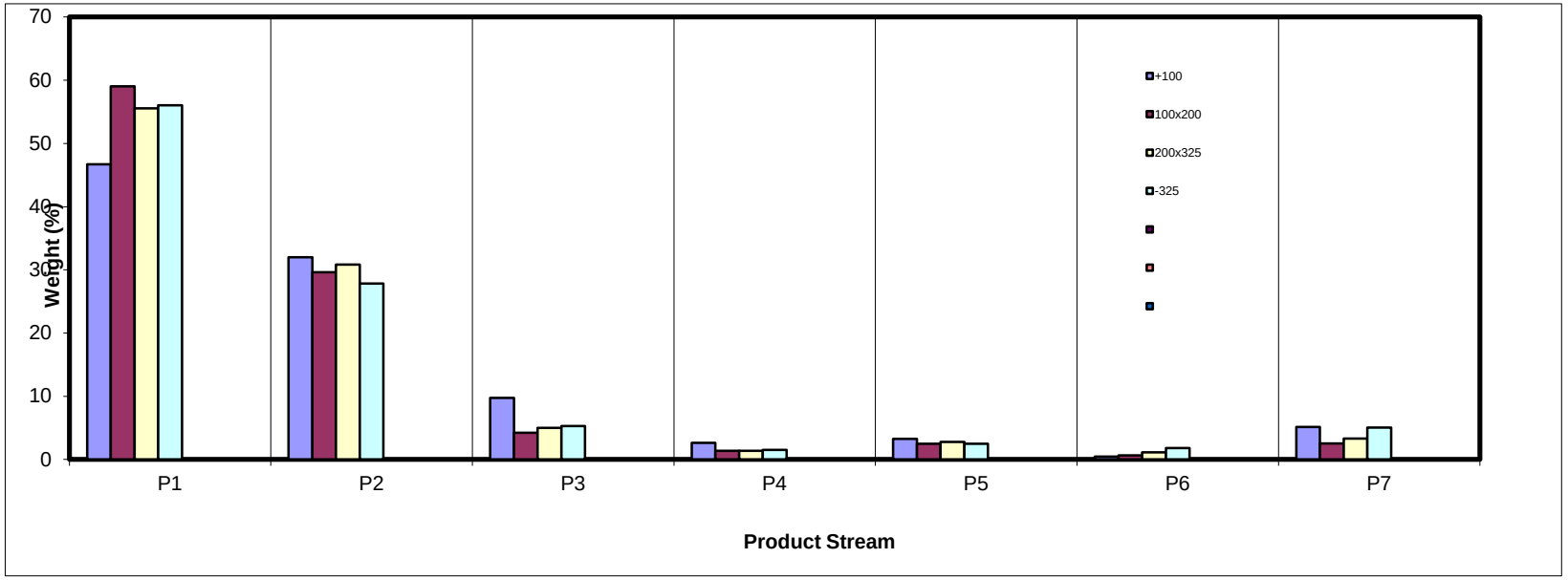
Description: Run 13 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	46.72	32.00	9.75	2.63	3.28	0.46	5.16		100.00
100x200	59.05	29.63	4.23	1.37	2.49	0.67	2.56		100.00
200x325	55.56	30.85	5.01	1.37	2.77	1.16	3.29		100.00
-325	56.02	27.84	5.28	1.54	2.48	1.80	5.04		100.00
Total (Calc)	56.37	29.21	5.15	1.51	2.59	1.25	3.93		100.00



SPIRAL DATA ANALYSIS

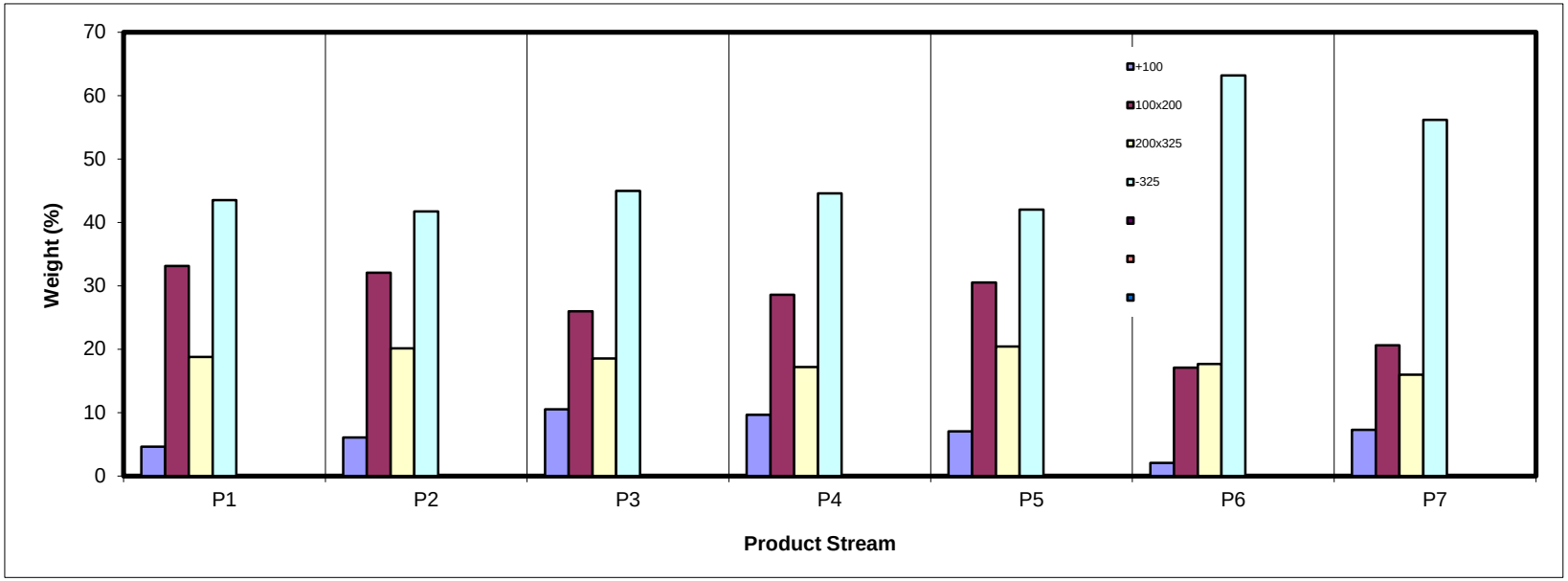
Description: Run 13 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	4.61	6.09	10.54	9.67	7.05	2.07	7.30		5.56
100x200	33.11	32.07	25.96	28.57	30.51	17.08	20.59		31.61
200x325	18.78	20.12	18.56	17.20	20.43	17.65	15.95		19.05
-325	43.50	41.72	44.95	44.56	42.01	63.20	56.15		43.78
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

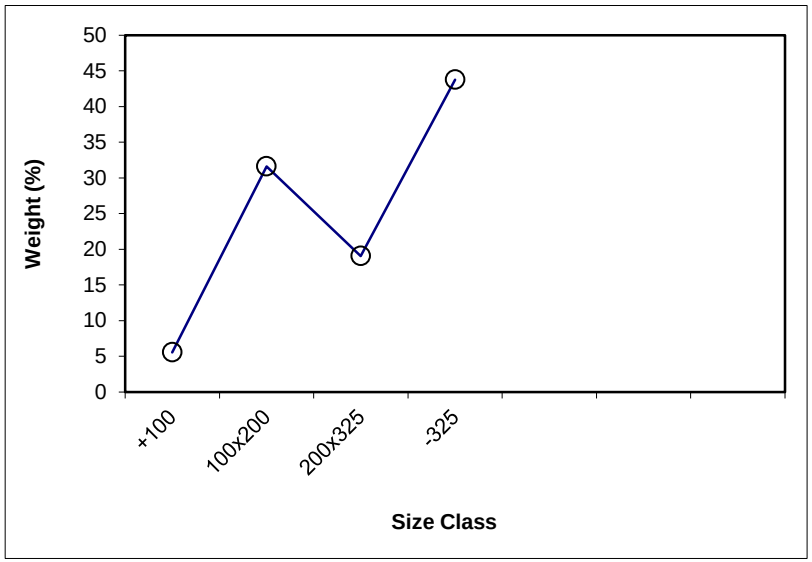
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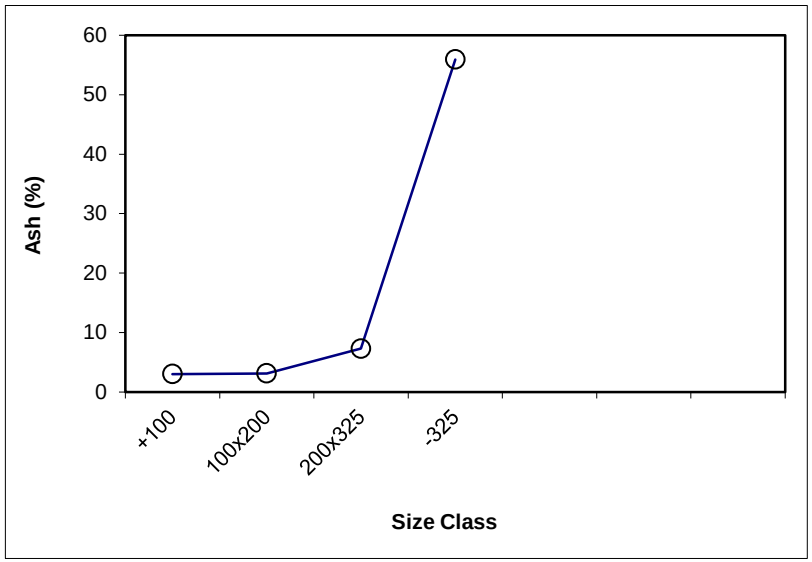
Comments: 0.15 x 0.044 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	373.0	366.9	6.10	5.56	3.02	5.56	3.02	100.00	27.03
100x200	382.1	347.4	34.70	31.61	3.12	37.17	3.10	94.44	28.44
200x325	423.6	402.7	20.92	19.05	7.29	56.22	4.52	62.83	41.18
-325	54.5	6.4	48.06	43.78	55.93	100.00	27.03	43.78	55.93
Total (Calc)	--	--	109.79	100.00	27.03	--	--	--	--





SPIRAL DATA ANALYSIS

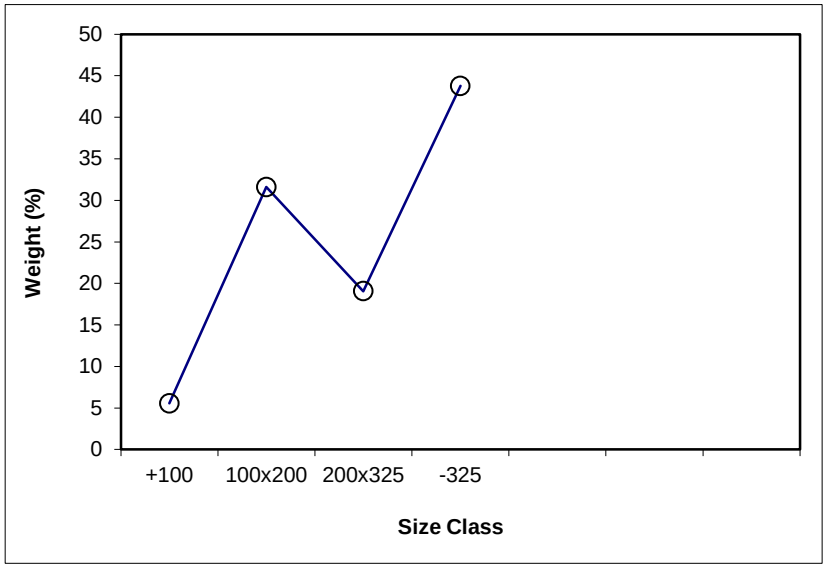
Description: Run 13 - Intermediate Spiral Test

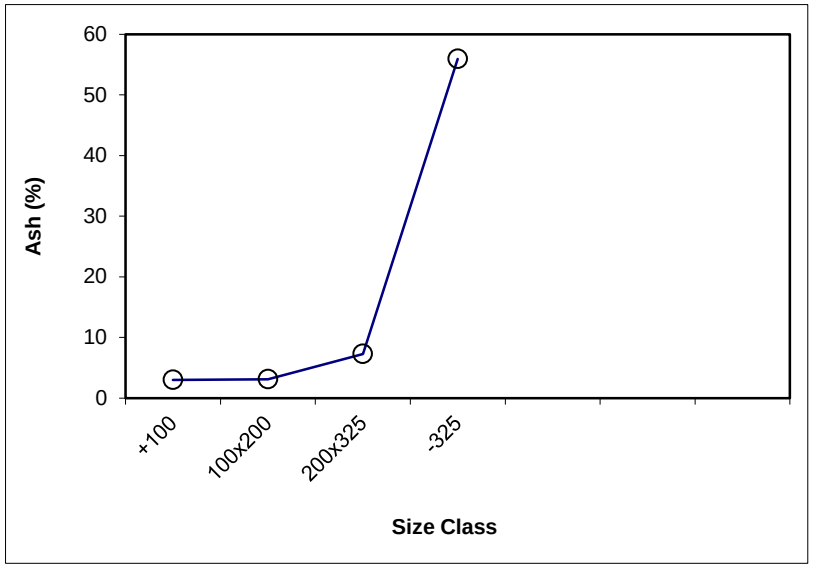
Comments: 0.15 x 0.044 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+100	5.56	3.02	5.56	3.02	100.00	27.03			
100x200	31.61	3.12	37.17	3.10	94.44	28.44	x	31.61	3.12
200x325	19.05	7.29	56.22	4.52	62.83	41.18	x	19.05	7.29
-325	43.78	55.93	100.00	27.03	43.78	55.93			
Total (Calc)	100.00	27.03	--	--	--	--	--	50.67	4.69





SPIRAL DATA ANALYSIS

Description: Run 13 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 56.37

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	318.92	307.8	11.11	4.61	2.65	4.61	2.65	100.00	25.16
100x200	374.35	294.5	79.86	33.11	2.92	37.72	2.88	95.39	26.25
200x325	343.29	298.0	45.30	18.78	5.93	56.50	3.90	62.28	38.65
-325	111.33	6.4	104.92	43.50	52.78	100.00	25.16	43.50	52.78
Total (Calc)	--	--	241.19	100.00	25.16	--	--	--	--

Product P2 Feed Weight (%): 29.21

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	400.6	393.0	7.61	6.09	2.89	6.09	2.89	100.00	26.18
100x200	367.3	327.2	40.07	32.07	3.04	38.15	3.01	93.91	27.69
200x325	411.0	385.9	25.15	20.12	7.22	58.28	4.47	61.84	40.47
-325	58.7	6.5	52.14	41.72	56.51	100.00	26.18	41.72	56.51
Total (Calc)	--	--	124.97	100.00	26.18	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 13 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 5.15

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	404.2	397.2	6.96	10.54	3.28	10.54	3.28	100.00	29.02
100x200	408.5	391.3	17.14	25.96	3.20	36.49	3.22	89.46	32.05
200x325	390.9	378.6	12.26	18.56	8.09	55.05	4.86	63.51	43.84
-325	36.1	6.4	29.69	44.95	58.60	100.00	29.02	44.95	58.60
Total (Calc)	--	--	66.04	100.00	29.02	--	--	--	--

Product P4 Feed Weight (%): 1.51

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	312.2	307.8	4.38	9.67	3.23	9.67	3.23	100.00	28.58
100x200	307.4	294.5	12.95	28.57	3.31	38.24	3.29	90.33	31.29
200x325	305.8	298.0	7.79	17.20	7.66	55.44	4.65	61.76	44.24
-325	26.6	6.4	20.19	44.56	58.35	100.00	28.58	44.56	58.35
Total (Calc)	--	--	45.31	100.00	28.58	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 13 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 2.59

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	396.9	393.0	3.90	7.05	3.57	7.05	3.57	100.00	30.18
100x200	344.1	327.2	16.87	30.50	3.70	37.56	3.67	92.95	32.20
200x325	397.2	385.9	11.30	20.43	10.85	57.99	6.20	62.44	46.12
-325	29.6	6.4	23.23	42.01	63.28	100.00	30.18	42.01	63.28
Total (Calc)	--	--	55.31	100.00	30.18	--	--	--	--

Product P6 Feed Weight (%): 1.25

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	399.0	397.2	1.77	2.07	5.22	2.07	5.22	100.00	53.27
100x200	405.9	391.3	14.60	17.08	7.25	19.15	7.03	97.93	54.28
200x325	393.7	378.6	15.09	17.65	23.09	36.80	14.73	80.85	64.22
-325	60.3	6.3	54.02	63.20	75.71	100.00	53.27	63.20	75.71
Total (Calc)	--	--	85.48	100.00	53.27	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 13 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 3.93

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	413.5	408.6	4.90	7.30	6.00	7.30	6.00	100.00	46.45
100x200	363.5	349.6	13.84	20.59	6.86	27.89	6.64	92.70	49.64
200x325	397.4	386.7	10.72	15.95	21.05	43.85	11.88	72.11	61.86
-325	43.9	6.2	37.73	56.15	73.45	100.00	46.45	56.15	73.45
Total (Calc)	--	--	67.20	100.00	46.45	--	--	--	--

SPIRAL DATA ANALYSIS

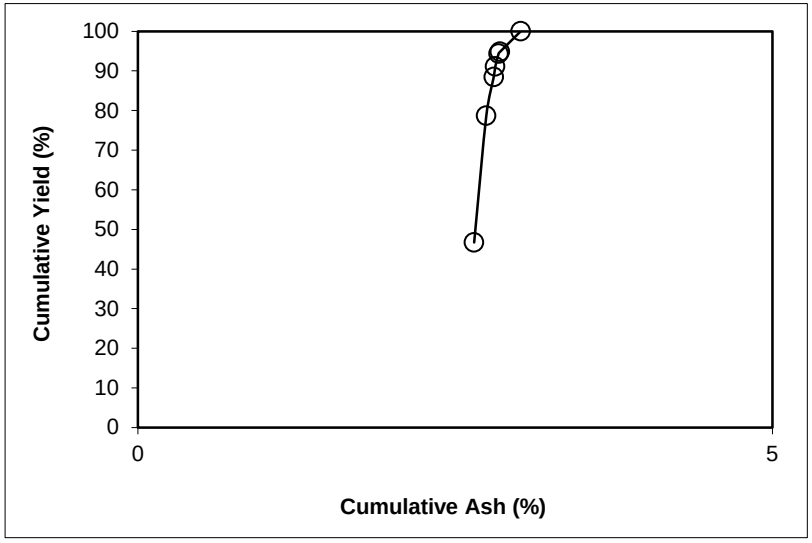
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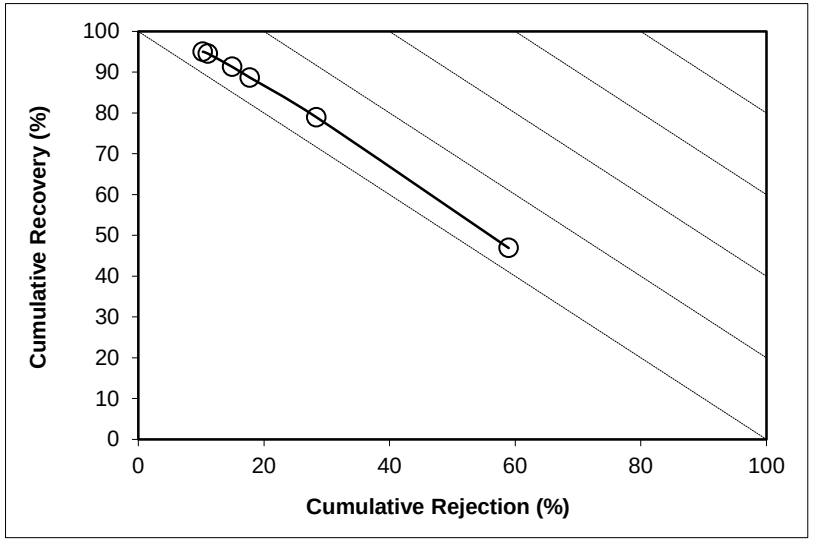
Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: +100 Feed Weight (%): 5.56

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	46.72	2.65	46.72	2.65	46.90	53.28	3.34	58.96	5.86
P2	32.00	2.89	78.72	2.75	78.93	21.28	4.02	28.35	7.29
P3	9.75	3.28	88.47	2.80	88.66	11.53	4.65	17.76	6.42
P4	2.63	3.23	91.10	2.82	91.29	8.90	5.06	14.94	6.23
P5	3.28	3.57	94.38	2.84	94.55	5.62	5.94	11.06	5.61
P6	0.46	5.22	94.84	2.85	95.00	5.16	6.00	10.26	5.26
P7	5.16	6.00	100.00	3.02	100.00	0.00			
Total (Calc)	100.00	3.02	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

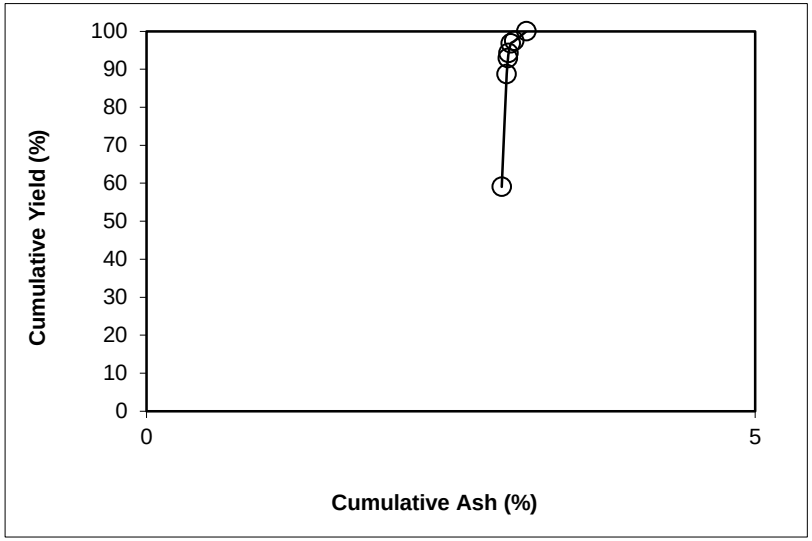
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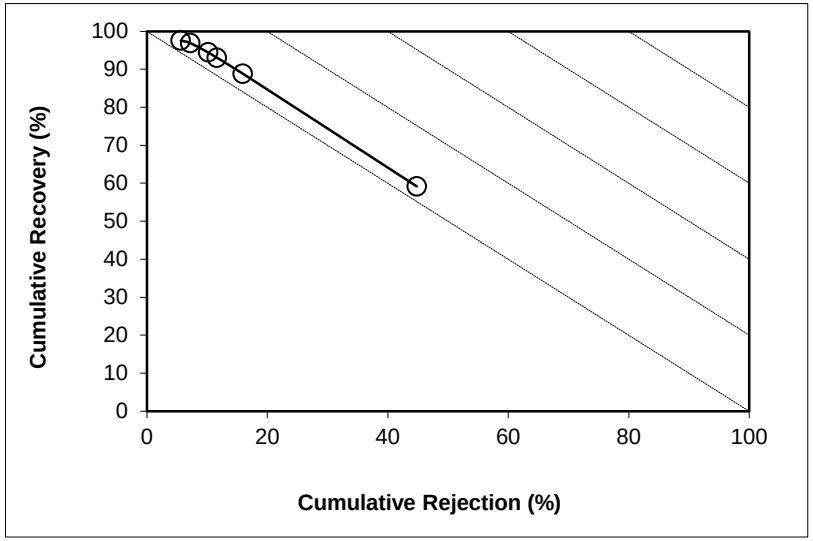
Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 31.61

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	59.05	2.92	59.05	2.92	59.17	40.95	3.41	44.79	3.96
P2	29.63	3.04	88.68	2.96	88.83	11.32	4.39	15.93	4.76
P3	4.23	3.20	92.90	2.97	93.05	7.10	5.10	11.60	4.65
P4	1.37	3.31	94.27	2.97	94.41	5.73	5.53	10.15	4.56
P5	2.49	3.70	96.77	2.99	96.89	3.23	6.94	7.19	4.09
P6	0.67	7.25	97.44	3.02	97.54	2.56	6.86	5.63	3.17
P7	2.56	6.86	100.00	3.12	100.00	0.00			
Total (Calc)	100.00	3.12	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

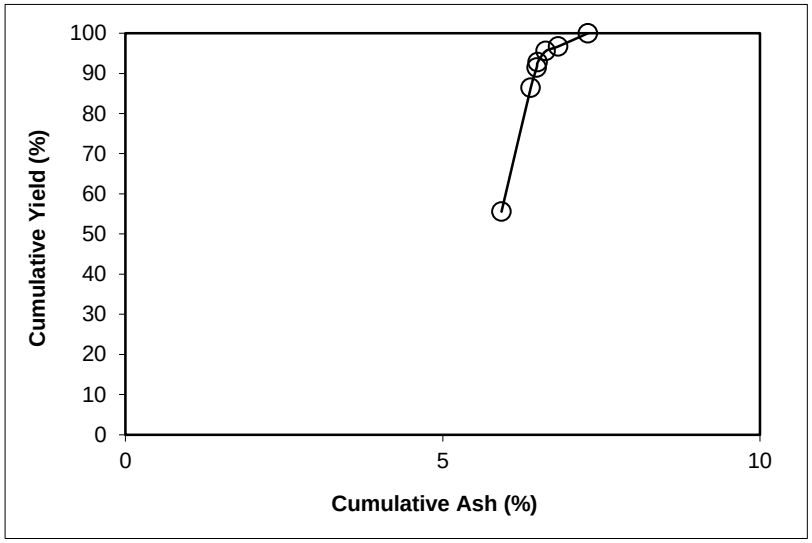
Description: Run 13 - Intermediate Spiral Test

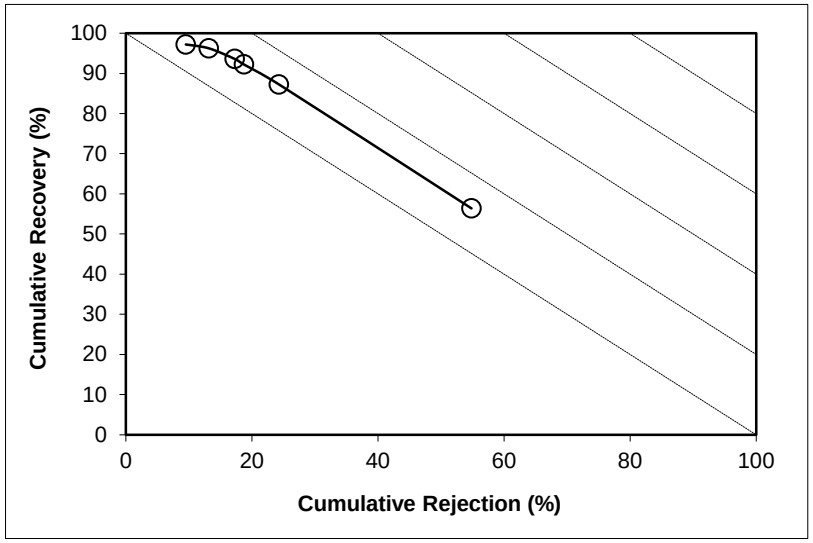
Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 19.05

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	55.56	5.93	55.56	5.93	56.38	44.44	8.99	54.83	11.20
P2	30.85	7.22	86.41	6.39	87.25	13.59	13.02	24.28	11.53
P3	5.01	8.09	91.42	6.48	92.22	8.58	15.90	18.72	10.94
P4	1.37	7.66	92.78	6.50	93.58	7.22	17.46	17.29	10.86
P5	2.77	10.85	95.56	6.62	96.24	4.44	21.58	13.16	9.40
P6	1.16	23.09	96.71	6.82	97.20	3.29	21.05	9.50	6.70
P7	3.29	21.05	100.00	7.29	100.00	0.00			
Total (Calc)	100.00	7.29	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

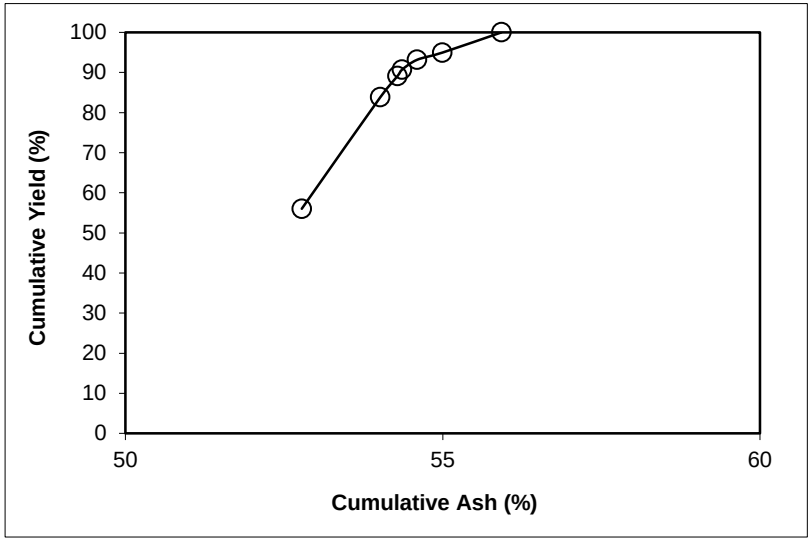
Description: Run 13 - Intermediate Spiral Test

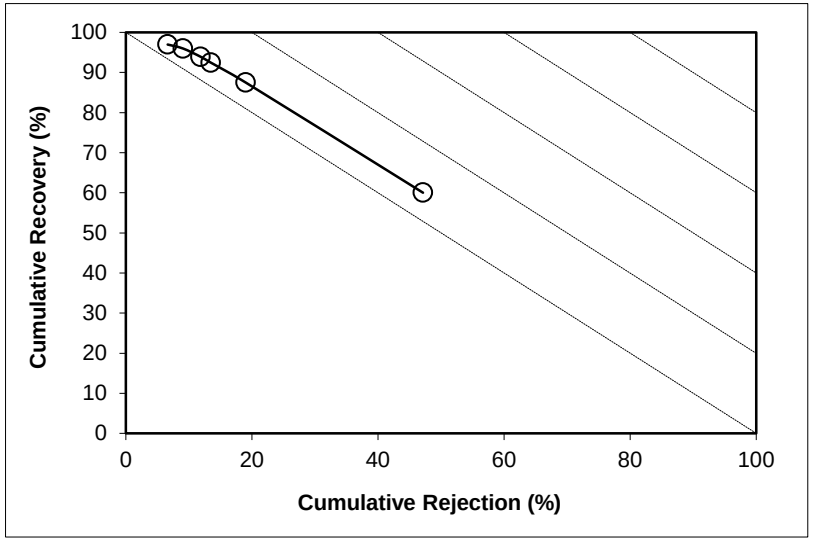
Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: -325.00 Feed Weight (%): 43.78

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	56.02	52.78	56.02	52.78	60.02	43.98	59.93	47.13	7.15
P2	27.84	56.51	83.86	54.02	87.49	16.14	65.84	19.01	6.49
P3	5.28	58.60	89.14	54.29	92.45	10.86	69.36	13.47	5.92
P4	1.54	58.35	90.68	54.36	93.91	9.32	71.18	11.86	5.77
P5	2.48	63.28	93.16	54.60	95.97	6.84	74.04	9.06	5.03
P6	1.80	75.71	94.96	55.00	96.97	5.04	73.45	6.61	3.58
P7	5.04	73.45	100.00	55.93	100.00	0.00			
Total (Calc)	100.00	55.93	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

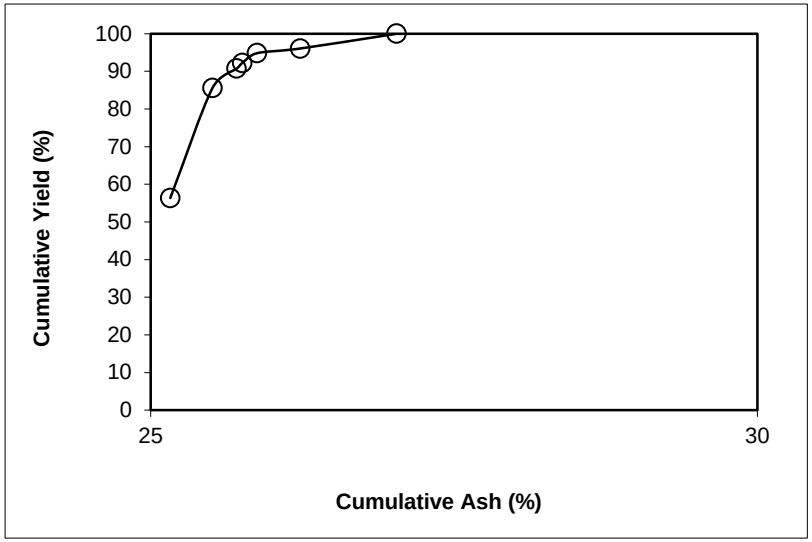
Description: Run 13 - Intermediate Spiral Test

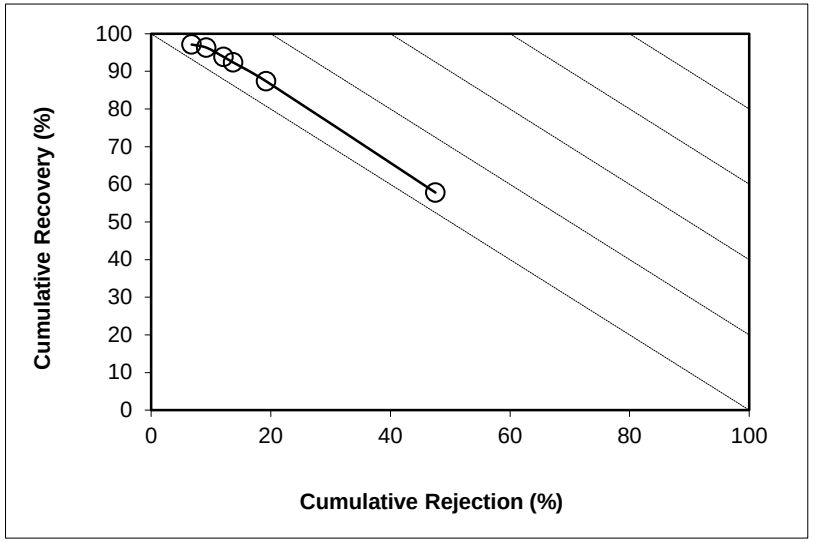
Comments: 0.15 x 0.044 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	56.37	25.16	56.37	25.16	57.81	43.63	29.43	47.52	5.33
P2	29.21	26.18	85.58	25.51	87.36	14.42	36.03	19.22	6.58
P3	5.15	29.02	90.73	25.71	92.36	9.27	39.92	13.70	6.06
P4	1.51	28.58	92.24	25.75	93.85	7.76	42.13	12.10	5.94
P5	2.59	30.18	94.82	25.87	96.32	5.18	48.10	9.21	5.53
P6	1.25	53.27	96.07	26.23	97.12	3.93	46.45	6.75	3.87
P7	3.93	46.45	100.00	27.03	100.00	0.00			
Total (Calc)	100.00	27.03	--	--	--	--	--	--	--

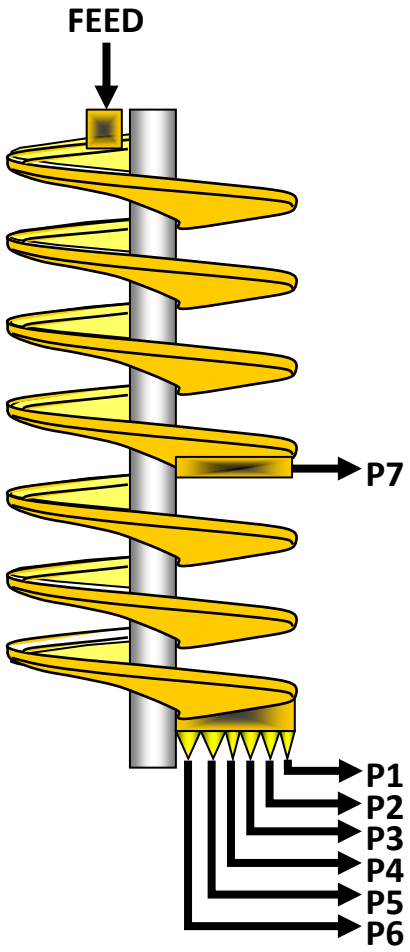




SPIRAL DATA ANALYSIS

Description: Run 28 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	0.405	15.8	8.61	9.53
P2	0.152	16.0	3.20	3.55
P3	0.037	16.4	0.76	0.84
P4	0.013	18.0	0.24	0.28
P5	0.023	18.8	0.40	0.45
P6	0.014	23.0	0.19	0.22
P7	0.041	22.0	0.58	0.67
Total	0.685	16.4	13.97	15.55

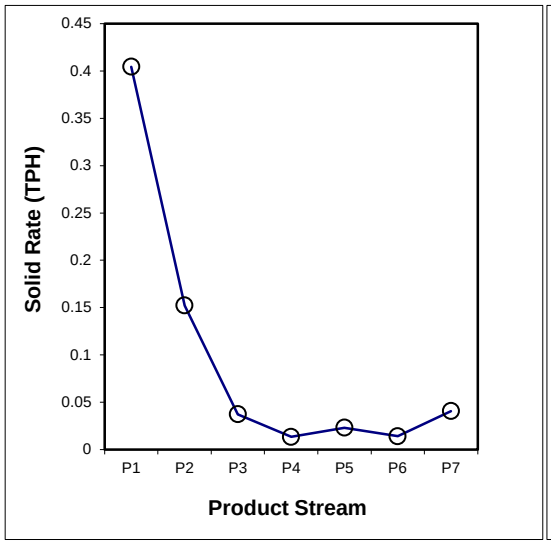
SPIRAL DATA ANALYSIS

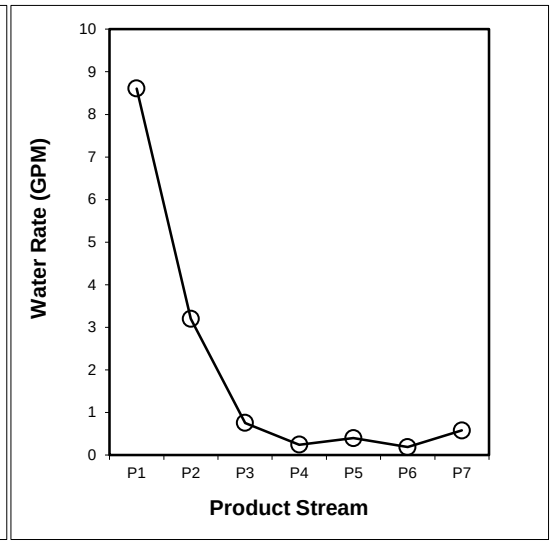
Description: Run 28 - Intermediate Spiral Test

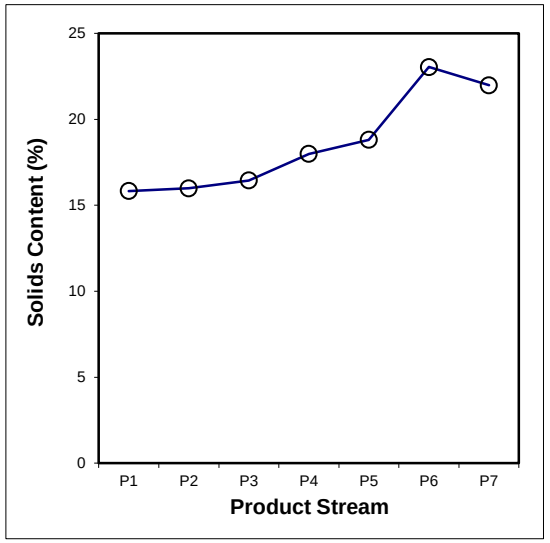
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	10	7842.00	1299.00	2.556	1927.3	907.0	0.405	59.03	15.83
P2	10	2606.13	167.97	0.952	1541.0	1157.1	0.152	22.21	15.98
P3	20	1254.03	93.92	0.227	1094.9	907.0	0.037	5.44	16.44
P4	40	846.96	85.30	0.074	1258.9	1123.9	0.013	1.95	17.99
P5	30	1038.99	97.56	0.123	1254.5	1080.0	0.023	3.37	18.81
P6	50	877.84	96.84	0.061	1334.5	1157.1	0.014	2.05	23.04
P7	20	1044.29	95.23	0.185	1379.1	1173.5	0.041	5.95	21.98
Total (Calc)	--	--	--	4.179	--	--	0.685	100.00	16.40
Total (Head)	1.51	1818.8	229.15	4.179	1434.2	1173.5	0.685	--	16.40







SPIRAL DATA ANALYSIS

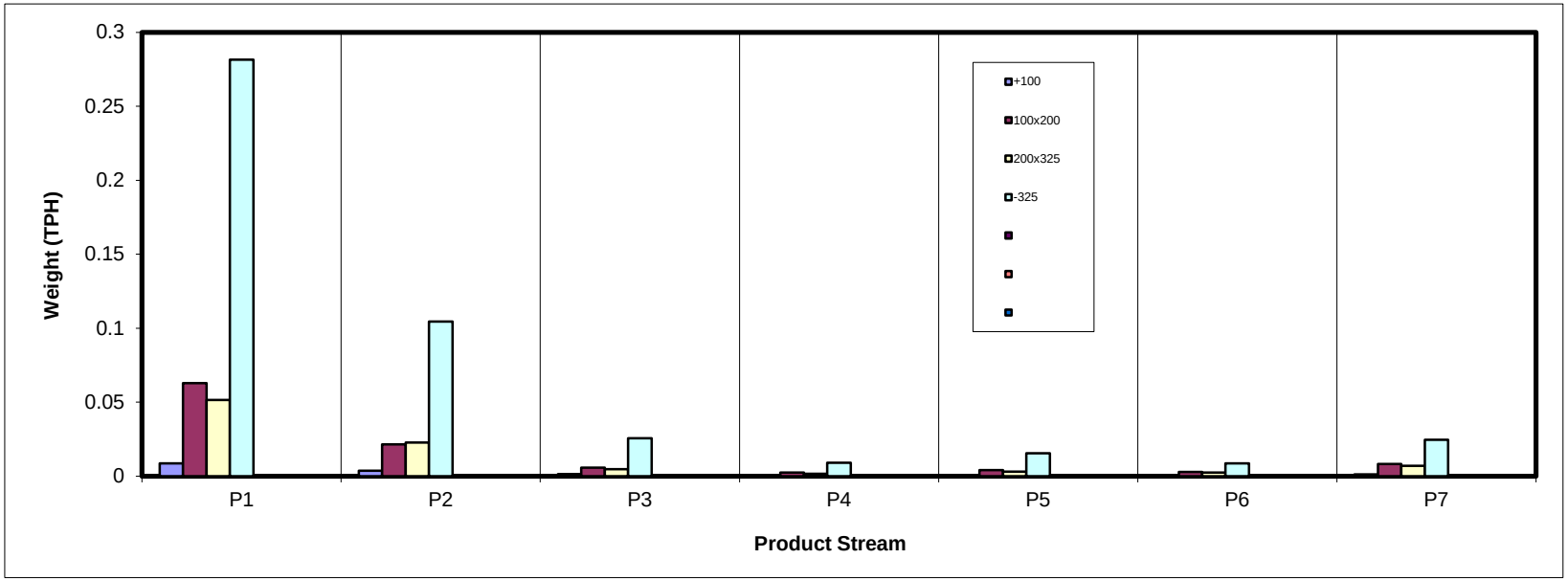
Description: Run 28 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	0.009	0.004	0.001	0.000	0.001	0.000	0.001		0.016
100x200	0.063	0.021	0.006	0.002	0.004	0.003	0.008		0.107
200x325	0.052	0.023	0.005	0.002	0.003	0.002	0.007		0.093
-325	0.282	0.105	0.026	0.009	0.015	0.009	0.025		0.469
Total (Calc)	0.405	0.152	0.037	0.013	0.023	0.014	0.041		0.685



SPIRAL DATA ANALYSIS

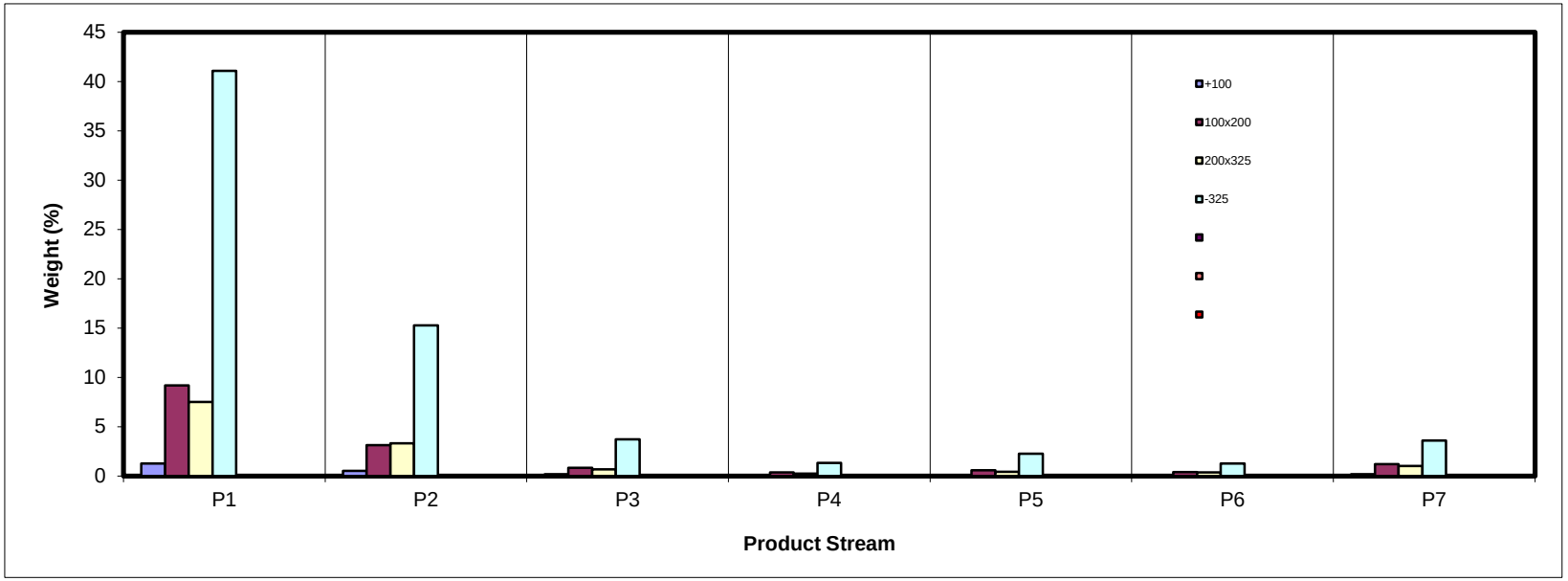
Description: Run 28 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	1.26	0.52	0.19	0.06	0.09	0.04	0.17		2.31
100x200	9.17	3.12	0.84	0.35	0.59	0.40	1.19		15.67
200x325	7.52	3.32	0.69	0.22	0.43	0.36	1.01		13.55
-325	41.08	15.26	3.73	1.32	2.25	1.25	3.58		68.47
Total (Calc)	59.03	22.21	5.44	1.95	3.37	2.05	5.95		100.00



SPIRAL DATA ANALYSIS

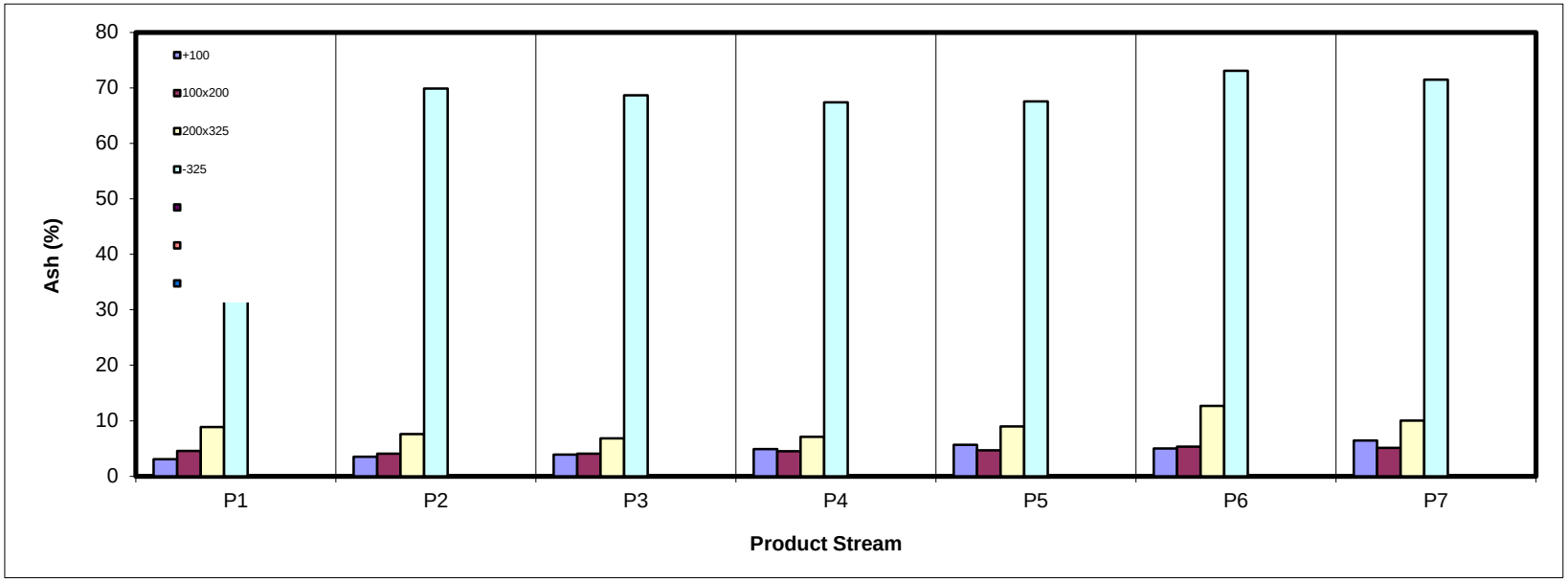
Description: Run 28 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	3.06	3.51	3.90	4.92	5.68	5.03	6.47		3.66
100x200	4.56	4.05	4.08	4.52	4.67	5.33	5.10		4.50
200x325	8.88	7.58	6.83	7.11	9.00	12.67	10.03		8.62
-325	69.31	69.86	68.68	67.38	67.56	73.05	71.48		69.49
Total (Calc)	50.14	49.76	48.70	47.46	47.35	47.85	45.89		49.53



SPIRAL DATA ANALYSIS

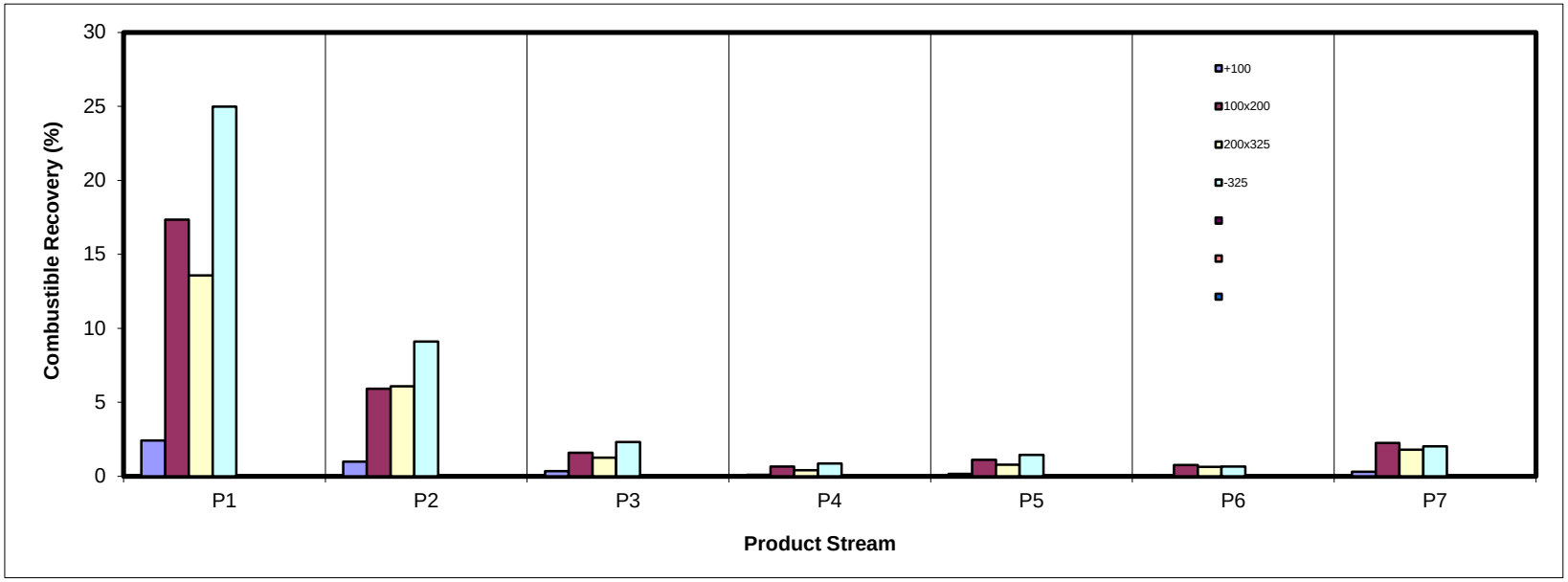
Description: Run 28 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	2.41	0.99	0.35	0.11	0.17	0.07	0.31		4.41
100x200	17.35	5.93	1.59	0.66	1.11	0.76	2.25		29.65
200x325	13.58	6.08	1.27	0.41	0.78	0.63	1.80		24.54
-325	24.98	9.11	2.31	0.86	1.45	0.67	2.02		41.40
Total (Calc)	58.32	22.11	5.53	2.03	3.51	2.12	6.38		100.00



SPIRAL DATA ANALYSIS

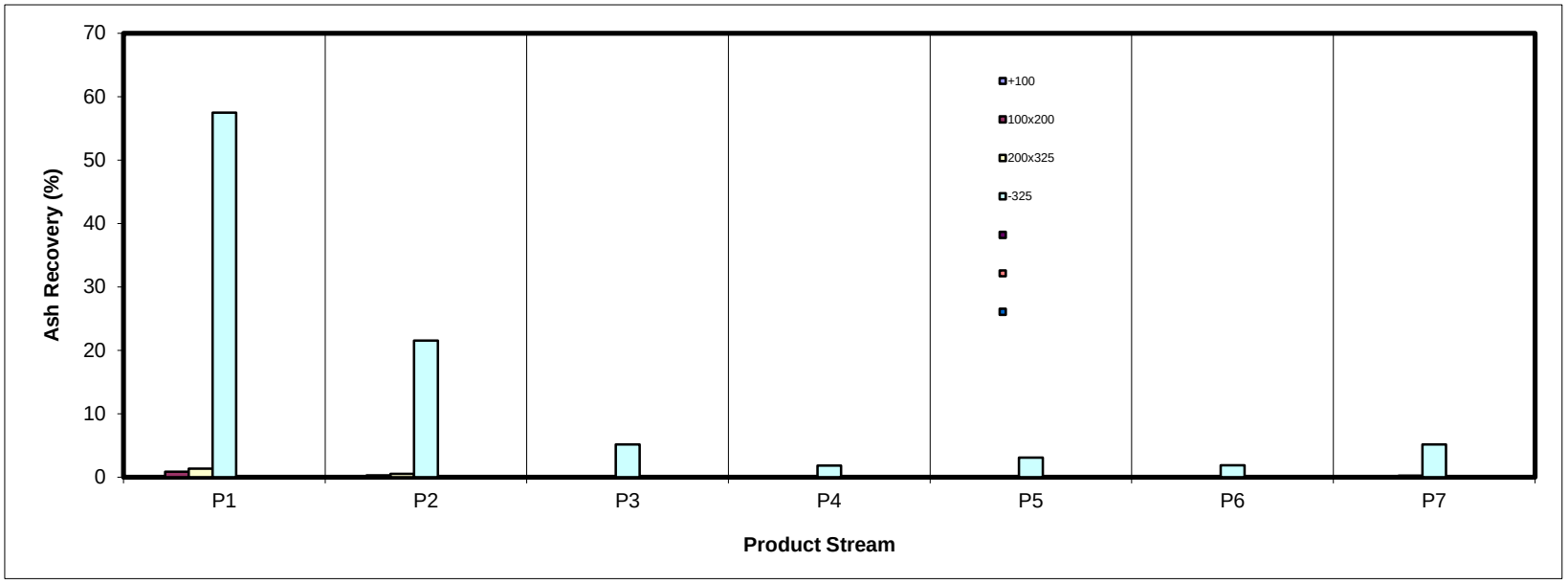
Description: Run 28 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	0.08	0.04	0.01	0.01	0.01	0.00	0.02		0.17
100x200	0.84	0.25	0.07	0.03	0.06	0.04	0.12		1.42
200x325	1.35	0.51	0.09	0.03	0.08	0.09	0.20		2.36
-325	57.49	21.52	5.17	1.80	3.07	1.84	5.16		96.05
Total (Calc)	59.76	22.32	5.35	1.87	3.22	1.98	5.51		100.00



SPIRAL DATA ANALYSIS

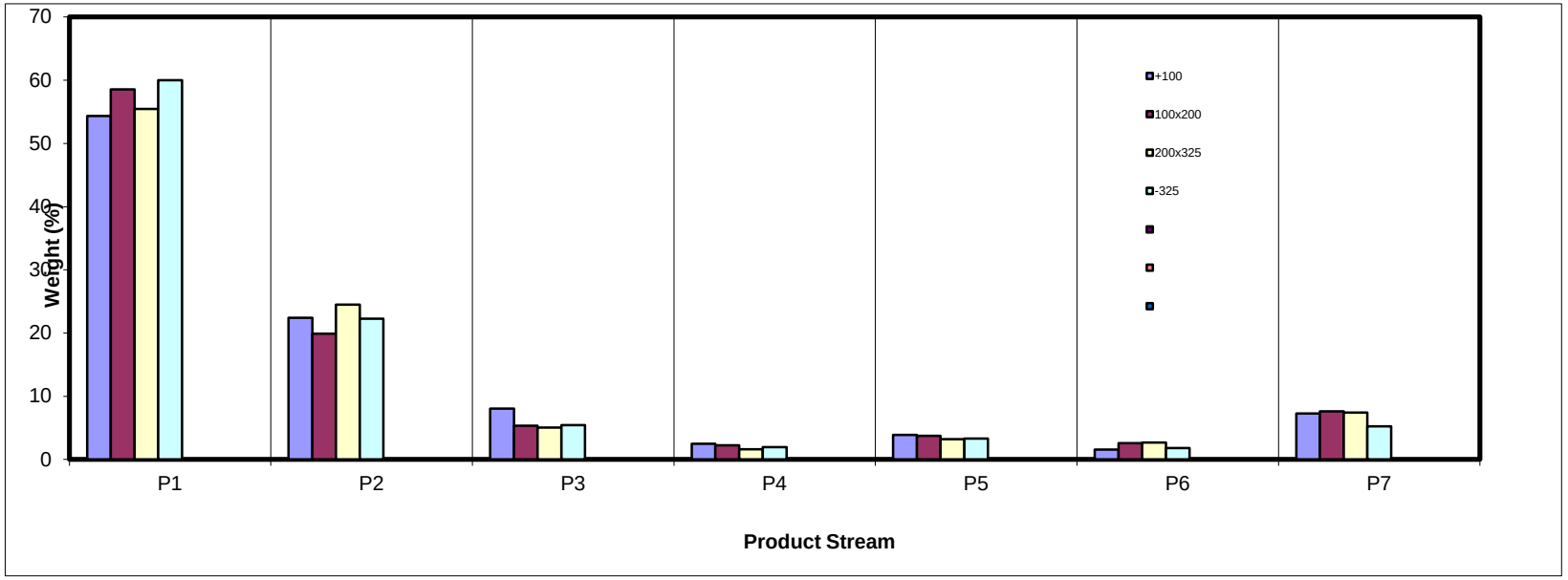
Description: Run 28 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	54.35	22.42	8.06	2.48	3.89	1.55	7.26		100.00
100x200	58.55	19.90	5.35	2.23	3.76	2.58	7.63		100.00
200x325	55.48	24.51	5.06	1.63	3.20	2.68	7.44		100.00
-325	60.00	22.28	5.44	1.93	3.29	1.82	5.22		100.00
Total (Calc)	59.03	22.21	5.44	1.95	3.37	2.05	5.95		100.00



SPIRAL DATA ANALYSIS

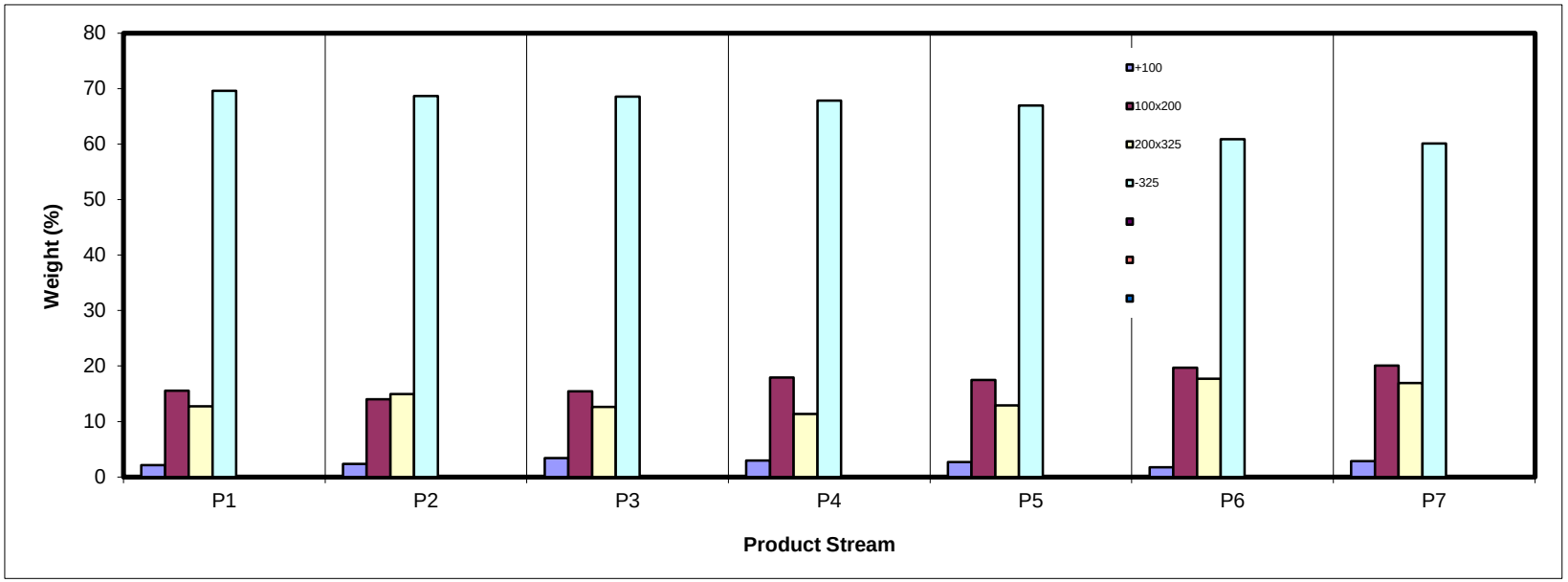
Description: Run 28 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	2.13	2.33	3.43	2.93	2.67	1.74	2.82		2.31
100x200	15.54	14.03	15.42	17.91	17.50	19.70	20.08		15.67
200x325	12.74	14.95	12.61	11.33	12.89	17.68	16.96		13.55
-325	69.60	68.68	68.54	67.83	66.94	60.88	60.14		68.47
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

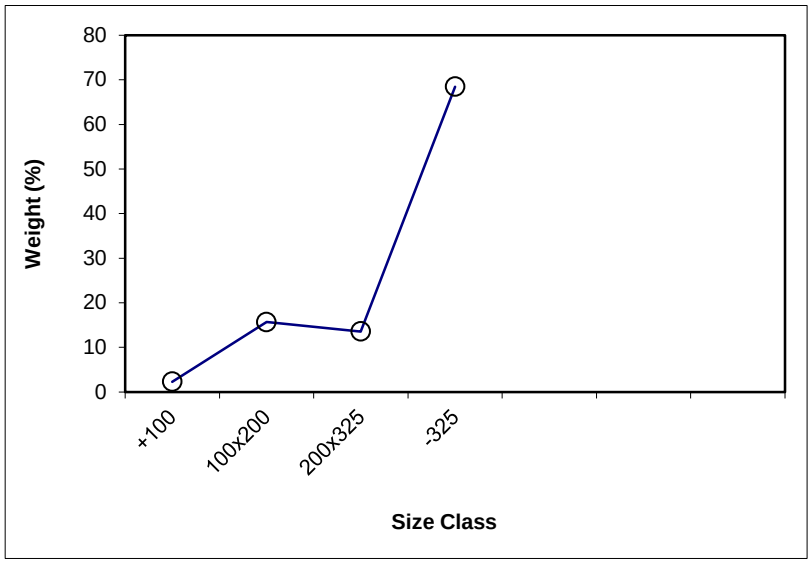
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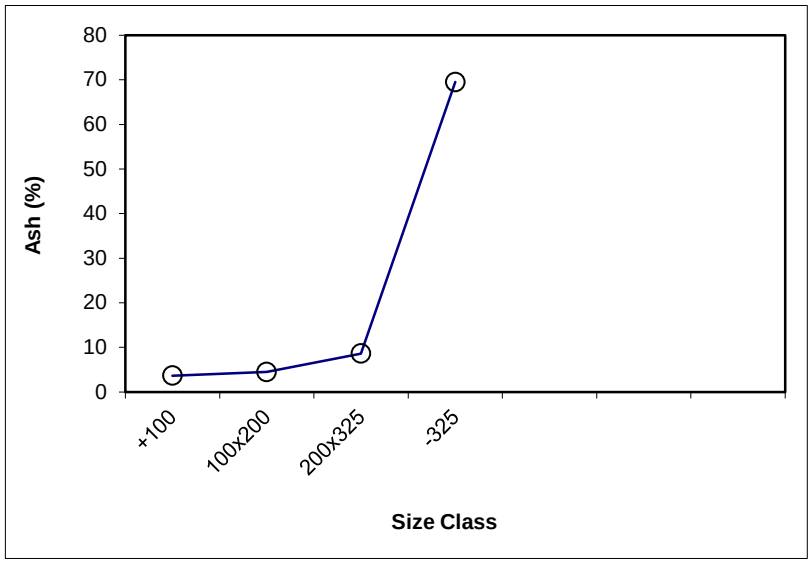
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	403.3	397.2	6.03	2.31	3.66	2.31	3.66	100.00	49.53
100x200	432.2	391.3	40.84	15.67	4.50	17.98	4.39	97.69	50.62
200x325	413.9	378.6	35.33	13.55	8.62	31.53	6.21	82.02	59.43
-325	184.8	6.4	178.49	68.47	69.49	100.00	49.53	68.47	69.49
Total (Calc)	--	--	260.69	100.00	49.53	--	--	--	--





SPIRAL DATA ANALYSIS

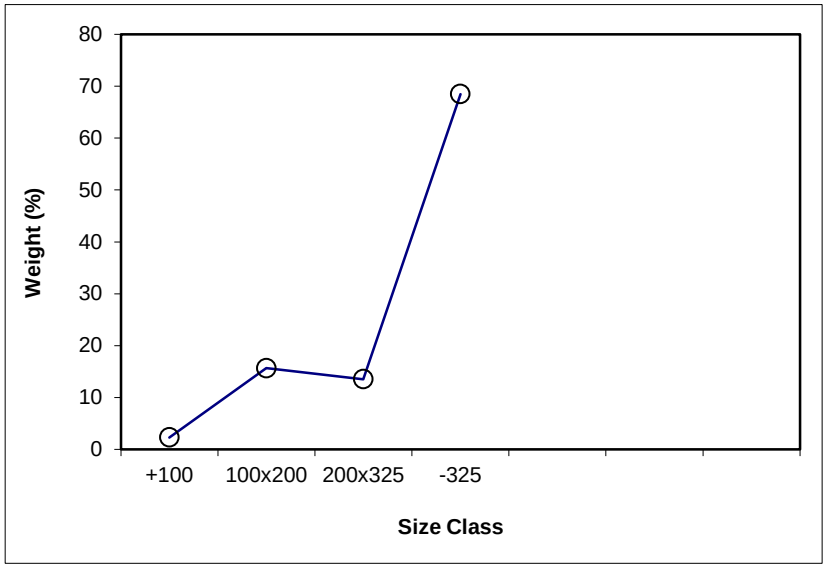
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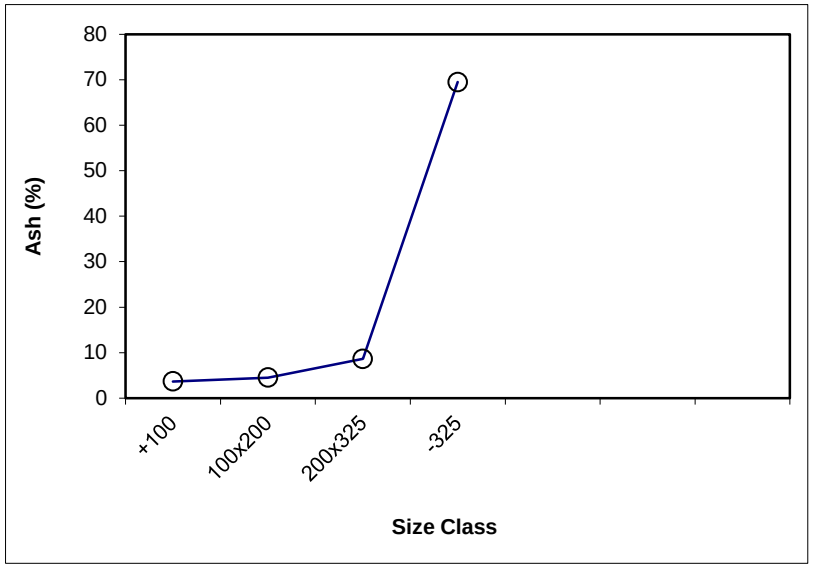
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+100	2.31	3.66	2.31	3.66	100.00	49.53			
100x200	15.67	4.50	17.98	4.39	97.69	50.62	x	15.67	4.50
200x325	13.55	8.62	31.53	6.21	82.02	59.43	x	13.55	8.62
-325	68.47	69.49	100.00	49.53	68.47	69.49			
Total (Calc)	100.00	49.53	--	--	--	--	--	29.22	6.41





SPIRAL DATA ANALYSIS

Description: Run 28 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 59.03

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	329.85	308.1	21.72	2.13	3.06	2.13	3.06	100.00	50.14
100x200	453.02	294.5	158.53	15.54	4.56	17.67	4.38	97.87	51.17
200x325	427.94	298.0	129.95	12.74	8.88	30.40	6.26	82.33	59.96
-325	716.45	6.4	710.06	69.60	69.31	100.00	50.14	69.60	69.31
Total (Calc)	--	--	1020.27	100.00	50.14	--	--	--	--

Product P2 Feed Weight (%): 22.21

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	396.7	387.7	8.96	2.33	3.51	2.33	3.51	100.00	49.76
100x200	430.7	376.8	53.87	14.03	4.05	16.36	3.97	97.67	50.87
200x325	443.7	386.3	57.42	14.95	7.58	31.32	5.70	83.64	58.72
-325	270.0	6.4	263.69	68.68	69.86	100.00	49.76	68.68	69.86
Total (Calc)	--	--	383.93	100.00	49.76	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 28 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 5.44

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	314.6	308.1	6.44	3.43	3.90	3.43	3.90	100.00	48.70
100x200	323.5	294.5	28.99	15.42	4.08	18.85	4.05	96.57	50.29
200x325	321.7	298.0	23.71	12.61	6.83	31.46	5.16	81.15	59.07
-325	135.2	6.4	128.82	68.54	68.68	100.00	48.70	68.54	68.68
Total (Calc)	--	--	187.96	100.00	48.70	--	--	--	--

Product P4 Feed Weight (%): 1.95

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	370.9	367.0	3.96	2.93	4.92	2.93	4.92	100.00	47.46
100x200	371.6	347.4	24.18	17.91	4.52	20.84	4.58	97.07	48.75
200x325	418.5	403.2	15.30	11.33	7.11	32.17	5.47	79.16	58.75
-325	97.8	6.2	91.57	67.83	67.38	100.00	47.46	67.83	67.38
Total (Calc)	--	--	135.01	100.00	47.46	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 28 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 3.37

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	397.7	393.0	4.67	2.67	5.68	2.67	5.68	100.00	47.35
100x200	380.2	349.6	30.54	17.50	4.67	20.17	4.80	97.33	48.50
200x325	353.5	331.0	22.49	12.89	9.00	33.06	6.44	79.83	58.10
-325	123.2	6.4	116.80	66.94	67.56	100.00	47.35	66.94	67.56
Total (Calc)	--	--	174.50	100.00	47.35	--	--	--	--

Product P6 Feed Weight (%): 2.05

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	390.8	387.7	3.09	1.74	5.03	1.74	5.03	100.00	47.85
100x200	411.7	376.8	34.94	19.70	5.33	21.44	5.31	98.26	48.61
200x325	417.6	386.3	31.36	17.68	12.67	39.12	8.64	78.56	59.46
-325	114.4	6.4	107.98	60.88	73.05	100.00	47.85	60.88	73.05
Total (Calc)	--	--	177.37	100.00	47.85	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 28 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 5.95

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	403.0	397.2	5.80	2.82	6.47	2.82	6.47	100.00	45.89
100x200	432.6	391.3	41.29	20.08	5.10	22.91	5.27	97.18	47.04
200x325	413.5	378.6	34.86	16.96	10.03	39.86	7.29	77.09	57.97
-325	130.0	6.4	123.63	60.14	71.48	100.00	45.89	60.14	71.48
Total (Calc)	--	--	205.58	100.00	45.89	--	--	--	--

SPIRAL DATA ANALYSIS

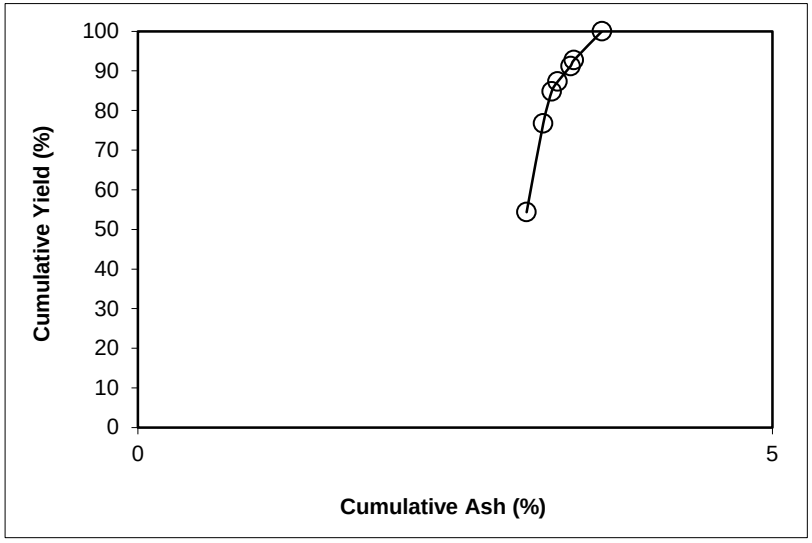
Description: Run 28 - Intermediate Spiral Test

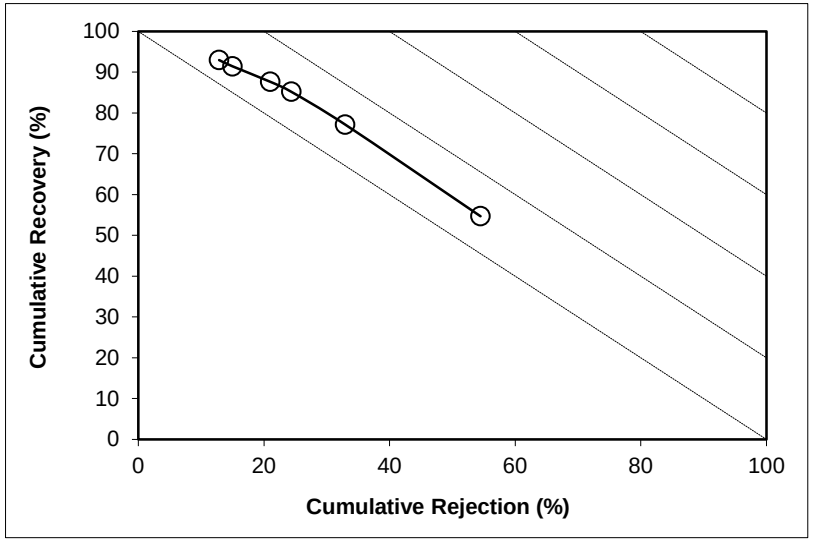
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: +100 Feed Weight (%): 2.31

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	54.35	3.06	54.35	3.06	54.69	45.65	4.36	54.47	9.16
P2	22.42	3.51	76.77	3.19	77.14	23.23	5.18	32.94	10.08
P3	8.06	3.90	84.83	3.26	85.17	15.17	5.87	24.36	9.53
P4	2.48	4.92	87.30	3.31	87.62	12.70	6.05	21.02	8.64
P5	3.89	5.68	91.19	3.41	91.43	8.81	6.22	14.98	6.41
P6	1.55	5.03	92.74	3.44	92.95	7.26	6.47	12.85	5.80
P7	7.26	6.47	100.00	3.66	100.00	0.00			
Total (Calc)	100.00	3.66	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

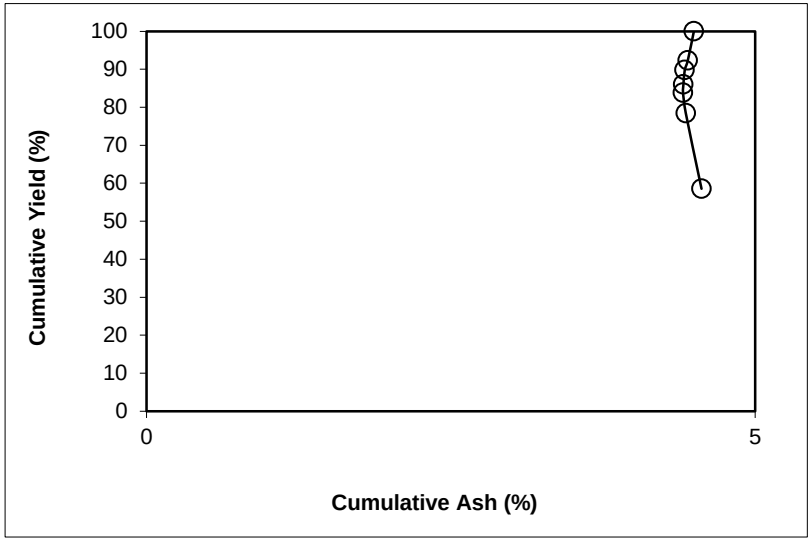
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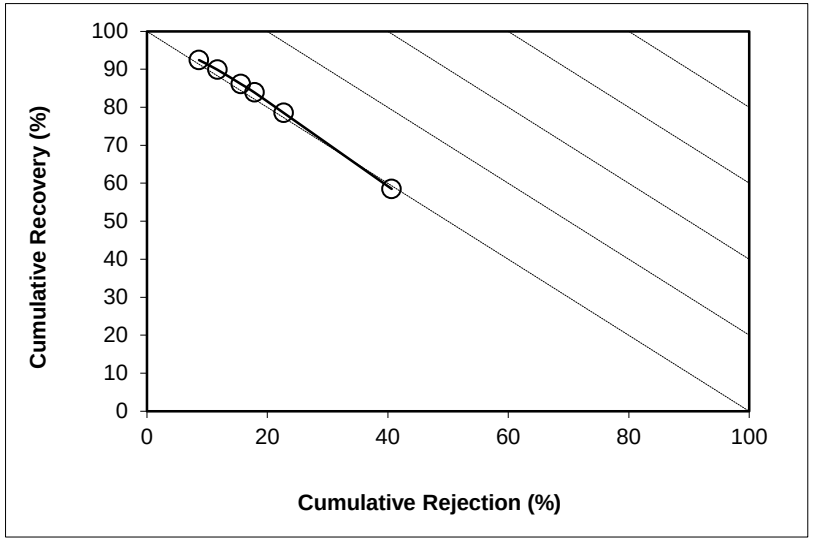
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 15.67

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	58.55	4.56	58.55	4.56	58.51	41.45	4.41	40.63	-0.86
P2	19.90	4.05	78.45	4.43	78.50	21.55	4.74	22.71	1.21
P3	5.35	4.08	83.80	4.41	83.88	16.20	4.96	17.85	1.73
P4	2.23	4.52	86.03	4.41	86.11	13.97	5.02	15.61	1.72
P5	3.76	4.67	89.79	4.42	89.86	10.21	5.15	11.70	1.57
P6	2.58	5.33	92.37	4.45	92.42	7.63	5.10	8.64	1.06
P7	7.63	5.10	100.00	4.50	100.00	0.00			
Total (Calc)	100.00	4.50	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

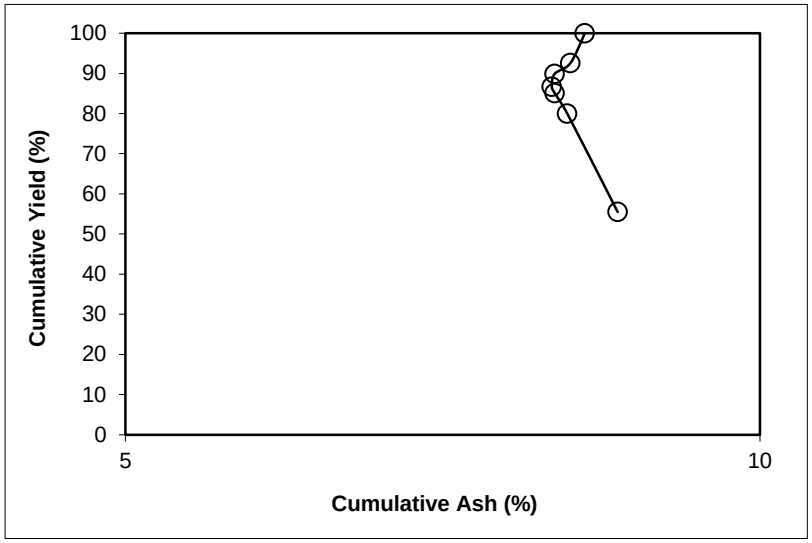
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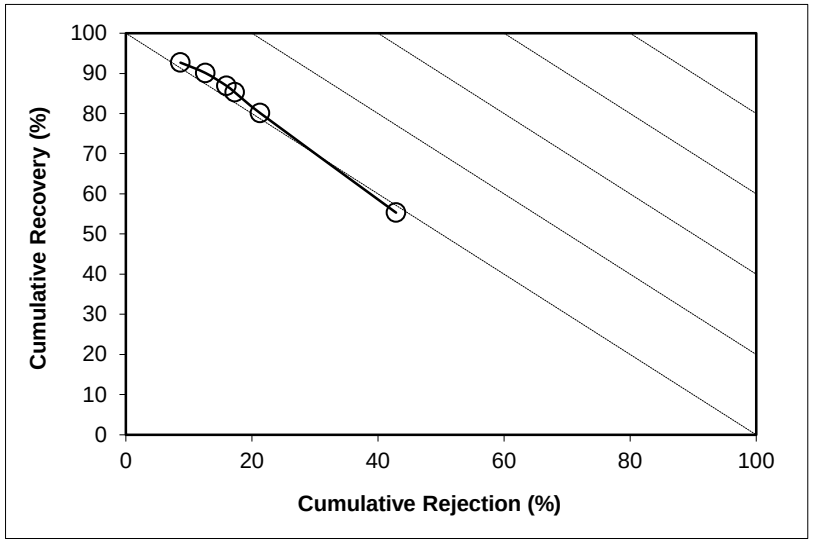
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 13.55

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	55.48	8.88	55.48	8.88	55.32	44.52	8.30	42.86	-1.83
P2	24.51	7.58	79.99	8.48	80.11	20.01	9.17	21.30	1.40
P3	5.06	6.83	85.05	8.38	85.27	14.95	9.96	17.28	2.55
P4	1.63	7.11	86.68	8.36	86.93	13.32	10.31	15.94	2.86
P5	3.20	9.00	89.88	8.38	90.12	10.12	10.73	12.59	2.71
P6	2.68	12.67	92.56	8.51	92.67	7.44	10.03	8.66	1.33
P7	7.44	10.03	100.00	8.62	100.00	0.00			
Total (Calc)	100.00	8.62	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

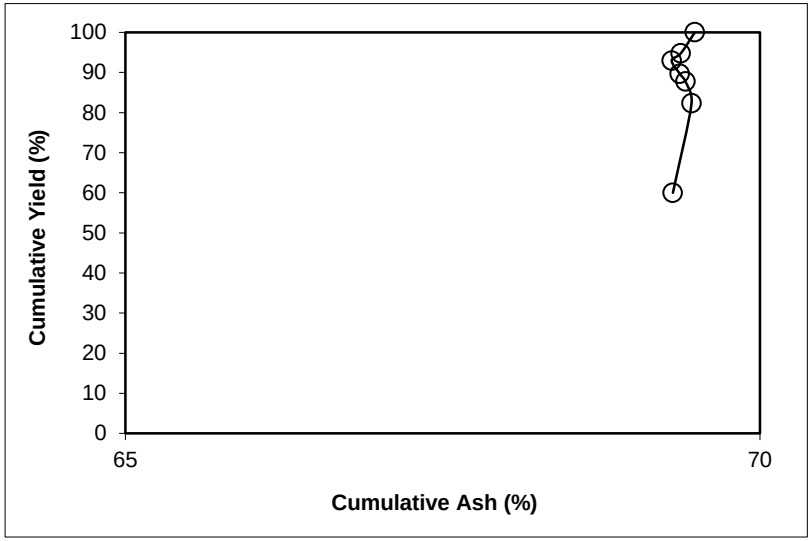
Description: Run 28 - Intermediate Spiral Test

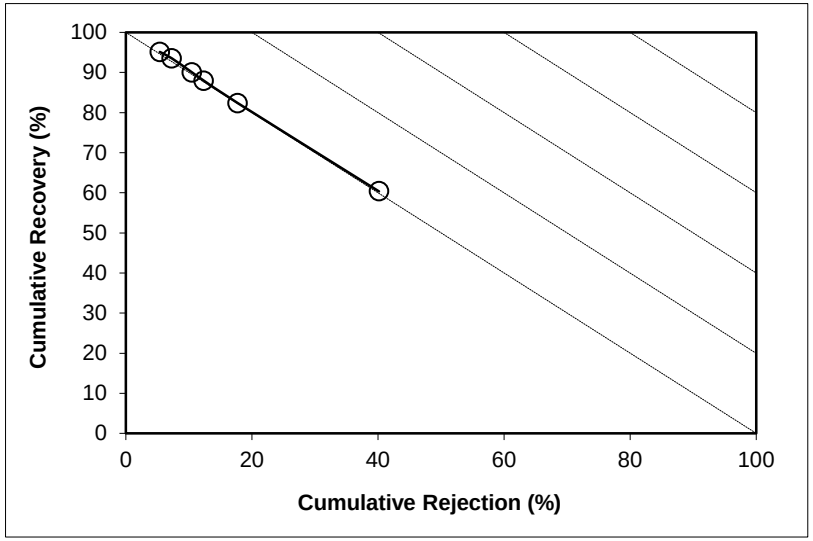
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: -325.00 Feed Weight (%): 68.47

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	60.00	69.31	60.00	69.31	60.34	40.00	69.75	40.15	0.49
P2	22.28	69.86	82.28	69.46	82.35	17.72	69.61	17.75	0.10
P3	5.44	68.68	87.73	69.41	87.94	12.27	70.02	12.37	0.31
P4	1.93	67.38	89.66	69.37	90.01	10.34	70.51	10.49	0.50
P5	3.29	67.56	92.95	69.30	93.51	7.05	71.89	7.29	0.80
P6	1.82	73.05	94.78	69.38	95.12	5.22	71.48	5.37	0.49
P7	5.22	71.48	100.00	69.49	100.00	0.00			
Total (Calc)	100.00	69.49	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

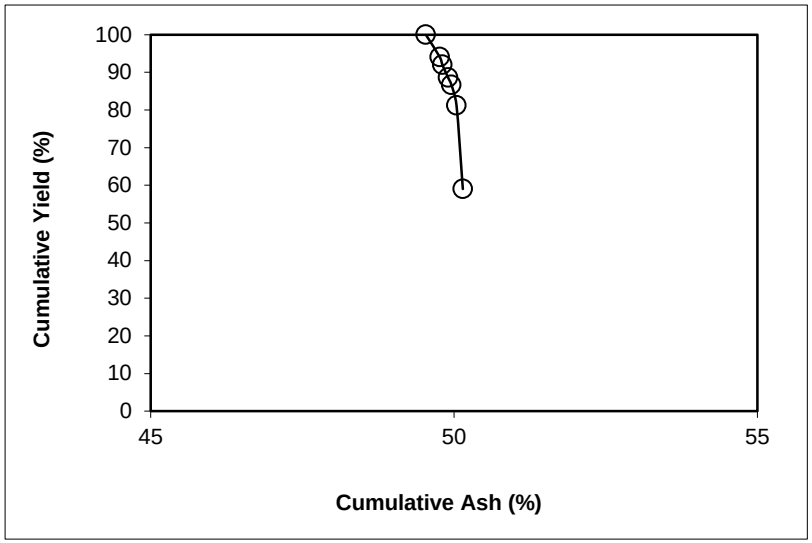
Description: Run 28 - Intermediate Spiral Test

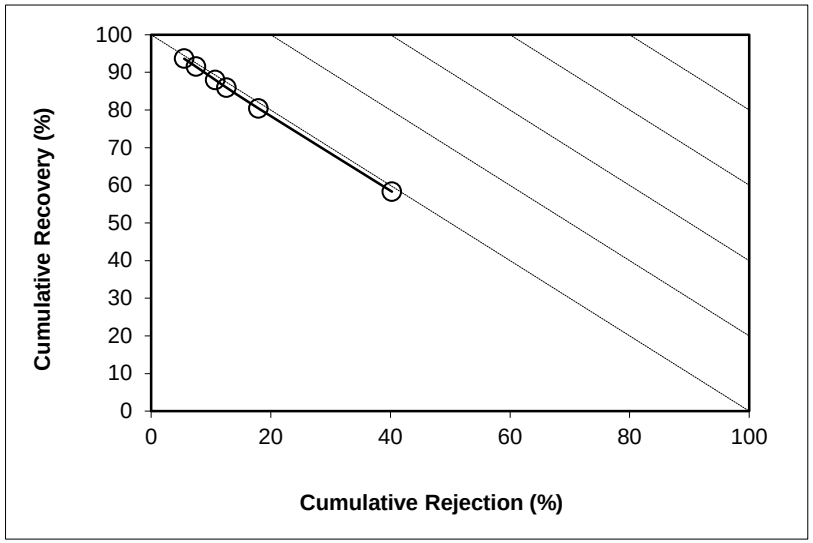
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	59.03	50.14	59.03	50.14	58.32	40.97	48.66	40.24	-1.44
P2	22.21	49.76	81.24	50.04	80.43	18.76	47.35	17.93	-1.64
P3	5.44	48.70	86.68	49.96	85.96	13.32	46.79	12.58	-1.46
P4	1.95	47.46	88.63	49.90	87.99	11.37	46.68	10.71	-1.30
P5	3.37	47.35	92.00	49.81	91.50	8.00	46.40	7.49	-1.00
P6	2.05	47.85	94.05	49.76	93.62	5.95	45.89	5.51	-0.87
P7	5.95	45.89	100.00	49.53	100.00	0.00			
Total (Calc)	100.00	49.53	--	--	--	--	--	--	--

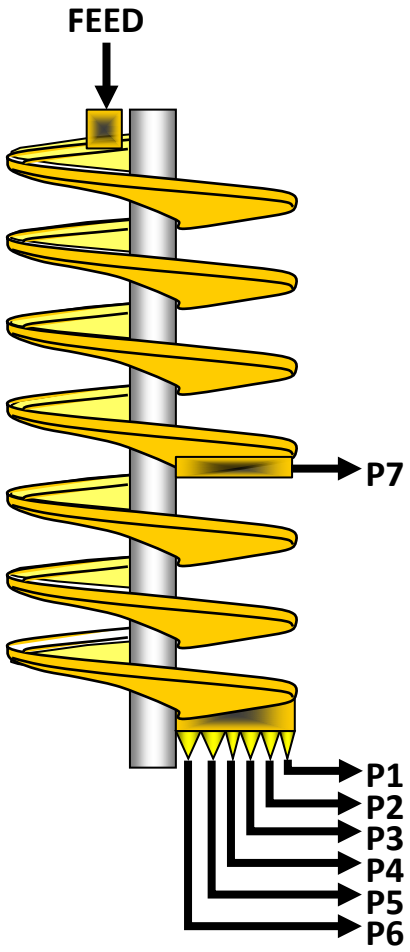




SPIRAL DATA ANALYSIS

Description: Run 29 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	0.128	11.7	3.86	4.15
P2	0.148	15.5	3.23	3.57
P3	0.034	16.3	0.71	0.79
P4	0.013	17.6	0.24	0.27
P5	0.023	18.5	0.40	0.46
P6	0.014	22.9	0.19	0.22
P7	0.039	21.6	0.57	0.66
Total	0.399	14.8	9.20	10.12

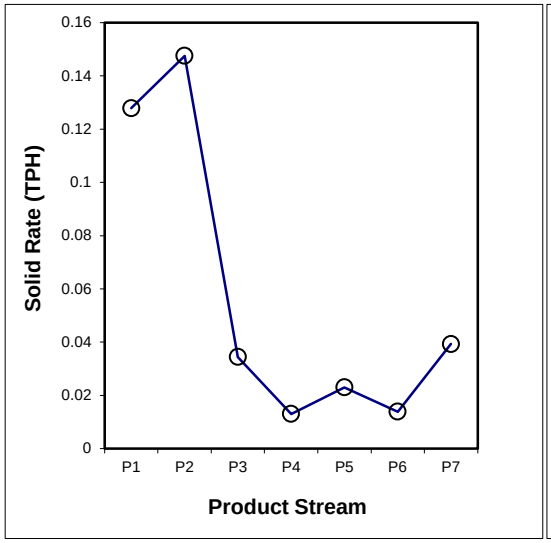
SPIRAL DATA ANALYSIS

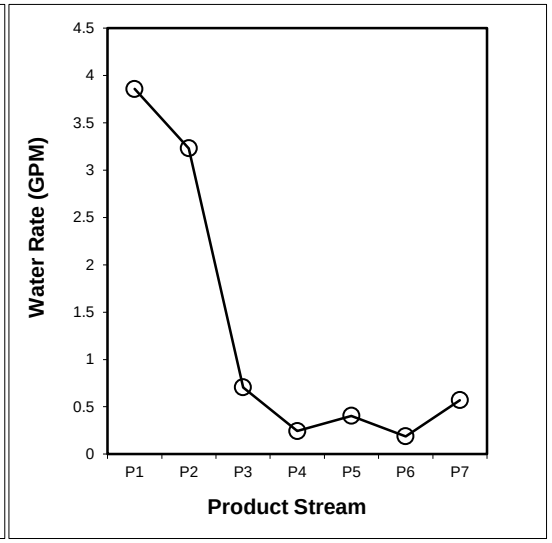
Description: Run 29 - Intermediate Spiral Test

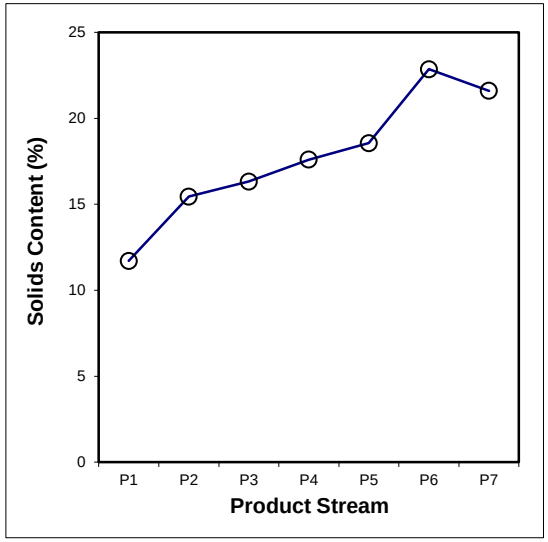
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	10	3966.00	1169.00	1.092	1229.4	906.9	0.128	32.05	11.71
P2	10	2620.31	175.67	0.955	1496.1	1123.9	0.148	36.98	15.45
P3	20	1174.90	95.24	0.211	1080.6	907.0	0.034	8.63	16.32
P4	40	851.16	94.41	0.074	1255.3	1124.0	0.013	3.26	17.60
P5	30	1047.45	96.13	0.124	1254.0	1080.1	0.023	5.76	18.55
P6	50	874.10	96.48	0.061	1332.3	1157.1	0.014	3.48	22.86
P7	20	1026.08	95.49	0.182	1371.7	1173.6	0.039	9.84	21.59
Total (Calc)	--	--	--	2.699	--	--	0.399	100.00	14.78
Total (Head)	1.67	1305.79	171.92	2.699	1074.6	906.9	0.399	--	14.78







SPIRAL DATA ANALYSIS

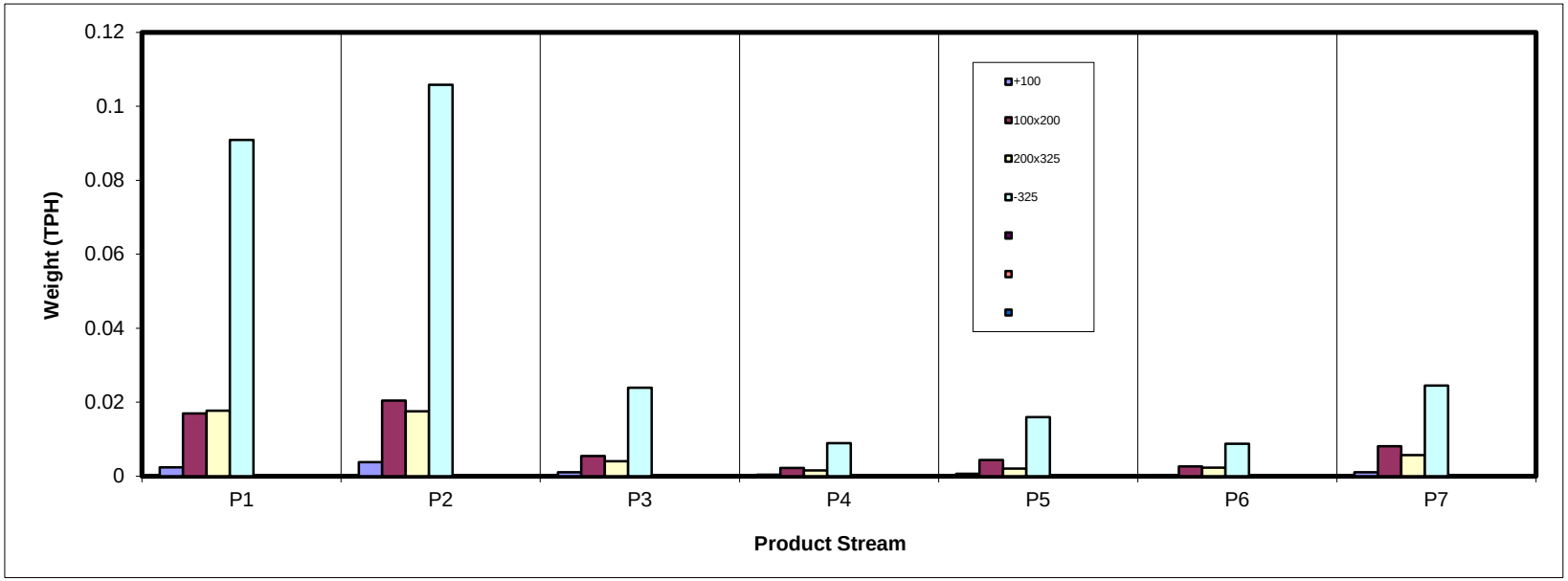
Description: Run 29 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	0.002	0.004	0.001	0.000	0.001	0.000	0.001		0.010
100x200	0.017	0.020	0.005	0.002	0.004	0.003	0.008		0.060
200x325	0.018	0.018	0.004	0.002	0.002	0.002	0.006		0.051
-325	0.091	0.106	0.024	0.009	0.016	0.009	0.025		0.279
Total (Calc)	0.128	0.148	0.034	0.013	0.023	0.014	0.039		0.399



SPIRAL DATA ANALYSIS

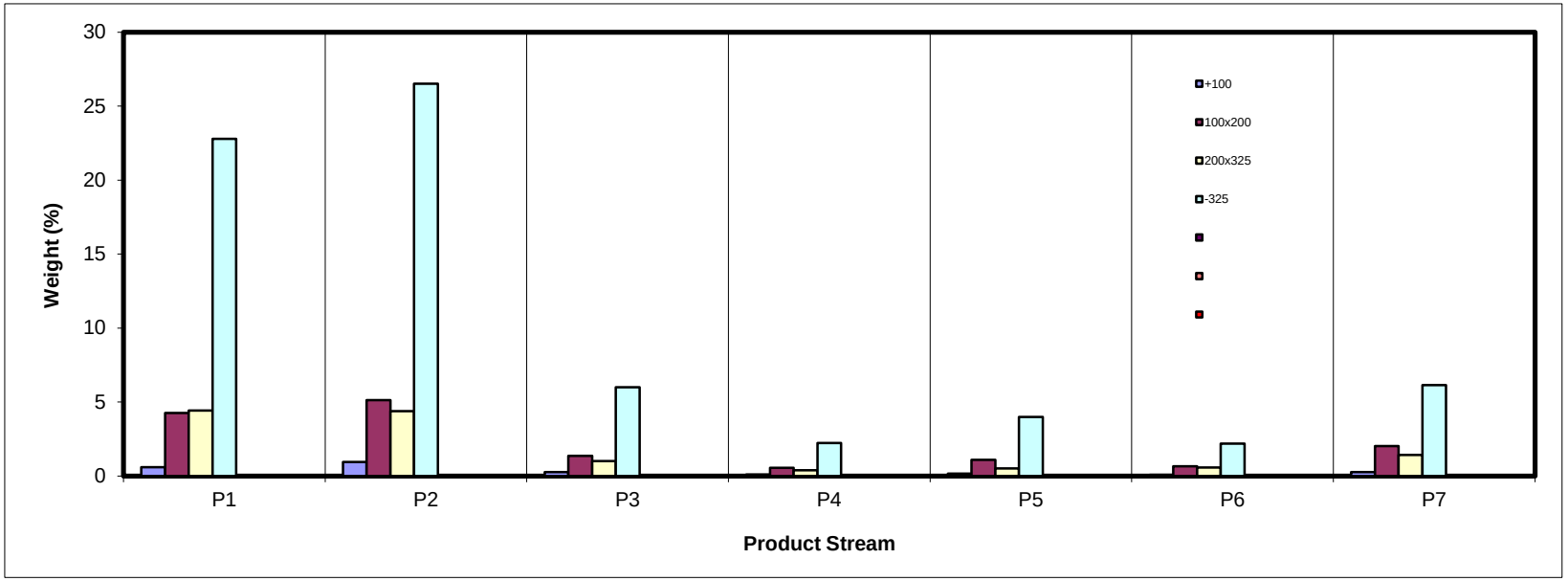
Description: Run 29 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	0.59	0.94	0.27	0.09	0.17	0.07	0.26		2.38
100x200	4.25	5.12	1.35	0.56	1.09	0.65	2.02		15.04
200x325	4.43	4.39	1.00	0.38	0.51	0.58	1.42		12.71
-325	22.79	26.52	6.00	2.24	3.99	2.19	6.14		69.86
Total (Calc)	32.05	36.98	8.63	3.26	5.76	3.48	9.84		100.00



SPIRAL DATA ANALYSIS

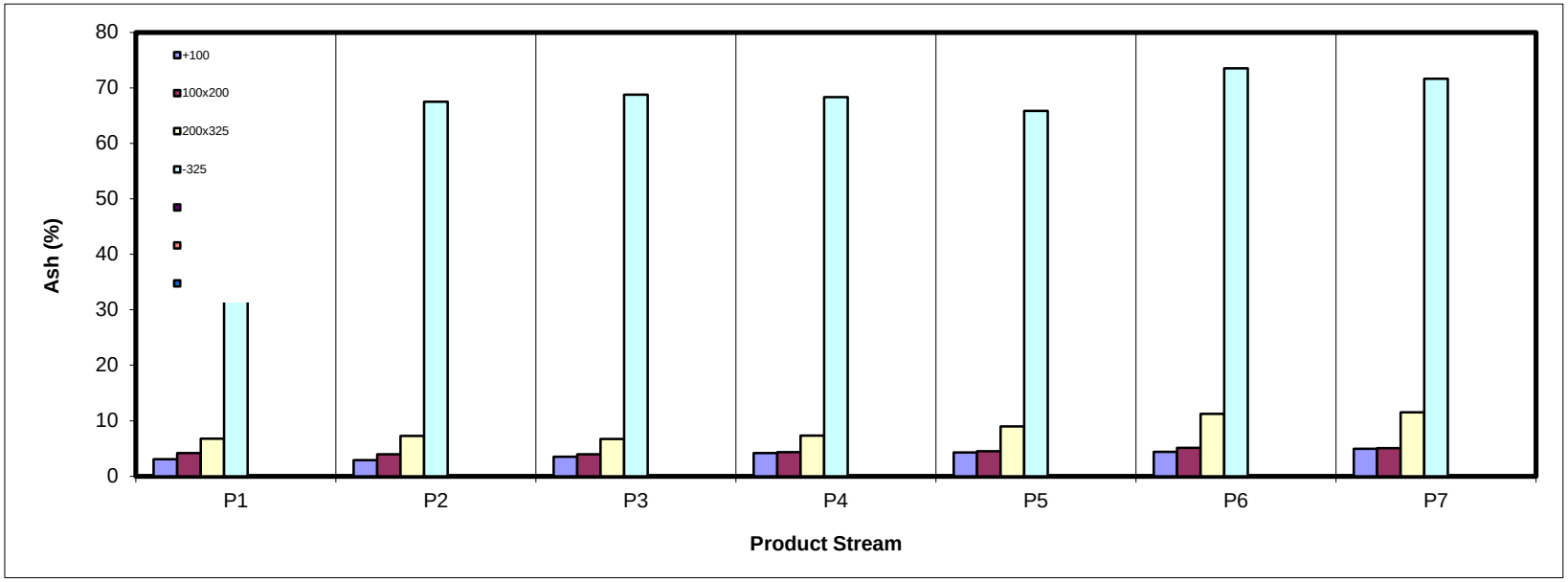
Description: Run 29 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	3.10	2.94	3.51	4.17	4.30	4.39	4.93		3.44
100x200	4.20	3.97	3.97	4.37	4.52	5.11	5.09		4.29
200x325	6.79	7.29	6.73	7.33	8.97	11.23	11.52		7.79
-325	68.35	67.51	68.77	68.30	65.85	73.54	71.62		68.37
Total (Calc)	50.15	49.91	49.33	48.55	47.42	49.10	47.53		49.49



SPIRAL DATA ANALYSIS

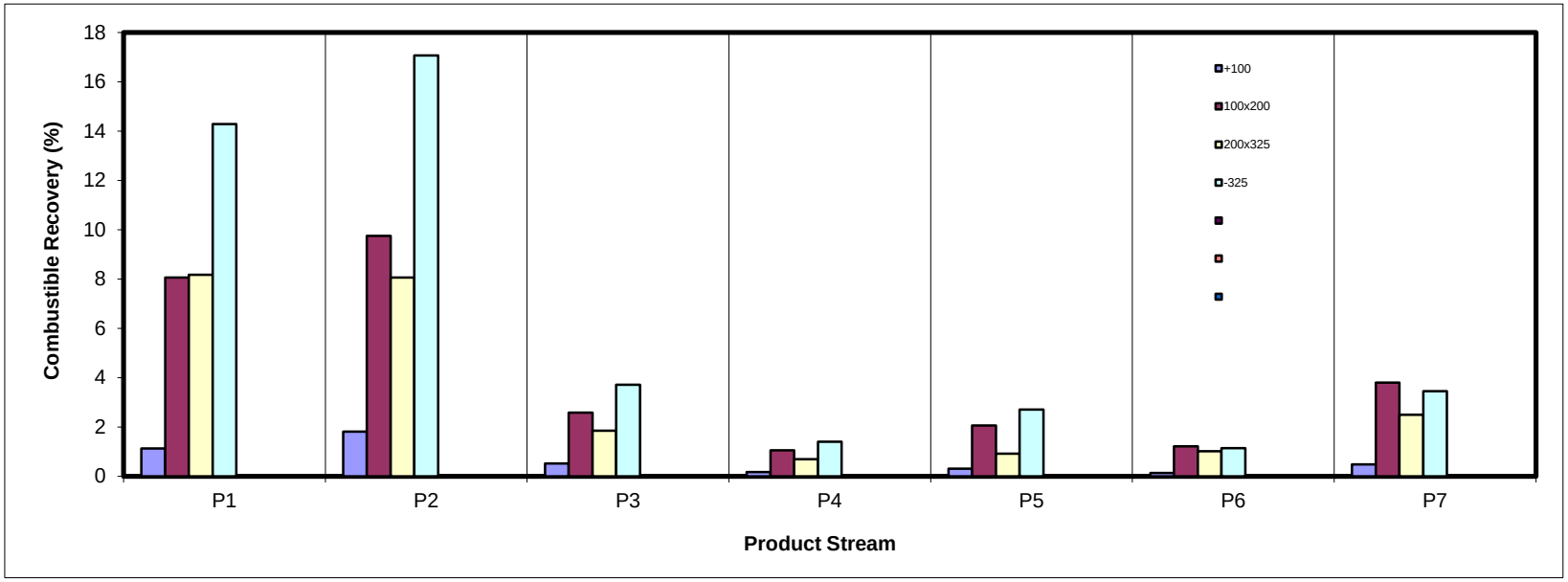
Description: Run 29 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	1.13	1.82	0.52	0.17	0.31	0.13	0.49		4.56
100x200	8.06	9.74	2.58	1.05	2.06	1.22	3.79		28.50
200x325	8.17	8.05	1.85	0.70	0.92	1.02	2.49		23.20
-325	14.28	17.06	3.71	1.40	2.70	1.15	3.45		43.74
Total (Calc)	31.63	36.67	8.65	3.32	6.00	3.51	10.22		100.00



SPIRAL DATA ANALYSIS

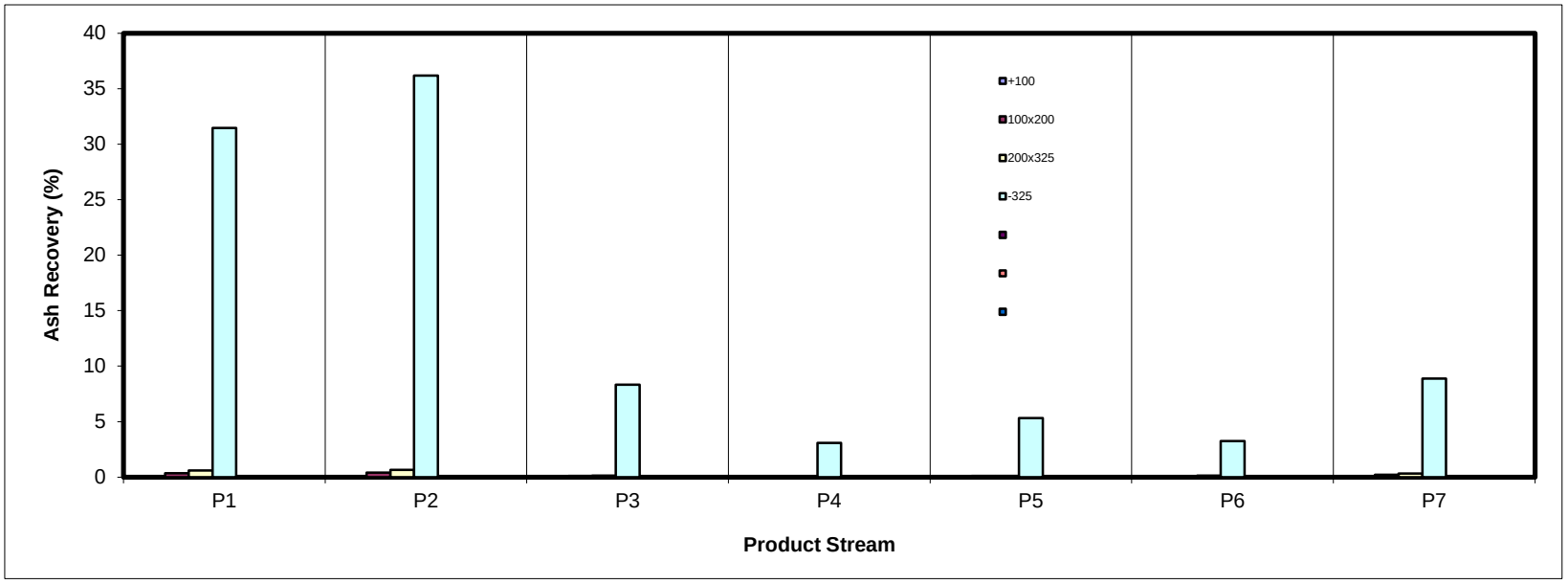
Description: Run 29 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	0.04	0.06	0.02	0.01	0.01	0.01	0.03		0.17
100x200	0.36	0.41	0.11	0.05	0.10	0.07	0.21		1.30
200x325	0.61	0.65	0.14	0.06	0.09	0.13	0.33		2.00
-325	31.48	36.18	8.33	3.09	5.31	3.25	8.89		96.53
Total (Calc)	32.48	37.30	8.60	3.20	5.52	3.45	9.45		100.00



SPIRAL DATA ANALYSIS

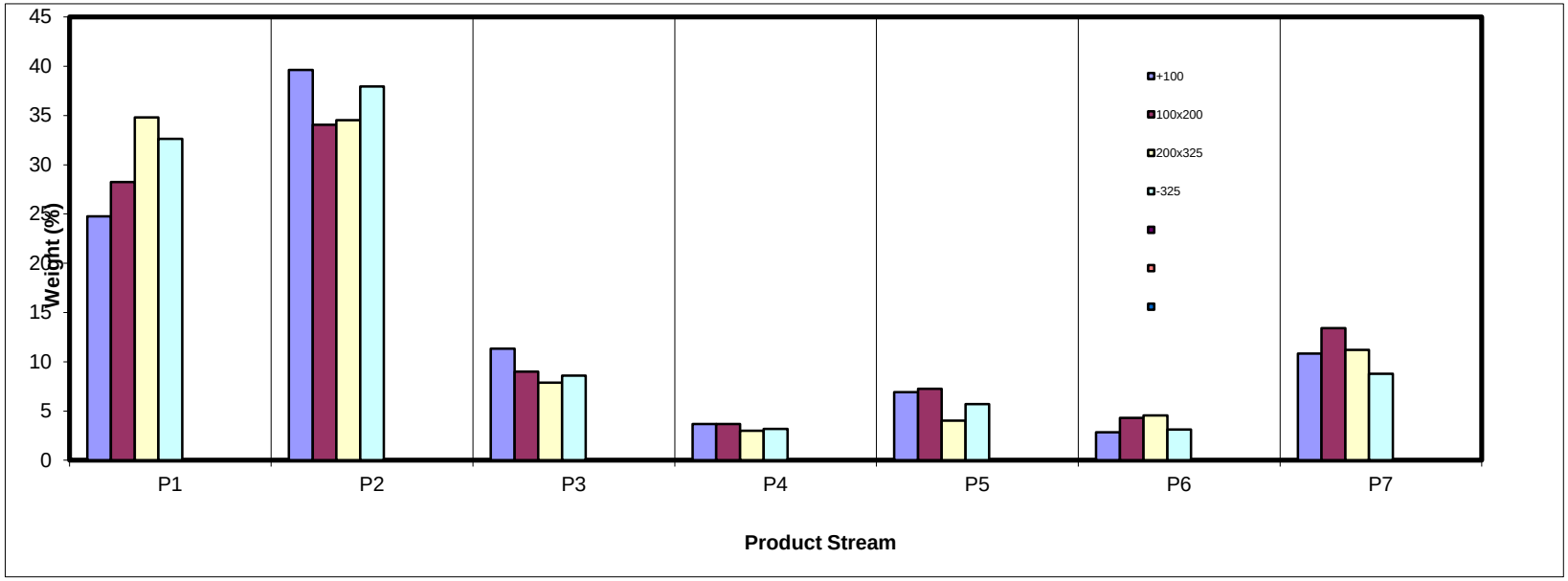
Description: Run 29 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	24.77	39.63	11.34	3.69	6.93	2.83	10.82		100.00
100x200	28.24	34.07	9.01	3.70	7.25	4.32	13.42		100.00
200x325	34.82	34.53	7.90	2.99	4.02	4.55	11.19		100.00
-325	32.62	37.96	8.58	3.20	5.72	3.13	8.79		100.00
Total (Calc)	32.05	36.98	8.63	3.26	5.76	3.48	9.84		100.00



SPIRAL DATA ANALYSIS

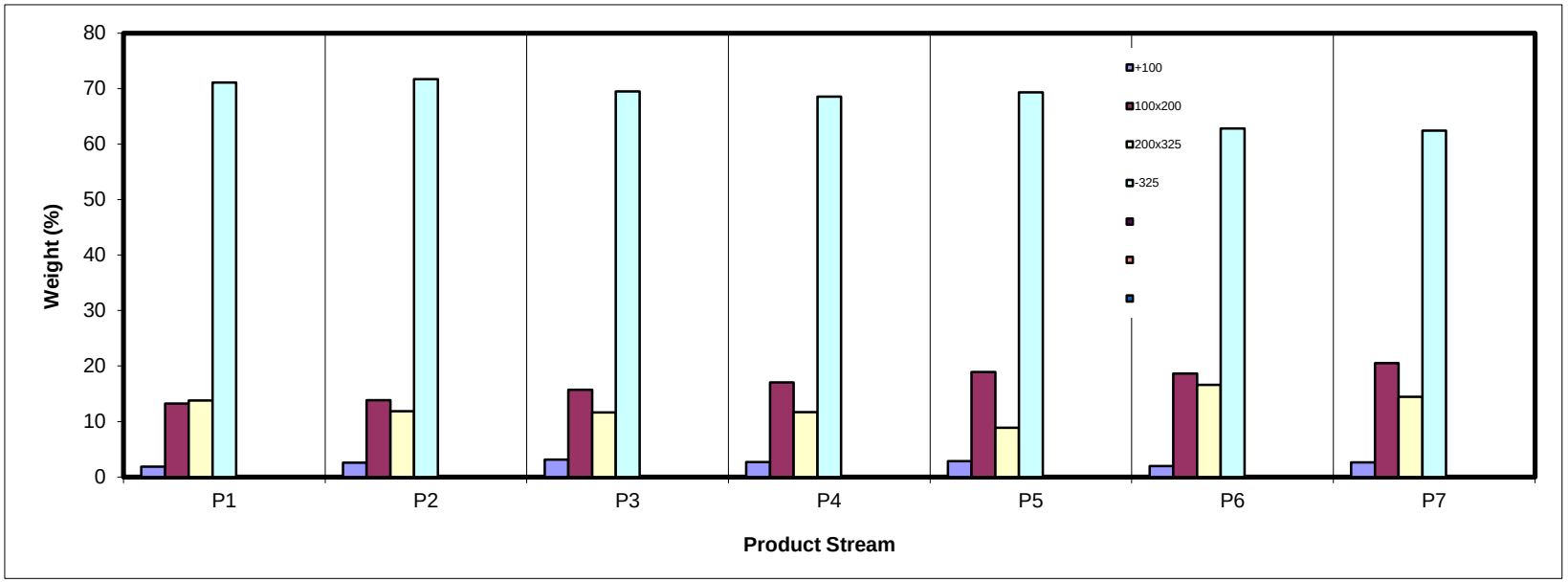
Description: Run 29 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	1.84	2.55	3.13	2.70	2.87	1.94	2.62		2.38
100x200	13.25	13.86	15.71	17.06	18.94	18.64	20.52		15.04
200x325	13.81	11.87	11.63	11.67	8.87	16.60	14.46		12.71
-325	71.10	71.72	69.53	68.58	69.32	62.82	62.40		69.86
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

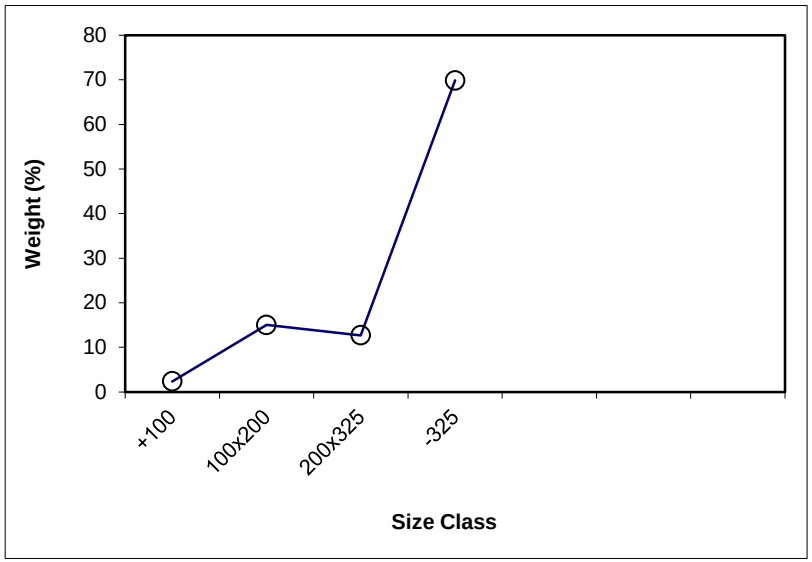
Description: Run 29 - Intermediate Spiral Test

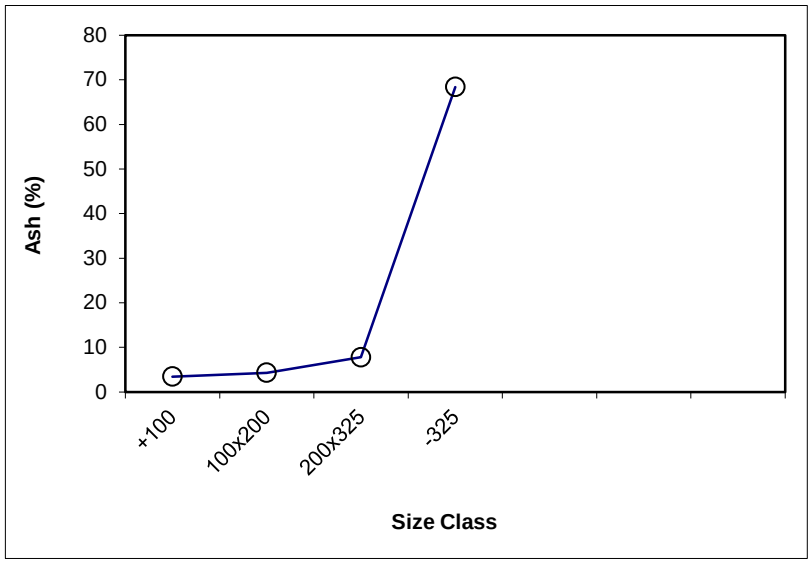
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	312.1	308.1	4.00	2.38	3.44	2.38	3.44	100.00	49.49
100x200	319.7	294.5	25.22	15.04	4.29	17.43	4.17	97.62	50.61
200x325	319.3	298.0	21.31	12.71	7.79	30.14	5.70	82.57	59.05
-325	123.4	6.3	117.12	69.86	68.37	100.00	49.49	69.86	68.37
Total (Calc)	--	--	167.64	100.00	49.49	--	--	--	--





SPIRAL DATA ANALYSIS

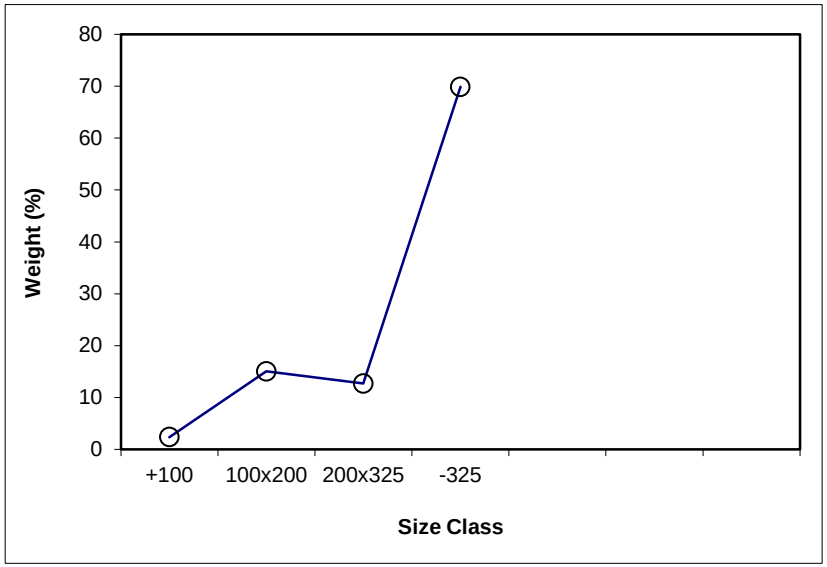
Description: Run 29 - Intermediate Spiral Test

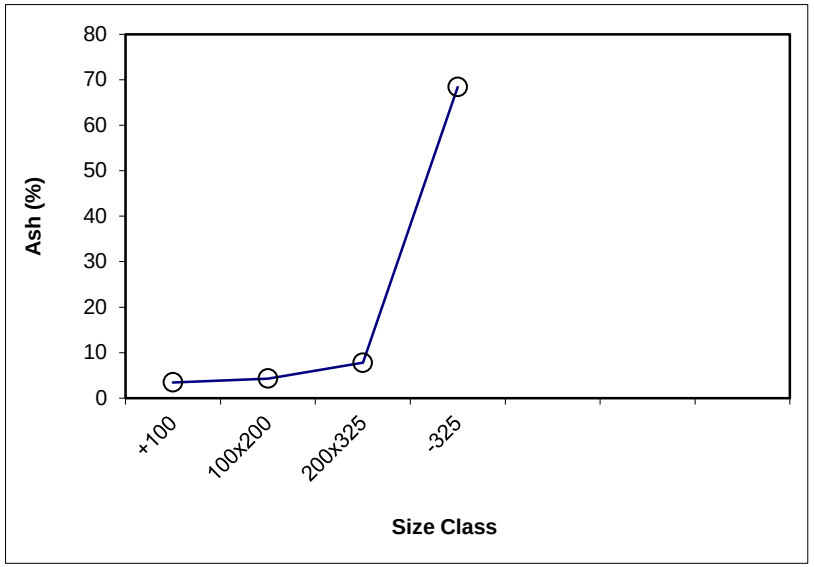
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+100	2.38	3.44	2.38	3.44	100.00	49.49			
100x200	15.04	4.29	17.43	4.17	97.62	50.61	x	15.04	4.29
200x325	12.71	7.79	30.14	5.70	82.57	59.05	x	12.71	7.79
-325	69.86	68.37	100.00	49.49	69.86	68.37			
Total (Calc)	100.00	49.49	--	--	--	--	--	27.75	5.89





SPIRAL DATA ANALYSIS

Description: Run 29 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 32.05

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	314.07	308.1	5.94	1.84	3.10	1.84	3.10	100.00	50.15
100x200	337.24	294.5	42.75	13.25	4.20	15.10	4.07	98.16	51.03
200x325	342.53	298.0	44.54	13.81	6.79	28.90	5.37	84.90	58.34
-325	235.61	6.3	229.35	71.10	68.35	100.00	50.15	71.10	68.35
Total (Calc)	--	--	322.58	100.00	50.15	--	--	--	--

Product P2 Feed Weight (%): 36.98

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	376.5	367.0	9.51	2.55	2.94	2.55	2.94	100.00	49.91
100x200	399.0	347.4	51.58	13.86	3.97	16.41	3.81	97.45	51.14
200x325	447.4	403.2	44.17	11.87	7.29	28.28	5.27	83.59	58.96
-325	273.2	6.3	266.92	71.72	67.51	100.00	49.91	71.72	67.51
Total (Calc)	--	--	372.17	100.00	49.91	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 29 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 8.63

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	313.6	308.1	5.44	3.13	3.51	3.13	3.51	100.00	49.33
100x200	321.8	294.5	27.27	15.71	3.97	18.84	3.90	96.87	50.81
200x325	318.2	298.0	20.20	11.63	6.73	30.47	4.98	81.16	59.88
-325	127.1	6.4	120.71	69.53	68.77	100.00	49.33	69.53	68.77
Total (Calc)	--	--	173.61	100.00	49.33	--	--	--	--

Product P4 Feed Weight (%): 3.26

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	370.5	367.0	3.54	2.70	4.17	2.70	4.17	100.00	48.55
100x200	369.8	347.4	22.39	17.06	4.37	19.76	4.34	97.30	49.78
200x325	418.6	403.2	15.31	11.67	7.33	31.42	5.45	80.24	59.44
-325	96.4	6.4	90.01	68.58	68.30	100.00	48.55	68.58	68.30
Total (Calc)	--	--	131.25	100.00	48.55	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 29 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 5.76

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	398.0	393.0	4.98	2.87	4.30	2.87	4.30	100.00	47.42
100x200	382.6	349.6	32.94	18.94	4.52	21.81	4.49	97.13	48.69
200x325	346.4	331.0	15.42	8.87	8.97	30.68	5.79	78.19	59.40
-325	127.0	6.5	120.56	69.32	65.85	100.00	47.42	69.32	65.85
Total (Calc)	--	--	173.91	100.00	47.42	--	--	--	--

Product P6 Feed Weight (%): 3.48

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	391.1	387.7	3.40	1.94	4.39	1.94	4.39	100.00	49.10
100x200	409.5	376.8	32.66	18.64	5.11	20.58	5.05	98.06	49.98
200x325	415.3	386.3	29.08	16.60	11.23	37.18	7.81	79.42	60.52
-325	116.4	6.4	110.06	62.82	73.54	100.00	49.10	62.82	73.54
Total (Calc)	--	--	175.20	100.00	49.10	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 29 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 9.84

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	402.4	397.2	5.19	2.62	4.93	2.62	4.93	100.00	47.53
100x200	432.0	391.3	40.63	20.52	5.09	23.14	5.07	97.38	48.68
200x325	407.2	378.6	28.64	14.46	11.52	37.60	7.55	76.86	60.31
-325	130.0	6.4	123.60	62.40	71.62	100.00	47.53	62.40	71.62
Total (Calc)	--	--	198.06	100.00	47.53	--	--	--	--

SPIRAL DATA ANALYSIS

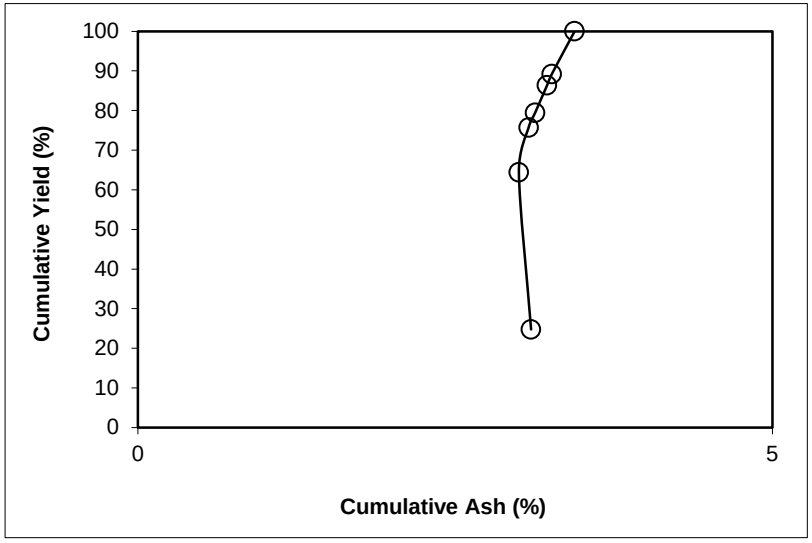
Description: Run 29 - Intermediate Spiral Test

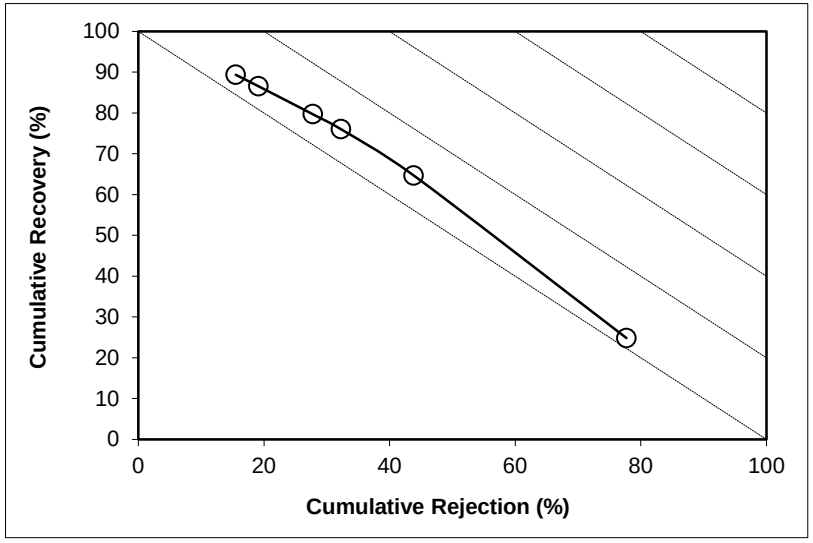
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: +100 Feed Weight (%): 2.38

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	24.77	3.10	24.77	3.10	24.85	75.23	3.55	77.70	2.56
P2	39.63	2.94	64.39	3.00	64.69	35.61	4.24	43.83	8.52
P3	11.34	3.51	75.73	3.08	76.01	24.27	4.57	32.25	8.27
P4	3.69	4.17	79.42	3.13	79.67	20.58	4.64	27.78	7.45
P5	6.93	4.30	86.34	3.22	86.54	13.66	4.82	19.12	5.66
P6	2.83	4.39	89.18	3.26	89.35	10.82	4.93	15.50	4.84
P7	10.82	4.93	100.00	3.44	100.00	0.00			
Total (Calc)	100.00	3.44	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

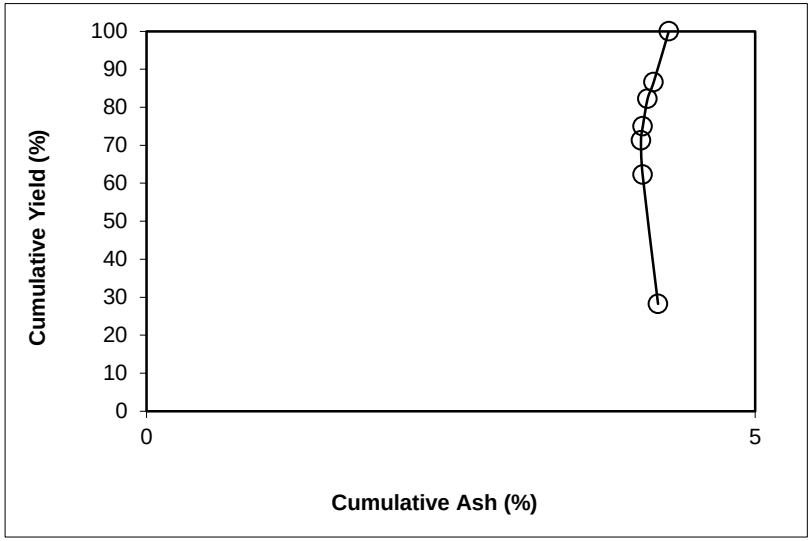
Description: Run 29 - Intermediate Spiral Test

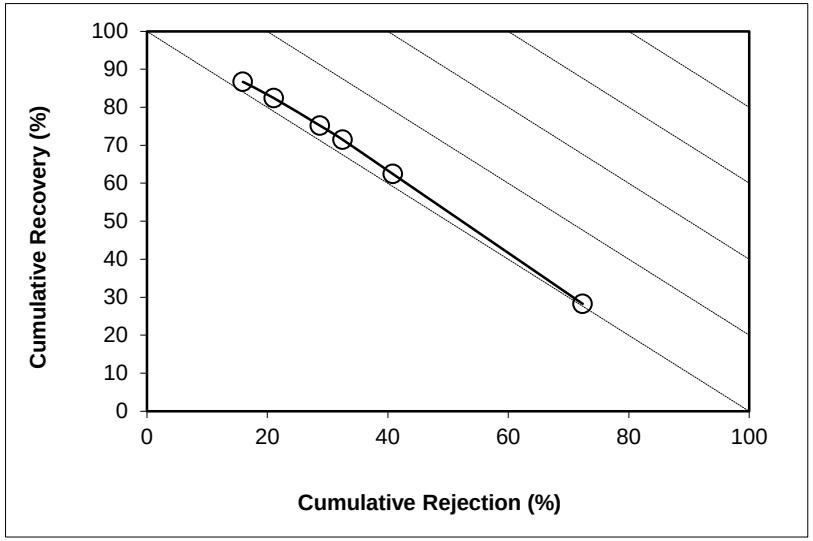
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 15.04

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	28.24	4.20	28.24	4.20	28.27	71.76	4.32	72.34	0.61
P2	34.07	3.97	62.31	4.07	62.45	37.69	4.65	40.82	3.26
P3	9.01	3.97	71.31	4.06	71.48	28.69	4.86	32.48	3.96
P4	3.70	4.37	75.01	4.08	75.18	24.99	4.93	28.71	3.89
P5	7.25	4.52	82.26	4.12	82.41	17.74	5.10	21.07	3.48
P6	4.32	5.11	86.58	4.17	86.69	13.42	5.09	15.92	2.62
P7	13.42	5.09	100.00	4.29	100.00	0.00			
Total (Calc)	100.00	4.29	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

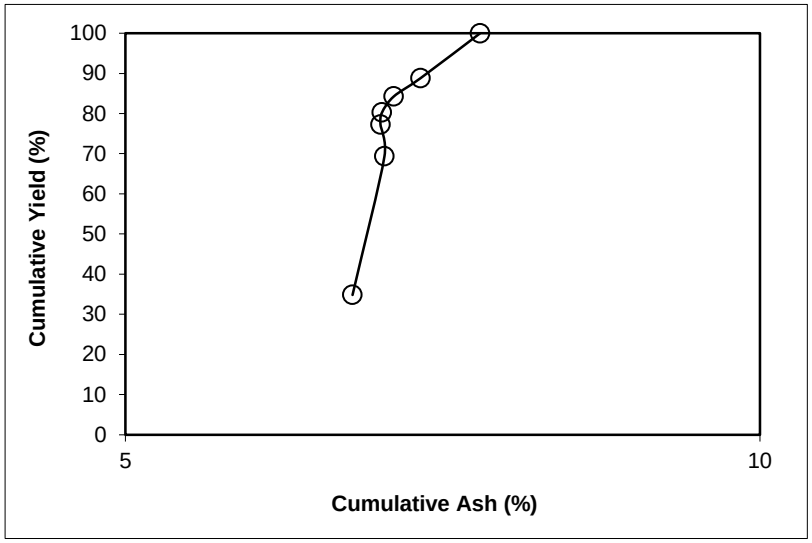
Description: Run 29 - Intermediate Spiral Test

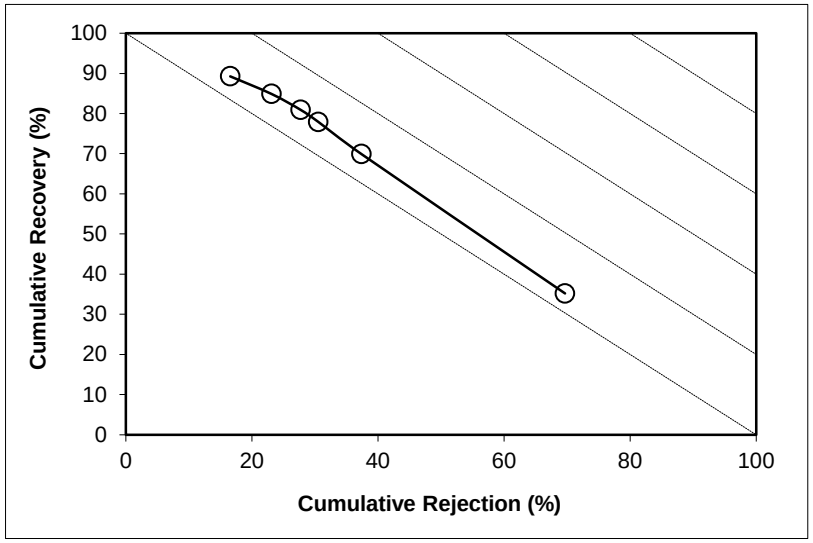
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 12.71

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	34.82	6.79	34.82	6.79	35.20	65.18	8.33	69.67	4.87
P2	34.53	7.29	69.35	7.04	69.92	30.65	9.50	37.36	7.28
P3	7.90	6.73	77.25	7.01	77.91	22.75	10.46	30.54	8.44
P4	2.99	7.33	80.24	7.02	80.91	19.76	10.94	27.72	8.64
P5	4.02	8.97	84.26	7.11	84.88	15.74	11.44	23.10	7.98
P6	4.55	11.23	88.81	7.32	89.26	11.19	11.52	16.55	5.80
P7	11.19	11.52	100.00	7.79	100.00	0.00			
Total (Calc)	100.00	7.79	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

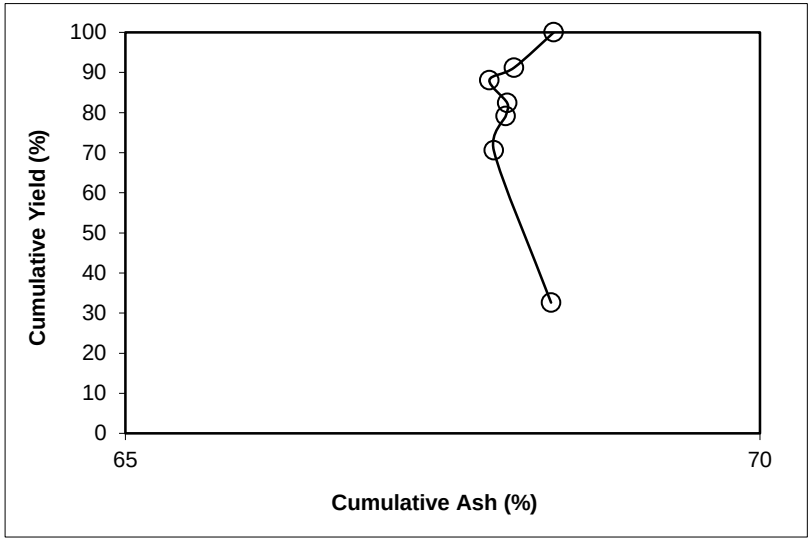
Description: Run 29 - Intermediate Spiral Test

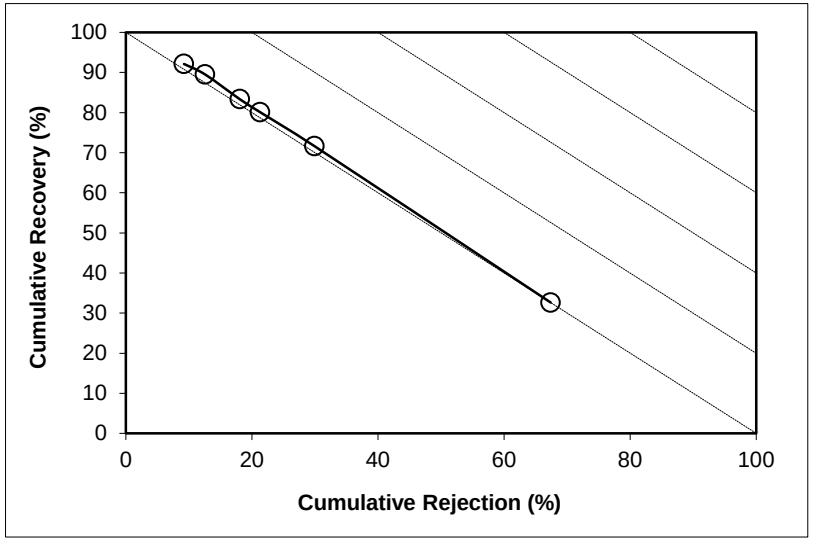
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: -325.00 Feed Weight (%): 69.86

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	32.62	68.35	32.62	68.35	32.64	67.38	68.39	67.39	0.03
P2	37.96	67.51	70.58	67.90	71.64	29.42	69.51	29.91	1.54
P3	8.58	68.77	79.16	68.00	80.11	20.84	69.81	21.27	1.39
P4	3.20	68.30	82.36	68.01	83.32	17.64	70.09	18.08	1.40
P5	5.72	65.85	88.08	67.87	89.49	11.92	72.12	12.57	2.06
P6	3.13	73.54	91.21	68.06	92.11	8.79	71.62	9.21	1.32
P7	8.79	71.62	100.00	68.37	100.00	0.00			
Total (Calc)	100.00	68.37	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

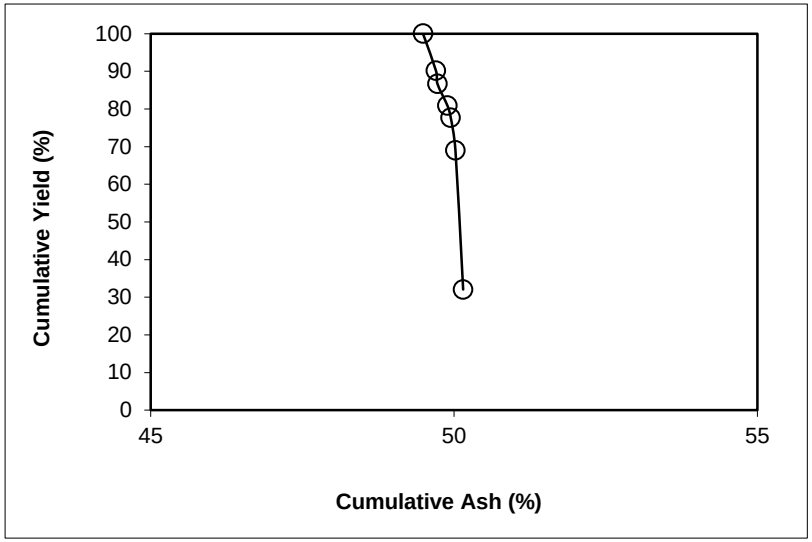
Description: Run 29 - Intermediate Spiral Test

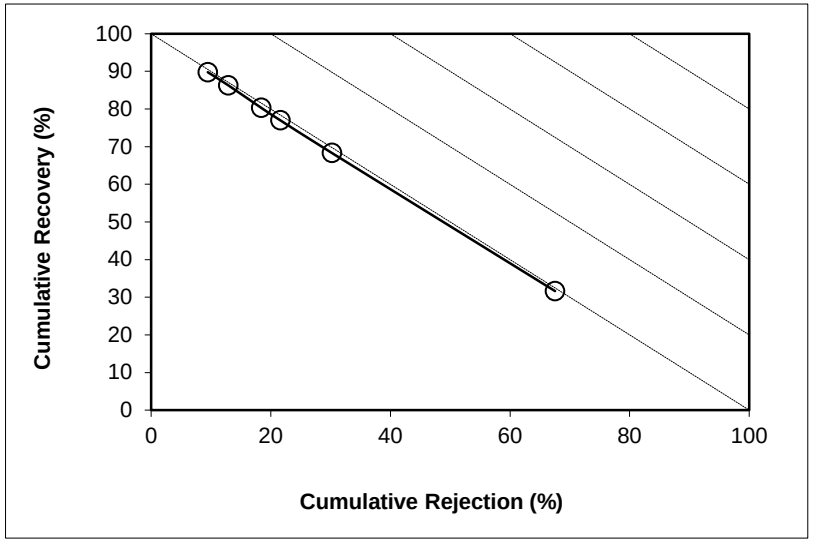
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	32.05	50.15	32.05	50.15	31.63	67.95	49.18	67.52	-0.85
P2	36.98	49.91	69.03	50.02	68.30	30.97	48.30	30.22	-1.48
P3	8.63	49.33	77.66	49.95	76.95	22.34	47.90	21.62	-1.42
P4	3.26	48.55	80.92	49.89	80.27	19.08	47.78	18.43	-1.30
P5	5.76	47.42	86.68	49.73	86.27	13.32	47.94	12.91	-0.82
P6	3.48	49.10	90.16	49.70	89.78	9.84	47.53	9.45	-0.77
P7	9.84	47.53	100.00	49.49	100.00	0.00			
Total (Calc)	100.00	49.49	--	--	--	--	--	--	--

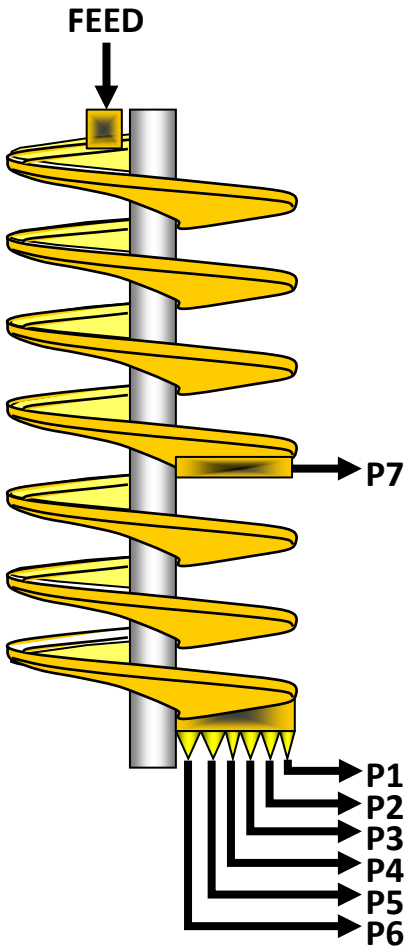




SPIRAL DATA ANALYSIS

Description: Run 30 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	0.586	16.0	12.35	13.69
P2	0.173	16.0	3.61	4.01
P3	0.037	16.4	0.76	0.85
P4	0.012	17.7	0.23	0.26
P5	0.022	18.7	0.39	0.44
P6	0.014	22.8	0.19	0.22
P7	0.039	21.7	0.57	0.66
Total	0.884	16.3	18.09	20.12

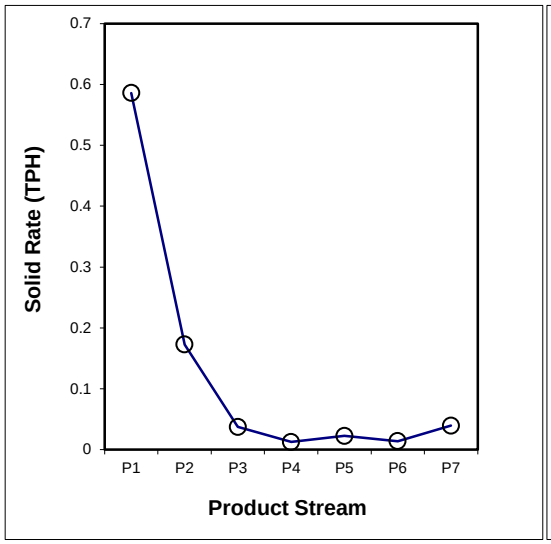
SPIRAL DATA ANALYSIS

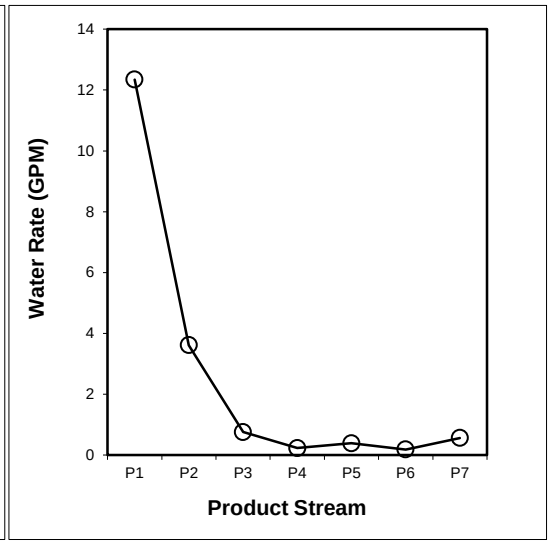
Description: Run 30 - Intermediate Spiral Test

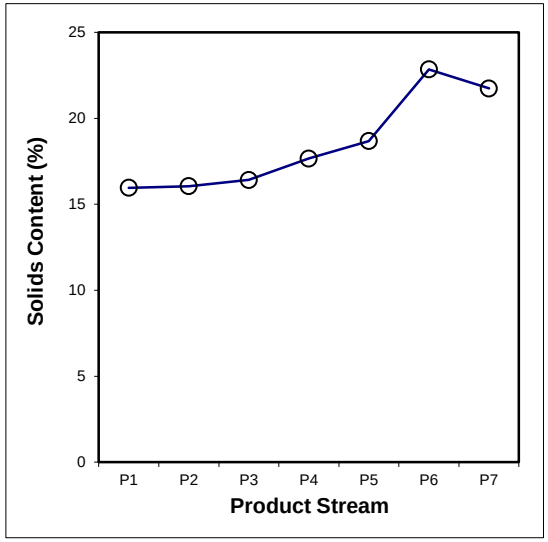
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	10	10420.00	1020.00	3.672	2651.8	1173.5	0.586	66.31	15.96
P2	10	2925.22	171.96	1.076	1608.9	1173.5	0.173	19.53	16.05
P3	20	1259.09	95.51	0.227	1095.2	907.0	0.037	4.22	16.41
P4	40	812.08	93.10	0.070	1249.3	1124.2	0.012	1.40	17.66
P5	30	1014.88	93.20	0.120	1249.7	1080.1	0.022	2.54	18.68
P6	50	865.68	92.84	0.060	1331.3	1157.3	0.014	1.56	22.84
P7	20	1022.32	97.58	0.181	1371.9	1173.7	0.039	4.44	21.74
Total (Calc)	--	--	--	5.407	--	--	0.884	100.00	16.35
Total (Head)	1.20	1808.18	175.38	5.407	1390.9	1123.9	0.884	--	16.35







SPIRAL DATA ANALYSIS

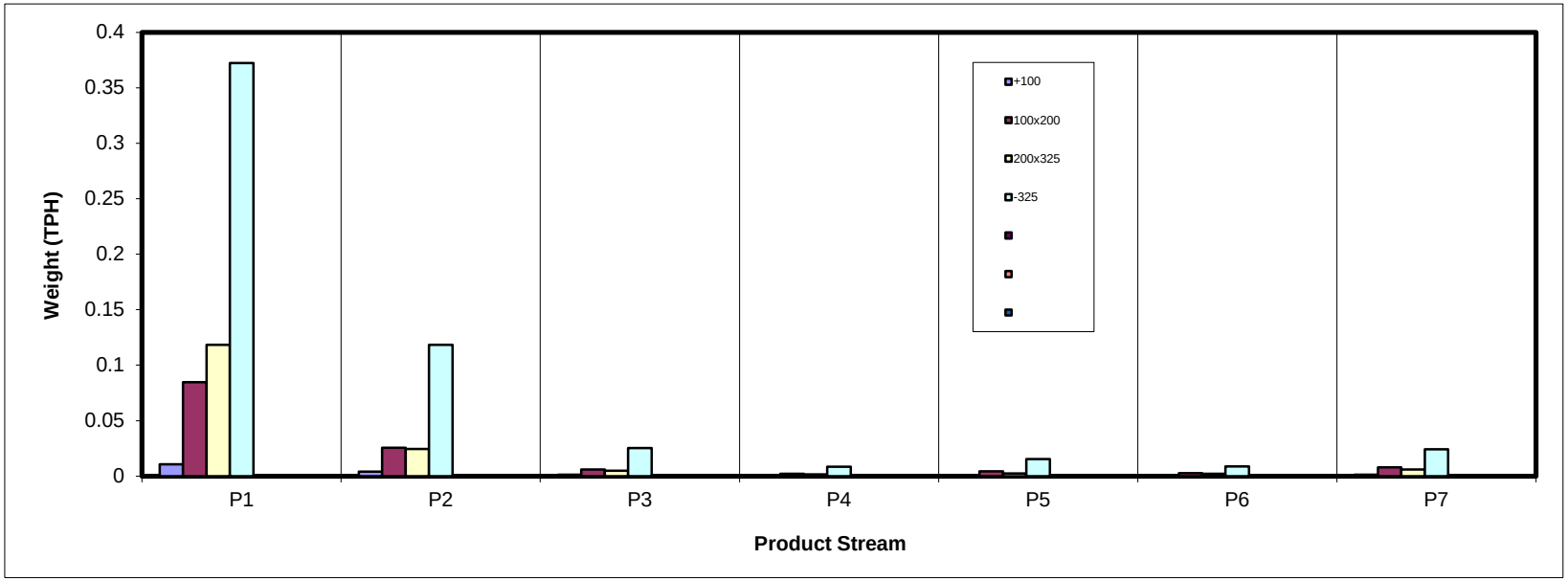
Description: Run 30 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	0.011	0.004	0.001	0.000	0.001	0.000	0.001		0.019
100x200	0.085	0.026	0.006	0.002	0.004	0.003	0.008		0.133
200x325	0.118	0.025	0.005	0.002	0.002	0.002	0.006		0.160
-325	0.372	0.118	0.025	0.008	0.015	0.009	0.024		0.572
Total (Calc)	0.586	0.173	0.037	0.012	0.022	0.014	0.039		0.884



SPIRAL DATA ANALYSIS

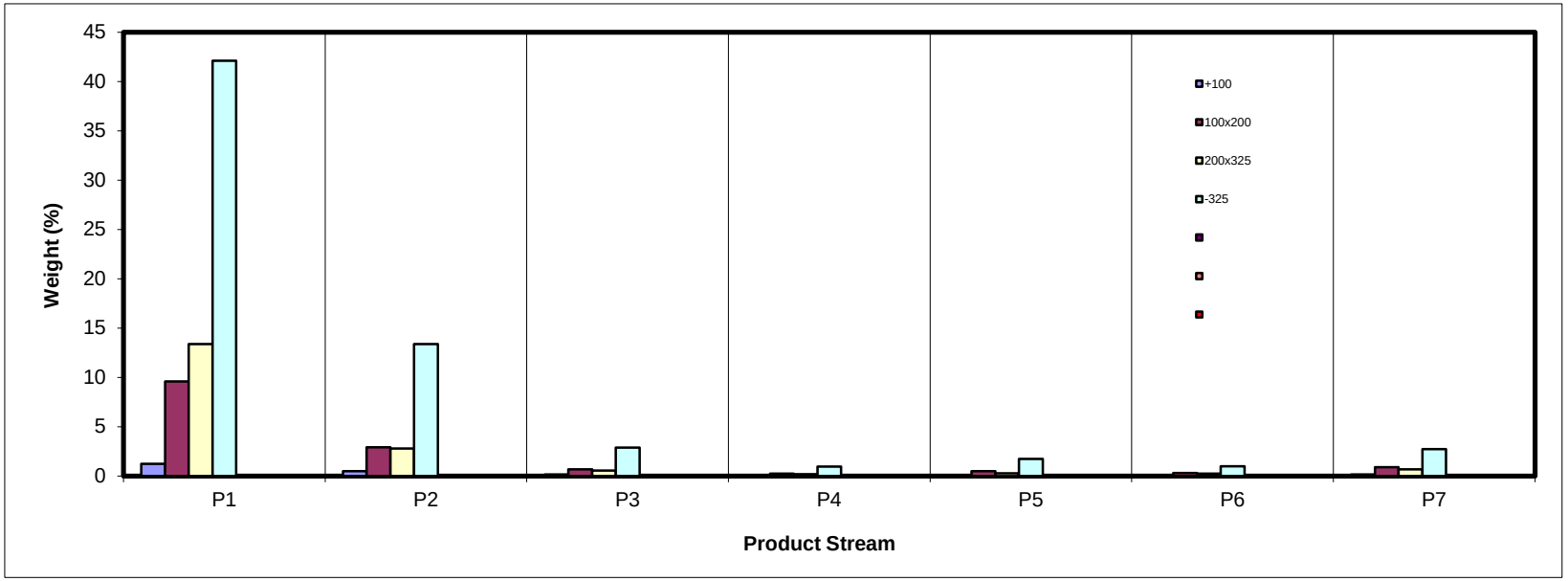
Description: Run 30 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	1.22	0.47	0.16	0.04	0.07	0.03	0.13		2.12
100x200	9.58	2.90	0.66	0.23	0.47	0.31	0.90		15.06
200x325	13.38	2.77	0.54	0.17	0.27	0.24	0.68		18.06
-325	42.12	13.38	2.86	0.95	1.72	0.98	2.73		64.75
Total (Calc)	66.31	19.53	4.22	1.40	2.54	1.56	4.44		100.00



SPIRAL DATA ANALYSIS

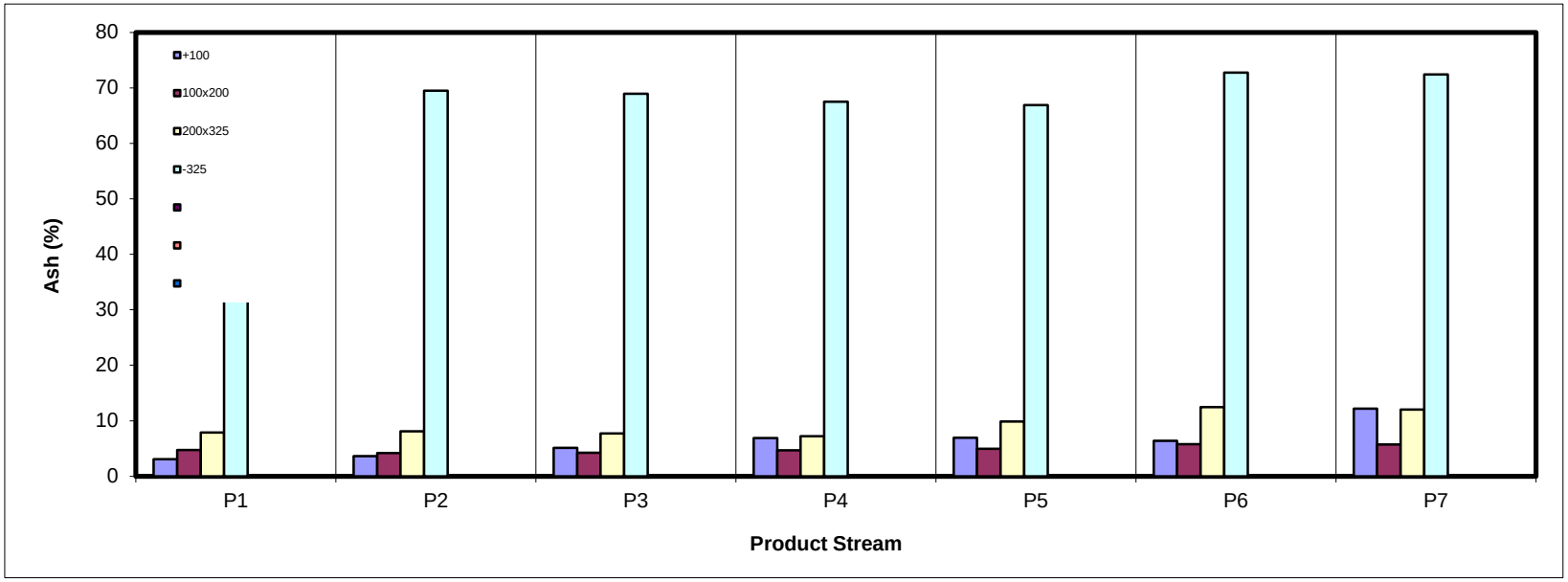
Description: Run 30 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	3.07	3.62	5.12	6.91	6.92	6.40	12.20		4.16
100x200	4.75	4.16	4.23	4.69	4.93	5.81	5.75		4.70
200x325	7.89	8.12	7.71	7.22	9.85	12.47	12.00		8.16
-325	74.59	69.48	68.95	67.49	66.89	72.75	72.42		72.86
Total (Calc)	49.72	49.47	48.61	47.76	47.56	49.07	47.84		49.45



SPIRAL DATA ANALYSIS

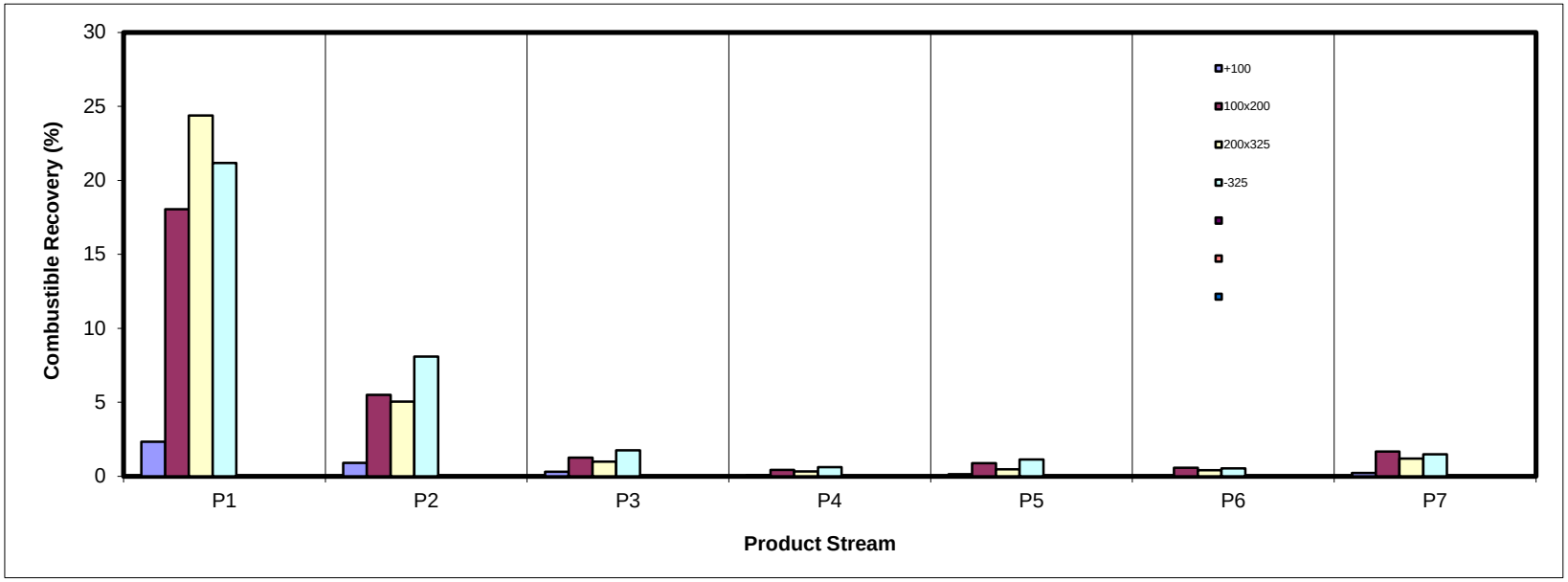
Description: Run 30 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	2.34	0.90	0.30	0.08	0.14	0.05	0.23		4.03
100x200	18.05	5.50	1.25	0.44	0.89	0.58	1.68		28.39
200x325	24.39	5.04	0.98	0.32	0.48	0.42	1.19		32.81
-325	21.17	8.08	1.76	0.61	1.13	0.53	1.49		34.77
Total (Calc)	65.95	19.52	4.29	1.45	2.63	1.57	4.59		100.00



SPIRAL DATA ANALYSIS

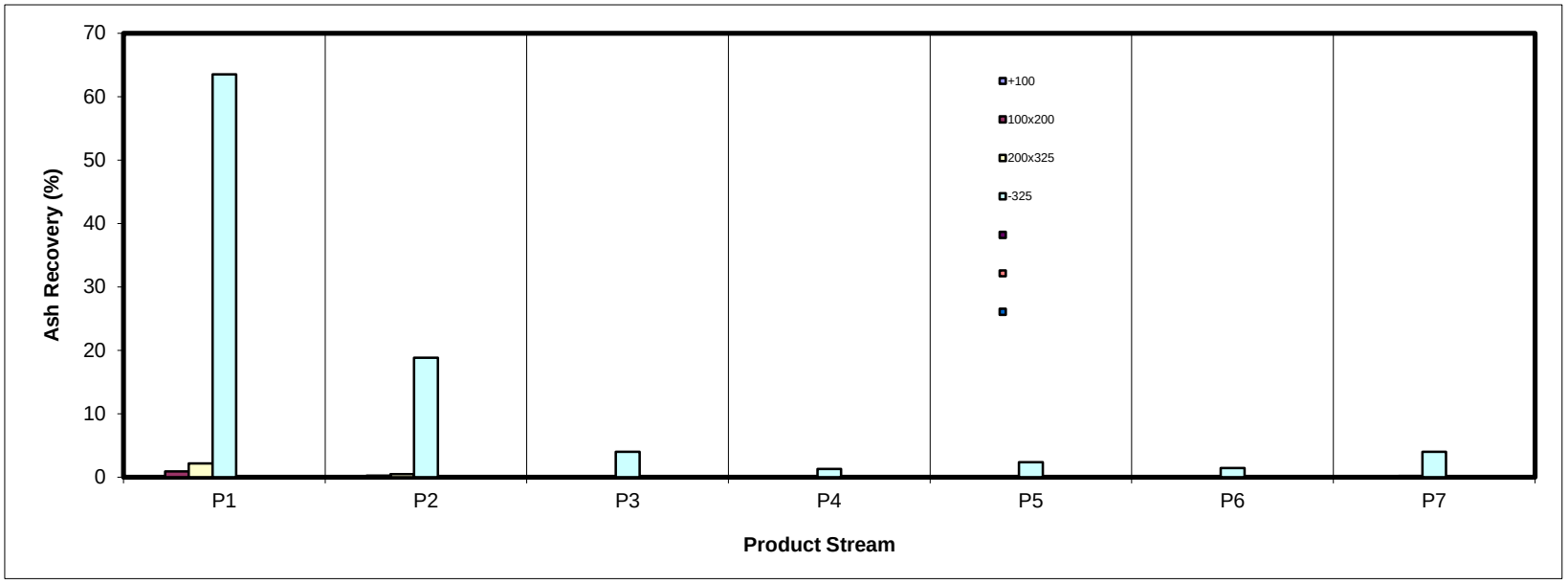
Description: Run 30 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	0.08	0.03	0.02	0.01	0.01	0.00	0.03		0.18
100x200	0.92	0.24	0.06	0.02	0.05	0.04	0.10		1.43
200x325	2.13	0.46	0.08	0.03	0.05	0.06	0.17		2.98
-325	63.54	18.81	3.99	1.30	2.33	1.45	4.00		95.41
Total (Calc)	66.67	19.54	4.15	1.36	2.44	1.55	4.30		100.00



SPIRAL DATA ANALYSIS

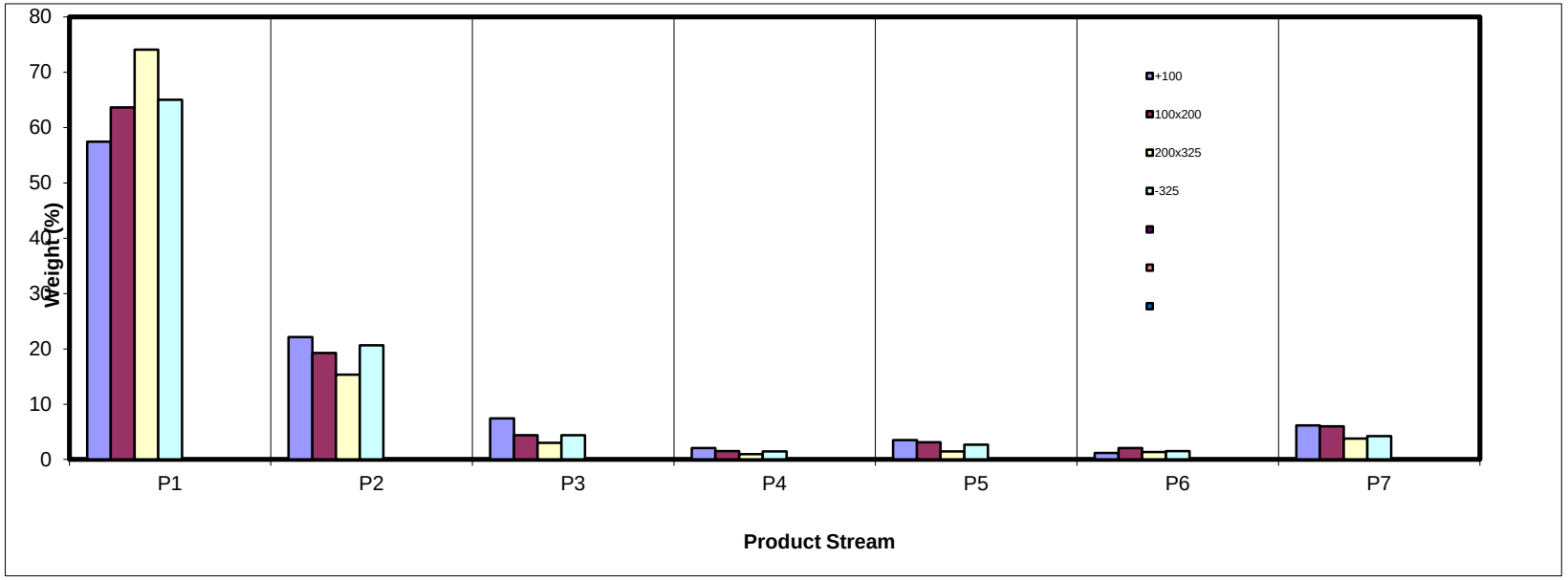
Description: Run 30 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	57.47	22.15	7.44	2.10	3.50	1.19	6.16		100.00
100x200	63.63	19.28	4.39	1.54	3.14	2.05	5.98		100.00
200x325	74.10	15.35	2.99	0.96	1.48	1.34	3.79		100.00
-325	65.04	20.67	4.42	1.47	2.66	1.52	4.21		100.00
Total (Calc)	66.31	19.53	4.22	1.40	2.54	1.56	4.44		100.00



SPIRAL DATA ANALYSIS

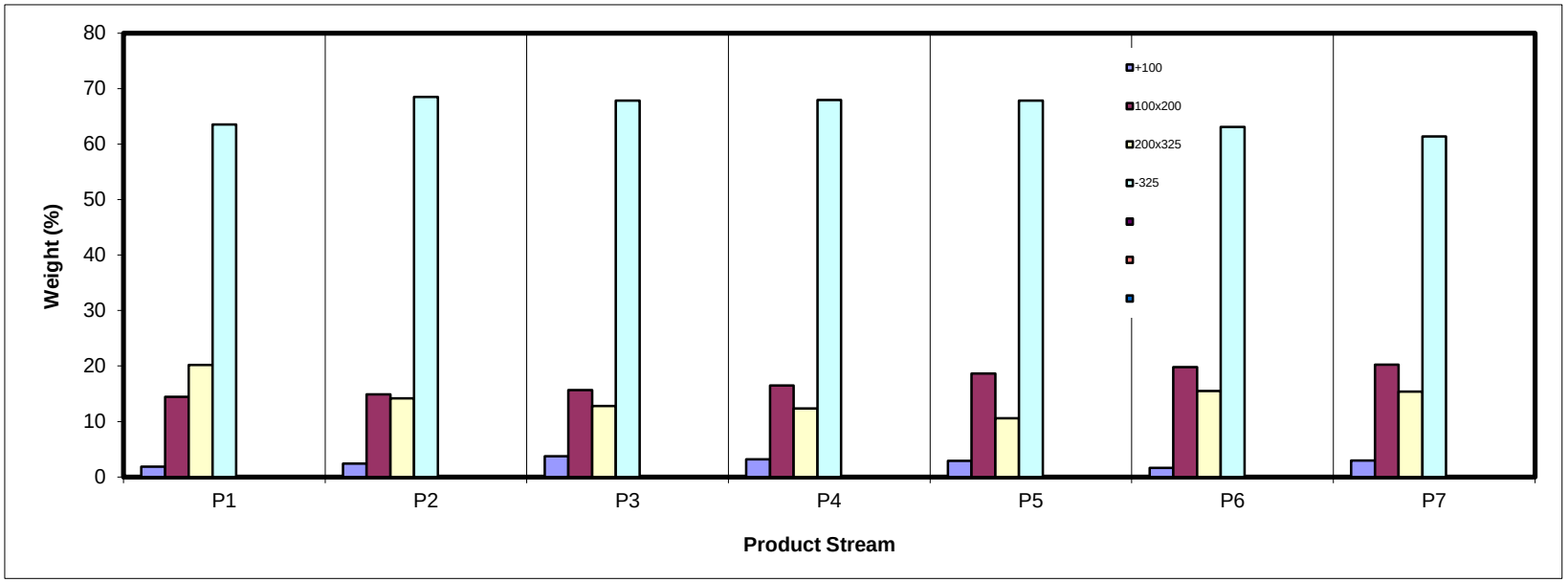
Description: Run 30 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	1.84	2.41	3.74	3.17	2.93	1.62	2.94		2.12
100x200	14.45	14.86	15.65	16.50	18.64	19.81	20.27		15.06
200x325	20.18	14.19	12.78	12.35	10.57	15.50	15.39		18.06
-325	63.52	68.53	67.83	67.98	67.87	63.07	61.40		64.75
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

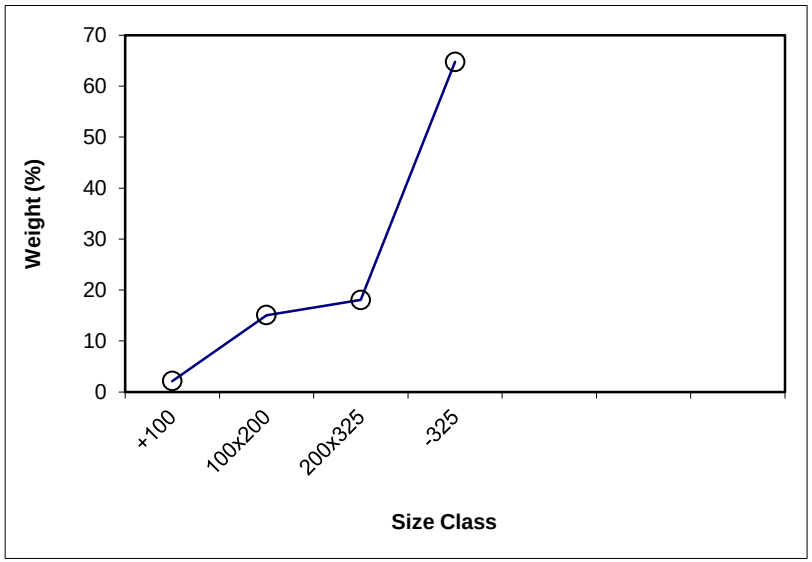
Description: Run 30 - Intermediate Spiral Test

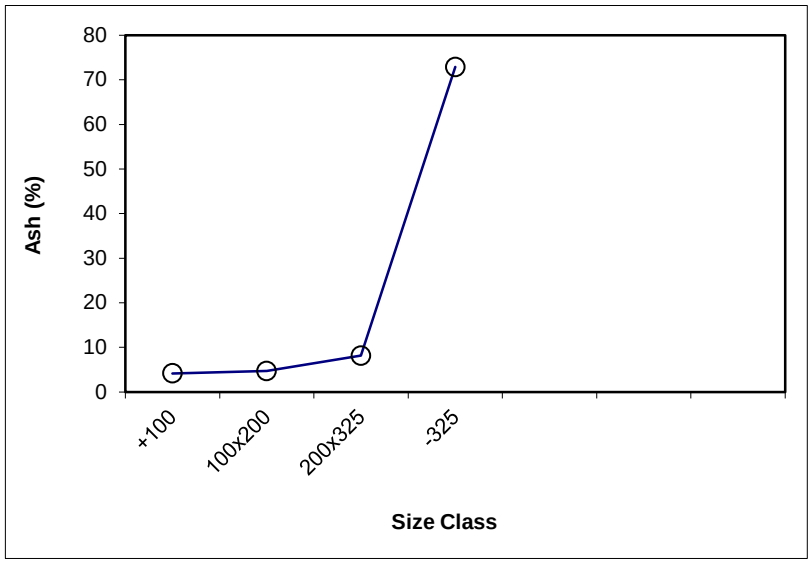
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	372.6	367.0	5.67	2.12	4.16	2.12	4.16	100.00	49.45
100x200	387.6	347.4	40.20	15.06	4.70	17.18	4.63	97.88	50.43
200x325	451.5	403.2	48.22	18.06	8.16	35.25	6.44	82.82	58.75
-325	179.1	6.3	172.86	64.75	72.86	100.00	49.45	64.75	72.86
Total (Calc)	--	--	266.94	100.00	49.45	--	--	--	--





SPIRAL DATA ANALYSIS

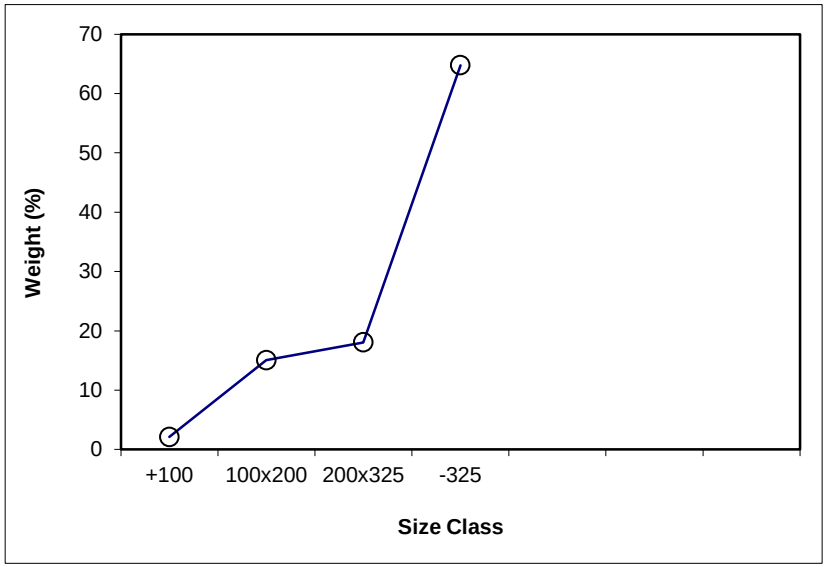
Description: Run 30 - Intermediate Spiral Test

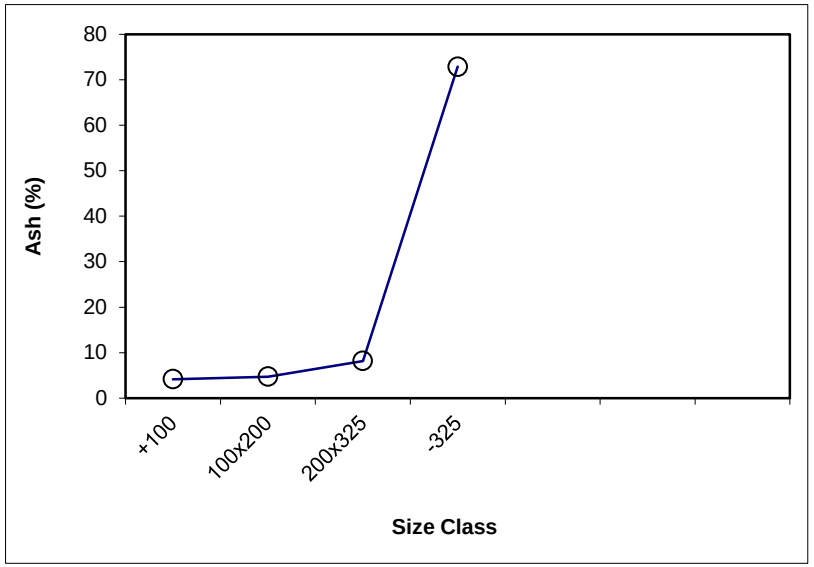
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+100	2.12	4.16	2.12	4.16	100.00	49.45			
100x200	15.06	4.70	17.18	4.63	97.88	50.43	x	15.06	4.70
200x325	18.06	8.16	35.25	6.44	82.82	58.75	x	18.06	8.16
-325	64.75	72.86	100.00	49.45	64.75	72.86			
Total (Calc)	100.00	49.45	--	--	--	--	--	33.12	6.59





SPIRAL DATA ANALYSIS

Description: Run 30 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 66.31

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	424.45	397.2	27.22	1.84	3.07	1.84	3.07	100.00	49.72
100x200	604.97	391.3	213.63	14.45	4.75	16.29	4.56	98.16	50.59
200x325	676.98	378.6	298.38	20.18	7.89	36.48	6.40	83.71	58.51
-325	945.36	6.3	939.04	63.52	74.59	100.00	49.72	63.52	74.59
Total (Calc)	--	--	1478.27	100.00	49.72	--	--	--	--

Product P2 Feed Weight (%): 19.53

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	407.7	397.2	10.49	2.41	3.62	2.41	3.62	100.00	49.47
100x200	456.1	391.3	64.72	14.86	4.16	17.27	4.09	97.59	50.60
200x325	440.4	378.6	61.81	14.19	8.12	31.47	5.91	82.73	58.95
-325	304.7	6.3	298.40	68.53	69.48	100.00	49.47	68.53	69.48
Total (Calc)	--	--	435.41	100.00	49.47	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 30 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 4.22

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	315.2	308.1	7.04	3.74	5.12	3.74	5.12	100.00	48.61
100x200	323.9	294.5	29.46	15.65	4.23	19.40	4.40	96.26	50.30
200x325	322.0	298.0	24.04	12.78	7.71	32.17	5.72	80.60	59.24
-325	134.0	6.4	127.62	67.83	68.95	100.00	48.61	67.83	68.95
Total (Calc)	--	--	188.16	100.00	48.61	--	--	--	--

Product P4 Feed Weight (%): 1.40

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	370.9	367.0	3.97	3.17	6.91	3.17	6.91	100.00	47.76
100x200	368.1	347.4	20.64	16.50	4.69	19.67	5.04	96.83	49.10
200x325	418.7	403.2	15.45	12.35	7.22	32.02	5.88	80.33	58.23
-325	91.6	6.5	85.05	67.98	67.49	100.00	47.76	67.98	67.49
Total (Calc)	--	--	125.11	100.00	47.76	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 30 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 2.54

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	398.0	393.0	4.97	2.93	6.92	2.93	6.92	100.00	47.56
100x200	381.2	349.6	31.62	18.64	4.93	21.56	5.20	97.07	48.79
200x325	348.9	331.0	17.93	10.57	9.85	32.13	6.73	78.44	59.21
-325	121.6	6.5	115.14	67.87	66.89	100.00	47.56	67.87	66.89
Total (Calc)	--	--	169.65	100.00	47.56	--	--	--	--

Product P6 Feed Weight (%): 1.56

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	390.5	387.7	2.81	1.62	6.40	1.62	6.40	100.00	49.07
100x200	411.3	376.8	34.47	19.81	5.81	21.42	5.85	98.38	49.77
200x325	413.2	386.3	26.97	15.50	12.47	36.93	8.63	78.58	60.85
-325	116.3	6.5	109.75	63.07	72.75	100.00	49.07	63.07	72.75
Total (Calc)	--	--	174.01	100.00	49.07	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 30 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 4.44

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	403.1	397.2	5.84	2.94	12.20	2.94	12.20	100.00	47.84
100x200	431.5	391.3	40.16	20.27	5.75	23.21	6.57	97.06	48.92
200x325	409.1	378.6	30.49	15.39	12.00	38.60	8.73	76.79	60.32
-325	128.2	6.6	121.67	61.40	72.42	100.00	47.84	61.40	72.42
Total (Calc)	--	--	198.16	100.00	47.84	--	--	--	--

SPIRAL DATA ANALYSIS

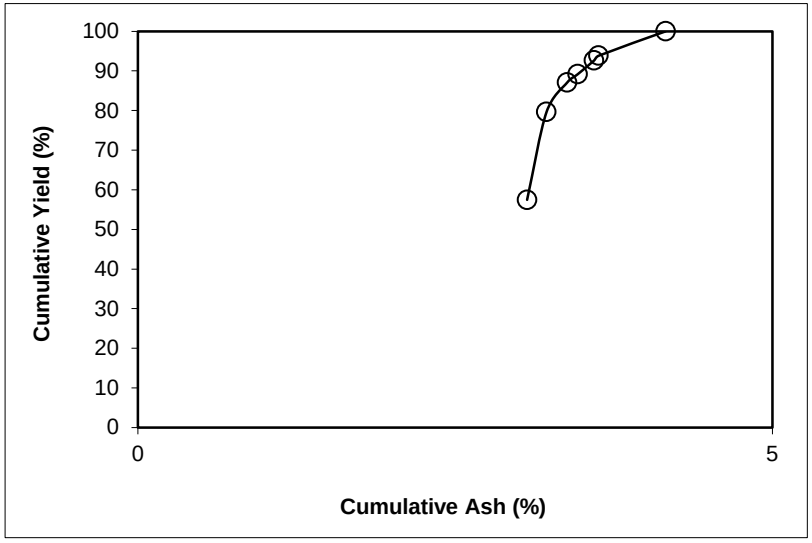
Description: Run 30 - Intermediate Spiral Test

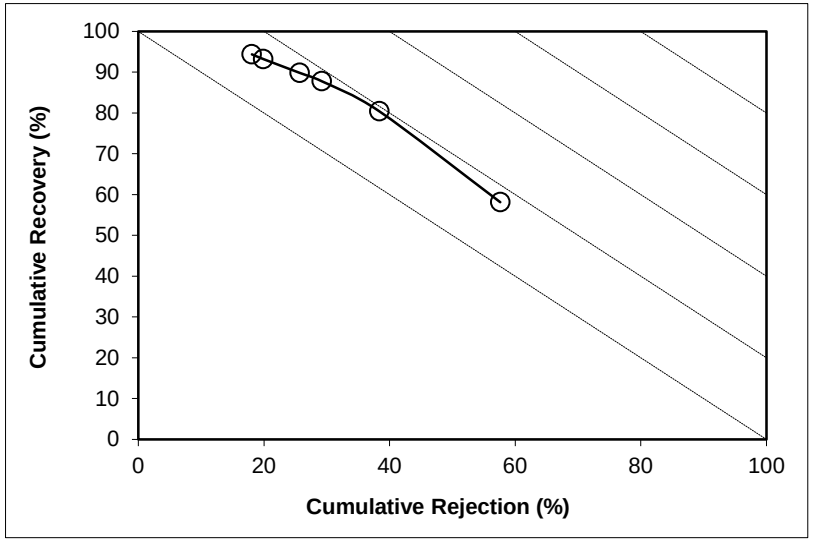
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: +100 Feed Weight (%): 2.12

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	57.47	3.07	57.47	3.07	58.13	42.53	5.63	57.62	15.75
P2	22.15	3.62	79.62	3.22	80.40	20.38	7.83	38.36	18.76
P3	7.44	5.12	87.06	3.38	87.76	12.94	9.38	29.20	16.96
P4	2.10	6.91	89.15	3.47	89.80	10.85	9.86	25.72	15.52
P5	3.50	6.92	92.65	3.60	93.20	7.35	11.26	19.90	13.10
P6	1.19	6.40	93.84	3.63	94.36	6.16	12.20	18.07	12.43
P7	6.16	12.20	100.00	4.16	100.00	0.00			
Total (Calc)	100.00	4.16	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

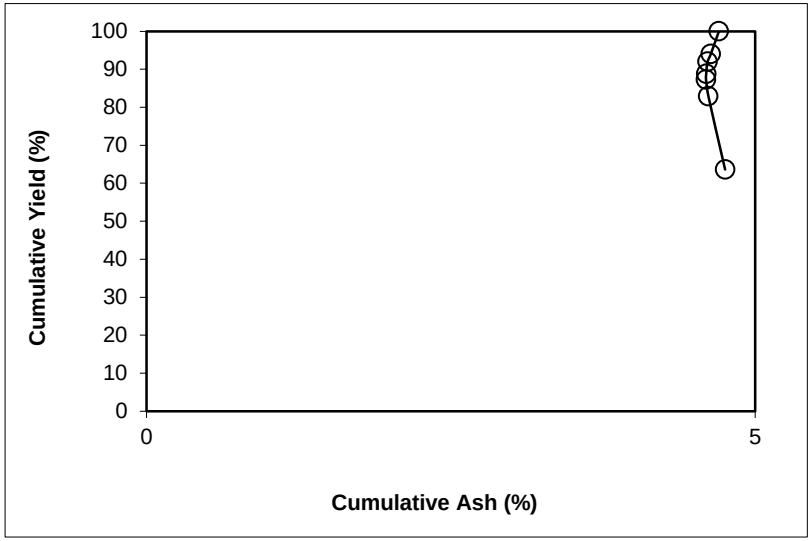
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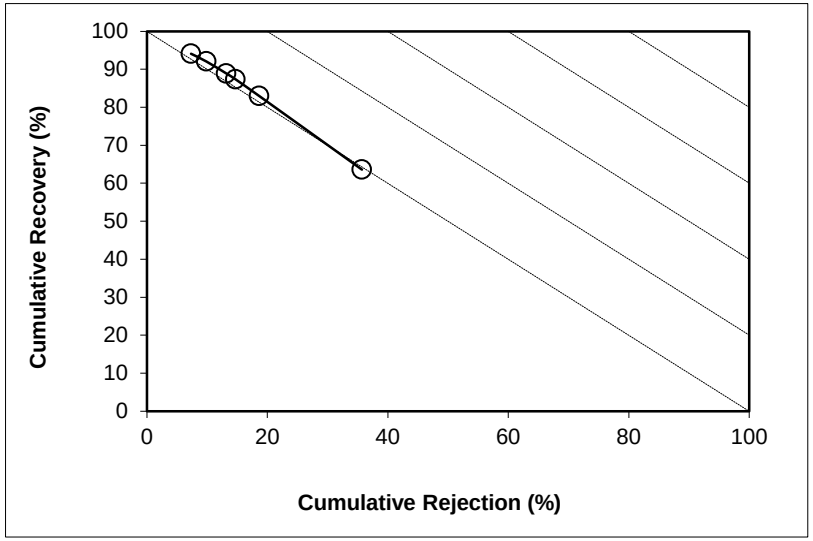
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 15.06

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	63.63	4.75	63.63	4.75	63.59	36.37	4.61	35.69	-0.72
P2	19.28	4.16	82.90	4.61	82.98	17.10	5.12	18.62	1.60
P3	4.39	4.23	87.29	4.60	87.39	12.71	5.43	14.68	2.06
P4	1.54	4.69	88.83	4.60	88.92	11.17	5.53	13.14	2.07
P5	3.14	4.93	91.97	4.61	92.06	8.03	5.77	9.85	1.91
P6	2.05	5.81	94.02	4.63	94.09	5.98	5.75	7.32	1.40
P7	5.98	5.75	100.00	4.70	100.00	0.00			
Total (Calc)	100.00	4.70	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

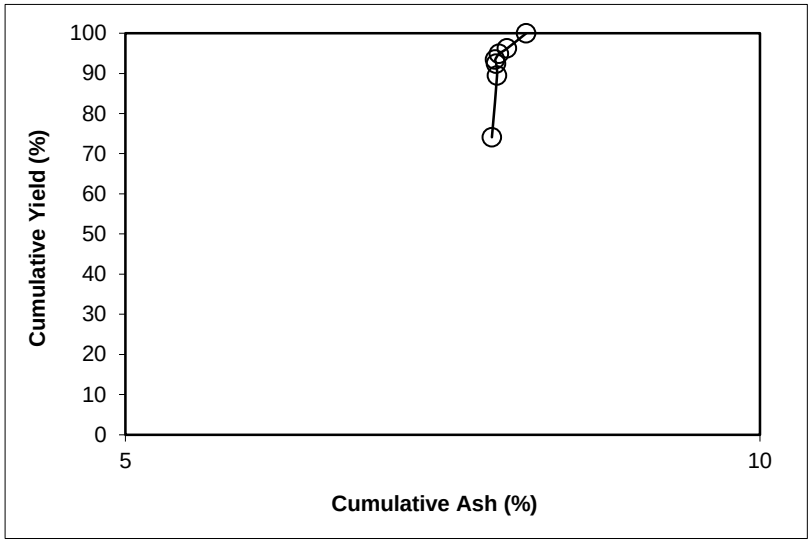
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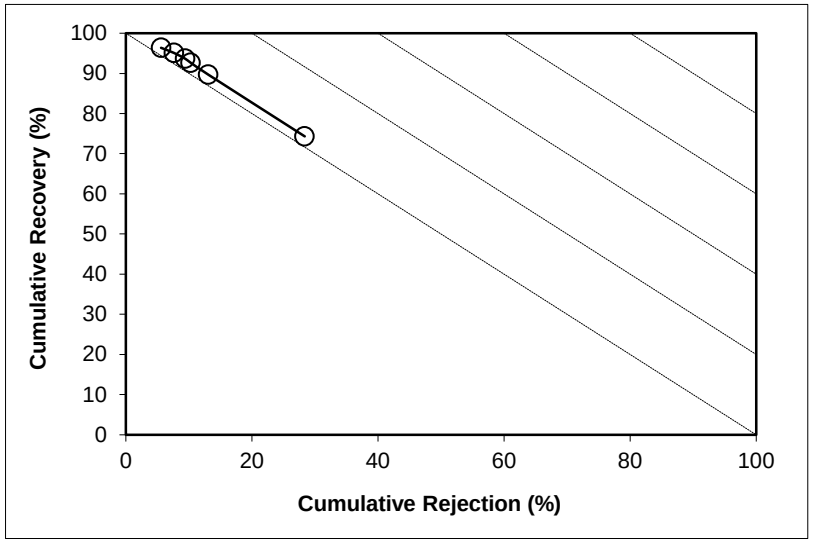
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 18.06

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	74.10	7.89	74.10	7.89	74.32	25.90	8.93	28.36	2.68
P2	15.35	8.12	89.45	7.93	89.67	10.55	10.11	13.08	2.75
P3	2.99	7.71	92.43	7.92	92.67	7.57	11.06	10.26	2.93
P4	0.96	7.22	93.39	7.91	93.64	6.61	11.61	9.41	3.05
P5	1.48	9.85	94.87	7.94	95.10	5.13	12.12	7.62	2.71
P6	1.34	12.47	96.21	8.01	96.37	3.79	12.00	5.57	1.94
P7	3.79	12.00	100.00	8.16	100.00	0.00			
Total (Calc)	100.00	8.16	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

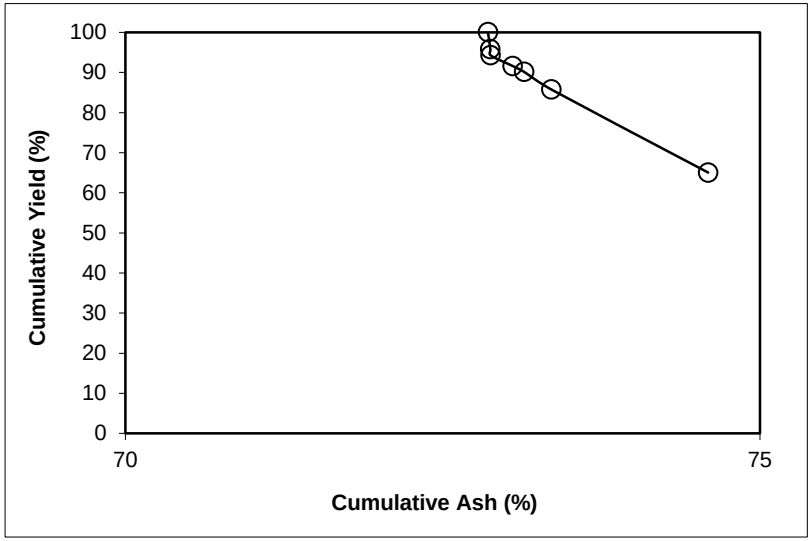
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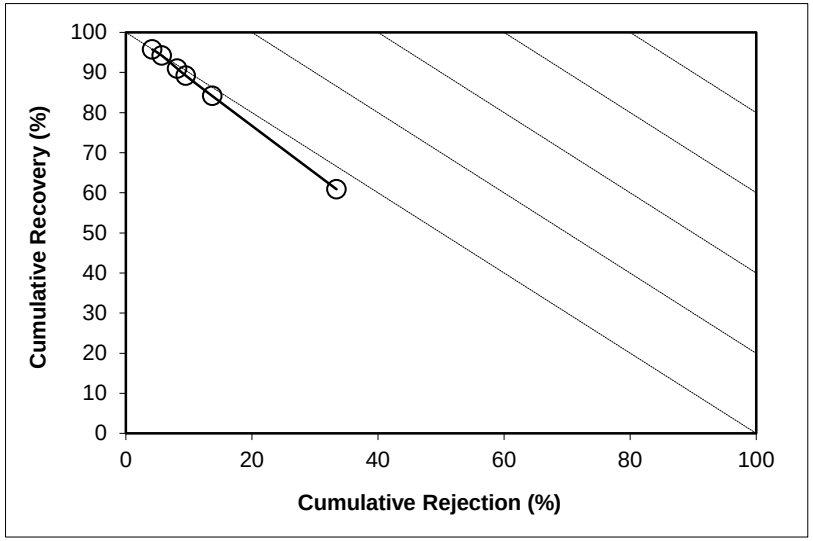
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: -325.00 Feed Weight (%): 64.75

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	65.04	74.59	65.04	74.59	60.89	34.96	69.63	33.41	-5.71
P2	20.67	69.48	85.71	73.36	84.13	14.29	69.85	13.70	-2.17
P3	4.42	68.95	90.13	73.14	89.19	9.87	70.25	9.51	-1.30
P4	1.47	67.49	91.61	73.05	90.95	8.39	70.73	8.15	-0.90
P5	2.66	66.89	94.27	72.88	94.19	5.73	72.51	5.71	-0.10
P6	1.52	72.75	95.79	72.88	95.72	4.21	72.42	4.19	-0.09
P7	4.21	72.42	100.00	72.86	100.00	0.00			
Total (Calc)	100.00	72.86	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

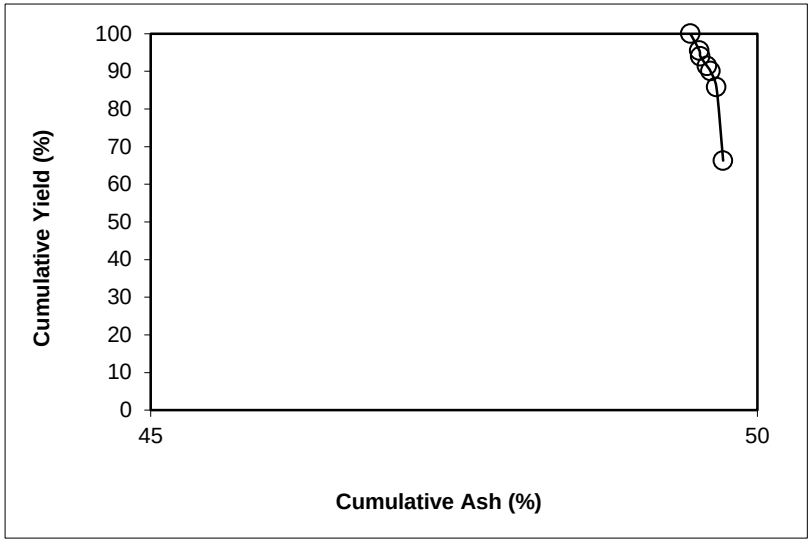
Description: Run 30 - Intermediate Spiral Test

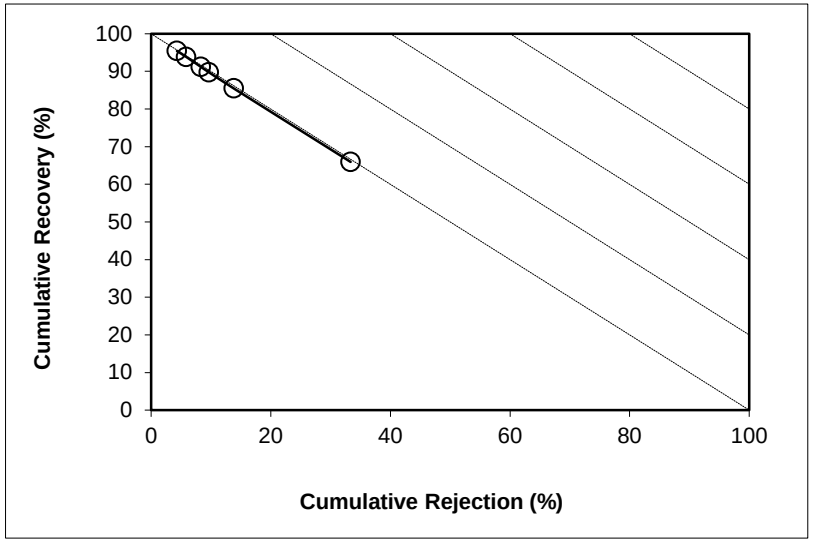
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	66.31	49.72	66.31	49.72	65.95	33.69	48.92	33.33	-0.72
P2	19.53	49.47	85.84	49.66	85.47	14.16	48.15	13.79	-0.74
P3	4.22	48.61	90.06	49.61	89.76	9.94	47.95	9.64	-0.60
P4	1.40	47.76	91.46	49.58	91.21	8.54	47.98	8.29	-0.50
P5	2.54	47.56	93.99	49.53	93.84	6.01	48.16	5.85	-0.31
P6	1.56	49.07	95.56	49.52	95.41	4.44	47.84	4.30	-0.29
P7	4.44	47.84	100.00	49.45	100.00	0.00			
Total (Calc)	100.00	49.45	--	--	--	--	--	--	--

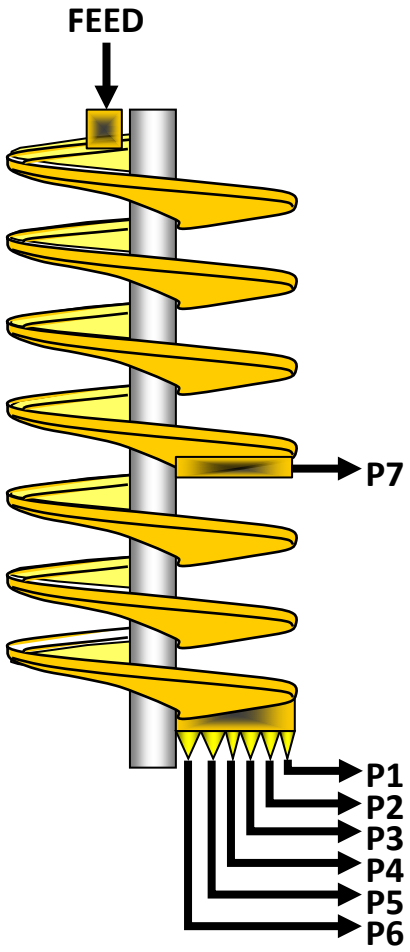




SPIRAL DATA ANALYSIS

Description: Run 31 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	0.823	16.1	17.13	19.02
P2	0.175	16.2	3.62	4.02
P3	0.038	16.6	0.76	0.85
P4	0.013	17.8	0.24	0.27
P5	0.023	18.7	0.40	0.45
P6	0.014	22.8	0.19	0.22
P7	0.040	21.6	0.58	0.67
Total	1.124	16.4	22.90	25.49

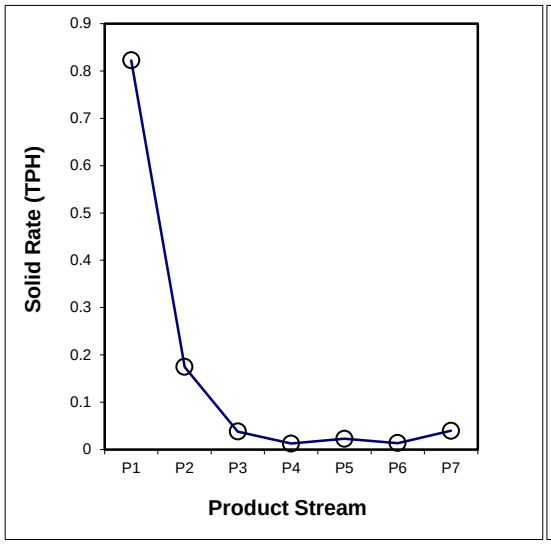
SPIRAL DATA ANALYSIS

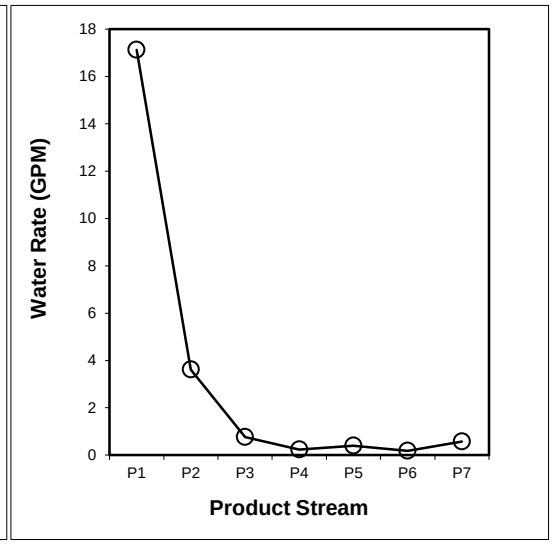
Description: Run 31 - Intermediate Spiral Test

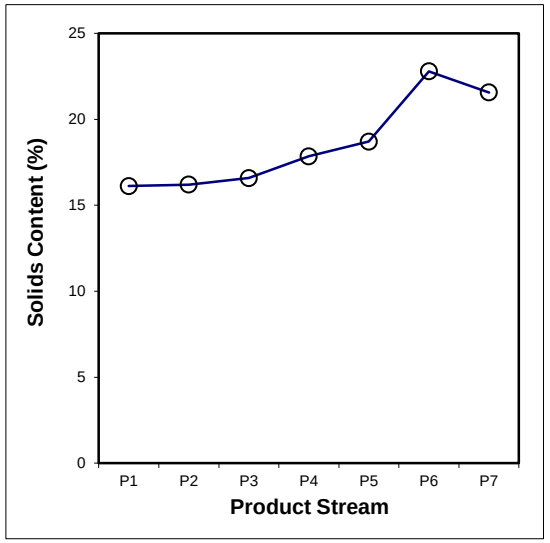
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	10	14126.00	1065.00	5.105	6646.1	4571.5	0.823	73.15	16.11
P2	10	2976.82	216.46	1.079	1597.9	1157.0	0.175	15.55	16.20
P3	20	1255.33	84.72	0.229	1098.4	907.1	0.038	3.37	16.58
P4	40	827.47	94.19	0.072	1253.0	1124.0	0.013	1.14	17.85
P5	30	1031.14	92.49	0.122	1253.1	1080.0	0.023	2.03	18.70
P6	50	867.54	95.61	0.060	1330.6	1157.1	0.014	1.22	22.79
P7	20	1035.53	93.52	0.184	1373.8	1173.5	0.040	3.53	21.56
Total (Calc)	--	--	--	6.851	--	--	1.124	100.00	16.41
Total (Head)	1.12	2154.96	214.52	6.851	1398.4	1079.9	1.124	--	16.41







SPIRAL DATA ANALYSIS

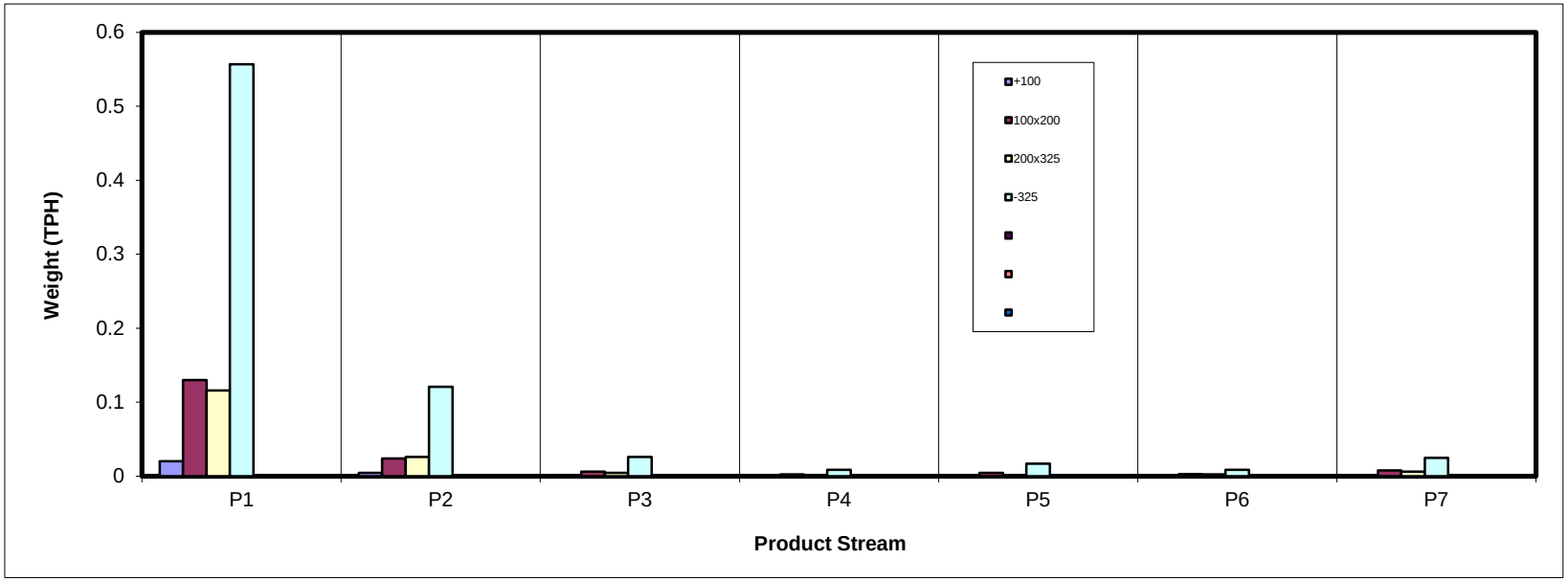
Description: Run 31 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	0.020	0.004	0.001	0.000	0.001	0.000	0.001		0.028
100x200	0.130	0.024	0.006	0.002	0.004	0.003	0.008		0.176
200x325	0.116	0.026	0.005	0.002	0.001	0.002	0.006		0.158
-325	0.557	0.121	0.026	0.009	0.017	0.009	0.025		0.762
Total (Calc)	0.823	0.175	0.038	0.013	0.023	0.014	0.040		1.124



SPIRAL DATA ANALYSIS

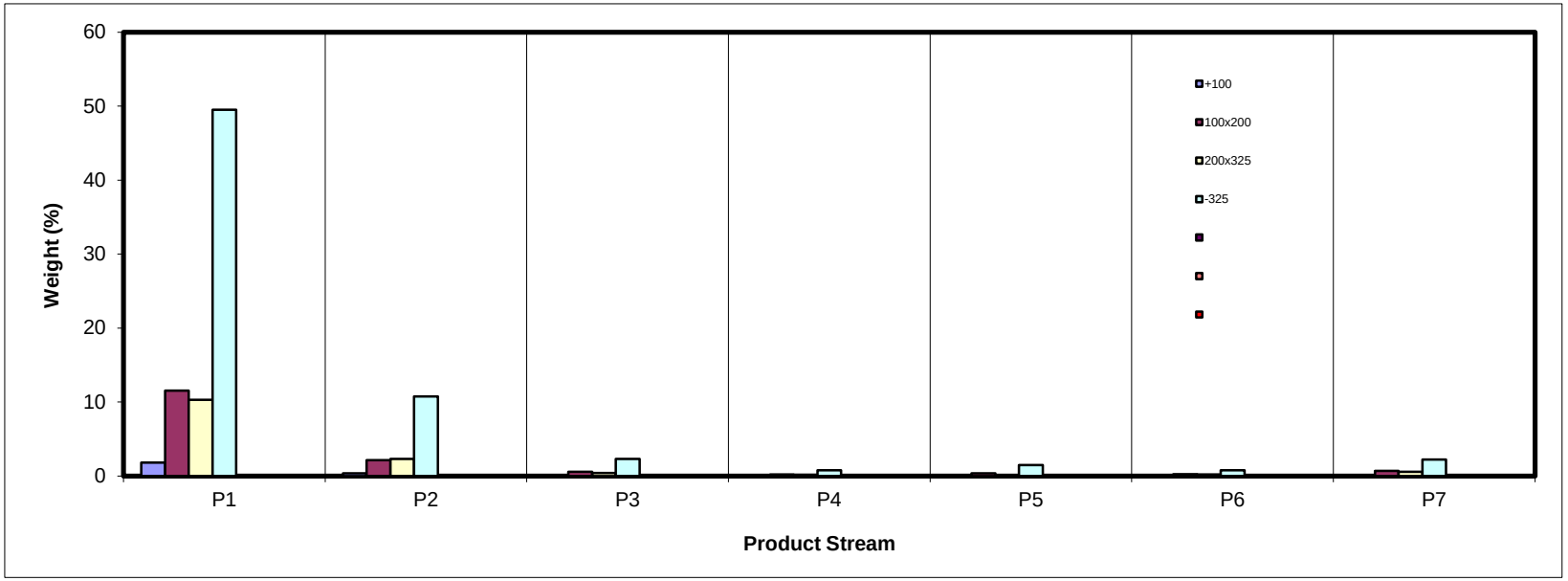
Description: Run 31 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	1.79	0.37	0.13	0.03	0.06	0.02	0.11		2.50
100x200	11.55	2.13	0.54	0.19	0.38	0.22	0.67		15.69
200x325	10.31	2.30	0.40	0.14	0.12	0.20	0.55		14.03
-325	49.51	10.74	2.30	0.77	1.48	0.78	2.20		67.78
Total (Calc)	73.15	15.55	3.37	1.14	2.03	1.22	3.53		100.00



SPIRAL DATA ANALYSIS

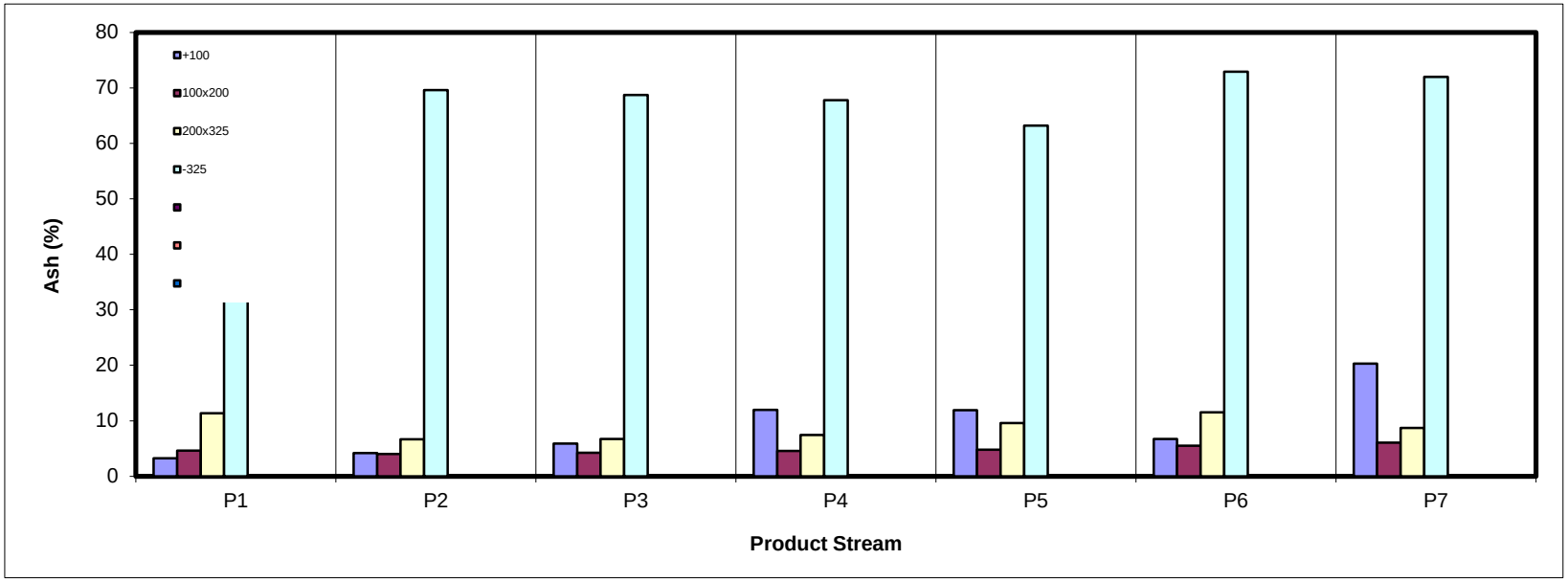
Description: Run 31 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	3.25	4.18	5.90	11.97	11.89	6.72	20.32		4.59
100x200	4.65	4.00	4.26	4.56	4.81	5.52	6.09		4.63
200x325	11.37	6.65	6.73	7.42	9.61	11.55	8.73		10.30
-325	69.27	69.57	68.72	67.76	63.20	72.90	71.98		69.28
Total (Calc)	49.30	49.71	48.59	47.75	47.89	49.30	48.04		49.24



SPIRAL DATA ANALYSIS

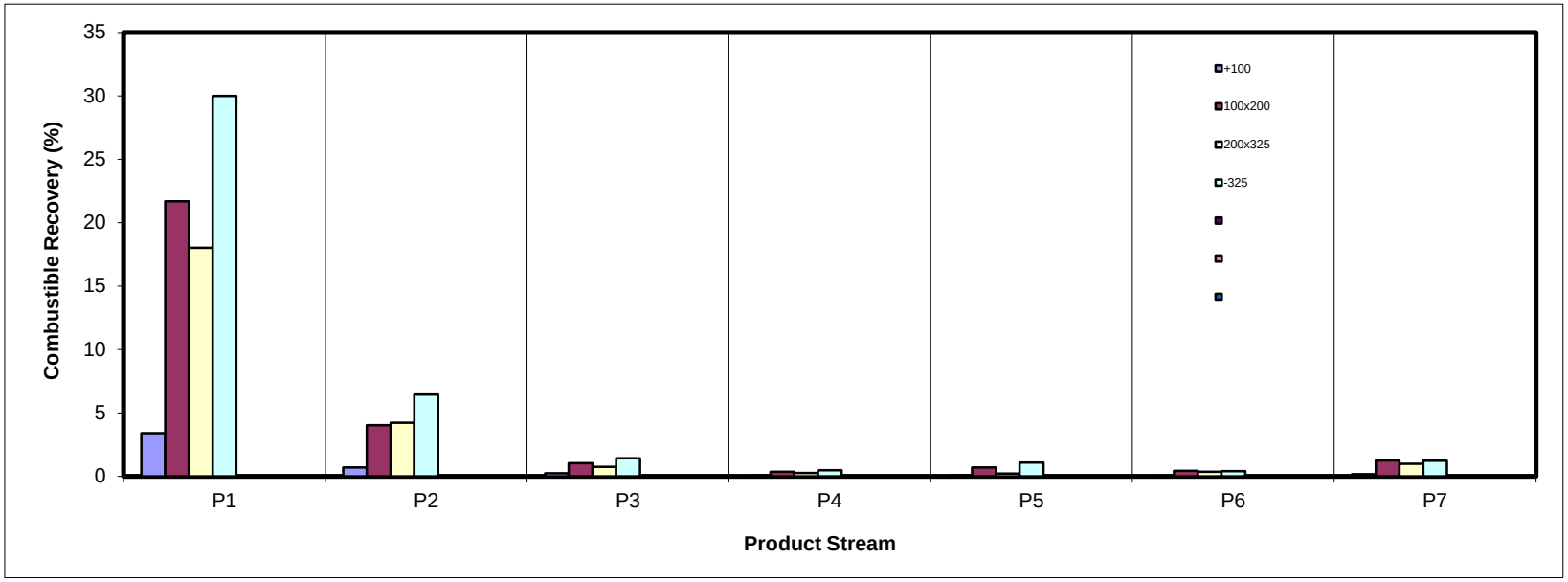
Description: Run 31 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	3.41	0.70	0.23	0.06	0.10	0.03	0.17		4.70
100x200	21.69	4.03	1.03	0.36	0.71	0.42	1.24		29.48
200x325	18.01	4.23	0.74	0.26	0.21	0.35	0.99		24.79
-325	29.98	6.44	1.42	0.49	1.08	0.41	1.22		41.03
Total (Calc)	73.08	15.41	3.42	1.17	2.09	1.22	3.61		100.00



SPIRAL DATA ANALYSIS

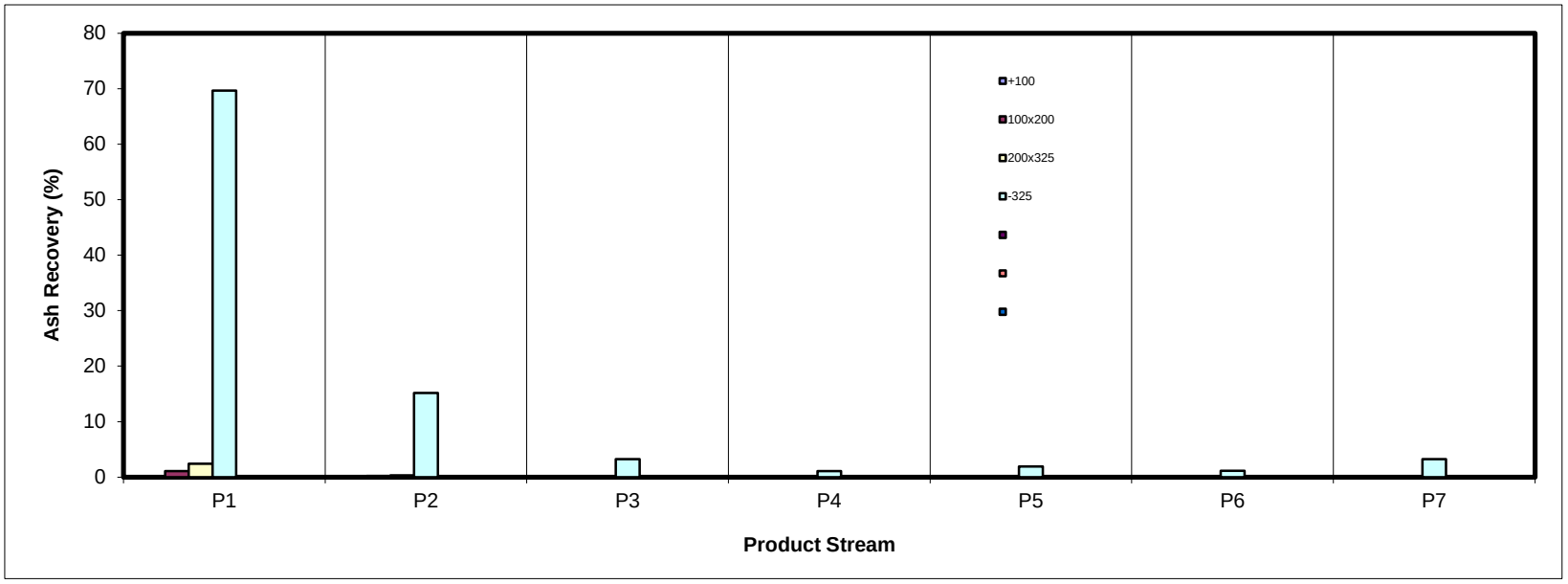
Description: Run 31 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	0.12	0.03	0.02	0.01	0.01	0.00	0.04		0.23
100x200	1.09	0.17	0.05	0.02	0.04	0.03	0.08		1.47
200x325	2.38	0.31	0.06	0.02	0.02	0.05	0.10		2.93
-325	69.64	15.18	3.21	1.05	1.90	1.15	3.22		95.36
Total (Calc)	73.23	15.69	3.33	1.10	1.98	1.22	3.45		100.00



SPIRAL DATA ANALYSIS

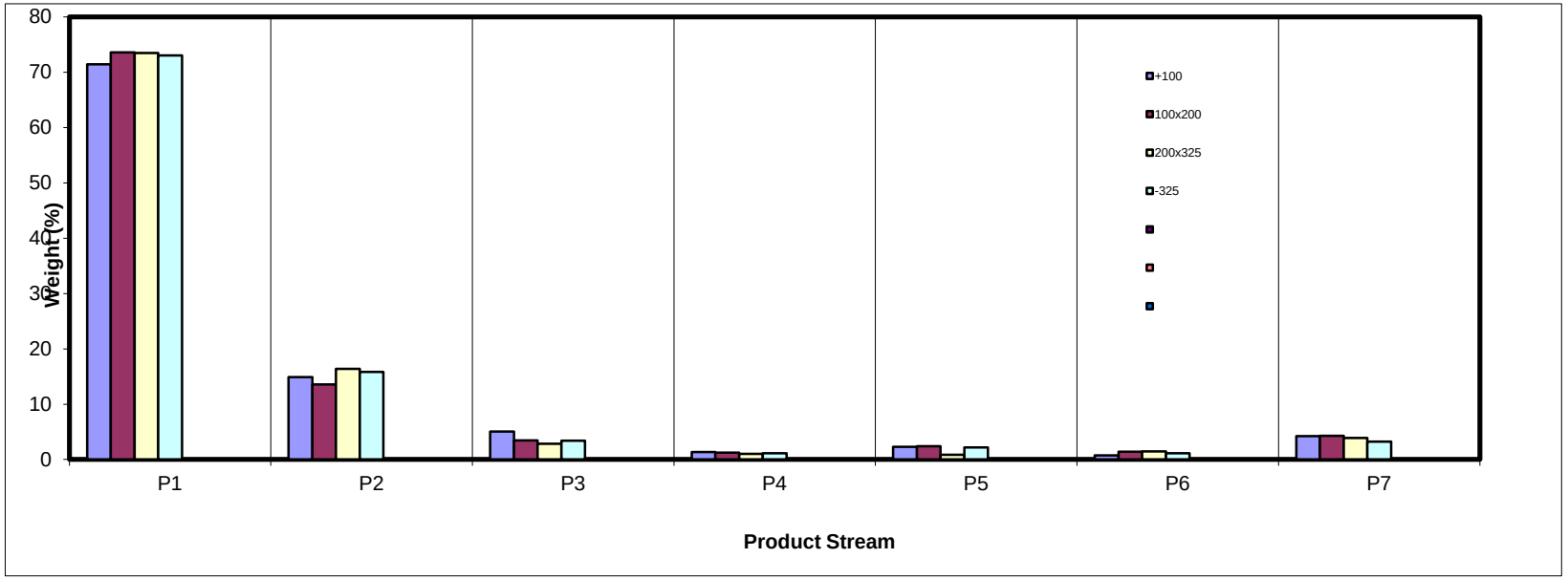
Description: Run 31 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	71.46	14.87	5.05	1.38	2.28	0.76	4.21		100.00
100x200	73.59	13.59	3.47	1.23	2.40	1.43	4.29		100.00
200x325	73.51	16.39	2.87	1.02	0.83	1.45	3.92		100.00
-325	73.04	15.85	3.40	1.13	2.19	1.15	3.25		100.00
Total (Calc)	73.15	15.55	3.37	1.14	2.03	1.22	3.53		100.00



SPIRAL DATA ANALYSIS

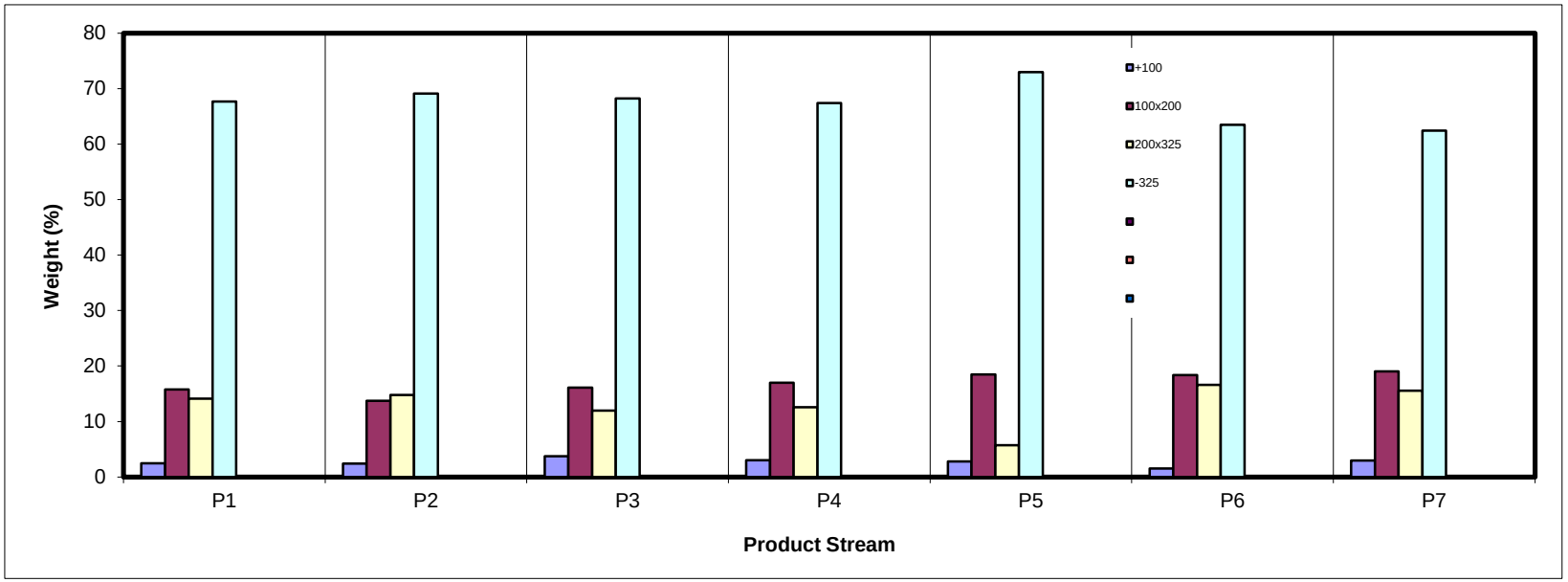
Description: Run 31 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+100	2.44	2.39	3.74	3.03	2.80	1.55	2.98		2.50
100x200	15.78	13.72	16.11	16.97	18.48	18.37	19.05		15.69
200x325	14.09	14.79	11.93	12.59	5.75	16.61	15.56		14.03
-325	67.68	69.10	68.21	67.41	72.97	63.47	62.41		67.78
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

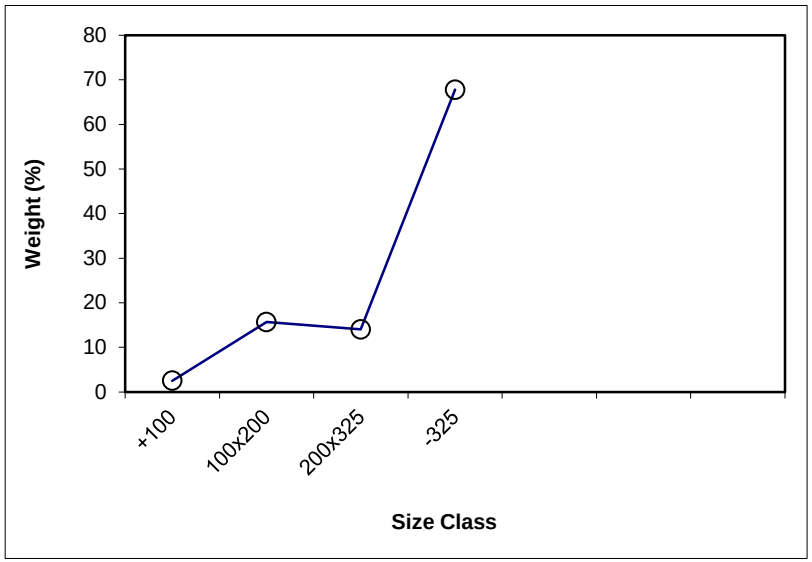
Description: Run 31 - Intermediate Spiral Test

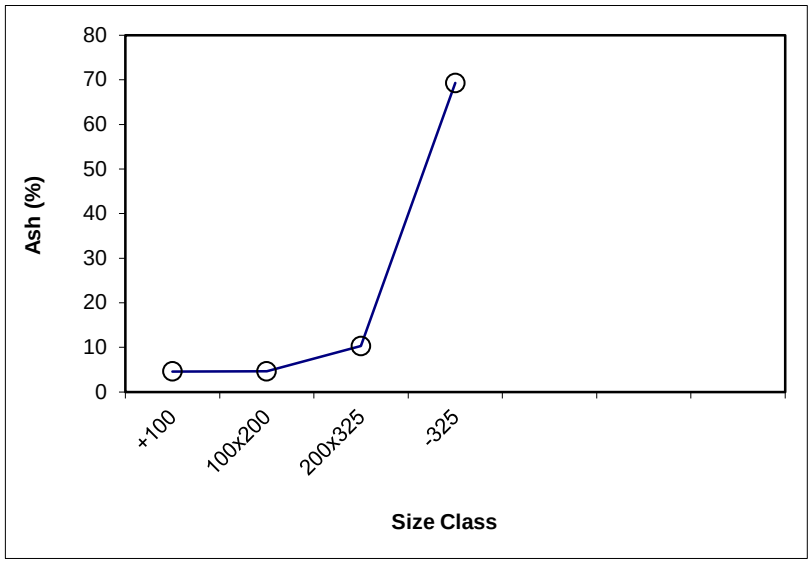
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	401.0	393.0	7.97	2.50	4.59	2.50	4.59	100.00	49.24
100x200	399.6	349.6	49.96	15.69	4.63	18.19	4.62	97.50	50.39
200x325	375.6	331.0	44.67	14.03	10.30	32.22	7.09	81.81	59.17
-325	222.2	6.3	215.88	67.78	69.28	100.00	49.24	67.78	69.28
Total (Calc)	--	--	318.48	100.00	49.24	--	--	--	--





SPIRAL DATA ANALYSIS

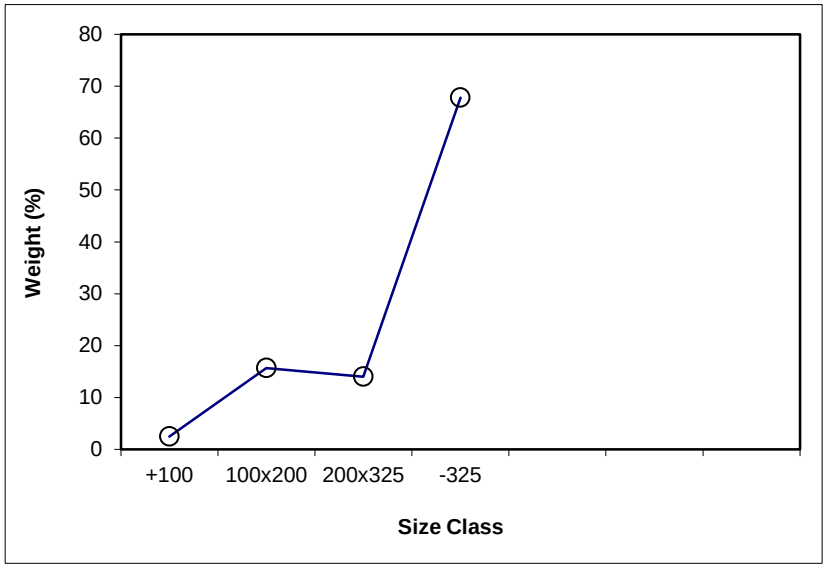
Description: Run 31 - Intermediate Spiral Test

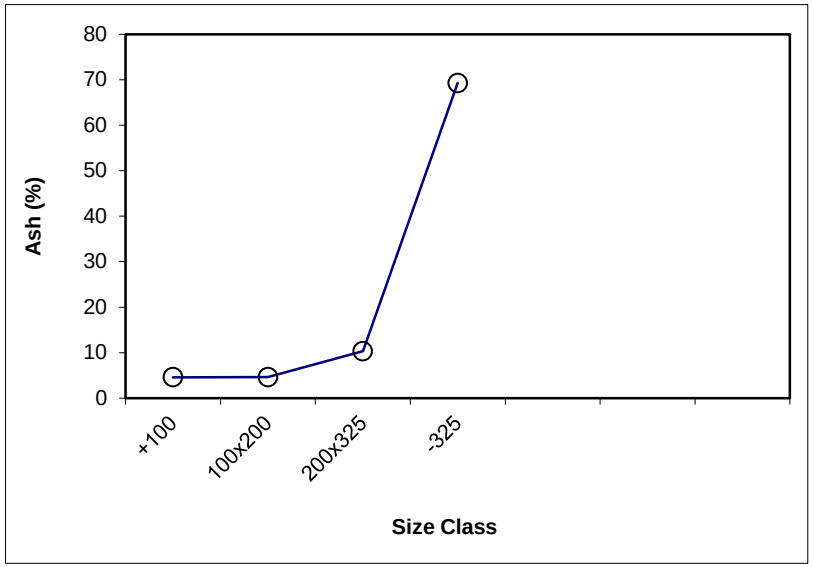
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+100	2.50	4.59	2.50	4.59	100.00	49.24			
100x200	15.69	4.63	18.19	4.62	97.50	50.39	x	15.69	4.63
200x325	14.03	10.30	32.22	7.09	81.81	59.17	x	14.03	10.30
-325	67.78	69.28	100.00	49.24	67.78	69.28			
Total (Calc)	100.00	49.24	--	--	--	--	--	29.71	7.31





SPIRAL DATA ANALYSIS

Description: Run 31 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 73.15

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	805.34	754.7	50.69	2.44	3.25	2.44	3.25	100.00	49.30
100x200	1052.19	724.8	327.42	15.78	4.65	18.23	4.46	97.56	50.45
200x325	1082.09	789.7	292.40	14.09	11.37	32.32	7.47	81.77	59.29
-325	3706.47	2302.4	1404.04	67.68	69.27	100.00	49.30	67.68	69.27
Total (Calc)	--	--	2074.55	100.00	49.30	--	--	--	--

Product P2 Feed Weight (%): 15.55

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	398.2	387.7	10.55	2.39	4.18	2.39	4.18	100.00	49.71
100x200	437.3	376.8	60.48	13.72	4.00	16.11	4.03	97.61	50.82
200x325	451.5	386.3	65.21	14.79	6.65	30.90	5.28	83.89	58.48
-325	310.9	6.3	304.64	69.10	69.57	100.00	49.71	69.10	69.57
Total (Calc)	--	--	440.88	100.00	49.71	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 31 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 3.37

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	315.3	308.1	7.16	3.74	5.90	3.74	5.90	100.00	48.59
100x200	325.3	294.5	30.84	16.11	4.26	19.85	4.57	96.26	50.24
200x325	320.8	298.0	22.84	11.93	6.73	31.79	5.38	80.15	59.49
-325	137.0	6.5	130.54	68.21	68.72	100.00	48.59	68.21	68.72
Total (Calc)	--	--	191.38	100.00	48.59	--	--	--	--

Product P4 Feed Weight (%): 1.14

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	370.9	367.0	3.91	3.03	11.97	3.03	11.97	100.00	47.75
100x200	369.3	347.4	21.90	16.97	4.56	20.01	5.68	96.97	48.86
200x325	419.5	403.2	16.24	12.59	7.42	32.59	6.35	79.99	58.27
-325	93.3	6.4	86.96	67.41	67.76	100.00	47.75	67.41	67.76
Total (Calc)	--	--	129.00	100.00	47.75	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 31 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 2.03

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	397.9	393.0	4.85	2.80	11.89	2.80	11.89	100.00	47.89
100x200	381.6	349.6	31.99	18.48	4.81	21.29	5.75	97.20	48.93
200x325	340.9	331.0	9.94	5.75	9.61	27.03	6.57	78.71	59.29
-325	132.6	6.4	126.28	72.97	63.20	100.00	47.89	72.97	63.20
Total (Calc)	--	--	173.06	100.00	47.89	--	--	--	--

Product P6 Feed Weight (%): 1.22

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	390.4	387.7	2.68	1.55	6.72	1.55	6.72	100.00	49.30
100x200	408.7	376.8	31.86	18.37	5.52	19.91	5.61	98.45	49.97
200x325	415.1	386.3	28.82	16.61	11.55	36.53	8.31	80.09	60.17
-325	116.4	6.4	110.10	63.47	72.90	100.00	49.30	63.47	72.90
Total (Calc)	--	--	173.46	100.00	49.30	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 31 - Intermediate Spiral Test

Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 3.53

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+100	403.2	397.2	5.97	2.98	20.32	2.98	20.32	100.00	48.04
100x200	429.5	391.3	38.15	19.05	6.09	22.03	8.01	97.02	48.89
200x325	409.8	378.6	31.17	15.56	8.73	37.59	8.31	77.97	59.35
-325	131.3	6.3	125.00	62.41	71.98	100.00	48.04	62.41	71.98
Total (Calc)	--	--	200.29	100.00	48.04	--	--	--	--

SPIRAL DATA ANALYSIS

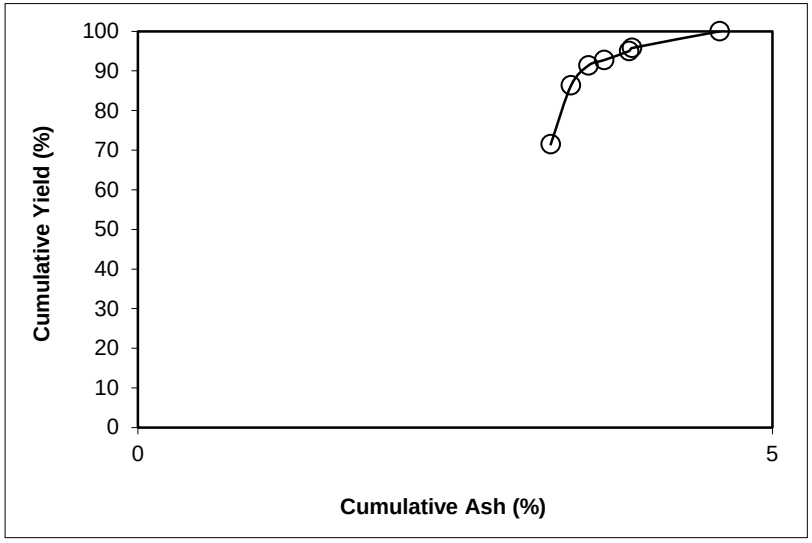
Description: Run 31 - Intermediate Spiral Test

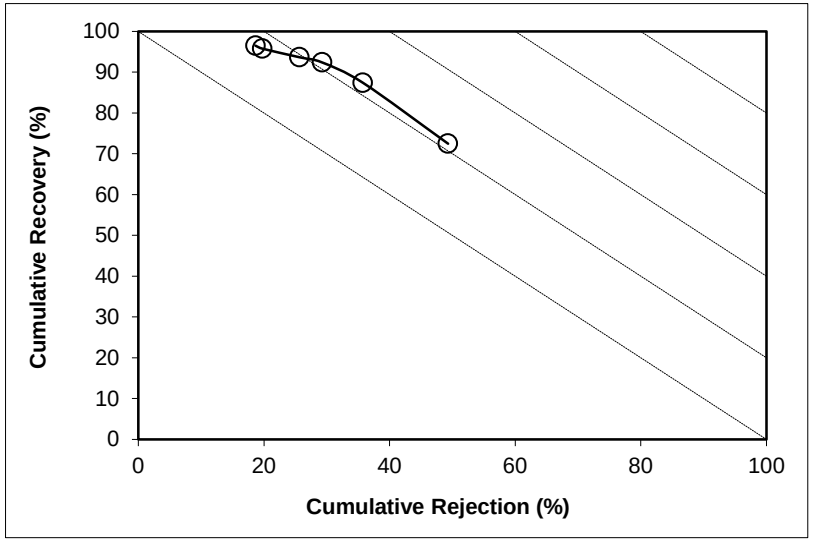
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: +100 Feed Weight (%): 2.50

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	71.46	3.25	71.46	3.25	72.46	28.54	7.92	49.31	21.77
P2	14.87	4.18	86.33	3.41	87.40	13.67	12.00	35.74	23.14
P3	5.05	5.90	91.38	3.55	92.37	8.62	15.56	29.25	21.63
P4	1.38	11.97	92.76	3.68	93.65	7.24	16.25	25.65	19.30
P5	2.28	11.89	95.04	3.87	95.75	4.96	18.25	19.75	15.49
P6	0.76	6.72	95.79	3.90	96.49	4.21	20.32	18.64	15.13
P7	4.21	20.32	100.00	4.59	100.00	0.00			
Total (Calc)	100.00	4.59	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

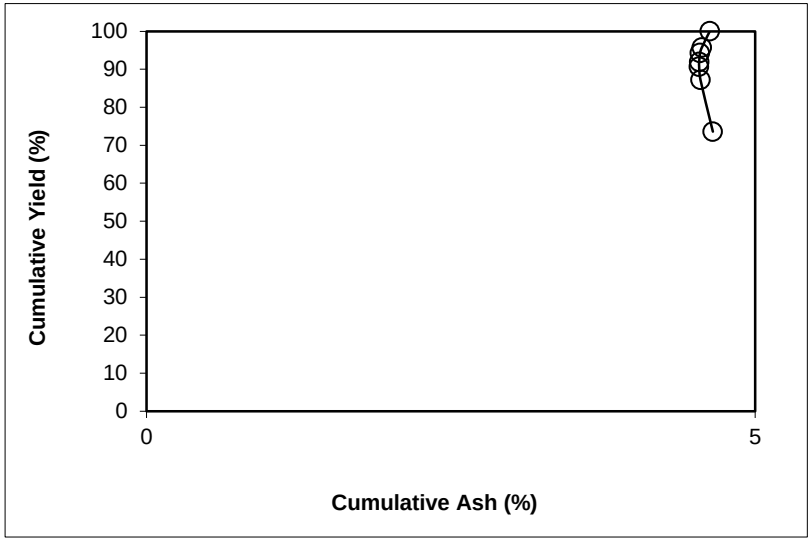
Description: Run 31 - Intermediate Spiral Test

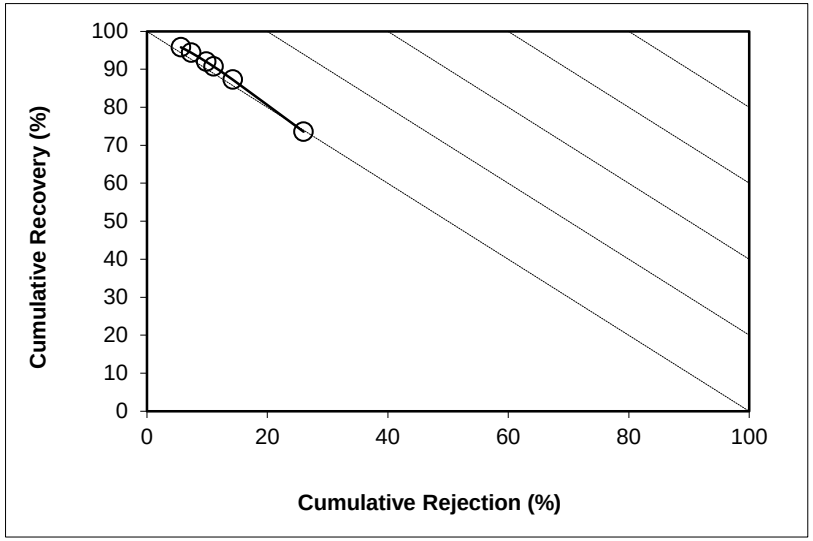
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 15.69

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	73.59	4.65	73.59	4.65	73.57	26.41	4.55	26.00	-0.43
P2	13.59	4.00	87.19	4.55	87.26	12.81	5.14	14.25	1.51
P3	3.47	4.26	90.65	4.54	90.74	9.35	5.47	11.05	1.79
P4	1.23	4.56	91.88	4.54	91.97	8.12	5.61	9.84	1.81
P5	2.40	4.81	94.28	4.55	94.36	5.72	5.94	7.35	1.71
P6	1.43	5.52	95.71	4.56	95.78	4.29	6.09	5.64	1.42
P7	4.29	6.09	100.00	4.63	100.00	0.00			
Total (Calc)	100.00	4.63	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

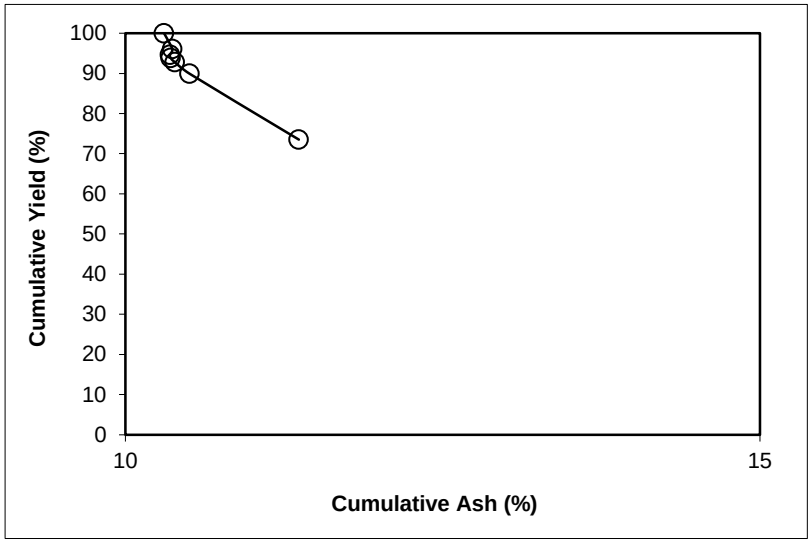
Description: Run 31 - Intermediate Spiral Test

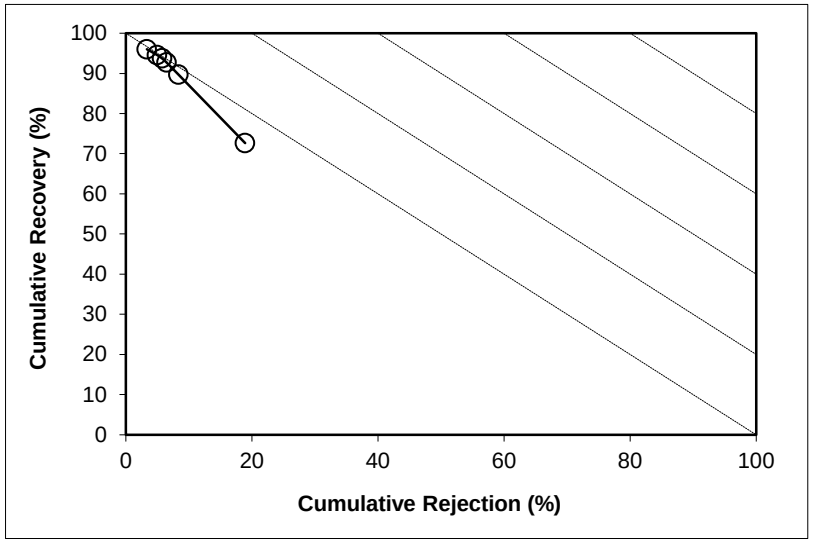
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 14.03

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	73.51	11.37	73.51	11.37	72.64	26.49	7.36	18.91	-8.45
P2	16.39	6.65	89.91	10.51	89.71	10.09	8.51	8.33	-1.96
P3	2.87	6.73	92.78	10.39	92.69	7.22	9.21	6.46	-0.85
P4	1.02	7.42	93.80	10.36	93.74	6.20	9.51	5.72	-0.53
P5	0.83	9.61	94.63	10.35	94.58	5.37	9.49	4.94	-0.47
P6	1.45	11.55	96.08	10.37	96.01	3.92	8.73	3.32	-0.67
P7	3.92	8.73	100.00	10.30	100.00	0.00			
Total (Calc)	100.00	10.30	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

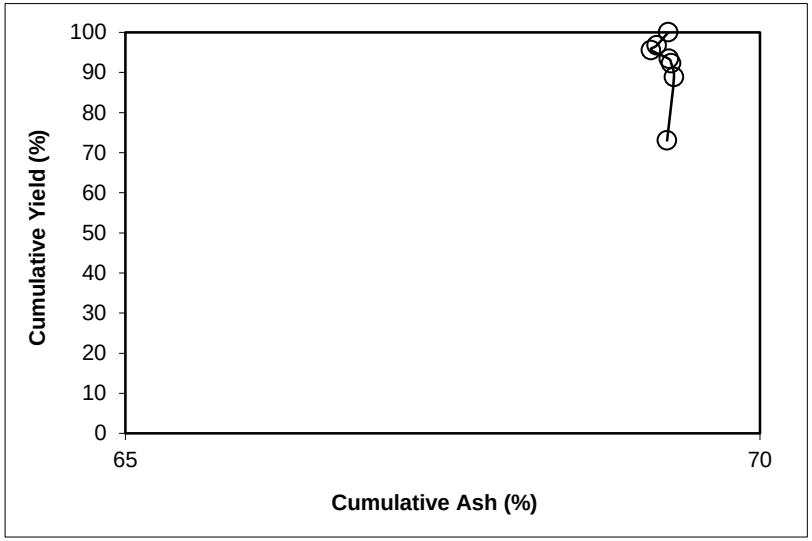
Description: Run 31 - Intermediate Spiral Test

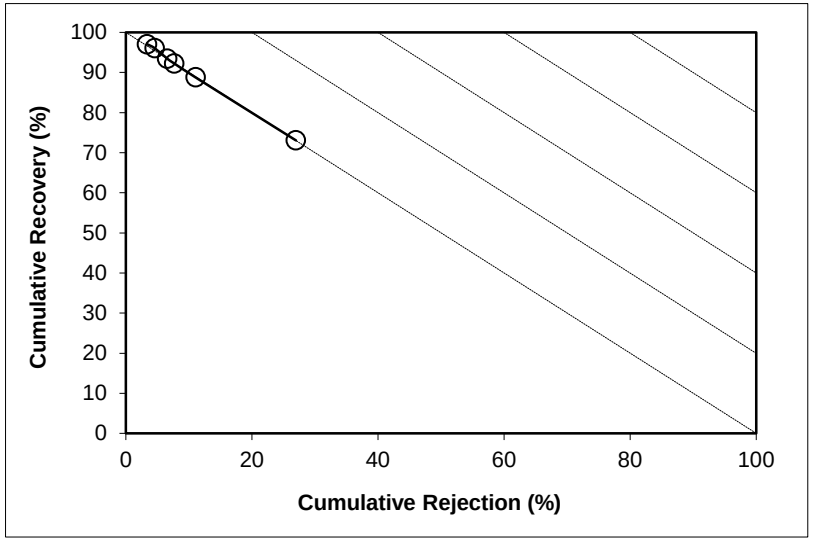
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: -325.00 Feed Weight (%): 67.78

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	73.04	69.27	73.04	69.27	73.06	26.96	69.30	26.97	0.03
P2	15.85	69.57	88.89	69.32	88.76	11.11	68.92	11.06	-0.19
P3	3.40	68.72	92.28	69.30	92.21	7.72	69.00	7.69	-0.10
P4	1.13	67.76	93.41	69.28	93.40	6.59	69.22	6.58	-0.02
P5	2.19	63.20	95.60	69.14	96.02	4.40	72.22	4.58	0.61
P6	1.15	72.90	96.75	69.19	97.03	3.25	71.98	3.38	0.41
P7	3.25	71.98	100.00	69.28	100.00	0.00			
Total (Calc)	100.00	69.28	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

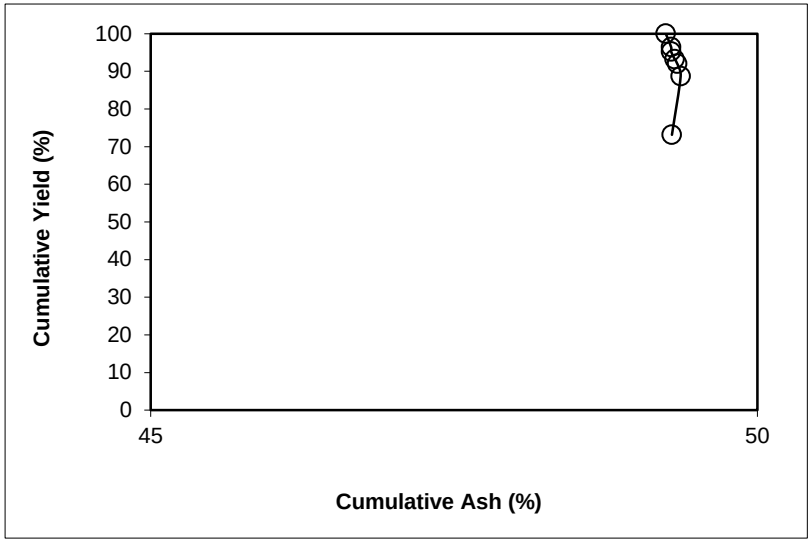
Description: Run 31 - Intermediate Spiral Test

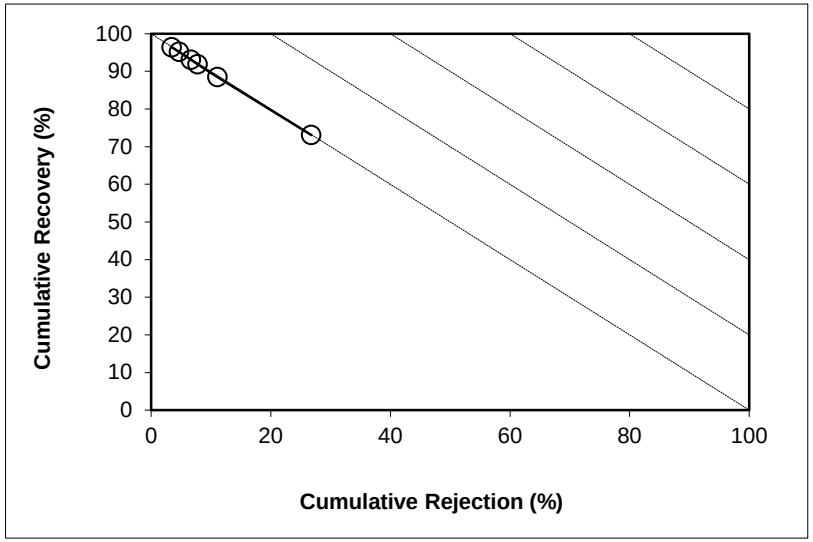
Comments: 0.15 x 0.044 mm Nominal Particle Size (Cyclone U/F)

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	73.15	49.30	73.15	49.30	73.08	26.85	49.11	26.77	-0.15
P2	15.55	49.71	88.70	49.37	88.49	11.30	48.28	11.08	-0.43
P3	3.37	48.59	92.07	49.34	91.90	7.93	48.16	7.75	-0.35
P4	1.14	47.75	93.21	49.32	93.07	6.79	48.23	6.65	-0.28
P5	2.03	47.89	95.25	49.29	95.16	4.75	48.37	4.67	-0.17
P6	1.22	49.30	96.47	49.29	96.39	3.53	48.04	3.45	-0.17
P7	3.53	48.04	100.00	49.24	100.00	0.00			
Total (Calc)	100.00	49.24	--	--	--	--	--	--	--



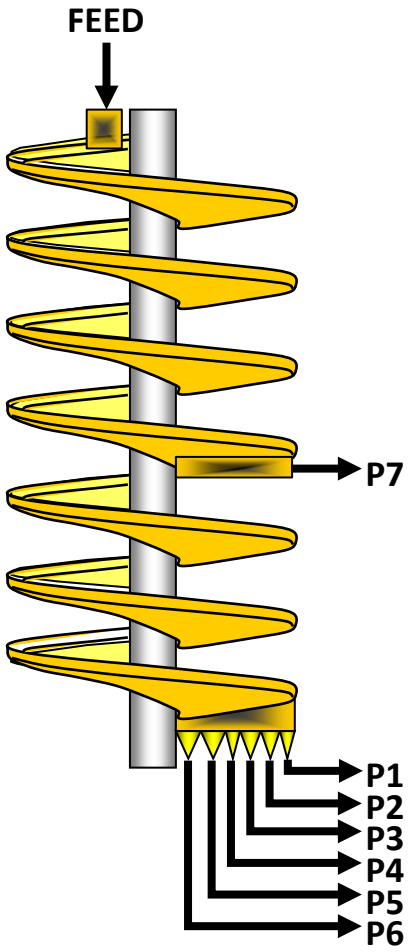


APPENDIX C – Spiral Circuit Results (Coarse Coal Feed Stock, 3.36 x 1 mm)

SPIRAL DATA ANALYSIS

Description: Run 14 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	1.733	24.2	21.69	26.90
P2	0.440	32.7	3.63	4.91
P3	0.155	31.6	1.34	1.74
P4	0.070	37.1	0.47	0.62
P5	0.066	29.2	0.64	0.78
P6	0.001	1.5	0.22	0.22
P7	0.232	43.1	1.22	1.65
Total	2.696	27.0	29.21	36.83

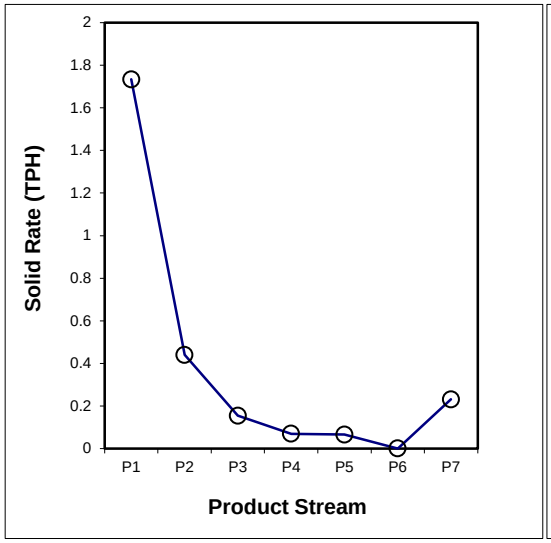
SPIRAL DATA ANALYSIS

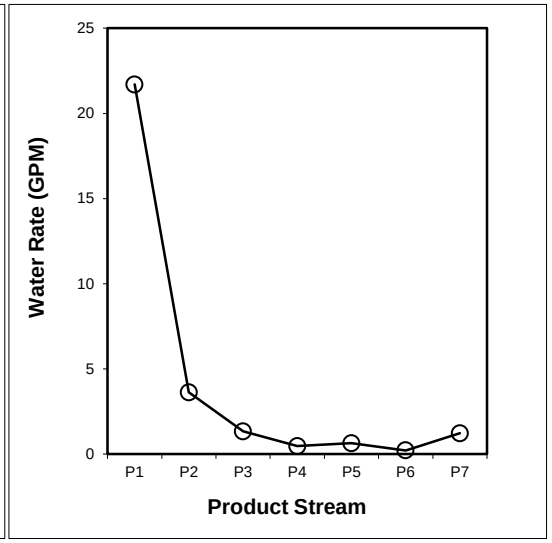
Description: Run 14 - Intermediate Spiral Test

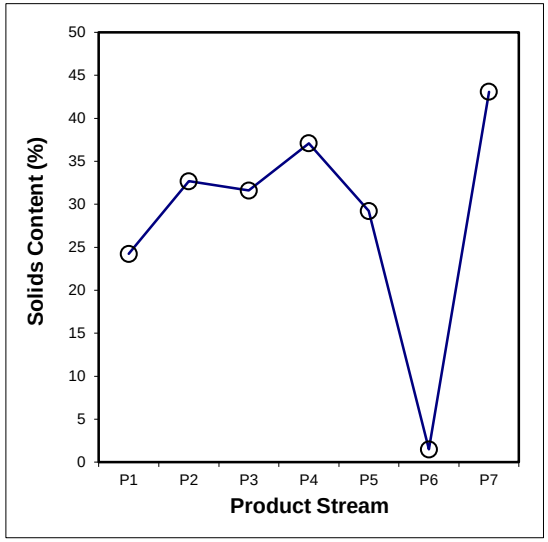
Comments: 3.36 x 1.0 mm Nominal Particle Size

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	3	6687.00	1187.00	7.156	2597.0	1285.4	1.733	64.29	24.22
P2	3	1127.14	94.32	1.347	1683.4	1350.2	0.440	16.33	32.67
P3	10	1348.82	99.94	0.489	1675.5	1285.5	0.155	5.73	31.60
P4	10	657.02	178.95	0.187	1460.9	1285.5	0.070	2.58	37.10
P5	10	670.77	94.01	0.226	2146.6	1980.2	0.066	2.45	29.21
P6	60	923.87	84.87	0.055	1362.5	1350.2	0.001	0.03	1.49
P7	5	774.61	95.57	0.537	2428.2	2136.3	0.232	8.59	43.08
Total (Calc)	--	--	--	9.998	--	--	2.696	100.00	26.97
Total (Head)	0.48	1447.6	229.18	9.998	1614.0	1285.4	2.696	--	26.97







SPIRAL DATA ANALYSIS

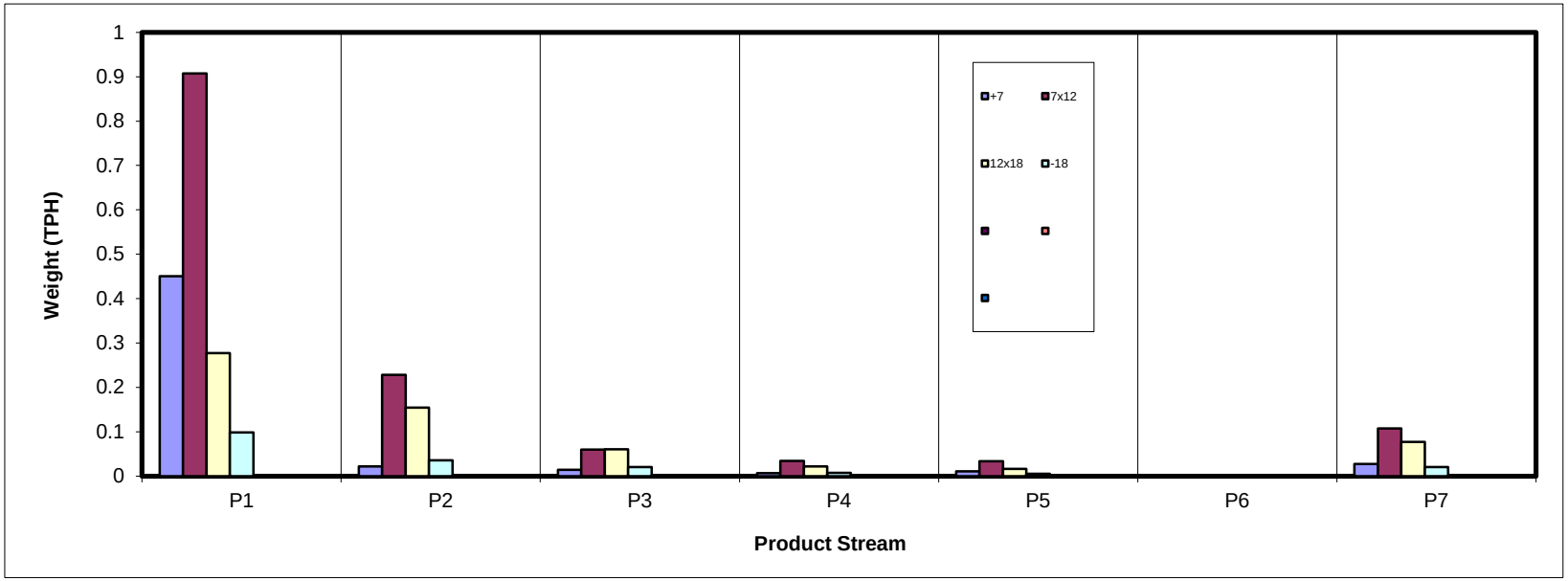
Description: Run 14 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	0.451	0.022	0.014	0.006	0.011	0.000	0.027		0.531
7x12	0.908	0.228	0.060	0.034	0.033	0.000	0.107		1.371
12x18	0.277	0.155	0.060	0.022	0.017	0.000	0.077		0.607
-18	0.098	0.035	0.020	0.007	0.005	0.001	0.020		0.187
Total (Calc)	1.733	0.440	0.155	0.070	0.066	0.001	0.232		2.696



SPIRAL DATA ANALYSIS

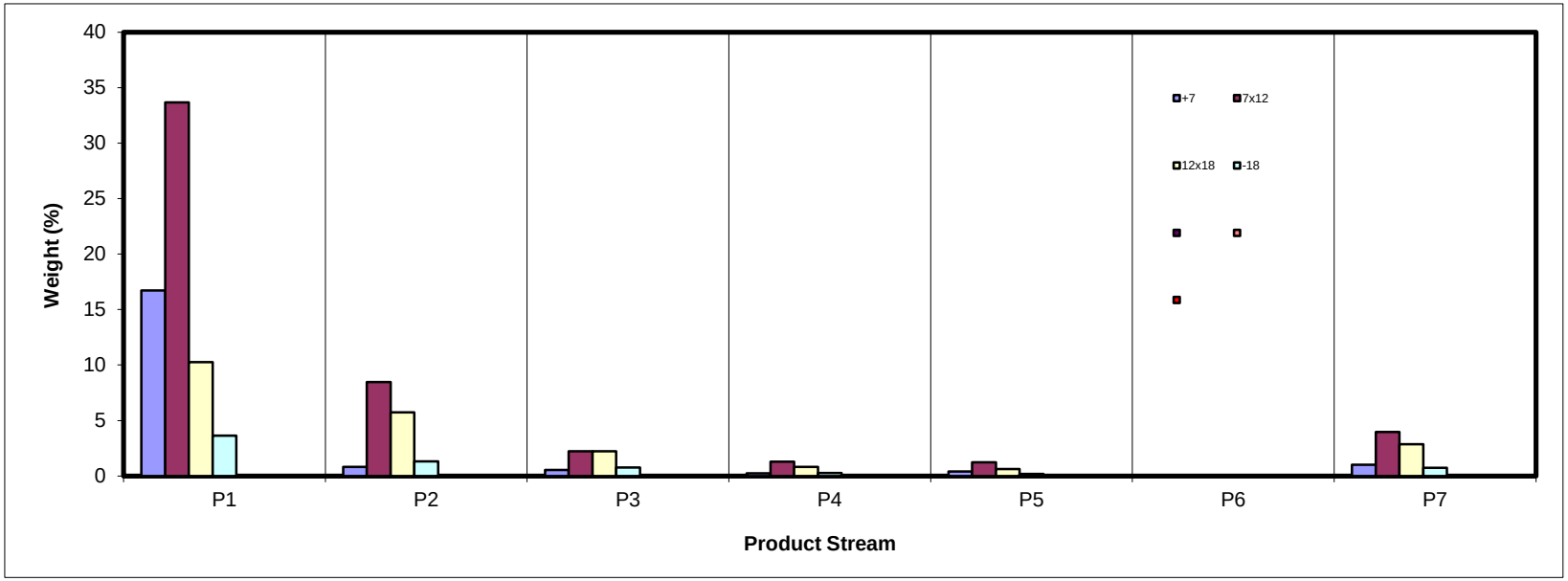
Description: Run 14 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	16.71	0.81	0.53	0.24	0.40	0.00	1.02		19.71
7x12	33.67	8.47	2.22	1.27	1.24	0.00	3.97		50.85
12x18	10.27	5.74	2.24	0.80	0.61	0.00	2.85		22.51
-18	3.64	1.31	0.75	0.26	0.19	0.02	0.75		6.93
Total (Calc)	64.29	16.33	5.73	2.58	2.45	0.03	8.59		100.00



SPIRAL DATA ANALYSIS

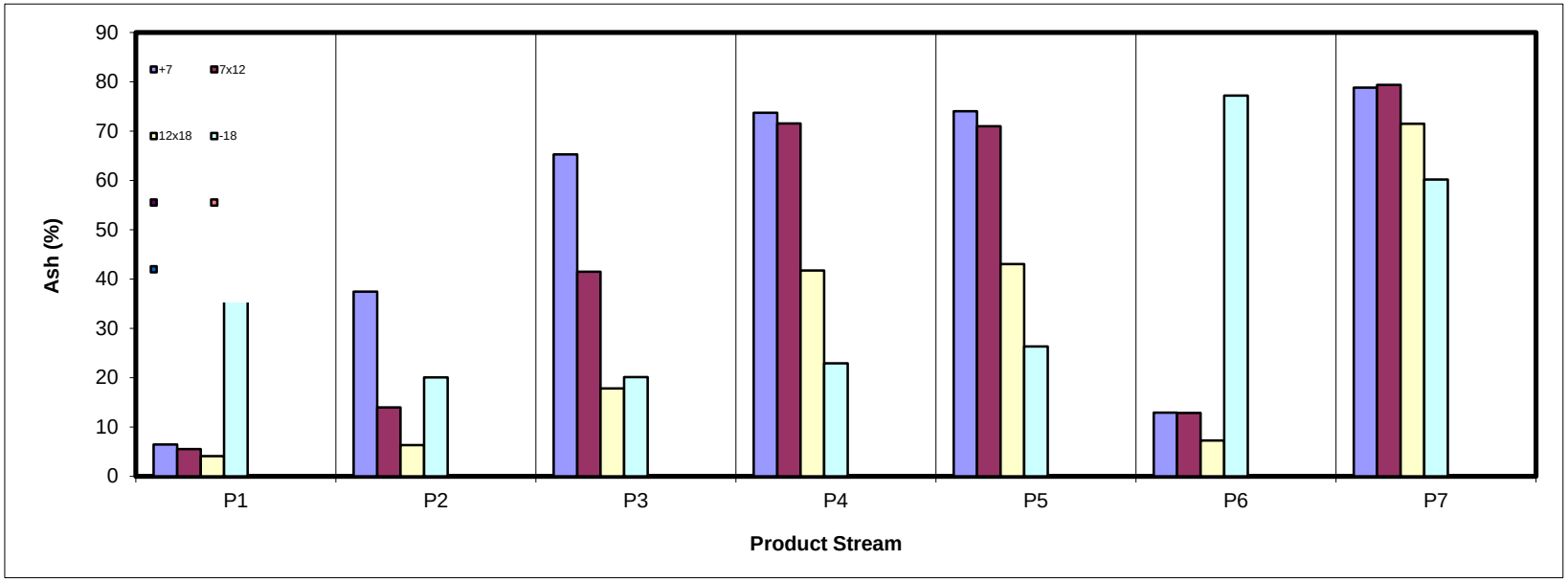
Description: Run 14 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	6.42	37.43	65.28	73.71	74.00	12.88	78.77		15.19
7x12	5.53	13.99	41.48	71.52	70.95	12.87	79.36		17.53
12x18	4.10	6.31	17.79	41.70	43.05	7.27	71.48		16.96
-18	44.66	20.08	20.11	22.93	26.34	77.16	60.18		37.80
Total (Calc)	7.75	12.95	31.65	57.44	60.95	63.40	75.01		18.34



SPIRAL DATA ANALYSIS

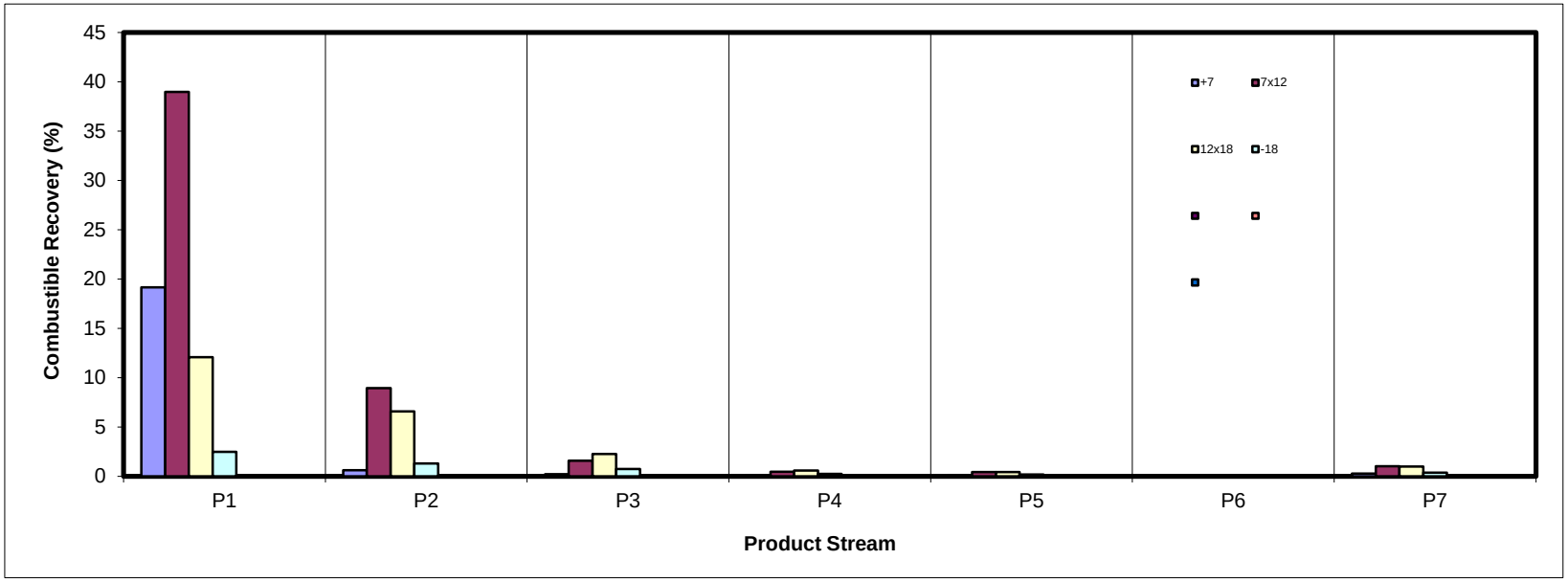
Description: Run 14 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	19.15	0.62	0.23	0.08	0.13	0.00	0.26		20.47
7x12	38.95	8.92	1.59	0.44	0.44	0.00	1.00		51.35
12x18	12.06	6.58	2.25	0.57	0.43	0.00	1.00		22.90
-18	2.47	1.28	0.73	0.25	0.17	0.01	0.36		5.28
Total (Calc)	72.64	17.41	4.80	1.34	1.17	0.01	2.63		100.00



SPIRAL DATA ANALYSIS

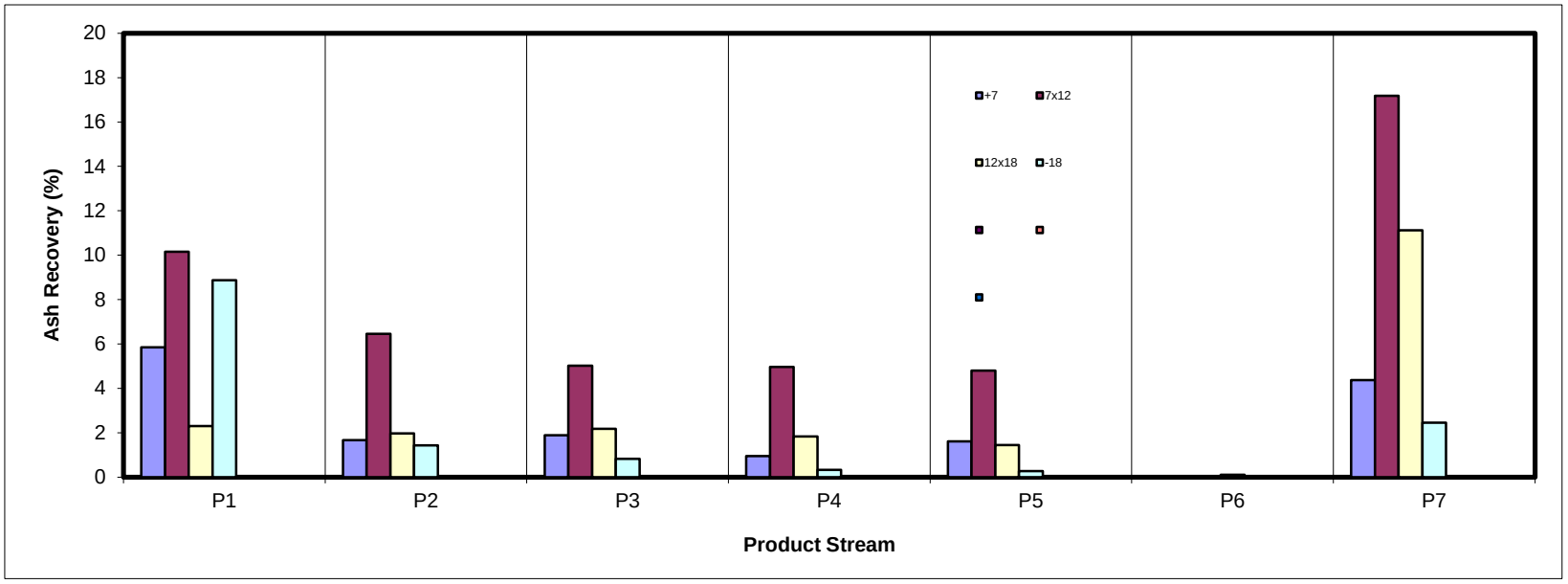
Description: Run 14 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	5.85	1.66	1.89	0.95	1.61	0.00	4.37		16.32
7x12	10.16	6.46	5.01	4.97	4.80	0.00	17.18		48.58
12x18	2.29	1.97	2.17	1.83	1.44	0.00	11.12		20.82
-18	8.87	1.43	0.82	0.33	0.28	0.10	2.45		14.28
Total (Calc)	27.17	11.52	9.89	8.07	8.13	0.10	35.11		100.00



SPIRAL DATA ANALYSIS

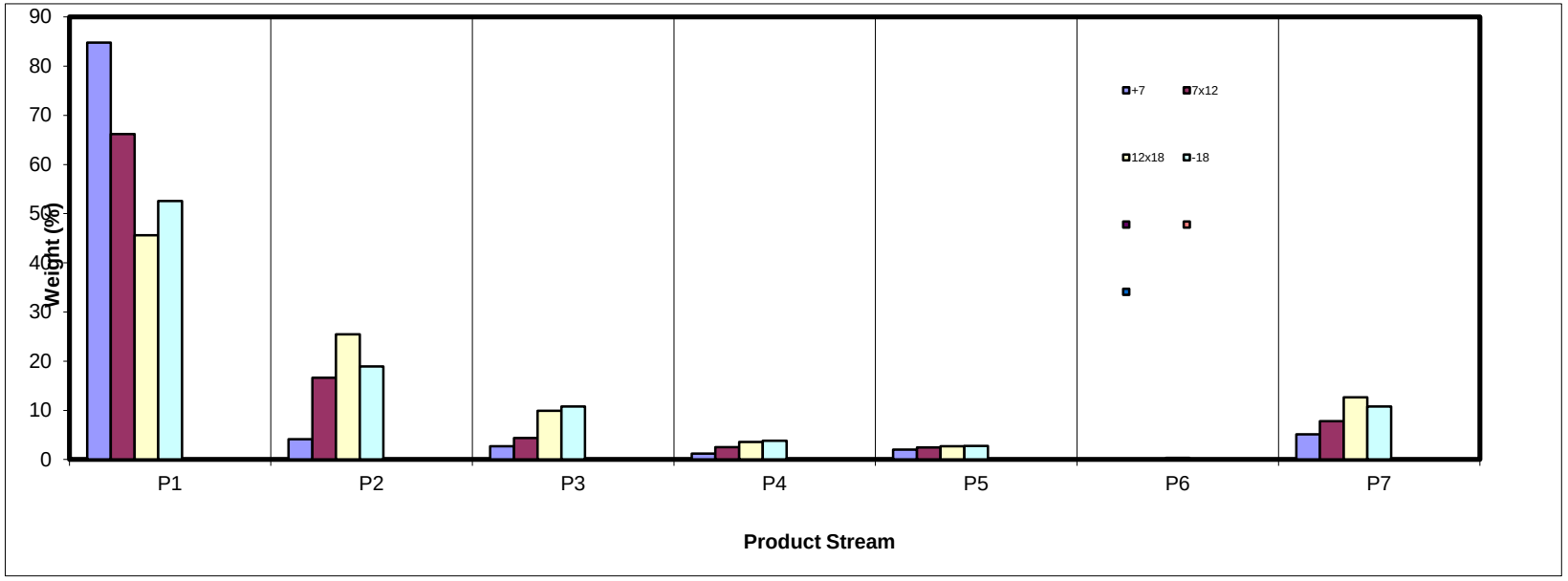
Description: Run 14 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	84.79	4.13	2.69	1.19	2.03	0.01	5.16		100.00
7x12	66.22	16.66	4.36	2.51	2.44	0.01	7.81		100.00
12x18	45.62	25.47	9.93	3.57	2.72	0.01	12.67		100.00
-18	52.57	18.91	10.82	3.81	2.78	0.35	10.76		100.00
Total (Calc)	64.29	16.33	5.73	2.58	2.45	0.03	8.59		100.00



SPIRAL DATA ANALYSIS

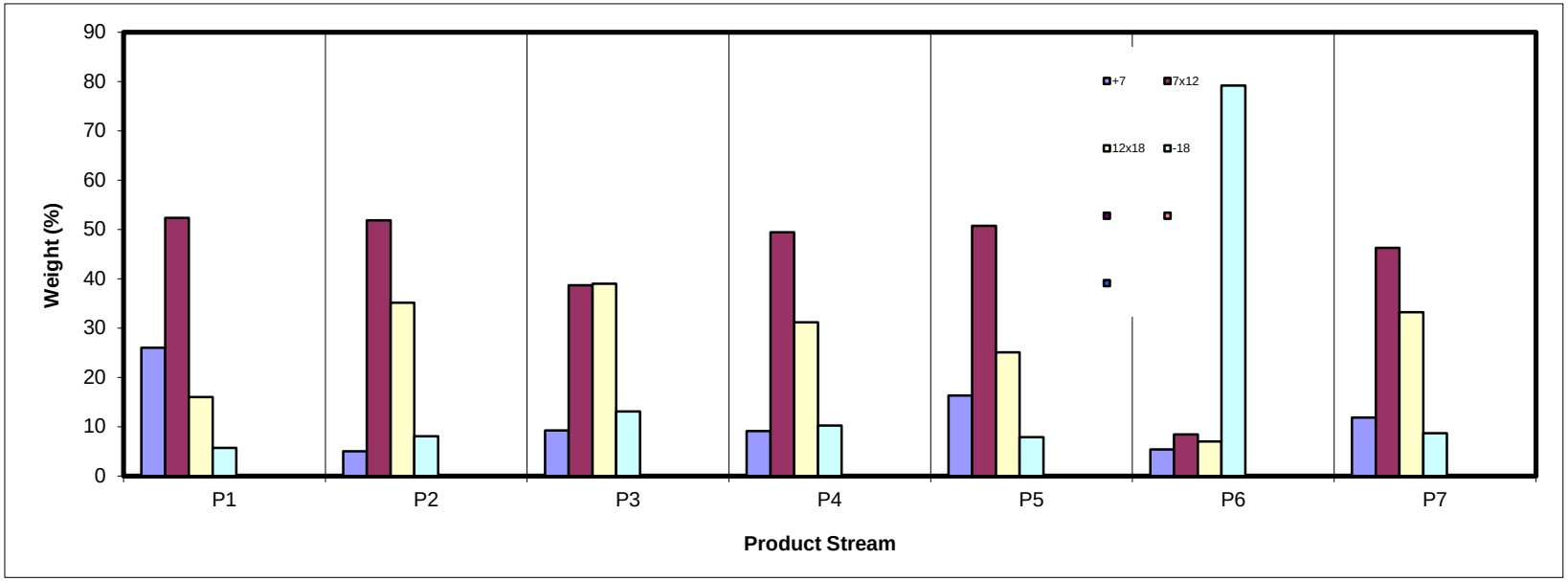
Description: Run 14 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	25.99	4.99	9.25	9.12	16.34	5.38	11.84		19.71
7x12	52.37	51.87	38.67	49.45	50.73	8.43	46.25		50.85
12x18	15.97	35.12	39.00	31.19	25.07	6.98	33.22		22.51
-18	5.67	8.03	13.07	10.25	7.86	79.21	8.69		6.93
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

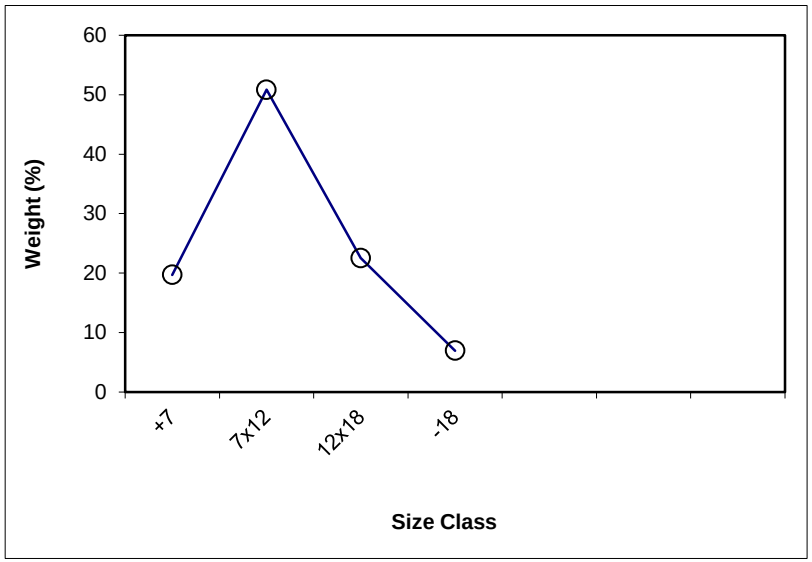
Description: Run 14 - Intermediate Spiral Test

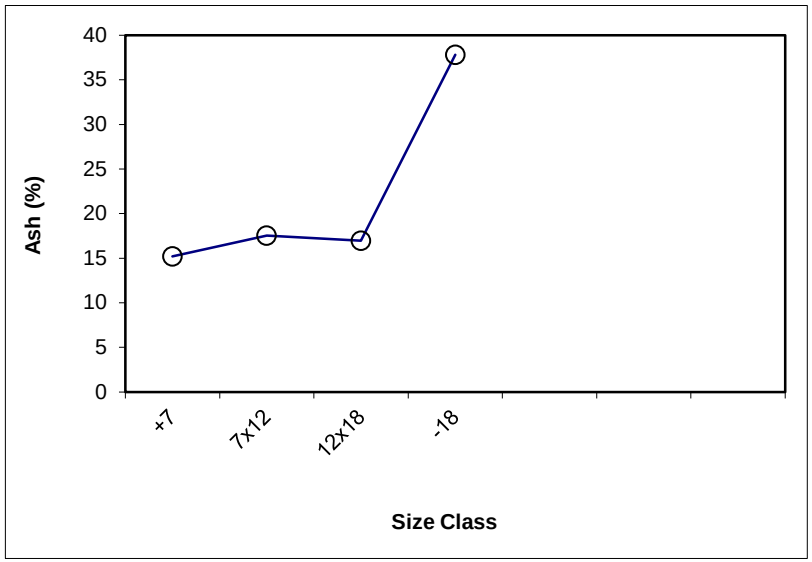
Comments: 3.36 x 1.0 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	508.1	443.4	64.76	19.71	15.19	19.71	15.19	100.00	18.34
7x12	601.6	434.6	167.05	50.85	17.53	70.56	16.88	80.29	19.12
12x18	475.2	401.2	73.97	22.51	16.96	93.07	16.90	29.44	21.87
-18	29.1	6.3	22.77	6.93	37.80	100.00	18.34	6.93	37.80
Total (Calc)	--	--	328.55	100.00	18.34	--	--	--	--





SPIRAL DATA ANALYSIS

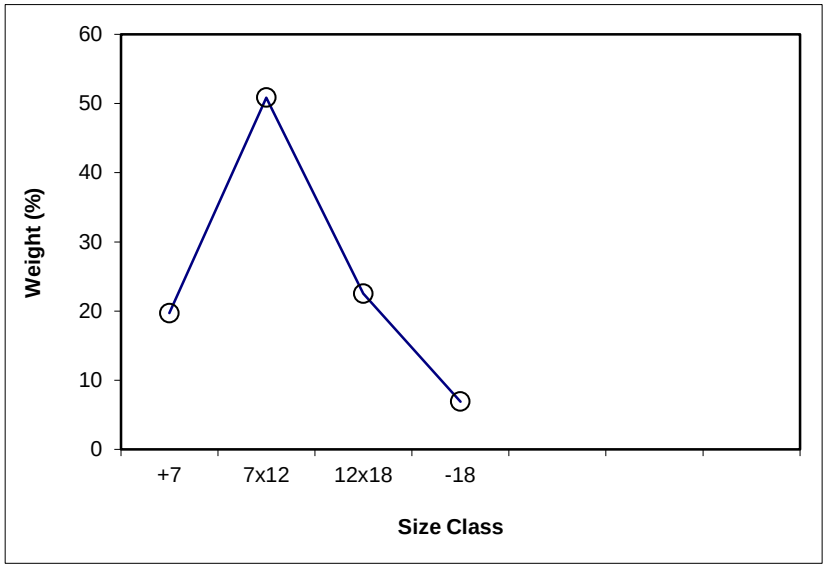
Description: Run 14 - Intermediate Spiral Test

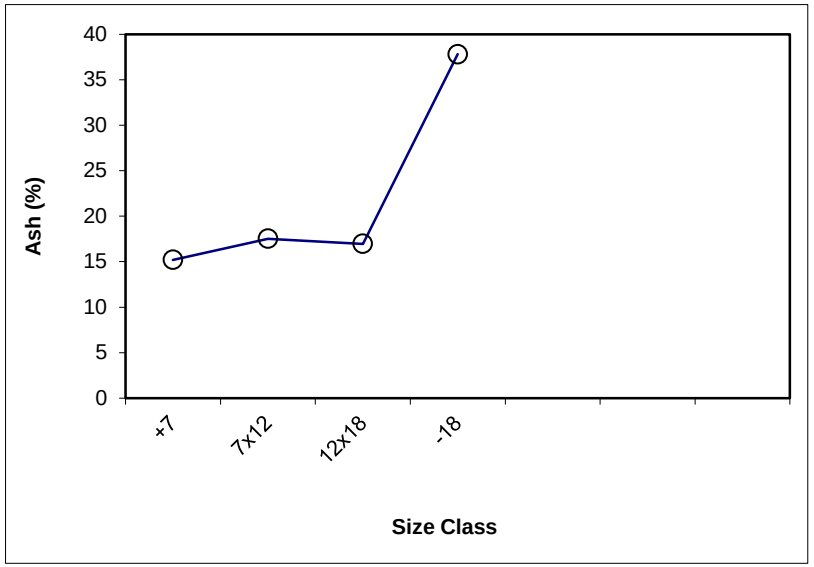
Comments: 3.36 x 1.0 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+7	19.71	15.19	19.71	15.19	100.00	18.34			
7x12	50.85	17.53	70.56	16.88	80.29	19.12	x	50.85	17.53
12x18	22.51	16.96	93.07	16.90	29.44	21.87	x	22.51	16.96
-18	6.93	37.80	100.00	18.34	6.93	37.80			
Total (Calc)	100.00	18.34	--	--	--	--	--	73.36	17.35





SPIRAL DATA ANALYSIS

Description: Run 14 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 64.29

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	784.28	443.4	340.92	25.99	6.42	25.99	6.42	100.00	7.75
7x12	1121.40	434.6	686.84	52.37	5.53	78.36	5.83	74.01	8.22
12x18	610.73	401.2	209.53	15.97	4.10	94.33	5.53	21.64	14.72
-18	80.56	6.2	74.33	5.67	44.66	100.00	7.75	5.67	44.66
Total (Calc)	--	--	1311.61	100.00	7.75	--	--	--	--

Product P2 Feed Weight (%): 16.33

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	456.0	439.4	16.61	4.99	37.43	4.99	37.43	100.00	12.95
7x12	617.1	444.3	172.78	51.87	13.99	56.85	16.04	95.01	11.66
12x18	577.1	460.1	117.00	35.12	6.31	91.97	12.32	43.15	8.87
-18	33.2	6.4	26.74	8.03	20.08	100.00	12.95	8.03	20.08
Total (Calc)	--	--	333.12	100.00	12.95	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 14 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 5.73

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	479.4	443.4	36.07	9.25	65.28	9.25	65.28	100.00	31.65
7x12	585.4	434.6	150.80	38.67	41.48	47.92	46.07	90.75	28.22
12x18	553.3	401.2	152.09	39.00	17.79	86.93	33.39	52.08	18.37
-18	57.4	6.4	50.98	13.07	20.11	100.00	31.65	13.07	20.11
Total (Calc)	--	--	389.94	100.00	31.65	--	--	--	--

Product P4 Feed Weight (%): 2.58

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	459.4	443.4	16.00	9.12	73.71	9.12	73.71	100.00	57.44
7x12	521.2	434.6	86.69	49.45	71.52	58.57	71.86	90.88	55.81
12x18	455.9	401.2	54.68	31.19	41.70	89.75	61.38	41.43	37.06
-18	24.4	6.4	17.96	10.25	22.93	100.00	57.44	10.25	22.93
Total (Calc)	--	--	175.33	100.00	57.44	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 14 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 2.45

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	681.9	654.7	27.20	16.34	74.00	16.34	74.00	100.00	60.95
7x12	739.5	655.1	84.42	50.73	70.95	67.07	71.69	83.66	58.40
12x18	705.8	664.1	41.71	25.07	43.05	92.14	63.90	32.93	39.06
-18	19.4	6.3	13.08	7.86	26.34	100.00	60.95	7.86	26.34
Total (Calc)	--	--	166.41	100.00	60.95	--	--	--	--

Product P6 Feed Weight (%): 0.03

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	440.0	439.4	0.66	5.38	12.88	5.38	12.88	100.00	63.40
7x12	445.3	444.3	1.04	8.43	12.87	13.80	12.87	94.62	66.27
12x18	461.0	460.1	0.86	6.98	7.27	20.79	10.99	86.20	71.50
-18	16.1	6.4	9.77	79.21	77.16	100.00	63.40	79.21	77.16
Total (Calc)	--	--	12.33	100.00	63.40	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 14 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 8.59

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	844.1	809.5	34.57	11.84	78.77	11.84	78.77	100.00	75.01
7x12	790.5	655.5	135.03	46.25	79.36	58.09	79.24	88.16	74.50
12x18	761.7	664.7	96.99	33.22	71.48	91.31	76.42	41.91	69.14
-18	31.9	6.6	25.36	8.69	60.18	100.00	75.01	8.69	60.18
Total (Calc)	--	--	291.95	100.00	75.01	--	--	--	--

SPIRAL DATA ANALYSIS

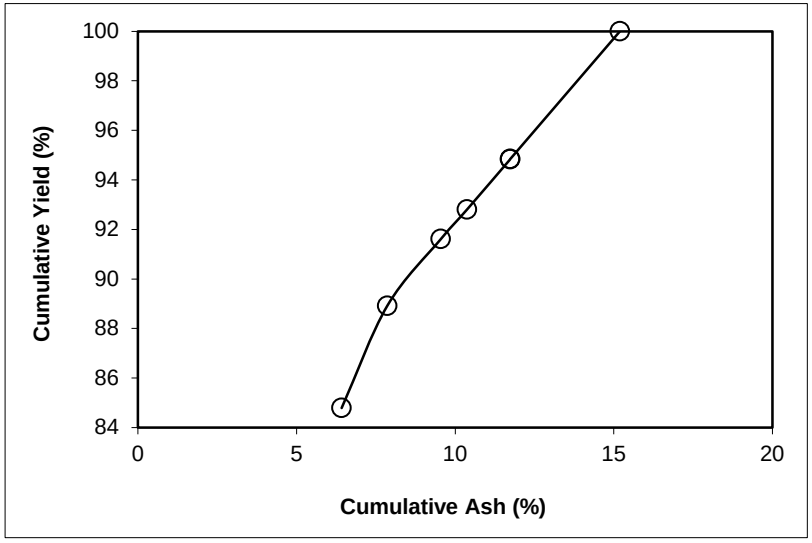
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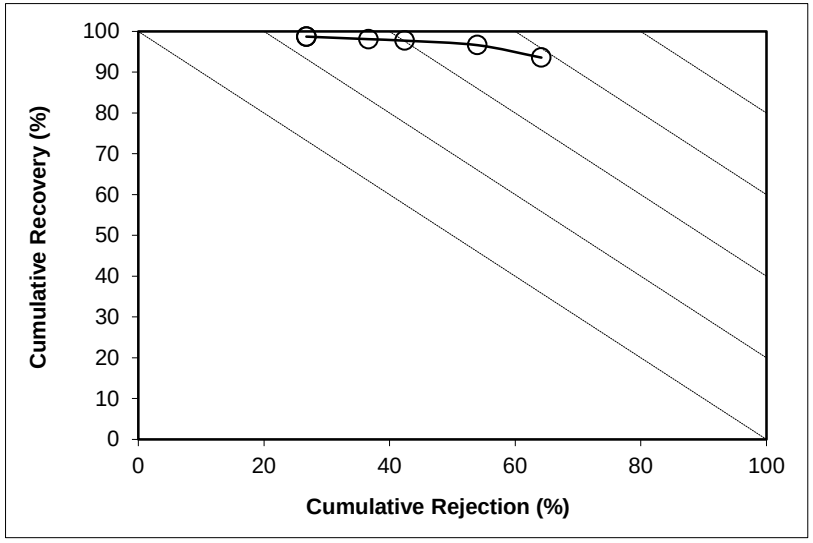
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: +7 Feed Weight (%): 19.71

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	84.79	6.42	84.79	6.42	93.56	15.21	64.09	64.17	57.73
P2	4.13	37.43	88.92	7.86	96.61	11.08	74.03	53.99	50.60
P3	2.69	65.28	91.61	9.55	97.71	8.39	76.83	42.43	40.14
P4	1.19	73.71	92.80	10.37	98.08	7.20	77.35	36.64	34.72
P5	2.03	74.00	94.83	11.73	98.70	5.17	78.67	26.76	25.46
P6	0.01	12.88	94.84	11.73	98.71	5.16	78.77	26.75	25.46
P7	5.16	78.77	100.00	15.19	100.00	0.00			
Total (Calc)	100.00	15.19	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

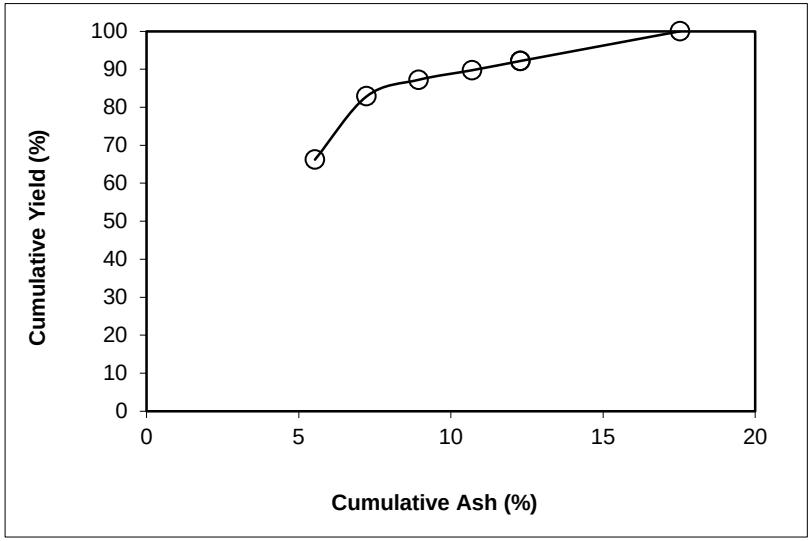
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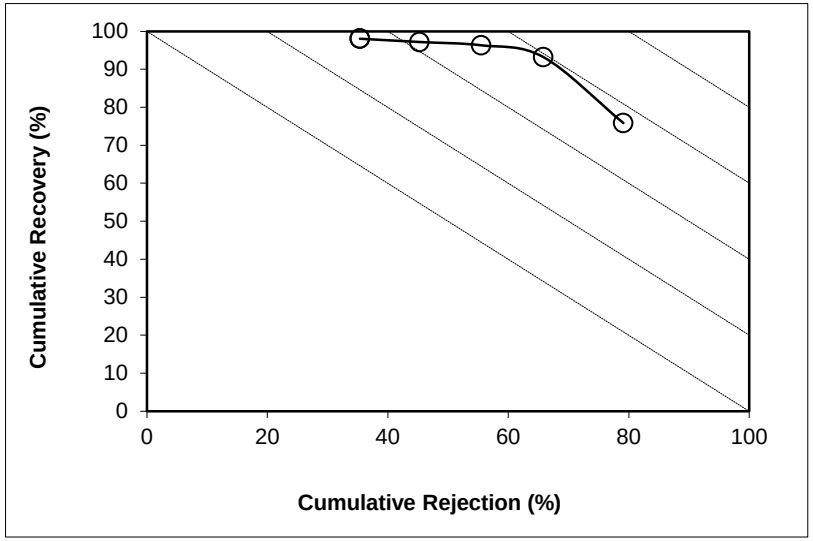
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 7x12 Feed Weight (%): 50.85

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	66.22	5.53	66.22	5.53	75.85	33.78	41.04	79.10	54.94
P2	16.66	13.99	82.87	7.23	93.22	17.13	67.34	65.80	59.02
P3	4.36	41.48	87.24	8.94	96.31	12.76	76.18	55.48	51.80
P4	2.51	71.52	89.74	10.69	97.18	10.26	77.32	45.25	42.43
P5	2.44	70.95	92.18	12.29	98.04	7.82	79.31	35.37	33.41
P6	0.01	12.87	92.19	12.29	98.04	7.81	79.36	35.36	33.41
P7	7.81	79.36	100.00	17.53	100.00	0.00			
Total (Calc)	100.00	17.53	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

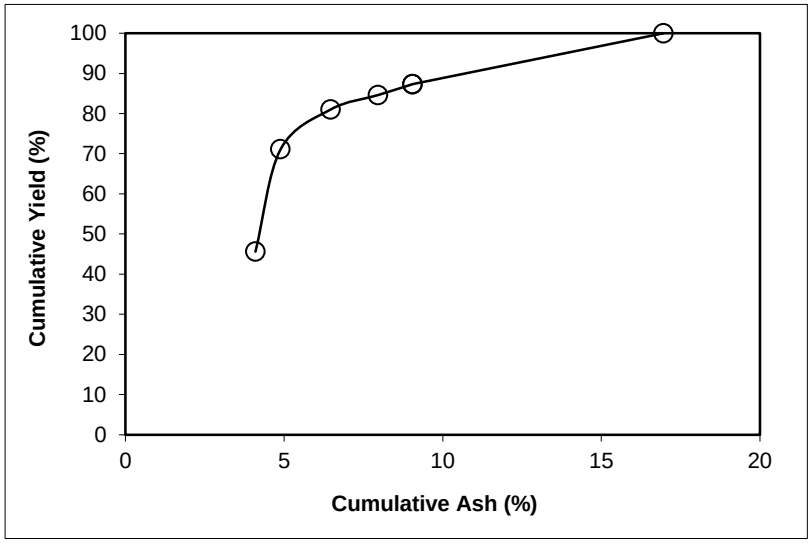
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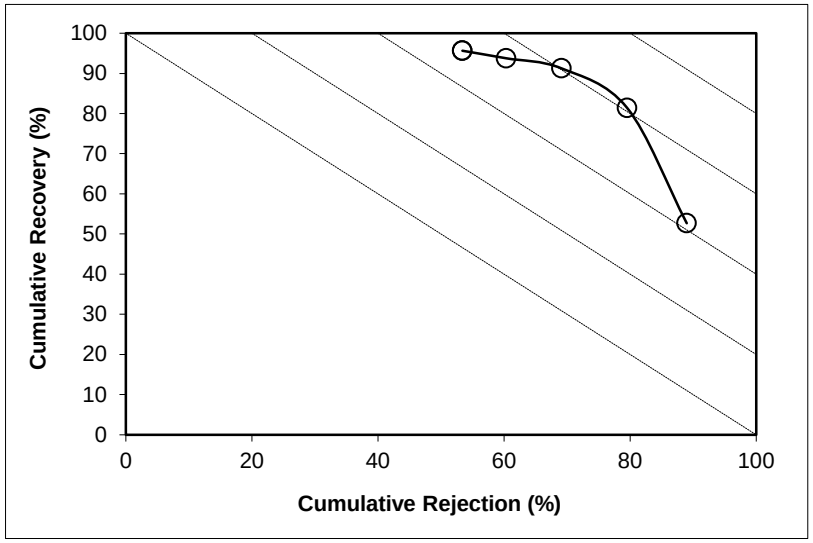
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 12x18 Feed Weight (%): 22.51

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	45.62	4.10	45.62	4.10	52.69	54.38	27.75	88.98	41.67
P2	25.47	6.31	71.09	4.89	81.43	28.91	46.65	79.51	60.94
P3	9.93	17.79	81.03	6.47	91.26	18.97	61.76	69.09	60.36
P4	3.57	41.70	84.60	7.96	93.77	15.40	66.41	60.31	54.08
P5	2.72	43.05	87.32	9.05	95.64	12.68	71.44	53.40	49.04
P6	0.01	7.27	87.33	9.05	95.65	12.67	71.48	53.39	49.04
P7	12.67	71.48	100.00	16.96	100.00	0.00			
Total (Calc)	100.00	16.96	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

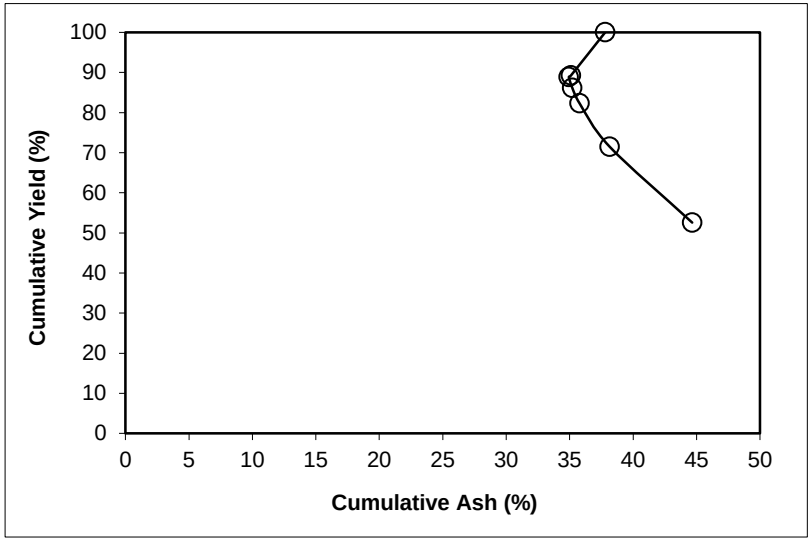
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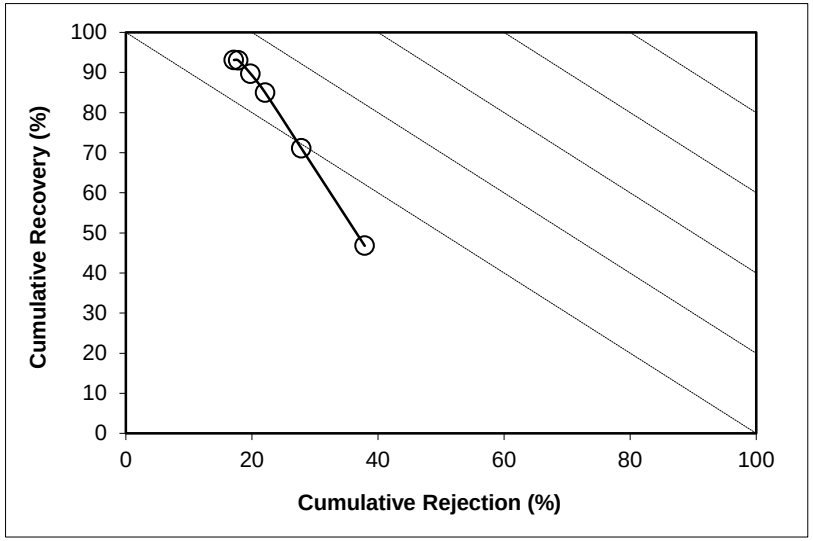
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: -18.00 Feed Weight (%): 6.93

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	52.57	44.66	52.57	44.66	46.78	47.43	30.20	37.89	-15.33
P2	18.91	20.08	71.48	38.15	71.08	28.52	36.91	27.84	-1.08
P3	10.82	20.11	82.30	35.78	84.97	17.70	47.18	22.09	7.06
P4	3.81	22.93	86.11	35.21	89.69	13.89	53.83	19.78	9.47
P5	2.78	26.34	88.89	34.93	92.98	11.11	60.71	17.84	10.82
P6	0.35	77.16	89.24	35.10	93.11	10.76	60.18	17.14	10.25
P7	10.76	60.18	100.00	37.80	100.00	0.00			
Total (Calc)	100.00	37.80	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

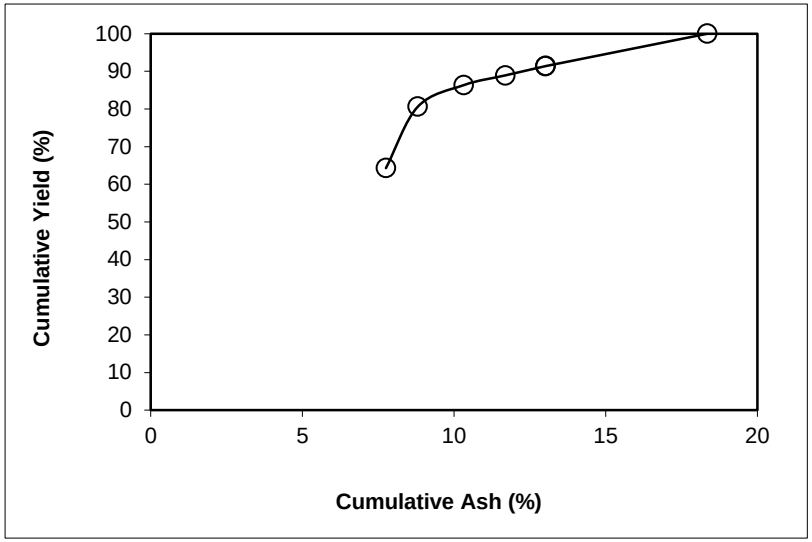
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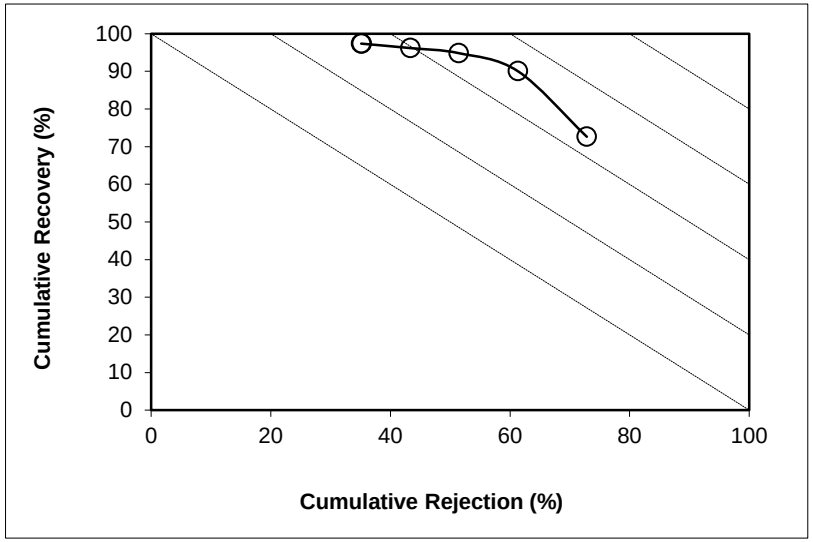
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	64.29	7.75	64.29	7.75	72.64	35.71	37.42	72.83	45.47
P2	16.33	12.95	80.62	8.80	90.04	19.38	58.04	61.31	51.35
P3	5.73	31.65	86.36	10.32	94.84	13.64	69.14	51.42	46.26
P4	2.58	57.44	88.94	11.69	96.19	11.06	71.86	43.34	39.53
P5	2.45	60.95	91.38	13.01	97.36	8.62	74.96	35.21	32.57
P6	0.03	63.40	91.41	13.02	97.37	8.59	75.01	35.11	32.48
P7	8.59	75.01	100.00	18.34	100.00	0.00			
Total (Calc)	100.00	18.34	--	--	--	--	--	--	--

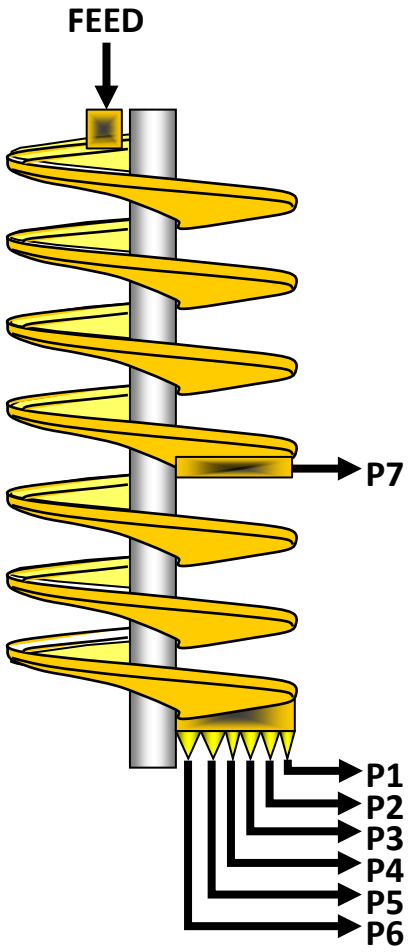




SPIRAL DATA ANALYSIS

Description: Run 15 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	0.814	23.3	10.73	13.17
P2	0.414	31.8	3.55	4.75
P3	0.154	33.1	1.25	1.66
P4	0.066	36.1	0.47	0.62
P5	0.040	22.7	0.54	0.64
P6	0.003	6.5	0.19	0.19
P7	0.384	47.6	1.69	2.45
Total	1.874	28.9	18.42	23.48

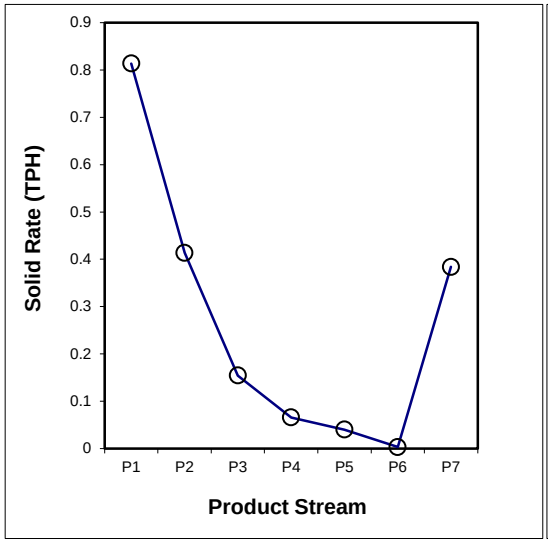
SPIRAL DATA ANALYSIS

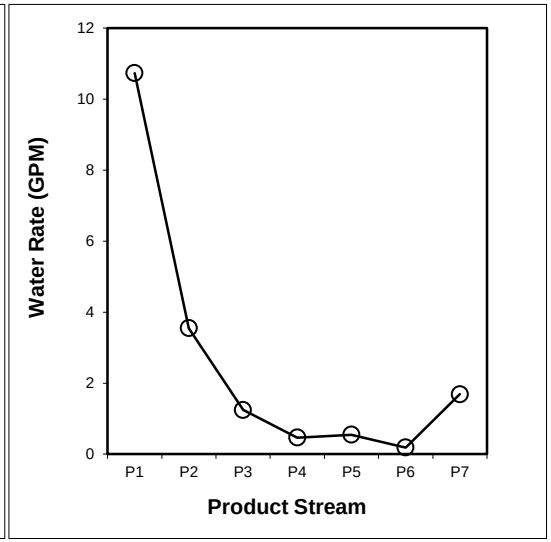
Description: Run 15 - Intermediate Spiral Test

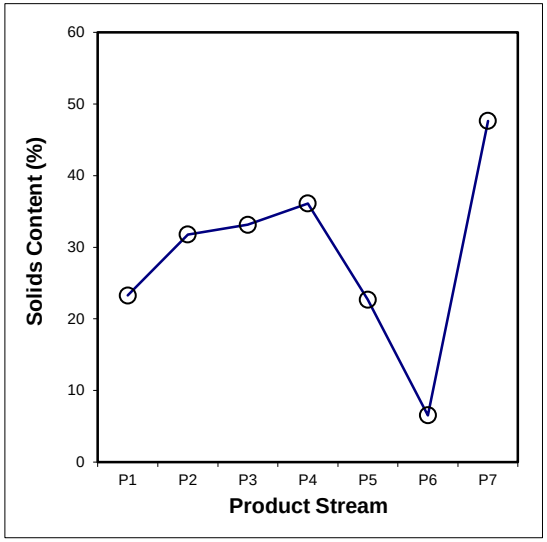
Comments: 3.36 x 1.0 mm Nominal Particle Size

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	5	5554.50	1092.50	3.497	2311.6	1285.6	0.814	43.40	23.26
P2	5	1754.90	93.11	1.301	1807.0	1285.4	0.414	22.06	31.79
P3	10	1276.24	84.57	0.466	1739.4	1350.0	0.154	8.24	33.14
P4	10	561.64	95.55	0.182	2301.8	2135.9	0.066	3.51	36.10
P5	15	767.90	91.48	0.176	2131.5	1980.2	0.040	2.13	22.69
P6	60	853.71	92.13	0.050	1334.7	1285.6	0.003	0.17	6.54
P7	5	1134.90	93.87	0.806	1834.4	1350.2	0.384	20.48	47.62
Total (Calc)	--	--	--	6.478	--	--	1.874	100.00	28.93
Total (Head)	0.72	1415.14	233.38	6.478	1692.1	1350.2	1.874	--	28.93







SPIRAL DATA ANALYSIS

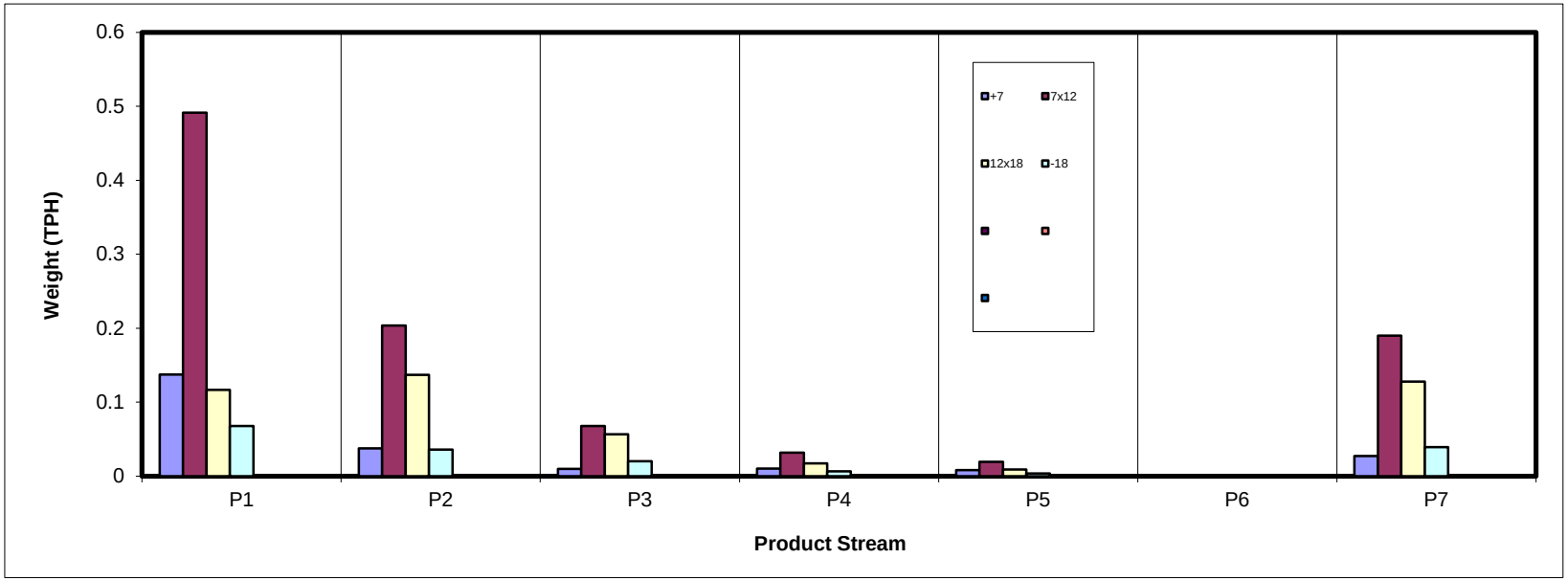
Description: Run 15 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	0.137	0.037	0.010	0.010	0.008	0.000	0.027		0.230
7x12	0.492	0.204	0.068	0.032	0.019	0.001	0.190		1.005
12x18	0.117	0.137	0.057	0.017	0.009	0.001	0.128		0.465
-18	0.068	0.036	0.020	0.007	0.004	0.001	0.039		0.174
Total (Calc)	0.814	0.414	0.154	0.066	0.040	0.003	0.384		1.874



SPIRAL DATA ANALYSIS

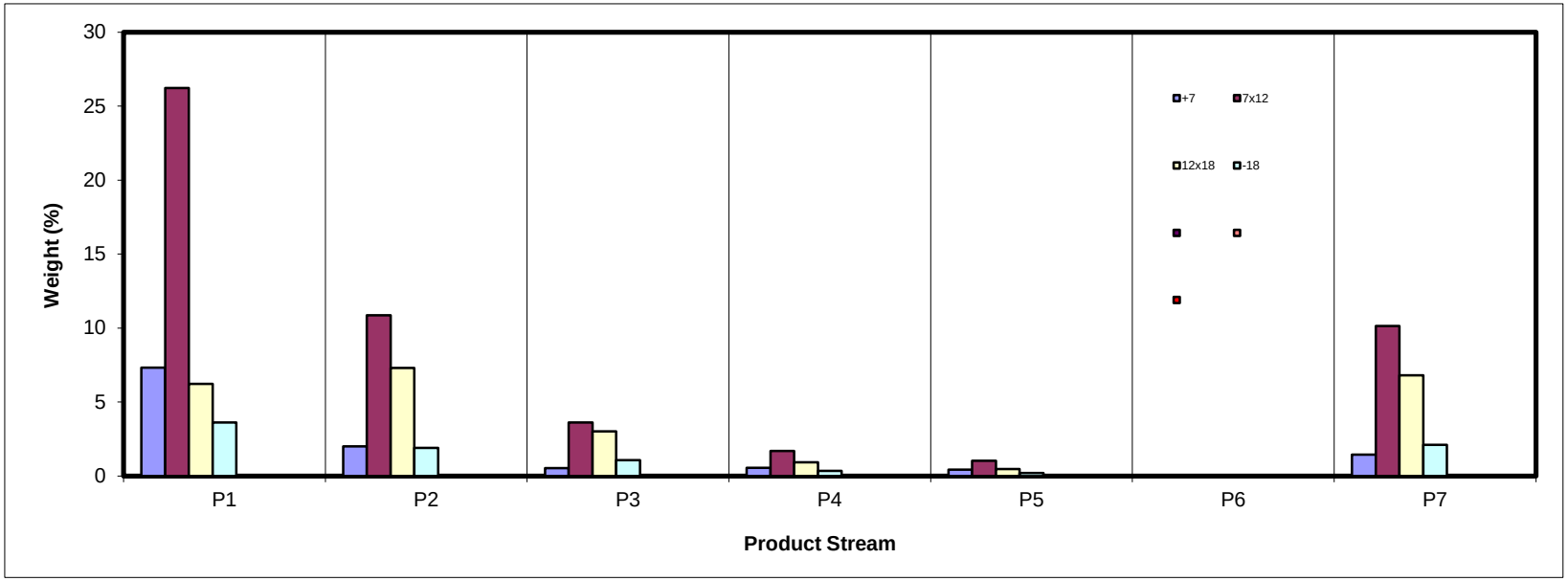
Description: Run 15 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	7.33	1.99	0.53	0.54	0.44	0.02	1.45		12.29
7x12	26.22	10.87	3.62	1.69	1.03	0.06	10.13		53.63
12x18	6.23	7.30	3.02	0.92	0.48	0.04	6.81		24.80
-18	3.62	1.90	1.07	0.35	0.20	0.05	2.09		9.28
Total (Calc)	43.40	22.06	8.24	3.51	2.13	0.17	20.48		100.00



SPIRAL DATA ANALYSIS

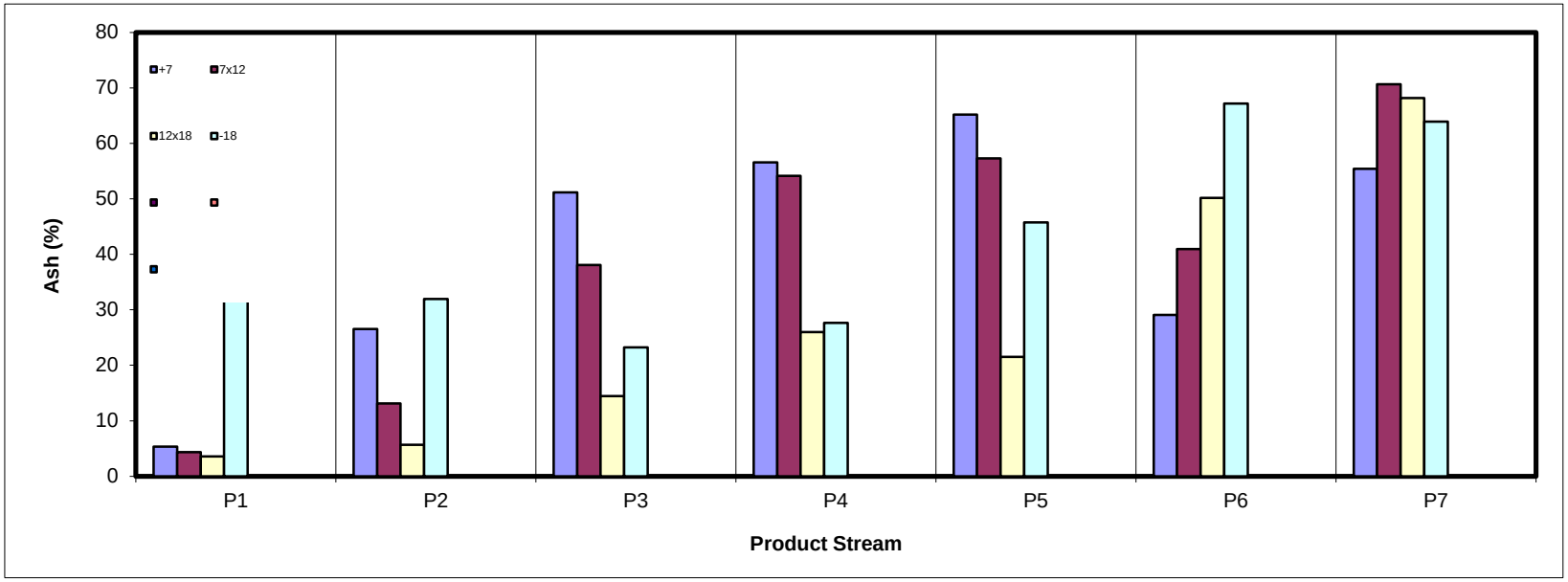
Description: Run 15 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	5.36	26.56	51.18	56.57	65.20	29.05	55.42		21.06
7x12	4.37	13.11	38.07	54.12	57.31	40.94	70.66		23.57
12x18	3.55	5.67	14.47	25.98	21.53	50.19	68.16		24.51
-18	52.37	31.96	23.20	27.63	45.73	67.14	63.93		46.44
Total (Calc)	8.42	13.49	28.33	44.43	49.88	49.39	68.06		25.62



SPIRAL DATA ANALYSIS

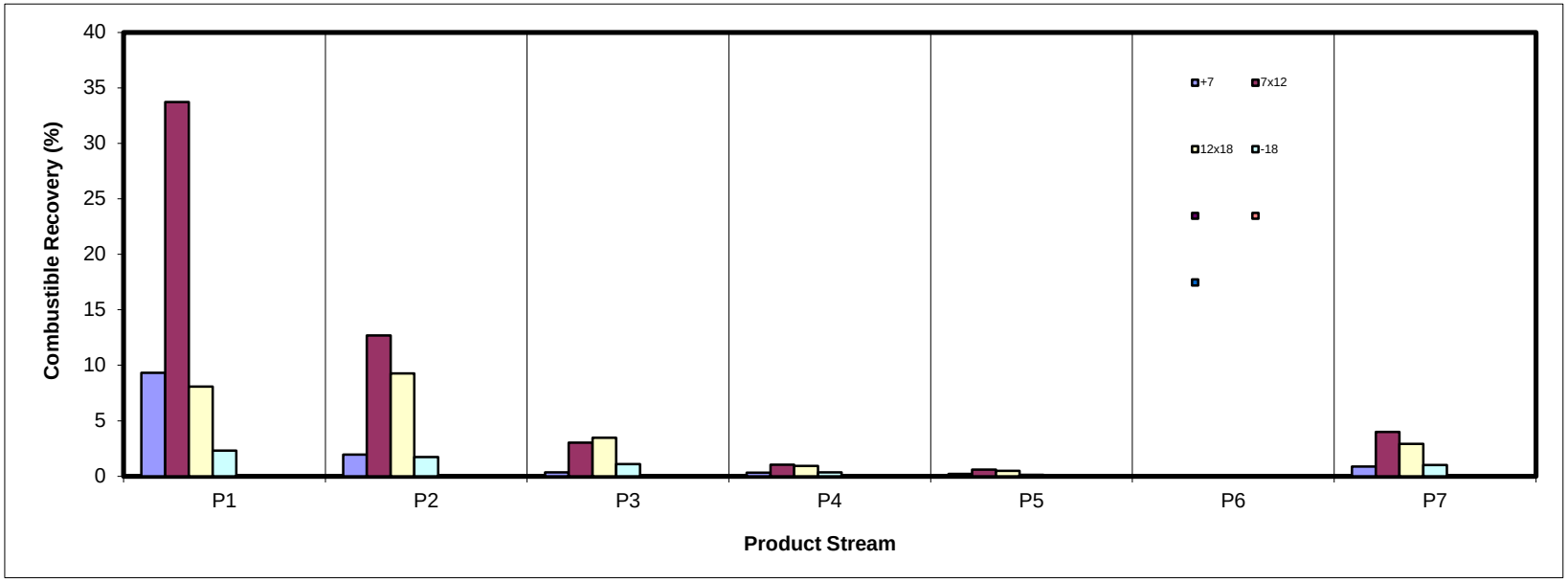
Description: Run 15 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	9.33	1.97	0.35	0.32	0.20	0.02	0.87		13.04
7x12	33.72	12.70	3.02	1.04	0.59	0.05	4.00		55.11
12x18	8.07	9.26	3.47	0.92	0.50	0.03	2.91		25.17
-18	2.32	1.74	1.10	0.34	0.14	0.02	1.02		6.68
Total (Calc)	53.43	25.66	7.94	2.62	1.44	0.12	8.79		100.00



SPIRAL DATA ANALYSIS

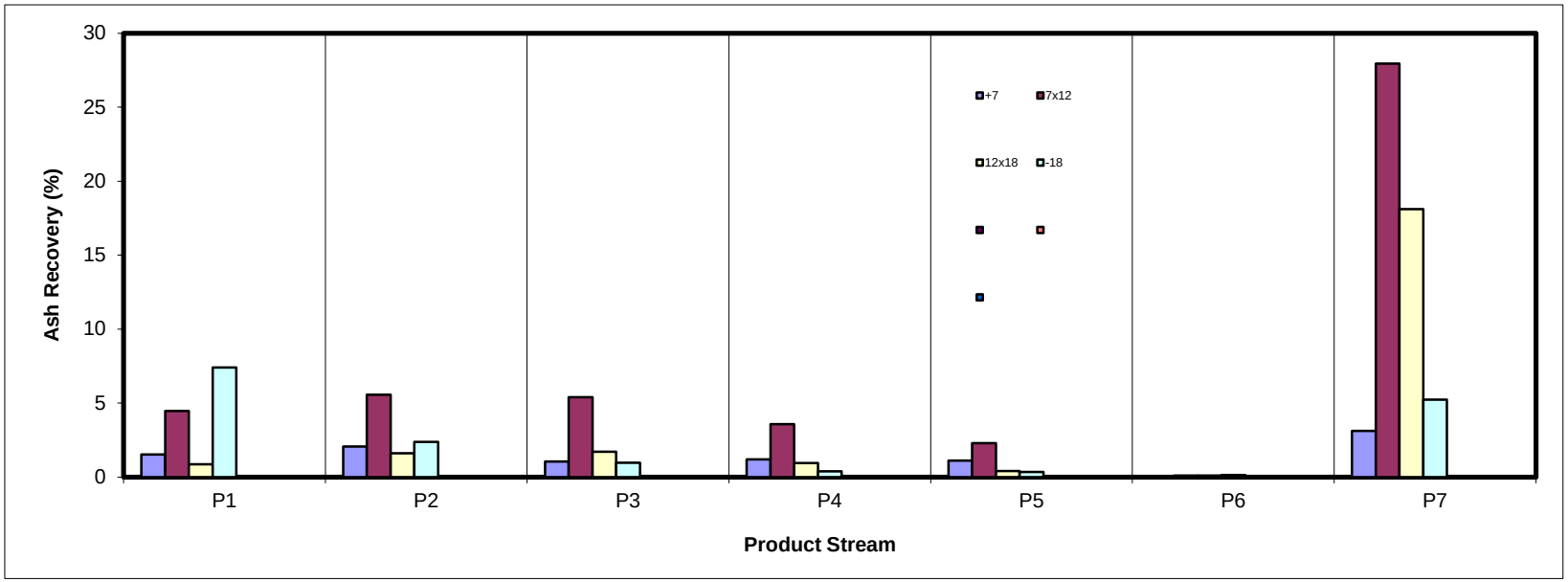
Description: Run 15 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	1.53	2.07	1.05	1.20	1.11	0.02	3.13		10.11
7x12	4.47	5.56	5.39	3.57	2.29	0.10	27.96		49.34
12x18	0.86	1.62	1.71	0.94	0.40	0.09	18.12		23.72
-18	7.40	2.38	0.97	0.38	0.35	0.13	5.23		16.83
Total (Calc)	14.27	11.62	9.11	6.09	4.16	0.33	54.42		100.00



SPIRAL DATA ANALYSIS

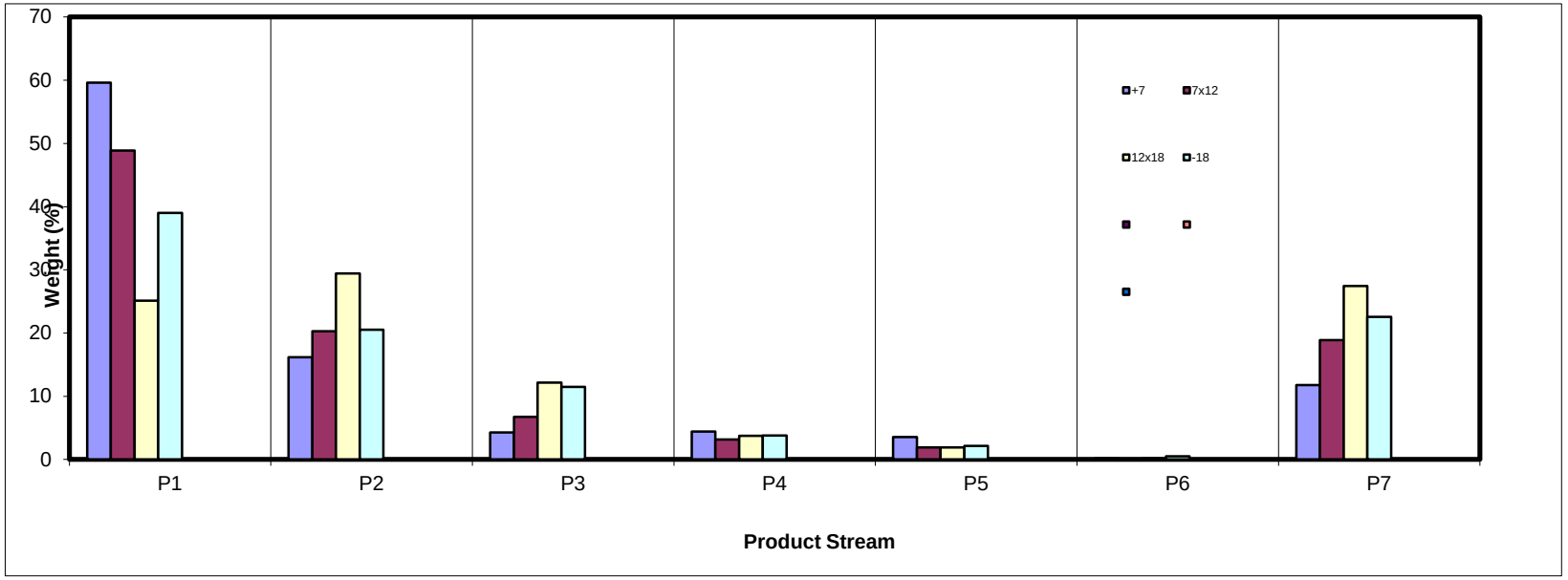
Description: Run 15 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	59.64	16.20	4.29	4.43	3.54	0.15	11.76		100.00
7x12	48.90	20.27	6.76	3.15	1.91	0.12	18.90		100.00
12x18	25.11	29.43	12.18	3.73	1.92	0.18	27.46		100.00
-18	38.99	20.52	11.48	3.80	2.13	0.52	22.55		100.00
Total (Calc)	43.40	22.06	8.24	3.51	2.13	0.17	20.48		100.00



SPIRAL DATA ANALYSIS

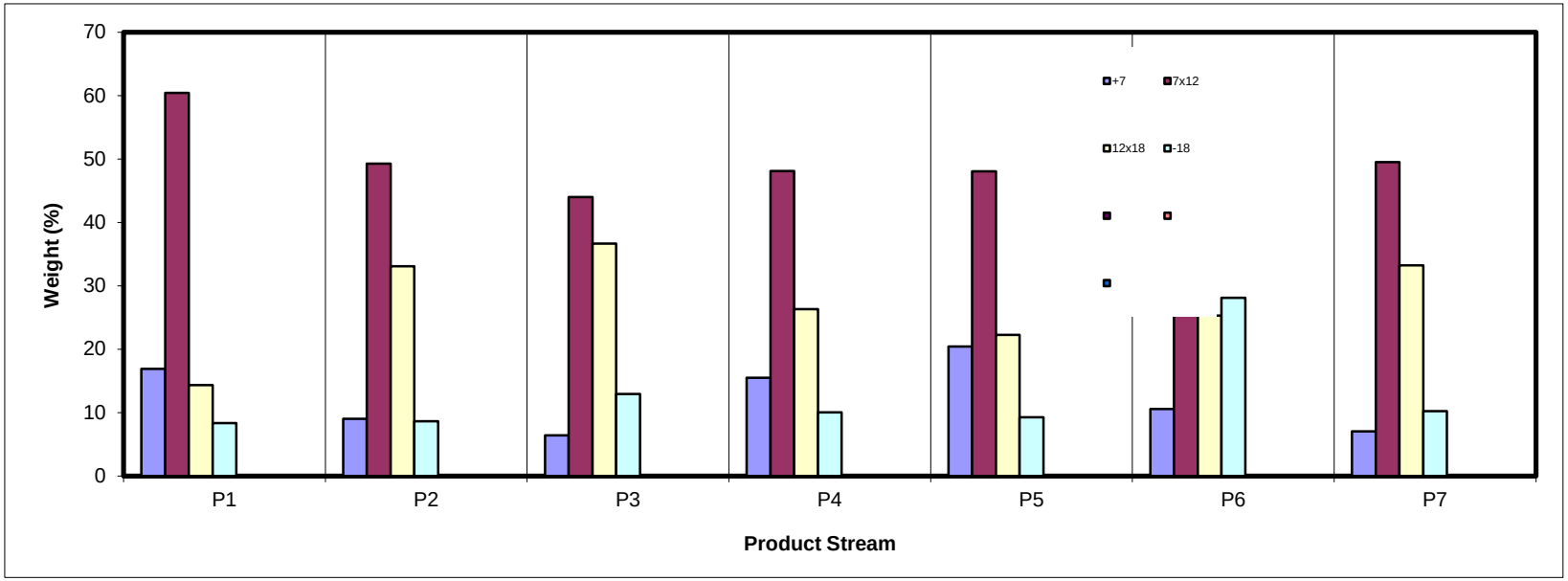
Description: Run 15 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	16.89	9.02	6.39	15.50	20.40	10.58	7.06		12.29
7x12	60.42	49.26	44.00	48.11	48.06	36.01	49.48		53.63
12x18	14.35	33.08	36.66	26.33	22.27	25.30	33.24		24.80
-18	8.34	8.63	12.94	10.05	9.27	28.10	10.22		9.28
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

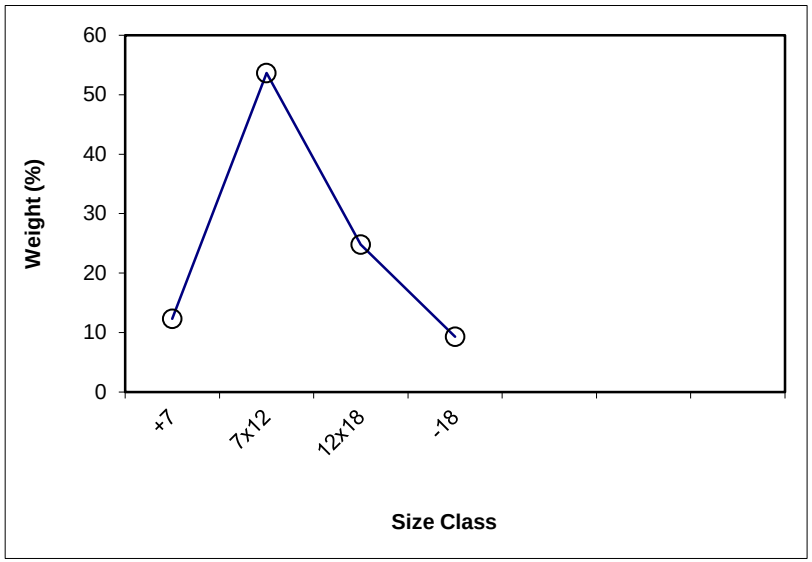
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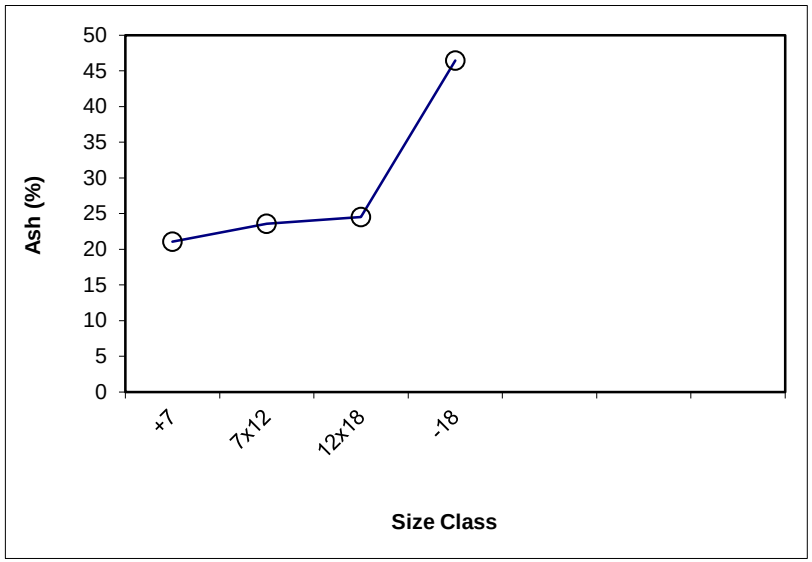
Comments: 3.36 x 1.0 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	481.4	439.4	42.03	12.29	21.06	12.29	21.06	100.00	25.61
7x12	627.7	444.3	183.38	53.63	23.57	65.92	23.10	87.71	26.25
12x18	544.9	460.1	84.79	24.80	24.51	90.72	23.48	34.08	30.48
-18	38.1	6.4	31.74	9.28	46.44	100.00	25.61	9.28	46.44
Total (Calc)	--	--	341.93	100.00	25.61	--	--	--	--





SPIRAL DATA ANALYSIS

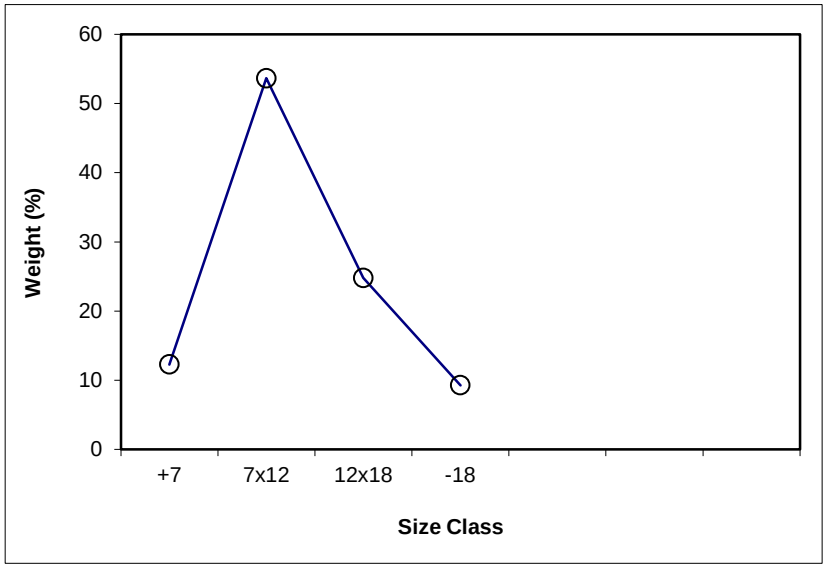
Description: Run 15 - Intermediate Spiral Test

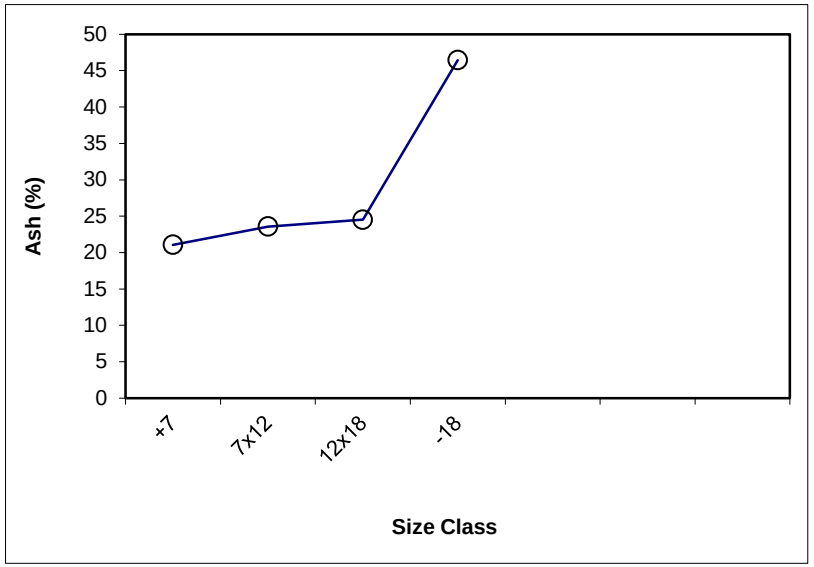
Comments: 3.36 x 1.0 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+7	12.29	21.06	12.29	21.06	100.00	25.62			
7x12	53.63	23.57	65.92	23.10	87.71	26.25	x	53.63	23.57
12x18	24.80	24.51	90.72	23.48	34.08	30.48	x	24.80	24.51
-18	9.28	46.44	100.00	25.62	9.28	46.44			
Total (Calc)	100.00	25.62	--	--	--	--	--	78.43	23.86





SPIRAL DATA ANALYSIS

Description: Run 15 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 43.40

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	616.62	443.4	173.26	16.89	5.36	16.89	5.36	100.00	8.42
7x12	1054.46	434.6	619.90	60.42	4.37	77.31	4.58	83.11	9.04
12x18	548.41	401.2	147.21	14.35	3.55	91.66	4.42	22.69	21.50
-18	92.07	6.5	85.56	8.34	52.37	100.00	8.42	8.34	52.37
Total (Calc)	--	--	1025.93	100.00	8.42	--	--	--	--

Product P2 Feed Weight (%): 22.06

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	490.4	443.4	47.07	9.02	26.56	9.02	26.56	100.00	13.49
7x12	691.5	434.6	256.93	49.26	13.11	58.29	15.19	90.98	12.19
12x18	573.7	401.2	172.53	33.08	5.67	91.37	11.75	41.71	11.12
-18	51.3	6.3	45.03	8.63	31.96	100.00	13.49	8.63	31.96
Total (Calc)	--	--	521.57	100.00	13.49	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 15 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 8.24

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	464.3	439.4	24.90	6.39	51.18	6.39	51.18	100.00	28.33
7x12	615.6	444.3	171.34	44.00	38.07	50.40	39.73	93.61	26.77
12x18	602.9	460.1	142.74	36.66	14.47	87.06	29.10	49.60	16.75
-18	56.6	6.2	50.40	12.94	23.20	100.00	28.33	12.94	23.20
Total (Calc)	--	--	389.37	100.00	28.33	--	--	--	--

Product P4 Feed Weight (%): 3.51

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	835.2	809.5	25.72	15.50	56.57	15.50	56.57	100.00	44.43
7x12	735.3	655.5	79.83	48.11	54.12	63.62	54.72	84.50	42.20
12x18	708.4	664.7	43.69	26.33	25.98	89.95	46.31	36.38	26.43
-18	22.9	6.2	16.67	10.05	27.63	100.00	44.43	10.05	27.63
Total (Calc)	--	--	165.92	100.00	44.43	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 15 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 2.13

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	685.5	654.7	30.87	20.40	65.20	20.40	65.20	100.00	49.88
7x12	727.9	655.1	72.73	48.06	57.31	68.47	59.66	79.60	45.95
12x18	697.8	664.1	33.69	22.27	21.53	90.73	50.30	31.53	28.64
-18	20.4	6.3	14.02	9.27	45.73	100.00	49.88	9.27	45.73
Total (Calc)	--	--	151.32	100.00	49.88	--	--	--	--

Product P6 Feed Weight (%): 0.17

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	448.6	443.4	5.19	10.58	29.05	10.58	29.05	100.00	49.39
7x12	452.2	434.6	17.67	36.01	40.94	46.60	38.24	89.42	51.79
12x18	413.6	401.2	12.41	25.30	50.19	71.90	42.44	53.40	59.11
-18	20.3	6.5	13.79	28.10	67.14	100.00	49.39	28.10	67.14
Total (Calc)	--	--	49.05	100.00	49.39	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 15 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 20.48

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	473.5	439.4	34.16	7.06	55.42	7.06	55.42	100.00	68.06
7x12	683.9	444.3	239.57	49.48	70.66	56.54	68.76	92.94	69.02
12x18	621.1	460.1	160.94	33.24	68.16	89.78	68.53	43.46	67.16
-18	55.9	6.4	49.49	10.22	63.93	100.00	68.06	10.22	63.93
Total (Calc)	--	--	484.15	100.00	68.06	--	--	--	--

SPIRAL DATA ANALYSIS

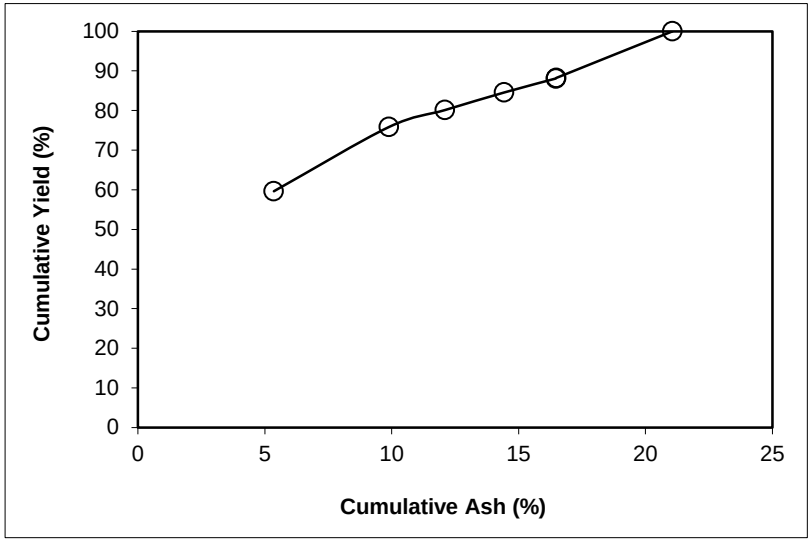
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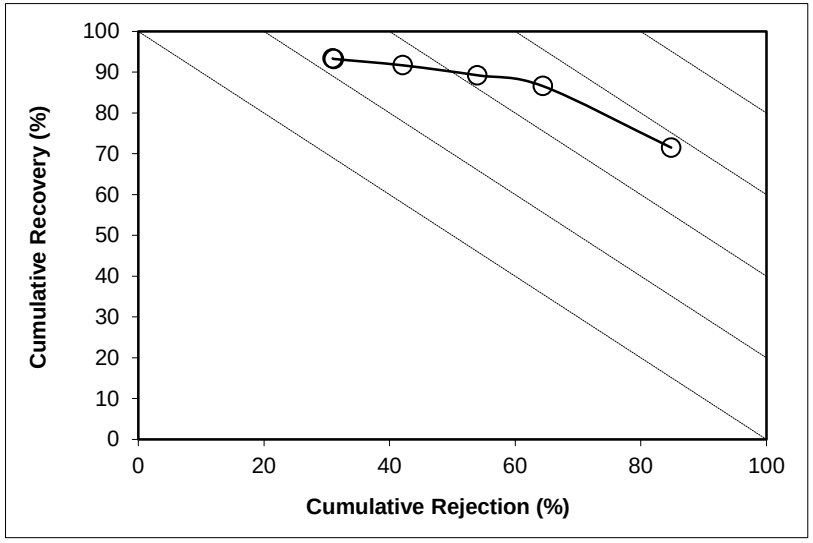
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: +7 Feed Weight (%): 12.29

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	59.64	5.36	59.64	5.36	71.51	40.36	44.27	84.84	56.34
P2	16.20	26.56	75.84	9.89	86.58	24.16	56.15	64.40	50.98
P3	4.29	51.18	80.12	12.10	89.23	19.88	57.22	53.99	43.22
P4	4.43	56.57	84.55	14.42	91.66	15.45	57.41	42.10	33.77
P5	3.54	65.20	88.09	16.47	93.23	11.91	55.09	31.14	24.36
P6	0.15	29.05	88.24	16.49	93.36	11.76	55.42	30.93	24.29
P7	11.76	55.42	100.00	21.06	100.00	0.00			
Total (Calc)	100.00	21.06	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

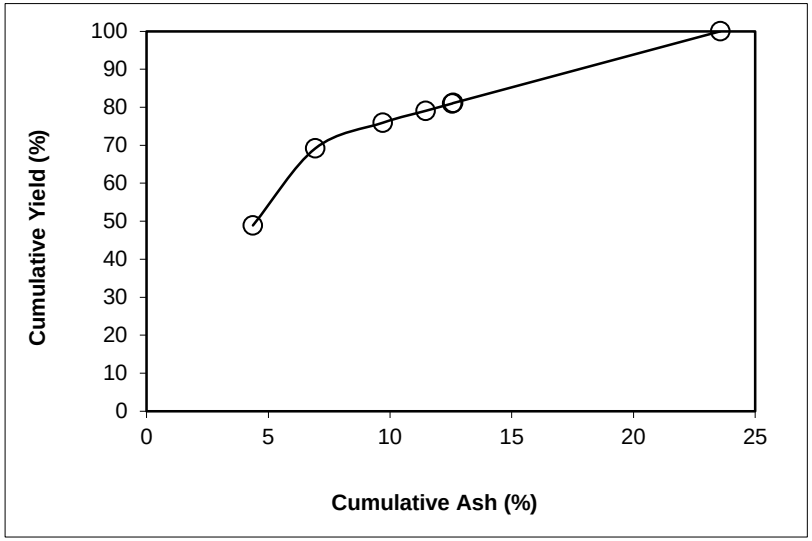
Description: Run 15 - Intermediate Spiral Test

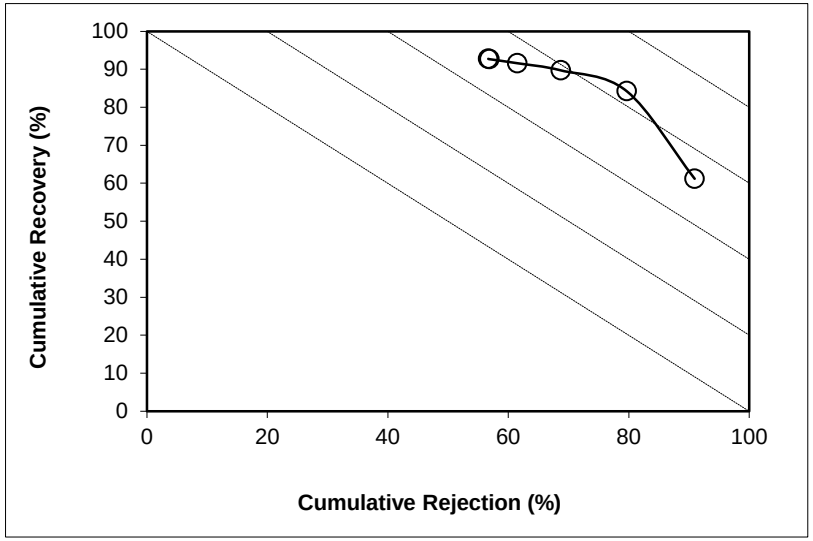
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 7x12 Feed Weight (%): 53.63

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	48.90	4.37	48.90	4.37	61.18	51.10	41.94	90.93	52.12
P2	20.27	13.11	69.17	6.93	84.22	30.83	60.89	79.66	63.88
P3	6.76	38.07	75.93	9.70	89.70	24.07	67.29	68.74	58.44
P4	3.15	54.12	79.07	11.47	91.59	20.93	69.27	61.51	53.10
P5	1.91	57.31	80.99	12.55	92.66	19.01	70.48	56.86	49.52
P6	0.12	40.94	81.10	12.59	92.75	18.90	70.66	56.66	49.41
P7	18.90	70.66	100.00	23.57	100.00	0.00			
Total (Calc)	100.00	23.57	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

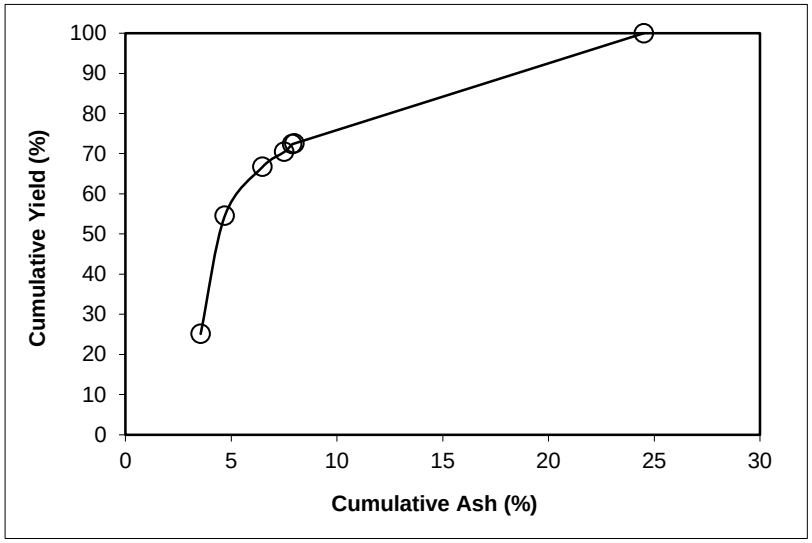
Description: Run 15 - Intermediate Spiral Test

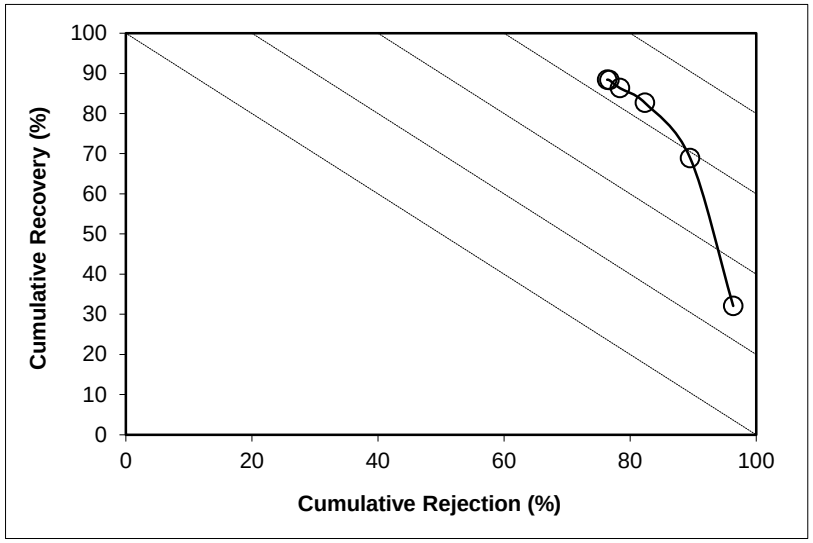
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 12x18 Feed Weight (%): 24.80

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	25.11	3.55	25.11	3.55	32.08	74.89	31.53	96.36	28.45
P2	29.43	5.67	54.55	4.70	68.86	45.45	48.28	89.54	58.41
P3	12.18	14.47	66.72	6.48	82.66	33.28	60.65	82.35	65.01
P4	3.73	25.98	70.45	7.51	86.31	29.55	65.03	78.40	64.71
P5	1.92	21.53	72.37	7.88	88.30	27.63	68.04	76.72	65.02
P6	0.18	50.19	72.54	7.99	88.42	27.46	68.16	76.36	64.78
P7	27.46	68.16	100.00	24.51	100.00	0.00			
Total (Calc)	100.00	24.51	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

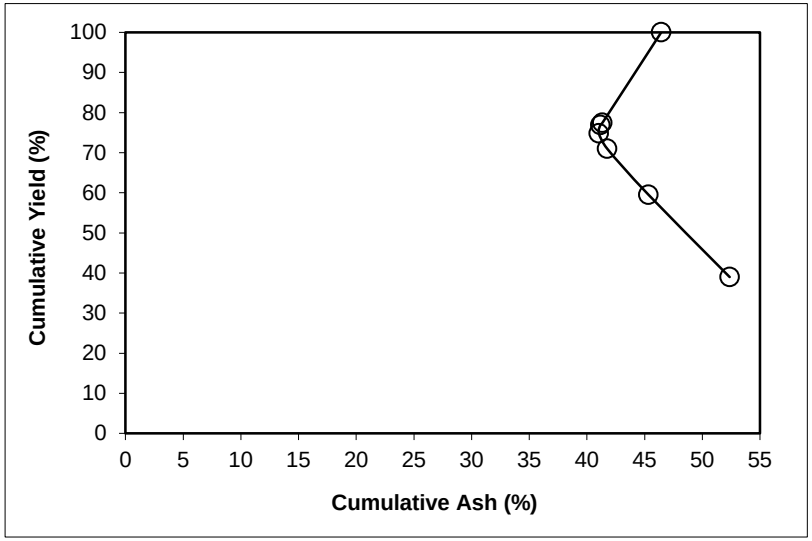
Description: Run 15 - Intermediate Spiral Test

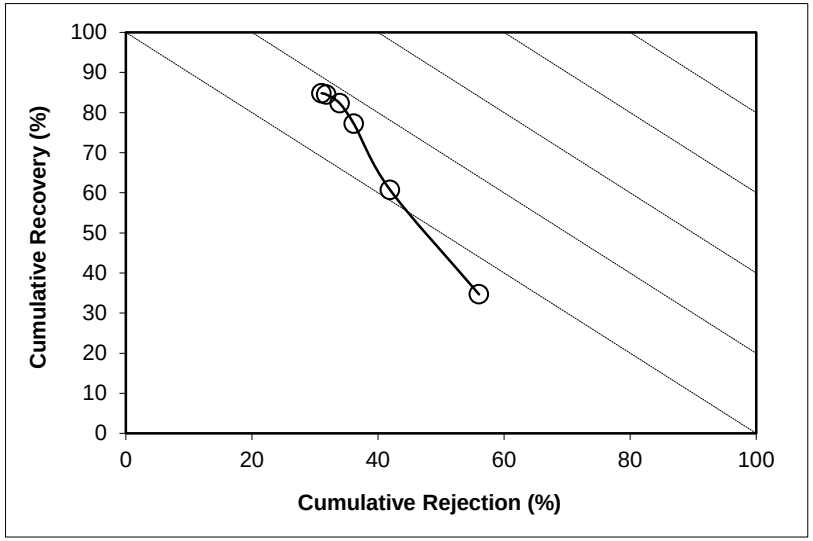
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: -18.00 Feed Weight (%): 9.28

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	38.99	52.37	38.99	52.37	34.67	61.01	42.64	56.03	-9.30
P2	20.52	31.96	59.51	45.33	60.74	40.49	48.06	41.90	2.64
P3	11.48	23.20	70.99	41.75	77.20	29.01	57.90	36.16	13.37
P4	3.80	27.63	74.79	41.04	82.34	25.21	62.46	33.90	16.24
P5	2.13	45.73	76.92	41.16	84.49	23.08	64.00	31.81	16.30
P6	0.52	67.14	77.45	41.34	84.81	22.55	63.93	31.05	15.86
P7	22.55	63.93	100.00	46.44	100.00	0.00			
Total (Calc)	100.00	46.44	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

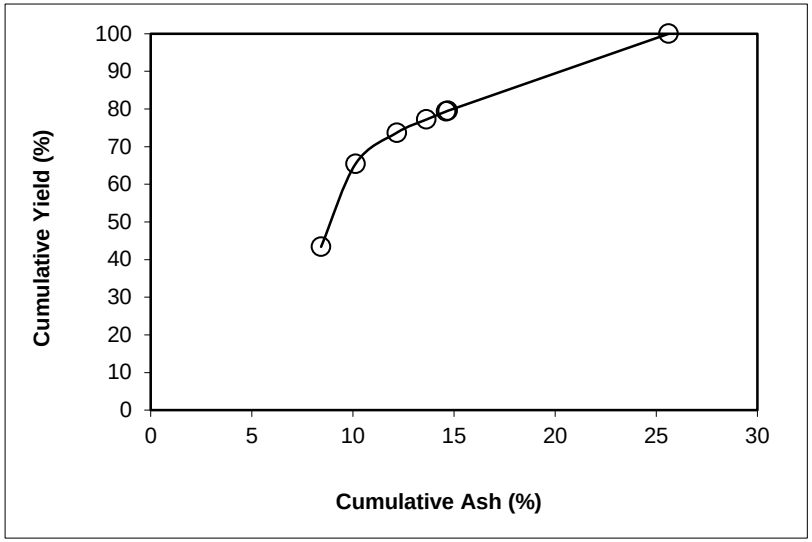
Description: Run 15 - Intermediate Spiral Test

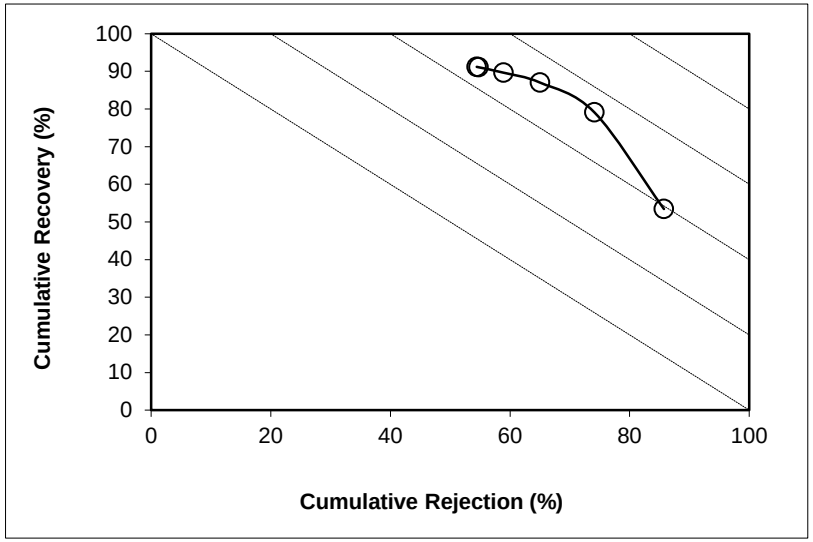
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	43.40	8.42	43.40	8.42	53.43	56.60	38.80	85.73	39.16
P2	22.06	13.49	65.47	10.13	79.09	34.53	54.97	74.11	53.20
P3	8.24	28.33	73.70	12.16	87.03	26.30	63.31	65.00	52.03
P4	3.51	44.43	77.21	13.63	89.65	22.79	66.22	58.91	48.56
P5	2.13	49.88	79.35	14.61	91.09	20.65	67.91	54.76	45.85
P6	0.17	49.39	79.52	14.68	91.21	20.48	68.06	54.42	45.63
P7	20.48	68.06	100.00	25.62	100.00	0.00			
Total (Calc)	100.00	25.62	--	--	--	--	--	--	--

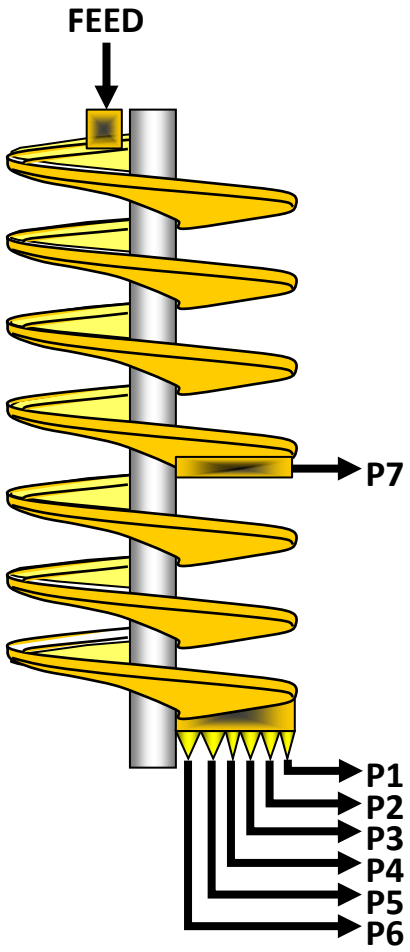




SPIRAL DATA ANALYSIS

Description: Run 16 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	1.262	18.1	22.80	26.52
P2	0.415	29.9	3.90	5.09
P3	0.126	28.8	1.24	1.57
P4	0.036	27.5	0.38	0.47
P5	0.016	12.6	0.44	0.47
P6	0.002	4.5	0.16	0.17
P7	0.260	42.8	1.39	1.85
Total	2.116	21.8	30.31	36.14

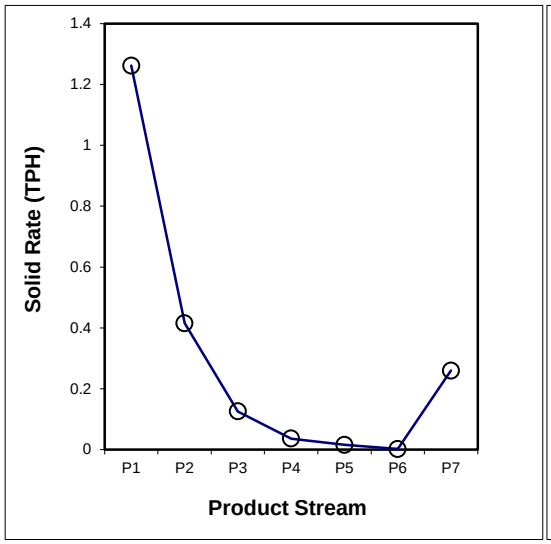
SPIRAL DATA ANALYSIS

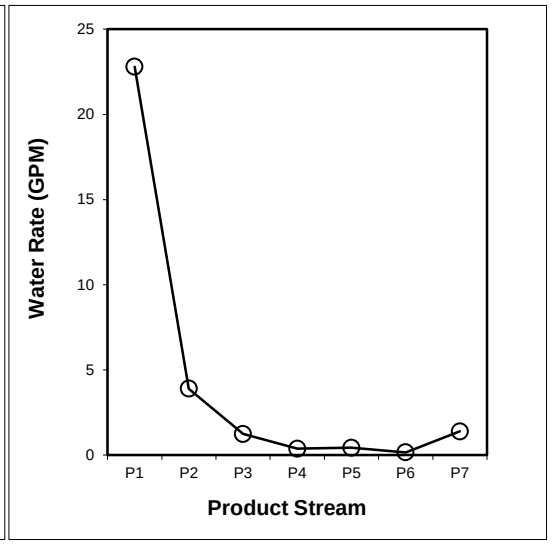
Description: Run 16 - Intermediate Spiral Test

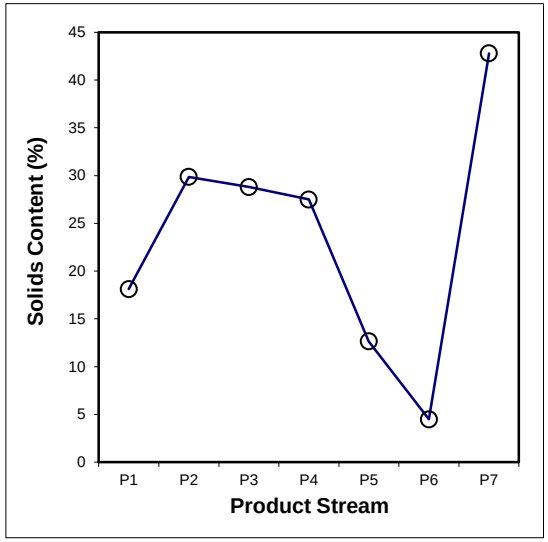
Comments: 3.36 x 1.0 mm Nominal Particle Size

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	3	6549.00	1151.00	6.961	2305.1	1350.1	1.262	59.63	18.13
P2	5	1884.17	91.82	1.391	1874.2	1350.2	0.415	19.63	29.87
P3	10	1215.88	93.50	0.436	1602.1	1285.5	0.126	5.93	28.80
P4	15	599.49	93.13	0.131	2116.5	1980.3	0.036	1.70	27.50
P5	30	1056.58	92.18	0.125	2255.2	2136.1	0.016	0.74	12.64
P6	60	752.91	93.21	0.043	2165.0	2136.1	0.002	0.09	4.49
P7	5	862.85	91.92	0.607	2307.9	1980.2	0.260	12.28	42.79
Total (Calc)	--	--	--	9.693	--	--	2.116	100.00	21.83
Total (Head)	0.60	1648.67	177.7	9.693	1606.7	1285.5	2.116	--	21.83







SPIRAL DATA ANALYSIS

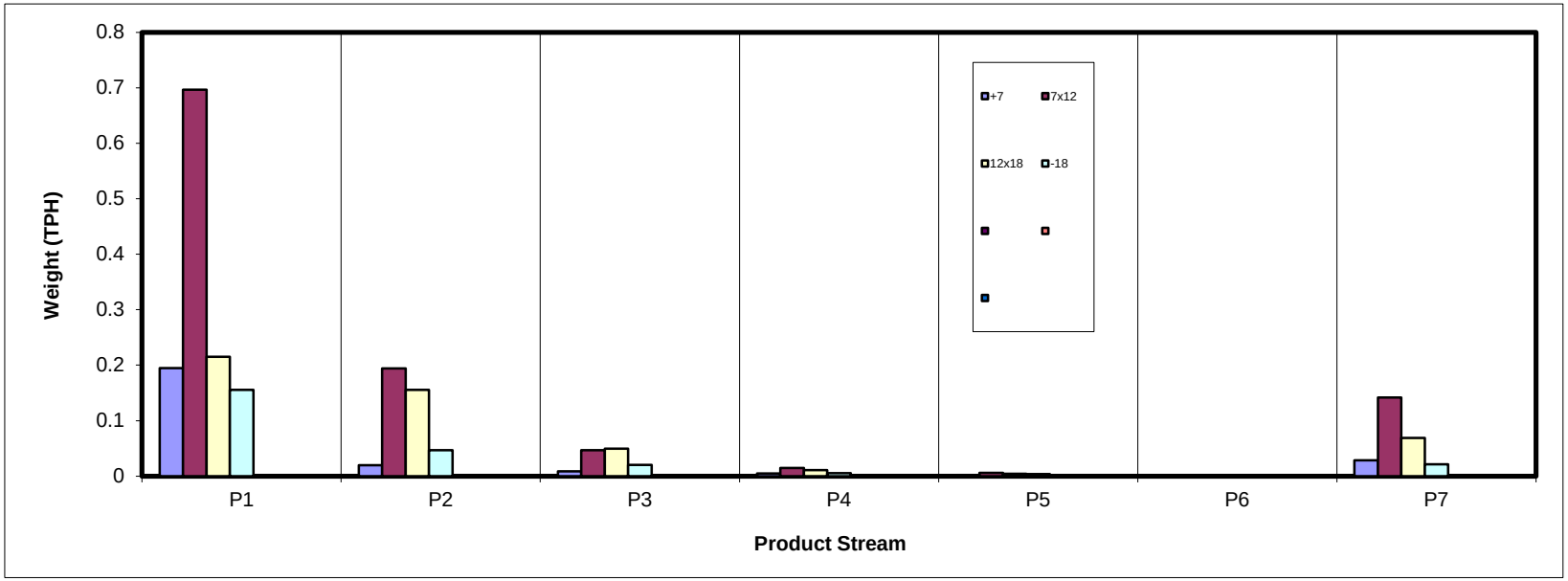
Description: Run 16 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	0.195	0.020	0.009	0.005	0.002	0.000	0.028		0.259
7x12	0.697	0.194	0.047	0.015	0.006	0.001	0.142		1.100
12x18	0.215	0.155	0.050	0.011	0.004	0.000	0.069		0.505
-18	0.155	0.046	0.020	0.005	0.004	0.001	0.021		0.253
Total (Calc)	1.262	0.415	0.126	0.036	0.016	0.002	0.260		2.116



SPIRAL DATA ANALYSIS

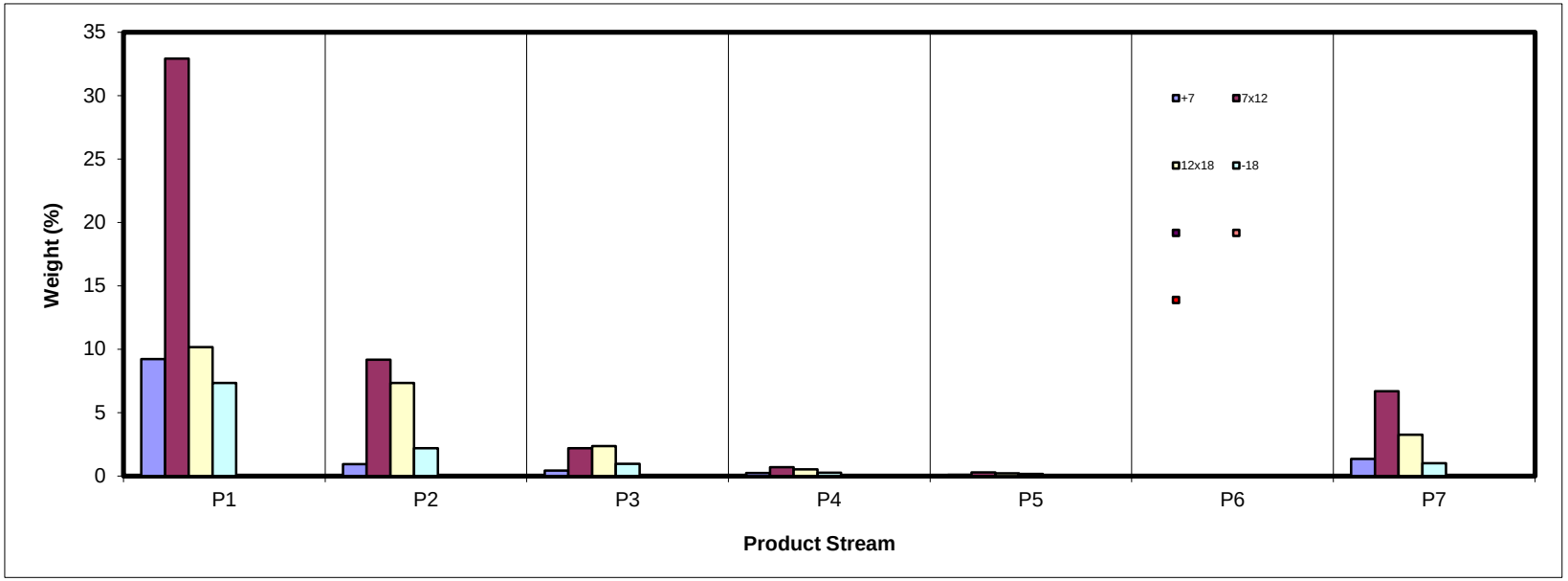
Description: Run 16 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	9.21	0.93	0.42	0.24	0.09	0.01	1.33		12.24
7x12	32.92	9.16	2.20	0.69	0.27	0.03	6.69		51.96
12x18	10.17	7.33	2.35	0.52	0.21	0.01	3.25		23.84
-18	7.34	2.20	0.97	0.25	0.17	0.04	1.01		11.96
Total (Calc)	59.63	19.63	5.93	1.70	0.74	0.09	12.28		100.00



SPIRAL DATA ANALYSIS

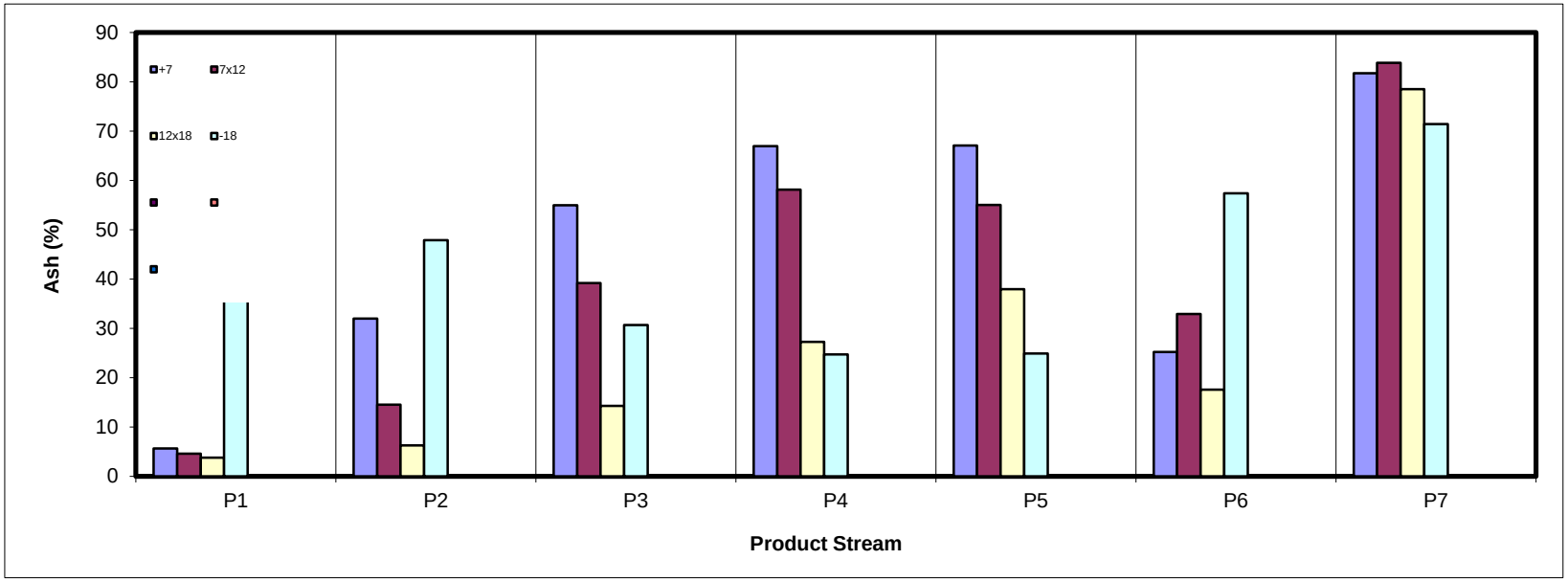
Description: Run 16 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	5.61	31.99	54.93	66.96	67.06	25.23	81.68		19.28
7x12	4.61	14.53	39.16	58.14	54.99	32.92	83.82		19.01
12x18	3.79	6.25	14.29	27.26	37.94	17.59	78.48		16.59
-18	55.50	47.85	30.69	24.69	24.87	57.35	71.39		52.37
Total (Calc)	10.89	15.99	29.04	44.98	45.01	40.23	81.15		22.45



SPIRAL DATA ANALYSIS

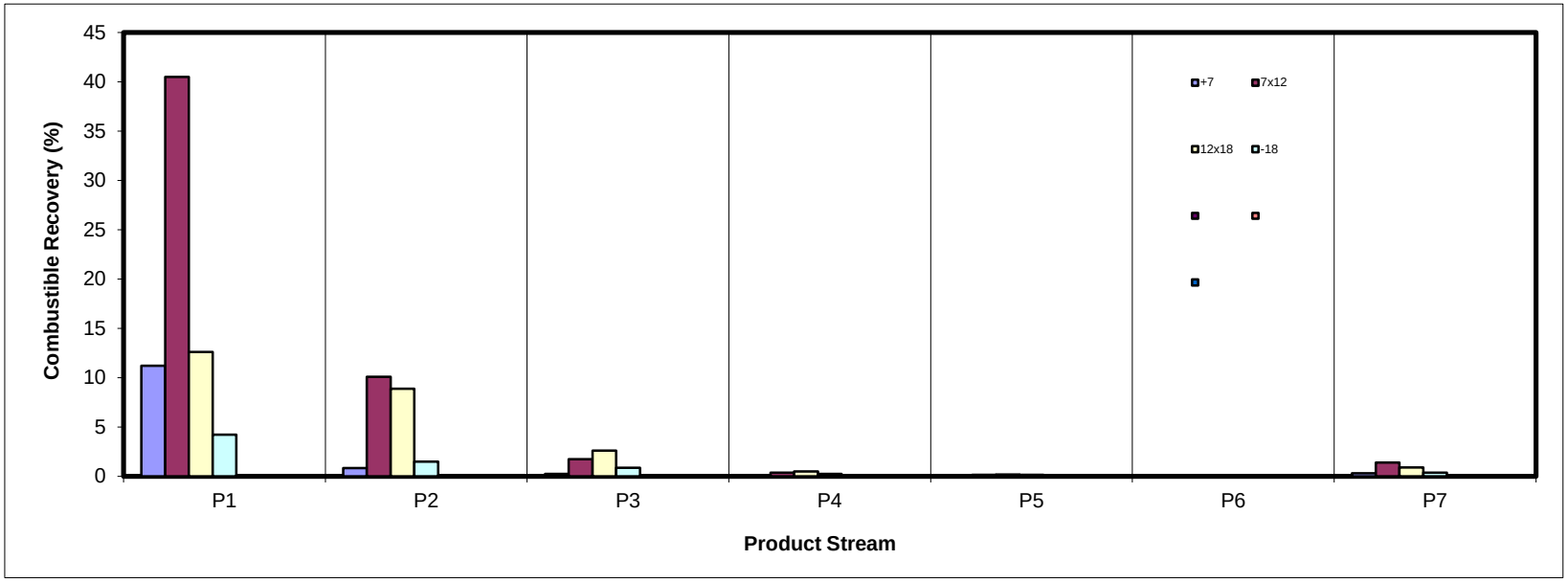
Description: Run 16 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	11.21	0.82	0.24	0.10	0.04	0.01	0.32		12.74
7x12	40.49	10.10	1.73	0.37	0.16	0.02	1.40		54.27
12x18	12.61	8.87	2.60	0.49	0.17	0.01	0.90		25.65
-18	4.21	1.48	0.86	0.24	0.16	0.02	0.37		7.35
Total (Calc)	68.52	21.26	5.43	1.21	0.53	0.07	2.98		100.00



SPIRAL DATA ANALYSIS

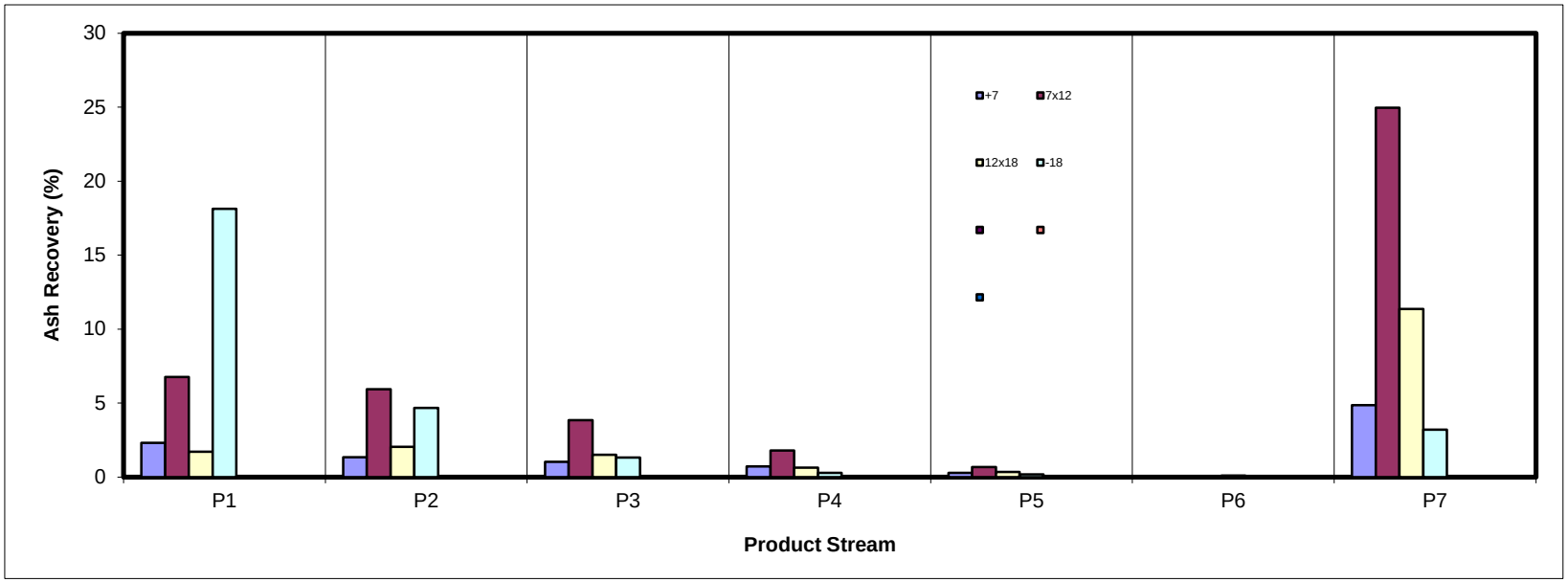
Description: Run 16 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	2.30	1.33	1.02	0.71	0.28	0.01	4.85		10.51
7x12	6.76	5.93	3.84	1.79	0.67	0.04	24.96		43.98
12x18	1.72	2.04	1.49	0.63	0.35	0.01	11.36		17.61
-18	18.14	4.68	1.32	0.28	0.18	0.10	3.20		27.89
Total (Calc)	28.91	13.98	7.67	3.41	1.49	0.16	44.38		100.00



SPIRAL DATA ANALYSIS

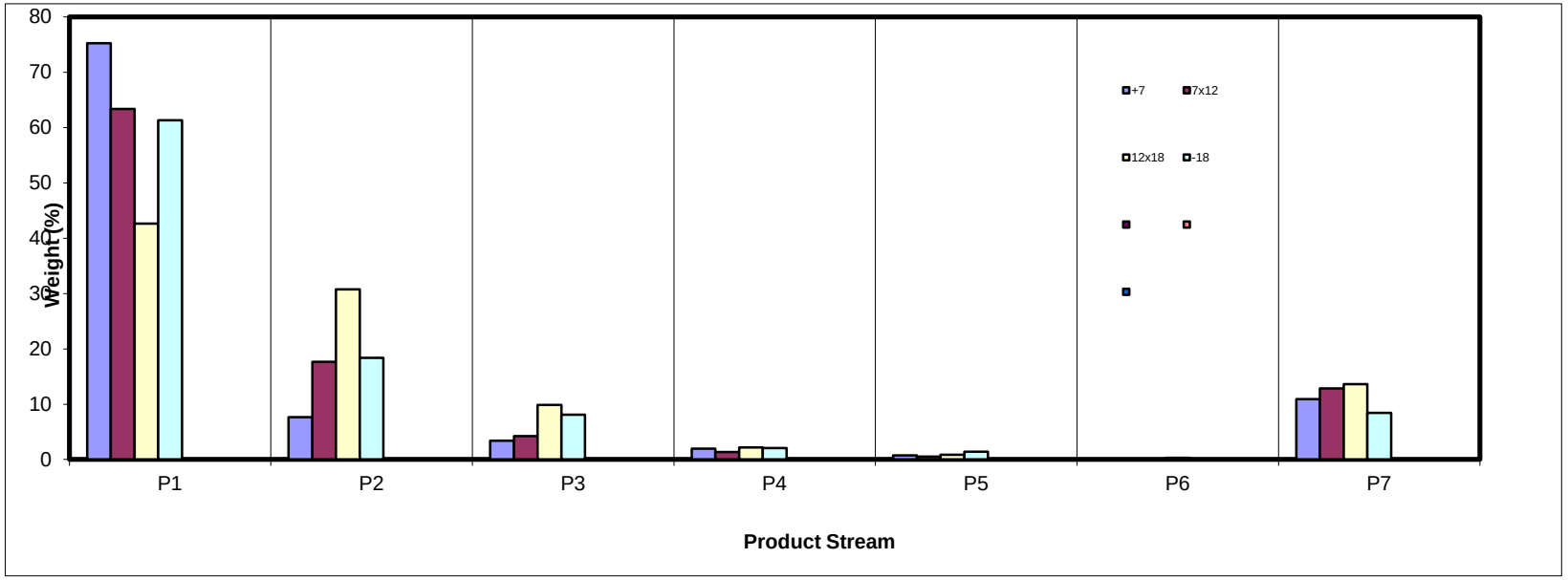
Description: Run 16 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	75.24	7.64	3.41	1.94	0.77	0.10	10.90		100.00
7x12	63.35	17.64	4.23	1.33	0.53	0.05	12.87		100.00
12x18	42.64	30.76	9.85	2.19	0.88	0.05	13.63		100.00
-18	61.34	18.36	8.07	2.09	1.39	0.33	8.42		100.00
Total (Calc)	59.63	19.63	5.93	1.70	0.74	0.09	12.28		100.00



SPIRAL DATA ANALYSIS

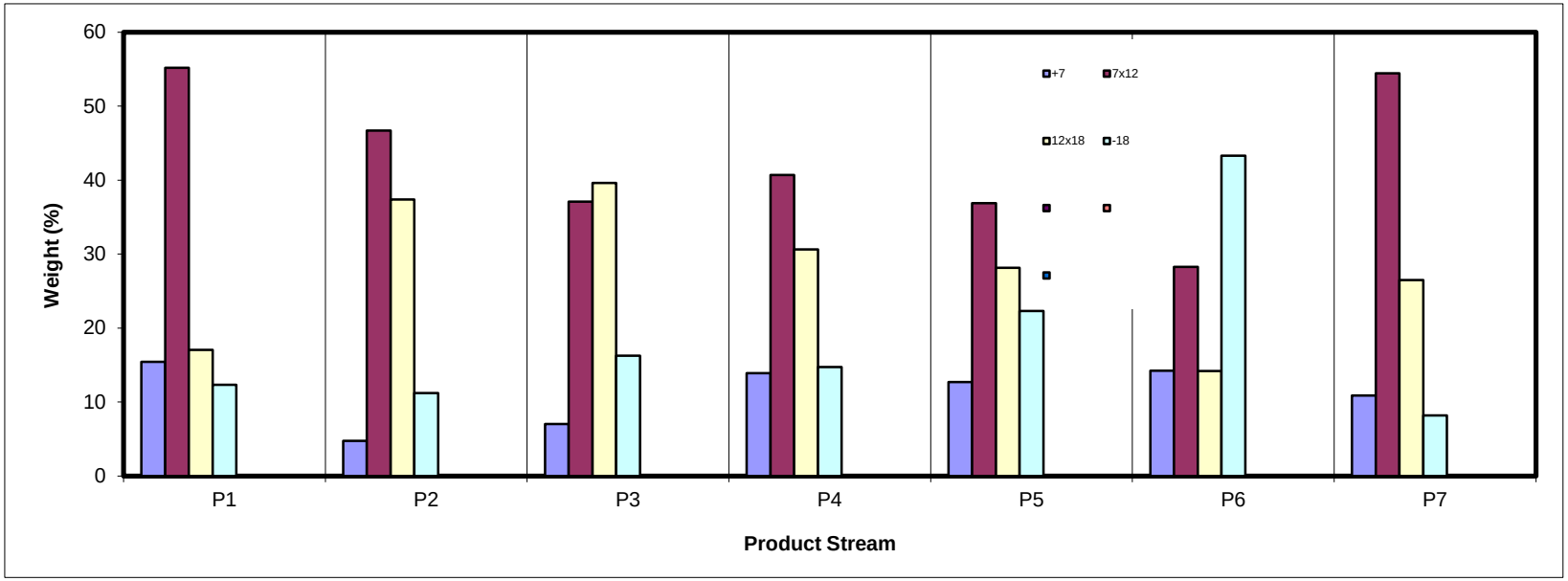
Description: Run 16 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	15.44	4.76	7.04	13.92	12.69	14.22	10.87		12.24
7x12	55.20	46.68	37.09	40.71	36.88	28.27	54.46		51.96
12x18	17.05	37.37	39.60	30.65	28.13	14.19	26.48		23.84
-18	12.30	11.19	16.28	14.72	22.30	43.32	8.20		11.96
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

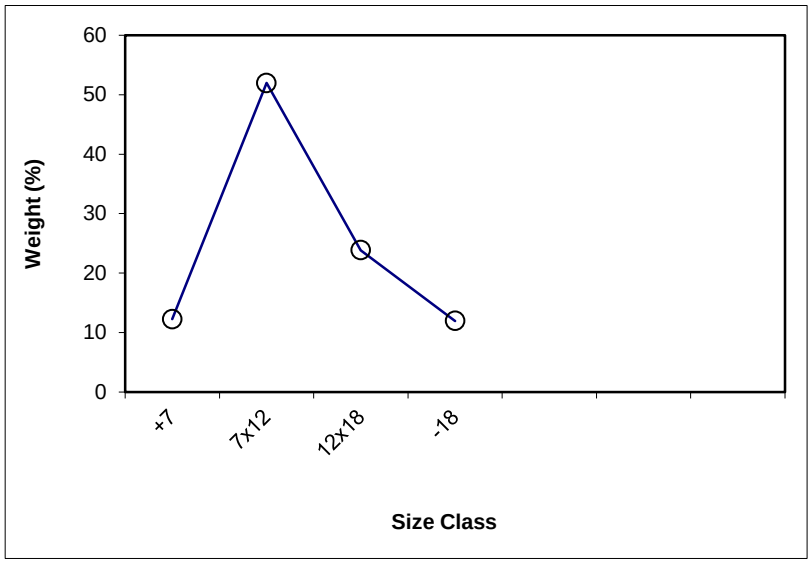
Description: Run 16 - Intermediate Spiral Test

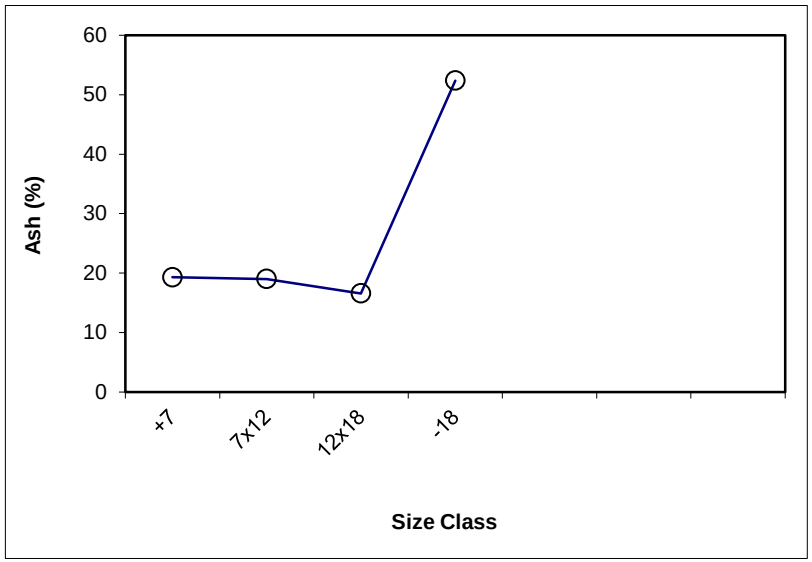
Comments: 3.36 x 1.0 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	482.7	443.4	39.31	12.24	19.28	12.24	19.28	100.00	22.45
7x12	601.4	434.6	166.88	51.96	19.01	64.20	19.06	87.76	22.90
12x18	477.8	401.2	76.58	23.84	16.59	88.04	18.39	35.80	28.54
-18	44.8	6.4	38.42	11.96	52.37	100.00	22.45	11.96	52.37
Total (Calc)	--	--	321.19	100.00	22.45	--	--	--	--





SPIRAL DATA ANALYSIS

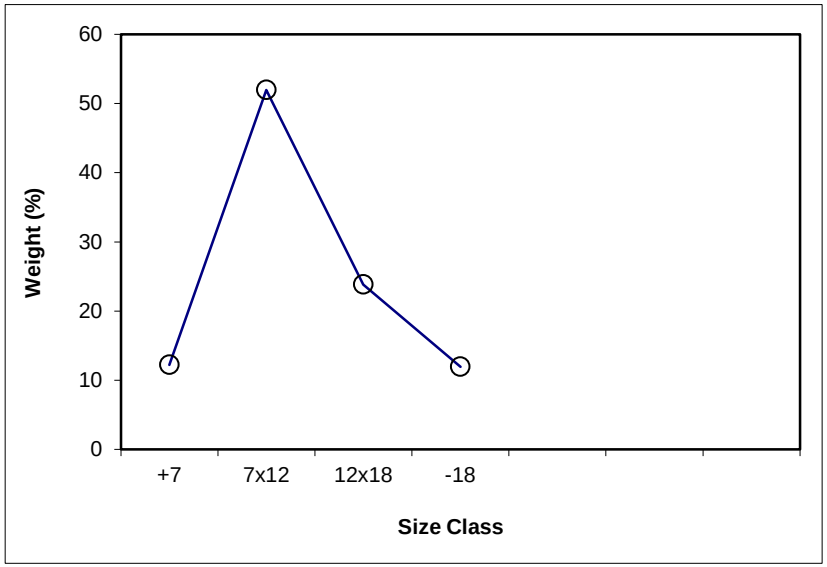
Description: Run 16 - Intermediate Spiral Test

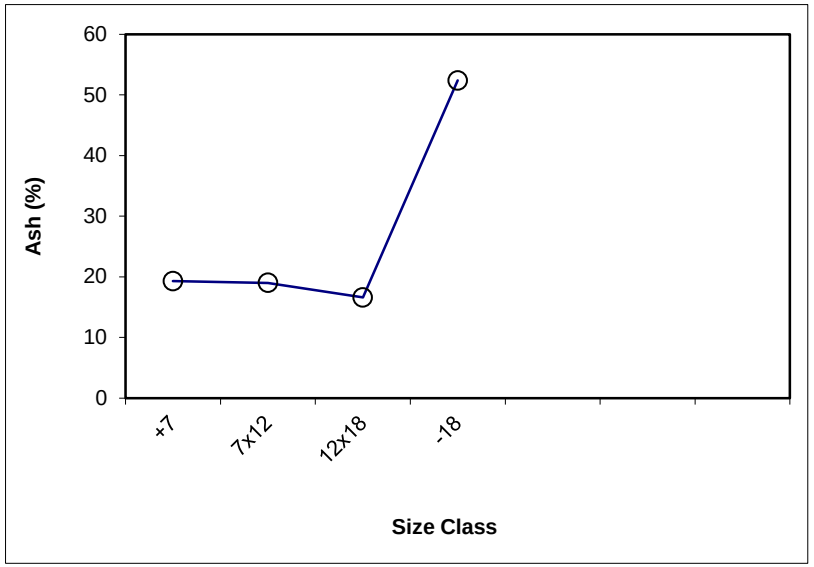
Comments: 3.36 x 1.0 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+7	12.24	19.28	12.24	19.28	100.00	22.45			
7x12	51.96	19.01	64.20	19.06	87.76	22.90	x	51.96	19.01
12x18	23.84	16.59	88.04	18.39	35.80	28.54	x	23.84	16.59
-18	11.96	52.37	100.00	22.45	11.96	52.37			
Total (Calc)	100.00	22.45	--	--	--	--	--	75.80	18.25





SPIRAL DATA ANALYSIS

Description: Run 16 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 59.63

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	586.84	439.4	147.48	15.44	5.61	15.44	5.61	100.00	10.89
7x12	971.43	444.3	527.13	55.20	4.61	70.65	4.83	84.56	11.85
12x18	622.95	460.1	162.81	17.05	3.79	87.70	4.63	29.35	25.47
-18	123.83	6.3	117.50	12.30	55.50	100.00	10.89	12.30	55.50
Total (Calc)	--	--	954.93	100.00	10.89	--	--	--	--

Product P2 Feed Weight (%): 19.63

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	464.3	439.4	24.94	4.76	31.99	4.76	31.99	100.00	15.99
7x12	688.9	444.3	244.57	46.68	14.53	51.44	16.14	95.24	15.19
12x18	655.9	460.1	195.78	37.37	6.25	88.81	11.98	48.56	15.83
-18	65.1	6.4	58.62	11.19	47.85	100.00	15.99	11.19	47.85
Total (Calc)	--	--	523.91	100.00	15.99	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 16 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 5.93

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	465.6	443.4	22.27	7.04	54.93	7.04	54.93	100.00	29.04
7x12	552.0	434.6	117.40	37.09	39.16	44.12	41.67	92.96	27.08
12x18	526.6	401.2	125.35	39.60	14.29	83.72	28.72	55.88	19.07
-18	57.9	6.4	51.53	16.28	30.69	100.00	29.04	16.28	30.69
Total (Calc)	--	--	316.55	100.00	29.04	--	--	--	--

Product P4 Feed Weight (%): 1.70

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	673.6	654.7	18.96	13.92	66.96	13.92	66.96	100.00	44.98
7x12	710.6	655.1	55.47	40.71	58.14	54.63	60.39	86.08	41.42
12x18	705.8	664.1	41.76	30.65	27.26	85.28	48.48	45.37	26.42
-18	26.4	6.4	20.06	14.72	24.69	100.00	44.98	14.72	24.69
Total (Calc)	--	--	136.25	100.00	44.98	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 16 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 0.74

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	824.6	809.5	15.11	12.69	67.06	12.69	67.06	100.00	45.01
7x12	699.4	655.5	43.91	36.88	54.99	49.57	58.08	87.31	41.81
12x18	698.2	664.7	33.50	28.13	37.94	77.70	50.79	50.43	32.16
-18	33.0	6.4	26.55	22.30	24.87	100.00	45.01	22.30	24.87
Total (Calc)	--	--	119.07	100.00	45.01	--	--	--	--

Product P6 Feed Weight (%): 0.09

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	813.6	809.5	4.11	14.22	25.23	14.22	25.23	100.00	40.23
7x12	663.7	655.5	8.18	28.27	32.92	42.49	30.35	85.78	42.72
12x18	668.8	664.7	4.10	14.19	17.59	56.68	27.15	57.51	47.54
-18	18.9	6.4	12.53	43.32	57.35	100.00	40.23	43.32	57.35
Total (Calc)	--	--	28.92	100.00	40.23	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 16 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 12.28

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	690.3	654.7	35.61	10.87	81.68	10.87	81.68	100.00	81.15
7x12	833.6	655.1	178.46	54.46	83.82	65.32	83.46	89.13	81.09
12x18	750.9	664.1	86.77	26.48	78.48	91.80	82.02	34.68	76.81
-18	33.1	6.3	26.87	8.20	71.39	100.00	81.15	8.20	71.39
Total (Calc)	--	--	327.71	100.00	81.15	--	--	--	--

SPIRAL DATA ANALYSIS

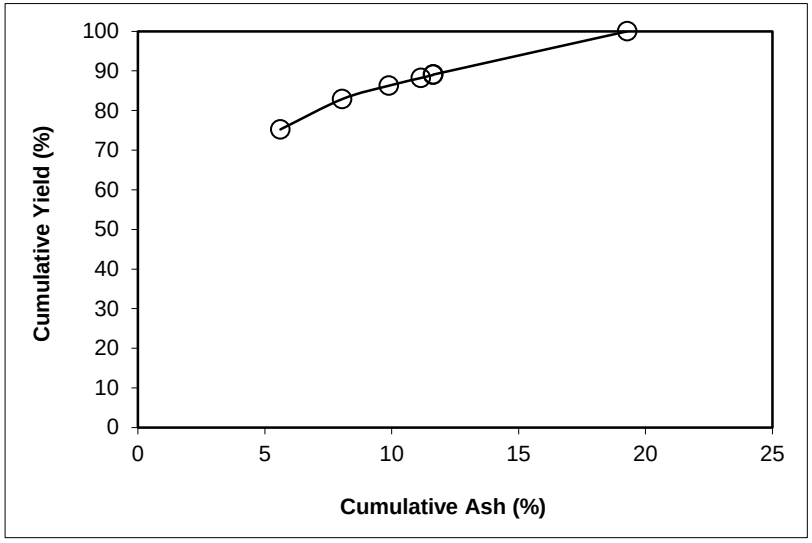
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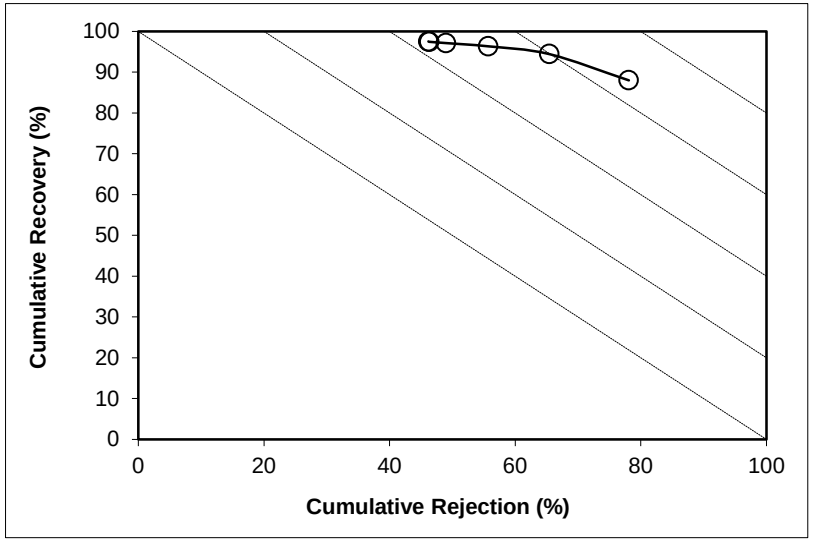
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: +7 Feed Weight (%): 12.24

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	75.24	5.61	75.24	5.61	87.99	24.76	60.82	78.10	66.08
P2	7.64	31.99	82.88	8.04	94.42	17.12	73.69	65.43	59.85
P3	3.41	54.93	86.29	9.90	96.32	13.71	78.35	55.72	52.04
P4	1.94	66.96	88.22	11.15	97.11	11.78	80.22	49.00	46.11
P5	0.77	67.06	88.99	11.63	97.43	11.01	81.14	46.32	43.74
P6	0.10	25.23	89.10	11.65	97.53	10.90	81.68	46.18	43.70
P7	10.90	81.68	100.00	19.28	100.00	0.00			
Total (Calc)	100.00	19.28	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

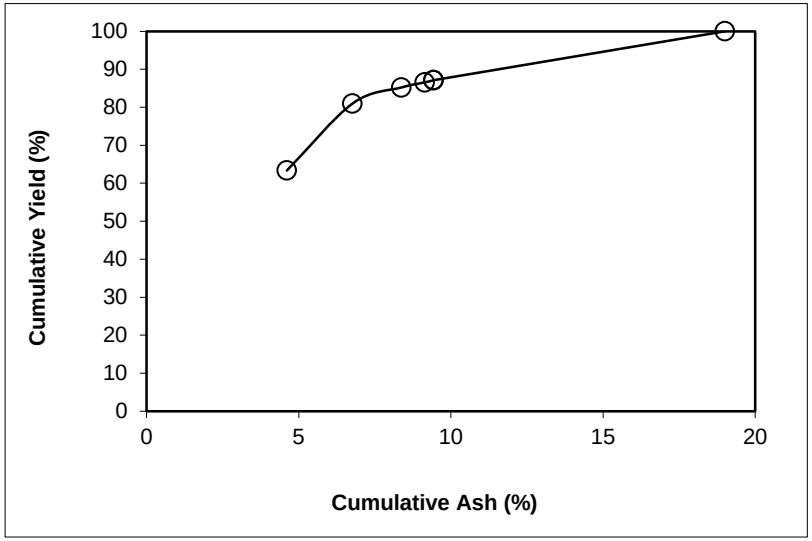
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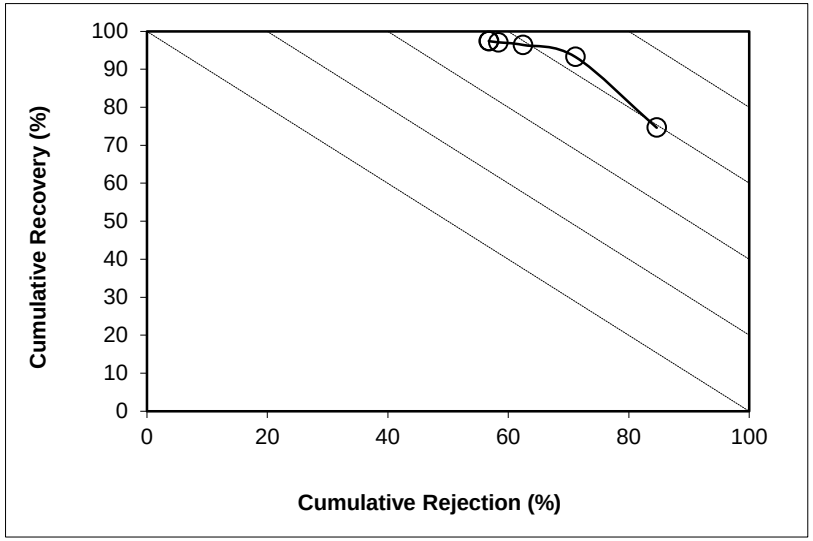
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 7x12 Feed Weight (%): 51.96

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	63.35	4.61	63.35	4.61	74.61	36.65	43.90	84.64	59.25
P2	17.64	14.53	80.99	6.77	93.23	19.01	71.14	71.16	64.38
P3	4.23	39.16	85.22	8.38	96.41	14.78	80.30	62.44	58.84
P4	1.33	58.14	86.55	9.14	97.09	13.45	82.50	58.36	55.45
P5	0.53	54.99	87.08	9.42	97.39	12.92	83.62	56.83	54.22
P6	0.05	32.92	87.13	9.44	97.43	12.87	83.82	56.75	54.17
P7	12.87	83.82	100.00	19.01	100.00	0.00			
Total (Calc)	100.00	19.01	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

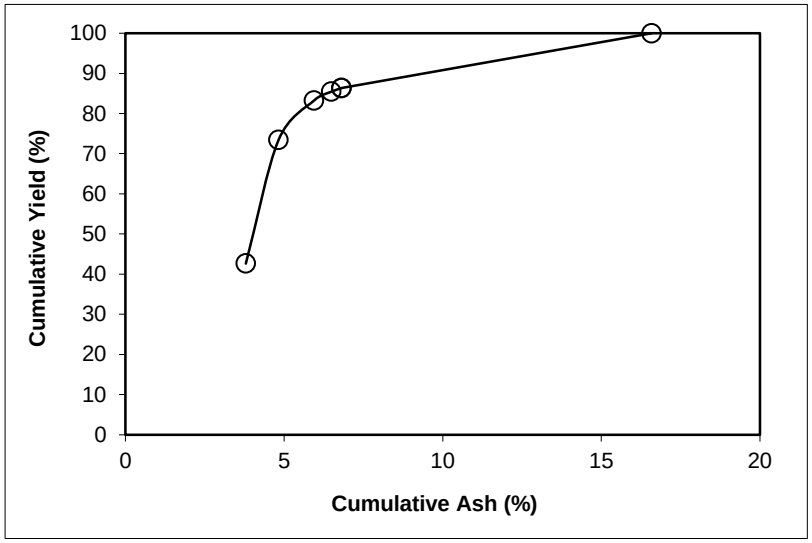
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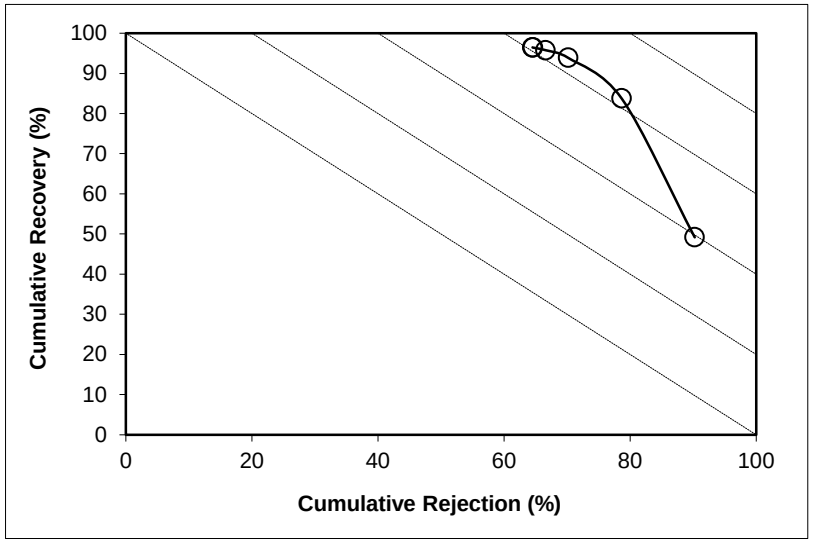
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 12x18 Feed Weight (%): 23.84

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	42.64	3.79	42.64	3.79	49.18	57.36	26.09	90.25	39.43
P2	30.76	6.25	73.40	4.82	83.75	26.60	49.04	78.66	62.41
P3	9.85	14.29	83.25	5.94	93.87	16.75	69.48	70.17	64.04
P4	2.19	27.26	85.43	6.49	95.78	14.57	75.82	66.58	62.36
P5	0.88	37.94	86.31	6.81	96.43	13.69	78.24	64.57	61.00
P6	0.05	17.59	86.37	6.81	96.48	13.63	78.48	64.52	61.00
P7	13.63	78.48	100.00	16.59	100.00	0.00			
Total (Calc)	100.00	16.59	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

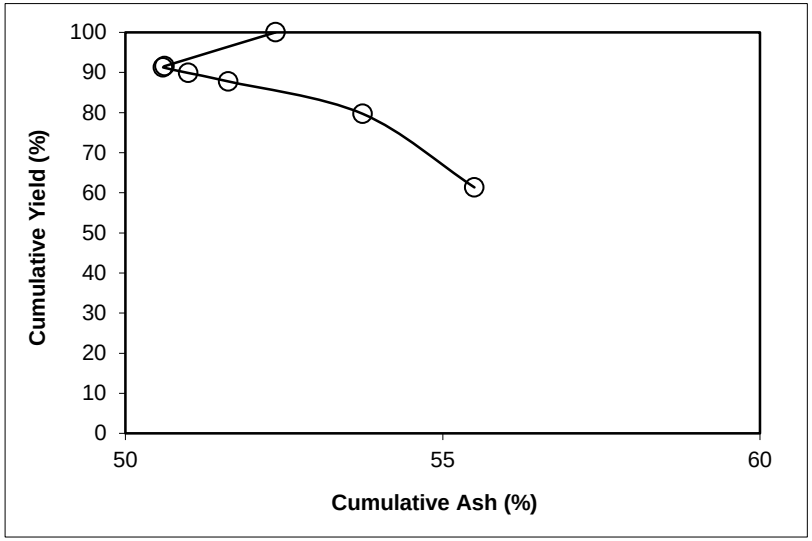
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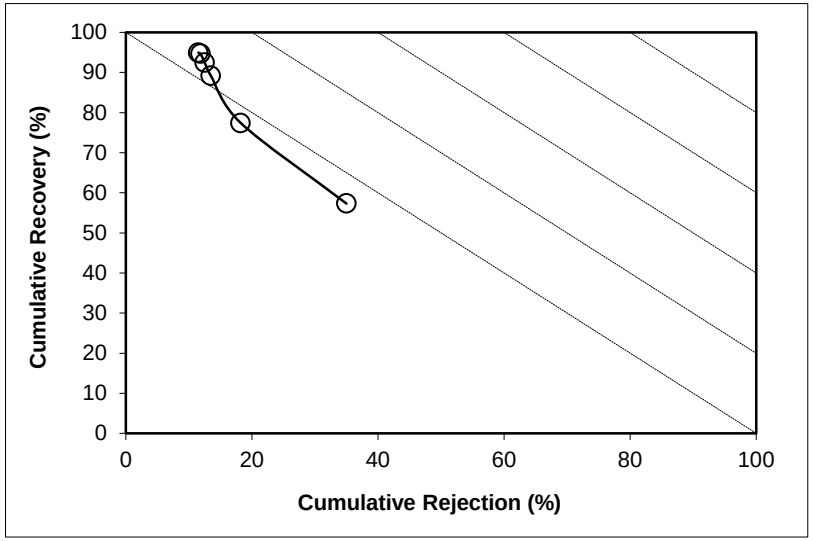
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: -18.00 Feed Weight (%): 11.96

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	61.34	55.50	61.34	55.50	57.31	38.66	47.39	34.99	-7.71
P2	18.36	47.85	79.71	53.74	77.41	20.29	46.98	18.21	-4.38
P3	8.07	30.69	87.78	51.62	89.15	12.22	57.74	13.48	2.63
P4	2.09	24.69	89.87	50.99	92.47	10.13	64.57	12.49	4.96
P5	1.39	24.87	91.26	50.59	94.65	8.74	70.86	11.83	6.48
P6	0.33	57.35	91.58	50.62	94.94	8.42	71.39	11.47	6.42
P7	8.42	71.39	100.00	52.37	100.00	0.00			
Total (Calc)	100.00	52.37	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

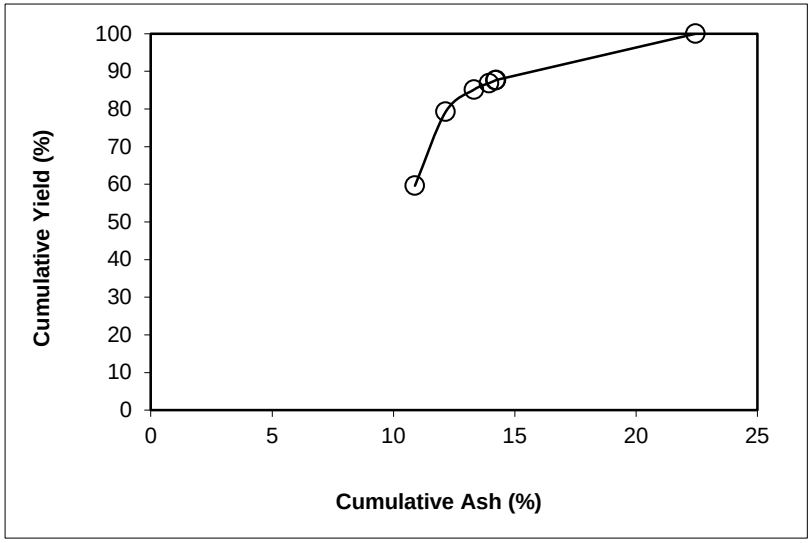
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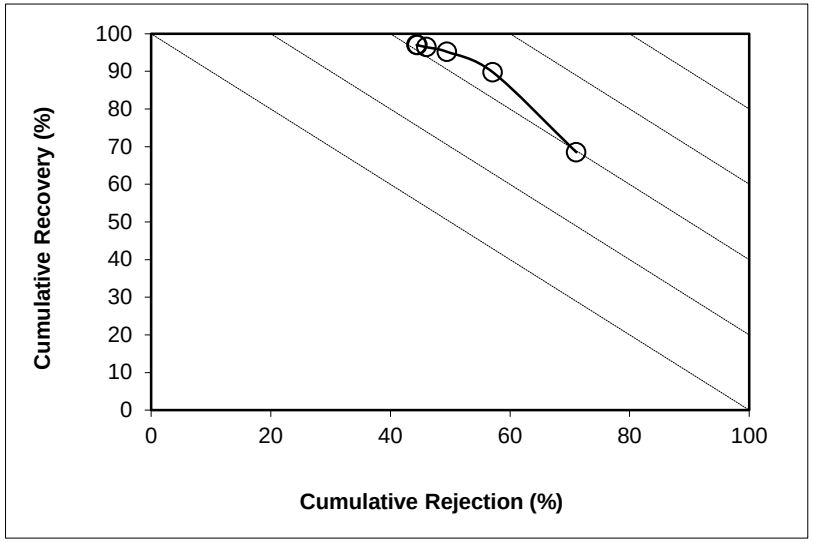
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	59.63	10.89	59.63	10.89	68.52	40.37	39.54	71.09	39.61
P2	19.63	15.99	79.26	12.15	89.79	20.74	61.81	57.11	46.89
P3	5.93	29.04	85.19	13.33	95.21	14.81	74.93	49.44	44.65
P4	1.70	44.98	86.89	13.95	96.42	13.11	78.82	46.03	42.45
P5	0.74	45.01	87.63	14.21	96.95	12.37	80.85	44.54	41.48
P6	0.09	40.23	87.72	14.24	97.02	12.28	81.15	44.38	41.39
P7	12.28	81.15	100.00	22.45	100.00	0.00			
Total (Calc)	100.00	22.45	--	--	--	--	--	--	--

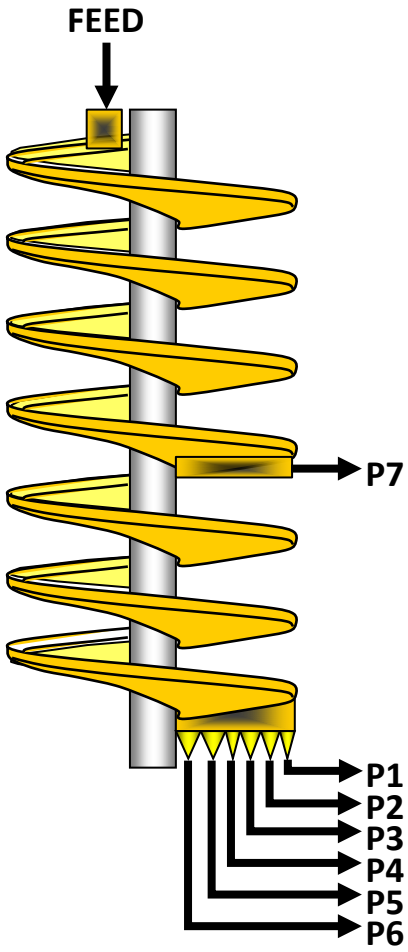




SPIRAL DATA ANALYSIS

Description: Run 17 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	1.171	14.8	27.00	30.46
P2	0.413	29.3	3.98	5.18
P3	0.124	28.5	1.25	1.58
P4	0.039	27.7	0.41	0.48
P5	0.013	10.8	0.43	0.46
P6	0.001	3.0	0.15	0.16
P7	0.338	46.3	1.57	2.32
Total	2.100	19.4	34.80	40.64

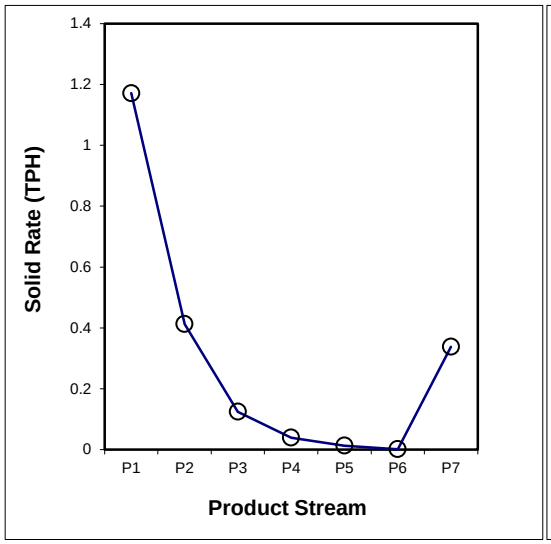
SPIRAL DATA ANALYSIS

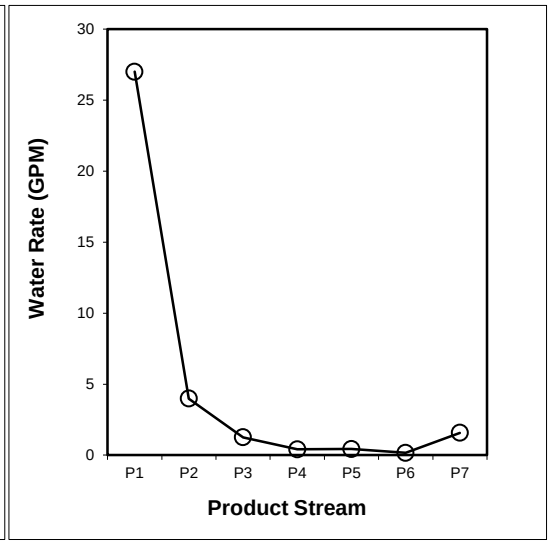
Description: Run 17 - Intermediate Spiral Test

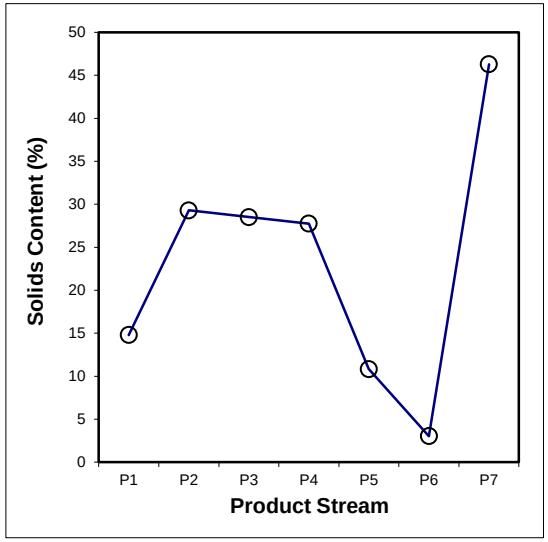
Comments: 3.36 x 1.0 mm Nominal Particle Size

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	3	7267.50	1138.00	7.922	2171.6	1285.3	1.171	55.78	14.79
P2	5	1902.73	93.16	1.408	1870.4	1350.0	0.413	19.65	29.30
P3	10	1202.01	84.07	0.436	1599.3	1285.5	0.124	5.93	28.51
P4	20	811.90	91.28	0.141	2177.1	1980.2	0.039	1.86	27.74
P5	30	1025.87	94.46	0.121	2234.7	2135.9	0.013	0.62	10.82
P6	60	710.09	94.96	0.040	2539.6	2521.3	0.001	0.06	3.04
P7	5	1001.26	92.44	0.730	1711.8	1285.5	0.338	16.10	46.28
Total (Calc)	--	--	--	10.799	--	--	2.100	100.00	19.44
Total (Head)	0.55	1711.28	211.2	10.799	1641.9	1350.2	2.100	--	19.44







SPIRAL DATA ANALYSIS

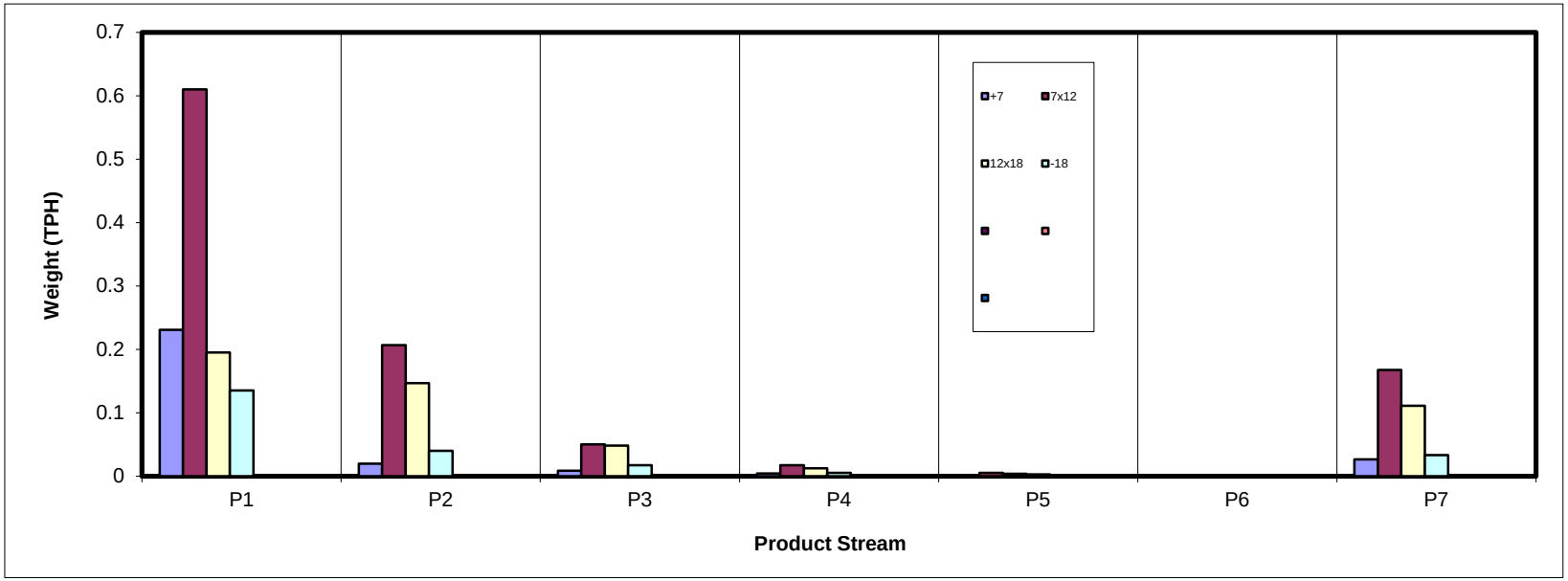
Description: Run 17 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	0.231	0.020	0.009	0.004	0.002	0.000	0.026		0.292
7x12	0.610	0.207	0.050	0.017	0.005	0.000	0.167		1.057
12x18	0.195	0.147	0.048	0.012	0.004	0.000	0.111		0.517
-18	0.135	0.040	0.017	0.005	0.003	0.001	0.033		0.234
Total (Calc)	1.171	0.413	0.124	0.039	0.013	0.001	0.338		2.100



SPIRAL DATA ANALYSIS

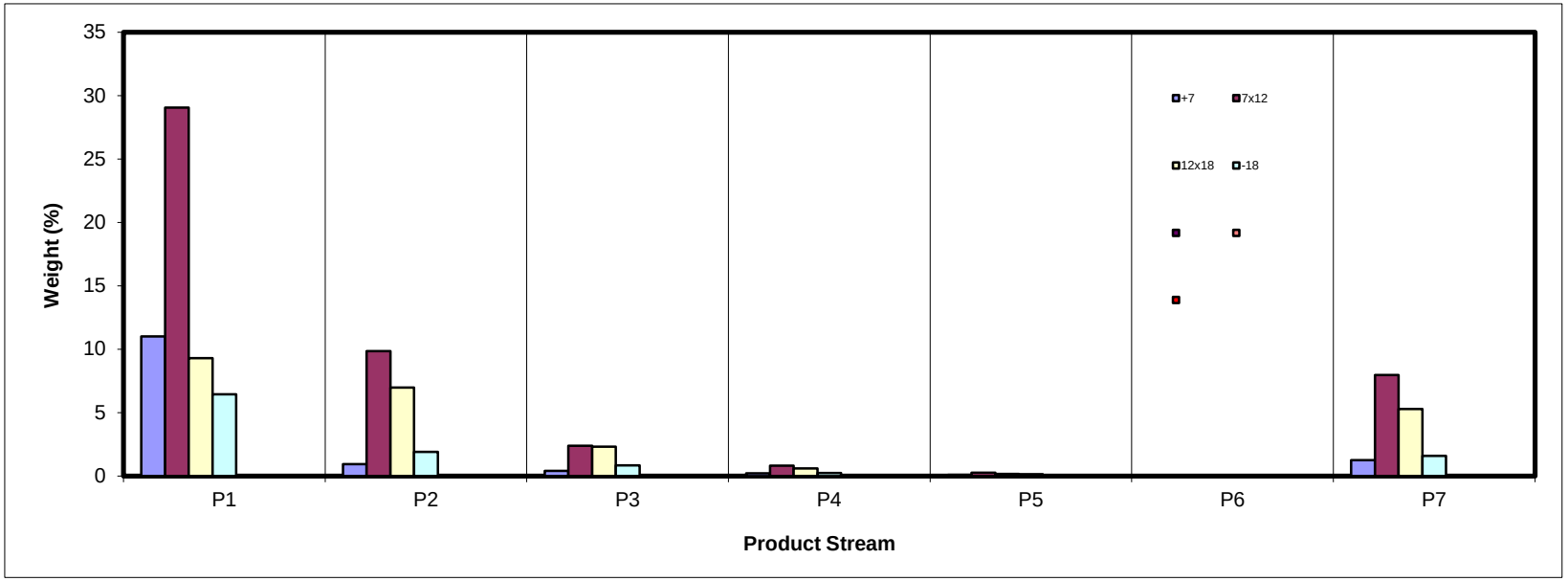
Description: Run 17 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	11.00	0.94	0.41	0.21	0.08	0.01	1.25		13.89
7x12	29.05	9.84	2.39	0.82	0.25	0.01	7.97		50.34
12x18	9.29	6.98	2.30	0.59	0.17	0.01	5.29		24.63
-18	6.44	1.90	0.83	0.24	0.12	0.03	1.58		11.14
Total (Calc)	55.78	19.65	5.93	1.86	0.62	0.06	16.10		100.00



SPIRAL DATA ANALYSIS

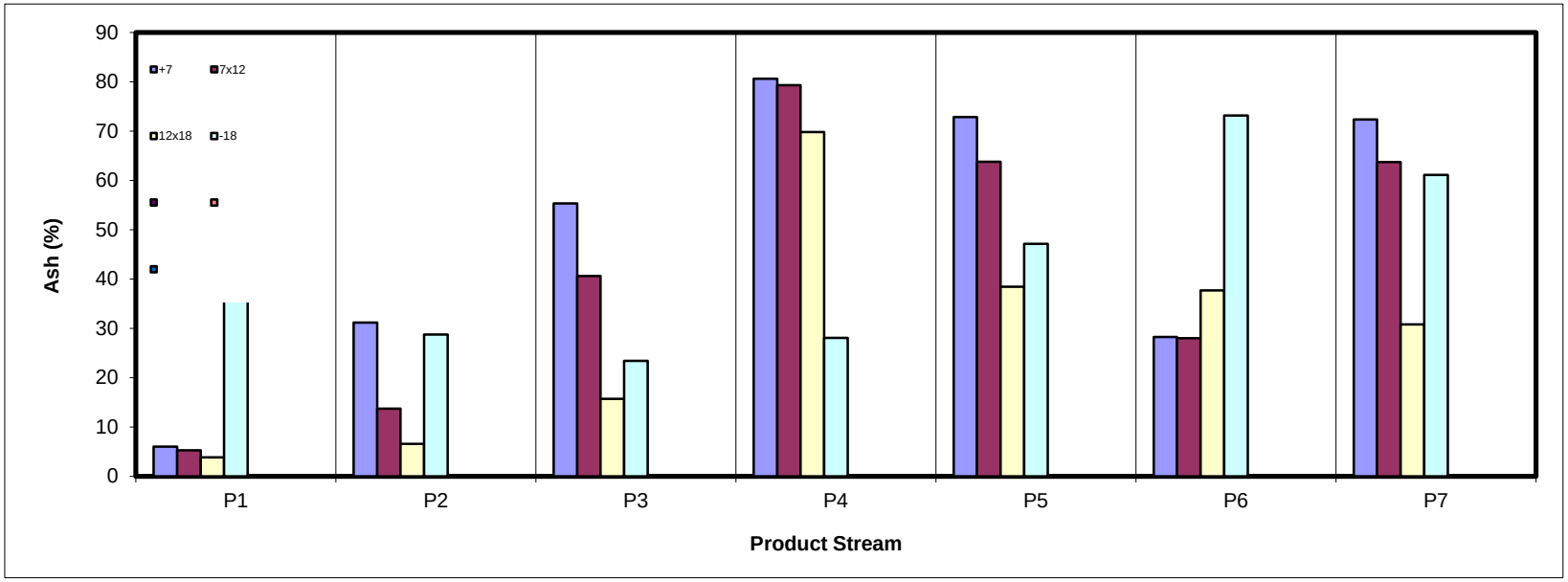
Description: Run 17 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	6.00	31.15	55.30	80.60	72.81	28.24	72.33		16.63
7x12	5.24	13.69	40.59	79.30	63.77	27.99	63.70		19.33
12x18	3.85	6.55	15.68	69.81	38.42	37.65	30.78		13.34
-18	56.56	28.72	23.43	28.03	47.09	73.16	61.09		49.33
Total (Calc)	11.08	13.44	29.56	69.87	54.59	53.39	53.29		20.82



SPIRAL DATA ANALYSIS

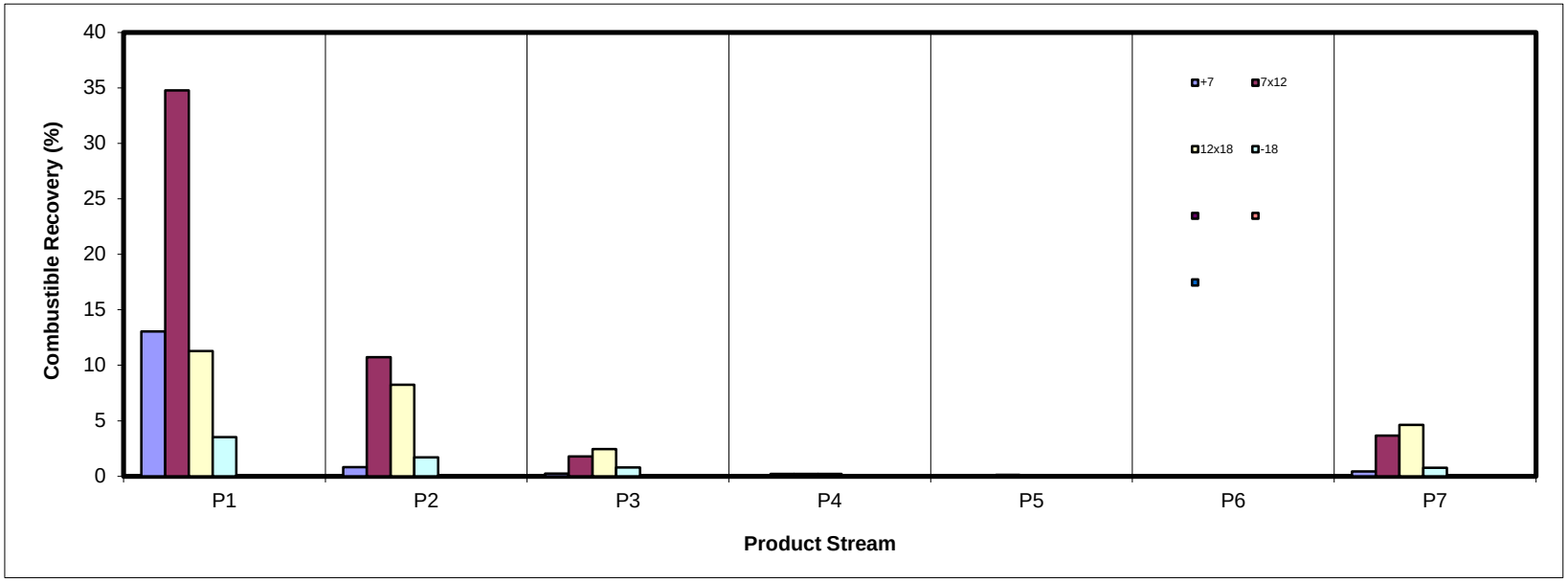
Description: Run 17 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	13.06	0.82	0.23	0.05	0.03	0.01	0.44		14.63
7x12	34.77	10.73	1.79	0.22	0.11	0.01	3.65		51.28
12x18	11.28	8.24	2.45	0.23	0.13	0.01	4.63		26.96
-18	3.53	1.71	0.80	0.22	0.08	0.01	0.78		7.13
Total (Calc)	62.65	21.48	5.27	0.71	0.36	0.03	9.50		100.00



SPIRAL DATA ANALYSIS

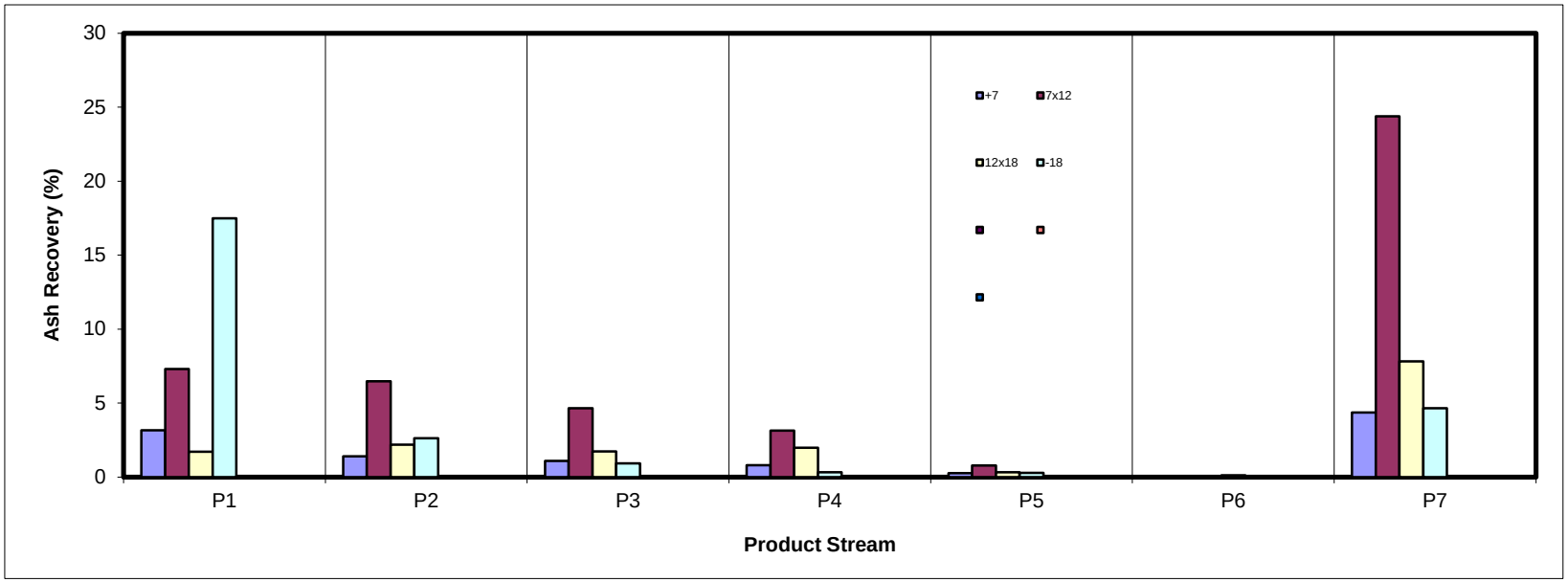
Description: Run 17 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	3.17	1.40	1.09	0.80	0.27	0.01	4.35		11.09
7x12	7.31	6.47	4.66	3.13	0.77	0.02	24.38		46.73
12x18	1.72	2.19	1.73	1.98	0.31	0.02	7.82		15.78
-18	17.49	2.62	0.93	0.32	0.28	0.11	4.65		26.39
Total (Calc)	29.68	12.68	8.41	6.24	1.63	0.15	41.20		100.00



SPIRAL DATA ANALYSIS

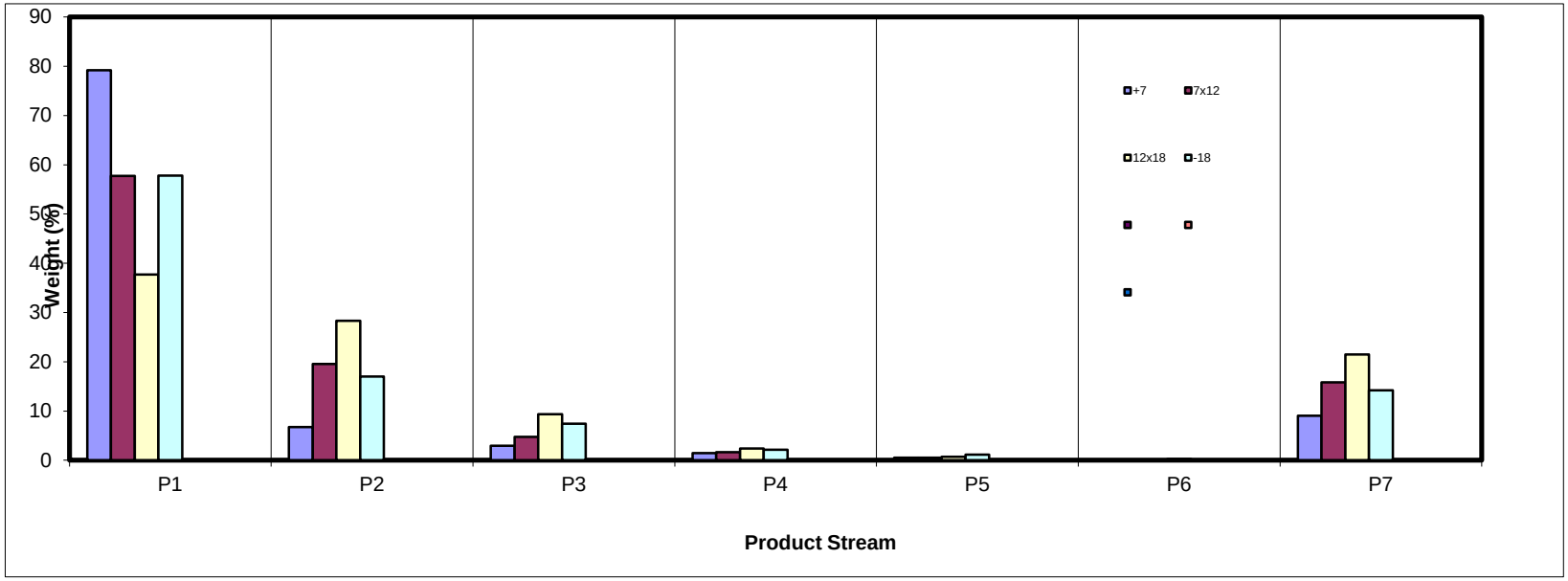
Description: Run 17 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	79.18	6.75	2.96	1.49	0.55	0.05	9.02		100.00
7x12	57.72	19.55	4.75	1.63	0.50	0.02	15.83		100.00
12x18	37.72	28.33	9.33	2.40	0.69	0.04	21.49		100.00
-18	57.81	17.03	7.42	2.13	1.12	0.27	14.23		100.00
Total (Calc)	55.78	19.65	5.93	1.86	0.62	0.06	16.10		100.00



SPIRAL DATA ANALYSIS

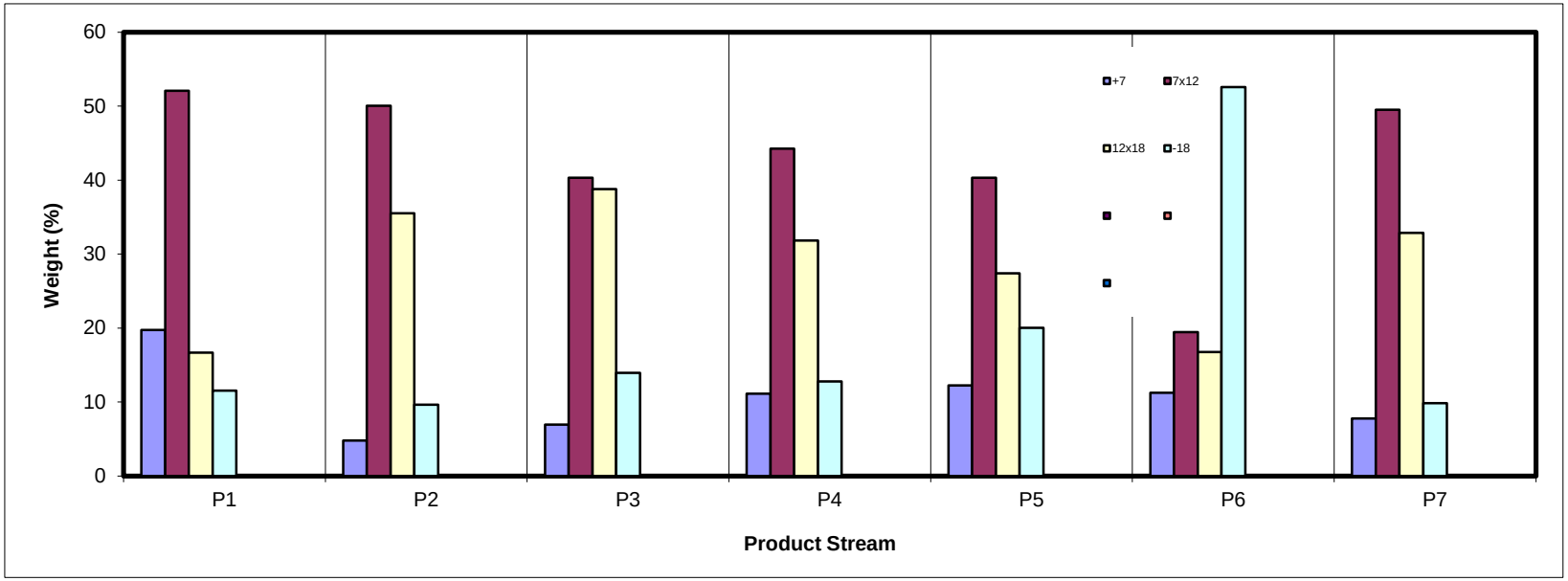
Description: Run 17 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	19.72	4.77	6.94	11.13	12.26	11.23	7.79		13.89
7x12	52.08	50.07	40.34	44.25	40.32	19.44	49.50		50.34
12x18	16.66	35.50	38.78	31.83	27.40	16.74	32.87		24.63
-18	11.54	9.65	13.94	12.79	20.01	52.59	9.84		11.14
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

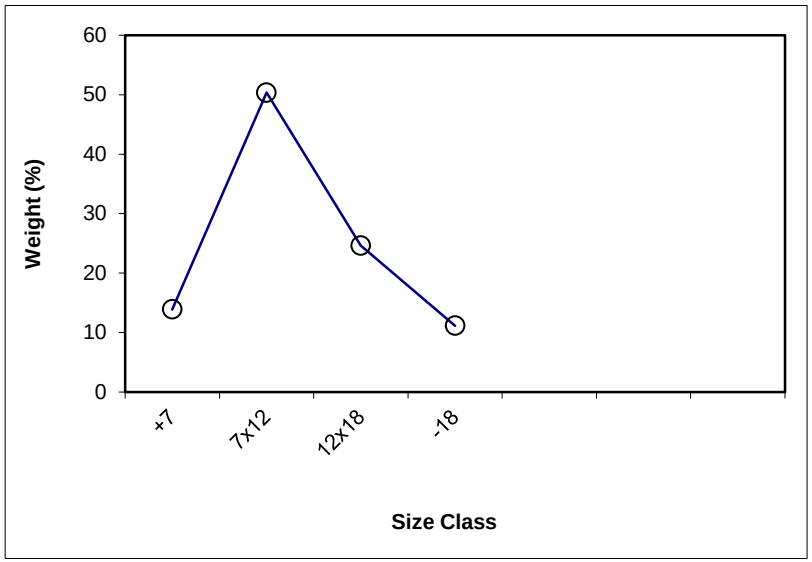
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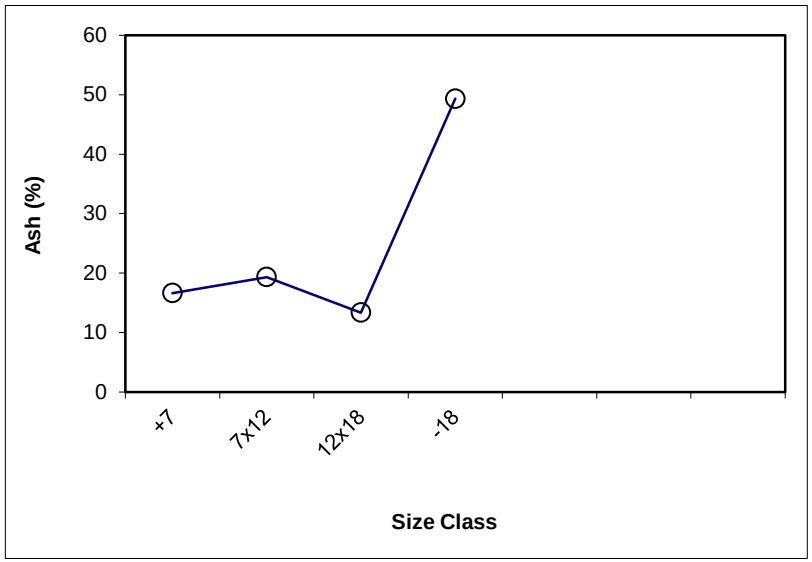
Comments: 3.36 x 1.0 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	479.9	439.4	40.52	13.89	16.63	13.89	16.63	100.00	20.82
7x12	591.1	444.3	146.82	50.34	19.33	64.23	18.75	86.11	21.50
12x18	532.0	460.1	71.84	24.63	13.34	88.86	17.25	35.77	24.55
-18	38.9	6.4	32.49	11.14	49.33	100.00	20.82	11.14	49.33
Total (Calc)	--	--	291.69	100.00	20.82	--	--	--	--





SPIRAL DATA ANALYSIS

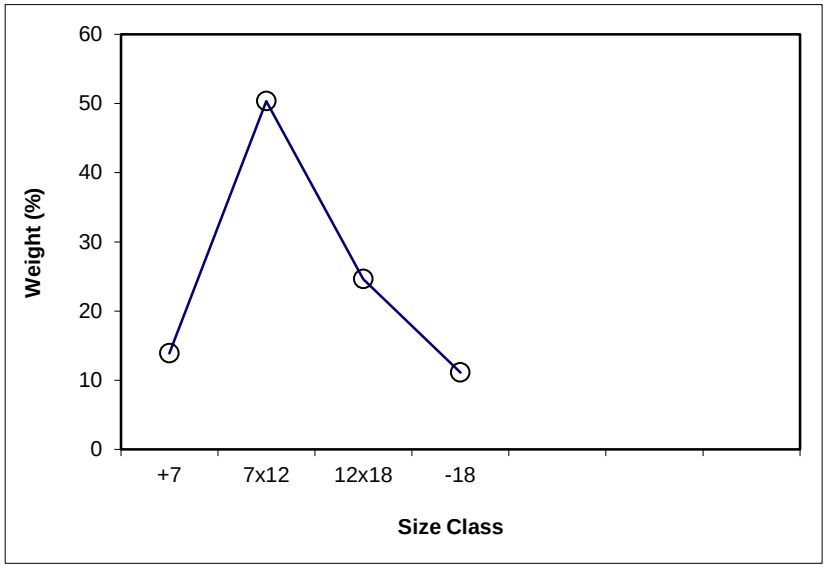
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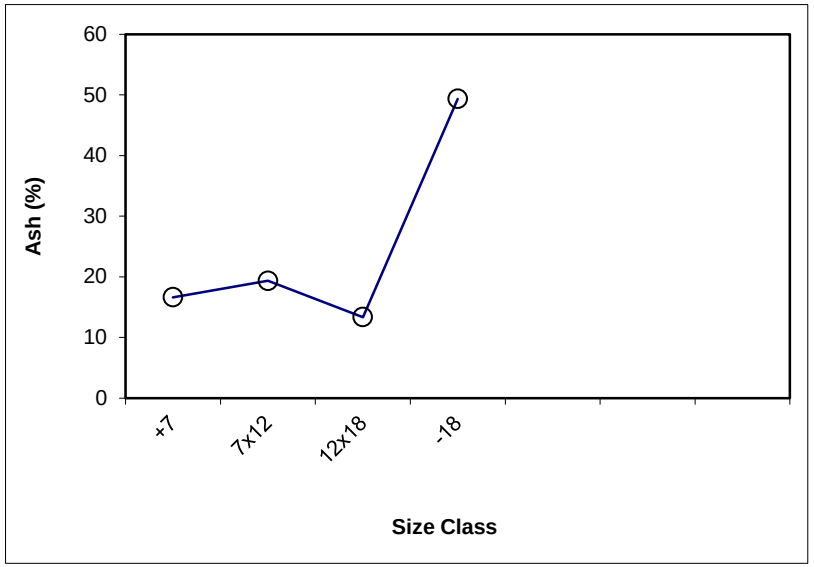
Comments: 3.36 x 1.0 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+7	13.89	16.63	13.89	16.63	100.00	20.82			
7x12	50.34	19.33	64.23	18.75	86.11	21.50	x	50.34	19.33
12x18	24.63	13.34	88.86	17.25	35.77	24.55	x	24.63	13.34
-18	11.14	49.33	100.00	20.82	11.14	49.33			
Total (Calc)	100.00	20.82	--	--	--	--	--	74.97	17.36





SPIRAL DATA ANALYSIS

Description: Run 17 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 55.78

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	618.14	443.4	174.78	19.72	6.00	19.72	6.00	100.00	11.08
7x12	896.15	434.6	461.59	52.08	5.24	71.80	5.45	80.28	12.33
12x18	548.82	401.2	147.62	16.66	3.85	88.46	5.15	28.20	25.42
-18	108.50	6.2	102.31	11.54	56.56	100.00	11.08	11.54	56.56
Total (Calc)	--	--	886.30	100.00	11.08	--	--	--	--

Product P2 Feed Weight (%): 19.65

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	464.2	439.4	24.82	4.77	31.15	4.77	31.15	100.00	13.44
7x12	704.9	444.3	260.57	50.07	13.69	54.84	15.21	95.23	12.55
12x18	644.9	460.1	184.75	35.50	6.55	90.35	11.81	45.16	11.29
-18	56.4	6.2	50.23	9.65	28.72	100.00	13.44	9.65	28.72
Total (Calc)	--	--	520.37	100.00	13.44	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 17 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 5.93

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	465.2	443.4	21.79	6.94	55.30	6.94	55.30	100.00	29.56
7x12	561.2	434.6	126.60	40.34	40.59	47.28	42.75	93.06	27.64
12x18	522.9	401.2	121.70	38.78	15.68	86.06	30.55	52.72	17.72
-18	50.1	6.4	43.76	13.94	23.43	100.00	29.56	13.94	23.43
Total (Calc)	--	--	313.85	100.00	29.56	--	--	--	--

Product P4 Feed Weight (%): 1.86

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	676.6	654.7	21.92	11.13	80.60	11.13	80.60	100.00	69.87
7x12	742.3	655.1	87.13	44.25	79.30	55.38	79.56	88.87	68.52
12x18	726.8	664.1	62.69	31.83	69.81	87.21	76.00	44.62	57.84
-18	31.5	6.3	25.18	12.79	28.03	100.00	69.87	12.79	28.03
Total (Calc)	--	--	196.92	100.00	69.87	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 17 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 0.62

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	821.6	809.5	12.12	12.26	72.81	12.26	72.81	100.00	54.59
7x12	695.4	655.5	39.86	40.32	63.77	52.58	65.88	87.74	52.05
12x18	691.8	664.7	27.09	27.40	38.42	79.99	56.47	47.42	42.08
-18	26.0	6.2	19.78	20.01	47.09	100.00	54.59	20.01	47.09
Total (Calc)	--	--	98.86	100.00	54.59	--	--	--	--

Product P6 Feed Weight (%): 0.06

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	813.5	811.5	2.06	11.23	28.24	11.23	28.24	100.00	53.39
7x12	830.9	827.4	3.56	19.44	27.99	30.67	28.08	88.77	56.58
12x18	879.1	876.1	3.06	16.74	37.65	47.41	31.46	69.33	64.59
-18	16.0	6.4	9.62	52.59	73.16	100.00	53.39	52.59	73.16
Total (Calc)	--	--	18.30	100.00	53.39	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 17 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 16.10

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	476.6	443.4	33.20	7.79	72.33	7.79	72.33	100.00	53.29
7x12	645.6	434.6	211.01	49.50	63.70	57.28	64.87	92.21	51.69
12x18	541.3	401.2	140.14	32.87	30.78	90.16	52.44	42.72	37.76
-18	48.4	6.4	41.96	9.84	61.09	100.00	53.29	9.84	61.09
Total (Calc)	--	--	426.30	100.00	53.29	--	--	--	--

SPIRAL DATA ANALYSIS

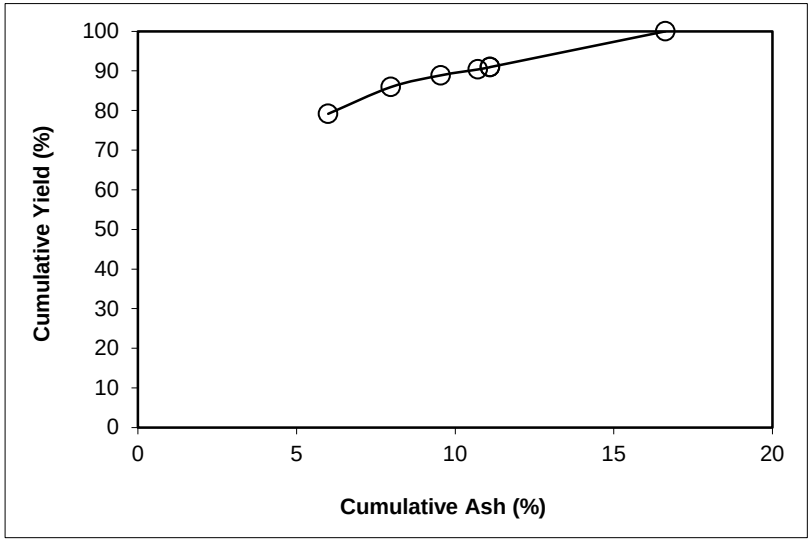
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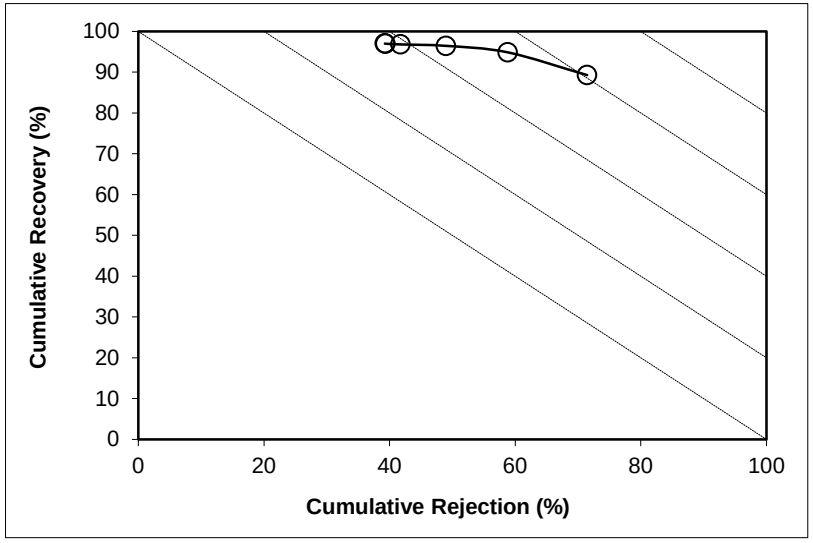
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: +7 Feed Weight (%): 13.89

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	79.18	6.00	79.18	6.00	89.28	20.82	57.07	71.44	60.72
P2	6.75	31.15	85.93	7.97	94.85	14.07	69.49	58.80	53.66
P3	2.96	55.30	88.89	9.55	96.44	11.11	73.28	48.96	45.40
P4	1.49	80.60	90.38	10.72	96.79	9.62	72.15	41.73	38.52
P5	0.55	72.81	90.93	11.09	96.97	9.07	72.11	39.33	36.30
P6	0.05	28.24	90.98	11.10	97.01	9.02	72.33	39.25	36.26
P7	9.02	72.33	100.00	16.63	100.00	0.00			
Total (Calc)	100.00	16.63	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

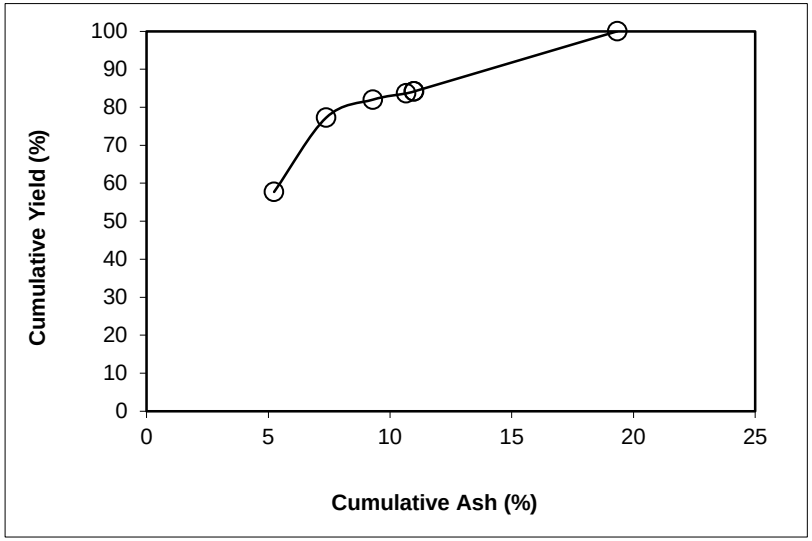
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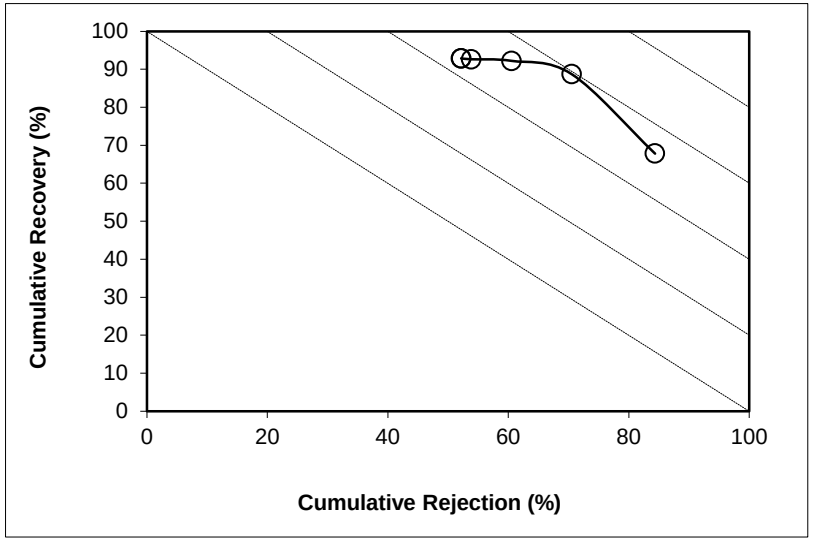
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 7x12 Feed Weight (%): 50.34

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	57.72	5.24	57.72	5.24	67.80	42.28	38.57	84.36	52.16
P2	19.55	13.69	77.27	7.38	88.72	22.73	59.96	70.51	59.23
P3	4.75	40.59	82.01	9.30	92.21	17.99	65.08	60.54	52.76
P4	1.63	79.30	83.65	10.67	92.63	16.35	63.65	53.84	46.47
P5	0.50	63.77	84.15	10.98	92.86	15.85	63.65	52.19	45.05
P6	0.02	27.99	84.17	10.99	92.88	15.83	63.70	52.16	45.04
P7	15.83	63.70	100.00	19.33	100.00	0.00			
Total (Calc)	100.00	19.33	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

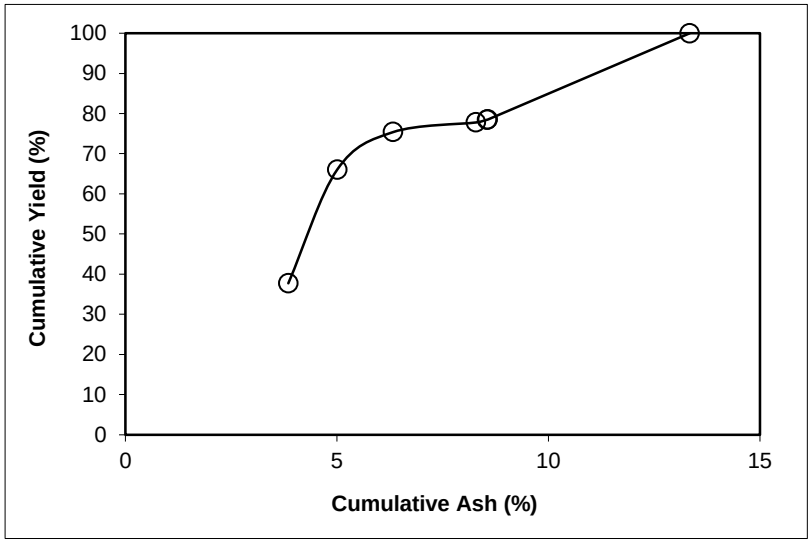
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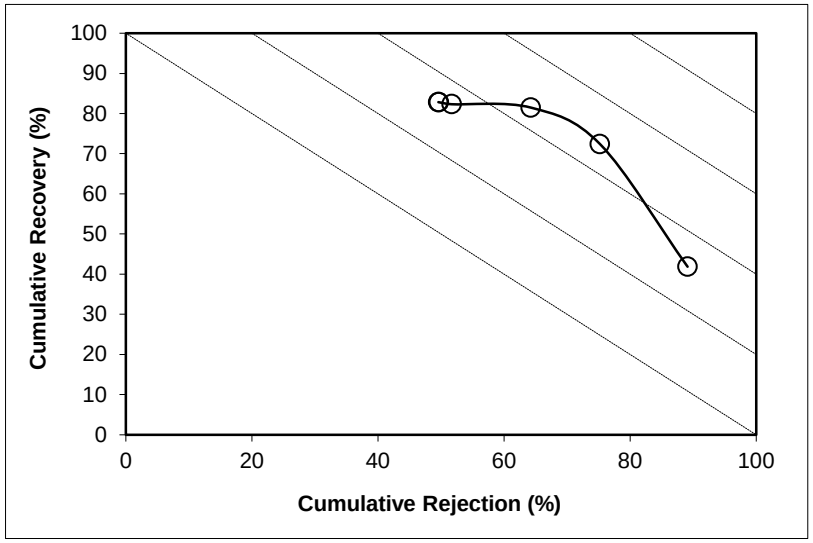
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 12x18 Feed Weight (%): 24.63

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	37.72	3.85	37.72	3.85	41.85	62.28	19.09	89.12	30.97
P2	28.33	6.55	66.05	5.01	72.40	33.95	29.55	75.22	47.62
P3	9.33	15.68	75.38	6.33	81.48	24.62	34.81	64.25	45.73
P4	2.40	69.81	77.78	8.29	82.32	22.22	31.03	51.68	34.00
P5	0.69	38.42	78.47	8.55	82.81	21.53	30.79	49.68	32.49
P6	0.04	37.65	78.51	8.57	82.84	21.49	30.78	49.57	32.41
P7	21.49	30.78	100.00	13.34	100.00	0.00			
Total (Calc)	100.00	13.34	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

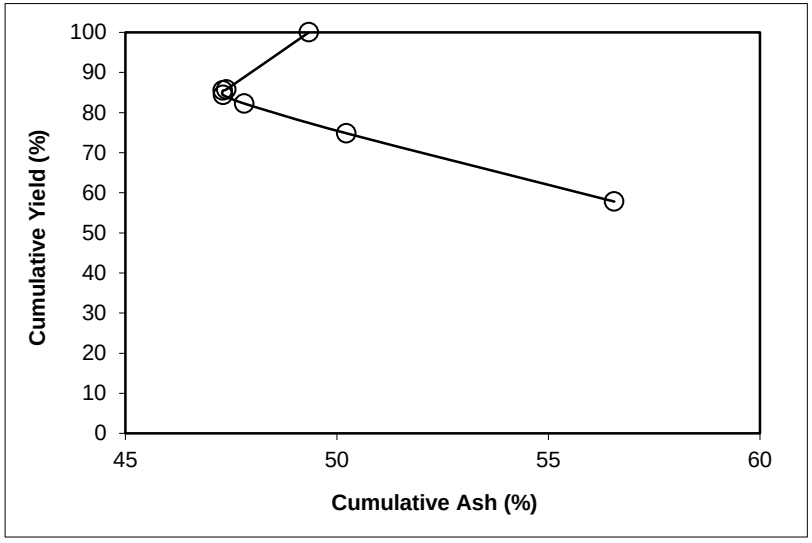
Description: Run 17 - Intermediate Spiral Test

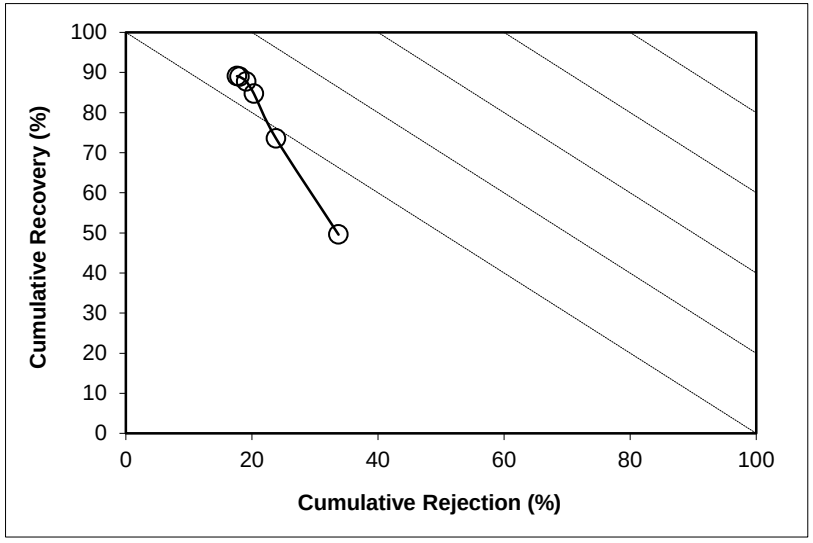
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: -18.00 Feed Weight (%): 11.14

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	57.81	56.56	57.81	56.56	49.57	42.19	39.44	33.73	-16.70
P2	17.03	28.72	74.83	50.22	73.52	25.17	46.69	23.82	-2.66
P3	7.42	23.43	82.25	47.81	84.73	17.75	56.42	20.30	5.03
P4	2.13	28.03	84.39	47.31	87.76	15.61	60.30	19.08	6.85
P5	1.12	47.09	85.50	47.30	88.93	14.50	61.31	18.02	6.95
P6	0.27	73.16	85.77	47.38	89.07	14.23	61.09	17.61	6.69
P7	14.23	61.09	100.00	49.33	100.00	0.00			
Total (Calc)	100.00	49.33	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

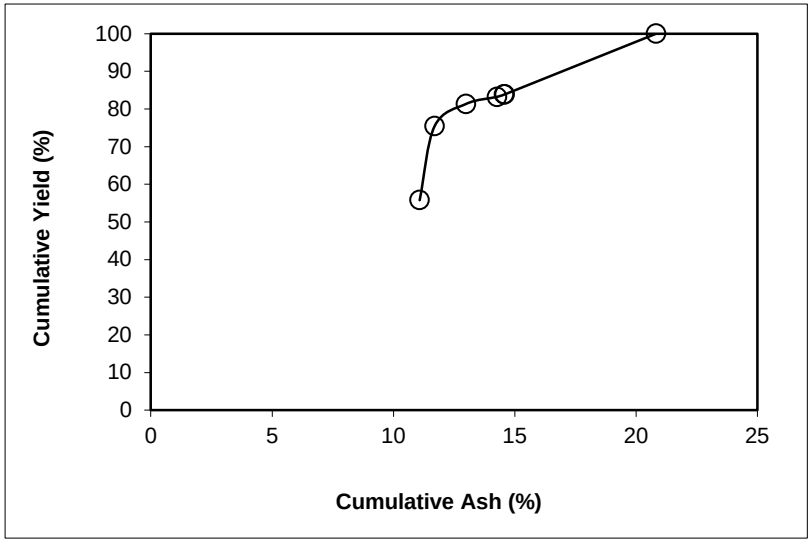
Description: Run 17 - Intermediate Spiral Test

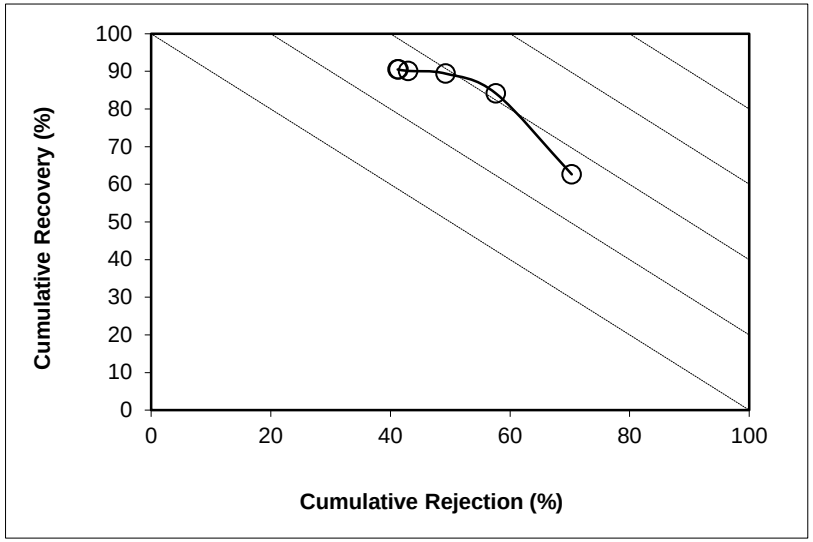
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	55.78	11.08	55.78	11.08	62.65	44.22	33.11	70.32	32.96
P2	19.65	13.44	75.44	11.69	84.13	24.56	48.86	57.63	41.77
P3	5.93	29.56	81.36	13.00	89.41	18.64	54.99	49.22	38.63
P4	1.86	69.87	83.22	14.27	90.11	16.78	53.34	42.98	33.10
P5	0.62	54.59	83.84	14.57	90.47	16.16	53.29	41.35	31.82
P6	0.06	53.39	83.90	14.59	90.50	16.10	53.29	41.20	31.71
P7	16.10	53.29	100.00	20.82	100.00	0.00			
Total (Calc)	100.00	20.82	--	--	--	--	--	--	--

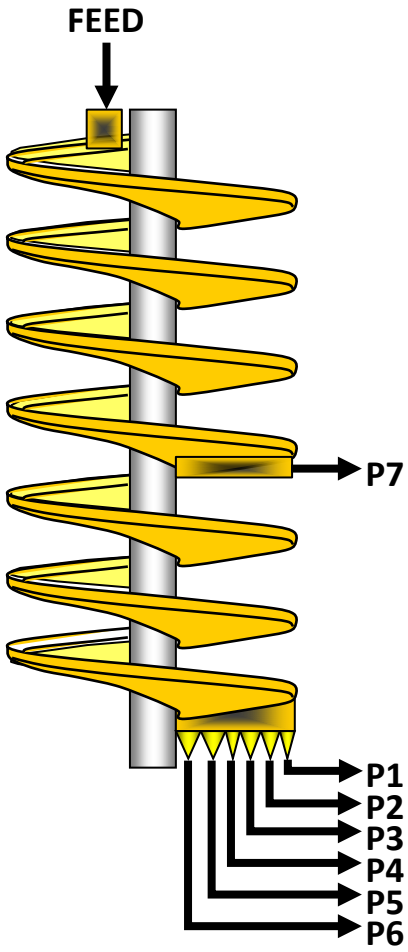




SPIRAL DATA ANALYSIS

Description: Run 18 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	0.865	14.4	20.53	23.02
P2	0.356	28.9	3.50	4.53
P3	0.103	27.0	1.12	1.39
P4	0.030	25.3	0.35	0.42
P5	0.012	10.2	0.41	0.43
P6	0.002	4.6	0.16	0.16
P7	0.146	35.3	1.07	1.35
Total	1.514	18.2	27.14	31.31

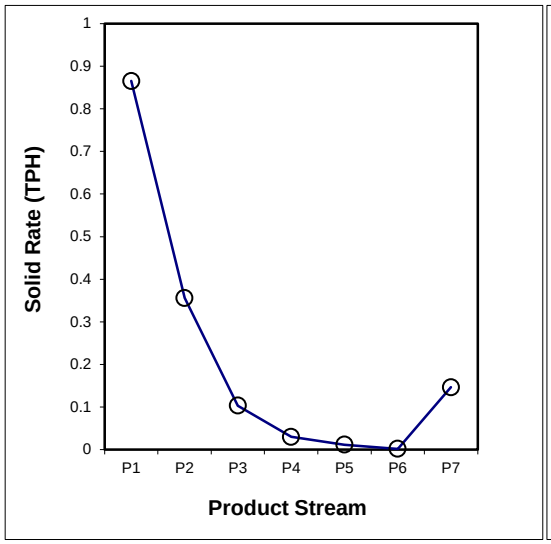
SPIRAL DATA ANALYSIS

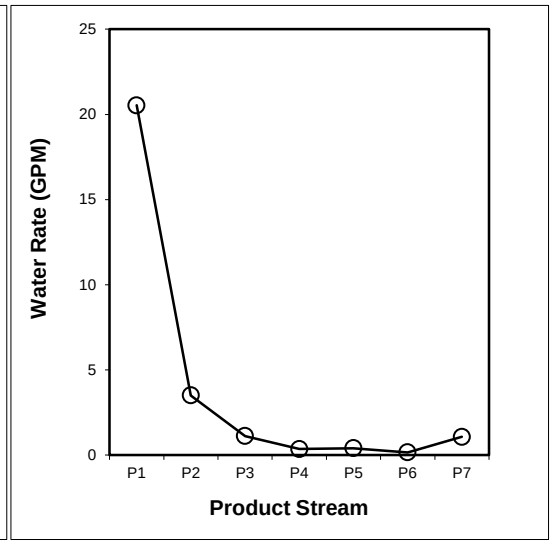
Description: Run 18 - Intermediate Spiral Test

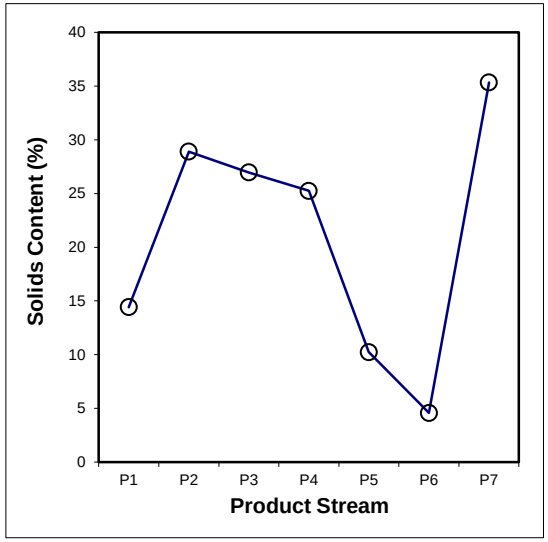
Comments: 3.36 x 1.0 mm Nominal Particle Size

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	3	5824.50	1180.00	5.997	2005.2	1350.3	0.865	57.16	14.43
P2	5	1680.07	92.91	1.231	1798.9	1350.2	0.356	23.50	28.90
P3	10	1080.02	93.99	0.382	1610.1	1350.2	0.103	6.80	26.96
P4	20	707.56	95.14	0.119	1436.8	1285.6	0.030	1.98	25.25
P5	30	978.97	94.27	0.114	2609.7	2521.2	0.012	0.77	10.25
P6	60	737.02	96.88	0.041	2009.0	1980.4	0.002	0.12	4.58
P7	5	629.79	95.09	0.414	2320.4	2136.1	0.146	9.65	35.32
Total (Calc)	--	--	--	8.298	--	--	1.514	100.00	18.25
Total (Head)	0.66	1568.98	181.09	8.298	1538.4	1285.2	1.514	--	18.25







SPIRAL DATA ANALYSIS

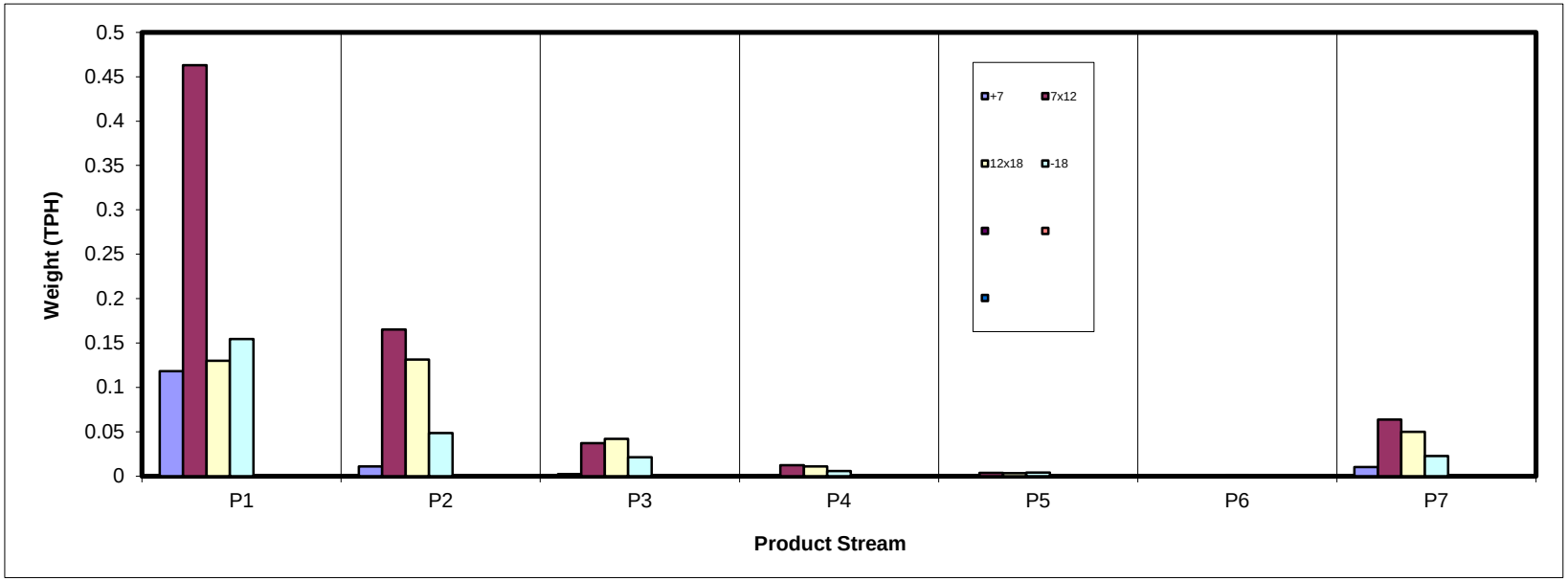
Description: Run 18 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	0.118	0.011	0.002	0.001	0.001	0.000	0.010		0.144
7x12	0.463	0.165	0.037	0.012	0.004	0.000	0.064		0.745
12x18	0.130	0.131	0.042	0.011	0.003	0.000	0.050		0.368
-18	0.154	0.048	0.021	0.006	0.004	0.001	0.023		0.258
Total (Calc)	0.865	0.356	0.103	0.030	0.012	0.002	0.146		1.514



SPIRAL DATA ANALYSIS

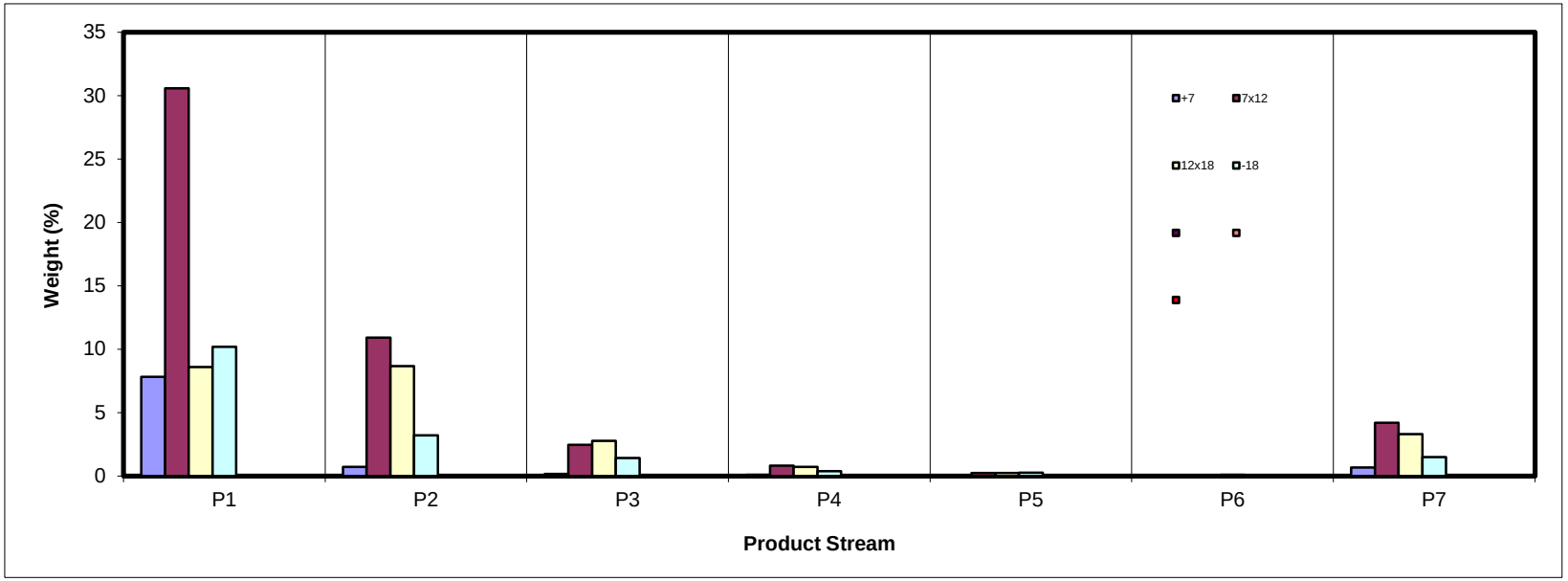
Description: Run 18 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	7.81	0.72	0.16	0.08	0.05	0.01	0.67		9.50
7x12	30.58	10.91	2.46	0.80	0.23	0.02	4.21		49.21
12x18	8.58	8.67	2.77	0.71	0.22	0.01	3.29		24.27
-18	10.19	3.20	1.41	0.39	0.26	0.08	1.49		17.02
Total (Calc)	57.16	23.50	6.80	1.98	0.77	0.12	9.65		100.00



SPIRAL DATA ANALYSIS

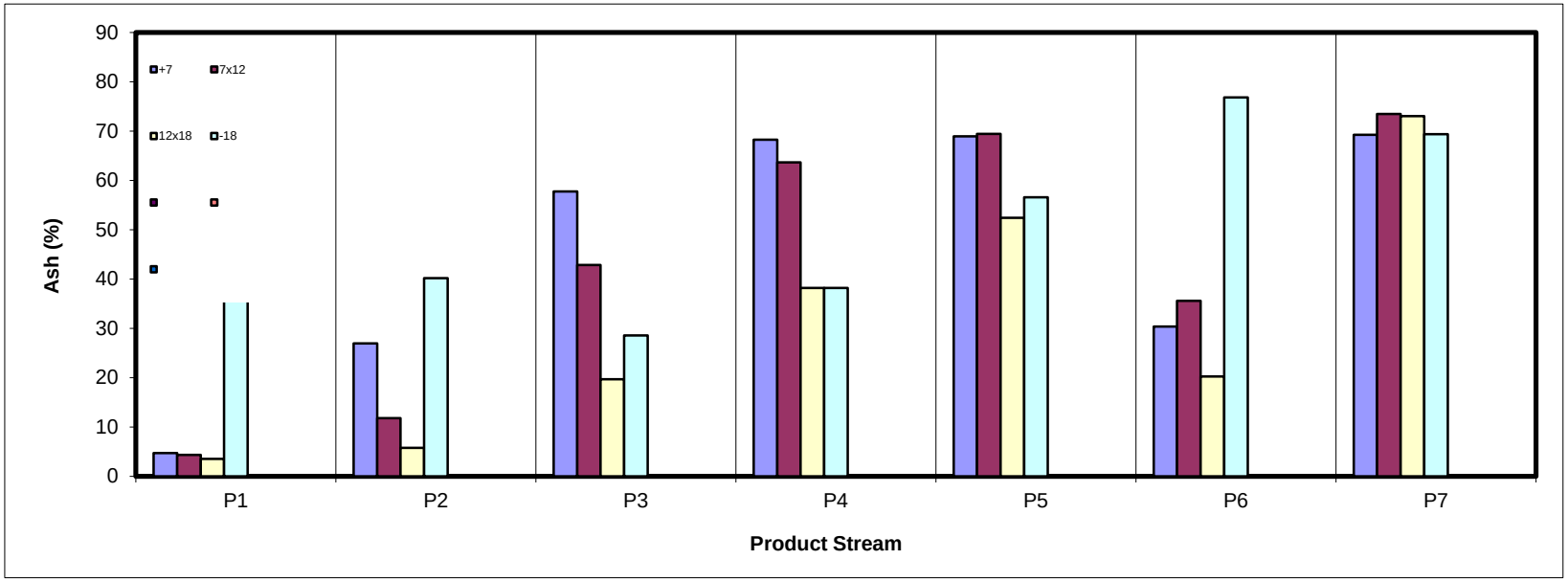
Description: Run 18 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	4.72	26.94	57.74	68.21	68.90	30.33	69.21		12.74
7x12	4.32	11.76	42.82	63.64	69.41	35.54	73.45		15.09
12x18	3.55	5.74	19.66	38.19	52.40	20.21	73.03		17.08
-18	64.52	40.19	28.55	38.20	56.53	76.83	69.33		56.72
Total (Calc)	14.99	13.88	30.77	49.68	60.08	58.59	72.38		22.44



SPIRAL DATA ANALYSIS

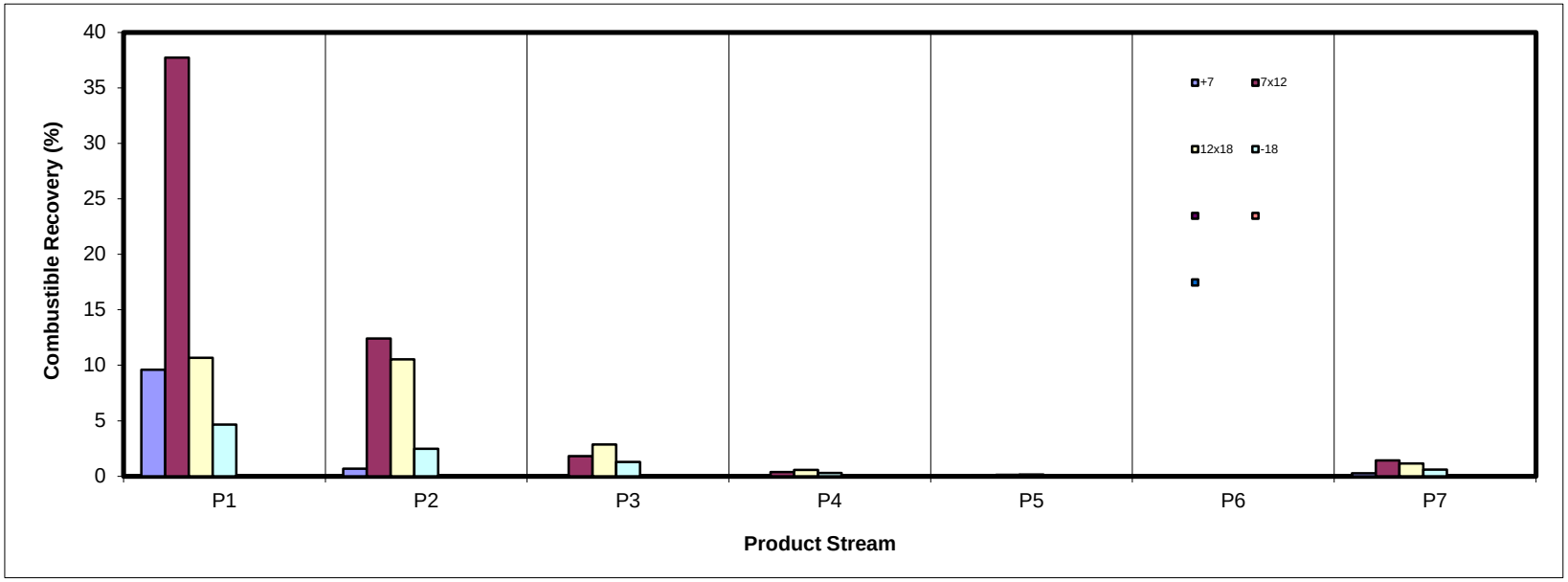
Description: Run 18 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	9.59	0.68	0.09	0.03	0.02	0.01	0.26		10.69
7x12	37.72	12.41	1.81	0.38	0.09	0.02	1.44		53.87
12x18	10.67	10.54	2.87	0.57	0.14	0.01	1.15		25.95
-18	4.66	2.47	1.30	0.31	0.15	0.02	0.59		9.50
Total (Calc)	62.65	26.09	6.07	1.28	0.40	0.07	3.44		100.00



SPIRAL DATA ANALYSIS

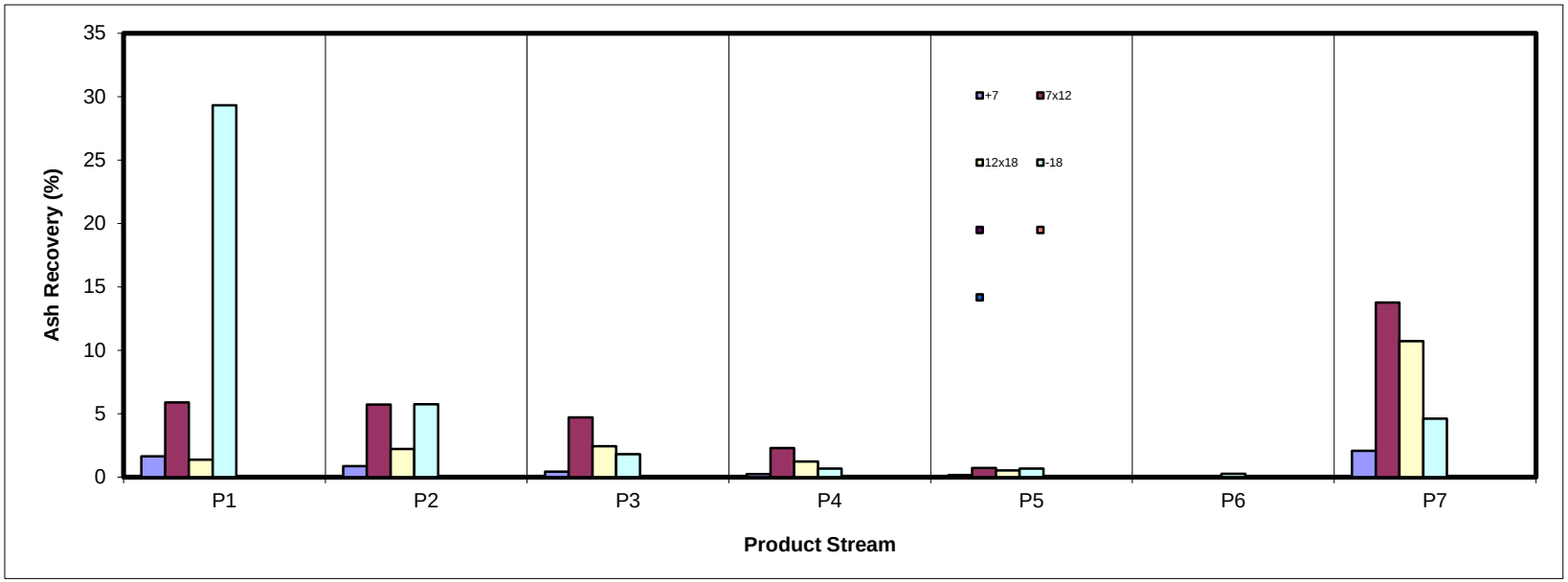
Description: Run 18 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	1.64	0.87	0.41	0.23	0.16	0.02	2.06		5.39
7x12	5.89	5.72	4.70	2.28	0.72	0.03	13.77		33.11
12x18	1.36	2.22	2.43	1.21	0.52	0.01	10.72		18.48
-18	29.31	5.74	1.79	0.66	0.66	0.26	4.60		43.02
Total (Calc)	38.20	14.54	9.33	4.38	2.07	0.33	31.15		100.00



SPIRAL DATA ANALYSIS

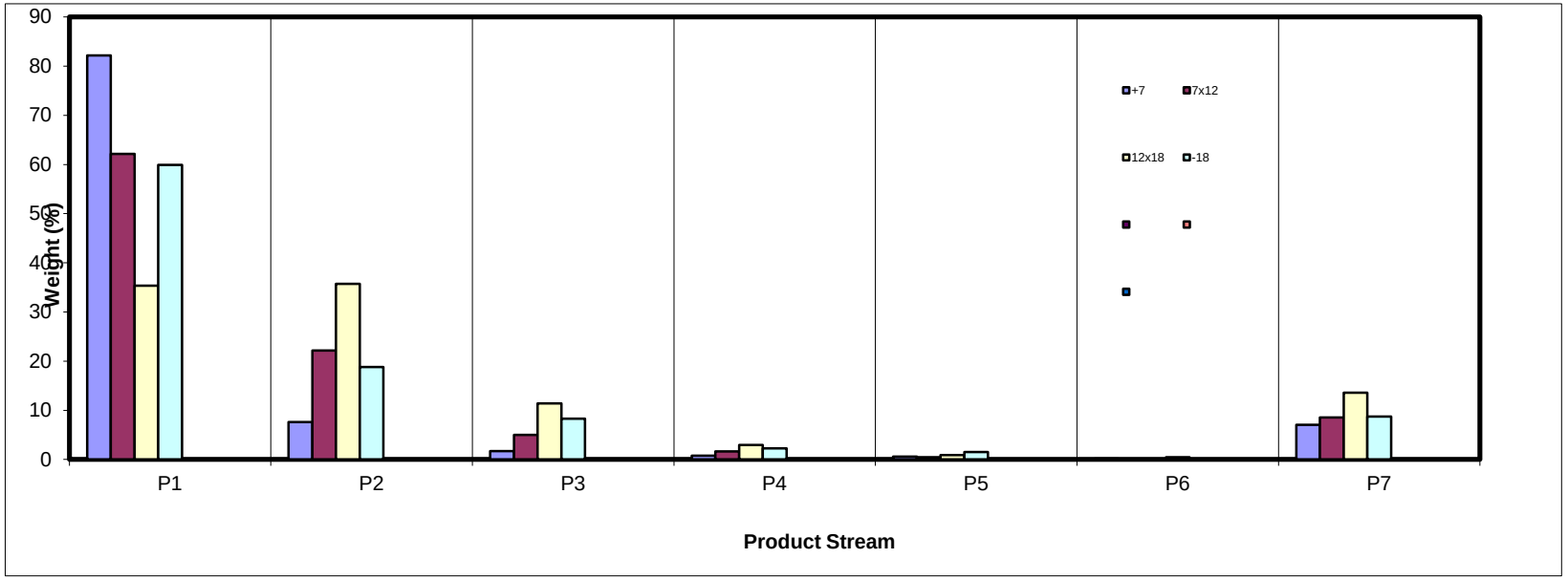
Description: Run 18 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	82.19	7.59	1.69	0.80	0.56	0.14	7.03		100.00
7x12	62.14	22.16	5.00	1.63	0.48	0.04	8.55		100.00
12x18	35.36	35.73	11.43	2.94	0.92	0.06	13.57		100.00
-18	59.89	18.82	8.29	2.27	1.54	0.45	8.75		100.00
Total (Calc)	57.16	23.50	6.80	1.98	0.77	0.12	9.65		100.00



SPIRAL DATA ANALYSIS

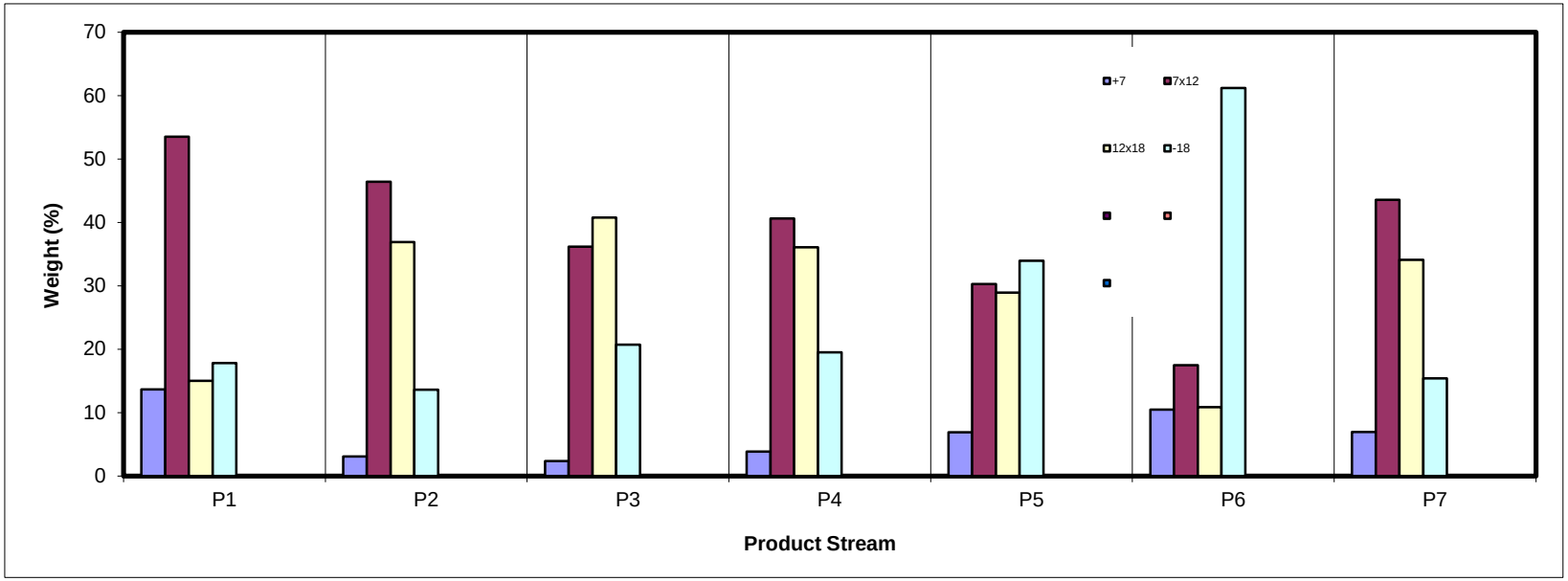
Description: Run 18 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	13.66	3.07	2.36	3.85	6.87	10.47	6.91		9.50
7x12	53.50	46.40	36.15	40.61	30.26	17.48	43.56		49.21
12x18	15.01	36.90	40.76	36.06	28.93	10.86	34.11		24.27
-18	17.83	13.63	20.73	19.48	33.93	61.19	15.42		17.02
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

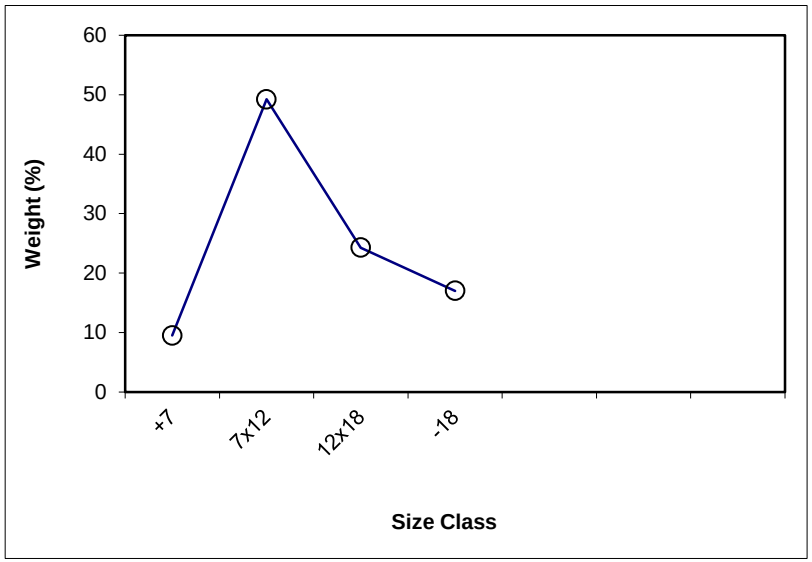
Description: Run 18 - Intermediate Spiral Test

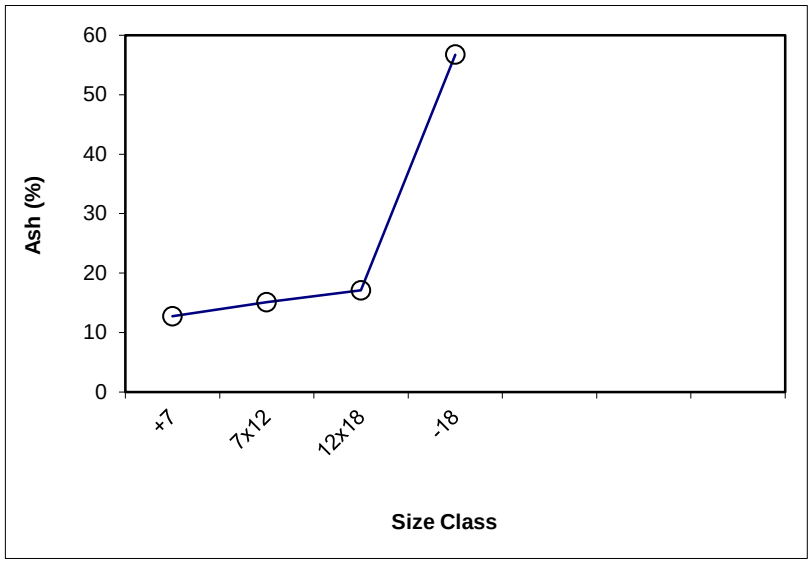
Comments: 3.36 x 1.0 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	467.4	443.4	24.05	9.50	12.74	9.50	12.74	100.00	22.44
7x12	559.2	434.6	124.61	49.21	15.09	58.71	14.71	90.50	23.45
12x18	462.6	401.1	61.46	24.27	17.08	82.98	15.41	41.29	33.42
-18	49.2	6.1	43.10	17.02	56.72	100.00	22.44	17.02	56.72
Total (Calc)	--	--	253.23	100.00	22.44	--	--	--	--





SPIRAL DATA ANALYSIS

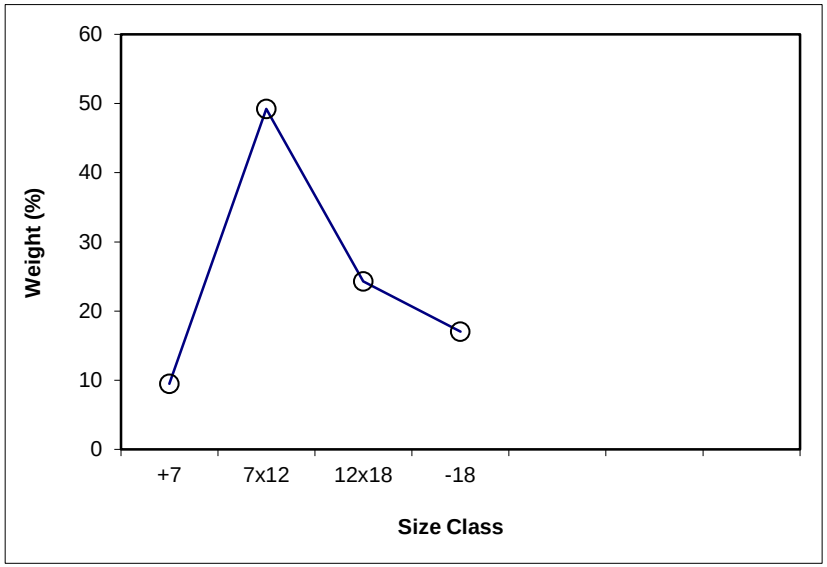
Description: Run 18 - Intermediate Spiral Test

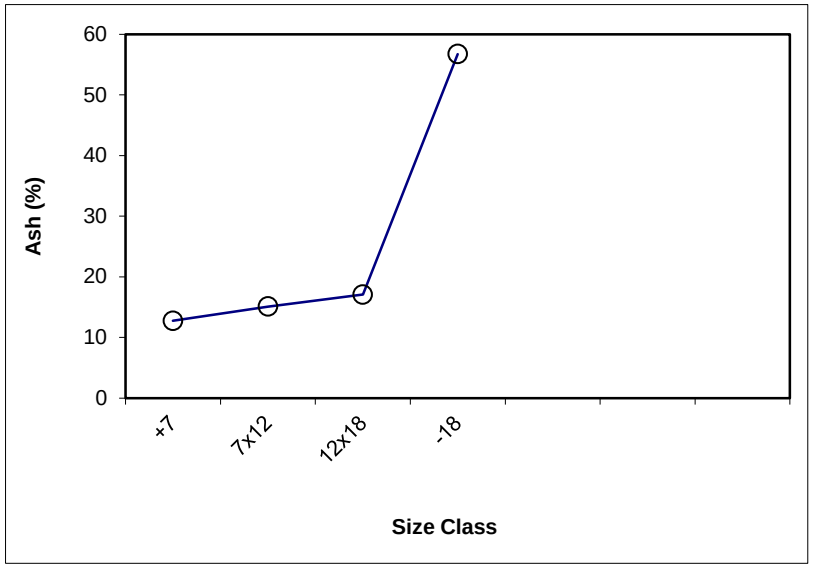
Comments: 3.36 x 1.0 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+7	9.50	12.74	9.50	12.74	100.00	22.44			
7x12	49.21	15.09	58.71	14.71	90.50	23.45	x	49.21	15.09
12x18	24.27	17.08	82.98	15.41	41.29	33.42	x	24.27	17.08
-18	17.02	56.72	100.00	22.44	17.02	56.72			
Total (Calc)	100.00	22.44	--	--	--	--	--	73.48	15.75





SPIRAL DATA ANALYSIS

Description: Run 18 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 57.16

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	528.81	439.4	89.45	13.66	4.72	13.66	4.72	100.00	14.99
7x12	794.64	444.3	350.34	53.50	4.32	67.15	4.40	86.34	16.62
12x18	558.47	460.1	98.33	15.01	3.55	82.17	4.25	32.85	36.65
-18	123.24	6.5	116.77	17.83	64.52	100.00	14.99	17.83	64.52
Total (Calc)	--	--	654.89	100.00	14.99	--	--	--	--

Product P2 Feed Weight (%): 23.50

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	453.1	439.4	13.77	3.07	26.94	3.07	26.94	100.00	13.88
7x12	652.5	444.3	208.23	46.40	11.76	49.47	12.70	96.93	13.47
12x18	625.7	460.1	165.59	36.90	5.74	86.37	9.73	50.53	15.03
-18	67.5	6.4	61.16	13.63	40.19	100.00	13.88	13.63	40.19
Total (Calc)	--	--	448.75	100.00	13.88	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 18 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 6.80

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	445.5	439.4	6.14	2.36	57.74	2.36	57.74	100.00	30.77
7x12	538.3	444.3	93.95	36.15	42.82	38.51	43.73	97.64	30.12
12x18	566.1	460.1	105.92	40.76	19.66	79.27	31.35	61.49	22.65
-18	60.2	6.4	53.86	20.73	28.55	100.00	30.77	20.73	28.55
Total (Calc)	--	--	259.87	100.00	30.77	--	--	--	--

Product P4 Feed Weight (%): 1.98

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	449.2	443.4	5.81	3.85	68.21	3.85	68.21	100.00	49.68
7x12	495.9	434.6	61.39	40.61	63.64	44.46	64.04	96.15	48.94
12x18	455.7	401.2	54.52	36.06	38.19	80.52	52.46	55.54	38.19
-18	35.9	6.5	29.45	19.48	38.20	100.00	49.68	19.48	38.20
Total (Calc)	--	--	151.17	100.00	49.68	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 18 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 0.77

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	833.5	827.4	6.08	6.87	68.90	6.87	68.90	100.00	60.08
7x12	838.2	811.5	26.78	30.26	69.41	37.14	69.32	93.13	59.43
12x18	901.7	876.1	25.61	28.93	52.40	66.07	61.91	62.86	54.63
-18	36.4	6.3	30.03	33.93	56.53	100.00	60.08	33.93	56.53
Total (Calc)	--	--	88.51	100.00	60.08	--	--	--	--

Product P6 Feed Weight (%): 0.12

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	657.7	654.7	3.00	10.47	30.33	10.47	30.33	100.00	58.59
7x12	660.1	655.1	5.01	17.48	35.54	27.95	33.59	89.53	61.90
12x18	667.2	664.1	3.11	10.86	20.21	38.81	29.85	72.05	68.30
-18	24.0	6.5	17.52	61.19	76.83	100.00	58.59	61.19	76.83
Total (Calc)	--	--	28.63	100.00	58.59	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 18 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 9.65

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	822.3	809.5	12.75	6.91	69.21	6.91	69.21	100.00	72.38
7x12	735.8	655.5	80.31	43.56	73.45	50.47	72.87	93.09	72.61
12x18	727.6	664.7	62.88	34.11	73.03	84.58	72.93	49.53	71.88
-18	34.8	6.4	28.42	15.42	69.33	100.00	72.38	15.42	69.33
Total (Calc)	--	--	184.35	100.00	72.38	--	--	--	--

SPIRAL DATA ANALYSIS

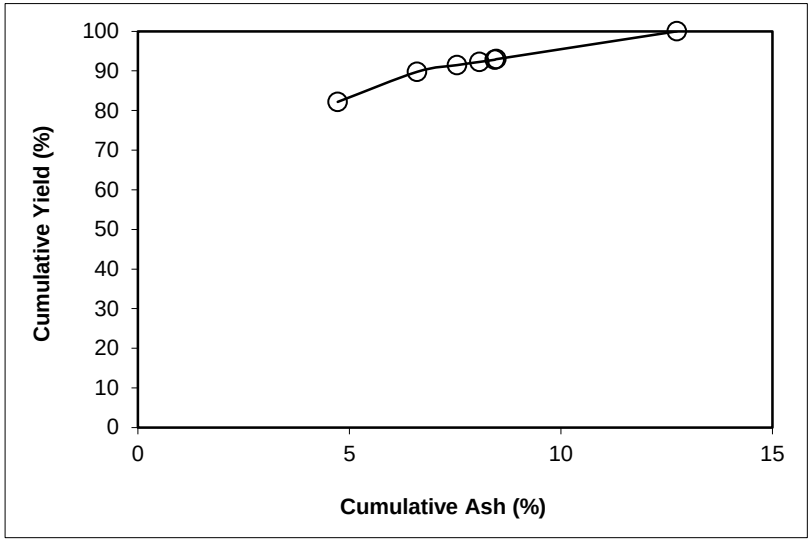
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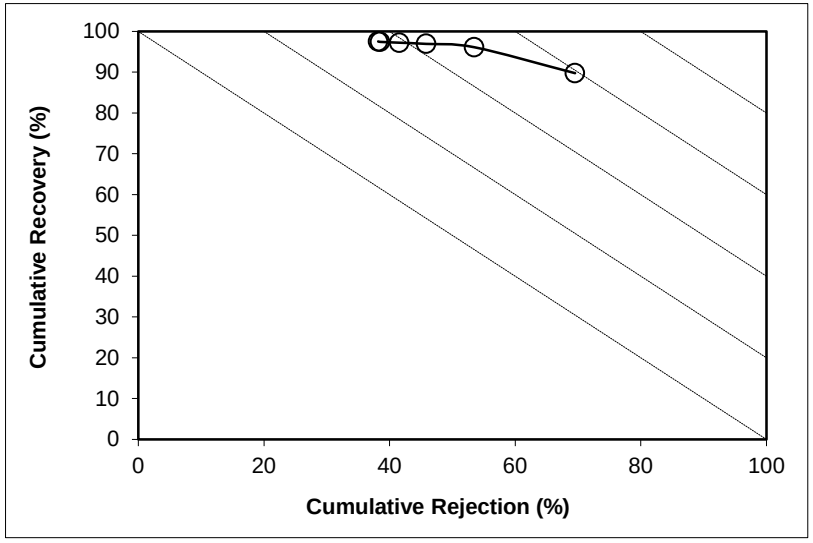
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: +7 Feed Weight (%): 9.50

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	82.19	4.72	82.19	4.72	89.74	17.81	49.75	69.53	59.28
P2	7.59	26.94	89.78	6.60	96.10	10.22	66.69	53.48	49.58
P3	1.69	57.74	91.47	7.55	96.92	8.53	68.47	45.82	42.74
P4	0.80	68.21	92.28	8.07	97.21	7.72	68.50	41.53	38.74
P5	0.56	68.90	92.83	8.44	97.41	7.17	68.47	38.50	35.91
P6	0.14	30.33	92.97	8.47	97.52	7.03	69.21	38.18	35.70
P7	7.03	69.21	100.00	12.74	100.00	0.00			
Total (Calc)	100.00	12.74	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

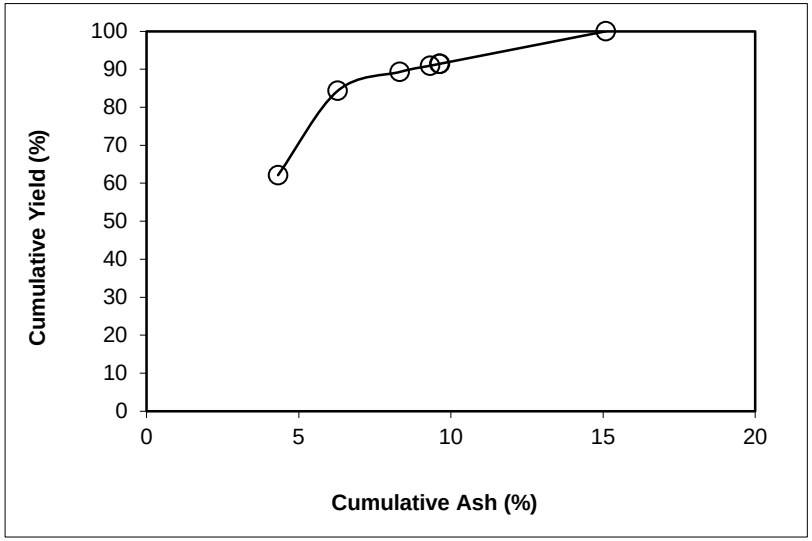
Description: Run 18 - Intermediate Spiral Test

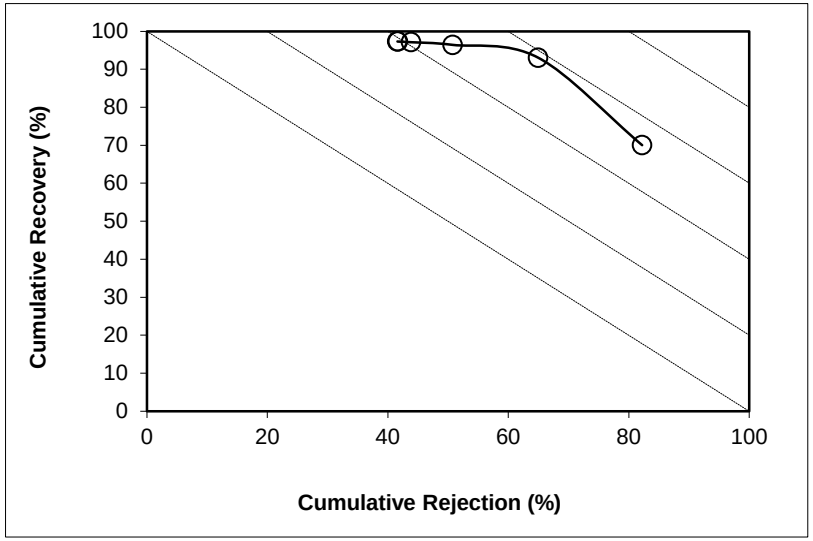
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 7x12 Feed Weight (%): 49.21

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	62.14	4.32	62.14	4.32	70.03	37.86	32.78	82.21	52.24
P2	22.16	11.76	84.30	6.28	93.06	15.70	62.44	64.94	58.00
P3	5.00	42.82	89.30	8.32	96.42	10.70	71.62	50.76	47.19
P4	1.63	63.64	90.93	9.32	97.12	9.07	73.05	43.88	41.00
P5	0.48	69.41	91.41	9.63	97.29	8.59	73.25	41.69	38.98
P6	0.04	35.54	91.45	9.64	97.33	8.55	73.45	41.59	38.91
P7	8.55	73.45	100.00	15.09	100.00	0.00			
Total (Calc)	100.00	15.09	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

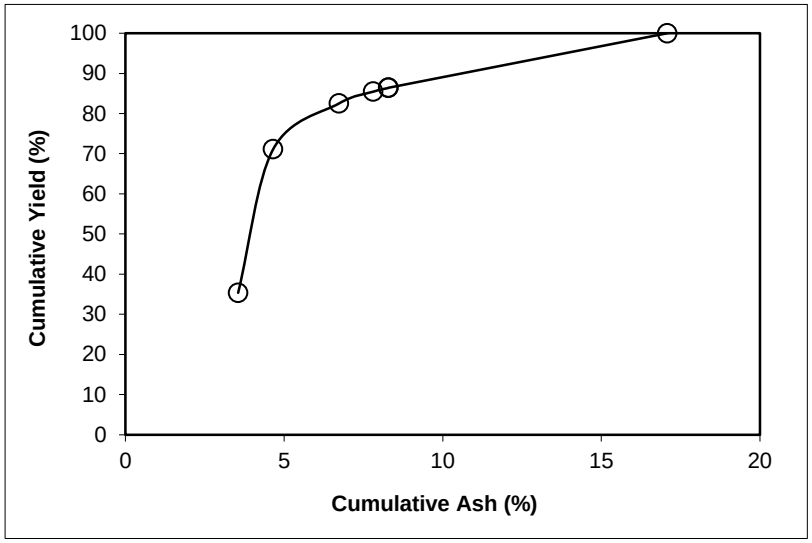
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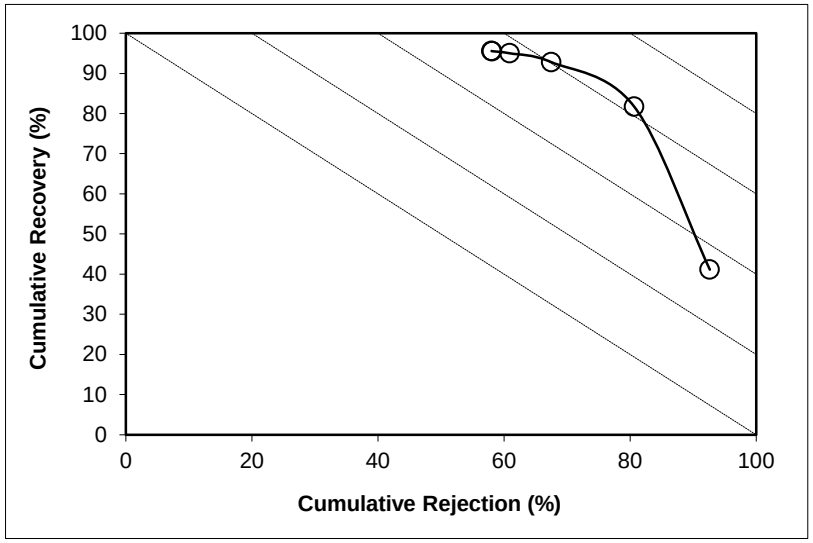
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 12x18 Feed Weight (%): 24.27

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	35.36	3.55	35.36	3.55	41.13	64.64	24.48	92.65	33.78
P2	35.73	5.74	71.09	4.65	81.74	28.91	47.63	80.64	62.38
P3	11.43	19.66	82.52	6.73	92.81	17.48	65.91	67.48	60.30
P4	2.94	38.19	85.46	7.81	95.00	14.54	71.52	60.91	55.91
P5	0.92	52.40	86.38	8.29	95.53	13.62	72.81	58.08	53.62
P6	0.06	20.21	86.43	8.30	95.59	13.57	73.03	58.02	53.60
P7	13.57	73.03	100.00	17.08	100.00	0.00			
Total (Calc)	100.00	17.08	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

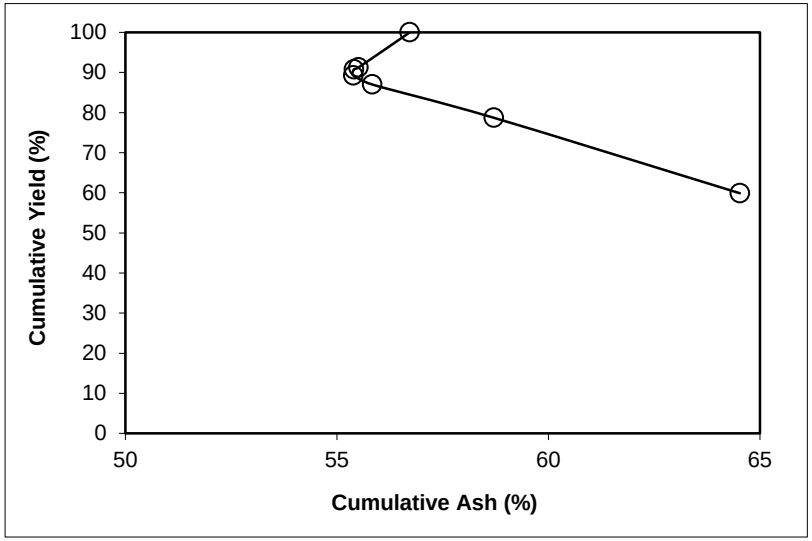
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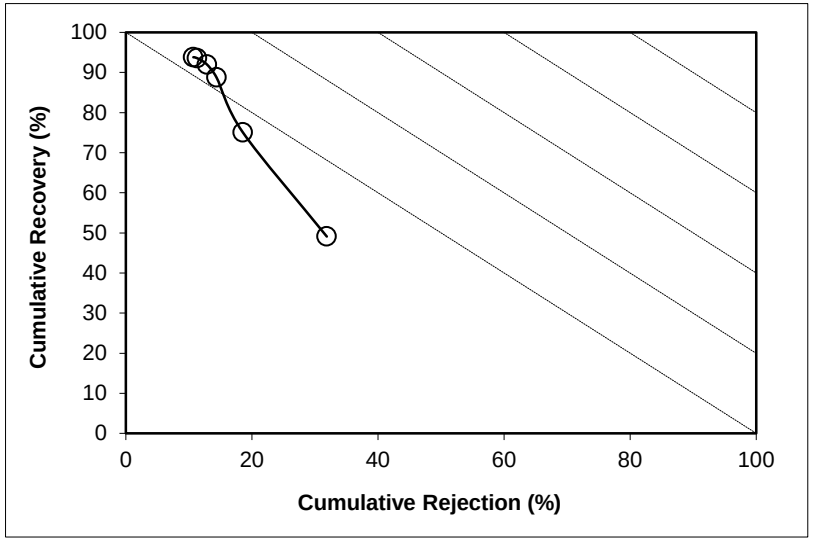
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: -18.00 Feed Weight (%): 17.02

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	59.89	64.52	59.89	64.52	49.09	40.11	45.07	31.87	-19.04
P2	18.82	40.19	78.71	58.71	75.10	21.29	49.37	18.53	-6.37
P3	8.29	28.55	87.00	55.83	88.78	13.00	62.65	14.36	3.14
P4	2.27	38.20	89.26	55.38	92.01	10.74	67.81	12.83	4.85
P5	1.54	56.53	90.80	55.40	93.56	9.20	69.70	11.30	4.86
P6	0.45	76.83	91.25	55.51	93.80	8.75	69.33	10.69	4.49
P7	8.75	69.33	100.00	56.72	100.00	0.00			
Total (Calc)	100.00	56.72	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

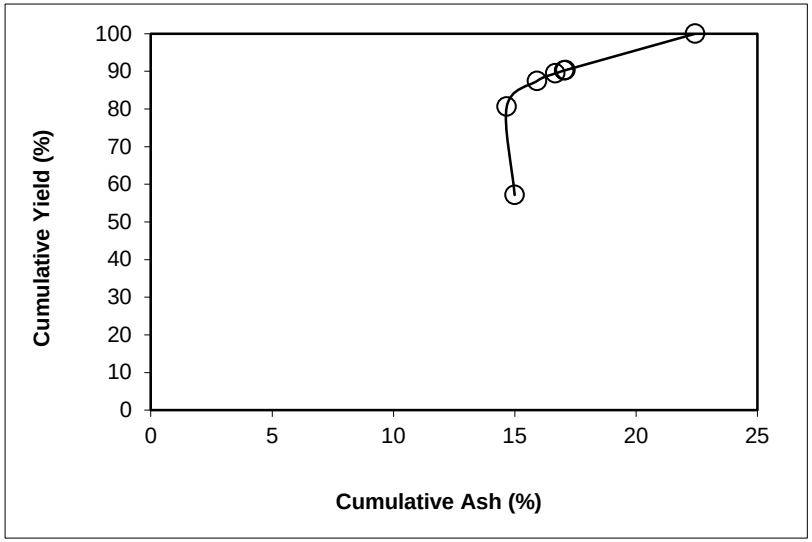
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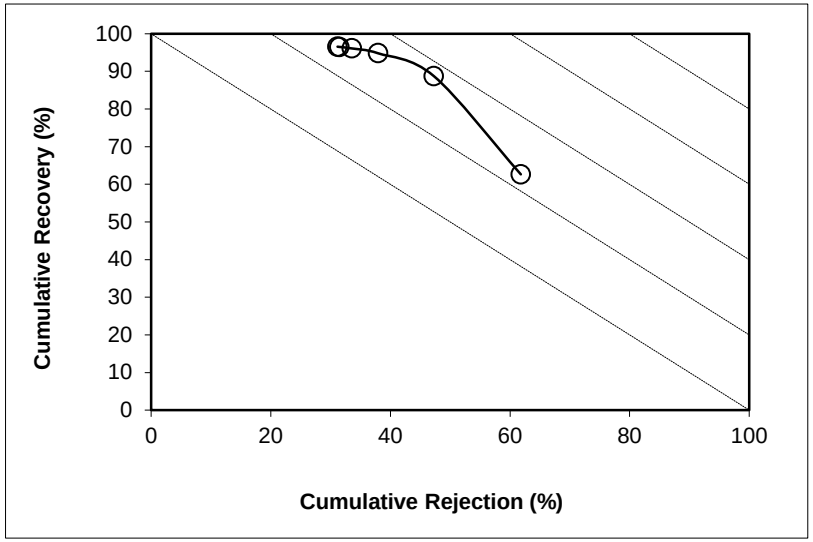
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	57.16	14.99	57.16	14.99	62.65	42.84	32.37	61.80	24.44
P2	23.50	13.88	80.66	14.67	88.74	19.34	54.83	47.26	36.00
P3	6.80	30.77	87.47	15.92	94.81	12.53	67.90	37.92	32.74
P4	1.98	49.68	89.45	16.67	96.10	10.55	71.31	33.54	29.64
P5	0.77	60.08	90.22	17.04	96.49	9.78	72.20	31.47	27.97
P6	0.12	58.59	90.35	17.10	96.56	9.65	72.38	31.15	27.71
P7	9.65	72.38	100.00	22.44	100.00	0.00			
Total (Calc)	100.00	22.44	--	--	--	--	--	--	--

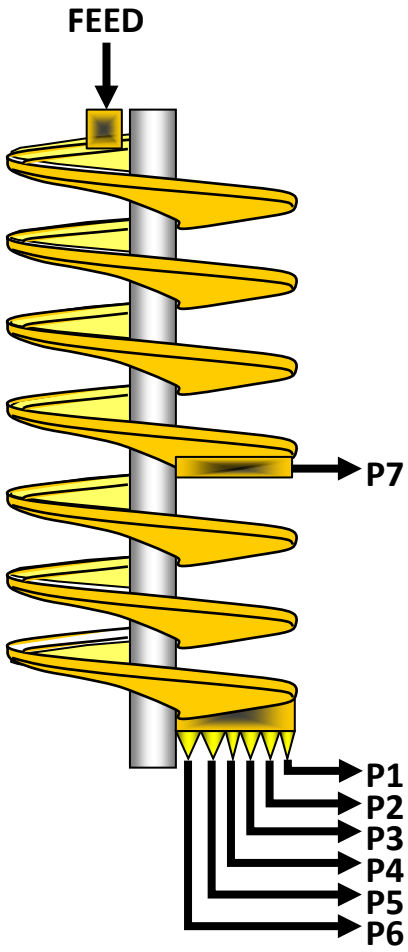




SPIRAL DATA ANALYSIS

Description: Run 22 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	1.702	36.5	11.87	16.62
P2	0.404	35.4	2.95	3.99
P3	0.165	39.6	1.00	1.40
P4	0.042	35.7	0.31	0.41
P5	0.063	35.0	0.47	0.61
P6	0.015	25.0	0.18	0.22
P7	0.269	50.8	1.04	1.54
Total	2.661	37.4	17.82	24.78

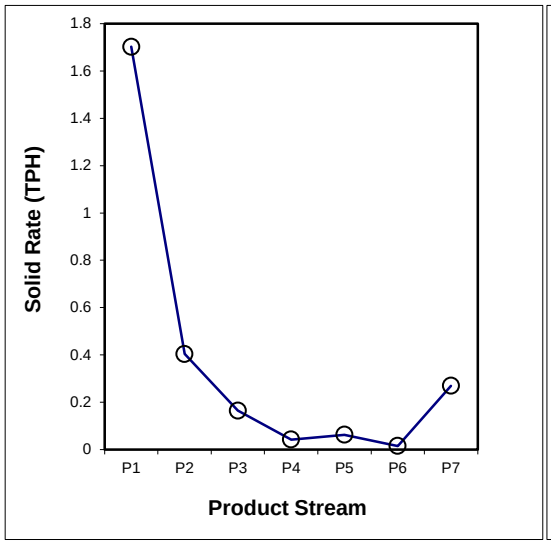
SPIRAL DATA ANALYSIS

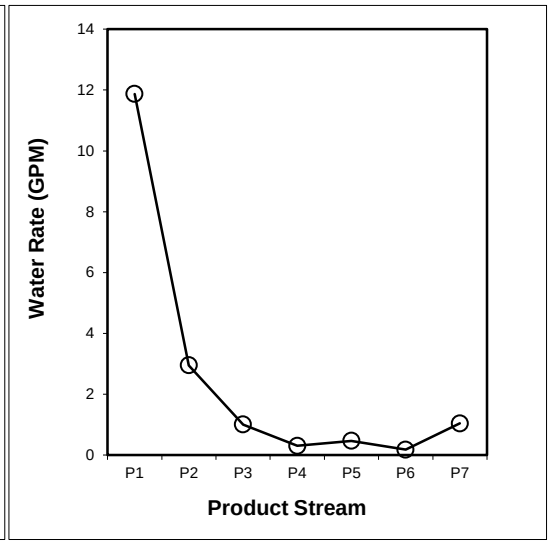
Description: Run 22 - Intermediate Spiral Test

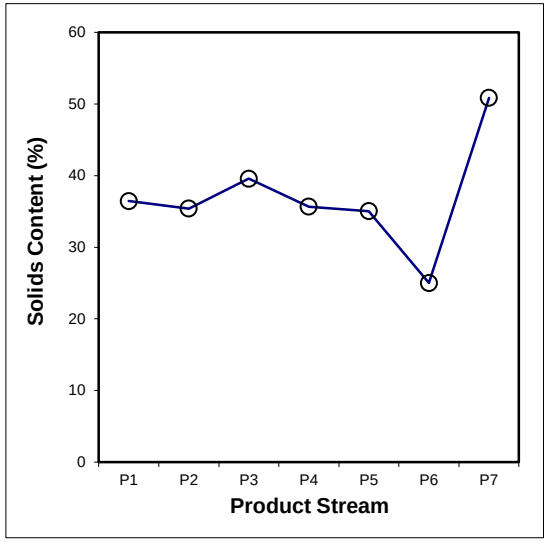
Comments: 3.36 x 1.0 mm Nominal Particle Size

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	3	4791.00	1171.00	4.670	2638.1	1350.0	1.702	63.98	36.45
P2	5	1566.93	100.33	1.142	1859.9	1350.4	0.404	15.19	35.39
P3	10	1167.24	99.11	0.416	1700.7	1285.8	0.165	6.18	39.58
P4	30	1016.97	97.61	0.119	1667.3	1346.3	0.042	1.59	35.66
P5	30	1483.86	96.80	0.180	1762.0	1285.8	0.063	2.37	35.04
P6	80	1340.24	98.11	0.060	1647.8	1344.1	0.015	0.57	25.01
P7	10	1448.61	103.37	0.530	2033.4	1354.3	0.269	10.12	50.84
Total (Calc)	--	--	--	7.116	--	--	2.661	100.00	37.39
Total (Head)	0.87	1752.78	188.45	7.116	1935.3	1350.4	2.661	--	37.39







SPIRAL DATA ANALYSIS

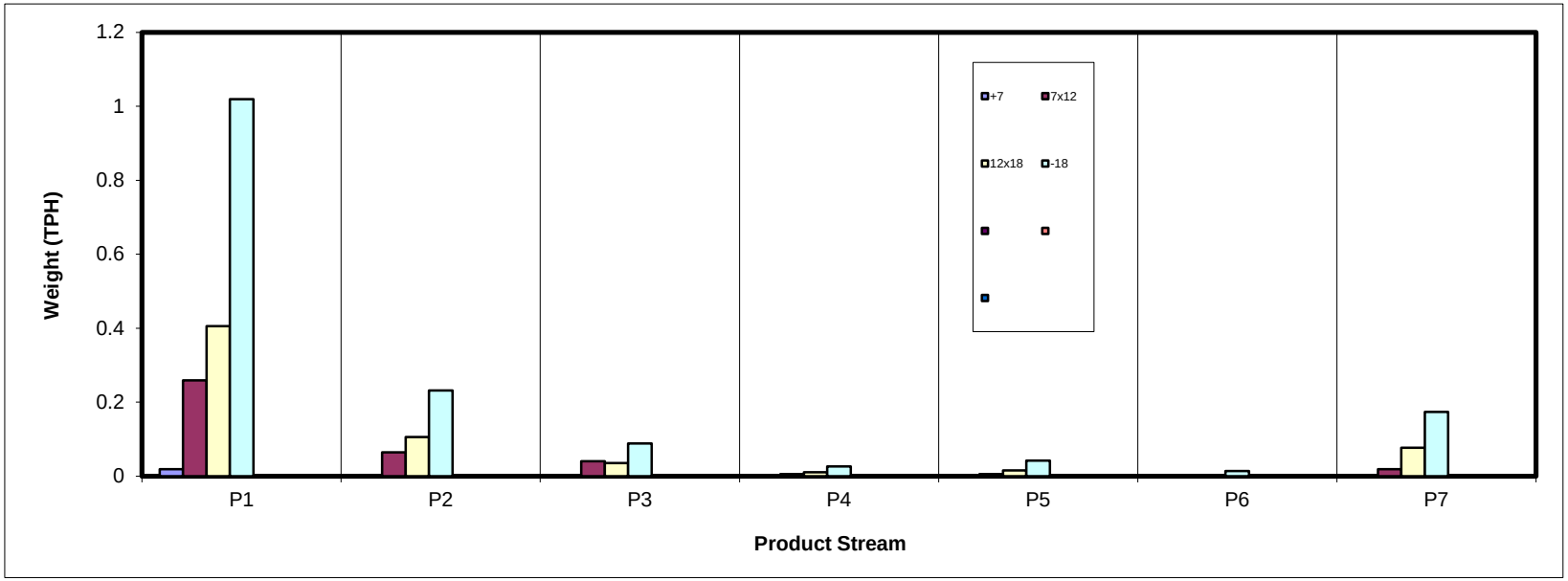
Description: Run 22 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	0.019	0.003	0.001	0.000	0.000	0.000	0.001		0.023
7x12	0.259	0.064	0.041	0.006	0.005	0.000	0.018		0.393
12x18	0.405	0.105	0.035	0.010	0.016	0.001	0.076		0.649
-18	1.019	0.232	0.088	0.026	0.042	0.014	0.174		1.595
Total (Calc)	1.702	0.404	0.165	0.042	0.063	0.015	0.269		2.661



SPIRAL DATA ANALYSIS

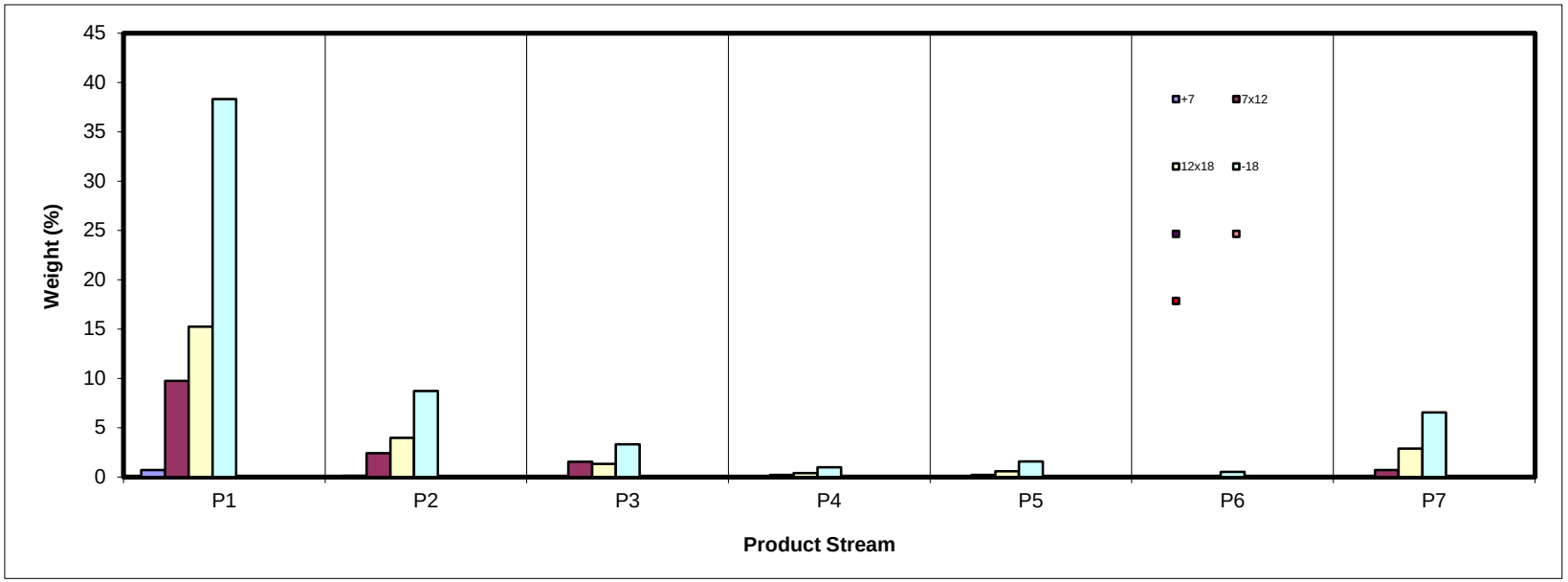
Description: Run 22 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	0.70	0.10	0.03	0.00	0.00	0.01	0.03		0.88
7x12	9.74	2.41	1.53	0.21	0.20	0.01	0.69		14.79
12x18	15.24	3.96	1.32	0.39	0.59	0.02	2.87		24.39
-18	38.31	8.72	3.31	0.99	1.57	0.53	6.53		59.94
Total (Calc)	63.98	15.19	6.18	1.59	2.37	0.57	10.12		100.00



SPIRAL DATA ANALYSIS

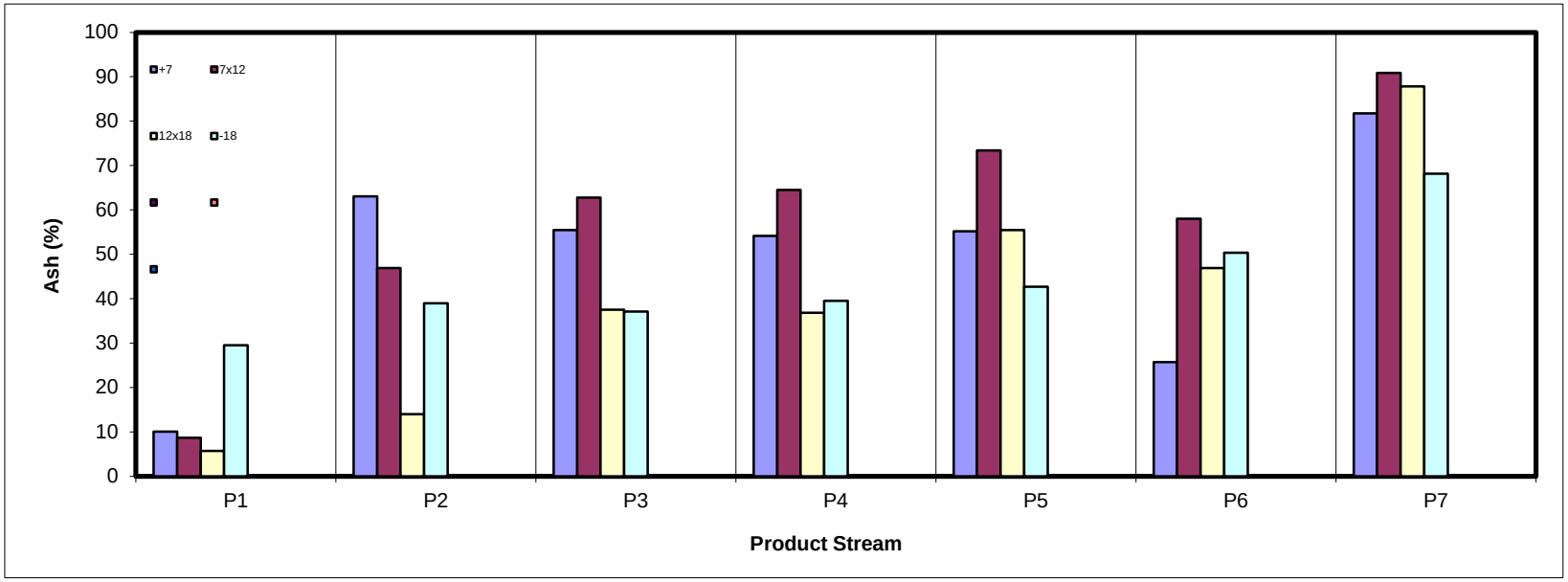
Description: Run 22 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	10.03	63.04	55.48	54.13	55.16	25.69	81.74		20.40
7x12	8.67	46.94	62.77	64.51	73.38	58.04	90.87		26.05
12x18	5.74	13.97	37.53	36.85	55.44	46.87	87.79		20.19
-18	29.55	38.98	37.12	39.52	42.71	50.36	68.17		36.24
Total (Calc)	20.49	33.87	43.62	42.23	48.55	49.84	75.33		30.68



SPIRAL DATA ANALYSIS

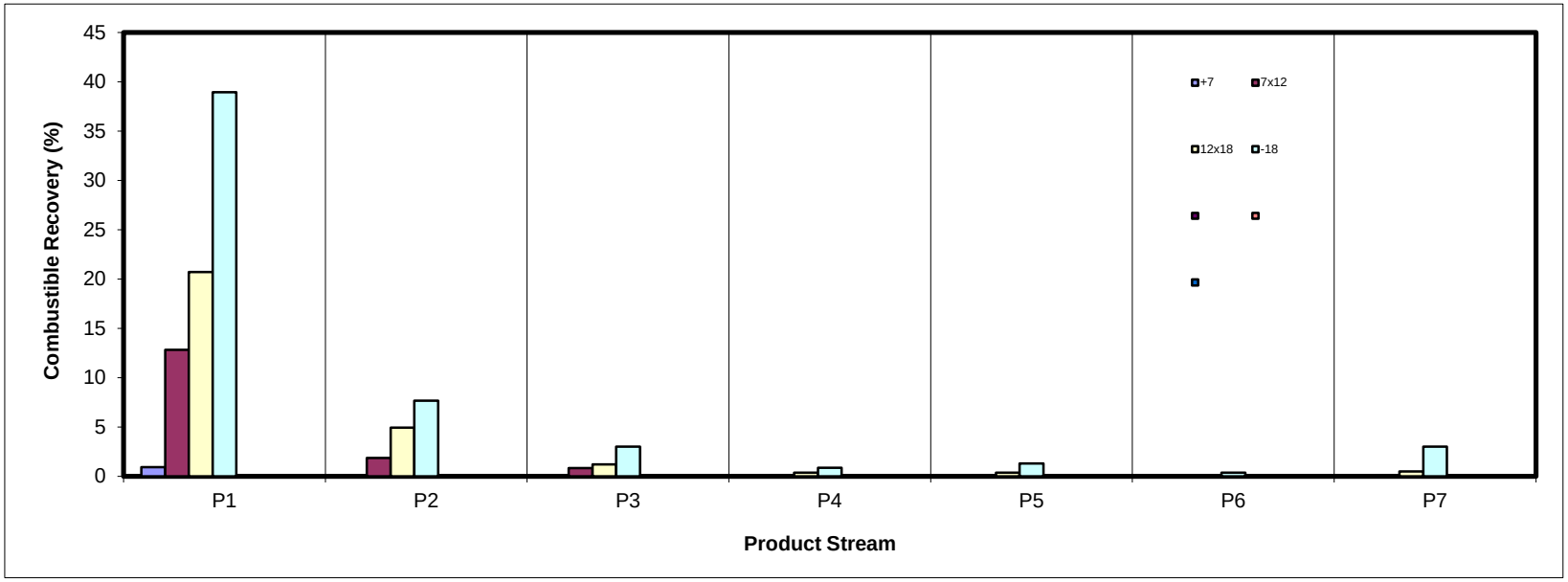
Description: Run 22 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	0.91	0.05	0.02	0.00	0.00	0.01	0.01		1.01
7x12	12.83	1.84	0.82	0.11	0.08	0.00	0.09		15.77
12x18	20.72	4.92	1.19	0.36	0.38	0.02	0.51		28.08
-18	38.93	7.67	3.00	0.86	1.30	0.38	3.00		55.14
Total (Calc)	73.39	14.49	5.03	1.33	1.76	0.41	3.60		100.00



SPIRAL DATA ANALYSIS

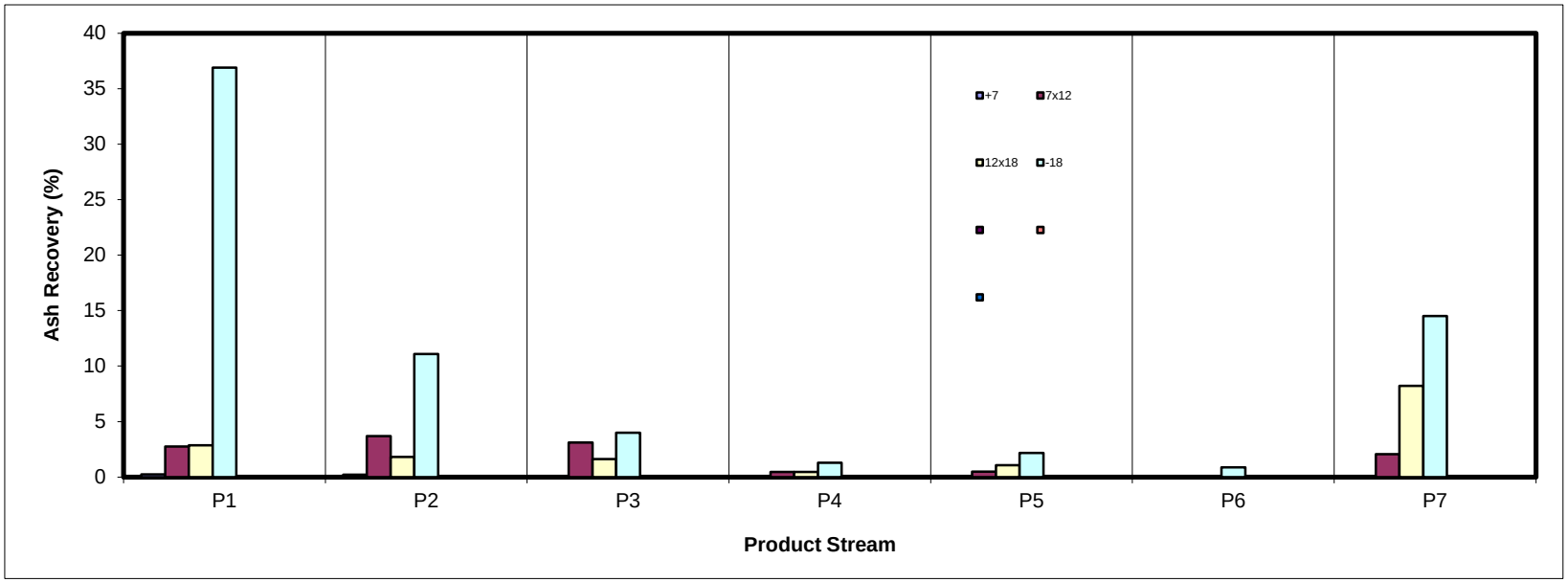
Description: Run 22 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	0.23	0.20	0.05	0.01	0.01	0.01	0.08		0.58
7x12	2.75	3.68	3.12	0.45	0.49	0.01	2.05		12.55
12x18	2.85	1.80	1.62	0.47	1.07	0.03	8.21		16.05
-18	36.90	11.08	4.00	1.27	2.18	0.87	14.51		70.81
Total (Calc)	42.73	16.77	8.79	2.19	3.74	0.92	24.85		100.00



SPIRAL DATA ANALYSIS

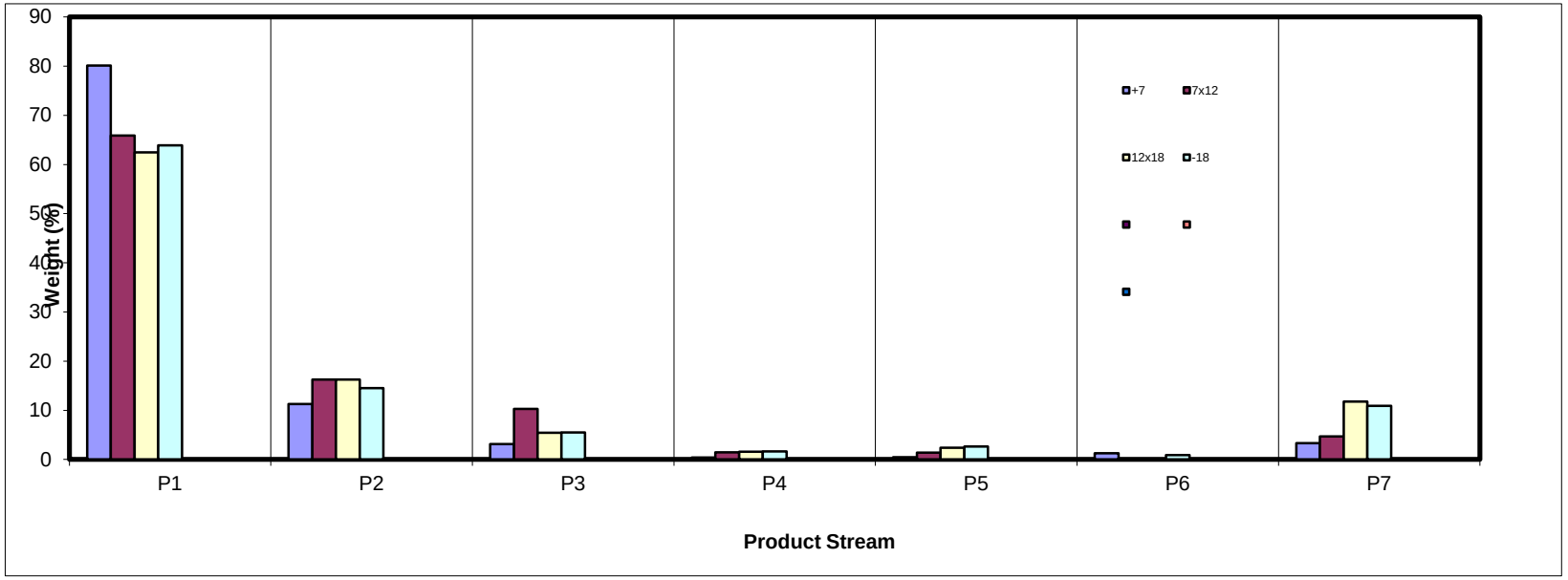
Description: Run 22 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	80.15	11.27	3.13	0.38	0.46	1.27	3.35		100.00
7x12	65.86	16.27	10.32	1.44	1.38	0.04	4.69		100.00
12x18	62.47	16.25	5.42	1.60	2.42	0.08	11.76		100.00
-18	63.90	14.54	5.52	1.65	2.61	0.88	10.89		100.00
Total (Calc)	63.98	15.19	6.18	1.59	2.37	0.57	10.12		100.00



SPIRAL DATA ANALYSIS

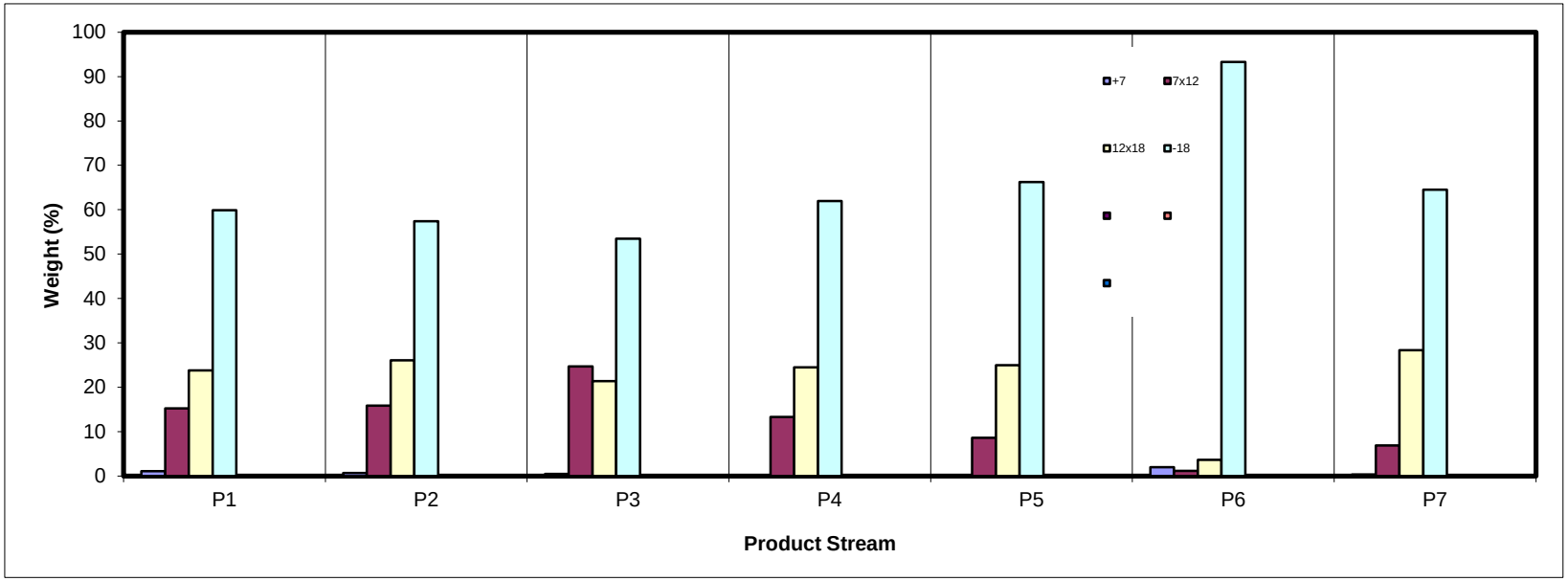
Description: Run 22 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+7	1.10	0.65	0.44	0.21	0.17	1.97	0.29		0.88
7x12	15.22	15.85	24.68	13.33	8.60	1.14	6.85		14.79
12x18	23.81	26.10	21.38	24.49	24.97	3.60	28.35		24.39
-18	59.87	57.41	53.50	61.98	66.26	93.29	64.52		59.94
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

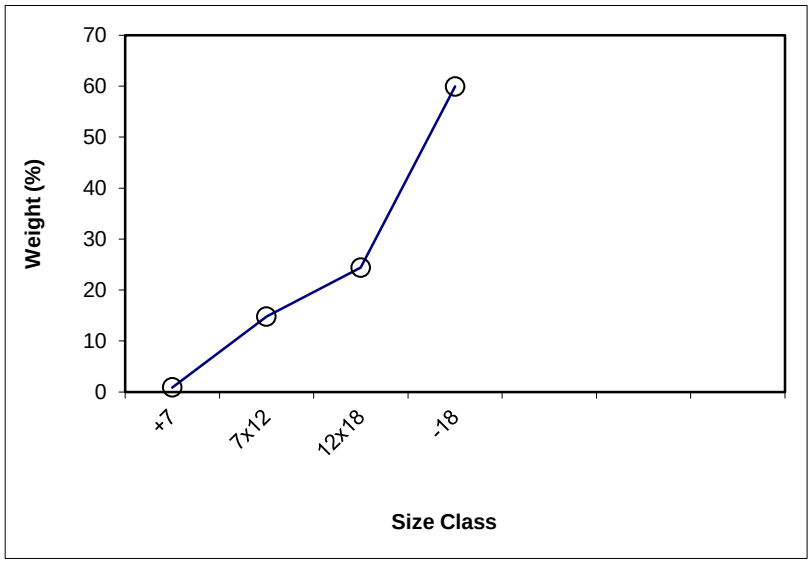
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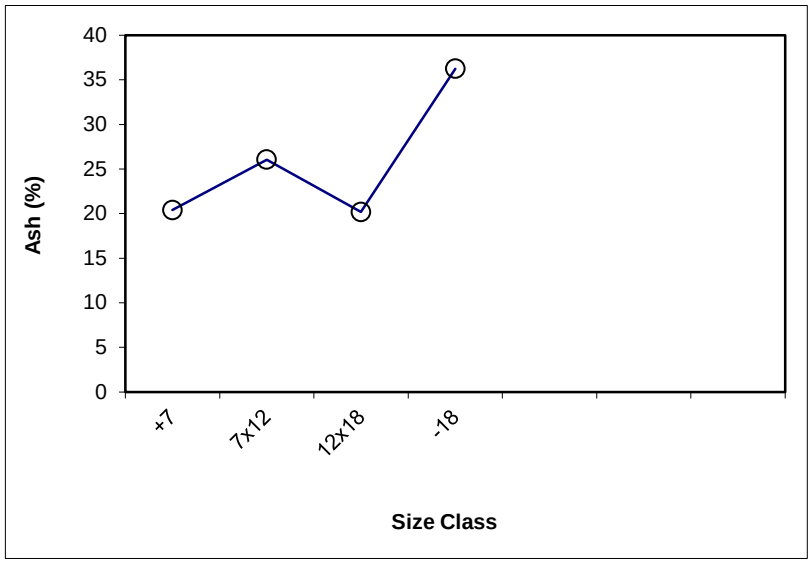
Comments: 3.36 x 1.0 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	444.5	439.4	5.14	0.88	20.40	0.88	20.40	100.00	30.68
7x12	530.8	444.3	86.48	14.79	26.05	15.66	25.73	99.12	30.77
12x18	602.8	460.1	142.66	24.39	20.19	40.06	22.35	84.34	31.59
-18	357.2	6.6	350.61	59.94	36.24	100.00	30.68	59.94	36.24
Total (Calc)	--	--	584.88	100.00	30.68	--	--	--	--





SPIRAL DATA ANALYSIS

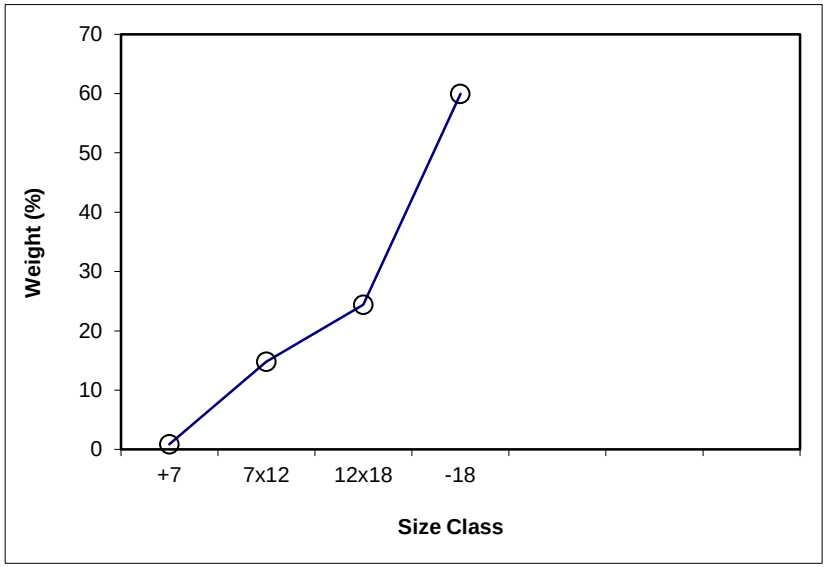
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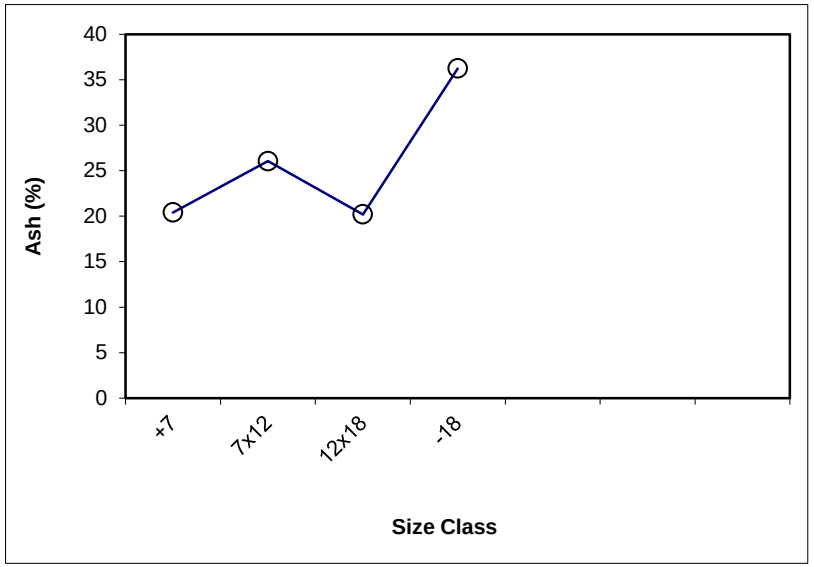
Comments: 3.36 x 1.0 mm Nominal Particle Size

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+7	0.88	20.40	0.88	20.40	100.00	30.68			
7x12	14.79	26.05	15.66	25.73	99.12	30.77	x	14.79	26.05
12x18	24.39	20.19	40.06	22.35	84.34	31.59	x	24.39	20.19
-18	59.94	36.24	100.00	30.68	59.94	36.24			
Total (Calc)	100.00	30.68	--	--	--	--	--	39.18	22.40





SPIRAL DATA ANALYSIS

Description: Run 22 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 63.98

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	453.52	439.4	14.17	1.10	10.03	1.10	10.03	100.00	20.49
7x12	640.34	444.3	196.04	15.22	8.67	16.32	8.76	98.90	20.60
12x18	766.88	460.1	306.74	23.81	5.74	40.13	6.97	83.68	22.77
-18	777.38	6.2	771.14	59.87	29.55	100.00	20.49	59.87	29.55
Total (Calc)	--	--	1288.09	100.00	20.49	--	--	--	--

Product P2 Feed Weight (%): 15.19

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	442.7	439.4	3.32	0.65	63.04	0.65	63.04	100.00	33.87
7x12	525.0	444.3	80.73	15.85	46.94	16.50	47.57	99.35	33.68
12x18	593.1	460.1	132.96	26.10	13.97	42.59	26.98	83.50	31.16
-18	299.1	6.6	292.49	57.41	38.98	100.00	33.87	57.41	38.98
Total (Calc)	--	--	509.50	100.00	33.87	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 22 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 6.18

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	445.4	443.5	1.84	0.44	55.48	0.44	55.48	100.00	43.62
7x12	537.0	434.6	102.39	24.68	62.77	25.12	62.64	99.56	43.57
12x18	489.9	401.2	88.70	21.38	37.53	46.50	51.10	74.88	37.24
-18	228.5	6.5	221.97	53.50	37.12	100.00	43.62	53.50	37.12
Total (Calc)	--	--	414.91	100.00	43.62	--	--	--	--

Product P4 Feed Weight (%): 1.59

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	440.0	439.4	0.67	0.21	54.13	0.21	54.13	100.00	42.23
7x12	483.1	440.3	42.77	13.33	64.51	13.53	64.35	99.79	42.20
12x18	538.7	460.1	78.61	24.49	36.85	38.02	46.64	86.47	38.77
-18	205.5	6.6	198.94	61.98	39.52	100.00	42.23	61.98	39.52
Total (Calc)	--	--	320.99	100.00	42.23	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 22 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 2.37

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	444.3	443.5	0.82	0.17	55.16	0.17	55.16	100.00	48.55
7x12	475.5	434.6	40.93	8.60	73.38	8.77	73.03	99.83	48.54
12x18	520.1	401.2	118.90	24.97	55.44	33.74	60.01	91.23	46.19
-18	322.1	6.6	315.53	66.26	42.71	100.00	48.55	66.26	42.71
Total (Calc)	--	--	476.18	100.00	48.55	--	--	--	--

Product P6 Feed Weight (%): 0.57

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	439.3	433.4	5.98	1.97	25.69	1.97	25.69	100.00	49.84
7x12	447.8	444.3	3.46	1.14	58.04	3.11	37.54	98.03	50.33
12x18	471.1	460.1	10.94	3.60	46.87	6.71	42.55	96.89	50.23
-18	289.7	6.3	283.38	93.29	50.36	100.00	49.84	93.29	50.36
Total (Calc)	--	--	303.76	100.00	49.84	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 22 - Intermediate Spiral Test

Comments: 3.36 x 1.0 mm Nominal Particle Size

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 10.12

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+7	445.5	443.5	1.97	0.29	81.74	0.29	81.74	100.00	75.33
7x12	490.8	444.3	46.50	6.85	90.87	7.14	90.50	99.71	75.31
12x18	652.6	460.1	192.51	28.35	87.79	35.48	88.34	92.86	74.16
-18	444.5	6.4	438.17	64.52	68.17	100.00	75.33	64.52	68.17
Total (Calc)	--	--	679.15	100.00	75.33	--	--	--	--

SPIRAL DATA ANALYSIS

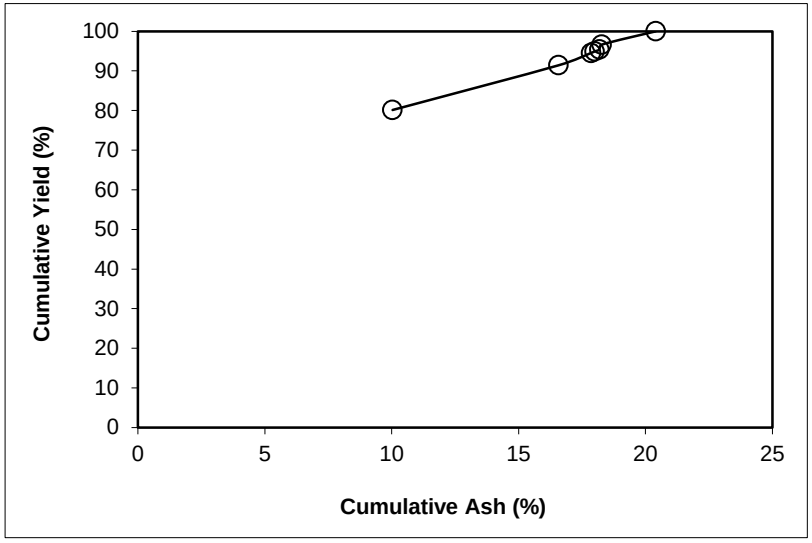
Description: Run 22 - Intermediate Spiral Test

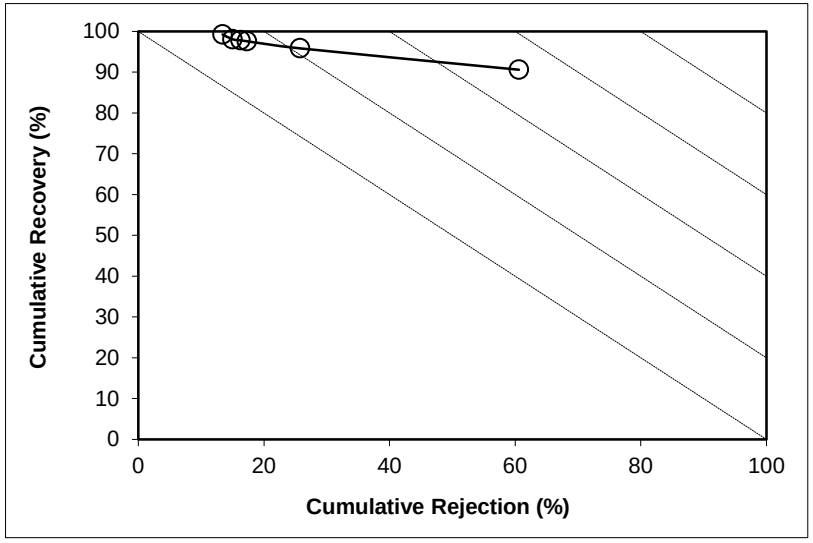
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: +7 Feed Weight (%): 0.88

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	80.15	10.03	80.15	10.03	90.59	19.85	62.26	60.59	51.17
P2	11.27	63.04	91.42	16.57	95.82	8.58	61.23	25.76	21.58
P3	3.13	55.48	94.54	17.86	97.57	5.46	64.53	17.26	14.83
P4	0.38	54.13	94.92	18.00	97.79	5.08	65.31	16.26	14.04
P5	0.46	55.16	95.39	18.18	98.05	4.61	66.33	15.00	13.05
P6	1.27	25.69	96.65	18.28	99.23	3.35	81.74	13.40	12.64
P7	3.35	81.74	100.00	20.40	100.00	0.00			
Total (Calc)	100.00	20.40	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

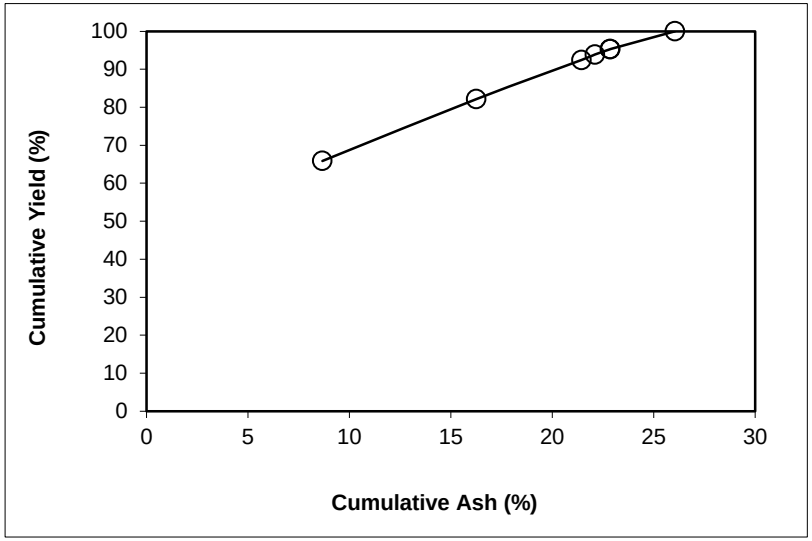
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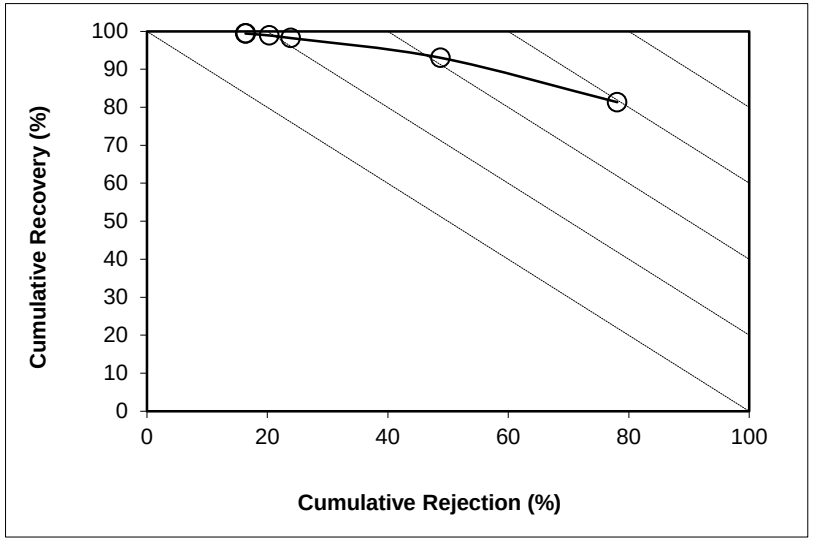
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 7x12 Feed Weight (%): 14.79

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	65.86	8.67	65.86	8.67	81.34	34.14	59.57	78.08	59.42
P2	16.27	46.94	82.14	16.25	93.02	17.86	71.09	48.75	41.77
P3	10.32	62.77	92.46	21.44	98.21	7.54	82.47	23.88	22.09
P4	1.44	64.51	93.89	22.10	98.90	6.11	86.70	20.32	19.22
P5	1.38	73.38	95.27	22.84	99.40	4.73	90.57	16.45	15.84
P6	0.04	58.04	95.31	22.86	99.42	4.69	90.87	16.35	15.77
P7	4.69	90.87	100.00	26.05	100.00	0.00			
Total (Calc)	100.00	26.05	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

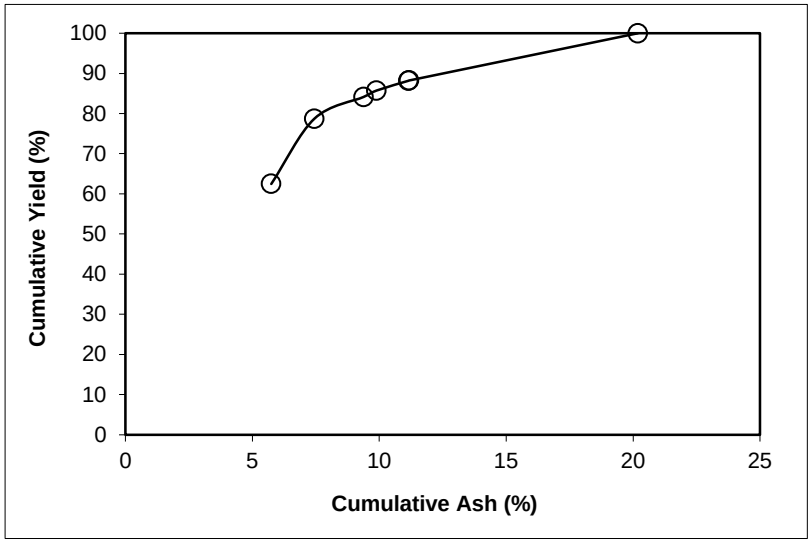
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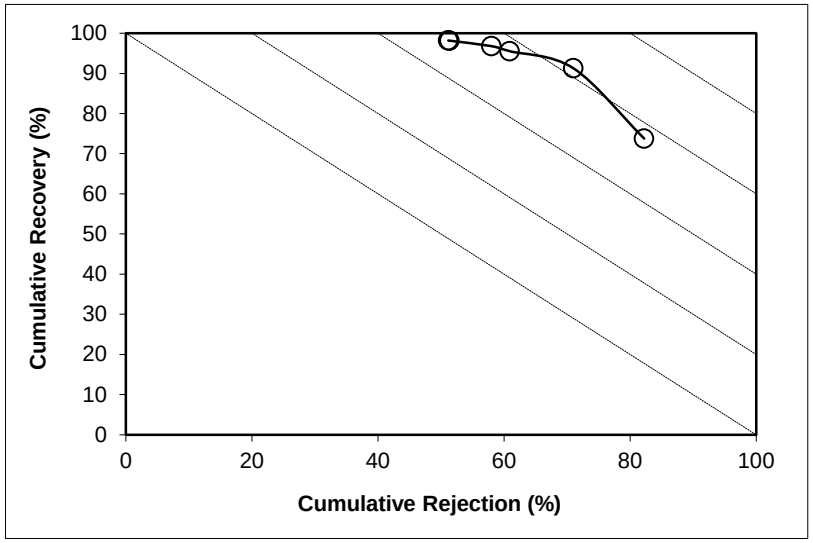
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: 12x18 Feed Weight (%): 24.39

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	62.47	5.74	62.47	5.74	73.77	37.53	44.23	82.23	56.00
P2	16.25	13.97	78.71	7.44	91.29	21.29	67.33	70.99	62.27
P3	5.42	37.53	84.13	9.38	95.53	15.87	77.50	60.91	56.44
P4	1.60	36.85	85.73	9.89	96.79	14.27	82.06	57.99	54.79
P5	2.42	55.44	88.16	11.14	98.15	11.84	87.51	51.34	49.49
P6	0.08	46.87	88.24	11.18	98.20	11.76	87.79	51.15	49.35
P7	11.76	87.79	100.00	20.19	100.00	0.00			
Total (Calc)	100.00	20.19	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

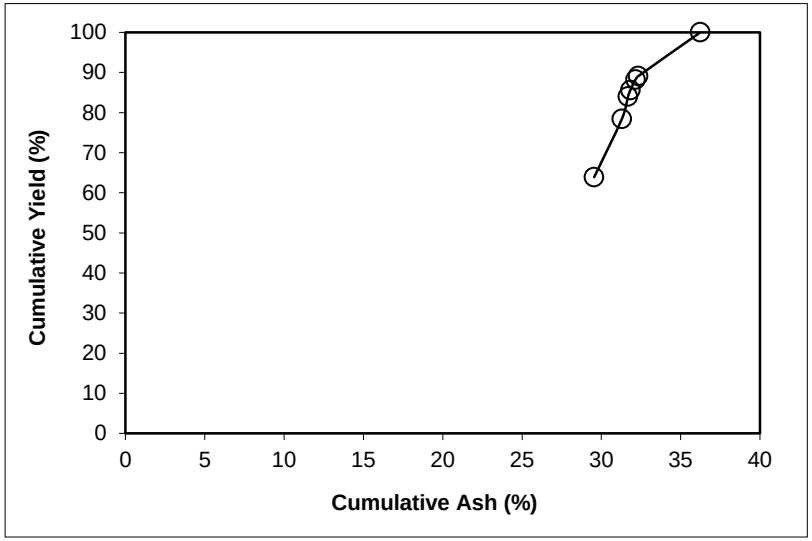
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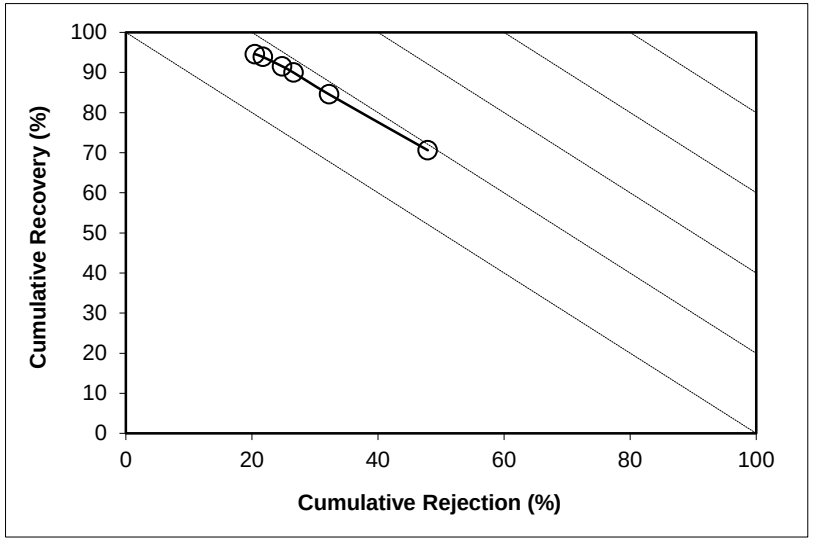
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: -18.00 Feed Weight (%): 59.94

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	63.90	29.55	63.90	29.55	70.61	36.10	48.08	47.89	18.50
P2	14.54	38.98	78.44	31.29	84.52	21.56	54.22	32.25	16.77
P3	5.52	37.12	83.96	31.68	89.96	16.04	60.10	26.60	16.56
P4	1.65	39.52	85.61	31.83	91.53	14.39	62.46	24.80	16.33
P5	2.61	42.71	88.23	32.15	93.88	11.77	66.84	21.72	15.60
P6	0.88	50.36	89.11	32.33	94.56	10.89	68.17	20.49	15.06
P7	10.89	68.17	100.00	36.24	100.00	0.00			
Total (Calc)	100.00	36.24	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

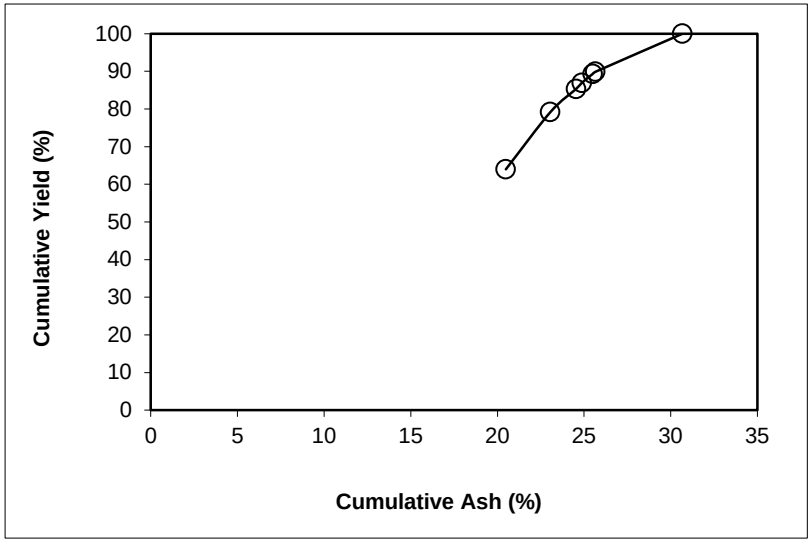
Description: Run 22 - Intermediate Spiral Test

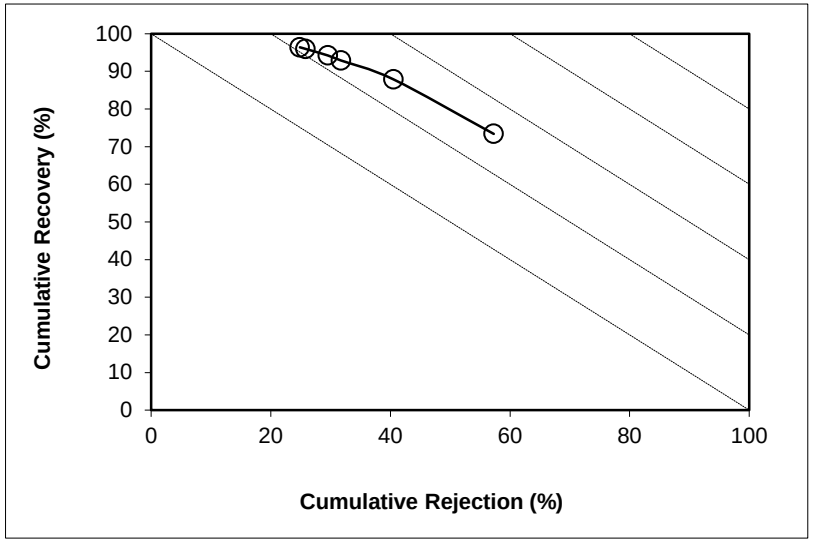
Comments: 3.36 x 1.0 mm Nominal Particle Size

PERFORMANCE ANALYSIS

Size Class: over all

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	63.98	20.49	63.98	20.49	73.39	36.02	48.78	57.27	30.66
P2	15.19	33.87	79.17	23.05	87.88	20.83	59.65	40.50	28.38
P3	6.18	43.62	85.35	24.54	92.90	14.65	66.41	31.71	24.62
P4	1.59	42.23	86.95	24.87	94.23	13.05	69.37	29.52	23.75
P5	2.37	48.55	89.31	25.49	95.99	10.69	73.98	25.77	21.76
P6	0.57	49.84	89.88	25.65	96.40	10.12	75.33	24.85	21.25
P7	10.12	75.33	100.00	30.68	100.00	0.00			
Total (Calc)	100.00	30.68	--	--	--	--	--	--	--



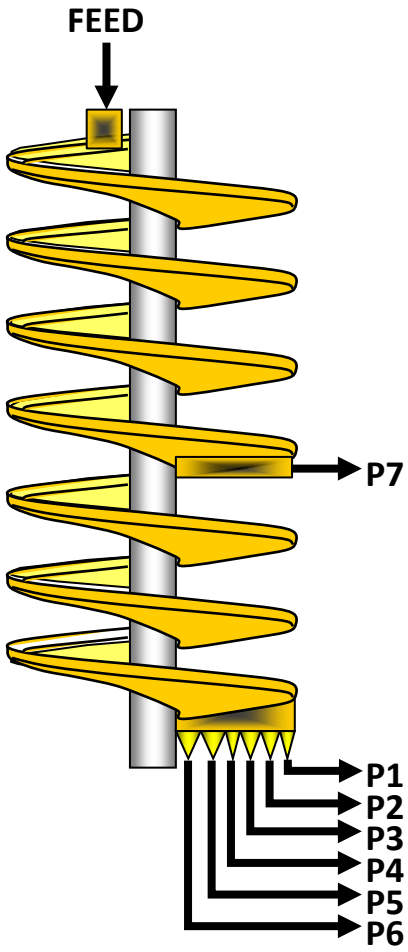


APPENDIX D – Spiral Circuit Results (Mixed Coal Feed Stock, 3.36 x 0.15 mm)

SPIRAL DATA ANALYSIS

Description: Run 23 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	1.768	26.7	19.37	24.05
P2	0.380	32.5	3.16	4.17
P3	0.142	35.1	1.05	1.40
P4	0.041	34.9	0.31	0.41
P5	0.045	28.4	0.45	0.56
P6	0.014	23.1	0.18	0.21
P7	0.203	43.7	1.05	1.47
Total	2.593	28.9	25.57	32.26

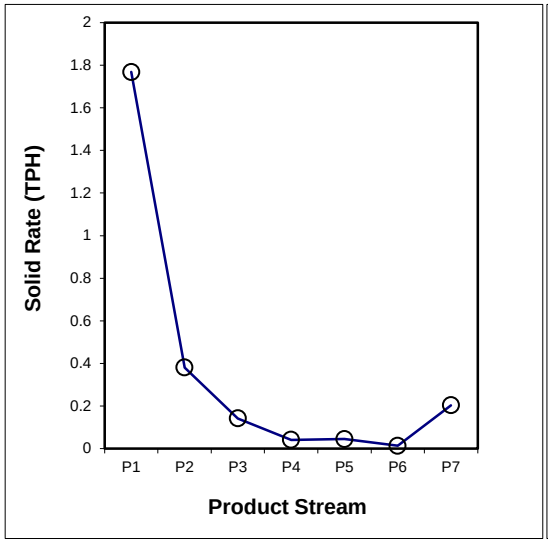
SPIRAL DATA ANALYSIS

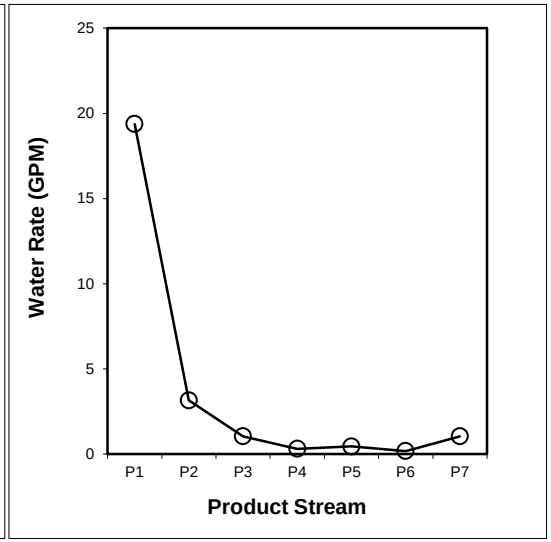
Description: Run 23 - Intermediate Spiral Test

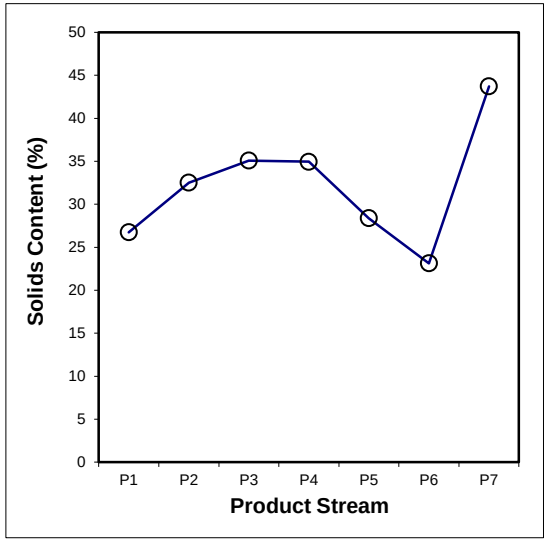
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	3	6366.50	1294.00	6.611	3786.7	2448.7	1.768	68.19	26.75
P2	5	1590.40	94.11	1.170	3403.1	2923.3	0.380	14.67	32.51
P3	10	1125.58	92.48	0.404	2806.3	2448.9	0.142	5.46	35.08
P4	40	1303.06	91.91	0.118	3340.8	2923.4	0.041	1.60	34.95
P5	30	1301.38	92.43	0.158	2787.1	2448.8	0.045	1.72	28.38
P6	60	987.17	84.04	0.059	3129.2	2923.2	0.014	0.52	23.14
P7	10	1286.03	94.65	0.465	2961.3	2448.7	0.203	7.84	43.72
Total (Calc)	--	--	--	8.985	--	--	2.593	100.00	28.86
Total (Head)	0.69	1766.53	204.44	8.985	3374.2	2923.3	2.593	--	28.86







SPIRAL DATA ANALYSIS

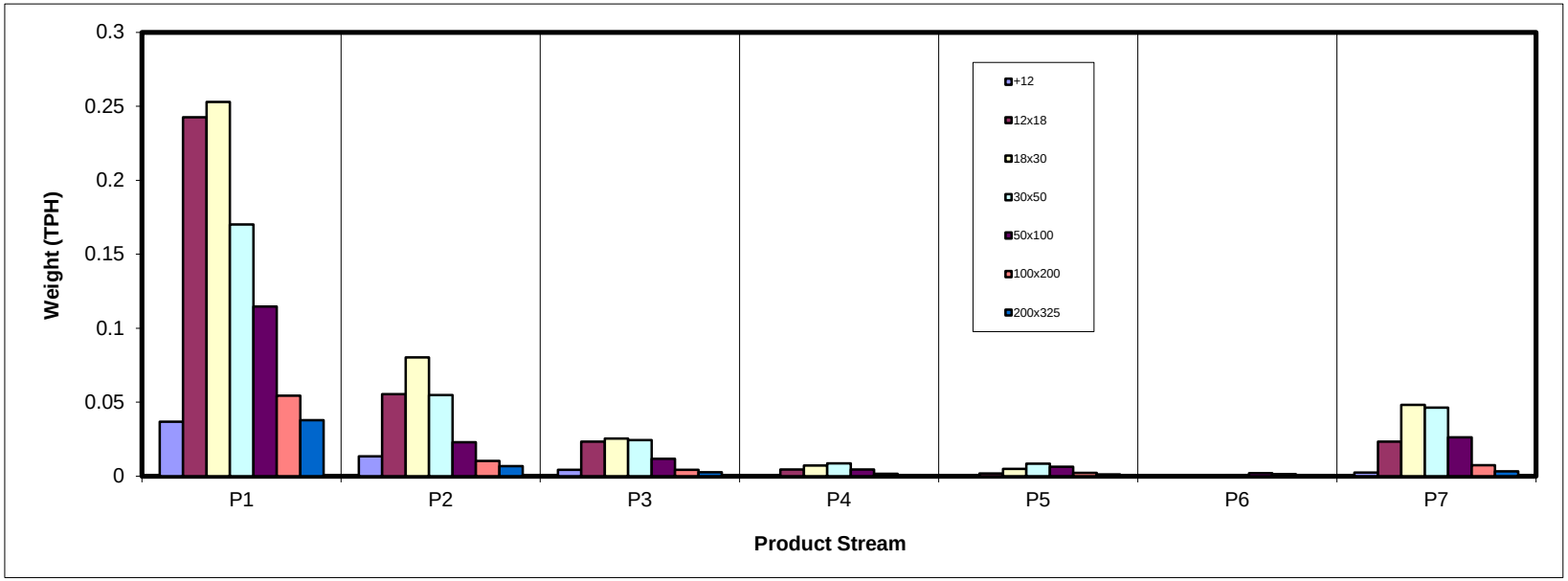
Description: Run 23 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	0.037	0.013	0.004	0.001	0.000	0.000	0.002		0.057
12x18	0.243	0.056	0.023	0.005	0.002	0.000	0.023		0.351
18x30	0.253	0.080	0.025	0.007	0.005	0.000	0.048		0.419
30x50	0.170	0.055	0.024	0.009	0.008	0.001	0.046		0.313
50x100	0.115	0.023	0.012	0.004	0.006	0.002	0.026		0.188
100x200	0.054	0.010	0.004	0.002	0.002	0.001	0.007		0.081
200x325	0.038	0.007	0.003	0.001	0.001	0.001	0.003		0.053
-325	0.859	0.137	0.046	0.014	0.020	0.009	0.046		1.130
Total (Calc)	1.768	0.380	0.142	0.041	0.045	0.014	0.203		2.593



SPIRAL DATA ANALYSIS

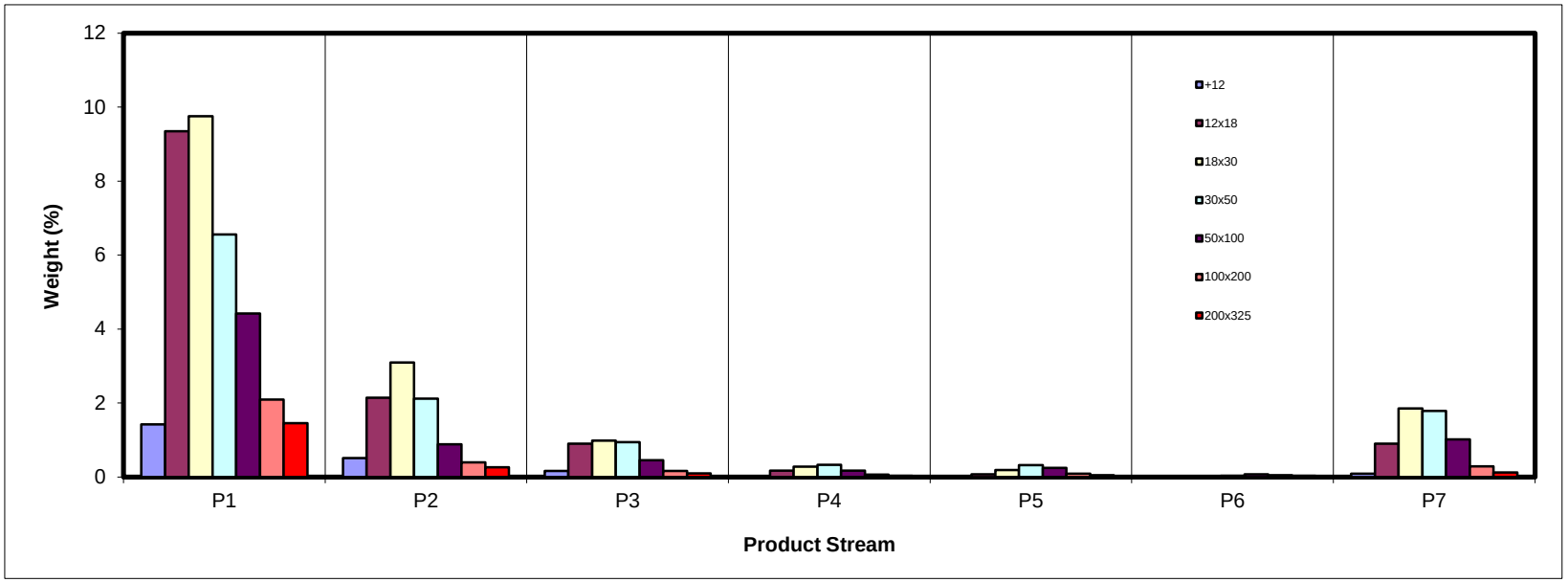
Description: Run 23 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	1.42	0.51	0.16	0.02	0.01	0.00	0.09		2.22
12x18	9.35	2.14	0.90	0.17	0.07	0.00	0.90		13.53
18x30	9.76	3.09	0.98	0.28	0.18	0.01	1.86		16.15
30x50	6.56	2.12	0.94	0.33	0.32	0.03	1.79		12.09
50x100	4.42	0.88	0.45	0.17	0.24	0.08	1.01		7.26
100x200	2.09	0.40	0.16	0.06	0.09	0.05	0.28		3.13
200x325	1.46	0.26	0.10	0.03	0.05	0.03	0.12		2.05
-325	33.13	5.27	1.77	0.53	0.77	0.33	1.79		43.58
Total (Calc)	68.19	14.67	5.46	1.60	1.72	0.52	7.84		100.00



SPIRAL DATA ANALYSIS

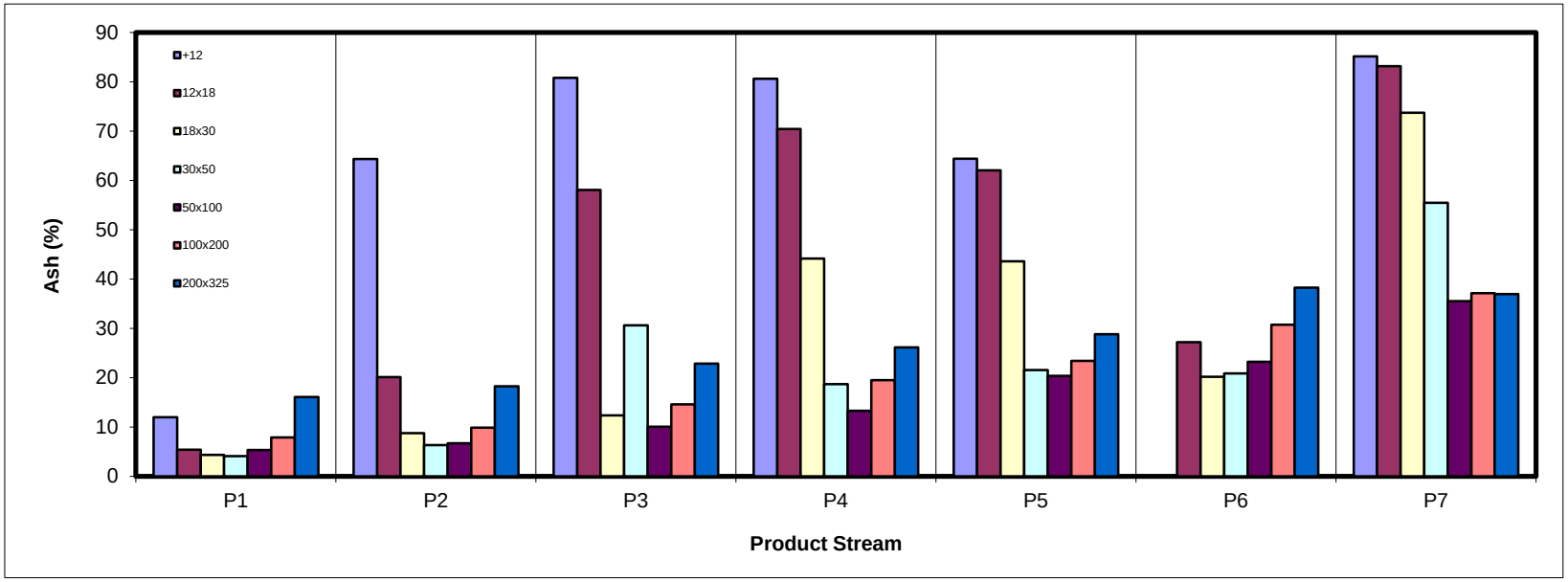
Description: Run 23 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	11.97	64.35	80.80	80.58	64.38	0.00	85.11		32.98
12x18	5.36	20.11	58.02	70.41	62.05	27.17	83.13		17.47
18x30	4.36	8.74	12.32	44.13	43.58	20.16	73.70		14.79
30x50	4.11	6.31	30.62	18.69	21.53	20.88	55.45		15.05
50x100	5.35	6.71	10.05	13.30	20.36	23.18	35.51		10.89
100x200	7.87	9.86	14.56	19.49	23.43	30.72	37.13		12.13
200x325	16.10	18.22	22.84	26.15	28.83	38.27	36.93		18.70
-325	53.87	55.91	56.36	58.05	58.38	61.13	60.56		54.67
Total (Calc)	29.11	29.02	39.37	42.24	42.15	48.50	60.91		32.68



SPIRAL DATA ANALYSIS

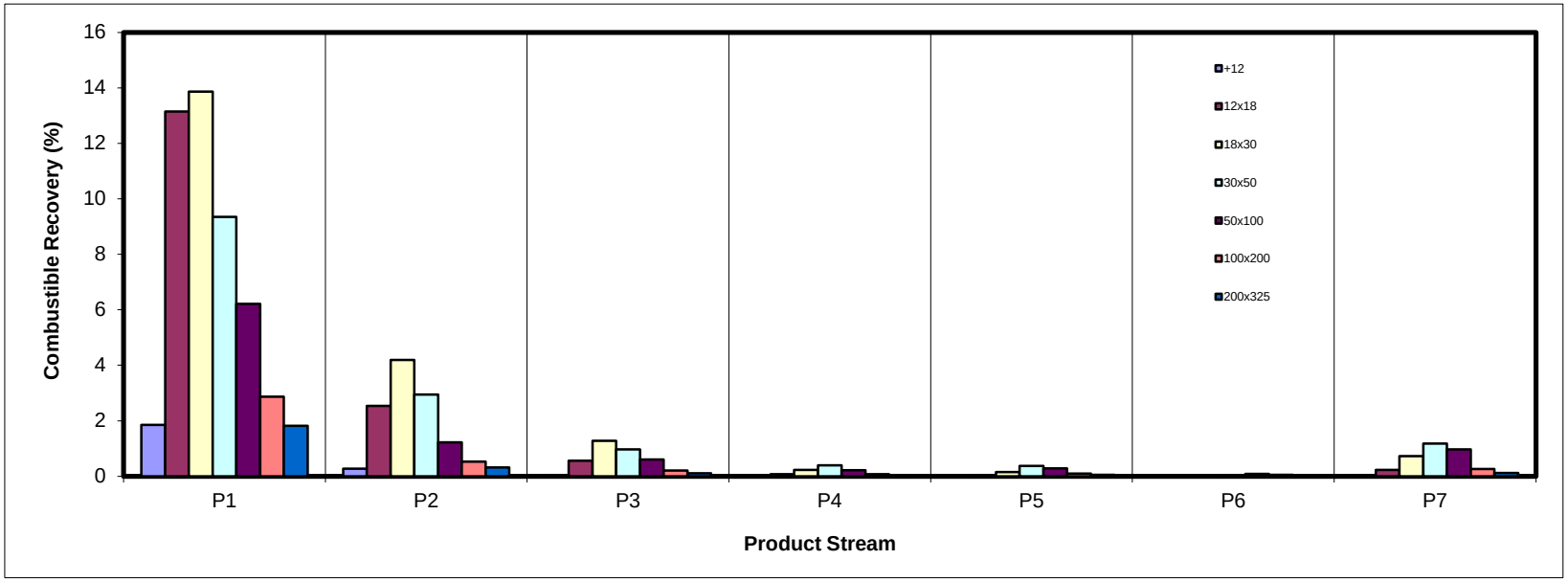
Description: Run 23 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	1.86	0.27	0.05	0.01	0.00	0.00	0.02		2.21
12x18	13.15	2.54	0.56	0.08	0.04	0.00	0.22		16.59
18x30	13.86	4.19	1.28	0.23	0.15	0.01	0.72		20.45
30x50	9.34	2.95	0.97	0.40	0.38	0.04	1.18		15.25
50x100	6.22	1.22	0.60	0.22	0.29	0.09	0.97		9.60
100x200	2.87	0.53	0.21	0.07	0.10	0.05	0.26		4.09
200x325	1.82	0.32	0.11	0.03	0.05	0.02	0.12		2.48
-325	22.70	3.45	1.15	0.33	0.47	0.19	1.05		29.34
Total (Calc)	71.81	15.47	4.92	1.37	1.48	0.40	4.55		100.00



SPIRAL DATA ANALYSIS

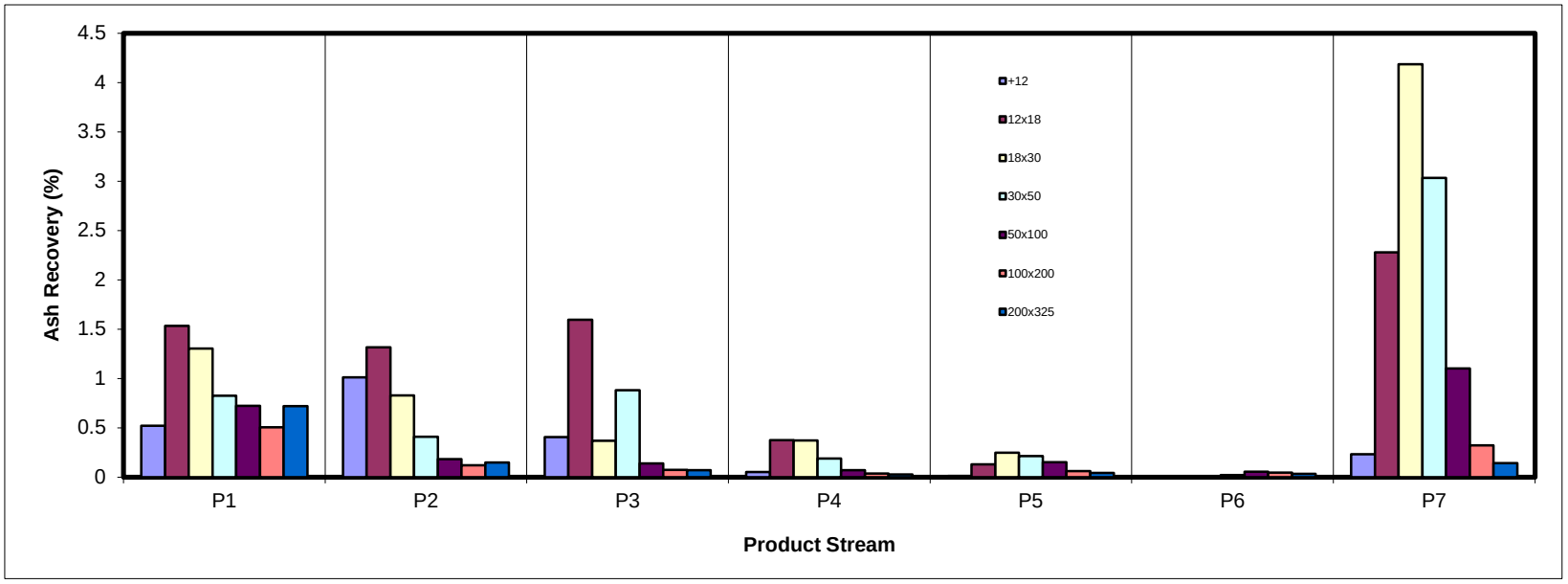
Description: Run 23 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	0.52	1.01	0.41	0.05	0.01	0.00	0.23		2.24
12x18	1.53	1.32	1.60	0.38	0.13	0.00	2.28		7.23
18x30	1.30	0.83	0.37	0.37	0.25	0.00	4.19		7.31
30x50	0.82	0.41	0.88	0.19	0.21	0.02	3.03		5.57
50x100	0.72	0.18	0.14	0.07	0.15	0.05	1.10		2.42
100x200	0.50	0.12	0.07	0.04	0.06	0.05	0.32		1.16
200x325	0.72	0.15	0.07	0.03	0.04	0.03	0.14		1.17
-325	54.60	9.01	3.05	0.94	1.37	0.62	3.31		72.90
Total (Calc)	60.73	13.03	6.58	2.06	2.22	0.78	14.60		100.00



SPIRAL DATA ANALYSIS

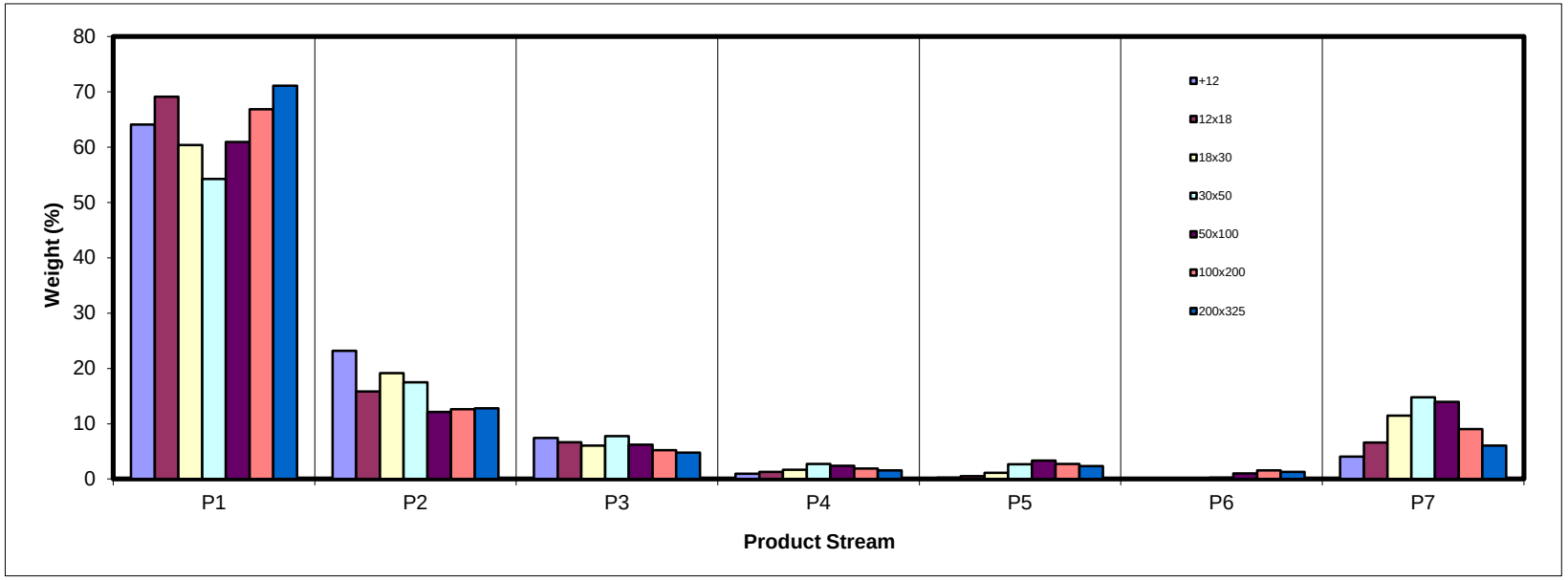
Description: Run 23 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	64.12	23.20	7.41	0.97	0.27	0.00	4.03		100.00
12x18	69.11	15.82	6.64	1.29	0.50	0.02	6.62		100.00
18x30	60.41	19.14	6.07	1.71	1.14	0.04	11.49		100.00
30x50	54.27	17.51	7.78	2.72	2.67	0.26	14.79		100.00
50x100	60.93	12.12	6.21	2.39	3.35	1.03	13.96		100.00
100x200	66.86	12.64	5.19	1.92	2.73	1.59	9.06		100.00
200x325	71.13	12.82	4.80	1.55	2.32	1.32	6.06		100.00
-325	76.01	12.09	4.06	1.22	1.76	0.76	4.10		100.00
Total (Calc)	68.19	14.67	5.46	1.60	1.72	0.52	7.84		100.00



SPIRAL DATA ANALYSIS

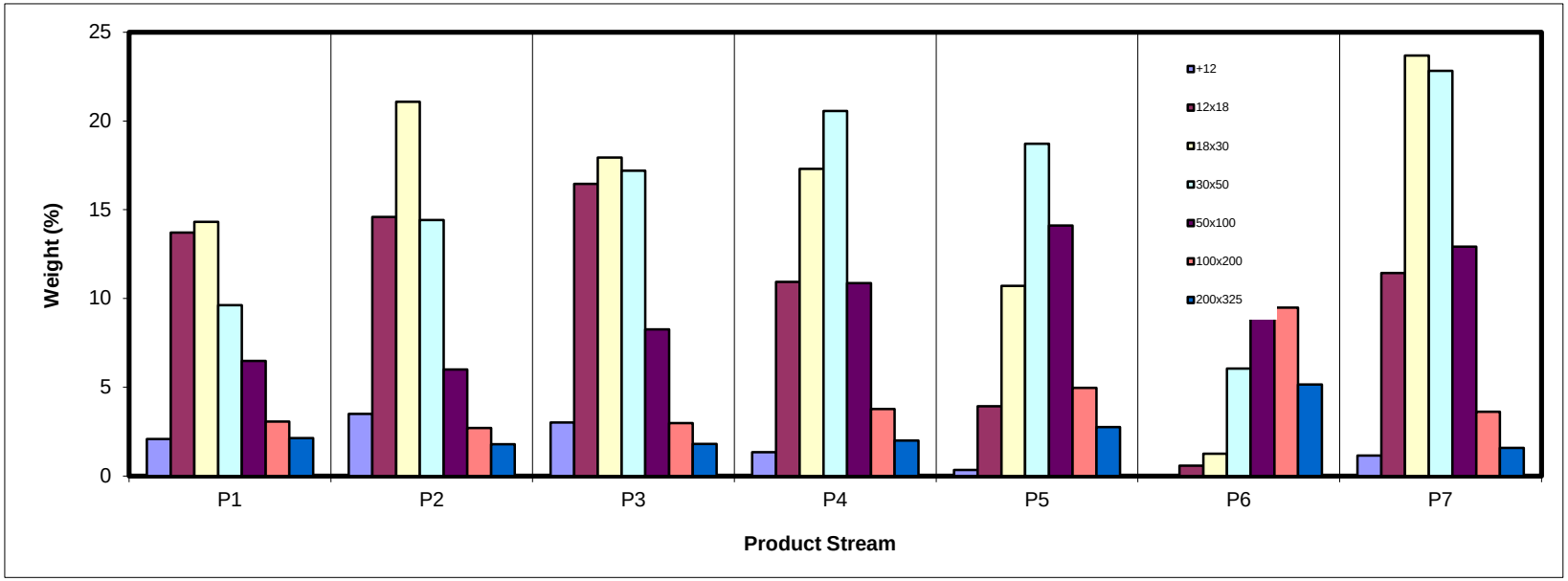
Description: Run 23 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	2.08	3.50	3.01	1.34	0.35	0.00	1.14		2.22
12x18	13.71	14.59	16.45	10.93	3.93	0.58	11.43		13.53
18x30	14.31	21.07	17.94	17.30	10.70	1.25	23.68		16.15
30x50	9.62	14.43	17.21	20.57	18.72	6.05	22.82		12.09
50x100	6.48	6.00	8.25	10.87	14.11	14.29	12.92		7.26
100x200	3.07	2.70	2.98	3.77	4.96	9.49	3.62		3.13
200x325	2.14	1.79	1.80	2.00	2.76	5.15	1.58		2.05
-325	48.58	35.92	32.37	33.22	44.48	63.20	22.80		43.58
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

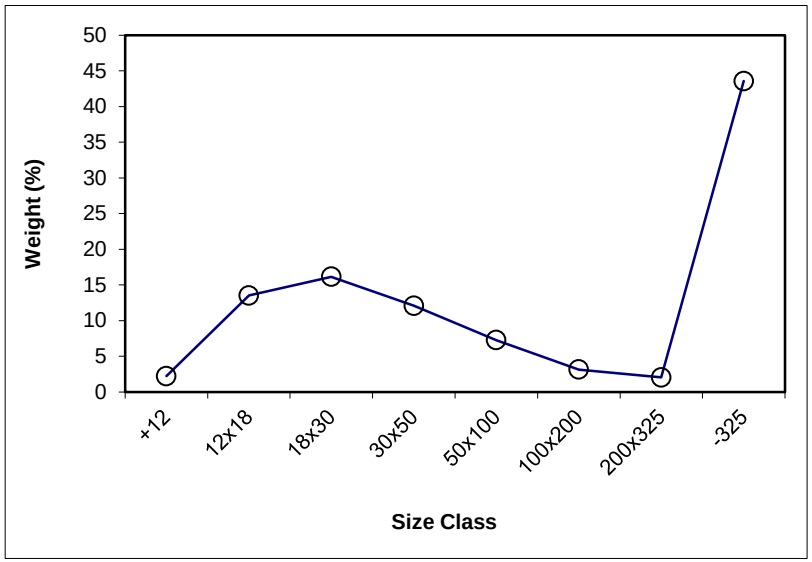
Description: Run 23 - Intermediate Spiral Test

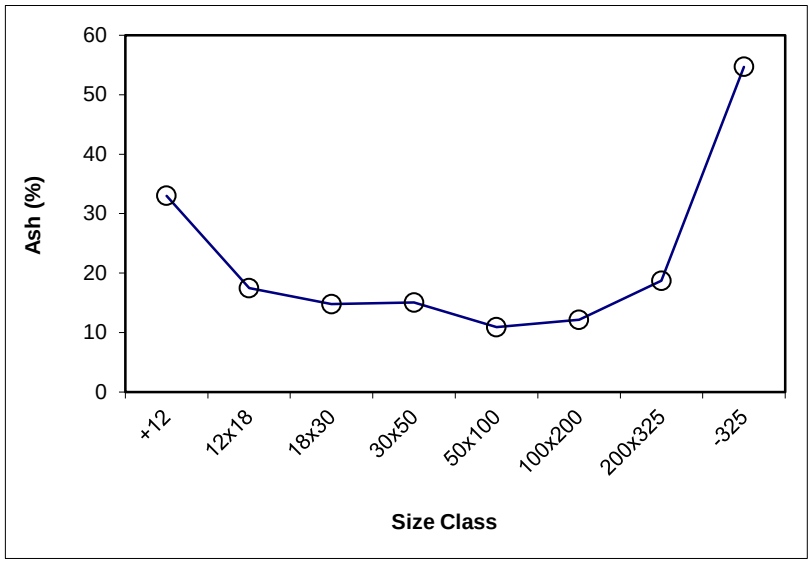
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	454.3	444.3	9.99	2.22	32.98	2.22	32.98	100.00	32.68
12x18	521.1	460.1	61.01	13.53	17.47	15.75	19.65	97.78	32.68
18x30	515.0	442.2	72.83	16.15	14.79	31.90	17.19	84.25	35.12
30x50	467.0	412.5	54.50	12.09	15.05	43.98	16.60	68.10	39.94
50x100	420.4	387.7	32.72	7.26	10.89	51.24	15.79	56.02	45.31
100x200	405.5	391.3	14.12	3.13	12.13	54.37	15.58	48.76	50.43
200x325	387.8	378.6	9.24	2.05	18.70	56.42	15.70	45.63	53.06
-325	203.0	6.5	196.50	43.58	54.67	100.00	32.68	43.58	54.67
Total (Calc)	--	--	450.90	100.00	32.68	--	--	--	--





SPIRAL DATA ANALYSIS

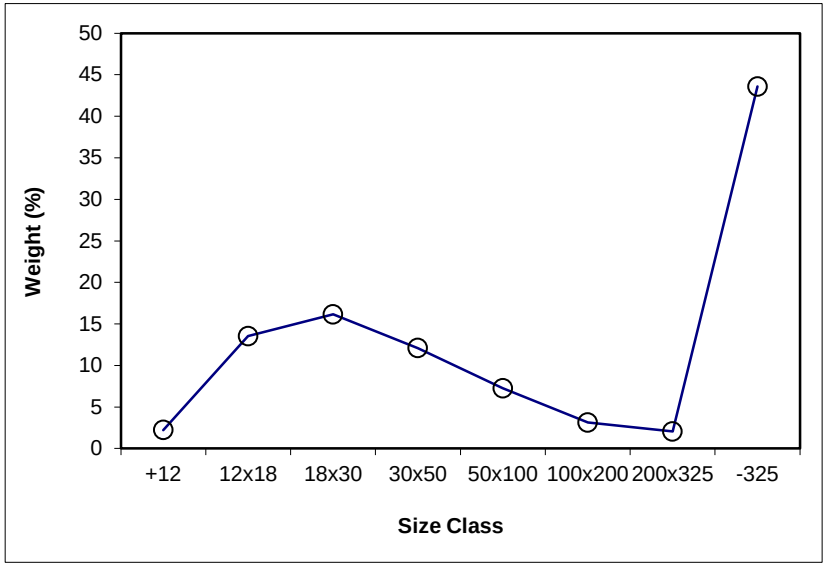
Description: Run 23 - Intermediate Spiral Test

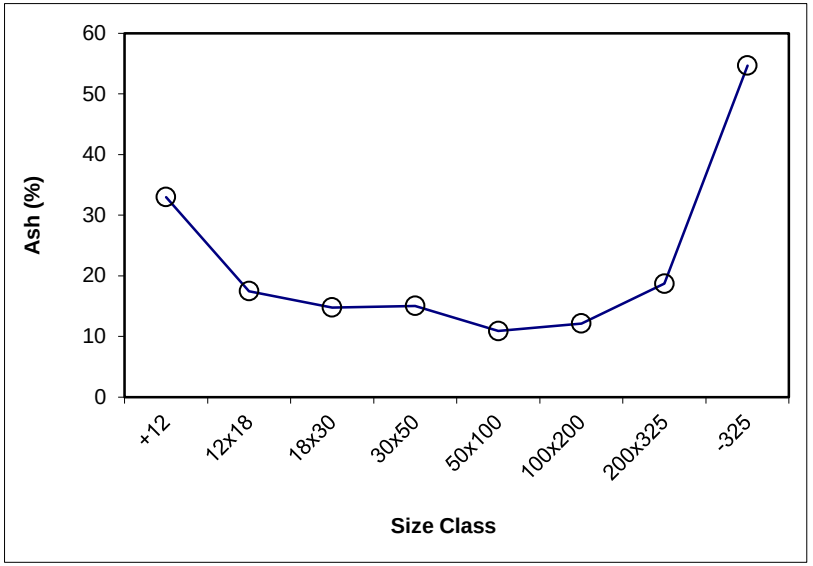
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+12	2.22	32.98	2.22	32.98	100.00	32.68			
12x18	13.53	17.47	15.75	19.65	97.78	32.68	x	13.53	17.47
18x30	16.15	14.79	31.90	17.19	84.25	35.12	x	16.15	14.79
30x50	12.09	15.05	43.98	16.60	68.10	39.94	x	12.09	15.05
50x100	7.26	10.89	51.24	15.79	56.02	45.31	x	7.26	10.89
100x200	3.13	12.13	54.37	15.58	48.76	50.43	x	3.13	12.13
200x325	2.05	18.70	56.42	15.70	45.63	53.06	x	2.05	18.70
-325	43.58	54.67	100.00	32.68	43.58	54.67			
Total (Calc)	100.00	32.68	--	--	--	--	--	54.20	14.99





SPIRAL DATA ANALYSIS

Description: Run 23 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 68.19

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	462.44	434.6	27.88	2.08	11.97	2.08	11.97	100.00	29.11
12x18	584.70	401.2	183.50	13.71	5.36	15.80	6.24	97.92	29.47
18x30	561.50	370.0	191.46	14.31	4.36	30.11	5.34	84.20	33.40
30x50	465.00	336.3	128.72	9.62	4.11	39.73	5.04	69.89	39.34
50x100	394.58	307.8	86.77	6.48	5.35	46.21	5.09	60.27	44.96
100x200	335.57	294.5	41.08	3.07	7.87	49.28	5.26	53.79	49.74
200x325	326.60	298.0	28.61	2.14	16.10	51.42	5.71	50.72	52.27
-325	656.36	6.3	650.08	48.58	53.87	100.00	29.11	48.58	53.87
Total (Calc)	--	--	1338.10	100.00	29.11	--	--	--	--

Product P2 Feed Weight (%): 14.67

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	461.2	444.4	16.81	3.50	64.35	3.50	64.35	100.00	29.02
12x18	530.1	460.1	70.01	14.59	20.11	18.09	28.68	96.50	27.74
18x30	543.3	442.2	101.12	21.07	8.74	39.17	17.95	81.91	29.09
30x50	481.7	412.5	69.21	14.43	6.31	53.59	14.82	60.83	36.15
50x100	416.5	387.7	28.77	6.00	6.71	59.59	14.00	46.41	45.42
100x200	404.3	391.3	12.95	2.70	9.86	62.29	13.82	40.41	51.17
200x325	387.2	378.6	8.59	1.79	18.22	64.08	13.95	37.71	54.12
-325	178.9	6.5	172.34	35.92	55.91	100.00	29.02	35.92	55.91
Total (Calc)	--	--	479.82	100.00	29.02	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 23 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 5.46

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	445.3	434.6	10.74	3.01	80.80	3.01	80.80	100.00	39.37
12x18	460.0	401.2	58.78	16.45	58.02	19.45	61.54	96.99	38.09
18x30	434.2	370.0	64.12	17.94	12.32	37.40	37.93	80.55	34.01
30x50	397.8	336.3	61.49	17.21	30.62	54.60	35.62	62.60	40.23
50x100	337.3	307.8	29.48	8.25	10.05	62.85	32.27	45.40	43.87
100x200	305.1	294.5	10.64	2.98	14.56	65.83	31.47	37.15	51.38
200x325	304.4	298.0	6.43	1.80	22.84	67.63	31.24	34.17	54.59
-325	122.3	6.6	115.68	32.37	56.36	100.00	39.37	32.37	56.36
Total (Calc)	--	--	357.37	100.00	39.37	--	--	--	--

Product P4 Feed Weight (%): 1.60

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	450.0	444.4	5.61	1.34	80.58	1.34	80.58	100.00	42.24
12x18	505.7	460.1	45.61	10.93	70.41	12.27	71.52	98.66	41.72
18x30	514.4	442.2	72.21	17.30	44.13	29.57	55.50	87.73	38.15
30x50	498.4	412.5	85.86	20.57	18.69	50.13	40.39	70.43	36.68
50x100	433.1	387.7	45.38	10.87	13.30	61.01	35.57	49.87	44.10
100x200	407.1	391.3	15.75	3.77	19.49	64.78	34.63	38.99	52.69
200x325	386.9	378.6	8.33	2.00	26.15	66.78	34.38	35.22	56.24
-325	145.3	6.6	138.69	33.22	58.05	100.00	42.24	33.22	58.05
Total (Calc)	--	--	417.44	100.00	42.24	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 23 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 1.72

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	435.7	434.6	1.17	0.35	64.38	0.35	64.38	100.00	42.15
12x18	414.5	401.2	13.28	3.93	62.05	4.27	62.24	99.65	42.07
18x30	406.2	370.0	36.20	10.70	43.58	14.98	48.90	95.73	41.25
30x50	399.6	336.3	63.32	18.72	21.53	33.69	33.70	85.02	40.96
50x100	355.5	307.8	47.71	14.11	20.36	47.80	29.76	66.31	46.44
100x200	311.3	294.5	16.78	4.96	23.43	52.76	29.16	52.20	53.49
200x325	307.3	298.0	9.34	2.76	28.83	55.52	29.15	47.24	56.65
-325	156.9	6.5	150.44	44.48	58.38	100.00	42.15	44.48	58.38
Total (Calc)	--	--	338.25	100.00	42.15	--	--	--	--

Product P6 Feed Weight (%): 0.52

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	444.4	444.4	0.00	0.00	0.00	0.00	0.00	100.00	48.50
12x18	461.3	460.1	1.19	0.58	27.17	0.58	27.17	100.00	48.50
18x30	444.7	442.2	2.57	1.25	20.16	1.83	22.37	99.42	48.63
30x50	425.0	412.5	12.46	6.05	20.88	7.88	21.22	98.17	48.99
50x100	417.1	387.7	29.44	14.29	23.18	22.17	22.49	92.12	50.83
100x200	410.9	391.3	19.54	9.49	30.72	31.65	24.95	77.83	55.91
200x325	389.2	378.6	10.60	5.15	38.27	36.80	26.81	68.35	59.41
-325	136.6	6.4	130.19	63.20	61.13	100.00	48.50	63.20	61.13
Total (Calc)	--	--	205.99	100.00	48.50	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 23 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 7.84

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	440.4	434.6	5.85	1.14	85.11	1.14	85.11	100.00	60.91
12x18	459.8	401.2	58.59	11.43	83.13	12.57	83.31	98.86	60.63
18x30	491.4	370.0	121.41	23.68	73.70	36.26	77.04	87.43	57.69
30x50	453.2	336.3	116.97	22.82	55.45	59.07	68.70	63.74	51.73
50x100	374.1	307.8	66.25	12.92	35.51	72.00	62.74	40.93	49.66
100x200	313.0	294.5	18.55	3.62	37.13	75.62	61.51	28.00	56.20
200x325	306.1	298.0	8.12	1.58	36.93	77.20	61.01	24.38	59.02
-325	123.2	6.3	116.87	22.80	60.56	100.00	60.91	22.80	60.56
Total (Calc)	--	--	512.61	100.00	60.91	--	--	--	--

SPIRAL DATA ANALYSIS

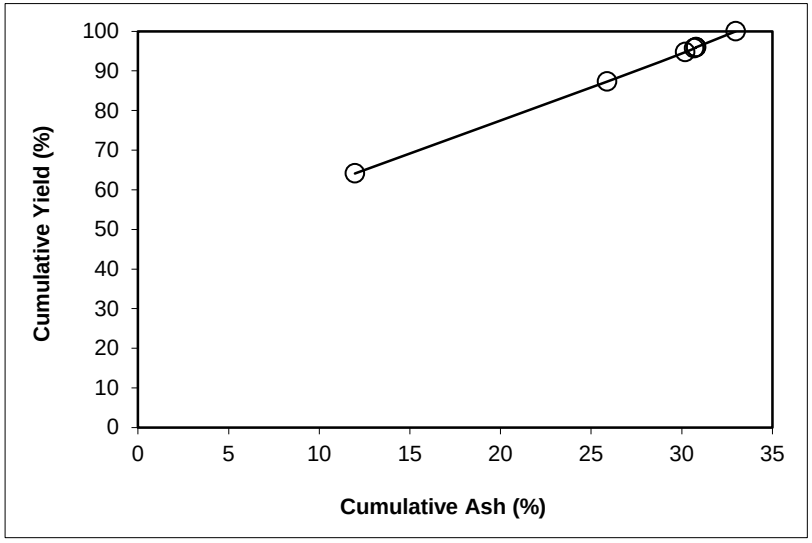
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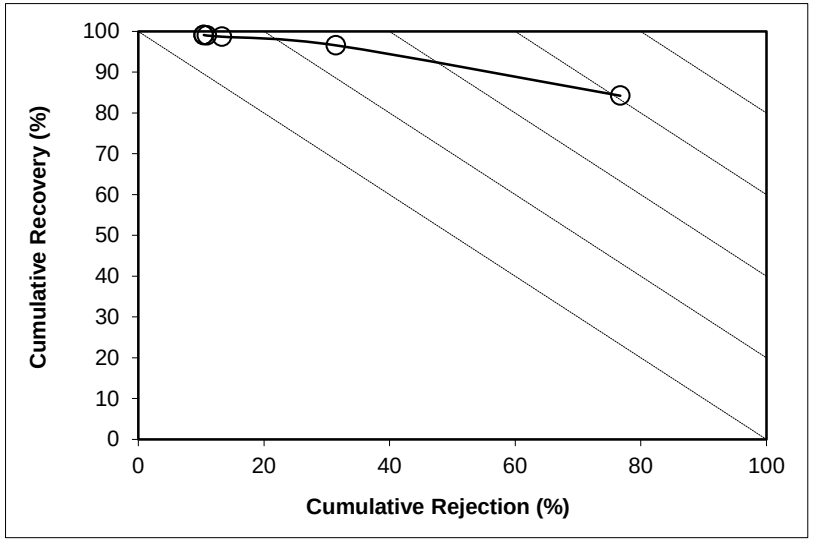
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: +12 Feed Weight (%): 2.22

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	64.12	11.97	64.12	11.97	84.22	35.88	70.52	76.73	60.95
P2	23.20	64.35	87.32	25.89	96.56	12.68	81.81	31.46	28.02
P3	7.41	80.80	94.73	30.18	98.68	5.27	83.22	13.30	11.98
P4	0.97	80.58	95.70	30.69	98.96	4.30	83.82	10.94	9.90
P5	0.27	64.38	95.97	30.79	99.10	4.03	85.11	10.41	9.52
P6	0.00	0.00	95.97	30.79	99.10	4.03	85.11	10.41	9.52
P7	4.03	85.11	100.00	32.98	100.00	0.00			
-325									
Total (Calc)	100.00	32.98	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

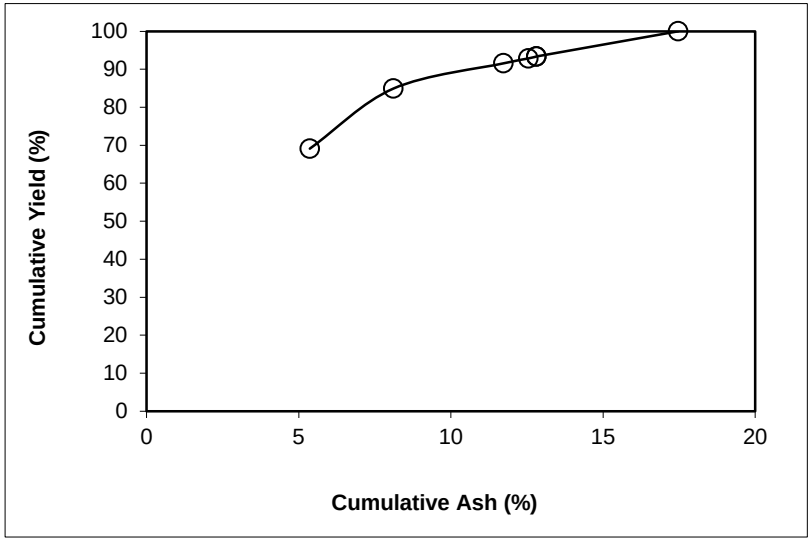
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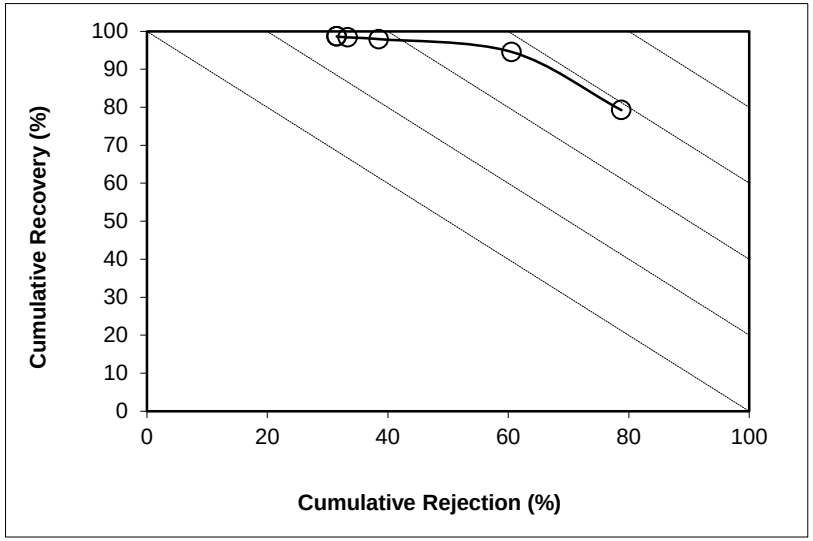
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: 12x18 Feed Weight (%): 13.53

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	69.11	5.36	69.11	5.36	79.25	30.89	44.55	78.78	58.02
P2	15.82	20.11	84.93	8.11	94.56	15.07	70.20	60.57	55.12
P3	6.64	58.02	91.57	11.73	97.94	8.43	79.79	38.51	36.44
P4	1.29	70.41	92.86	12.55	98.40	7.14	81.48	33.31	31.71
P5	0.50	62.05	93.36	12.81	98.63	6.64	82.94	31.54	30.16
P6	0.02	27.17	93.38	12.81	98.65	6.62	83.13	31.50	30.15
P7	6.62	83.13	100.00	17.47	100.00	0.00			
-325									
Total (Calc)	100.00	17.47	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

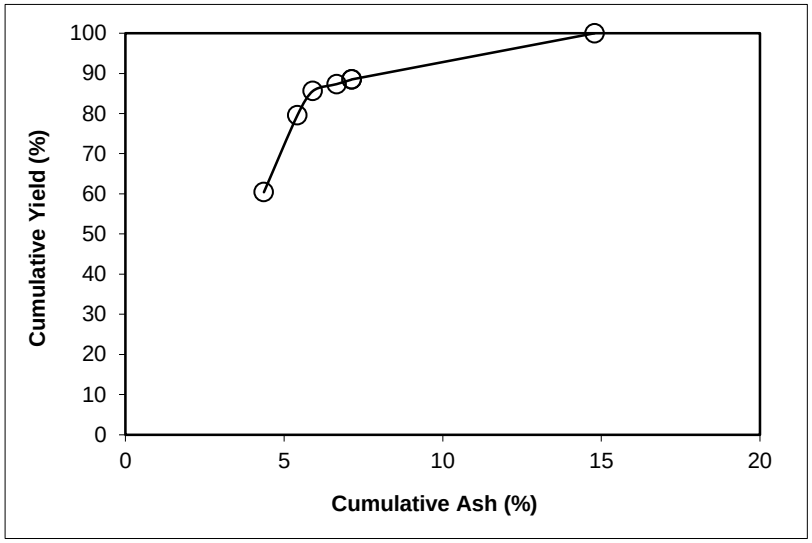
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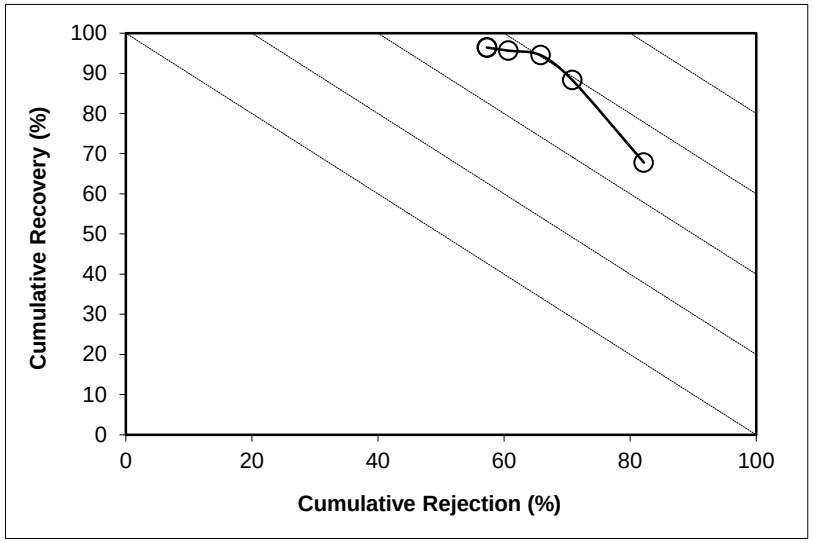
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 16.15

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	60.41	4.36	60.41	4.36	67.80	39.59	30.69	82.18	49.98
P2	19.14	8.74	79.55	5.42	88.30	20.45	51.23	70.86	59.16
P3	6.07	12.32	85.62	5.91	94.54	14.38	67.65	65.80	60.34
P4	1.71	44.13	87.33	6.65	95.66	12.67	70.82	60.70	56.36
P5	1.14	43.58	88.47	7.13	96.42	11.53	73.52	57.34	53.75
P6	0.04	20.16	88.51	7.14	96.45	11.49	73.70	57.28	53.74
P7	11.49	73.70	100.00	14.79	100.00	0.00			
-325									
Total (Calc)	100.00	14.79	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

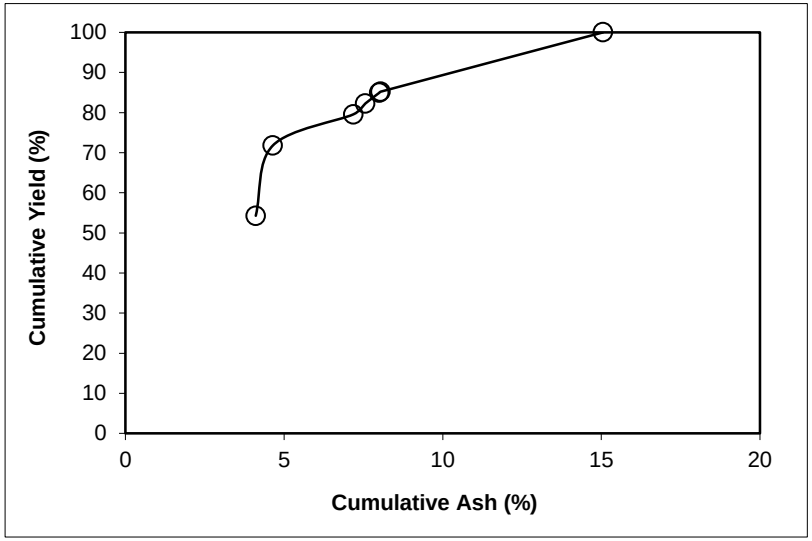
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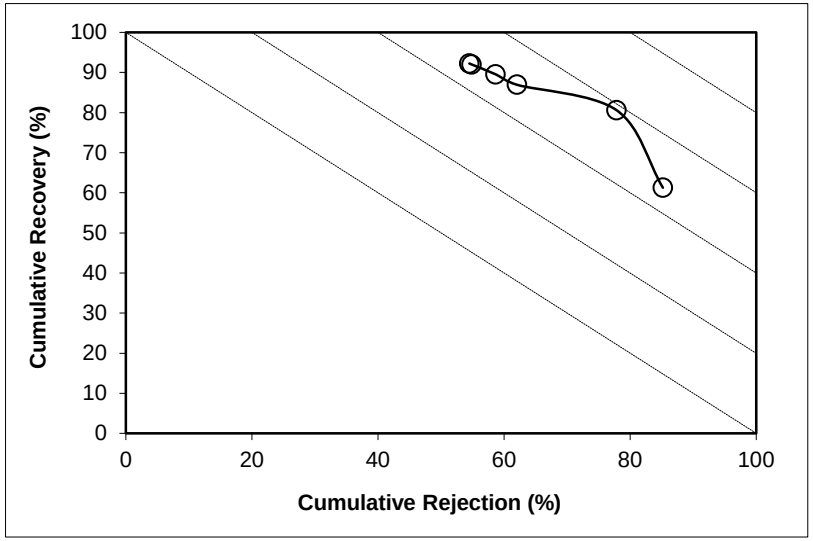
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 12.09

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	54.27	4.11	54.27	4.11	61.27	45.73	28.05	85.20	46.47
P2	17.51	6.31	71.78	4.64	80.58	28.22	41.54	77.86	58.44
P3	7.78	30.62	79.56	7.18	86.93	20.44	45.69	62.05	48.98
P4	2.72	18.69	82.27	7.56	89.53	17.73	49.83	58.68	48.21
P5	2.67	21.53	84.94	8.00	92.00	15.06	54.85	54.86	46.85
P6	0.26	20.88	85.21	8.04	92.24	14.79	55.45	54.49	46.73
P7	14.79	55.45	100.00	15.05	100.00	0.00			
-325									
Total (Calc)	100.00	15.05	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

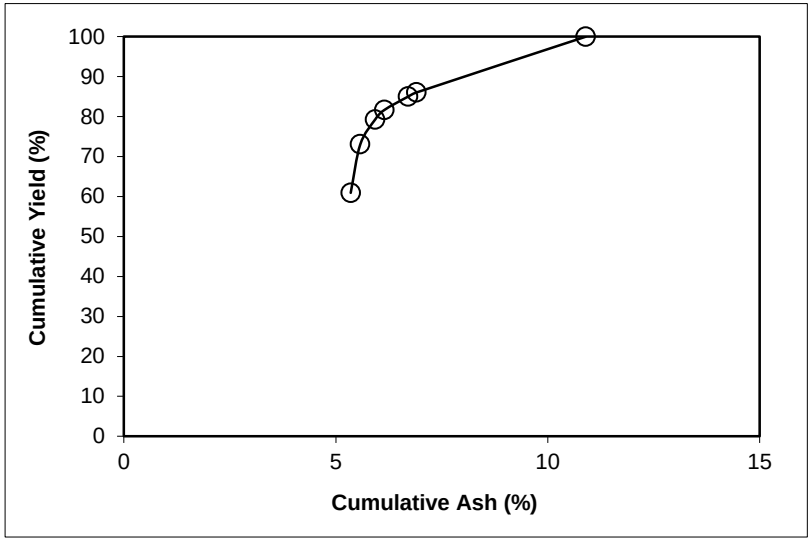
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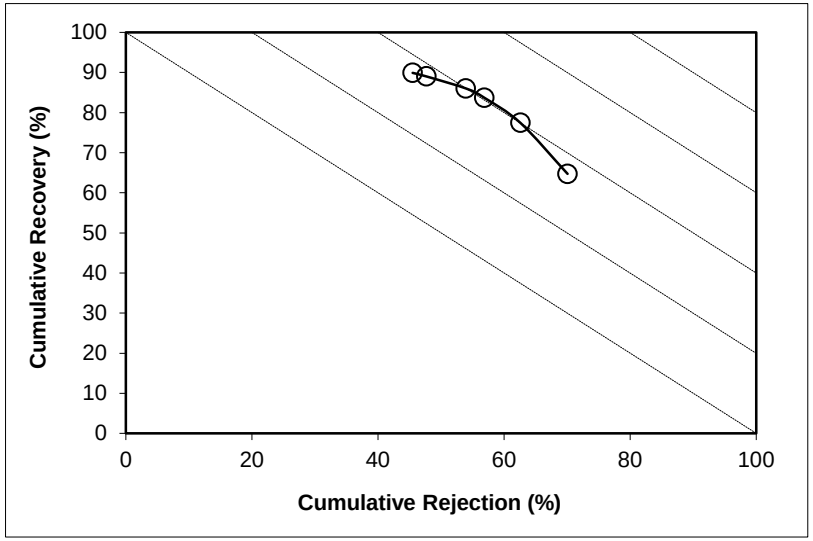
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 7.26

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	60.93	5.35	60.93	5.35	64.72	39.07	19.54	70.07	34.80
P2	12.12	6.71	73.06	5.58	77.42	26.94	25.31	62.60	40.02
P3	6.21	10.05	79.27	5.93	83.69	20.73	29.88	56.87	40.56
P4	2.39	13.30	81.66	6.14	86.01	18.34	32.04	53.95	39.96
P5	3.35	20.36	85.01	6.70	89.01	14.99	34.66	47.69	36.70
P6	1.03	23.18	86.04	6.90	89.90	13.96	35.51	45.49	35.39
P7	13.96	35.51	100.00	10.89	100.00	0.00			
-325									
Total (Calc)	100.00	10.89	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

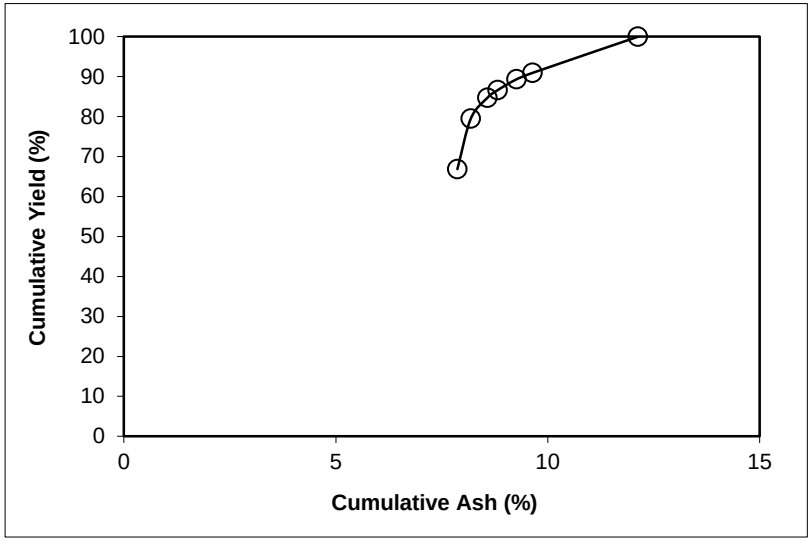
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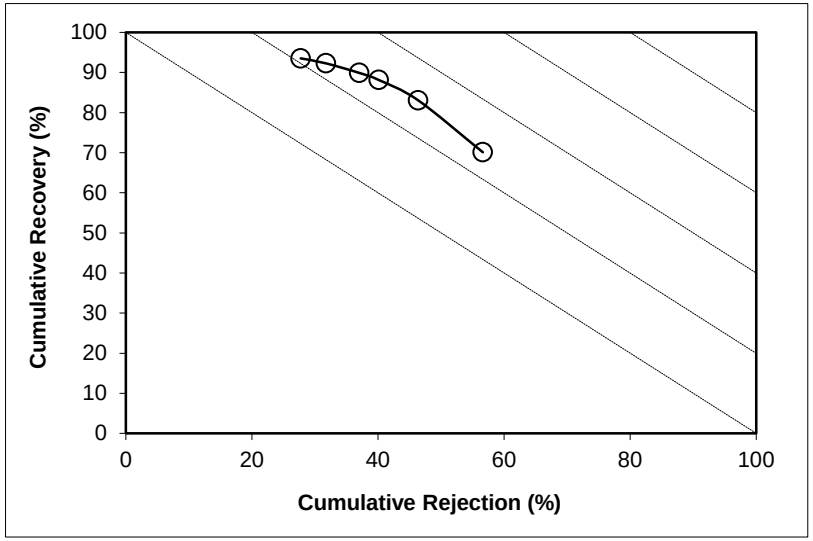
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 3.13

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	66.86	7.87	66.86	7.87	70.11	33.14	20.73	56.63	26.74
P2	12.64	9.86	79.51	8.18	83.07	20.49	27.43	46.35	29.43
P3	5.19	14.56	84.70	8.58	88.13	15.30	31.80	40.12	28.24
P4	1.92	19.49	86.62	8.82	89.89	13.38	33.57	37.03	26.91
P5	2.73	23.43	89.35	9.26	92.27	10.65	36.17	31.75	24.02
P6	1.59	30.72	90.94	9.64	93.52	9.06	37.13	27.72	21.25
P7	9.06	37.13	100.00	12.13	100.00	0.00			
-325									
Total (Calc)	100.00	12.13	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

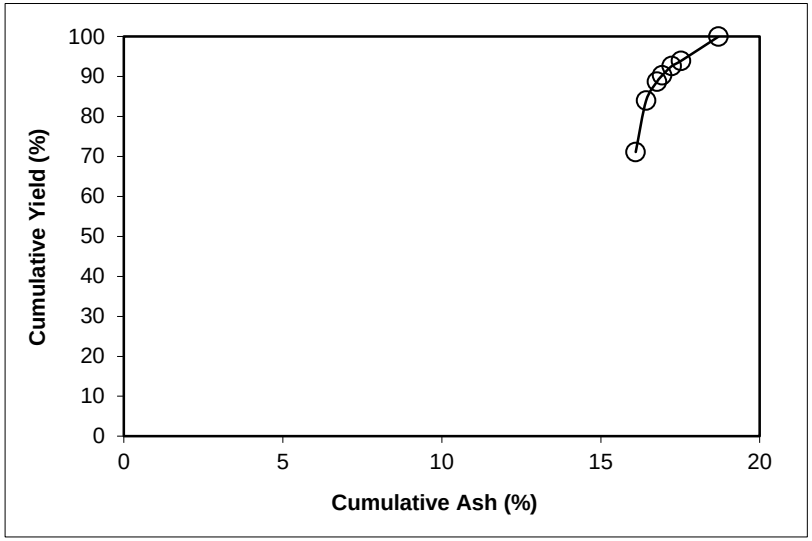
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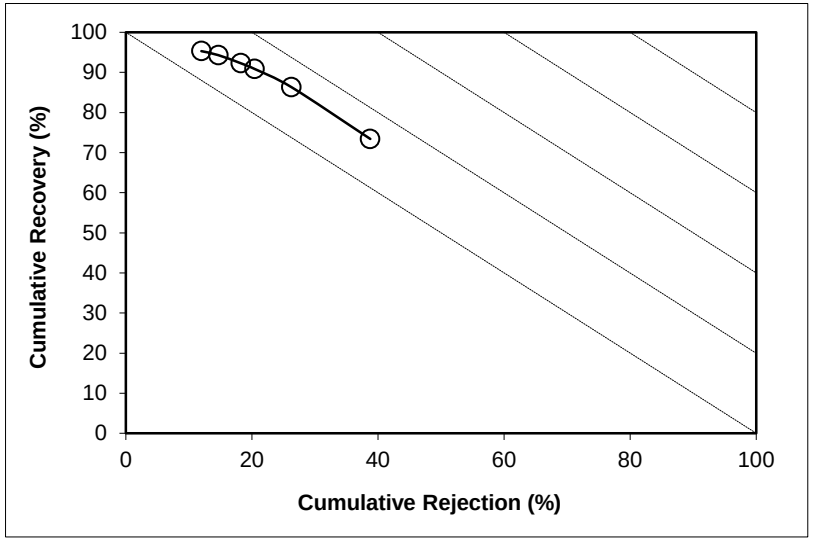
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 2.05

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	71.13	16.10	71.13	16.10	73.41	28.87	25.11	38.77	12.17
P2	12.82	18.22	83.95	16.42	86.30	16.05	30.61	26.28	12.58
P3	4.80	22.84	88.75	16.77	90.85	11.25	33.92	20.42	11.27
P4	1.55	26.15	90.30	16.93	92.26	9.70	35.17	18.24	10.51
P5	2.32	28.83	92.62	17.23	94.30	7.38	37.17	14.66	8.96
P6	1.32	38.27	93.94	17.53	95.30	6.06	36.93	11.97	7.27
P7	6.06	36.93	100.00	18.70	100.00	0.00			
-325									
Total (Calc)	100.00	18.70	--	--	--	--	--	--	--





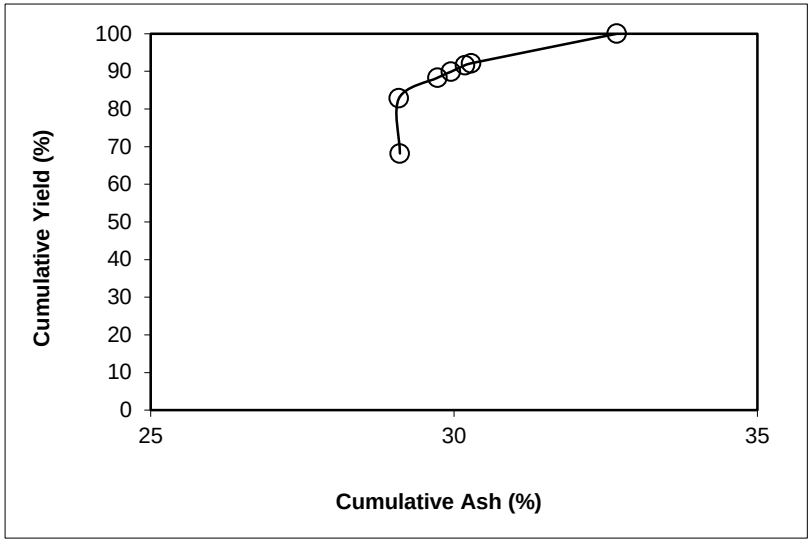
SPIRAL DATA ANALYSIS

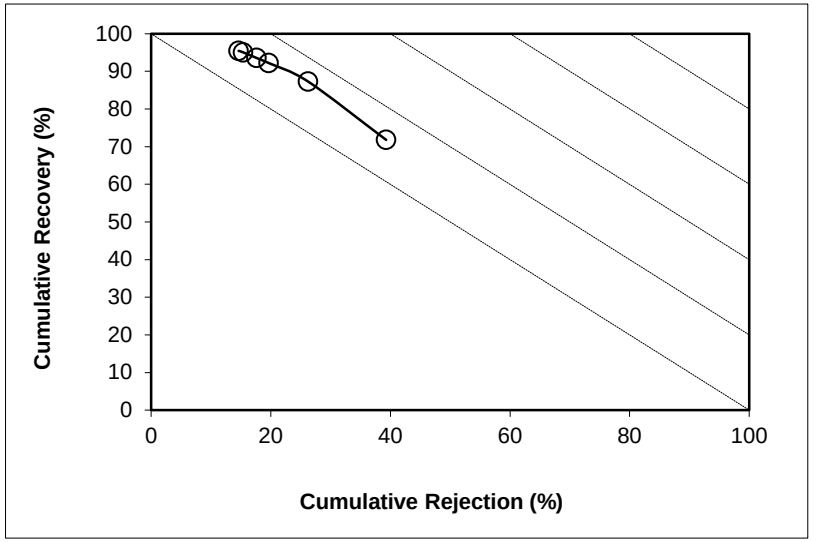
Description: Run 23 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	68.19	29.11	68.19	29.11	71.81	31.81	40.35	39.27	11.08
P2	14.67	29.02	82.86	29.09	87.28	17.14	50.04	26.25	13.53
P3	5.46	39.37	88.32	29.73	92.20	11.68	55.03	19.67	11.87
P4	1.60	42.24	89.92	29.95	93.57	10.08	57.06	17.61	11.17
P5	1.72	42.15	91.64	30.18	95.05	8.36	60.13	15.38	10.43
P6	0.52	48.50	92.16	30.28	95.45	7.84	60.91	14.60	10.05
P7	7.84	60.91	100.00	32.68	100.00	0.00			
Total (Calc)	100.00	32.68	--	--	--	--	--	--	--

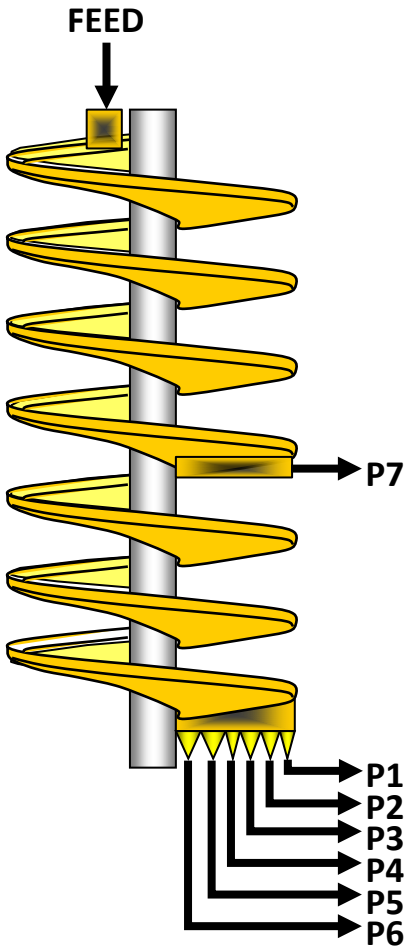




SPIRAL DATA ANALYSIS

Description: Run 24 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	1.904	29.6	18.09	23.08
P2	0.399	33.1	3.22	4.27
P3	0.104	35.5	0.76	1.02
P4	0.048	36.6	0.33	0.45
P5	0.059	32.2	0.50	0.65
P6	0.017	26.5	0.19	0.23
P7	0.198	42.9	1.05	1.48
Total	2.729	31.1	24.14	31.17

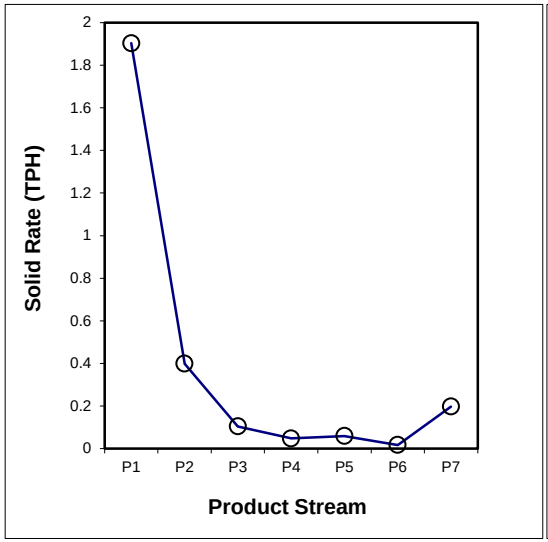
SPIRAL DATA ANALYSIS

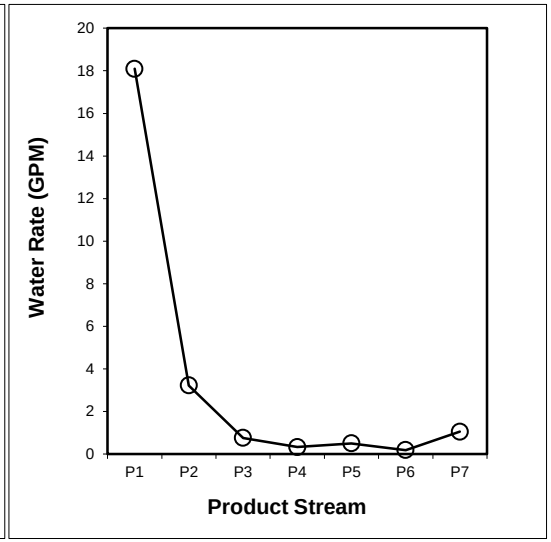
Description: Run 24 - Intermediate Spiral Test

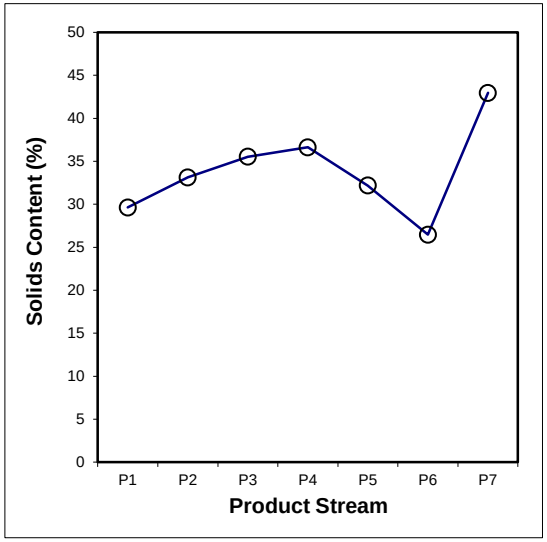
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	3	6182.00	1251.00	6.426	4363.7	2923.1	1.904	69.76	29.63
P2	5	1634.32	94.08	1.205	3426.5	2923.3	0.399	14.62	33.12
P3	10	835.39	84.97	0.293	2711.8	2448.9	0.104	3.82	35.52
P4	30	1090.93	91.75	0.130	3284.3	2923.2	0.048	1.75	36.63
P5	30	1510.79	93.81	0.185	2898.6	2449.0	0.059	2.18	32.17
P6	60	1087.00	92.15	0.065	3181.7	2922.0	0.017	0.63	26.47
P7	10	1270.86	94.98	0.460	2947.1	2448.8	0.198	7.24	42.95
Total (Calc)	--	--	--	8.764	--	--	2.729	100.00	31.14
Total (Head)	0.64	1674.59	252.46	8.764	2890.3	2447.5	2.729	--	31.14







SPIRAL DATA ANALYSIS

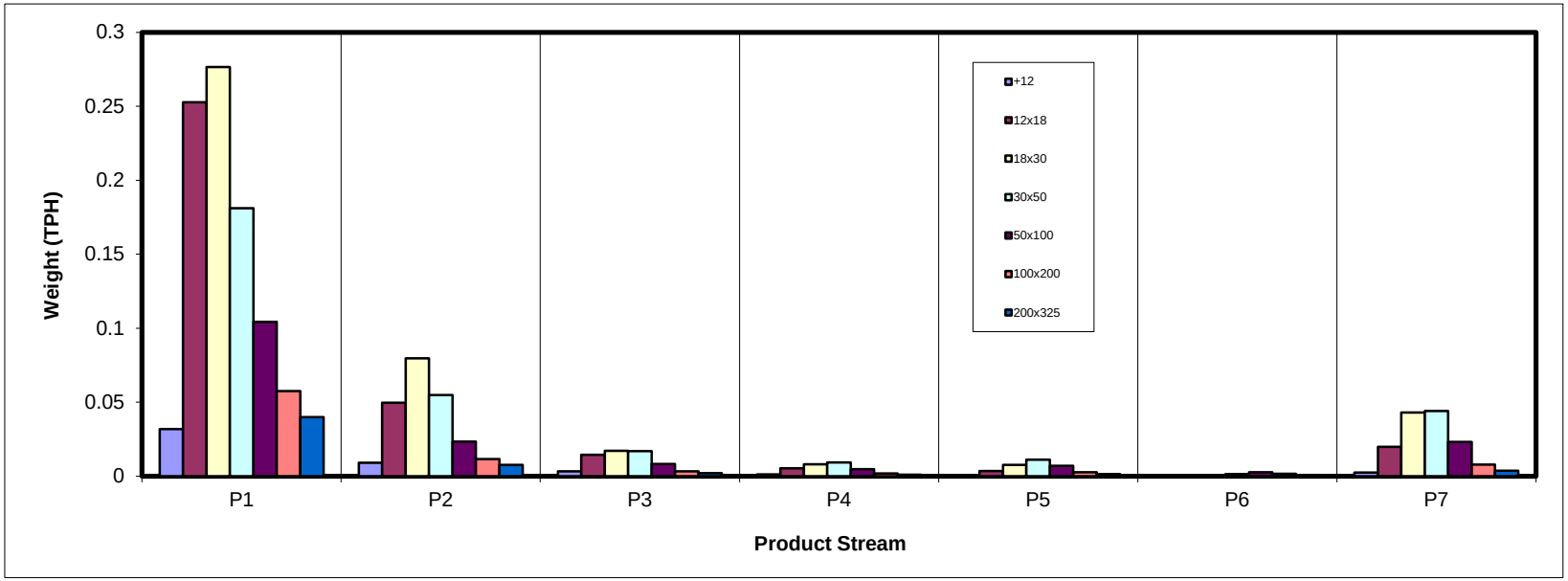
Description: Run 24 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	0.032	0.009	0.003	0.001	0.000	0.000	0.002		0.048
12x18	0.253	0.050	0.014	0.005	0.003	0.000	0.020		0.345
18x30	0.277	0.080	0.017	0.008	0.008	0.000	0.043		0.432
30x50	0.181	0.055	0.017	0.009	0.011	0.001	0.044		0.318
50x100	0.104	0.023	0.008	0.005	0.007	0.003	0.023		0.173
100x200	0.057	0.012	0.003	0.002	0.003	0.002	0.008		0.086
200x325	0.040	0.008	0.002	0.001	0.001	0.001	0.004		0.056
-325	0.960	0.164	0.039	0.017	0.026	0.010	0.054		1.270
Total (Calc)	1.904	0.399	0.104	0.048	0.059	0.017	0.198		2.729



SPIRAL DATA ANALYSIS

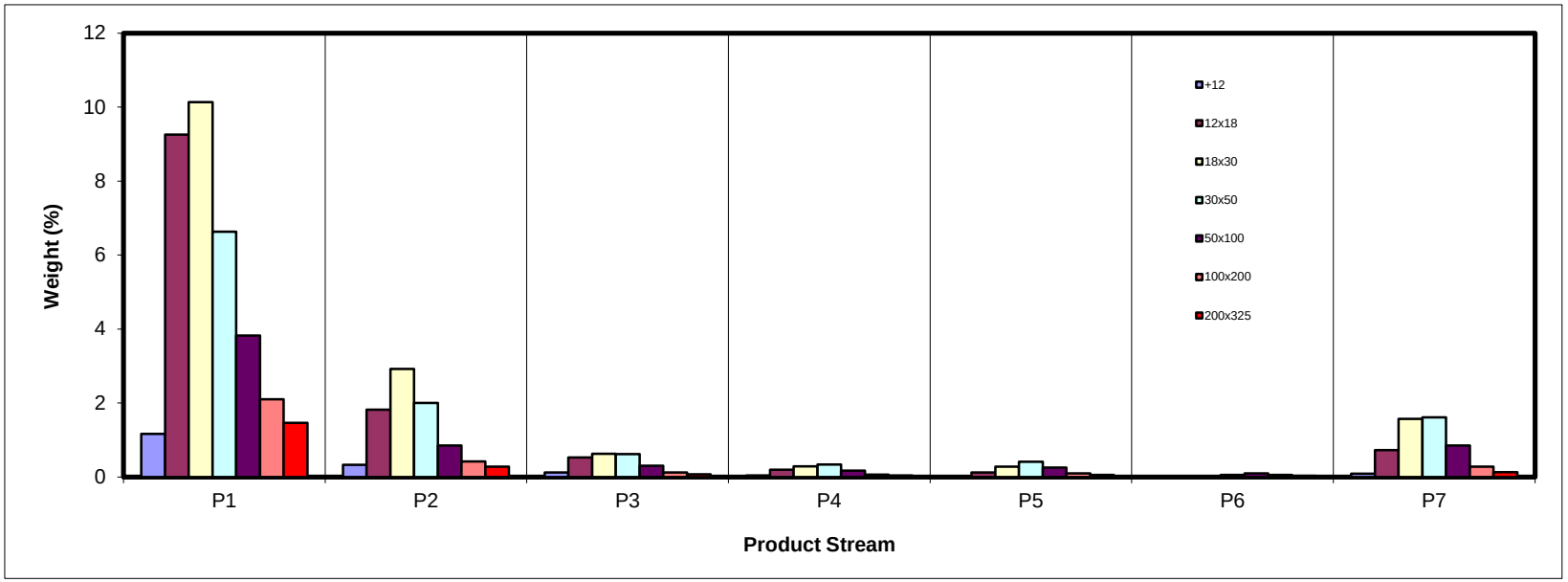
Description: Run 24 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	1.16	0.33	0.12	0.04	0.02	0.00	0.09		1.76
12x18	9.26	1.82	0.53	0.20	0.12	0.00	0.72		12.65
18x30	10.13	2.92	0.63	0.29	0.28	0.01	1.57		15.84
30x50	6.63	2.00	0.62	0.34	0.41	0.05	1.61		11.67
50x100	3.82	0.85	0.30	0.17	0.26	0.10	0.85		6.35
100x200	2.10	0.42	0.12	0.06	0.10	0.06	0.28		3.14
200x325	1.46	0.28	0.07	0.04	0.05	0.03	0.13		2.06
-325	35.18	6.00	1.43	0.62	0.94	0.38	1.98		46.54
Total (Calc)	69.76	14.62	3.82	1.75	2.18	0.63	7.24		100.00



SPIRAL DATA ANALYSIS

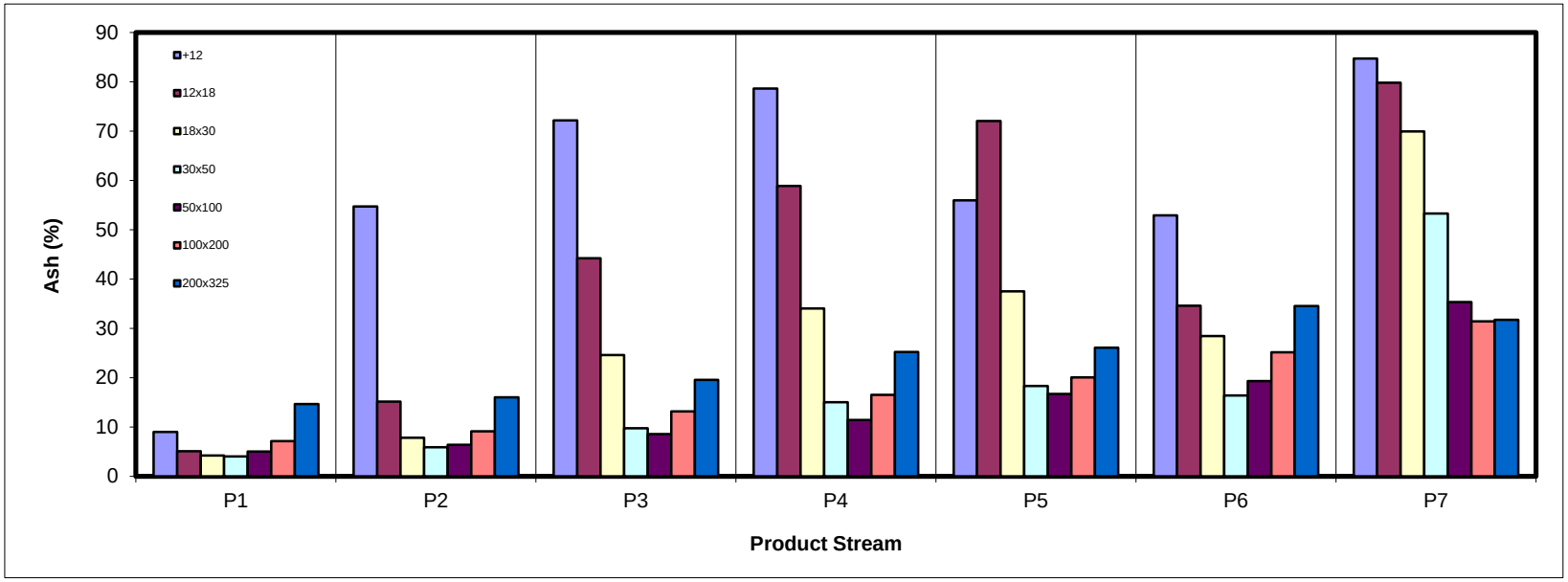
Description: Run 24 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	9.01	54.73	72.16	78.60	55.92	52.88	84.72		27.72
12x18	5.05	15.13	44.23	58.86	72.00	34.59	79.77		13.90
18x30	4.18	7.79	24.55	34.03	37.51	28.40	69.90		13.33
30x50	4.05	5.89	9.72	15.01	18.29	16.36	53.27		12.34
50x100	5.01	6.39	8.55	11.41	16.71	19.32	35.33		10.29
100x200	7.14	9.11	13.15	16.50	20.04	25.14	31.38		10.71
200x325	14.64	16.03	19.53	25.22	26.08	34.50	31.74		16.83
-325	55.36	56.30	56.76	57.51	57.75	59.55	58.33		55.76
Total (Calc)	30.53	29.52	36.73	39.46	41.25	44.95	57.95		33.08



SPIRAL DATA ANALYSIS

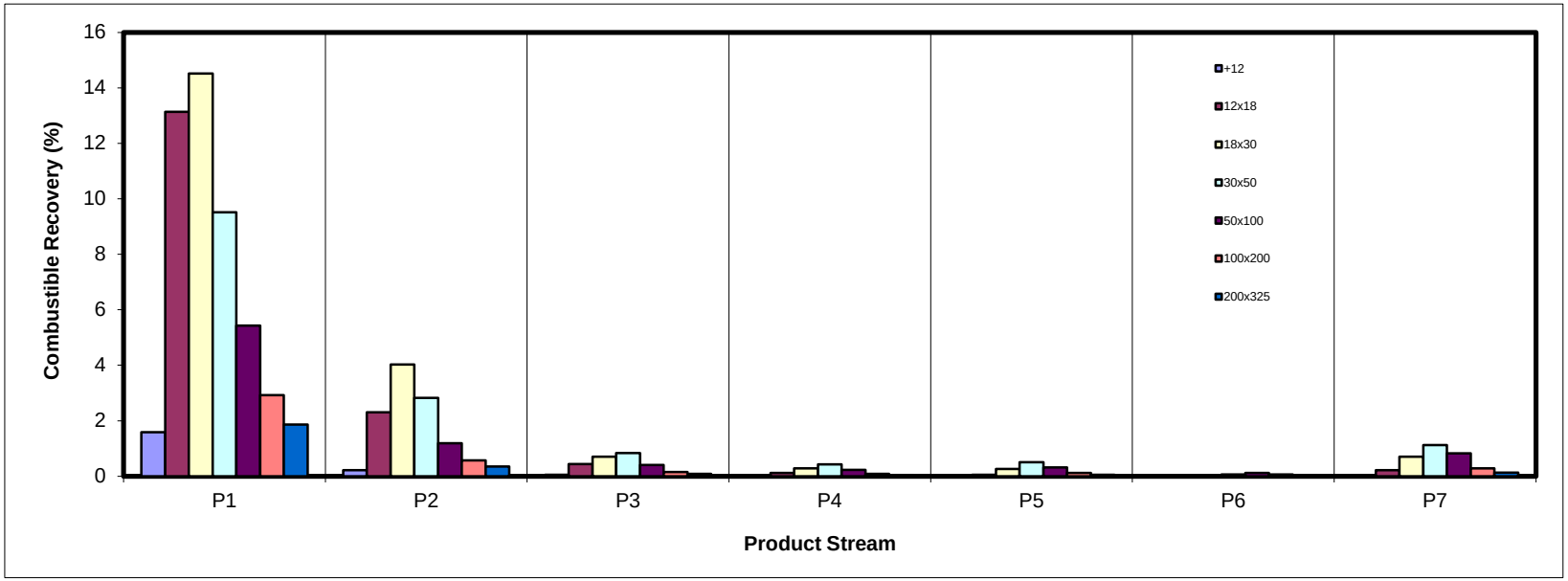
Description: Run 24 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	1.58	0.22	0.05	0.01	0.01	0.00	0.02		1.90
12x18	13.14	2.31	0.44	0.12	0.05	0.00	0.22		16.28
18x30	14.51	4.02	0.71	0.29	0.26	0.01	0.71		20.51
30x50	9.51	2.82	0.84	0.43	0.50	0.07	1.13		15.29
50x100	5.43	1.19	0.41	0.22	0.32	0.12	0.82		8.51
100x200	2.92	0.57	0.15	0.08	0.11	0.06	0.29		4.19
200x325	1.87	0.35	0.09	0.04	0.06	0.03	0.13		2.56
-325	23.47	3.92	0.93	0.39	0.59	0.23	1.23		30.76
Total (Calc)	72.43	15.40	3.61	1.58	1.91	0.52	4.55		100.00



SPIRAL DATA ANALYSIS

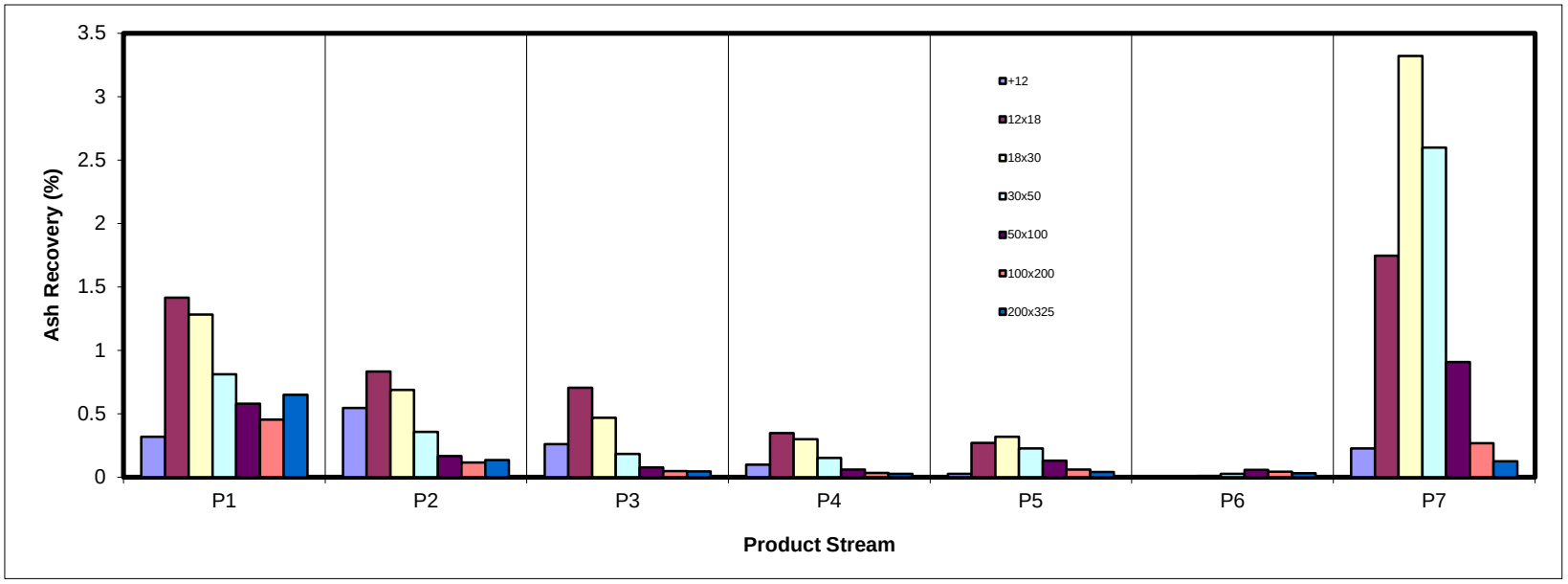
Description: Run 24 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	0.32	0.55	0.26	0.10	0.03	0.00	0.23		1.47
12x18	1.41	0.83	0.70	0.35	0.27	0.00	1.75		5.32
18x30	1.28	0.69	0.47	0.30	0.32	0.01	3.32		6.38
30x50	0.81	0.36	0.18	0.15	0.23	0.03	2.60		4.35
50x100	0.58	0.16	0.08	0.06	0.13	0.06	0.91		1.97
100x200	0.45	0.12	0.05	0.03	0.06	0.04	0.27		1.02
200x325	0.65	0.13	0.04	0.03	0.04	0.03	0.13		1.05
-325	58.87	10.21	2.46	1.07	1.64	0.69	3.49		78.43
Total (Calc)	64.38	13.05	4.24	2.09	2.71	0.85	12.68		100.00



SPIRAL DATA ANALYSIS

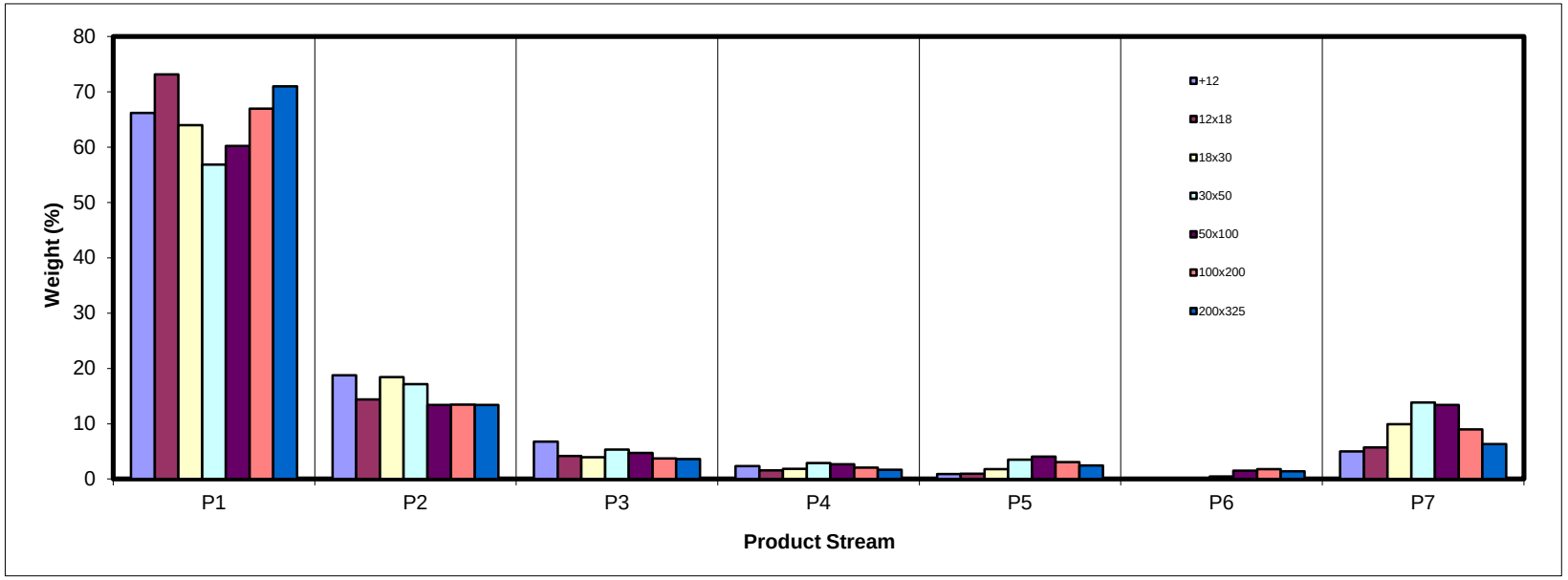
Description: Run 24 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	66.19	18.77	6.77	2.32	0.90	0.02	5.02		100.00
12x18	73.18	14.37	4.17	1.54	0.98	0.04	5.72		100.00
18x30	64.00	18.44	3.97	1.83	1.77	0.07	9.93		100.00
30x50	56.84	17.18	5.31	2.88	3.52	0.45	13.83		100.00
50x100	60.23	13.42	4.71	2.67	4.05	1.51	13.40		100.00
100x200	66.98	13.43	3.73	2.05	3.06	1.77	8.96		100.00
200x325	71.03	13.43	3.63	1.70	2.48	1.38	6.35		100.00
-325	75.61	12.89	3.08	1.33	2.02	0.82	4.25		100.00
Total (Calc)	69.76	14.62	3.82	1.75	2.18	0.63	7.24		100.00



SPIRAL DATA ANALYSIS

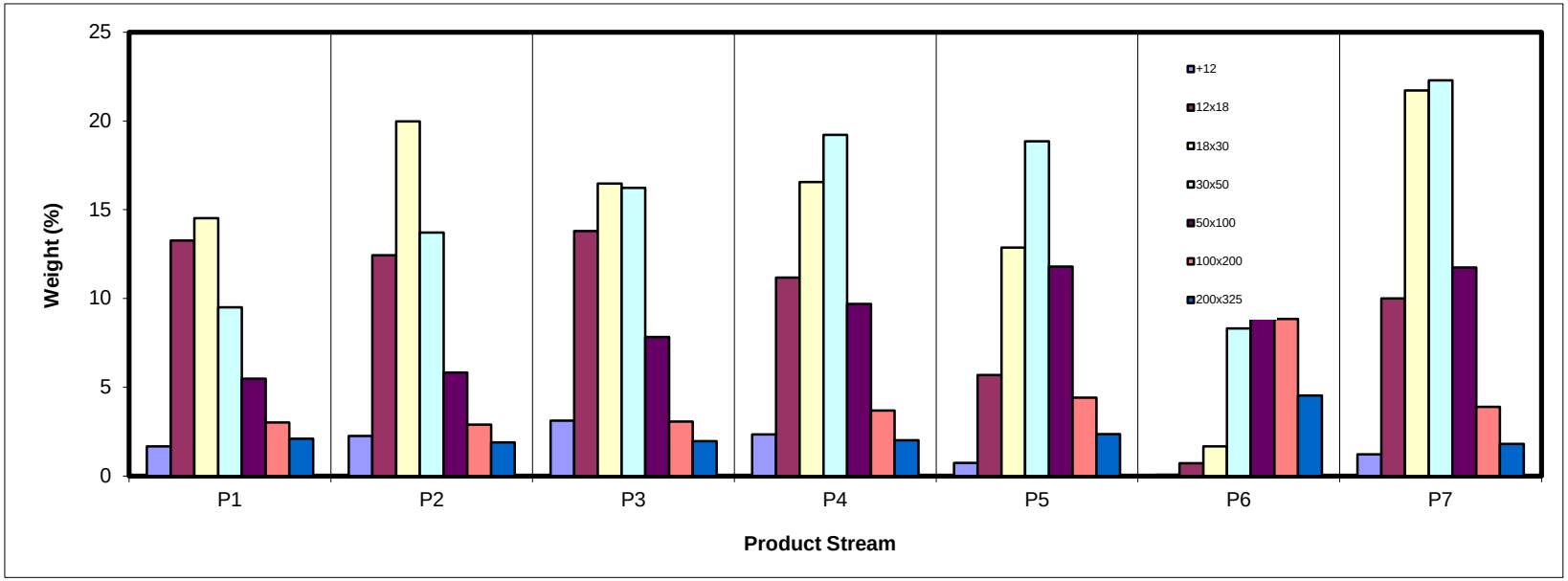
Description: Run 24 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	1.67	2.26	3.12	2.33	0.73	0.06	1.22		1.76
12x18	13.27	12.44	13.79	11.18	5.69	0.71	10.00		12.65
18x30	14.53	19.97	16.47	16.55	12.87	1.67	21.71		15.84
30x50	9.51	13.71	16.22	19.22	18.85	8.32	22.29		11.67
50x100	5.48	5.82	7.83	9.70	11.80	15.23	11.75		6.35
100x200	3.02	2.89	3.07	3.69	4.42	8.84	3.89		3.14
200x325	2.10	1.89	1.96	2.01	2.35	4.54	1.81		2.06
-325	50.43	41.02	37.53	35.32	43.28	60.62	27.33		46.54
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

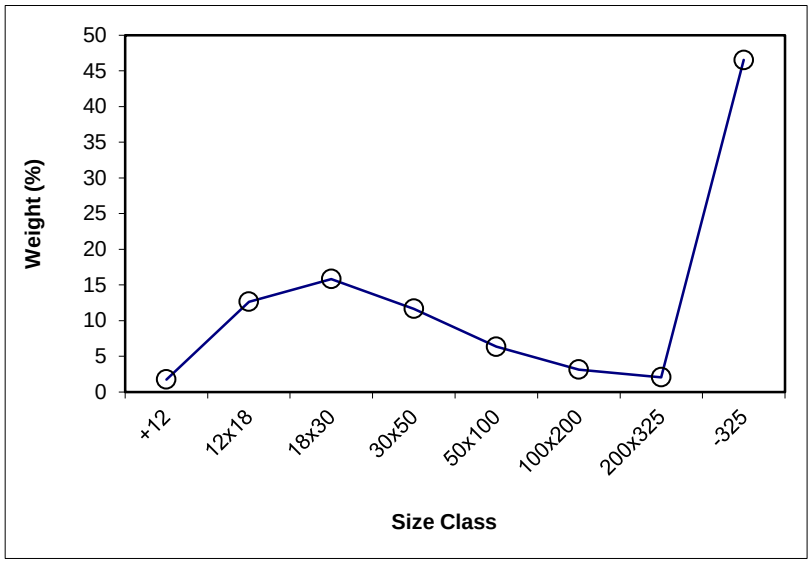
Description: Run 24 - Intermediate Spiral Test

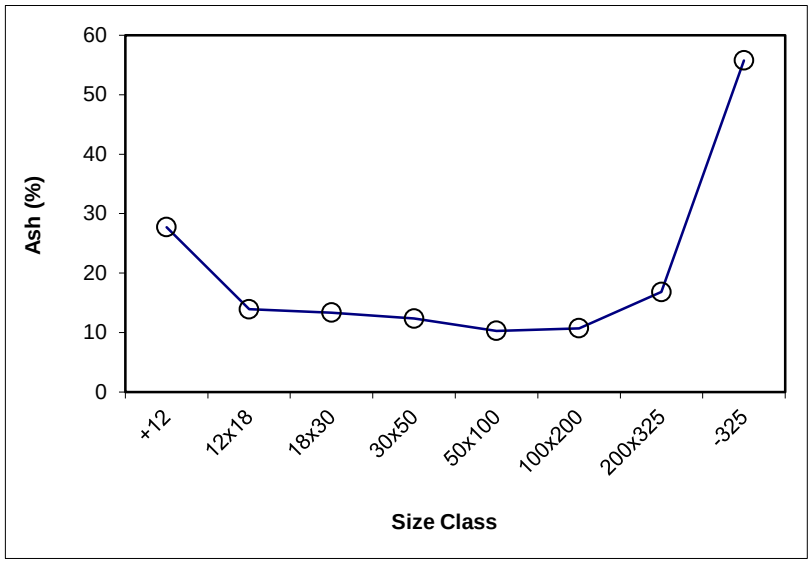
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	442.3	434.6	7.79	1.76	27.72	1.76	27.72	100.00	33.08
12x18	457.2	401.2	56.02	12.65	13.90	14.41	15.59	98.24	33.18
18x30	440.2	370.0	70.12	15.84	13.33	30.25	14.41	85.59	36.03
30x50	388.0	336.3	51.68	11.67	12.34	41.92	13.83	69.75	41.18
50x100	335.9	307.8	28.10	6.35	10.29	48.26	13.37	58.08	46.98
100x200	308.4	294.5	13.91	3.14	10.71	51.40	13.21	51.74	51.48
200x325	307.1	298.0	9.13	2.06	16.83	53.46	13.34	48.60	54.11
-325	211.2	5.1	206.07	46.54	55.76	100.00	33.08	46.54	55.76
Total (Calc)	--	--	442.82	100.00	33.08	--	--	--	--





SPIRAL DATA ANALYSIS

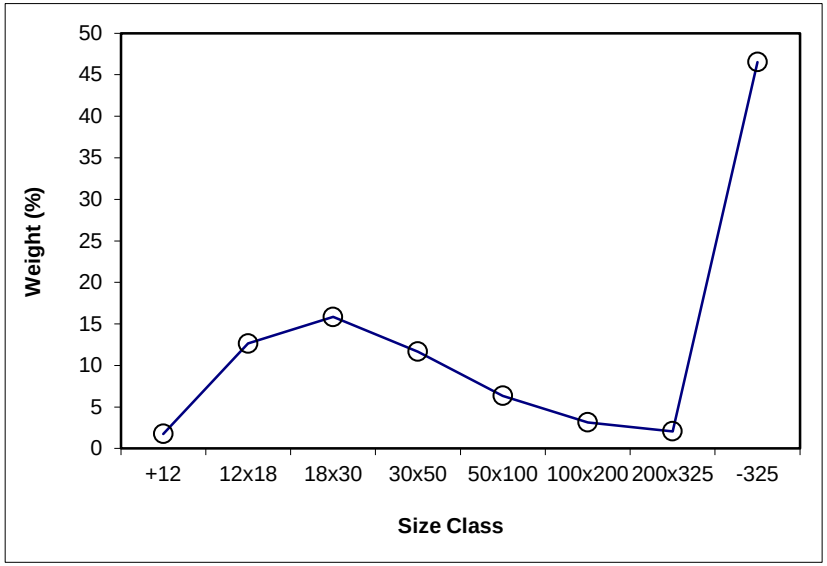
Description: Run 24 - Intermediate Spiral Test

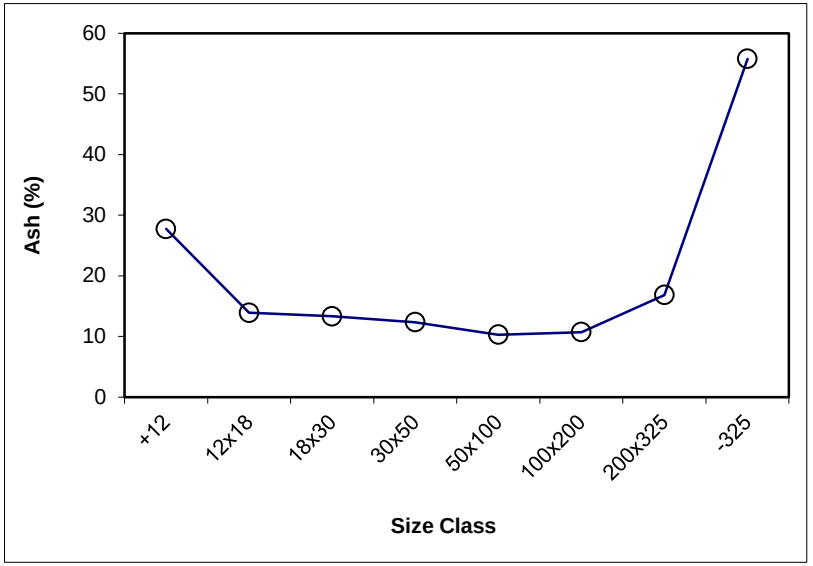
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+12	1.76	27.72	1.76	27.72	100.00	33.08			
12x18	12.65	13.90	14.41	15.59	98.24	33.18	x	12.65	13.90
18x30	15.84	13.33	30.25	14.41	85.59	36.03	x	15.84	13.33
30x50	11.67	12.34	41.92	13.83	69.75	41.18	x	11.67	12.34
50x100	6.35	10.29	48.26	13.37	58.08	46.98	x	6.35	10.29
100x200	3.14	10.71	51.40	13.21	51.74	51.48	x	3.14	10.71
200x325	2.06	16.83	53.46	13.34	48.60	54.11	x	2.06	16.83
-325	46.54	55.76	100.00	33.08	46.54	55.76			
Total (Calc)	100.00	33.08	--	--	--	--	--	51.71	12.86





SPIRAL DATA ANALYSIS

Description: Run 24 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 69.76

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	468.34	444.3	24.04	1.67	9.01	1.67	9.01	100.00	30.53
12x18	651.32	460.1	191.18	13.27	5.05	14.94	5.49	98.33	30.90
18x30	651.40	442.2	209.25	14.53	4.18	29.47	4.85	85.06	34.93
30x50	549.50	412.5	136.97	9.51	4.05	38.97	4.65	70.53	41.26
50x100	466.62	387.7	78.93	5.48	5.01	44.45	4.70	61.03	47.06
100x200	434.78	391.3	43.44	3.02	7.14	47.47	4.85	55.55	51.21
200x325	408.84	378.6	30.24	2.10	14.64	49.57	5.27	52.53	53.74
-325	732.86	6.4	726.50	50.43	55.36	100.00	30.53	50.43	55.36
Total (Calc)	--	--	1440.55	100.00	30.53	--	--	--	--

Product P2 Feed Weight (%): 14.62

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	455.7	444.4	11.36	2.26	54.73	2.26	54.73	100.00	29.52
12x18	522.7	460.1	62.57	12.44	15.13	14.69	21.22	97.74	28.94
18x30	542.6	442.2	100.49	19.97	7.79	34.66	13.48	85.31	30.95
30x50	481.5	412.5	68.98	13.71	5.89	48.37	11.33	65.34	38.03
50x100	417.0	387.7	29.31	5.82	6.39	54.20	10.80	51.63	46.56
100x200	405.9	391.3	14.52	2.89	9.11	57.08	10.72	45.80	51.67
200x325	388.1	378.6	9.53	1.89	16.03	58.98	10.89	42.92	54.53
-325	212.9	6.5	206.43	41.02	56.30	100.00	29.52	41.02	56.30
Total (Calc)	--	--	503.20	100.00	29.52	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 24 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 3.82

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	442.8	434.6	8.20	3.12	72.16	3.12	72.16	100.00	36.73
12x18	437.5	401.2	36.27	13.79	44.23	16.91	49.38	96.88	35.59
18x30	413.4	370.0	43.32	16.47	24.55	33.39	37.13	83.09	34.16
30x50	378.9	336.3	42.66	16.22	9.72	49.61	28.17	66.61	36.53
50x100	328.4	307.8	20.59	7.83	8.55	57.44	25.49	50.39	45.16
100x200	302.6	294.5	8.07	3.07	13.15	60.51	24.87	42.56	51.90
200x325	303.1	298.0	5.15	1.96	19.53	62.47	24.70	39.49	54.91
-325	105.2	6.5	98.69	37.53	56.76	100.00	36.73	37.53	56.76
Total (Calc)	--	--	262.94	100.00	36.73	--	--	--	--

Product P4 Feed Weight (%): 1.75

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	452.8	444.4	8.42	2.33	78.60	2.33	78.60	100.00	39.46
12x18	500.5	460.1	40.35	11.18	58.86	13.51	62.27	97.67	38.53
18x30	501.9	442.2	59.77	16.55	34.03	30.06	46.72	86.49	35.90
30x50	481.9	412.5	69.39	19.22	15.01	49.28	34.35	69.94	36.34
50x100	422.7	387.7	35.02	9.70	11.41	58.98	30.58	50.72	44.43
100x200	404.7	391.3	13.33	3.69	16.50	62.67	29.75	41.02	52.24
200x325	385.9	378.6	7.25	2.01	25.22	64.68	29.61	37.33	55.77
-325	134.0	6.4	127.52	35.32	57.51	100.00	39.46	35.32	57.51
Total (Calc)	--	--	361.06	100.00	39.46	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 24 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 2.18

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	437.8	434.6	3.27	0.73	55.92	0.73	55.92	100.00	41.25
12x18	426.8	401.2	25.59	5.69	72.00	6.42	70.18	99.27	41.14
18x30	427.9	370.0	57.87	12.87	37.51	19.29	48.38	93.58	39.26
30x50	421.0	336.3	84.76	18.85	18.29	38.15	33.51	80.71	39.54
50x100	360.9	307.8	53.06	11.80	16.71	49.95	29.54	61.85	46.02
100x200	314.4	294.5	19.86	4.42	20.04	54.37	28.77	50.05	52.93
200x325	308.6	298.0	10.57	2.35	26.08	56.72	28.66	45.63	56.12
-325	201.2	6.6	194.57	43.28	57.75	100.00	41.25	43.28	57.75
Total (Calc)	--	--	449.55	100.00	41.25	--	--	--	--

Product P6 Feed Weight (%): 0.63

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	444.5	444.4	0.17	0.06	52.88	0.06	52.88	100.00	44.95
12x18	462.0	460.1	1.85	0.71	34.59	0.78	36.12	99.94	44.94
18x30	446.5	442.2	4.35	1.67	28.40	2.45	30.85	99.22	45.02
30x50	434.1	412.5	21.59	8.32	16.36	10.77	19.66	97.55	45.30
50x100	427.2	387.7	39.54	15.23	19.32	26.00	19.46	89.23	48.00
100x200	414.3	391.3	22.96	8.84	25.14	34.84	20.90	74.00	53.90
200x325	390.4	378.6	11.78	4.54	34.50	39.38	22.47	65.16	57.80
-325	162.6	5.2	157.39	60.62	59.55	100.00	44.95	60.62	59.55
Total (Calc)	--	--	259.63	100.00	44.95	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 24 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 7.24

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	440.6	434.6	6.08	1.22	84.72	1.22	84.72	100.00	57.95
12x18	451.0	401.2	49.83	10.00	79.77	11.22	80.31	98.78	57.62
18x30	478.2	370.0	108.18	21.71	69.90	32.93	73.44	88.78	55.12
30x50	447.4	336.3	111.07	22.29	53.27	55.22	65.30	67.07	50.34
50x100	366.4	307.8	58.55	11.75	35.33	66.97	60.04	44.78	48.88
100x200	313.9	294.5	19.38	3.89	31.38	70.86	58.47	33.03	53.70
200x325	307.0	298.0	9.01	1.81	31.74	72.67	57.80	29.14	56.68
-325	142.6	6.5	136.17	27.33	58.33	100.00	57.95	27.33	58.33
Total (Calc)	--	--	498.26	100.00	57.95	--	--	--	--

SPIRAL DATA ANALYSIS

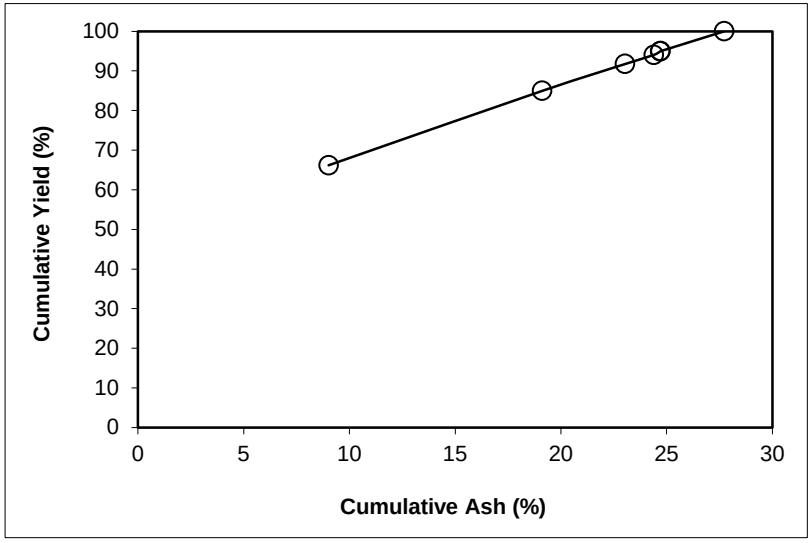
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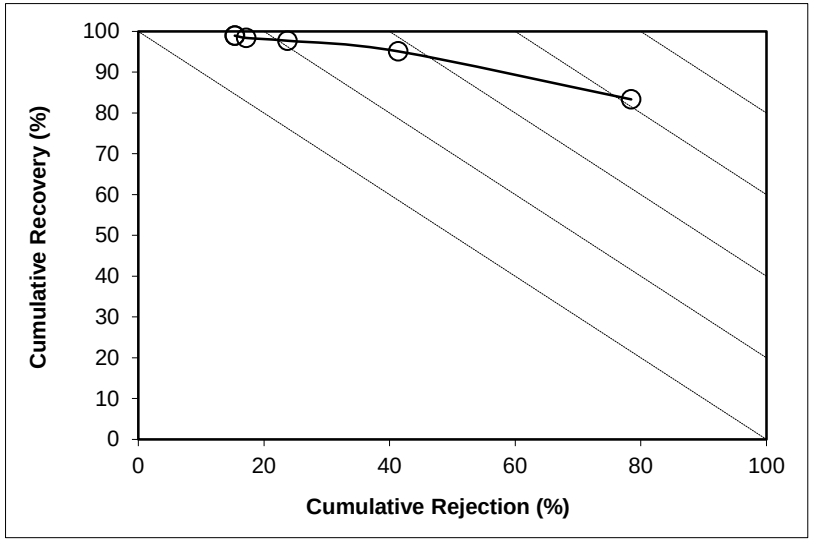
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: +12 Feed Weight (%): 1.76

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	66.19	9.01	66.19	9.01	83.32	33.81	64.34	78.47	61.79
P2	18.77	54.73	84.96	19.11	95.08	15.04	76.34	41.41	36.49
P3	6.77	72.16	91.74	23.03	97.69	8.26	79.77	23.78	21.47
P4	2.32	78.60	94.06	24.40	98.37	5.94	80.23	17.20	15.58
P5	0.90	55.92	94.96	24.70	98.92	5.04	84.58	15.39	14.31
P6	0.02	52.88	94.98	24.71	98.94	5.02	84.72	15.34	14.28
P7 -325	5.02	84.72	100.00	27.72	100.00	0.00			
Total (Calc)	100.00	27.72	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

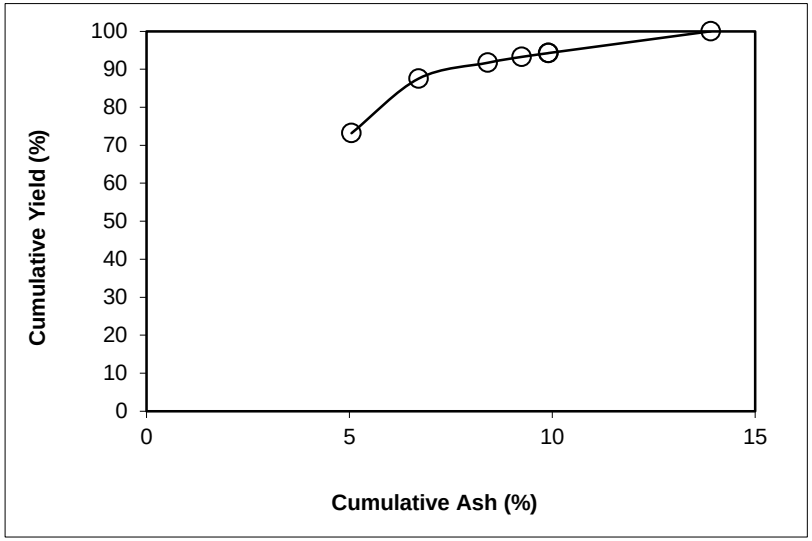
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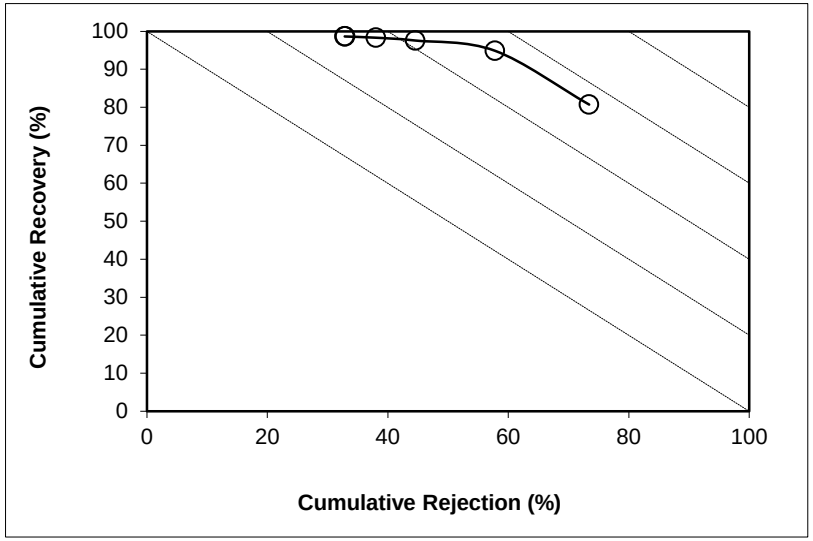
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: 12x18 Feed Weight (%): 12.65

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	73.18	5.05	73.18	5.05	80.71	26.82	38.06	73.42	54.12
P2	14.37	15.13	87.55	6.71	94.87	12.45	64.54	57.77	52.65
P3	4.17	44.23	91.72	8.41	97.57	8.28	74.76	44.53	42.10
P4	1.54	58.86	93.26	9.25	98.31	6.74	78.40	37.99	36.30
P5	0.98	72.00	94.24	9.90	98.63	5.76	79.49	32.91	31.54
P6	0.04	34.59	94.28	9.91	98.66	5.72	79.77	32.83	31.48
P7 -325	5.72	79.77	100.00	13.90	100.00	0.00			
Total (Calc)	100.00	13.90	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

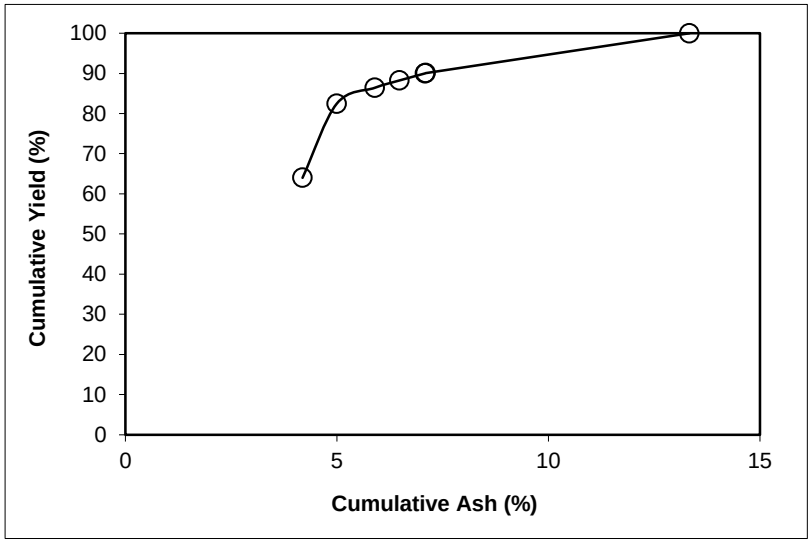
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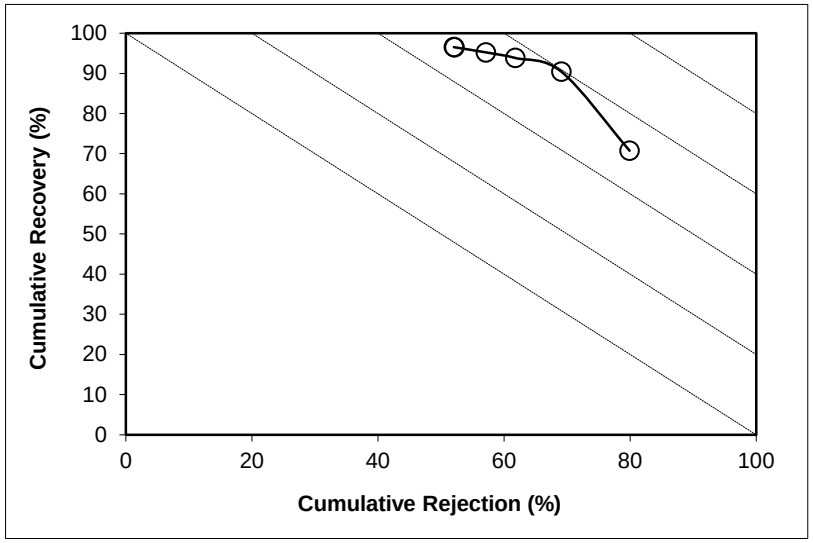
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 15.84

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	64.00	4.18	64.00	4.18	70.75	36.00	29.60	79.92	50.67
P2	18.44	7.79	82.44	4.99	90.37	17.56	52.48	69.14	59.51
P3	3.97	24.55	86.41	5.89	93.83	13.59	60.65	61.82	55.65
P4	1.83	34.03	88.24	6.47	95.22	11.76	64.79	57.15	52.37
P5	1.77	37.51	90.01	7.08	96.50	9.99	69.62	52.17	48.67
P6	0.07	28.40	90.07	7.10	96.55	9.93	69.90	52.03	48.58
P7	9.93	69.90	100.00	13.33	100.00	0.00			
-325									
Total (Calc)	100.00	13.33	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

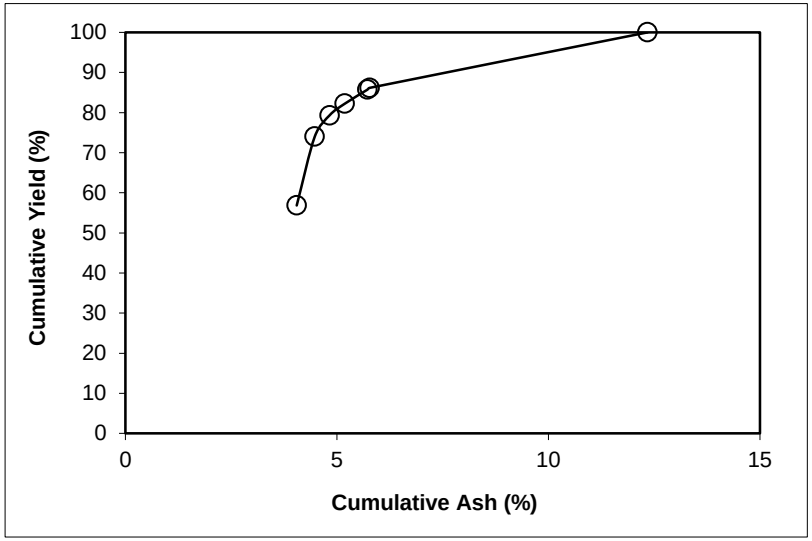
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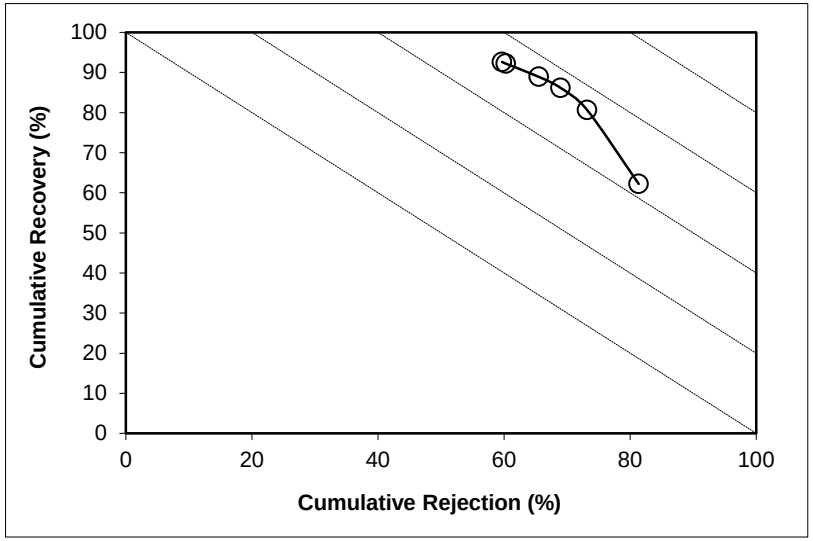
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 11.67

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	56.84	4.05	56.84	4.05	62.22	43.16	23.27	81.36	43.58
P2	17.18	5.89	74.02	4.47	80.66	25.98	34.76	73.17	53.83
P3	5.31	9.72	79.33	4.83	86.13	20.67	41.19	68.99	55.12
P4	2.88	15.01	82.21	5.18	88.92	17.79	45.43	65.49	54.41
P5	3.52	18.29	85.72	5.72	92.20	14.28	52.11	60.27	52.48
P6	0.45	16.36	86.17	5.78	92.63	13.83	53.27	59.68	52.31
P7 -325	13.83	53.27	100.00	12.34	100.00	0.00			
Total (Calc)	100.00	12.34	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

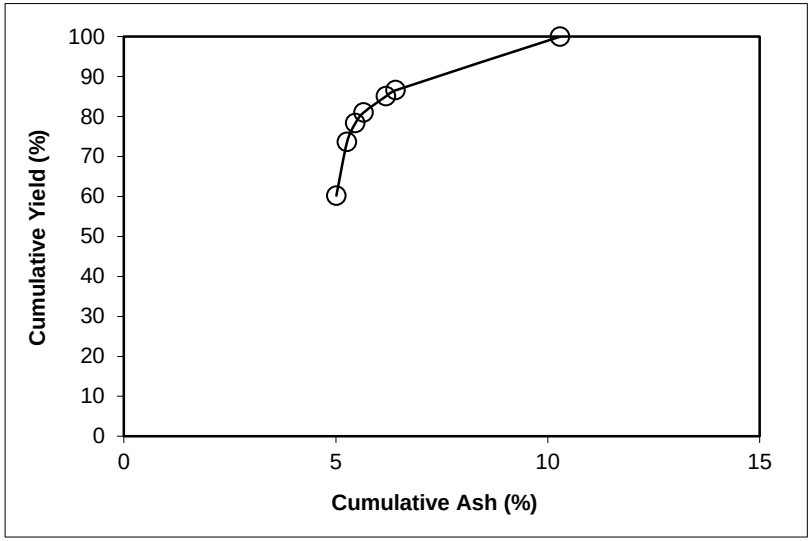
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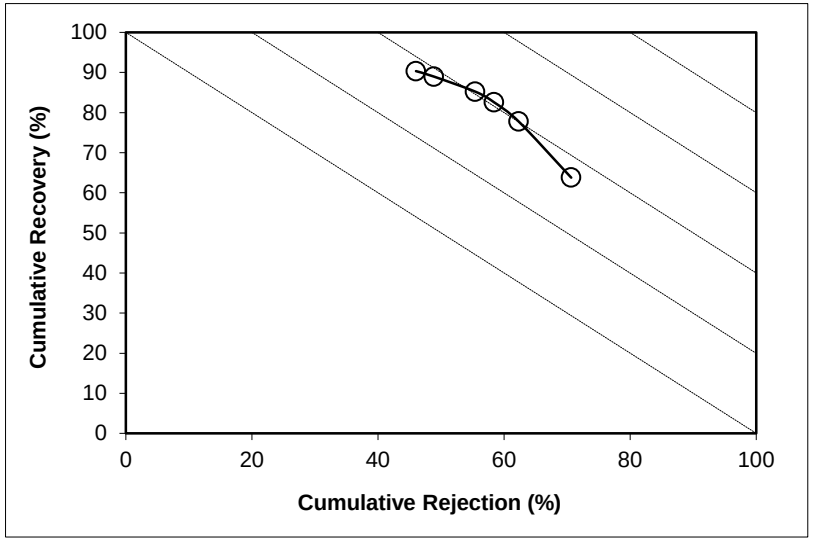
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 6.35

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	60.23	5.01	60.23	5.01	63.78	39.77	18.28	70.65	34.43
P2	13.42	6.39	73.65	5.26	77.78	26.35	24.33	62.31	40.09
P3	4.71	8.55	78.37	5.46	82.58	21.63	27.77	58.40	40.98
P4	2.67	11.41	81.04	5.66	85.22	18.96	30.08	55.43	40.65
P5	4.05	16.71	85.09	6.18	88.98	14.91	33.71	48.85	37.84
P6	1.51	19.32	86.60	6.41	90.34	13.40	35.33	46.02	36.36
P7	13.40	35.33	100.00	10.29	100.00	0.00			
-325									
Total (Calc)	100.00	10.29	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

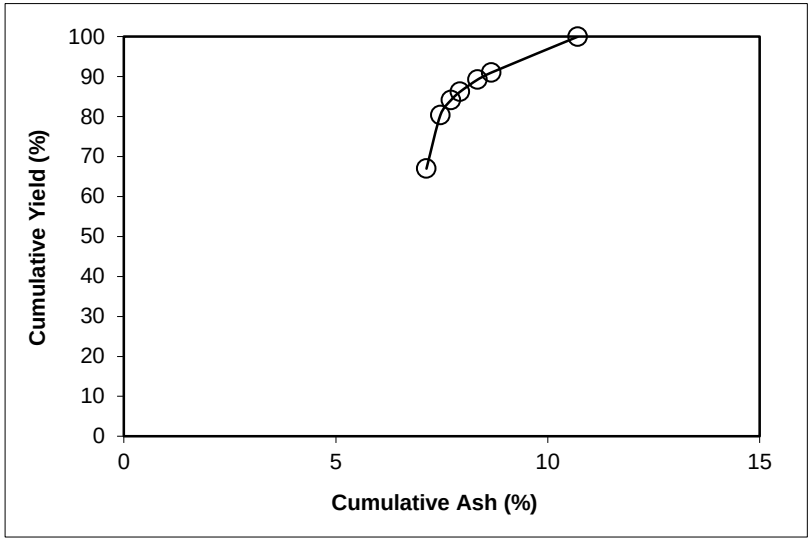
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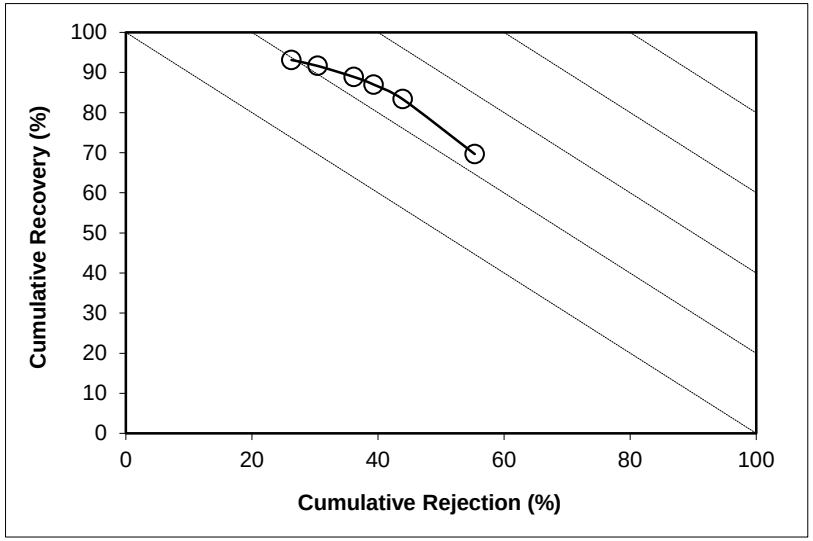
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 3.14

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	66.98	7.14	66.98	7.14	69.66	33.02	17.95	55.34	25.00
P2	13.43	9.11	80.42	7.47	83.33	19.58	24.01	43.91	27.25
P3	3.73	13.15	84.15	7.72	86.96	15.85	26.56	39.33	26.29
P4	2.05	16.50	86.20	7.93	88.89	13.80	28.06	36.16	25.05
P5	3.06	20.04	89.27	8.34	91.63	10.73	30.35	30.43	22.06
P6	1.77	25.14	91.04	8.67	93.11	8.96	31.38	26.27	19.38
P7	8.96	31.38	100.00	10.71	100.00	0.00			
-325									
Total (Calc)	100.00	10.71	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

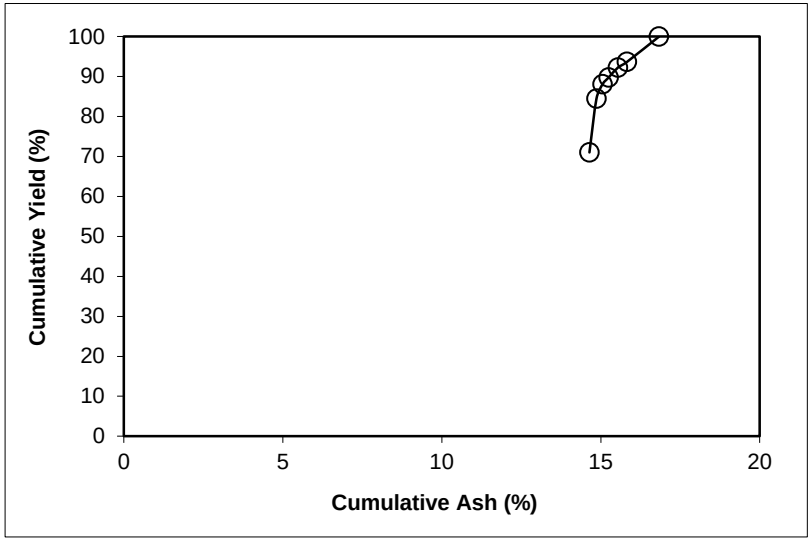
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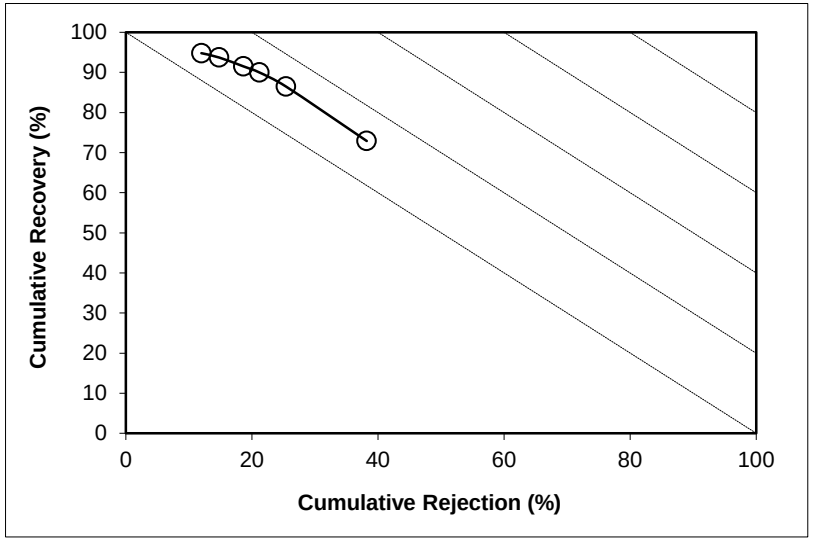
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 2.06

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	71.03	14.64	71.03	14.64	72.90	28.97	22.19	38.21	11.10
P2	13.43	16.03	84.45	14.86	86.45	15.55	27.51	25.42	11.87
P3	3.63	19.53	88.08	15.06	89.96	11.92	29.95	21.20	11.17
P4	1.70	25.22	89.79	15.25	91.49	10.21	30.73	18.65	10.14
P5	2.48	26.08	92.27	15.54	93.70	7.73	32.23	14.80	8.50
P6	1.38	34.50	93.65	15.82	94.79	6.35	31.74	11.97	6.76
P7	6.35	31.74	100.00	16.83	100.00	0.00			
-325									
Total (Calc)	100.00	16.83	--	--	--	--	--	--	--





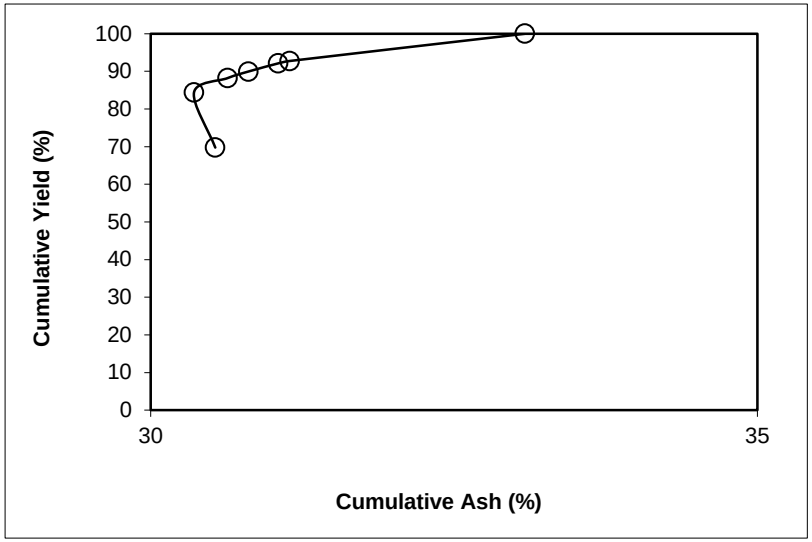
SPIRAL DATA ANALYSIS

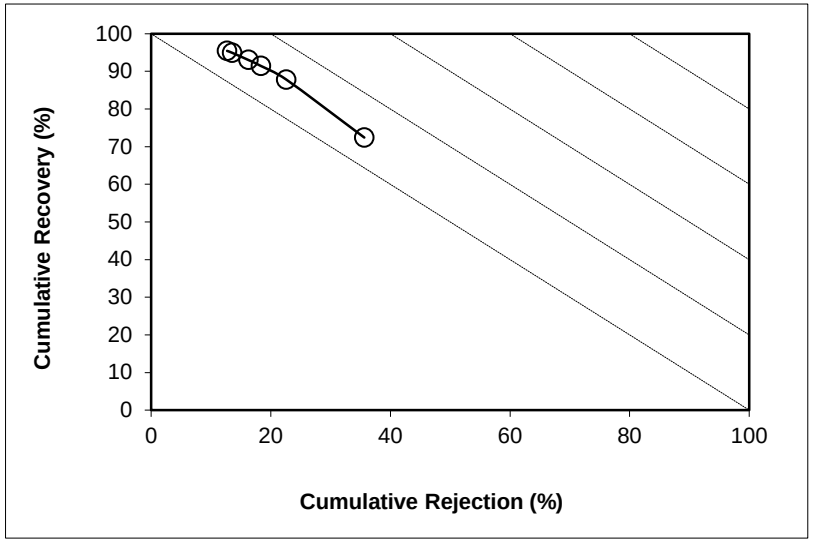
Description: Run 24 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	69.76	30.53	69.76	30.53	72.43	30.24	38.98	35.62	8.05
P2	14.62	29.52	84.39	30.36	87.83	15.61	47.83	22.57	10.40
P3	3.82	36.73	88.21	30.63	91.44	11.79	51.43	18.33	9.77
P4	1.75	39.46	89.96	30.80	93.02	10.04	53.51	16.25	9.27
P5	2.18	41.25	92.13	31.05	94.93	7.87	56.91	13.53	8.47
P6	0.63	44.95	92.76	31.14	95.45	7.24	57.95	12.68	8.13
P7	7.24	57.95	100.00	33.08	100.00	0.00			
Total (Calc)	100.00	33.08	--	--	--	--	--	--	--

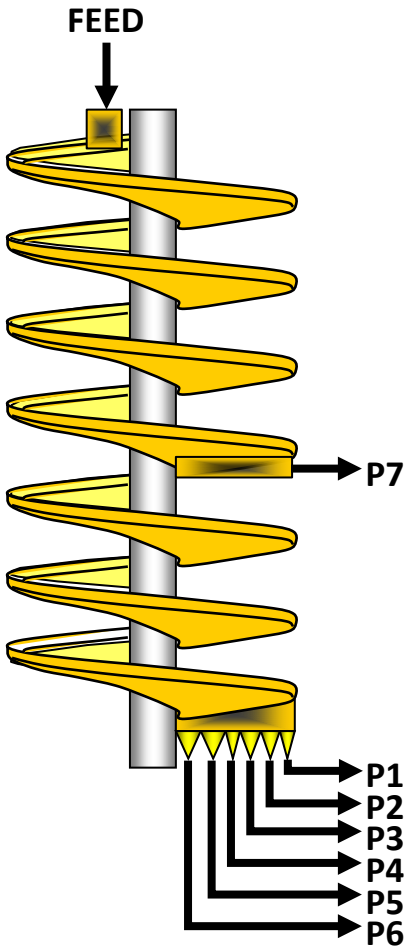




SPIRAL DATA ANALYSIS

Description: Run 25 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	1.677	21.5	24.46	28.81
P2	0.373	29.8	3.52	4.53
P3	0.112	31.6	0.98	1.26
P4	0.033	30.9	0.29	0.37
P5	0.033	23.9	0.42	0.50
P6	0.010	18.9	0.18	0.20
P7	0.132	37.4	0.88	1.16
Total	2.370	23.6	30.72	36.83

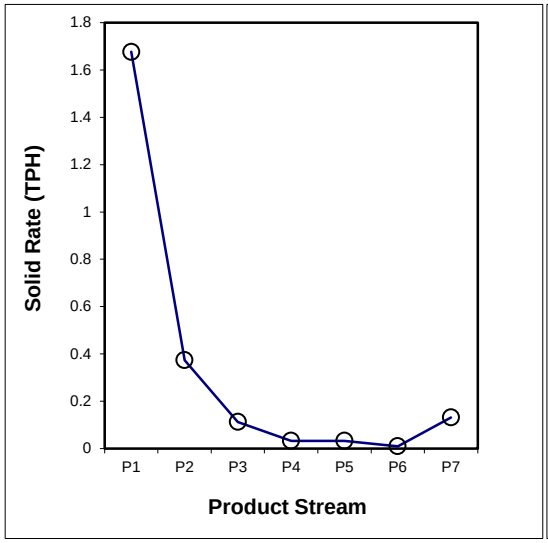
SPIRAL DATA ANALYSIS

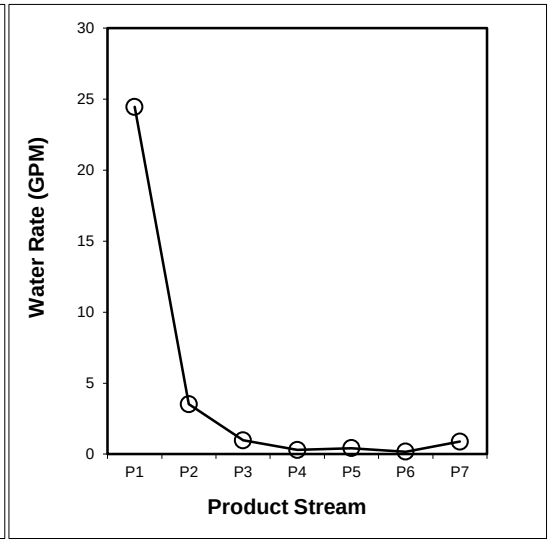
Description: Run 25 - Intermediate Spiral Test

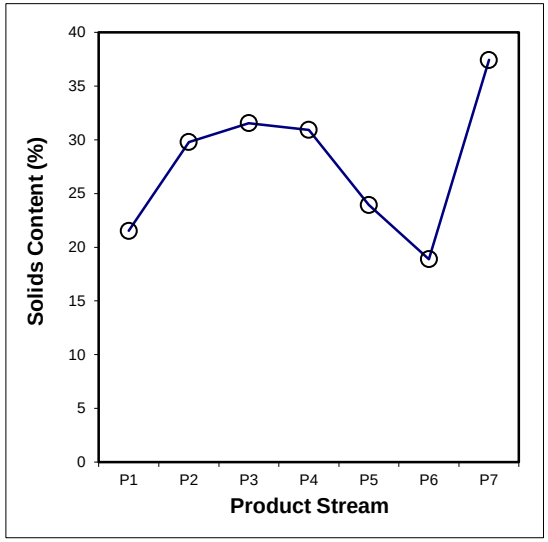
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	3	7086.00	1104.82	7.791	3717.5	2448.7	1.677	70.74	21.52
P2	5	1698.29	95.36	1.254	3392.8	2922.0	0.373	15.75	29.78
P3	10	1006.64	95.25	0.356	2731.1	2447.6	0.112	4.74	31.55
P4	30	915.40	97.05	0.107	3171.5	2922.0	0.033	1.39	30.92
P5	30	1149.72	96.42	0.137	2696.1	2447.6	0.033	1.39	23.94
P6	60	923.72	94.03	0.054	3076.5	2922.0	0.010	0.43	18.90
P7	10	993.35	93.19	0.352	3254.2	2922.0	0.132	5.56	37.43
Total (Calc)	--	--	--	10.051	--	--	2.370	100.00	23.58
Total (Head)	0.76	2114.11	179.5	10.051	2903.9	2447.6	2.370	--	23.58







SPIRAL DATA ANALYSIS

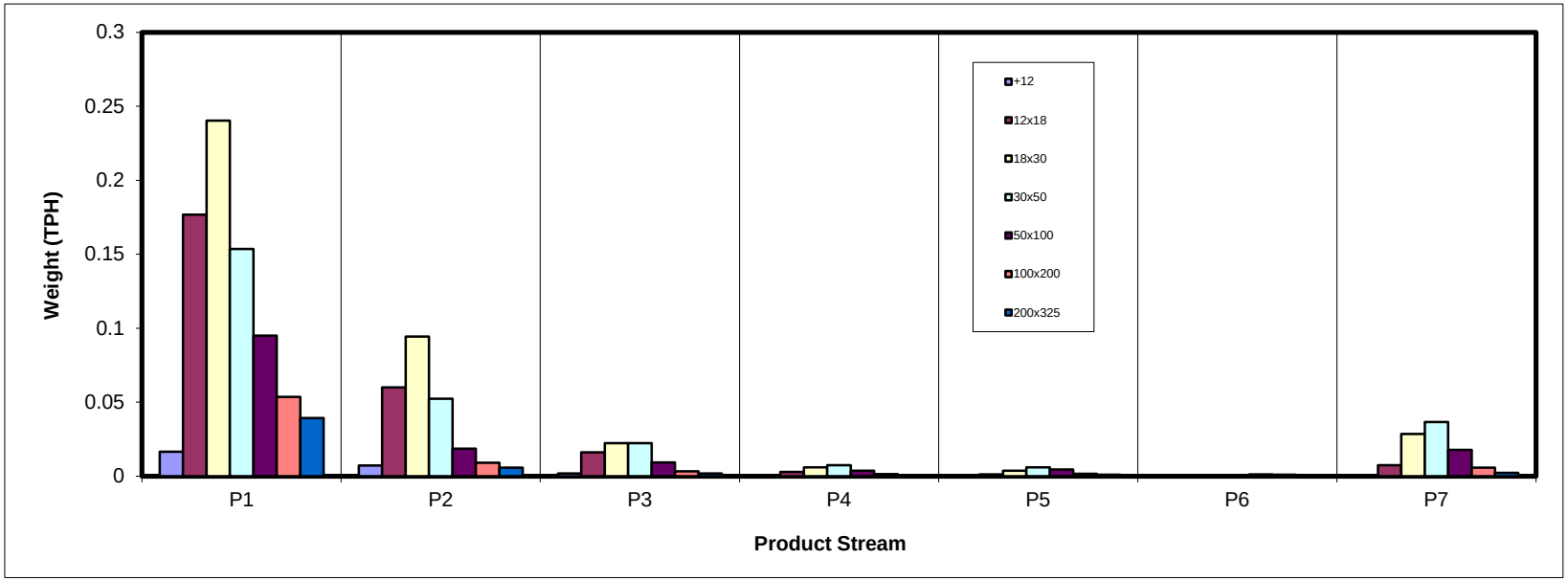
Description: Run 25 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	0.016	0.007	0.002	0.000	0.000	0.000	0.000		0.026
12x18	0.177	0.060	0.016	0.003	0.001	0.000	0.007		0.264
18x30	0.240	0.094	0.022	0.006	0.004	0.000	0.028		0.395
30x50	0.154	0.052	0.022	0.007	0.006	0.001	0.037		0.279
50x100	0.095	0.018	0.009	0.004	0.004	0.001	0.018		0.150
100x200	0.054	0.009	0.003	0.001	0.002	0.001	0.006		0.075
200x325	0.039	0.006	0.002	0.001	0.001	0.000	0.002		0.051
-325	0.902	0.126	0.036	0.011	0.015	0.007	0.033		1.131
Total (Calc)	1.677	0.373	0.112	0.033	0.033	0.010	0.132		2.370



SPIRAL DATA ANALYSIS

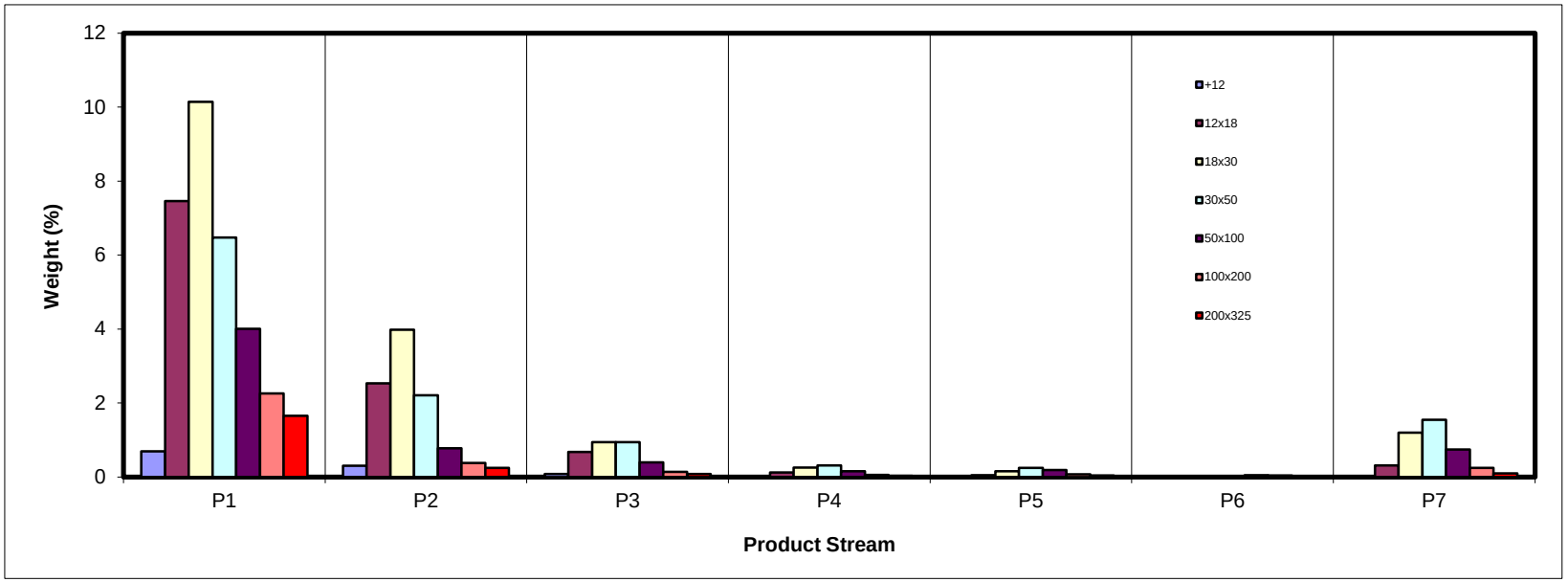
Description: Run 25 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	0.69	0.31	0.08	0.01	0.00	0.00	0.01		1.09
12x18	7.46	2.53	0.67	0.12	0.05	0.00	0.31		11.14
18x30	10.14	3.98	0.94	0.25	0.16	0.01	1.20		16.67
30x50	6.48	2.21	0.94	0.31	0.25	0.02	1.55		11.75
50x100	4.00	0.78	0.39	0.16	0.18	0.05	0.75		6.31
100x200	2.26	0.38	0.14	0.05	0.07	0.04	0.24		3.18
200x325	1.66	0.24	0.08	0.03	0.04	0.02	0.10		2.15
-325	38.06	5.33	1.51	0.47	0.64	0.29	1.41		47.70
Total (Calc)	70.74	15.75	4.74	1.39	1.39	0.43	5.56		100.00



SPIRAL DATA ANALYSIS

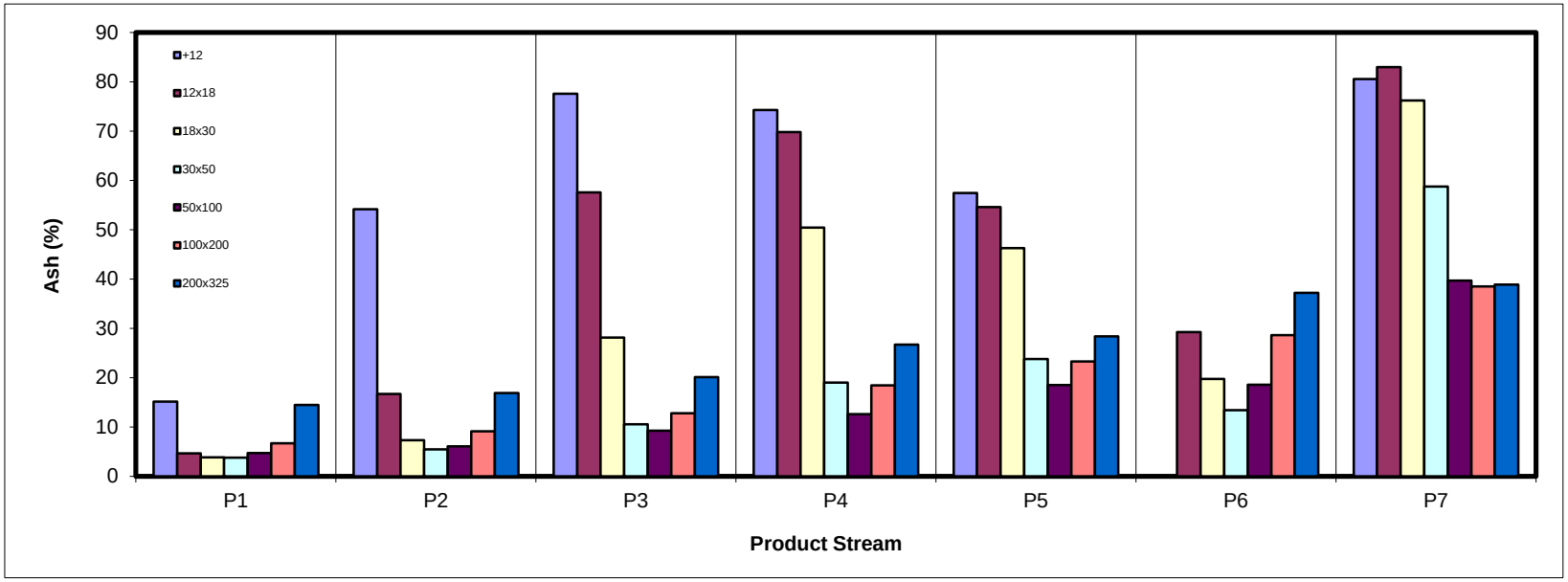
Description: Run 25 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	15.13	54.14	77.56	74.25	57.40	0.00	80.50		31.41
12x18	4.66	16.68	57.58	69.78	54.58	29.23	82.95		13.70
18x30	3.84	7.32	28.15	50.40	46.26	19.71	76.21		12.35
30x50	3.77	5.46	10.52	18.97	23.75	13.42	58.74		12.70
50x100	4.70	6.07	9.24	12.61	18.50	18.58	39.65		10.00
100x200	6.68	9.09	12.80	18.45	23.30	28.63	38.49		10.47
200x325	14.47	16.85	20.10	26.68	28.35	37.19	38.88		16.62
-325	54.98	55.46	56.08	57.23	57.43	60.38	62.08		55.37
Total (Calc)	31.93	25.88	36.39	41.50	42.49	48.15	60.96		33.15



SPIRAL DATA ANALYSIS

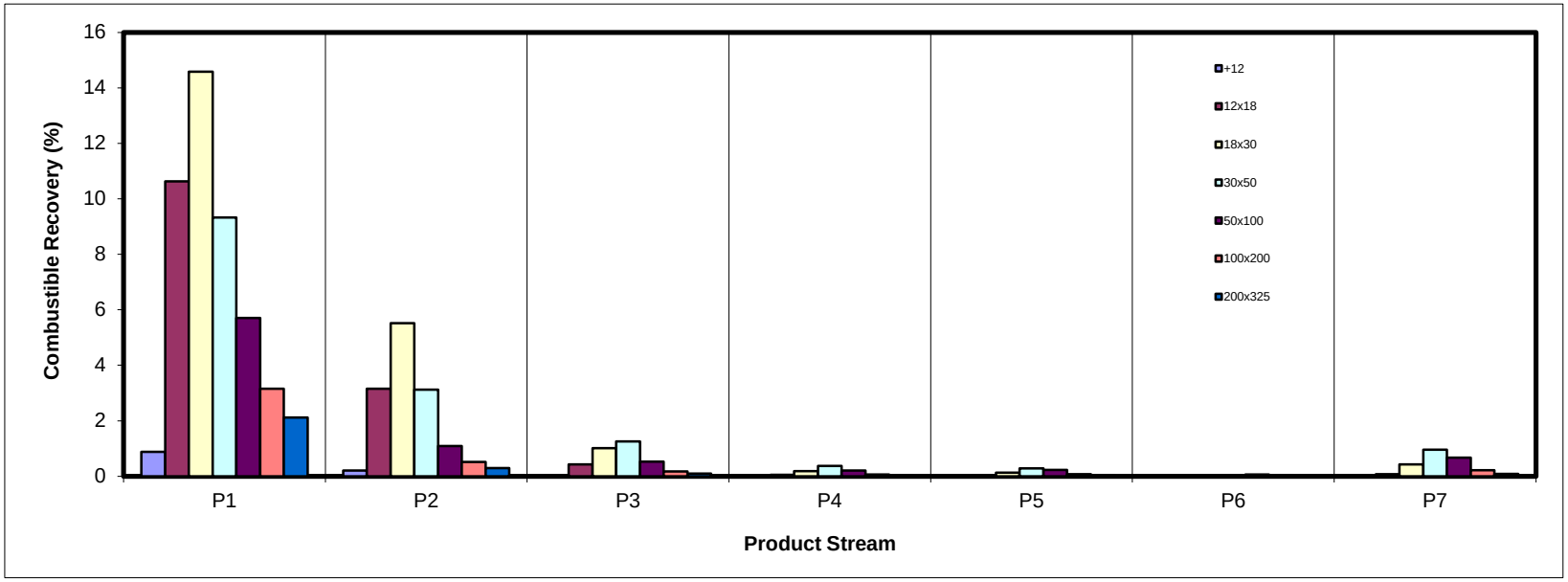
Description: Run 25 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	0.88	0.21	0.03	0.00	0.00	0.00	0.00		1.12
12x18	10.63	3.15	0.43	0.05	0.03	0.00	0.08		14.38
18x30	14.59	5.52	1.01	0.19	0.13	0.01	0.43		21.86
30x50	9.32	3.13	1.26	0.37	0.28	0.03	0.95		15.35
50x100	5.71	1.09	0.53	0.21	0.22	0.06	0.67		8.50
100x200	3.16	0.52	0.18	0.07	0.08	0.04	0.22		4.26
200x325	2.12	0.30	0.09	0.03	0.04	0.02	0.09		2.69
-325	25.63	3.55	0.99	0.30	0.41	0.17	0.80		31.85
Total (Calc)	72.03	17.46	4.51	1.22	1.19	0.33	3.25		100.00



SPIRAL DATA ANALYSIS

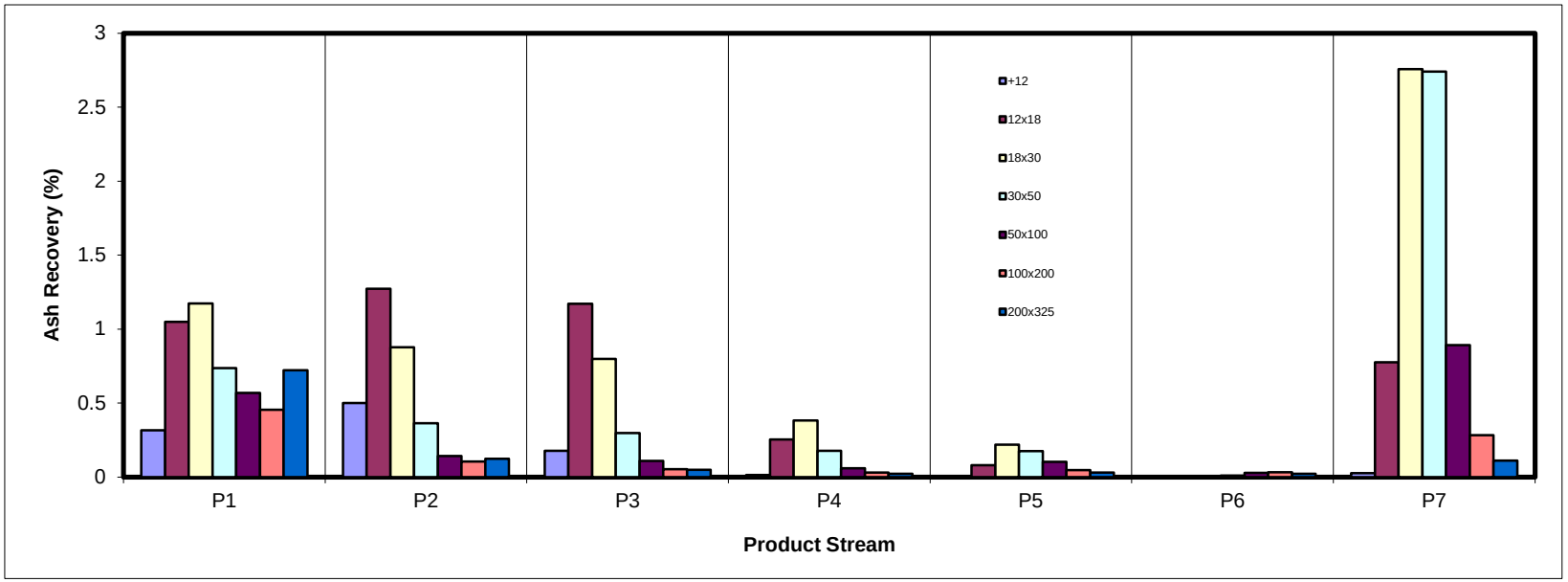
Description: Run 25 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	0.32	0.50	0.18	0.01	0.00	0.00	0.03		1.04
12x18	1.05	1.27	1.17	0.25	0.08	0.00	0.78		4.60
18x30	1.17	0.88	0.80	0.38	0.22	0.00	2.76		6.21
30x50	0.74	0.36	0.30	0.18	0.18	0.01	2.74		4.50
50x100	0.57	0.14	0.11	0.06	0.10	0.03	0.89		1.90
100x200	0.46	0.10	0.05	0.03	0.05	0.03	0.28		1.00
200x325	0.72	0.12	0.05	0.02	0.03	0.02	0.11		1.08
-325	63.11	8.91	2.55	0.80	1.12	0.53	2.63		79.66
Total (Calc)	68.13	12.30	5.21	1.74	1.78	0.63	10.22		100.00



SPIRAL DATA ANALYSIS

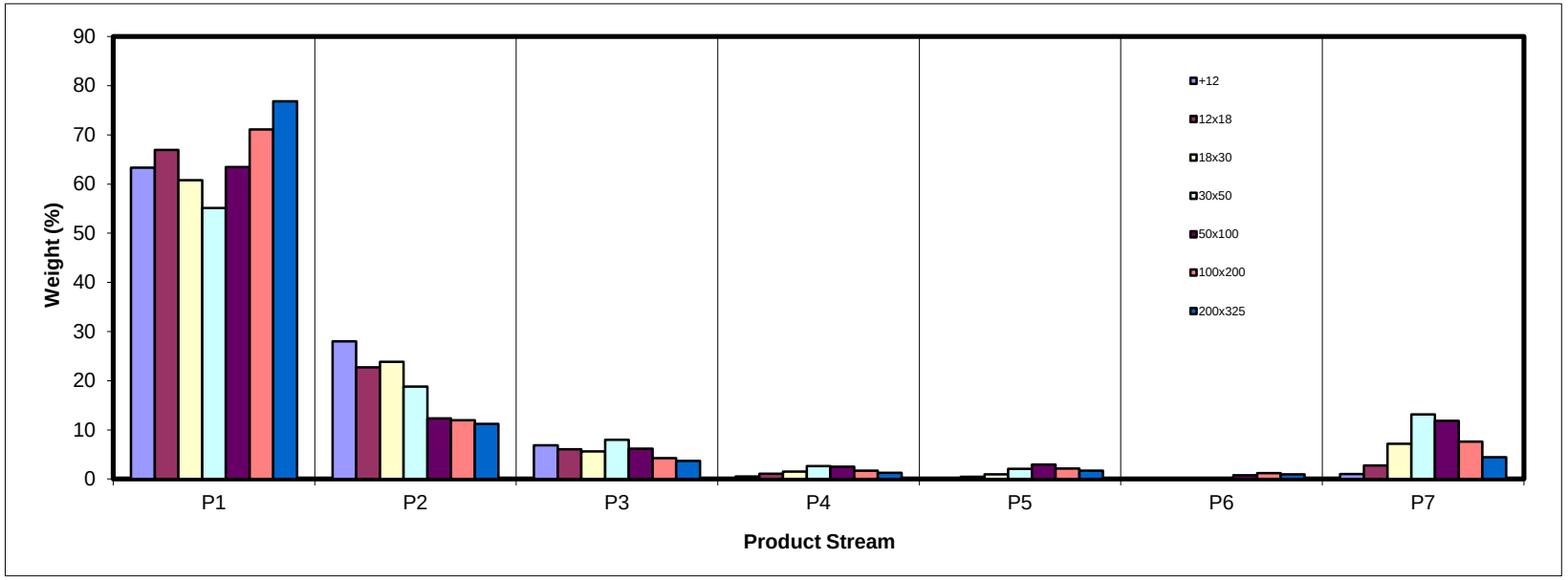
Description: Run 25 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	63.35	28.04	6.89	0.53	0.19	0.00	1.00		100.00
12x18	66.93	22.70	6.05	1.08	0.43	0.03	2.78		100.00
18x30	60.81	23.86	5.64	1.51	0.94	0.04	7.20		100.00
30x50	55.11	18.81	7.99	2.63	2.09	0.21	13.16		100.00
50x100	63.45	12.34	6.18	2.49	2.92	0.79	11.83		100.00
100x200	71.12	11.95	4.25	1.72	2.14	1.18	7.64		100.00
200x325	76.84	11.20	3.68	1.24	1.68	0.94	4.42		100.00
-325	79.79	11.17	3.17	0.98	1.35	0.61	2.95		100.00
Total (Calc)	70.74	15.75	4.74	1.39	1.39	0.43	5.56		100.00



SPIRAL DATA ANALYSIS

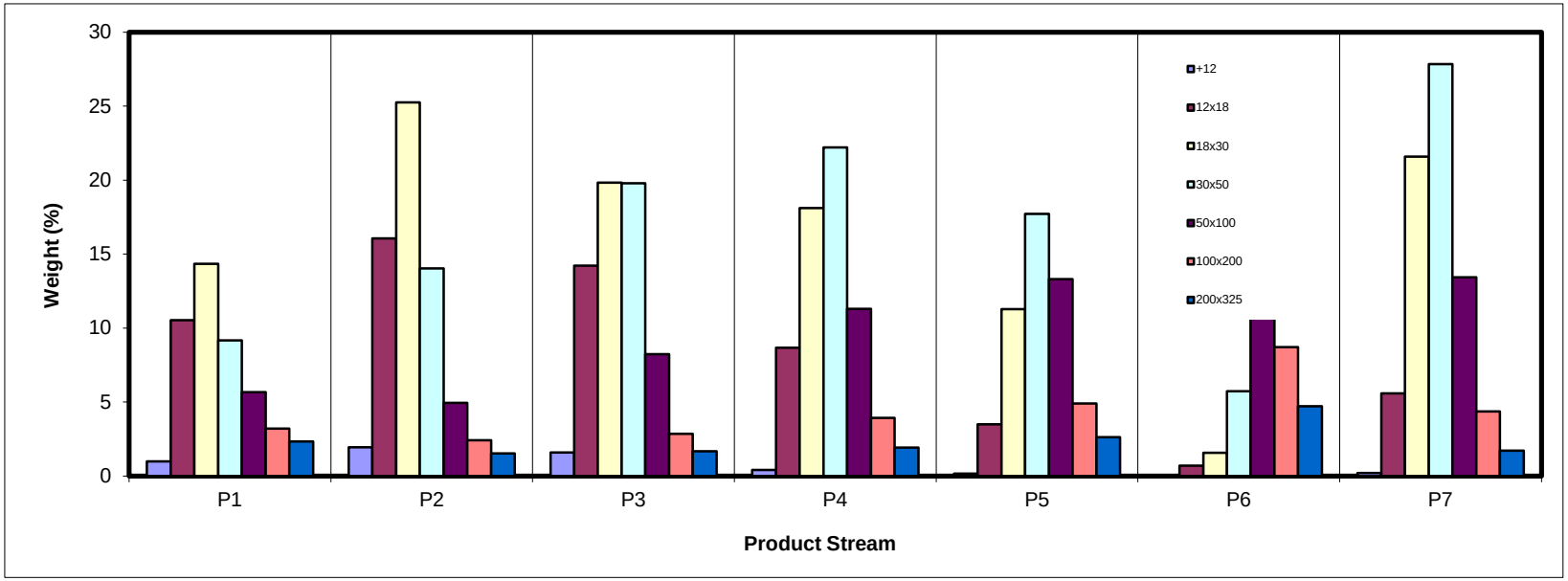
Description: Run 25 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+12	0.98	1.95	1.59	0.41	0.15	0.00	0.20		1.09
12x18	10.54	16.05	14.21	8.66	3.49	0.70	5.58		11.14
18x30	14.33	25.26	19.83	18.12	11.28	1.56	21.59		16.67
30x50	9.16	14.04	19.79	22.20	17.72	5.72	27.83		11.75
50x100	5.66	4.94	8.23	11.31	13.31	11.58	13.43		6.31
100x200	3.20	2.41	2.85	3.94	4.90	8.70	4.37		3.18
200x325	2.34	1.53	1.67	1.92	2.61	4.72	1.71		2.15
-325	53.80	33.82	31.83	33.44	46.53	67.03	25.29		47.70
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

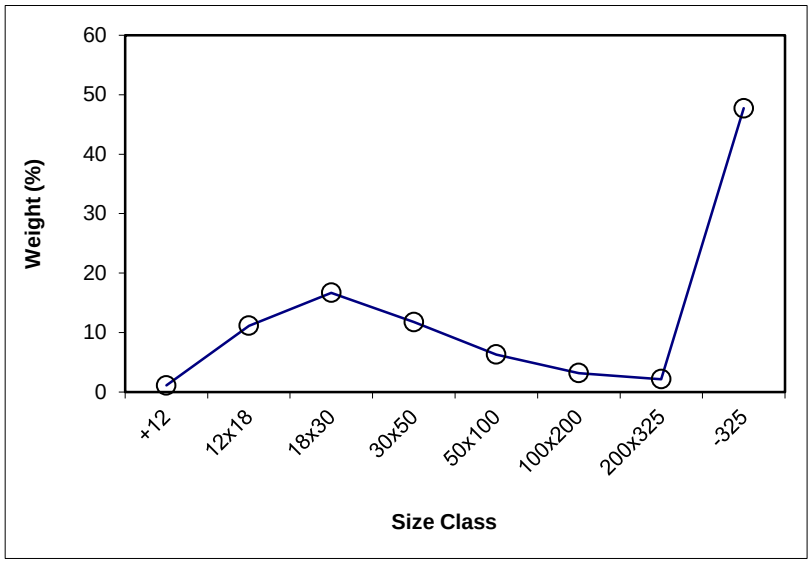
Description: Run 25 - Intermediate Spiral Test

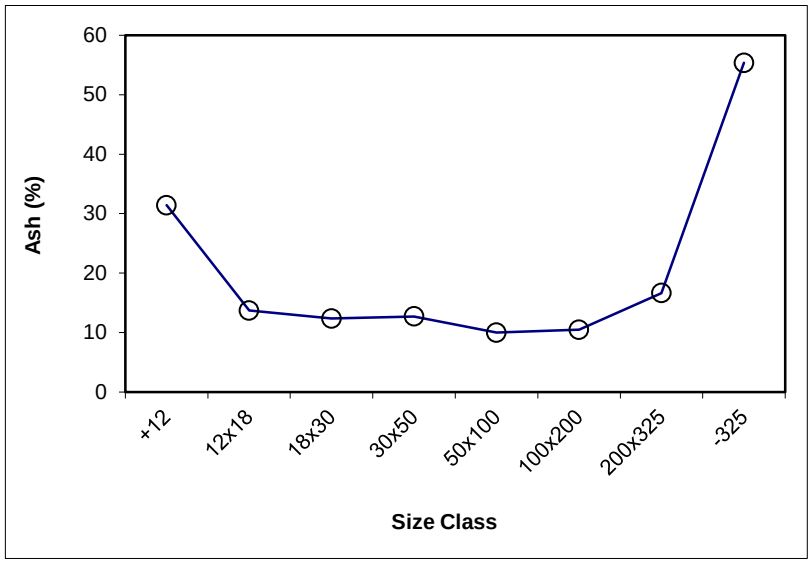
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	439.5	434.6	4.99	1.09	31.41	1.09	31.41	100.00	33.15
12x18	452.0	401.2	50.83	11.14	13.70	12.23	15.28	98.91	33.17
18x30	446.1	370.0	76.07	16.67	12.35	28.91	13.59	87.77	35.64
30x50	389.9	336.3	53.62	11.75	12.70	40.66	13.33	71.09	41.10
50x100	336.6	307.8	28.79	6.31	10.00	46.97	12.89	59.34	46.73
100x200	309.0	294.5	14.50	3.18	10.47	50.15	12.73	53.03	51.10
200x325	307.8	298.0	9.83	2.15	16.62	52.30	12.89	49.85	53.69
-325	222.9	5.3	217.62	47.70	55.37	100.00	33.15	47.70	55.37
Total (Calc)	--	--	456.25	100.00	33.15	--	--	--	--





SPIRAL DATA ANALYSIS

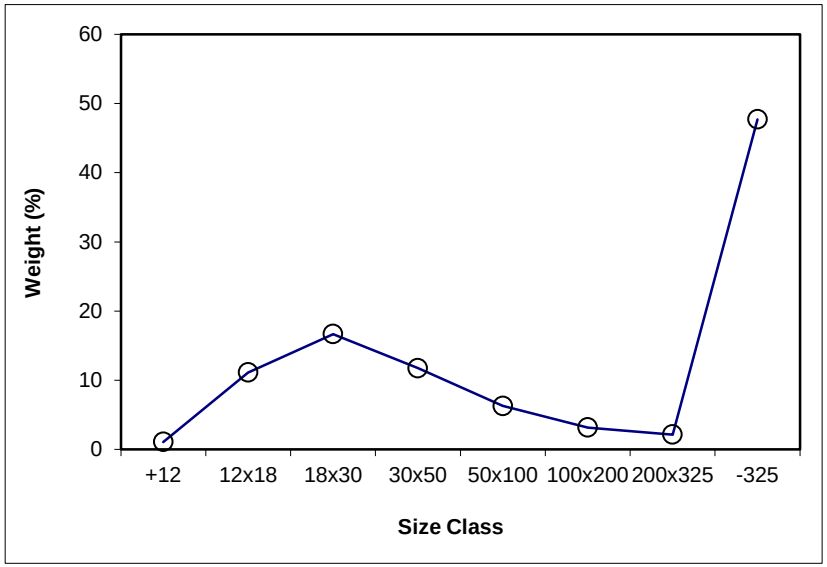
Description: Run 25 - Intermediate Spiral Test

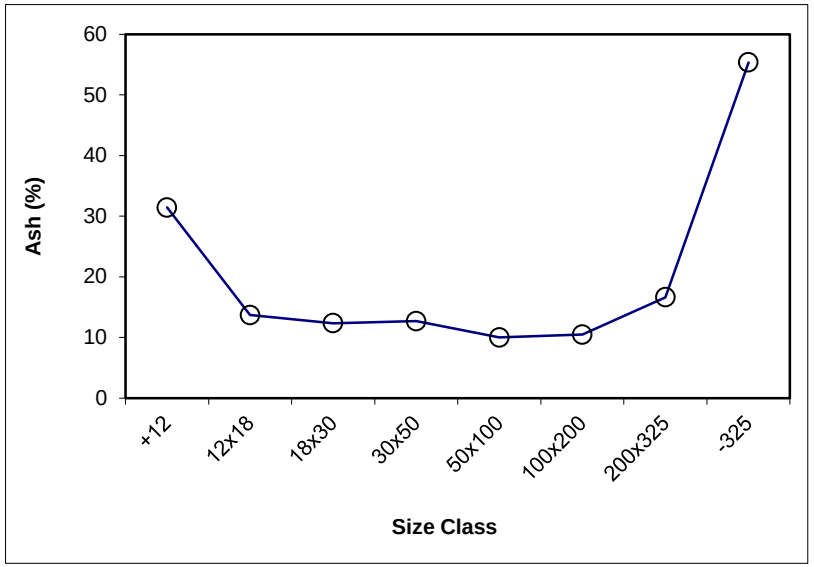
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+12	1.09	31.41	1.09	31.41	100.00	33.15			
12x18	11.14	13.70	12.23	15.28	98.91	33.17	x	11.14	13.70
18x30	16.67	12.35	28.91	13.59	87.77	35.64	x	16.67	12.35
30x50	11.75	12.70	40.66	13.33	71.09	41.10	x	11.75	12.70
50x100	6.31	10.00	46.97	12.89	59.34	46.73	x	6.31	10.00
100x200	3.18	10.47	50.15	12.73	53.03	51.10	x	3.18	10.47
200x325	2.15	16.62	52.30	12.89	49.85	53.69	x	2.15	16.62
-325	47.70	55.37	100.00	33.15	47.70	55.37			
Total (Calc)	100.00	33.15	--	--	--	--	--	51.21	12.50





SPIRAL DATA ANALYSIS

Description: Run 25 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 70.74

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	446.98	434.6	12.42	0.98	15.13	0.98	15.13	100.00	31.93
12x18	534.94	401.2	133.74	10.54	4.66	11.52	5.55	99.02	32.10
18x30	551.90	370.0	181.86	14.33	3.84	25.85	4.60	88.48	35.36
30x50	452.46	336.3	116.18	9.16	3.77	35.01	4.38	74.15	41.46
50x100	379.61	307.8	71.80	5.66	4.70	40.67	4.43	64.99	46.77
100x200	335.03	294.5	40.54	3.20	6.68	43.86	4.59	59.33	50.78
200x325	327.68	298.0	29.69	2.34	14.47	46.20	5.09	56.14	53.29
-325	688.91	6.3	682.57	53.80	54.98	100.00	31.93	53.80	54.98
Total (Calc)	--	--	1268.81	100.00	31.93	--	--	--	--

Product P2 Feed Weight (%): 15.75

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	453.5	444.3	9.16	1.95	54.14	1.95	54.14	100.00	25.88
12x18	535.7	460.1	75.59	16.05	16.68	18.00	20.73	98.05	25.32
18x30	561.1	442.2	118.92	25.26	7.32	43.26	12.90	82.00	27.01
30x50	478.6	412.5	66.08	14.04	5.46	57.29	11.07	56.74	35.78
50x100	411.0	387.7	23.27	4.94	6.07	62.23	10.68	42.71	45.74
100x200	402.7	391.3	11.35	2.41	9.09	64.65	10.62	37.77	50.94
200x325	385.8	378.6	7.21	1.53	16.85	66.18	10.76	35.35	53.79
-325	164.5	5.2	159.25	33.82	55.46	100.00	25.88	33.82	55.46
Total (Calc)	--	--	470.83	100.00	25.88	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 25 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 4.74

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	439.1	434.6	4.50	1.59	77.56	1.59	77.56	100.00	36.39
12x18	441.5	401.2	40.30	14.21	57.58	15.80	59.59	98.41	35.73
18x30	426.3	370.0	56.22	19.83	28.15	35.63	42.09	84.20	32.04
30x50	392.4	336.3	56.13	19.79	10.52	55.42	30.82	64.37	33.24
50x100	331.1	307.8	23.33	8.23	9.24	63.65	28.03	44.58	43.33
100x200	302.6	294.5	8.08	2.85	12.80	66.50	27.38	36.35	51.04
200x325	302.7	298.0	4.74	1.67	20.10	68.17	27.20	33.50	54.29
-325	95.5	5.2	90.28	31.83	56.08	100.00	36.39	31.83	56.08
Total (Calc)	--	--	283.58	100.00	36.39	--	--	--	--

Product P4 Feed Weight (%): 1.39

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	445.3	444.3	1.03	0.41	74.25	0.41	74.25	100.00	41.50
12x18	481.7	460.1	21.61	8.66	69.78	9.07	69.99	99.59	41.36
18x30	487.4	442.2	45.21	18.12	50.40	27.19	56.94	90.93	38.65
30x50	467.9	412.5	55.40	22.20	18.97	49.39	39.87	72.81	35.73
50x100	415.9	387.7	28.21	11.31	12.61	60.70	34.79	50.61	43.08
100x200	401.2	391.3	9.82	3.94	18.45	64.63	33.80	39.30	51.85
200x325	383.4	378.6	4.80	1.92	26.68	66.56	33.59	35.37	55.56
-325	88.7	5.2	83.46	33.44	57.23	100.00	41.50	33.44	57.23
Total (Calc)	--	--	249.53	100.00	41.50	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 25 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 1.39

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	434.9	434.6	0.38	0.15	57.40	0.15	57.40	100.00	42.49
12x18	409.9	401.2	8.69	3.49	54.58	3.65	54.70	99.85	42.47
18x30	398.1	370.0	28.03	11.28	46.26	14.93	48.32	96.35	42.03
30x50	380.3	336.3	44.05	17.72	23.75	32.65	34.98	85.07	41.47
50x100	340.9	307.8	33.07	13.31	18.50	45.96	30.21	67.35	46.13
100x200	306.7	294.5	12.18	4.90	23.30	50.86	29.54	54.04	52.93
200x325	304.5	298.0	6.50	2.61	28.35	53.47	29.49	49.14	55.89
-325	120.9	5.2	115.64	46.53	57.43	100.00	42.49	46.53	57.43
Total (Calc)	--	--	248.53	100.00	42.49	--	--	--	--

Product P6 Feed Weight (%): 0.43

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	444.3	444.3	0.00	0.00	0.00	0.00	0.00	100.00	48.15
12x18	461.2	460.1	1.08	0.70	29.23	0.70	29.23	100.00	48.15
18x30	444.6	442.2	2.41	1.56	19.71	2.25	22.66	99.30	48.28
30x50	421.4	412.5	8.84	5.72	13.42	7.98	16.03	97.75	48.74
50x100	405.6	387.7	17.89	11.58	18.58	19.55	17.54	92.02	50.93
100x200	404.8	391.3	13.44	8.70	28.63	28.25	20.95	80.45	55.59
200x325	385.9	378.6	7.29	4.72	37.19	32.97	23.28	71.75	58.86
-325	108.8	5.2	103.57	67.03	60.38	100.00	48.15	67.03	60.38
Total (Calc)	--	--	154.51	100.00	48.15	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Run 25 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PRODUCT SIZE ANALYSIS

Product P7

Feed Weight (%): 5.56

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+12	445.0	444.3	0.65	0.20	80.50	0.20	80.50	100.00	60.96
12x18	478.7	460.1	18.54	5.58	82.95	5.78	82.87	99.80	60.92
18x30	513.9	442.2	71.73	21.59	76.21	27.37	77.62	94.22	59.62
30x50	505.0	412.5	92.47	27.83	58.74	55.20	68.10	72.63	54.69
50x100	432.3	387.7	44.62	13.43	39.65	68.63	62.53	44.80	52.17
100x200	405.9	391.3	14.52	4.37	38.49	73.00	61.09	31.37	57.53
200x325	384.3	378.6	5.69	1.71	38.88	74.71	60.58	27.00	60.61
-325	89.2	5.2	84.02	25.29	62.08	100.00	60.96	25.29	62.08
Total (Calc)	--	--	332.24	100.00	60.96	--	--	--	--

SPIRAL DATA ANALYSIS

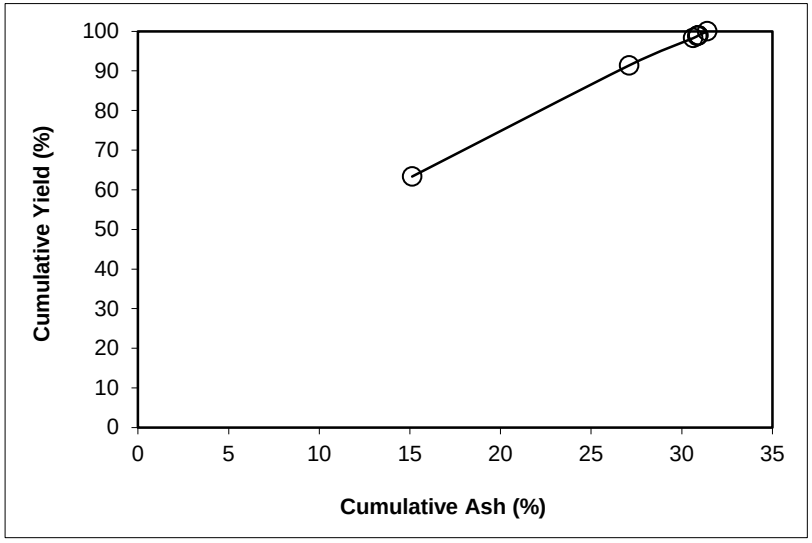
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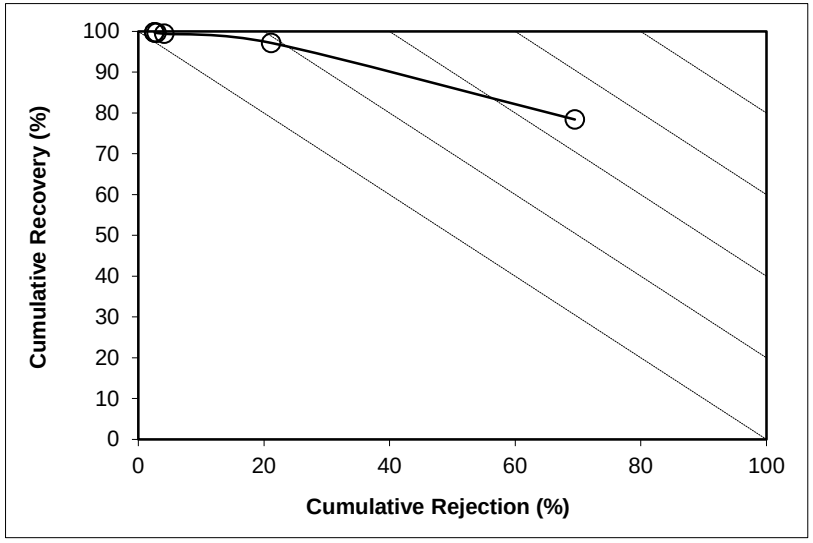
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: +12 Feed Weight (%): 1.09

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	63.35	15.13	63.35	15.13	78.40	36.65	59.57	69.50	47.89
P2	28.04	54.14	91.39	27.09	97.14	8.61	77.25	21.17	18.32
P3	6.89	77.56	98.28	30.63	99.40	1.72	76.01	4.16	3.56
P4	0.53	74.25	98.81	30.86	99.60	1.19	76.78	2.91	2.51
P5	0.19	57.40	99.00	30.92	99.72	1.00	80.50	2.56	2.28
P6	0.00	0.00	99.00	30.92	99.72	1.00	80.50	2.56	2.28
P7	1.00	80.50	100.00	31.41	100.00	0.00			
-325									
Total (Calc)	100.00	31.41	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

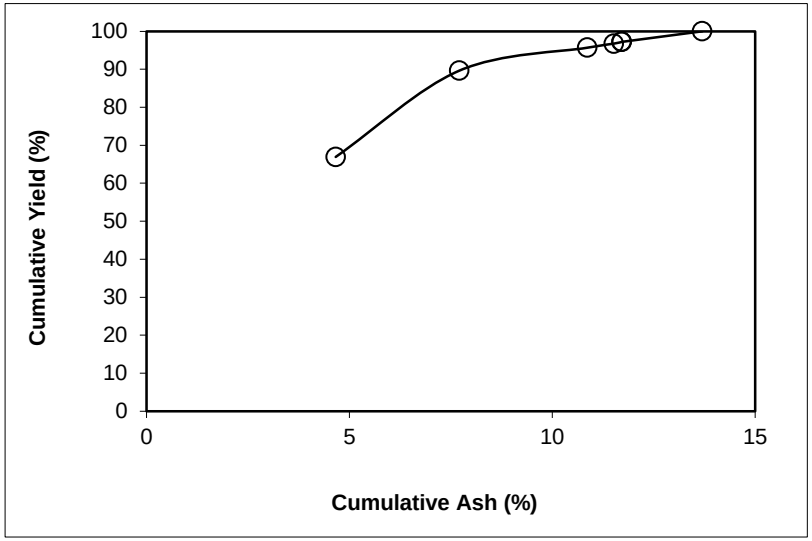
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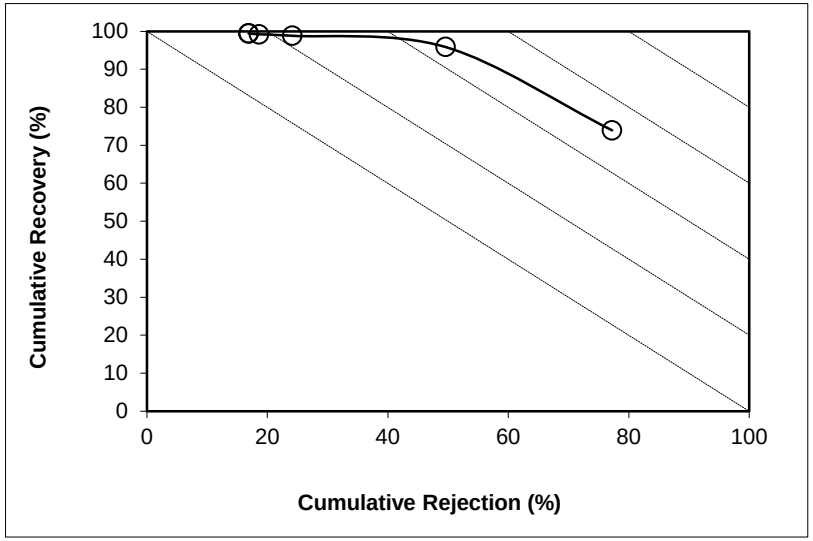
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: 12x18 Feed Weight (%): 11.14

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	66.93	4.66	66.93	4.66	73.94	33.07	31.98	77.22	51.16
P2	22.70	16.68	89.62	7.70	95.85	10.38	65.46	49.59	45.43
P3	6.05	57.58	95.67	10.86	98.82	4.33	76.47	24.15	22.97
P4	1.08	69.78	96.76	11.52	99.20	3.24	78.70	18.64	17.84
P5	0.43	54.58	97.19	11.71	99.43	2.81	82.44	16.91	16.34
P6	0.03	29.23	97.22	11.71	99.45	2.78	82.95	16.85	16.30
P7 -325	2.78	82.95	100.00	13.70	100.00	0.00			
Total (Calc)	100.00	13.70	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

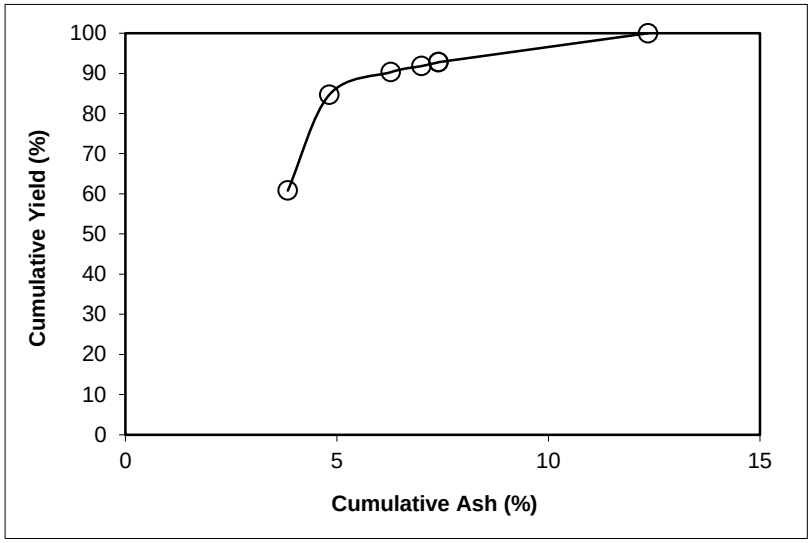
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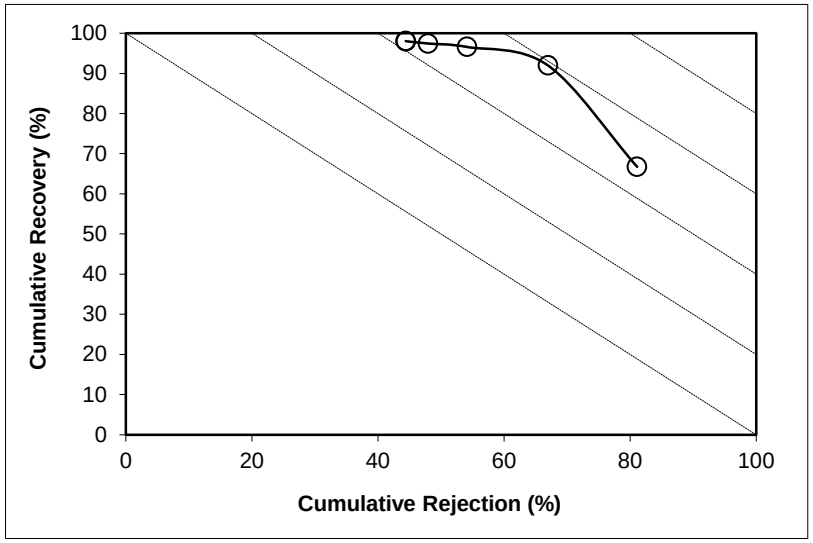
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 16.67

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	60.81	3.84	60.81	3.84	66.72	39.19	25.57	81.11	47.84
P2	23.86	7.32	84.67	4.82	91.96	15.33	54.00	66.98	58.94
P3	5.64	28.15	90.31	6.27	96.58	9.69	69.05	54.13	50.71
P4	1.51	50.40	91.83	7.00	97.44	8.17	72.50	47.96	45.40
P5	0.94	46.26	92.76	7.40	98.01	7.24	75.90	44.45	42.46
P6	0.04	19.71	92.80	7.40	98.05	7.20	76.21	44.39	42.44
P7	7.20	76.21	100.00	12.35	100.00	0.00			
-325									
Total (Calc)	100.00	12.35	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

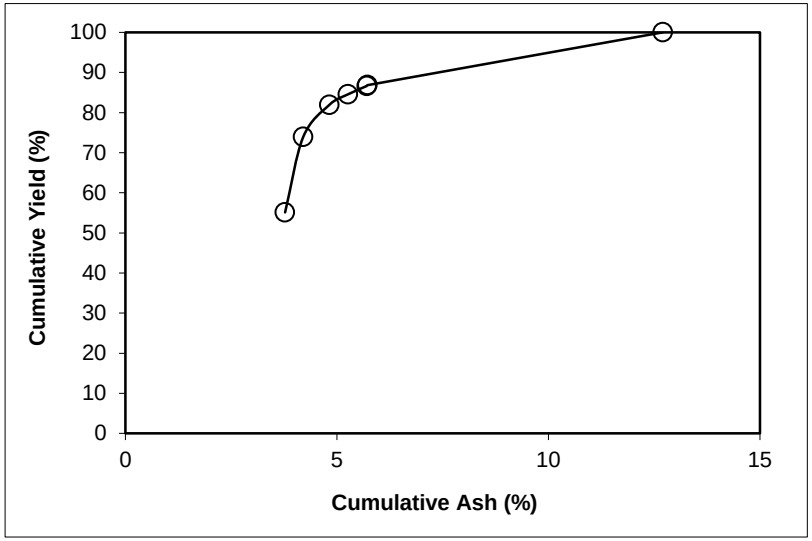
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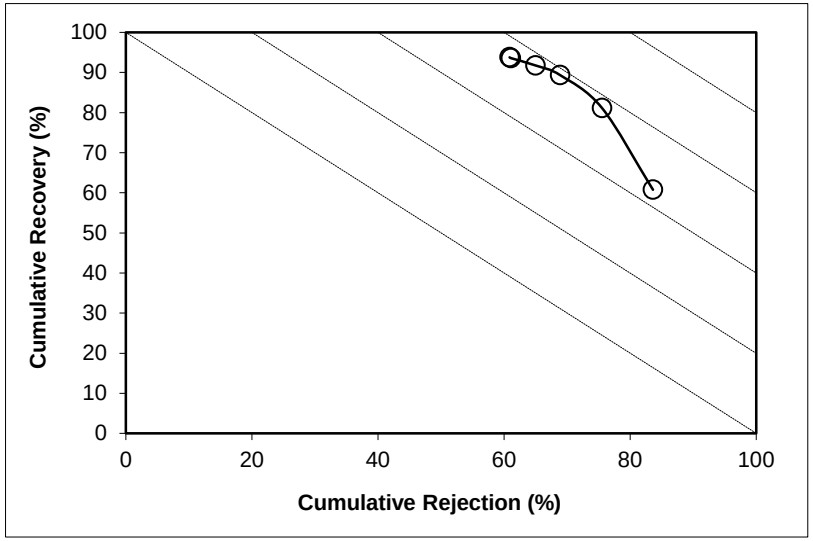
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 11.75

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	55.11	3.77	55.11	3.77	60.75	44.89	23.66	83.63	44.38
P2	18.81	5.46	73.92	4.20	81.12	26.08	36.79	75.55	56.67
P3	7.99	10.52	81.91	4.82	89.31	18.09	48.39	68.93	58.24
P4	2.63	18.97	84.54	5.26	91.75	15.46	53.40	65.00	56.75
P5	2.09	23.75	86.63	5.70	93.57	13.37	58.03	61.09	54.67
P6	0.21	13.42	86.84	5.72	93.78	13.16	58.74	60.87	54.65
P7	13.16	58.74	100.00	12.70	100.00	0.00			
-325									
Total (Calc)	100.00	12.70	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

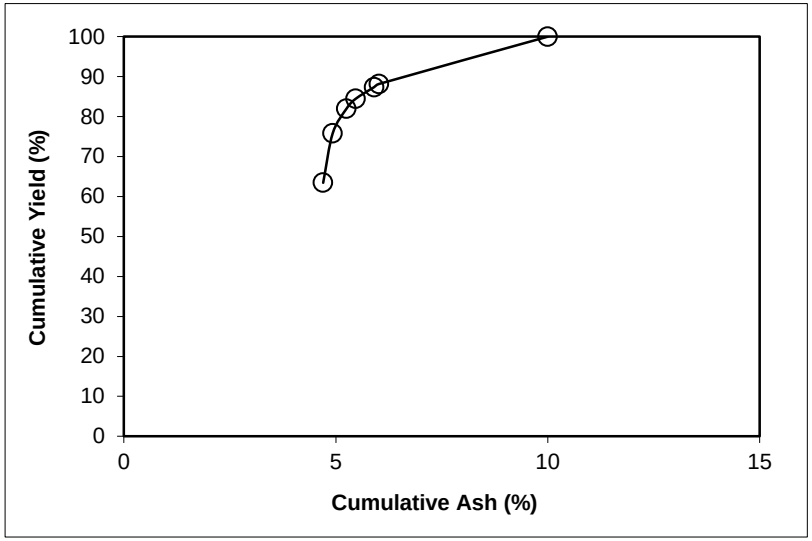
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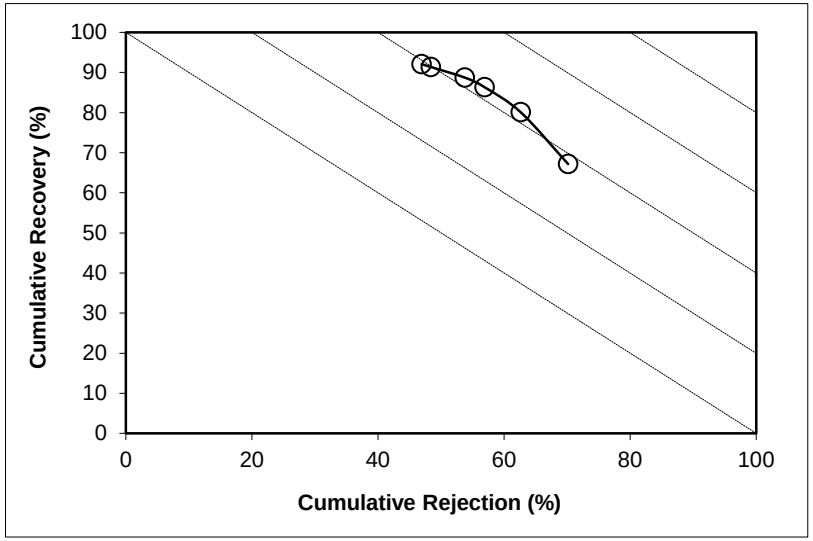
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 6.31

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	63.45	4.70	63.45	4.70	67.18	36.55	19.18	70.16	37.34
P2	12.34	6.07	75.78	4.92	80.05	24.22	25.86	62.66	42.71
P3	6.18	9.24	81.97	5.25	86.29	18.03	31.56	56.94	43.23
P4	2.49	12.61	84.46	5.47	88.71	15.54	34.60	53.80	42.51
P5	2.92	18.50	87.38	5.90	91.36	12.62	38.33	48.39	39.75
P6	0.79	18.58	88.17	6.02	92.07	11.83	39.65	46.92	38.99
P7	11.83	39.65	100.00	10.00	100.00	0.00			
-325									
Total (Calc)	100.00	10.00	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

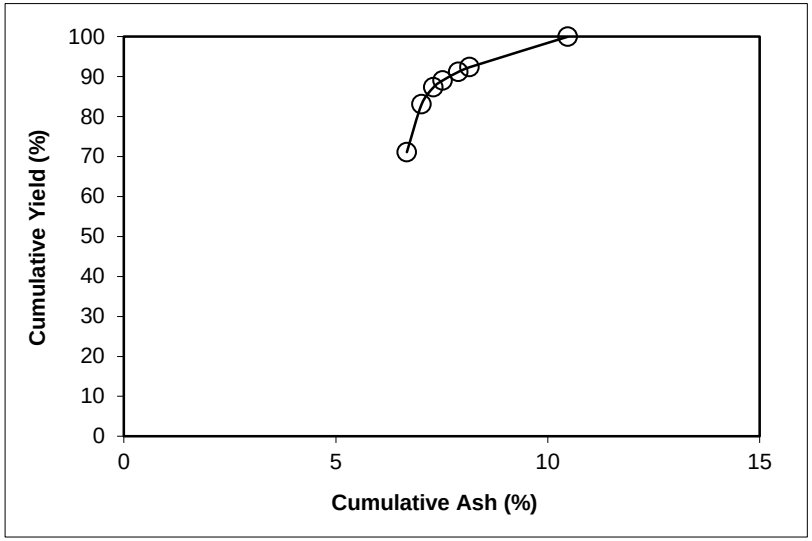
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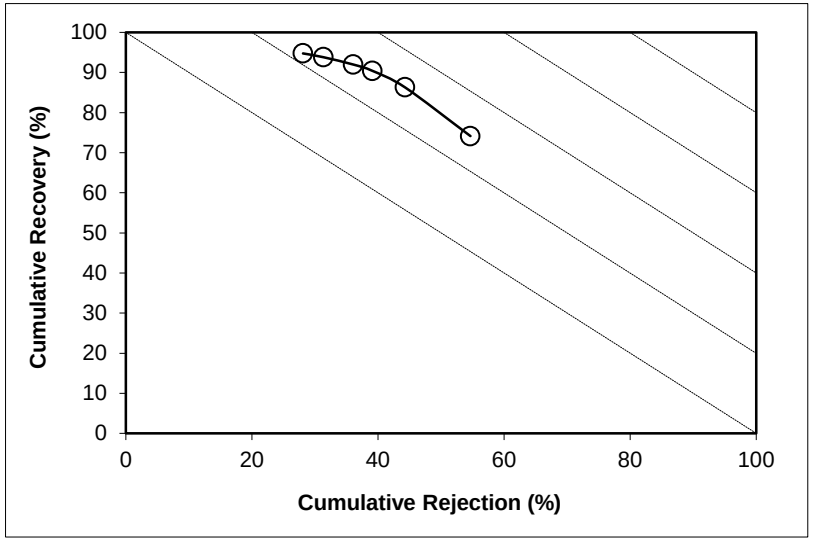
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 3.18

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	71.12	6.68	71.12	6.68	74.14	28.88	19.82	54.66	28.80
P2	11.95	9.09	83.07	7.02	86.27	16.93	27.40	44.29	30.56
P3	4.25	12.80	87.32	7.30	90.41	12.68	32.29	39.10	29.51
P4	1.72	18.45	89.04	7.52	91.98	10.96	34.47	36.07	28.05
P5	2.14	23.30	91.18	7.89	93.81	8.82	37.17	31.31	25.12
P6	1.18	28.63	92.36	8.15	94.75	7.64	38.49	28.09	22.84
P7	7.64	38.49	100.00	10.47	100.00	0.00			
-325									
Total (Calc)	100.00	10.47	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

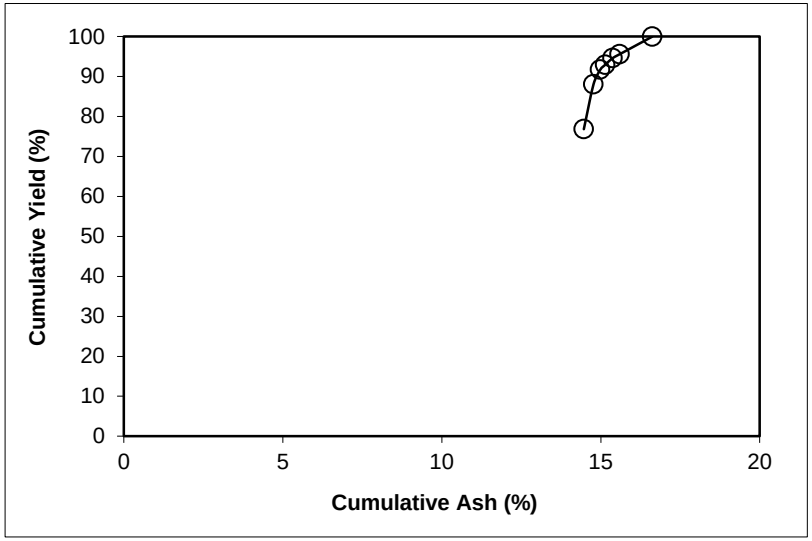
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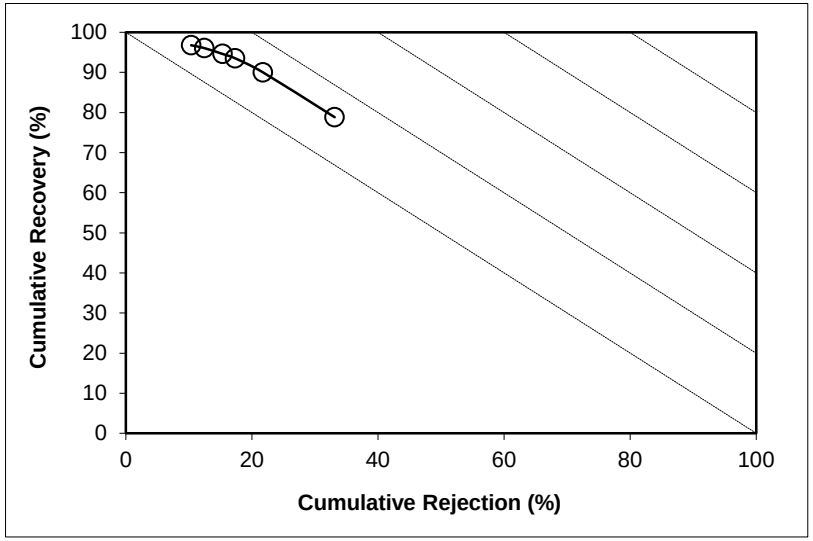
Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 2.15

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	76.84	14.47	76.84	14.47	78.82	23.16	23.76	33.12	11.94
P2	11.20	16.85	88.04	14.77	89.99	11.96	30.23	21.76	11.75
P3	3.68	20.10	91.71	14.98	93.51	8.29	34.72	17.31	10.83
P4	1.24	26.68	92.96	15.14	94.60	7.04	36.14	15.32	9.93
P5	1.68	28.35	94.64	15.37	96.05	5.36	38.59	12.45	8.50
P6	0.94	37.19	95.58	15.59	96.76	4.42	38.88	10.34	7.10
P7	4.42	38.88	100.00	16.62	100.00	0.00			
-325									
Total (Calc)	100.00	16.62	--	--	--	--	--	--	--





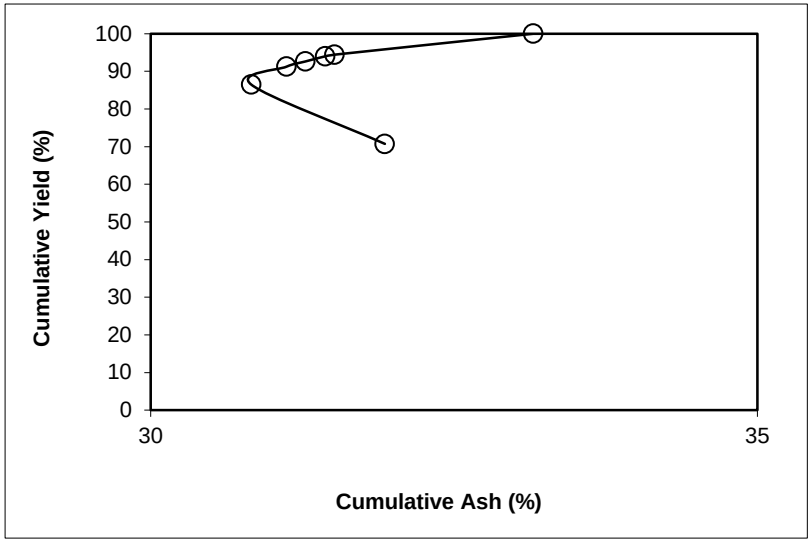
SPIRAL DATA ANALYSIS

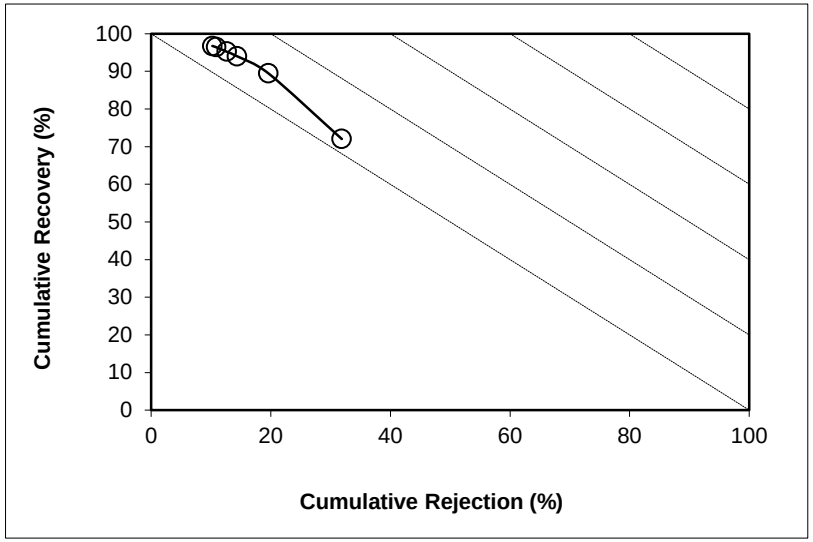
Description: Run 25 - Intermediate Spiral Test

Comments: 3.36 x 0.15 mm Nominal Particle Size (Mix feed)

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	70.74	31.93	70.74	31.93	72.03	29.26	36.10	31.87	3.90
P2	15.75	25.88	86.49	30.83	89.50	13.51	48.03	19.57	9.07
P3	4.74	36.39	91.24	31.12	94.01	8.76	54.32	14.36	8.37
P4	1.39	41.50	92.63	31.27	95.23	7.37	56.74	12.62	7.85
P5	1.39	42.49	94.01	31.44	96.42	5.99	60.04	10.84	7.27
P6	0.43	48.15	94.44	31.51	96.75	5.56	60.96	10.22	6.97
P7	5.56	60.96	100.00	33.15	100.00	0.00			
Total (Calc)	100.00	33.15	--	--	--	--	--	--	--



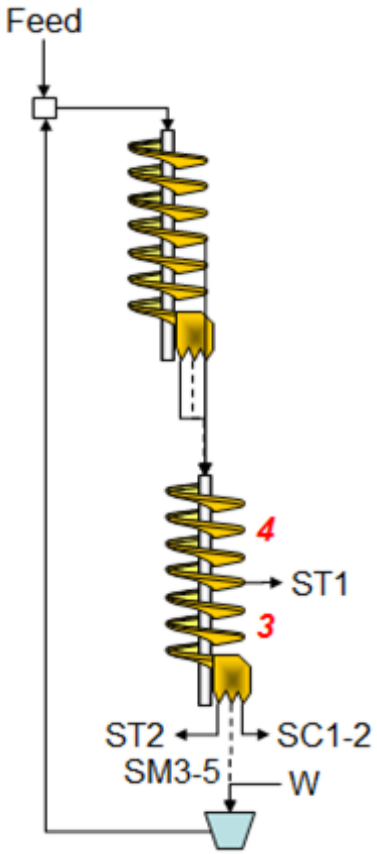


APPENDIX E – Spiral Circuit Results (In-Plant Testing of Different Spiral Circuits)

SPIRAL DATA ANALYSIS

Description: Experiment: 1 - Cardinal In-Plant Test

Comments: $1_{2T0}+2_{CT1}$ Compound Spiral (1 x 0.15 mm Nominal Particle Size)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
SC1	40.0	34.9	100	87
SC2	34.9	28.6	87	72
SM3	28.6	21.6	72	54
SM4	21.6	16.7	54	42
SM5	16.7	8.3	42	21
ST2	8.3	0.0	21	0
ST1	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
SC1	1.153	16.1	24.02	27.37
SC2	0.323	27.2	3.45	4.35
SM3	0.197	39.2	1.22	1.68
SM4	0.071	40.5	0.42	0.57
SM5	0.053	30.7	0.48	0.59
ST2	0.008	15.3	0.17	0.19
ST1	0.715	59.5	1.94	3.16
Total	2.519	24.1	31.70	37.90

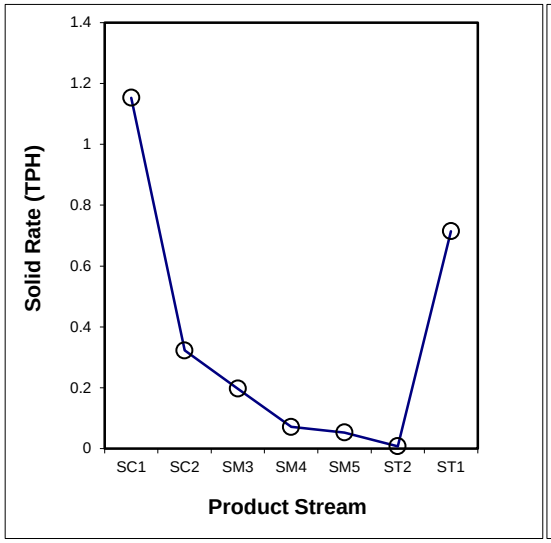
SPIRAL DATA ANALYSIS

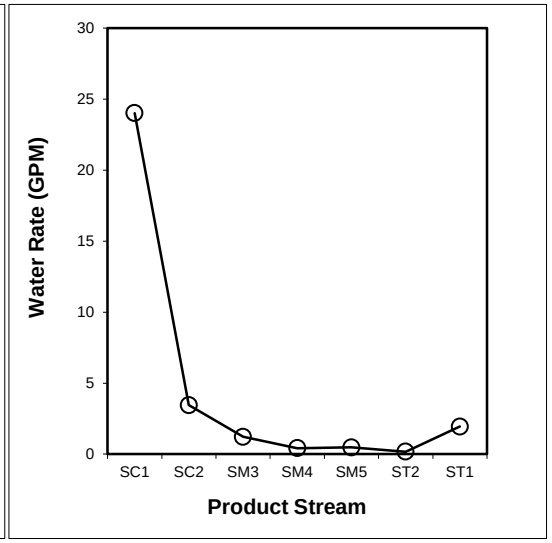
Description: Experiment: 1 - Cardinal In-Plant Test

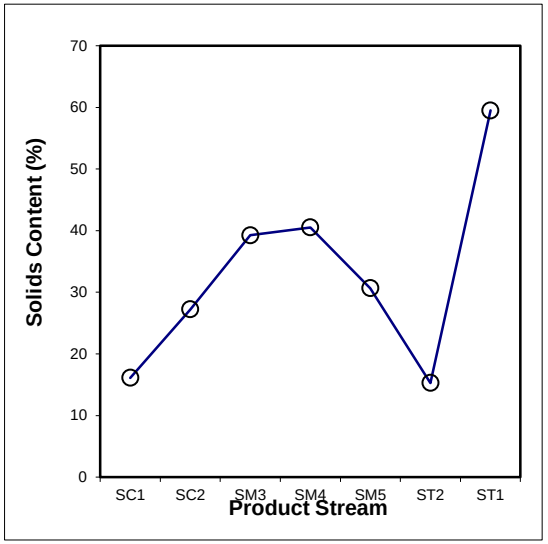
Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
SC1	5	10439.00	1103.40	7.157	3475.1	2021.1	1.153	45.76	16.11
SC2	5	1703.25	174.02	1.186	2421.3	2014.2	0.323	12.81	27.23
SM3	10	1377.03	91.62	0.502	2980.0	2483.1	0.197	7.82	39.24
SM4	20	996.21	94.65	0.176	2373.0	2014.2	0.071	2.82	40.52
SM5	20	979.16	90.43	0.173	2281.7	2014.3	0.053	2.10	30.67
ST2	70	1029.27	103.68	0.051	2622.8	2484.3	0.008	0.31	15.27
ST1	10	3041.54	176.15	1.201	3816.8	2014.3	0.715	28.37	59.51
Total (Calc)	--	--	--	10.445	--	--	2.519	100.00	24.12
Total (Head)	5	13256	1014.26	10.445	5198.2	2021.0	2.519	--	24.12







SPIRAL DATA ANALYSIS

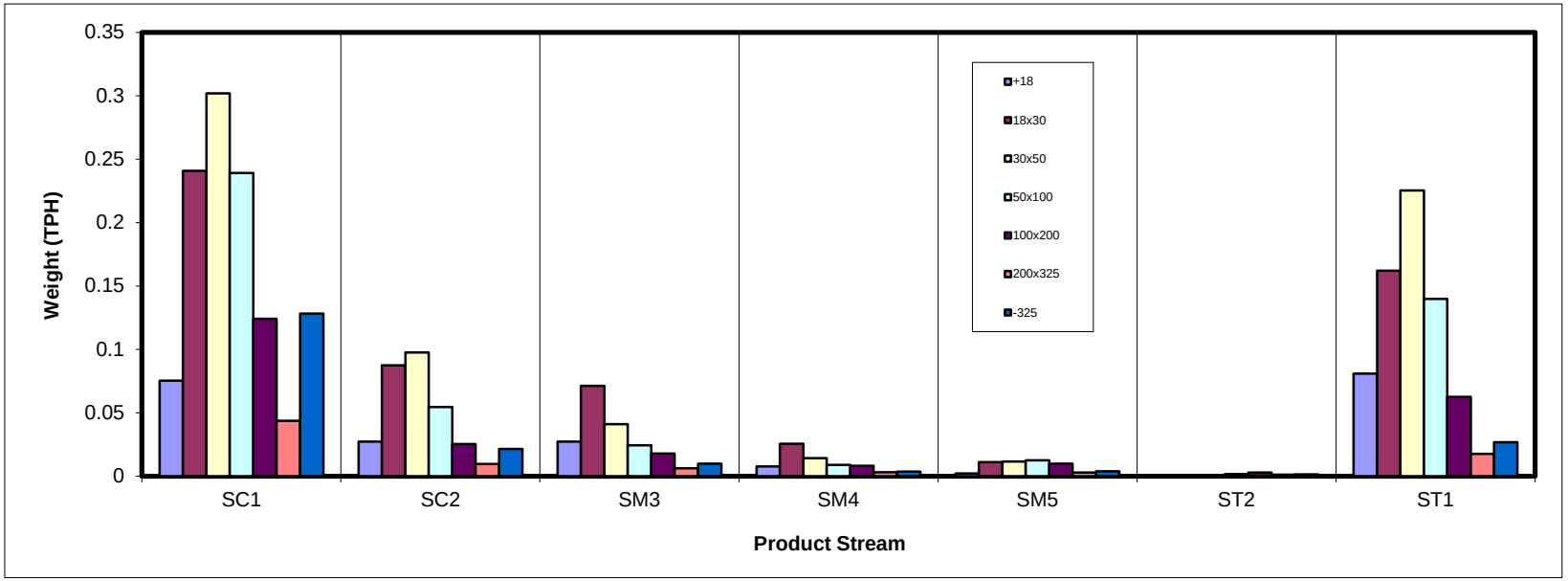
Description: Experiment: 1 - Cardinal In-Plant Test

Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%		
+18	0.075	0.027	0.027	0.008	0.002	0.000	0.081		0.220
18x30	0.241	0.087	0.071	0.026	0.011	0.000	0.162		0.598
30x50	0.302	0.097	0.041	0.014	0.011	0.001	0.225		0.692
50x100	0.239	0.055	0.024	0.009	0.012	0.002	0.140		0.481
100x200	0.124	0.025	0.018	0.008	0.010	0.003	0.062		0.250
200x325	0.044	0.010	0.006	0.003	0.003	0.001	0.018		0.084
-325	0.128	0.021	0.010	0.004	0.004	0.001	0.027		0.195
Total (Calc)	1.153	0.323	0.197	0.071	0.053	0.008	0.715		2.519



SPIRAL DATA ANALYSIS

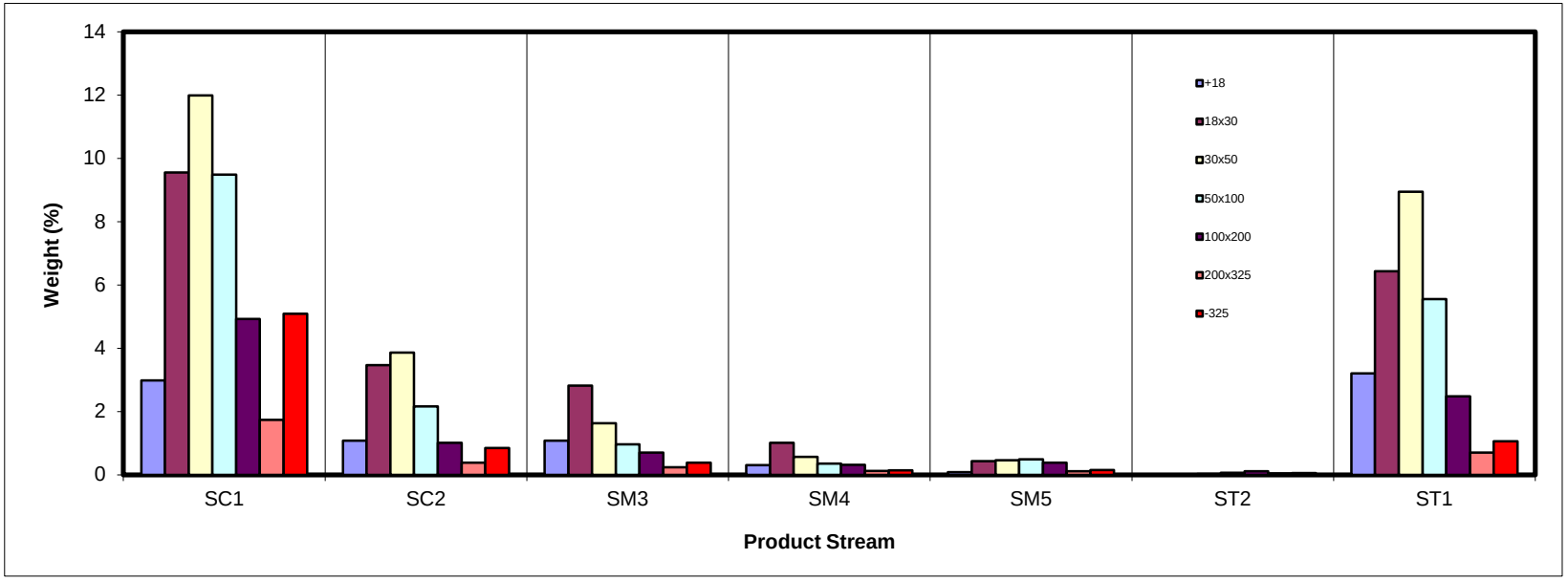
Description: Experiment: 1 - Cardinal In-Plant Test

Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%		
+18	2.99	1.08	1.08	0.31	0.08	0.00	3.21		8.74
18x30	9.56	3.47	2.82	1.01	0.43	0.01	6.43		23.73
30x50	11.99	3.87	1.63	0.56	0.46	0.03	8.94		27.47
50x100	9.49	2.16	0.97	0.35	0.49	0.07	5.55		19.08
100x200	4.93	1.01	0.70	0.32	0.38	0.11	2.48		9.93
200x325	1.74	0.38	0.24	0.12	0.11	0.04	0.70		3.33
-325	5.09	0.85	0.39	0.14	0.15	0.05	1.06		7.72
Total (Calc)	45.76	12.81	7.82	2.82	2.10	0.31	28.37		100.00



SPIRAL DATA ANALYSIS

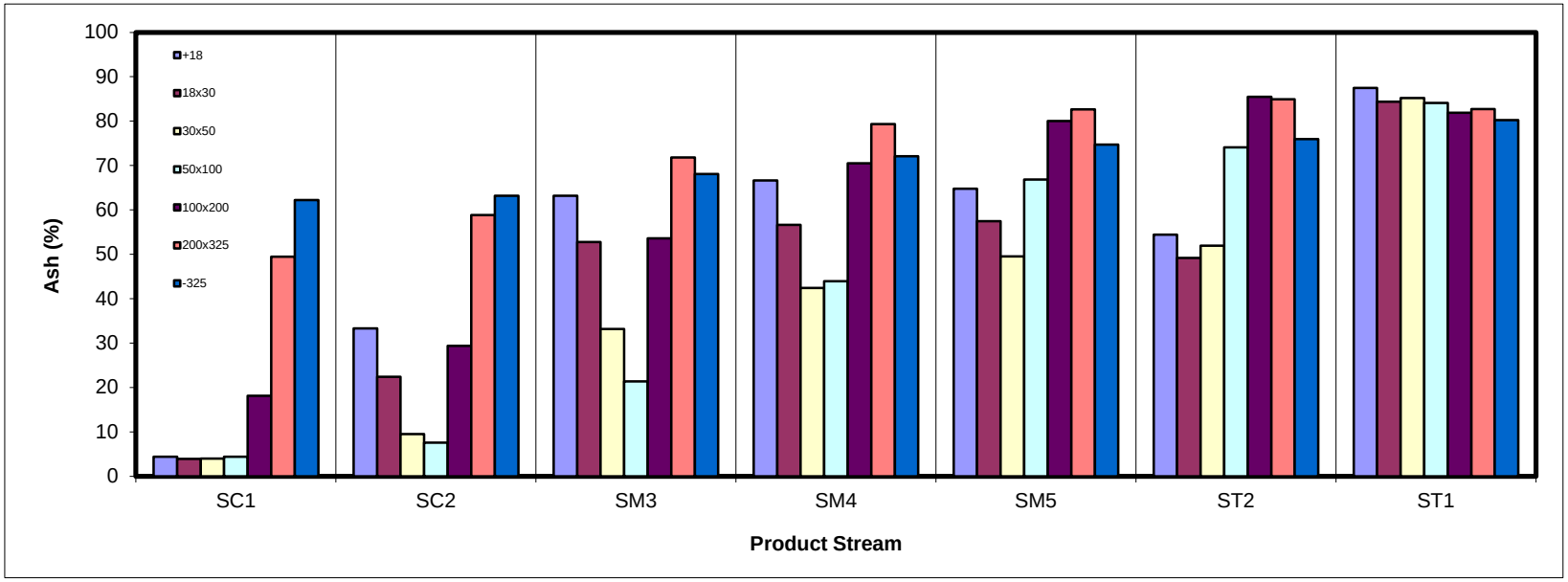
Description: Experiment: 1 - Cardinal In-Plant Test

Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%		
+18	4.38	33.35	63.16	66.64	64.74	54.44	87.46		48.45
18x30	3.94	22.43	52.74	56.65	57.47	49.18	84.35		37.47
30x50	4.00	9.49	33.16	42.41	49.54	51.96	85.22		34.53
50x100	4.41	7.59	21.35	43.92	66.82	74.07	84.09		31.40
100x200	18.13	29.36	53.57	70.53	80.03	85.46	81.91		42.54
200x325	49.46	58.81	71.79	79.31	82.66	84.94	82.73		61.77
-325	62.20	63.16	68.10	72.06	74.68	75.93	80.27		65.59
Total (Calc)	13.81	21.26	47.64	56.65	64.87	77.39	84.52		39.95



SPIRAL DATA ANALYSIS

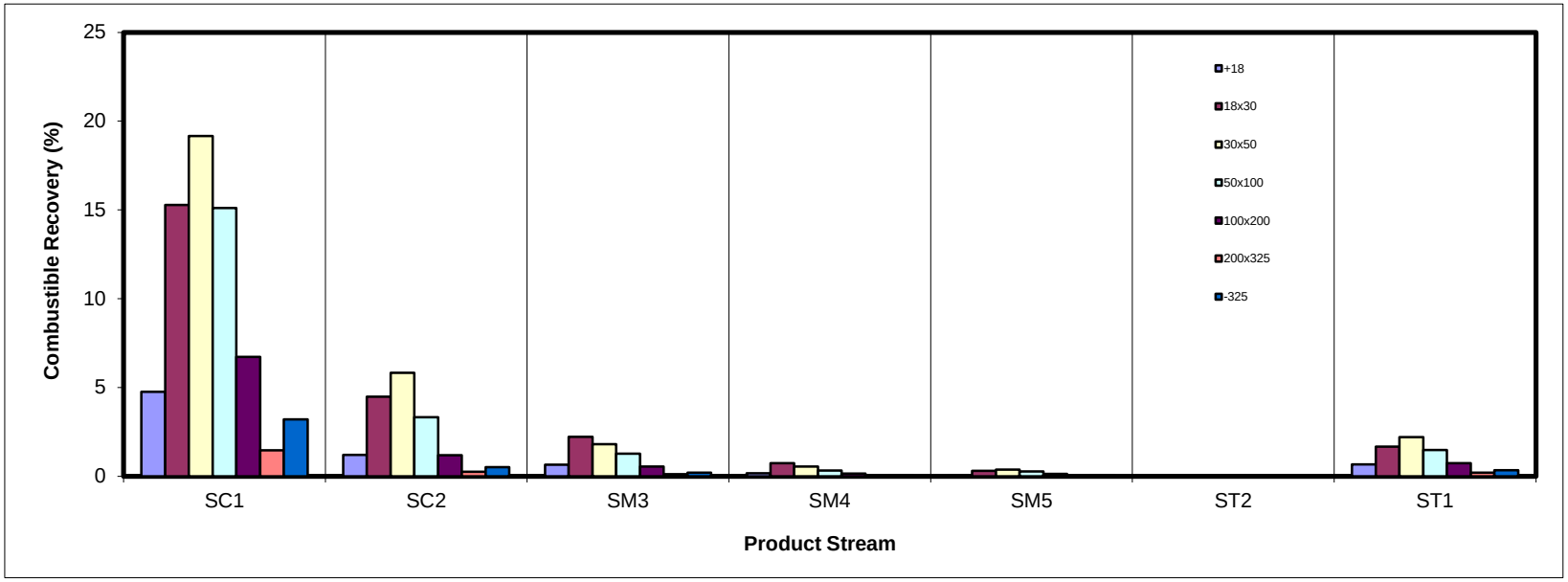
Description: Experiment: 1 - Cardinal In-Plant Test

Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%		
+18	4.75	1.20	0.66	0.17	0.05	0.00	0.67		7.50
18x30	15.29	4.48	2.22	0.73	0.31	0.01	1.68		24.71
30x50	19.16	5.83	1.81	0.54	0.38	0.02	2.20		29.95
50x100	15.10	3.33	1.27	0.33	0.27	0.03	1.47		21.80
100x200	6.72	1.18	0.54	0.16	0.13	0.03	0.75		9.50
200x325	1.46	0.26	0.11	0.04	0.03	0.01	0.20		2.12
-325	3.20	0.52	0.20	0.07	0.06	0.02	0.35		4.42
Total (Calc)	65.68	16.80	6.82	2.04	1.23	0.12	7.31		100.00



SPIRAL DATA ANALYSIS

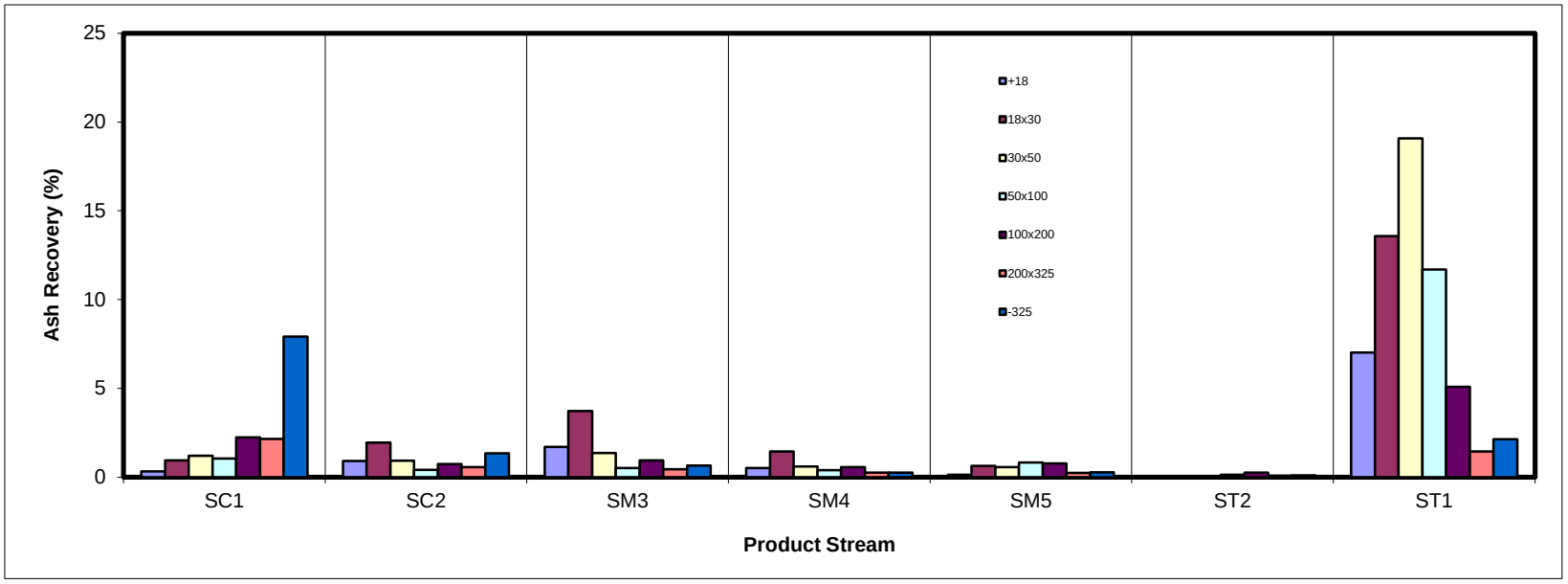
Description: Experiment: 1 - Cardinal In-Plant Test

Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%		
+18	0.33	0.90	1.70	0.51	0.13	0.00	7.02		10.60
18x30	0.94	1.95	3.72	1.44	0.62	0.01	13.58		22.26
30x50	1.20	0.92	1.35	0.60	0.57	0.03	19.08		23.74
50x100	1.05	0.41	0.52	0.39	0.82	0.13	11.69		15.00
100x200	2.24	0.74	0.94	0.56	0.77	0.24	5.08		10.57
200x325	2.15	0.56	0.43	0.25	0.23	0.09	1.44		5.15
-325	7.92	1.34	0.66	0.26	0.27	0.10	2.13		12.68
Total (Calc)	15.82	6.82	9.32	4.00	3.42	0.60	60.01		100.00



SPIRAL DATA ANALYSIS

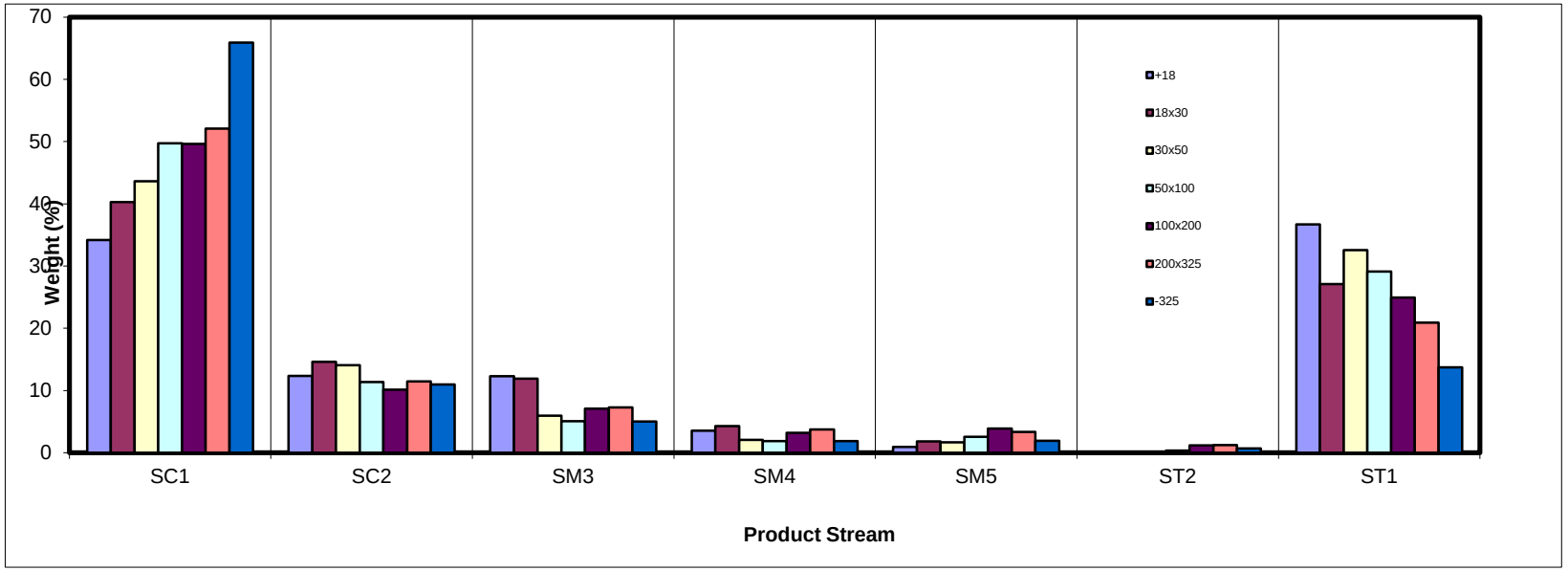
Description: Experiment: 1 - Cardinal In-Plant Test

Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%		
+18	34.17	12.34	12.31	3.52	0.94	0.02	36.70		100.00
18x30	40.27	14.61	11.89	4.27	1.83	0.04	27.10		100.00
30x50	43.64	14.07	5.92	2.05	1.66	0.09	32.56		100.00
50x100	49.71	11.34	5.06	1.85	2.57	0.36	29.10		100.00
100x200	49.61	10.13	7.08	3.21	3.88	1.15	24.94		100.00
200x325	52.07	11.47	7.25	3.74	3.32	1.23	20.92		100.00
-325	65.89	10.98	4.99	1.85	1.90	0.67	13.72		100.00
Total (Calc)	45.76	12.81	7.82	2.82	2.10	0.31	28.37		100.00



SPIRAL DATA ANALYSIS

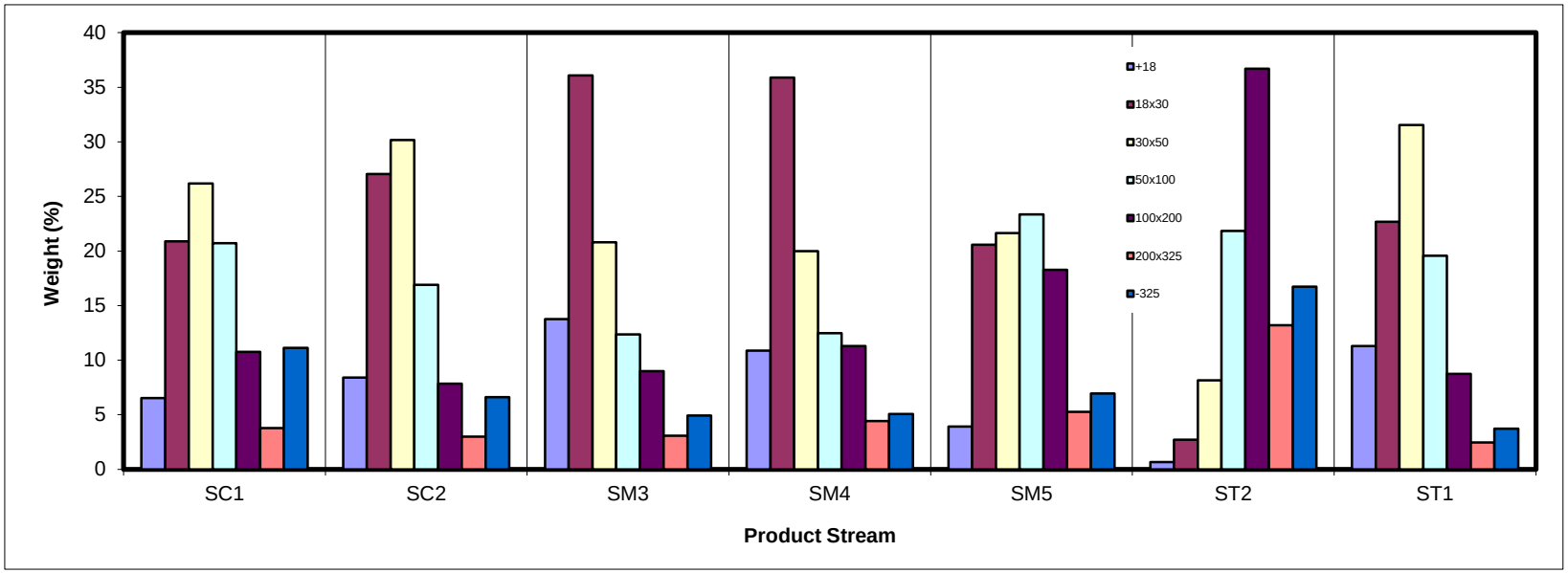
Description: Experiment: 1 - Cardinal In-Plant Test

Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%		
+18	6.52	8.42	13.75	10.88	3.92	0.66	11.30		8.74
18x30	20.88	27.06	36.07	35.89	20.59	2.71	22.67		23.73
30x50	26.19	30.17	20.81	19.99	21.65	8.16	31.53		27.47
50x100	20.73	16.90	12.36	12.47	23.34	21.83	19.58		19.08
100x200	10.76	7.86	8.99	11.29	18.29	36.72	8.73		9.93
200x325	3.79	2.98	3.09	4.41	5.26	13.19	2.46		3.33
-325	11.12	6.62	4.93	5.07	6.96	16.74	3.73		7.72
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

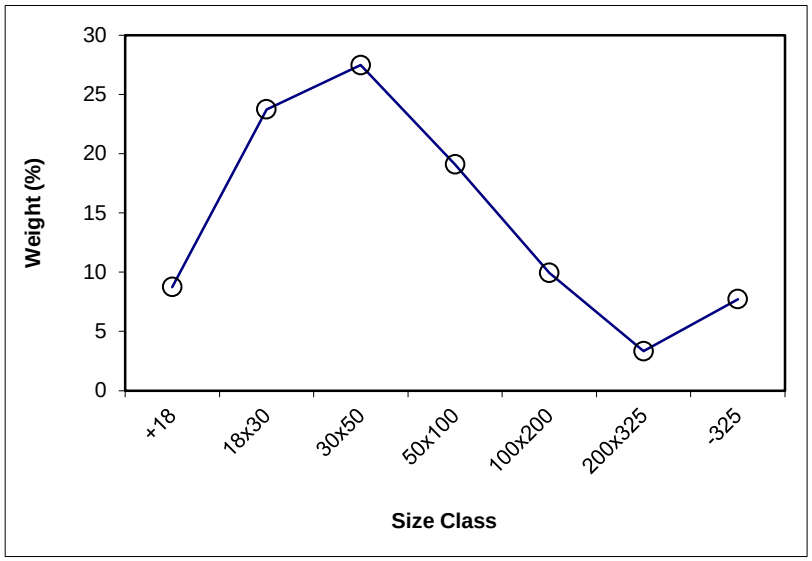
Description: Experiment: 1 - Cardinal In-Plant Test

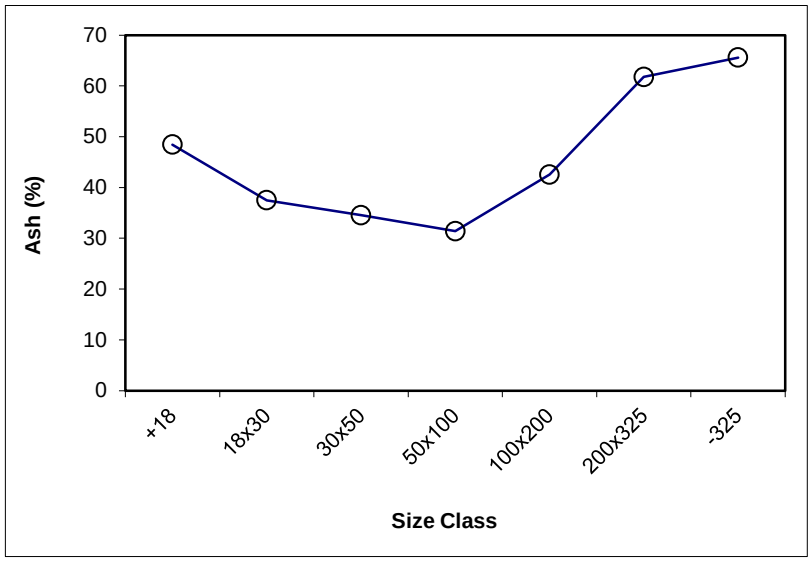
Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	678.8	401.2	277.60	8.74	48.45	8.74	48.45	100.00	39.95
18x30	1124.0	370.0	753.91	23.73	37.47	32.47	40.43	91.26	39.14
30x50	1209.0	336.3	872.72	27.47	34.53	59.93	37.73	67.53	39.72
50x100	914.4	308.1	606.26	19.08	31.40	79.02	36.20	40.07	43.27
100x200	610.0	294.5	315.52	9.93	42.54	88.95	36.91	20.98	54.07
200x325	403.9	298.0	105.87	3.33	61.77	92.28	37.80	11.05	64.44
-325	258.1	12.8	245.33	7.72	65.59	100.00	39.95	7.72	65.59
Total (Calc)	--	--	3177.21	100.00	39.95	--	--	--	--





SPIRAL DATA ANALYSIS

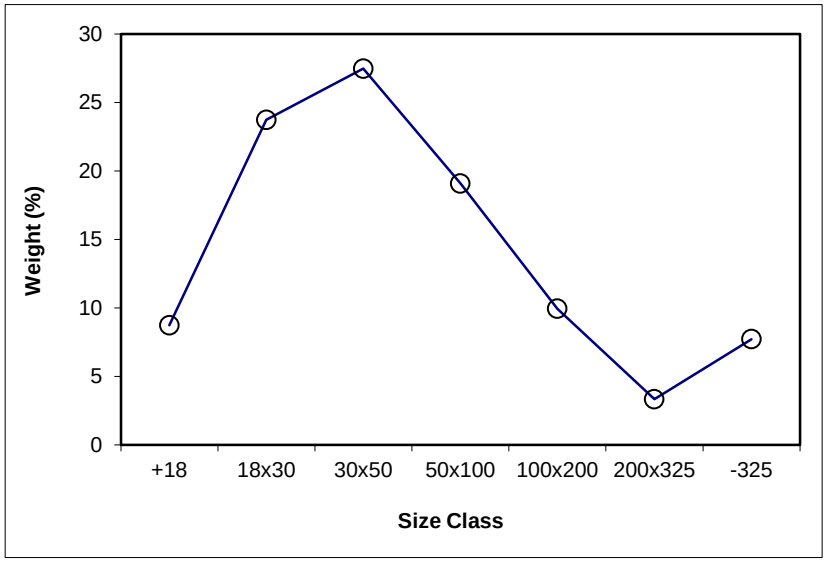
Description: Experiment: 1 - Cardinal In-Plant Test

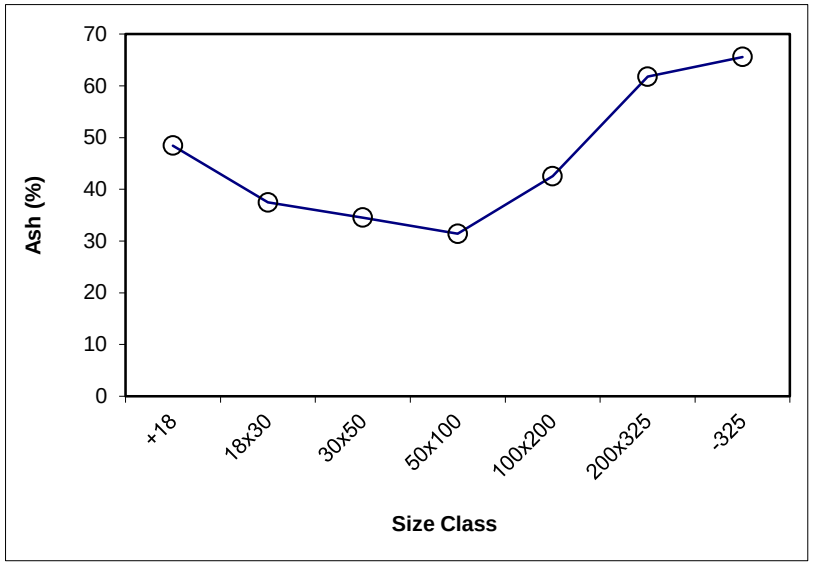
Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	8.74	48.45	8.74	48.45	100.00	39.95			
18x30	23.73	37.47	32.47	40.43	91.26	39.14	x	23.73	37.47
30x50	27.47	34.53	59.93	37.73	67.53	39.72	x	27.47	34.53
50x100	19.08	31.40	79.02	36.20	40.07	43.27	x	19.08	31.40
100x200	9.93	42.54	88.95	36.91	20.98	54.07	x	9.93	42.54
200x325	3.33	61.77	92.28	37.80	11.05	64.44	x	3.33	61.77
-325	7.72	65.59	100.00	39.95	7.72	65.59			
Total (Calc)	100.00	39.95	--	--	--	--	--	83.54	36.69





SPIRAL DATA ANALYSIS

Description: Experiment: 1 - Cardinal In-Plant Test

Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product SC1 Feed Weight (%): 45.76

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	496.07	401.2	94.86	6.52	4.38	6.52	4.38	100.00	13.81
18x30	673.65	370.0	303.61	20.88	3.94	27.41	4.04	93.48	14.47
30x50	717.10	336.3	380.82	26.19	4.00	53.60	4.02	72.59	17.50
50x100	609.53	308.1	301.40	20.73	4.41	74.33	4.13	46.40	25.12
100x200	451.01	294.5	156.52	10.76	18.13	85.09	5.90	25.67	41.84
200x325	353.12	298.0	55.13	3.79	49.46	88.88	7.76	14.91	58.96
-325	174.60	13.0	161.65	11.12	62.20	100.00	13.81	11.12	62.20
Total (Calc)	--	--	1453.98	100.00	13.81	--	--	--	--

Product SC2 Feed Weight (%): 12.81

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	435.5	401.2	34.26	8.42	33.35	8.42	33.35	100.00	21.26
18x30	480.2	370.0	110.15	27.06	22.43	35.48	25.02	91.58	20.15
30x50	459.1	336.3	122.83	30.17	9.49	65.65	17.88	64.52	19.19
50x100	376.9	308.1	68.77	16.90	7.59	82.55	15.77	34.35	27.72
100x200	326.5	294.5	31.98	7.86	29.36	90.40	16.95	17.45	47.21
200x325	310.1	298.0	12.14	2.98	58.81	93.38	18.29	9.60	61.81
-325	33.0	6.1	26.93	6.62	63.16	100.00	21.26	6.62	63.16
Total (Calc)	--	--	407.06	100.00	21.26	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Experiment: 1 - Cardinal In-Plant Test

Comments: 12T0+2CT1 Compound Spiral (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product SM3 Feed Weight (%): 7.82

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	528.5	460.1	68.33	13.75	63.16	13.75	63.16	100.00	47.64
18x30	621.4	442.2	179.25	36.07	52.74	49.83	55.62	86.25	45.17
30x50	515.2	411.8	103.39	20.81	33.16	70.63	49.00	50.17	39.72
50x100	454.4	393.0	61.40	12.36	21.35	82.99	44.88	29.37	44.37
100x200	436.0	391.3	44.69	8.99	53.57	91.98	45.73	17.01	61.09
200x325	394.0	378.6	15.35	3.09	71.79	95.07	46.58	8.02	69.52
-325	30.5	6.0	24.49	4.93	68.10	100.00	47.64	4.93	68.10
Total (Calc)	--	--	496.90	100.00	47.64	--	--	--	--

Product SM4 Feed Weight (%): 2.82

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	440.3	401.2	39.04	10.88	66.64	10.88	66.64	100.00	56.65
18x30	498.8	370.0	128.76	35.89	56.65	46.77	58.97	89.12	55.43
30x50	408.0	336.3	71.70	19.99	42.41	66.76	54.01	53.23	54.61
50x100	352.9	308.1	44.75	12.47	43.92	79.23	52.43	33.24	61.94
100x200	335.0	294.5	40.50	11.29	70.53	90.52	54.68	20.77	72.77
200x325	313.8	298.0	15.83	4.41	79.31	94.93	55.83	9.48	75.43
-325	24.3	6.1	18.18	5.07	72.06	100.00	56.65	5.07	72.06
Total (Calc)	--	--	358.77	100.00	56.65	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Experiment: 1 - Cardinal In-Plant Test

Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product SM5 Feed Weight (%): 2.10

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	411.7	401.2	10.47	3.92	64.74	3.92	64.74	100.00	64.87
18x30	425.1	370.0	55.07	20.59	57.47	24.50	58.64	96.08	64.88
30x50	394.2	336.3	57.90	21.65	49.54	46.15	54.37	75.50	66.89
50x100	370.6	308.1	62.44	23.34	66.82	69.50	58.55	53.85	73.87
100x200	343.4	294.5	48.91	18.29	80.03	87.78	63.03	30.50	79.26
200x325	312.0	298.0	14.06	5.26	82.66	93.04	64.14	12.22	78.11
-325	24.7	6.1	18.62	6.96	74.68	100.00	64.87	6.96	74.68
Total (Calc)	--	--	267.47	100.00	64.87	--	--	--	--

Product ST2 Feed Weight (%): 0.31

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	461.1	460.1	0.91	0.66	54.44	0.66	54.44	100.00	77.39
18x30	445.9	442.2	3.75	2.71	49.18	3.37	50.21	99.34	77.54
30x50	423.1	411.8	11.29	8.16	51.96	11.52	51.45	96.63	78.34
50x100	423.3	393.0	30.22	21.83	74.07	33.35	66.25	88.48	80.77
100x200	442.2	391.3	50.84	36.72	85.46	70.07	76.32	66.65	82.96
200x325	397.9	379.6	18.27	13.19	84.94	83.26	77.68	29.93	79.90
-325	29.4	6.2	23.18	16.74	75.93	100.00	77.39	16.74	75.93
Total (Calc)	--	--	138.47	100.00	77.39	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Experiment: 1 - Cardinal In-Plant Test

Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product ST1 Feed Weight (%): 28.37

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	605.0	401.2	203.74	11.30	87.46	11.30	87.46	100.00	84.52
18x30	778.6	370.0	408.60	22.67	84.35	33.97	85.38	88.70	84.14
30x50	904.6	336.3	568.34	31.53	85.22	65.50	85.31	66.03	84.08
50x100	661.0	308.1	352.87	19.58	84.09	85.08	85.03	34.50	83.02
100x200	451.9	294.5	157.39	8.73	81.91	93.81	84.74	14.92	81.63
200x325	342.3	298.0	44.30	2.46	82.73	96.27	84.69	6.19	81.24
-325	73.4	6.1	67.31	3.73	80.27	100.00	84.52	3.73	80.27
Total (Calc)	--	--	1802.54	100.00	84.52	--	--	--	--

SPIRAL DATA ANALYSIS

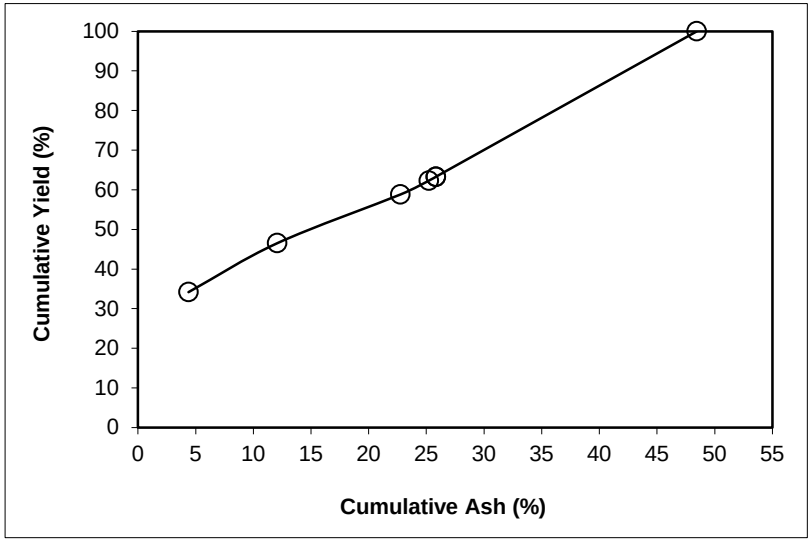
Description: Experiment: 1 - Cardinal In-Plant Test

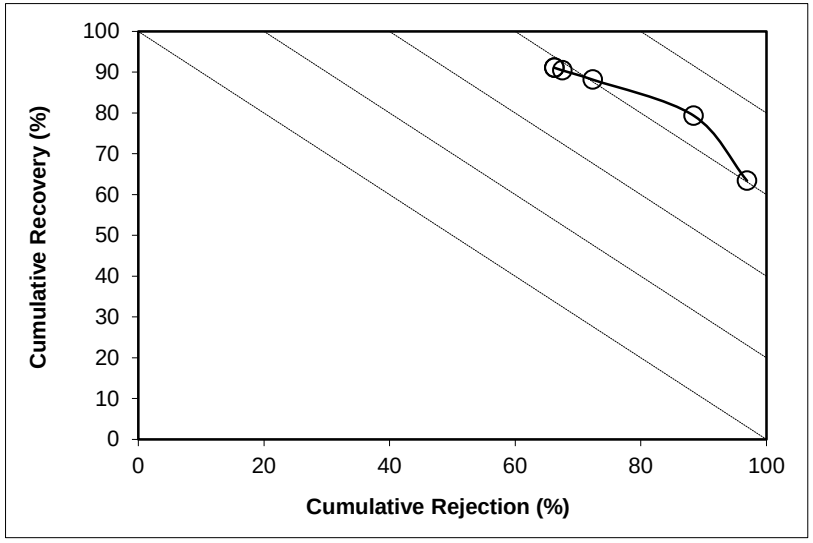
Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 8.74

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	34.17	4.38	34.17	4.38	63.38	65.83	71.32	96.91	60.29
SC2	12.34	33.35	46.51	12.07	79.34	53.49	80.09	88.42	67.76
SM3	12.31	63.16	58.82	22.76	88.14	41.18	85.15	72.37	60.51
SM4	3.52	66.64	62.34	25.23	90.41	37.66	86.87	67.54	57.95
SM5	0.94	64.74	63.28	25.82	91.06	36.72	87.44	66.28	57.33
ST2	0.02	54.44	63.30	25.83	91.08	36.70	87.46	66.25	57.33
ST1	36.70	87.46	100.00	48.45	100.00	0.00			
Total (Calc)	100.00	48.45	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

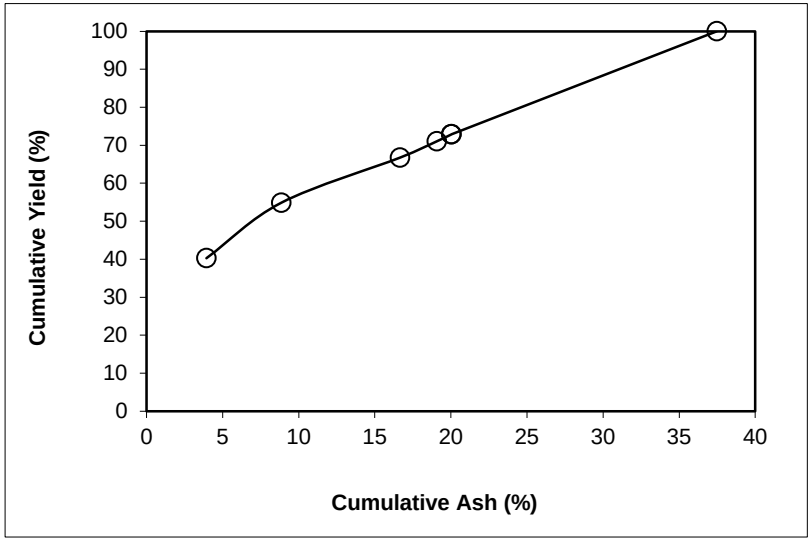
Description: Experiment: 1 - Cardinal In-Plant Test

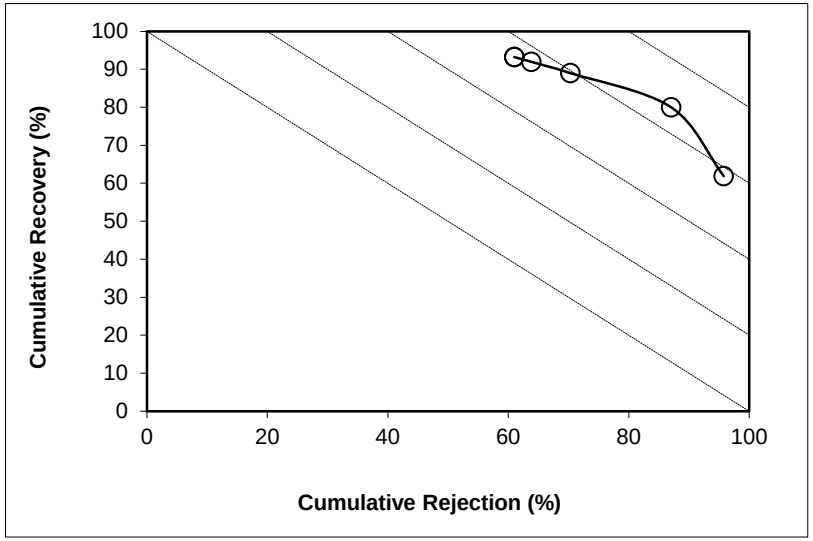
Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 23.73

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	40.27	3.94	40.27	3.94	61.87	59.73	60.09	95.77	57.64
SC2	14.61	22.43	54.88	8.86	80.00	45.12	72.28	87.03	67.03
SM3	11.89	52.74	66.77	16.67	88.98	33.23	79.27	70.30	59.28
SM4	4.27	56.65	71.04	19.07	91.95	28.96	82.61	63.84	55.79
SM5	1.83	57.47	72.87	20.04	93.19	27.13	84.30	61.04	54.23
ST2	0.04	49.18	72.90	20.05	93.22	27.10	84.35	60.99	54.21
ST1	27.10	84.35	100.00	37.47	100.00	0.00			
Total (Calc)	100.00	37.47	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

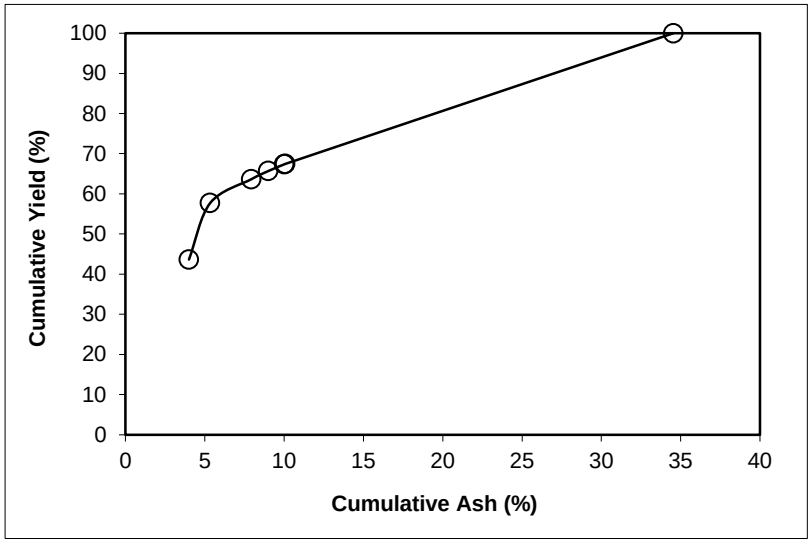
Description: Experiment: 1 - Cardinal In-Plant Test

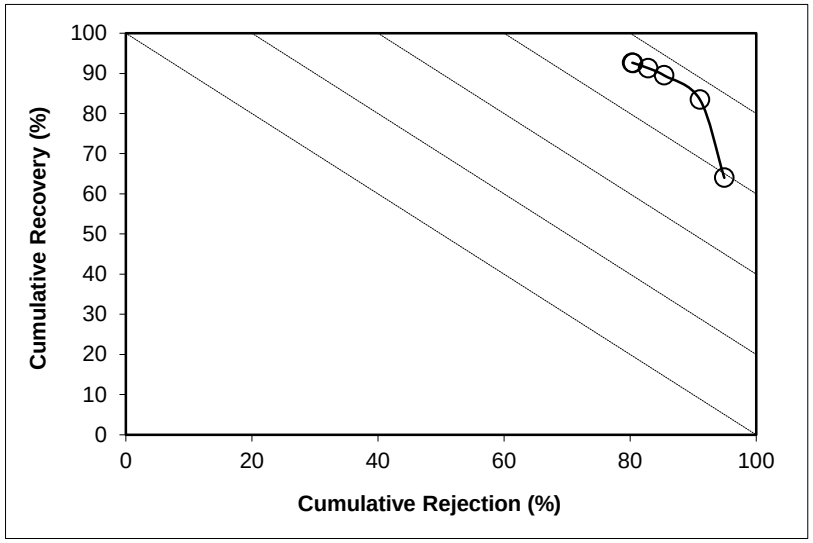
Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 27.47

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	43.64	4.00	43.64	4.00	63.99	56.36	58.18	94.95	58.94
SC2	14.07	9.49	57.71	5.34	83.45	42.29	74.38	91.08	74.53
SM3	5.92	33.16	63.63	7.93	89.50	36.37	81.09	85.40	74.89
SM4	2.05	42.41	65.69	9.00	91.30	34.31	83.41	82.87	74.18
SM5	1.66	49.54	67.35	10.00	92.58	32.65	85.13	80.49	73.08
ST2	0.09	51.96	67.44	10.06	92.65	32.56	85.22	80.35	73.01
ST1	32.56	85.22	100.00	34.53	100.00	0.00			
Total (Calc)	100.00	34.53	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

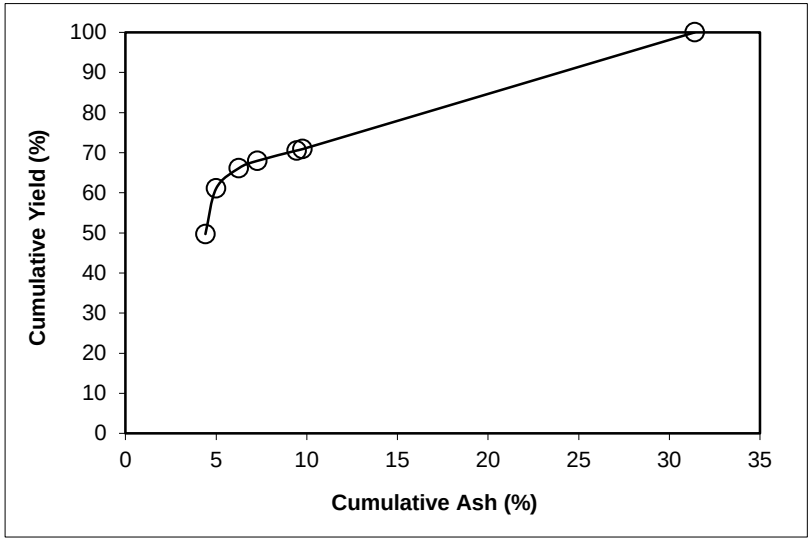
Description: Experiment: 1 - Cardinal In-Plant Test

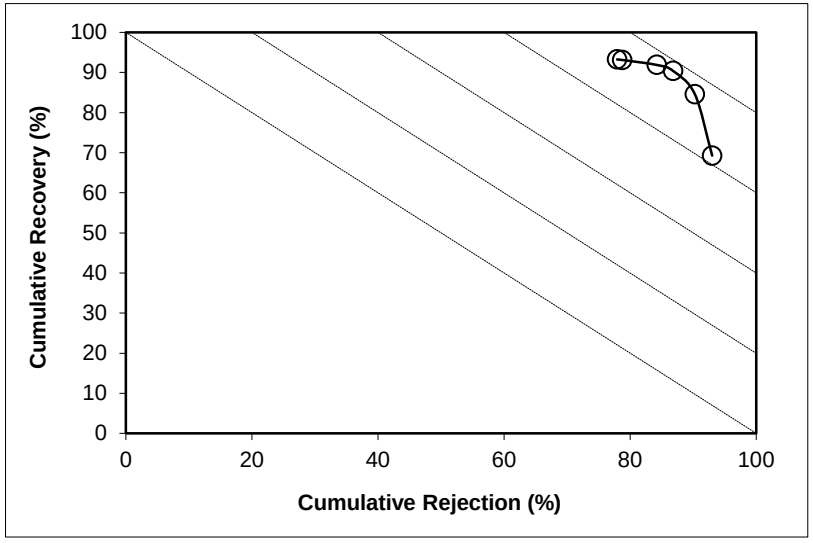
Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 19.08

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	49.71	4.41	49.71	4.41	69.27	50.29	58.08	93.02	62.30
SC2	11.34	7.59	61.06	5.00	84.56	38.94	72.79	90.28	74.84
SM3	5.06	21.35	66.12	6.25	90.36	33.88	80.48	86.84	77.20
SM4	1.85	43.92	67.97	7.27	91.87	32.03	82.59	84.26	76.13
SM5	2.57	66.82	70.54	9.45	93.11	29.46	83.96	78.78	71.89
ST2	0.36	74.07	70.90	9.77	93.25	29.10	84.09	77.94	71.19
ST1	29.10	84.09	100.00	31.40	100.00	0.00			
Total (Calc)	100.00	31.40	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

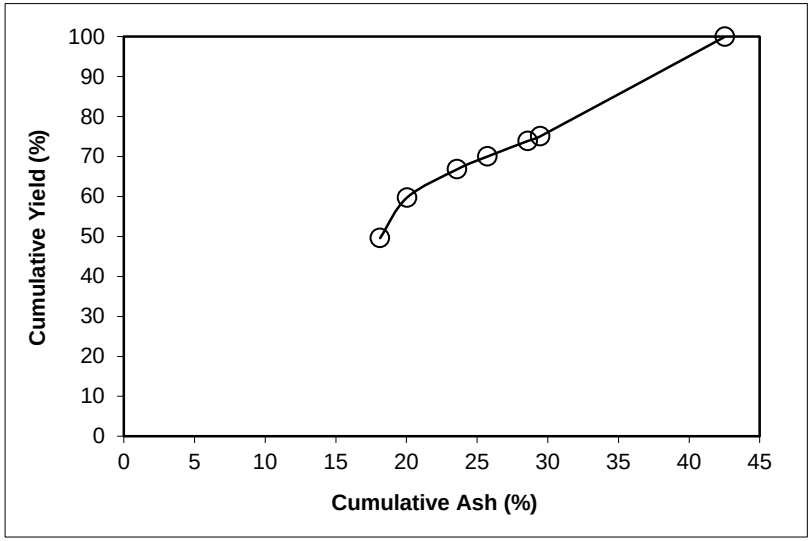
Description: Experiment: 1 - Cardinal In-Plant Test

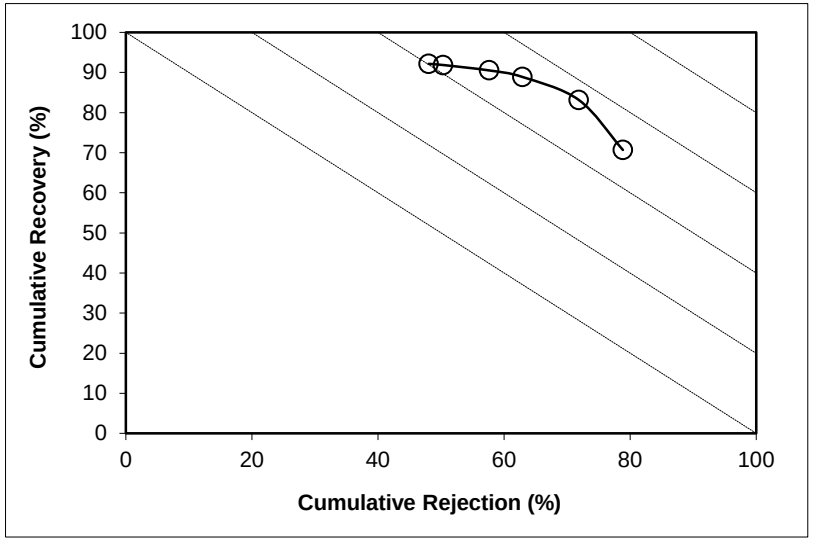
Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 9.93

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	49.61	18.13	49.61	18.13	70.68	50.39	66.57	78.86	49.54
SC2	10.13	29.36	59.74	20.04	83.14	40.26	75.94	71.86	55.00
SM3	7.08	53.57	66.82	23.59	88.86	33.18	80.71	62.94	51.81
SM4	3.21	70.53	70.03	25.74	90.51	29.97	81.80	57.62	48.13
SM5	3.88	80.03	73.91	28.59	91.86	26.09	82.07	50.33	42.19
ST2	1.15	85.46	75.06	29.46	92.15	24.94	81.91	48.02	40.17
ST1	24.94	81.91	100.00	42.54	100.00	0.00			
Total (Calc)	100.00	42.54	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

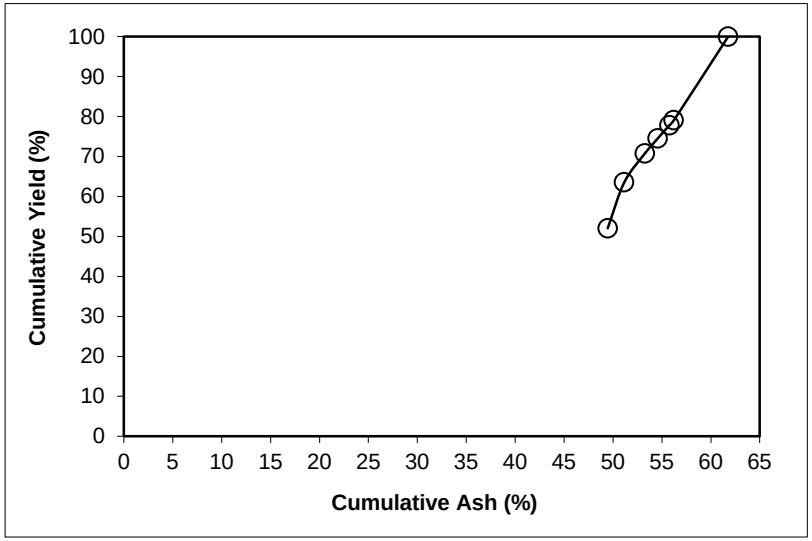
Description: Experiment: 1 - Cardinal In-Plant Test

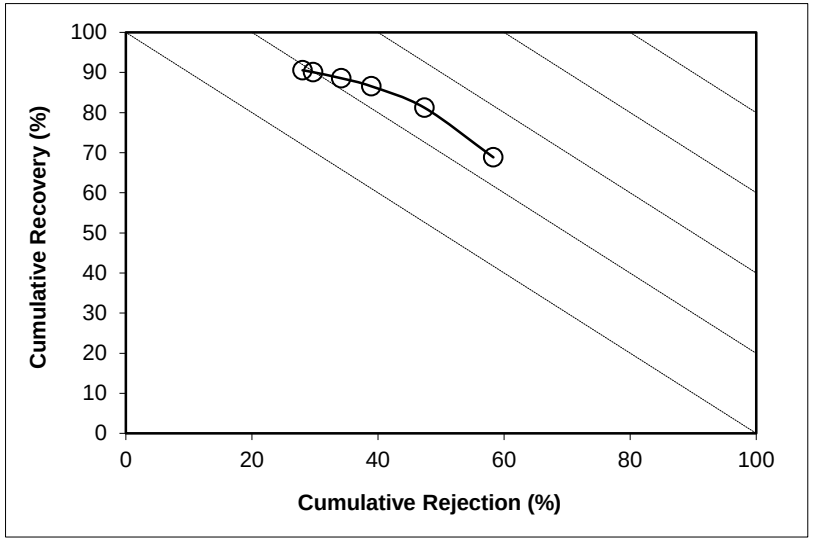
Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 3.33

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	52.07	49.46	52.07	49.46	68.84	47.93	75.14	58.30	27.14
SC2	11.47	58.81	63.54	51.15	81.19	36.46	80.27	47.39	28.57
SM3	7.25	71.79	70.79	53.26	86.54	29.21	82.38	38.96	25.50
SM4	3.74	79.31	74.53	54.57	88.56	25.47	82.83	34.16	22.72
SM5	3.32	82.66	77.85	55.77	90.07	22.15	82.85	29.72	19.78
ST2	1.23	84.94	79.08	56.22	90.55	20.92	82.73	28.02	18.57
ST1	20.92	82.73	100.00	61.77	100.00	0.00			
Total (Calc)	100.00	61.77	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

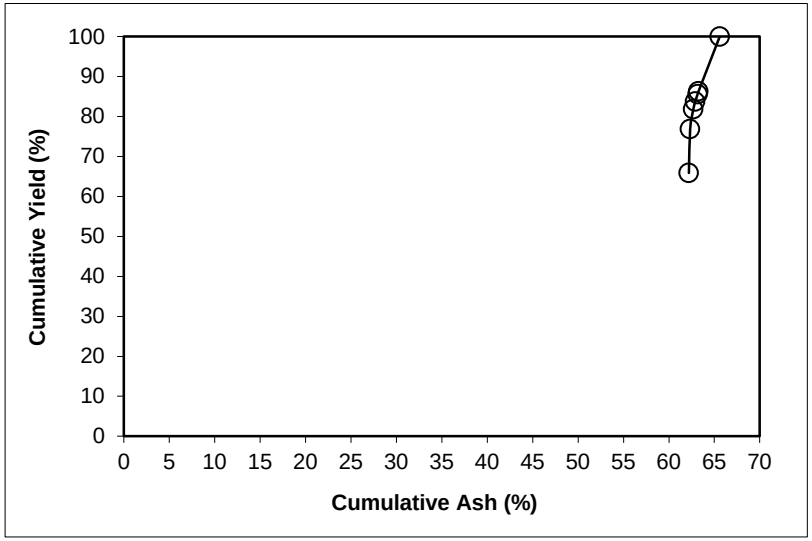
Description: Experiment: 1 - Cardinal In-Plant Test

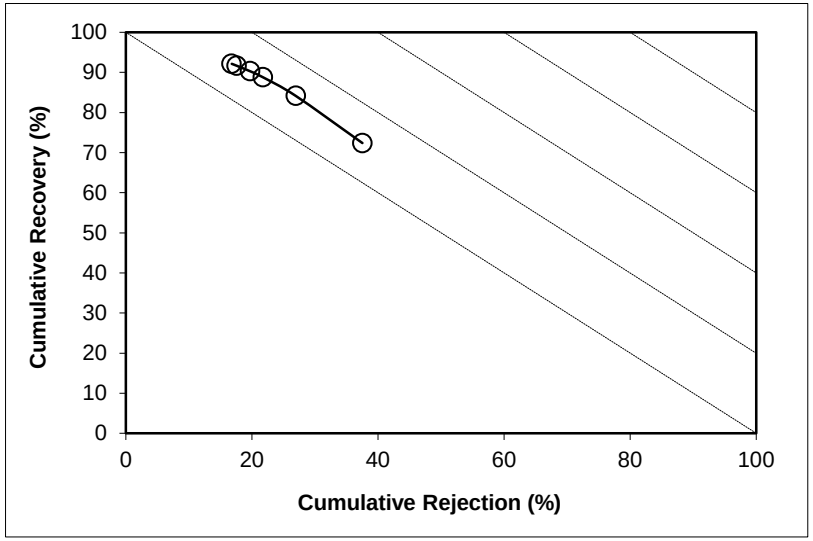
Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 7.72

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	65.89	62.20	65.89	62.20	72.38	34.11	72.14	37.52	9.90
SC2	10.98	63.16	76.87	62.34	84.13	23.13	76.40	26.95	11.08
SM3	4.99	68.10	81.86	62.69	88.76	18.14	78.68	21.76	10.52
SM4	1.85	72.06	83.71	62.90	90.27	16.29	79.44	19.73	9.99
SM5	1.90	74.68	85.61	63.16	91.66	14.39	80.06	17.57	9.23
ST2	0.67	75.93	86.28	63.26	92.13	13.72	80.27	16.79	8.92
ST1	13.72	80.27	100.00	65.59	100.00	0.00			
Total (Calc)	100.00	65.59	--	--	--	--	--	--	--





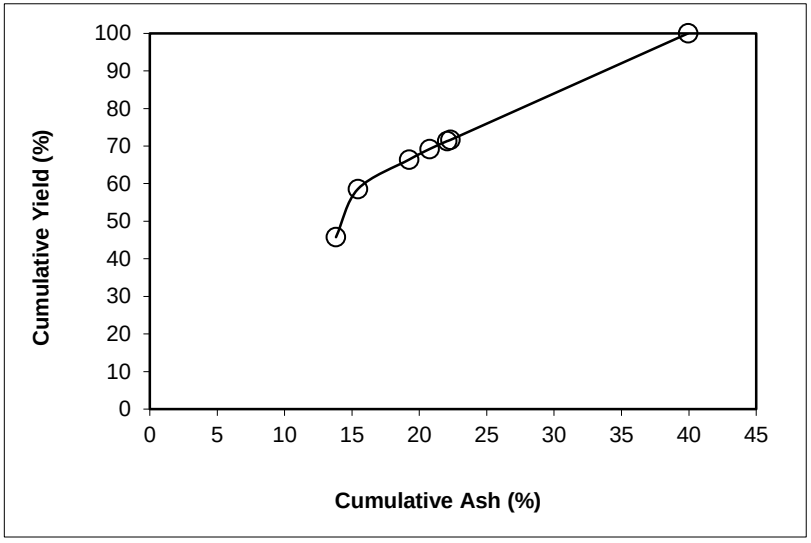
SPIRAL DATA ANALYSIS

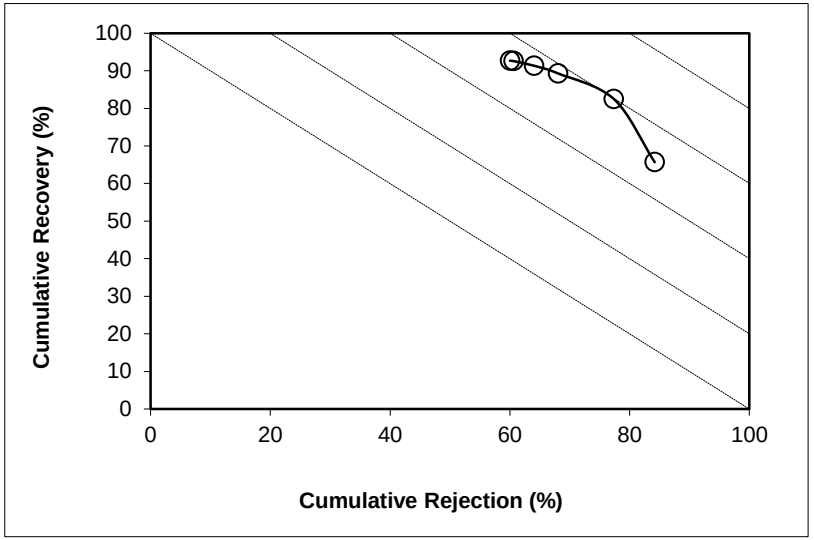
Description: Experiment: 1 - Cardinal In-Plant Test

Comments: 12T0+2CT1 Compund Spiral (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	45.76	13.81	45.76	13.81	65.68	54.24	62.01	84.18	49.86
SC2	12.81	21.26	58.57	15.44	82.48	41.43	74.61	77.36	59.85
SM3	7.82	47.64	66.39	19.23	89.30	33.61	80.88	68.04	57.34
SM4	2.82	56.65	69.22	20.76	91.34	30.78	83.10	64.03	55.37
SM5	2.10	64.87	71.32	22.06	92.57	28.68	84.44	60.62	53.19
ST2	0.31	77.39	71.63	22.30	92.69	28.37	84.52	60.01	52.70
ST1	28.37	84.52	100.00	39.95	100.00	0.00			
Total (Calc)	100.00	39.95	--	--	--	--	--	--	--

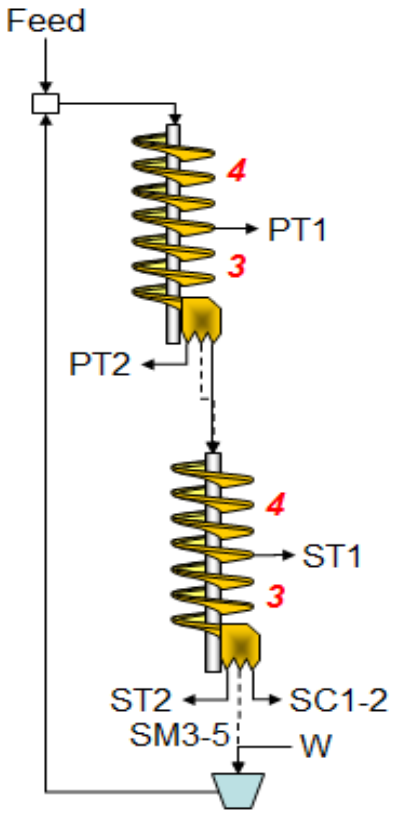




SPIRAL DATA ANALYSIS

Description: Experiment: 2 -Cardinal In-Plant Spiral Test

Comments: $1_{2T0}+2_{3T0}+3_{4T0}+4_{CT1}$ Spiral Circuit (1 x 0.15 mm Nominal Particle Size)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
SC1	40.0	34.9	100	87
SC2	34.9	28.6	87	72
SM3	28.6	21.6	72	54
SM4	21.6	16.7	54	42
SM5	16.7	8.3	42	21
ST2	8.3	0.0	21	0
ST1	0.0	--	0	--
PT2	0.0	--	0	--
PT1				

Stream ID	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
SC1	1.171	16.5	23.78	27.14
SC2	0.313	26.3	3.51	4.39
SM3	0.144	33.4	1.15	1.50
SM4	0.036	30.8	0.33	0.41
SM5	0.023	19.3	0.38	0.44
ST2	0.006	11.7	0.17	0.18
ST1	0.178	39.5	1.09	1.46
PT2	0.024	20.3	0.37	0.42
PT1	0.709	60.6	1.84	3.01
Total	2.604	24.2	32.63	38.94

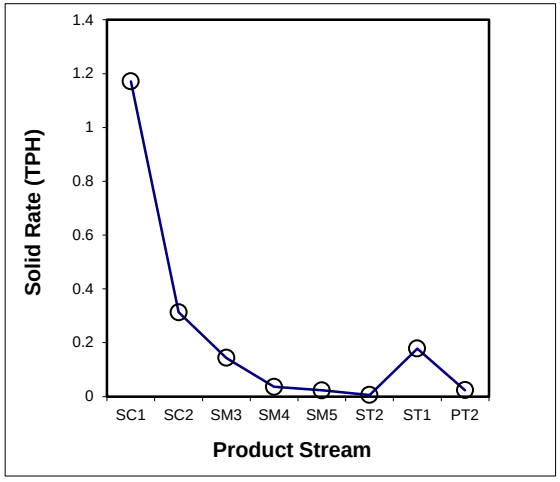
SPIRAL DATA ANALYSIS

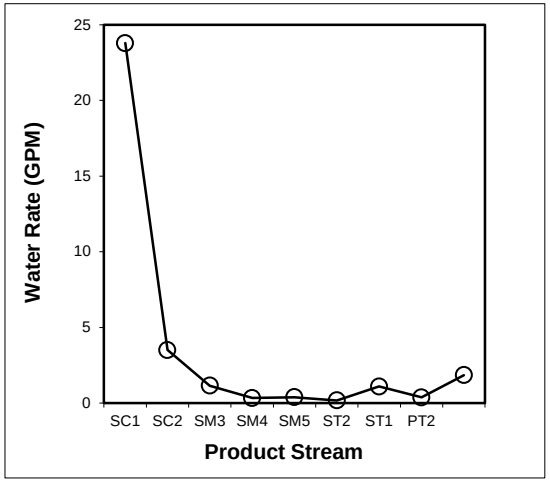
Description: Experiment: 2 -Cardinal In-Plant Spiral Test

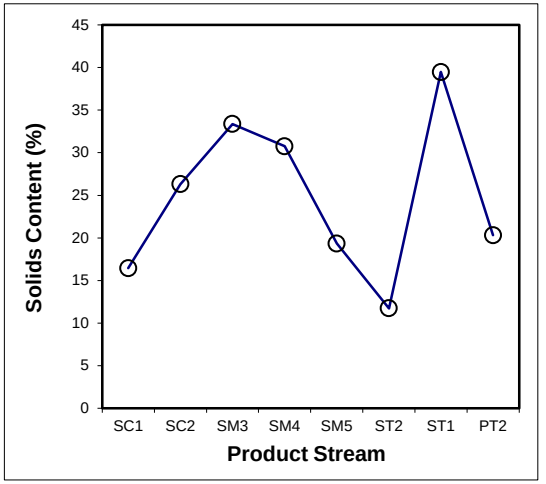
Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
SC1	5	10346.00	1162.60	7.117	3497.6	2020.8	1.171	44.97	16.45
SC2	5	1701.96	169.37	1.190	2409.2	2014.3	0.313	12.03	26.31
SM3	10	1199.73	91.57	0.431	2847.3	2484.3	0.144	5.53	33.37
SM4	25	853.55	93.68	0.118	2243.3	2014.2	0.036	1.40	30.76
SM5	20	707.42	93.61	0.119	2600.3	2484.2	0.023	0.88	19.35
ST2	70	949.06	90.80	0.047	2582.9	2484.5	0.006	0.21	11.74
ST1	10	1250.04	93.70	0.451	2463.7	2014.4	0.178	6.84	39.48
PT2	25	850.73	94.85	0.117	2634.9	2484.7	0.024	0.91	20.31
PT1	11	3461.05	169.09	1.170	3982.1	2014.7	0.709	27.23	60.62
Total (Calc)	--	--	--	10.762	--	--	2.604	100.00	24.20
Total (Head)	4	11189	1083.89	10.762	4647.8	2020.5	2.604	--	24.20







SPIRAL DATA ANALYSIS

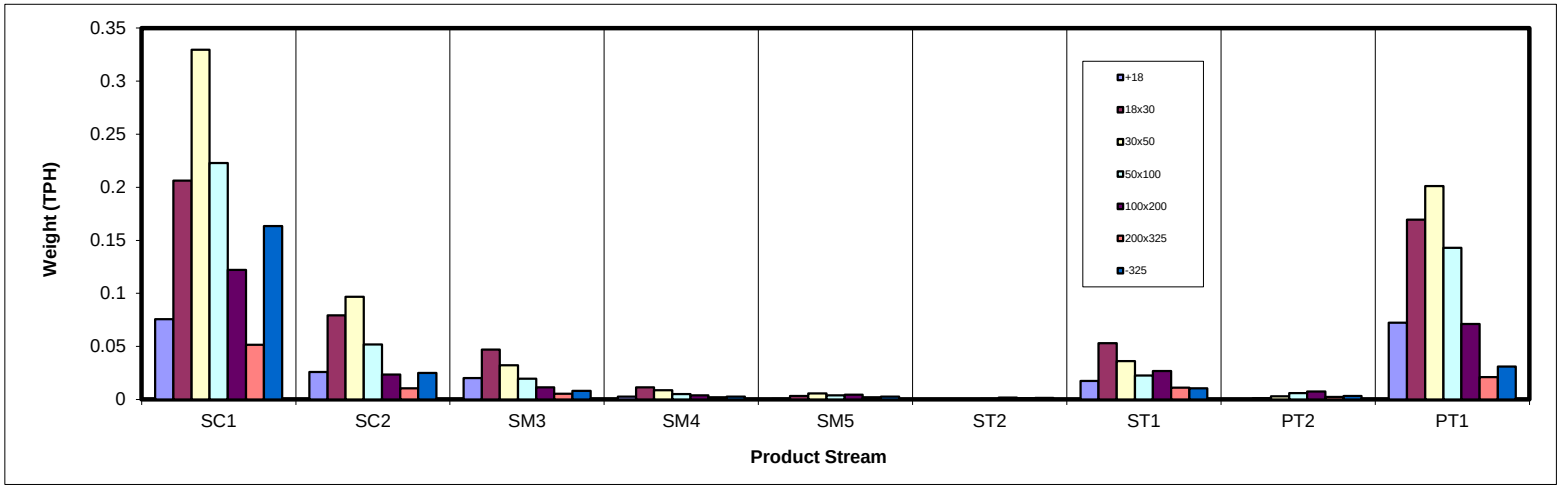
Description: Experiment: 2 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class									Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	PT1	
+18	0.076	0.026	0.020	0.003	0.001	0.000	0.018	0.000	0.072	0.215
18x30	0.206	0.079	0.047	0.011	0.003	0.000	0.053	0.001	0.170	0.571
30x50	0.329	0.097	0.032	0.009	0.006	0.000	0.036	0.003	0.201	0.713
50x100	0.223	0.052	0.020	0.005	0.004	0.001	0.023	0.006	0.143	0.475
100x200	0.122	0.023	0.011	0.004	0.004	0.002	0.027	0.007	0.071	0.273
200x325	0.052	0.011	0.005	0.002	0.002	0.001	0.011	0.002	0.021	0.108
-325	0.163	0.025	0.008	0.003	0.003	0.002	0.011	0.003	0.031	0.249
Total (Calc)	1.171	0.313	0.144	0.036	0.023	0.006	0.178	0.024	0.709	2.604



SPIRAL DATA ANALYSIS

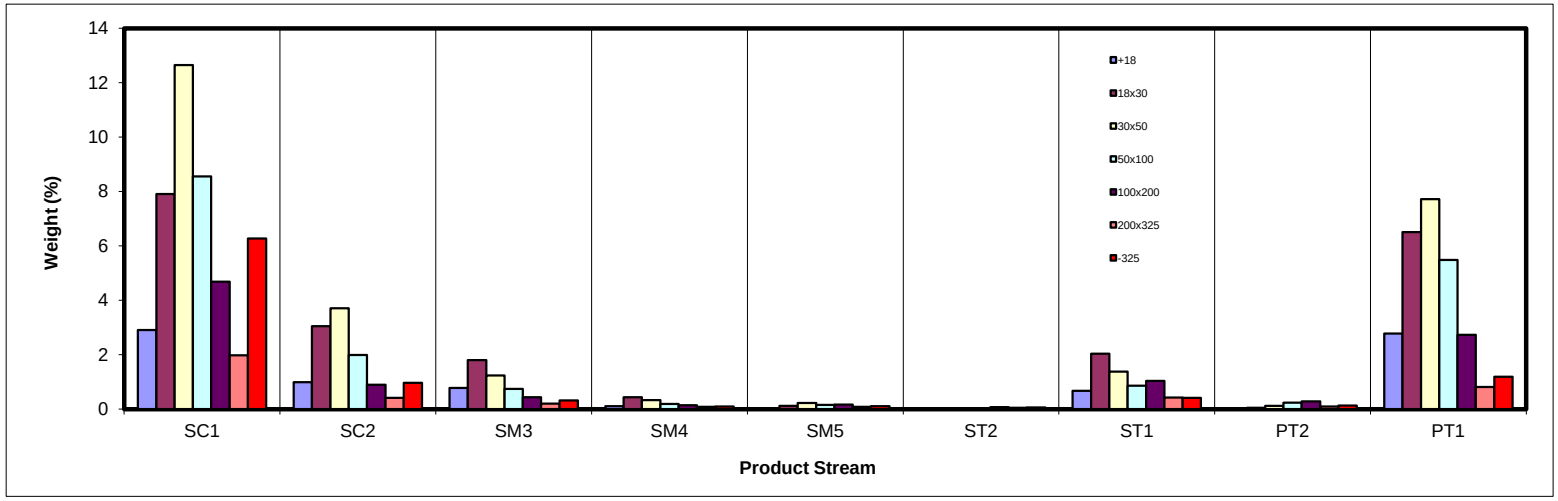
Description: Experiment: 2 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class									Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	PT1	
+18	2.91	1.00	0.78	0.10	0.02	0.00	0.68	0.01	2.78	8.27
18x30	7.92	3.04	1.81	0.44	0.12	0.00	2.04	0.05	6.51	21.94
30x50	12.65	3.71	1.23	0.33	0.22	0.01	1.39	0.12	7.72	27.39
50x100	8.55	2.00	0.75	0.19	0.15	0.02	0.86	0.23	5.48	18.25
100x200	4.69	0.90	0.44	0.15	0.17	0.07	1.03	0.28	2.73	10.47
200x325	1.98	0.41	0.21	0.08	0.09	0.05	0.43	0.09	0.81	4.14
-325	6.27	0.97	0.32	0.10	0.11	0.06	0.41	0.13	1.19	9.55
Total (Calc)	44.97	12.03	5.53	1.40	0.88	0.21	6.84	0.91	27.23	100.00



SPIRAL DATA ANALYSIS

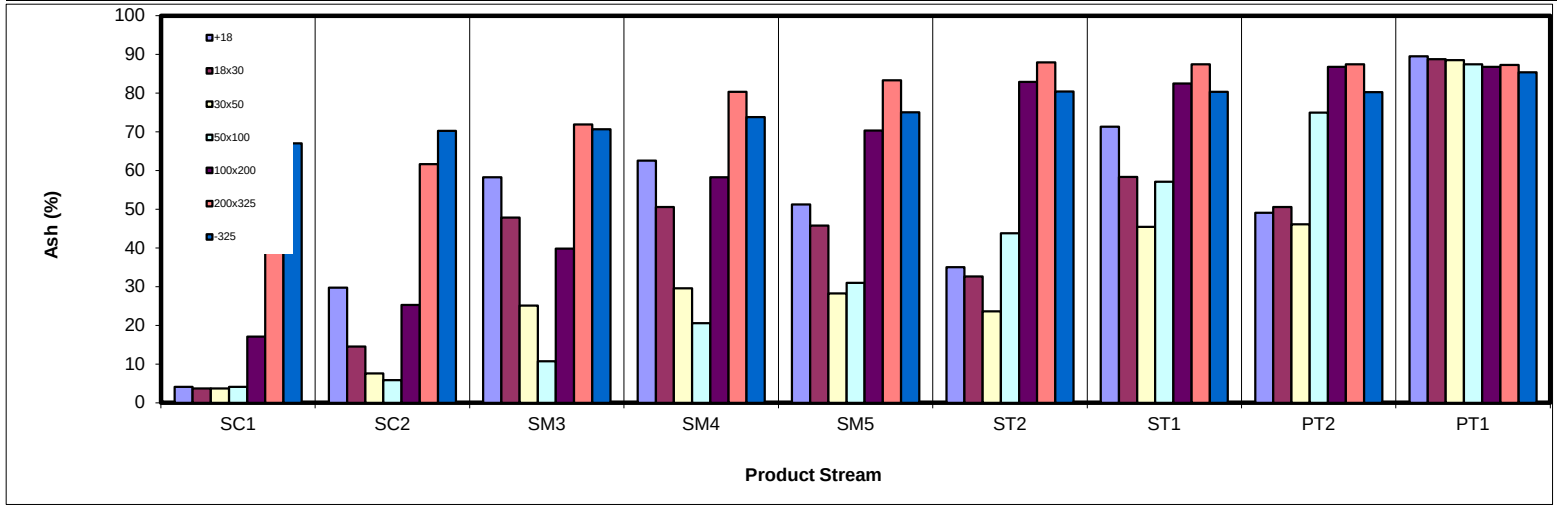
Description: Experiment: 2 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class									Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	PT1	
+18	4.10	29.72	58.27	62.59	51.21	35.02	71.34	49.04	89.48	47.37
18x30	3.70	14.50	47.87	50.53	45.77	32.60	58.35	50.56	88.73	40.45
30x50	3.68	7.54	25.14	29.59	28.22	23.61	45.40	46.10	88.49	31.89
50x100	4.11	5.83	10.71	20.52	31.01	43.79	57.14	74.92	87.43	33.47
100x200	17.11	25.24	39.80	58.21	70.34	82.86	82.51	86.79	86.79	47.18
200x325	50.74	61.68	71.91	80.35	83.31	87.97	87.43	87.41	87.29	66.33
-325	67.01	70.22	70.66	73.82	75.04	80.43	80.36	80.27	85.34	70.74
Total (Calc)	16.10	19.06	40.78	46.52	50.78	74.71	63.65	75.45	88.09	42.07



SPIRAL DATA ANALYSIS

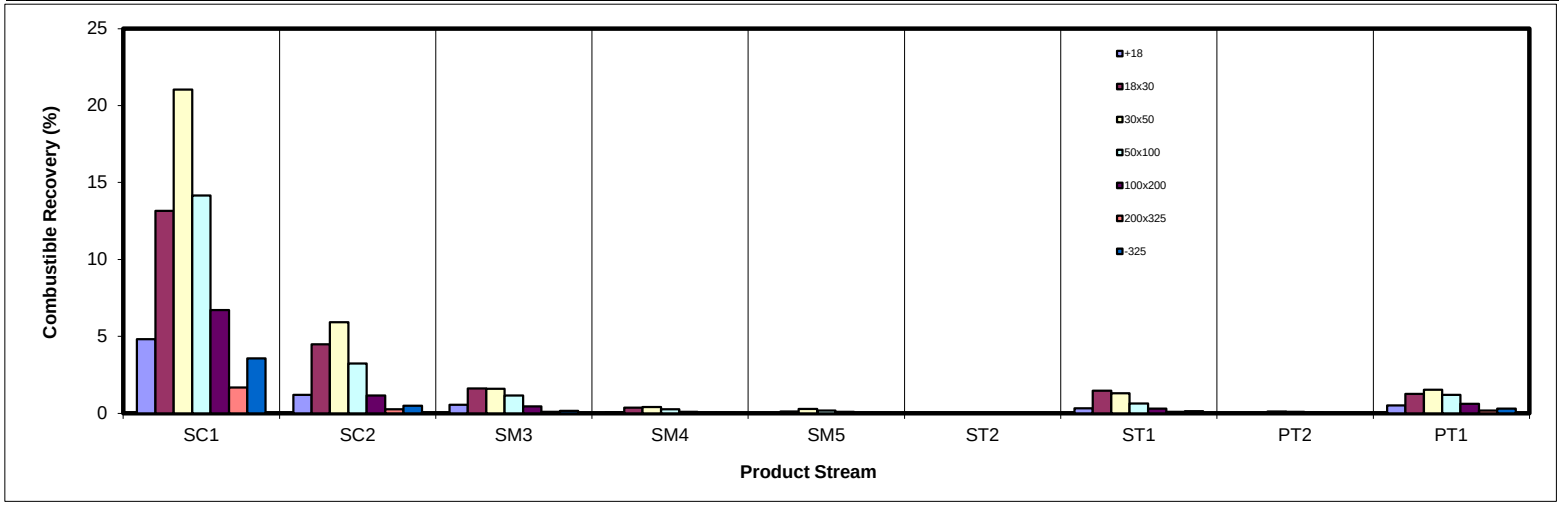
Description: Experiment: 2 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class									Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	PT1	
+18	4.81	1.21	0.56	0.07	0.02	0.00	0.33	0.01	0.50	7.51
18x30	13.16	4.49	1.62	0.38	0.12	0.00	1.47	0.04	1.27	22.55
30x50	21.04	5.93	1.60	0.40	0.28	0.02	1.31	0.11	1.53	32.21
50x100	14.16	3.25	1.16	0.26	0.18	0.02	0.64	0.10	1.19	20.96
100x200	6.71	1.16	0.46	0.11	0.09	0.02	0.31	0.06	0.62	9.54
200x325	1.68	0.27	0.10	0.03	0.02	0.01	0.09	0.02	0.18	2.41
-325	3.57	0.50	0.16	0.05	0.05	0.02	0.14	0.04	0.30	4.82
Total (Calc)	65.13	16.80	5.65	1.29	0.75	0.09	4.29	0.39	5.60	100.00



SPIRAL DATA ANALYSIS

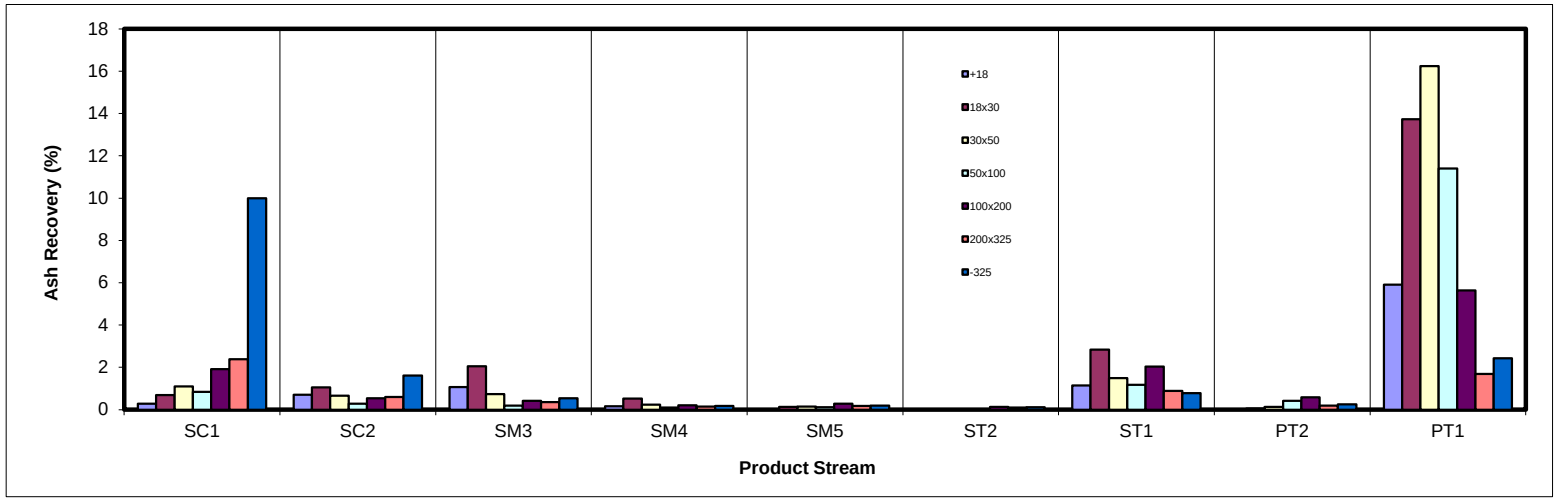
Description: Experiment: 2 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class									Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	PT1	
+18	0.28	0.70	1.07	0.15	0.02	0.00	1.15	0.01	5.91	9.31
18x30	0.70	1.05	2.05	0.53	0.13	0.00	2.83	0.06	13.73	21.09
30x50	1.11	0.67	0.74	0.23	0.15	0.01	1.49	0.13	16.24	20.76
50x100	0.83	0.28	0.19	0.09	0.11	0.02	1.17	0.41	11.40	14.52
100x200	1.91	0.54	0.41	0.21	0.29	0.13	2.03	0.59	5.63	11.74
200x325	2.39	0.60	0.35	0.15	0.17	0.10	0.89	0.20	1.68	6.53
-325	9.99	1.61	0.53	0.18	0.19	0.11	0.78	0.25	2.42	16.06
Total (Calc)	17.20	5.45	5.36	1.54	1.07	0.38	10.35	1.64	57.01	100.00



SPIRAL DATA ANALYSIS

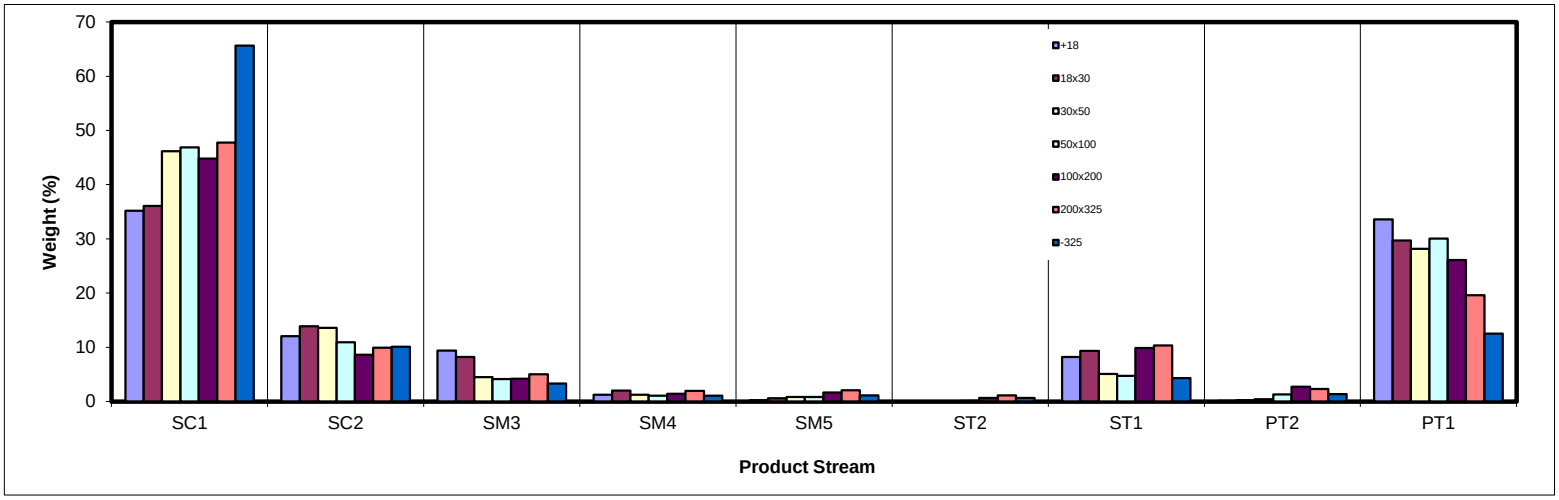
Description: Experiment: 2 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)									Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	PT1	
+18	35.16	12.05	9.37	1.26	0.24	0.01	8.18	0.11	33.62	100.00
18x30	36.09	13.88	8.23	2.01	0.56	0.02	9.31	0.21	29.69	100.00
30x50	46.19	13.56	4.51	1.21	0.82	0.05	5.06	0.43	28.18	100.00
50x100	46.87	10.94	4.11	1.05	0.85	0.12	4.74	1.27	30.05	100.00
100x200	44.82	8.60	4.19	1.42	1.63	0.65	9.88	2.72	26.08	100.00
200x325	47.79	9.90	5.00	1.92	2.08	1.15	10.31	2.29	19.57	100.00
-325	65.67	10.10	3.31	1.05	1.11	0.62	4.29	1.35	12.50	100.00
Total (Calc)	44.97	12.03	5.53	1.40	0.88	0.21	6.84	0.91	27.23	100.00



SPIRAL DATA ANALYSIS

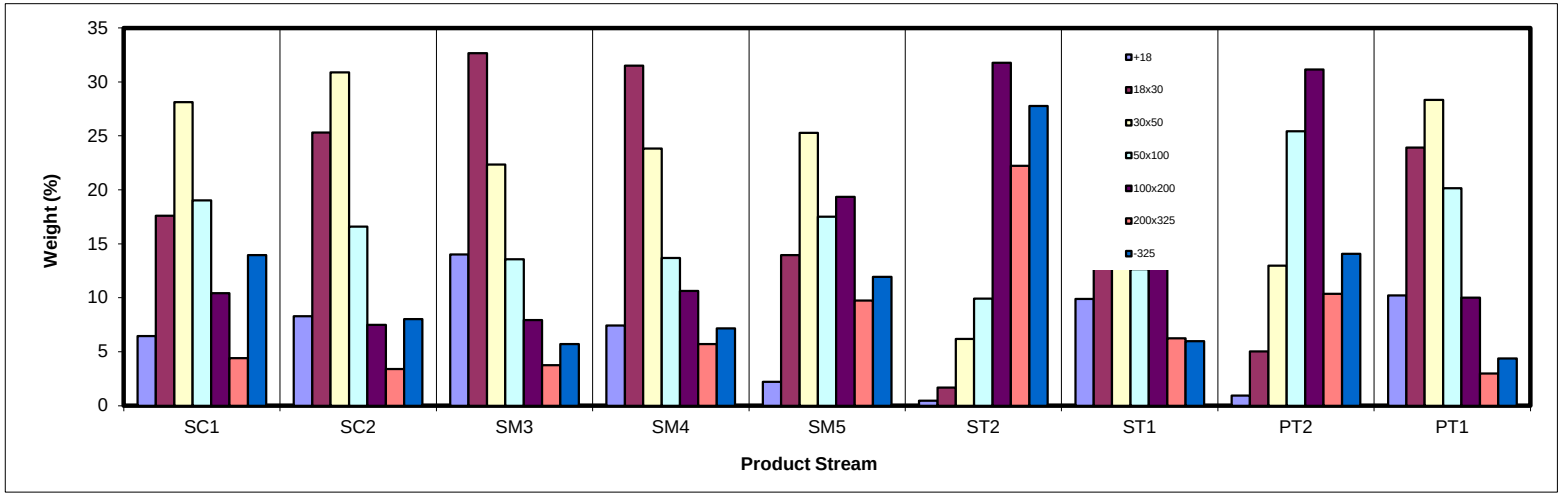
Description: Experiment: 2 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)									Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	PT1	
+18	6.46	8.28	14.02	7.45	2.21	0.45	9.89	0.95	10.21	8.27
18x30	17.60	25.32	32.67	31.52	13.95	1.69	29.87	5.05	23.92	21.94
30x50	28.13	30.88	22.34	23.81	25.28	6.18	20.25	12.98	28.35	27.39
50x100	19.02	16.60	13.56	13.70	17.53	9.93	12.64	25.43	20.14	18.25
100x200	10.43	7.49	7.94	10.64	19.34	31.76	15.12	31.16	10.03	10.47
200x325	4.40	3.41	3.75	5.71	9.75	22.22	6.24	10.37	2.98	4.14
-325	13.95	8.03	5.72	7.18	11.94	27.76	5.99	14.07	4.38	9.55
#REF!										
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00



SPIRAL DATA ANALYSIS

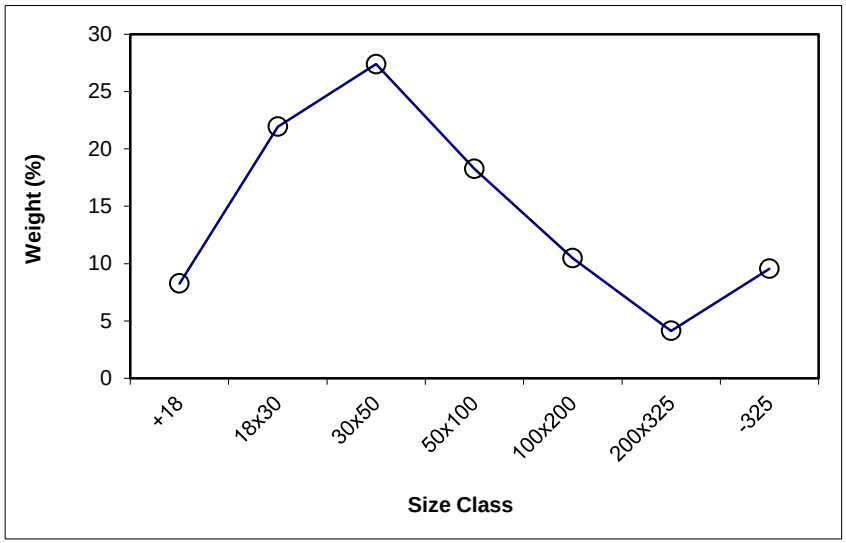
Description: Experiment: 2 -Cardinal In-Plant Spiral Test

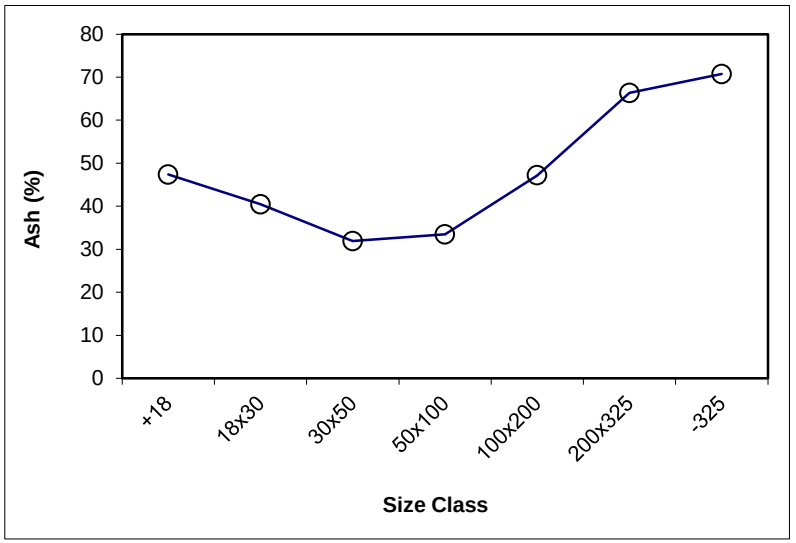
Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	618.4	401.2	217.21	8.27	47.37	8.27	47.37	100.00	42.07
18x30	946.3	370.0	576.30	21.94	40.45	30.20	42.34	91.73	41.59
30x50	1055.9	336.3	719.63	27.39	31.89	57.59	37.37	69.80	41.95
50x100	787.6	308.1	479.43	18.25	33.47	75.84	36.43	42.41	48.46
100x200	569.5	294.5	274.98	10.47	47.18	86.31	37.73	24.16	59.78
200x325	406.8	298.0	108.81	4.14	66.33	90.45	39.04	13.69	69.40
-325	263.3	12.3	250.95	9.55	70.74	100.00	42.07	9.55	70.74
Total (Calc)	--	--	2627.31	100.00	42.07	--	--	--	--





SPIRAL DATA ANALYSIS

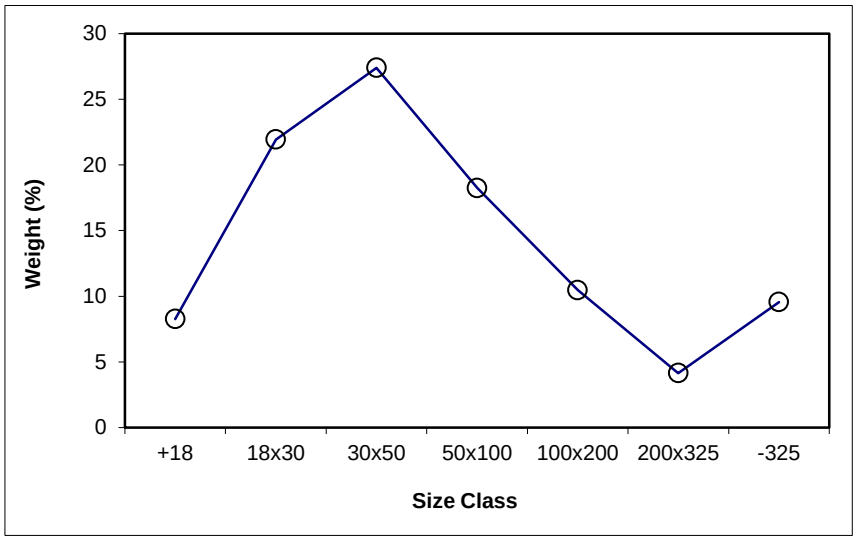
Description: Experiment: 2 -Cardinal In-Plant Spiral Test

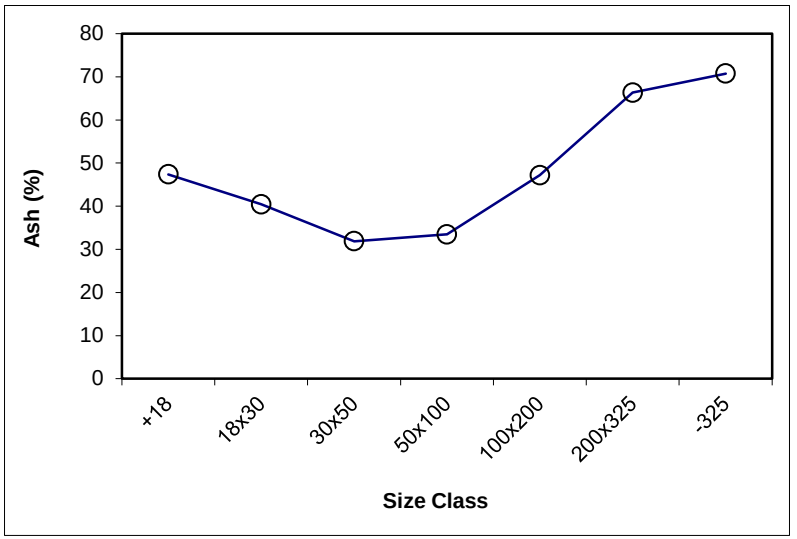
Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	8.27	47.37	8.27	47.37	100.00	42.07			
18x30	21.94	40.45	30.20	42.34	91.73	41.59	x	21.94	40.45
30x50	27.39	31.89	57.59	37.37	69.80	41.95	x	27.39	31.89
50x100	18.25	33.47	75.84	36.43	42.41	48.46	x	18.25	33.47
100x200	10.47	47.18	86.31	37.73	24.16	59.78	x	10.47	47.18
200x325	4.14	66.33	90.45	39.04	13.69	69.40	x	4.14	66.33
-325	9.55	70.74	100.00	42.07	9.55	70.74			
Total (Calc)	100.00	42.07	--	--	--	--	--	82.18	38.21





SPIRAL DATA ANALYSIS

Description: Experiment: 2 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product SC1 Feed Weight (%): 44.97

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	496.7	401.2	95.47	6.46	4.10	6.46	4.10	100.00	16.10
18x30	630.0	370.0	259.97	17.60	3.70	24.07	3.81	93.54	16.92
30x50	751.8	336.3	415.48	28.13	3.68	52.20	3.74	75.93	19.99
50x100	589.0	308.1	280.90	19.02	4.11	71.22	3.83	47.80	29.59
100x200	448.5	294.5	154.04	10.43	17.11	81.65	5.53	28.78	46.44
200x325	363.0	298.0	64.99	4.40	50.74	86.05	7.84	18.35	63.10
-325	218.6	12.6	206.00	13.95	67.01	100.00	16.10	13.95	67.01
Total (Calc)	--	--	1476.84	100.00	16.10	--	--	--	--

Product SC2 Feed Weight (%): 12.03

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	433.9	401.2	32.72	8.28	29.72	8.28	29.72	100.00	19.06
18x30	470.0	370.0	100.00	25.32	14.50	33.60	18.25	91.72	18.09
30x50	458.2	336.3	121.95	30.88	7.54	64.48	13.12	66.40	19.46
50x100	373.7	308.1	65.56	16.60	5.83	81.08	11.63	35.52	29.82
100x200	324.1	294.5	29.57	7.49	25.24	88.57	12.78	18.92	50.88
200x325	311.4	298.0	13.46	3.41	61.68	91.97	14.59	11.43	67.67
-325	37.8	6.1	31.70	8.03	70.22	100.00	19.06	8.03	70.22
Total (Calc)	--	--	394.96	100.00	19.06	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Experiment: 2 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product SM3 Feed Weight (%): 5.53

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	511.0	460.1	50.91	14.02	58.27	14.02	58.27	100.00	40.78
18x30	560.7	442.2	118.59	32.67	47.87	46.70	51.00	85.98	37.92
30x50	492.9	411.8	81.09	22.34	25.14	69.04	42.63	53.30	31.82
50x100	442.3	393.0	49.24	13.56	10.71	82.60	37.39	30.96	36.64
100x200	420.1	391.3	28.80	7.94	39.80	90.54	37.60	17.40	56.86
200x325	393.2	379.6	13.60	3.75	71.91	94.28	38.96	9.46	71.16
-325	27.0	6.2	20.75	5.72	70.66	100.00	40.78	5.72	70.66
Total (Calc)	--	--	362.98	100.00	40.78	--	--	--	--

Product SM4 Feed Weight (%): 1.40

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	418.3	401.2	17.07	7.45	62.59	7.45	62.59	100.00	46.52
18x30	442.3	370.0	72.23	31.52	50.53	38.97	52.84	92.55	45.23
30x50	390.9	336.3	54.58	23.81	29.59	62.78	44.02	61.03	42.49
50x100	339.5	308.1	31.39	13.70	20.52	76.48	39.81	37.22	50.75
100x200	318.9	294.5	24.38	10.64	58.21	87.11	42.06	23.52	68.35
200x325	311.1	298.0	13.08	5.71	80.35	92.82	44.41	12.89	76.72
-325	22.5	6.0	16.45	7.18	73.82	100.00	46.52	7.18	73.82
Total (Calc)	--	--	229.18	100.00	46.52	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Experiment: 2 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product SM5 Feed Weight (%): 0.88

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	462.7	460.1	2.56	2.21	51.21	2.21	51.21	100.00	50.78
18x30	458.4	442.2	16.20	13.95	45.77	16.16	46.51	97.79	50.77
30x50	441.2	411.8	29.37	25.28	28.22	41.44	35.35	83.84	51.60
50x100	413.4	393.0	20.36	17.53	31.01	58.96	34.06	58.56	61.69
100x200	413.8	391.3	22.47	19.34	70.34	78.31	43.02	41.04	74.79
200x325	390.9	379.6	11.33	9.75	83.31	88.06	47.48	21.69	78.76
-325	19.9	6.1	13.87	11.94	75.04	100.00	50.78	11.94	75.04
Total (Calc)	--	--	116.16	100.00	50.78	--	--	--	--

Product ST2 Feed Weight (%): 0.21

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	460.6	460.1	0.45	0.45	35.02	0.45	35.02	100.00	74.71
18x30	443.8	442.2	1.66	1.69	32.60	2.14	33.11	99.55	74.89
30x50	417.9	411.8	6.08	6.18	23.61	8.32	26.06	97.86	75.62
50x100	402.8	393.0	9.77	9.93	43.79	18.26	35.70	91.68	79.13
100x200	422.6	391.3	31.25	31.76	82.86	50.02	65.65	81.74	83.42
200x325	401.5	379.6	21.86	22.22	87.97	72.24	72.51	49.98	83.78
-325	33.7	6.4	27.31	27.76	80.43	100.00	74.71	27.76	80.43
Total (Calc)	--	--	98.38	100.00	74.71	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Experiment: 2 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product ST1 Feed Weight (%): 6.84

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	445.6	401.2	44.43	9.89	71.34	9.89	71.34	100.00	63.65
18x30	504.2	370.0	134.21	29.87	58.35	39.76	61.58	90.11	62.80
30x50	427.3	336.3	90.97	20.25	45.40	60.01	56.12	60.24	65.01
50x100	364.9	308.1	56.78	12.64	57.14	72.64	56.30	39.99	74.94
100x200	362.4	294.5	67.94	15.12	82.51	87.76	60.82	27.36	83.16
200x325	326.0	298.0	28.04	6.24	87.43	94.01	62.58	12.24	83.96
-325	33.2	6.3	26.93	5.99	80.36	100.00	63.65	5.99	80.36
Total (Calc)	--	--	449.30	100.00	63.65	--	--	--	--

Product PT2 Feed Weight (%): 0.91

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	461.6	460.1	1.43	0.95	49.04	0.95	49.04	100.00	75.45
18x30	449.7	442.2	7.58	5.05	50.56	6.00	50.32	99.05	75.70
30x50	431.3	411.8	19.49	12.98	46.10	18.98	47.43	94.00	76.23
50x100	431.2	393.0	38.19	25.43	74.92	44.41	63.17	81.02	82.01
100x200	438.1	391.3	46.79	31.16	86.79	75.56	72.91	55.59	85.26
200x325	395.2	379.6	15.57	10.37	87.41	85.93	74.66	24.44	83.30
-325	27.7	6.6	21.13	14.07	80.27	100.00	75.45	14.07	80.27
Total (Calc)	--	--	150.18	100.00	75.45	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Experiment: 2 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product PT1 Feed Weight (%): 27.23

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	602.0	401.2	200.81	10.21	89.48	10.21	89.48	100.00	88.09
18x30	840.6	370.0	470.53	23.92	88.73	34.12	88.95	89.79	87.93
30x50	894.0	336.3	557.69	28.35	88.49	62.47	88.74	65.88	87.64
50x100	704.4	308.1	396.25	20.14	87.43	82.61	88.42	37.53	87.00
100x200	491.7	294.5	197.24	10.03	86.79	92.64	88.25	17.39	86.51
200x325	356.6	298.0	58.57	2.98	87.29	95.62	88.22	7.36	86.13
-325	92.9	6.6	86.26	4.38	85.34	100.00	88.09	4.38	85.34
Total (Calc)	--	--	1967.35	100.00	88.09	--	--	--	--

SPIRAL DATA ANALYSIS

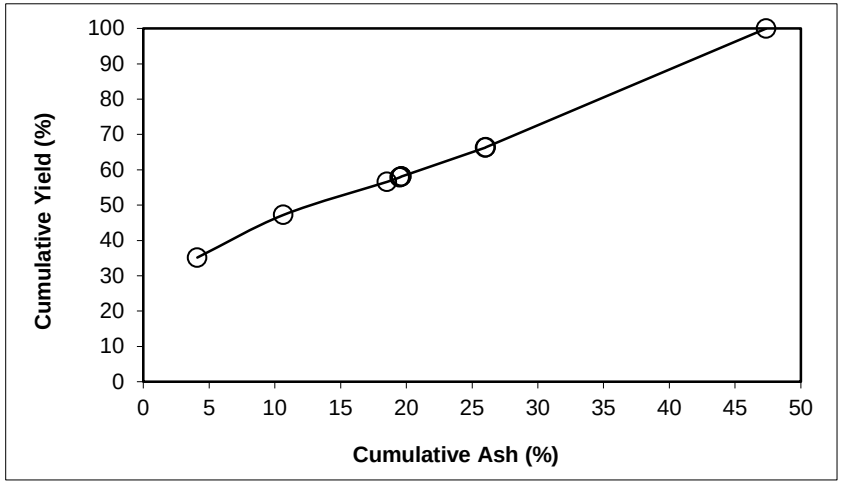
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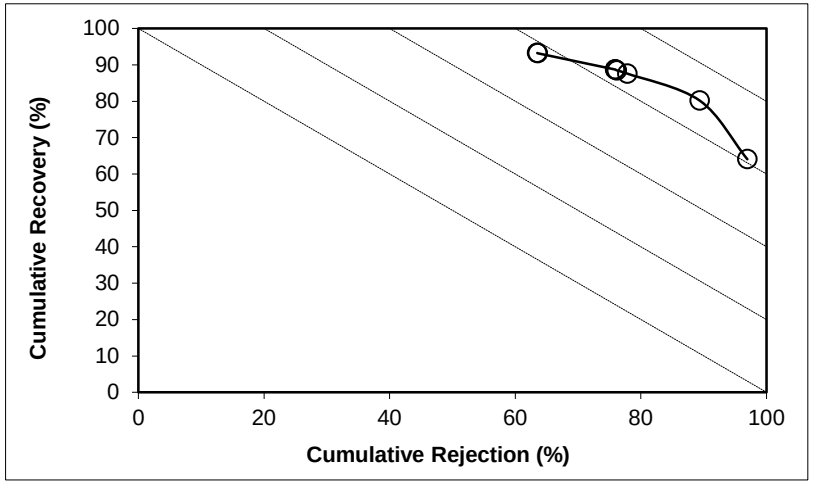
Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 8.27

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	35.16	4.10	35.16	4.10	64.07	64.84	70.83	96.96	61.03
SC2	12.05	29.72	47.21	10.64	80.16	52.79	80.22	89.39	69.56
SM3	9.37	58.27	56.59	18.53	87.60	43.41	84.96	77.86	65.46
SM4	1.26	62.59	57.85	19.49	88.49	42.15	85.63	76.20	64.69
SM5	0.24	51.21	58.08	19.62	88.71	41.92	85.82	75.95	64.65
ST2	0.01	35.02	58.09	19.62	88.72	41.91	85.84	75.94	64.66
ST1	8.18	71.34	66.28	26.01	93.18	33.72	89.35	63.61	56.79
PT2	0.11	49.04	66.38	26.04	93.28	33.62	89.48	63.51	56.79
PT1	33.62	89.48	100.00	47.37	100.00	0.00			
Total (Calc)	100.00	47.37	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

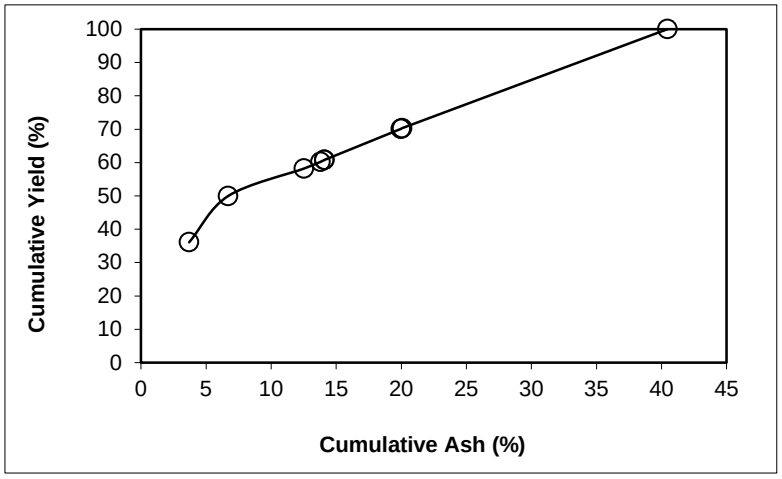
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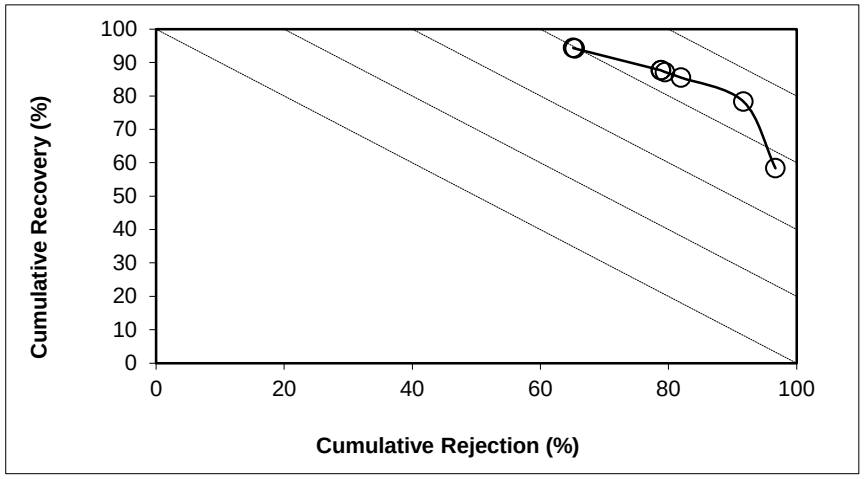
Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 21.94

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	36.09	3.70	36.09	3.70	58.36	63.91	61.20	96.70	55.06
SC2	13.88	14.50	49.97	6.70	78.29	50.03	74.16	91.72	70.01
SM3	8.23	47.87	58.20	12.52	85.50	41.80	79.34	81.98	67.48
SM4	2.01	50.53	60.21	13.79	87.16	39.79	80.79	79.48	66.64
SM5	0.56	45.77	60.77	14.08	87.67	39.23	81.29	78.84	66.51
ST2	0.02	32.60	60.79	14.09	87.69	39.21	81.31	78.83	66.52
ST1	9.31	58.35	70.10	19.97	94.21	29.90	88.46	65.39	59.60
PT2	0.21	50.56	70.31	20.06	94.38	29.69	88.73	65.13	59.51
PT1	29.69	88.73	100.00	40.45	100.00	0.00			
Total (Calc)	100.00	40.45	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

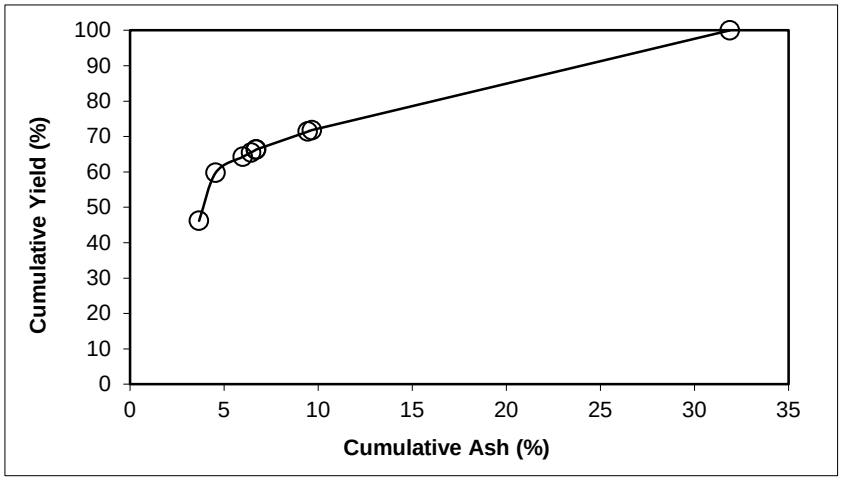
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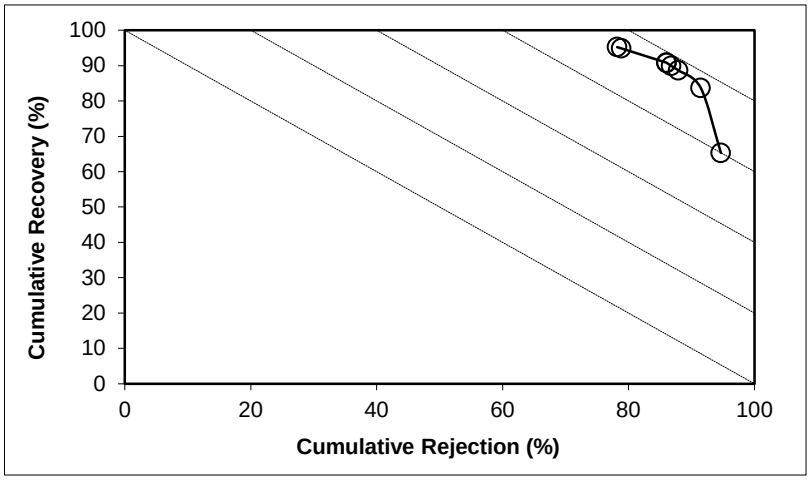
Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 27.39

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	46.19	3.68	46.19	3.68	65.32	53.81	56.10	94.68	59.99
SC2	13.56	7.54	59.74	4.55	83.72	40.26	72.45	91.47	75.19
SM3	4.51	25.14	64.25	6.00	88.67	35.75	78.42	87.92	76.59
SM4	1.21	29.59	65.47	6.43	89.93	34.53	80.13	86.79	76.72
SM5	0.82	28.22	66.28	6.70	90.79	33.72	81.39	86.07	76.85
ST2	0.05	23.61	66.33	6.72	90.84	33.67	81.47	86.03	76.87
ST1	5.06	45.40	71.39	9.46	94.90	28.61	87.85	78.83	73.73
PT2	0.43	46.10	71.82	9.68	95.24	28.18	88.49	78.20	73.44
PT1	28.18	88.49	100.00	31.89	100.00	0.00			
0									
Total (Calc)	100.00	31.89	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

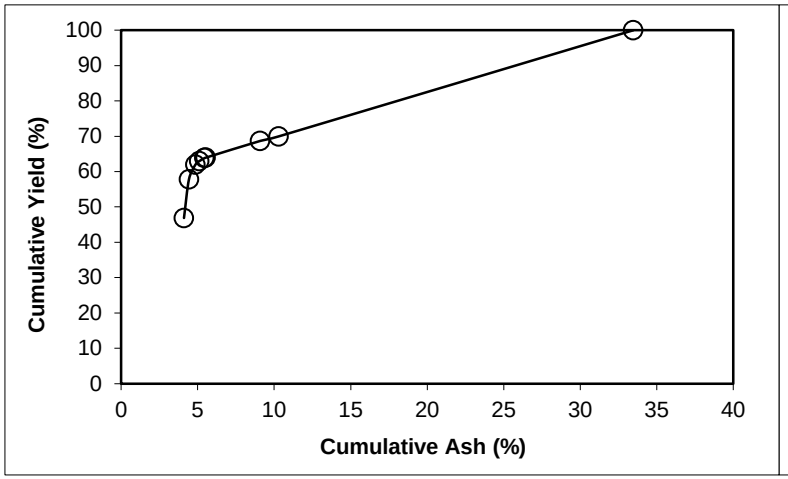
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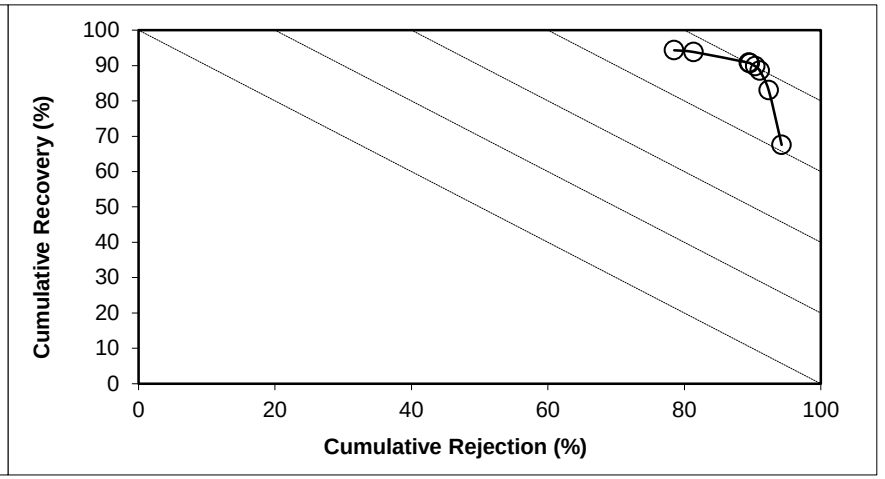
Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 18.25

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	46.87	4.11	46.87	4.11	67.56	53.13	59.38	94.25	61.81
SC2	10.94	5.83	57.81	4.43	83.05	42.19	73.26	92.35	75.39
SM3	4.11	10.71	61.92	4.85	88.56	38.08	80.01	91.03	79.59
SM4	1.05	20.52	62.97	5.11	89.81	37.03	81.69	90.39	80.20
SM5	0.85	31.01	63.82	5.45	90.69	36.18	82.88	89.60	80.29
ST2	0.12	43.79	63.93	5.52	90.79	36.07	83.01	89.45	80.24
ST1	4.74	57.14	68.67	9.08	93.84	31.33	86.92	81.36	75.20
PT2	1.27	74.92	69.95	10.28	94.32	30.05	87.43	78.51	72.83
PT1	30.05	87.43	100.00	33.47	100.00	0.00			
0									
Total (Calc)	100.00	33.47	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

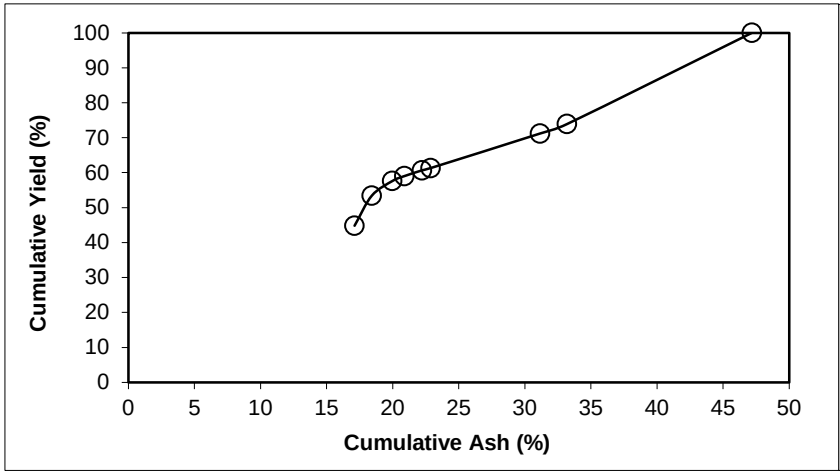
Description: Experiment: 2 -Cardinal In-Plant Spiral Test

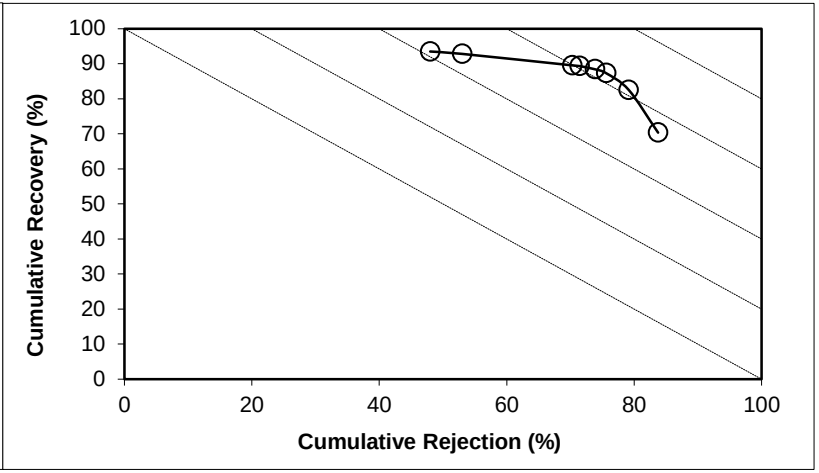
Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 10.47

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	44.82	17.11	44.82	17.11	70.32	55.18	71.59	83.74	54.07
SC2	8.60	25.24	53.42	18.42	82.50	46.58	80.15	79.14	61.64
SM3	4.19	39.80	57.61	19.98	87.27	42.39	84.14	75.61	62.88
SM4	1.42	58.21	59.03	20.89	88.39	40.97	85.04	73.86	62.25
SM5	1.63	70.34	60.66	22.23	89.31	39.34	85.65	71.42	60.73
ST2	0.65	82.86	61.31	22.87	89.52	38.69	85.70	70.28	59.80
ST1	9.88	82.51	71.19	31.15	92.80	28.81	86.79	53.00	45.79
PT2	2.72	86.79	73.92	33.20	93.48	26.08	86.79	47.99	41.46
PT1	26.08	86.79	100.00	47.18	100.00	0.00			
Total (Calc)	100.00	47.18	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

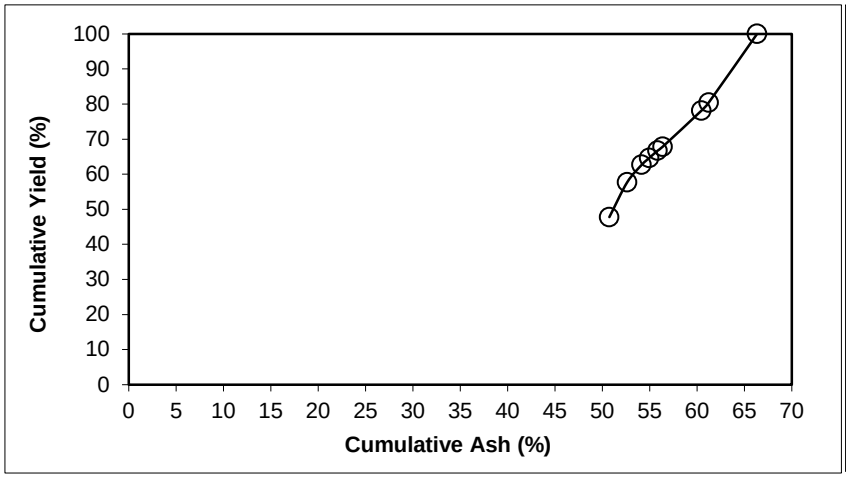
Description: Experiment: 2 -Cardinal In-Plant Spiral Test

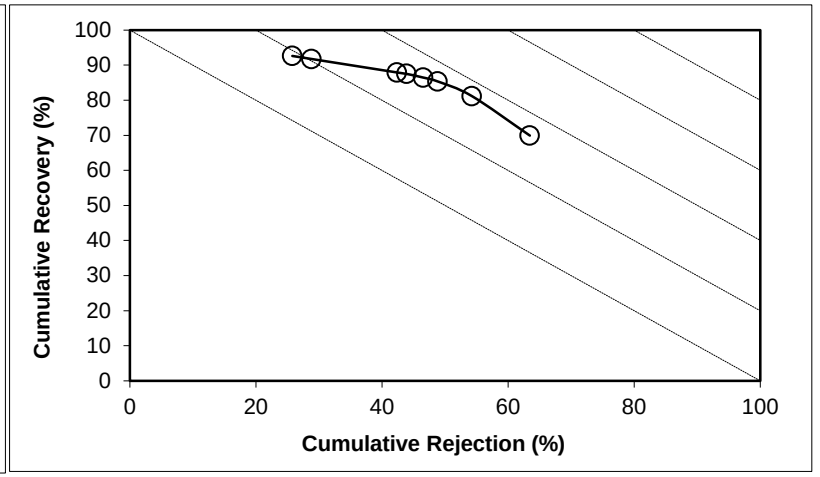
Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 4.14

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	47.79	50.74	47.79	50.74	69.91	52.21	80.60	63.45	33.36
SC2	9.90	61.68	57.68	52.61	81.17	42.32	85.02	54.25	35.42
SM3	5.00	71.91	62.68	54.15	85.34	37.32	86.78	48.83	34.17
SM4	1.92	80.35	64.60	54.93	86.47	35.40	87.13	46.50	32.96
SM5	2.08	83.31	66.68	55.82	87.50	33.32	87.36	43.88	31.38
ST2	1.15	87.97	67.83	56.36	87.91	32.17	87.34	42.36	30.27
ST1	10.31	87.43	78.14	60.46	91.76	21.86	87.30	28.77	20.53
PT2	2.29	87.41	80.43	61.23	92.61	19.57	87.29	25.76	18.37
PT1	19.57	87.29	100.00	66.33	100.00	0.00			
0									
Total (Calc)	100.00	66.33	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

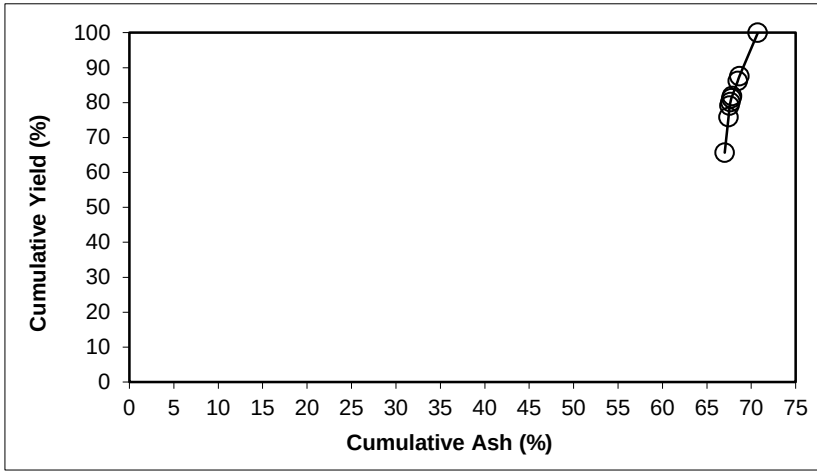
Description: Experiment: 2 -Cardinal In-Plant Spiral Test

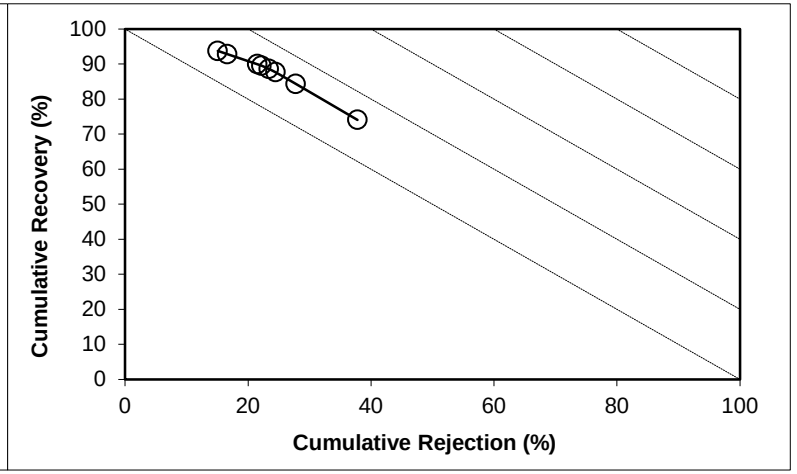
Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 9.55

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	65.67	67.01	65.67	67.01	74.05	34.33	77.88	37.79	11.84
SC2	10.10	70.22	75.78	67.43	84.33	24.22	81.08	27.76	12.10
SM3	3.31	70.66	79.08	67.57	87.65	20.92	82.72	24.46	12.11
SM4	1.05	73.82	80.13	67.65	88.59	19.87	83.19	23.37	11.95
SM5	1.11	75.04	81.24	67.75	89.53	18.76	83.67	22.19	11.72
ST2	0.62	80.43	81.86	67.85	89.95	18.14	83.78	21.49	11.43
ST1	4.29	80.36	86.15	68.47	92.83	13.85	84.85	16.61	9.44
PT2	1.35	80.27	87.50	68.65	93.74	12.50	85.34	15.08	8.82
PT1	12.50	85.34	100.00	70.74	100.00	0.00			
0									
Total (Calc)	100.00	70.74	--	--	--	--	--	--	--





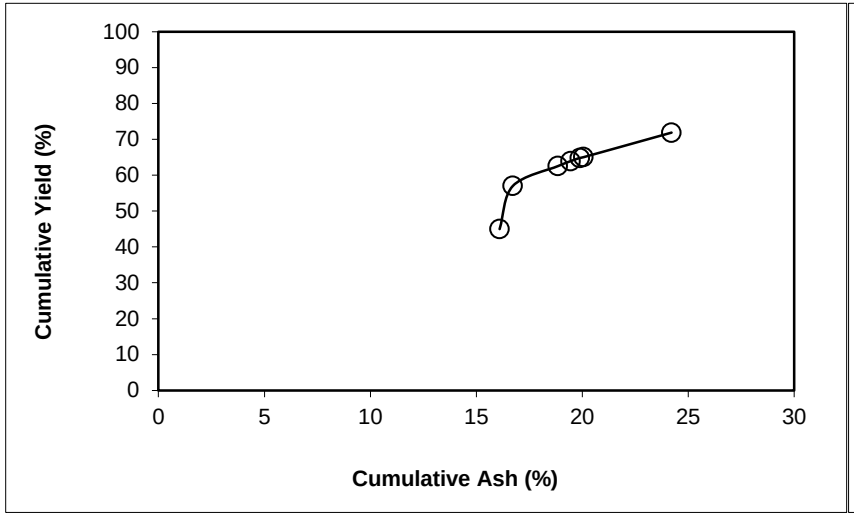
SPIRAL DATA ANALYSIS

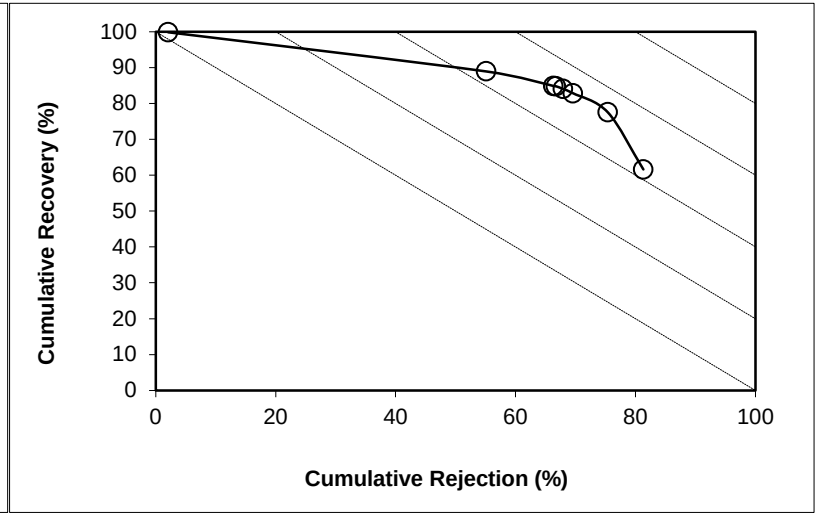
Description: Experiment: 2 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	44.97	16.10	44.97	16.10	61.60	55.03	57.25	81.32	42.92
SC2	12.03	19.06	57.00	16.72	77.49	43.00	67.94	75.40	52.89
SM3	5.53	40.78	62.52	18.85	82.83	37.48	71.94	69.59	52.42
SM4	1.40	46.52	63.92	19.45	84.05	36.08	72.92	67.91	51.96
SM5	0.88	50.78	64.80	19.88	84.76	35.20	73.48	66.75	51.51
ST2	0.21	74.71	65.02	20.06	84.85	34.98	73.47	66.34	51.19
ST1	6.84	63.65	71.86	24.21	88.91	28.14	75.86	55.10	44.01
PT1	27.23	75.45	99.09	38.29	99.82	0.91	88.09	2.08	1.90
PT2	0.91	88.09	100.00	38.74	100.00	0.00			
Total (Calc)	100.00	38.74	--	--	--	--	--	--	--

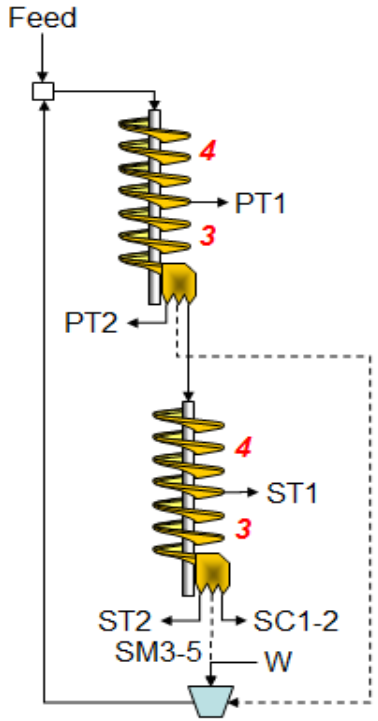




SPIRAL DATA ANALYSIS

Description: Experiment: 3 -Cardinal In-Plant Spiral Test

Comments: $1_{2T0}+2_{3T1}+3_{4T0}+4_{CT1}$ Spiral Circuit (1 x 0.15 mm Nominal Particle Size)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
SC1	40.0	34.9	100	87
SC2	34.9	28.6	87	72
SM3	28.6	21.6	72	54
SM4	21.6	16.7	54	42
SM5	16.7	8.3	42	21
ST2	8.3	0.0	21	0
ST1	0.0	--	0	--
PT2	0.0	--	0	--
PT1				

Stream ID	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
SC1	1.217	17.4	23.15	26.68
SC2	0.269	26.1	3.04	3.81
SM3	0.143	32.8	1.17	1.53
SM4	0.030	27.6	0.31	0.39
SM5	0.021	17.9	0.38	0.43
ST2	0.005	10.5	0.17	0.18
ST1	0.103	31.8	0.89	1.11
PT2	0.021	18.3	0.37	0.41
PT1	0.665	58.1	1.92	3.05
Total	2.474	24.0	31.40	37.58

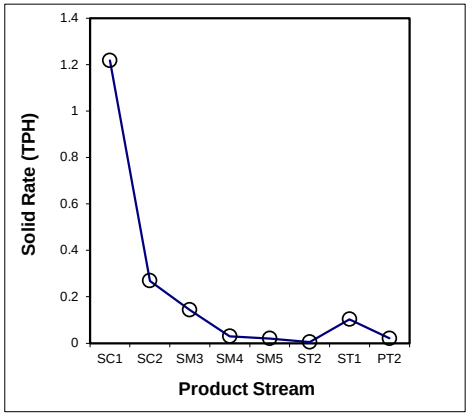
SPIRAL DATA ANALYSIS

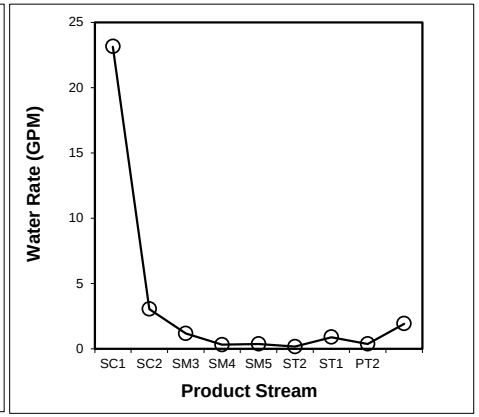
Description: Experiment: 3 -Cardinal In-Plant Spiral Test

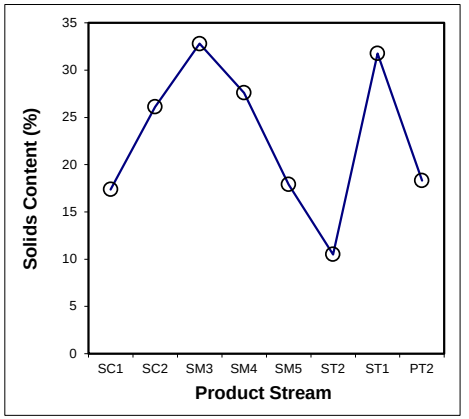
Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
SC1	5	10118.00	1162.60	7.005	3555.6	2020.4	1.217	49.21	17.38
SC2	6	1751.45	169.37	1.030	2421.0	2014.2	0.269	10.87	26.10
SM3	10	1206.91	91.57	0.436	2845.4	2484.6	0.143	5.78	32.80
SM4	30	922.49	93.68	0.108	2240.6	2014.4	0.030	1.21	27.61
SM5	35	1119.16	93.61	0.115	2665.6	2484.5	0.021	0.83	17.89
ST2	70	928.89	90.80	0.047	2570.9	2484.4	0.005	0.20	10.50
ST1	15	1338.03	93.70	0.325	2405.5	2014.4	0.103	4.18	31.77
PT2	25	824.36	94.85	0.114	2615.7	2484.2	0.021	0.84	18.31
PT1	11	3376.52	169.09	1.145	3859.2	2014.5	0.665	26.88	58.09
Total (Calc)	--	--	--	10.324	--	--	2.474	100.00	23.96
Total (Head)	4.13	11346	1083.89	10.324	4597.1	2020.4	2.474	--	23.96







SPIRAL DATA ANALYSIS

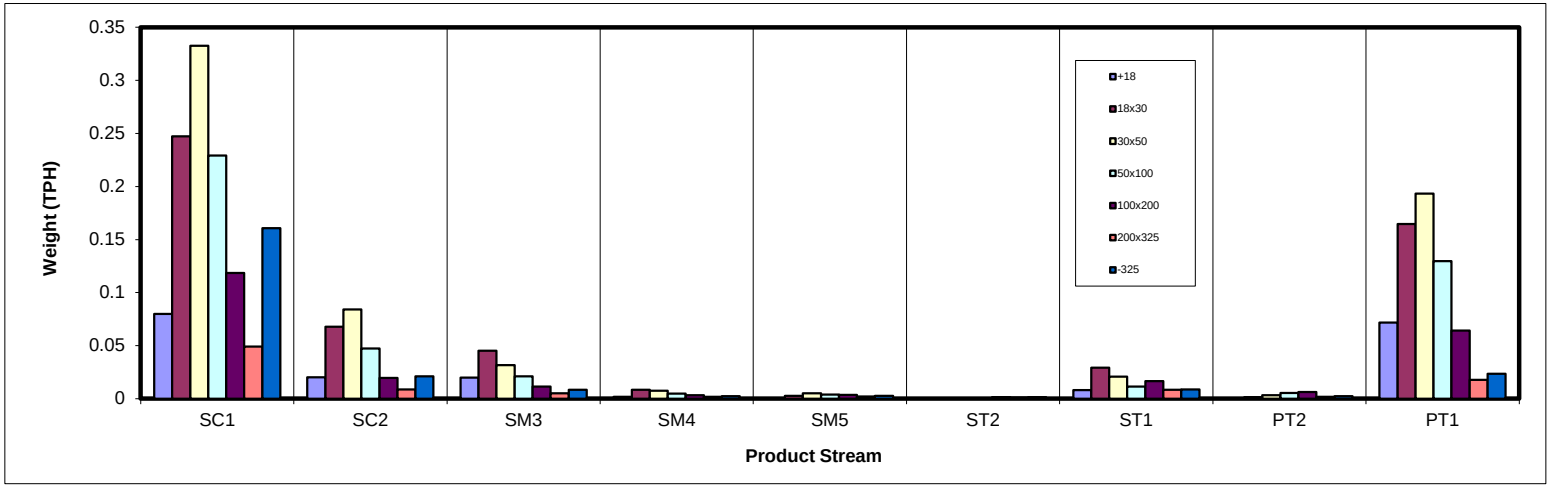
Description: Experiment: 3 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class									Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	PT1	
+18	0.080	0.020	0.020	0.002	0.000	0.000	0.008	0.000	0.072	0.202
18x30	0.247	0.068	0.045	0.008	0.003	0.000	0.029	0.002	0.165	0.567
30x50	0.332	0.084	0.032	0.007	0.005	0.000	0.021	0.003	0.193	0.679
50x100	0.229	0.047	0.021	0.005	0.004	0.000	0.011	0.005	0.130	0.453
100x200	0.118	0.020	0.011	0.003	0.004	0.001	0.017	0.006	0.064	0.245
200x325	0.049	0.009	0.005	0.002	0.002	0.001	0.008	0.002	0.018	0.096
-325	0.161	0.021	0.009	0.002	0.003	0.001	0.009	0.002	0.024	0.231
Total (Calc)	1.217	0.269	0.143	0.030	0.021	0.005	0.103	0.021	0.665	2.474



SPIRAL DATA ANALYSIS

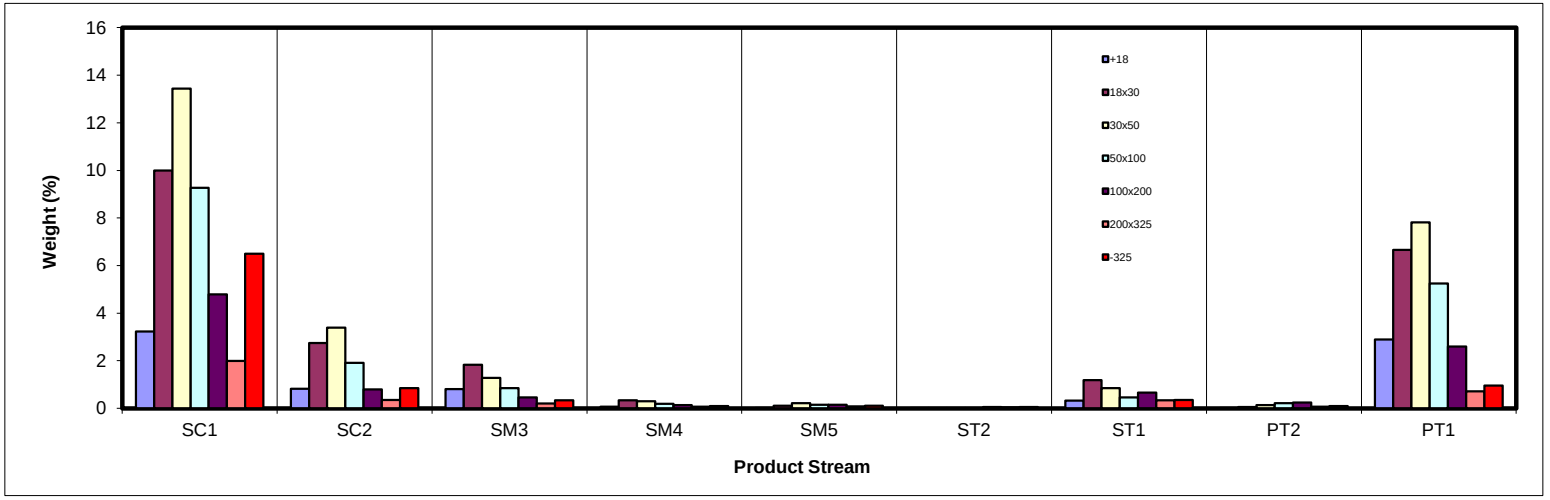
Description: Experiment: 3 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class									Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	PT1	
+18	3.23	0.82	0.80	0.07	0.01	0.00	0.33	0.01	2.90	8.17
18x30	10.00	2.74	1.83	0.34	0.11	0.00	1.19	0.06	6.66	22.93
30x50	13.44	3.40	1.28	0.30	0.21	0.01	0.85	0.14	7.82	27.45
50x100	9.27	1.91	0.85	0.20	0.15	0.02	0.46	0.22	5.24	18.32
100x200	4.79	0.80	0.46	0.13	0.15	0.06	0.67	0.25	2.60	9.91
200x325	1.99	0.35	0.21	0.07	0.08	0.04	0.34	0.07	0.72	3.87
-325	6.49	0.85	0.35	0.10	0.11	0.06	0.35	0.10	0.95	9.35
Total (Calc)	49.21	10.87	5.78	1.21	0.83	0.20	4.18	0.84	26.88	100.00



SPIRAL DATA ANALYSIS

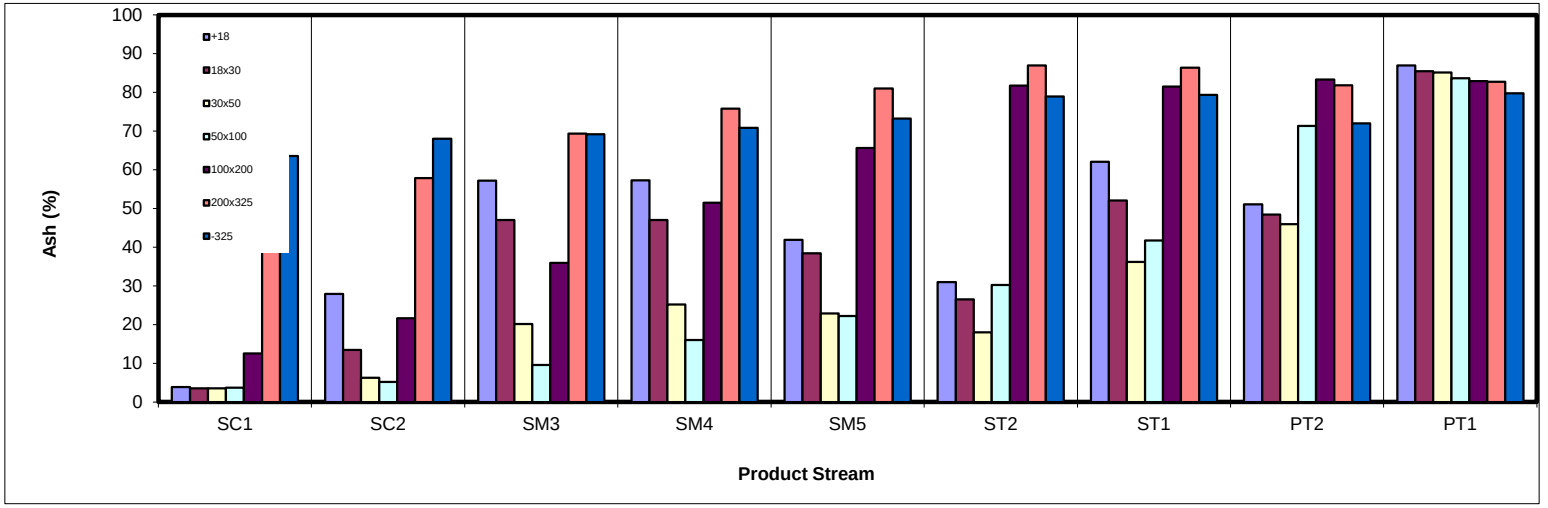
Description: Experiment: 3 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class									Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	PT1	
+18	3.85	27.88	57.15	57.26	41.91	30.94	62.09	51.09	86.95	43.88
18x30	3.52	13.45	47.04	46.98	38.38	26.50	52.04	48.38	85.41	35.39
30x50	3.50	6.29	20.15	25.19	22.88	18.01	36.15	45.94	85.15	29.49
50x100	3.66	5.20	9.56	16.05	22.24	30.21	41.71	71.33	83.64	29.06
100x200	12.56	21.62	35.93	51.49	65.65	81.73	81.52	83.32	82.92	41.01
200x325	46.91	57.80	69.36	75.80	80.95	86.91	86.36	81.81	82.72	61.54
-325	63.58	68.03	69.13	70.80	73.25	78.95	79.35	71.94	79.74	66.79
Total (Calc)	14.12	17.12	38.22	41.29	45.28	71.12	58.23	69.82	84.64	37.81



SPIRAL DATA ANALYSIS

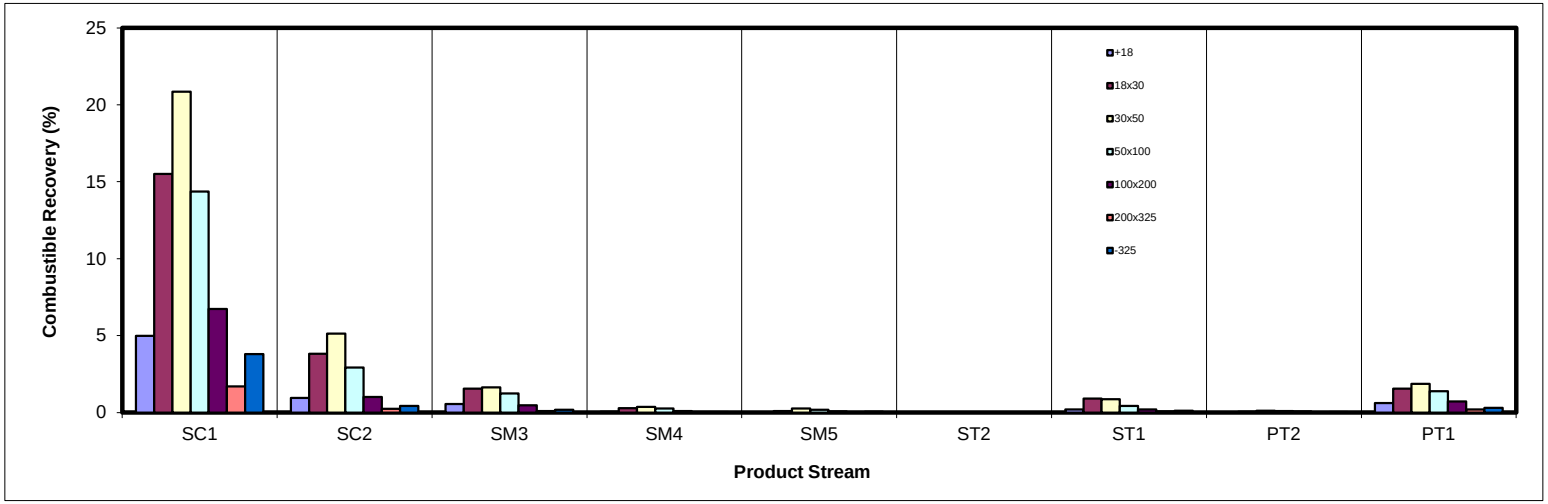
Description: Experiment: 3 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class									Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	PT1	
+18	4.99	0.95	0.55	0.05	0.01	0.00	0.20	0.01	0.61	7.37
18x30	15.51	3.82	1.56	0.29	0.11	0.01	0.92	0.05	1.56	23.82
30x50	20.86	5.12	1.65	0.36	0.26	0.02	0.87	0.12	1.87	31.12
50x100	14.36	2.92	1.23	0.26	0.19	0.02	0.44	0.10	1.38	20.90
100x200	6.73	1.01	0.48	0.10	0.08	0.02	0.20	0.07	0.71	9.40
200x325	1.70	0.24	0.10	0.03	0.03	0.01	0.07	0.02	0.20	2.40
-325	3.80	0.44	0.17	0.05	0.05	0.02	0.12	0.04	0.31	4.99
Total (Calc)	67.96	14.48	5.74	1.14	0.73	0.09	2.81	0.41	6.64	100.00



SPIRAL DATA ANALYSIS

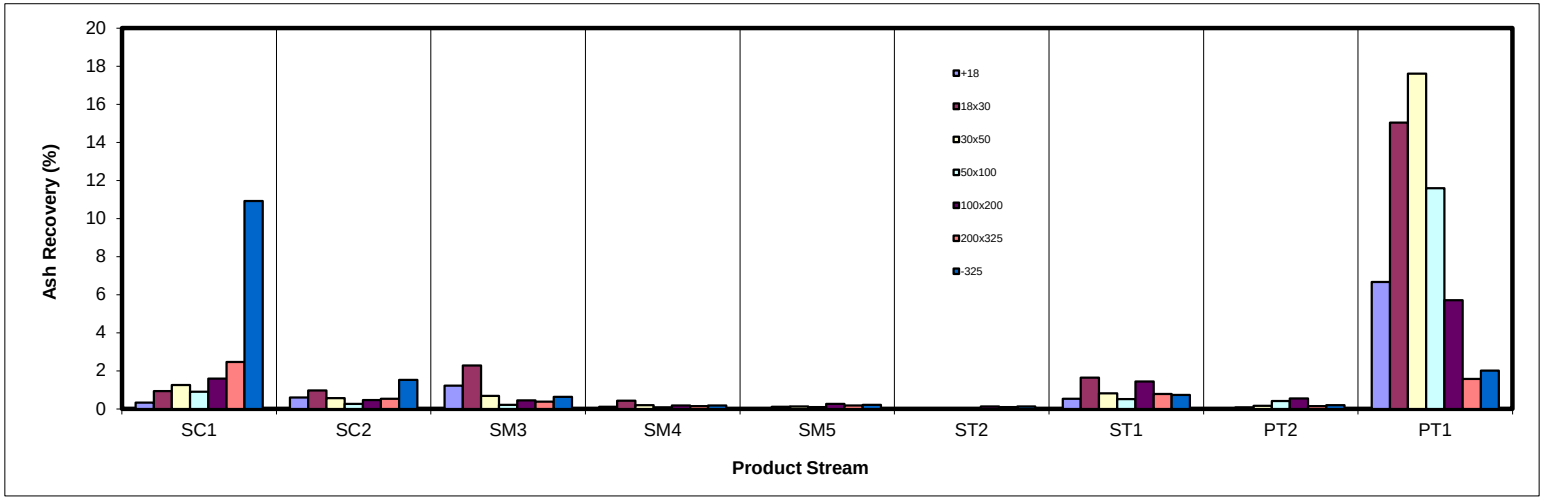
Description: Experiment: 3 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class									Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	PT1	
+18	0.33	0.60	1.22	0.11	0.02	0.00	0.53	0.01	6.66	9.48
18x30	0.93	0.98	2.27	0.42	0.11	0.00	1.63	0.08	15.04	21.46
30x50	1.25	0.57	0.68	0.20	0.13	0.01	0.81	0.16	17.60	21.41
50x100	0.90	0.26	0.21	0.08	0.09	0.01	0.51	0.41	11.59	14.08
100x200	1.59	0.46	0.44	0.18	0.26	0.13	1.44	0.55	5.70	10.75
200x325	2.47	0.53	0.39	0.15	0.18	0.10	0.78	0.15	1.57	6.30
-325	10.92	1.53	0.63	0.18	0.21	0.12	0.73	0.19	2.01	16.52
Total (Calc)	18.38	4.92	5.85	1.32	0.99	0.37	6.44	1.56	60.17	100.00



SPIRAL DATA ANALYSIS

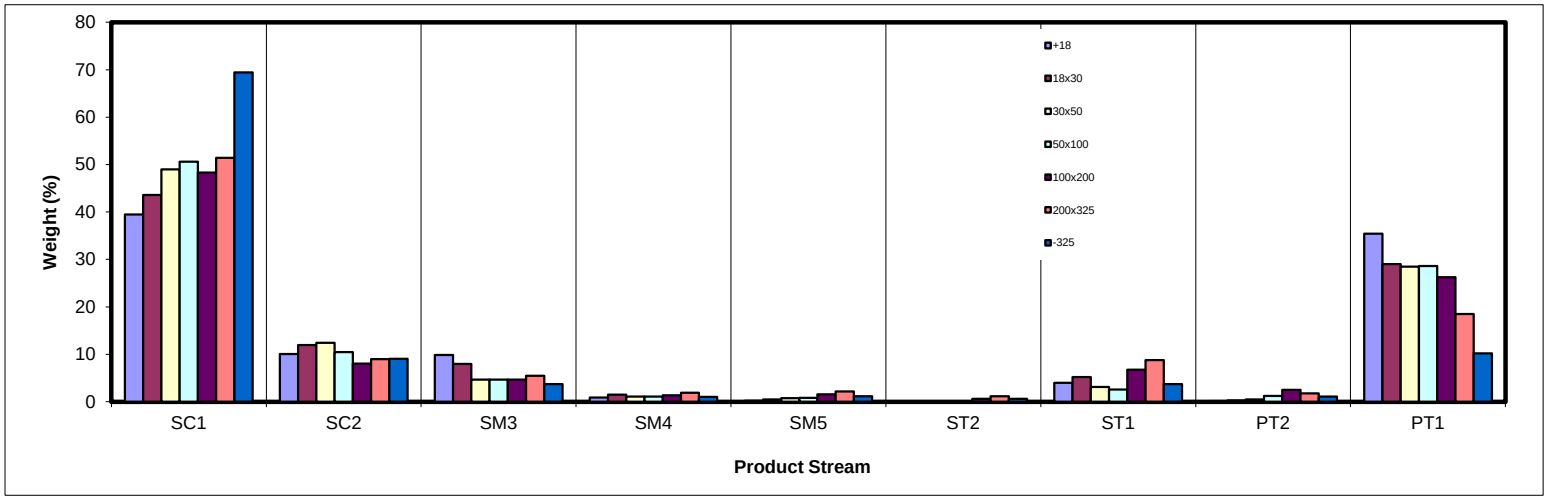
Description: Experiment: 3 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)									Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	PT1	
+18	39.50	10.03	9.85	0.88	0.18	0.02	3.98	0.12	35.44	100.00
18x30	43.62	11.96	7.97	1.48	0.47	0.02	5.18	0.27	29.03	100.00
30x50	48.97	12.38	4.67	1.09	0.77	0.05	3.08	0.49	28.48	100.00
50x100	50.60	10.44	4.63	1.07	0.83	0.10	2.54	1.19	28.60	100.00
100x200	48.33	8.05	4.69	1.33	1.52	0.59	6.73	2.52	26.24	100.00
200x325	51.39	8.98	5.44	1.87	2.14	1.12	8.77	1.79	18.51	100.00
-325	69.46	9.07	3.69	1.03	1.16	0.63	3.72	1.05	10.18	100.00
Total (Calc)	49.21	10.87	5.78	1.21	0.83	0.20	4.18	0.84	26.88	100.00



SPIRAL DATA ANALYSIS

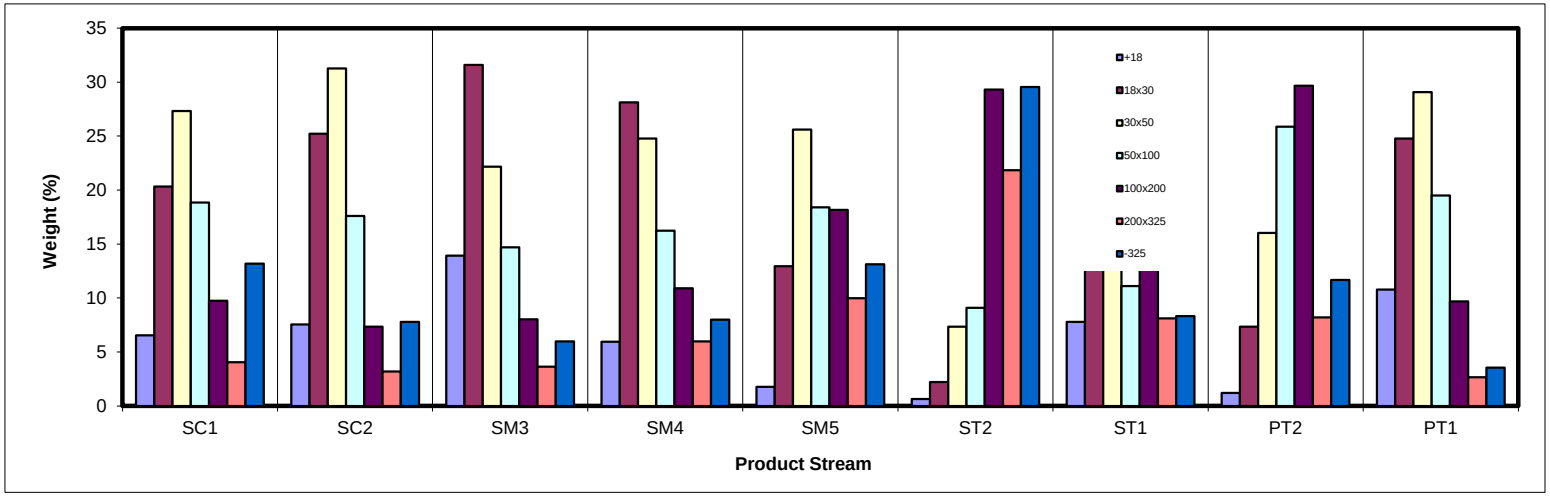
Description: Experiment: 3 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)									Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	PT1	
+18	6.56	7.54	13.91	5.96	1.77	0.66	7.79	1.20	10.78	8.17
18x30	20.32	25.23	31.60	28.12	12.95	2.21	28.42	7.35	24.76	22.93
30x50	27.31	31.27	22.16	24.79	25.61	7.34	20.25	16.03	29.08	27.45
50x100	18.84	17.60	14.68	16.23	18.40	9.10	11.12	25.87	19.50	18.32
100x200	9.73	7.34	8.03	10.91	18.16	29.30	15.97	29.68	9.68	9.91
200x325	4.04	3.20	3.64	5.99	9.99	21.85	8.12	8.22	2.67	3.87
-325	13.20	7.80	5.97	8.00	13.12	29.54	8.33	11.67	3.54	9.35
#REF!										
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00



SPIRAL DATA ANALYSIS

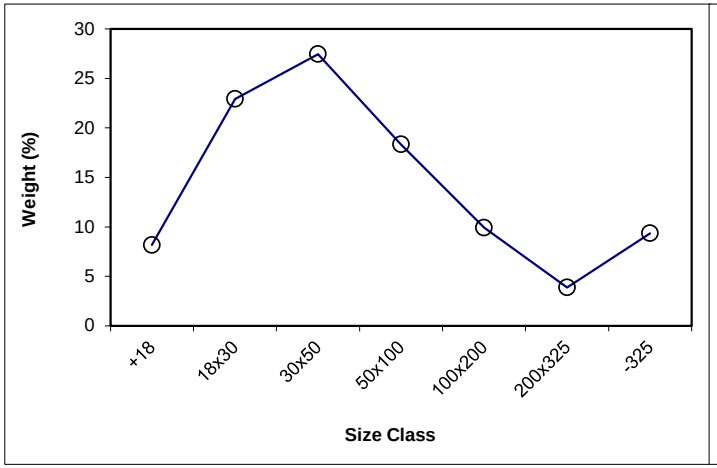
Description: Experiment: 3 -Cardinal In-Plant Spiral Test

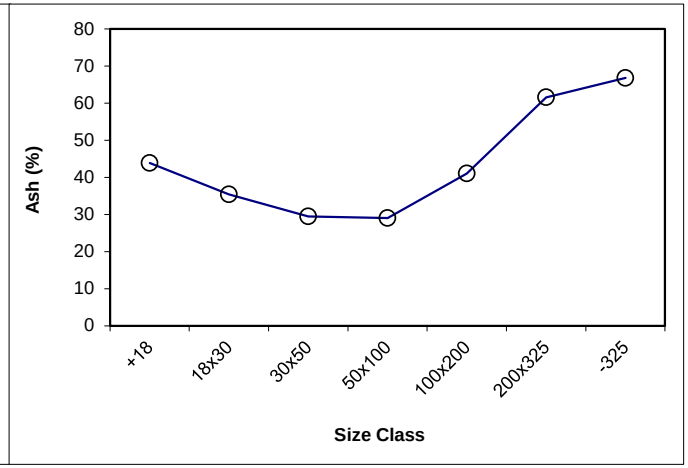
Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	611.8	401.2	210.56	8.17	43.88	8.17	43.88	100.00	37.81
18x30	960.8	370.0	590.76	22.93	35.39	31.10	37.63	91.83	37.27
30x50	1043.5	336.3	707.19	27.45	29.49	58.54	33.81	68.90	37.89
50x100	780.3	308.1	472.13	18.32	29.06	76.87	32.68	41.46	43.46
100x200	549.9	294.5	255.38	9.91	41.01	86.78	33.63	23.13	54.86
200x325	397.8	298.0	99.78	3.87	61.54	90.65	34.82	13.22	65.25
-325	253.2	12.3	240.92	9.35	66.79	100.00	37.81	9.35	66.79
Total (Calc)	--	--	2576.72	100.00	37.81	--	--	--	--





SPIRAL DATA ANALYSIS

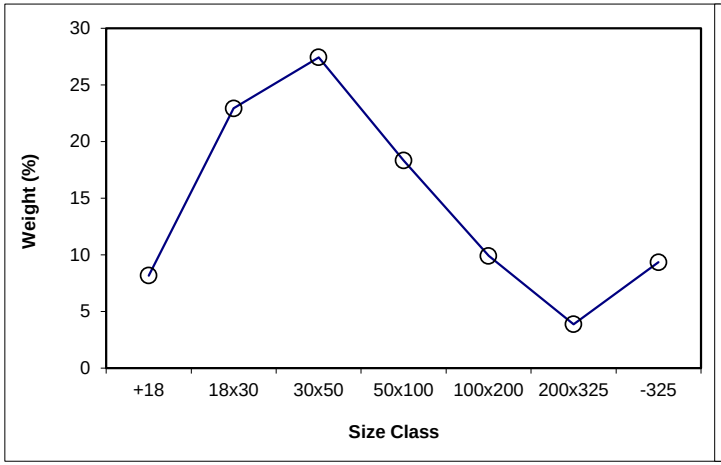
Description: Experiment: 3 -Cardinal In-Plant Spiral Test

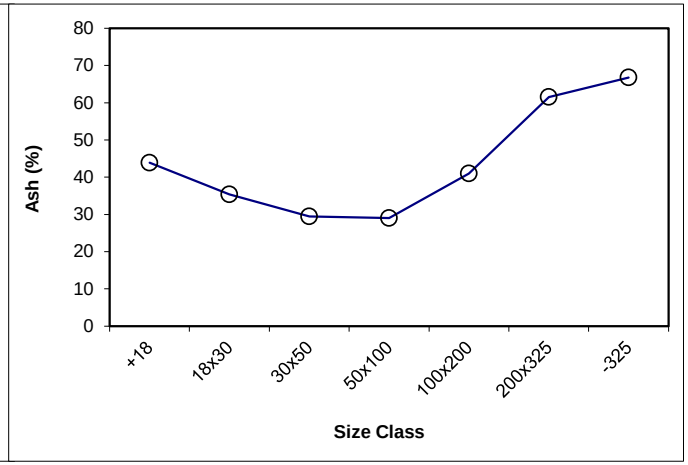
Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	8.17	43.88	8.17	43.88	100.00	37.81			
18x30	22.93	35.39	31.10	37.63	91.83	37.27	x	22.93	35.39
30x50	27.45	29.49	58.54	33.81	68.90	37.89	x	27.45	29.49
50x100	18.32	29.06	76.87	32.68	41.46	43.46	x	18.32	29.06
100x200	9.91	41.01	86.78	33.63	23.13	54.86	x	9.91	41.01
200x325	3.87	61.54	90.65	34.82	13.22	65.25	x	3.87	61.54
-325	9.35	66.79	100.00	37.81	9.35	66.79			
Total (Calc)	100.00	37.81	--	--	--	--	--	82.48	33.92





SPIRAL DATA ANALYSIS

Description: Experiment: 3 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product SC1 Feed Weight (%): 49.21

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	501.9	401.2	100.68	6.56	3.85	6.56	3.85	100.00	14.12
18x30	682.0	370.0	311.96	20.32	3.52	26.88	3.60	93.44	14.84
30x50	755.6	336.3	419.30	27.31	3.50	54.19	3.55	73.12	17.99
50x100	597.3	308.1	289.20	18.84	3.66	73.03	3.58	45.81	26.63
100x200	443.9	294.5	149.43	9.73	12.56	82.76	4.64	26.97	42.67
200x325	360.1	298.0	62.08	4.04	46.91	86.80	6.61	17.24	59.67
-325	214.8	12.3	202.58	13.20	63.58	100.00	14.12	13.20	63.58
Total (Calc)	--	--	1535.23	100.00	14.12	--	--	--	--

Product SC2 Feed Weight (%): 10.87

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	431.9	401.2	30.68	7.54	27.88	7.54	27.88	100.00	17.12
18x30	472.7	370.0	102.65	25.23	13.45	32.78	16.77	92.46	16.25
30x50	463.5	336.3	127.21	31.27	6.29	64.05	11.65	67.22	17.30
50x100	379.7	308.1	71.61	17.60	5.20	81.65	10.26	35.95	26.87
100x200	324.4	294.5	29.87	7.34	21.62	89.00	11.20	18.35	47.67
200x325	311.0	298.0	13.02	3.20	57.80	92.20	12.82	11.00	65.06
-325	37.8	6.1	31.75	7.80	68.03	100.00	17.12	7.80	68.03
Total (Calc)	--	--	406.79	100.00	17.12	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Experiment: 3 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product SM3 Feed Weight (%): 5.78

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	510.3	460.1	50.20	13.91	57.15	13.91	57.15	100.00	38.22
18x30	556.2	442.2	114.00	31.60	47.04	45.51	50.13	86.09	35.16
30x50	491.8	411.8	79.96	22.16	20.15	67.67	40.31	54.49	28.28
50x100	446.0	393.0	52.98	14.68	9.56	82.36	34.83	32.33	33.85
100x200	420.3	391.3	28.97	8.03	35.93	90.39	34.93	17.64	54.06
200x325	392.8	379.6	13.14	3.64	69.36	94.03	36.26	9.61	69.22
-325	28.0	6.5	21.54	5.97	69.13	100.00	38.22	5.97	69.13
Total (Calc)	--	--	360.79	100.00	38.22	--	--	--	--

Product SM4 Feed Weight (%): 1.21

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	414.7	401.2	13.48	5.96	57.26	5.96	57.26	100.00	41.29
18x30	433.6	370.0	63.60	28.12	46.98	34.09	48.77	94.04	40.28
30x50	392.3	336.3	56.06	24.79	25.19	58.88	38.84	65.91	37.42
50x100	344.8	308.1	36.70	16.23	16.05	75.10	33.92	41.12	44.80
100x200	319.2	294.5	24.66	10.91	51.49	86.01	36.14	24.90	63.54
200x325	311.5	298.0	13.54	5.99	75.80	92.00	38.73	13.99	72.94
-325	24.4	6.3	18.09	8.00	70.80	100.00	41.29	8.00	70.80
Total (Calc)	--	--	226.14	100.00	41.29	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Experiment: 3 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product SM5

Feed Weight (%): 0.83

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	463.3	460.1	3.20	1.77	41.91	1.77	41.91	100.00	45.28
18x30	465.6	442.2	23.46	12.95	38.38	14.72	38.81	98.23	45.34
30x50	458.2	411.8	46.40	25.61	22.88	40.33	28.69	85.28	46.40
50x100	426.4	393.0	33.33	18.40	22.24	58.73	26.67	59.67	56.49
100x200	424.2	391.3	32.90	18.16	65.65	76.89	35.88	41.27	71.77
200x325	397.7	379.6	18.09	9.99	80.95	86.88	41.06	23.11	76.58
-325	30.1	6.4	23.77	13.12	73.25	100.00	45.28	13.12	73.25
Total (Calc)	--	--	181.17	100.00	45.28	--	--	--	--

Product ST2

Feed Weight (%): 0.20

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	460.7	460.1	0.57	0.66	30.94	0.66	30.94	100.00	71.12
18x30	444.1	442.2	1.91	2.21	26.50	2.87	27.52	99.34	71.39
30x50	418.2	411.8	6.34	7.34	18.01	10.20	20.68	97.13	72.41
50x100	400.9	393.0	7.87	9.10	30.21	19.31	25.18	89.80	76.85
100x200	416.7	391.3	25.33	29.30	81.73	48.61	59.27	80.69	82.11
200x325	398.5	379.6	18.89	21.85	86.91	70.46	67.84	51.39	82.33
-325	31.9	6.3	25.53	29.54	78.95	100.00	71.12	29.54	78.95
Total (Calc)	--	--	86.43	100.00	71.12	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Experiment: 3 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product ST1 Feed Weight (%): 4.18

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	431.7	401.2	30.45	7.79	62.09	7.79	62.09	100.00	58.23
18x30	481.2	370.0	111.16	28.42	52.04	36.21	54.20	92.21	57.90
30x50	415.5	336.3	79.21	20.25	36.15	56.46	47.73	63.79	60.51
50x100	351.6	308.1	43.48	11.12	41.71	67.58	46.74	43.54	71.84
100x200	356.9	294.5	62.45	15.97	81.52	83.55	53.39	32.42	82.17
200x325	329.8	298.0	31.77	8.12	86.36	91.67	56.31	16.45	82.81
-325	38.9	6.3	32.56	8.33	79.35	100.00	58.23	8.33	79.35
Total (Calc)	--	--	391.07	100.00	58.23	--	--	--	--

Product PT2 Feed Weight (%): 0.84

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	461.7	460.1	1.57	1.20	51.09	1.20	51.09	100.00	69.82
18x30	451.8	442.2	9.66	7.35	48.38	8.54	48.76	98.80	70.05
30x50	432.9	411.8	21.08	16.03	45.94	24.57	46.92	91.46	70.76
50x100	427.0	393.0	34.01	25.87	71.33	50.44	59.44	75.43	77.28
100x200	430.4	391.3	39.02	29.68	83.32	80.12	68.29	49.56	80.39
200x325	390.4	379.6	10.80	8.22	81.81	88.33	69.54	19.88	76.02
-325	21.4	6.1	15.34	11.67	71.94	100.00	69.82	11.67	71.94
Total (Calc)	--	--	131.47	100.00	69.82	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Experiment: 3 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product PT1

Feed Weight (%): 26.88

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	600.0	401.2	198.77	10.78	86.95	10.78	86.95	100.00	84.64
18x30	826.8	370.0	456.79	24.76	85.41	35.54	85.88	89.22	84.36
30x50	872.7	336.3	536.42	29.08	85.15	64.62	85.55	64.46	83.96
50x100	667.8	308.1	359.68	19.50	83.64	84.11	85.11	35.38	82.98
100x200	473.0	294.5	178.49	9.68	82.92	93.79	84.88	15.89	82.18
200x325	347.2	298.0	49.19	2.67	82.72	96.46	84.82	6.21	81.02
-325	71.7	6.3	65.35	3.54	79.74	100.00	84.64	3.54	79.74
Total (Calc)	--	--	1844.69	100.00	84.64	--	--	--	--

SPIRAL DATA ANALYSIS

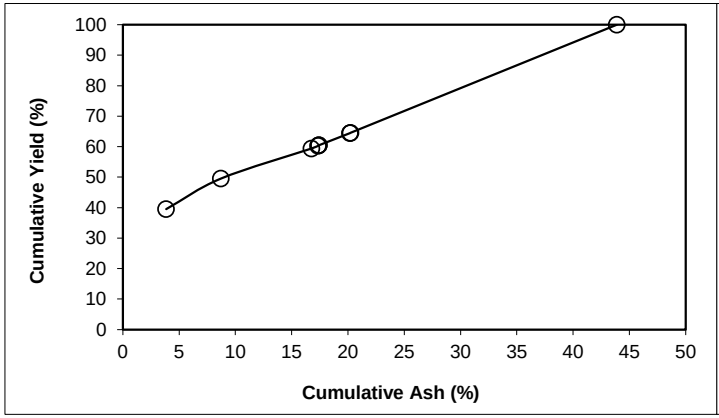
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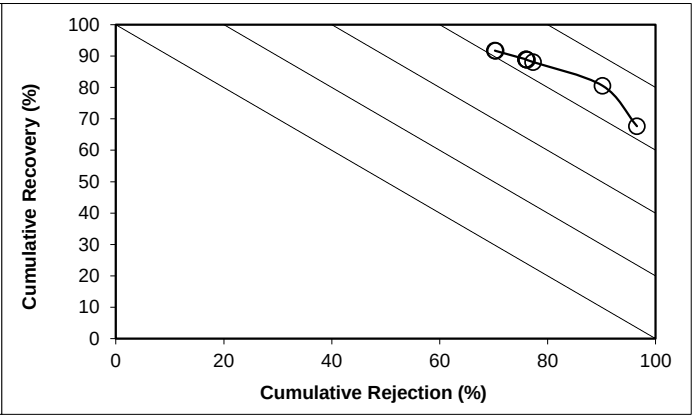
Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 8.17

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	39.50	3.85	39.50	3.85	67.67	60.50	70.02	96.53	64.20
SC2	10.03	27.88	49.53	8.72	80.56	50.47	78.39	90.16	70.72
SM3	9.85	57.15	59.37	16.75	88.08	40.63	83.54	77.33	65.42
SM4	0.88	57.26	60.26	17.34	88.75	39.74	84.12	76.18	64.94
SM5	0.18	41.91	60.44	17.42	88.94	39.56	84.31	76.01	64.95
ST2	0.02	30.94	60.45	17.42	88.96	39.55	84.34	76.00	64.96
ST1	3.98	62.09	64.43	20.18	91.65	35.57	86.83	70.37	62.02
PT2	0.12	51.09	64.56	20.24	91.76	35.44	86.95	70.22	61.98
PT1	35.44	86.95	100.00	43.88	100.00	0.00			
Total (Calc)	100.00	43.88	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

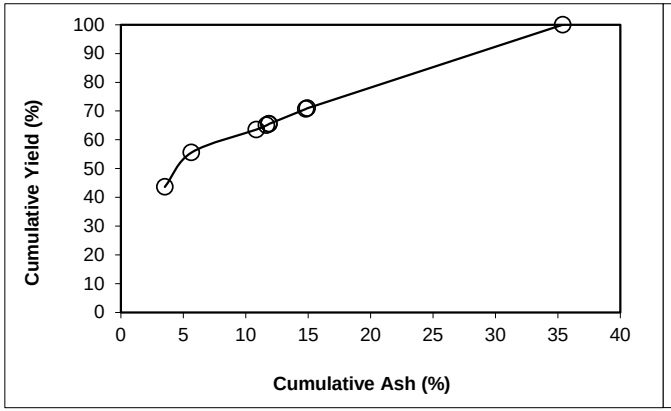
Description: Experiment: 3 -Cardinal In-Plant Spiral Test

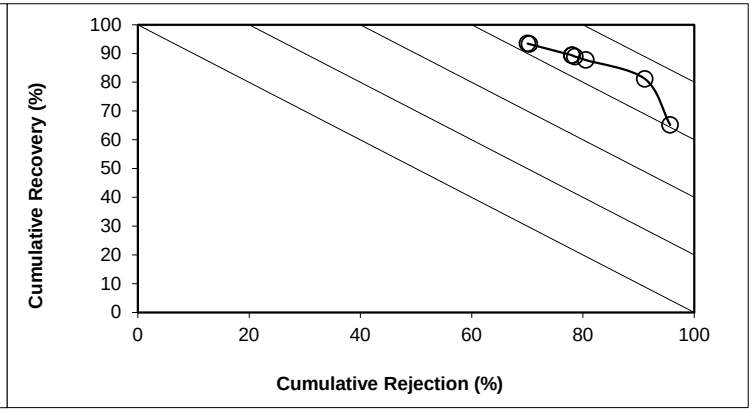
Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 22.93

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	43.62	3.52	43.62	3.52	65.14	56.38	60.06	95.67	60.81
SC2	11.96	13.45	55.58	5.65	81.16	44.42	72.60	91.12	72.29
SM3	7.97	47.04	63.55	10.84	87.70	36.45	78.19	80.53	68.23
SM4	1.48	46.98	65.03	11.67	88.91	34.97	79.52	78.56	67.48
SM5	0.47	38.38	65.50	11.86	89.36	34.50	80.08	78.05	67.42
ST2	0.02	26.50	65.52	11.86	89.38	34.48	80.11	78.04	67.42
ST1	5.18	52.04	70.70	14.81	93.23	29.30	85.07	70.42	63.65
PT2	0.27	48.38	70.97	14.93	93.44	29.03	85.41	70.05	63.50
PT1	29.03	85.41	100.00	35.39	100.00	0.00			
Total (Calc)	100.00	35.39	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

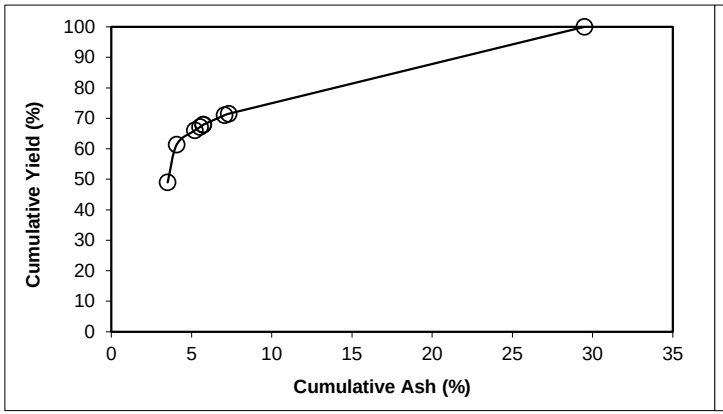
Description: Experiment: 3 -Cardinal In-Plant Spiral Test

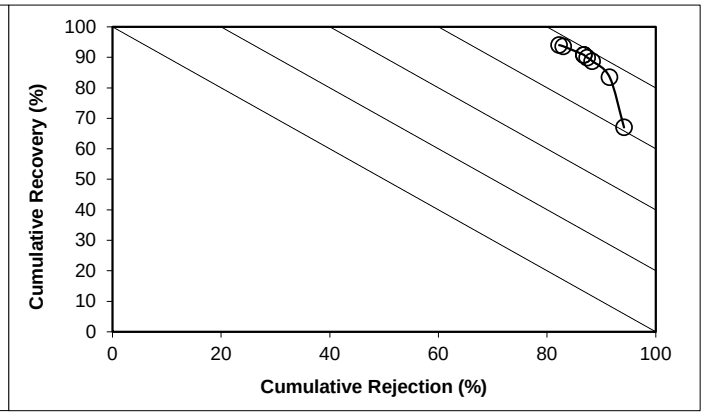
Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 27.45

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	48.97	3.50	48.97	3.50	67.02	51.03	54.43	94.18	61.20
SC2	12.38	6.29	61.36	4.07	83.48	38.64	69.85	91.54	75.02
SM3	4.67	20.15	66.03	5.20	88.77	33.97	76.68	88.35	77.11
SM4	1.09	25.19	67.12	5.53	89.92	32.88	78.39	87.42	77.34
SM5	0.77	22.88	67.89	5.73	90.77	32.11	79.73	86.81	77.59
ST2	0.05	18.01	67.94	5.74	90.83	32.06	79.83	86.78	77.61
ST1	3.08	36.15	71.03	7.06	93.62	28.97	84.48	83.00	76.63
PT2	0.49	45.94	71.52	7.33	94.00	28.48	85.15	82.23	76.24
PT1	28.48	85.15	100.00	29.49	100.00	0.00			
0									
Total (Calc)	100.00	29.49	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

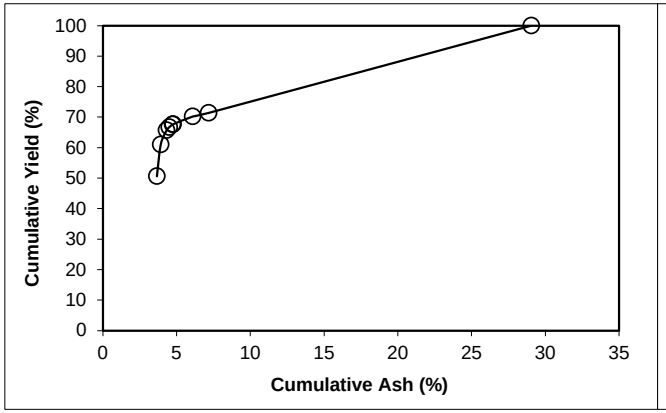
Description: Experiment: 3 -Cardinal In-Plant Spiral Test

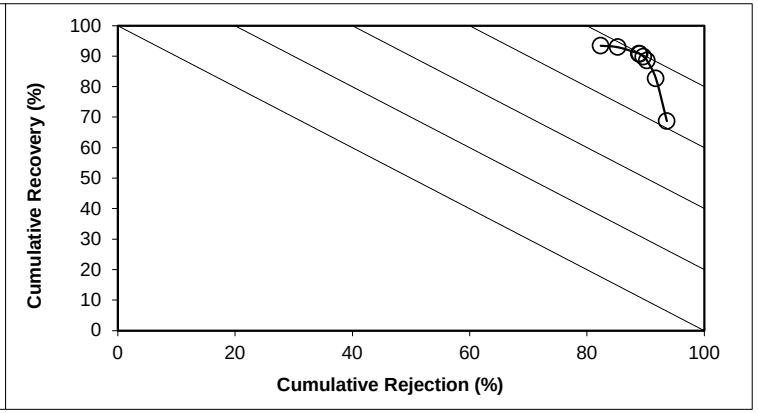
Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 18.32

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	50.60	3.66	50.60	3.66	68.70	49.40	55.06	93.62	62.32
SC2	10.44	5.20	61.04	3.93	82.66	38.96	68.42	91.75	74.41
SM3	4.63	9.56	65.67	4.32	88.56	34.33	76.37	90.23	78.79
SM4	1.07	16.05	66.74	4.51	89.83	33.26	78.31	89.64	79.47
SM5	0.83	22.24	67.57	4.73	90.74	32.43	79.75	89.00	79.74
ST2	0.10	30.21	67.67	4.77	90.84	32.33	79.90	88.90	79.74
ST1	2.54	41.71	70.21	6.10	92.92	29.79	83.15	85.26	78.18
PT2	1.19	71.33	71.40	7.19	93.40	28.60	83.64	82.34	75.74
PT1	28.60	83.64	100.00	29.06	100.00	0.00			
0									
Total (Calc)	100.00	29.06	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

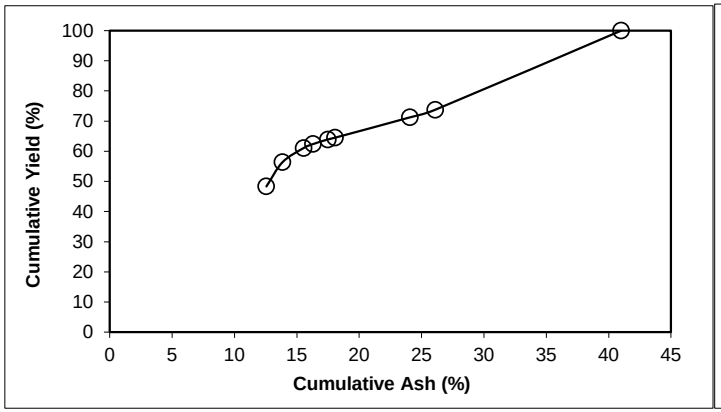
Description: Experiment: 3 -Cardinal In-Plant Spiral Test

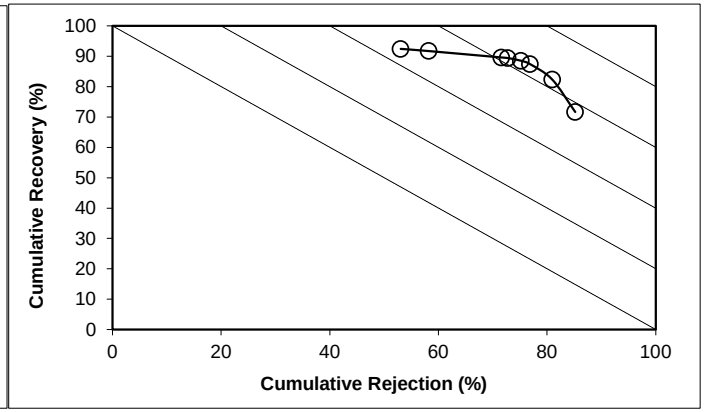
Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 9.91

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	48.33	12.56	48.33	12.56	71.64	51.67	67.61	85.19	56.83
SC2	8.05	21.62	56.38	13.85	82.33	43.62	76.10	80.95	63.28
SM3	4.69	35.93	61.07	15.55	87.42	38.93	80.94	76.84	64.26
SM4	1.33	51.49	62.40	16.31	88.51	37.60	81.98	75.18	63.69
SM5	1.52	65.65	63.92	17.49	89.40	36.08	82.67	72.74	62.14
ST2	0.59	81.73	64.50	18.07	89.58	35.50	82.68	71.58	61.16
ST1	6.73	81.52	71.24	24.07	91.69	28.76	82.96	58.19	49.88
PT2	2.52	83.32	73.76	26.09	92.40	26.24	82.92	53.06	45.47
PT1	26.24	82.92	100.00	41.01	100.00	0.00			
Total (Calc)	100.00	41.01	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

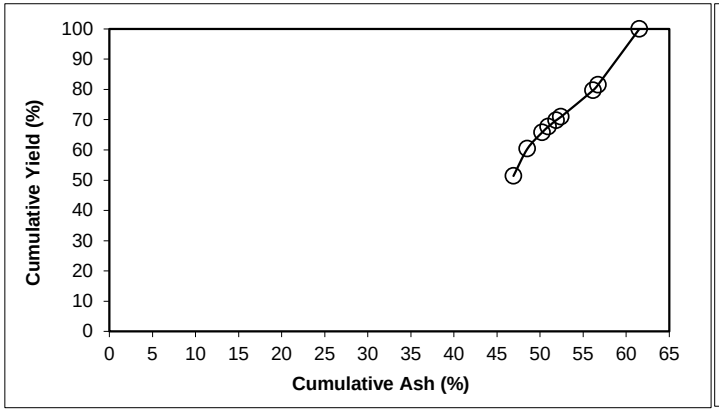
Description: Experiment: 3 -Cardinal In-Plant Spiral Test

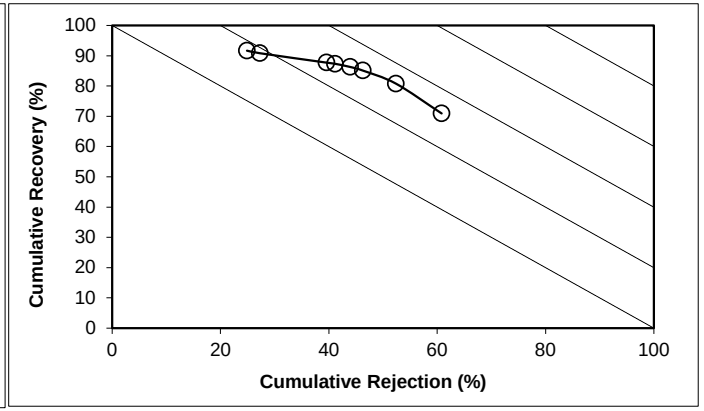
Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 3.87

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	51.39	46.91	51.39	46.91	70.93	48.61	77.00	60.82	31.76
SC2	8.98	57.80	60.37	48.53	80.78	39.63	81.35	52.39	33.17
SM3	5.44	69.36	65.81	50.25	85.11	34.19	83.25	46.26	31.37
SM4	1.87	75.80	67.68	50.96	86.29	32.32	83.68	43.96	30.25
SM5	2.14	80.95	69.82	51.88	87.35	30.18	83.88	41.14	28.49
ST2	1.12	86.91	70.93	52.43	87.73	29.07	83.76	39.56	27.29
ST1	8.77	86.36	79.70	56.16	90.84	20.30	82.64	27.26	18.10
PT2	1.79	81.81	81.49	56.72	91.68	18.51	82.72	24.88	16.57
PT1	18.51	82.72	100.00	61.54	100.00	0.00			
Total (Calc)	100.00	61.54	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

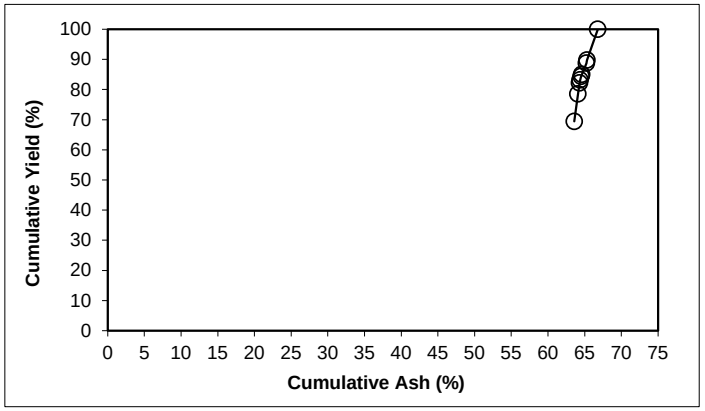
Description: Experiment: 3 -Cardinal In-Plant Spiral Test

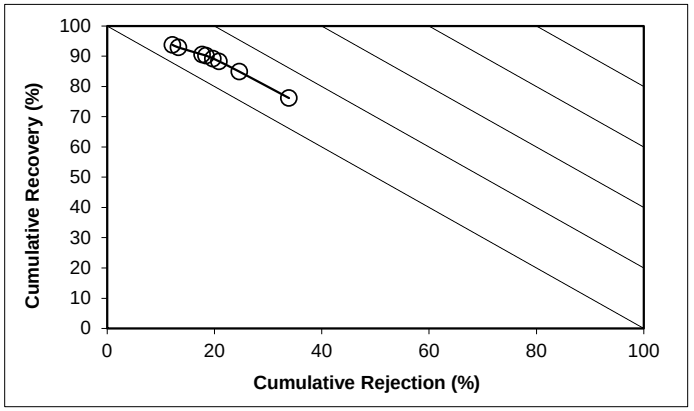
Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 9.35

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	69.46	63.58	69.46	63.58	76.18	30.54	74.10	33.88	10.06
SC2	9.07	68.03	78.53	64.09	84.91	21.47	76.66	24.65	9.55
SM3	3.69	69.13	82.22	64.32	88.34	17.78	78.22	20.82	9.17
SM4	1.03	70.80	83.25	64.40	89.25	16.75	78.68	19.73	8.98
SM5	1.16	73.25	84.42	64.52	90.19	15.58	79.09	18.45	8.64
ST2	0.63	78.95	85.04	64.63	90.58	14.96	79.09	17.71	8.30
ST1	3.72	79.35	88.76	65.24	92.90	11.24	79.01	13.29	6.19
PT2	1.05	71.94	89.82	65.32	93.79	10.18	79.74	12.16	5.95
PT1	10.18	79.74	100.00	66.79	100.00	0.00			
Total (Calc)	100.00	66.79	--	--	--	--	--	--	--





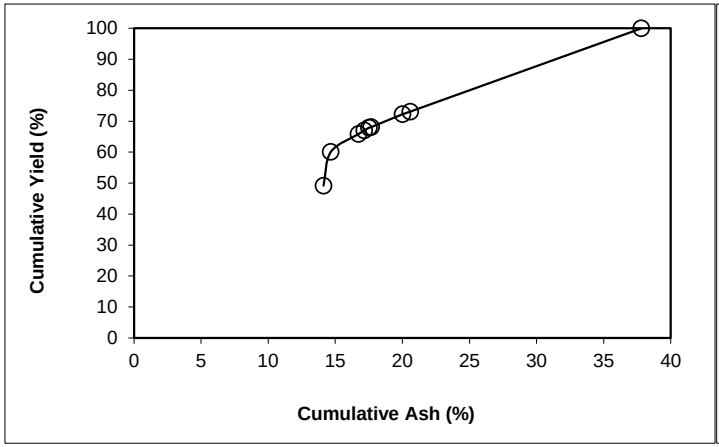
SPIRAL DATA ANALYSIS

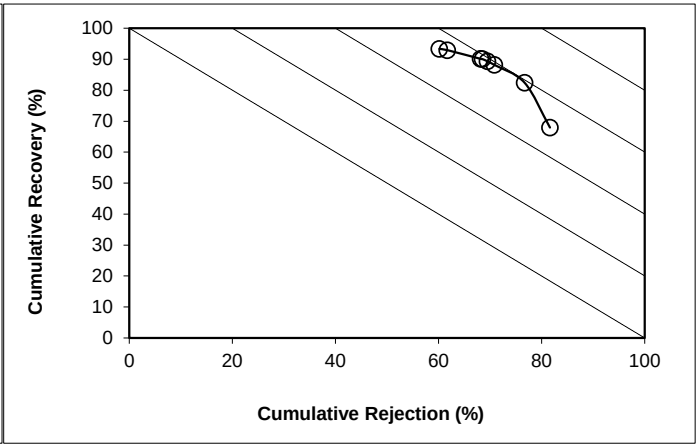
Description: Experiment: 3 -Cardinal In-Plant Spiral Test

Comments: 12T0+23T1+34T0+4CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	49.21	14.12	49.21	14.12	67.96	50.79	60.76	81.62	49.57
SC2	10.87	17.12	60.08	14.67	82.44	39.92	72.64	76.69	59.13
SM3	5.78	38.22	65.86	16.73	88.18	34.14	78.47	70.85	59.03
SM4	1.21	41.29	67.07	17.18	89.32	32.93	79.84	69.53	58.85
SM5	0.83	45.28	67.90	17.52	90.05	32.10	80.73	68.54	58.59
ST2	0.20	71.12	68.10	17.68	90.15	31.90	80.79	68.16	58.31
ST1	4.18	58.23	72.28	20.02	92.95	27.72	84.19	61.73	54.68
PT2	0.84	69.82	73.12	20.59	93.36	26.88	84.64	60.17	53.53
PT1	26.88	84.64	100.00	37.81	100.00	0.00			
Total (Calc)	100.00	37.81	--	--	--	--	--	--	--

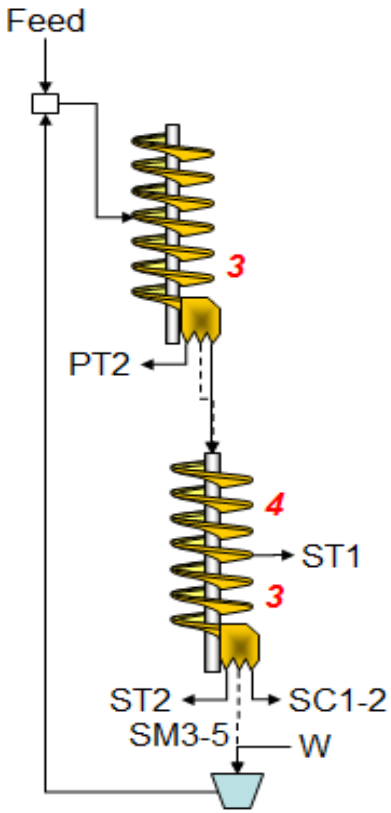




SPIRAL DATA ANALYSIS

Description: Experiment: 4 - Cardinal In-Plant Spiral Test

Comments: $1_{2T0}+2_{3T0}+3_{CT1}$ Spiral Circuit (1 x 0.15 mm Nominal Particle Size)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
SC1	40.0	34.9	100	87
SC2	34.9	28.6	87	72
SM3	28.6	21.6	72	54
SM4	21.6	16.7	54	42
SM5	16.7	8.3	42	21
ST2	8.3	0.0	21	0
ST1	0.0	--	0	--
PT2				

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
SC1	1.220	17.1	23.71	27.23
SC2	0.292	26.0	3.33	4.15
SM3	0.186	37.0	1.26	1.70
SM4	0.044	33.3	0.35	0.45
SM5	0.031	23.4	0.41	0.48
ST2	0.006	12.6	0.17	0.18
ST1	0.169	41.0	0.98	1.29
PT2	0.579	57.6	1.70	2.67
Total	2.528	24.1	31.92	38.15

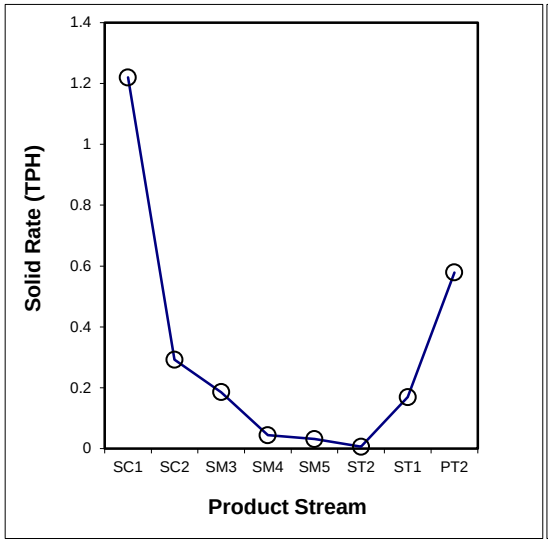
SPIRAL DATA ANALYSIS

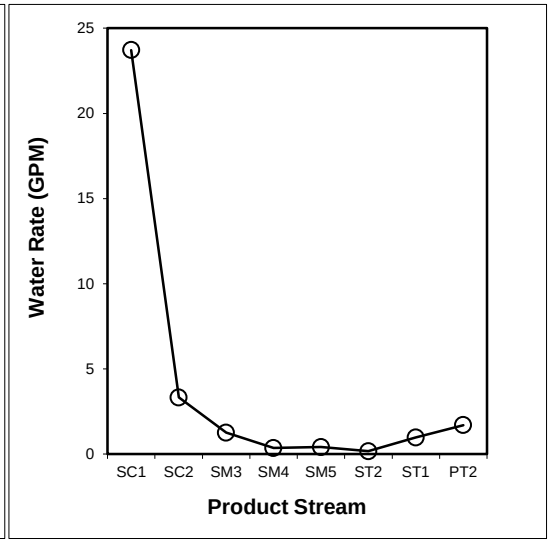
Description: Experiment: 4 - Cardinal In-Plant Spiral Test

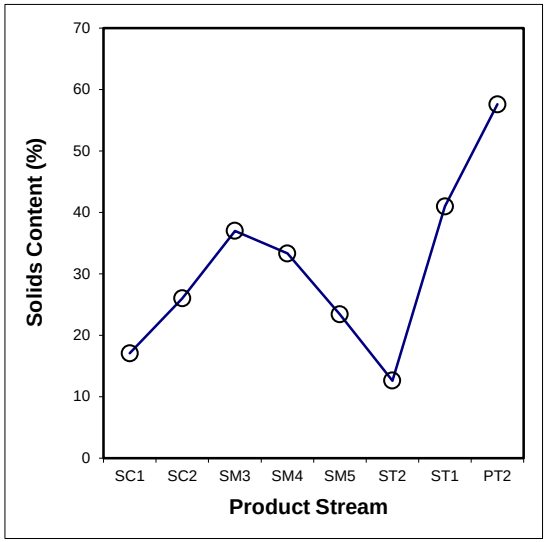
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
SC1	5	10276.00	1158.96	7.148	3553.1	2014.4	1.220	48.26	17.07
SC2	5	1605.54	170.03	1.124	2853.3	2484.5	0.292	11.57	26.01
SM3	10	1374.47	92.12	0.502	2482.3	2014.1	0.186	7.34	37.00
SM4	30	1111.06	92.98	0.133	2349.5	2014.6	0.044	1.75	33.32
SM5	30	1120.73	93.29	0.134	2721.9	2484.5	0.031	1.24	23.38
ST2	70	967.11	93.63	0.049	2593.2	2484.4	0.006	0.24	12.60
ST1	10	1230.52	173.86	0.413	2441.2	2014.2	0.169	6.70	40.98
PT2	10	2746.85	173.27	1.005	3474.4	2014.5	0.579	22.90	57.61
Total (Calc)	--	--	--	10.508	--	--	2.528	100.00	24.06
Total (Head)	5	13738	1042.07	10.508	5208.7	2020.5	2.528	--	25.11







SPIRAL DATA ANALYSIS

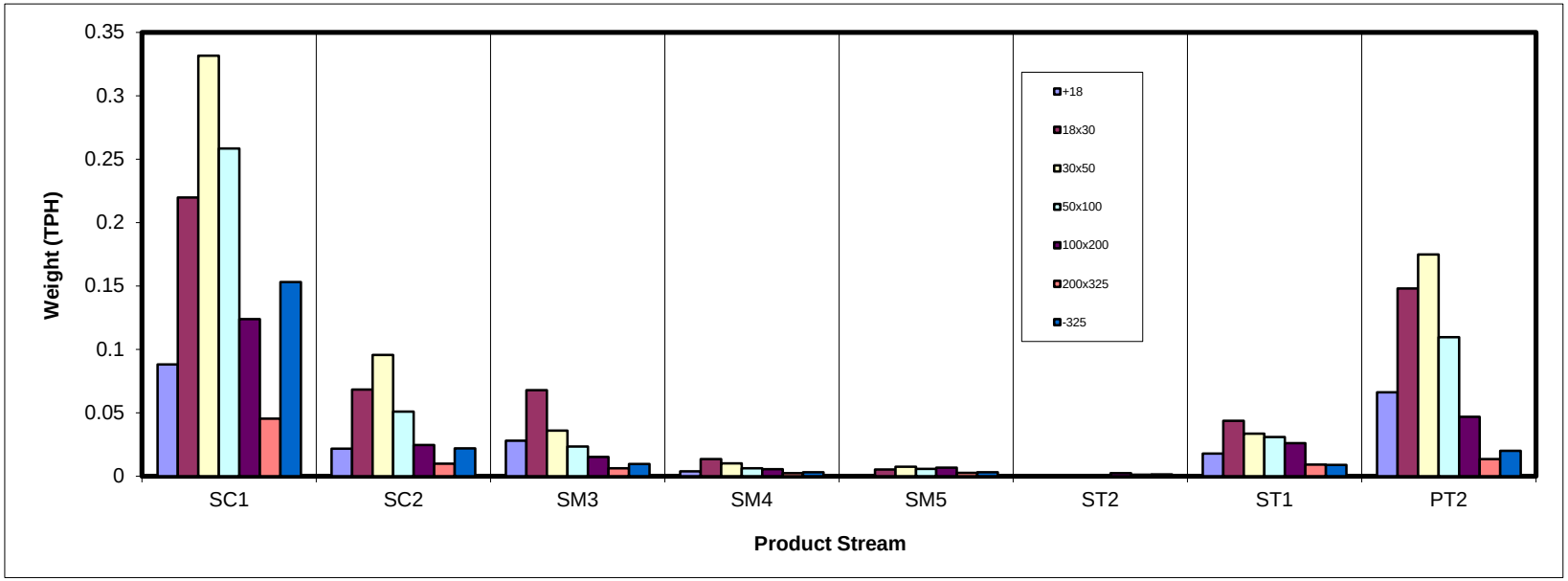
Description: Experiment: 4 - Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	
+18	0.088	0.022	0.028	0.004	0.001	0.000	0.018	0.066	0.226
18x30	0.220	0.068	0.068	0.013	0.005	0.000	0.044	0.148	0.566
30x50	0.332	0.095	0.036	0.010	0.007	0.000	0.033	0.175	0.689
50x100	0.258	0.051	0.023	0.006	0.006	0.001	0.031	0.110	0.486
100x200	0.124	0.024	0.015	0.005	0.007	0.002	0.026	0.047	0.250
200x325	0.045	0.010	0.006	0.002	0.003	0.001	0.009	0.014	0.090
-325	0.153	0.022	0.010	0.003	0.003	0.001	0.009	0.020	0.221
Total (Calc)	1.220	0.292	0.186	0.044	0.031	0.006	0.169	0.579	2.528



SPIRAL DATA ANALYSIS

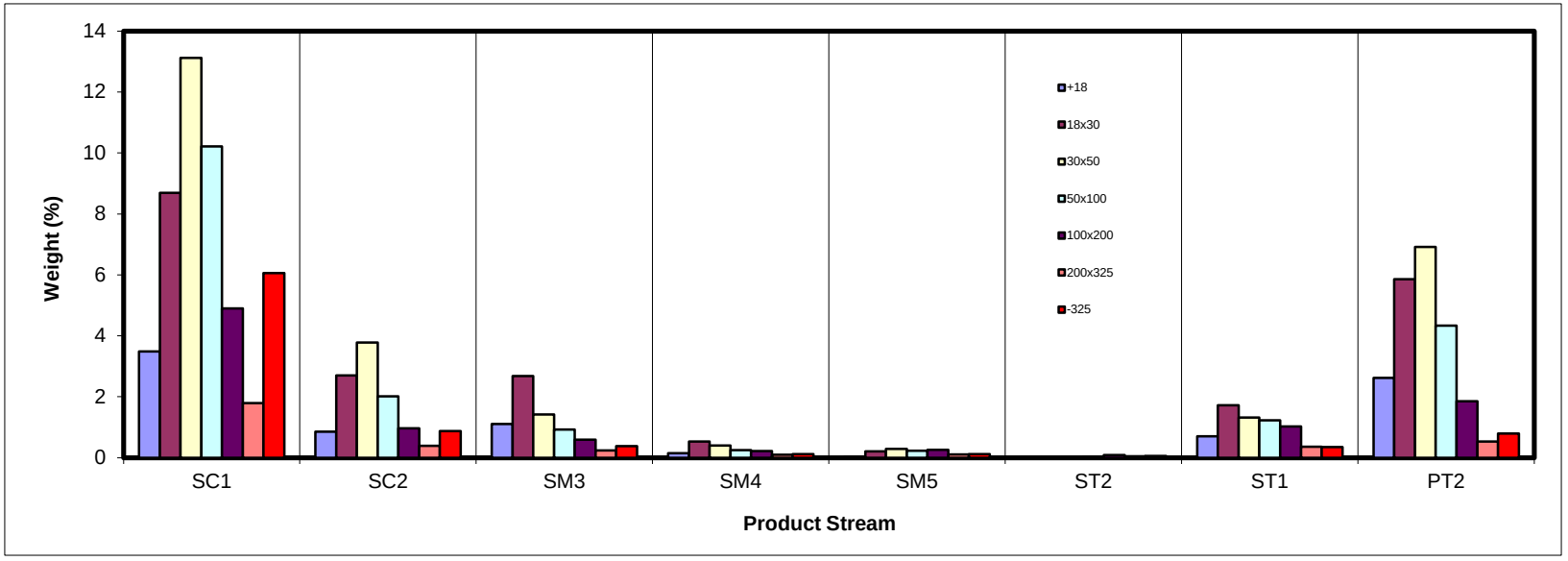
Description: Experiment: 4 - Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	
+18	3.48	0.86	1.10	0.15	0.03	0.00	0.70	2.62	8.94
18x30	8.69	2.70	2.68	0.53	0.20	0.01	1.72	5.86	22.39
30x50	13.12	3.78	1.42	0.40	0.29	0.02	1.32	6.91	27.26
50x100	10.22	2.01	0.92	0.25	0.23	0.04	1.22	4.33	19.22
100x200	4.90	0.97	0.60	0.21	0.26	0.09	1.02	1.85	9.90
200x325	1.80	0.38	0.24	0.09	0.10	0.04	0.36	0.53	3.55
-325	6.06	0.87	0.38	0.12	0.12	0.05	0.35	0.79	8.73
Total (Calc)	48.26	11.57	7.34	1.75	1.24	0.24	6.70	22.90	100.00



SPIRAL DATA ANALYSIS

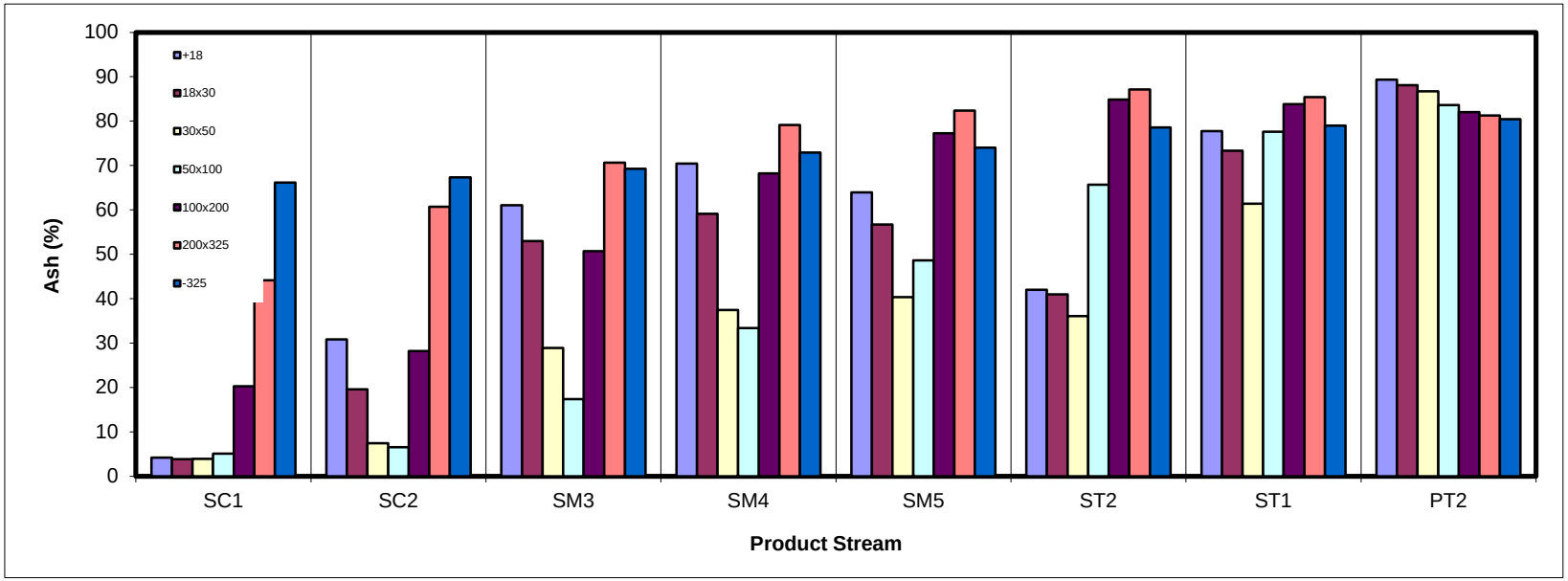
Description: Experiment: 4 - Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	
+18	4.18	30.82	61.08	70.41	63.97	42.03	77.75	89.33	45.76
18x30	3.85	19.58	52.97	59.10	56.69	40.95	73.30	88.08	40.80
30x50	3.91	7.46	28.91	37.44	40.36	36.09	61.36	86.72	30.40
50x100	5.11	6.53	17.37	33.36	48.64	65.68	77.61	83.58	29.15
100x200	20.30	28.17	50.68	68.25	77.27	84.88	83.83	82.01	44.12
200x325	44.16	60.70	70.62	79.10	82.40	87.15	85.43	81.30	60.03
-325	66.15	67.35	69.29	72.94	74.03	78.57	79.00	80.41	68.47
Total (Calc)	15.14	19.86	46.31	54.60	59.61	76.82	74.75	86.05	39.60



SPIRAL DATA ANALYSIS

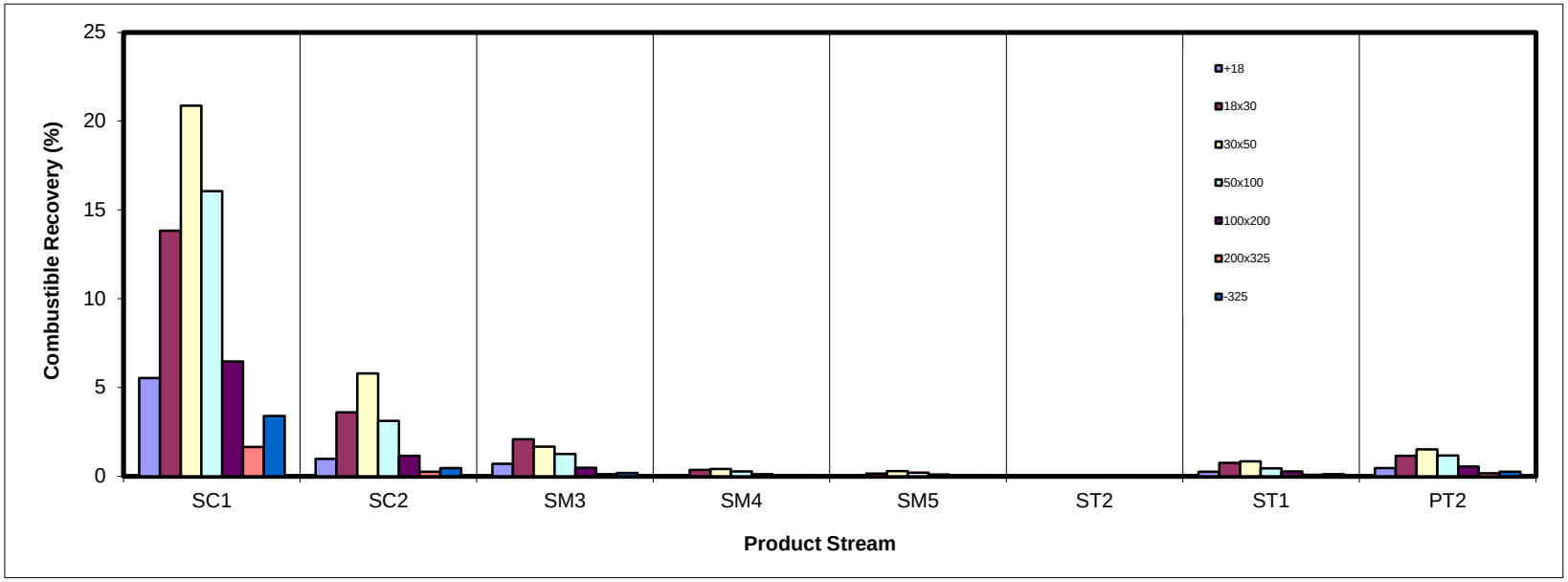
Description: Experiment: 4 - Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	
+18	5.53	0.98	0.71	0.07	0.02	0.00	0.26	0.46	8.03
18x30	13.83	3.60	2.09	0.36	0.15	0.01	0.76	1.16	21.95
30x50	20.87	5.79	1.67	0.41	0.29	0.02	0.85	1.52	31.41
50x100	16.05	3.11	1.26	0.27	0.20	0.02	0.45	1.18	22.54
100x200	6.47	1.15	0.49	0.11	0.10	0.02	0.27	0.55	9.16
200x325	1.66	0.25	0.12	0.03	0.03	0.01	0.09	0.17	2.35
-325	3.39	0.47	0.19	0.05	0.05	0.02	0.12	0.26	4.55
Total (Calc)	67.80	15.35	6.53	1.32	0.83	0.09	2.80	5.29	100.00



SPIRAL DATA ANALYSIS

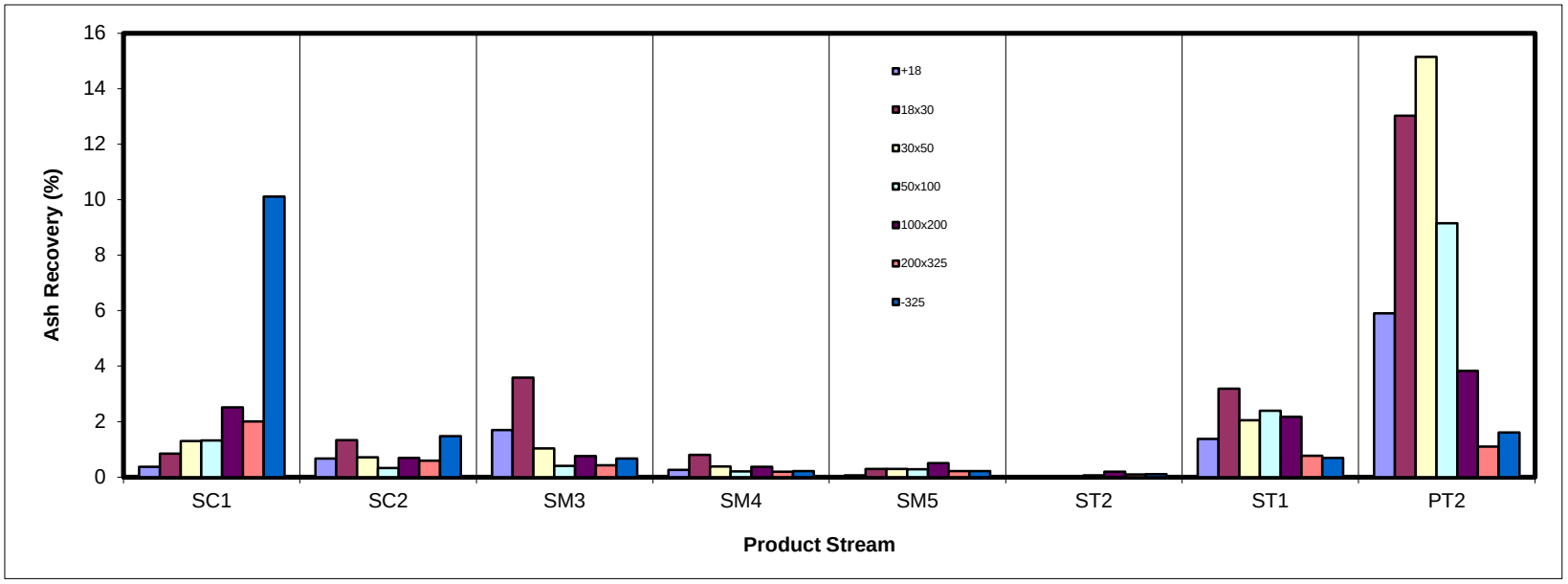
Description: Experiment: 4 - Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	
+18	0.37	0.67	1.70	0.26	0.06	0.00	1.38	5.91	10.34
18x30	0.84	1.34	3.59	0.80	0.29	0.01	3.19	13.03	23.08
30x50	1.30	0.71	1.04	0.38	0.30	0.01	2.05	15.14	20.93
50x100	1.32	0.33	0.40	0.21	0.28	0.06	2.40	9.15	14.15
100x200	2.51	0.69	0.76	0.37	0.51	0.20	2.17	3.83	11.03
200x325	2.00	0.59	0.43	0.19	0.21	0.09	0.77	1.10	5.39
-325	10.12	1.48	0.67	0.21	0.22	0.10	0.69	1.61	15.09
Total (Calc)	18.46	5.80	8.59	2.41	1.87	0.47	12.64	49.75	100.00



SPIRAL DATA ANALYSIS

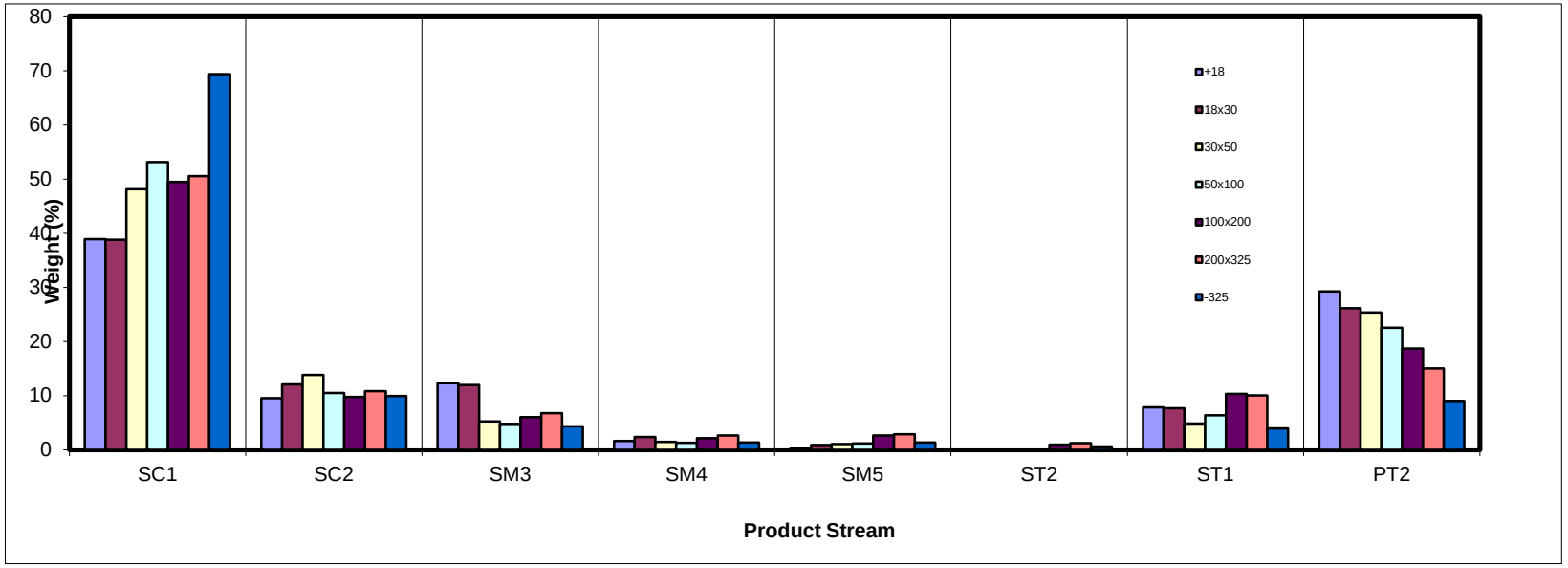
Description: Experiment: 4 - Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	
+18	38.95	9.57	12.33	1.63	0.39	0.01	7.85	29.27	100.00
18x30	38.80	12.06	11.97	2.38	0.91	0.02	7.70	26.15	100.00
30x50	48.12	13.85	5.22	1.46	1.08	0.06	4.85	25.36	100.00
50x100	53.17	10.47	4.78	1.28	1.20	0.18	6.36	22.55	100.00
100x200	49.50	9.77	6.02	2.16	2.62	0.92	10.34	18.67	100.00
200x325	50.56	10.82	6.76	2.67	2.87	1.21	10.06	15.05	100.00
-325	69.39	9.95	4.36	1.33	1.36	0.59	3.96	9.06	100.00
Total (Calc)	48.26	11.57	7.34	1.75	1.24	0.24	6.70	22.90	100.00



SPIRAL DATA ANALYSIS

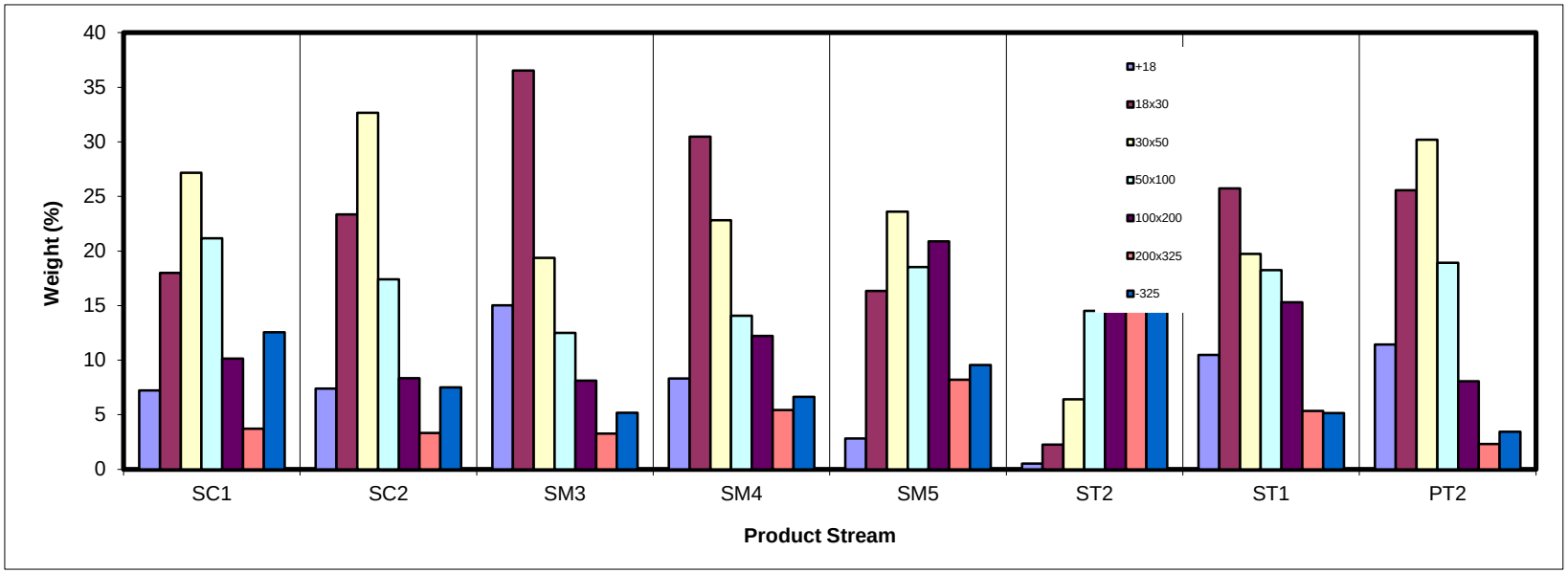
Description: Experiment: 4 - Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%	PT2	
+18	7.22	7.40	15.02	8.33	2.82	0.51	10.48	11.44	8.94
18x30	18.00	23.35	36.52	30.48	16.36	2.27	25.73	25.58	22.39
30x50	27.18	32.65	19.38	22.81	23.62	6.41	19.73	30.20	27.26
50x100	21.17	17.40	12.51	14.08	18.54	14.52	18.26	18.92	19.22
100x200	10.16	8.36	8.12	12.23	20.90	37.53	15.29	8.08	9.90
200x325	3.72	3.32	3.27	5.42	8.21	17.69	5.34	2.33	3.55
-325	12.55	7.51	5.18	6.65	9.56	21.07	5.16	3.45	8.73
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00



SPIRAL DATA ANALYSIS

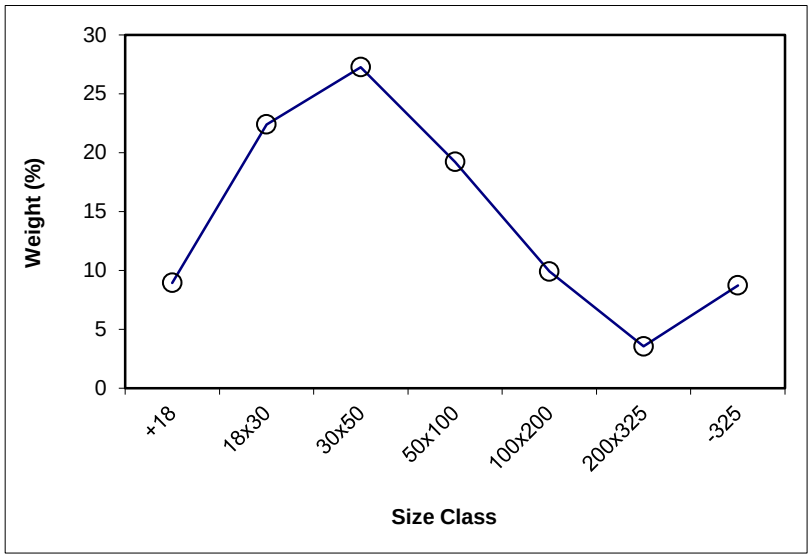
Description: Experiment: 4 - Cardinal In-Plant Spiral Test

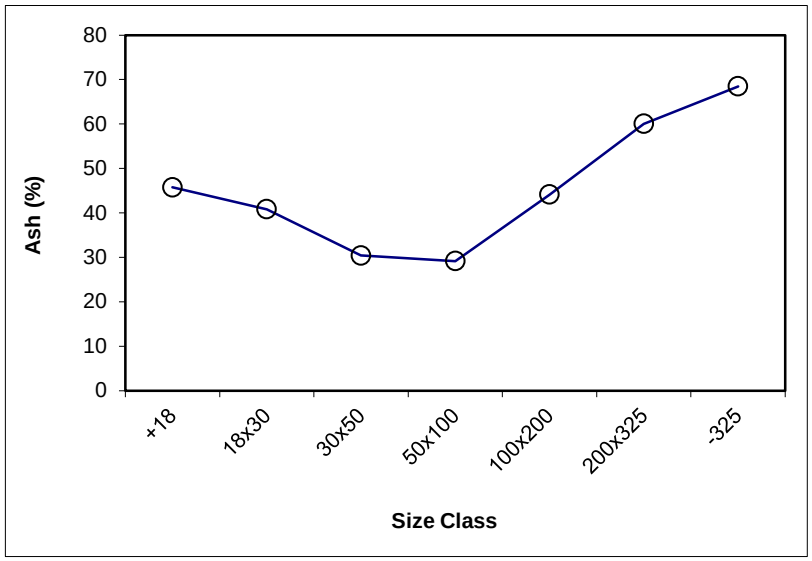
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	686.4	401.2	285.18	8.94	45.76	8.94	45.76	100.00	39.60
18x30	1084.0	370.0	713.95	22.39	40.80	31.34	42.22	91.06	38.99
30x50	1205.5	336.3	869.19	27.26	30.40	58.60	36.72	68.66	38.40
50x100	920.8	308.1	612.66	19.22	29.15	77.82	34.85	41.40	43.67
100x200	610.2	294.5	315.75	9.90	44.12	87.72	35.90	22.18	56.25
200x325	411.2	298.0	113.25	3.55	60.03	91.27	36.83	12.28	66.03
-325	290.6	12.4	278.22	8.73	68.47	100.00	39.60	8.73	68.47
Total (Calc)	--	--	3188.20	100.00	39.60	--	--	--	--





SPIRAL DATA ANALYSIS

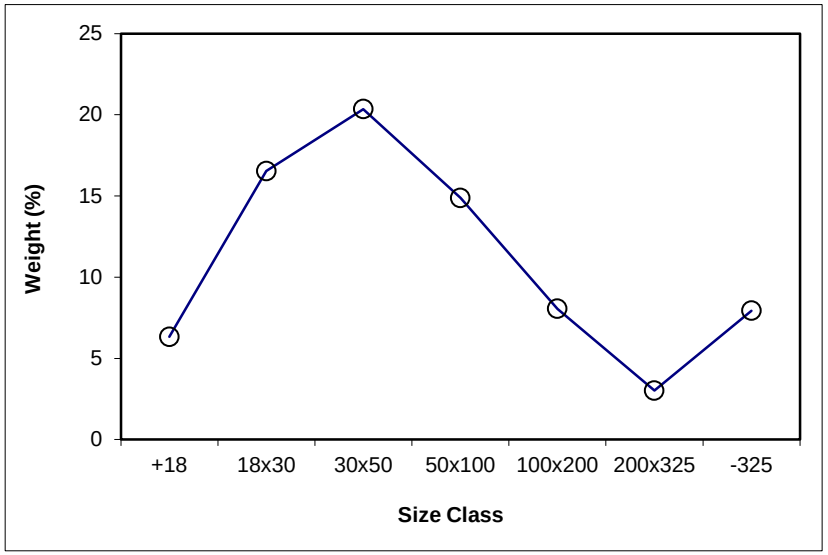
Description: Experiment: 4 - Cardinal In-Plant Spiral Test

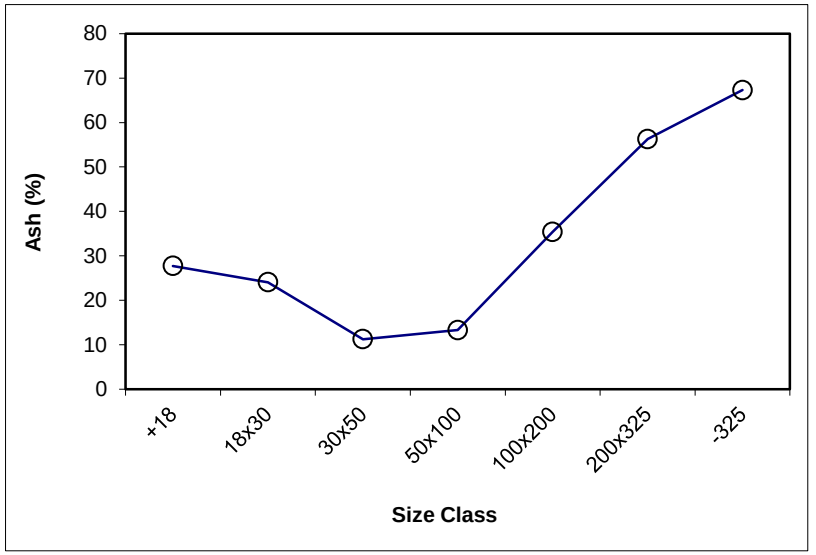
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	6.33	27.73	6.33	27.73	77.10	25.80			
18x30	16.54	24.06	22.86	25.08	70.78	25.63	x	16.54	24.06
30x50	20.35	11.26	43.21	18.57	54.24	26.11	x	20.35	11.26
50x100	14.88	13.30	58.10	17.22	33.89	35.02	x	14.88	13.30
100x200	8.05	35.42	66.15	19.44	19.01	52.03	x	8.05	35.42
200x325	3.02	56.27	69.17	21.04	10.95	64.25	x	3.02	56.27
-325	7.94	67.29	77.10	25.80	7.94	67.29			
Total (Calc)	77.10	25.80	--	--	--	--	--	62.84	20.37





SPIRAL DATA ANALYSIS

Description: Experiment: 4 - Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product SC1 Feed Weight (%): 48.26

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	512.3	401.2	111.08	7.22	4.18	7.22	4.18	100.00	15.14
18x30	647.1	370.0	277.05	18.00	3.85	25.22	3.94	92.78	16.00
30x50	754.5	336.3	418.26	27.18	3.91	52.41	3.93	74.78	18.92
50x100	633.9	308.1	325.75	21.17	5.11	73.58	4.27	47.59	27.50
100x200	450.8	294.5	156.29	10.16	20.30	83.73	6.21	26.42	45.43
200x325	355.2	298.0	57.26	3.72	44.16	87.45	7.83	16.27	61.12
-325	199.3	6.3	193.05	12.55	66.15	100.00	15.14	12.55	66.15
Total (Calc)	--	--	1538.74	100.00	15.14	--	--	--	--

Product SC2 Feed Weight (%): 11.57

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	487.4	460.1	27.28	7.40	30.82	7.40	30.82	100.00	19.86
18x30	528.3	442.2	86.12	23.35	19.58	30.75	22.29	92.60	18.98
30x50	532.2	411.8	120.41	32.65	7.46	63.40	14.65	69.25	18.78
50x100	457.2	393.0	64.17	17.40	6.53	80.80	12.90	36.60	28.88
100x200	422.2	391.3	30.84	8.36	28.17	89.17	14.34	19.20	49.13
200x325	391.9	379.6	12.25	3.32	60.70	92.49	16.00	10.83	65.31
-325	34.1	6.4	27.69	7.51	67.35	100.00	19.86	7.51	67.35
Total (Calc)	--	--	368.76	100.00	19.86	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Experiment: 4 - Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product SM3 Feed Weight (%): 7.34

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	471.5	401.2	70.32	15.02	61.08	15.02	61.08	100.00	46.31
18x30	541.0	370.0	170.99	36.52	52.97	51.54	55.34	84.98	43.70
30x50	427.0	336.3	90.74	19.38	28.91	70.92	48.11	48.46	36.70
50x100	366.7	308.1	58.59	12.51	17.37	83.44	43.50	29.08	41.90
100x200	332.5	294.5	38.00	8.12	50.68	91.55	44.14	16.56	60.43
200x325	313.3	298.0	15.30	3.27	70.62	94.82	45.05	8.45	69.81
-325	30.2	6.0	24.24	5.18	69.29	100.00	46.31	5.18	69.29
Total (Calc)	--	--	468.19	100.00	46.31	--	--	--	--

Product SM4 Feed Weight (%): 1.75

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	429.1	401.2	27.90	8.33	70.41	8.33	70.41	100.00	54.60
18x30	472.1	370.0	102.06	30.48	59.10	38.81	61.53	91.67	53.17
30x50	412.7	336.3	76.38	22.81	37.44	61.62	52.61	61.19	50.21
50x100	355.3	308.1	47.15	14.08	33.36	75.70	49.03	38.38	57.80
100x200	335.5	294.5	40.96	12.23	68.25	87.93	51.71	24.30	71.96
200x325	316.1	298.0	18.16	5.42	79.10	93.35	53.30	12.07	75.71
-325	28.7	6.5	22.26	6.65	72.94	100.00	54.60	6.65	72.94
Total (Calc)	--	--	334.86	100.00	54.60	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Experiment: 4 - Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product SM5 Feed Weight (%): 1.24

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	466.8	460.1	6.69	2.82	63.97	2.82	63.97	100.00	59.61
18x30	481.0	442.2	38.83	16.36	56.69	19.18	57.76	97.18	59.49
30x50	467.9	411.8	56.06	23.62	40.36	42.80	48.16	80.82	60.05
50x100	437.0	393.0	44.00	18.54	48.64	61.33	48.30	57.20	68.19
100x200	440.9	391.3	49.60	20.90	77.27	82.23	55.66	38.67	77.56
200x325	399.1	379.6	19.49	8.21	82.40	90.44	58.09	17.77	77.90
-325	29.1	6.4	22.69	9.56	74.03	100.00	59.61	9.56	74.03
Total (Calc)	--	--	237.38	100.00	59.61	--	--	--	--

Product ST2 Feed Weight (%): 0.24

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	460.7	460.1	0.56	0.51	42.03	0.51	42.03	100.00	76.82
18x30	444.6	442.2	2.47	2.27	40.95	2.78	41.15	99.49	77.00
30x50	418.8	411.8	6.98	6.41	36.09	9.20	37.62	97.22	77.84
50x100	408.8	393.0	15.80	14.52	65.68	23.71	54.80	90.80	80.79
100x200	432.2	391.3	40.85	37.53	84.88	61.24	73.23	76.29	83.66
200x325	398.9	379.6	19.26	17.69	87.15	78.93	76.35	38.76	82.48
-325	29.2	6.3	22.93	21.07	78.57	100.00	76.82	21.07	78.57
Total (Calc)	--	--	108.86	100.00	76.82	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Experiment: 4 - Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product ST1 Feed Weight (%): 6.70

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	446.0	401.2	44.75	10.48	77.75	10.48	77.75	100.00	74.75
18x30	479.9	370.0	109.88	25.73	73.30	36.21	74.59	89.52	74.40
30x50	420.5	336.3	84.25	19.73	61.36	55.94	69.93	63.79	74.84
50x100	386.1	308.1	77.97	18.26	77.61	74.20	71.82	44.06	80.88
100x200	359.8	294.5	65.31	15.29	83.83	89.50	73.87	25.80	83.20
200x325	320.8	298.0	22.79	5.34	85.43	94.84	74.52	10.50	82.27
-325	28.1	6.1	22.05	5.16	79.00	100.00	74.75	5.16	79.00
Total (Calc)	--	--	427.01	100.00	74.75	--	--	--	--

Product PT2 Feed Weight (%): 22.90

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	568.2	401.2	166.95	11.44	89.33	11.44	89.33	100.00	86.05
18x30	743.4	370.0	373.38	25.58	88.08	37.01	88.47	88.56	85.62
30x50	777.2	336.3	440.89	30.20	86.72	67.21	87.68	62.99	84.63
50x100	584.4	308.1	276.27	18.92	83.58	86.14	86.78	32.79	82.70
100x200	412.4	294.5	117.91	8.08	82.01	94.21	86.37	13.86	81.49
200x325	332.1	298.0	34.08	2.33	81.30	96.55	86.25	5.79	80.77
-325	56.8	6.4	50.41	3.45	80.41	100.00	86.05	3.45	80.41
Total (Calc)	--	--	1459.90	100.00	86.05	--	--	--	--

SPIRAL DATA ANALYSIS

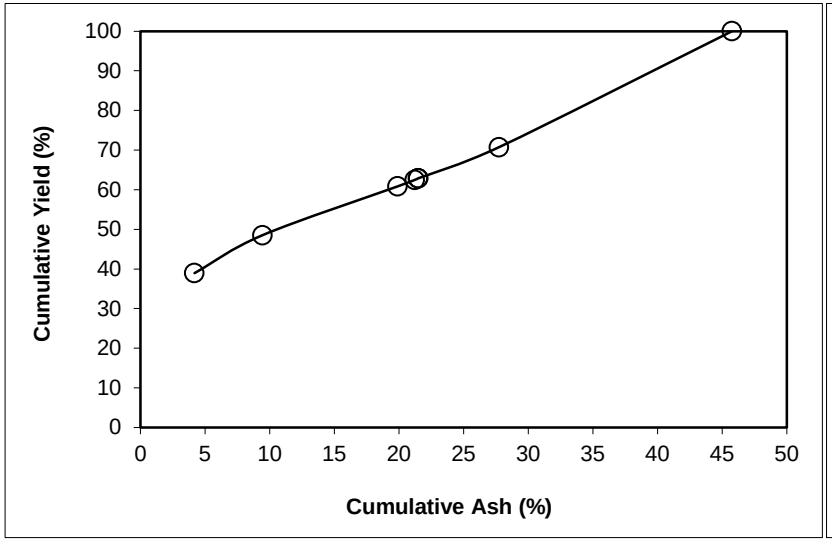
Description: Experiment: 4 - Cardinal In-Plant Spiral Test

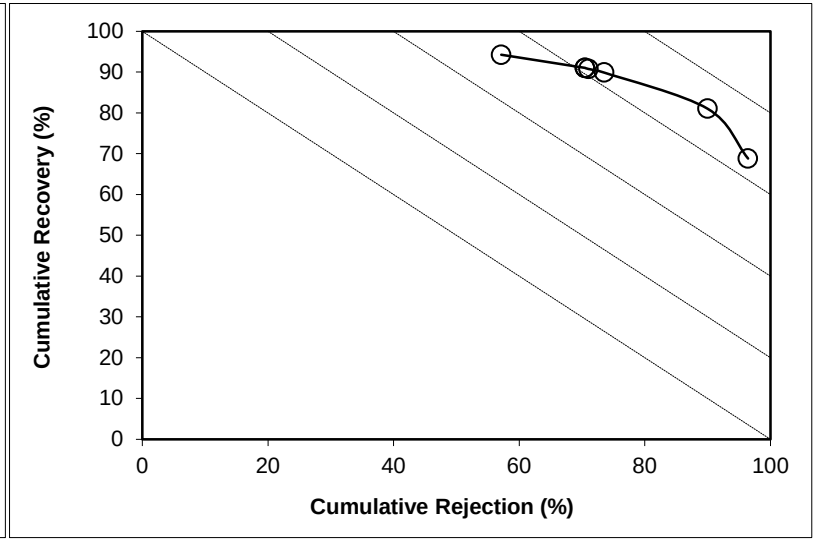
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 8.94

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	38.95	4.18	38.95	4.18	68.81	61.05	72.29	96.44	65.25
SC2	9.57	30.82	48.52	9.43	81.01	51.48	80.00	90.00	71.01
SM3	12.33	61.08	60.85	19.90	89.86	39.15	85.95	73.54	63.40
SM4	1.63	70.41	62.48	21.22	90.75	37.52	86.63	71.03	61.78
SM5	0.39	63.97	62.87	21.48	91.01	37.13	86.87	70.48	61.49
ST2	0.01	42.03	62.88	21.49	91.02	37.12	86.88	70.47	61.49
ST1	7.85	77.75	70.73	27.73	94.24	29.27	89.33	57.14	51.38
PT2	29.27	89.33	100.00	45.76	100.00	0.00			
Total (Calc)	100.00	45.76	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

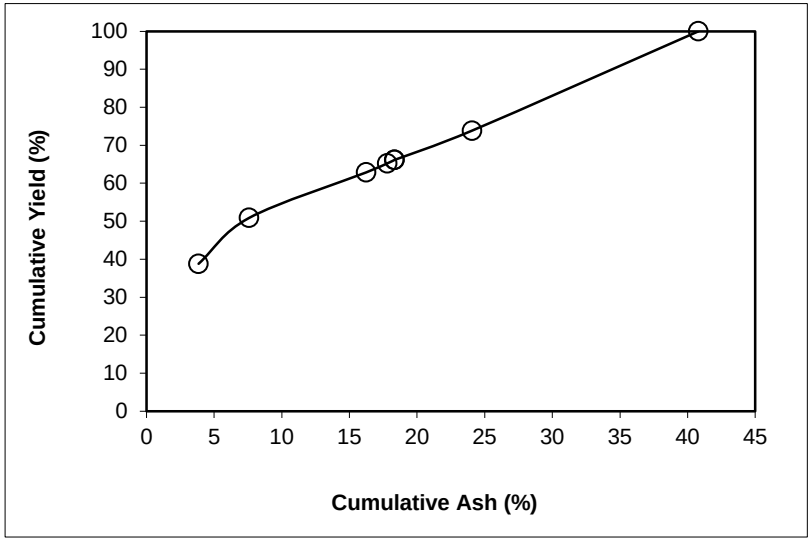
Description: Experiment: 4 - Cardinal In-Plant Spiral Test

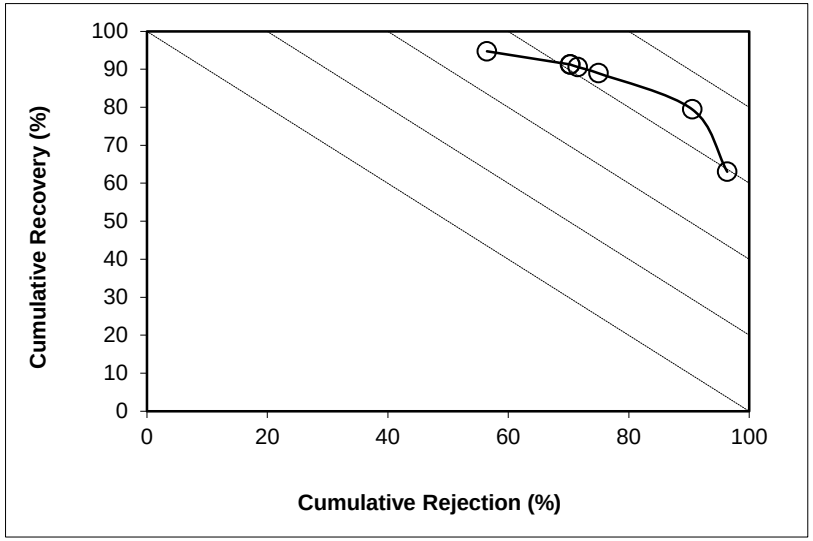
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 22.39

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	38.80	3.85	38.80	3.85	63.03	61.20	64.24	96.34	59.37
SC2	12.06	19.58	50.87	7.58	79.42	49.13	75.20	90.55	69.97
SM3	11.97	52.97	62.84	16.23	88.93	37.16	82.36	75.01	63.94
SM4	2.38	59.10	65.22	17.79	90.58	34.78	83.96	71.56	62.13
SM5	0.91	56.69	66.13	18.33	91.24	33.87	84.69	70.30	61.54
ST2	0.02	40.95	66.16	18.34	91.26	33.84	84.72	70.27	61.54
ST1	7.70	73.30	73.85	24.06	94.73	26.15	88.08	56.45	51.18
PT2	26.15	88.08	100.00	40.80	100.00	0.00			
Total (Calc)	100.00	40.80	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

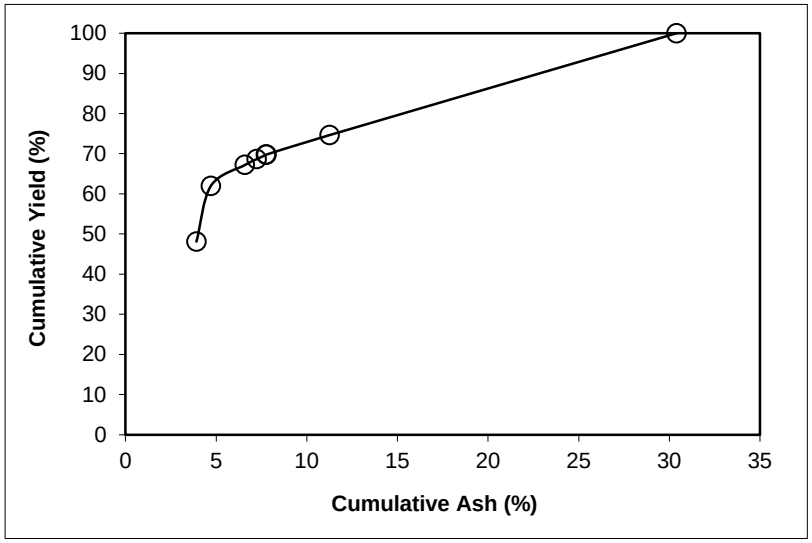
Description: Experiment: 4 - Cardinal In-Plant Spiral Test

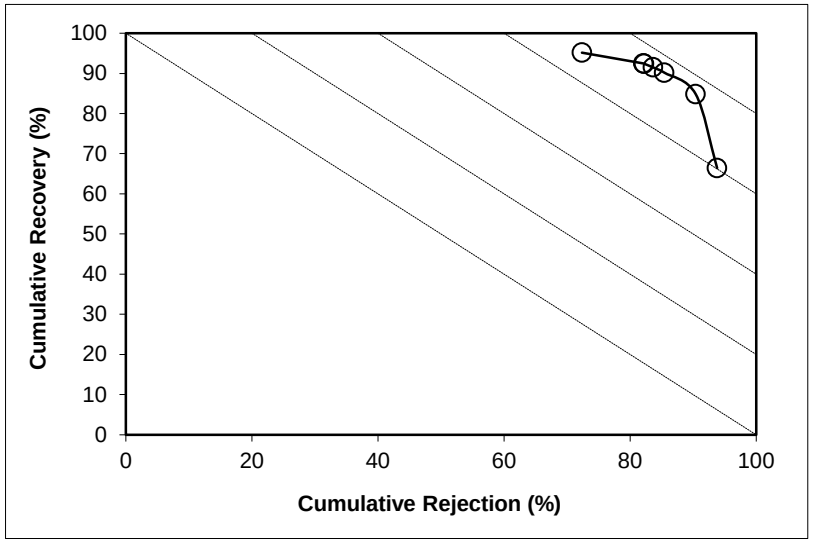
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 27.26

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	48.12	3.91	48.12	3.91	66.43	51.88	54.96	93.80	60.24
SC2	13.85	7.46	61.97	4.71	84.85	38.03	72.27	90.40	75.25
SM3	5.22	28.91	67.19	6.59	90.18	32.81	79.17	85.44	75.62
SM4	1.46	37.44	68.66	7.25	91.50	31.34	81.12	83.63	75.13
SM5	1.08	40.36	69.73	7.76	92.42	30.27	82.56	82.21	74.62
ST2	0.06	36.09	69.79	7.78	92.47	30.21	82.65	82.14	74.61
ST1	4.85	61.36	74.64	11.26	95.16	25.36	86.72	72.36	67.52
PT2	25.36	86.72	100.00	30.40	100.00	0.00			
Total (Calc)	100.00	30.40	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

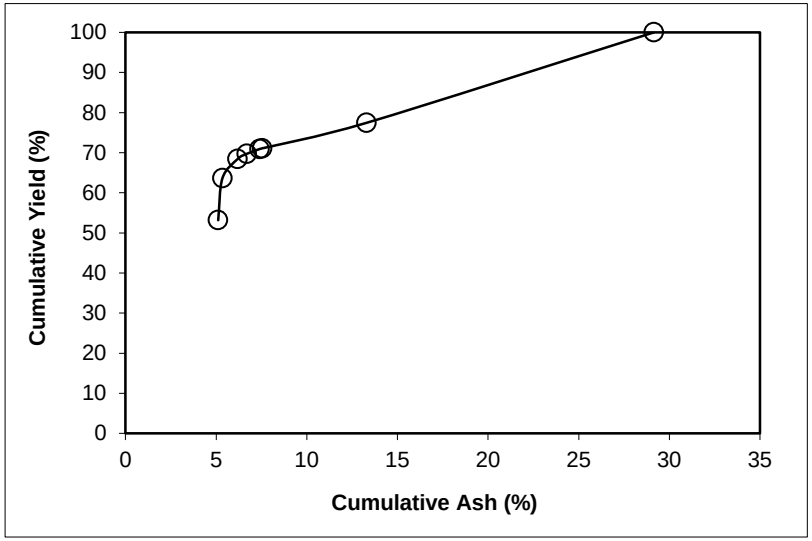
Description: Experiment: 4 - Cardinal In-Plant Spiral Test

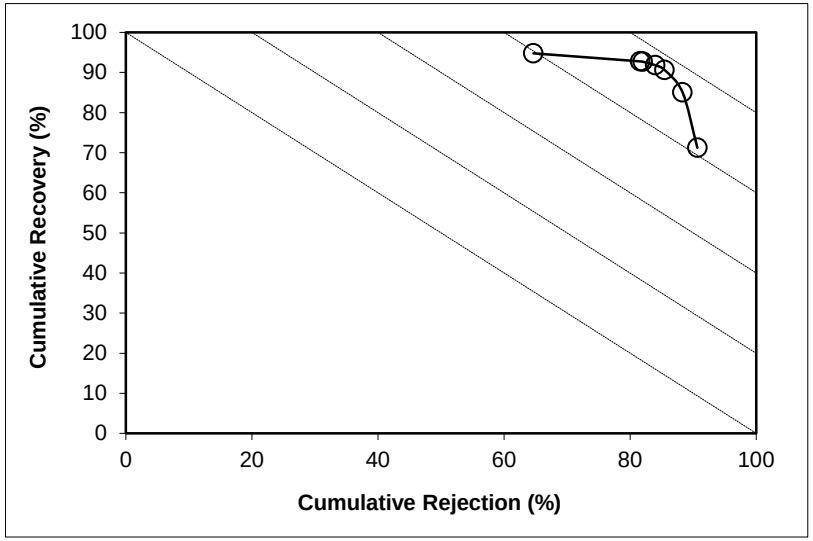
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 19.22

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	53.17	5.11	53.17	5.11	71.21	46.83	56.44	90.68	61.88
SC2	10.47	6.53	63.64	5.35	85.02	36.36	70.81	88.33	73.35
SM3	4.78	17.37	68.43	6.19	90.60	31.57	78.91	85.48	76.08
SM4	1.28	33.36	69.71	6.69	91.81	30.29	80.84	84.01	75.82
SM5	1.20	48.64	70.91	7.39	92.67	29.09	82.16	82.01	74.69
ST2	0.18	65.68	71.09	7.55	92.76	28.91	82.27	81.60	74.36
ST1	6.36	77.61	77.45	13.30	94.77	22.55	83.58	64.65	59.43
PT2	22.55	83.58	100.00	29.15	100.00	0.00			
Total (Calc)	100.00	29.15	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

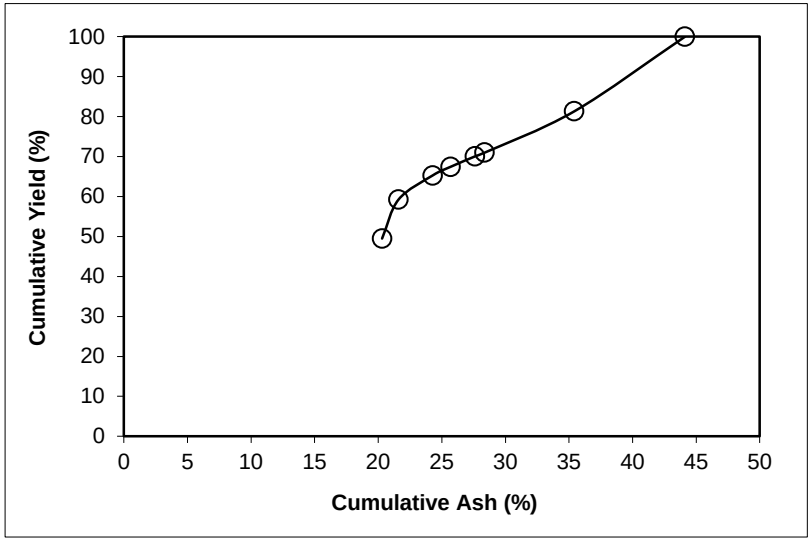
Description: Experiment: 4 - Cardinal In-Plant Spiral Test

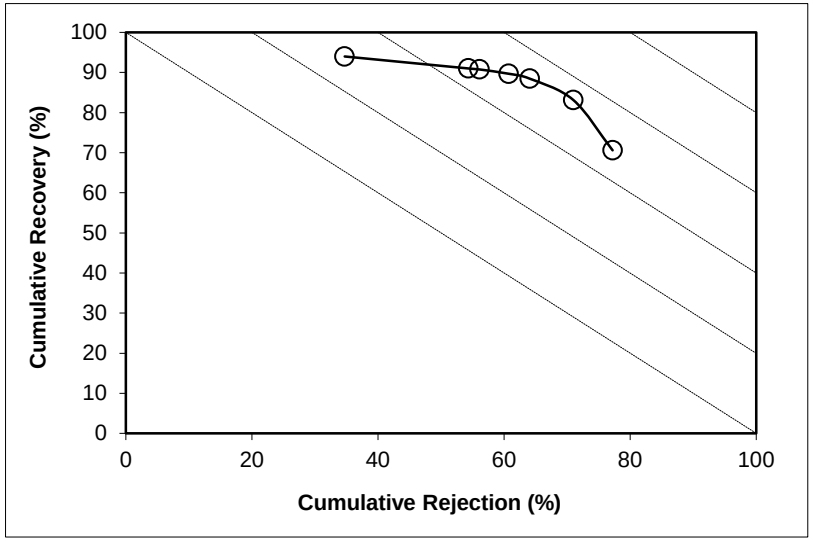
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 9.90

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	49.50	20.30	49.50	20.30	70.59	50.50	67.46	77.22	47.81
SC2	9.77	28.17	59.26	21.60	83.14	40.74	76.87	70.98	54.13
SM3	6.02	50.68	65.28	24.28	88.45	34.72	81.42	64.07	52.52
SM4	2.16	68.25	67.44	25.69	89.68	32.56	82.29	60.73	50.41
SM5	2.62	77.27	70.06	27.62	90.75	29.94	82.73	56.14	46.89
ST2	0.92	84.88	70.99	28.36	91.00	29.01	82.66	54.36	45.36
ST1	10.34	83.83	81.33	35.42	93.99	18.67	82.01	34.71	28.70
PT2	18.67	82.01	100.00	44.12	100.00	0.00			
Total (Calc)	100.00	44.12	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

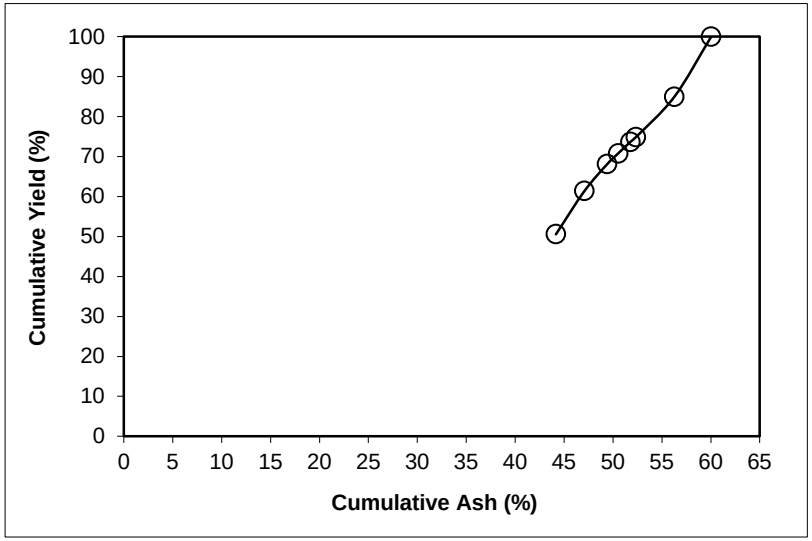
Description: Experiment: 4 - Cardinal In-Plant Spiral Test

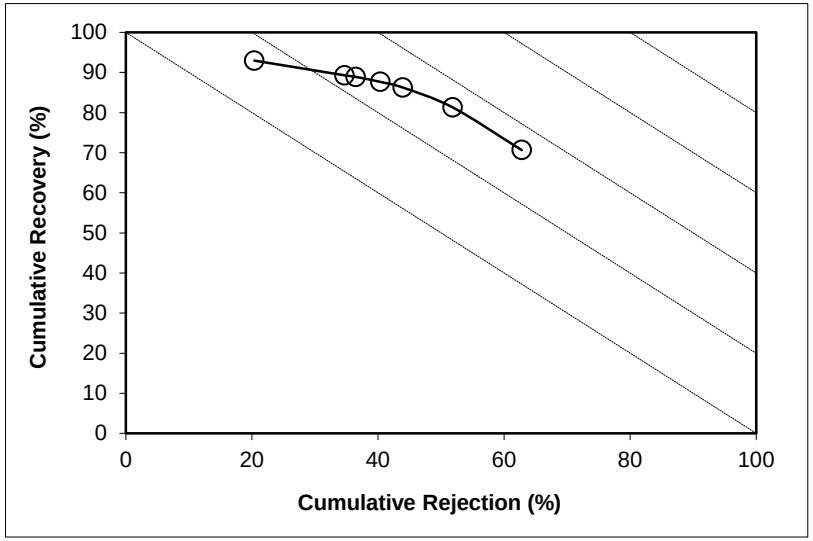
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 3.55

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	50.56	44.16	50.56	44.16	70.63	49.44	76.26	62.81	33.44
SC2	10.82	60.70	61.38	47.08	81.27	38.62	80.62	51.87	33.14
SM3	6.76	70.62	68.14	49.41	86.24	31.86	82.74	43.92	30.16
SM4	2.67	79.10	70.81	50.53	87.64	29.19	83.08	40.40	28.04
SM5	2.87	82.40	73.68	51.77	88.90	26.32	83.15	36.46	25.36
ST2	1.21	87.15	74.89	52.35	89.29	25.11	82.96	34.70	23.99
ST1	10.06	85.43	84.95	56.27	92.96	15.05	81.30	20.38	13.34
PT2	15.05	81.30	100.00	60.03	100.00	0.00			
Total (Calc)	100.00	60.03	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

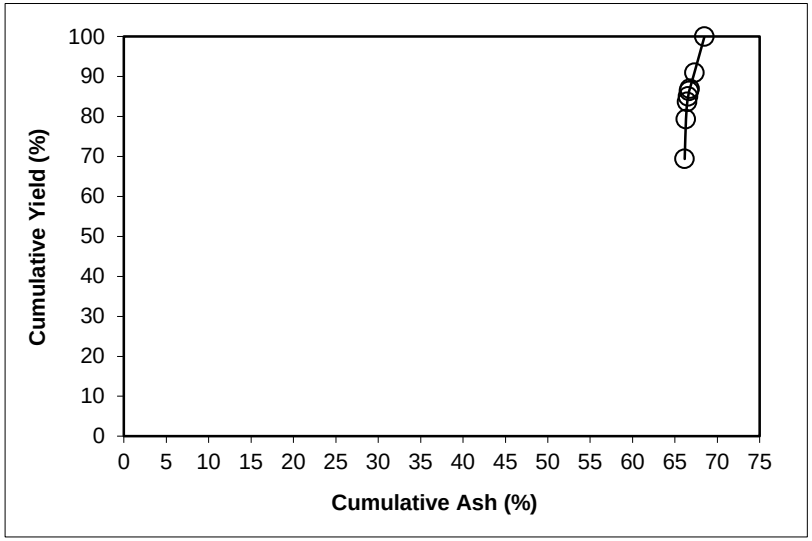
Description: Experiment: 4 - Cardinal In-Plant Spiral Test

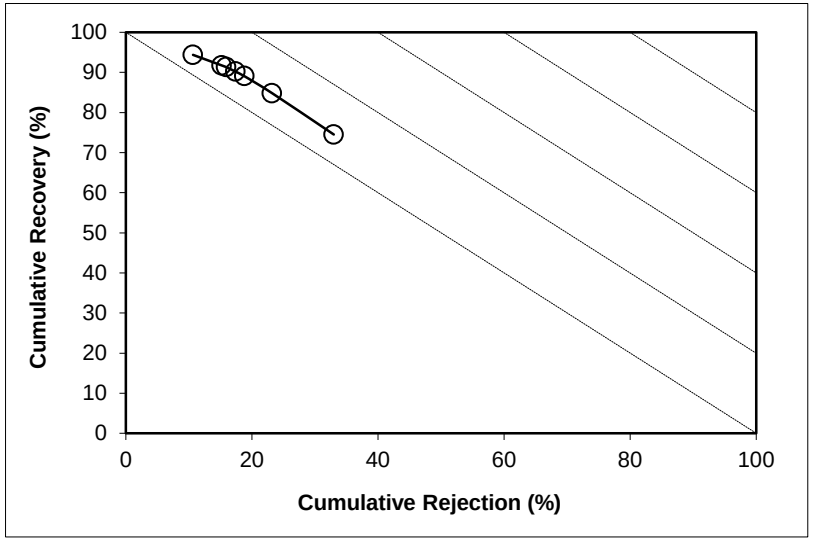
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 8.73

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	69.39	66.15	69.39	66.15	74.51	30.61	73.75	32.97	7.49
SC2	9.95	67.35	79.34	66.30	84.82	20.66	76.84	23.18	8.01
SM3	4.36	69.29	83.70	66.45	89.07	16.30	78.86	18.78	7.84
SM4	1.33	72.94	85.03	66.55	90.21	14.97	79.38	17.36	7.57
SM5	1.36	74.03	86.39	66.67	91.33	13.61	79.92	15.89	7.22
ST2	0.59	78.57	86.98	66.75	91.73	13.02	79.98	15.21	6.94
ST1	3.96	79.00	90.94	67.29	94.37	9.06	80.41	10.64	5.01
PT2	9.06	80.41	100.00	68.47	100.00	0.00			
Total (Calc)	100.00	68.47	--	--	--	--	--	--	--





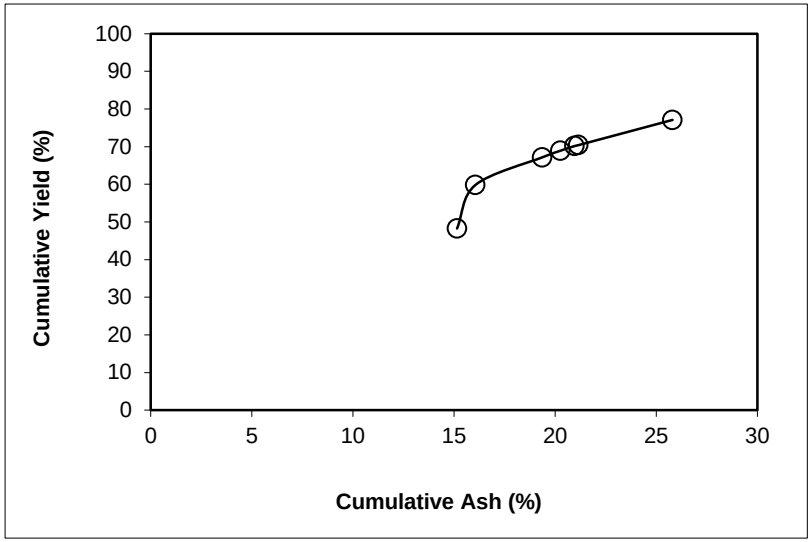
SPIRAL DATA ANALYSIS

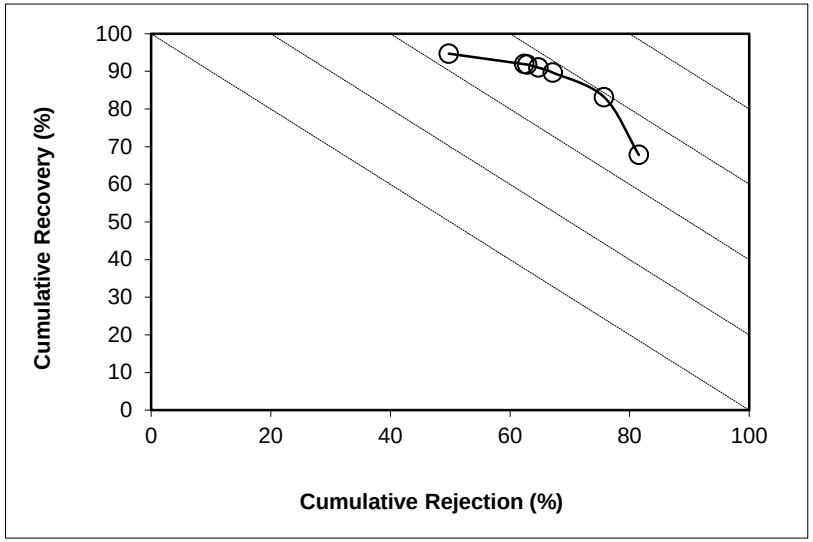
Description: Experiment: 4 - Cardinal In-Plant Spiral Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	48.26	15.14	48.26	15.14	67.80	51.74	62.41	81.54	49.34
SC2	11.57	19.86	59.83	16.06	83.15	40.17	74.66	75.74	58.89
SM3	7.34	46.31	67.17	19.36	89.67	32.83	81.00	67.15	56.83
SM4	1.75	54.60	68.92	20.26	90.99	31.08	82.49	64.74	55.73
SM5	1.24	59.61	70.16	20.95	91.82	29.84	83.44	62.87	54.69
ST2	0.24	76.82	70.41	21.15	91.91	29.59	83.49	62.40	54.31
ST1	6.70	74.75	77.10	25.80	94.71	22.90	86.05	49.75	44.47
PT2	22.90	86.05	100.00	39.60	100.00	0.00			
Total (Calc)	100.00	39.60	--	--	--	--	--	--	--

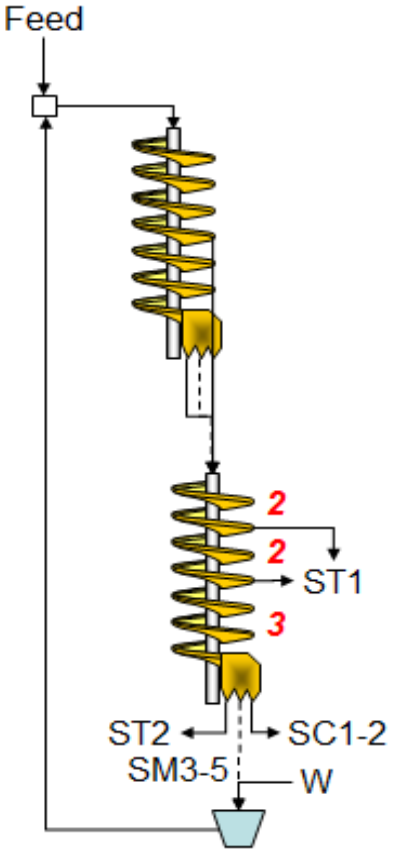




SPIRAL DATA ANALYSIS

Description: Experiment: 5 - Cardinal In-Plant Test

Comments: $1_{2T0}+2_{3T0}+3_{CT1}$ Spiral Circuit (1 x 0.15 mm Nominal Particle Size)



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
SC1	40.0	34.9	100	87
SC2	34.9	28.6	87	72
SM3	28.6	21.6	72	54
SM4	21.6	16.7	54	42
SM5	16.7	8.3	42	21
ST2	8.3	0.0	21	0
ST1	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
SC1	1.273	17.4	24.20	27.83
SC2	0.324	27.9	3.36	4.23
SM3	0.245	41.9	1.36	1.91
SM4	0.090	44.6	0.45	0.63
SM5	0.094	39.4	0.58	0.76
ST2	0.012	20.8	0.18	0.21
ST1	0.645	45.8	3.05	4.20
Total	2.683	24.4	33.18	39.76

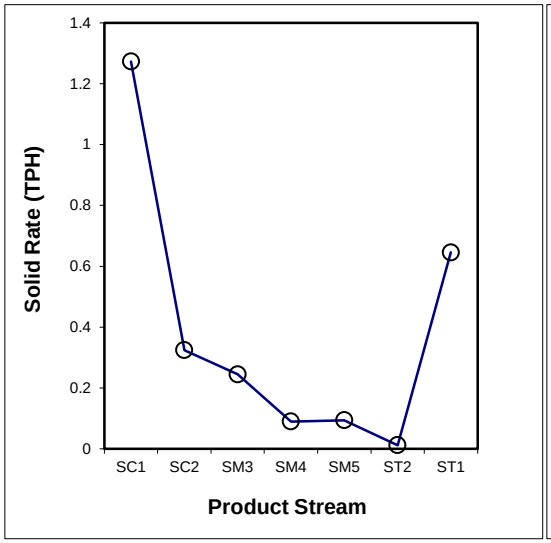
SPIRAL DATA ANALYSIS

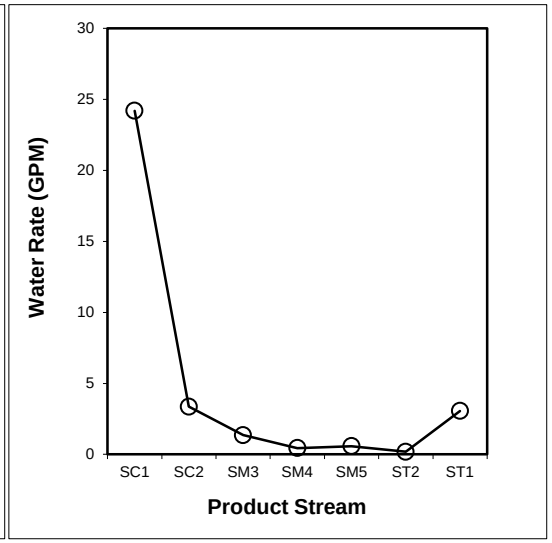
Description: Experiment: 5 - Cardinal In-Plant Test

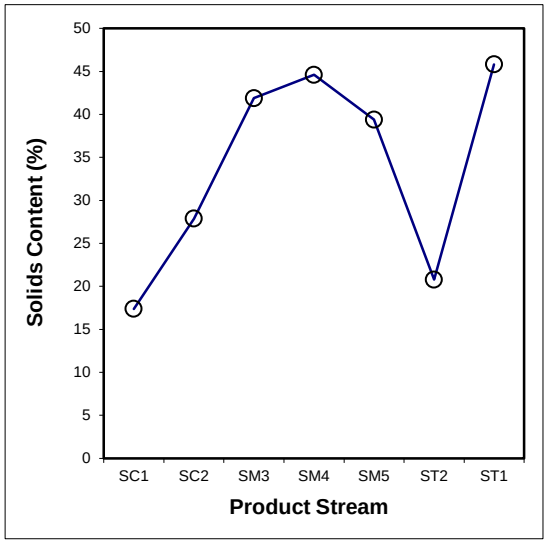
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
SC1	5	10542.00	1102.97	7.323	3619.4	2014.1	1.273	47.44	17.38
SC2	5	1682.82	172.15	1.164	2893.6	2484.6	0.324	12.09	27.88
SM3	10	1622.65	93.80	0.585	2631.9	2014.4	0.245	9.12	41.88
SM4	20	1142.47	92.57	0.201	2937.1	2484.6	0.090	3.34	44.61
SM5	20	1338.70	93.34	0.238	2488.1	2014.3	0.094	3.50	39.39
ST2	70	1166.25	105.07	0.058	2698.4	2484.5	0.012	0.45	20.79
ST1	10	3987.79	169.49	1.409	3642.5	2014.7	0.645	24.05	45.81
Total (Calc)	--	--	--	10.977	--	--	2.683	100.00	24.44
Total (Head)	5	13667	1145.07	10.977	5404.4	2020.5	2.683	--	24.44







SPIRAL DATA ANALYSIS

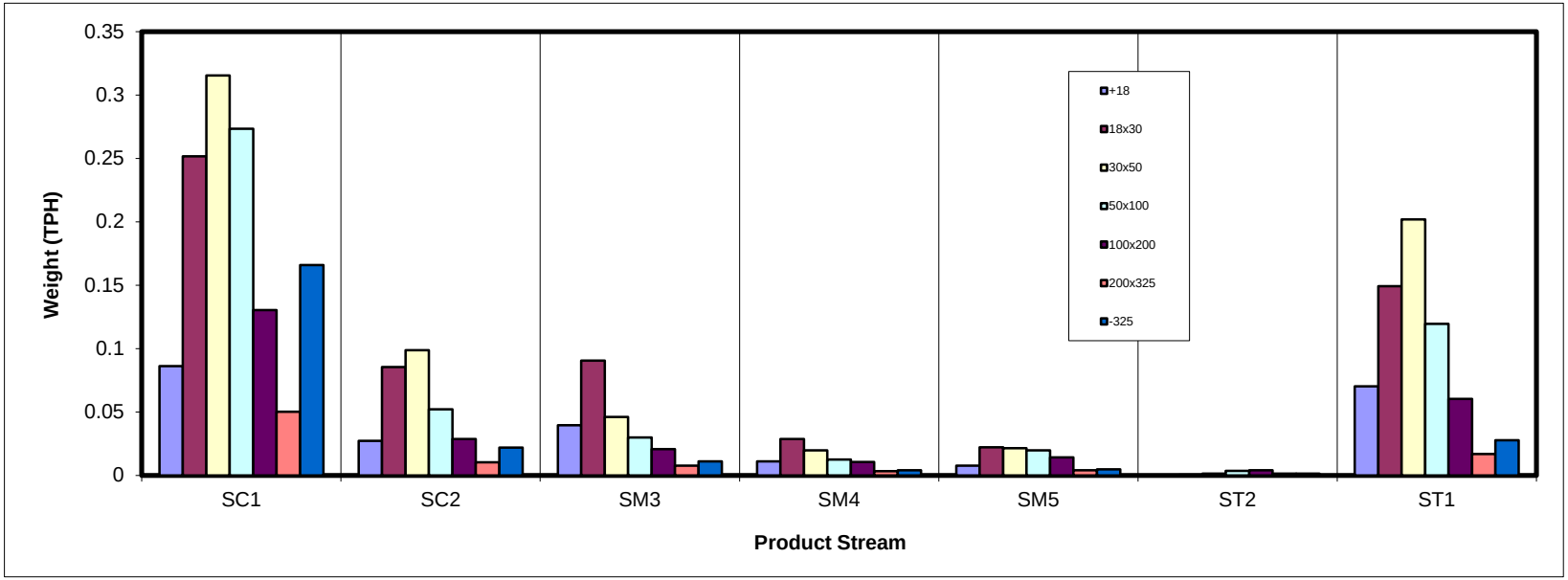
Description: Experiment: 5 - Cardinal In-Plant Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%		
+18	0.086	0.027	0.039	0.011	0.008	0.000	0.070		0.242
18x30	0.252	0.086	0.091	0.029	0.022	0.000	0.149		0.628
30x50	0.315	0.099	0.046	0.020	0.021	0.001	0.202		0.704
50x100	0.273	0.052	0.030	0.013	0.020	0.004	0.119		0.510
100x200	0.130	0.029	0.021	0.011	0.014	0.004	0.060		0.269
200x325	0.050	0.010	0.008	0.003	0.004	0.001	0.017		0.093
-325	0.166	0.022	0.011	0.004	0.005	0.001	0.028		0.237
Total (Calc)	1.273	0.324	0.245	0.090	0.094	0.012	0.645		2.683



SPIRAL DATA ANALYSIS

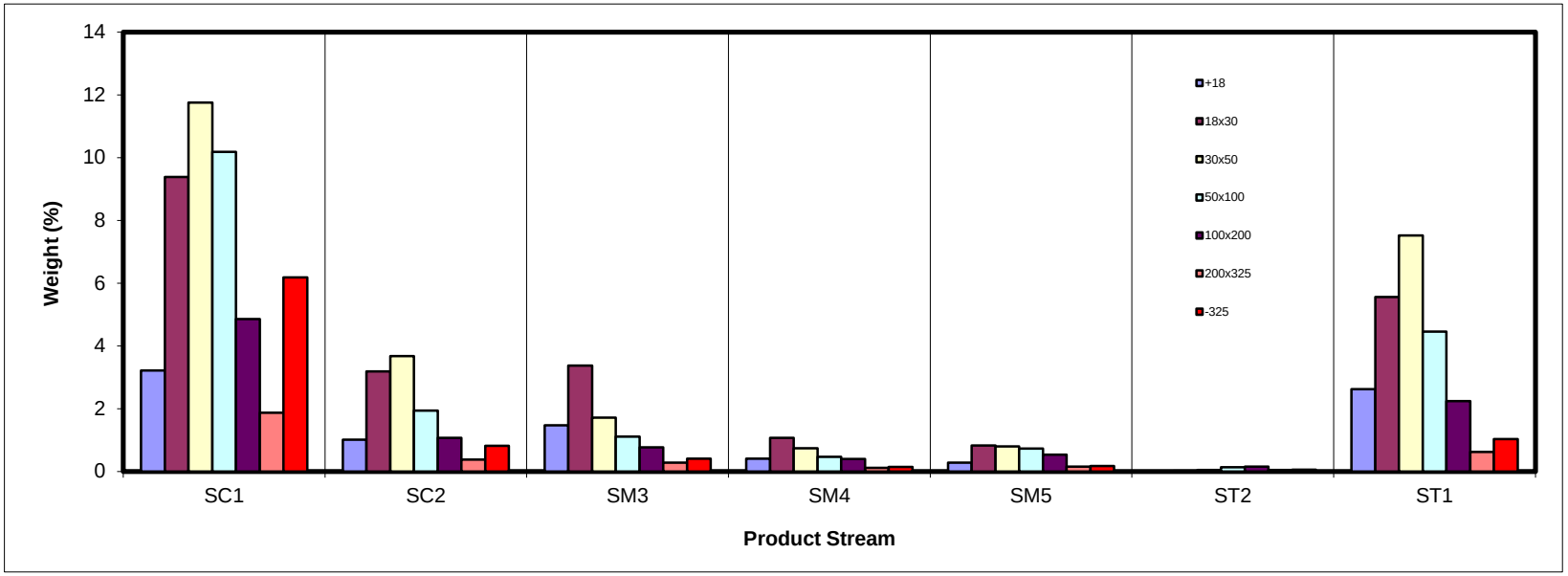
Description: Experiment: 5 - Cardinal In-Plant Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%		
+18	3.21	1.02	1.47	0.41	0.28	0.00	2.62		9.02
18x30	9.38	3.19	3.37	1.07	0.83	0.01	5.56		23.41
30x50	11.75	3.68	1.71	0.74	0.80	0.05	7.52		26.25
50x100	10.18	1.94	1.11	0.47	0.73	0.13	4.45		19.02
100x200	4.86	1.07	0.77	0.40	0.53	0.15	2.25		10.02
200x325	1.87	0.38	0.28	0.12	0.15	0.05	0.63		3.48
-325	6.18	0.82	0.41	0.15	0.18	0.05	1.03		8.82
Total (Calc)	47.44	12.09	9.12	3.34	3.50	0.45	24.05		100.00



SPIRAL DATA ANALYSIS

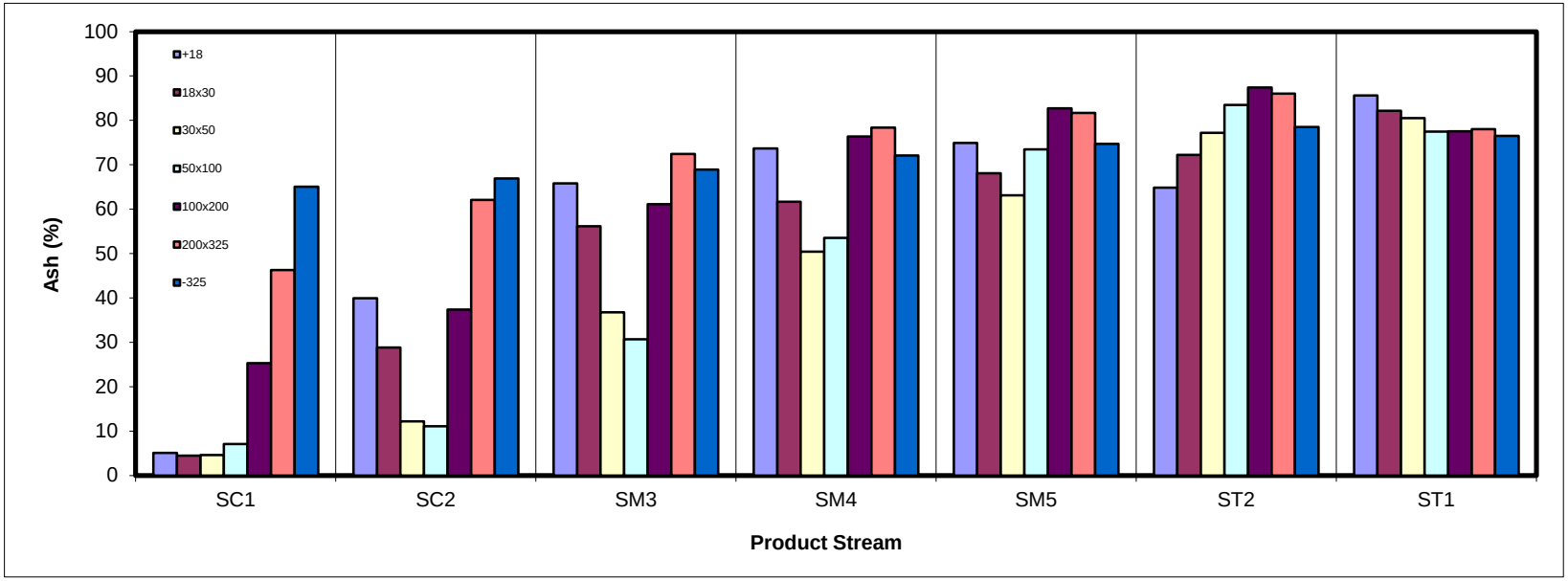
Description: Experiment: 5 - Cardinal In-Plant Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%		
+18	5.08	39.92	65.84	73.68	74.93	64.85	85.59		47.64
18x30	4.49	28.82	56.17	61.68	68.08	72.22	82.17		38.59
30x50	4.61	12.17	36.73	50.45	63.15	77.21	80.52		32.72
50x100	7.11	11.08	30.70	53.55	73.44	83.46	77.46		29.59
100x200	25.30	37.37	61.11	76.38	82.74	87.40	77.53		47.03
200x325	46.28	62.11	72.45	78.35	81.71	86.06	78.01		59.05
-325	65.06	66.94	68.92	72.10	74.73	78.54	76.51		67.15
Total (Calc)	16.79	26.22	52.47	62.34	71.77	83.34	80.37		40.23



SPIRAL DATA ANALYSIS

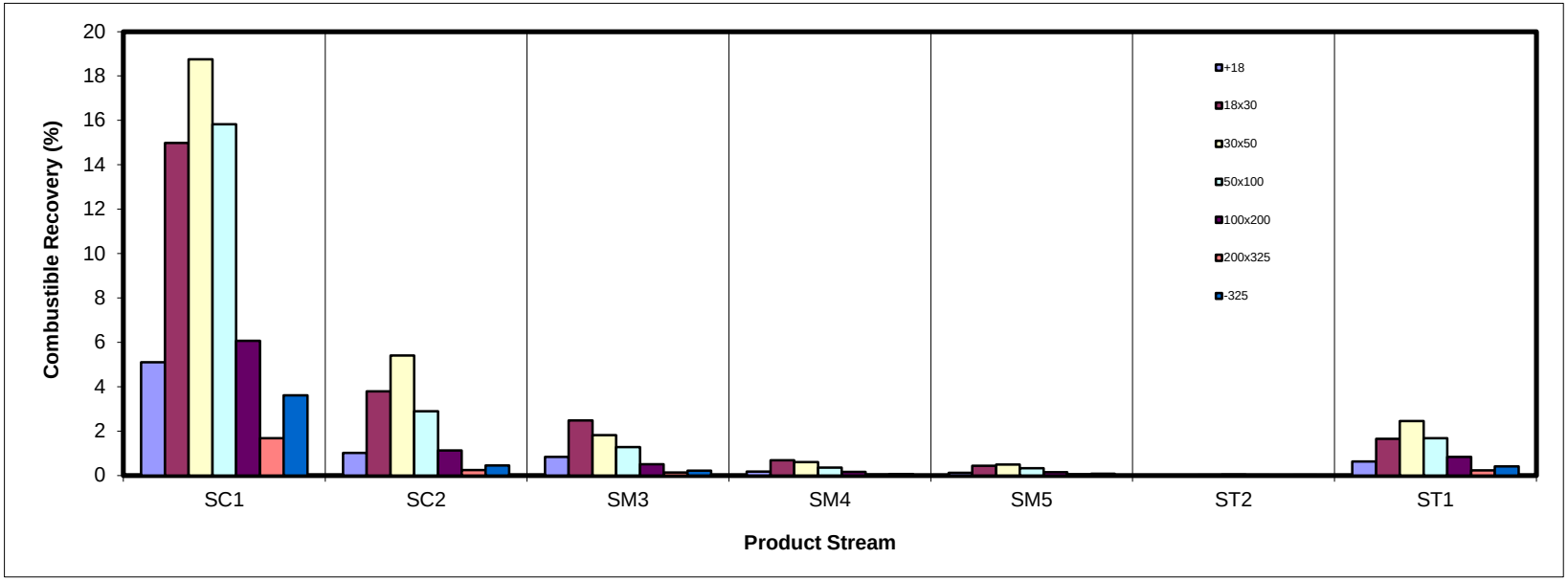
Description: Experiment: 5 - Cardinal In-Plant Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%		
+18	5.10	1.02	0.84	0.18	0.12	0.00	0.63		7.90
18x30	14.99	3.79	2.47	0.68	0.44	0.01	1.66		24.05
30x50	18.76	5.40	1.81	0.61	0.49	0.02	2.45		29.54
50x100	15.83	2.89	1.29	0.36	0.33	0.04	1.68		22.41
100x200	6.07	1.12	0.50	0.16	0.15	0.03	0.84		8.88
200x325	1.68	0.24	0.13	0.04	0.05	0.01	0.23		2.38
-325	3.61	0.45	0.21	0.07	0.07	0.02	0.41		4.85
Total (Calc)	66.04	14.92	7.26	2.11	1.65	0.13	7.90		100.00



SPIRAL DATA ANALYSIS

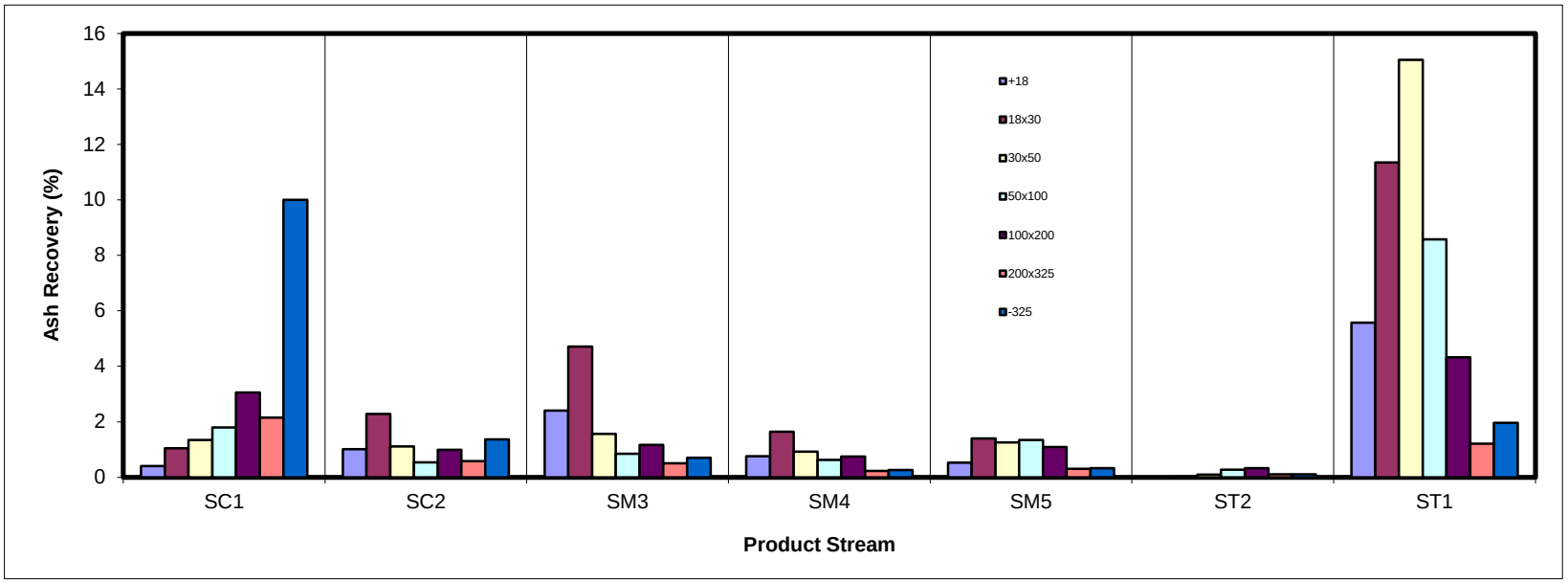
Description: Experiment: 5 - Cardinal In-Plant Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%		
+18	0.41	1.01	2.40	0.75	0.53	0.00	5.57		10.68
18x30	1.05	2.28	4.71	1.64	1.40	0.02	11.35		22.45
30x50	1.35	1.11	1.56	0.92	1.26	0.10	15.05		21.35
50x100	1.80	0.53	0.85	0.62	1.34	0.27	8.57		13.99
100x200	3.06	0.99	1.17	0.75	1.09	0.33	4.33		11.71
200x325	2.15	0.59	0.50	0.23	0.31	0.11	1.22		5.10
-325	10.00	1.36	0.70	0.27	0.33	0.11	1.96		14.72
Total (Calc)	19.80	7.88	11.90	5.18	6.25	0.94	48.06		100.00



SPIRAL DATA ANALYSIS

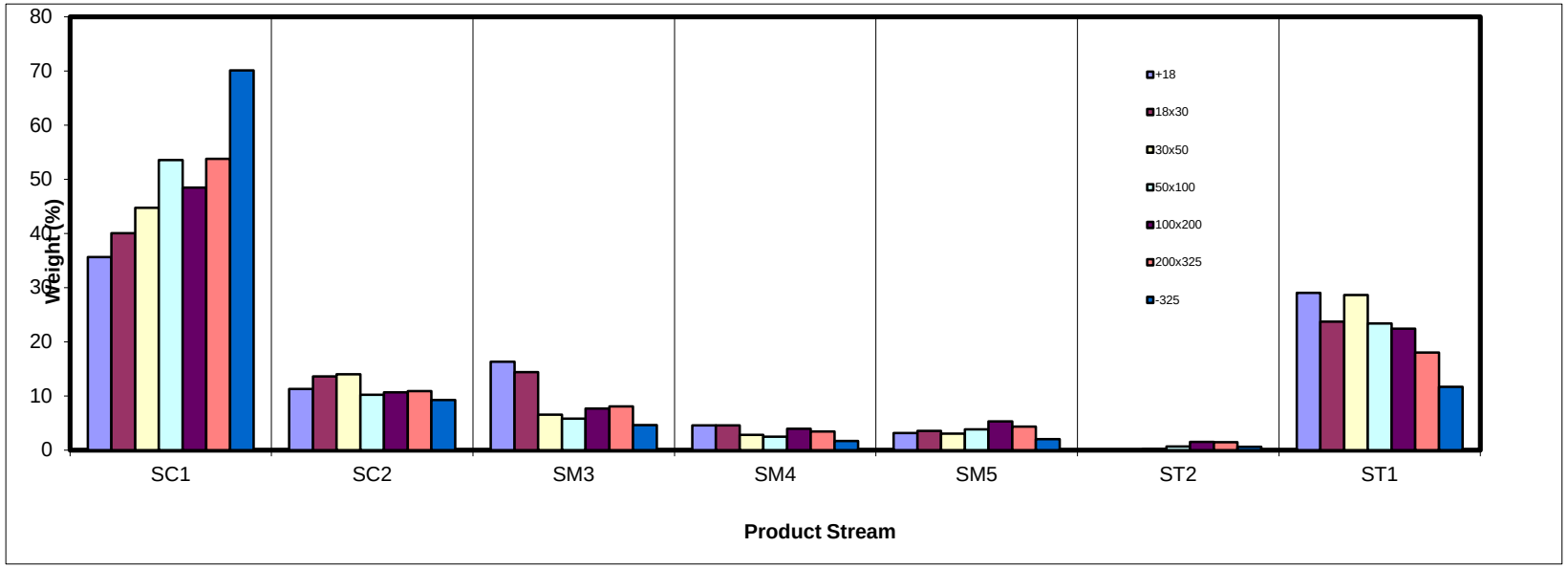
Description: Experiment: 5 - Cardinal In-Plant Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%		
+18	35.64	11.27	16.30	4.56	3.14	0.03	29.05		100.00
18x30	40.08	13.62	14.42	4.56	3.53	0.05	23.74		100.00
30x50	44.78	14.00	6.52	2.80	3.05	0.19	28.65		100.00
50x100	53.54	10.21	5.84	2.45	3.85	0.69	23.41		100.00
100x200	48.49	10.69	7.68	3.94	5.29	1.49	22.41		100.00
200x325	53.80	10.91	8.05	3.41	4.35	1.44	18.02		100.00
-325	70.10	9.28	4.62	1.68	2.00	0.61	11.70		100.00
Total (Calc)	47.44	12.09	9.12	3.34	3.50	0.45	24.05		100.00



SPIRAL DATA ANALYSIS

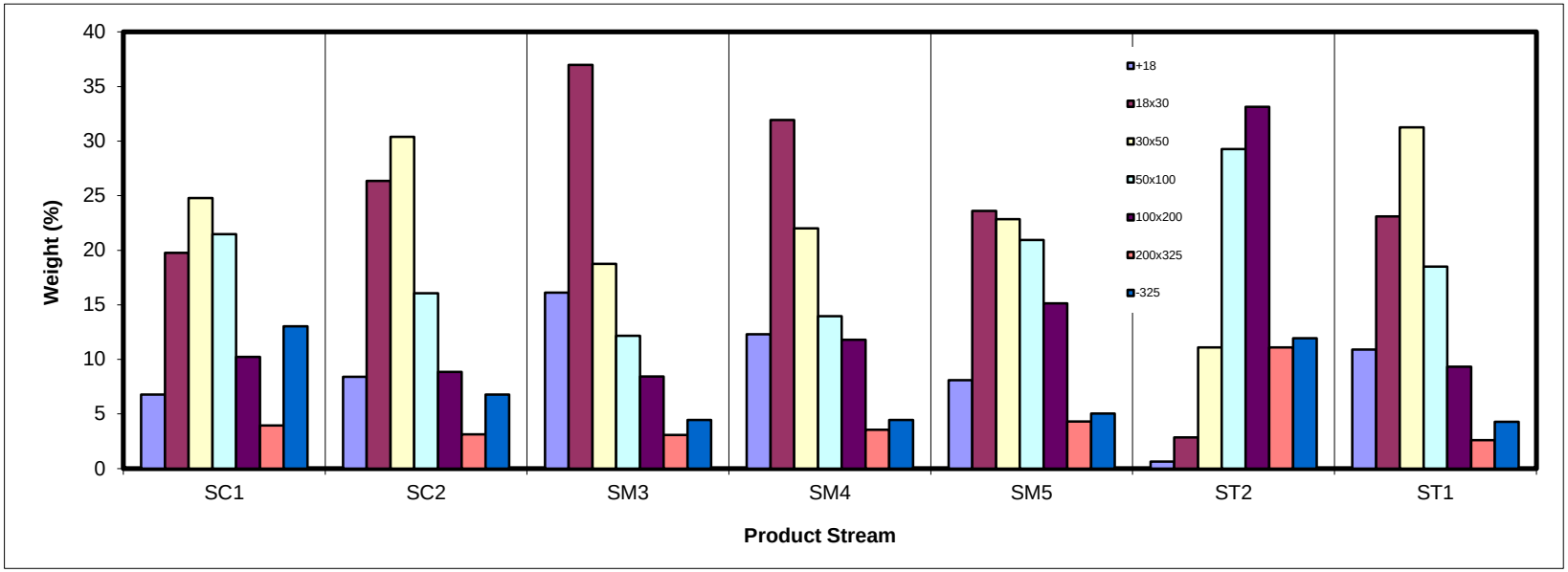
Description: Experiment: 5 - Cardinal In-Plant Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	SC1 100-87%	SC2 87-72%	SM3 72-54%	SM4 54-42%	SM5 42-21%	ST2 21-0%	ST1 0-0%		
+18	6.77	8.40	16.11	12.31	8.09	0.63	10.89		9.02
18x30	19.77	26.36	36.99	31.93	23.61	2.85	23.10		23.41
30x50	24.77	30.41	18.77	22.00	22.85	11.10	31.26		26.25
50x100	21.47	16.06	12.17	13.96	20.94	29.26	18.51		19.02
100x200	10.24	8.86	8.44	11.81	15.14	33.13	9.34		10.02
200x325	3.94	3.14	3.07	3.55	4.32	11.10	2.61		3.48
-325	13.03	6.77	4.46	4.44	5.04	11.93	4.29		8.82
#REF!									
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

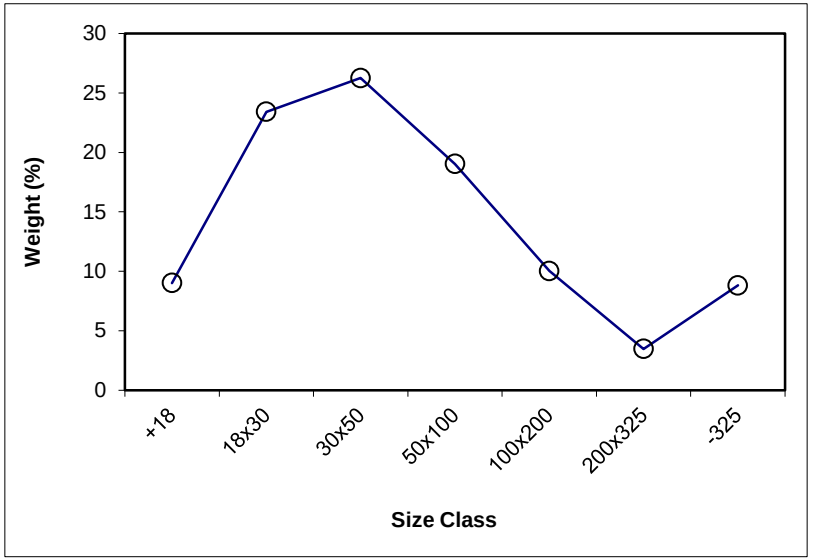
Description: Experiment: 5 - Cardinal In-Plant Test

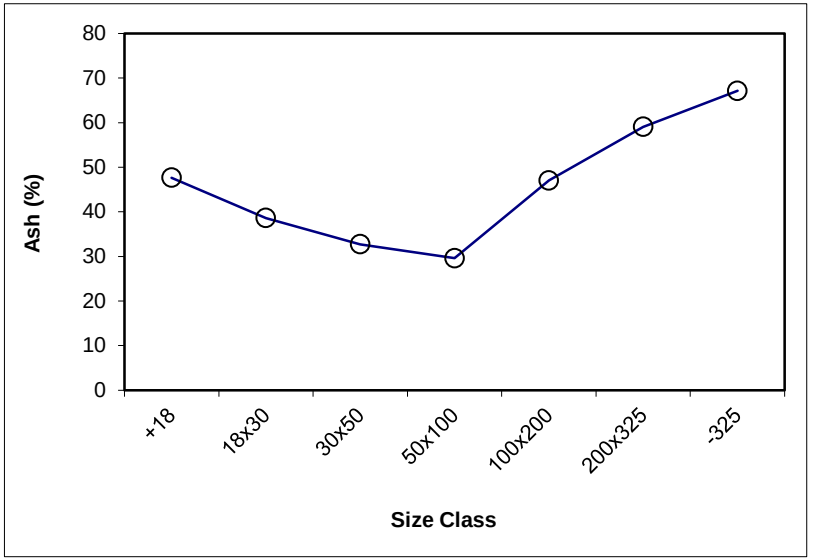
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	706.3	401.2	305.08	9.02	47.64	9.02	47.64	100.00	40.23
18x30	1162.1	370.0	792.02	23.41	38.59	32.42	41.11	90.98	39.49
30x50	1224.4	336.3	888.14	26.25	32.72	58.67	37.35	67.58	39.81
50x100	951.8	308.1	643.63	19.02	29.59	77.69	35.45	41.33	44.31
100x200	633.5	294.5	339.03	10.02	47.03	87.71	36.78	22.31	56.85
200x325	415.6	298.0	117.64	3.48	59.05	91.18	37.62	12.29	64.86
-325	310.7	12.4	298.39	8.82	67.15	100.00	40.23	8.82	67.15
Total (Calc)	--	--	3383.94	100.00	40.23	--	--	--	--





SPIRAL DATA ANALYSIS

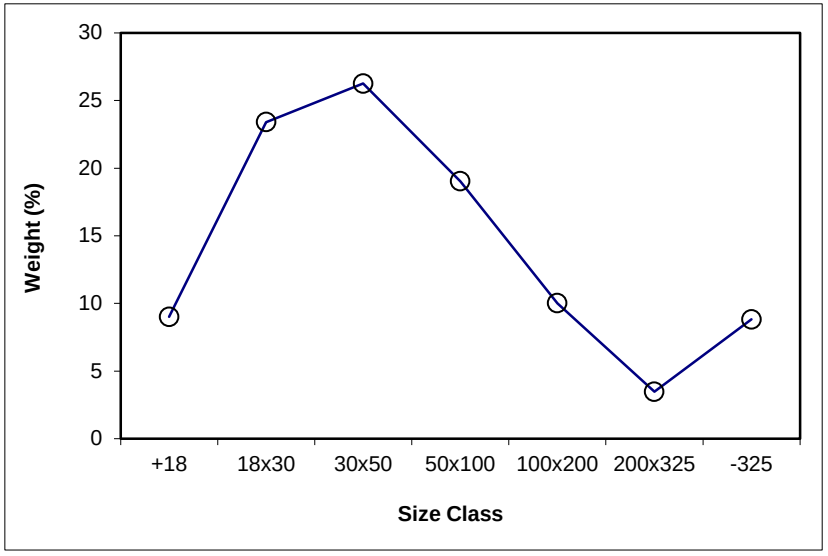
Description: Experiment: 5 - Cardinal In-Plant Test

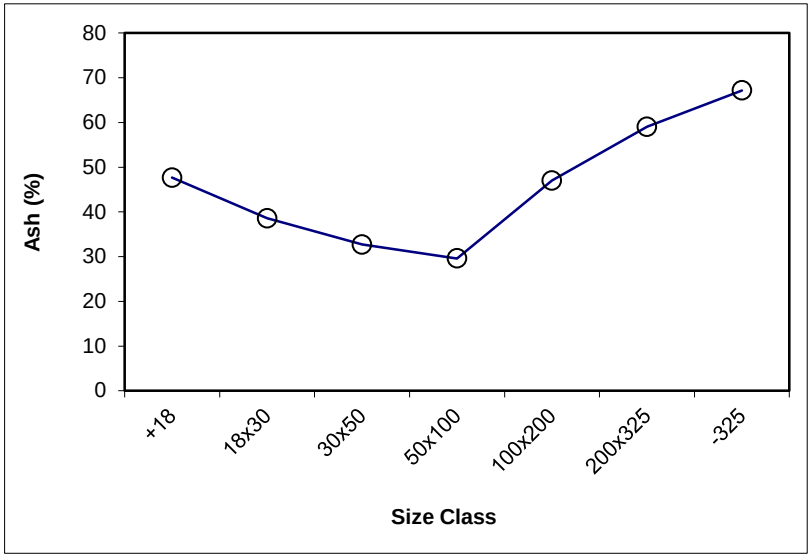
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed		Select Size Class	Dry Weight (%)	Dry Ash (%)
			Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)			
+18	9.02	47.64	9.02	47.64	100.00	40.23			
18x30	23.41	38.59	32.42	41.11	90.98	39.49	x	23.41	38.59
30x50	26.25	32.72	58.67	37.35	67.58	39.81	x	26.25	32.72
50x100	19.02	29.59	77.69	35.45	41.33	44.31	x	19.02	29.59
100x200	10.02	47.03	87.71	36.78	22.31	56.85	x	10.02	47.03
200x325	3.48	59.05	91.18	37.62	12.29	64.86	x	3.48	59.05
-325	8.82	67.15	100.00	40.23	8.82	67.15			
Total (Calc)	100.00	40.23	--	--	--	--	--	82.17	36.53





SPIRAL DATA ANALYSIS

Description: Experiment: 5 - Cardinal In-Plant Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product SC1 Feed Weight (%): 47.44

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	509.95	401.2	108.74	6.77	5.08	6.77	5.08	100.00	16.79
18x30	687.45	370.0	317.41	19.77	4.49	26.55	4.64	93.23	17.64
30x50	733.97	336.3	397.69	24.77	4.61	51.32	4.62	73.45	21.18
50x100	652.75	308.1	344.62	21.47	7.11	72.79	5.36	48.68	29.62
100x200	458.89	294.5	164.40	10.24	25.30	83.03	7.82	27.21	47.38
200x325	361.28	298.0	63.29	3.94	46.28	86.97	9.56	16.97	60.70
-325	215.15	6.0	209.19	13.03	65.06	100.00	16.79	13.03	65.06
Total (Calc)	--	--	1605.34	100.00	16.79	--	--	--	--

Product SC2 Feed Weight (%): 12.09

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	494.5	460.1	34.37	8.40	39.92	8.40	39.92	100.00	26.22
18x30	550.0	442.2	107.84	26.36	28.82	34.77	31.50	91.60	24.97
30x50	536.2	411.8	124.38	30.41	12.17	65.17	22.48	65.23	23.41
50x100	458.7	393.0	65.70	16.06	11.08	81.23	20.23	34.83	33.22
100x200	427.6	391.3	36.23	8.86	37.37	90.09	21.91	18.77	52.17
200x325	392.5	379.6	12.83	3.14	62.11	93.23	23.26	9.91	65.41
-325	34.2	6.5	27.70	6.77	66.94	100.00	26.22	6.77	66.94
Total (Calc)	--	--	409.06	100.00	26.22	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Experiment: 5 - Cardinal In-Plant Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product SM3 Feed Weight (%): 9.12

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	500.7	401.2	99.45	16.11	65.84	16.11	65.84	100.00	52.47
18x30	598.4	370.0	228.41	36.99	56.17	53.10	59.10	83.89	49.90
30x50	452.2	336.3	115.88	18.77	36.73	71.86	53.26	46.90	44.95
50x100	383.3	308.1	75.12	12.17	30.70	84.03	50.00	28.14	50.44
100x200	346.6	294.5	52.11	8.44	61.11	92.47	51.01	15.97	65.47
200x325	316.9	298.0	18.95	3.07	72.45	95.54	51.70	7.53	70.36
-325	33.8	6.3	27.56	4.46	68.92	100.00	52.47	4.46	68.92
Total (Calc)	--	--	617.48	100.00	52.47	--	--	--	--

Product SM4 Feed Weight (%): 3.34

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	515.8	460.1	55.69	12.31	73.68	12.31	73.68	100.00	62.34
18x30	586.6	442.2	144.49	31.93	61.68	44.23	65.02	87.69	60.75
30x50	511.4	411.8	99.58	22.00	50.45	66.24	60.18	55.77	60.22
50x100	456.2	393.0	63.17	13.96	53.55	80.19	59.02	33.76	66.58
100x200	444.8	391.3	53.47	11.81	76.38	92.01	61.25	19.81	75.77
200x325	395.7	379.6	16.07	3.55	78.35	95.56	61.89	7.99	74.88
-325	26.5	6.5	20.09	4.44	72.10	100.00	62.34	4.44	72.10
Total (Calc)	--	--	452.55	100.00	62.34	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Experiment: 5 - Cardinal In-Plant Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product SM5 Feed Weight (%): 3.50

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	439.5	401.2	38.33	8.09	74.93	8.09	74.93	100.00	71.77
18x30	481.9	370.0	111.86	23.61	68.08	31.70	69.83	91.91	71.50
30x50	444.5	336.3	108.26	22.85	63.15	54.55	67.03	68.30	72.68
50x100	407.3	308.1	99.22	20.94	73.44	75.49	68.81	45.45	77.47
100x200	366.2	294.5	71.75	15.14	82.74	90.63	71.14	24.51	80.91
200x325	318.5	298.0	20.48	4.32	81.71	94.96	71.62	9.37	77.95
-325	30.1	6.2	23.90	5.04	74.73	100.00	71.77	5.04	74.73
Total (Calc)	--	--	473.80	100.00	71.77	--	--	--	--

Product ST2 Feed Weight (%): 0.45

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	461.5	460.1	1.35	0.63	64.85	0.63	64.85	100.00	83.34
18x30	448.2	442.2	6.09	2.85	72.22	3.48	70.88	99.37	83.45
30x50	435.6	411.8	23.75	11.10	77.21	14.58	75.70	96.52	83.78
50x100	455.6	393.0	62.60	29.26	83.46	43.84	80.88	85.42	84.64
100x200	462.2	391.3	70.88	33.13	87.40	76.97	83.69	56.16	85.25
200x325	403.4	379.6	23.76	11.10	86.06	88.07	83.99	23.03	82.16
-325	31.9	6.4	25.52	11.93	78.54	100.00	83.34	11.93	78.54
Total (Calc)	--	--	213.94	100.00	83.34	--	--	--	--

SPIRAL DATA ANALYSIS

Description: Experiment: 5 - Cardinal In-Plant Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PRODUCT SIZE ANALYSIS

Product ST1 Feed Weight (%): 24.05

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Cumulative Retained		Cumulative Passed	
						Weight (%, dry)	Ash (%, dry)	Weight (%, dry)	Ash (%, dry)
+18	578.5	401.2	177.27	10.89	85.59	10.89	85.59	100.00	80.37
18x30	746.2	370.0	376.11	23.10	82.17	33.99	83.26	89.11	79.73
30x50	845.2	336.3	508.94	31.26	80.52	65.26	81.95	66.01	78.88
50x100	609.5	308.1	301.35	18.51	77.46	83.77	80.96	34.74	77.40
100x200	446.5	294.5	151.96	9.34	77.53	93.11	80.62	16.23	77.34
200x325	340.4	298.0	42.41	2.61	78.01	95.71	80.54	6.89	77.08
-325	76.3	6.5	69.81	4.29	76.51	100.00	80.37	4.29	76.51
Total (Calc)	--	--	1627.86	100.00	80.37	--	--	--	--

SPIRAL DATA ANALYSIS

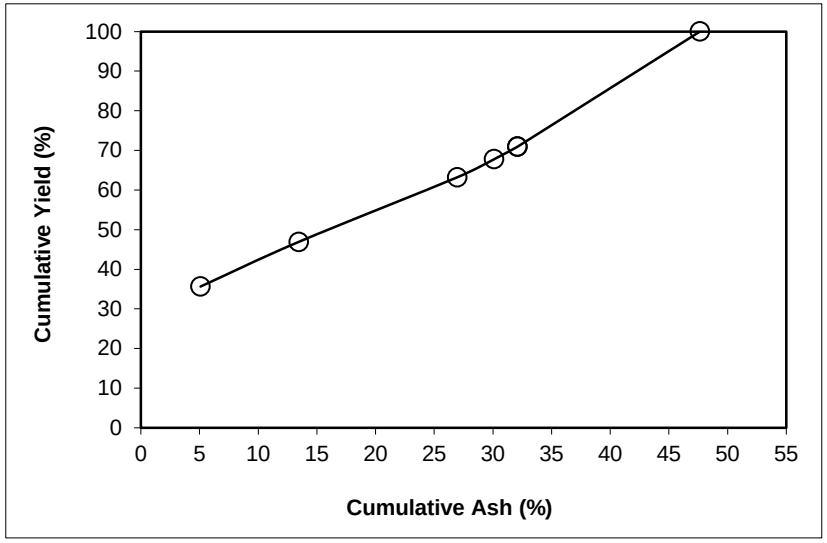
Description: Experiment: 5 - Cardinal In-Plant Test

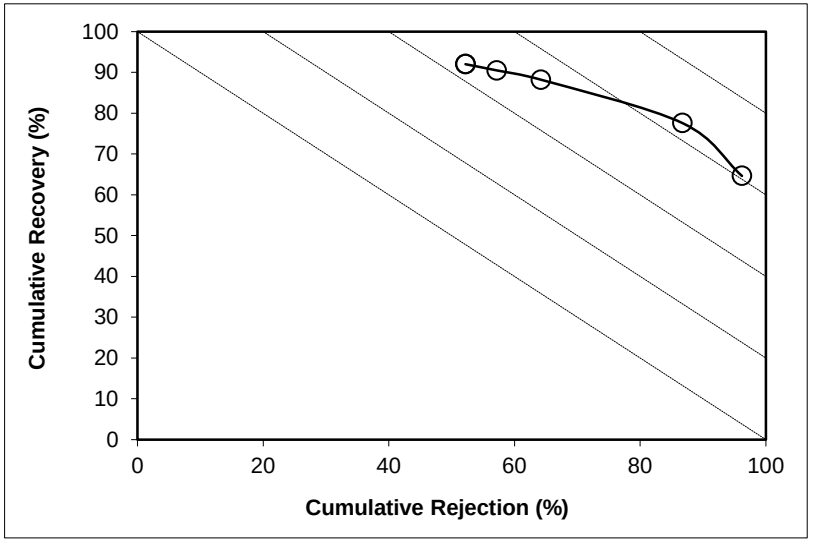
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: +18 Feed Weight (%): 9.02

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	35.64	5.08	35.64	5.08	64.62	64.36	71.22	96.20	60.82
SC2	11.27	39.92	46.91	13.45	77.55	53.09	77.86	86.76	64.31
SM3	16.30	65.84	63.21	26.96	88.19	36.79	83.19	64.24	52.42
SM4	4.56	73.68	67.77	30.10	90.48	32.23	84.53	57.18	47.66
SM5	3.14	74.93	70.91	32.09	91.98	29.09	85.57	52.24	44.22
ST2	0.03	64.85	70.95	32.10	92.00	29.05	85.59	52.20	44.20
ST1	29.05	85.59	100.00	47.64	100.00	0.00			
Total (Calc)	100.00	47.64	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

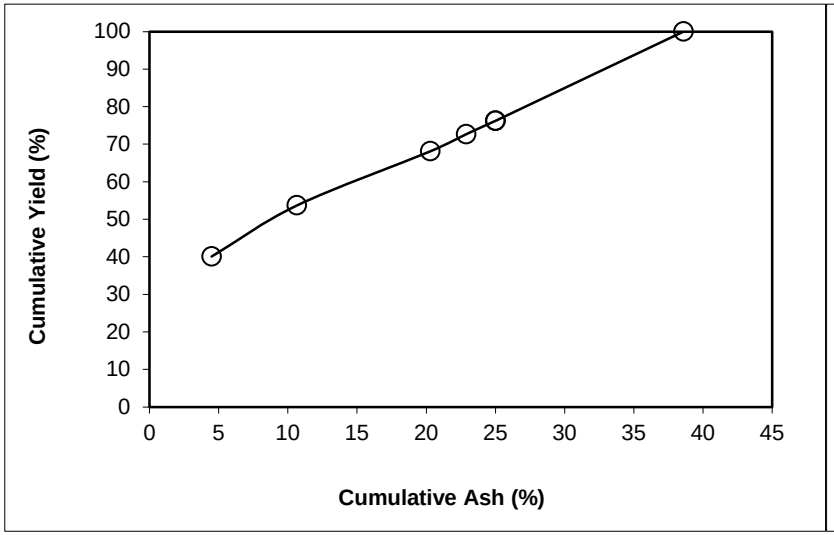
Description: Experiment: 5 - Cardinal In-Plant Test

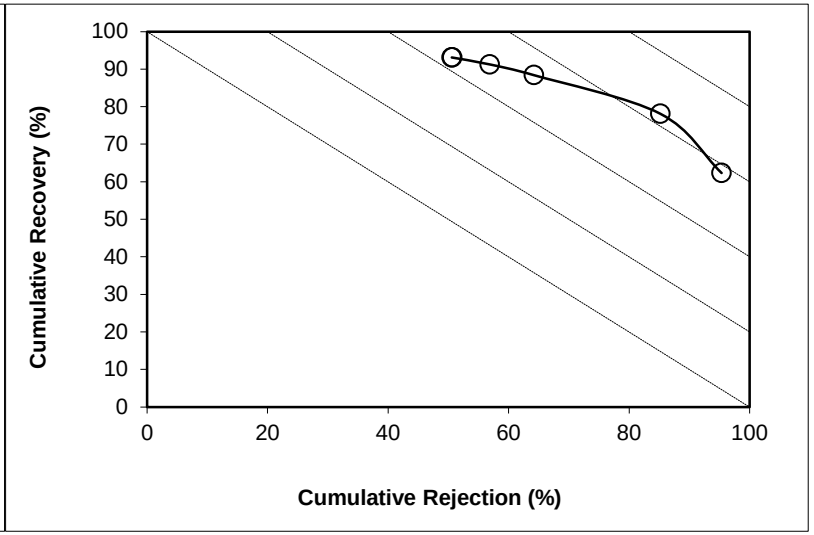
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 18x30 Feed Weight (%): 23.41

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	40.08	4.49	40.08	4.49	62.33	59.92	61.39	95.34	57.67
SC2	13.62	28.82	53.69	10.66	78.11	46.31	70.97	85.17	63.28
SM3	14.42	56.17	68.11	20.29	88.40	31.89	77.66	64.18	52.58
SM4	4.56	61.68	72.67	22.89	91.25	27.33	80.33	56.89	48.14
SM5	3.53	68.08	76.20	24.99	93.08	23.80	82.14	50.66	43.74
ST2	0.05	72.22	76.26	25.02	93.11	23.74	82.17	50.56	43.66
ST1	23.74	82.17	100.00	38.59	100.00	0.00			
Total (Calc)	100.00	38.59	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

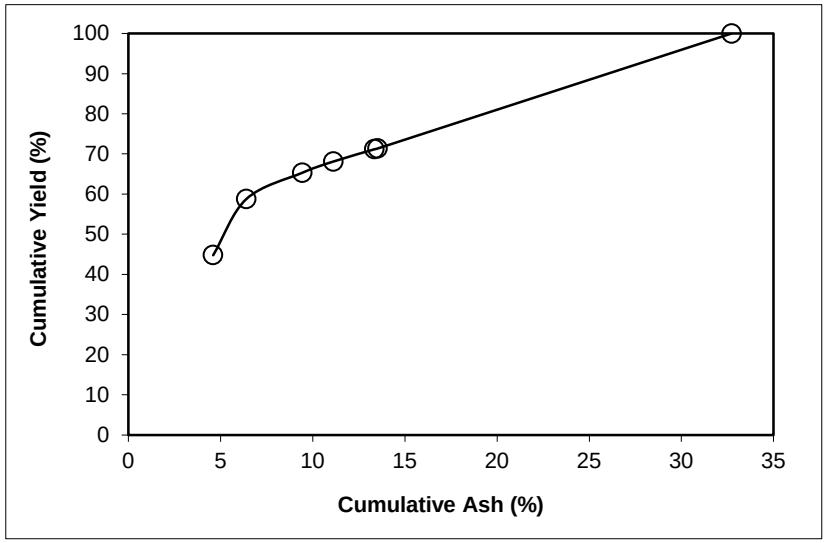
Description: Experiment: 5 - Cardinal In-Plant Test

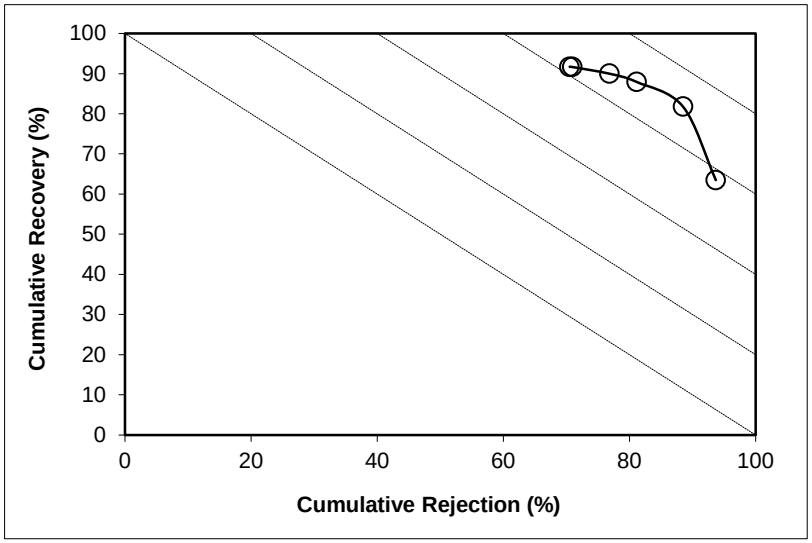
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 30x50 Feed Weight (%): 26.25

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	44.78	4.61	44.78	4.61	63.49	55.22	55.52	93.70	57.19
SC2	14.00	12.17	58.78	6.41	81.77	41.22	70.25	88.49	70.26
SM3	6.52	36.73	65.31	9.44	87.91	34.69	76.55	81.17	69.07
SM4	2.80	50.45	68.11	11.12	89.97	31.89	78.84	76.84	66.82
SM5	3.05	63.15	71.16	13.35	91.64	28.84	80.50	70.96	62.60
ST2	0.19	77.21	71.35	13.52	91.71	28.65	80.52	70.51	62.22
ST1	28.65	80.52	100.00	32.72	100.00	0.00			
Total (Calc)	100.00	32.72	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

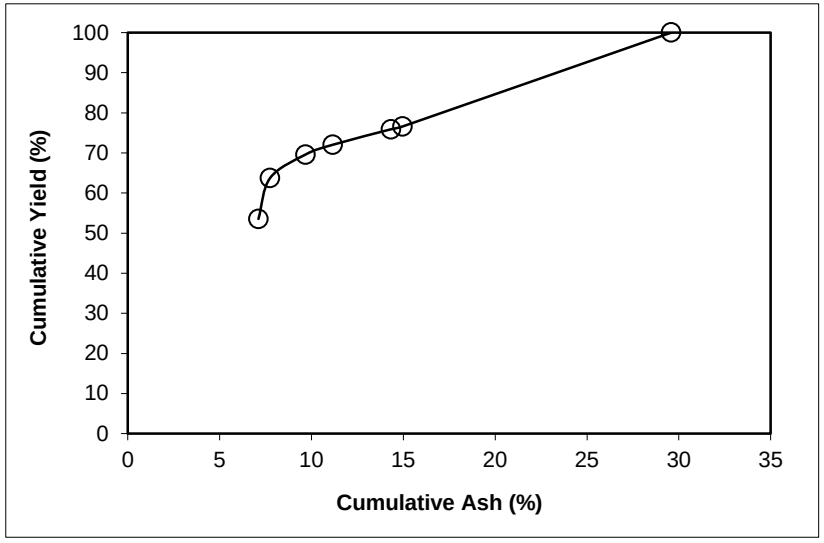
Description: Experiment: 5 - Cardinal In-Plant Test

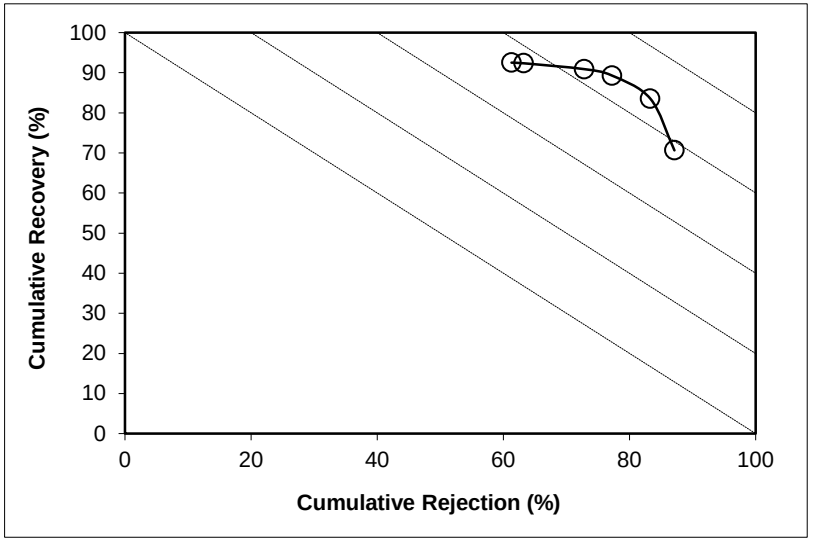
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 50x100 Feed Weight (%): 19.02

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	53.54	7.11	53.54	7.11	70.64	46.46	55.50	87.13	57.77
SC2	10.21	11.08	63.75	7.75	83.53	36.25	68.00	83.31	66.84
SM3	5.84	30.70	69.59	9.67	89.27	30.41	75.16	77.25	66.52
SM4	2.45	53.55	72.04	11.17	90.89	27.96	77.06	72.81	63.70
SM5	3.85	73.44	75.90	14.33	92.34	24.10	77.64	63.25	55.59
ST2	0.69	83.46	76.59	14.96	92.51	23.41	77.46	61.29	53.79
ST1	23.41	77.46	100.00	29.59	100.00	0.00			
Total (Calc)	100.00	29.59	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

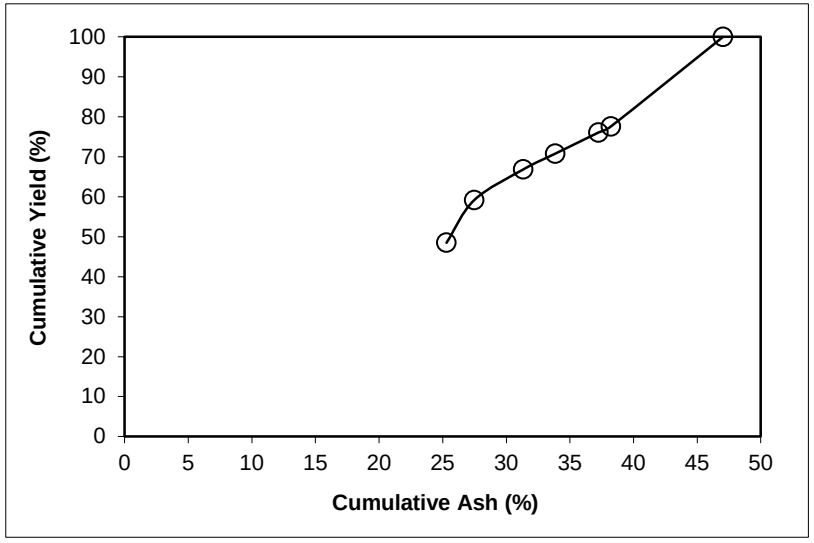
Description: Experiment: 5 - Cardinal In-Plant Test

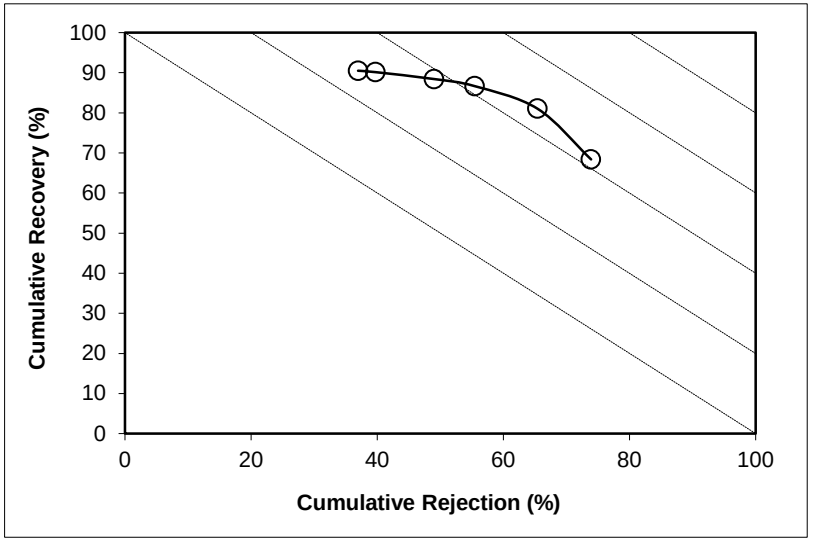
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 10.02

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	48.49	25.30	48.49	25.30	68.38	51.51	67.48	73.91	42.29
SC2	10.69	37.37	59.18	27.48	81.01	40.82	75.36	65.42	46.43
SM3	7.68	61.11	66.86	31.34	86.66	33.14	78.67	55.44	42.09
SM4	3.94	76.38	70.80	33.85	88.41	29.20	78.98	49.03	37.45
SM5	5.29	82.74	76.10	37.25	90.14	23.90	78.14	39.72	29.86
ST2	1.49	87.40	77.59	38.22	90.49	22.41	77.53	36.95	27.44
ST1	22.41	77.53	100.00	47.03	100.00	0.00			
Total (Calc)	100.00	47.03	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

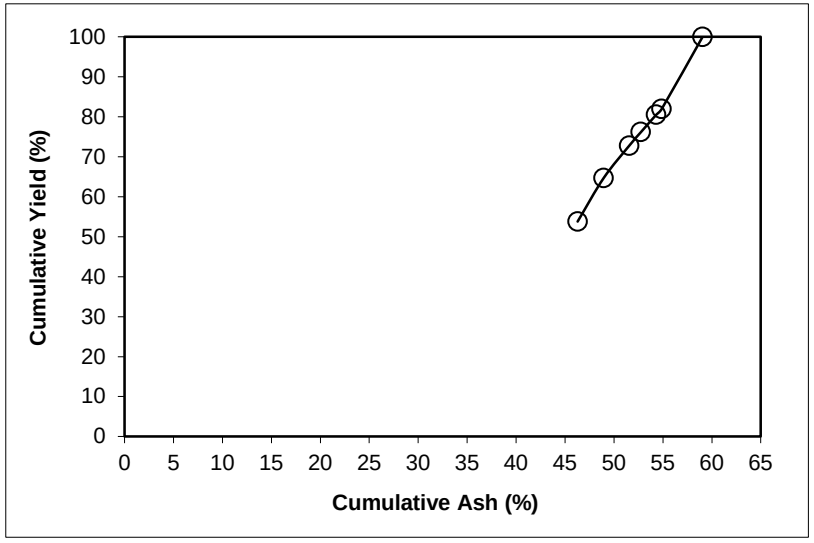
Description: Experiment: 5 - Cardinal In-Plant Test

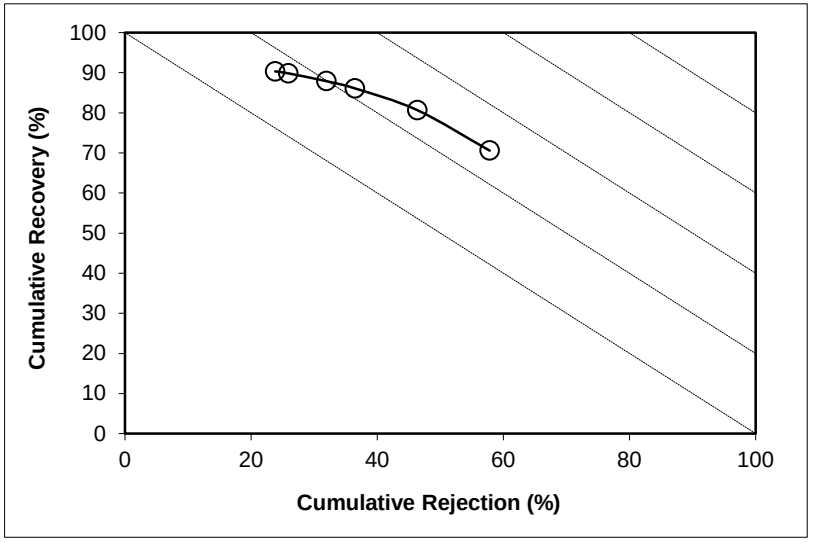
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 3.48

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	53.80	46.28	53.80	46.28	70.57	46.20	73.91	57.83	28.40
SC2	10.91	62.11	64.71	48.95	80.66	35.29	77.56	46.35	27.02
SM3	8.05	72.45	72.77	51.55	86.08	27.23	79.07	36.47	22.55
SM4	3.41	78.35	76.18	52.75	87.89	23.82	79.17	31.94	19.83
SM5	4.35	81.71	80.53	54.32	89.83	19.47	78.61	25.92	15.75
ST2	1.44	86.06	81.98	54.88	90.32	18.02	78.01	23.81	14.14
ST1	18.02	78.01	100.00	59.05	100.00	0.00			
Total (Calc)	100.00	59.05	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

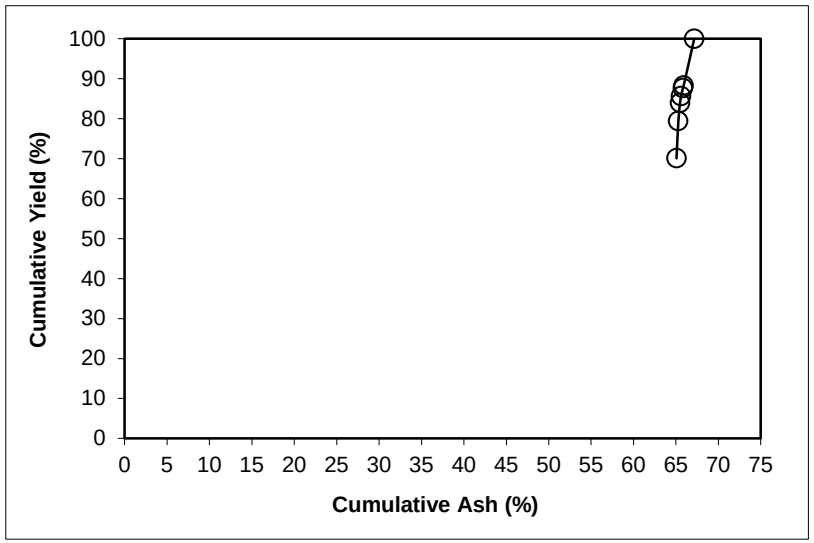
Description: Experiment: 5 - Cardinal In-Plant Test

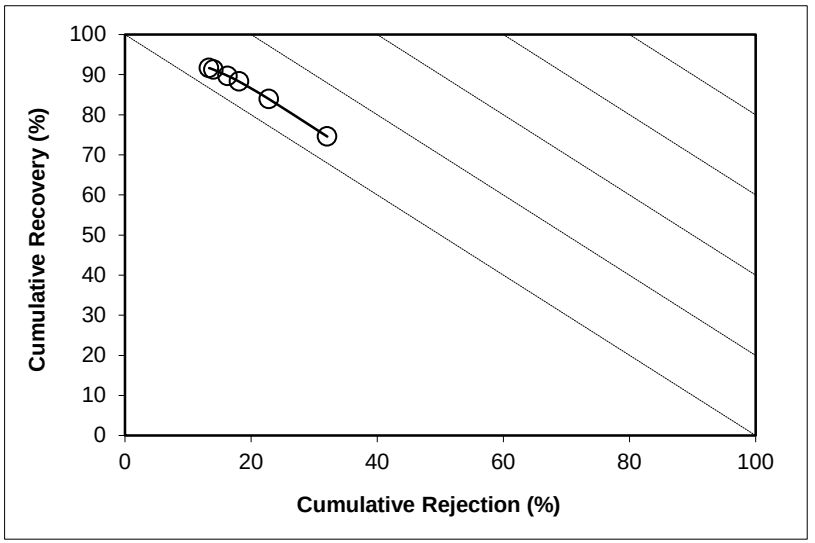
Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 8.82

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	70.10	65.06	70.10	65.06	74.56	29.90	72.04	32.07	6.63
SC2	9.28	66.94	79.39	65.28	83.90	20.61	74.34	22.82	6.72
SM3	4.62	68.92	84.01	65.48	88.27	15.99	75.90	18.08	6.35
SM4	1.68	72.10	85.69	65.61	89.70	14.31	76.35	16.27	5.97
SM5	2.00	74.73	87.69	65.82	91.24	12.31	76.61	14.04	5.28
ST2	0.61	78.54	88.30	65.91	91.64	11.70	76.51	13.33	4.96
ST1	11.70	76.51	100.00	67.15	100.00	0.00			
Total (Calc)	100.00	67.15	--	--	--	--	--	--	--





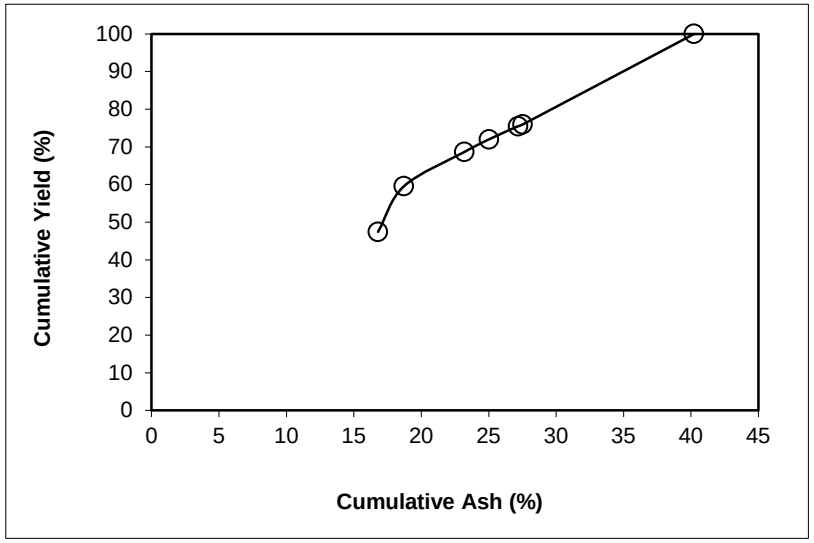
SPIRAL DATA ANALYSIS

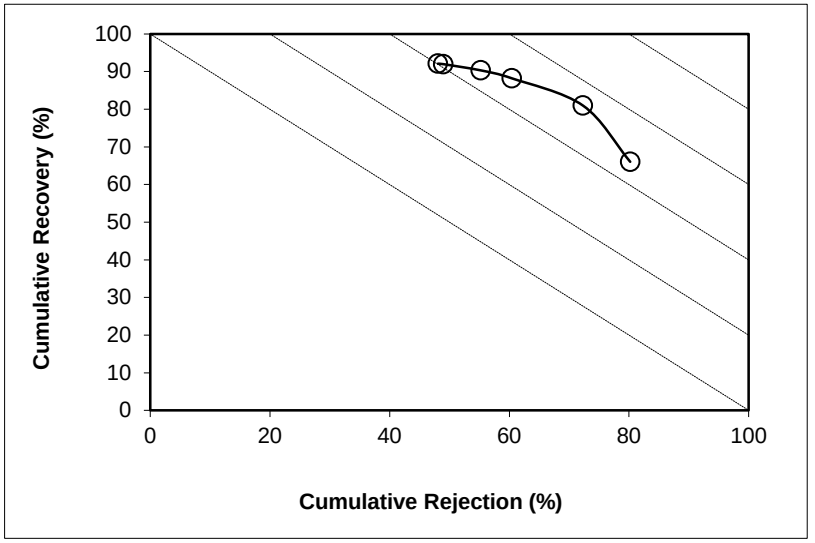
Description: Experiment: 5 - Cardinal In-Plant Test

Comments: 12T0+23T0+3CT1 Spiral Circuit (1 x 0.15 mm Nominal Particle Size)

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
SC1	47.44	16.79	47.44	16.79	66.04	52.56	61.38	80.20	46.24
SC2	12.09	26.22	59.53	18.71	80.96	40.47	71.88	72.32	53.28
SM3	9.12	52.47	68.65	23.19	88.22	31.35	77.53	60.42	48.63
SM4	3.34	62.34	72.00	25.01	90.32	28.00	79.34	55.24	45.56
SM5	3.50	71.77	75.50	27.18	91.98	24.50	80.43	48.99	40.97
ST2	0.45	83.34	75.95	27.51	92.10	24.05	80.37	48.06	40.16
ST1	24.05	80.37	100.00	40.23	100.00	0.00			
Total (Calc)	100.00	40.23	--	--	--	--	--	--	--



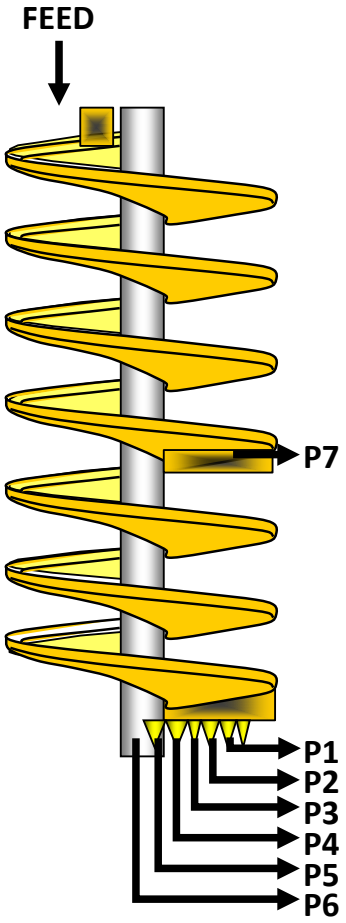


APPENDIX F – Spiral Circuit Results (High Sulfur Feed Stock)

SPIRAL DATA ANALYSIS

Description: Run 32 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	0.507	16.6	10.22	11.50
P2	0.241	19.4	4.00	4.63
P3	0.069	22.6	0.94	1.12
P4	0.027	26.1	0.31	0.38
P5	0.053	29.4	0.51	0.64
P6	0.028	34.8	0.21	0.26
P7	0.112	39.4	0.69	0.91
Total	1.037	19.7	16.88	19.43

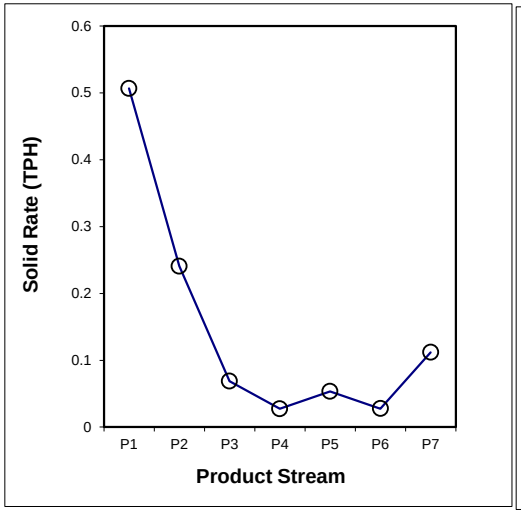
SPIRAL DATA ANALYSIS

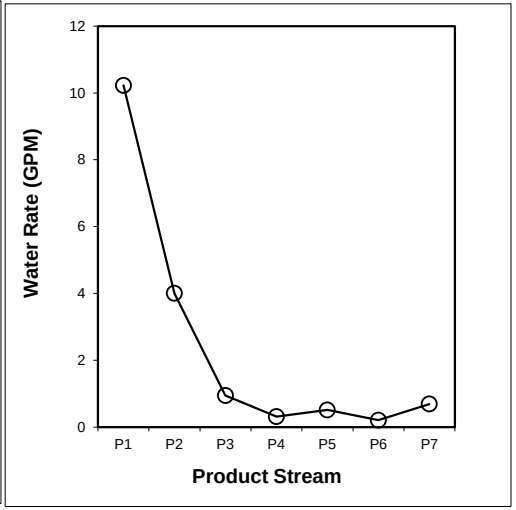
Description: Run 32 -Fine Spiral Test

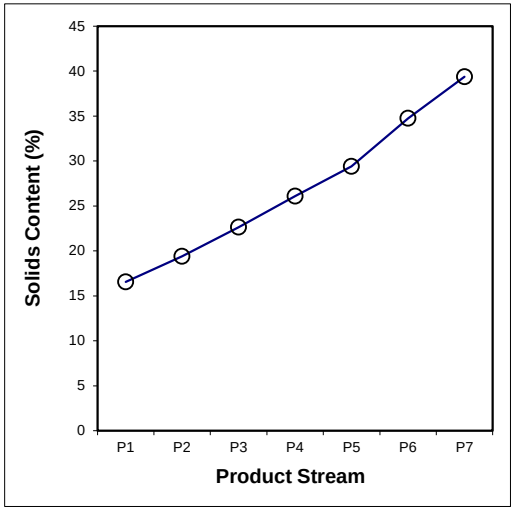
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	5	5347.00	1428.00	3.062	1875.2	1235.9	0.507	48.90	16.55
P2	5	1681.58	92.70	1.242	1110.9	807.1	0.241	23.24	19.40
P3	30	2426.30	95.46	0.304	1230.9	710.6	0.069	6.63	22.65
P4	30	894.05	92.07	0.105	939.2	732.8	0.027	2.63	26.10
P5	30	1485.85	92.86	0.182	1186.9	782.7	0.053	5.15	29.42
P6	30	706.27	97.45	0.079	626.3	417.6	0.028	2.66	34.76
P7	30	2270.10	93.54	0.284	1527.4	681.5	0.112	10.78	39.37
Total (Calc)	--	--	--	5.257	--	--	1.037	100.00	19.72
Total (Head)	0.86	1232.03	93.28	5.257	1009.4	784.9	1.037	--	19.72







SPIRAL DATA ANALYSIS

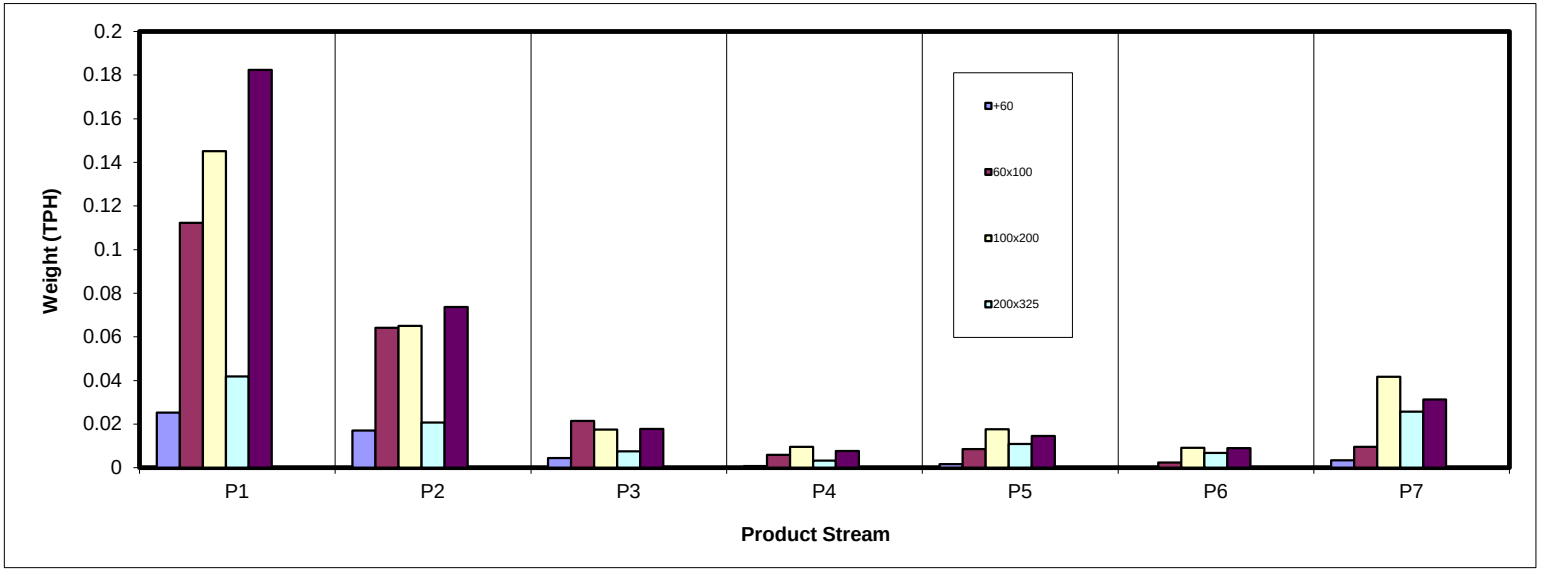
Description: Run 32 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	0.025	0.017	0.005	0.001	0.002	0.000	0.003		0.053
60x100	0.112	0.064	0.021	0.006	0.009	0.002	0.010		0.224
100x200	0.145	0.065	0.018	0.010	0.018	0.009	0.042		0.306
200x325	0.042	0.021	0.008	0.003	0.011	0.007	0.026		0.117
-325	0.182	0.074	0.018	0.008	0.015	0.009	0.031		0.337
Total (Calc)	0.507	0.241	0.069	0.027	0.053	0.028	0.112		1.037



SPIRAL DATA ANALYSIS

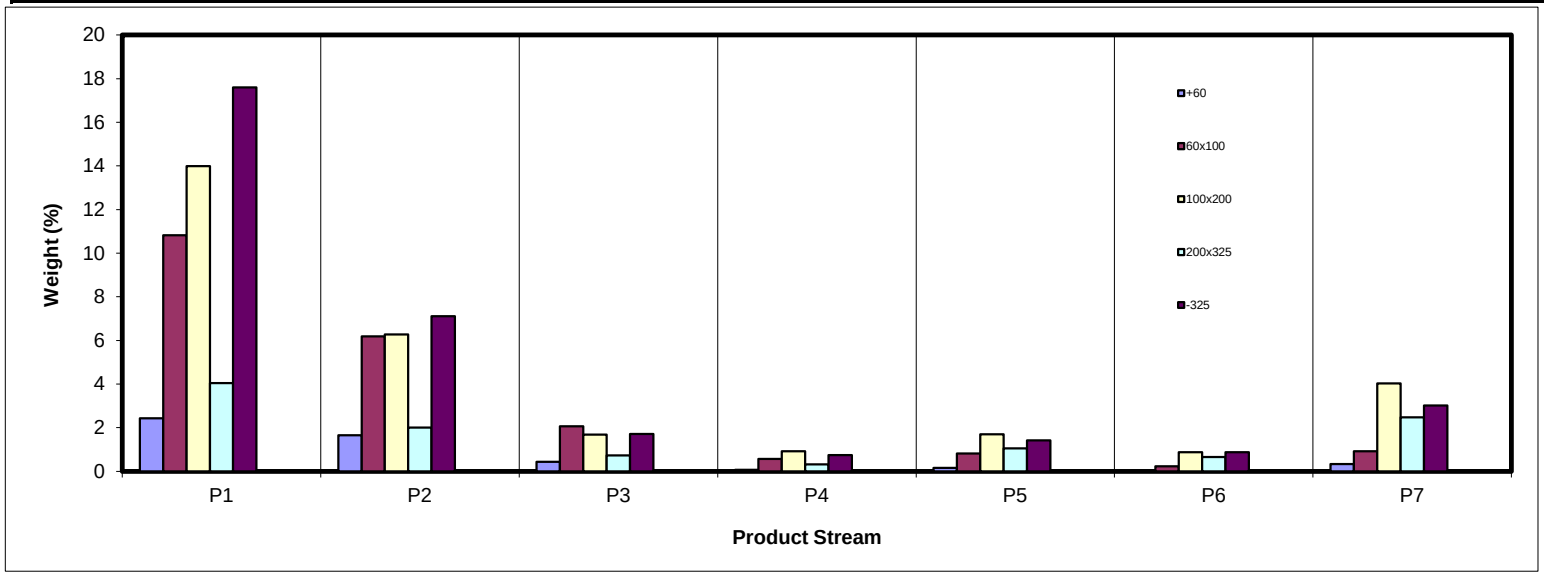
Description: Run 32 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	2.43	1.65	0.44	0.08	0.16	0.02	0.34		5.12
60x100	10.83	6.19	2.07	0.57	0.82	0.23	0.92		21.63
100x200	14.00	6.28	1.69	0.92	1.70	0.88	4.03		29.50
200x325	4.04	2.00	0.72	0.32	1.06	0.66	2.48		11.28
-325	17.60	7.11	1.71	0.74	1.41	0.87	3.02		32.47
Total (Calc)	48.90	23.24	6.63	2.63	5.15	2.66	10.78		100.00



SPIRAL DATA ANALYSIS

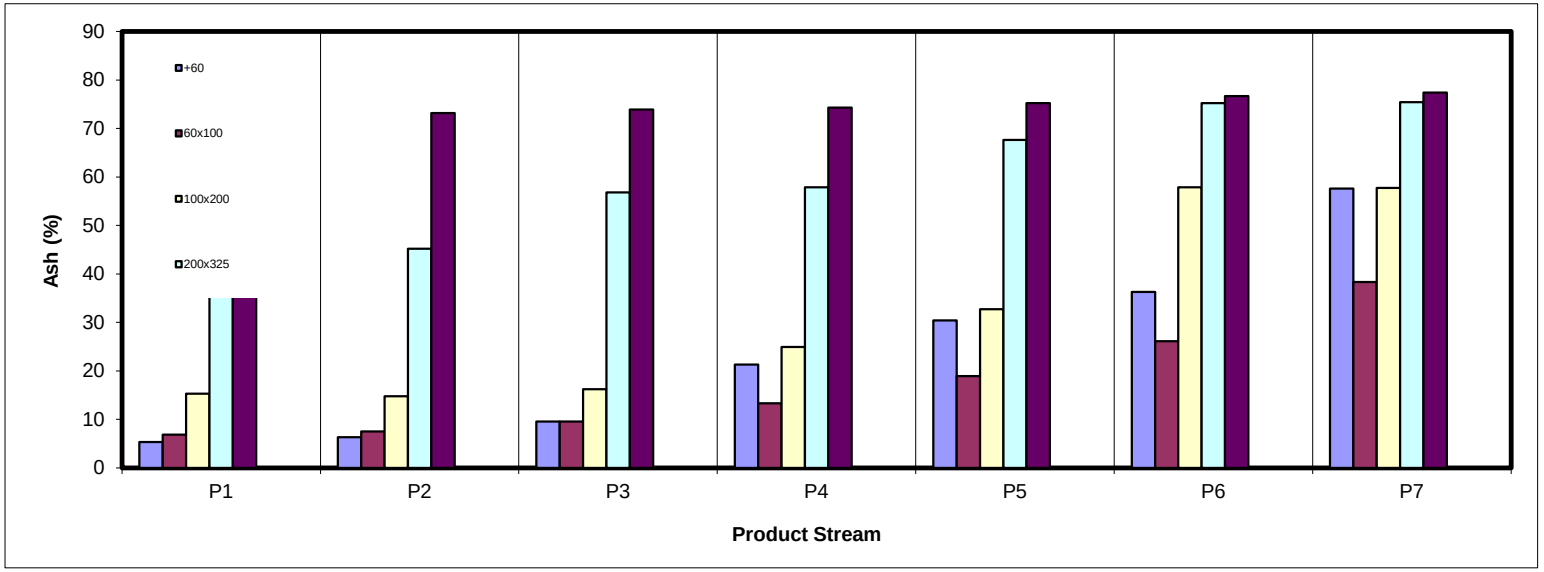
Description: Run 32 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	5.35	6.33	9.60	21.32	30.40	36.28	57.59		10.61
60x100	6.89	7.56	9.55	13.32	18.96	26.10	38.37		9.50
100x200	15.32	14.78	16.22	24.92	32.71	57.88	57.76		23.63
200x325	46.64	45.19	56.79	57.88	67.65	75.25	75.42		57.32
-325	72.77	73.20	73.91	74.28	75.25	76.69	77.39		73.60
Total (Calc)	36.22	32.76	33.03	40.23	49.27	65.50	65.65		39.94



SPIRAL DATA ANALYSIS

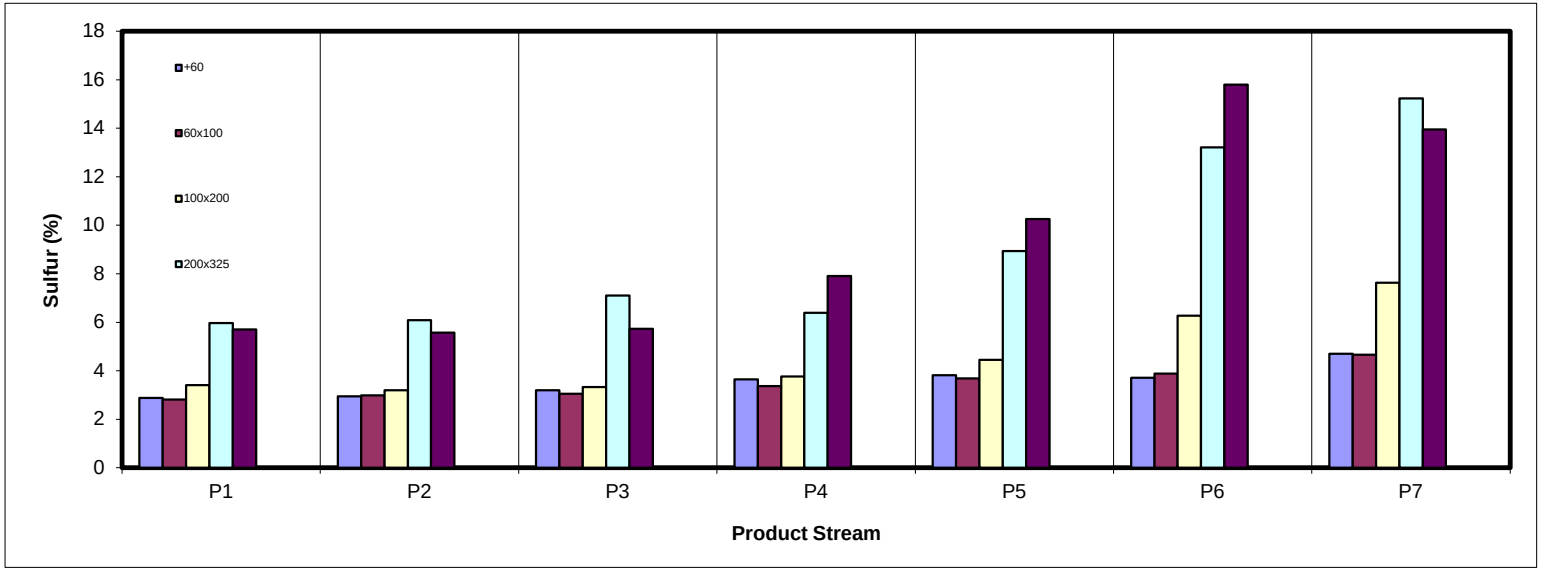
Description: Run 32 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Sulfur Content (%)

Sample ID	Dry Sulfur Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	2.88	2.95	3.19	3.64	3.81	3.71	4.70		3.09
60x100	2.82	2.98	3.06	3.37	3.69	3.88	4.66		3.02
100x200	3.40	3.20	3.33	3.77	4.45	6.27	7.63		4.09
200x325	5.97	6.09	7.11	6.39	8.94	13.22	15.23		8.82
-325	5.70	5.58	5.73	7.91	10.26	15.80	13.95		6.96
Total (Calc)	4.29	4.10	4.27	5.17	6.82	10.90	10.80		5.27



SPIRAL DATA ANALYSIS

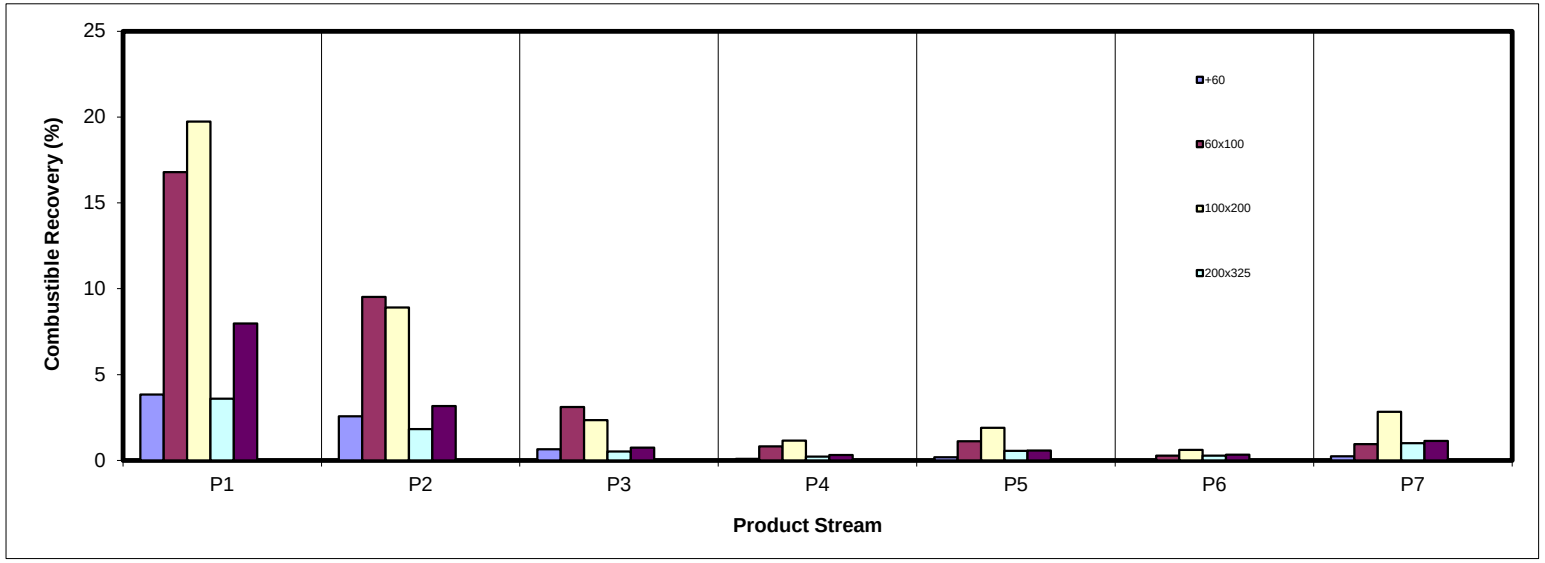
Description: Run 32 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	3.84	2.58	0.66	0.10	0.18	0.02	0.24		7.62
60x100	16.78	9.53	3.12	0.82	1.11	0.28	0.94		32.59
100x200	19.73	8.91	2.36	1.15	1.91	0.62	2.83		37.51
200x325	3.59	1.82	0.52	0.22	0.57	0.27	1.02		8.02
-325	7.98	3.17	0.74	0.32	0.58	0.34	1.13		14.27
Total (Calc)	51.93	26.01	7.40	2.62	4.35	1.53	6.17		100.00



SPIRAL DATA ANALYSIS

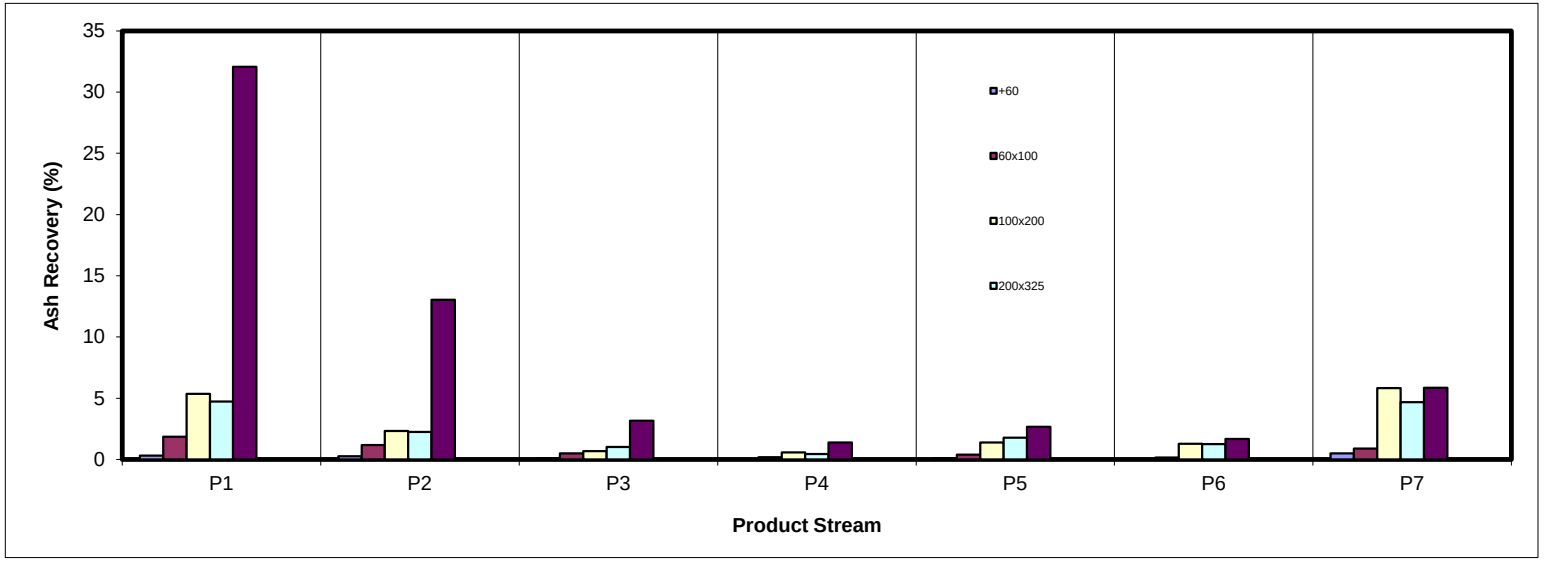
Description: Run 32 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	0.33	0.26	0.10	0.04	0.12	0.02	0.49		1.36
60x100	1.87	1.17	0.50	0.19	0.39	0.15	0.88		5.15
100x200	5.37	2.32	0.69	0.58	1.39	1.27	5.83		17.45
200x325	4.72	2.26	1.03	0.46	1.79	1.25	4.68		16.20
-325	32.07	13.04	3.17	1.38	2.66	1.68	5.84		59.85
Total (Calc)	44.35	19.06	5.49	2.65	6.36	4.37	17.73		100.00



SPIRAL DATA ANALYSIS

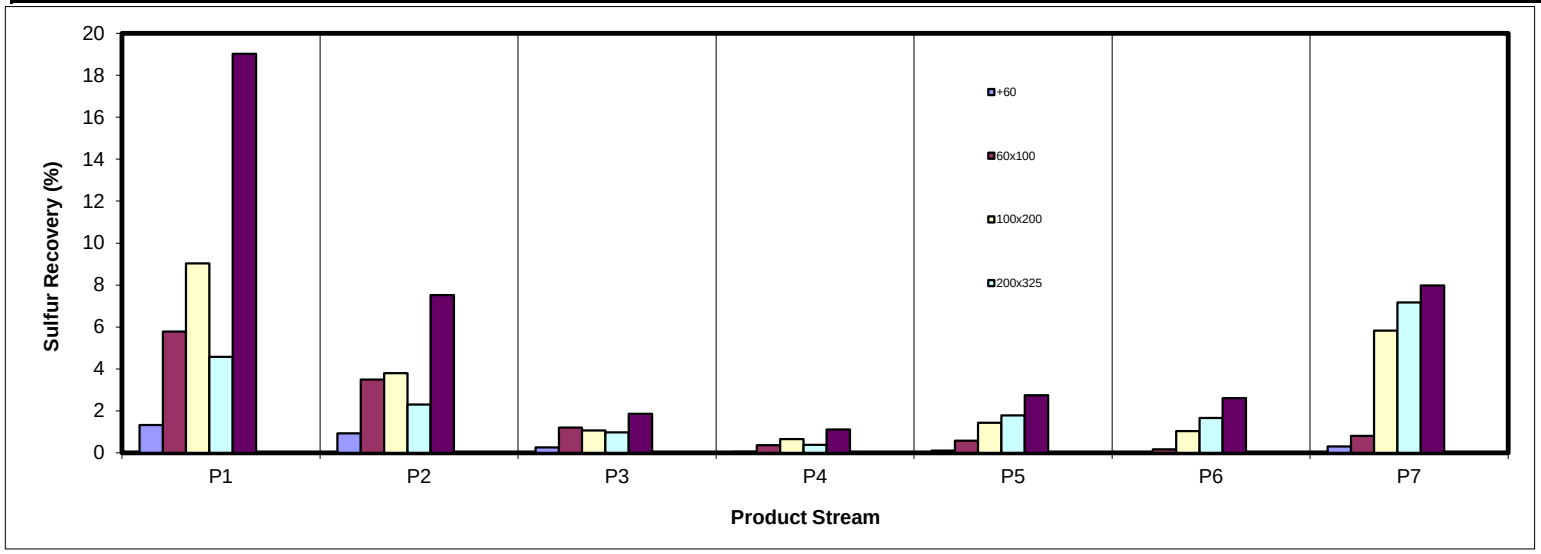
Description: Run 32 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Sulfur Recovery (%)

Sample ID	Sulfur Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	1.33	0.93	0.26	0.05	0.11	0.02	0.30		3.00
60x100	5.78	3.50	1.20	0.37	0.58	0.17	0.81		12.40
100x200	9.04	3.81	1.07	0.66	1.44	1.04	5.83		22.88
200x325	4.58	2.31	0.98	0.38	1.79	1.66	7.16		18.86
-325	19.02	7.52	1.86	1.12	2.75	2.62	7.98		42.86
Total (Calc)	39.74	18.06	5.37	2.58	6.66	5.50	22.08		100.00



SPIRAL DATA ANALYSIS

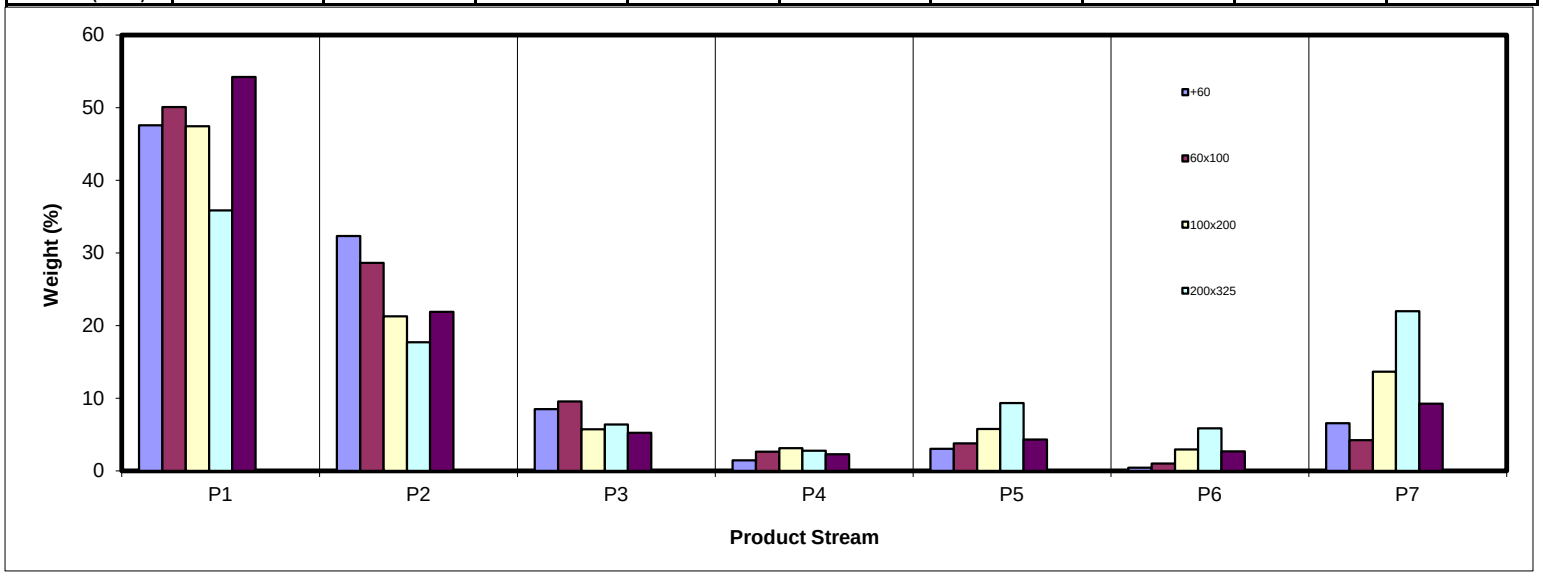
Description: Run 32 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	47.58	32.33	8.51	1.47	3.07	0.44	6.59		100.00
60x100	50.06	28.62	9.57	2.64	3.81	1.04	4.25		100.00
100x200	47.45	21.28	5.73	3.13	5.77	2.98	13.67		100.00
200x325	35.85	17.72	6.42	2.81	9.36	5.87	21.98		100.00
-325	54.20	21.91	5.28	2.29	4.35	2.69	9.29		100.00
Total (Calc)	48.90	23.24	6.63	2.63	5.15	2.66	10.78		100.00



SPIRAL DATA ANALYSIS

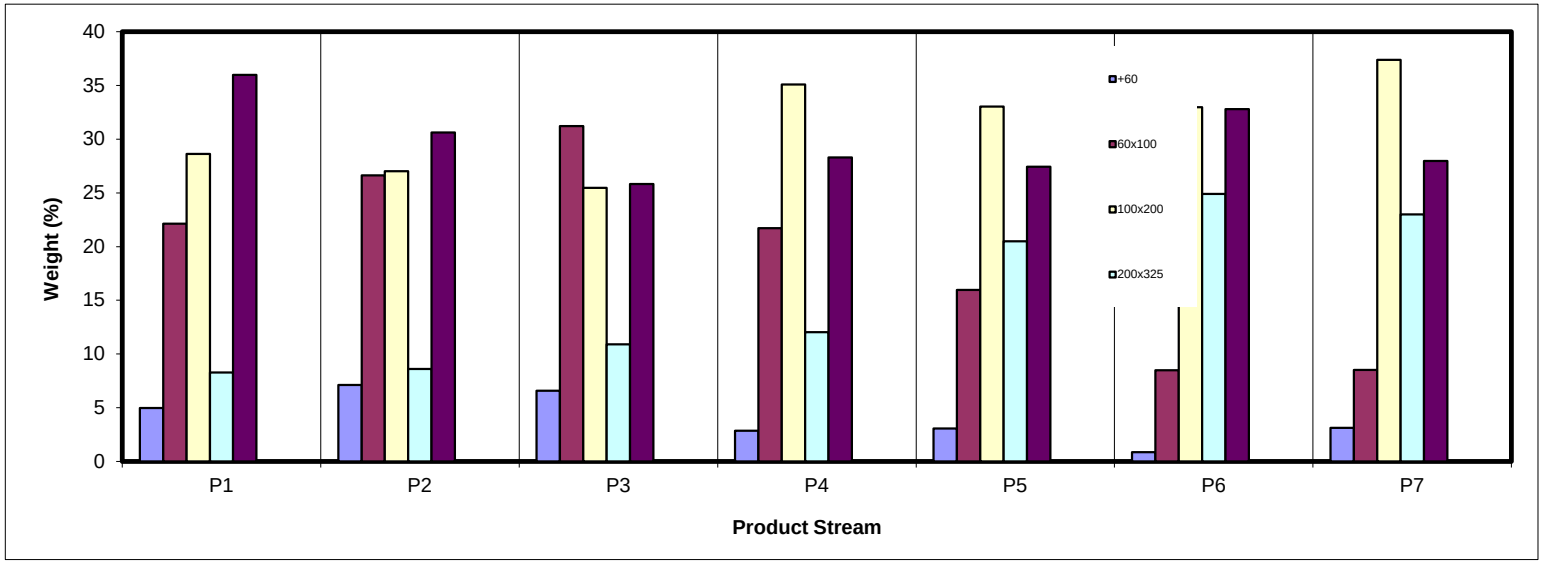
Description: Run 32 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	4.98	7.12	6.56	2.86	3.05	0.85	3.13		5.12
60x100	22.14	26.64	31.21	21.72	15.98	8.48	8.53		21.63
100x200	28.62	27.02	25.48	35.10	33.05	32.98	37.38		29.50
200x325	8.27	8.60	10.91	12.04	20.49	24.89	23.00		11.28
-325	35.99	30.62	25.83	28.29	27.44	32.81	27.96		32.47
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

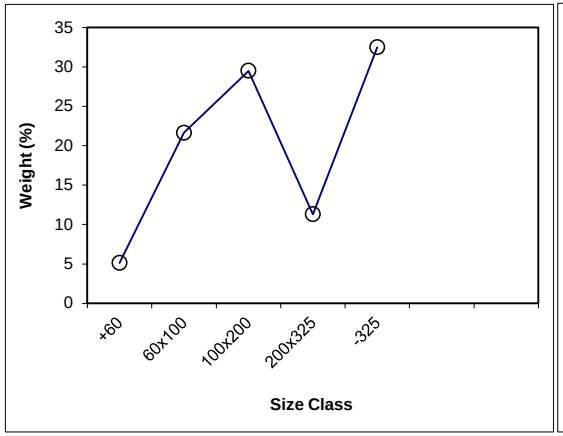
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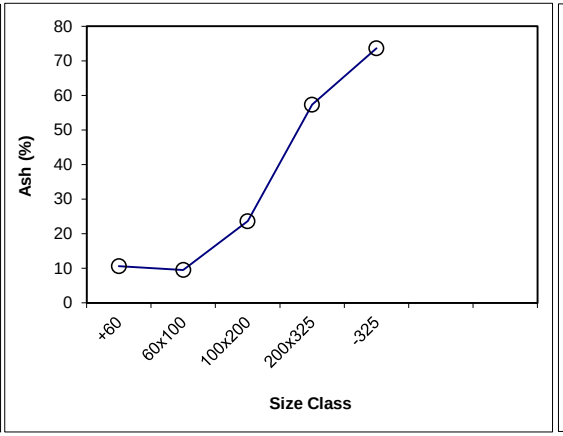
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

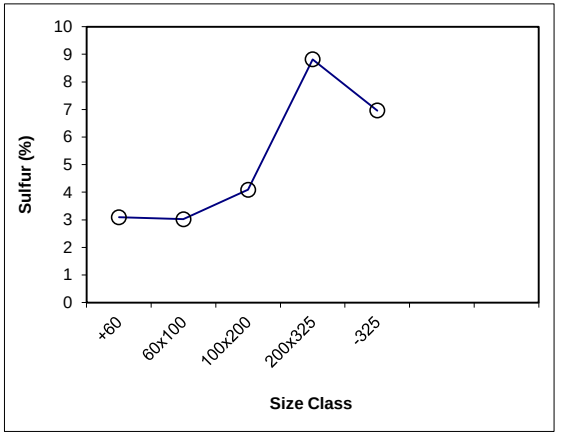
FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	17.7	6.2	11.49	5.12	10.61	3.09	5.12	10.61	3.09	100.00	39.94	5.27
60x100	465.4	416.8	48.56	21.63	9.50	3.02	26.74	9.71	3.04	94.88	41.52	5.39
100x200	415.9	349.6	66.24	29.50	23.63	4.09	56.24	17.01	3.59	73.26	50.97	6.09
200x325	31.5	6.1	25.34	11.28	57.32	8.82	67.53	23.75	4.46	43.76	69.41	7.44
-325	79.0	6.1	72.92	32.47	73.60	6.96	100.00	39.94	5.27	32.47	73.60	6.96
Total (Calc)	--	--	224.55	100.00	39.94	5.27	--	--		--		--







SPIRAL DATA ANALYSIS

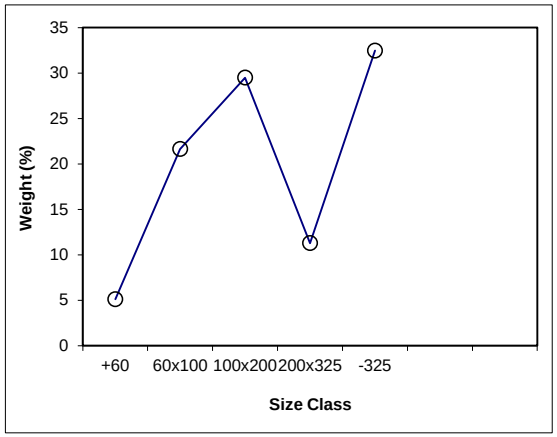
Description: Run 32 -Fine Spiral Test

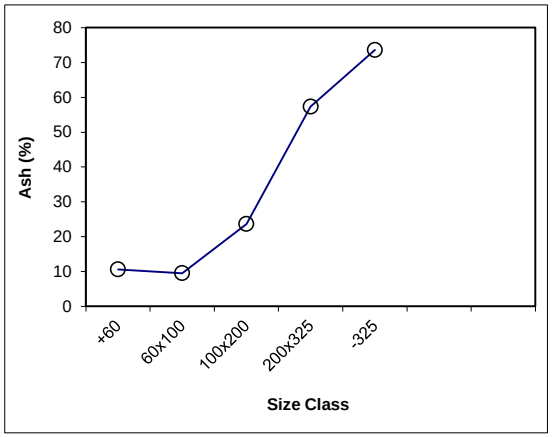
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

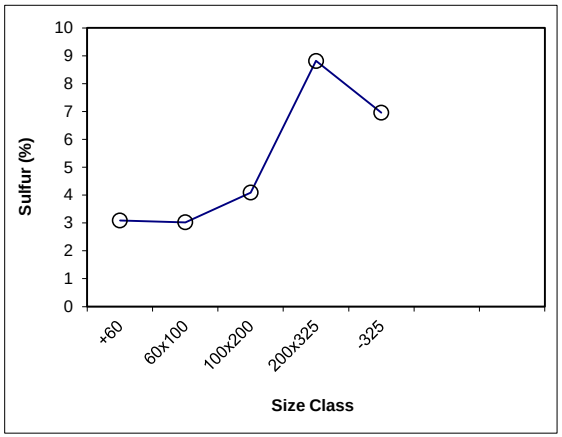
FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed			Select Size Class	Dry Weight (%)	Dry Ash (%)
				Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)			
+60	5.12	10.61	3.09	5.12	10.61	3.09	100.00	39.94	5.27	x	5.12	10.61
60x100	21.63	9.50	3.02	26.74	9.71	3.04	94.88	41.52	5.39	x	21.63	9.50
100x200	29.50	23.63	4.09	56.24	17.01	3.59	73.26	50.97	6.09	x	29.50	23.63
200x325	11.28	57.32	8.82	67.53	23.75	4.46	43.76	69.41	7.44	x	11.28	57.32
-325	32.47	73.60	6.96	100.00	39.94	5.27	32.47	73.60	6.96		32.47	73.60
Total (Calc)	100.00	39.94	5.27	--	--		--	--			100.00	39.94







SPIRAL DATA ANALYSIS

Description: Run 32 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 48.90

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	354.7	322.9	31.83	4.98	5.35	2.88	4.98	5.35	2.88	100.00	36.22	4.29
60x100	449.7	308.1	141.54	22.14	6.89	2.82	27.12	6.60	2.83	95.02	37.84	4.36
100x200	477.5	294.5	182.98	28.62	15.32	3.40	55.74	11.08	3.12	72.88	47.24	4.83
200x325	350.9	298.0	52.88	8.27	46.64	5.97	64.01	15.67	3.49	44.26	67.89	5.75
-325	242.5	12.4	230.08	35.99	72.77	5.70	100.00	36.22	4.29	35.99	72.77	5.70
Total (Calc)	--	--	639.31	100.00	36.22	4.29	--	--		--		--

Product P2 Feed Weight (%): 23.24

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	27.8	6.1	21.63	7.12	6.33	2.95	7.12	6.33	2.95	100.00	32.76	4.10
60x100	478.2	397.2	80.93	26.64	7.56	2.98	33.76	7.30	2.98	92.88	34.78	4.19
100x200	473.4	391.3	82.07	27.02	14.78	3.20	60.78	10.62	3.07	66.24	45.74	4.67
200x325	32.4	6.2	26.14	8.60	45.19	6.09	69.38	14.91	3.45	39.22	67.06	5.69
-325	99.2	6.2	93.01	30.62	73.20	5.58	100.00	32.76	4.10	30.62	73.20	5.58
Total (Calc)	--	--	303.77	100.00	32.76	4.10	--	--		--		--

SPIRAL DATA ANALYSIS

Description: Run 32 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 6.63

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	40.2	6.1	34.16	6.56	9.60	3.19	6.56	9.60	3.19	100.00	33.03	4.27
60x100	540.0	377.6	162.42	31.21	9.55	3.06	37.78	9.56	3.08	93.44	34.68	4.34
100x200	447.4	314.9	132.59	25.48	16.22	3.33	63.26	12.24	3.18	62.22	47.28	4.99
200x325	62.8	6.0	56.79	10.91	56.79	7.11	74.17	18.80	3.76	36.74	68.83	6.14
-325	140.5	6.1	134.38	25.83	73.91	5.73	100.00	33.03	4.27	25.83	73.91	5.73
Total (Calc)	--	--	520.33	100.00	33.03	4.27	--	--		--		--

Product P4 Feed Weight (%): 2.63

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	12.0	6.1	5.90	2.86	21.32	3.64	2.86	21.32	3.64	100.00	40.23	5.17
60x100	411.8	367.0	44.81	21.72	13.32	3.37	24.58	14.25	3.40	97.14	40.78	5.21
100x200	419.9	347.4	72.43	35.10	24.92	3.77	59.68	20.52	3.62	75.42	48.69	5.74
200x325	31.1	6.2	24.84	12.04	57.88	6.39	71.71	26.80	4.08	40.32	69.38	7.46
-325	64.5	6.1	58.37	28.29	74.28	7.91	100.00	40.23	5.17	28.29	74.28	7.91
Total (Calc)	--	--	206.35	100.00	40.23	5.17	--	--		--		--

SPIRAL DATA ANALYSIS

Description: Run 32 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 5.15

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	18.4	6.0	12.33	3.05	30.40	3.81	3.05	30.40	3.81	100.00	49.27	6.82
60x100	452.3	387.7	64.58	15.98	18.96	3.69	19.03	20.79	3.71	96.95	49.87	6.92
100x200	510.4	376.8	133.57	33.05	32.71	4.45	52.07	28.35	4.18	80.97	55.96	7.55
200x325	88.9	6.1	82.81	20.49	67.65	8.94	72.56	39.45	5.52	47.93	72.00	9.69
-325	117.0	6.1	110.91	27.44	75.25	10.26	100.00	49.27	6.82	27.44	75.25	10.26
Total (Calc)	--	--	404.20	100.00	49.27	6.82	--	--		--		--

Product P6 Feed Weight (%): 2.66

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	8.0	6.2	1.77	0.85	36.28	3.71	0.85	36.28	3.71	100.00	65.50	10.90
60x100	410.7	393.0	17.70	8.48	26.10	3.88	9.32	27.02	3.86	99.15	65.75	10.96
100x200	74.9	6.0	68.86	32.98	57.88	6.27	42.30	51.08	5.74	90.68	69.45	11.63
200x325	58.0	6.1	51.96	24.89	75.25	13.22	67.19	60.03	8.51	57.70	76.07	14.68
-325	74.7	6.2	68.50	32.81	76.69	15.80	100.00	65.50	10.90	32.81	76.69	15.80
Total (Calc)	--	--	208.78	100.00	65.50	10.90	--	--		--		--

SPIRAL DATA ANALYSIS

Description: Run 32 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P7 Feed Weight (%): 10.78

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	32.5	6.1	26.46	3.13	57.59	4.70	3.13	57.59	4.70	100.00	65.65	10.80
60x100	407.2	335.1	72.15	8.53	38.37	4.66	11.66	43.53	4.67	96.87	65.91	11.00
100x200	644.4	328.2	316.21	37.38	57.76	7.63	49.04	54.38	6.93	88.34	68.57	11.61
200x325	200.7	6.1	194.59	23.00	75.42	15.23	72.04	61.10	9.58	50.96	76.50	14.53
-325	242.5	6.0	236.50	27.96	77.39	13.95	100.00	65.65	10.80	27.96	77.39	13.95
Total (Calc)	--	--	845.91	100.00	65.65	10.80	--	--		--		--

SPIRAL DATA ANALYSIS

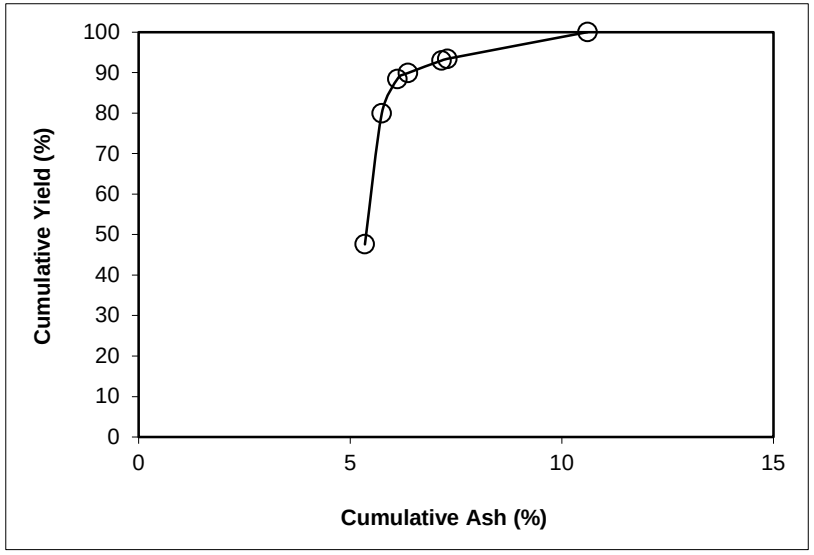
Description: Run 32 -Fine Spiral Test

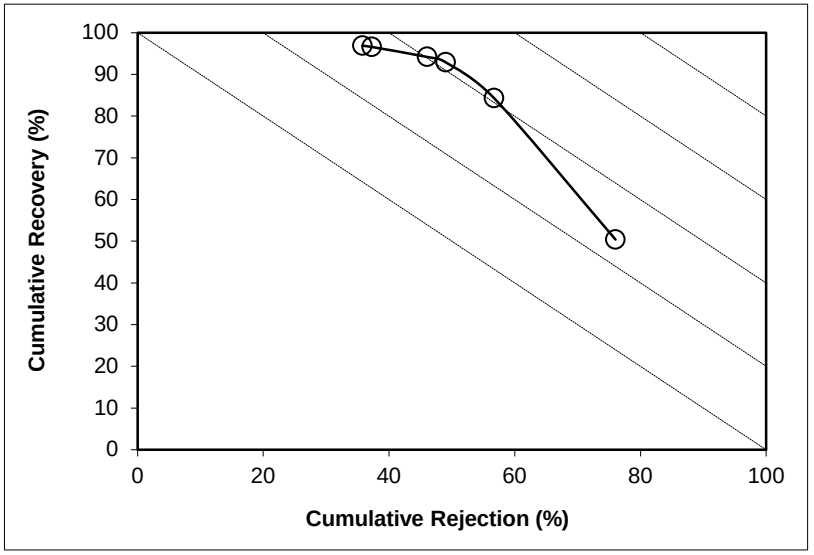
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: +60 Feed Weight (%): 5.12

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	47.58	5.35	47.58	5.35	50.39	52.42	15.39	76.02	26.41
P2	32.33	6.33	79.92	5.75	84.27	20.08	29.97	56.73	40.99
P3	8.51	9.60	88.43	6.12	92.87	11.57	44.96	49.03	41.90
P4	1.47	21.32	89.90	6.37	94.17	10.10	48.40	46.08	40.24
P5	3.07	30.40	92.97	7.16	96.56	7.03	56.26	37.28	33.84
P6	0.44	36.28	93.41	7.30	96.87	6.59	57.59	35.77	32.64
P7	6.59	57.59	100.00	10.61	100.00	0.00			
Total (Calc)	100.00	10.61	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

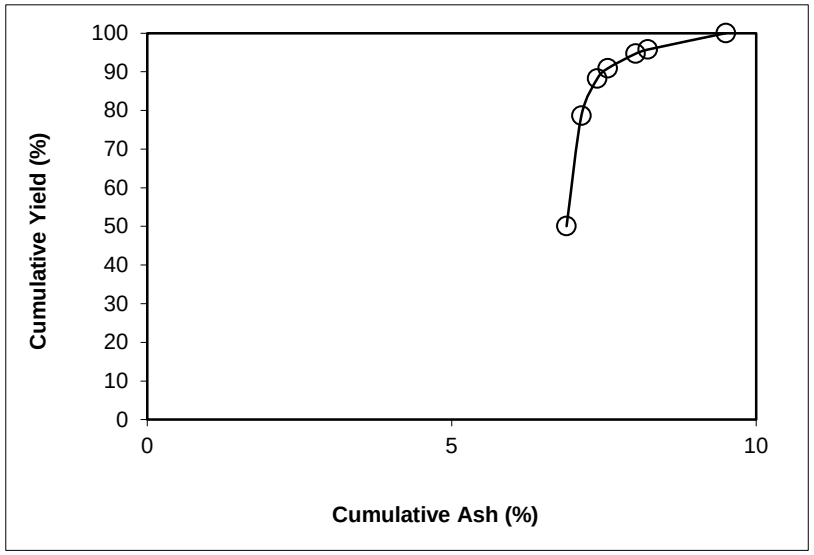
Description: Run 32 -Fine Spiral Test

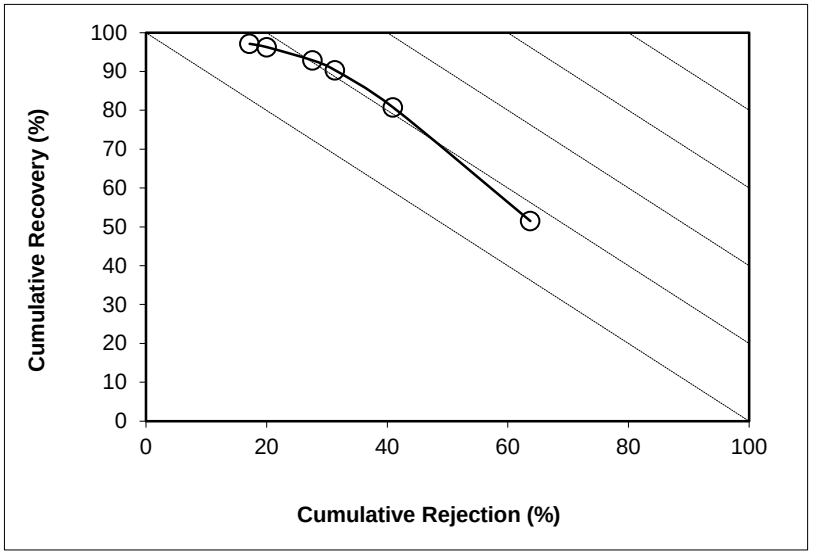
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 60x100 Feed Weight (%): 21.63

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	50.06	6.89	50.06	6.89	51.51	49.94	12.12	63.72	15.23
P2	28.62	7.56	78.68	7.13	80.74	21.32	18.26	40.96	21.70
P3	9.57	9.55	88.26	7.39	90.31	11.74	25.35	31.34	21.65
P4	2.64	13.32	90.90	7.56	92.84	9.10	28.84	27.63	20.48
P5	3.81	18.96	94.70	8.02	96.25	5.30	35.95	20.04	16.29
P6	1.04	26.10	95.75	8.22	97.10	4.25	38.37	17.17	14.28
P7	4.25	38.37	100.00	9.50	100.00	0.00			
Total (Calc)	100.00	9.50	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

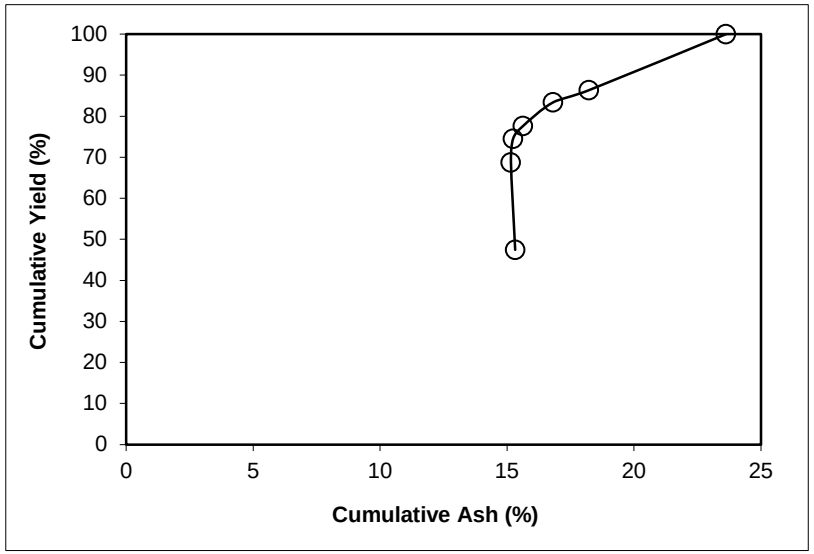
Description: Run 32 -Fine Spiral Test

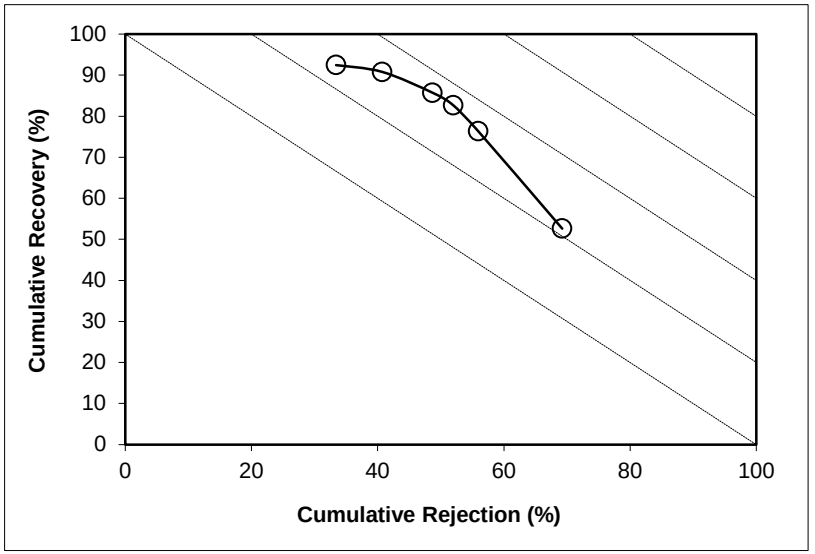
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 29.50

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	47.45	15.32	47.45	15.32	52.61	52.55	31.13	69.24	21.84
P2	21.28	14.78	68.73	15.15	76.35	31.27	42.25	55.92	32.27
P3	5.73	16.22	74.46	15.24	82.64	25.54	48.09	51.99	34.63
P4	3.13	24.92	77.59	15.63	85.71	22.41	51.32	48.69	34.40
P5	5.77	32.71	83.36	16.81	90.80	16.64	57.78	40.70	31.50
P6	2.98	57.88	86.33	18.22	92.44	13.67	57.76	33.41	25.85
P7	13.67	57.76	100.00	23.63	100.00	0.00			
Total (Calc)	100.00	23.63	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

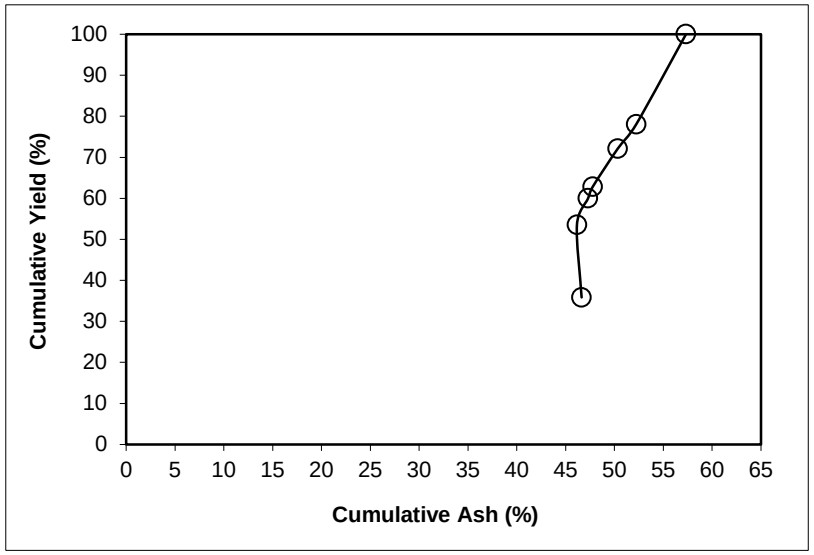
Description: Run 32 -Fine Spiral Test

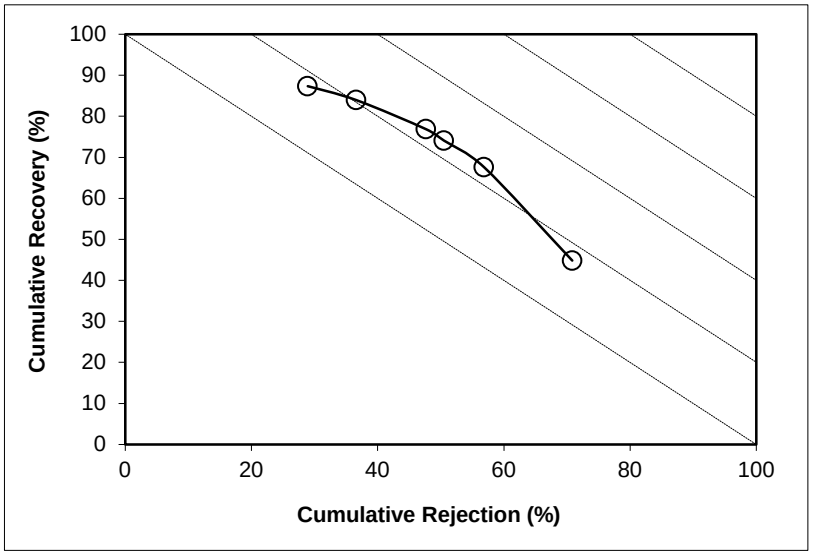
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 11.28

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	35.85	46.64	35.85	46.64	44.82	64.15	63.29	70.84	15.66
P2	17.72	45.19	53.57	46.16	67.58	46.43	70.20	56.87	24.44
P3	6.42	56.79	59.98	47.29	74.07	40.02	72.35	50.51	24.58
P4	2.81	57.88	62.79	47.77	76.84	37.21	73.44	47.68	24.52
P5	9.36	67.65	72.14	50.35	83.93	27.86	75.39	36.63	20.57
P6	5.87	75.25	78.02	52.22	87.34	21.98	75.42	28.93	16.27
P7	21.98	75.42	100.00	57.32	100.00	0.00			
Total (Calc)	100.00	57.32	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

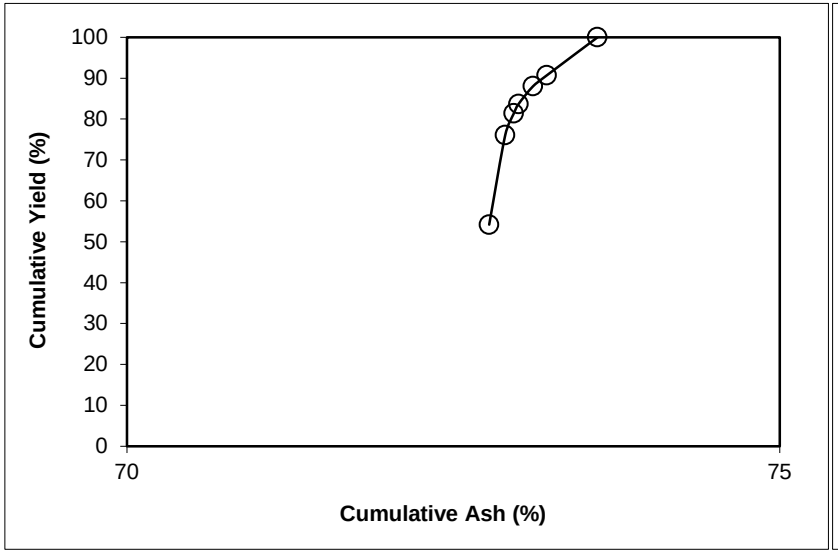
Description: Run 32 -Fine Spiral Test

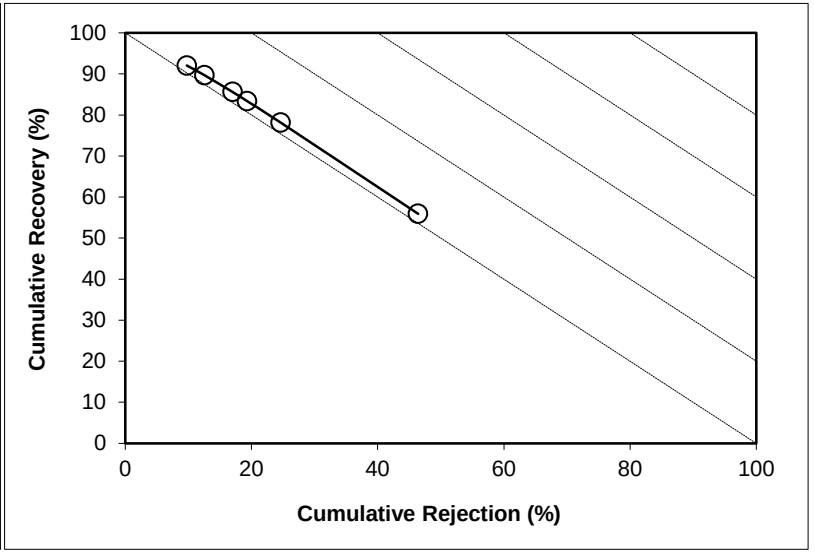
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 32.47

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	54.20	72.77	54.20	72.77	55.90	45.80	74.59	46.41	2.32
P2	21.91	73.20	76.10	72.90	78.14	23.90	75.86	24.63	2.77
P3	5.28	73.91	81.38	72.96	83.36	18.62	76.41	19.33	2.69
P4	2.29	74.28	83.67	73.00	85.59	16.33	76.71	17.02	2.61
P5	4.35	75.25	88.03	73.11	89.67	11.97	77.24	12.57	2.24
P6	2.69	76.69	90.71	73.22	92.05	9.29	77.39	9.76	1.81
P7	9.29	77.39	100.00	73.60	100.00	0.00			
Total (Calc)	100.00	73.60	--	--	--	--	--	--	--





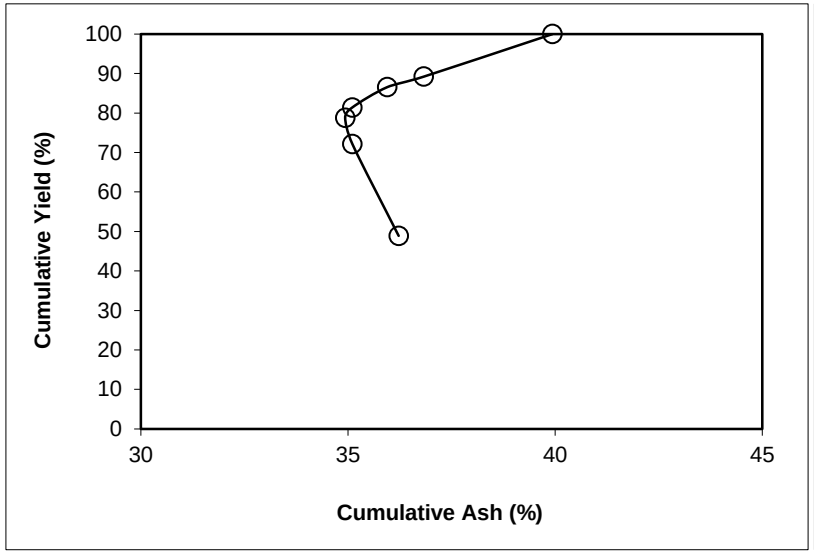
SPIRAL DATA ANALYSIS

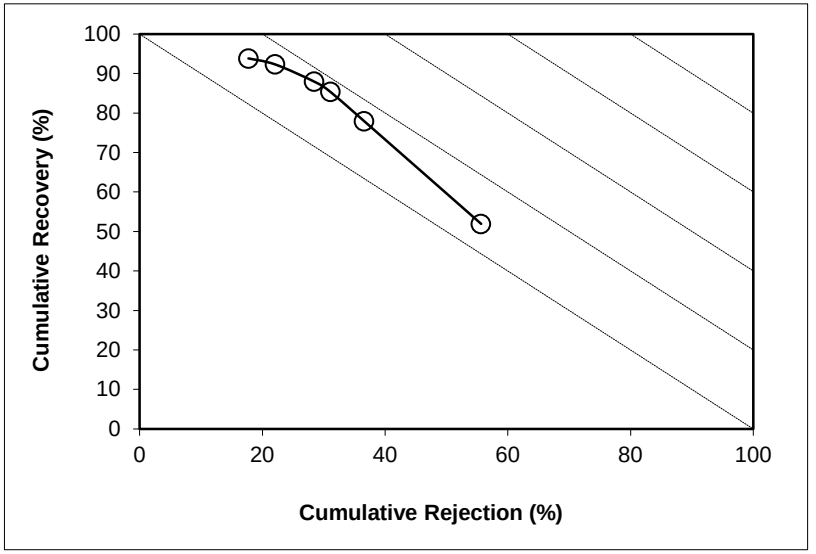
Description: Run 32 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	48.90	36.22	48.90	36.22	51.93	51.10	43.49	55.65	7.57
P2	23.24	32.76	72.14	35.11	77.94	27.86	52.44	36.59	14.52
P3	6.63	33.03	78.77	34.93	85.33	21.23	58.51	31.10	16.43
P4	2.63	40.23	81.40	35.10	87.95	18.60	61.09	28.45	16.40
P5	5.15	49.27	86.55	35.95	92.30	13.45	65.62	22.09	14.40
P6	2.66	65.50	89.22	36.83	93.83	10.78	65.65	17.73	11.56
P7	10.78	65.65	100.00	39.94	100.00	0.00			
Total (Calc)	100.00	39.94	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

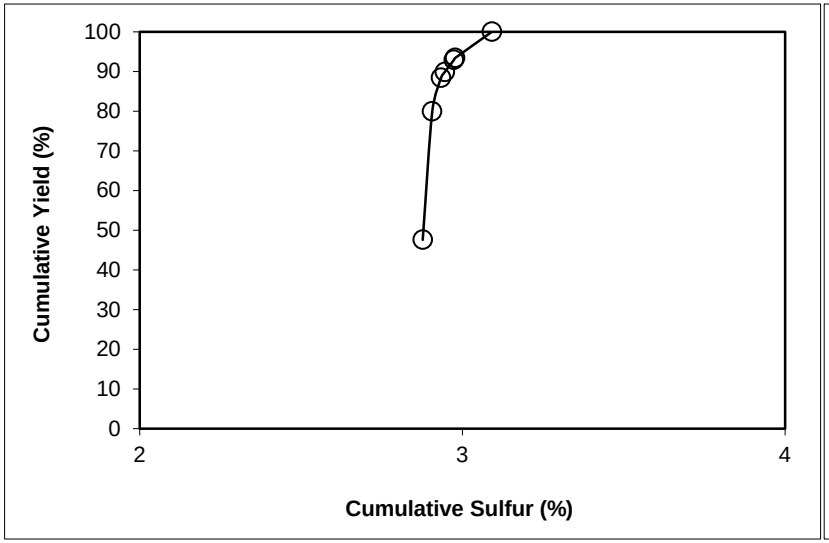
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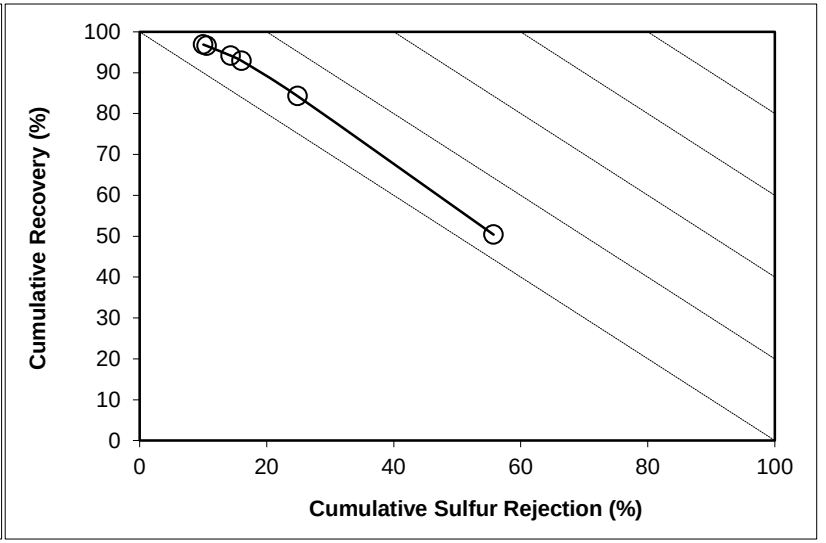
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: +60 Feed Weight (%): 5.12

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	47.58	2.88	47.58	2.88	50.39	52.42	3.29	55.72	6.10
P2	32.33	2.95	79.92	2.91	84.27	20.08	3.83	24.86	9.13
P3	8.51	3.19	88.43	2.93	92.87	11.57	4.29	16.08	8.95
P4	1.47	3.64	89.90	2.95	94.17	10.10	4.39	14.34	8.51
P5	3.07	3.81	92.97	2.97	96.56	7.03	4.64	10.56	7.12
P6	0.44	3.71	93.41	2.98	96.87	6.59	4.70	10.03	6.90
P7	6.59	4.70	100.00	3.09	100.00	0.00			
Total (Calc)	100.00	3.09	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

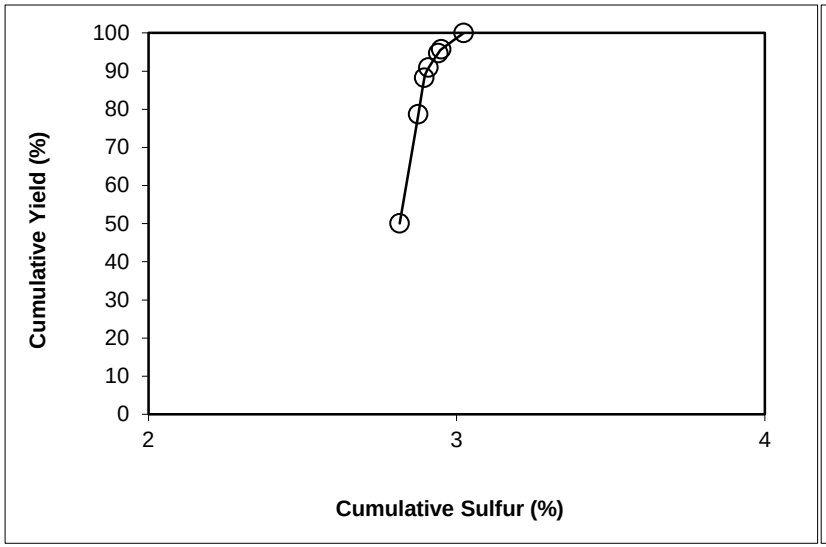
Description: Run 32 -Fine Spiral Test

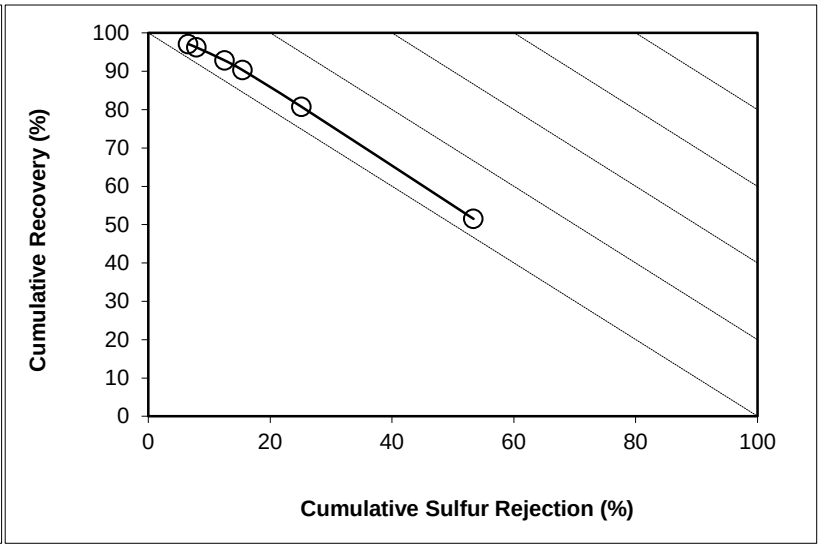
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 60x100 Feed Weight (%): 21.63

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	50.06	2.82	50.06	2.82	51.51	49.94	3.23	53.39	4.89
P2	28.62	2.98	78.68	2.88	80.74	21.32	3.57	25.15	5.90
P3	9.57	3.06	88.26	2.90	90.31	11.74	3.98	15.48	5.79
P4	2.64	3.37	90.90	2.91	92.84	9.10	4.16	12.53	5.37
P5	3.81	3.69	94.70	2.94	96.25	5.30	4.50	7.89	4.14
P6	1.04	3.88	95.75	2.95	97.10	4.25	4.66	6.55	3.65
P7	4.25	4.66	100.00	3.02	100.00	0.00			
Total (Calc)	100.00	3.02	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

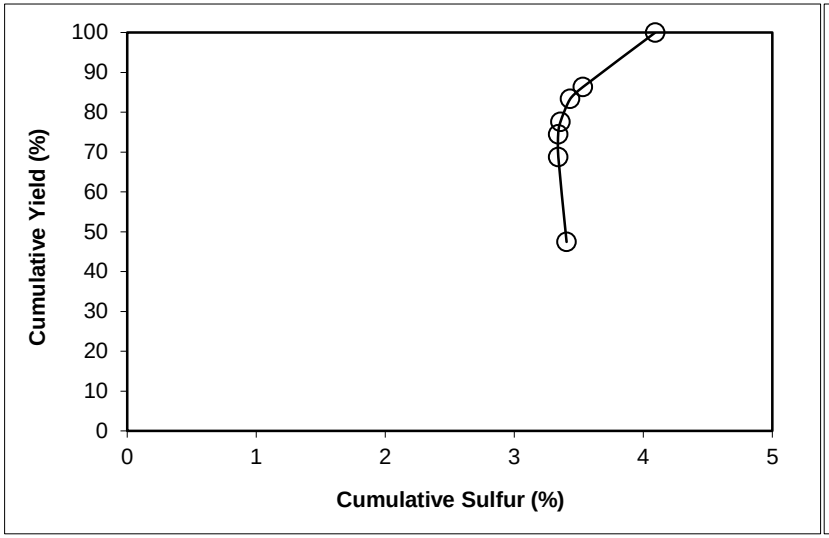
Description: Run 32 -Fine Spiral Test

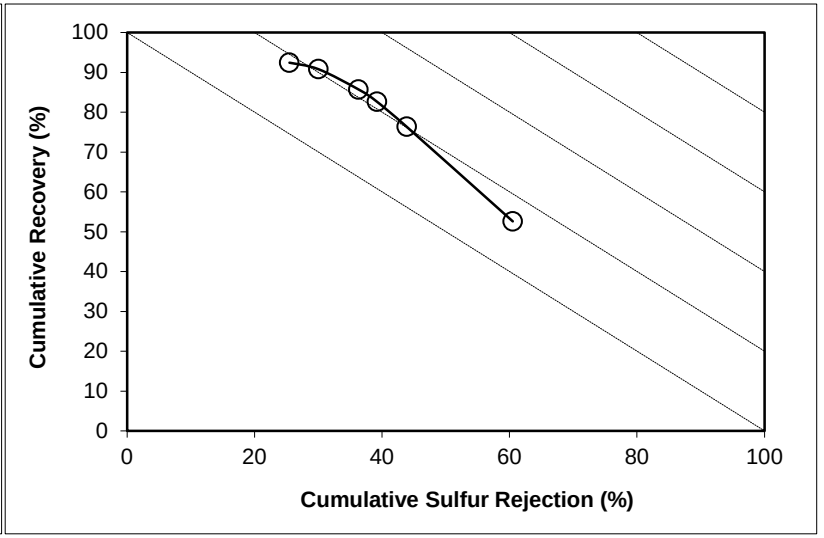
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 29.50

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	47.45	3.40	47.45	3.40	52.61	52.55	4.71	60.51	13.12
P2	21.28	3.20	68.73	3.34	76.35	31.27	5.74	43.88	20.23
P3	5.73	3.33	74.46	3.34	82.64	25.54	6.28	39.22	21.85
P4	3.13	3.77	77.59	3.36	85.71	22.41	6.63	36.33	22.05
P5	5.77	4.45	83.36	3.43	90.80	16.64	7.39	30.05	20.85
P6	2.98	6.27	86.33	3.53	92.44	13.67	7.63	25.48	17.93
P7	13.67	7.63	100.00	4.09	100.00	0.00			
Total (Calc)	100.00	4.09	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

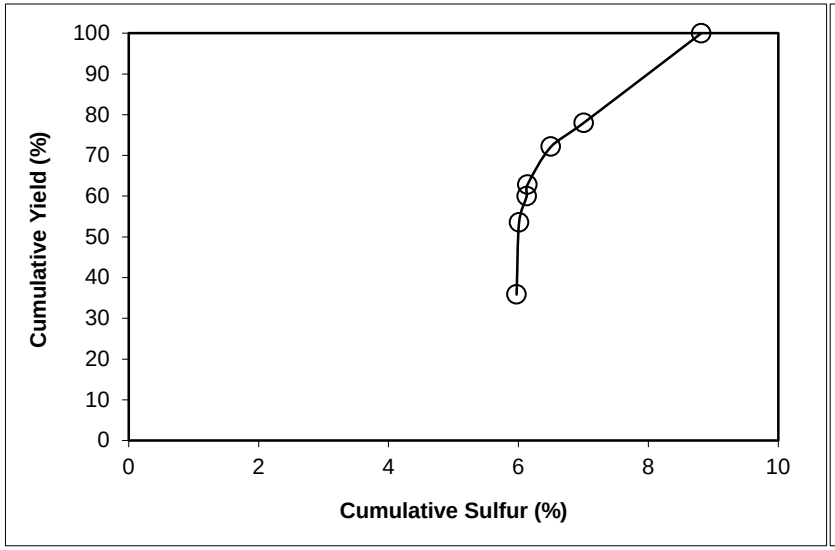
Description: Run 32 -Fine Spiral Test

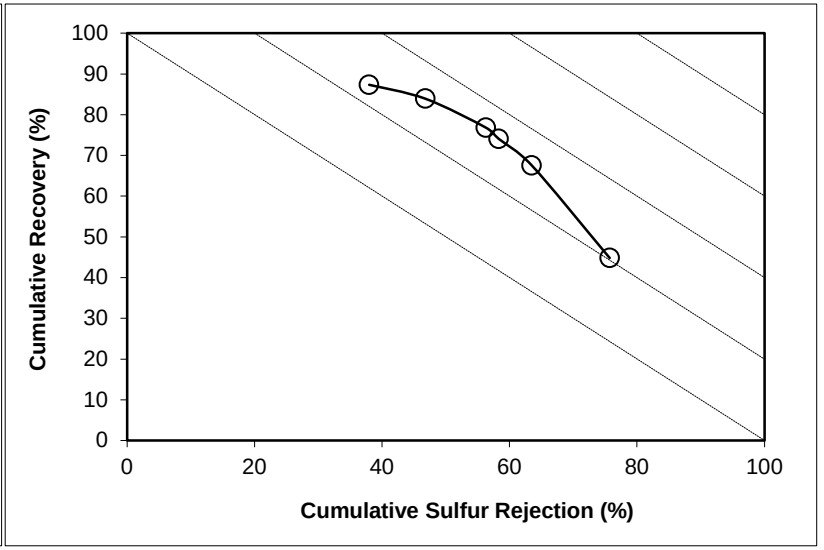
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 11.28

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	35.85	5.97	35.85	5.97	44.82	64.15	10.40	75.72	20.54
P2	17.72	6.09	53.57	6.01	67.58	46.43	12.05	63.48	31.06
P3	6.42	7.11	59.98	6.13	74.07	40.02	12.84	58.31	32.38
P4	2.81	6.39	62.79	6.14	76.84	37.21	13.33	56.27	33.12
P5	9.36	8.94	72.14	6.50	83.93	27.86	14.81	46.79	30.72
P6	5.87	13.22	78.02	7.01	87.34	21.98	15.23	37.99	25.33
P7	21.98	15.23	100.00	8.82	100.00	0.00			
Total (Calc)	100.00	8.82	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

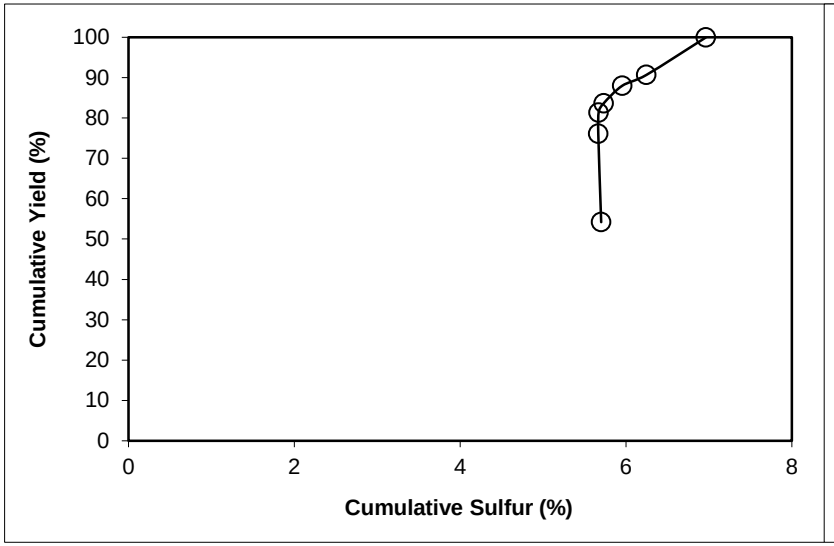
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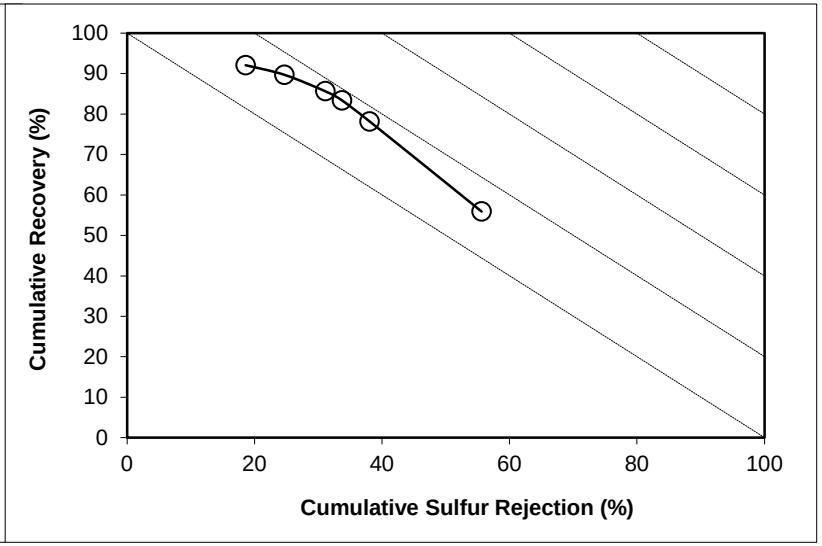
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 32.47

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	54.20	5.70	54.20	5.70	55.90	45.80	8.46	55.63	11.53
P2	21.91	5.58	76.10	5.67	78.14	23.90	11.09	38.07	16.22
P3	5.28	5.73	81.38	5.67	83.36	18.62	12.61	33.73	17.09
P4	2.29	7.91	83.67	5.73	85.59	16.33	13.27	31.12	16.71
P5	4.35	10.26	88.03	5.95	89.67	11.97	14.37	24.71	14.38
P6	2.69	15.80	90.71	6.25	92.05	9.29	13.95	18.61	10.66
P7	9.29	13.95	100.00	6.96	100.00	0.00			
Total (Calc)	100.00	6.96	--	--	--	--	--	--	--





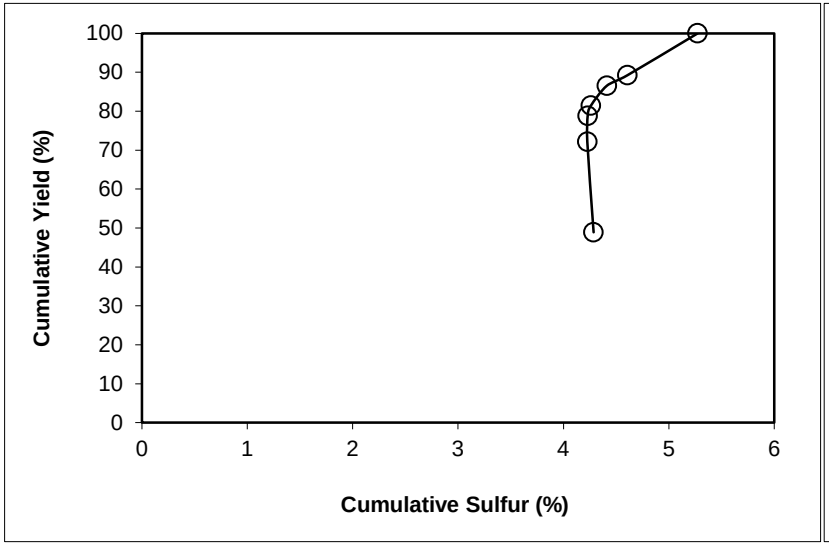
SPIRAL DATA ANALYSIS

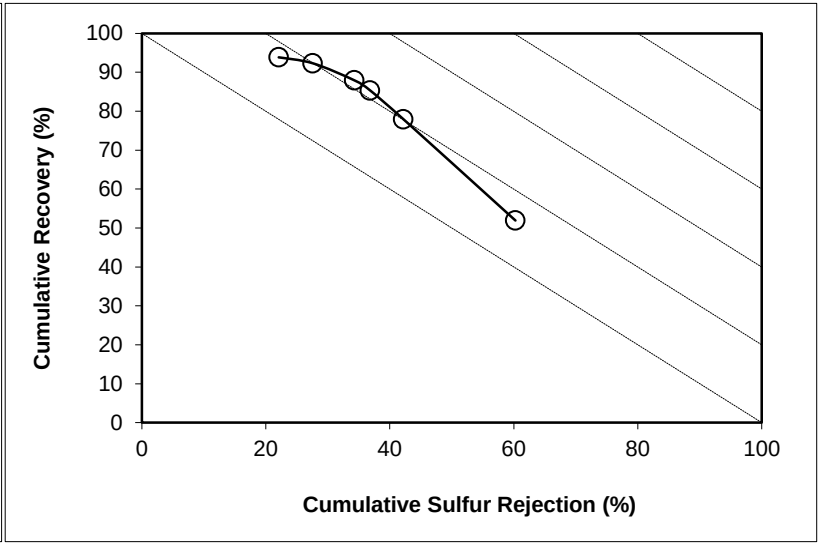
Description: Run 32 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	48.90	4.29	48.90	4.29	51.93	51.10	6.22	60.26	12.18
P2	23.24	4.10	72.14	4.23	77.94	27.86	7.99	42.19	20.13
P3	6.63	4.27	78.77	4.23	85.33	21.23	9.15	36.83	22.16
P4	2.63	5.17	81.40	4.26	87.95	18.60	9.71	34.25	22.20
P5	5.15	6.82	86.55	4.41	92.30	13.45	10.82	27.59	19.89
P6	2.66	10.90	89.22	4.61	93.83	10.78	10.80	22.08	15.92
P7	10.78	10.80	100.00	5.27	100.00	0.00			
Total (Calc)	100.00	5.27	--	--	--	--	--	--	--

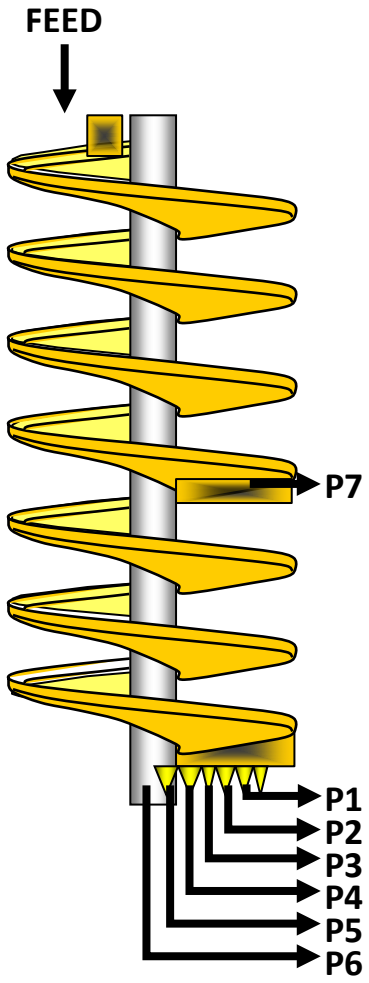




SPIRAL DATA ANALYSIS

Description: Run 33 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	0.916	17.6	17.21	19.50
P2	0.243	20.4	3.79	4.42
P3	0.073	23.3	0.95	1.14
P4	0.029	26.5	0.32	0.39
P5	0.059	30.4	0.54	0.67
P6	0.030	35.5	0.22	0.28
P7	0.112	37.7	0.74	0.97
Total	1.461	19.7	23.77	27.35

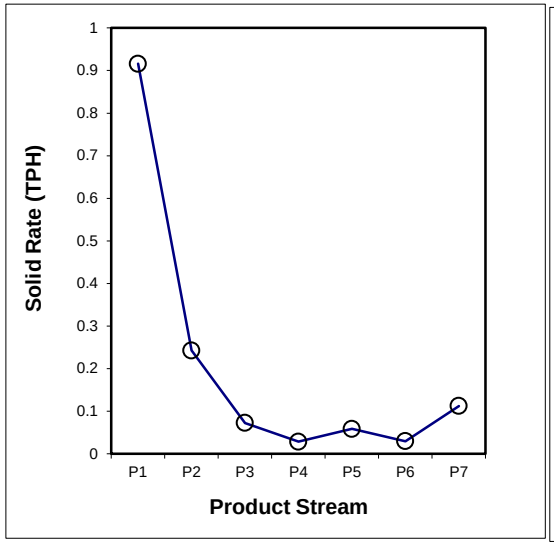
SPIRAL DATA ANALYSIS

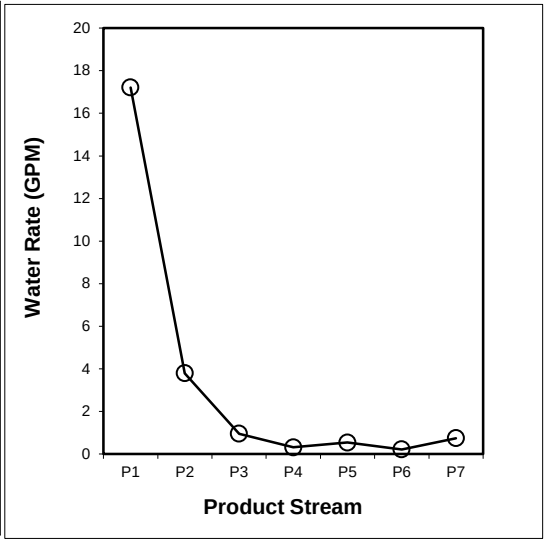
Description: Run 33 -Fine Spiral Test

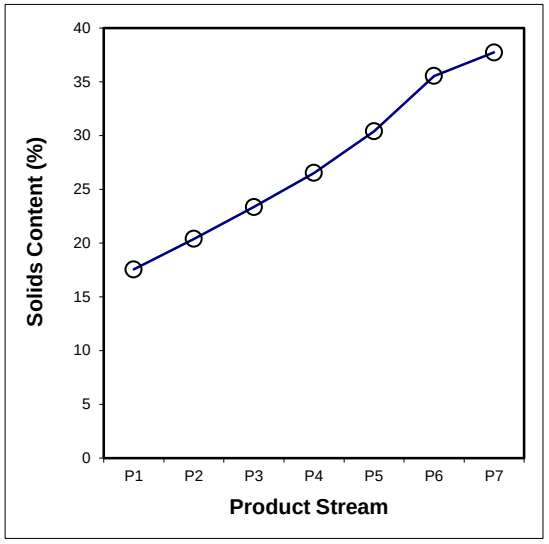
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	5	7814.00	1134.00	5.219	2067.9	912.8	0.916	62.70	17.55
P2	5	1618.93	96.86	1.191	1113.4	807.1	0.243	16.63	20.39
P3	15	1284.29	91.87	0.311	985.3	710.8	0.073	4.97	23.35
P4	30	921.69	94.50	0.108	949.2	732.8	0.029	1.96	26.53
P5	15	833.44	93.50	0.193	1004.6	782.8	0.059	4.01	30.39
P6	30	738.56	93.80	0.084	1040.0	814.1	0.030	2.04	35.55
P7	15	1240.04	94.99	0.298	1106.7	681.5	0.112	7.69	37.74
Total (Calc)	--	--	--	7.403	--	--	1.461	100.00	19.73
Total (Head)	0.52	1069.94	93.99	7.403	977.5	784.9	1.461	--	19.73







SPIRAL DATA ANALYSIS

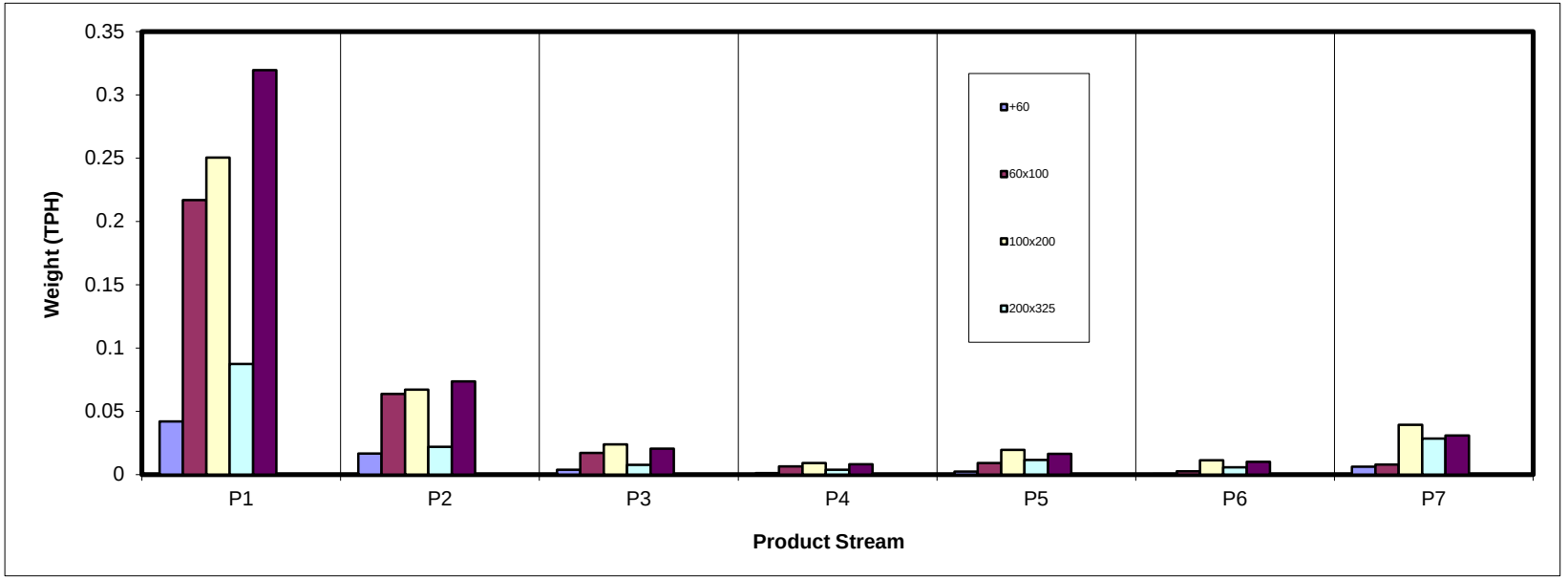
Description: Run 33 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	0.042	0.017	0.004	0.001	0.002	0.000	0.006		0.072
60x100	0.217	0.064	0.017	0.007	0.009	0.003	0.008		0.324
100x200	0.250	0.067	0.024	0.009	0.019	0.011	0.039		0.420
200x325	0.087	0.022	0.008	0.004	0.012	0.006	0.028		0.166
-325	0.319	0.074	0.021	0.008	0.016	0.010	0.031		0.479
Total (Calc)	0.916	0.243	0.073	0.029	0.059	0.030	0.112		1.461



SPIRAL DATA ANALYSIS

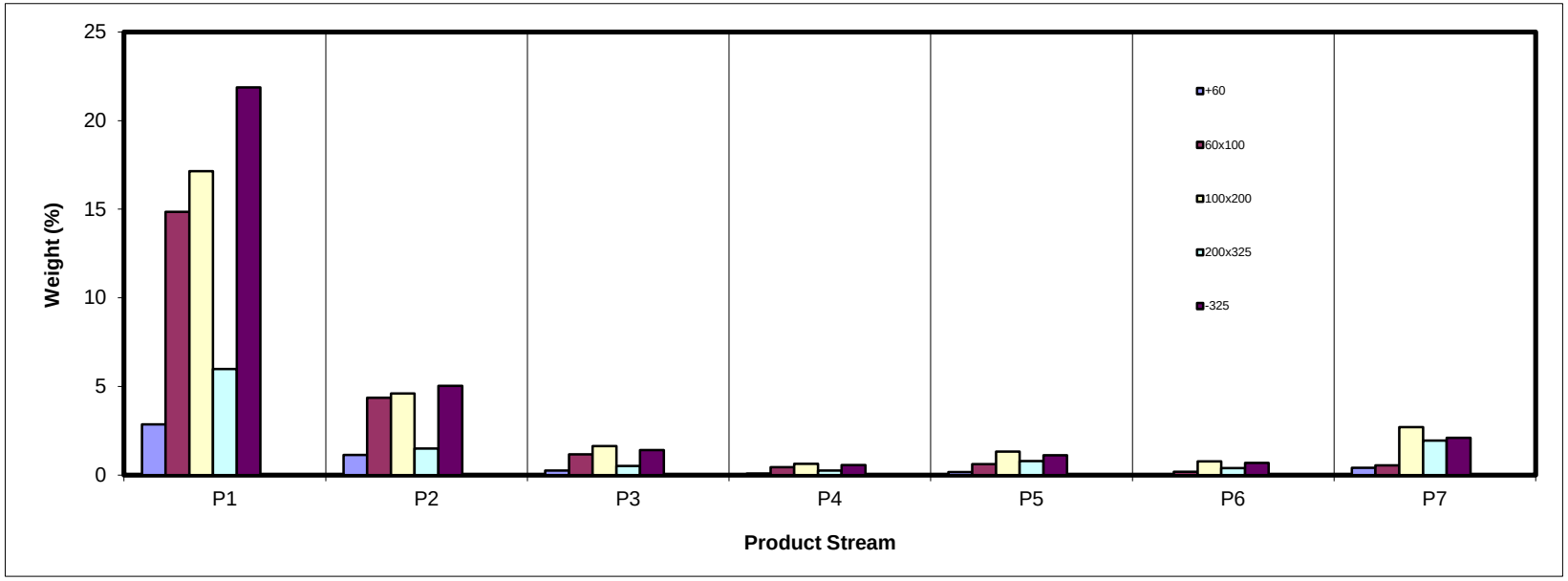
Description: Run 33 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	2.86	1.14	0.26	0.07	0.16	0.02	0.42		4.92
60x100	14.85	4.36	1.17	0.45	0.62	0.18	0.54		22.15
100x200	17.14	4.60	1.63	0.63	1.33	0.77	2.70		28.78
200x325	5.98	1.50	0.52	0.26	0.79	0.39	1.94		11.38
-325	21.87	5.03	1.40	0.55	1.12	0.68	2.10		32.77
Total (Calc)	62.70	16.63	4.97	1.96	4.01	2.04	7.69		100.00



SPIRAL DATA ANALYSIS

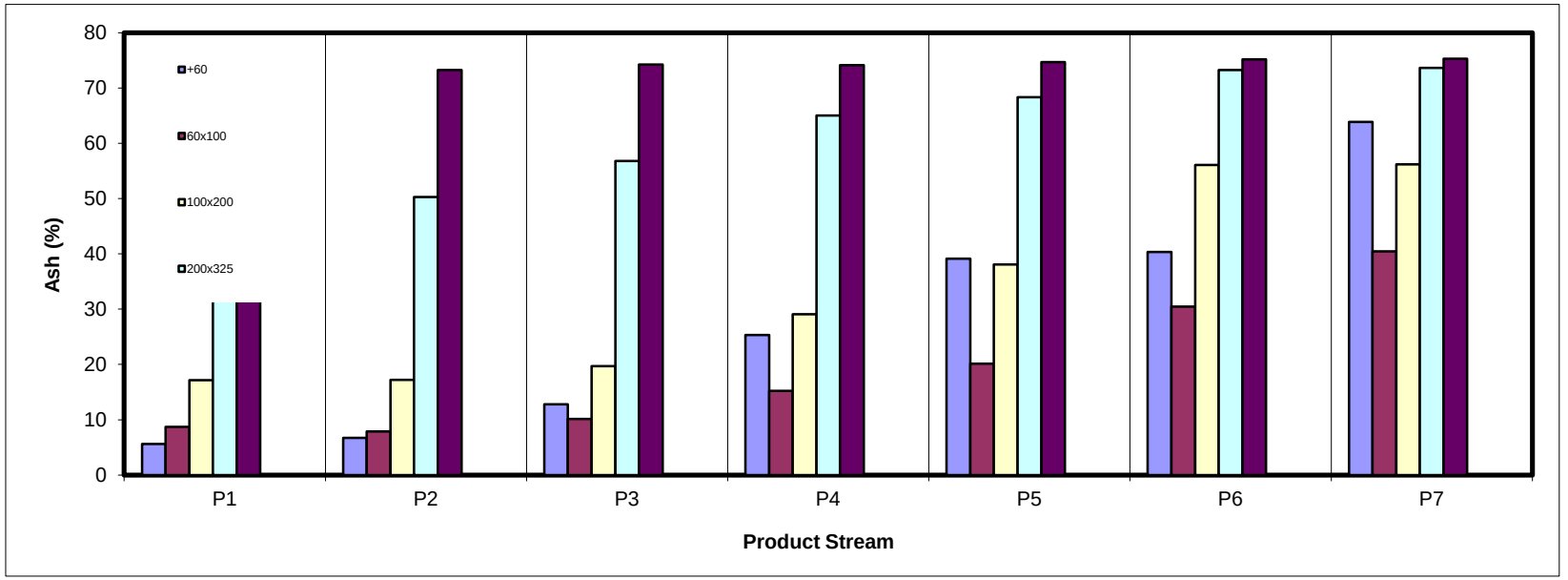
Description: Run 33 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	5.62	6.70	12.77	25.32	39.11	40.33	63.86		12.67
60x100	8.72	7.87	10.12	15.21	20.15	30.45	40.45		10.02
100x200	17.17	17.22	19.67	29.08	38.10	56.05	56.18		23.24
200x325	51.86	50.27	56.79	65.04	68.30	73.23	73.60		57.76
-325	74.11	73.21	74.25	74.13	74.65	75.20	75.28		74.09
Total (Calc)	37.81	33.99	36.35	43.29	51.57	63.33	65.11		40.38



SPIRAL DATA ANALYSIS

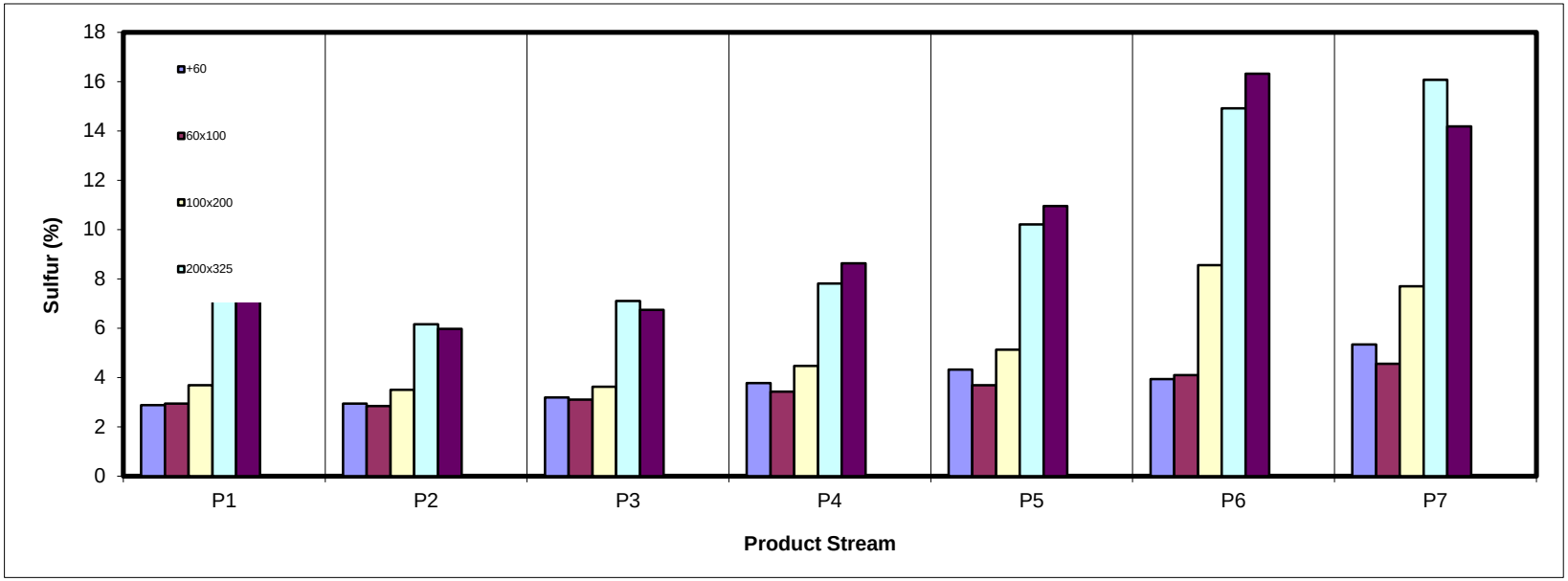
Description: Run 33 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Sulfur Content (%)

Sample ID	Dry Sulfur Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	2.88	2.94	3.19	3.77	4.32	3.93	5.34		3.18
60x100	2.94	2.84	3.10	3.43	3.69	4.09	4.56		3.01
100x200	3.68	3.50	3.62	4.47	5.13	8.55	7.70		4.24
200x325	8.07	6.16	7.10	7.81	10.21	14.92	16.07		9.52
-325	11.78	5.98	6.74	8.63	10.96	16.32	14.18		10.84
Total (Calc)	6.71	4.28	4.72	5.82	7.51	11.92	11.24		6.68



SPIRAL DATA ANALYSIS

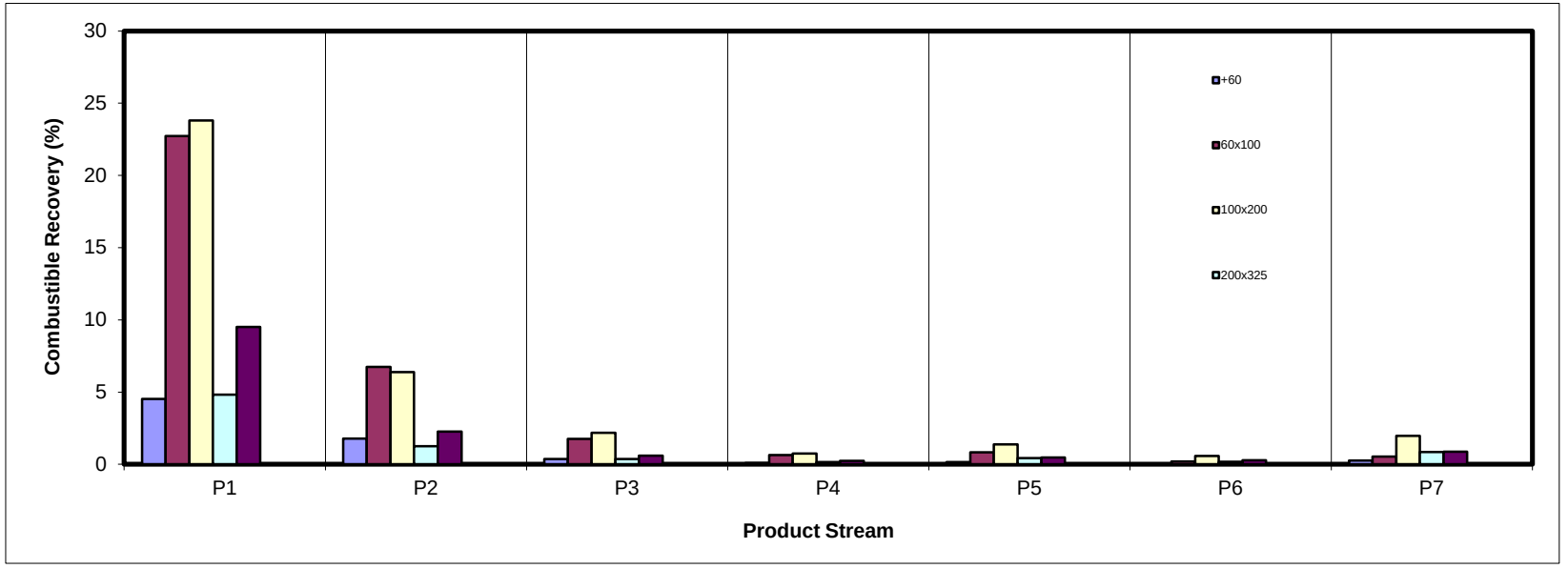
Description: Run 33 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	4.53	1.78	0.38	0.09	0.16	0.02	0.25		7.21
60x100	22.73	6.74	1.76	0.63	0.82	0.21	0.54		33.43
100x200	23.81	6.38	2.19	0.75	1.38	0.57	1.98		37.06
200x325	4.83	1.25	0.37	0.15	0.42	0.17	0.86		8.06
-325	9.50	2.26	0.61	0.24	0.48	0.28	0.87		14.24
Total (Calc)	65.40	18.41	5.30	1.86	3.26	1.26	4.50		100.00



SPIRAL DATA ANALYSIS

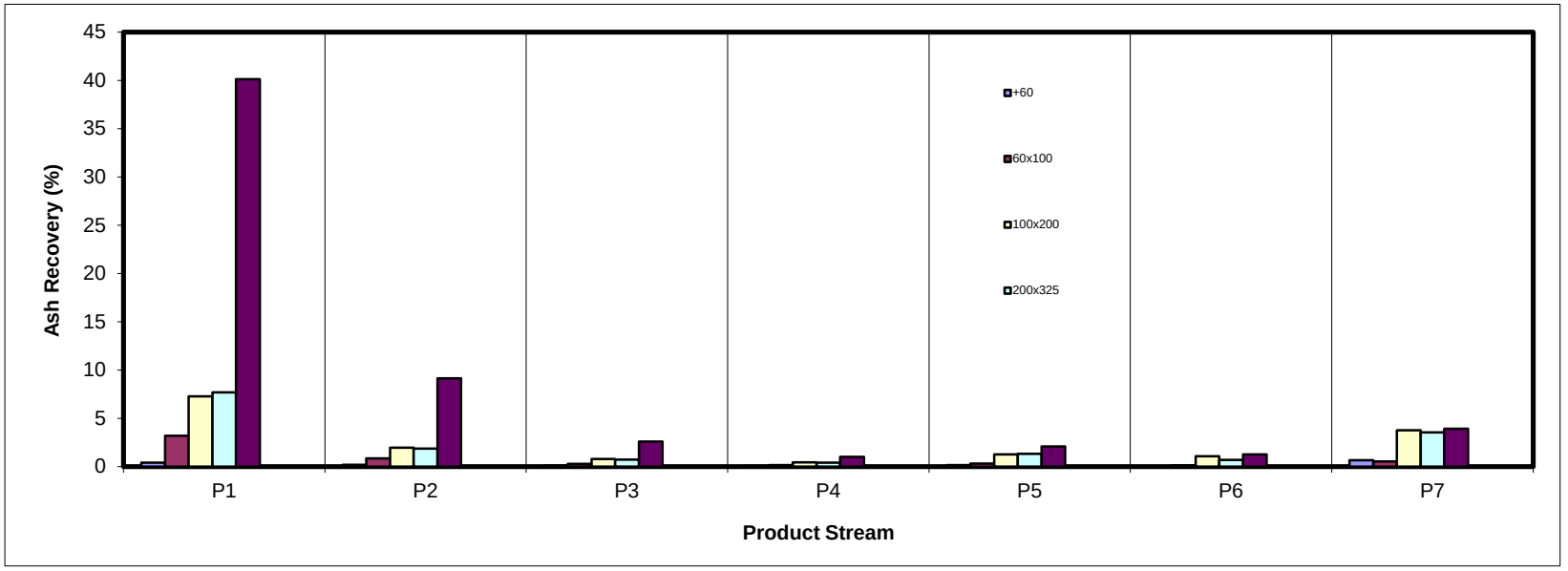
Description: Run 33 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	0.40	0.19	0.08	0.04	0.15	0.02	0.66		1.55
60x100	3.21	0.85	0.29	0.17	0.31	0.13	0.54		5.50
100x200	7.29	1.96	0.79	0.45	1.25	1.07	3.75		16.56
200x325	7.68	1.87	0.73	0.42	1.34	0.71	3.54		16.27
-325	40.13	9.13	2.58	1.02	2.07	1.27	3.92		60.13
Total (Calc)	58.70	13.99	4.47	2.10	5.12	3.21	12.41		100.00



SPIRAL DATA ANALYSIS

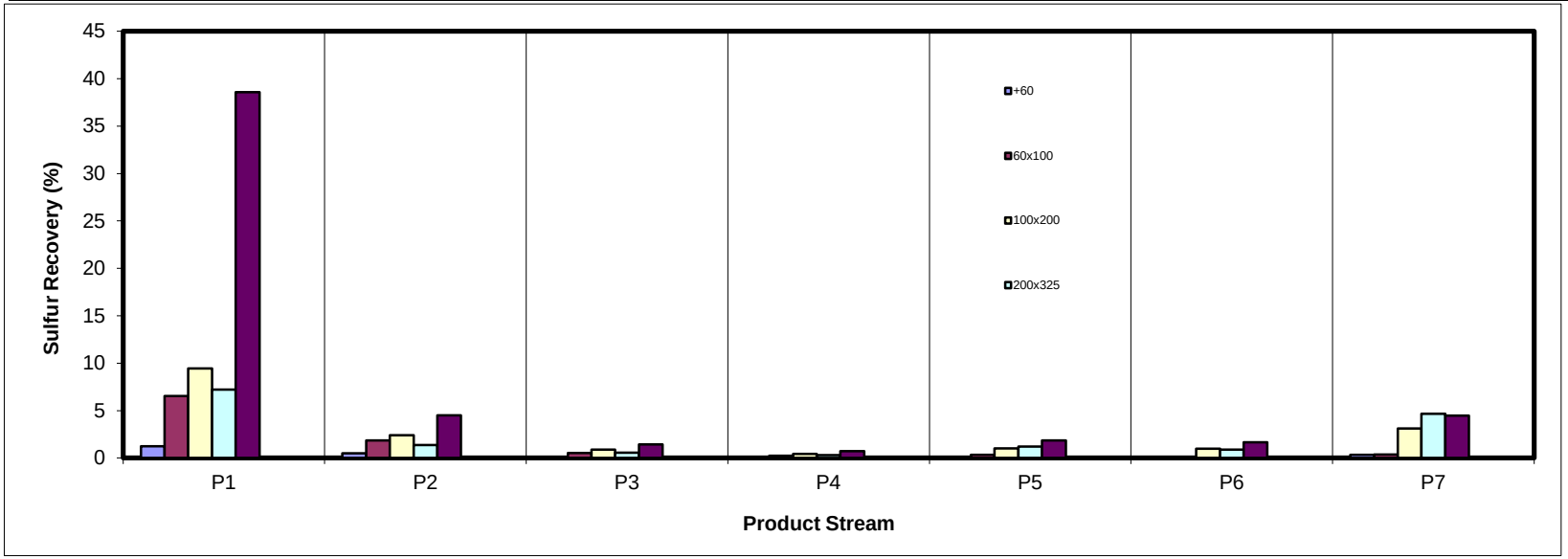
Description: Run 33 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Sulfur Recovery (%)

Sample ID	Sulfur Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	1.24	0.50	0.12	0.04	0.10	0.01	0.33		2.34
60x100	6.54	1.85	0.54	0.23	0.34	0.11	0.37		9.98
100x200	9.45	2.41	0.88	0.42	1.02	0.98	3.11		18.27
200x325	7.23	1.38	0.55	0.30	1.21	0.87	4.67		16.21
-325	38.57	4.51	1.42	0.72	1.84	1.67	4.47		53.19
Total (Calc)	63.03	10.65	3.51	1.71	4.51	3.65	12.94		100.00



SPIRAL DATA ANALYSIS

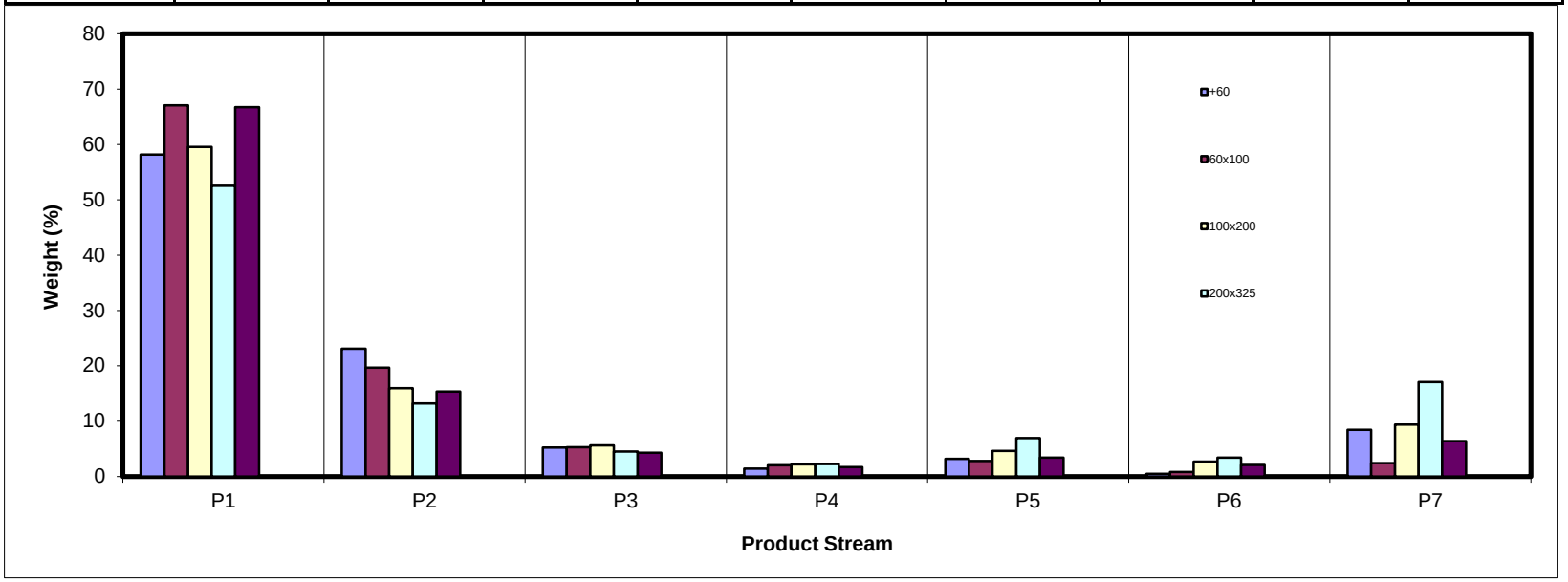
Description: Run 33 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	58.15	23.09	5.21	1.44	3.19	0.48	8.43		100.00
60x100	67.04	19.68	5.26	2.01	2.78	0.80	2.43		100.00
100x200	59.55	15.97	5.65	2.18	4.61	2.67	9.37		100.00
200x325	52.56	13.18	4.53	2.28	6.96	3.42	17.07		100.00
-325	66.73	15.36	4.28	1.69	3.42	2.09	6.42		100.00
Total (Calc)	62.70	16.63	4.97	1.96	4.01	2.04	7.69		100.00



SPIRAL DATA ANALYSIS

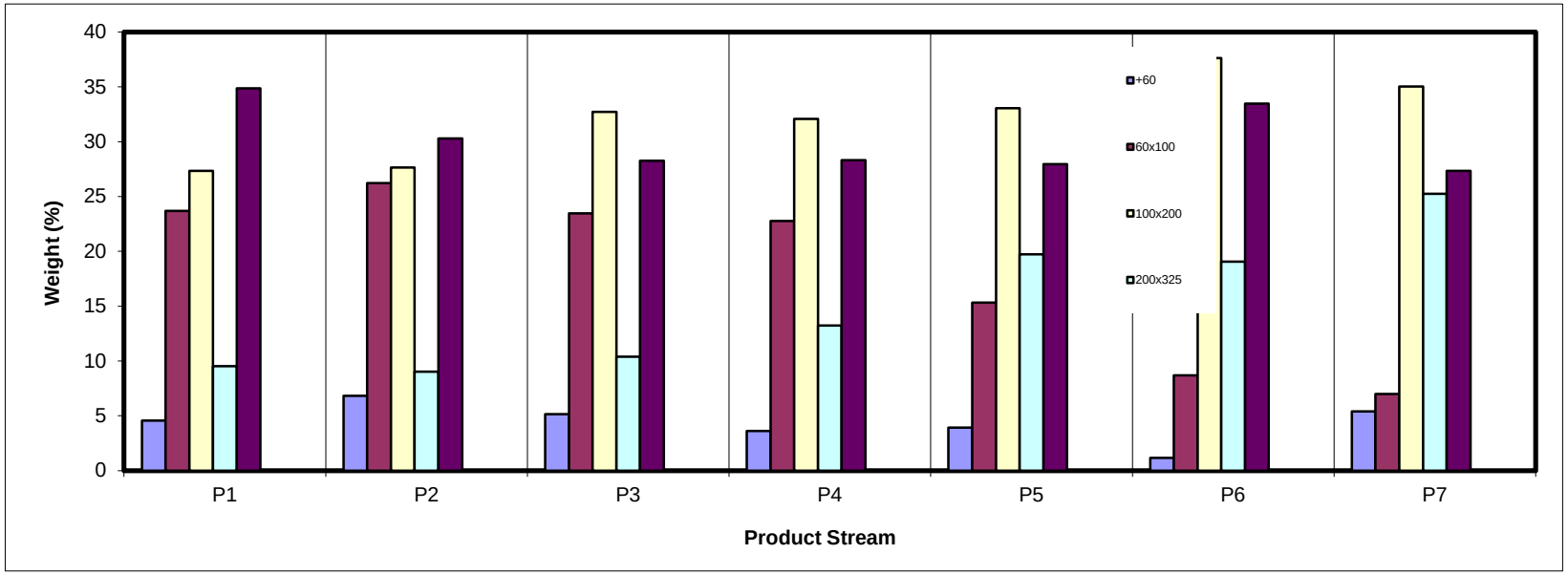
Description: Run 33 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	4.57	6.84	5.17	3.62	3.92	1.15	5.40		4.92
60x100	23.68	26.21	23.47	22.77	15.33	8.68	6.99		22.15
100x200	27.34	27.64	32.72	32.08	33.04	37.63	35.03		28.78
200x325	9.54	9.02	10.38	13.23	19.74	19.05	25.24		11.38
-325	34.88	30.28	28.26	28.31	27.97	33.49	27.34		32.77
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

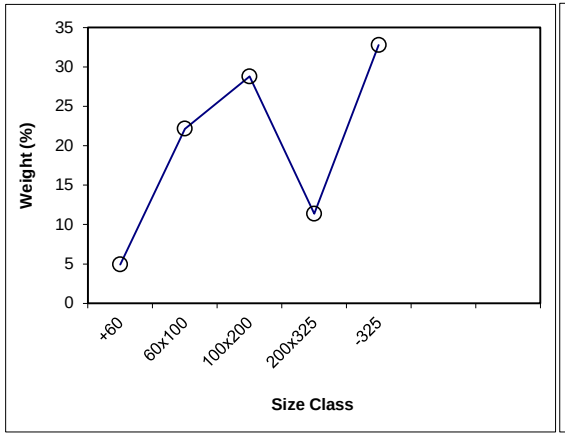
Description: Run 33 -Fine Spiral Test

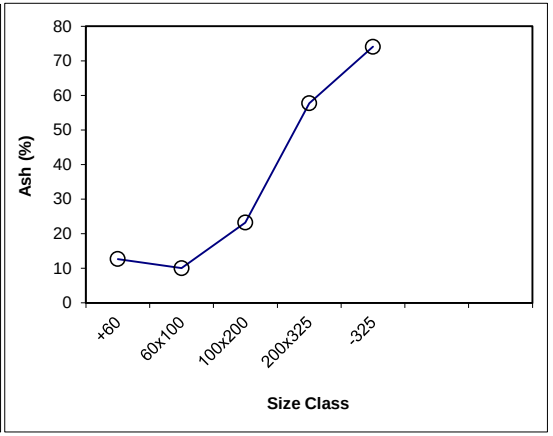
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

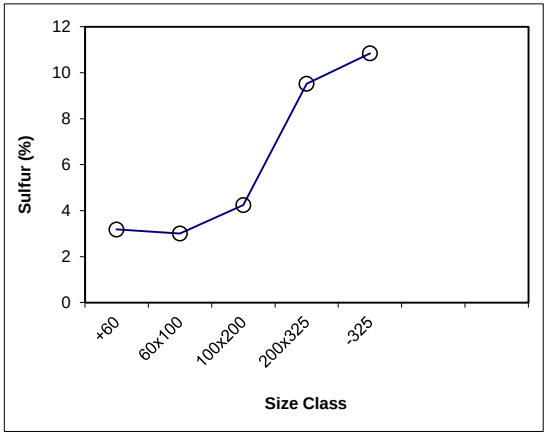
FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	15.6	6.1	9.48	4.92	12.67	3.18	4.92	12.67	3.18	100.00	40.38	6.68
60x100	459.5	416.8	42.65	22.15	10.02	3.01	27.07	10.50	3.04	95.08	41.82	6.86
100x200	405.1	349.6	55.42	28.78	23.24	4.24	55.85	17.07	3.66	72.93	51.48	8.03
200x325	28.1	6.2	21.91	11.38	57.76	9.52	67.23	23.95	4.65	44.15	69.88	10.50
-325	69.3	6.2	63.12	32.77	74.09	10.84	100.00	40.38	6.68	32.77	74.09	10.84
Total (Calc)	--	--	192.58	100.00	40.38	6.68	--	--		--		--







SPIRAL DATA ANALYSIS

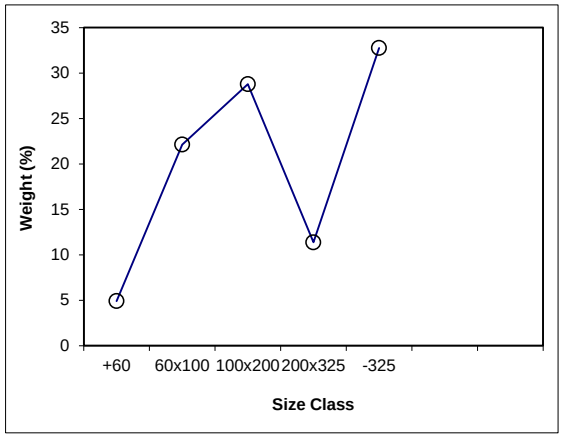
Description: Run 33 -Fine Spiral Test

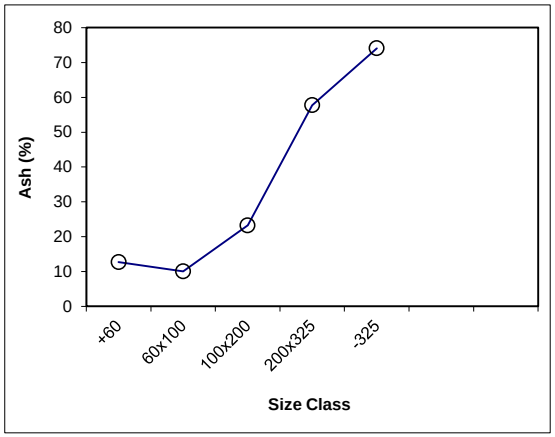
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

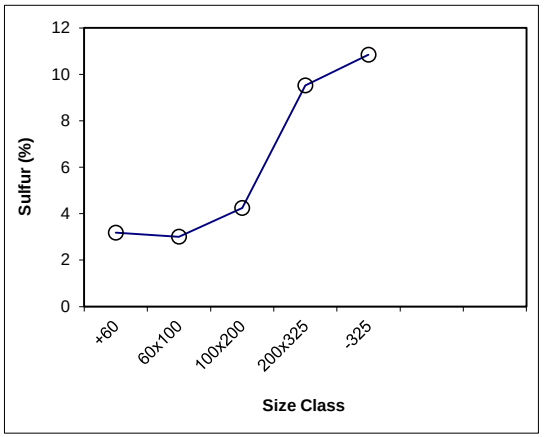
FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed			Select Size Class	Dry Weight (%)	Dry Ash (%)
				Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)			
+60	4.92	12.67	3.18	4.92	12.67	3.18	100.00	40.38	6.68	x	4.92	12.67
60x100	22.15	10.02	3.01	27.07	10.50	3.04	95.08	41.82	6.86	x	22.15	10.02
100x200	28.78	23.24	4.24	55.85	17.07	3.66	72.93	51.48	8.03	x	28.78	23.24
200x325	11.38	57.76	9.52	67.23	23.95	4.65	44.15	69.88	10.50	x	11.38	57.76
-325	32.77	74.09	10.84	100.00	40.38	6.68	32.77	74.09	10.84		32.77	74.09
Total (Calc)	100.00	40.38	6.68	--	--		--	--			100.00	40.38







SPIRAL DATA ANALYSIS

Description: Run 33 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 62.70

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	58.8	6.0	52.75	4.57	5.62	2.88	4.57	5.62	2.88	100.00	37.81	6.71
60x100	581.6	308.1	273.50	23.68	8.72	2.94	28.25	8.22	2.93	95.43	39.35	6.90
100x200	610.2	294.5	315.75	27.34	17.17	3.68	55.58	12.62	3.30	71.75	49.46	8.20
200x325	408.1	298.0	110.15	9.54	51.86	8.07	65.12	18.37	4.00	44.42	69.33	10.98
-325	409.1	6.1	402.92	34.88	74.11	11.78	100.00	37.81	6.71	34.88	74.11	11.78
Total (Calc)	--	--	1155.06	100.00	37.81	6.71	--	--		--		--

Product P2 Feed Weight (%): 16.63

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	27.1	6.1	20.94	6.84	6.70	2.94	6.84	6.70	2.94	100.00	33.99	4.28
60x100	477.5	397.2	80.29	26.21	7.87	2.84	33.05	7.63	2.86	93.16	35.99	4.38
100x200	476.0	391.3	84.67	27.64	17.22	3.50	60.69	11.99	3.15	66.95	47.00	4.98
200x325	33.8	6.2	27.63	9.02	50.27	6.16	69.72	16.95	3.54	39.31	67.95	6.02
-325	99.0	6.2	92.76	30.28	73.21	5.98	100.00	33.99	4.28	30.28	73.21	5.98
Total (Calc)	--	--	306.28	100.00	33.99	4.28	--	--		--		--

SPIRAL DATA ANALYSIS

Description: Run 33 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 4.97

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	20.3	6.1	14.18	5.17	12.77	3.19	5.17	12.77	3.19	100.00	36.35	4.72
60x100	442.0	377.5	64.44	23.47	10.12	3.10	28.64	10.60	3.12	94.83	37.64	4.80
100x200	404.7	314.9	89.85	32.72	19.67	3.62	61.36	15.44	3.38	71.36	46.68	5.36
200x325	34.7	6.2	28.50	10.38	56.79	7.10	71.74	21.42	3.92	38.64	69.56	6.84
-325	83.7	6.2	77.59	28.26	74.25	6.74	100.00	36.35	4.72	28.26	74.25	6.74
Total (Calc)	--	--	274.56	100.00	36.35	4.72	--	--		--		--

Product P4 Feed Weight (%): 1.96

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	14.0	6.2	7.83	3.62	25.32	3.77	3.62	25.32	3.77	100.00	43.29	5.82
60x100	416.2	367.0	49.26	22.77	15.21	3.43	26.39	16.60	3.47	96.38	43.97	5.90
100x200	416.9	347.4	69.41	32.08	29.08	4.47	58.47	23.44	4.02	73.61	52.86	6.67
200x325	34.7	6.1	28.62	13.23	65.04	7.81	71.69	31.12	4.72	41.53	71.23	8.36
-325	67.4	6.1	61.25	28.31	74.13	8.63	100.00	43.29	5.82	28.31	74.13	8.63
Total (Calc)	--	--	216.38	100.00	43.29	5.82	--	--		--		--

SPIRAL DATA ANALYSIS

Description: Run 33 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 4.01

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	14.8	6.1	8.68	3.92	39.11	4.32	3.92	39.11	4.32	100.00	51.57	7.51
60x100	421.7	387.7	34.00	15.33	20.15	3.69	19.25	24.01	3.82	96.08	52.08	7.64
100x200	450.1	376.8	73.27	33.04	38.10	5.13	52.29	32.91	4.65	80.75	58.14	8.39
200x325	49.9	6.1	43.77	19.74	68.30	10.21	72.03	42.61	6.17	47.71	72.02	10.65
-325	68.1	6.1	62.02	27.97	74.65	10.96	100.00	51.57	7.51	27.97	74.65	10.96
Total (Calc)	--	--	221.75	100.00	51.57	7.51	--	--		--		--

Product P6 Feed Weight (%): 2.04

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	8.8	6.2	2.61	1.15	40.33	3.93	1.15	40.33	3.93	100.00	63.33	11.92
60x100	412.6	393.0	19.61	8.68	30.45	4.09	9.83	31.61	4.07	98.85	63.60	12.02
100x200	487.6	402.6	85.02	37.63	56.05	8.55	47.46	50.98	7.62	90.17	66.79	12.78
200x325	49.2	6.1	43.04	19.05	73.23	14.92	66.51	57.36	9.71	52.54	74.48	15.81
-325	81.8	6.2	75.65	33.49	75.20	16.32	100.00	63.33	11.92	33.49	75.20	16.32
Total (Calc)	--	--	225.93	100.00	63.33	11.92	--	--		--		--

SPIRAL DATA ANALYSIS

Description: Run 33 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P7 Feed Weight (%): 7.69

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	29.0	6.1	22.95	5.40	63.86	5.34	5.40	63.86	5.34	100.00	65.11	11.24
60x100	364.8	335.1	29.72	6.99	40.45	4.56	12.39	50.65	4.90	94.60	65.19	11.57
100x200	477.2	328.2	148.97	35.03	56.18	7.70	47.42	54.74	6.97	87.61	67.16	12.13
200x325	113.4	6.0	107.32	25.24	73.60	16.07	72.66	61.29	10.13	52.58	74.48	15.09
-325	122.4	6.1	116.26	27.34	75.28	14.18	100.00	65.11	11.24	27.34	75.28	14.18
Total (Calc)	--	--	425.22	100.00	65.11	11.24	--	--		--		--

SPIRAL DATA ANALYSIS

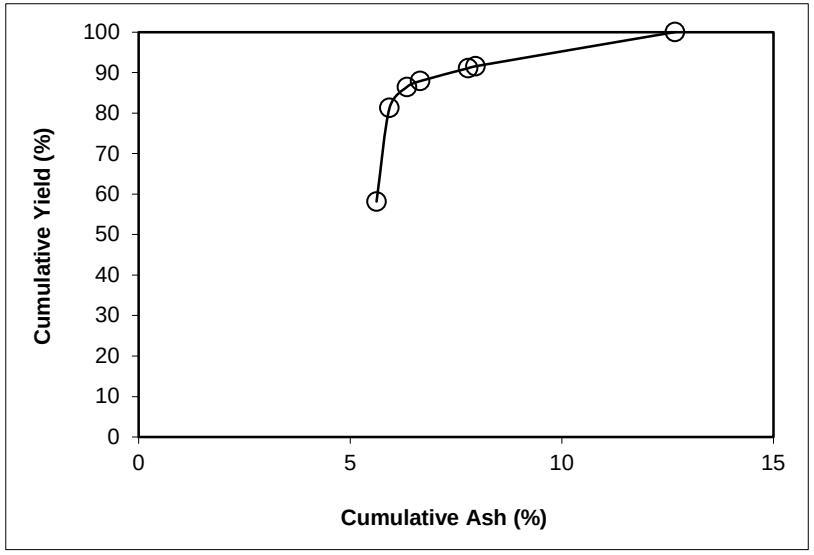
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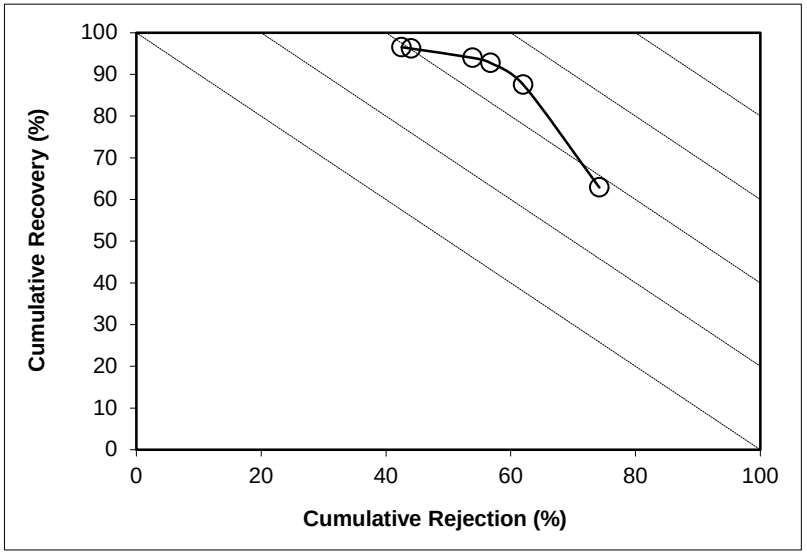
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: +60 Feed Weight (%): 4.92

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	58.15	5.62	58.15	5.62	62.85	41.85	22.48	74.21	37.06
P2	23.09	6.70	81.24	5.93	87.52	18.76	41.90	62.00	49.52
P3	5.21	12.77	86.45	6.34	92.73	13.55	53.10	56.75	49.48
P4	1.44	25.32	87.89	6.65	93.96	12.11	56.41	53.87	47.83
P5	3.19	39.11	91.09	7.79	96.18	8.91	62.60	44.02	40.21
P6	0.48	40.33	91.57	7.96	96.51	8.43	63.86	42.50	39.01
P7	8.43	63.86	100.00	12.67	100.00	0.00			
Total (Calc)	100.00	12.67	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

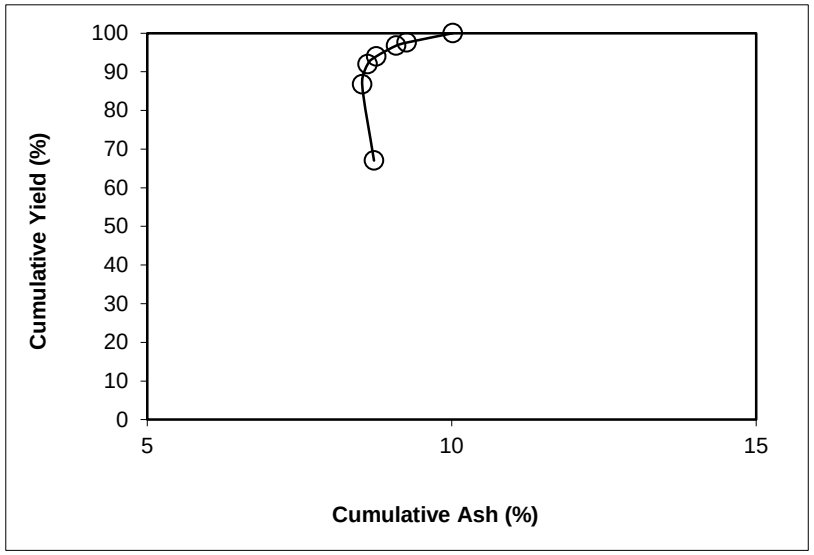
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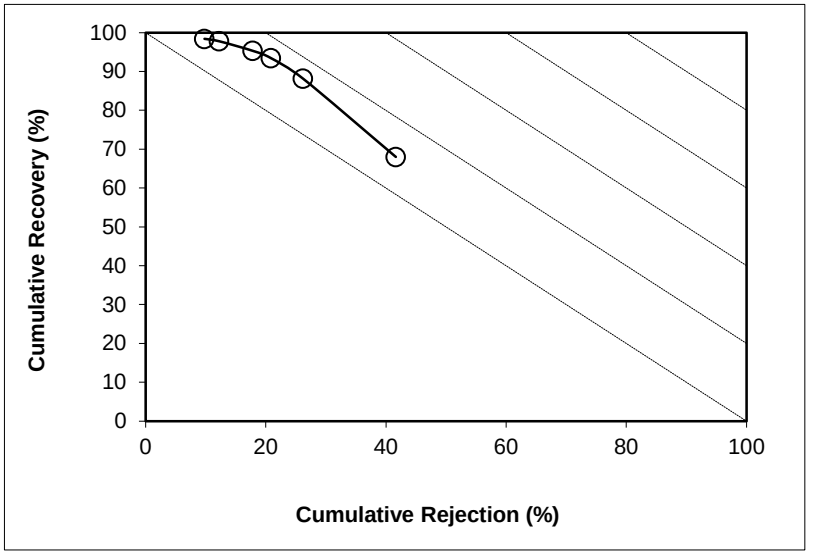
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 60x100 Feed Weight (%): 22.15

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	67.04	8.72	67.04	8.72	68.00	32.96	12.66	41.64	9.65
P2	19.68	7.87	86.72	8.53	88.15	13.28	19.76	26.19	14.35
P3	5.26	10.12	91.98	8.62	93.41	8.02	26.09	20.88	14.29
P4	2.01	15.21	93.99	8.76	95.31	6.01	29.73	17.82	13.13
P5	2.78	20.15	96.77	9.09	97.77	3.23	37.97	12.23	10.01
P6	0.80	30.45	97.57	9.26	98.39	2.43	40.45	9.80	8.19
P7	2.43	40.45	100.00	10.02	100.00	0.00			
Total (Calc)	100.00	10.02	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

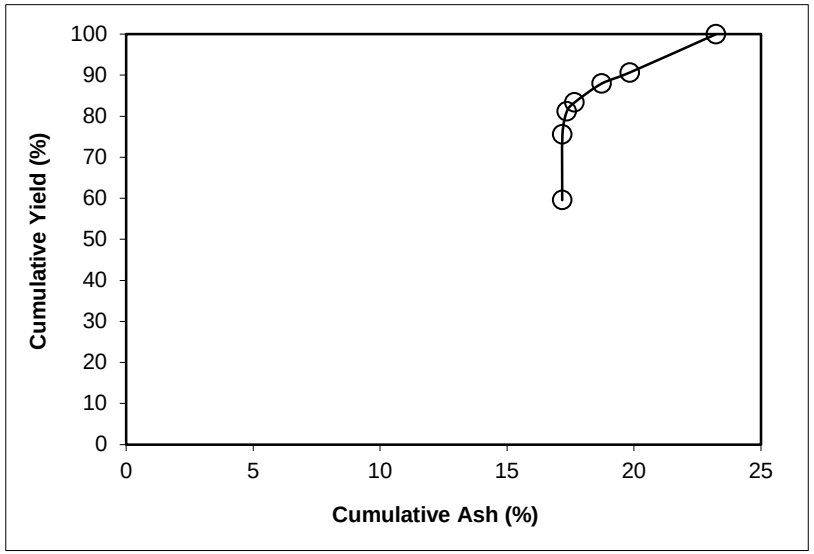
Description: Run 33 -Fine Spiral Test

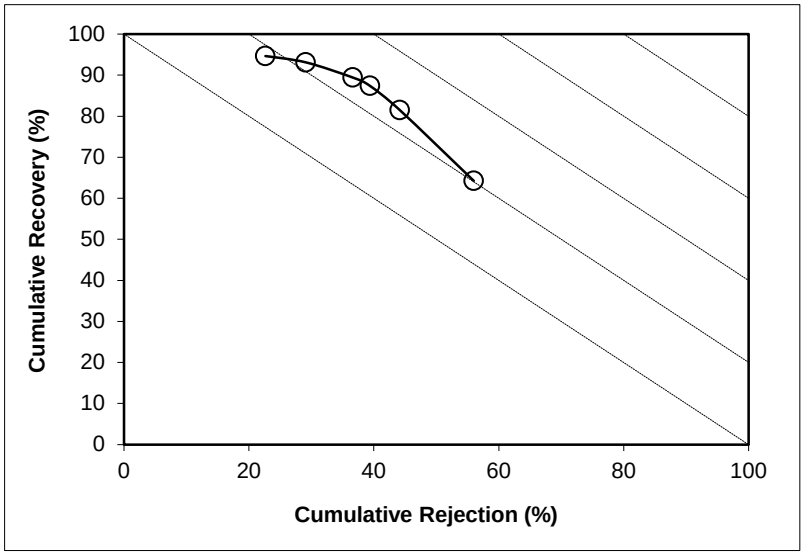
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 28.78

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	59.55	17.17	59.55	17.17	64.26	40.45	32.17	55.99	20.25
P2	15.97	17.22	75.52	17.18	81.48	24.48	41.92	44.16	25.64
P3	5.65	19.67	81.17	17.36	87.39	18.83	48.59	39.37	26.77
P4	2.18	29.08	83.35	17.66	89.41	16.65	51.15	36.64	26.05
P5	4.61	38.10	87.96	18.73	93.12	12.04	56.15	29.09	22.21
P6	2.67	56.05	90.63	19.83	94.65	9.37	56.18	22.64	17.30
P7	9.37	56.18	100.00	23.24	100.00	0.00			
Total (Calc)	100.00	23.24	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

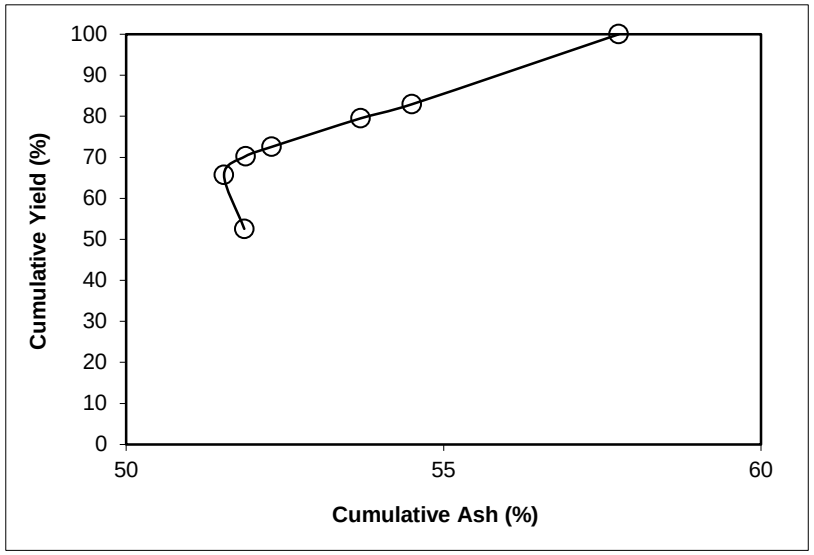
Description: Run 33 -Fine Spiral Test

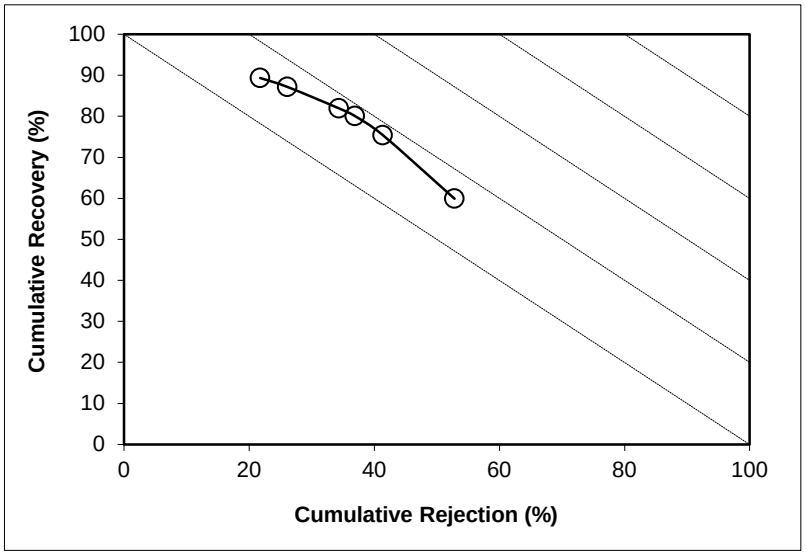
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 11.38

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	52.56	51.86	52.56	51.86	59.90	47.44	64.30	52.81	12.71
P2	13.18	50.27	65.74	51.54	75.42	34.26	69.70	41.34	16.76
P3	4.53	56.79	70.27	51.88	80.06	29.73	71.66	36.88	16.94
P4	2.28	65.04	72.55	52.29	81.94	27.45	72.21	34.32	16.26
P5	6.96	68.30	79.51	53.69	87.16	20.49	73.54	26.09	13.25
P6	3.42	73.23	82.93	54.50	89.33	17.07	73.60	21.75	11.08
P7	17.07	73.60	100.00	57.76	100.00	0.00			
Total (Calc)	100.00	57.76	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

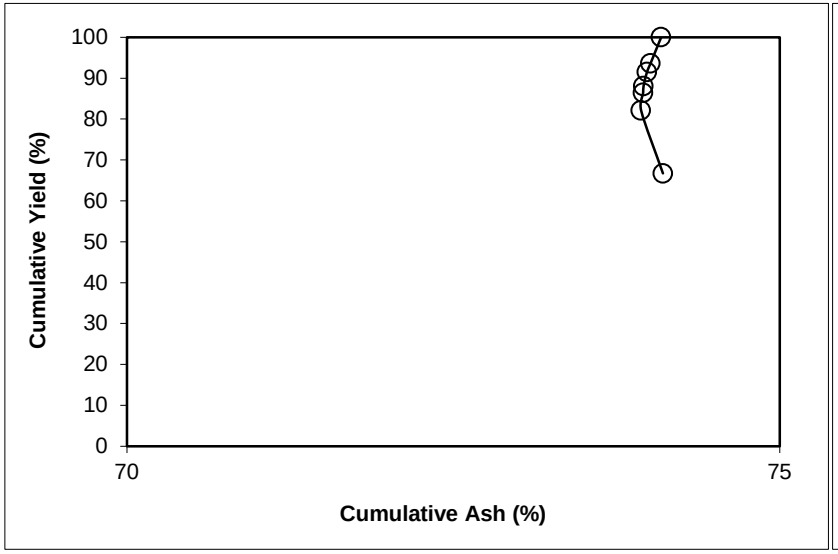
Description: Run 33 -Fine Spiral Test

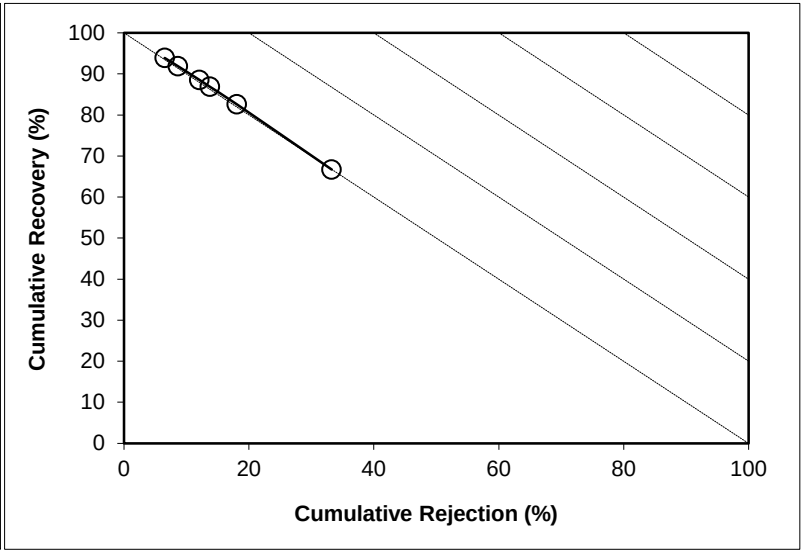
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 32.77

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	66.73	74.11	66.73	74.11	66.70	33.27	74.06	33.26	-0.05
P2	15.36	73.21	82.09	73.94	82.58	17.91	74.79	18.07	0.65
P3	4.28	74.25	86.38	73.95	86.84	13.62	74.97	13.78	0.62
P4	1.69	74.13	88.07	73.96	88.53	11.93	75.08	12.09	0.62
P5	3.42	74.65	91.49	73.98	91.88	8.51	75.26	8.64	0.52
P6	2.09	75.20	93.58	74.01	93.88	6.42	75.28	6.52	0.40
P7	6.42	75.28	100.00	74.09	100.00	0.00			
Total (Calc)	100.00	74.09	--	--	--	--	--	--	--





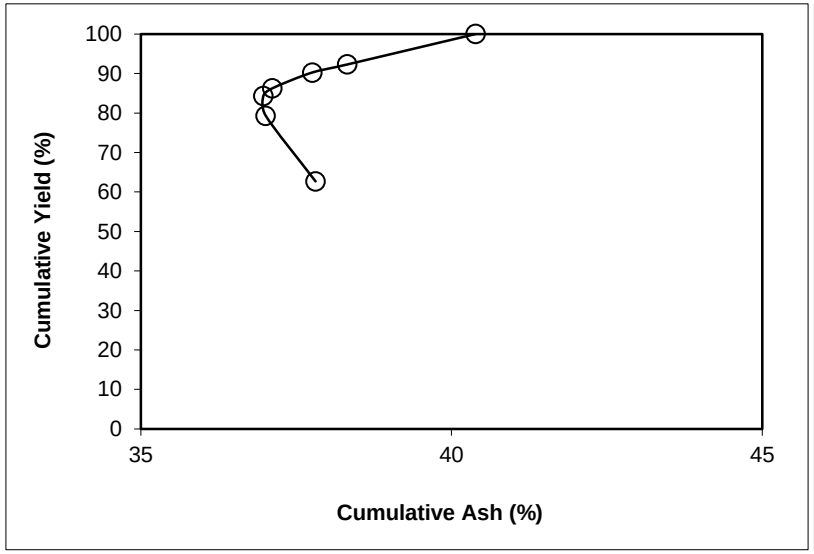
SPIRAL DATA ANALYSIS

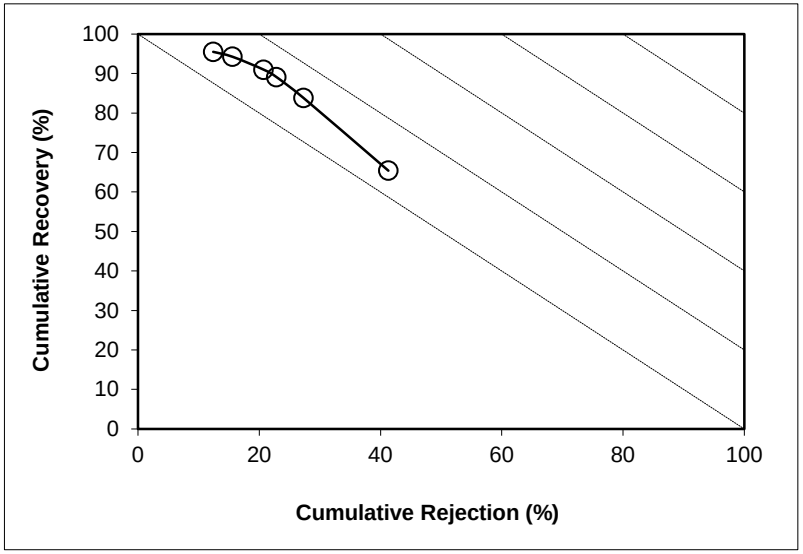
Description: Run 33 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	62.70	37.81	62.70	37.81	65.40	37.30	44.71	41.30	6.70
P2	16.63	33.99	79.32	37.01	83.81	20.68	53.33	27.30	11.12
P3	4.97	36.35	84.29	36.97	89.12	15.71	58.70	22.83	11.95
P4	1.96	43.29	86.25	37.11	90.98	13.75	60.90	20.73	11.72
P5	4.01	51.57	90.26	37.76	94.24	9.74	64.74	15.61	9.85
P6	2.04	63.33	92.31	38.32	95.50	7.69	65.11	12.41	7.90
P7	7.69	65.11	100.00	40.38	100.00	0.00			
Total (Calc)	100.00	40.38	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

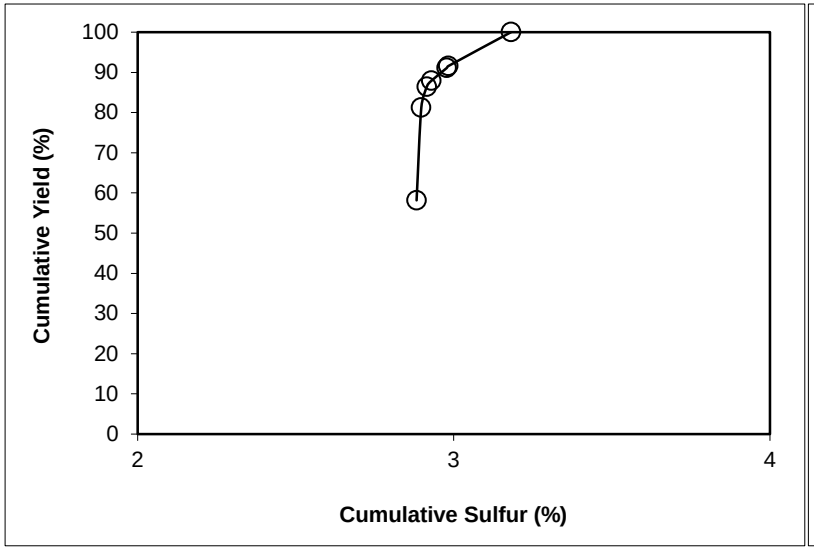
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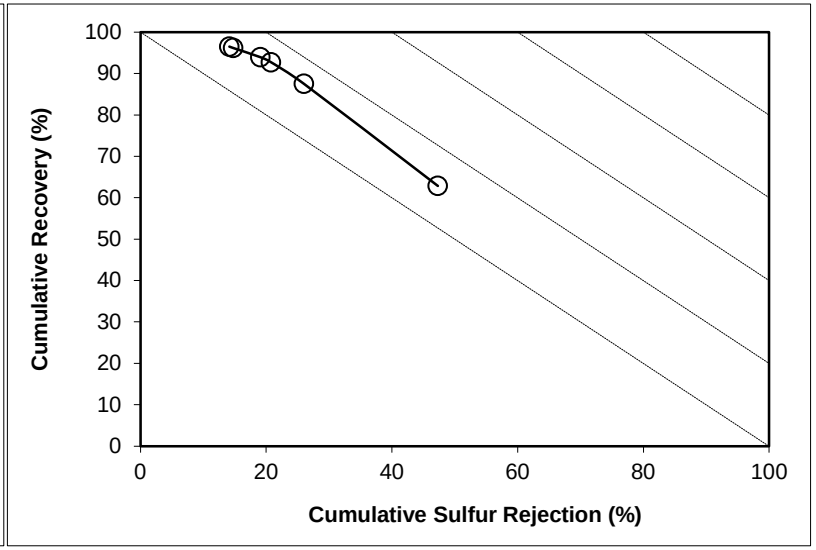
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: +60 Feed Weight (%): 4.92

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	58.15	2.88	58.15	2.88	62.85	41.85	3.60	47.31	10.16
P2	23.09	2.94	81.24	2.90	87.52	18.76	4.41	26.01	13.53
P3	5.21	3.19	86.45	2.92	92.73	13.55	4.88	20.78	13.50
P4	1.44	3.77	87.89	2.93	93.96	12.11	5.01	19.07	13.03
P5	3.19	4.32	91.09	2.98	96.18	8.91	5.26	14.74	10.92
P6	0.48	3.93	91.57	2.98	96.51	8.43	5.34	14.15	10.66
P7	8.43	5.34	100.00	3.18	100.00	0.00			
Total (Calc)	100.00	3.18	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

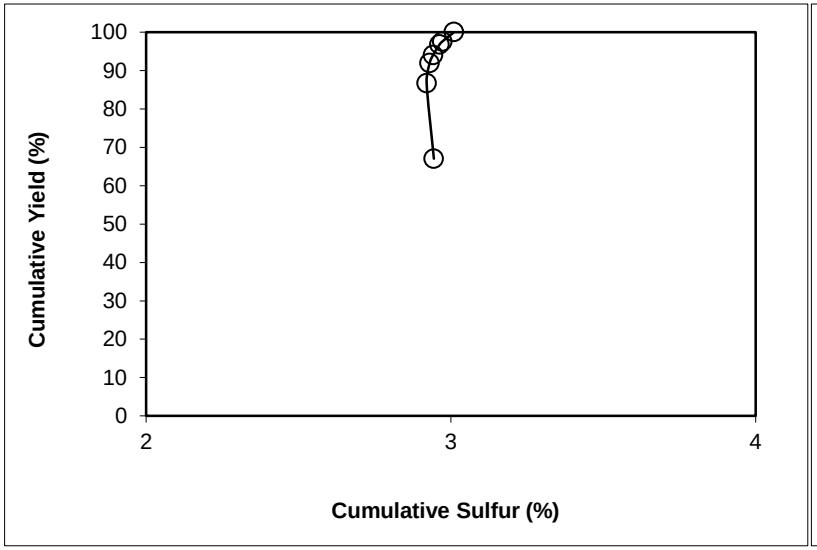
Description: Run 33 -Fine Spiral Test

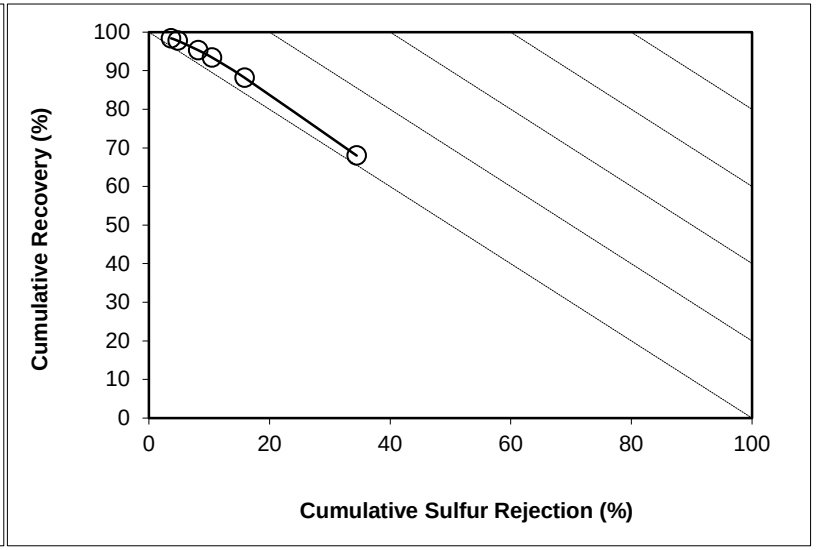
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 60x100 Feed Weight (%): 22.15

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	67.04	2.94	67.04	2.94	68.00	32.96	3.15	34.44	2.44
P2	19.68	2.84	86.72	2.92	88.15	13.28	3.60	15.88	4.03
P3	5.26	3.10	91.98	2.93	93.41	8.02	3.93	10.46	3.87
P4	2.01	3.43	93.99	2.94	95.31	6.01	4.09	8.17	3.48
P5	2.78	3.69	96.77	2.96	97.77	3.23	4.44	4.76	2.54
P6	0.80	4.09	97.57	2.97	98.39	2.43	4.56	3.68	2.07
P7	2.43	4.56	100.00	3.01	100.00	0.00			
Total (Calc)	100.00	3.01	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

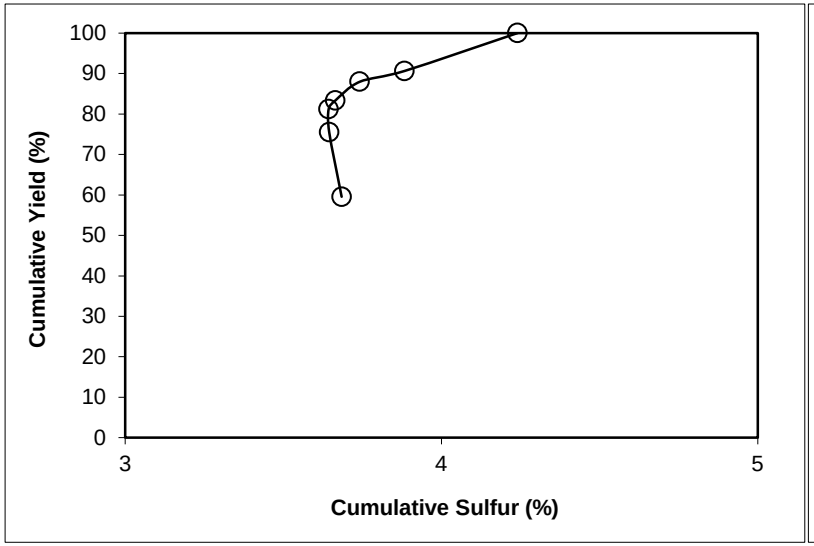
Description: Run 33 -Fine Spiral Test

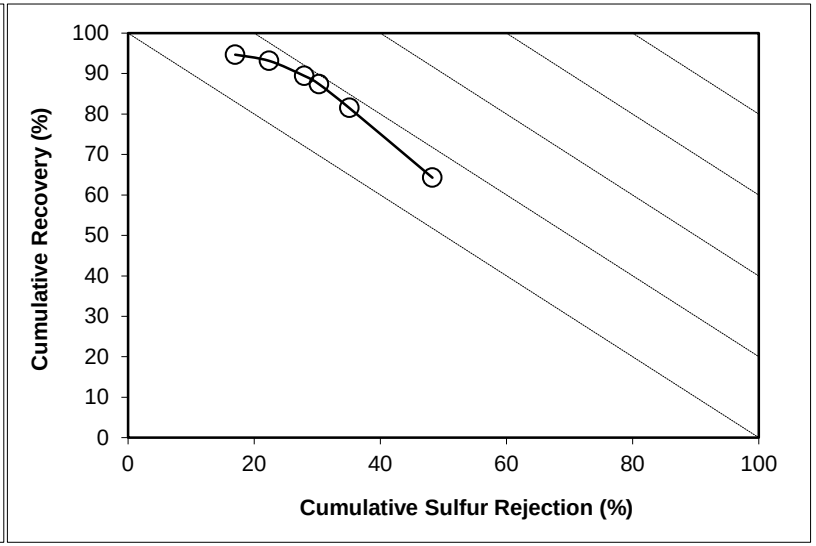
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 28.78

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	59.55	3.68	59.55	3.68	64.26	40.45	5.06	48.26	12.52
P2	15.97	3.50	75.52	3.65	81.48	24.48	6.08	35.08	16.56
P3	5.65	3.62	81.17	3.64	87.39	18.83	6.82	30.26	17.65
P4	2.18	4.47	83.35	3.66	89.41	16.65	7.12	27.96	17.37
P5	4.61	5.13	87.96	3.74	93.12	12.04	7.89	22.39	15.51
P6	2.67	8.55	90.63	3.88	94.65	9.37	7.70	17.00	11.65
P7	9.37	7.70	100.00	4.24	100.00	0.00			
Total (Calc)	100.00	4.24	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

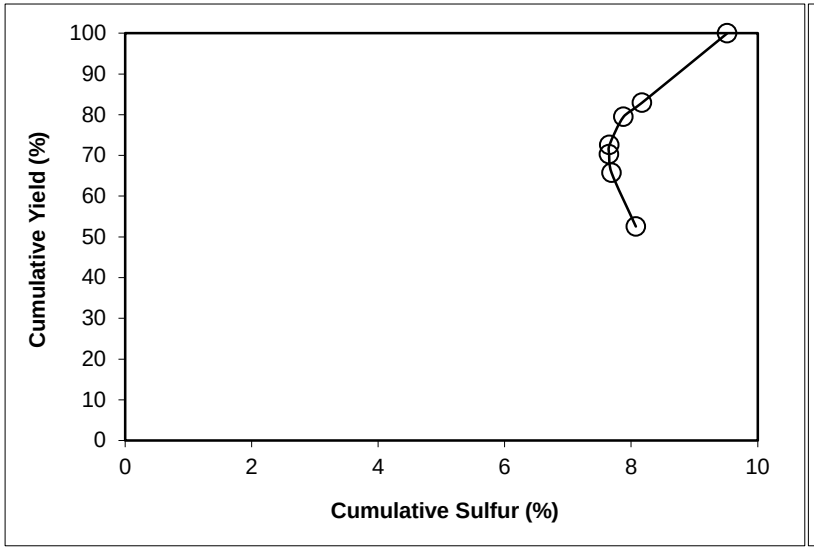
Description: Run 33 -Fine Spiral Test

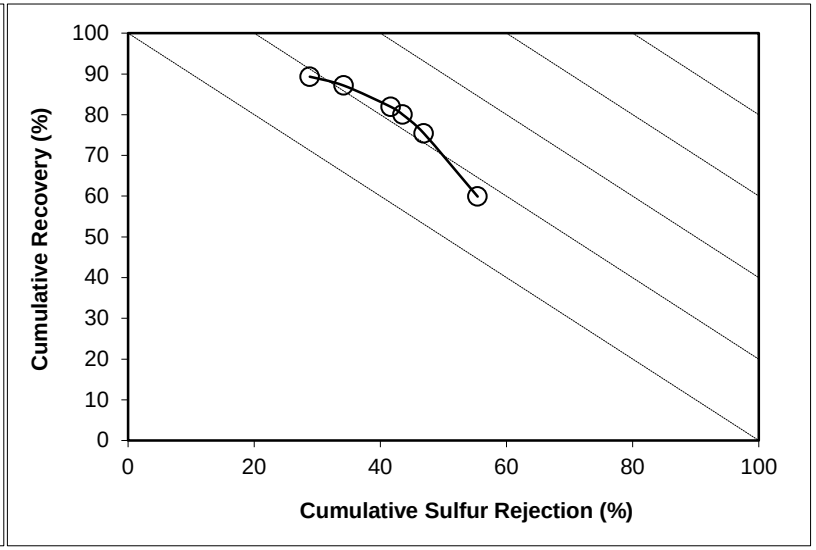
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 11.38

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	52.56	8.07	52.56	8.07	59.90	47.44	11.12	55.43	15.32
P2	13.18	6.16	65.74	7.69	75.42	34.26	13.03	46.90	22.32
P3	4.53	7.10	70.27	7.65	80.06	29.73	13.94	43.52	23.57
P4	2.28	7.81	72.55	7.66	81.94	27.45	14.44	41.65	23.59
P5	6.96	10.21	79.51	7.88	87.16	20.49	15.88	34.18	21.35
P6	3.42	14.92	82.93	8.17	89.33	17.07	16.07	28.82	18.15
P7	17.07	16.07	100.00	9.52	100.00	0.00			
Total (Calc)	100.00	9.52	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

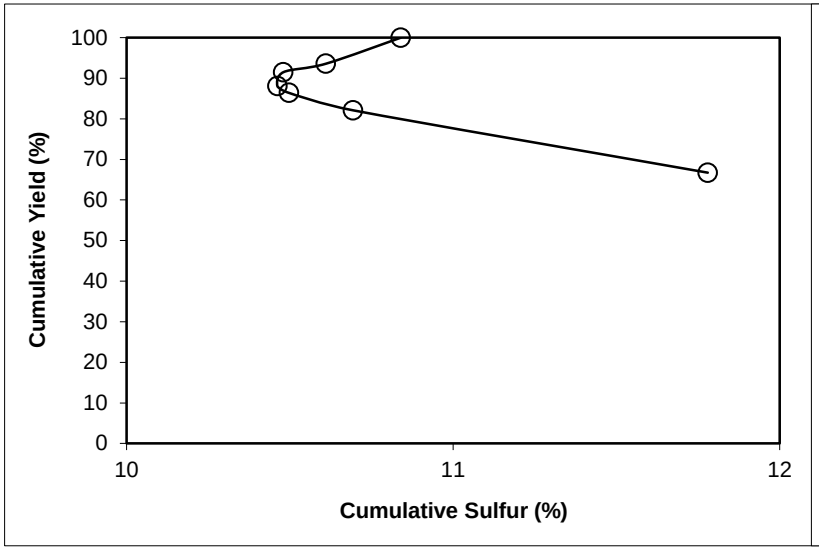
Description: Run 33 -Fine Spiral Test

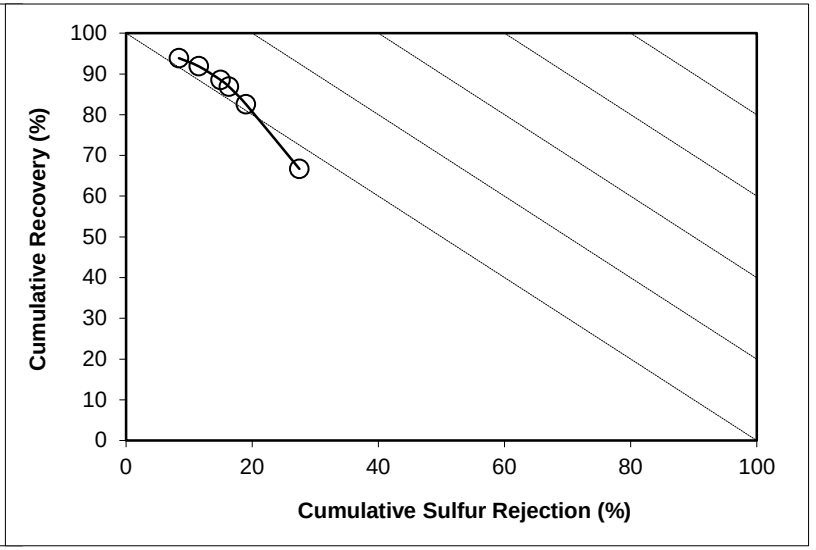
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 32.77

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	66.73	11.78	66.73	11.78	66.70	33.27	8.95	27.48	-5.82
P2	15.36	5.98	82.09	10.69	82.58	17.91	11.51	19.01	1.59
P3	4.28	6.74	86.38	10.50	86.84	13.62	13.01	16.35	3.19
P4	1.69	8.63	88.07	10.46	88.53	11.93	13.63	15.00	3.53
P5	3.42	10.96	91.49	10.48	91.88	8.51	14.71	11.54	3.42
P6	2.09	16.32	93.58	10.61	93.88	6.42	14.18	8.40	2.27
P7	6.42	14.18	100.00	10.84	100.00	0.00			
Total (Calc)	100.00	10.84	--	--	--	--	--	--	--





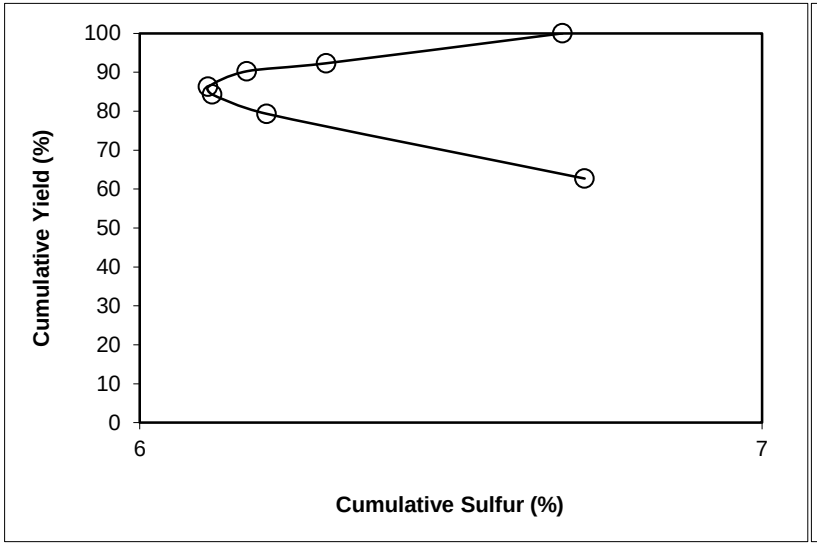
SPIRAL DATA ANALYSIS

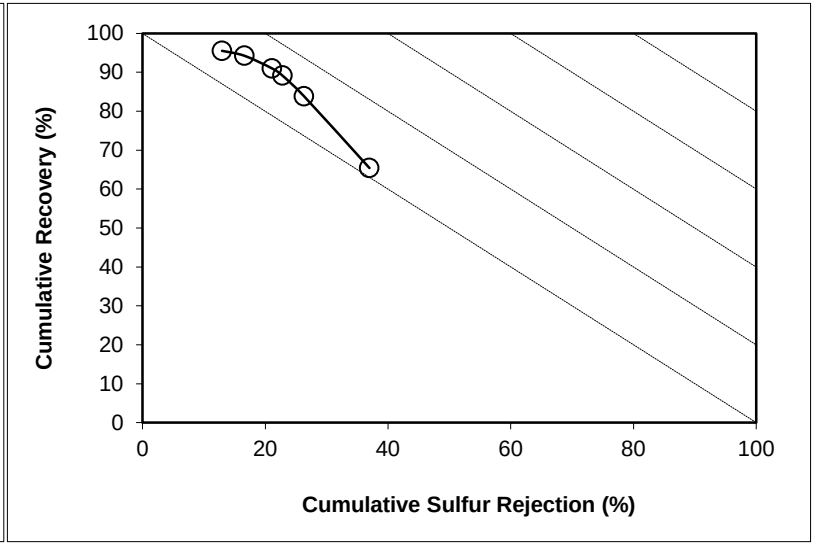
Description: Run 33 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	62.70	6.71	62.70	6.71	65.40	37.30	6.62	36.97	2.37
P2	16.63	4.28	79.32	6.20	83.81	20.68	8.50	26.32	10.14
P3	4.97	4.72	84.29	6.12	89.12	15.71	9.70	22.81	11.93
P4	1.96	5.82	86.25	6.11	90.98	13.75	10.25	21.10	12.09
P5	4.01	7.51	90.26	6.17	94.24	9.74	11.38	16.59	10.83
P6	2.04	11.92	92.31	6.30	95.50	7.69	11.24	12.94	8.44
P7	7.69	11.24	100.00	6.68	100.00	0.00			
Total (Calc)	100.00	6.68	--	--	--	--	--	--	--

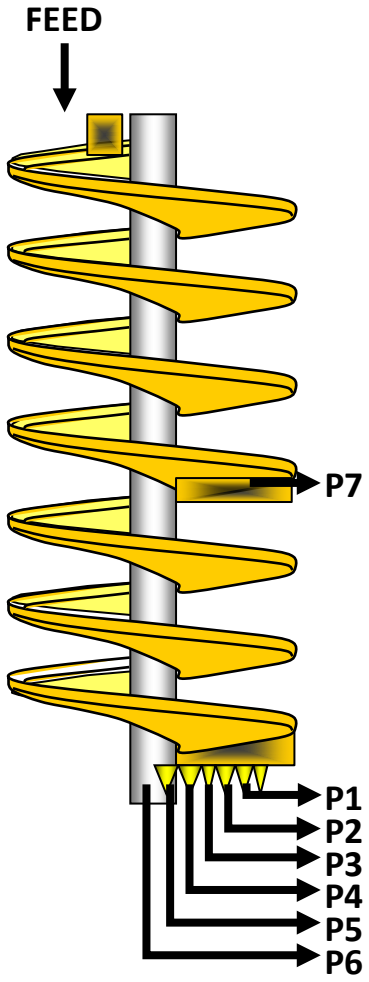




SPIRAL DATA ANALYSIS

Description: Run 34 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	0.463	10.6	15.66	16.81
P2	0.159	12.9	4.30	4.70
P3	0.045	16.1	0.94	1.05
P4	0.019	19.7	0.31	0.35
P5	0.031	21.3	0.46	0.54
P6	0.018	25.3	0.21	0.25
P7	0.064	28.8	0.64	0.78
Total	0.800	12.4	22.52	24.48

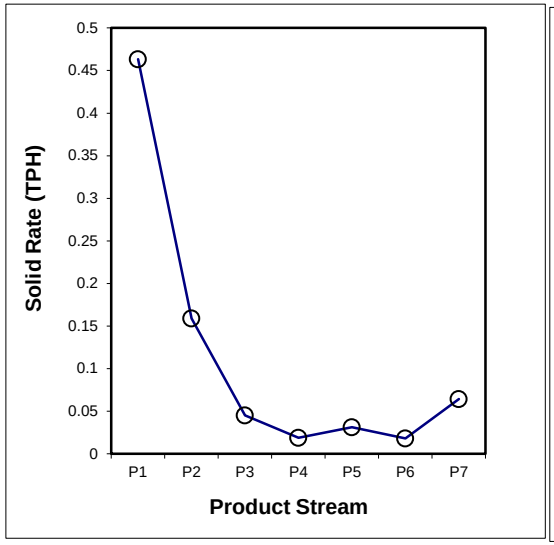
SPIRAL DATA ANALYSIS

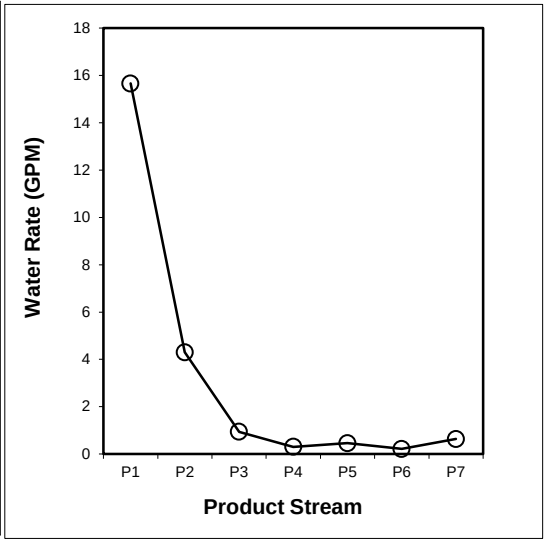
Description: Run 34 -Fine Spiral Test

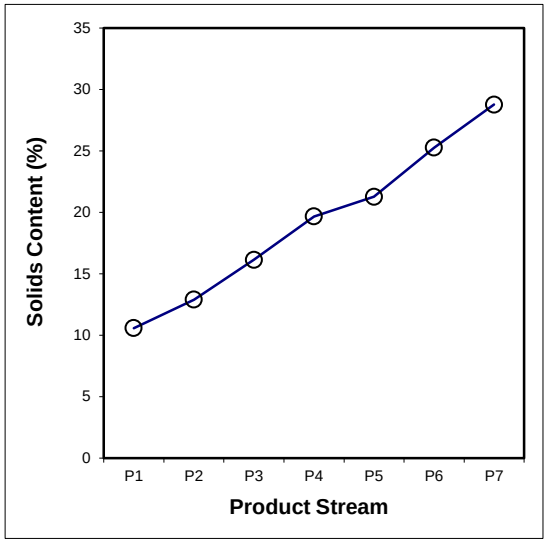
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	5	6752.00	1146.00	4.379	1497.0	912.9	0.463	57.93	10.58
P2	5	1672.07	92.78	1.234	1380.0	1179.5	0.159	19.89	12.89
P3	15	1165.85	93.37	0.279	1336.5	1166.0	0.045	5.64	16.14
P4	30	823.82	91.66	0.095	1271.6	1129.7	0.019	2.35	19.67
P5	15	657.52	93.91	0.147	1298.0	1179.8	0.031	3.91	21.28
P6	30	642.33	93.55	0.072	1302.8	1166.1	0.018	2.26	25.27
P7	15	954.15	97.69	0.223	1156.1	913.0	0.064	8.04	28.78
Total (Calc)	--	--	--	6.429	--	--	0.800	100.00	12.44
Total (Head)	0.86	1481.15	92.64	6.429	1302.6	1129.9	0.800	--	12.44







SPIRAL DATA ANALYSIS

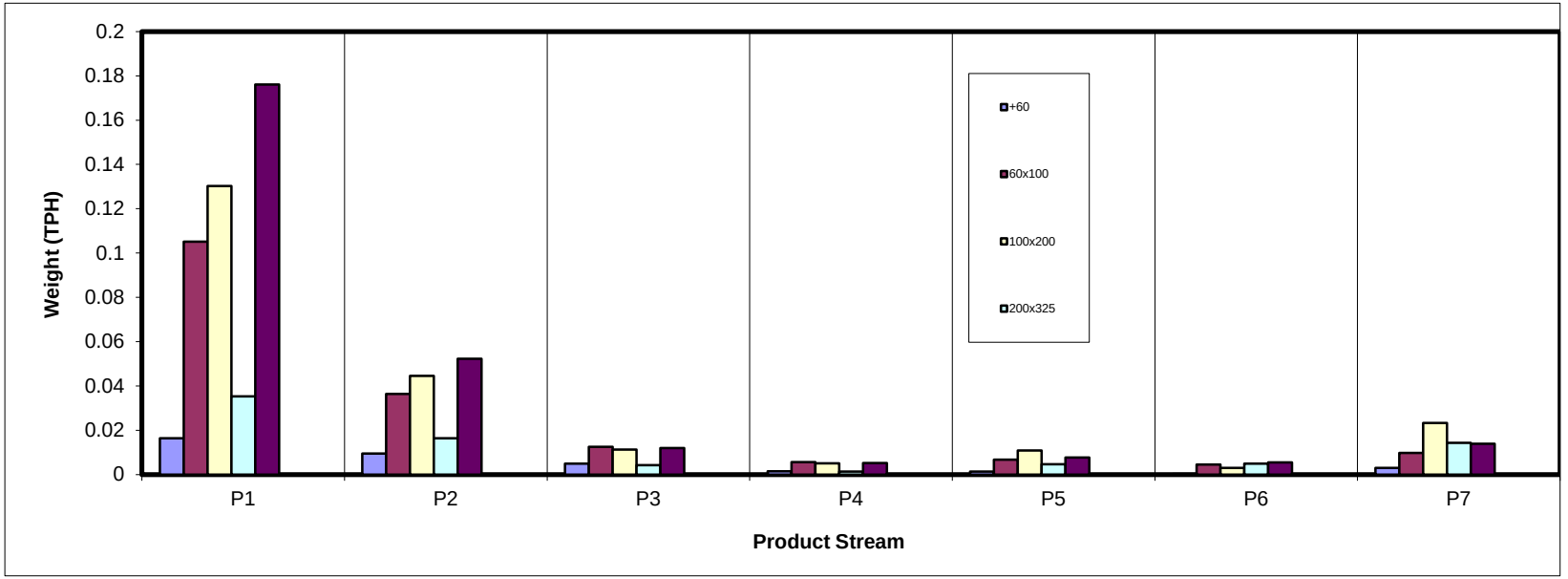
Description: Run 34 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	0.016	0.010	0.005	0.001	0.001	0.000	0.003		0.037
60x100	0.105	0.036	0.013	0.006	0.007	0.004	0.010		0.181
100x200	0.130	0.044	0.011	0.005	0.011	0.003	0.023		0.228
200x325	0.035	0.016	0.004	0.001	0.005	0.005	0.014		0.081
-325	0.176	0.052	0.012	0.005	0.008	0.006	0.014		0.273
Total (Calc)	0.463	0.159	0.045	0.019	0.031	0.018	0.064		0.800



SPIRAL DATA ANALYSIS

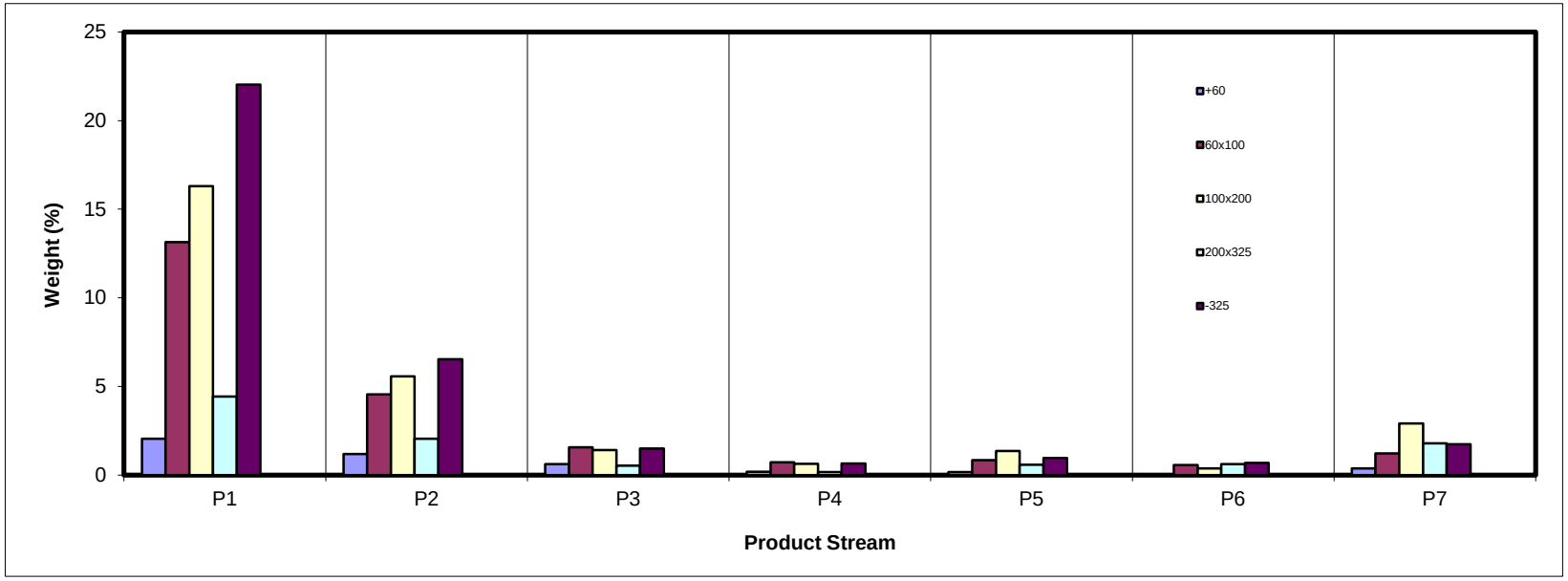
Description: Run 34 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	2.05	1.19	0.62	0.18	0.17	0.02	0.38		4.61
60x100	13.14	4.56	1.57	0.71	0.84	0.56	1.23		22.60
100x200	16.29	5.57	1.42	0.64	1.36	0.37	2.91		28.56
200x325	4.42	2.04	0.53	0.17	0.58	0.61	1.78		10.14
-325	22.02	6.53	1.50	0.65	0.95	0.69	1.74		34.09
Total (Calc)	57.93	19.89	5.64	2.35	3.91	2.26	8.04		100.00



SPIRAL DATA ANALYSIS

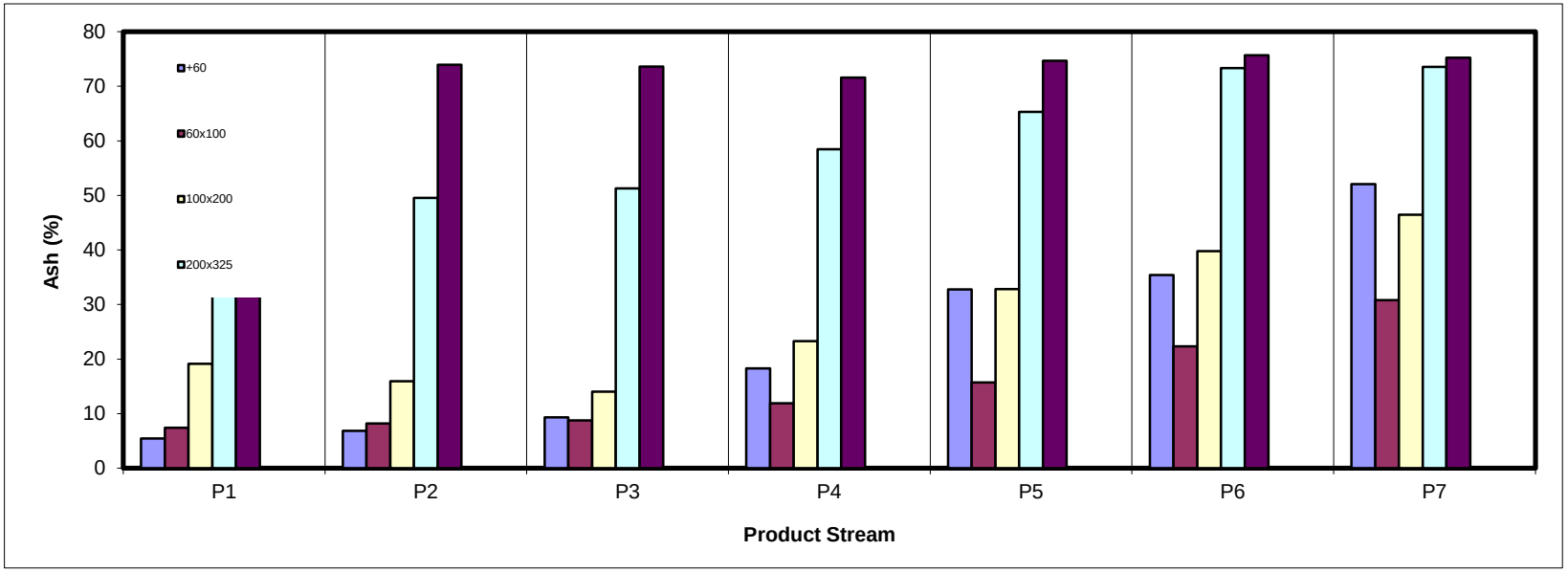
Description: Run 34 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	5.47	6.84	9.32	18.27	32.78	35.42	52.05		11.80
60x100	7.41	8.19	8.76	11.91	15.72	22.34	30.78		9.75
100x200	19.13	15.96	14.01	23.30	32.82	39.80	46.45		22.06
200x325	43.43	49.56	51.26	58.47	65.31	73.31	73.55		53.69
-325	74.48	73.96	73.59	71.61	74.69	75.66	75.25		74.36
Total (Calc)	38.89	36.14	31.41	35.40	44.21	55.50	56.58		39.84



SPIRAL DATA ANALYSIS

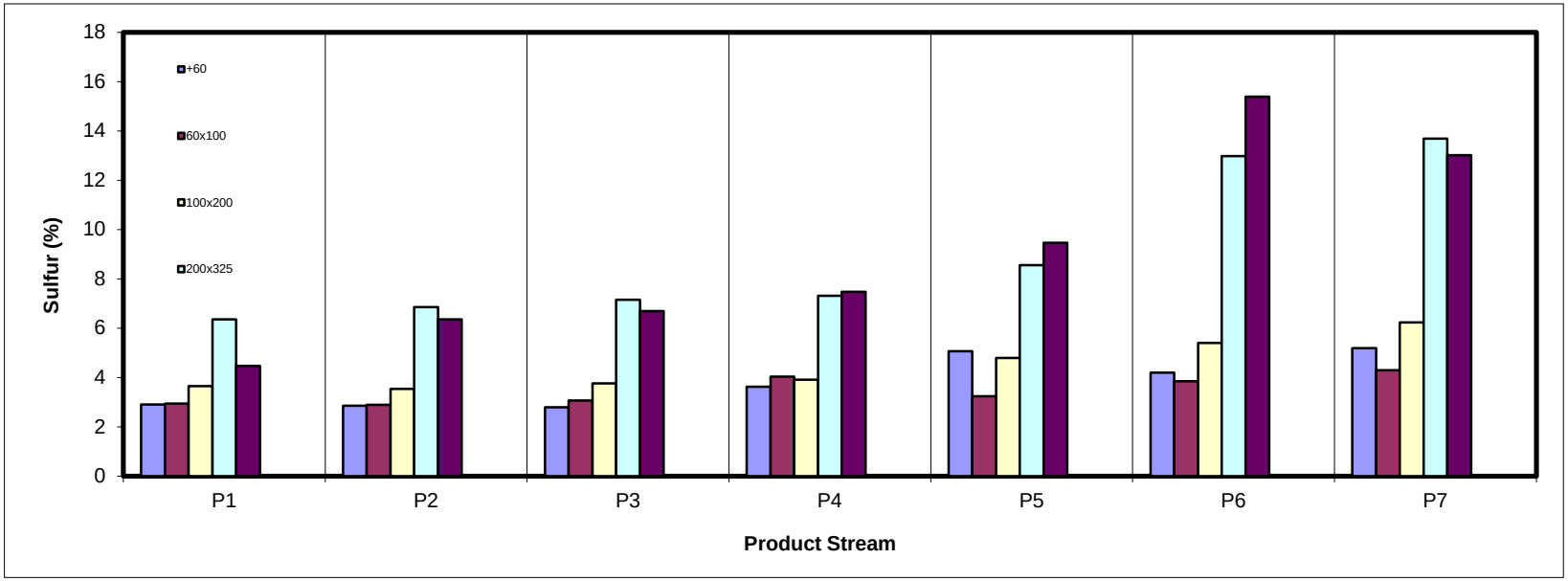
Description: Run 34 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Sulfur Content (%)

Sample ID	Dry Sulfur Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	2.90	2.85	2.79	3.62	5.07	4.20	5.19		3.18
60x100	2.94	2.89	3.06	4.03	3.24	3.85	4.30		3.08
100x200	3.65	3.54	3.76	3.91	4.79	5.40	6.24		3.98
200x325	6.36	6.85	7.15	7.31	8.56	12.98	13.68		8.33
-325	4.46	6.36	6.70	7.47	9.46	15.39	13.01		5.78
Total (Calc)	3.98	4.62	4.56	5.16	6.17	10.11	9.01		4.79



SPIRAL DATA ANALYSIS

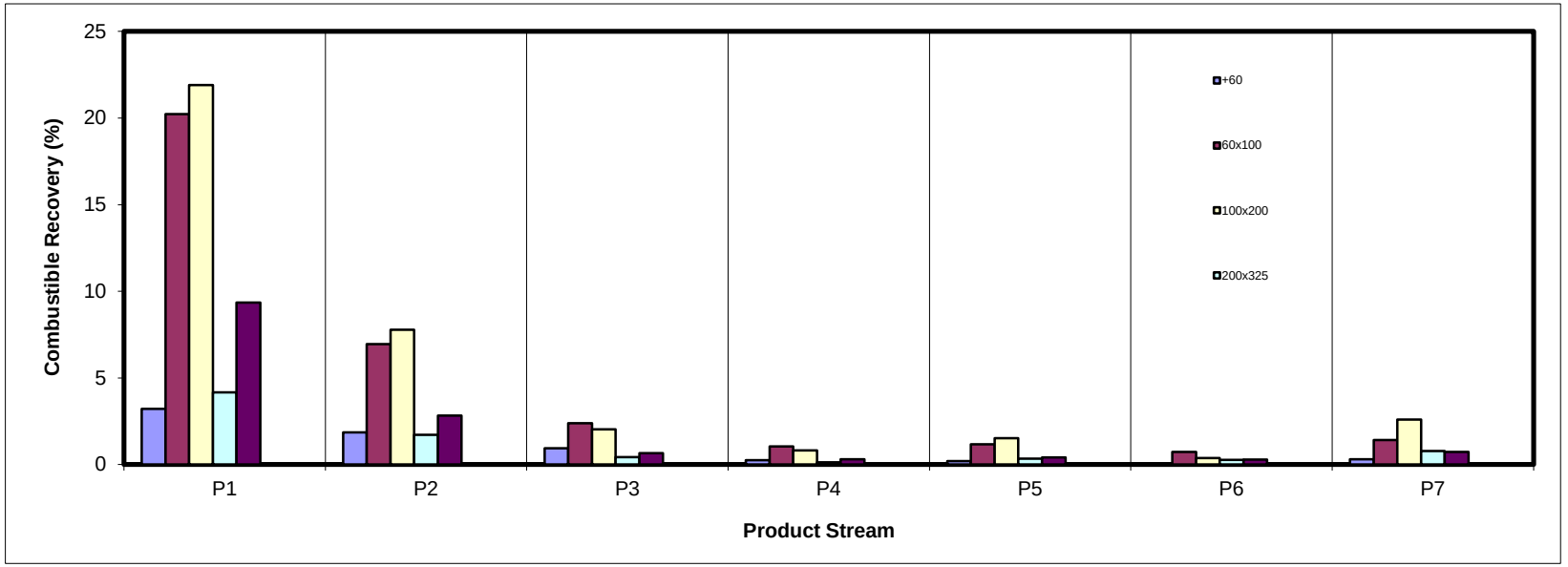
Description: Run 34 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	3.22	1.84	0.94	0.24	0.19	0.02	0.30		6.76
60x100	20.23	6.95	2.38	1.04	1.17	0.72	1.41		33.90
100x200	21.90	7.77	2.02	0.81	1.52	0.38	2.59		37.00
200x325	4.16	1.71	0.43	0.12	0.34	0.27	0.78		7.81
-325	9.34	2.83	0.66	0.31	0.40	0.28	0.72		14.53
Total (Calc)	58.85	21.11	6.43	2.52	3.62	1.67	5.80		100.00



SPIRAL DATA ANALYSIS

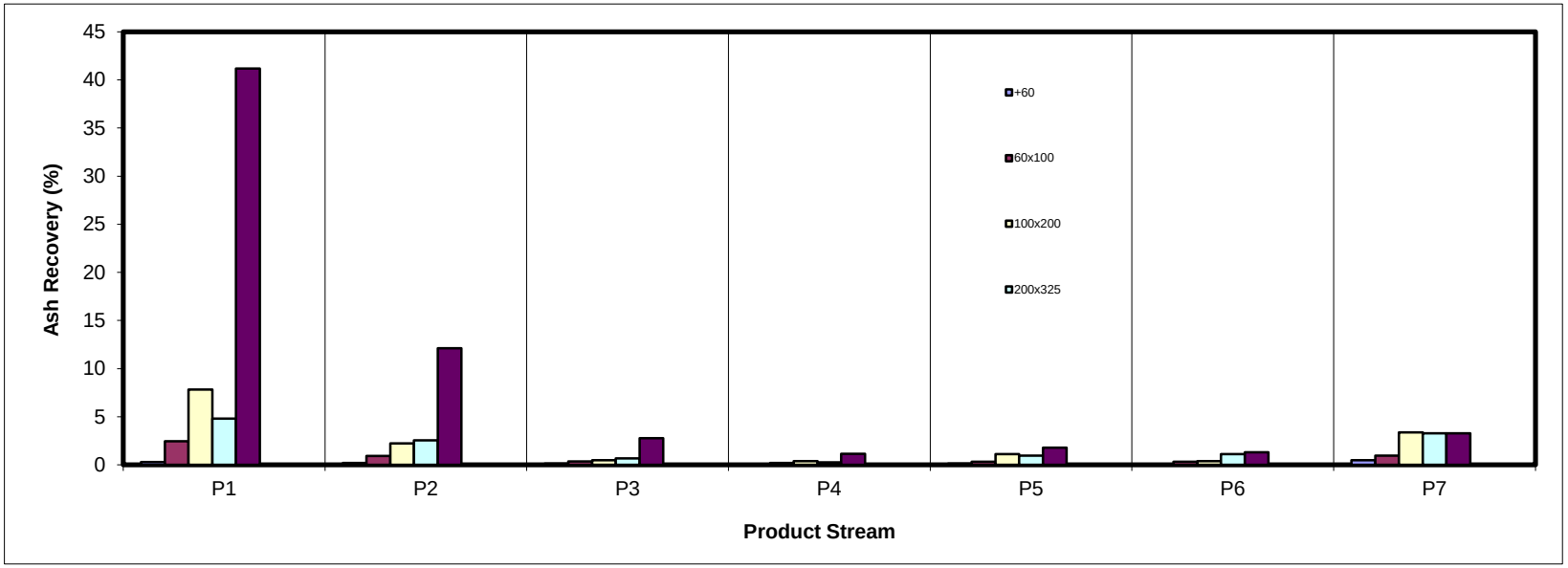
Description: Run 34 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	0.28	0.20	0.15	0.08	0.14	0.02	0.49		1.37
60x100	2.44	0.94	0.34	0.21	0.33	0.31	0.95		5.53
100x200	7.82	2.23	0.50	0.37	1.12	0.37	3.39		15.81
200x325	4.82	2.54	0.69	0.25	0.96	1.13	3.29		13.67
-325	41.17	12.13	2.77	1.16	1.78	1.31	3.29		63.62
Total (Calc)	56.54	18.04	4.44	2.08	4.34	3.15	11.41		100.00



SPIRAL DATA ANALYSIS

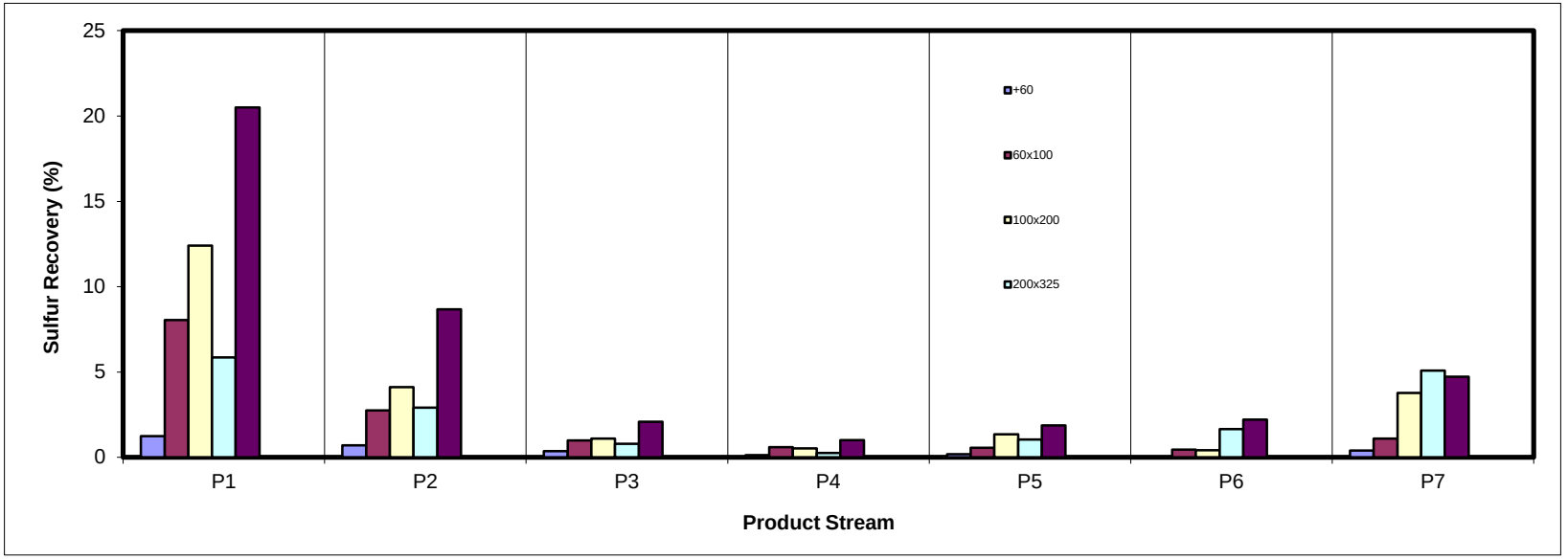
Description: Run 34 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Sulfur Recovery (%)

Sample ID	Sulfur Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	1.24	0.71	0.36	0.14	0.18	0.02	0.41		3.05
60x100	8.05	2.74	1.00	0.60	0.57	0.45	1.10		14.51
100x200	12.41	4.11	1.11	0.52	1.36	0.42	3.78		23.72
200x325	5.86	2.92	0.80	0.26	1.04	1.66	5.08		17.62
-325	20.50	8.67	2.09	1.01	1.88	2.22	4.73		41.10
Total (Calc)	48.06	19.15	5.36	2.52	5.03	4.77	15.10		100.00



SPIRAL DATA ANALYSIS

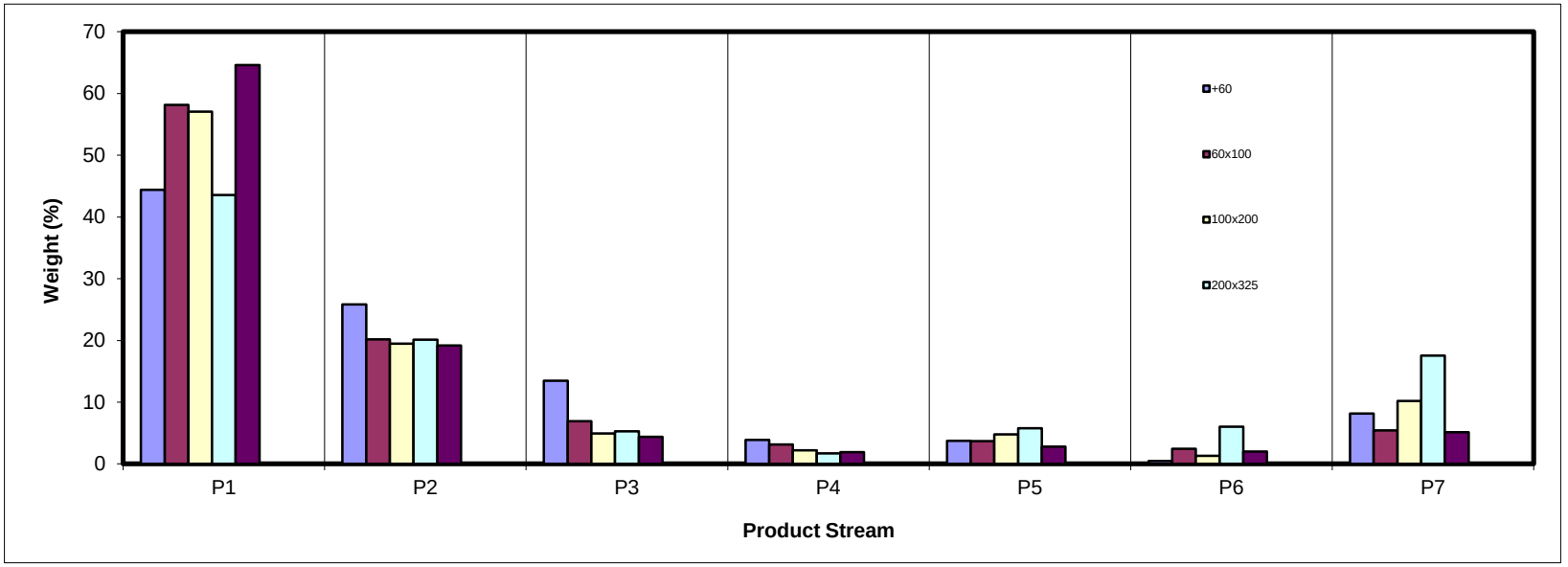
Description: Run 34 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	44.40	25.85	13.48	3.89	3.75	0.46	8.17		100.00
60x100	58.16	20.16	6.93	3.14	3.70	2.48	5.42		100.00
100x200	57.06	19.49	4.96	2.23	4.77	1.31	10.19		100.00
200x325	43.57	20.11	5.26	1.70	5.76	6.05	17.55		100.00
-325	64.61	19.16	4.40	1.90	2.79	2.02	5.11		100.00
Total (Calc)	57.93	19.89	5.64	2.35	3.91	2.26	8.04		100.00



SPIRAL DATA ANALYSIS

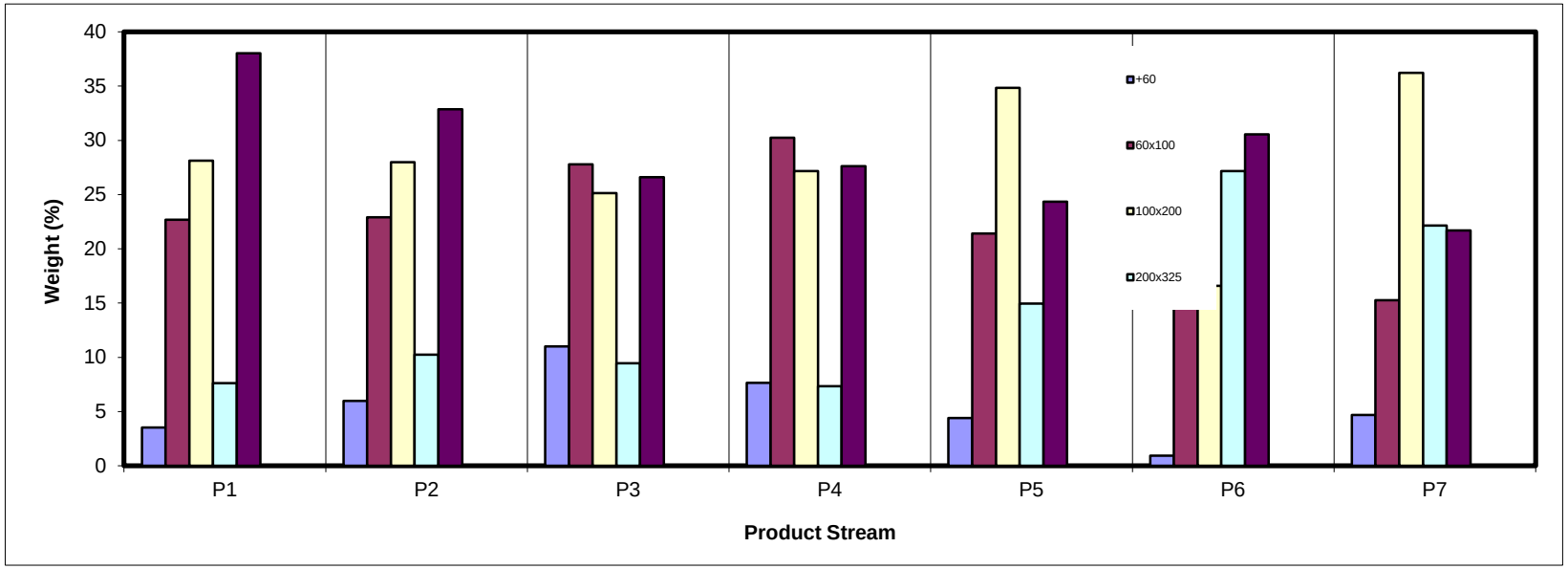
Description: Run 34 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	3.53	5.99	11.02	7.65	4.42	0.94	4.68		4.61
60x100	22.69	22.91	27.79	30.24	21.42	24.76	15.25		22.60
100x200	28.13	27.99	25.12	27.16	34.84	16.59	36.21		28.56
200x325	7.63	10.26	9.47	7.35	14.96	27.17	22.15		10.14
-325	38.02	32.85	26.61	27.61	24.35	30.54	21.70		34.09
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

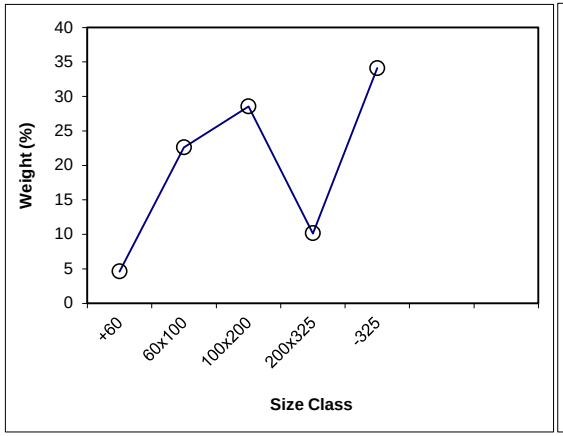
Description: Run 34 -Fine Spiral Test

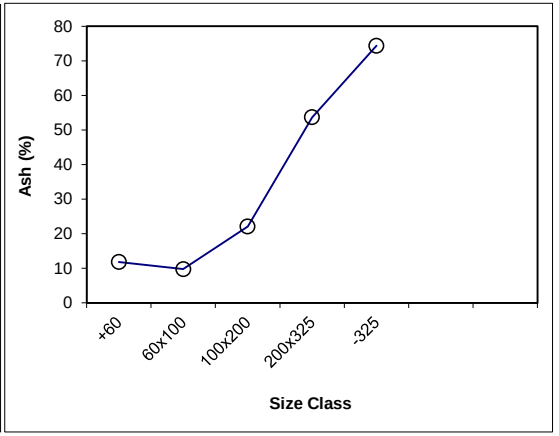
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

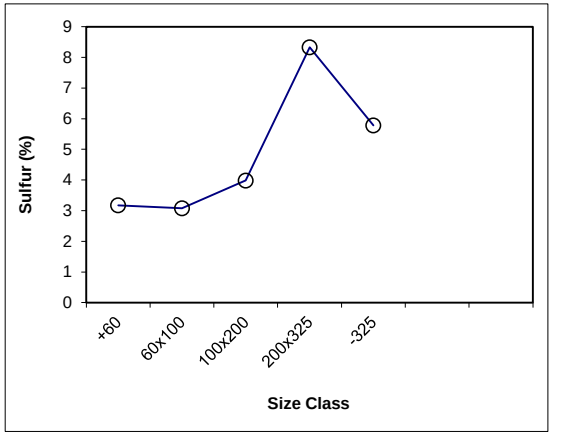
FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	14.1	6.1	7.96	4.61	11.80	3.18	4.61	11.80	3.18	100.00	39.84	4.79
60x100	406.0	367.0	39.02	22.60	9.75	3.08	27.21	10.10	3.09	95.39	41.20	4.87
100x200	396.8	347.4	49.32	28.56	22.06	3.98	55.76	16.22	3.55	72.79	50.96	5.43
200x325	420.8	403.2	17.52	10.14	53.69	8.33	65.91	21.99	4.28	44.24	69.62	6.36
-325	65.0	6.1	58.87	34.09	74.36	5.78	100.00	39.84	4.79	34.09	74.36	5.78
Total (Calc)	--	--	172.69	100.00	39.84	4.79	--	--		--		--







SPIRAL DATA ANALYSIS

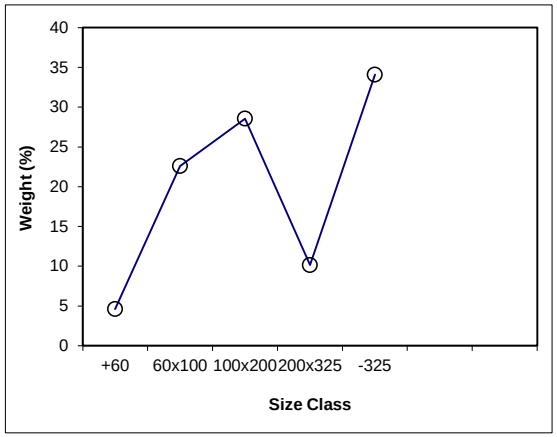
Description: Run 34 -Fine Spiral Test

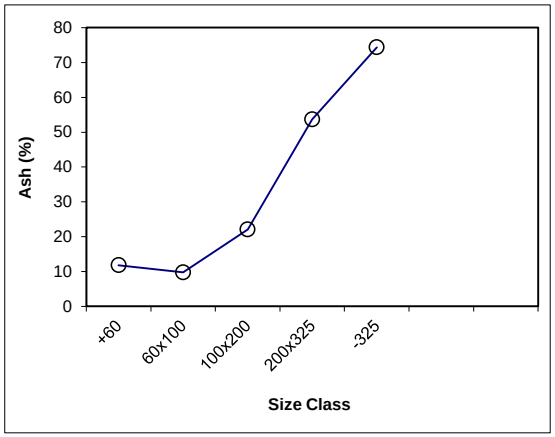
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

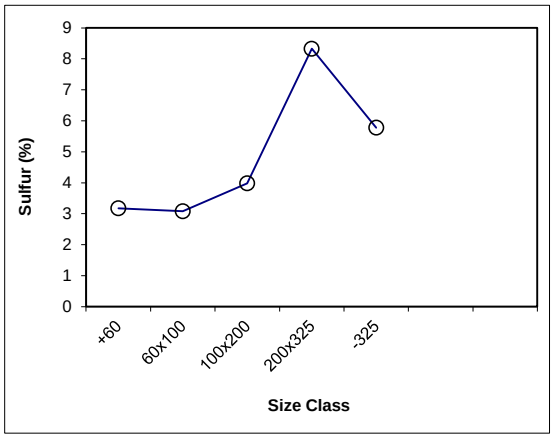
FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed			Select Size Class	Dry Weight (%)	Dry Ash (%)
				Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)			
+60	4.61	11.80	3.18	4.61	11.80	3.18	100.00	39.84	4.79	x	4.61	11.80
60x100	22.60	9.75	3.08	27.21	10.10	3.09	95.39	41.20	4.87	x	22.60	9.75
100x200	28.56	22.06	3.98	55.76	16.22	3.55	72.79	50.96	5.43	x	28.56	22.06
200x325	10.14	53.69	8.33	65.91	21.99	4.28	44.24	69.62	6.36	x	10.14	53.69
-325	34.09	74.36	5.78	100.00	39.84	4.79	34.09	74.36	5.78		34.09	74.36
Total (Calc)	100.00	39.84	4.79	--	--		--	--			100.00	39.84







SPIRAL DATA ANALYSIS

Description: Run 34 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 57.93

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	26.9	6.3	20.63	3.53	5.47	2.90	3.53	5.47	2.90	100.00	38.89	3.98
60x100	440.7	308.1	132.53	22.69	7.41	2.94	26.22	7.15	2.93	96.47	40.11	4.02
100x200	458.8	294.5	164.30	28.13	19.13	3.65	54.35	13.35	3.30	73.78	50.17	4.35
200x325	342.6	298.0	44.57	7.63	43.43	6.36	61.98	17.05	3.68	45.65	69.29	4.78
-325	228.1	6.0	222.08	38.02	74.48	4.46	100.00	38.89	3.98	38.02	74.48	4.46
Total (Calc)	--	--	584.11	100.00	38.89	3.98	--	--		--		--

Product P2 Feed Weight (%): 19.89

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	18.2	6.2	12.01	5.99	6.84	2.85	5.99	6.84	2.85	100.00	36.14	4.62
60x100	443.2	397.2	45.94	22.91	8.19	2.89	28.90	7.91	2.88	94.01	38.00	4.73
100x200	447.5	391.3	56.12	27.99	15.96	3.54	56.89	11.87	3.21	71.10	47.61	5.32
200x325	399.2	378.6	20.57	10.26	49.56	6.85	67.15	17.63	3.76	43.11	68.16	6.48
-325	72.1	6.2	65.88	32.85	73.96	6.36	100.00	36.14	4.62	32.85	73.96	6.36
Total (Calc)	--	--	200.51	100.00	36.14	4.62	--	--		--		--

SPIRAL DATA ANALYSIS

Description: Run 34 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 5.64

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	24.9	6.1	18.79	11.02	9.32	2.79	11.02	9.32	2.79	100.00	31.41	4.56
60x100	435.1	387.7	47.38	27.79	8.76	3.06	38.81	8.92	2.99	88.98	34.15	4.78
100x200	422.6	379.8	42.84	25.12	14.01	3.76	63.93	10.92	3.29	61.19	45.67	5.56
200x325	402.4	386.3	16.14	9.47	51.26	7.15	73.39	16.12	3.79	36.07	67.73	6.82
-325	51.5	6.1	45.37	26.61	73.59	6.70	100.00	31.41	4.56	26.61	73.59	6.70
Total (Calc)	--	--	170.54	100.00	31.41	4.56	--	--		--		--

Product P4 Feed Weight (%): 2.35

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	17.0	6.1	10.86	7.65	18.27	3.62	7.65	18.27	3.62	100.00	35.40	5.16
60x100	409.9	367.0	42.91	30.24	11.91	4.03	37.89	13.20	3.95	92.35	36.81	5.29
100x200	385.9	347.4	38.55	27.16	23.30	3.91	65.04	17.42	3.93	62.11	48.93	5.90
200x325	413.6	403.2	10.43	7.35	58.47	7.31	72.39	21.58	4.28	34.96	68.85	7.44
-325	45.2	6.0	39.19	27.61	71.61	7.47	100.00	35.40	5.16	27.61	71.61	7.47
Total (Calc)	--	--	141.93	100.00	35.40	5.16	--	--		--		--

SPIRAL DATA ANALYSIS

Description: Run 34 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 3.91

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	11.4	6.2	5.22	4.42	32.78	5.07	4.42	32.78	5.07	100.00	44.21	6.17
60x100	422.5	397.2	25.32	21.42	15.72	3.24	25.84	18.64	3.55	95.58	44.74	6.22
100x200	432.8	391.6	41.18	34.84	32.82	4.79	60.68	26.78	4.27	74.16	53.13	7.09
200x325	396.3	378.6	17.69	14.96	65.31	8.56	75.65	34.40	5.11	39.32	71.12	9.12
-325	35.0	6.2	28.78	24.35	74.69	9.46	100.00	44.21	6.17	24.35	74.69	9.46
Total (Calc)	--	--	118.19	100.00	44.21	6.17	--	--		--		--

Product P6 Feed Weight (%): 2.26

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	7.4	6.1	1.29	0.94	35.42	4.20	0.94	35.42	4.20	100.00	55.50	10.11
60x100	421.5	387.7	33.85	24.76	22.34	3.85	25.70	22.82	3.86	99.06	55.69	10.17
100x200	402.5	379.8	22.68	16.59	39.80	5.40	42.29	29.48	4.46	74.30	66.80	12.28
200x325	423.4	386.3	37.15	27.17	73.31	12.98	69.46	46.63	7.79	57.71	74.56	14.25
-325	48.0	6.2	41.76	30.54	75.66	15.39	100.00	55.50	10.11	30.54	75.66	15.39
Total (Calc)	--	--	136.72	100.00	55.50	10.11	--	--		--		--

SPIRAL DATA ANALYSIS

Description: Run 34 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P7 Feed Weight (%): 8.04

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	17.6	6.2	11.39	4.68	52.05	5.19	4.68	52.05	5.19	100.00	56.58	9.01
60x100	345.2	308.1	37.08	15.25	30.78	4.30	19.94	35.78	4.51	95.32	56.80	9.20
100x200	382.5	294.5	88.01	36.21	46.45	6.24	56.14	42.66	5.62	80.06	61.76	10.13
200x325	351.9	298.0	53.85	22.15	73.55	13.68	78.30	51.40	7.90	43.86	74.39	13.35
-325	58.9	6.2	52.75	21.70	75.25	13.01	100.00	56.58	9.01	21.70	75.25	13.01
Total (Calc)	--	--	243.07	100.00	56.58	9.01	--	--		--		--

SPIRAL DATA ANALYSIS

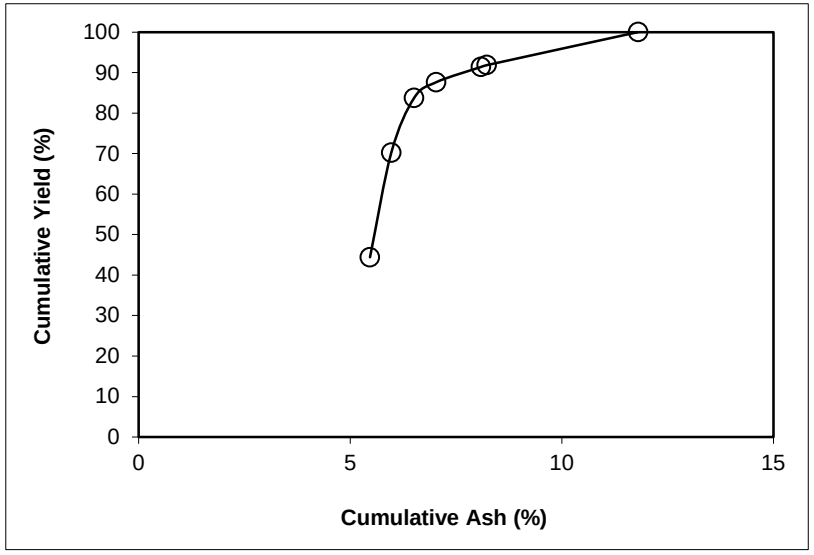
Description: Run 34 -Fine Spiral Test

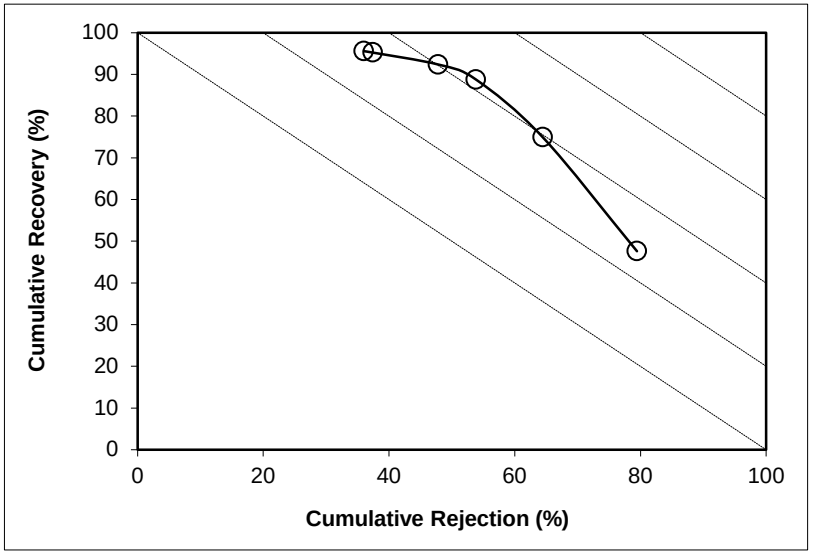
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: +60 Feed Weight (%): 4.61

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	44.40	5.47	44.40	5.47	47.59	55.60	16.87	79.44	27.03
P2	25.85	6.84	70.25	5.97	74.90	29.75	25.58	64.47	39.36
P3	13.48	9.32	83.73	6.51	88.76	16.27	39.05	53.83	42.59
P4	3.89	18.27	87.62	7.03	92.37	12.38	45.59	47.80	40.17
P5	3.75	32.78	91.37	8.09	95.22	8.63	51.16	37.40	32.62
P6	0.46	35.42	91.83	8.23	95.56	8.17	52.05	36.01	31.57
P7	8.17	52.05	100.00	11.80	100.00	0.00			
Total (Calc)	100.00	11.80	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

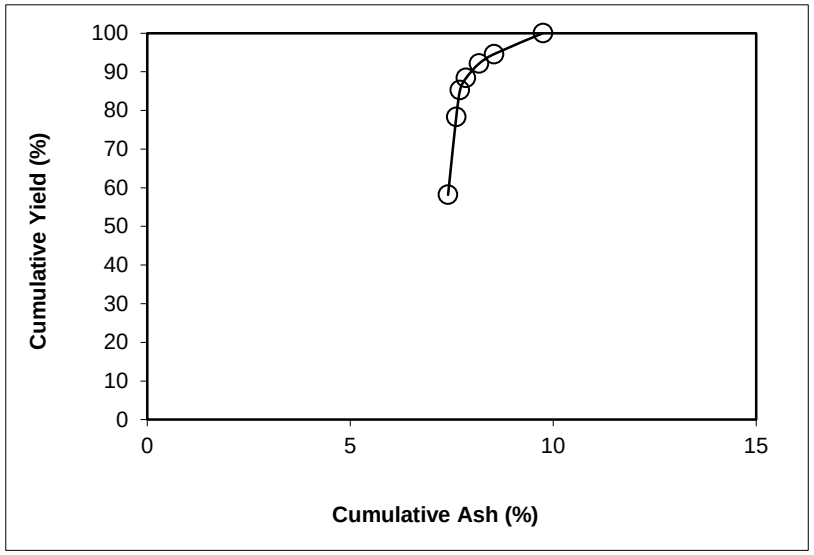
Description: Run 34 -Fine Spiral Test

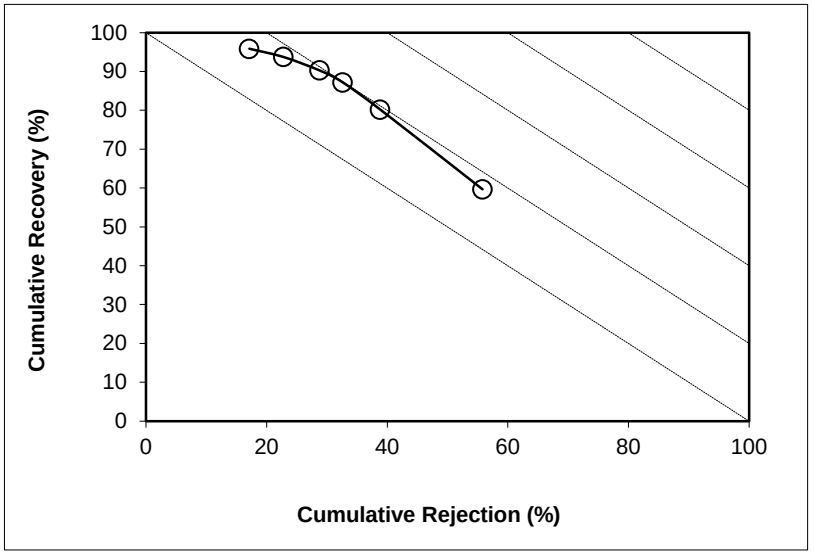
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 60x100 Feed Weight (%): 22.60

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	58.16	7.41	58.16	7.41	59.67	41.84	13.00	55.79	15.46
P2	20.16	8.19	78.32	7.61	80.18	21.68	17.47	38.84	19.02
P3	6.93	8.76	85.26	7.71	87.19	14.74	21.56	32.61	19.80
P4	3.14	11.91	88.40	7.85	90.25	11.60	24.17	28.78	19.03
P5	3.70	15.72	92.10	8.17	93.71	7.90	28.14	22.80	16.51
P6	2.48	22.34	94.58	8.54	95.84	5.42	30.78	17.13	12.97
P7	5.42	30.78	100.00	9.75	100.00	0.00			
Total (Calc)	100.00	9.75	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

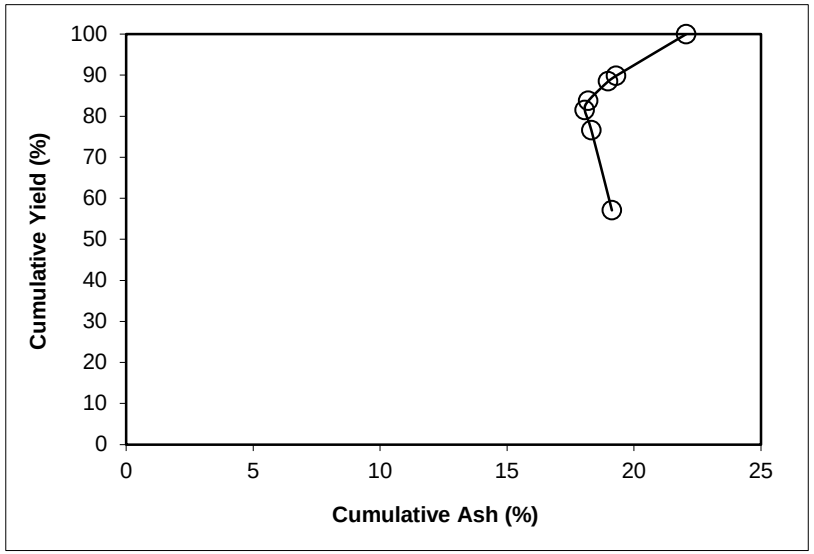
Description: Run 34 -Fine Spiral Test

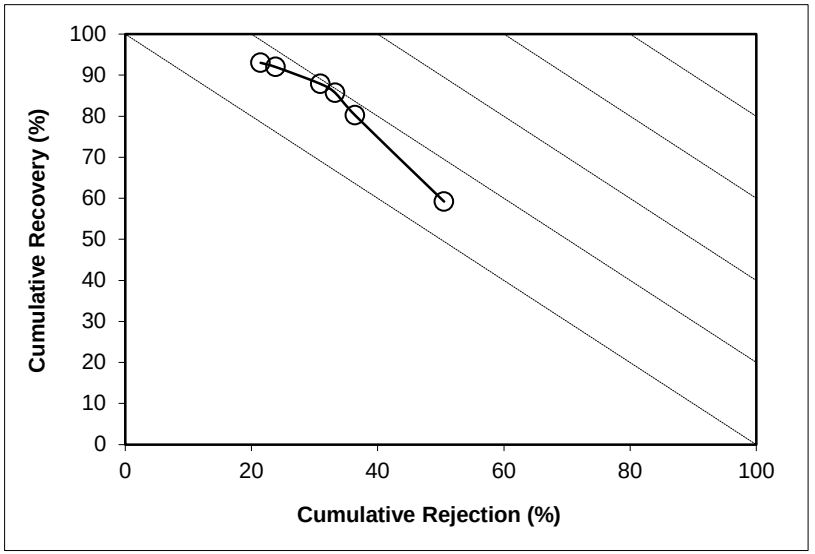
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 28.56

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	57.06	19.13	57.06	19.13	59.20	42.94	25.95	50.52	9.72
P2	19.49	15.96	76.54	18.32	80.21	23.46	34.25	36.42	16.63
P3	4.96	14.01	81.50	18.06	85.68	18.50	39.68	33.27	18.95
P4	2.23	23.30	83.73	18.20	87.88	16.27	41.92	30.91	18.79
P5	4.77	32.82	88.50	18.99	91.99	11.50	45.69	23.82	15.81
P6	1.31	39.80	89.81	19.29	93.00	10.19	46.45	21.45	14.46
P7	10.19	46.45	100.00	22.06	100.00	0.00			
Total (Calc)	100.00	22.06	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

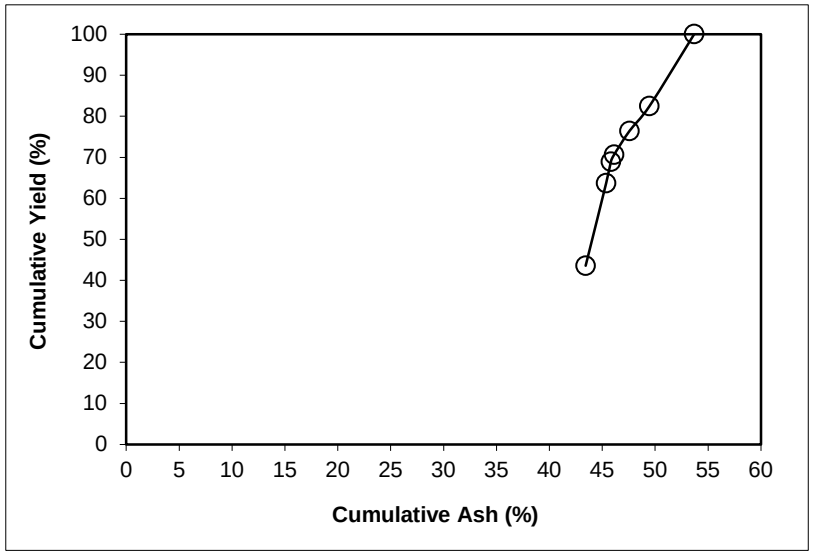
Description: Run 34 -Fine Spiral Test

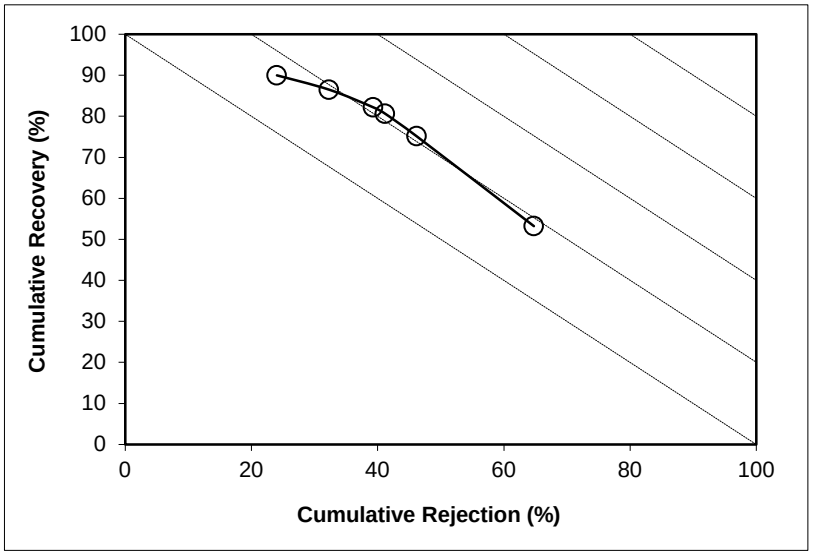
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 10.14

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	43.57	43.43	43.57	43.43	53.22	56.43	61.60	64.76	17.97
P2	20.11	49.56	63.68	45.37	75.11	36.32	68.27	46.19	21.31
P3	5.26	51.26	68.94	45.82	80.65	31.06	71.15	41.17	21.82
P4	1.70	58.47	70.63	46.12	82.17	29.37	71.88	39.32	21.49
P5	5.76	65.31	76.40	47.57	86.49	23.60	73.49	32.31	18.80
P6	6.05	73.31	82.45	49.46	89.98	17.55	73.55	24.04	14.02
P7	17.55	73.55	100.00	53.69	100.00	0.00			
Total (Calc)	100.00	53.69	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

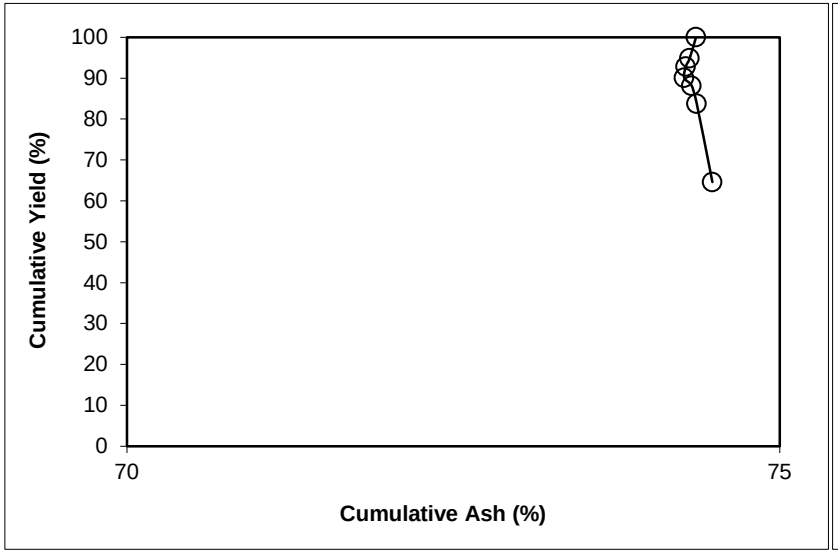
Description: Run 34 -Fine Spiral Test

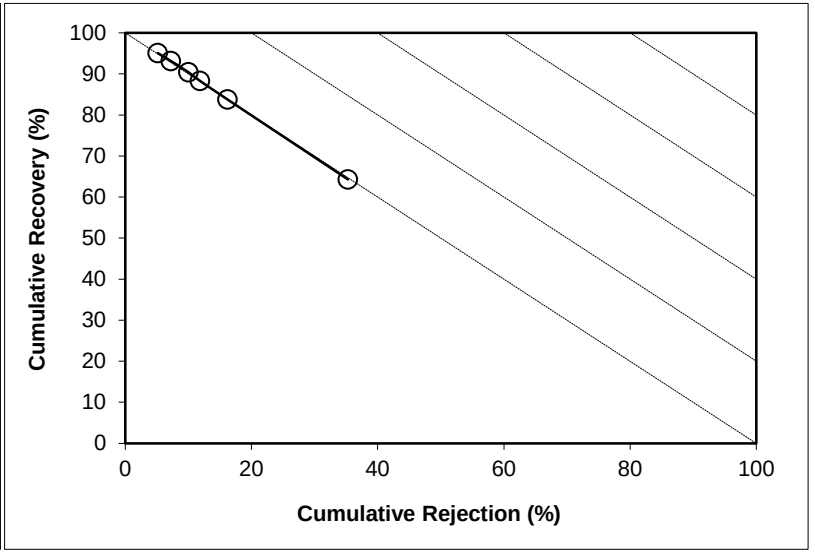
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 34.09

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	64.61	74.48	64.61	74.48	64.29	35.39	74.13	35.28	-0.43
P2	19.16	73.96	83.77	74.36	83.75	16.23	74.33	16.22	-0.03
P3	4.40	73.59	88.17	74.33	88.28	11.83	74.60	11.87	0.15
P4	1.90	71.61	90.07	74.27	90.39	9.93	75.18	10.04	0.43
P5	2.79	74.69	92.86	74.28	93.14	7.14	75.37	7.24	0.38
P6	2.02	75.66	94.89	74.31	95.06	5.11	75.25	5.18	0.24
P7	5.11	75.25	100.00	74.36	100.00	0.00			
Total (Calc)	100.00	74.36	--	--	--	--	--	--	--





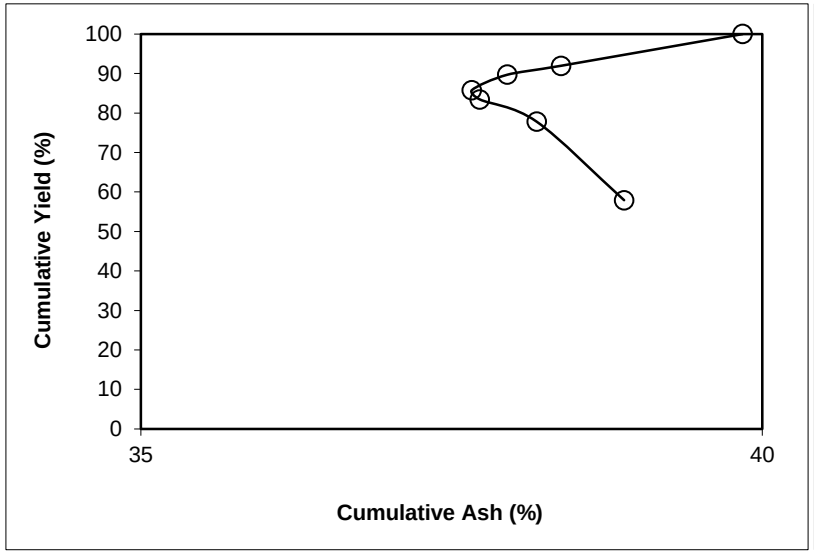
SPIRAL DATA ANALYSIS

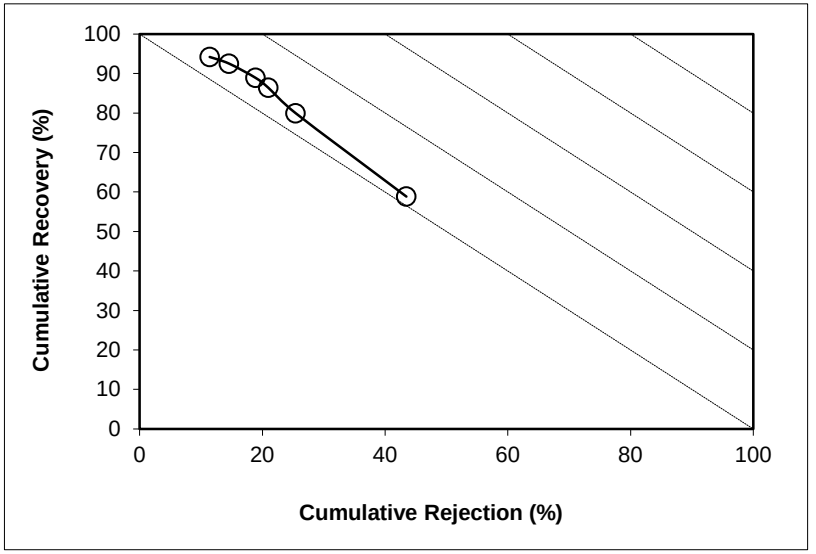
Description: Run 34 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	57.93	38.89	57.93	38.89	58.85	42.07	41.16	43.46	2.31
P2	19.89	36.14	77.81	38.18	79.96	22.19	45.65	25.42	5.38
P3	5.64	31.41	83.45	37.73	86.39	16.55	50.51	20.98	7.36
P4	2.35	35.40	85.80	37.66	88.90	14.20	53.00	18.89	7.80
P5	3.91	44.21	89.70	37.95	92.53	10.30	56.34	14.56	7.09
P6	2.26	55.50	91.96	38.38	94.20	8.04	56.58	11.41	5.61
P7	8.04	56.58	100.00	39.84	100.00	0.00			
Total (Calc)	100.00	39.84	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

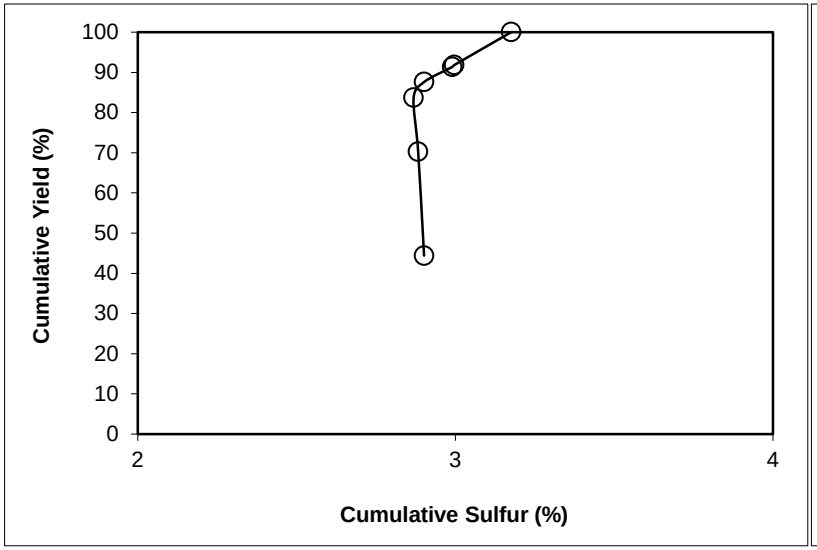
Description: Run 34 -Fine Spiral Test

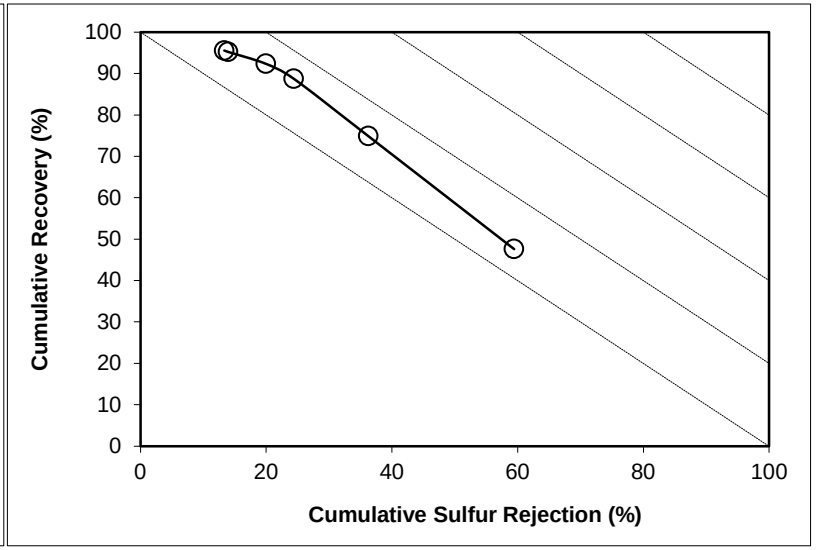
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: +60 Feed Weight (%): 4.61

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	44.40	2.90	44.40	2.90	47.59	55.60	3.40	59.44	7.03
P2	25.85	2.85	70.25	2.88	74.90	29.75	3.87	36.24	11.13
P3	13.48	2.79	83.73	2.87	88.76	16.27	4.76	24.38	13.13
P4	3.89	3.62	87.62	2.90	92.37	12.38	5.12	19.94	12.30
P5	3.75	5.07	91.37	2.99	95.22	8.63	5.14	13.96	9.18
P6	0.46	4.20	91.83	3.00	95.56	8.17	5.19	13.35	8.91
P7	8.17	5.19	100.00	3.18	100.00	0.00			
Total (Calc)	100.00	3.18	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

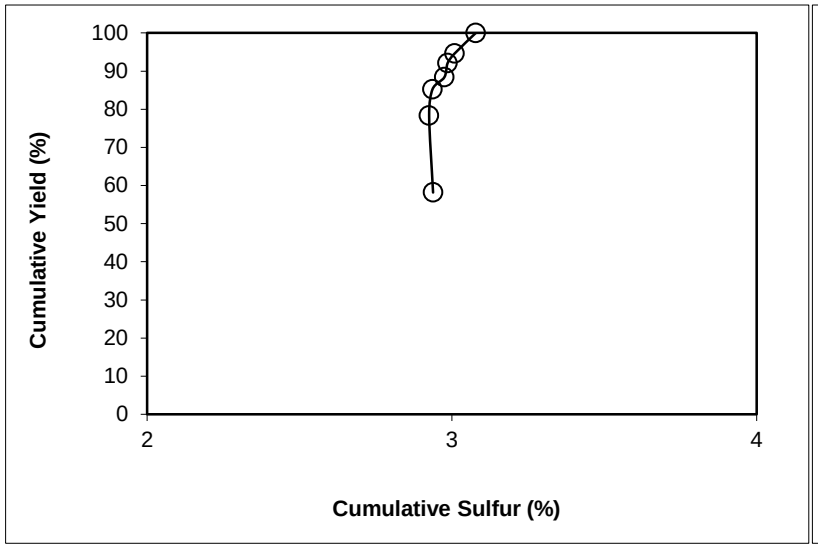
Description: Run 34 -Fine Spiral Test

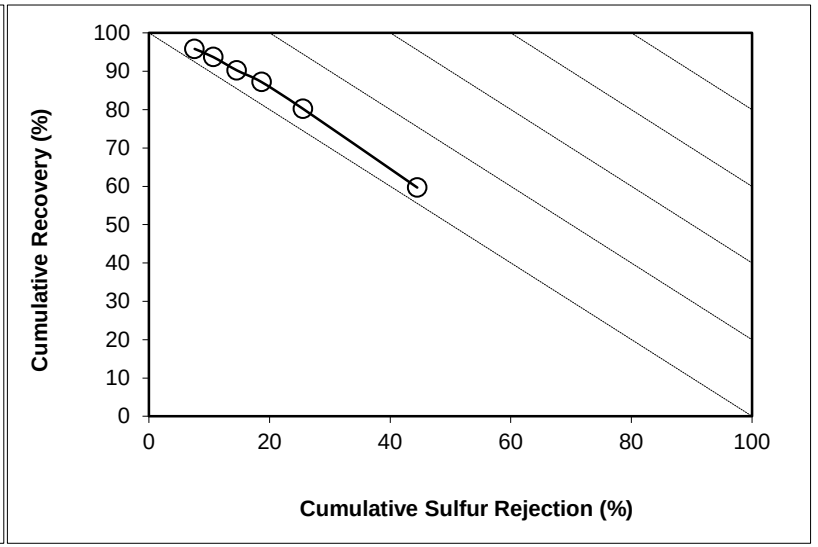
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 60x100 Feed Weight (%): 22.60

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	58.16	2.94	58.16	2.94	59.67	41.84	3.27	44.48	4.16
P2	20.16	2.89	78.32	2.93	80.18	21.68	3.63	25.57	5.75
P3	6.93	3.06	85.26	2.94	87.19	14.74	3.90	18.67	5.86
P4	3.14	4.03	88.40	2.98	90.25	11.60	3.86	14.56	4.82
P5	3.70	3.24	92.10	2.99	93.71	7.90	4.16	10.67	4.38
P6	2.48	3.85	94.58	3.01	95.84	5.42	4.30	7.57	3.41
P7	5.42	4.30	100.00	3.08	100.00	0.00			
Total (Calc)	100.00	3.08	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

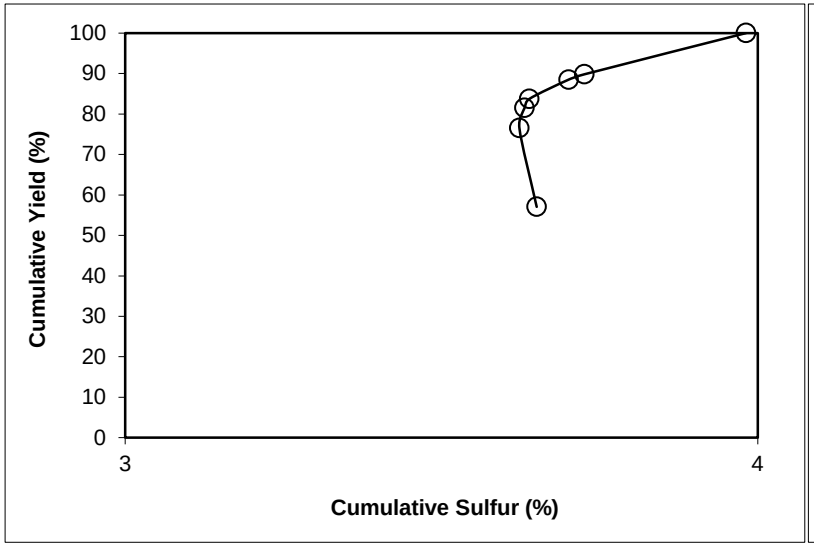
Description: Run 34 -Fine Spiral Test

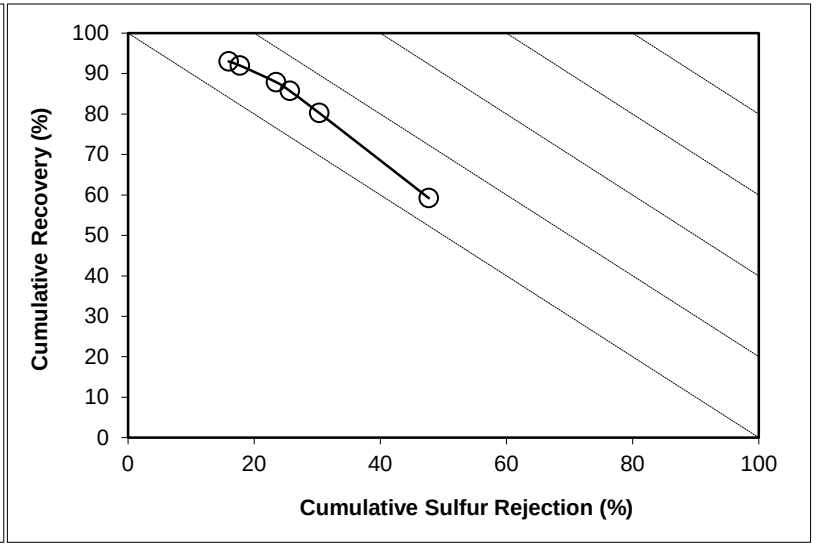
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 28.56

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	57.06	3.65	57.06	3.65	59.20	42.94	4.42	47.69	6.89
P2	19.49	3.54	76.54	3.62	80.21	23.46	5.15	30.35	10.56
P3	4.96	3.76	81.50	3.63	85.68	18.50	5.52	25.67	11.35
P4	2.23	3.91	83.73	3.64	87.88	16.27	5.75	23.47	11.35
P5	4.77	4.79	88.50	3.70	91.99	11.50	6.14	17.73	9.72
P6	1.31	5.40	89.81	3.73	93.00	10.19	6.24	15.95	8.95
P7	10.19	6.24	100.00	3.98	100.00	0.00			
Total (Calc)	100.00	3.98	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

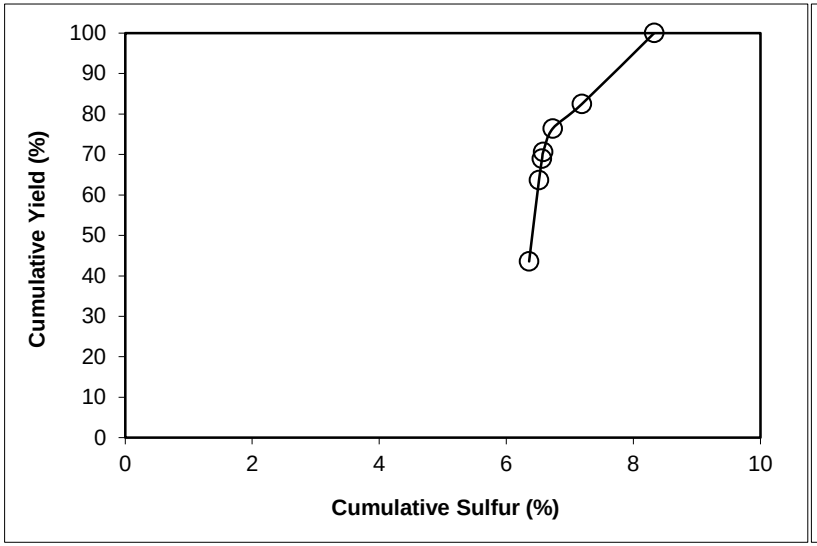
Description: Run 34 -Fine Spiral Test

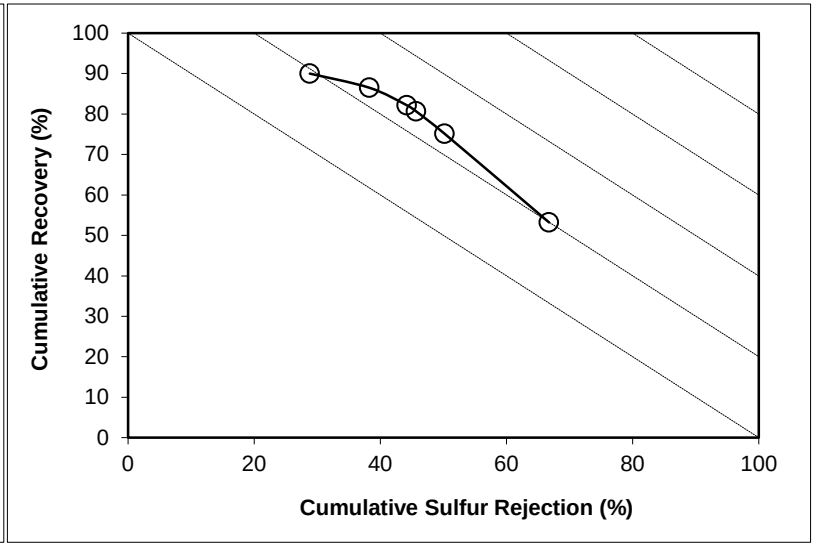
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 10.14

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	43.57	6.36	43.57	6.36	53.22	56.43	9.85	66.74	19.95
P2	20.11	6.85	63.68	6.51	75.11	36.32	11.51	50.19	25.30
P3	5.26	7.15	68.94	6.56	80.65	31.06	12.24	45.67	26.32
P4	1.70	7.31	70.63	6.58	82.17	29.37	12.53	44.18	26.35
P5	5.76	8.56	76.40	6.73	86.49	23.60	13.50	38.26	24.75
P6	6.05	12.98	82.45	7.19	89.98	17.55	13.68	28.83	18.80
P7	17.55	13.68	100.00	8.33	100.00	0.00			
Total (Calc)	100.00	8.33	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

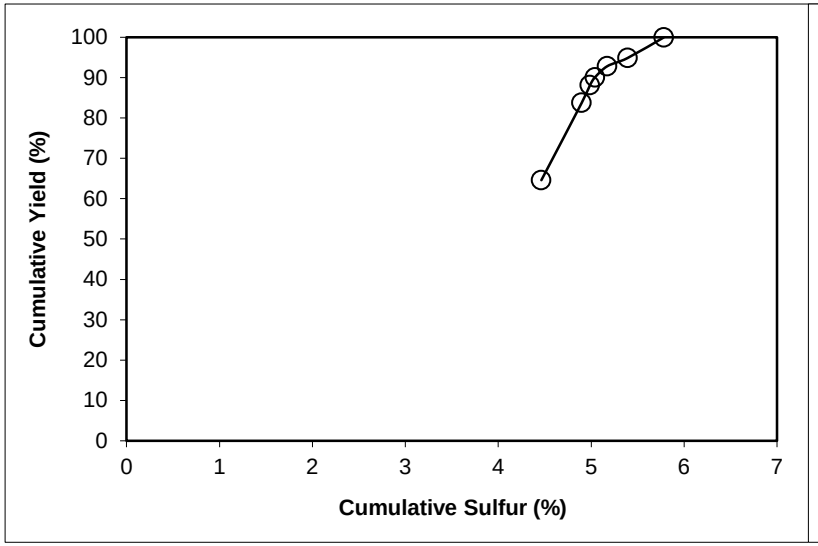
Description: Run 34 -Fine Spiral Test

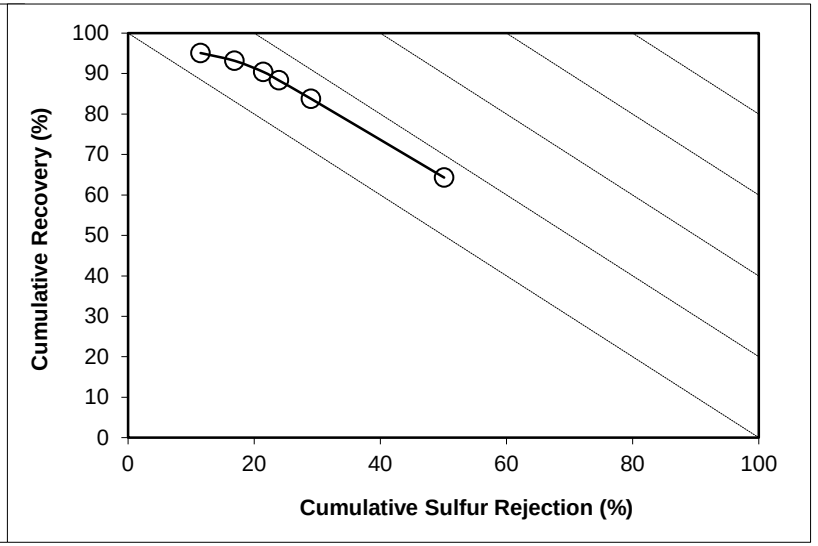
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 34.09

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	64.61	4.46	64.61	4.46	64.29	35.39	8.18	50.11	14.40
P2	19.16	6.36	83.77	4.90	83.75	16.23	10.34	29.03	12.78
P3	4.40	6.70	88.17	4.99	88.28	11.83	11.69	23.93	12.21
P4	1.90	7.47	90.07	5.04	90.39	9.93	12.50	21.47	11.86
P5	2.79	9.46	92.86	5.17	93.14	7.14	13.69	16.90	10.04
P6	2.02	15.39	94.89	5.39	95.06	5.11	13.01	11.51	6.58
P7	5.11	13.01	100.00	5.78	100.00	0.00			
Total (Calc)	100.00	5.78	--	--	--	--	--	--	--





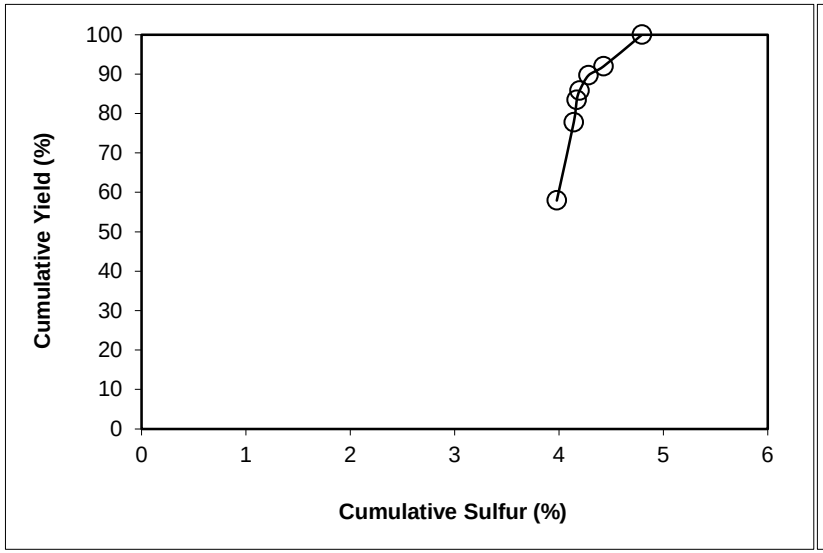
SPIRAL DATA ANALYSIS

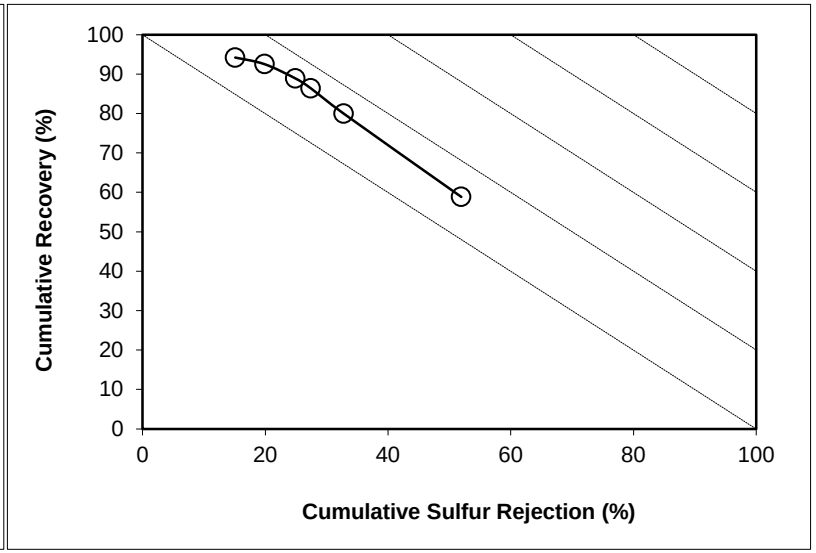
Description: Run 34 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	57.93	3.98	57.93	3.98	58.85	42.07	5.92	51.94	10.78
P2	19.89	4.62	77.81	4.14	79.96	22.19	7.09	32.79	12.75
P3	5.64	4.56	83.45	4.17	86.39	16.55	7.95	27.42	13.81
P4	2.35	5.16	85.80	4.20	88.90	14.20	8.41	24.90	13.80
P5	3.91	6.17	89.70	4.28	92.53	10.30	9.25	19.87	12.40
P6	2.26	10.11	91.96	4.43	94.20	8.04	9.01	15.10	9.30
P7	8.04	9.01	100.00	4.79	100.00	0.00			
Total (Calc)	100.00	4.79	--	--	--	--	--	--	--

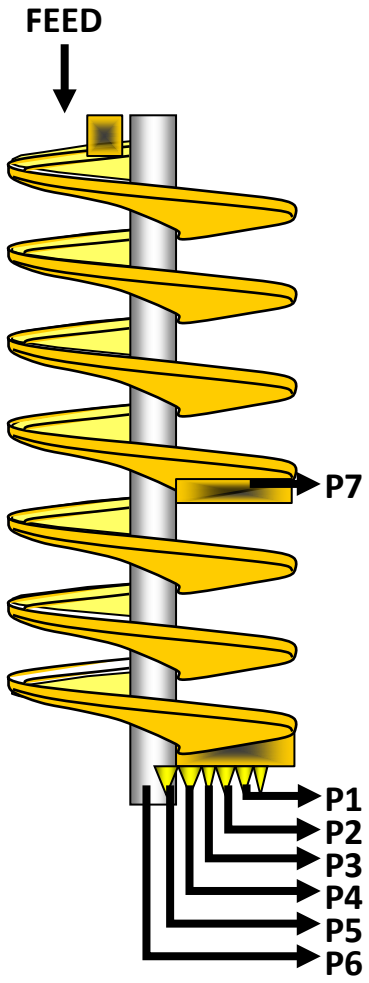




SPIRAL DATA ANALYSIS

Description: Run 35 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	0.326	10.1	11.60	12.41
P2	0.157	12.3	4.48	4.88
P3	0.045	15.7	0.96	1.08
P4	0.017	18.5	0.30	0.35
P5	0.028	19.9	0.45	0.52
P6	0.017	24.3	0.21	0.24
P7	0.057	27.4	0.61	0.73
Total	0.647	12.2	18.61	20.21

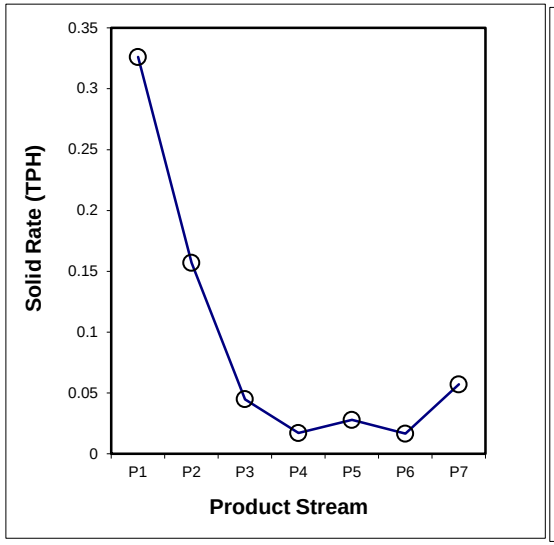
SPIRAL DATA ANALYSIS

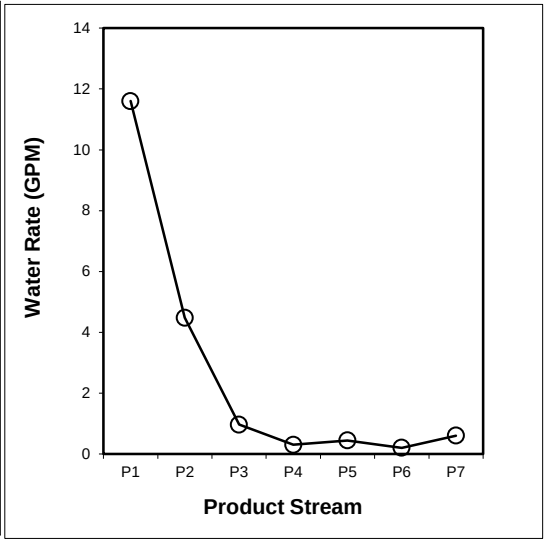
Description: Run 35 -Fine Spiral Test

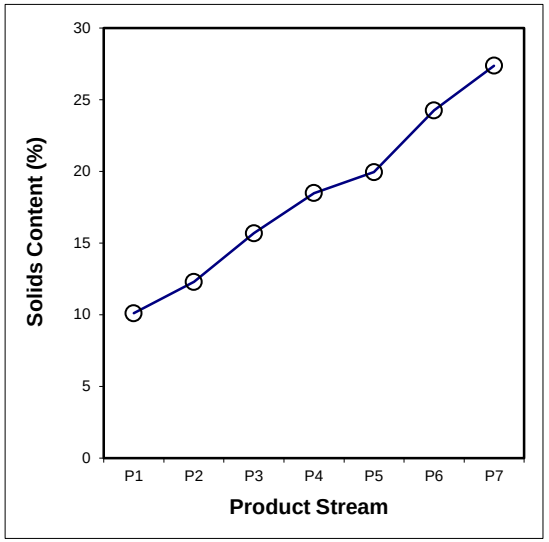
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	5	5183.00	1052.00	3.227	1640.9	1229.7	0.326	50.43	10.11
P2	5	1807.23	172.88	1.277	1694.0	1496.0	0.157	24.27	12.29
P3	15	1270.00	171.72	0.286	1649.6	1479.9	0.045	6.94	15.68
P4	35	1002.73	172.29	0.093	1597.8	1446.5	0.017	2.65	18.49
P5	20	887.08	170.24	0.140	1637.0	1496.1	0.028	4.32	19.95
P6	35	782.51	170.52	0.068	1626.1	1479.8	0.017	2.56	24.26
P7	15	971.68	171.58	0.208	1445.5	1229.6	0.057	8.83	27.37
Total (Calc)	--	--	--	5.299	--	--	0.647	100.00	12.20
Total (Head)	0.83	1360.79	246.32	5.299	1582.7	1446.7	0.647	--	12.20







SPIRAL DATA ANALYSIS

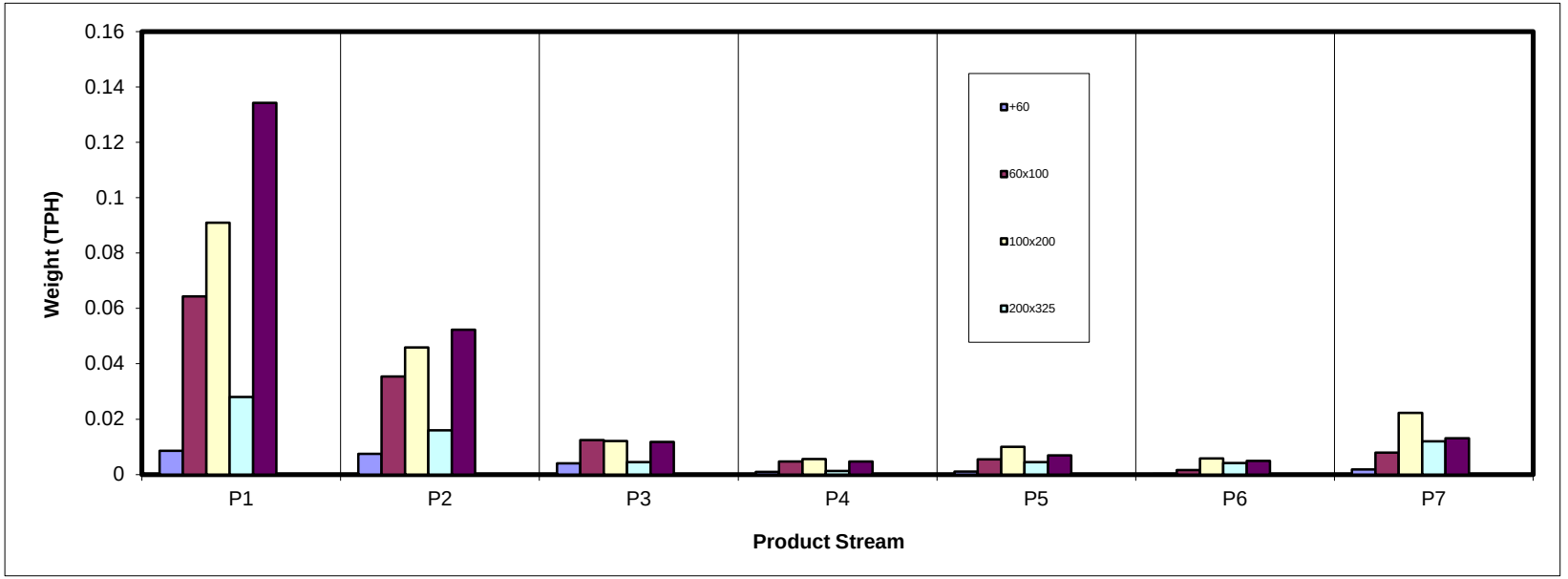
Description: Run 35 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	0.009	0.007	0.004	0.001	0.001	0.000	0.002		0.024
60x100	0.064	0.035	0.012	0.005	0.005	0.002	0.008		0.132
100x200	0.091	0.046	0.012	0.006	0.010	0.006	0.022		0.192
200x325	0.028	0.016	0.005	0.001	0.004	0.004	0.012		0.070
-325	0.134	0.052	0.012	0.005	0.007	0.005	0.013		0.228
Total (Calc)	0.326	0.157	0.045	0.017	0.028	0.017	0.057		0.647



SPIRAL DATA ANALYSIS

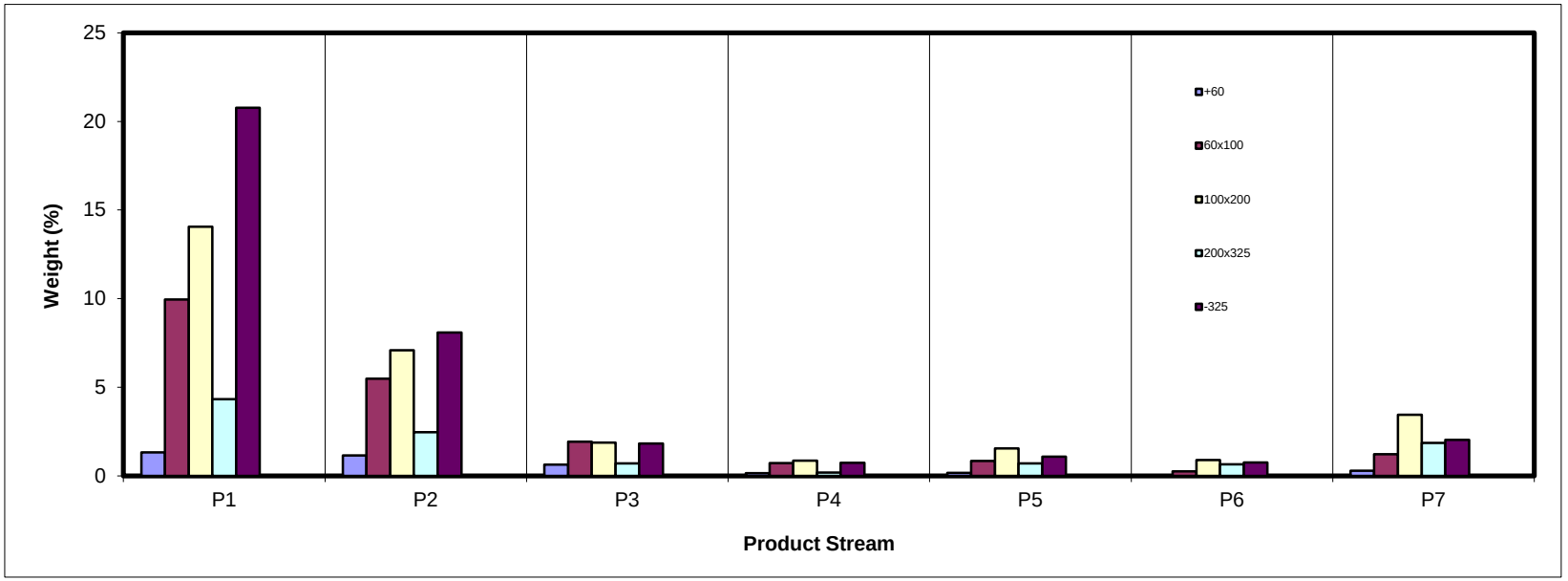
Description: Run 35 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	1.32	1.15	0.63	0.15	0.16	0.02	0.28		3.71
60x100	9.95	5.48	1.92	0.72	0.85	0.25	1.22		20.39
100x200	14.06	7.09	1.87	0.86	1.54	0.89	3.44		29.75
200x325	4.33	2.47	0.70	0.19	0.70	0.64	1.86		10.89
-325	20.77	8.09	1.82	0.73	1.07	0.75	2.03		35.27
Total (Calc)	50.43	24.27	6.94	2.65	4.32	2.56	8.83		100.00



SPIRAL DATA ANALYSIS

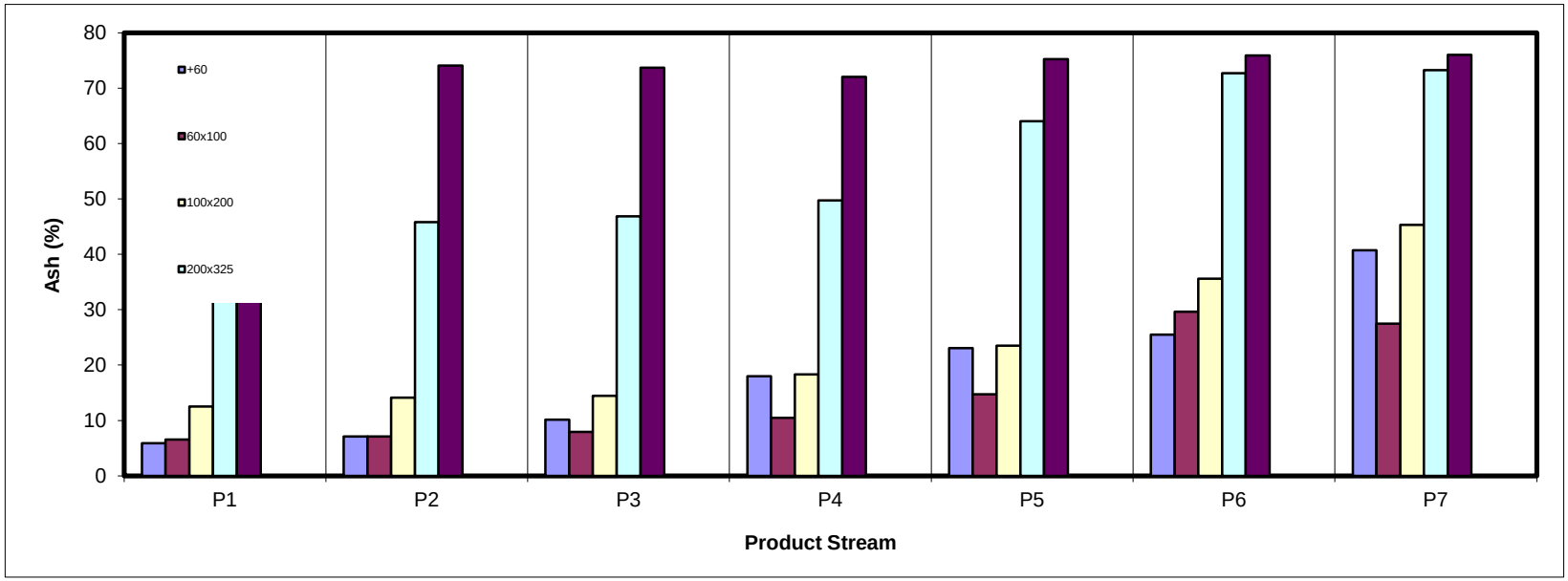
Description: Run 35 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	5.88	7.12	10.12	17.98	23.07	25.50	40.72		10.97
60x100	6.56	7.11	7.93	10.49	14.72	29.63	27.50		8.85
100x200	12.52	14.13	14.45	18.34	23.50	35.60	45.33		18.25
200x325	39.86	45.79	46.84	49.74	64.05	72.68	73.26		51.02
-325	73.64	74.07	73.67	72.03	75.20	75.91	75.99		73.94
Total (Calc)	38.69	35.41	31.05	33.25	41.15	56.11	55.64		39.27



SPIRAL DATA ANALYSIS

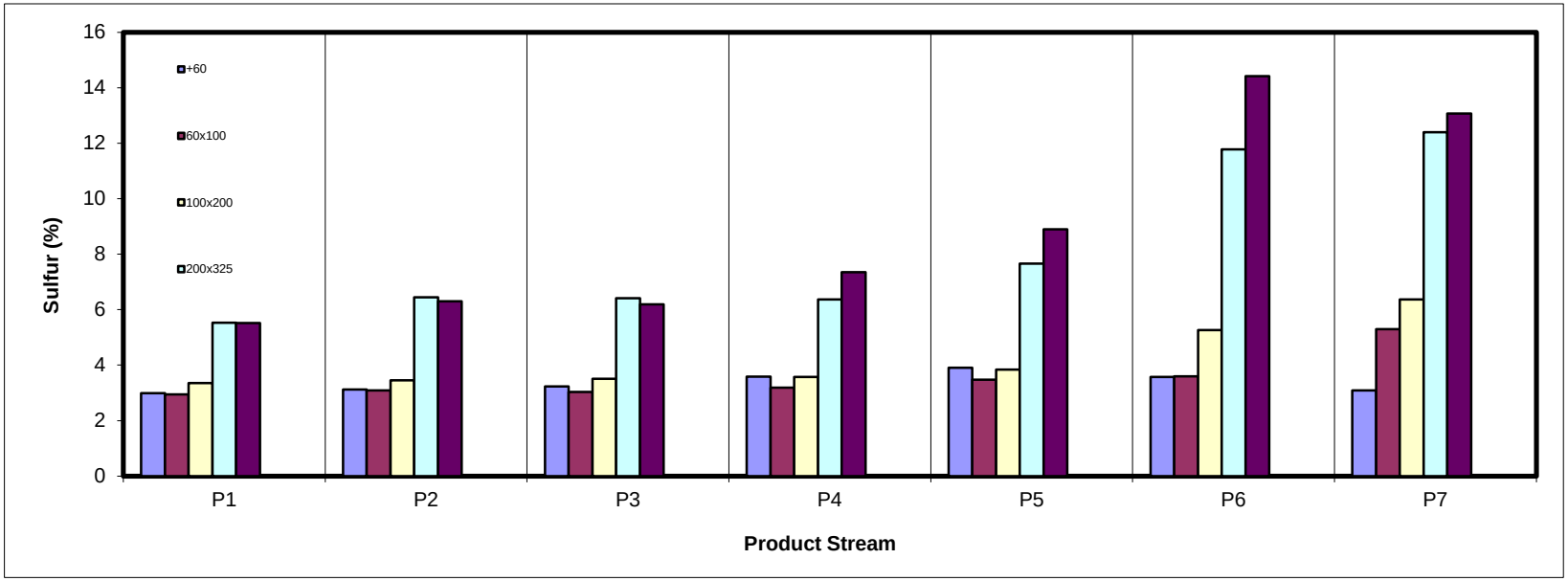
Description: Run 35 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Sulfur Content (%)

Sample ID	Dry Sulfur Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	2.99	3.12	3.23	3.58	3.90	3.58	3.09		3.15
60x100	2.94	3.09	3.03	3.19	3.47	3.60	5.30		3.17
100x200	3.35	3.45	3.50	3.58	3.84	5.27	6.37		3.82
200x325	5.53	6.44	6.41	6.37	7.66	11.78	12.39		7.49
-325	5.52	6.30	6.19	7.35	8.90	14.42	13.07		6.50
Total (Calc)	4.34	4.61	4.35	4.71	5.64	9.42	8.92		5.01



SPIRAL DATA ANALYSIS

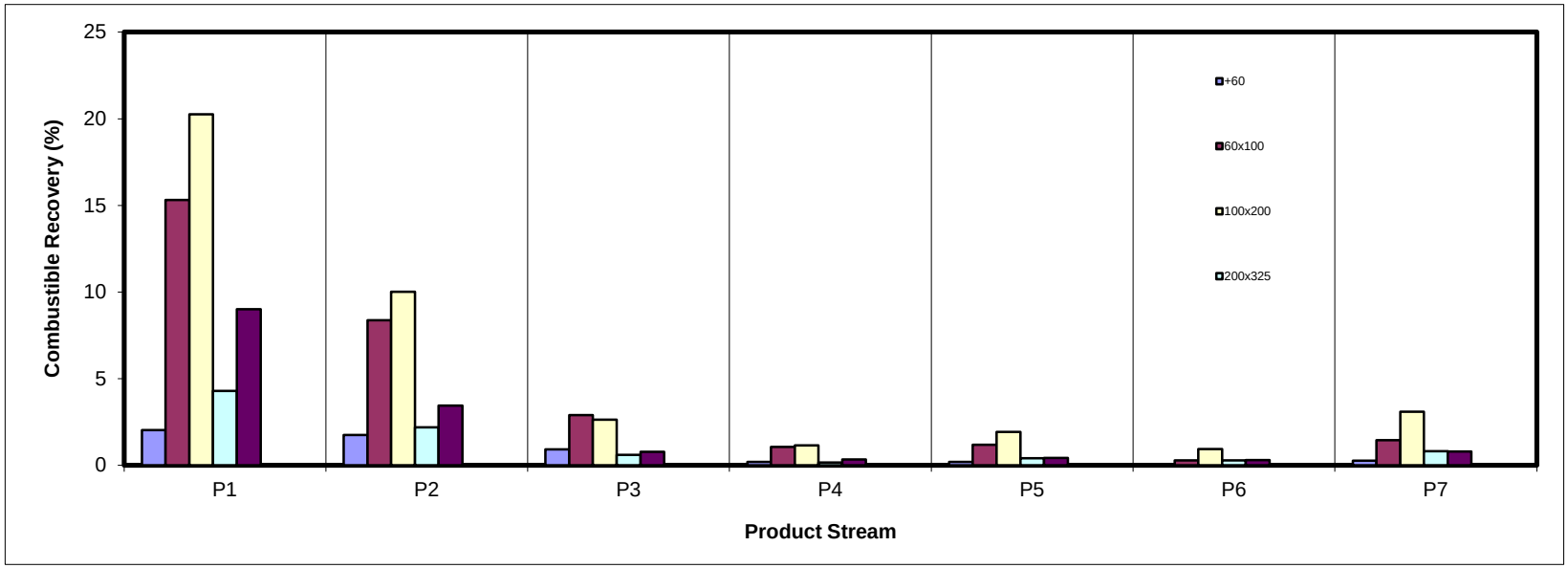
Description: Run 35 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	2.04	1.75	0.93	0.20	0.21	0.03	0.27		5.43
60x100	15.32	8.38	2.91	1.06	1.19	0.29	1.46		30.60
100x200	20.25	10.02	2.63	1.16	1.94	0.95	3.10		40.05
200x325	4.29	2.20	0.61	0.16	0.41	0.29	0.82		8.78
-325	9.01	3.46	0.79	0.34	0.44	0.30	0.80		15.13
Total (Calc)	50.91	25.81	7.88	2.91	4.19	1.85	6.45		100.00



SPIRAL DATA ANALYSIS

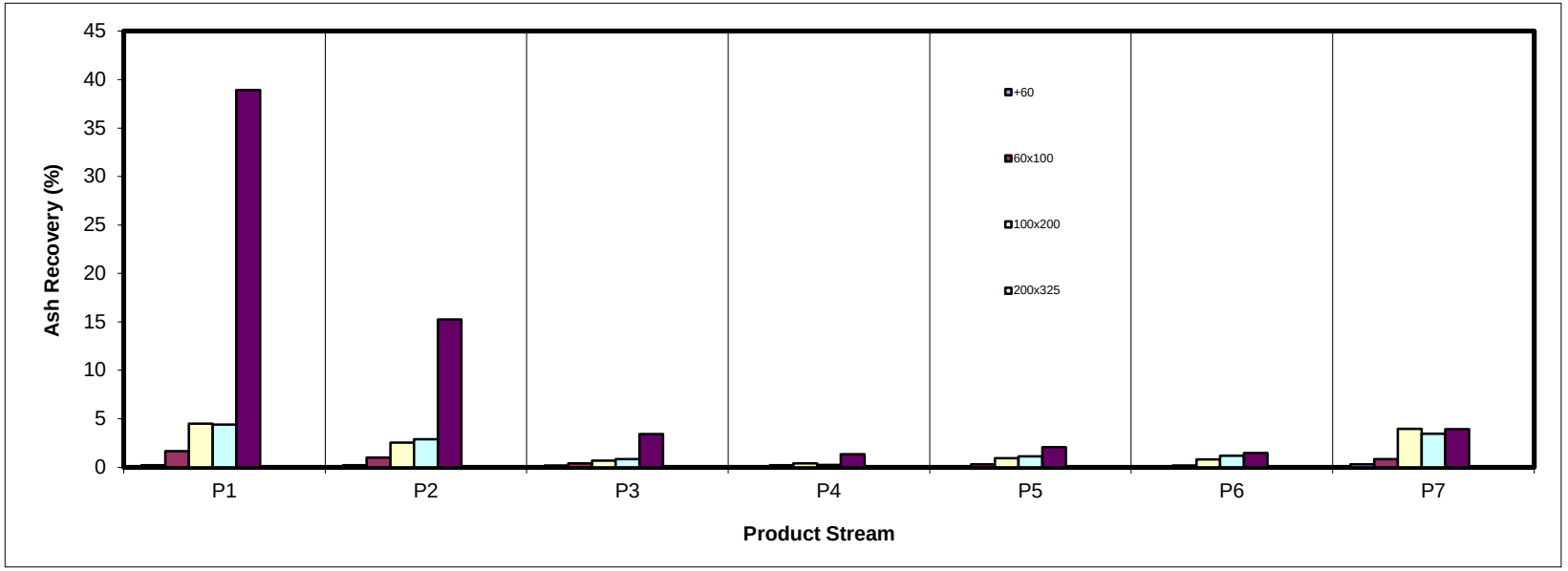
Description: Run 35 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	0.20	0.21	0.16	0.07	0.10	0.01	0.29		1.04
60x100	1.66	0.99	0.39	0.19	0.32	0.19	0.85		4.59
100x200	4.48	2.55	0.69	0.40	0.92	0.81	3.97		13.83
200x325	4.40	2.87	0.83	0.24	1.13	1.19	3.47		14.14
-325	38.94	15.26	3.42	1.34	2.06	1.46	3.92		66.40
Total (Calc)	49.68	21.89	5.49	2.24	4.53	3.66	12.51		100.00



SPIRAL DATA ANALYSIS

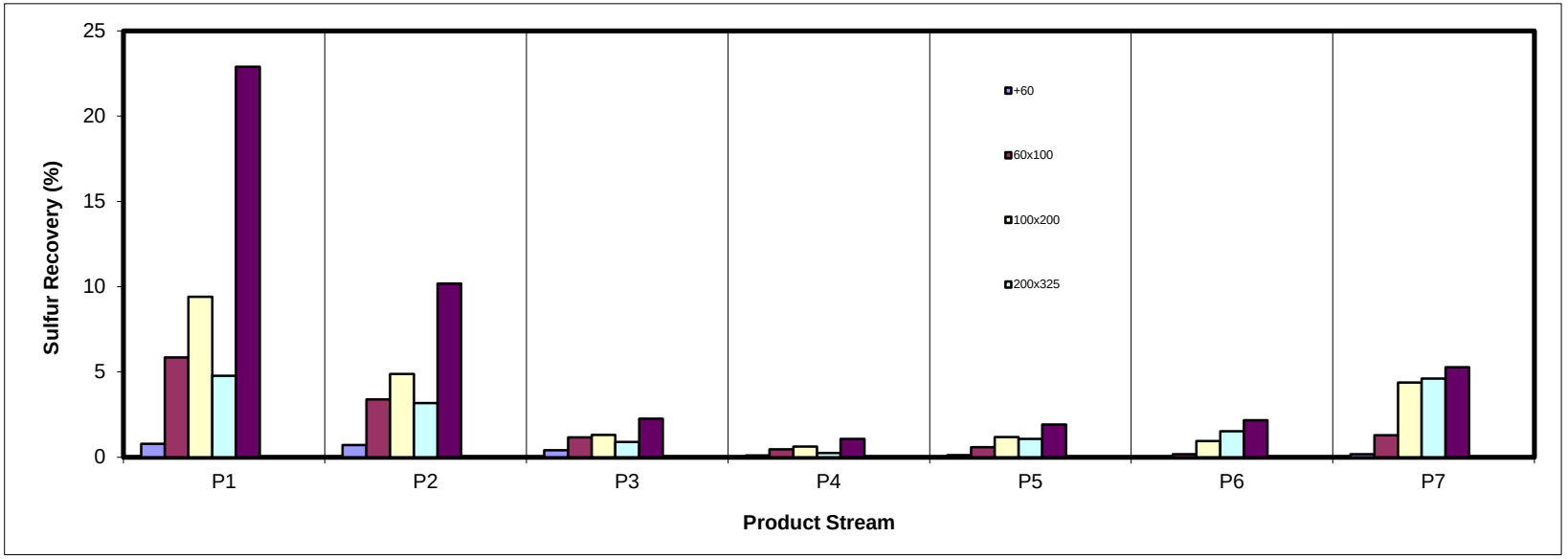
Description: Run 35 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Sulfur Recovery (%)

Sample ID	Sulfur Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	0.79	0.71	0.41	0.10	0.13	0.02	0.17		2.33
60x100	5.85	3.38	1.16	0.46	0.59	0.18	1.29		12.92
100x200	9.40	4.89	1.31	0.62	1.18	0.94	4.38		22.71
200x325	4.78	3.17	0.89	0.24	1.06	1.51	4.61		16.27
-325	22.90	10.18	2.25	1.07	1.91	2.17	5.28		45.77
Total (Calc)	43.72	22.34	6.02	2.50	4.87	4.82	15.73		100.00



SPIRAL DATA ANALYSIS

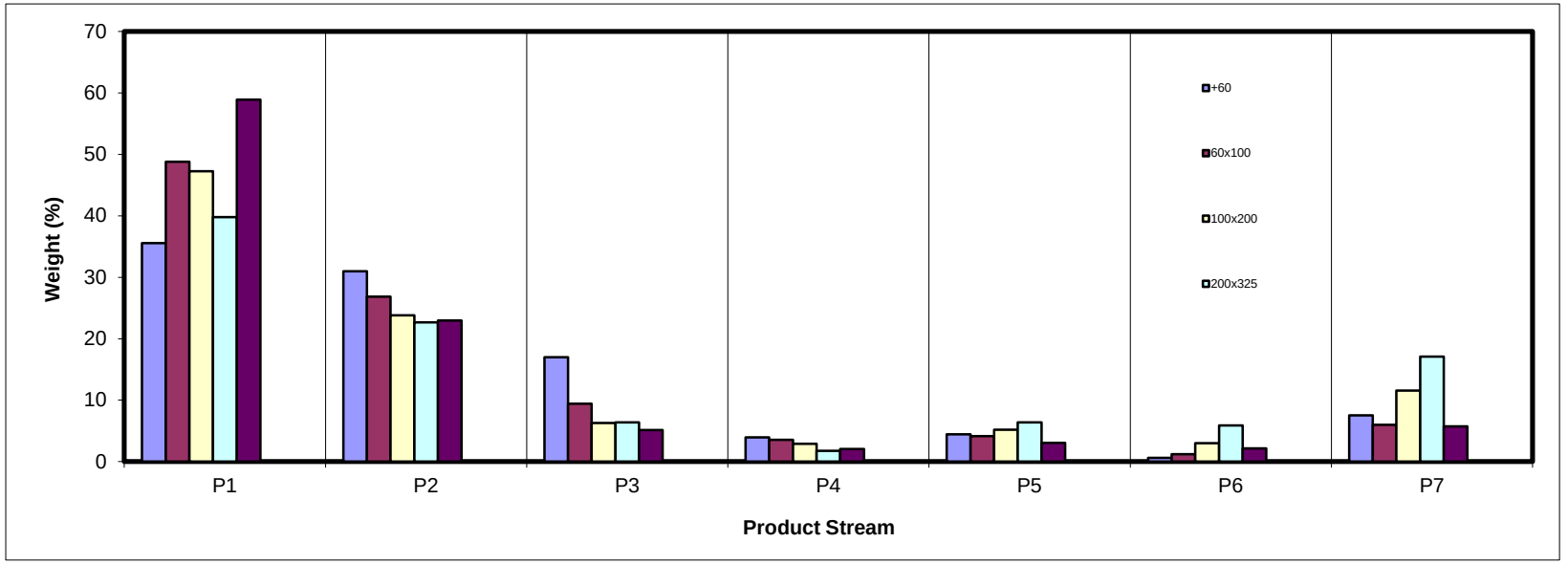
Description: Run 35 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	35.54	30.96	16.99	3.93	4.43	0.61	7.55		100.00
60x100	48.82	26.87	9.41	3.54	4.15	1.22	5.98		100.00
100x200	47.25	23.83	6.29	2.90	5.18	3.00	11.56		100.00
200x325	39.80	22.65	6.41	1.75	6.39	5.91	17.09		100.00
-325	58.89	22.95	5.16	2.07	3.05	2.14	5.74		100.00
Total (Calc)	50.43	24.27	6.94	2.65	4.32	2.56	8.83		100.00



SPIRAL DATA ANALYSIS

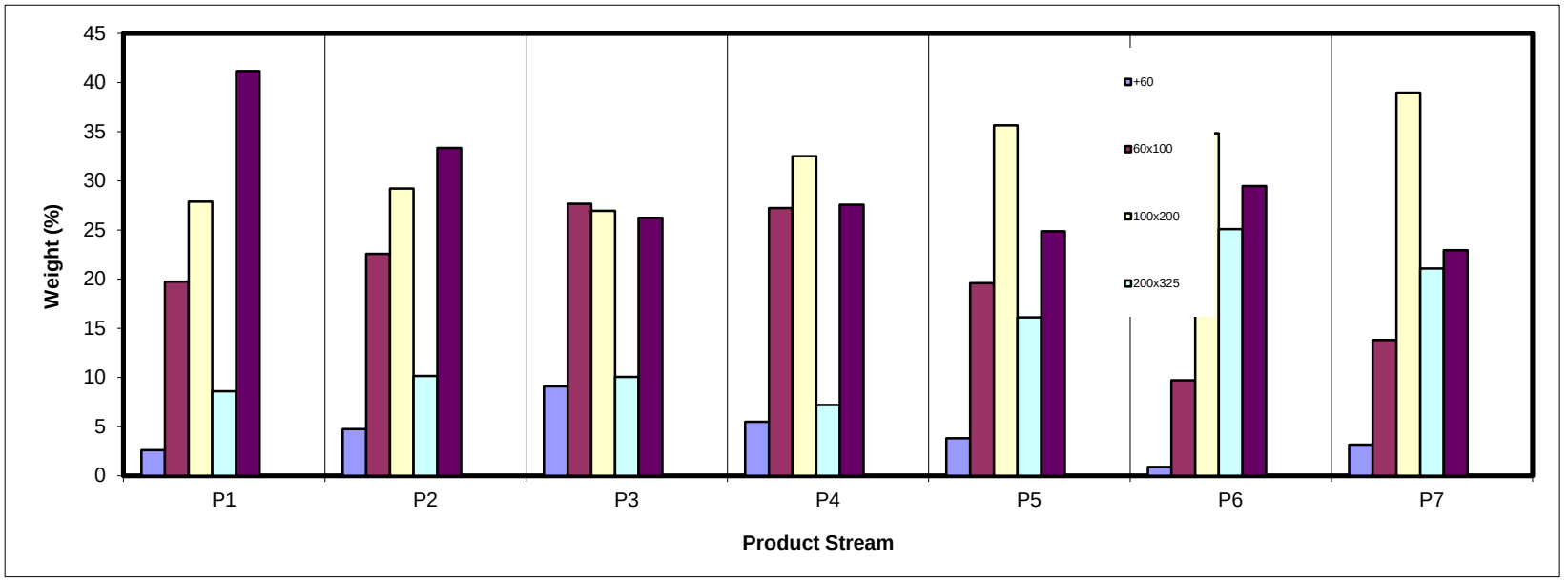
Description: Run 35 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	2.61	4.73	9.07	5.49	3.80	0.88	3.17		3.71
60x100	19.74	22.57	27.66	27.24	19.57	9.72	13.82		20.39
100x200	27.88	29.21	26.96	32.50	35.65	34.85	38.98		29.75
200x325	8.59	10.16	10.06	7.19	16.11	25.09	21.08		10.89
-325	41.18	33.34	26.24	27.57	24.87	29.45	22.95		35.27
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

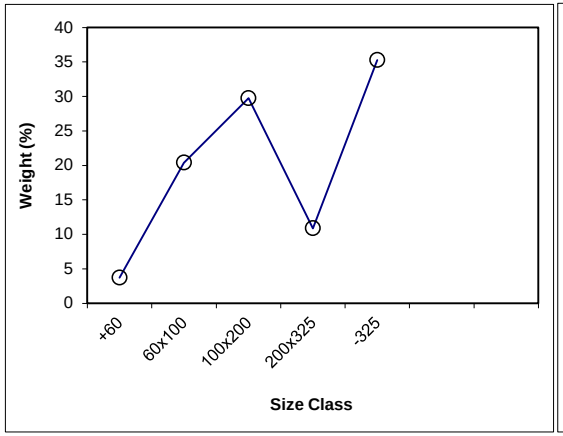
Description: Run 35 -Fine Spiral Test

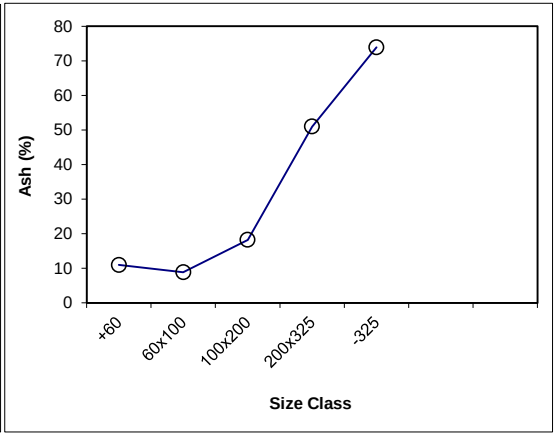
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

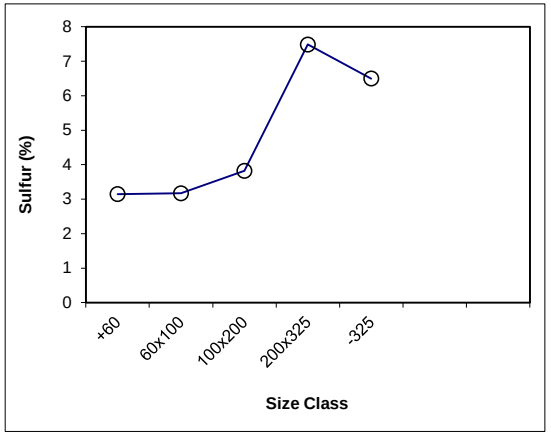
FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	327.9	322.9	5.04	3.71	10.97	3.15	3.71	10.97	3.15	100.00	39.27	5.01
60x100	394.7	367.0	27.73	20.39	8.85	3.17	24.09	9.18	3.17	96.29	40.36	5.08
100x200	387.9	347.4	40.46	29.75	18.25	3.82	53.85	14.19	3.53	75.91	48.82	5.59
200x325	418.0	403.2	14.80	10.89	51.02	7.49	64.73	20.38	4.19	46.15	68.53	6.73
-325	54.2	6.2	47.96	35.27	73.94	6.50	100.00	39.27	5.01	35.27	73.94	6.50
Total (Calc)	--	--	136.00	100.00	39.27	5.01	--	--		--		--







SPIRAL DATA ANALYSIS

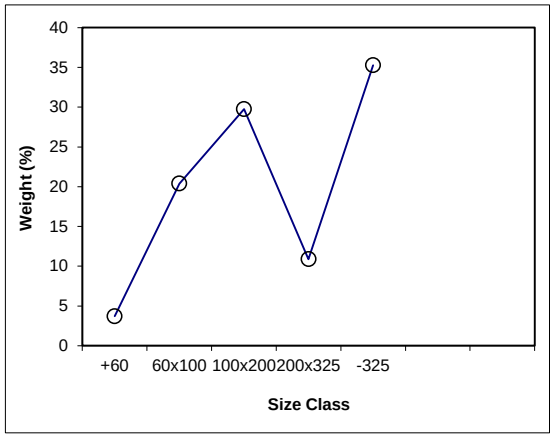
Description: Run 35 -Fine Spiral Test

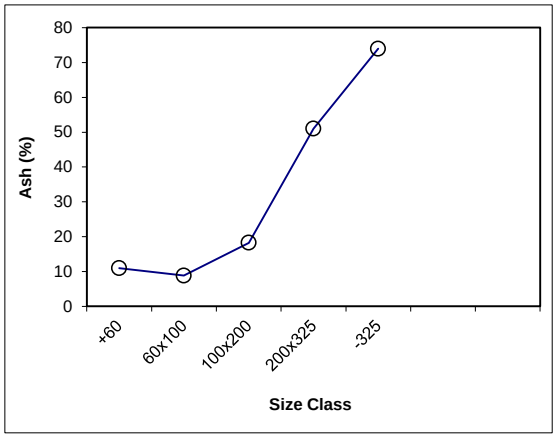
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

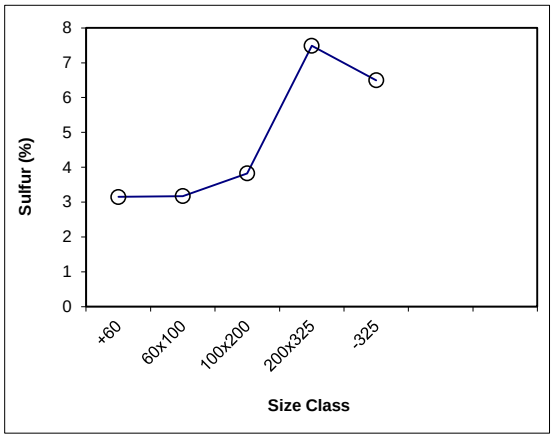
FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed			Select Size Class	Dry Weight (%)	Dry Ash (%)
				Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)			
+60	3.71	10.97	3.15	3.71	10.97	3.15	100.00	39.27	5.01	x	3.71	10.97
60x100	20.39	8.85	3.17	24.09	9.18	3.17	96.29	40.36	5.08	x	20.39	8.85
100x200	29.75	18.25	3.82	53.85	14.19	3.53	75.91	48.82	5.59	x	29.75	18.25
200x325	10.89	51.02	7.49	64.73	20.38	4.19	46.15	68.53	6.73	x	10.89	51.02
-325	35.27	73.94	6.50	100.00	39.27	5.01	35.27	73.94	6.50		35.27	73.94
Total (Calc)	100.00	39.27	5.01	--	--		--	--			100.00	39.27







SPIRAL DATA ANALYSIS

Description: Run 35 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 50.43

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	333.6	322.9	10.74	2.61	5.88	2.99	2.61	5.88	2.99	100.00	38.69	4.34
60x100	389.3	308.1	81.18	19.74	6.56	2.94	22.35	6.48	2.95	97.39	39.57	4.38
100x200	409.1	294.5	114.64	27.88	12.52	3.35	50.23	9.84	3.17	77.65	47.96	4.74
200x325	333.3	298.0	35.33	8.59	39.86	5.53	58.82	14.22	3.52	49.77	67.81	5.52
-325	175.6	6.2	169.36	41.18	73.64	5.52	100.00	38.69	4.34	41.18	73.64	5.52
Total (Calc)	--	--	411.25	100.00	38.69	4.34	--	--		--		--

Product P2 Feed Weight (%): 24.27

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	332.3	322.9	9.36	4.73	7.12	3.12	4.73	7.12	3.12	100.00	35.41	4.61
60x100	441.9	397.2	44.67	22.57	7.11	3.09	27.29	7.11	3.10	95.27	36.82	4.68
100x200	449.1	391.3	57.82	29.21	14.13	3.45	56.50	10.74	3.28	72.71	46.04	5.17
200x325	398.7	378.6	20.10	10.16	45.79	6.44	66.66	16.08	3.76	43.50	67.46	6.33
-325	72.0	6.0	66.00	33.34	74.07	6.30	100.00	35.41	4.61	33.34	74.07	6.30
Total (Calc)	--	--	197.95	100.00	35.41	4.61	--	--		--		--

SPIRAL DATA ANALYSIS

Description: Run 35 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 6.94

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	338.3	322.9	15.40	9.07	10.12	3.23	9.07	10.12	3.23	100.00	31.05	4.35
60x100	434.7	387.7	46.96	27.66	7.93	3.03	36.74	8.47	3.08	90.93	33.14	4.46
100x200	422.6	376.8	45.76	26.96	14.45	3.50	63.70	11.00	3.26	63.26	44.17	5.08
200x325	403.4	386.3	17.08	10.06	46.84	6.41	73.76	15.89	3.69	36.30	66.24	6.25
-325	50.7	6.2	44.55	26.24	73.67	6.19	100.00	31.05	4.35	26.24	73.67	6.19
Total (Calc)	--	--	169.74	100.00	31.05	4.35	--	--		--		--

Product P4 Feed Weight (%): 2.65

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	331.2	322.9	8.31	5.49	17.98	3.58	5.49	17.98	3.58	100.00	33.25	4.71
60x100	408.2	367.0	41.22	27.24	10.49	3.19	32.73	11.75	3.26	94.51	34.13	4.78
100x200	396.6	347.4	49.18	32.50	18.34	3.58	65.23	15.03	3.42	67.27	43.71	5.42
200x325	414.1	403.2	10.89	7.19	49.74	6.37	72.43	18.48	3.71	34.77	67.42	7.15
-325	47.7	6.0	41.73	27.57	72.03	7.35	100.00	33.25	4.71	27.57	72.03	7.35
Total (Calc)	--	--	151.32	100.00	33.25	4.71	--	--		--		--

SPIRAL DATA ANALYSIS

Description: Run 35 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 4.32

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	328.3	322.9	5.36	3.80	23.07	3.90	3.80	23.07	3.90	100.00	41.15	5.64
60x100	424.8	397.2	27.58	19.57	14.72	3.47	23.37	16.08	3.54	96.20	41.87	5.71
100x200	441.5	391.3	50.24	35.65	23.50	3.84	59.03	20.56	3.72	76.63	48.80	6.28
200x325	401.3	378.6	22.70	16.11	64.05	7.66	75.13	29.89	4.57	40.97	70.82	8.41
-325	41.1	6.1	35.04	24.87	75.20	8.90	100.00	41.15	5.64	24.87	75.20	8.90
Total (Calc)	--	--	140.92	100.00	41.15	5.64	--	--		--		--

Product P6 Feed Weight (%): 2.56

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	324.2	322.9	1.29	0.88	25.50	3.58	0.88	25.50	3.58	100.00	56.11	9.42
60x100	401.9	387.7	14.23	9.72	29.63	3.60	10.61	29.29	3.60	99.12	56.38	9.47
100x200	427.8	376.8	51.00	34.85	35.60	5.27	45.46	34.12	4.88	89.39	59.29	10.11
200x325	423.0	386.3	36.72	25.09	72.68	11.78	70.55	47.84	7.33	54.54	74.42	13.20
-325	49.2	6.1	43.10	29.45	75.91	14.42	100.00	56.11	9.42	29.45	75.91	14.42
Total (Calc)	--	--	146.35	100.00	56.11	9.42	--	--		--		--

SPIRAL DATA ANALYSIS

Description: Run 35 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P7 Feed Weight (%): 8.83

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	329.7	322.9	6.84	3.17	40.72	3.09	3.17	40.72	3.09	100.00	55.64	8.92
60x100	337.9	308.1	29.84	13.82	27.50	5.30	16.99	29.97	4.89	96.83	56.13	9.12
100x200	378.7	294.5	84.17	38.98	45.33	6.37	55.97	40.67	5.92	83.01	60.90	9.75
200x325	343.5	298.0	45.52	21.08	73.26	12.39	77.05	49.58	7.69	44.03	74.68	12.74
-325	55.6	6.1	49.55	22.95	75.99	13.07	100.00	55.64	8.92	22.95	75.99	13.07
Total (Calc)	--	--	215.91	100.00	55.64	8.92	--	--		--		--

SPIRAL DATA ANALYSIS

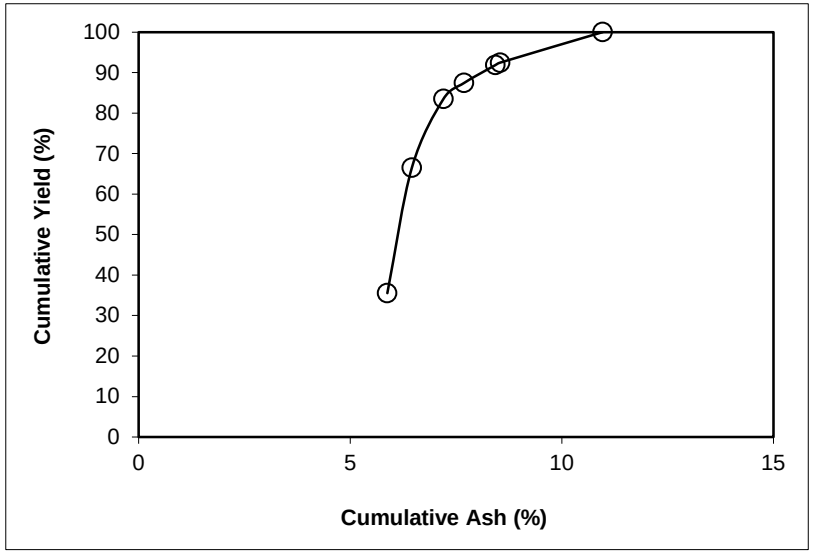
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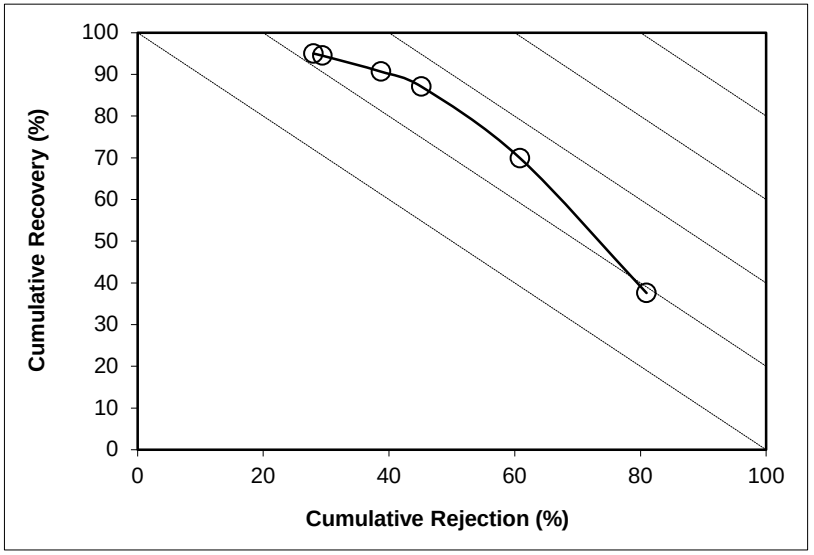
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: +60 Feed Weight (%): 3.71

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	35.54	5.88	35.54	5.88	37.57	64.46	13.78	80.96	18.53
P2	30.96	7.12	66.50	6.46	69.87	33.50	19.93	60.86	30.73
P3	16.99	10.12	83.48	7.20	87.02	16.52	30.01	45.19	32.20
P4	3.93	17.98	87.41	7.69	90.64	12.59	33.77	38.75	29.38
P5	4.43	23.07	91.84	8.43	94.46	8.16	39.58	29.43	23.89
P6	0.61	25.50	92.45	8.54	94.98	7.55	40.72	28.01	22.99
P7	7.55	40.72	100.00	10.97	100.00	0.00			
Total (Calc)	100.00	10.97	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

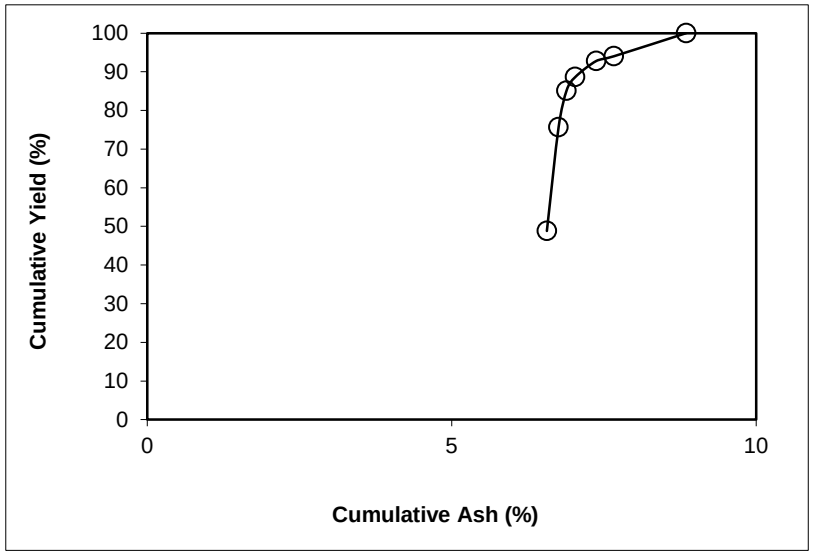
Description: Run 35 -Fine Spiral Test

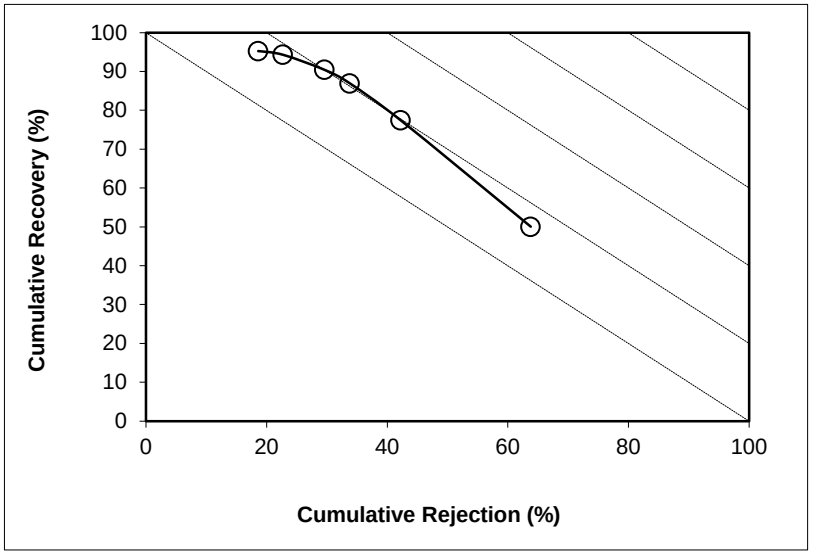
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 60x100 Feed Weight (%): 20.39

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	48.82	6.56	48.82	6.56	50.05	51.18	11.03	63.79	13.84
P2	26.87	7.11	75.69	6.76	77.43	24.31	15.37	42.22	19.65
P3	9.41	7.93	85.11	6.89	86.94	14.89	20.07	33.78	20.73
P4	3.54	10.49	88.65	7.03	90.42	11.35	23.06	29.59	20.00
P5	4.15	14.72	92.79	7.37	94.30	7.21	27.86	22.69	16.98
P6	1.22	29.63	94.02	7.66	95.24	5.98	27.50	18.59	13.83
P7	5.98	27.50	100.00	8.85	100.00	0.00			
Total (Calc)	100.00	8.85	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

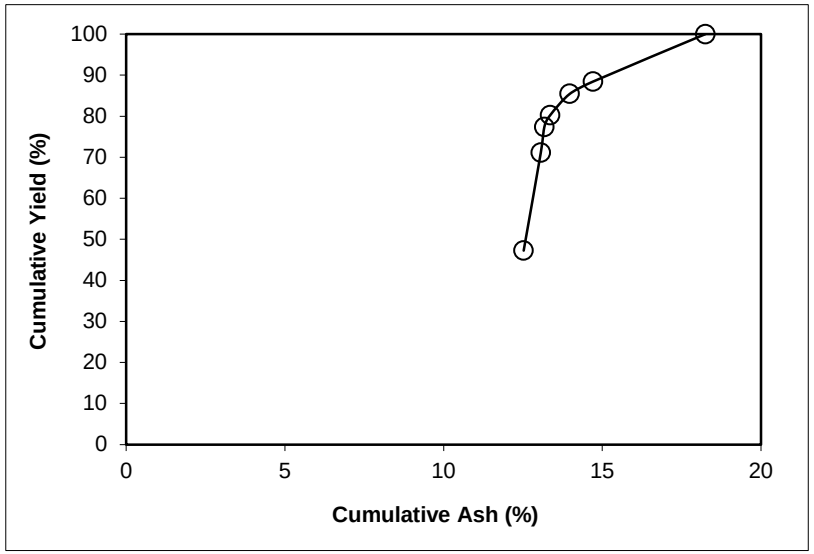
Description: Run 35 -Fine Spiral Test

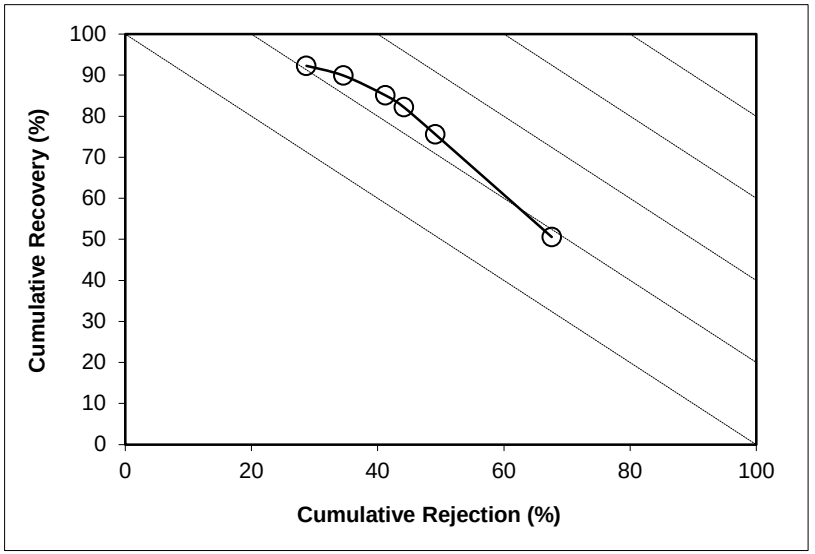
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 29.75

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	47.25	12.52	47.25	12.52	50.56	52.75	23.38	67.58	18.14
P2	23.83	14.13	71.08	13.06	75.59	28.92	31.00	49.13	24.71
P3	6.29	14.45	77.36	13.18	82.17	22.64	35.59	44.15	26.32
P4	2.90	18.34	80.26	13.36	85.06	19.74	38.13	41.24	26.30
P5	5.18	23.50	85.43	13.98	89.90	14.57	43.32	34.58	24.48
P6	3.00	35.60	88.44	14.71	92.27	11.56	45.33	28.72	20.99
P7	11.56	45.33	100.00	18.25	100.00	0.00			
Total (Calc)	100.00	18.25	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

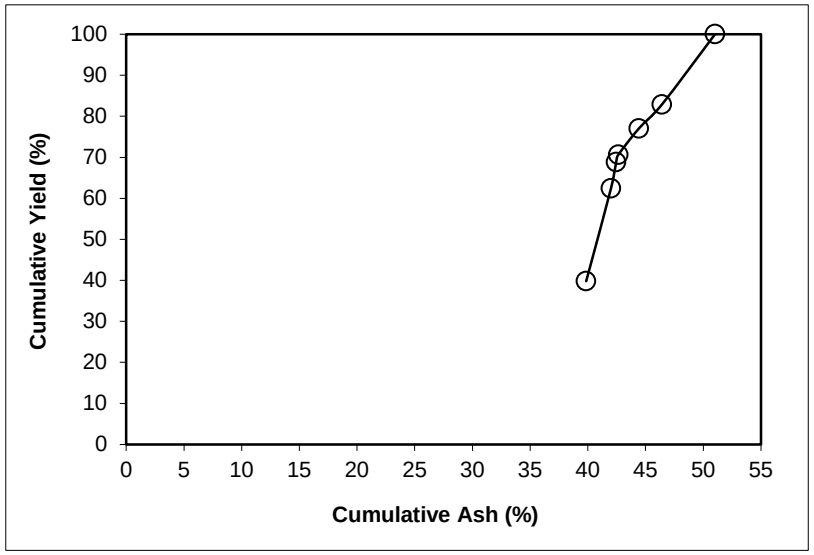
Description: Run 35 -Fine Spiral Test

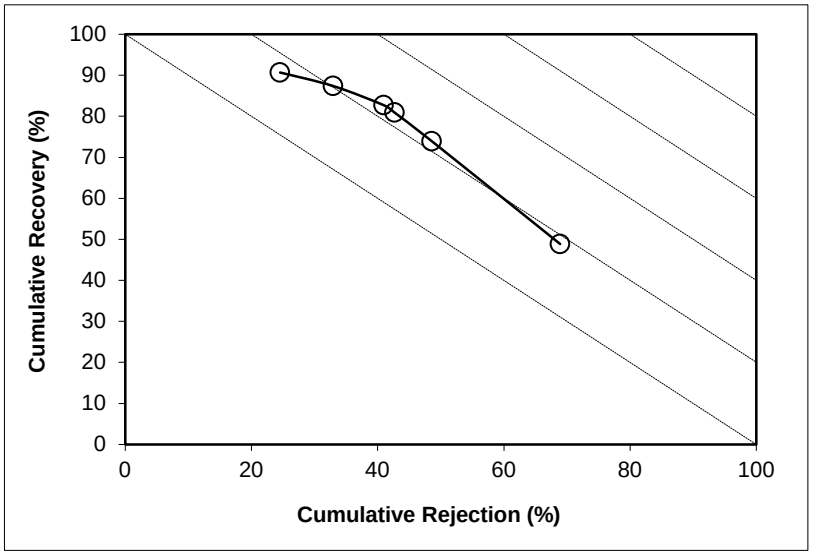
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 10.89

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	39.80	39.86	39.80	39.86	48.86	60.20	58.39	68.91	17.77
P2	22.65	45.79	62.44	42.01	73.93	37.56	65.99	48.58	22.51
P3	6.41	46.84	68.85	42.46	80.89	31.15	69.94	42.70	23.58
P4	1.75	49.74	70.61	42.64	82.68	29.39	71.14	40.99	23.67
P5	6.39	64.05	77.00	44.42	87.38	23.00	73.11	32.96	20.34
P6	5.91	72.68	82.91	46.43	90.67	17.09	73.26	24.54	15.21
P7	17.09	73.26	100.00	51.02	100.00	0.00			
Total (Calc)	100.00	51.02	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

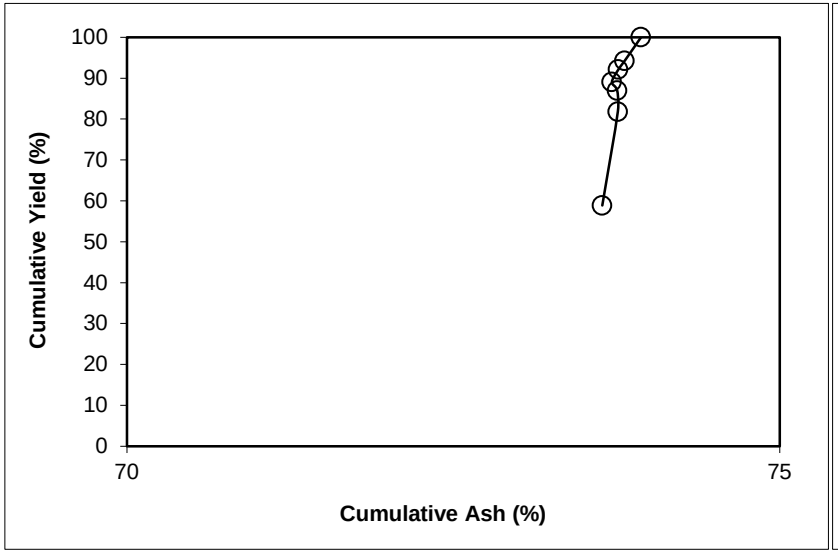
Description: Run 35 -Fine Spiral Test

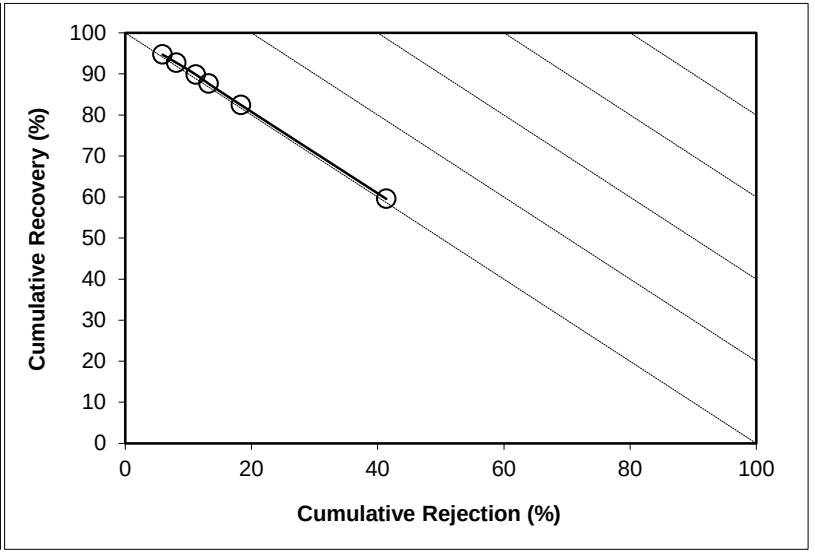
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 35.27

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	58.89	73.64	58.89	73.64	59.56	41.11	74.36	41.35	0.91
P2	22.95	74.07	81.83	73.76	82.39	18.17	74.74	18.36	0.75
P3	5.16	73.67	87.00	73.75	87.61	13.00	75.16	13.22	0.82
P4	2.07	72.03	89.07	73.71	89.83	10.93	75.75	11.20	1.03
P5	3.05	75.20	92.12	73.76	92.73	7.88	75.97	8.10	0.83
P6	2.14	75.91	94.26	73.81	94.71	5.74	75.99	5.90	0.61
P7	5.74	75.99	100.00	73.94	100.00	0.00			
Total (Calc)	100.00	73.94	--	--	--	--	--	--	--





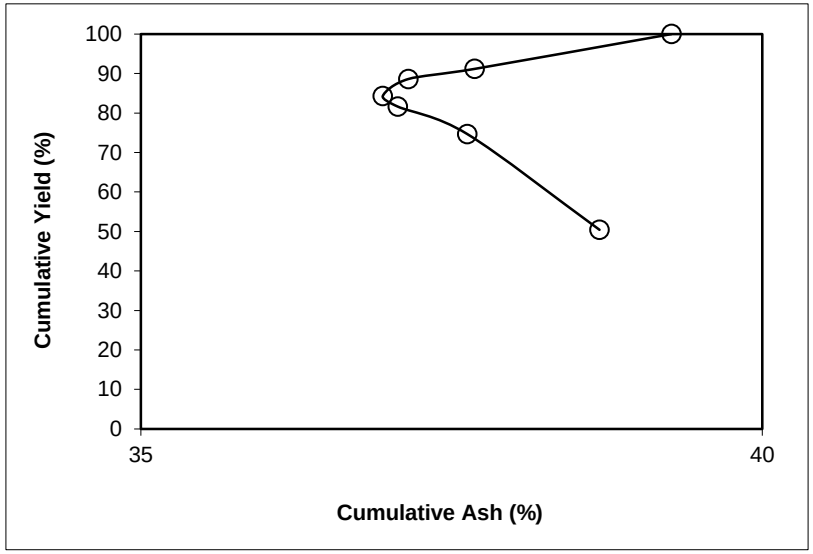
SPIRAL DATA ANALYSIS

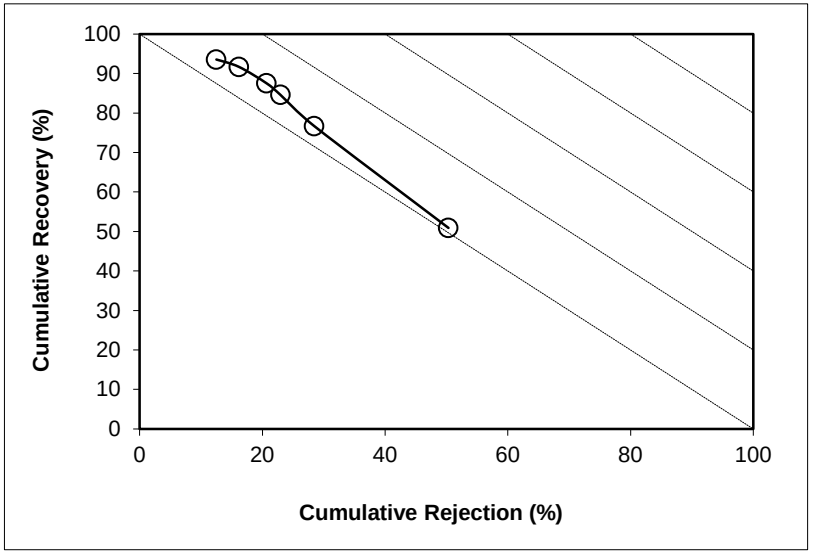
Description: Run 35 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	50.43	38.69	50.43	38.69	50.91	49.57	39.86	50.32	1.23
P2	24.27	35.41	74.70	37.63	76.72	25.30	44.13	28.43	5.15
P3	6.94	31.05	81.64	37.07	84.60	18.36	49.07	22.94	7.54
P4	2.65	33.25	84.29	36.95	87.52	15.71	51.73	20.70	8.21
P5	4.32	41.15	88.61	37.15	91.70	11.39	55.75	16.17	7.87
P6	2.56	56.11	91.17	37.68	93.55	8.83	55.64	12.51	6.06
P7	8.83	55.64	100.00	39.27	100.00	0.00			
Total (Calc)	100.00	39.27	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

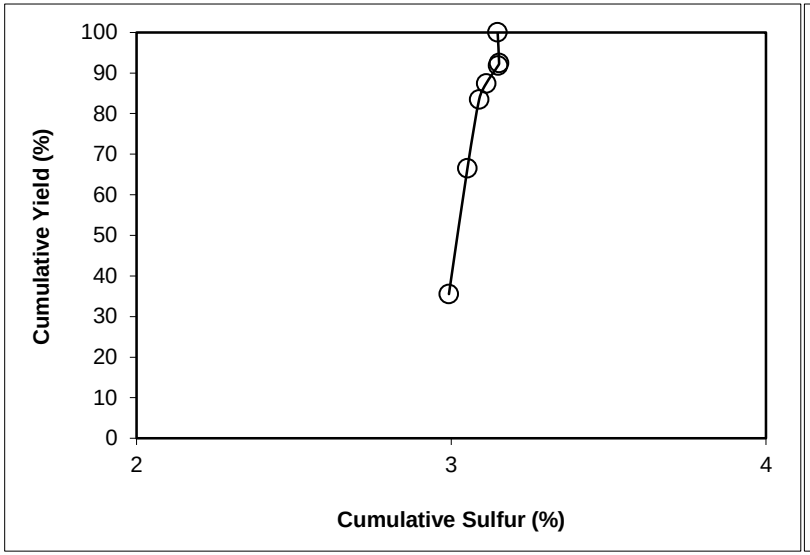
Description: Run 35 -Fine Spiral Test

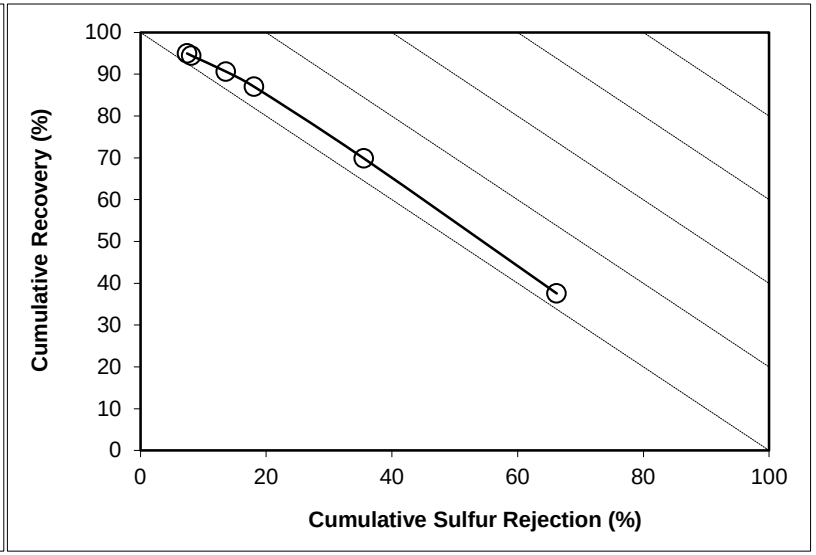
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: +60 Feed Weight (%): 3.71

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	35.54	2.99	35.54	2.99	37.57	64.46	3.23	66.21	3.78
P2	30.96	3.12	66.50	3.05	69.87	33.50	3.34	35.53	5.40
P3	16.99	3.23	83.48	3.09	87.02	16.52	3.44	18.07	5.09
P4	3.93	3.58	87.41	3.11	90.64	12.59	3.40	13.60	4.24
P5	4.43	3.90	91.84	3.15	94.46	8.16	3.13	8.10	2.57
P6	0.61	3.58	92.45	3.15	94.98	7.55	3.09	7.41	2.39
P7	7.55	3.09	100.00	3.15	100.00	0.00			
Total (Calc)	100.00	3.15	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

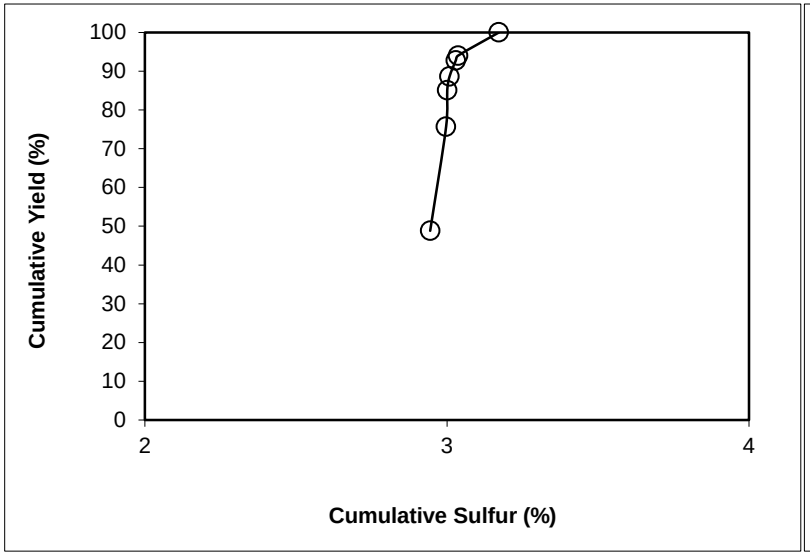
Description: Run 35 -Fine Spiral Test

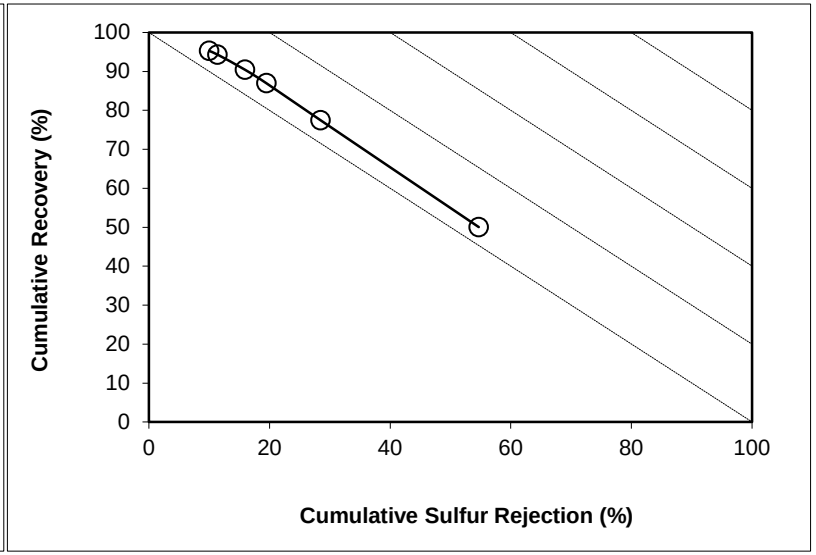
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 60x100 Feed Weight (%): 20.39

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	48.82	2.94	48.82	2.94	50.05	51.18	3.39	54.68	4.73
P2	26.87	3.09	75.69	3.00	77.43	24.31	3.72	28.48	5.91
P3	9.41	3.03	85.11	3.00	86.94	14.89	4.15	19.49	6.43
P4	3.54	3.19	88.65	3.01	90.42	11.35	4.45	15.92	6.34
P5	4.15	3.47	92.79	3.03	94.30	7.21	5.01	11.38	5.68
P6	1.22	3.60	94.02	3.04	95.24	5.98	5.30	9.99	5.24
P7	5.98	5.30	100.00	3.17	100.00	0.00			
Total (Calc)	100.00	3.17	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

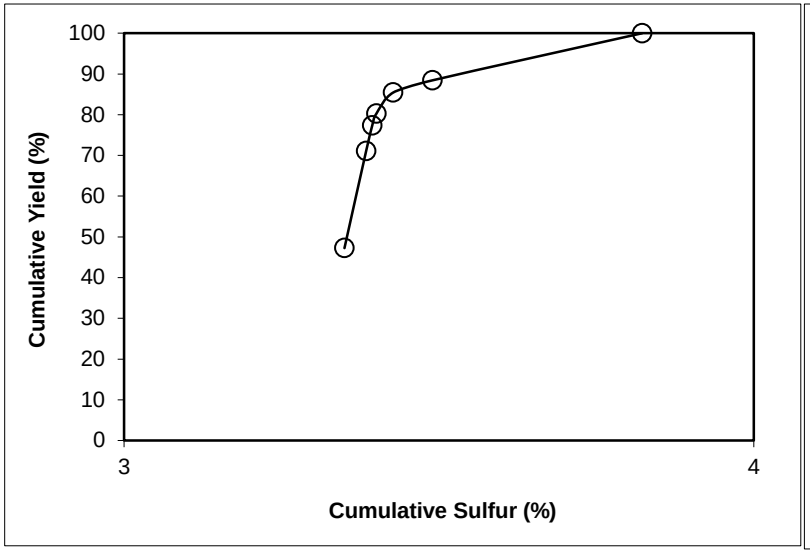
Description: Run 35 -Fine Spiral Test

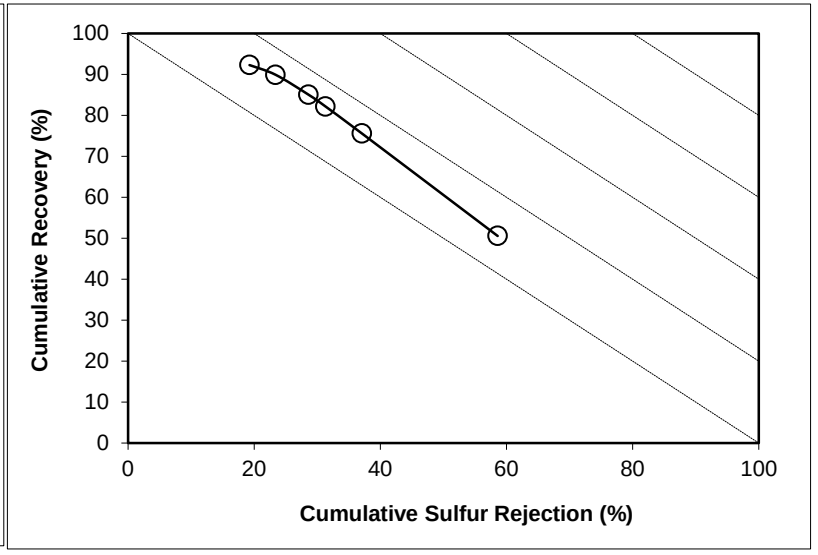
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 29.75

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	47.25	3.35	47.25	3.35	50.56	52.75	4.25	58.60	9.15
P2	23.83	3.45	71.08	3.38	75.59	28.92	4.90	37.07	12.66
P3	6.29	3.50	77.36	3.39	82.17	22.64	5.29	31.31	13.48
P4	2.90	3.58	80.26	3.40	85.06	19.74	5.54	28.60	13.66
P5	5.18	3.84	85.43	3.43	89.90	14.57	6.14	23.40	13.30
P6	3.00	5.27	88.44	3.49	92.27	11.56	6.37	19.27	11.53
P7	11.56	6.37	100.00	3.82	100.00	0.00			
Total (Calc)	100.00	3.82	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

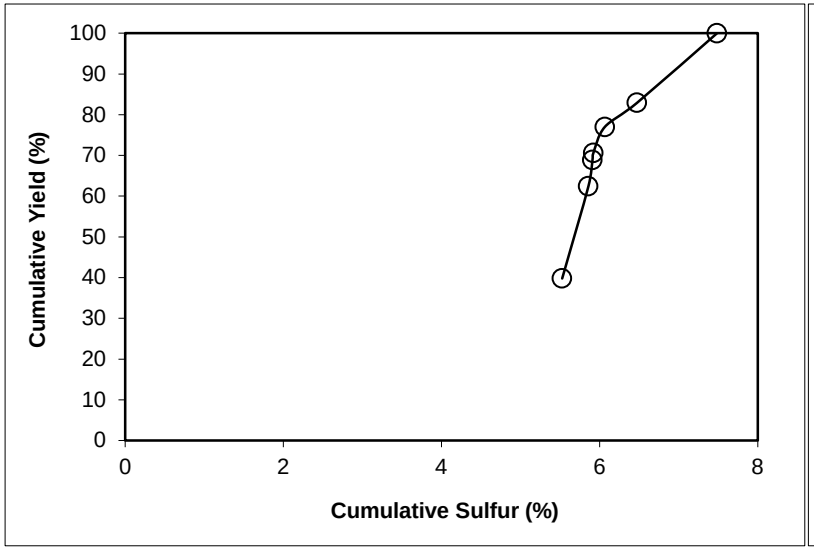
Description: Run 35 -Fine Spiral Test

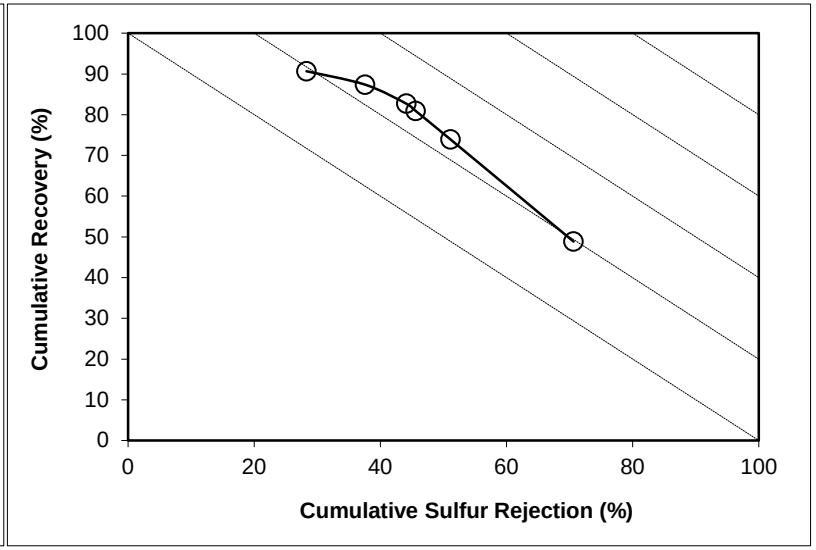
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 10.89

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	39.80	5.53	39.80	5.53	48.86	60.20	8.78	70.62	19.48
P2	22.65	6.44	62.44	5.86	73.93	37.56	10.19	51.12	25.05
P3	6.41	6.41	68.85	5.91	80.89	31.15	10.97	45.63	26.52
P4	1.75	6.37	70.61	5.92	82.68	29.39	11.24	44.14	26.82
P5	6.39	7.66	77.00	6.07	87.38	23.00	12.24	37.60	24.97
P6	5.91	11.78	82.91	6.47	90.67	17.09	12.39	28.30	18.97
P7	17.09	12.39	100.00	7.49	100.00	0.00			
Total (Calc)	100.00	7.49	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

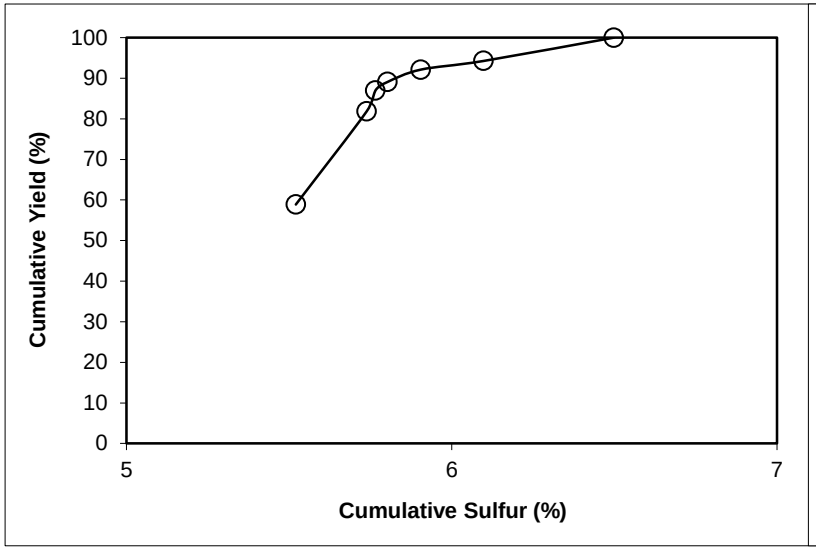
Description: Run 35 -Fine Spiral Test

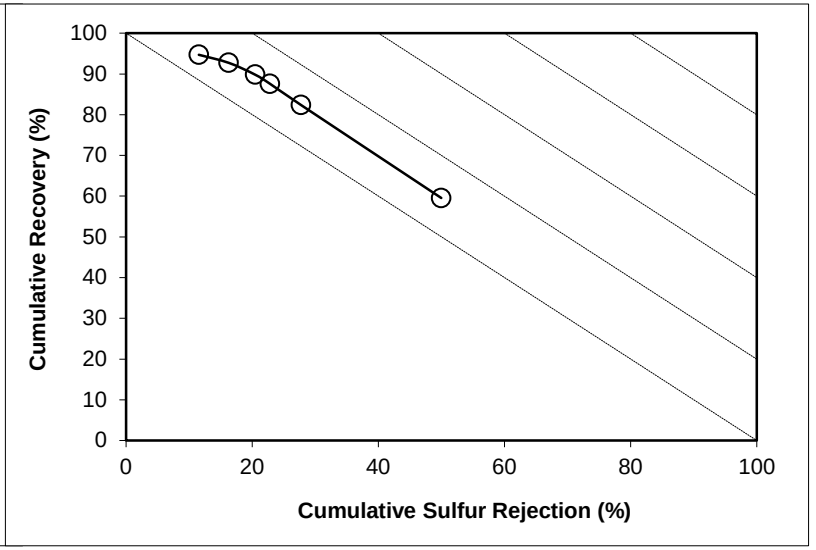
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 35.27

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	58.89	5.52	58.89	5.52	59.56	41.11	7.90	49.97	9.53
P2	22.95	6.30	81.83	5.74	82.39	18.17	9.92	27.73	10.13
P3	5.16	6.19	87.00	5.77	87.61	13.00	11.40	22.81	10.42
P4	2.07	7.35	89.07	5.80	89.83	10.93	12.17	20.47	10.30
P5	3.05	8.90	92.12	5.90	92.73	7.88	13.43	16.30	9.03
P6	2.14	14.42	94.26	6.10	94.71	5.74	13.07	11.55	6.26
P7	5.74	13.07	100.00	6.50	100.00	0.00			
Total (Calc)	100.00	6.50	--	--	--	--	--	--	--





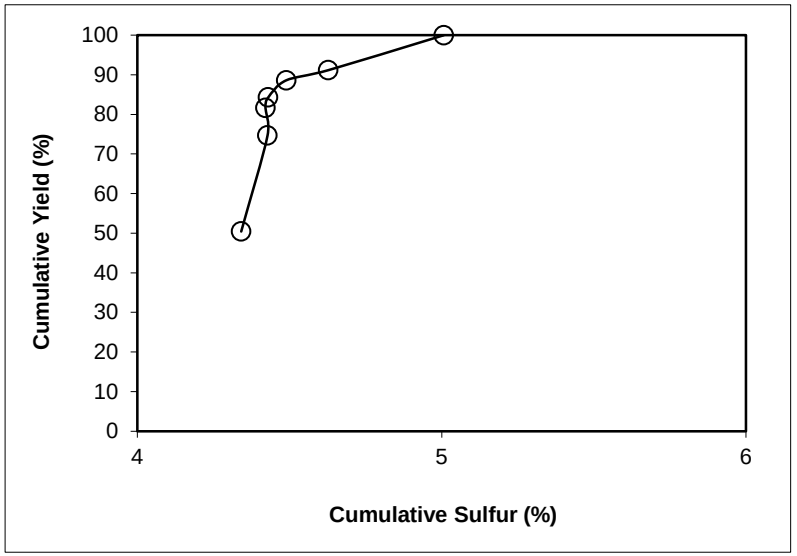
SPIRAL DATA ANALYSIS

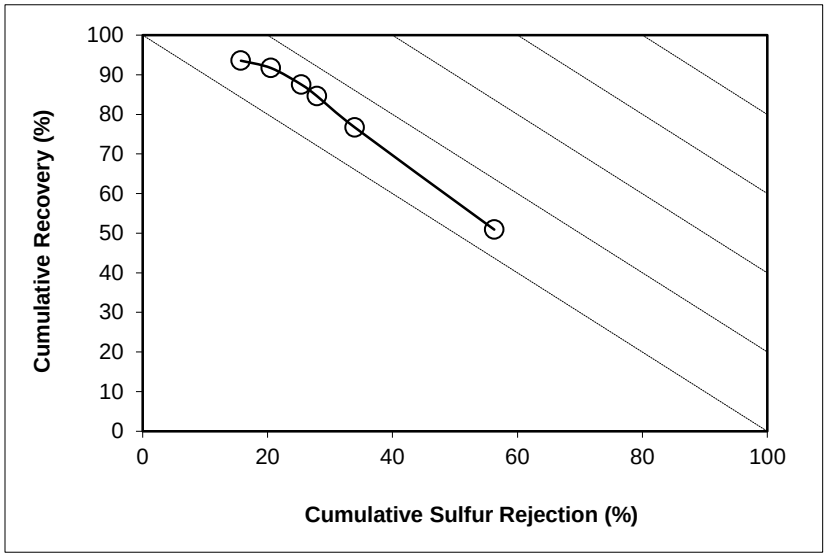
Description: Run 35 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	50.43	4.34	50.43	4.34	50.91	49.57	5.68	56.28	7.19
P2	24.27	4.61	74.70	4.43	76.72	25.30	6.72	33.94	10.66
P3	6.94	4.35	81.64	4.42	84.60	18.36	7.61	27.92	12.52
P4	2.65	4.71	84.29	4.43	87.52	15.71	8.10	25.42	12.94
P5	4.32	5.64	88.61	4.49	91.70	11.39	9.04	20.55	12.25
P6	2.56	9.42	91.17	4.63	93.55	8.83	8.92	15.73	9.28
P7	8.83	8.92	100.00	5.01	100.00	0.00			
Total (Calc)	100.00	5.01	--	--	--	--	--	--	--

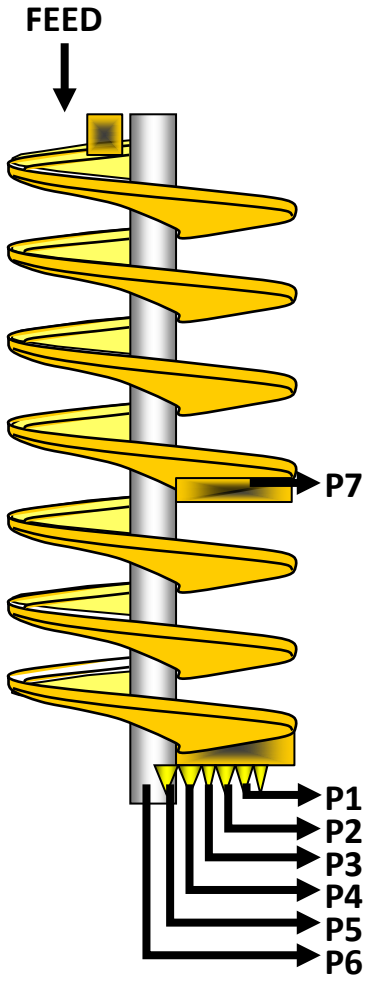




SPIRAL DATA ANALYSIS

Description: Run 36 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios



Stream ID	Splitter Distance from Center Tube			
	Inside (cm)	Outside (cm)	Inside (%)	Outside (%)
P1	40.0	34.9	100	87
P2	34.9	28.6	87	72
P3	28.6	21.6	72	54
P4	21.6	16.7	54	42
P5	16.7	8.3	42	21
P6	8.3	0.0	21	0
P7	0.0	--	0	--

Stream	Solid (TPH)	Solids (%)	Water (GPM)	Slurry (GPM)
P1	0.181	9.5	6.89	7.34
P2	0.132	11.7	3.98	4.32
P3	0.043	14.9	0.98	1.09
P4	0.017	17.8	0.32	0.37
P5	0.026	18.9	0.44	0.51
P6	0.015	22.0	0.21	0.25
P7	0.050	25.6	0.58	0.69
Total	0.464	12.1	13.41	14.56

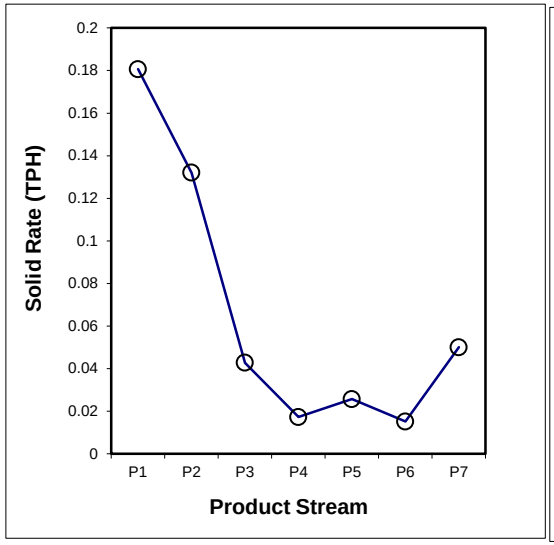
SPIRAL DATA ANALYSIS

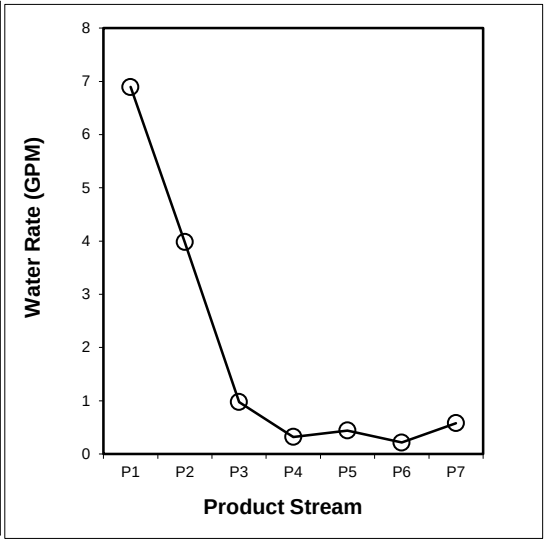
Description: Run 36 -Fine Spiral Test

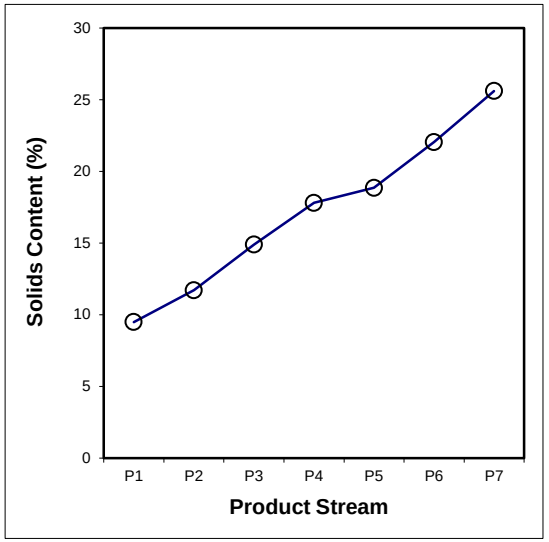
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

FULL STREAM DATA

Sample ID	Sample Time (sec)	Slurry + Tare Weight (gm)	Tare Weight (gm)	Slurry Weight (ton/hr)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (ton/hr)	Dry Weight (%)	Solids Content (%)
P1	5	3649.00	1211.00	1.904	1457.4	1229.6	0.181	38.96	9.49
P2	5	1666.12	223.01	1.127	1662.9	1496.4	0.132	28.47	11.71
P3	20	1686.32	215.91	0.287	1696.0	1480.2	0.043	9.23	14.89
P4	35	1096.55	224.81	0.097	1599.8	1446.8	0.017	3.74	17.81
P5	20	790.78	93.41	0.136	1625.9	1496.3	0.026	5.54	18.86
P6	35	838.74	222.07	0.069	1613.9	1479.9	0.015	3.27	22.04
P7	20	1243.11	244.56	0.195	1482.0	1229.7	0.050	10.79	25.61
Total (Calc)	--	--	--	3.816	--	--	0.464	100.00	12.15
Total (Head)	1.28	1322.86	94.17	3.816	1596.0	1446.7	0.464	--	12.15







SPIRAL DATA ANALYSIS

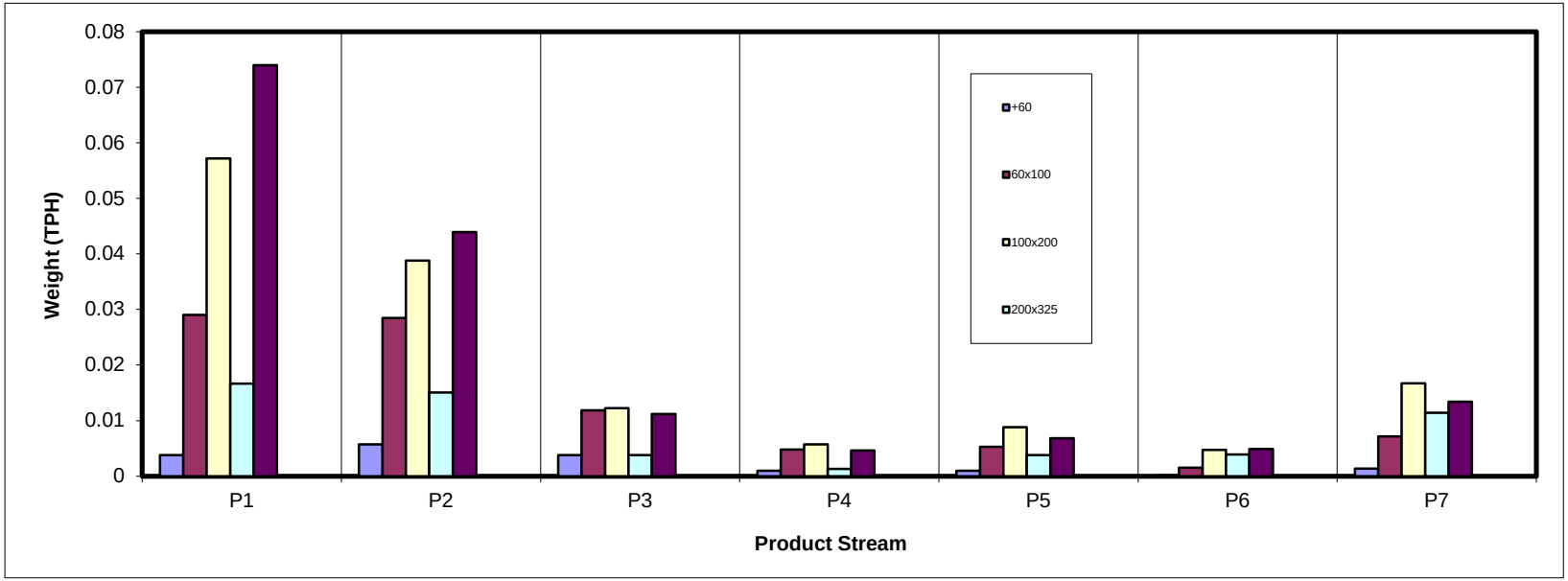
Description: Run 36 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (TPH)

Sample (Position %)	Dry Ton Per Hour in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	0.004	0.006	0.004	0.001	0.001	0.000	0.001		0.017
60x100	0.029	0.028	0.012	0.005	0.005	0.002	0.007		0.088
100x200	0.057	0.039	0.012	0.006	0.009	0.005	0.017		0.144
200x325	0.017	0.015	0.004	0.001	0.004	0.004	0.011		0.056
-325	0.074	0.044	0.011	0.005	0.007	0.005	0.013		0.159
Total (Calc)	0.181	0.132	0.043	0.017	0.026	0.015	0.050		0.464



SPIRAL DATA ANALYSIS

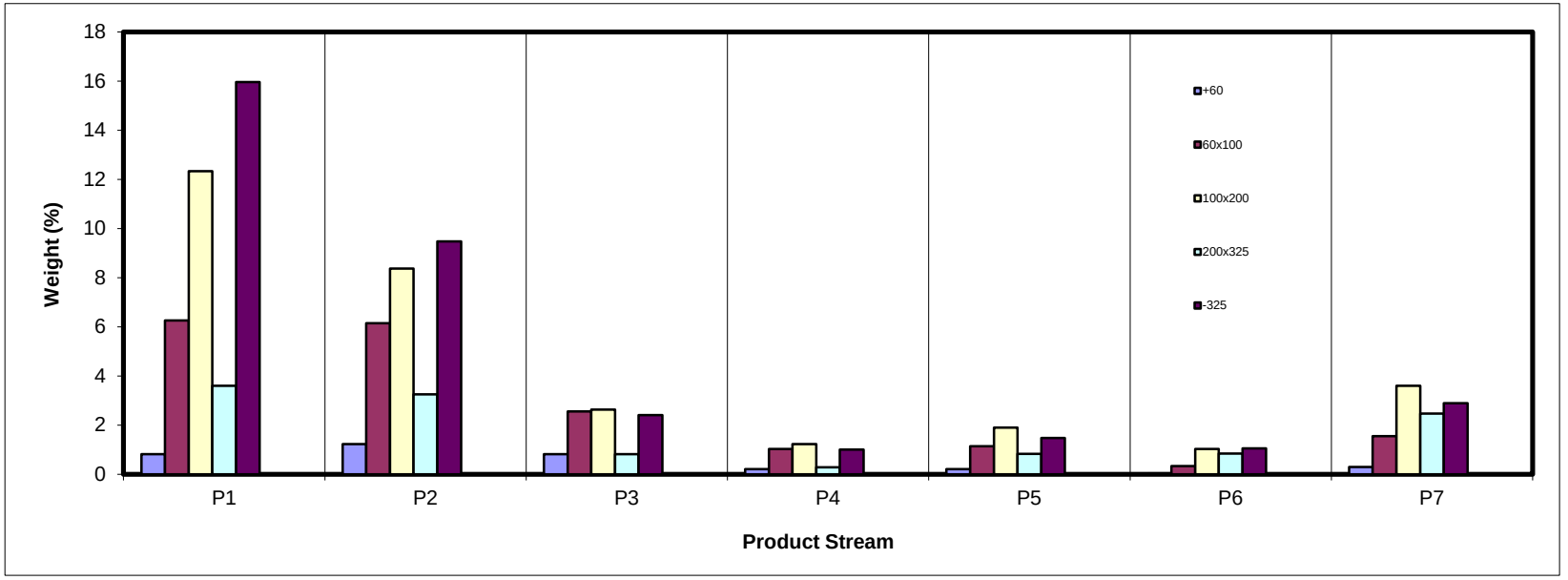
Description: Run 36 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	0.82	1.23	0.82	0.21	0.21	0.03	0.29		3.60
60x100	6.26	6.14	2.55	1.03	1.14	0.33	1.54		18.99
100x200	12.34	8.37	2.63	1.23	1.90	1.02	3.60		31.08
200x325	3.59	3.25	0.81	0.28	0.82	0.84	2.47		12.06
-325	15.96	9.48	2.41	1.00	1.48	1.05	2.89		34.26
Total (Calc)	38.96	28.47	9.23	3.74	5.54	3.27	10.79		100.00



SPIRAL DATA ANALYSIS

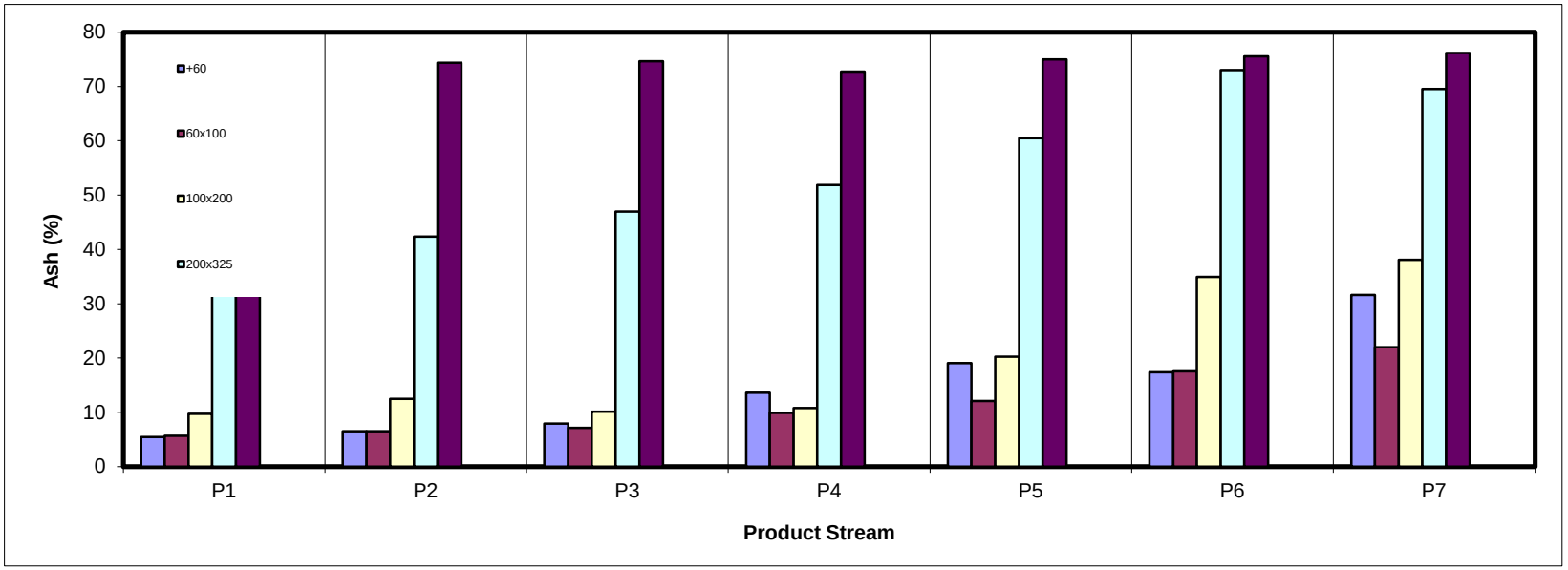
Description: Run 36 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	5.46	6.54	7.94	13.59	19.06	17.37	31.61		9.86
60x100	5.67	6.54	7.16	9.91	12.09	17.54	22.02		8.30
100x200	9.71	12.47	10.14	10.79	20.27	34.93	38.10		15.29
200x325	42.37	42.35	46.97	51.88	60.47	73.02	69.54		51.82
-325	74.58	74.34	74.67	72.72	74.96	75.56	76.14		74.64
Total (Calc)	38.56	34.94	29.21	30.29	39.06	55.85	53.00		38.51



SPIRAL DATA ANALYSIS

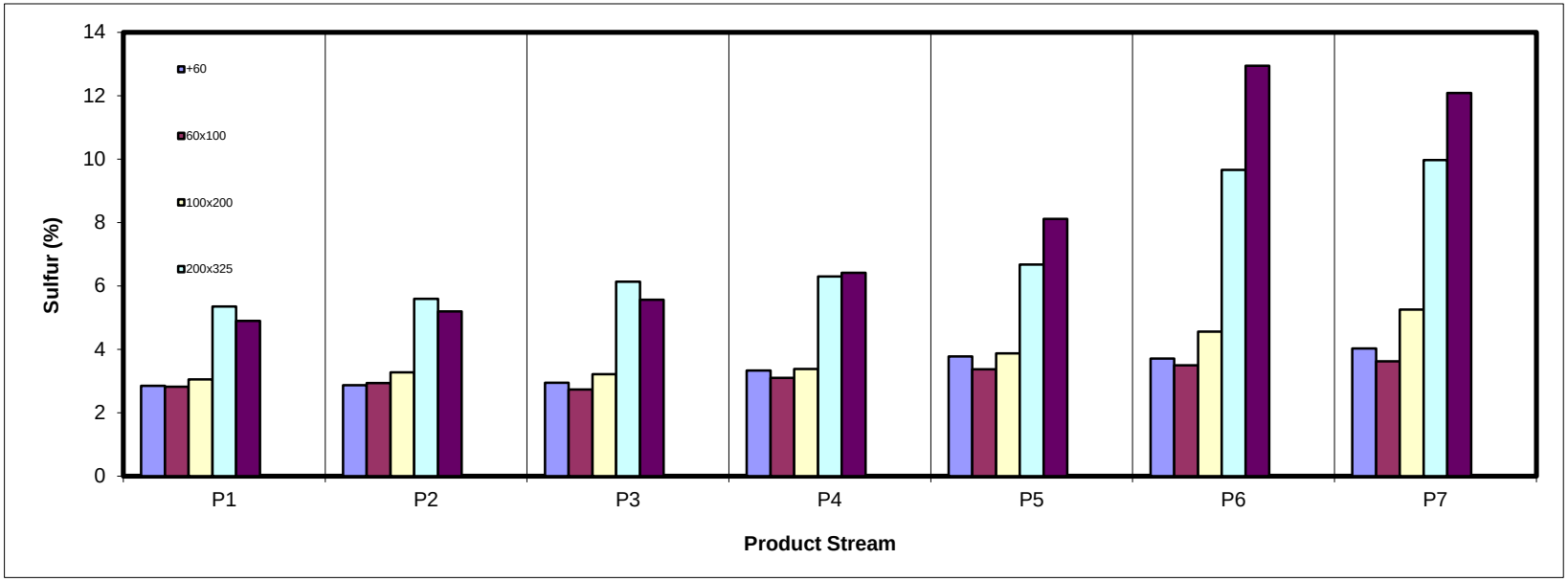
Description: Run 36 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Sulfur Content (%)

Sample ID	Dry Sulfur Percent in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	2.85	2.87	2.94	3.33	3.78	3.70	4.03		3.06
60x100	2.82	2.94	2.73	3.10	3.37	3.50	3.62		2.97
100x200	3.05	3.27	3.22	3.38	3.88	4.56	5.25		3.49
200x325	5.35	5.59	6.13	6.30	6.68	9.66	9.96		6.82
-325	4.89	5.20	5.57	6.41	8.11	12.94	12.08		6.06
Total (Calc)	3.98	4.09	3.93	4.32	5.31	8.45	7.89		4.66



SPIRAL DATA ANALYSIS

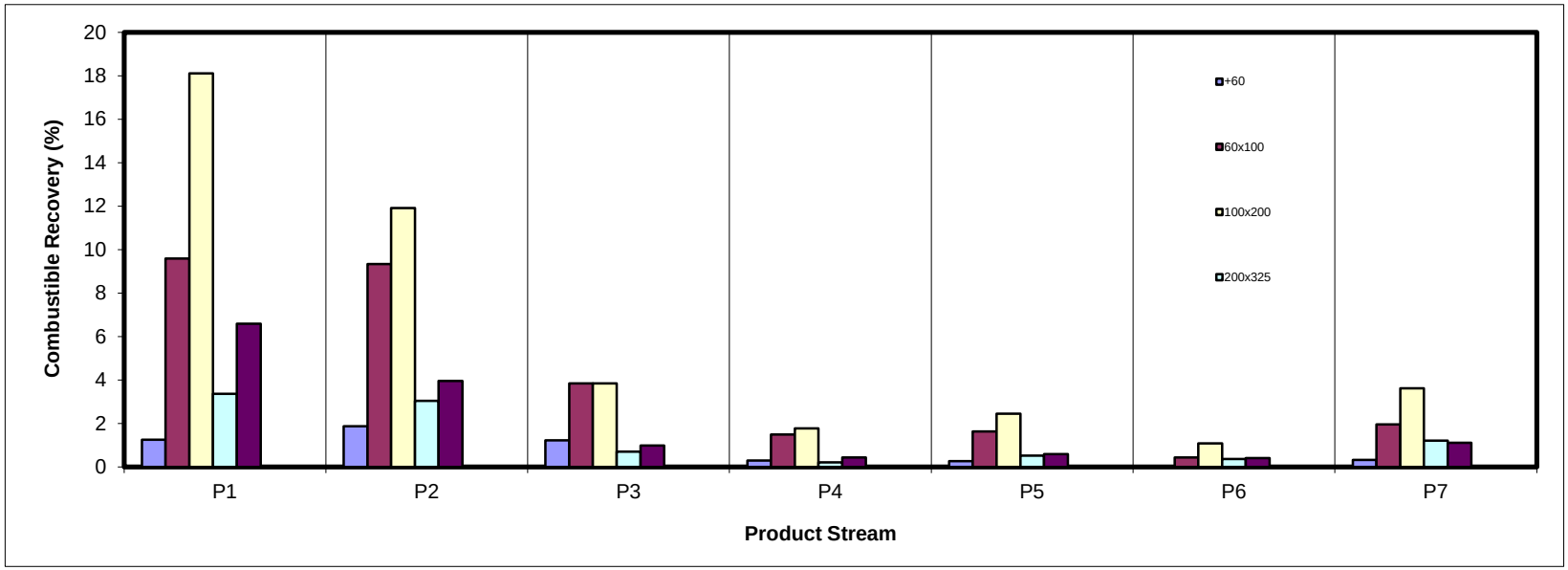
Description: Run 36 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Combustible Recovery (%)

Sample ID	Combustible Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	1.25	1.87	1.23	0.29	0.27	0.04	0.33		5.28
60x100	9.60	9.33	3.85	1.50	1.64	0.44	1.96		28.32
100x200	18.11	11.91	3.85	1.78	2.46	1.08	3.62		42.82
200x325	3.37	3.05	0.70	0.22	0.53	0.37	1.22		9.45
-325	6.60	3.96	0.99	0.44	0.60	0.42	1.12		14.13
Total (Calc)	38.93	30.12	10.62	4.24	5.49	2.35	8.25		100.00



SPIRAL DATA ANALYSIS

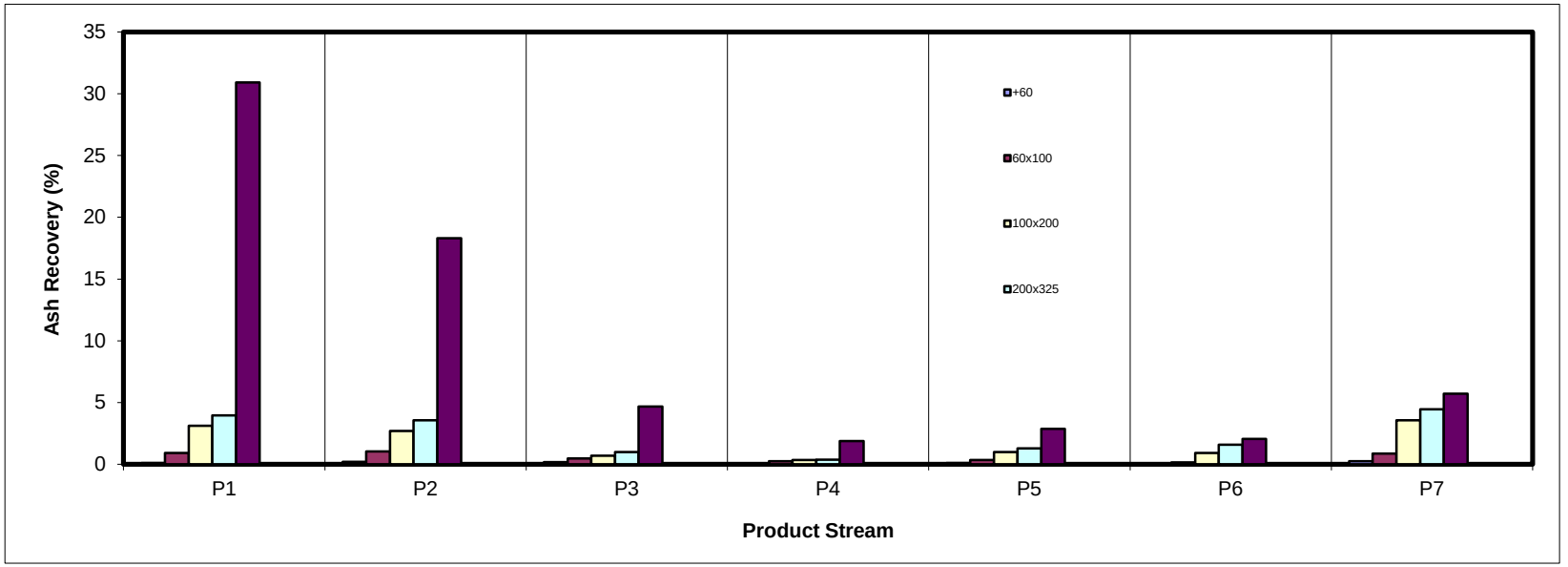
Description: Run 36 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Ash Recovery (%)

Sample ID	Ash Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	0.12	0.21	0.17	0.07	0.10	0.01	0.24		0.92
60x100	0.92	1.04	0.47	0.26	0.36	0.15	0.88		4.09
100x200	3.11	2.71	0.69	0.34	1.00	0.93	3.56		12.34
200x325	3.95	3.57	0.99	0.37	1.29	1.60	4.45		16.23
-325	30.91	18.30	4.67	1.89	2.87	2.06	5.71		66.41
Total (Calc)	39.01	25.83	7.00	2.94	5.62	4.75	14.85		100.00



SPIRAL DATA ANALYSIS

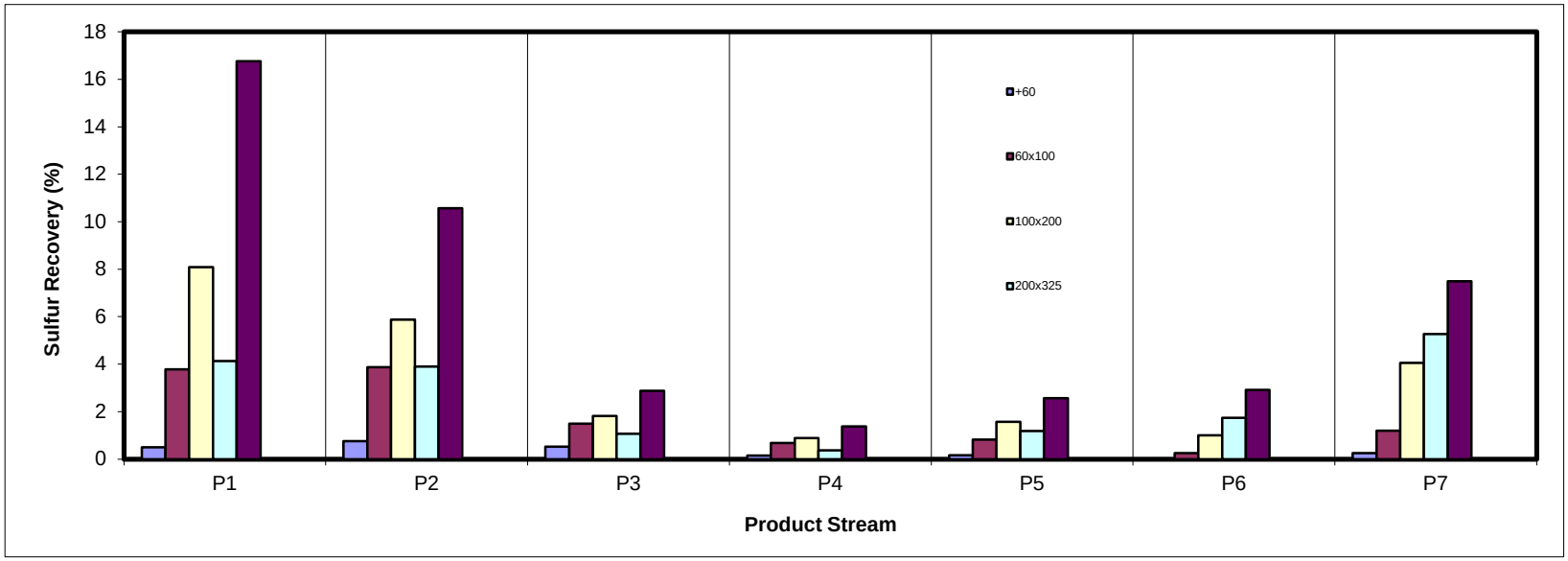
Description: Run 36 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Sulfur Recovery (%)

Sample ID	Sulfur Recovery in Size and Product Class								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	0.50	0.76	0.52	0.15	0.17	0.02	0.25		2.37
60x100	3.78	3.87	1.49	0.68	0.83	0.25	1.20		12.11
100x200	8.08	5.88	1.82	0.89	1.58	1.00	4.06		23.30
200x325	4.13	3.90	1.07	0.37	1.18	1.74	5.27		17.67
-325	16.76	10.57	2.88	1.37	2.57	2.92	7.49		44.56
Total (Calc)	33.25	24.98	7.78	3.47	6.32	5.93	18.27		100.00



SPIRAL DATA ANALYSIS

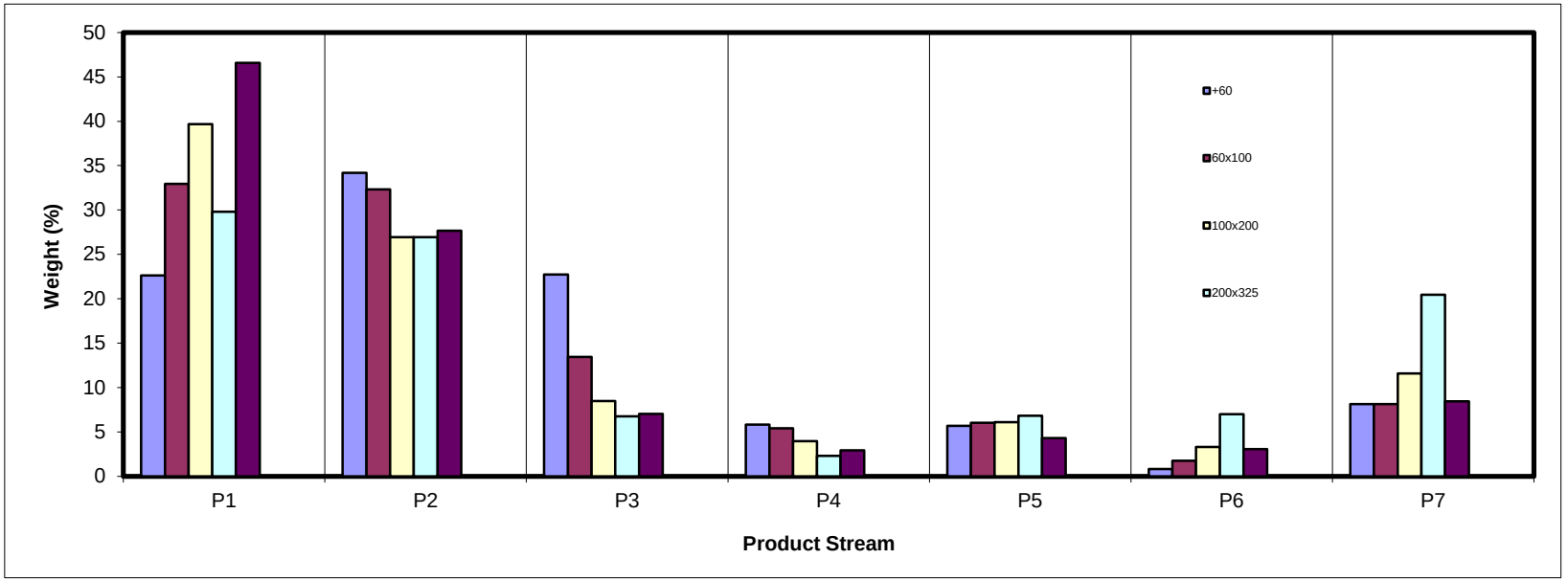
Description: Run 36 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Size Class (Size Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	22.64	34.17	22.74	5.81	5.69	0.82	8.13		100.00
60x100	32.94	32.34	13.43	5.40	6.02	1.73	8.12		100.00
100x200	39.69	26.92	8.47	3.95	6.10	3.29	11.58		100.00
200x325	29.79	26.93	6.76	2.30	6.81	6.98	20.44		100.00
-325	46.58	27.67	7.03	2.91	4.31	3.07	8.44		100.00
Total (Calc)	38.96	28.47	9.23	3.74	5.54	3.27	10.79		100.00



SPIRAL DATA ANALYSIS

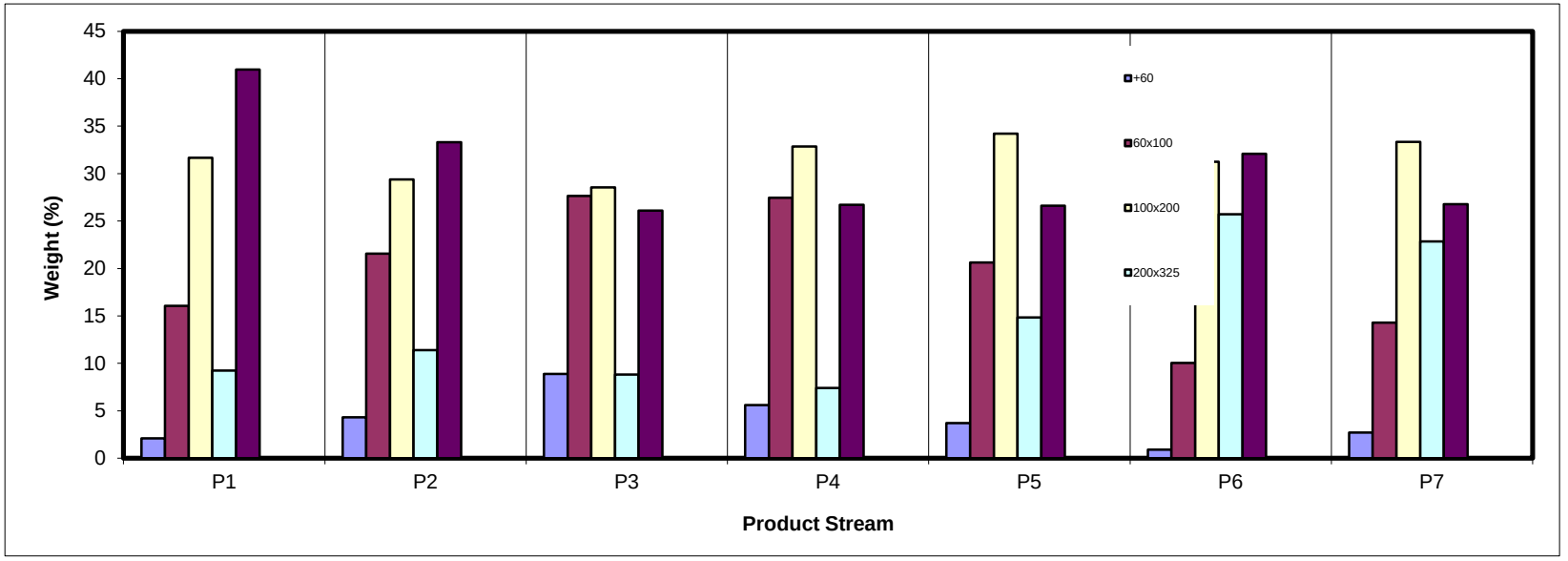
Description: Run 36 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE BY PRODUCT AND SIZE

Weight (%)

Sample ID	Weight Percent in Product Class (Product Adds to 100%)								Total
	P1 100-87%	P2 87-72%	P3 72-54%	P4 54-42%	P5 42-21%	P6 21-0%	P7 0-0%		
+60	2.09	4.32	8.88	5.59	3.70	0.90	2.71		3.60
60x100	16.06	21.57	27.65	27.44	20.64	10.06	14.30		18.99
100x200	31.66	29.40	28.55	32.85	34.20	31.25	33.35		31.08
200x325	9.22	11.41	8.83	7.41	14.83	25.70	22.85		12.06
-325	40.96	33.30	26.09	26.71	26.62	32.09	26.79		34.26
Total (Calc)	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00



SPIRAL DATA ANALYSIS

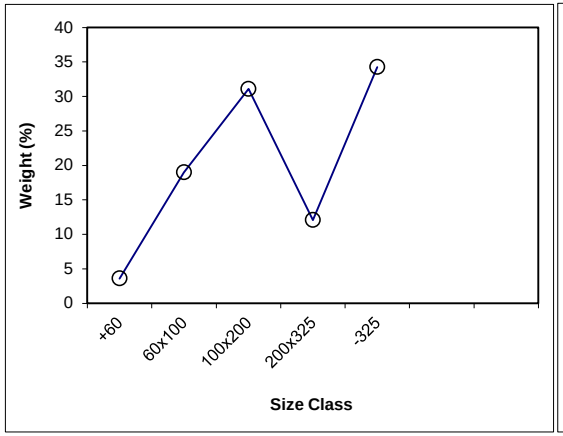
Description: Run 36 -Fine Spiral Test

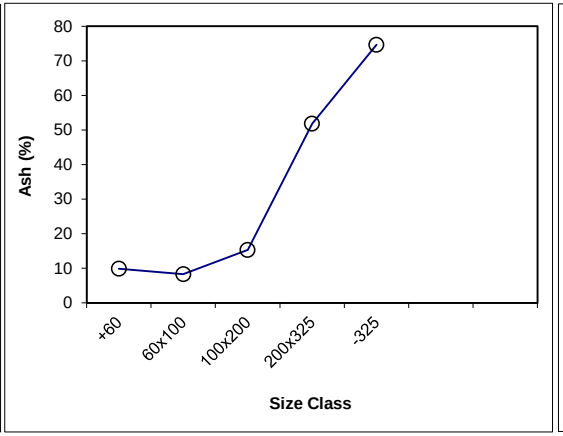
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

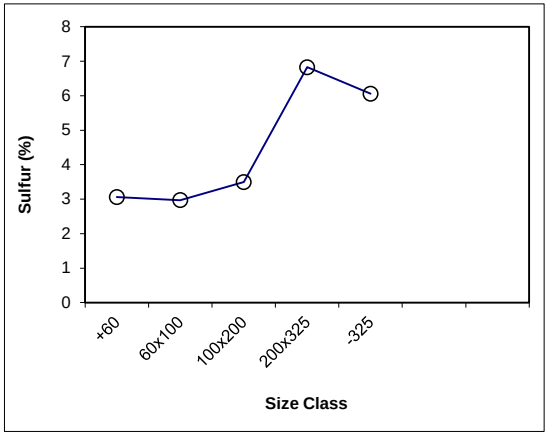
FEED SIZE ANALYSIS

Head (As-Sampled)

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	328.3	322.9	5.38	3.60	9.86	3.06	3.60	9.86	3.06	100.00	38.51	4.66
60x100	395.3	367.0	28.35	18.99	8.30	2.97	22.59	8.55	2.98	96.40	39.58	4.72
100x200	393.8	347.4	46.40	31.08	15.29	3.49	53.68	12.45	3.28	77.41	47.25	5.15
200x325	421.2	403.2	18.01	12.06	51.82	6.82	65.74	19.68	3.93	46.32	68.70	6.26
-325	57.3	6.2	51.14	34.26	74.64	6.06	100.00	38.51	4.66	34.26	74.64	6.06
Total (Calc)	--	--	149.27	100.00	38.51	4.66	--	--		--		--







SPIRAL DATA ANALYSIS

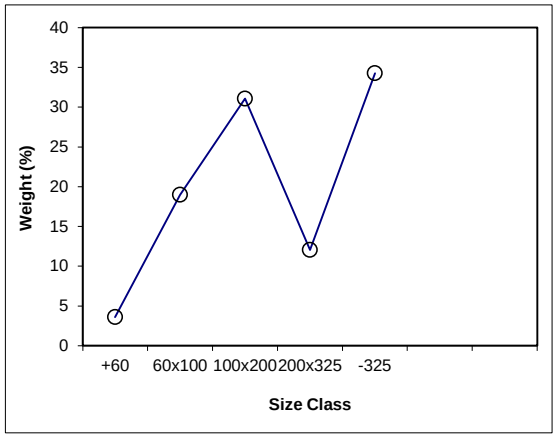
Description: Run 36 -Fine Spiral Test

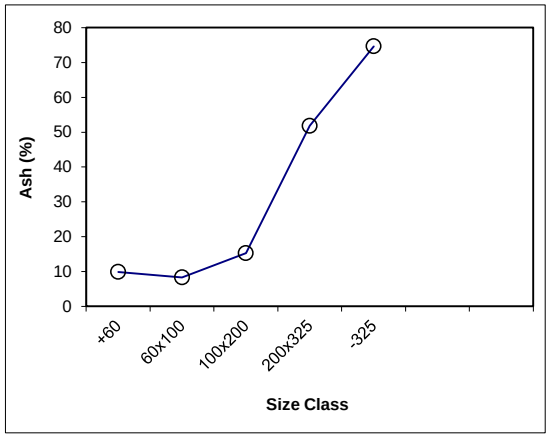
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

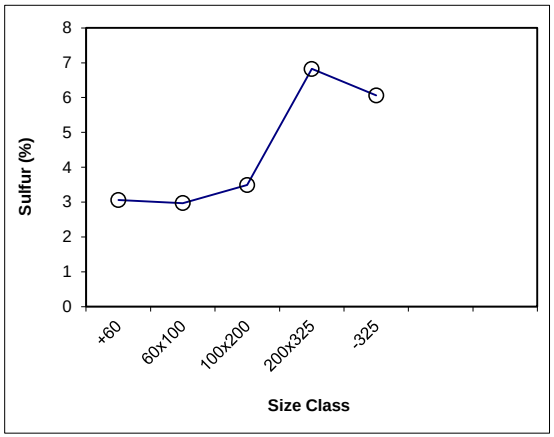
FEED SIZE ANALYSIS

Head (Back-Calculated Composite)

Sample Size (Mesh)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed			Select Size Class	Dry Weight (%)	Dry Ash (%)
				Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)			
+60	3.60	9.86	3.06	3.60	9.86	3.06	100.00	38.51	4.66	x	3.60	9.86
60x100	18.99	8.30	2.97	22.59	8.55	2.98	96.40	39.58	4.72	x	18.99	8.30
100x200	31.08	15.29	3.49	53.68	12.45	3.28	77.41	47.25	5.15	x	31.08	15.29
200x325	12.06	51.82	6.82	65.74	19.68	3.93	46.32	68.70	6.26	x	12.06	51.82
-325	34.26	74.64	6.06	100.00	38.51	4.66	34.26	74.64	6.06		34.26	74.64
Total (Calc)	100.00	38.51	4.66	--	--		--	--			100.00	38.51







SPIRAL DATA ANALYSIS

Description: Run 36 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P1 Feed Weight (%): 38.96

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	327.7	322.9	4.77	2.09	5.46	2.85	2.09	5.46	2.85	100.00	38.56	3.98
60x100	344.7	308.1	36.58	16.06	5.67	2.82	18.15	5.65	2.82	97.91	39.27	4.00
100x200	366.6	294.5	72.13	31.66	9.71	3.05	49.81	8.23	2.97	81.85	45.86	4.23
200x325	319.0	298.0	21.01	9.22	42.37	5.35	59.04	13.56	3.34	50.19	68.66	4.98
-325	99.4	6.1	93.32	40.96	74.58	4.89	100.00	38.56	3.98	40.96	74.58	4.89
Total (Calc)	--	--	227.81	100.00	38.56	3.98	--	--		--		--

Product P2 Feed Weight (%): 28.47

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	330.1	322.9	7.20	4.32	6.54	2.87	4.32	6.54	2.87	100.00	34.94	4.09
60x100	433.1	397.2	35.91	21.57	6.54	2.94	25.90	6.54	2.93	95.68	36.23	4.14
100x200	440.2	391.3	48.93	29.40	12.47	3.27	55.29	9.69	3.11	74.10	44.87	4.49
200x325	397.6	378.6	18.99	11.41	42.35	5.59	66.70	15.28	3.54	44.71	66.17	5.30
-325	61.8	6.4	55.43	33.30	74.34	5.20	100.00	34.94	4.09	33.30	74.34	5.20
Total (Calc)	--	--	166.46	100.00	34.94	4.09	--	--		--		--

SPIRAL DATA ANALYSIS

Description: Run 36 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P3 Feed Weight (%): 9.23

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	342.1	322.9	19.16	8.88	7.94	2.94	8.88	7.94	2.94	100.00	29.21	3.93
60x100	447.4	387.7	59.65	27.65	7.16	2.73	36.53	7.35	2.78	91.12	31.28	4.02
100x200	438.4	376.8	61.59	28.55	10.14	3.22	65.07	8.57	2.97	63.47	41.79	4.59
200x325	405.4	386.3	19.06	8.83	46.97	6.13	73.91	13.16	3.35	34.93	67.66	5.71
-325	62.8	6.5	56.30	26.09	74.67	5.57	100.00	29.21	3.93	26.09	74.67	5.57
Total (Calc)	--	--	215.76	100.00	29.21	3.93	--	--		--		--

Product P4 Feed Weight (%): 3.74

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	331.5	322.9	8.56	5.59	13.59	3.33	5.59	13.59	3.33	100.00	30.29	4.32
60x100	409.0	367.0	42.00	27.44	9.91	3.10	33.04	10.53	3.14	94.41	31.28	4.38
100x200	397.7	347.4	50.27	32.85	10.79	3.38	65.89	10.66	3.26	66.96	40.04	4.91
200x325	414.5	403.2	11.33	7.41	51.88	6.30	73.29	14.82	3.56	34.11	68.20	6.39
-325	47.2	6.3	40.87	26.71	72.72	6.41	100.00	30.29	4.32	26.71	72.72	6.41
Total (Calc)	--	--	153.02	100.00	30.29	4.32	--	--		--		--

SPIRAL DATA ANALYSIS

Description: Run 36 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P5 Feed Weight (%): 5.54

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	327.7	322.9	4.80	3.70	19.06	3.78	3.70	19.06	3.78	100.00	39.06	5.31
60x100	424.1	397.3	26.76	20.64	12.09	3.37	24.34	13.15	3.43	96.30	39.83	5.37
100x200	435.6	391.3	44.33	34.20	20.27	3.88	58.55	17.31	3.69	75.66	47.40	5.92
200x325	397.8	378.6	19.22	14.83	60.47	6.68	73.38	26.03	4.29	41.45	69.78	7.60
-325	40.7	6.2	34.51	26.62	74.96	8.11	100.00	39.06	5.31	26.62	74.96	8.11
Total (Calc)	--	--	129.61	100.00	39.06	5.31	--	--		--		--

Product P6 Feed Weight (%): 3.27

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	324.1	322.9	1.21	0.90	17.37	3.70	0.90	17.37	3.70	100.00	55.85	8.45
60x100	401.2	387.7	13.48	10.06	17.54	3.50	10.96	17.53	3.52	99.10	56.20	8.49
100x200	418.7	376.8	41.88	31.25	34.93	4.56	42.21	30.41	4.29	89.04	60.57	9.05
200x325	420.7	386.3	34.45	25.70	73.02	9.66	67.91	46.54	6.32	57.79	74.43	11.48
-325	49.2	6.2	43.01	32.09	75.56	12.94	100.00	55.85	8.45	32.09	75.56	12.94
Total (Calc)	--	--	134.02	100.00	55.85	8.45	--	--		--		--

SPIRAL DATA ANALYSIS

Description: Run 36 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PRODUCT SIZE ANALYSIS

Product P7 Feed Weight (%): 10.79

Sample Size (Mesh)	Dry + Tare Weight (gm)	Tare Weight (gm)	Dry Weight (gm)	Dry Weight (%)	Dry Ash (%)	Dry Sulfur (%)	Cumulative Retained			Cumulative Passed		
							Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)	Weight (%, dry)	Ash (%, dry)	Sulfur (%, dry)
+60	329.7	322.9	6.85	2.71	31.61	4.03	2.71	31.61	4.03	100.00	53.00	7.89
60x100	344.2	308.1	36.07	14.30	22.02	3.62	17.01	23.55	3.69	97.29	53.60	8.00
100x200	378.7	294.5	84.16	33.35	38.10	5.25	50.36	33.18	4.72	82.99	59.03	8.75
200x325	355.7	298.0	57.66	22.85	69.54	9.96	73.21	44.53	6.36	49.64	73.10	11.11
-325	73.8	6.2	67.59	26.79	76.14	12.08	100.00	53.00	7.89	26.79	76.14	12.08
Total (Calc)	--	--	252.33	100.00	53.00	7.89	--	--		--		--

SPIRAL DATA ANALYSIS

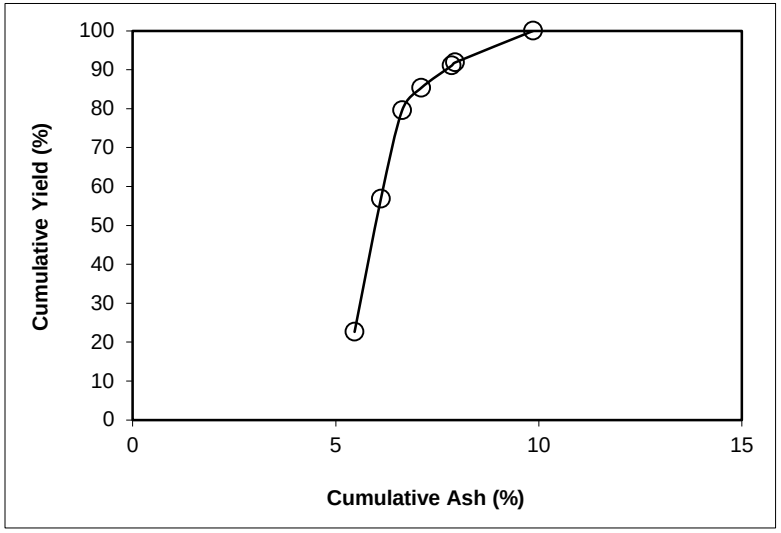
Description: Run 36 -Fine Spiral Test

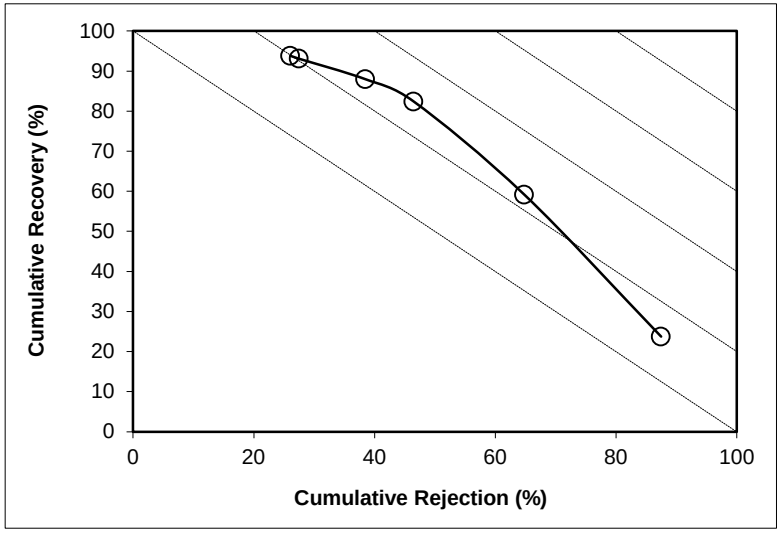
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: +60 Feed Weight (%): 3.60

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	22.64	5.46	22.64	5.46	23.74	77.36	11.15	87.46	11.20
P2	34.17	6.54	56.81	6.11	59.18	43.19	14.80	64.79	23.97
P3	22.74	7.94	79.56	6.63	82.41	20.44	22.43	46.48	28.89
P4	5.81	13.59	85.36	7.11	87.97	14.64	25.93	38.48	26.46
P5	5.69	19.06	91.06	7.85	93.08	8.94	30.30	27.48	20.57
P6	0.82	17.37	91.87	7.94	93.83	8.13	31.61	26.04	19.88
P7	8.13	31.61	100.00	9.86	100.00	0.00			
Total (Calc)	100.00	9.86	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

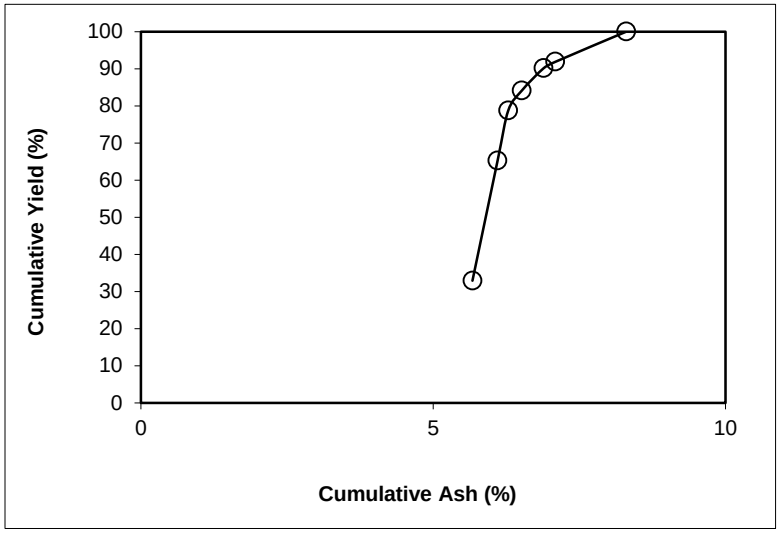
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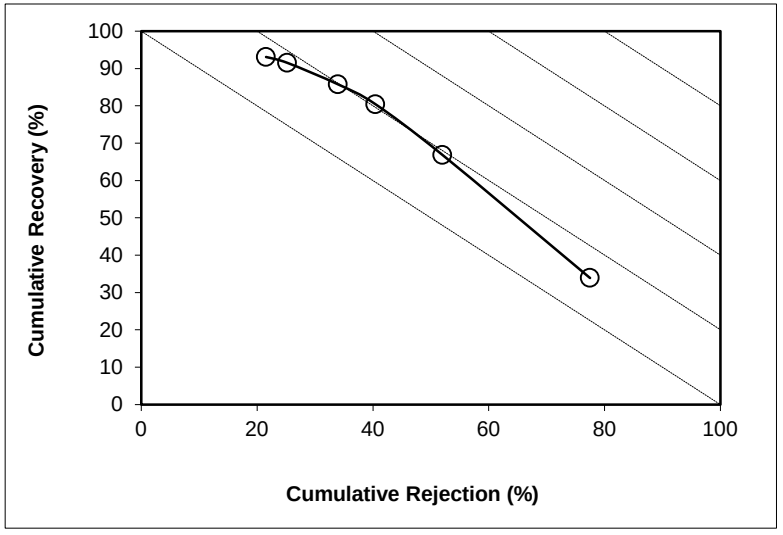
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 60x100 Feed Weight (%): 18.99

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	32.94	5.67	32.94	5.67	33.89	67.06	9.59	77.49	11.38
P2	32.34	6.54	65.29	6.10	66.85	34.71	12.44	52.02	18.87
P3	13.43	7.16	78.72	6.28	80.45	21.28	15.77	40.43	20.88
P4	5.40	9.91	84.12	6.52	85.76	15.88	17.76	33.98	19.74
P5	6.02	12.09	90.14	6.89	91.53	9.86	21.23	25.20	16.74
P6	1.73	17.54	91.88	7.09	93.09	8.12	22.02	21.54	14.63
P7	8.12	22.02	100.00	8.30	100.00	0.00			
Total (Calc)	100.00	8.30	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

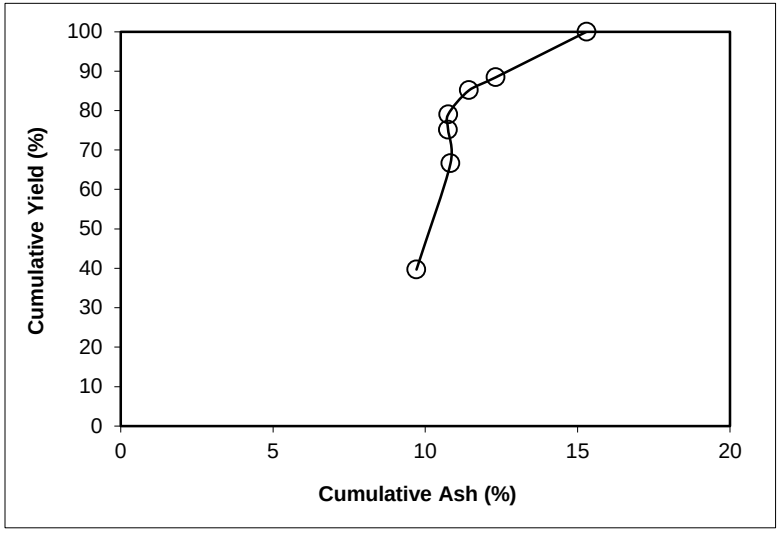
Description: Run 36 -Fine Spiral Test

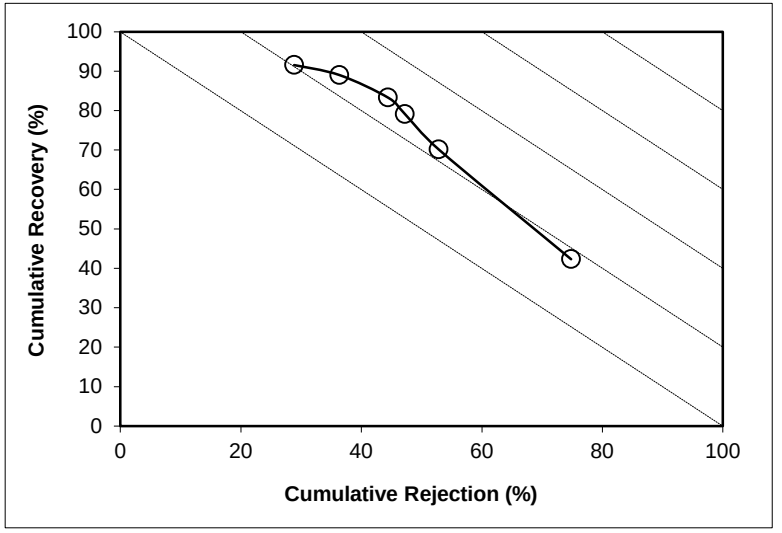
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 31.08

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	39.69	9.71	39.69	9.71	42.30	60.31	18.97	74.80	17.11
P2	26.92	12.47	66.61	10.83	70.12	33.39	24.20	52.85	22.97
P3	8.47	10.14	75.08	10.75	79.11	24.92	28.99	47.23	26.34
P4	3.95	10.79	79.03	10.75	83.27	20.97	32.42	44.44	27.71
P5	6.10	20.27	85.13	11.43	89.01	14.87	37.40	36.36	25.37
P6	3.29	34.93	88.42	12.31	91.54	11.58	38.10	28.84	20.38
P7	11.58	38.10	100.00	15.29	100.00	0.00			
Total (Calc)	100.00	15.29	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

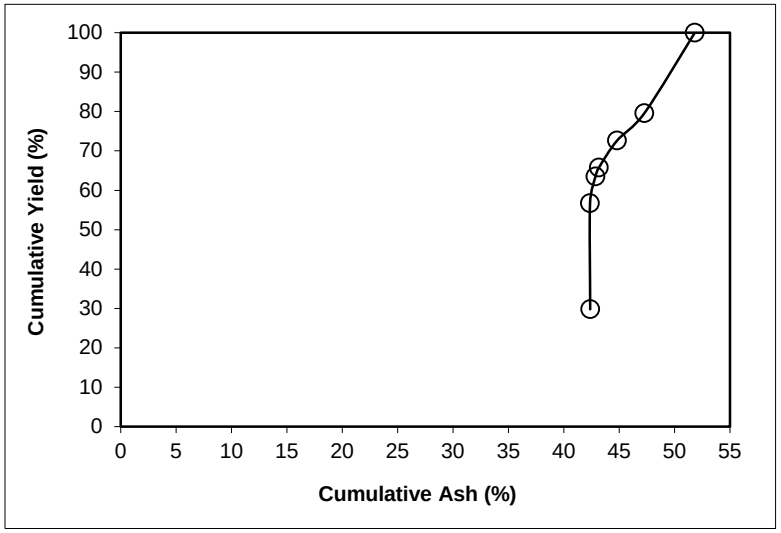
Description: Run 36 -Fine Spiral Test

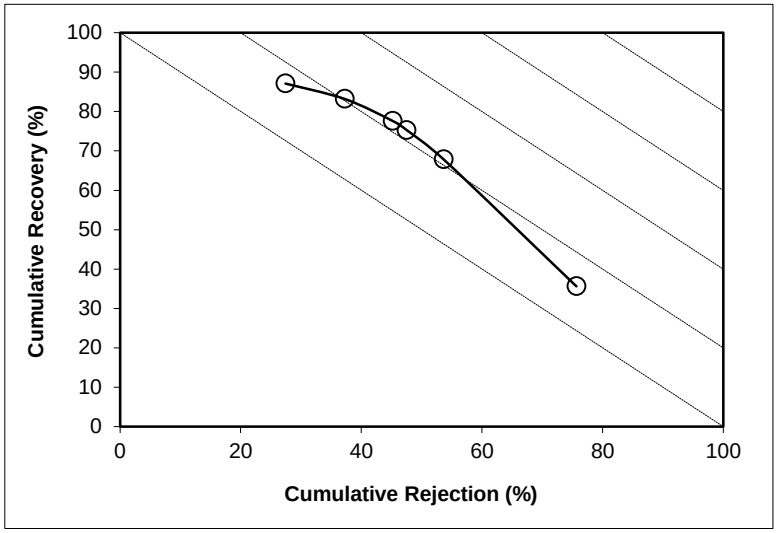
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 12.06

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	29.79	42.37	29.79	42.37	35.63	70.21	55.82	75.64	11.27
P2	26.93	42.35	56.72	42.36	67.85	43.28	64.21	53.63	21.48
P3	6.76	46.97	63.48	42.85	75.29	36.52	67.40	47.51	22.80
P4	2.30	51.88	65.77	43.17	77.58	34.23	68.44	45.21	22.79
P5	6.81	60.47	72.59	44.79	83.17	27.41	70.42	37.26	20.43
P6	6.98	73.02	79.56	47.27	87.08	20.44	69.54	27.43	14.51
P7	20.44	69.54	100.00	51.82	100.00	0.00			
Total (Calc)	100.00	51.82	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

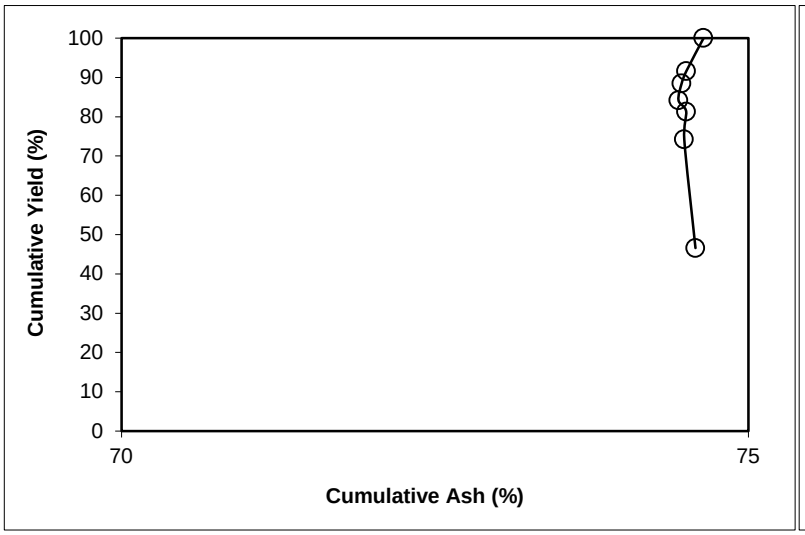
Description: Run 36 -Fine Spiral Test

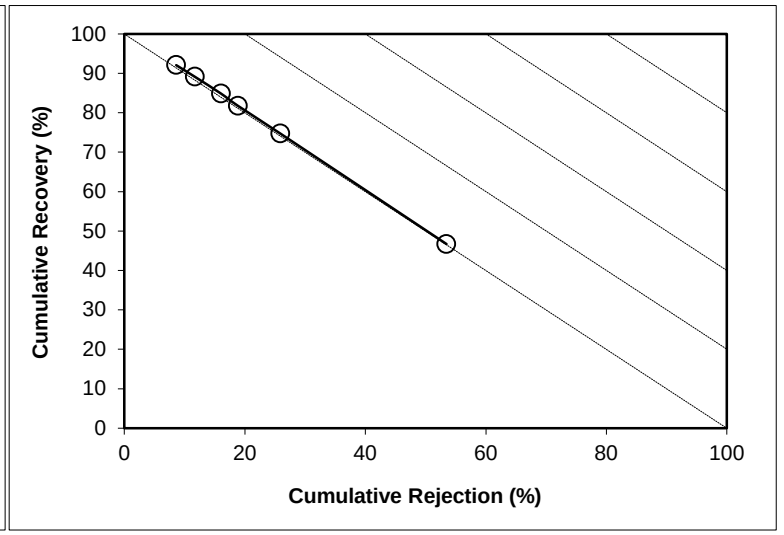
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 34.26

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	46.58	74.58	46.58	74.58	46.70	53.42	74.70	53.46	0.16
P2	27.67	74.34	74.25	74.49	74.70	25.75	75.09	25.90	0.60
P3	7.03	74.67	81.28	74.50	81.72	18.72	75.24	18.87	0.59
P4	2.91	72.72	84.19	74.44	84.86	15.81	75.71	16.03	0.89
P5	4.31	74.96	88.50	74.47	89.11	11.50	75.99	11.71	0.82
P6	3.07	75.56	91.56	74.50	92.06	8.44	76.14	8.60	0.67
P7	8.44	76.14	100.00	74.64	100.00	0.00			
Total (Calc)	100.00	74.64	--	--	--	--	--	--	--





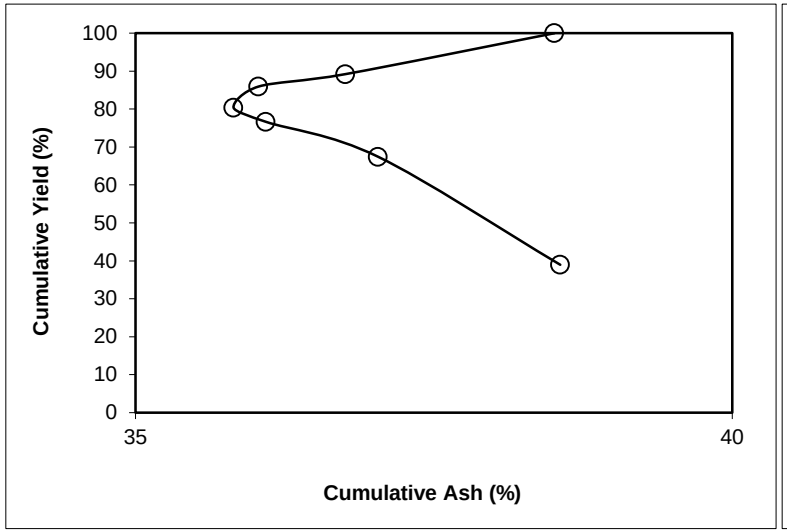
SPIRAL DATA ANALYSIS

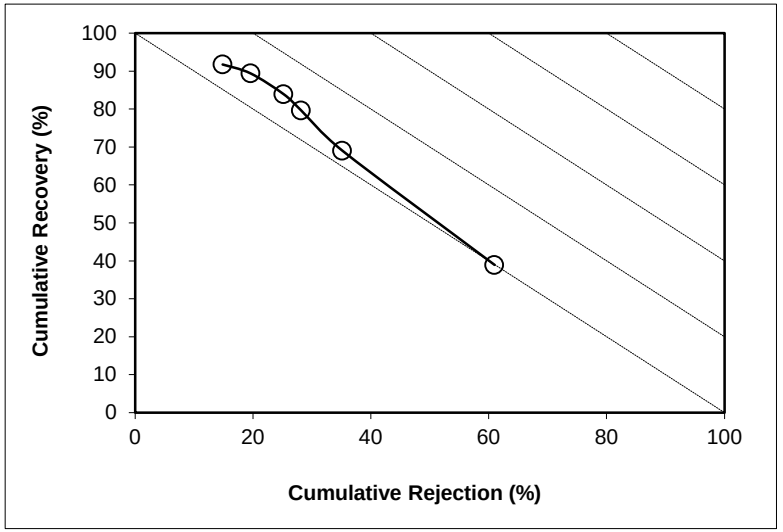
Description: Run 36 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Ash Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Ash (%, dry)	Recovery (%, dry)	Weight (%, dry)	Ash (%, dry)	Rejection (%, dry)	
P1	38.96	38.56	38.96	38.56	38.93	61.04	38.48	60.99	-0.08
P2	28.47	34.94	67.43	37.03	69.05	32.57	41.57	35.16	4.21
P3	9.23	29.21	76.66	36.09	79.67	23.34	46.45	28.16	7.83
P4	3.74	30.29	80.40	35.82	83.91	19.60	49.53	25.22	9.13
P5	5.54	39.06	85.94	36.03	89.40	14.06	53.66	19.60	9.00
P6	3.27	55.85	89.21	36.76	91.75	10.79	53.00	14.85	6.60
P7	10.79	53.00	100.00	38.51	100.00	0.00			
Total (Calc)	100.00	38.51	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

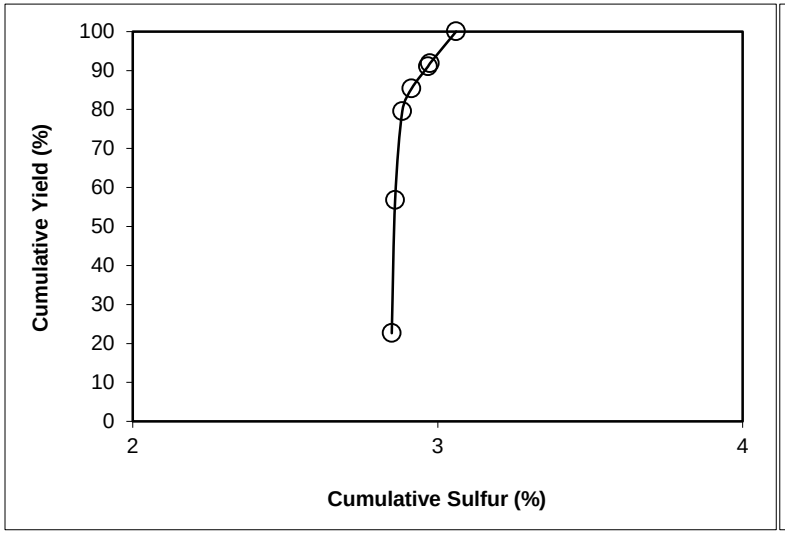
Description: Run 36 -Fine Spiral Test

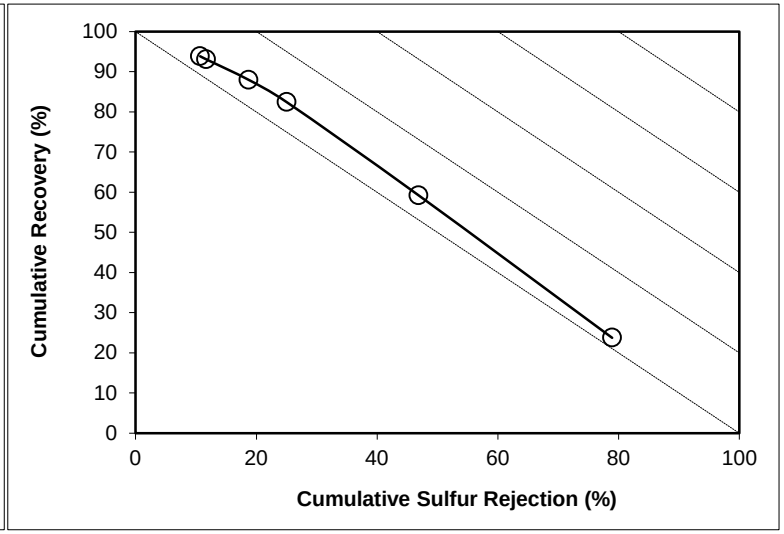
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: +60 Feed Weight (%): 3.60

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	22.64	2.85	22.64	2.85	23.74	77.36	3.12	78.92	2.67
P2	34.17	2.87	56.81	2.86	59.18	43.19	3.32	46.90	6.08
P3	22.74	2.94	79.56	2.88	82.41	20.44	3.75	25.03	7.44
P4	5.81	3.33	85.36	2.91	87.97	14.64	3.91	18.71	6.69
P5	5.69	3.78	91.06	2.97	93.08	8.94	4.00	11.68	4.77
P6	0.82	3.70	91.87	2.97	93.83	8.13	4.03	10.69	4.53
P7	8.13	4.03	100.00	3.06	100.00	0.00			
Total (Calc)	100.00	3.06	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

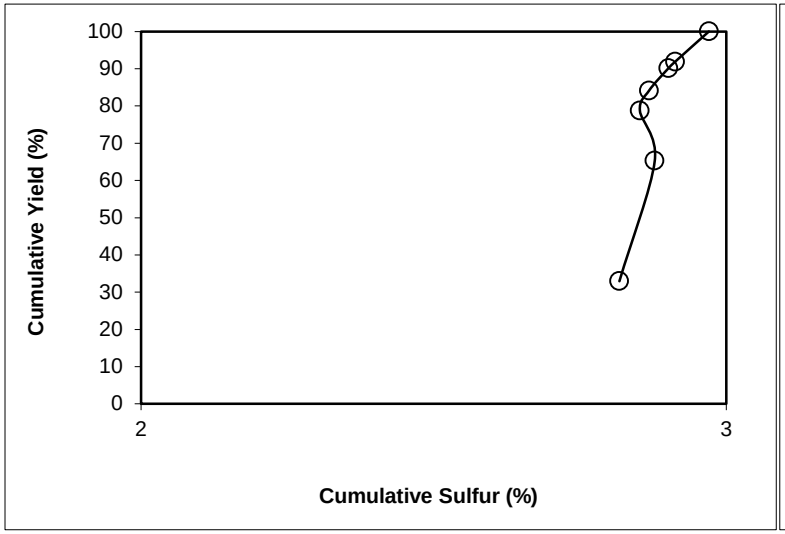
Description: Run 36 -Fine Spiral Test

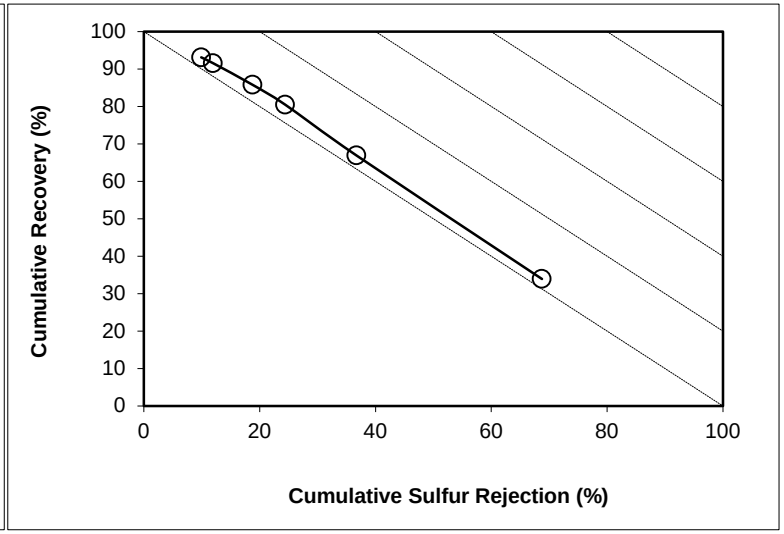
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 60x100 Feed Weight (%): 18.99

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	32.94	2.82	32.94	2.82	33.89	67.06	3.05	68.75	2.64
P2	32.34	2.94	65.29	2.88	66.85	34.71	3.14	36.75	3.60
P3	13.43	2.73	78.72	2.85	80.45	21.28	3.41	24.41	4.86
P4	5.40	3.10	84.12	2.87	85.76	15.88	3.51	18.78	4.53
P5	6.02	3.37	90.14	2.90	91.53	9.86	3.60	11.95	3.48
P6	1.73	3.50	91.88	2.91	93.09	8.12	3.62	9.91	3.00
P7	8.12	3.62	100.00	2.97	100.00	0.00			
Total (Calc)	100.00	2.97	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

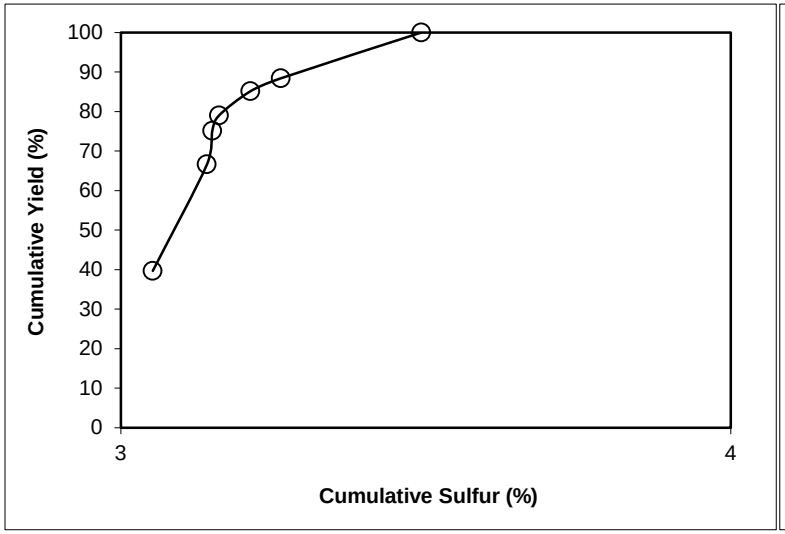
Description: Run 36 -Fine Spiral Test

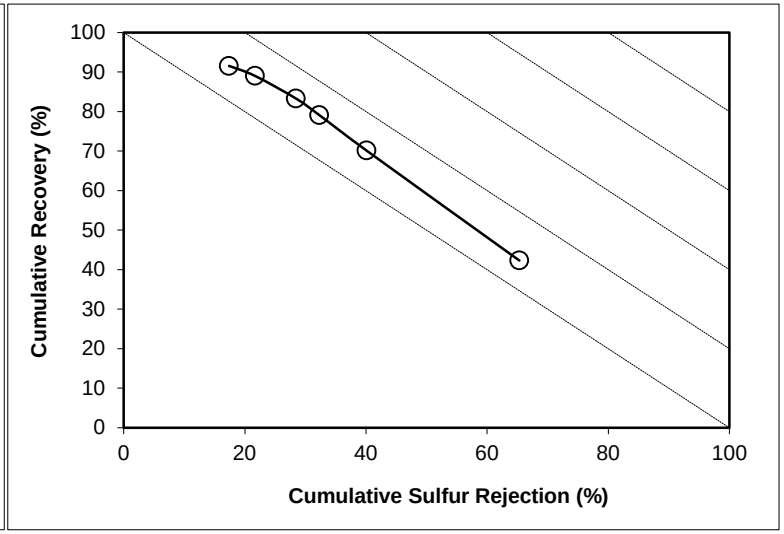
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 100x200 Feed Weight (%): 31.08

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	39.69	3.05	39.69	3.05	42.30	60.31	3.78	65.32	7.62
P2	26.92	3.27	66.61	3.14	70.12	33.39	4.19	40.09	10.22
P3	8.47	3.22	75.08	3.15	79.11	24.92	4.53	32.29	11.40
P4	3.95	3.38	79.03	3.16	83.27	20.97	4.74	28.47	11.74
P5	6.10	3.88	85.13	3.21	89.01	14.87	5.10	21.70	10.71
P6	3.29	4.56	88.42	3.26	91.54	11.58	5.25	17.40	8.94
P7	11.58	5.25	100.00	3.49	100.00	0.00			
Total (Calc)	100.00	3.49	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

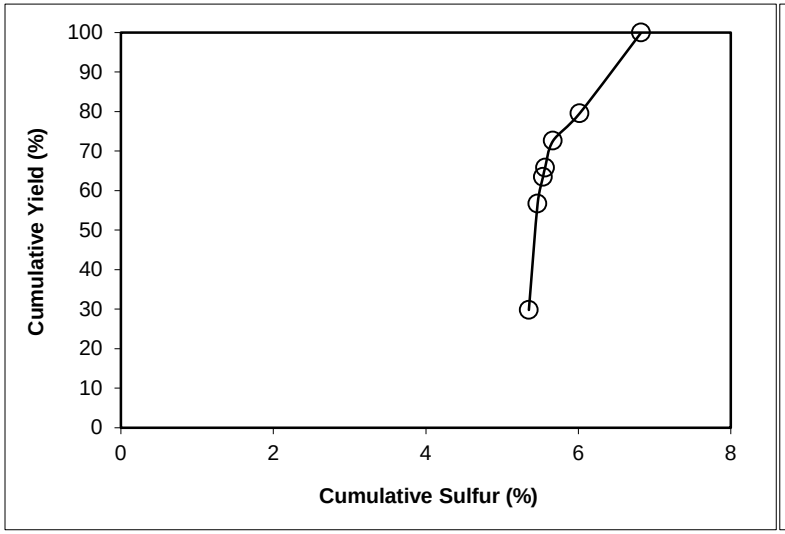
Description: Run 36 -Fine Spiral Test

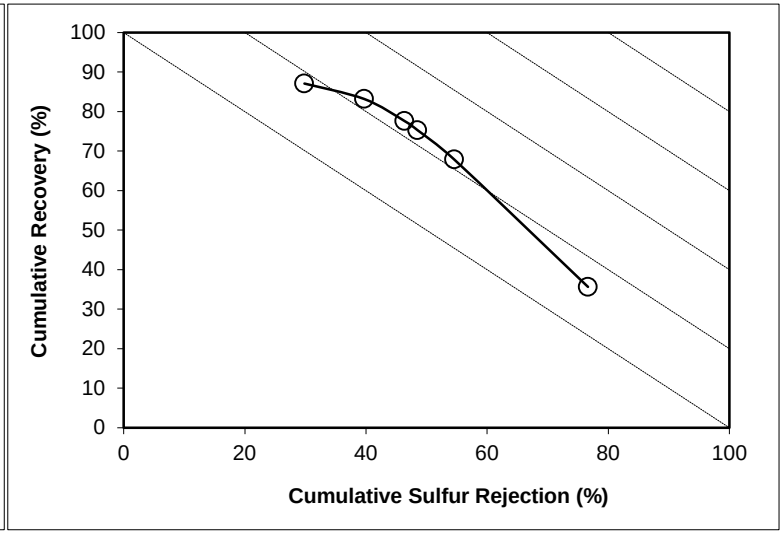
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: 200x325 Feed Weight (%): 12.06

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	29.79	5.35	29.79	5.35	35.63	70.21	7.45	76.64	12.27
P2	26.93	5.59	56.72	5.47	67.85	43.28	8.61	54.57	22.42
P3	6.76	6.13	63.48	5.54	75.29	36.52	9.06	48.50	23.79
P4	2.30	6.30	65.77	5.56	77.58	34.23	9.25	46.38	23.96
P5	6.81	6.68	72.59	5.67	83.17	27.41	9.89	39.71	22.89
P6	6.98	9.66	79.56	6.02	87.08	20.44	9.96	29.84	16.92
P7	20.44	9.96	100.00	6.82	100.00	0.00			
Total (Calc)	100.00	6.82	--	--	--	--	--	--	--





SPIRAL DATA ANALYSIS

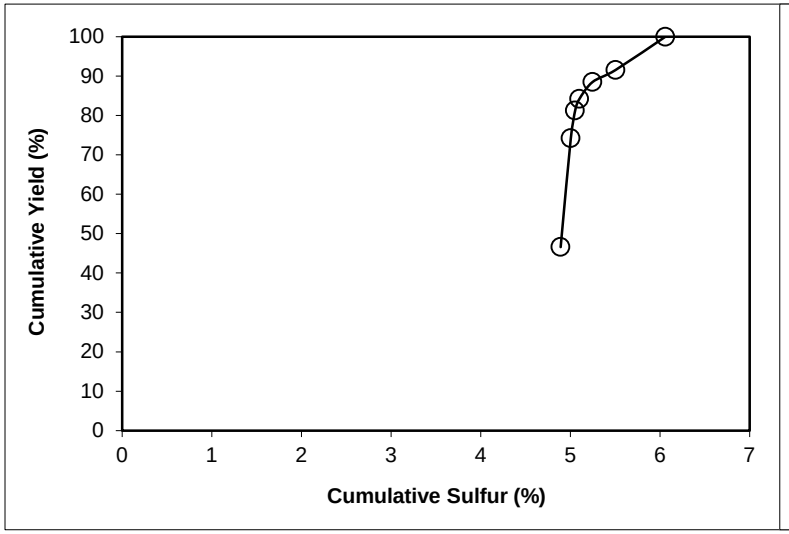
Description: Run 36 -Fine Spiral Test

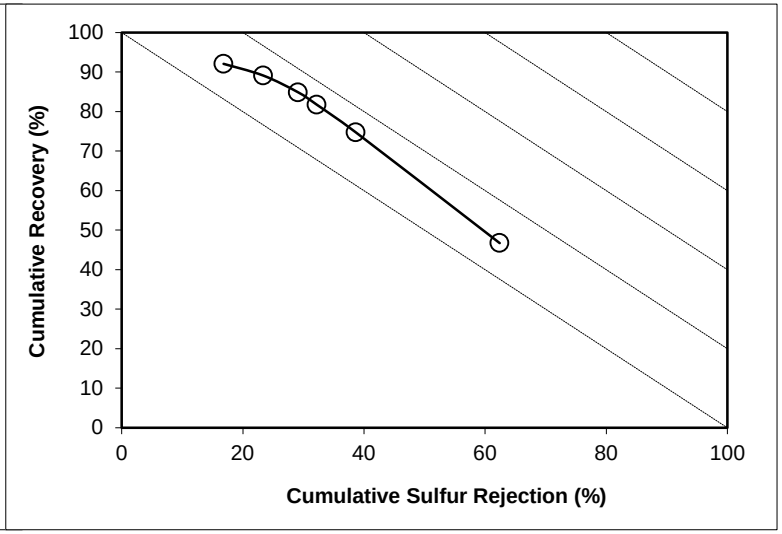
Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Size Class: -325 Feed Weight (%): 34.26

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	46.58	4.89	46.58	4.89	46.70	53.42	7.08	62.39	9.10
P2	27.67	5.20	74.25	5.01	74.70	25.75	9.10	38.67	13.37
P3	7.03	5.57	81.28	5.05	81.72	18.72	10.43	32.21	13.93
P4	2.91	6.41	84.19	5.10	84.86	15.81	11.17	29.13	13.99
P5	4.31	8.11	88.50	5.25	89.11	11.50	12.31	23.37	12.47
P6	3.07	12.94	91.56	5.51	92.06	8.44	12.08	16.82	8.88
P7	8.44	12.08	100.00	6.06	100.00	0.00			
Total (Calc)	100.00	6.06	--	--	--	--	--	--	--





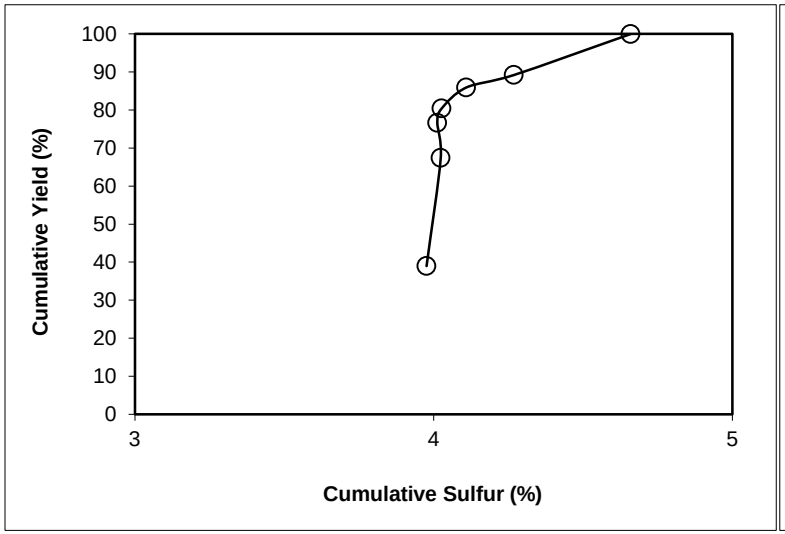
SPIRAL DATA ANALYSIS

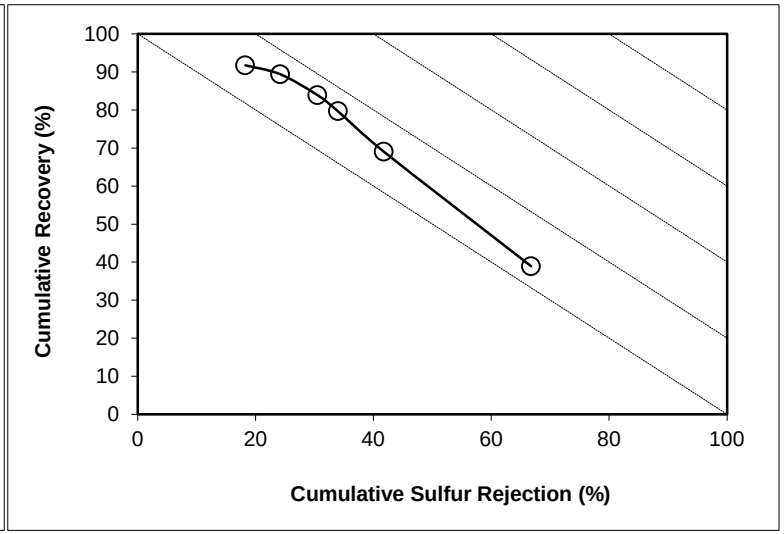
Description: Run 36 -Fine Spiral Test

Comments: 0.15 x 0 mm Nominal Particle Size (Sieve U/F), Illinios

PERFORMANCE ANALYSIS

Sample ID	Dry Weight (%, dry)	Sulfur Content (%, dry)	Cumulative Clean			Cumulative Reject			Separation Efficiency (%)
			Weight (%, dry)	Sulfur (%, dry)	Recovery (%, dry)	Weight (%, dry)	Sulfur (%, dry)	Rejection (%, dry)	
P1	38.96	3.98	38.96	3.98	38.93	61.04	5.10	66.75	5.68
P2	28.47	4.09	67.43	4.02	69.05	32.57	5.98	41.77	10.82
P3	9.23	3.93	76.66	4.01	79.67	23.34	6.79	33.99	13.66
P4	3.74	4.32	80.40	4.03	83.91	19.60	7.25	30.52	14.43
P5	5.54	5.31	85.94	4.11	89.40	14.06	8.02	24.21	13.61
P6	3.27	8.45	89.21	4.27	91.75	10.79	7.89	18.27	10.03
P7	10.79	7.89	100.00	4.66	100.00	0.00			
Total (Calc)	100.00	4.66	--	--	--	--	--	--	--





APPENDIX G – Water Only Cyclone Circuit Results

Water Only Cyclone Data (Mass Balancing)

Description: Test No. 8 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals

PERFORMANCE BY PRODUCT AND SIZE

	Size Class (Mesh)	Measured Values			Estimated Values			% Change in Measured Values			Relatvie Error in Measured Values			Weighted Sum of Squares			Total	X
		Under Flow (U)	Over Flow (O)	Feed F	Under Flow (U)	Over Flow (O)	Feed F	Under Flow (U)	Over Flow (O)	Feed F	Under Flow (U)	Over Flow (O)	Feed F	Under Flow (U)	Over Flow (O)	Feed F	SSQ F+U+O	Const F-U-O
Mass % Stream	Plus 100	35.40	7.50	28.78	35.16	7.47	29.13	-0.67	-0.42	1.23	1	1	1	0.00	0.00	0.00	0.00	***
	100x200	28.02	11.85	24.50	28.07	11.83	24.53	0.18	-0.18	0.11	1	1	1	0.00	0.00	0.00	0.00	***
	200x325	13.15	5.28	11.45	13.16	5.28	11.45	0.12	-0.04	-0.02	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 325	23.44	75.37	35.27	23.61	75.42	34.89	0.72	0.07	-1.07	1	1	1	0.00	0.00	0.00	0.00	***
	Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**0.00**	**0.00**	**0.00**	***	***	***	***	***	***	***	***
Ash % Stream	Plus 100	12.42	5.23	14.35	13.41	5.24	12.95	7.96	0.20	-9.74	1	1	1	0.01	0.00	0.01	0.02	***
	100x200	23.63	9.31	22.60	23.88	9.31	22.35	1.04	0.05	-1.12	1	1	1	0.00	0.00	0.00	0.00	***
	200x325	58.75	26.68	53.33	57.55	26.65	54.44	-2.04	-0.11	2.09	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 325	73.88	75.04	74.44	73.90	75.06	74.44	0.02	0.03	0.01	1	1	1	0.00	0.00	0.00	0.00	***
															***	***	***	***
															***	***	***	***
	Total	**36.06**	**59.46**	**42.03**	**36.44**	**59.51**	**41.46**	**1.05**	**0.09**	**-1.35**	***	***	***	***	***	***	***	***
Sulfur % Stream	Plus 100	3.29	2.85	3.40	3.35	2.85	3.32	1.99	0.10	-2.18	1	1	1	0.00	0.00	0.00	0.00	***
	100x200	4.56	3.14	4.52	4.62	3.15	4.46	1.24	0.10	-1.37	1	1	1	0.00	0.00	0.00	0.00	***
	200x325	10.56	4.22	10.35	10.78	4.23	10.12	2.06	0.09	-2.25	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 325	10.89	2.53	6.97	10.91	2.53	6.96	0.11	0.02	-0.13	1	1	1	0.00	0.00	0.00	0.00	***
	Total	**6.38**	**2.72**	**5.73**	**6.47**	**2.72**	**5.65**	**1.33**	**0.04**	**-1.40**	***	***	***					
Mass (TPH)	Plus 100	0.46	0.03	0.50	0.46	0.03	0.48	-0.16	-18.66	-3.11	***	***	***	***	***	***	***	0.00
	100x200	0.36	0.05	0.42	0.36	0.04	0.41	0.70	-18.46	-4.19	***	***	***	***	***	***	***	0.00
	200x325	0.17	0.02	0.20	0.17	0.02	0.19	0.63	-18.35	-4.31	***	***	***	***	***	***	***	0.00
	Minus 325	0.30	0.33	0.61	0.31	0.27	0.58	1.24	-18.25	-5.32	***	***	***	***	***	***	***	0.00
															***	***	***	
															***	***	***	
	Total	**1.29**	**0.44**	**1.73**	**1.30**	**0.36**	**1.66**	**0.51**	**-18.31**	**-4.29**	***	***	***	***	***	***	***	0.00
Ash (TPH)	Plus 100	0.06	0.00	0.07	0.06	0.00	0.06	7.79	-18.50	-12.55	***	***	***	***	***	***	***	0.00
	100x200	0.09	0.00	0.10	0.09	0.00	0.09	1.75	-18.42	-5.26	***	***	***	***	***	***	***	0.00
	200x325	0.10	0.01	0.11	0.10	0.01	0.10	-1.43	-18.43	-2.31	***	***	***	***	***	***	***	0.00
	Minus 325	0.22	0.25	0.45	0.23	0.20	0.43	1.26	-18.23	-5.31	***	***	***	***	***	***	***	0.00
															***	***	***	
															***	***	***	
	Total	**0.47**	**0.26**	**0.73**	**0.47**	**0.21**	**0.69**	**1.57**	**-18.24**	**-5.58**	***	***	***	***	***	***	***	0.00
Sulfur (TPH)	Plus 100	0.02	0.00	0.02	0.02	0.00	0.02	1.83	-18.57	-5.22	***	***	***	***	***	***	***	0.00
	100x200	0.02	0.00	0.02	0.02	0.00	0.02	1.94	-18.38	-5.50	***	***	***	***	***	***	***	0.00
	200x325	0.02	0.00	0.02	0.02	0.00	0.02	2.70	-18.27	-6.46	***	***	***	***	***	***	***	0.00
	Minus 325	0.03	0.01	0.04	0.03	0.01	0.04	1.35	-18.23	-5.44	***	***	***	***	***	***	***	0.00
											***	***	***	***	***	***	***	
											***	***	***	***	***	***	***	
	Total	**0.08**	**0.01**	**0.10**	**0.08**	**0.01**	**0.09**	**1.85**	**-18.28**	**-5.63**	***	***	***	***				0.00

Sum SSQ = 0.02

WOC PERFORMANCE

Description: Test No. 8 - WOC (0.15x0 mm)
Comments: Mass balanced data and performance comparision of WOC with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	U/F Wt % Feed	O/F Wt % Feed	Feed Wt % Feed	U/F Ash %	O/F Ash (%)	Feed Ash (%)	U/F Sulfur (%)	O/F Sulfur (%)
Plus 100	27.51	1.63	29.13	13.41	5.24	12.95	3.35	2.85
100x200	21.96	2.58	24.53	23.88	9.31	22.35	4.62	3.15
200x325	10.30	1.15	11.45	57.55	26.65	54.44	10.78	4.23
Minus 325	18.47	16.42	34.89	73.90	75.06	74.44	10.91	2.53
Total	78.22	21.78	100.00	36.44	59.51	41.46	6.47	2.72

WOC PERFORMANCE

Description: Test No. 8 - WOC (0.15x0 mm)
Comments: Mass balanced data and performance comparision of WOC with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	Feed Sulfur (%)	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)	Sulfur Rej. (%)	Separation Efficiency Ash (%)	Separation Efficiency Sulfur (%)
Plus 100	3.32	5.59	94.41	6.08	97.74	95.21	3.82	1.29
100x200	4.46	10.50	89.50	12.26	95.62	92.60	7.88	4.86
200x325	10.12	10.05	89.95	16.18	95.08	95.80	11.26	11.98
Minus 325	6.96	47.07	52.93	45.94	52.54	82.89	-1.52	28.83
Total	5.65	21.78	78.22	15.06	68.74	89.53	-16.20	4.59

PERFORMANCE COMPARISON

Description: Test No. 8 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals

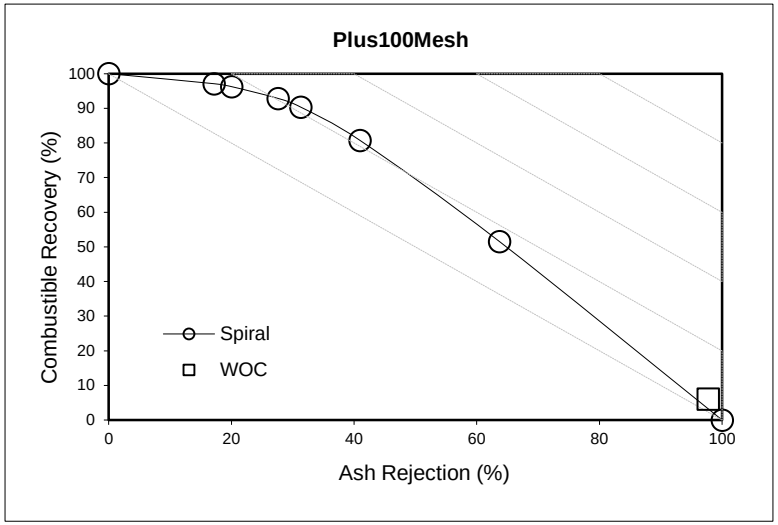
Size Class (Mesh)	WOC Comb. Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 100	6.08	0.00	51.51	80.74	90.31	92.84	96.25	97.10	100.00	
100x200	12.26	0.00	52.61	76.35	82.64	85.71	90.80	92.44	100.00	
200x325	16.18	0.00	44.82	67.58	74.07	76.84	83.93	87.34	100.00	
Minus 325	45.94	0.00	55.90	78.14	83.36	85.59	89.67	92.05	100.00	
Total	15.06	0.00	51.93	77.94	85.33	87.95	92.30	93.83	100.00	

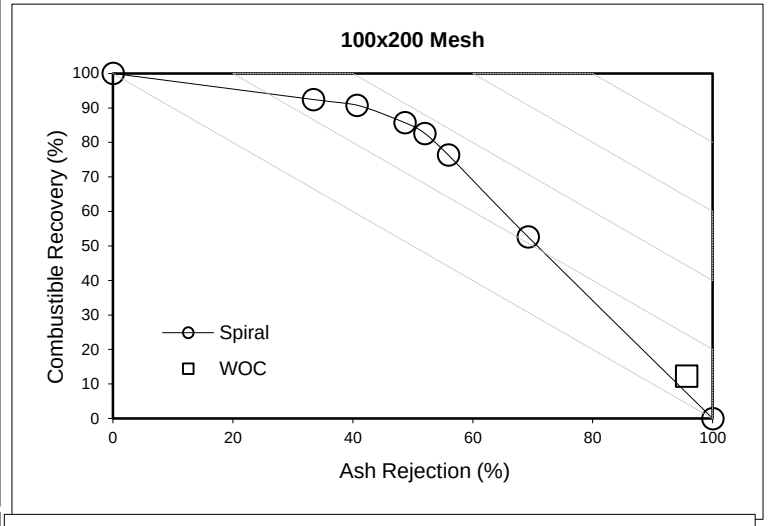
Size Class (Mesh)	WOC Ash Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 100	97.74	100.00	63.72	40.96	31.34	27.63	20.04	17.17	0.00	
100x200	95.62	100.00	69.24	55.92	51.99	48.69	40.70	33.41	0.00	
200x325	95.08	100.00	70.84	56.87	50.51	47.68	36.63	28.93	0.00	
Minus 325	52.54	100.00	46.41	24.63	19.33	17.02	12.57	9.76	0.00	
Total	68.74	100.00	55.65	36.59	31.10	28.45	22.09	17.73	0.00	

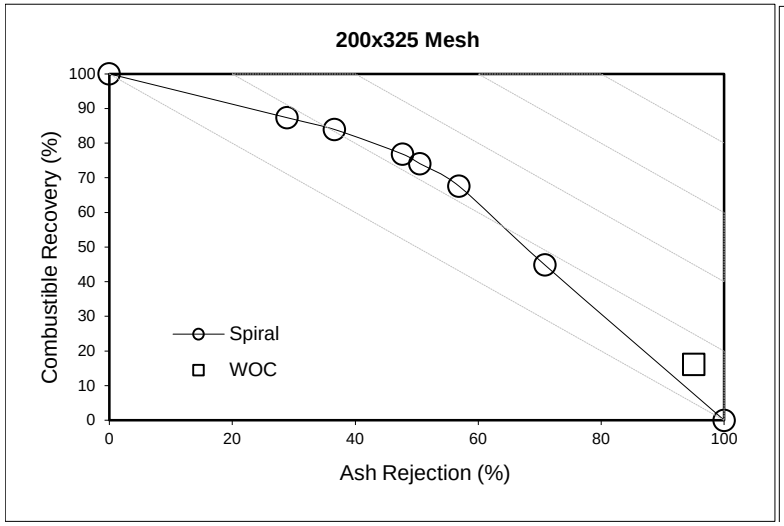
PERFORMANCE COMPARISON

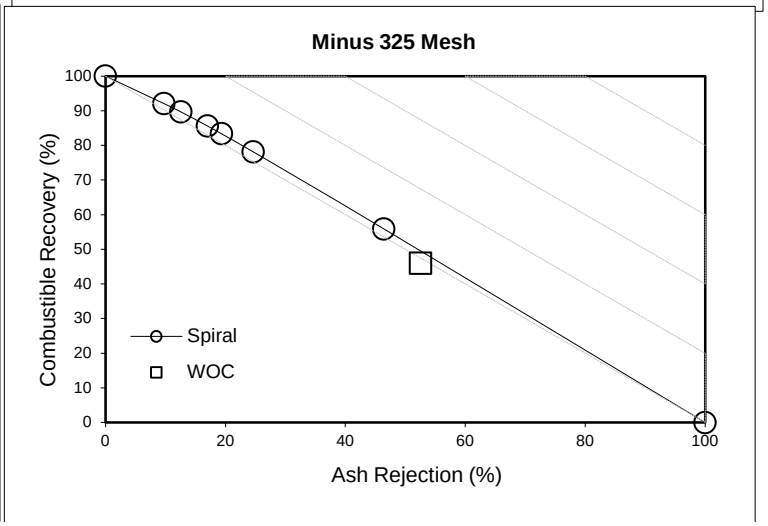
Description: Test No. 8 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals





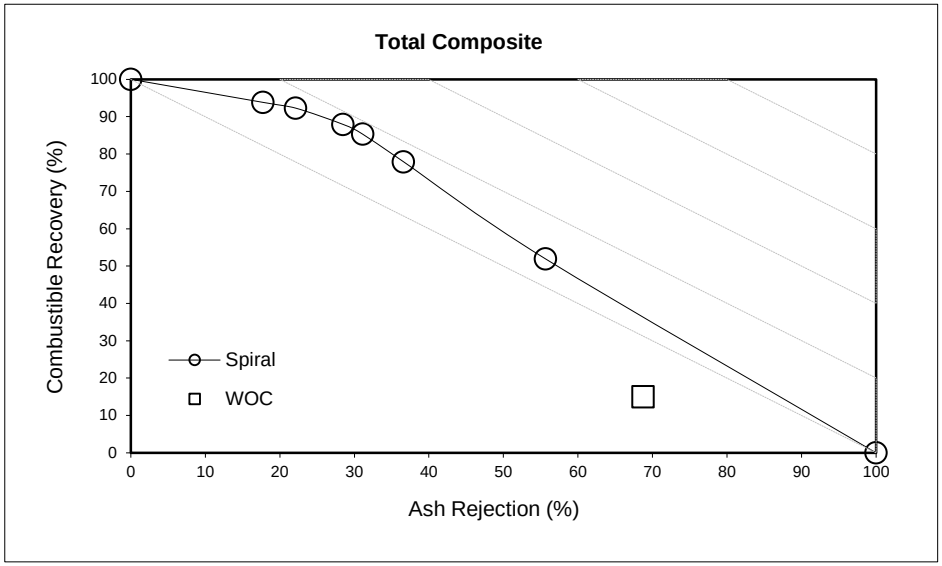




PERFORMANCE COMPARISON

Description: Test No. 8 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals



PERFORMANCE COMPARISON

Description: Test No. 8 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals

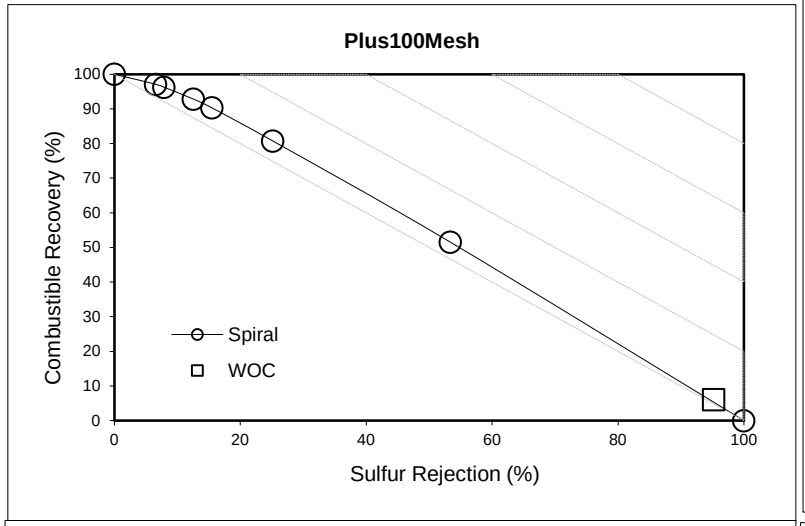
Size Class (Mesh)	WOC Comb. Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 100	6.08	0.00	51.51	80.74	90.31	92.84	96.25	97.10	100.00	
100x200	12.26	0.00	52.61	76.35	82.64	85.71	90.80	92.44	100.00	
200x325	16.18	0.00	44.82	67.58	74.07	76.84	83.93	87.34	100.00	
Minus 325	45.94	0.00	55.90	78.14	83.36	85.59	89.67	92.05	100.00	
Total	15.06	0.00	51.93	77.94	85.33	87.95	92.30	93.83	100.00	

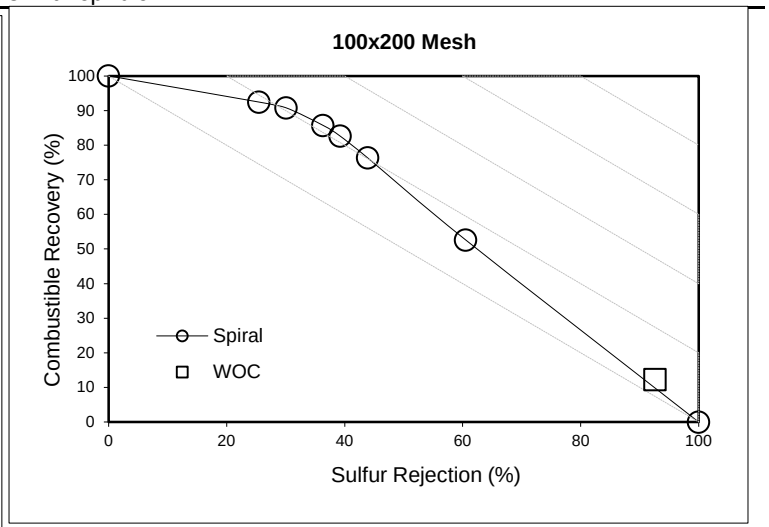
Size Class (Mesh)	WOC Sulfur Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 100	95.21	100.00	53.39	25.15	15.48	12.53	7.89	6.55	0.00	
100x200	92.60	100.00	60.51	43.88	39.22	36.33	30.05	25.48	0.00	
200x325	95.80	100.00	75.72	63.48	58.31	56.27	46.79	37.99	0.00	
Minus 325	82.89	100.00	55.63	38.07	33.73	31.12	24.71	18.61	0.00	
Total	89.53	100.00	60.26	42.19	36.83	34.25	27.59	22.08	0.00	

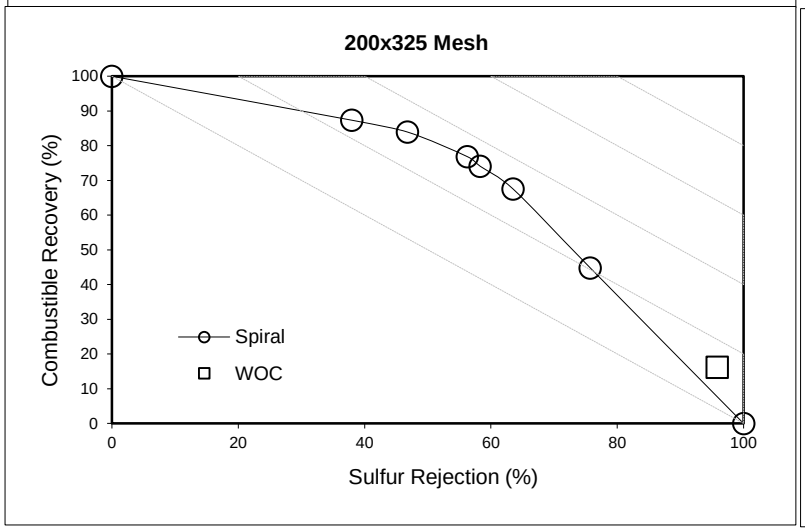
PERFORMANCE COMPARISON

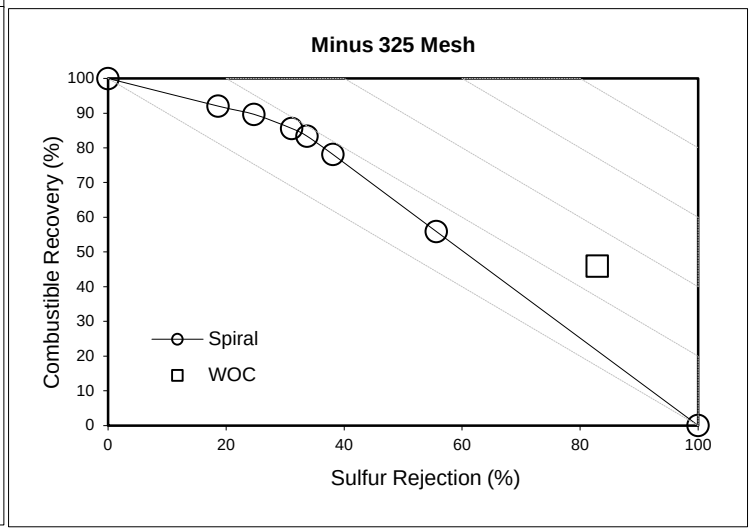
Description: Test No. 8 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals





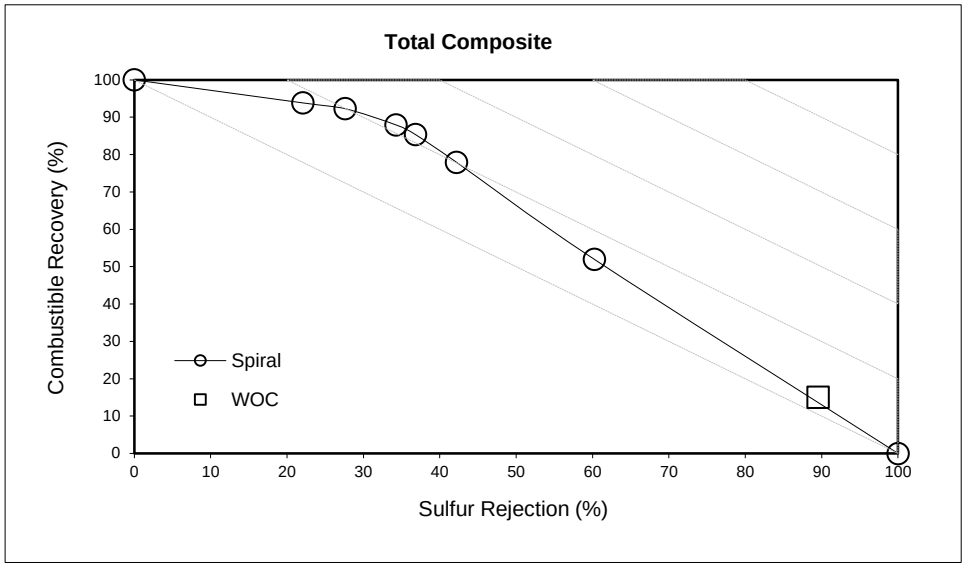




PERFORMANCE COMPARISON

Description: Test No. 8 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals



Water Only Cyclone Data (Mass Balancing)

Description: Test No. 9 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals

PERFORMANCE BY PRODUCT AND SIZE

	Size Class (Mesh)	Measured Values			Estimated Values			% Change in Measured Values			Relatvie Error in Measured Values			Weighted Sum of Squares			Total	X
		Under Flow (U)	Over Flow (O)	Feed F	Under Flow (U)	Over Flow (O)	Feed F	Under Flow (U)	Over Flow (O)	Feed F	Under Flow (U)	Over Flow (O)	Feed F	Under Flow (U)	Over Flow (O)	Feed F	SSQ F+U+O	Const F-U-O
Mass % Stream	Plus 100	35.22	6.90	27.03	33.93	6.90	28.21	-3.64	0.00	4.37	1	1	1	0.00	0.00	0.00	0.00	***
	100x200	27.58	10.53	25.15	28.29	10.58	24.54	2.60	0.51	-2.42	1	1	1	0.00	0.00	0.00	0.00	***
	200x325	13.85	5.05	11.71	13.72	5.04	11.88	-0.90	-0.23	1.44	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 325	23.36	77.52	36.11	24.05	77.48	35.36	2.96	-0.05	-2.06	1	1	1	0.00	0.00	0.00	0.00	***
	Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**0.00**	**0.00**	**0.00**	***	***	***	***	***	***	***	***
Ash % Stream	Plus 100	11.92	6.15	9.62	10.70	6.13	10.46	-10.26	-0.29	8.73	1	1	1	0.01	0.00	0.01	0.02	***
	100x200	22.40	9.53	19.77	21.58	9.52	20.48	-3.67	-0.15	3.57	1	1	1	0.00	0.00	0.00	0.00	***
	200x325	54.37	25.77	53.22	55.09	25.79	52.46	1.33	0.06	-1.43	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 325	73.66	75.01	74.39	73.66	75.04	74.30	0.00	0.04	-0.12	1	1	1	0.00	0.00	0.00	0.00	***
															***	***	***	***
															***	***	***	***
	Total	**35.11**	**60.88**	**40.67**	**35.01**	**60.87**	**40.49**	**-0.29**	**-0.01**	**-0.45**	***	***	***	***	***	***	***	***
Sulfur % Stream	Plus 100	3.26	3.03	3.08	3.17	3.02	3.16	-2.72	-0.14	2.71	1	1	1	0.00	0.00	0.00	0.00	***
	100x200	4.61	3.05	4.24	4.49	3.05	4.35	-2.75	-0.18	2.78	1	1	1	0.00	0.00	0.00	0.00	***
	200x325	10.27	4.21	9.93	10.37	4.21	9.82	1.04	0.04	-1.10	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 325	9.78	2.63	7.09	10.19	2.66	6.69	4.16	0.97	-5.63	1	1	1	0.00	0.00	0.00	0.00	***
	Total	**6.13**	**2.78**	**5.62**	**6.22**	**2.80**	**5.50**	**1.51**	**0.68**	**-2.26**	***	***	***					
Mass (TPH)	Plus 100	0.38	0.02	0.37	0.37	0.02	0.39	-3.16	-1.81	4.37	***	***	***	***	***	***	***	0.00
	100x200	0.30	0.03	0.35	0.31	0.03	0.34	3.11	-1.31	-2.42	***	***	***	***	***	***	***	0.00
	200x325	0.15	0.02	0.16	0.15	0.01	0.16	-0.40	-2.03	1.44	***	***	***	***	***	***	***	0.00
	Minus 325	0.25	0.23	0.50	0.26	0.23	0.49	3.47	-1.86	-2.06	***	***	***	***	***	***	***	0.00
															***	***	***	
															***	***	***	
	Total	**1.09**	**0.30**	**1.39**	**1.09**	**0.29**	**1.39**	**0.50**	**-1.81**	**0.00**	***	***	***	***	***	***	***	0.00
Ash (TPH)	Plus 100	0.05	0.00	0.04	0.04	0.00	0.04	-13.10	-2.09	13.49	***	***	***	***	***	***	***	0.00
	100x200	0.07	0.00	0.07	0.07	0.00	0.07	-0.68	-1.46	1.07	***	***	***	***	***	***	***	0.00
	200x325	0.08	0.00	0.09	0.08	0.00	0.09	0.92	-1.97	0.00	***	***	***	***	***	***	***	0.00
	Minus 325	0.19	0.17	0.37	0.19	0.17	0.36	3.47	-1.82	-2.18	***	***	***	***	***	***	***	0.00
															***	***	***	
															***	***	***	
	Total	**0.38**	**0.18**	**0.56**	**0.38**	**0.18**	**0.56**	**0.21**	**-1.82**	**-0.45**	***	***	***	***	***	***	***	0.00
Sulfur (TPH)	Plus 100	0.01	0.00	0.01	0.01	0.00	0.01	-5.80	-1.94	7.20	***	***	***	***	***	***	***	0.00
	100x200	0.01	0.00	0.01	0.01	0.00	0.01	0.28	-1.49	0.29	***	***	***	***	***	***	***	0.00
	200x325	0.02	0.00	0.02	0.02	0.00	0.02	0.63	-1.99	0.33	***	***	***	***	***	***	***	0.00
	Minus 325	0.02	0.01	0.04	0.03	0.01	0.03	7.78	-0.91	-7.57	***	***	***	***	***	***	***	0.00
											***	***	***	***	***	***	***	
											***	***	***	***	***	***	***	
	Total	**0.07**	**0.01**	**0.08**	**0.07**	**0.01**	**0.08**	**2.02**	**-1.14**	**-2.26**	***	***	***	***				0.00

Sum SSQ = 0.04

WOC PERFORMANCE

Description: Test No. 9 - WOC (0.15x0 mm)
Comments: Mass balanced data and performance comparision of WOC with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	U/F Wt % Feed	O/F Wt % Feed	Feed Wt % Feed	U/F Ash %	O/F Ash (%)	Feed Ash (%)	U/F Sulfur (%)	O/F Sulfur (%)
Plus 100	26.75	1.46	28.21	10.70	6.13	10.46	3.17	3.02
100x200	22.30	2.24	24.54	21.58	9.52	20.48	4.49	3.05
200x325	10.82	1.07	11.88	55.09	25.79	52.46	10.37	4.21
Minus 325	18.96	16.41	35.36	73.66	75.04	74.30	10.19	2.66
Total	78.82	21.18	100.00	35.01	60.87	40.49	6.22	2.80

WOC PERFORMANCE

Description: Test No. 9 - WOC (0.15x0 mm)
Comments: Mass balanced data and performance comparision of WOC with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	Feed Sulfur (%)	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)	Sulfur Rej. (%)	Separation Efficiency Ash (%)	Separation Efficiency Sulfur (%)
Plus 100	3.16	5.18	94.82	5.43	96.96	95.05	2.39	0.48
100x200	4.35	9.13	90.87	10.39	95.76	93.61	6.15	4.00
200x325	9.82	8.98	91.02	14.02	95.59	96.15	9.60	10.16
Minus 325	6.69	46.39	53.61	45.06	53.14	81.58	-1.80	26.63
Total	5.50	21.18	78.82	13.92	68.16	89.20	-17.91	3.12

PERFORMANCE COMPARISON

Description: Test No. 9 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals

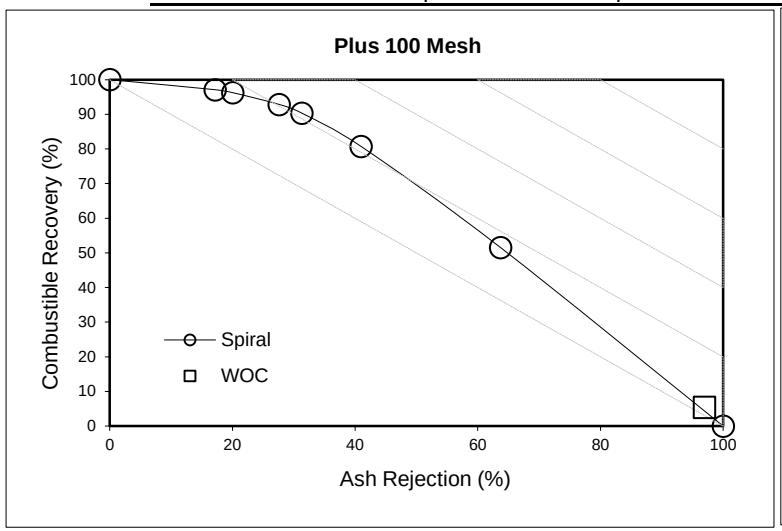
Size Class (Mesh)	WOC Comb. Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 100	5.43	0.00	51.51	80.74	90.31	92.84	96.25	97.10	100.00	
100x200	10.39	0.00	52.61	76.35	82.64	85.71	90.80	92.44	100.00	
200x325	14.02	0.00	44.82	67.58	74.07	76.84	83.93	87.34	100.00	
Minus 325	45.06	0.00	55.90	78.14	83.36	85.59	89.67	92.05	100.00	
Total	13.92	0.00	51.93	77.94	85.33	87.95	92.30	93.83	100.00	

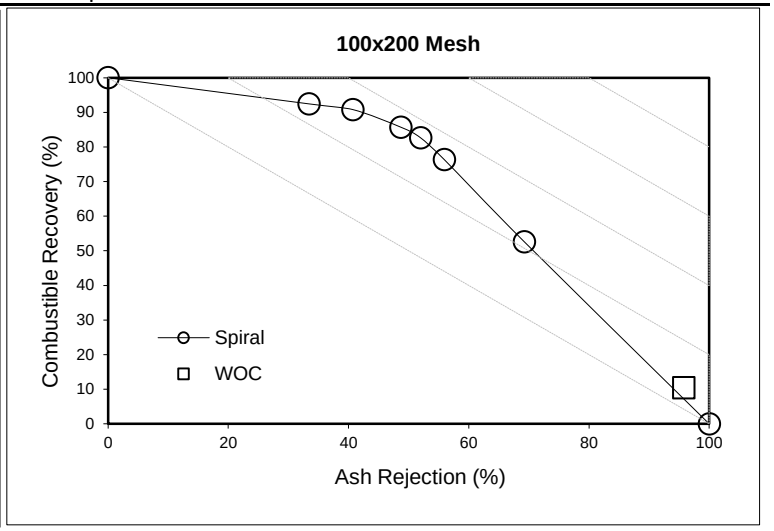
Size Class (Mesh)	WOC Ash Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 100	96.96	100.00	63.72	40.96	31.34	27.63	20.04	17.17	0.00	
100x200	95.76	100.00	69.24	55.92	51.99	48.69	40.70	33.41	0.00	
200x325	95.59	100.00	70.84	56.87	50.51	47.68	36.63	28.93	0.00	
Minus 325	53.14	100.00	46.41	24.63	19.33	17.02	12.57	9.76	0.00	
Total	68.16	100.00	55.65	36.59	31.10	28.45	22.09	17.73	0.00	

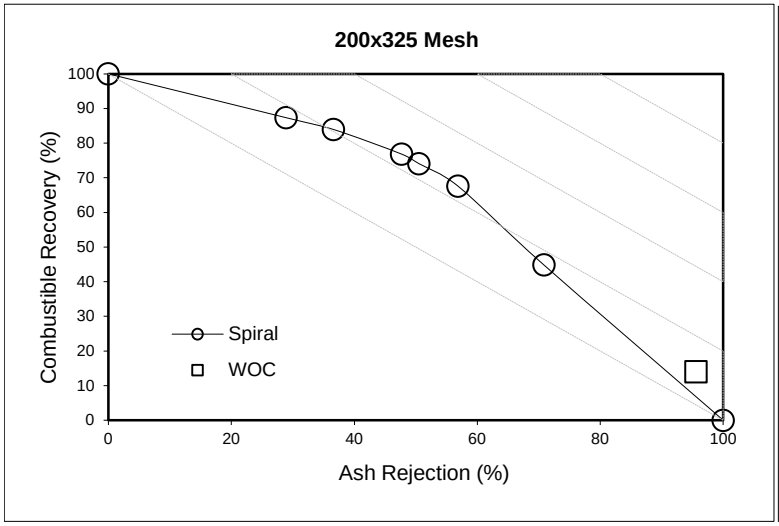
PERFORMANCE COMPARISON

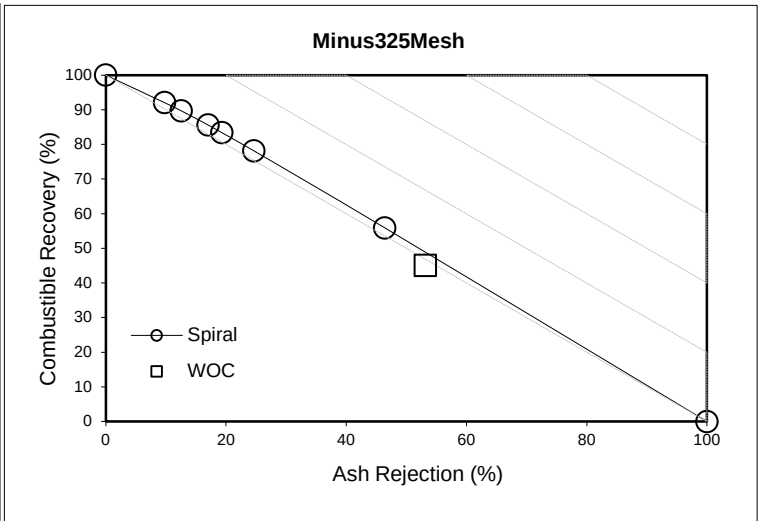
Description: Test No. 9 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals





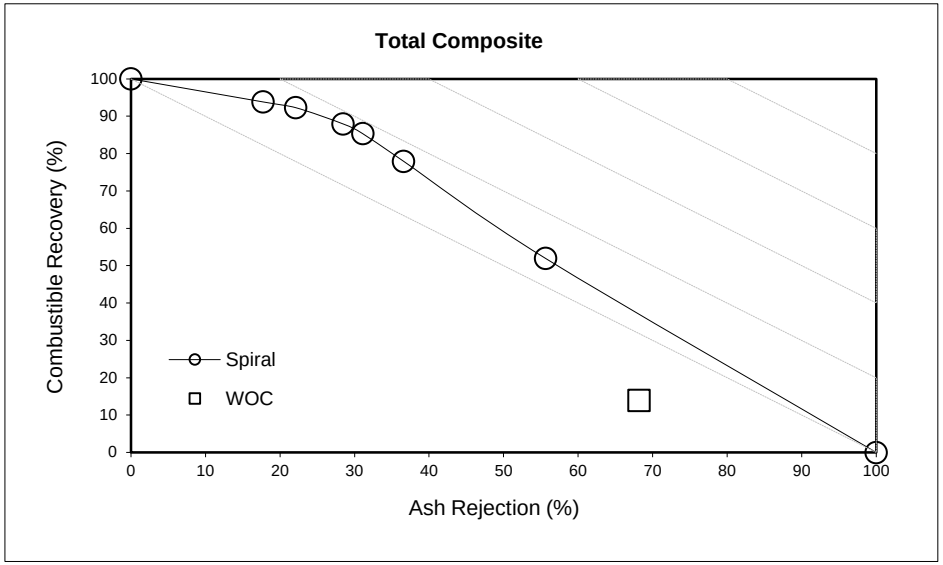




PERFORMANCE COMPARISON

Description: Test No. 9 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals



PERFORMANCE COMPARISON

Description: Test No. 9 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals

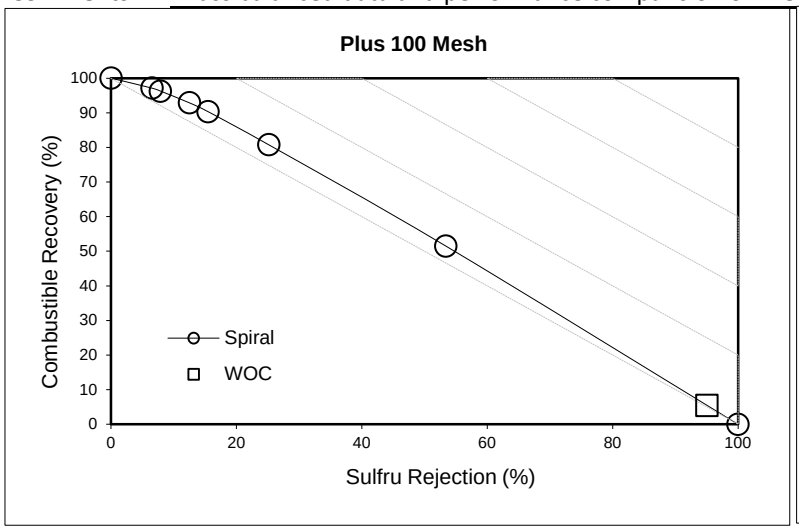
Size Class (Mesh)	WOC Comb. Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 100	5.43	0.00	51.51	80.74	90.31	92.84	96.25	97.10	100.00	
100x200	10.39	0.00	52.61	76.35	82.64	85.71	90.80	92.44	100.00	
200x325	14.02	0.00	44.82	67.58	74.07	76.84	83.93	87.34	100.00	
Minus 325	45.06	0.00	55.90	78.14	83.36	85.59	89.67	92.05	100.00	
Total	13.92	0.00	51.93	77.94	85.33	87.95	92.30	93.83	100.00	

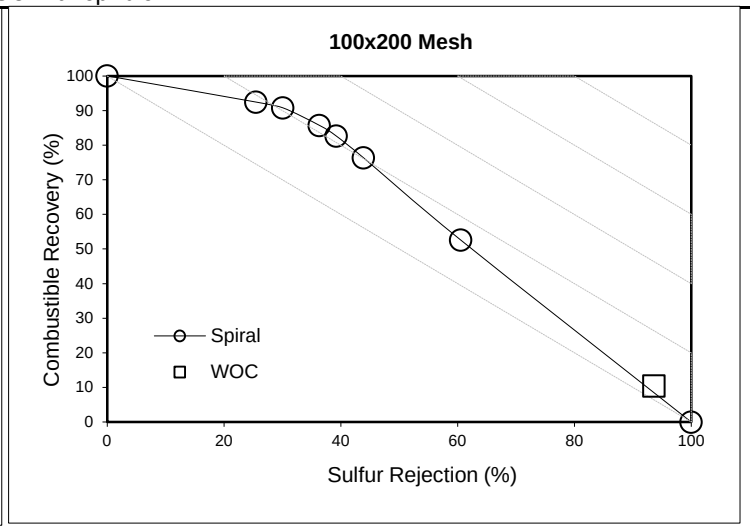
Size Class (Mesh)	WOC Sulfur Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 100	95.05	100.00	53.39	25.15	15.48	12.53	7.89	6.55	0.00	
100x200	93.61	100.00	60.51	43.88	39.22	36.33	30.05	25.48	0.00	
200x325	96.15	100.00	75.72	63.48	58.31	56.27	46.79	37.99	0.00	
Minus 325	81.58	100.00	55.63	38.07	33.73	31.12	24.71	18.61	0.00	
Total	89.20	100.00	60.26	42.19	36.83	34.25	27.59	22.08	0.00	

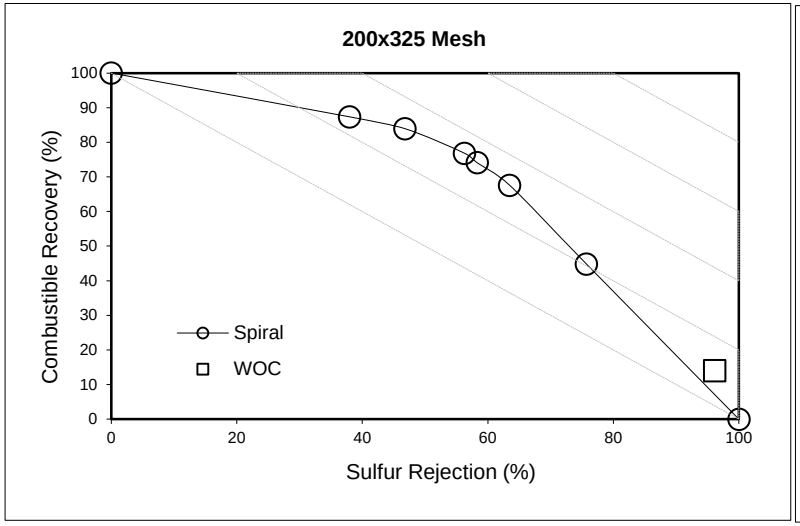
PERFORMANCE COMPARISON

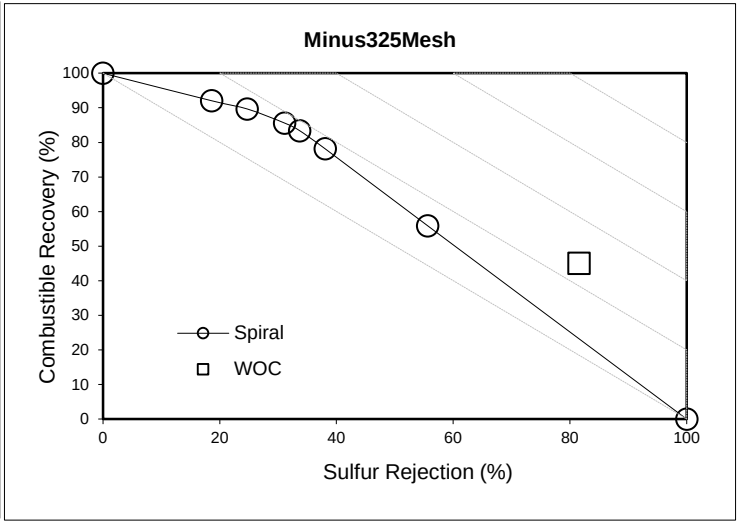
Description: Test No. 9 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals





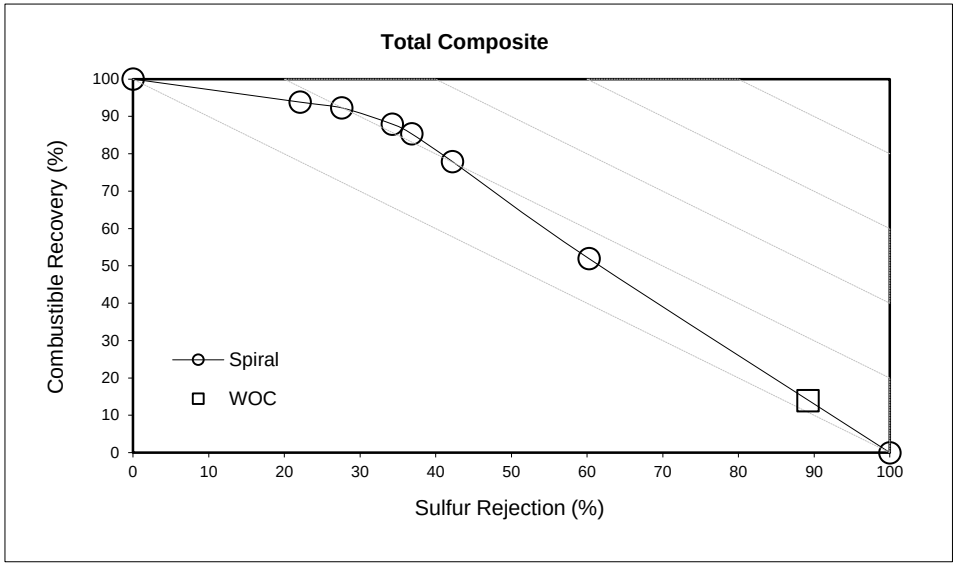




PERFORMANCE COMPARISON

Description: Test No. 9 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals



Water Only Cyclone Data (Mass Balancing)

Description: Test No. 10 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals

PERFORMANCE BY PRODUCT AND SIZE

	Size Class (Mesh)	Measured Values			Estimated Values			% Change in Measured Values			Relatvie Error in Measured Values			Weighted Sum of Squares			Total	X
		Under Flow (U)	Over Flow (O)	Feed F	Under Flow (U)	Over Flow (O)	Feed F	Under Flow (U)	Over Flow (O)	Feed F	Under Flow (U)	Over Flow (O)	Feed F	Under Flow (U)	Over Flow (O)	Feed F	SSQ F+U+O	Const F-U-O
Mass % Stream	Plus 100	31.78	5.31	26.44	31.57	5.32	26.73	-0.66	0.16	1.12	1	1	1	0.00	0.00	0.00	0.00	***
	100x200	30.04	10.81	25.00	29.18	10.83	25.80	-2.85	0.16	3.19	1	1	1	0.00	0.00	0.00	0.00	***
	200x325	12.22	4.77	11.86	12.76	4.78	11.29	4.43	0.16	-4.86	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 325	25.97	79.10	36.70	26.50	79.07	36.18	2.03	-0.04	-1.41	1	1	1	0.00	0.00	0.00	0.00	***
	Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**0.00**	**0.00**	**0.00**	***	***	***	***	***	***	***	***
Ash % Stream	Plus 100	12.33	4.81	10.16	11.19	4.80	10.96	-9.21	-0.14	7.88	1	1	1	0.01	0.00	0.01	0.01	***
	100x200	23.41	8.73	15.23	18.31	8.67	17.57	-21.77	-0.68	15.35	1	1	1	0.05	0.00	0.02	0.07	***
	200x325	52.65	22.68	51.43	53.23	22.69	50.85	1.11	0.04	-1.12	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 325	72.77	75.21	74.15	72.88	75.35	73.87	0.15	0.18	-0.37	1	1	1	0.00	0.00	0.00	0.00	***
															***	***	***	***
															***	***	***	***
	Total	**36.28**	**61.78**	**39.81**	**34.98**	**61.86**	**39.93**	**-3.59**	**0.13**	**0.31**	***	***	***	***	***	***	***	***
Sulfur % Stream	Plus 100	3.38	2.81	3.13	3.25	2.81	3.24	-3.66	-0.12	3.52	1	1	1	0.00	0.00	0.00	0.00	***
	100x200	4.38	3.01	3.92	4.18	3.00	4.09	-4.60	-0.26	4.46	1	1	1	0.00	0.00	0.00	0.00	***
	200x325	9.08	3.93	8.92	9.20	3.93	8.79	1.39	0.05	-1.48	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 325	10.96	2.44	7.89	11.20	2.45	7.68	2.24	0.34	-2.71	1	1	1	0.00	0.00	0.00	0.00	***
	Total	**6.34**	**2.59**	**5.76**	**6.39**	**2.60**	**5.69**	**0.72**	**0.23**	**-1.21**	***	***	***					
Mass (TPH)	Plus 100	0.24	0.01	0.23	0.20	0.01	0.21	-16.87	17.90	-10.62	***	***	***	***	***	***	***	0.00
	100x200	0.23	0.01	0.22	0.19	0.02	0.20	-18.70	17.90	-8.78	***	***	***	***	***	***	***	0.00
	200x325	0.09	0.01	0.11	0.08	0.01	0.09	-12.60	17.90	-15.90	***	***	***	***	***	***	***	0.00
	Minus 325	0.20	0.10	0.33	0.17	0.11	0.28	-14.62	17.66	-12.85	***	***	***	***	***	***	***	0.00
															***	***	***	
															***	***	***	
	Total	**0.76**	**0.12**	**0.89**	**0.64**	**0.14**	**0.78**	**-16.31**	**17.71**	**-11.61**	***	***	***	***	***	***	***	0.00
Ash (TPH)	Plus 100	0.03	0.00	0.02	0.02	0.00	0.02	-24.52	17.74	-3.58	***	***	***	***	***	***	***	0.00
	100x200	0.05	0.00	0.03	0.03	0.00	0.04	-36.40	17.10	5.22	***	***	***	***	***	***	***	0.00
	200x325	0.05	0.00	0.05	0.04	0.00	0.04	-11.63	17.94	-16.85	***	***	***	***	***	***	***	0.00
	Minus 325	0.14	0.07	0.24	0.12	0.09	0.21	-14.49	17.87	-13.18	***	***	***	***	***	***	***	0.00
															***	***	***	
															***	***	***	
	Total	**0.28**	**0.08**	**0.35**	**0.22**	**0.09**	**0.31**	**-19.31**	**17.86**	**-11.33**	***	***	***	***	***	***	***	0.00
Sulfur (TPH)	Plus 100	0.01	0.00	0.01	0.01	0.00	0.01	-19.91	17.76	-7.47	***	***	***	***	***	***	***	0.00
	100x200	0.01	0.00	0.01	0.01	0.00	0.01	-22.44	17.59	-4.72	***	***	***	***	***	***	***	0.00
	200x325	0.01	0.00	0.01	0.01	0.00	0.01	-11.39	17.96	-17.15	***	***	***	***	***	***	***	0.00
	Minus 325	0.02	0.00	0.03	0.02	0.00	0.02	-12.70	18.06	-15.21	***	***	***	***	***	***	***	0.00
											***	***	***	***	***	***	***	
											***	***	***	***	***	***	***	
	Total	**0.05**	**0.00**	**0.05**	**0.04**	**0.00**	**0.04**	**-15.71**	**17.97**	**-12.67**	***	***	***	***				0.00
																Sum SSQ =		**0.10**

WOC PERFORMANCE

Description: Test No. 10 - WOC (0.15x0 mm)
Comments: Mass balanced data and performance comparision of WOC with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	U/F Wt % Feed	O/F Wt % Feed	Feed Wt % Feed	U/F Ash %	O/F Ash (%)	Feed Ash (%)	U/F Sulfur (%)	O/F Sulfur (%)
Plus 100	25.75	0.98	26.73	11.19	4.80	10.96	3.25	2.81
100x200	23.80	2.00	25.80	18.31	8.67	17.57	4.18	3.00
200x325	10.41	0.88	11.29	53.23	22.69	50.85	9.20	3.93
Minus 325	21.61	14.57	36.18	72.88	75.35	73.87	11.20	2.45
Total	81.58	18.42	100.00	34.98	61.86	39.93	6.39	2.60

WOC PERFORMANCE

Description: Test No. 10 - WOC (0.15x0 mm)
Comments: Mass balanced data and performance comparision of WOC with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	Feed Sulfur (%)	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)	Sulfur Rej. (%)	Separation Efficiency Ash (%)	Separation Efficiency Sulfur (%)
Plus 100	3.24	3.67	96.33	3.92	98.39	96.82	2.31	0.74
100x200	4.09	7.73	92.27	8.57	96.18	94.33	4.75	2.90
200x325	8.79	7.80	92.20	12.26	96.52	96.51	8.79	8.78
Minus 325	7.68	40.26	59.74	37.99	58.93	87.16	-3.08	25.15
Total	5.69	18.42	81.58	11.70	71.46	91.59	-16.84	3.29

PERFORMANCE COMPARISON

Description: Test No. 10 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals

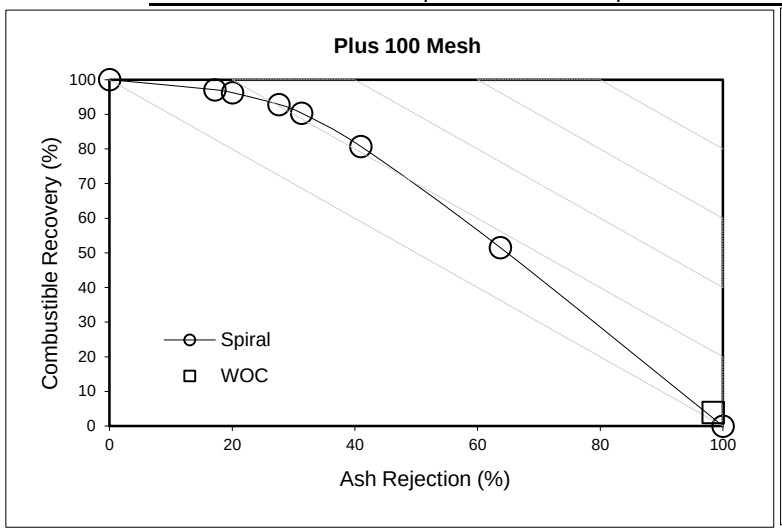
Size Class (Mesh)	WOC Comb. Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 100	3.92	0.00	51.51	80.74	90.31	92.84	96.25	97.10	100.00	
100x200	8.57	0.00	52.61	76.35	82.64	85.71	90.80	92.44	100.00	
200x325	12.26	0.00	44.82	67.58	74.07	76.84	83.93	87.34	100.00	
Minus 325	37.99	0.00	55.90	78.14	83.36	85.59	89.67	92.05	100.00	
Total	11.70	0.00	51.93	77.94	85.33	87.95	92.30	93.83	100.00	

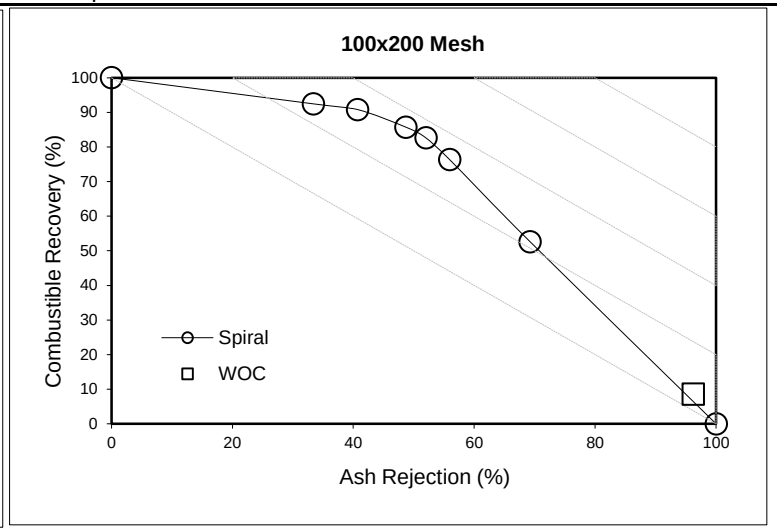
Size Class (Mesh)	WOC Ash Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 100	98.39	100.00	63.72	40.96	31.34	27.63	20.04	17.17	0.00	
100x200	96.18	100.00	69.24	55.92	51.99	48.69	40.70	33.41	0.00	
200x325	96.52	100.00	70.84	56.87	50.51	47.68	36.63	28.93	0.00	
Minus 325	58.93	100.00	46.41	24.63	19.33	17.02	12.57	9.76	0.00	
Total	71.46	100.00	55.65	36.59	31.10	28.45	22.09	17.73	0.00	

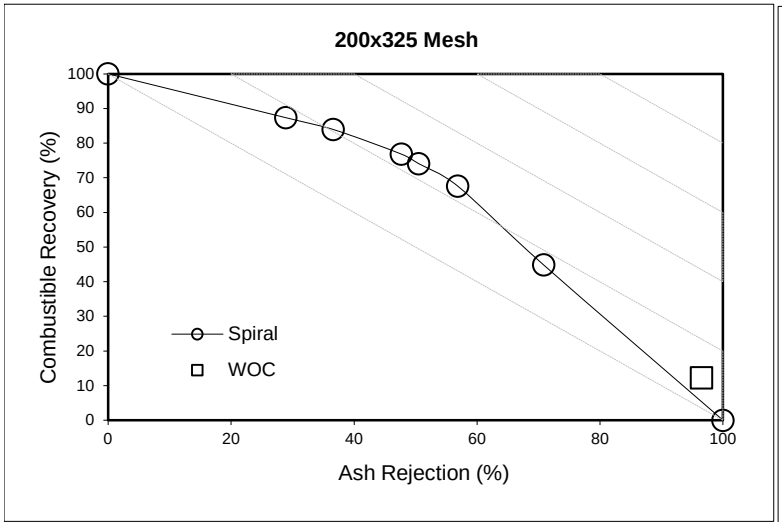
PERFORMANCE COMPARISON

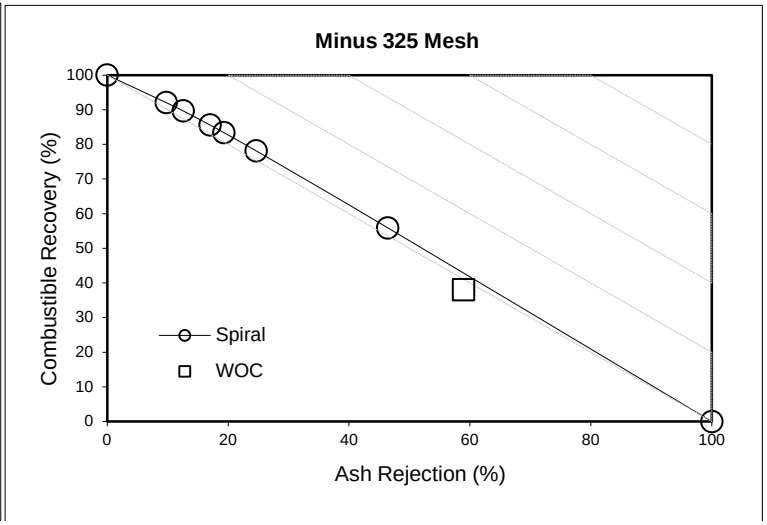
Description: Test No. 10 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals





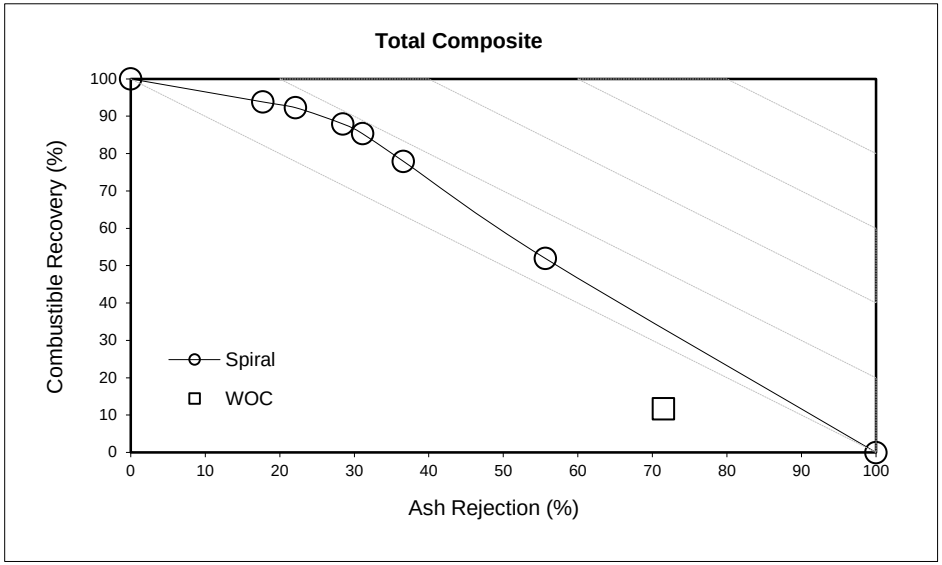




PERFORMANCE COMPARISON

Description: Test No. 10 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals



PERFORMANCE COMPARISON

Description: Test No. 10 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals

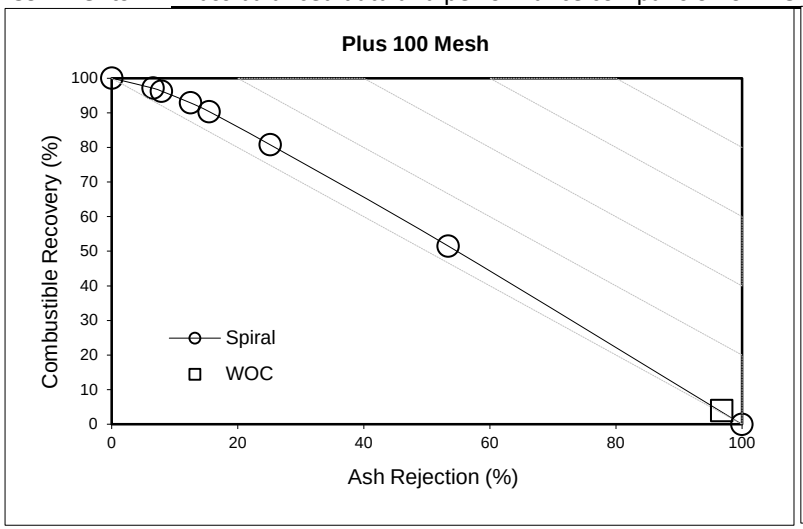
Size Class (Mesh)	WOC Comb. Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 100	3.92	0.00	51.51	80.74	90.31	92.84	96.25	97.10	100.00	
100x200	8.57	0.00	52.61	76.35	82.64	85.71	90.80	92.44	100.00	
200x325	12.26	0.00	44.82	67.58	74.07	76.84	83.93	87.34	100.00	
Minus 325	37.99	0.00	55.90	78.14	83.36	85.59	89.67	92.05	100.00	
Total	11.70	0.00	51.93	77.94	85.33	87.95	92.30	93.83	100.00	

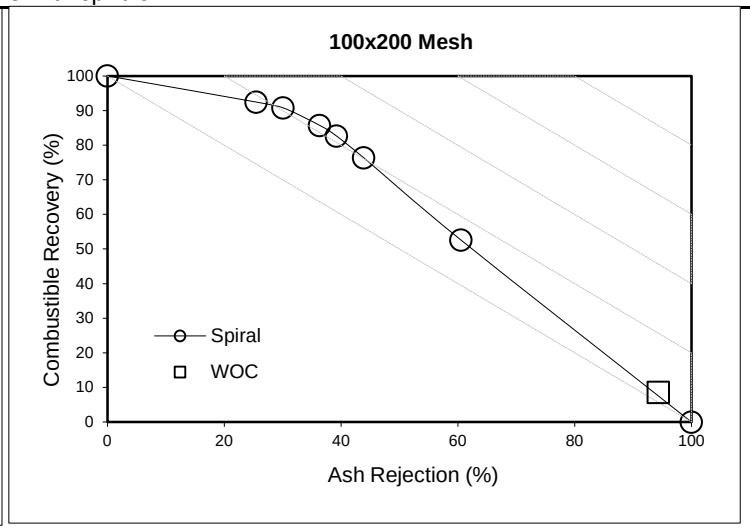
Size Class (Mesh)	WOC Sulfur Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 100	96.82	100.00	53.39	25.15	15.48	12.53	7.89	6.55	0.00	
100x200	94.33	100.00	60.51	43.88	39.22	36.33	30.05	25.48	0.00	
200x325	96.51	100.00	75.72	63.48	58.31	56.27	46.79	37.99	0.00	
Minus 325	87.16	100.00	55.63	38.07	33.73	31.12	24.71	18.61	0.00	
Total	91.59	100.00	60.26	42.19	36.83	34.25	27.59	22.08	0.00	

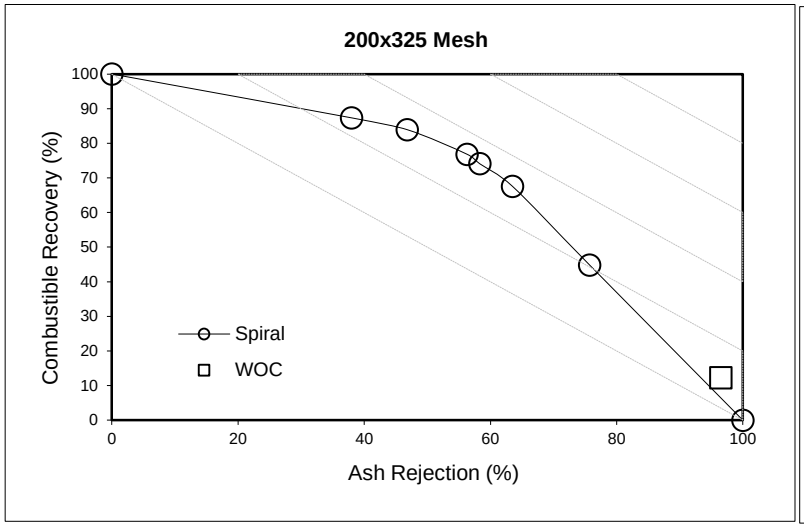
PERFORMANCE COMPARISON

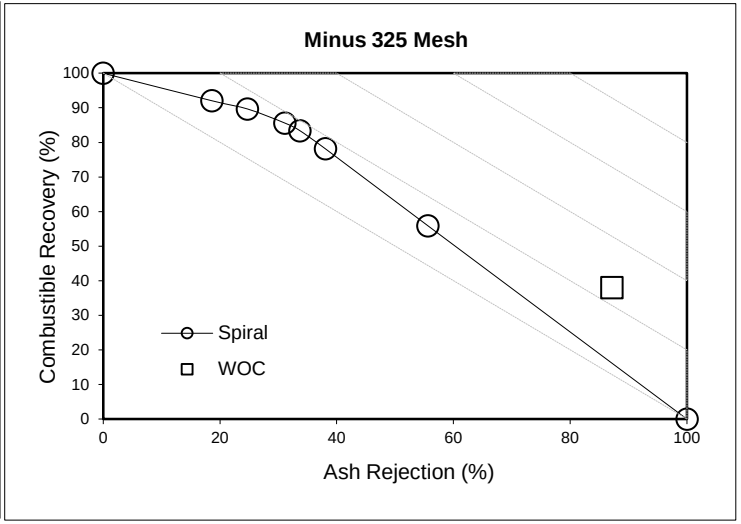
Description: Test No. 10 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals





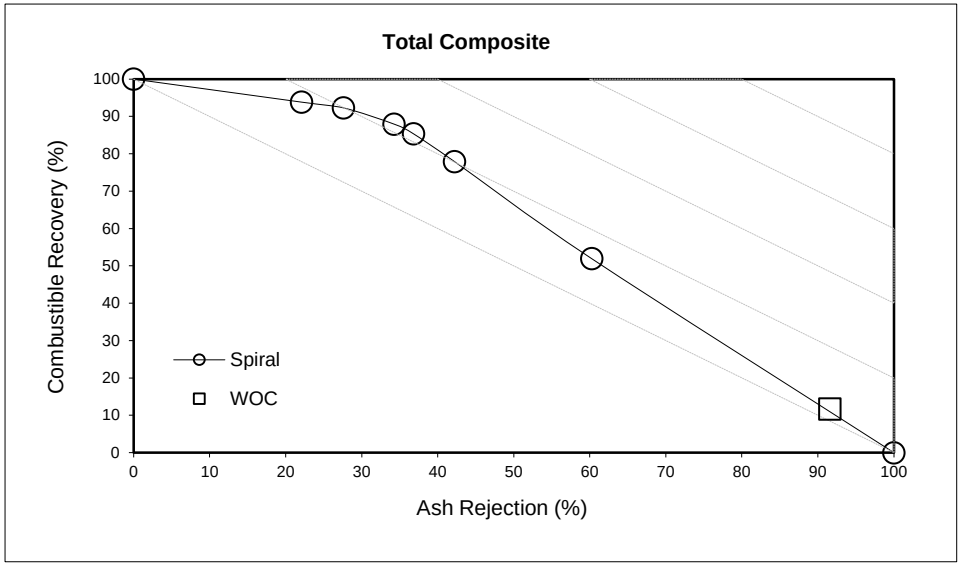




PERFORMANCE COMPARISON

Description: Test No. 10 - WOC (0.15x0 mm)

Comments: Mass balanced data and performance comparision of WOC with spirals



APPENDIX H – Teeter bed/HydroFloat Circuit Results

Teeter Bed Data/HydroFloat (Mass Balancing)

Description: Test No. 1 - Teeter Bed (3x1 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

	Size	Measured Values			Estimated Values			% Change in Measured Values			Relatvie Error in Measured Values			Weighted Sum of Squares			Total	X
	Class (Mesh)	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	SSQ F+C+T	Const F-C-T
Mass % Stream	Plus 7	19.61	18.36	19.74	19.80	18.59	19.30	0.97	1.24	-2.21	1	1	1	0.00	0.00	0.00	0.00	***
	7x8	16.34	17.22	16.12	15.90	17.30	16.48	-2.70	0.51	2.21	1	1	1	0.00	0.00	0.00	0.00	***
	8x12	30.30	33.95	31.22	29.98	33.89	31.59	-1.05	-0.15	1.20	1	1	1	0.00	0.00	0.00	0.00	***
	12x18	28.55	28.06	28.38	28.89	27.74	28.41	1.17	-1.14	0.13	1	1	1	0.00	0.00	0.00	0.00	***
	18x30	4.48	2.20	3.94	4.65	2.26	3.67	3.82	2.57	-6.95	1	1	1	0.00	0.00	0.00	0.01	***
	Minus 30	0.72	0.22	0.61	0.78	0.22	0.55	8.86	-0.62	-10.01	1	1	1	0.01	0.00	0.01	0.02	***
	Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**0.00**	**0.00**	**0.00**	***	***	***	***	***	***	***	***
Ash % Stream	Plus 7	4.80	86.73	38.53	4.80	87.81	37.75	0.09	1.24	-2.04	1	1	1	0.00	0.00	0.00	0.00	***
	7x8	5.95	89.19	45.05	5.97	91.66	43.05	0.29	2.77	-4.43	1	1	1	0.00	0.00	0.00	0.00	***
	8x12	6.92	90.32	46.23	6.94	92.25	44.66	0.24	2.14	-3.41	1	1	1	0.00	0.00	0.00	0.00	***
	12x18	8.15	91.19	41.31	8.14	90.95	41.46	-0.09	-0.27	0.35	1	1	1	0.00	0.00	0.00	0.00	***
	18x30	12.20	91.39	33.51	12.27	92.52	32.67	0.59	1.24	-2.51	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 30	33.61	84.36	35.13	30.68	81.68	38.94	-8.70	-3.18	10.86	1	1	1	0.01	0.00	0.01	0.02	***
	Total	**7.12**	**89.72**	**42.56**	**7.14**	**90.94**	**41.68**	**0.24**	**1.36**	**-2.06**	***	***	***	***	***	***	***	***
Mass (TPH)	Plus 7	11.20	7.88	19.74	11.64	7.66	19.30	3.95	-2.74	-2.21	***	***	***	***	***	***	***	0.00
	7x8	9.33	7.38	16.12	9.35	7.13	16.48	0.17	-3.44	2.21	***	***	***	***	***	***	***	0.00
	8x12	17.30	14.56	31.22	17.63	13.97	31.59	1.87	-4.07	1.20	***	***	***	***	***	***	***	0.00
	12x18	16.30	12.04	28.38	16.98	11.43	28.41	4.16	-5.02	0.13	***	***	***	***	***	***	***	0.00
	18x30	2.56	0.95	3.94	2.73	0.93	3.67	6.88	-1.46	-6.95	***	***	***	***	***	***	***	0.00
	Minus 30	0.41	0.09	0.61	0.46	0.09	0.55	12.08	-4.53	-10.01	***	***	***	***	***	***	***	0.00
	Total	**57.10**	**42.90**	**100.00**	**58.79**	**41.21**	**100.00**	**2.95**	**-3.93**	**0.00**	***	***	***	***	***	***	***	0.00
Ash (TPH)	Plus 7	0.54	6.83	7.60	0.56	6.73	7.29	4.04	-1.53	-4.20	***	***	***	***	***	***	***	0.00
	7x8	0.56	6.59	7.26	0.56	6.54	7.09	0.46	-0.77	-2.32	***	***	***	***	***	***	***	0.00
	8x12	1.20	13.15	14.43	1.22	12.89	14.11	2.12	-2.02	-2.24	***	***	***	***	***	***	***	0.00
	12x18	1.33	10.98	11.72	1.38	10.40	11.78	4.06	-5.28	0.48	***	***	***	***	***	***	***	0.00
	18x30	0.31	0.86	1.32	0.34	0.86	1.20	7.52	-0.24	-9.29	***	***	***	***	***	***	***	0.00
	Minus 30	0.14	0.08	0.21	0.14	0.07	0.21	2.32	-7.56	-0.24	***	***	***	***	***	***	***	0.00
	Total	**4.07**	**38.49**	**42.56**	**4.20**	**37.48**	**41.68**	**3.20**	**-2.62**	**-2.06**	***	***	***	***	***	***	***	0.00
																Sum SSQ =		**0.05**

PERFORMANCE COMPARISON

Description Test No. 1 - Teeter Bed (3x1 mm)

Comments Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	Conc Wt % Feed	Tail Wt % Feed	Feed Wt % Feed	Conc Ash %	Tail Ash %	Feed Ash %	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)
Plus 7	11.64	7.66	19.30	4.80	87.81	37.75	60.31	39.69	92.23	92.32
7x8	9.35	7.13	16.48	5.97	91.66	43.05	56.72	43.28	93.66	92.14
8x12	17.63	13.97	31.59	6.94	92.25	44.66	55.79	44.21	93.81	91.33
12x18	16.98	11.43	28.41	8.14	90.95	41.46	59.77	40.23	93.78	88.26
18x30	2.73	0.93	3.67	12.27	92.52	32.67	74.59	25.41	97.18	71.98
Minus 30	0.46	0.09	0.55	30.68	81.68	38.94	83.80	16.20	95.14	33.97
Total	58.79	41.21	100.00	7.14	90.94	41.68	58.79	41.21	93.60	89.93

COMPOSITE (COMPARE WITH SPIRALS)

Size Class (Mesh)	Conc Wt % Feed	Tail Wt % Feed	Feed Wt % Feed	Conc Ash %	Tail Ash %	Feed Ash %	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)
Plus 7	11.64	7.66	19.30	4.80	87.81	37.75	60.31	39.69	92.23	92.32
7x12	26.97	21.10	48.07	6.60	92.05	44.11	56.11	43.89	93.76	91.60
12x18	16.98	11.43	28.41	8.14	90.95	41.46	59.77	40.23	93.78	88.26
Minus 18	3.19	1.02	4.21	14.92	91.58	33.48	75.78	24.22	96.93	66.23
Total	58.79	41.21	100.00	7.14	90.94	41.68	58.79	41.21	93.60	89.93

PERFORMANCE COMPARISON

Description Test No. 1 - Teeter Bed (3x1 mm)

Comments Mass balanced data and performance comparision of teeter bed with spirals

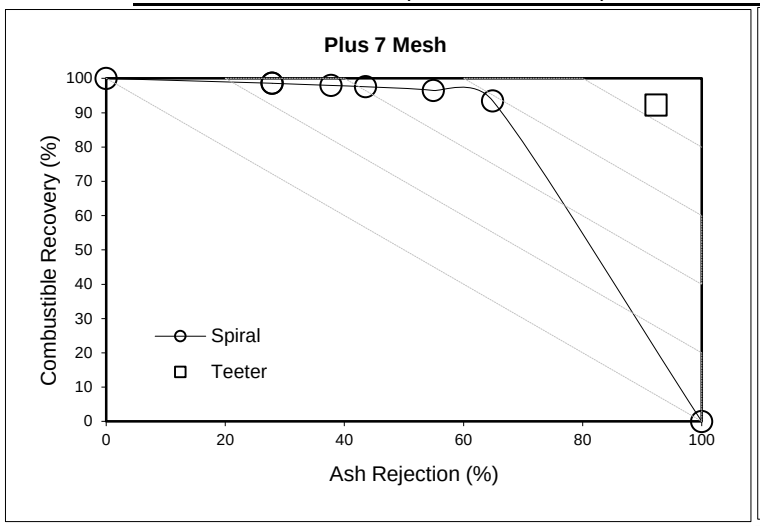
Size Class (Mesh)	Teeter Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 7	92.23	0.00	93.49	96.49	97.58	97.96	98.59	98.60	100.00	
7x12	93.76	0.00	75.93	92.96	95.98	96.84	97.70	97.71	100.00	
12x18	93.78	0.00	52.88	81.72	91.53	94.02	95.87	95.88	100.00	
Minus 18	96.93	0.00	47.24	71.43	85.20	89.87	93.12	93.24	100.00	
Total	93.60	0.00	72.68	89.95	94.71	96.05	97.22	97.23	100.00	

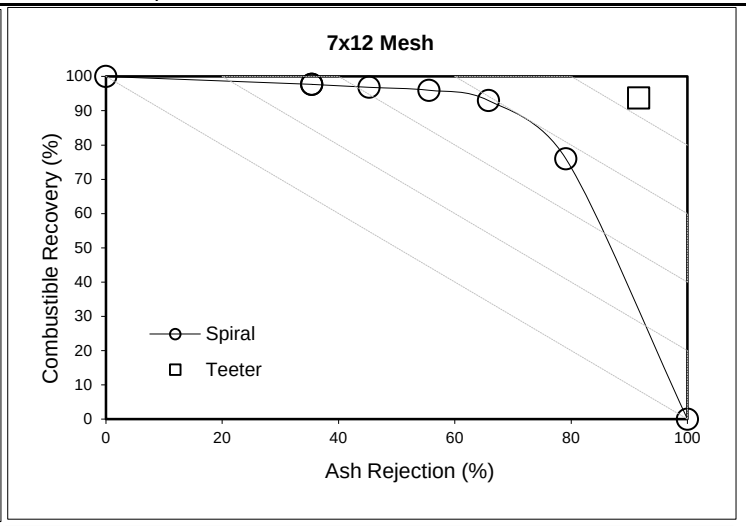
Size Class (Mesh)	Teeter Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 7	92.32	100.00	64.90	54.95	43.52	37.74	27.83	27.83	0.00	
7x12	91.60	100.00	79.11	65.80	55.54	45.27	35.40	35.40	0.00	
12x18	88.26	100.00	87.97	77.57	66.21	56.71	49.21	49.20	0.00	
Minus 18	66.23	100.00	38.09	27.86	22.02	19.68	17.72	17.01	0.00	
Total	89.93	100.00	72.52	60.80	50.76	42.56	34.29	34.19	0.00	

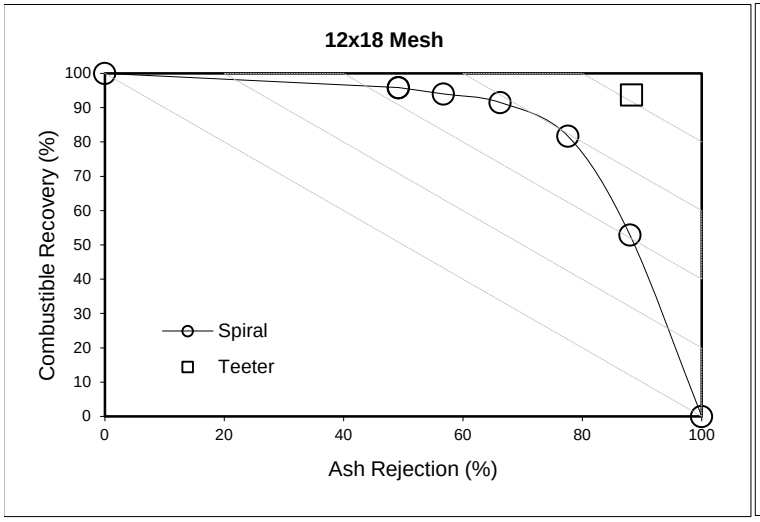
PERFORMANCE COMPARISON

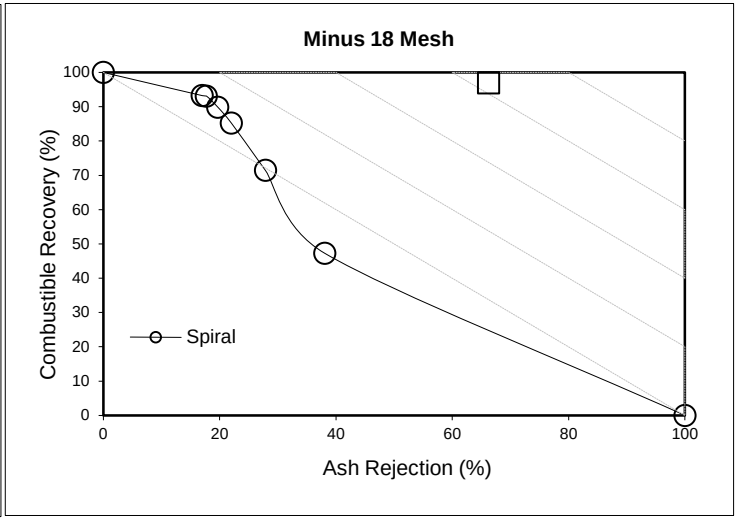
Description Test No. 1 - Teeter Bed (3x1 mm)

Comments Mass balanced data and performance comparision of teeter bed with spirals





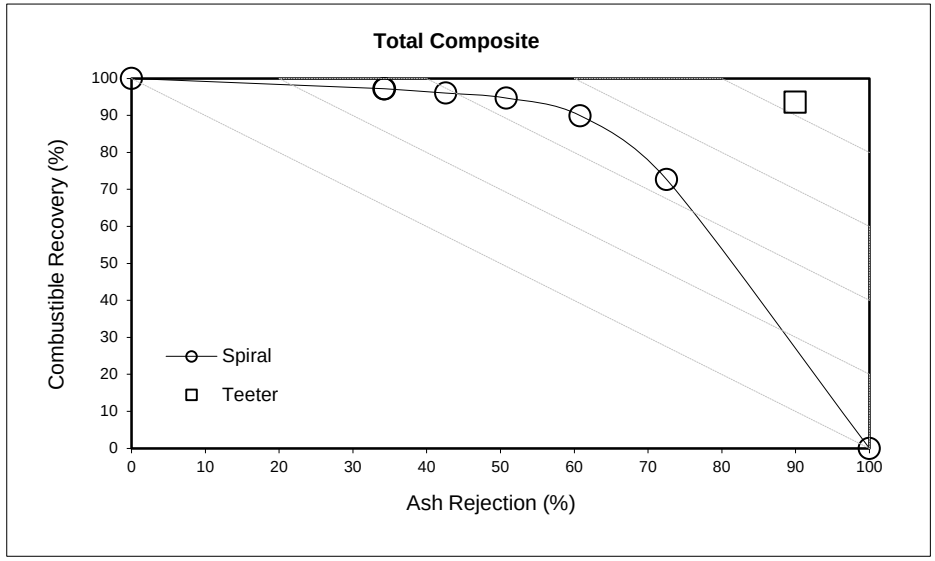




PERFORMANCE COMPARISON

Description Test No. 1 - Teeter Bed (3x1 mm)

Comments Mass balanced data and performance comparision of teeter bed with spirals



Teeter Bed Data/HydroFloat (Mass Balancing)

Description: Test No. 2 - Teeter Bed (3x1 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

	Size Class (Mesh)	Measured Values			Estimated Values			% Change in Measured Values			Relatvie Error in Measured Values			Weighted Sum of Squares			Total	X
		Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	SSQ F+C+T	Const F-C-T
Mass % Stream	Plus 7	14.94	20.24	16.59	15.03	19.90	16.97	0.60	-1.69	2.29	1	1	1	0.00	0.00	0.00	0.00	***
	7x8	21.65	16.42	22.27	21.03	18.18	19.89	-2.87	10.71	-10.68	1	1	1	0.00	0.01	0.01	0.02	***
	8x12	29.84	31.00	29.86	30.57	30.30	30.47	2.45	-2.23	2.03	1	1	1	0.00	0.00	0.00	0.00	***
	12x18	28.20	28.03	26.74	28.03	27.58	27.85	-0.59	-1.59	4.16	1	1	1	0.00	0.00	0.00	0.00	***
	18x30	4.58	4.06	3.94	4.53	3.78	4.23	-1.11	-6.87	7.29	1	1	1	0.00	0.00	0.01	0.01	***
	Minus 30	0.79	0.25	0.59	0.81	0.25	0.58	2.29	-0.72	-1.61	1	1	1	0.00	0.00	0.00	0.00	***
	Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**0.00**	**0.00**	**0.00**	***	***	***	***	***	***	***	***
Ash % Stream	Plus 7	4.59	80.99	38.69	4.58	79.33	39.50	-0.13	-2.05	2.10	1	1	1	0.00	0.00	0.00	0.00	***
	7x8	5.00	84.03	47.23	5.08	94.92	37.78	1.53	12.95	-20.00	1	1	1	0.00	0.02	0.04	0.06	***
	8x12	6.17	86.69	35.34	6.14	83.37	36.75	-0.42	-3.83	3.98	1	1	1	0.00	0.00	0.00	0.00	***
	12x18	7.56	89.17	39.06	7.55	88.39	39.45	-0.12	-0.87	0.99	1	1	1	0.00	0.00	0.00	0.00	***
	18x30	11.29	91.53	34.85	11.11	85.16	37.49	-1.60	-6.96	7.57	1	1	1	0.00	0.00	0.01	0.01	***
	Minus 30	30.88	86.25	37.37	29.87	84.70	39.16	-3.27	-1.80	4.78	1	1	1	0.00	0.00	0.00	0.00	***
	Total	**6.50**	**85.99**	**39.53**	**6.50**	**86.12**	**38.22**	**-0.09**	**0.15**	**-3.32**	***	***	***	***	***	***	***	***
Mass (TPH)	Plus 7	8.73	8.41	16.59	9.04	7.93	16.97	3.55	-5.74	2.29	***	***	***	***	***	***	***	0.00
	7x8	12.66	6.82	22.27	12.65	7.24	19.89	-0.03	6.15	-10.68	***	***	***	***	***	***	***	0.00
	8x12	17.44	12.88	29.86	18.39	12.07	30.47	5.46	-6.26	2.03	***	***	***	***	***	***	***	0.00
	12x18	16.48	11.65	26.74	16.86	10.99	27.85	2.32	-5.65	4.16	***	***	***	***	***	***	***	0.00
	18x30	2.68	1.69	3.94	2.72	1.51	4.23	1.79	-10.71	7.29	***	***	***	***	***	***	***	0.00
	Minus 30	0.46	0.10	0.59	0.48	0.10	0.58	5.29	-4.81	-1.61	***	***	***	***	***	***	***	0.00
	Total	**58.45**	**41.55**	**100.00**	**60.16**	**39.84**	**100.00**	**2.93**	**-4.12**	**0.00**	***	***	***	***	***	***	***	0.00
Ash (TPH)	Plus 7	0.40	6.81	6.42	0.41	6.29	6.70	3.42	-7.67	4.43	***	***	***	***	***	***	***	0.00
	7x8	0.63	5.73	10.52	0.64	6.87	7.52	1.51	19.90	-28.54	***	***	***	***	***	***	***	0.00
	8x12	1.08	11.17	10.55	1.13	10.06	11.19	5.01	-9.86	6.09	***	***	***	***	***	***	***	0.00
	12x18	1.25	10.38	10.44	1.27	9.71	10.99	2.20	-6.47	5.20	***	***	***	***	***	***	***	0.00
	18x30	0.30	1.55	1.37	0.30	1.28	1.59	0.16	-16.93	15.42	***	***	***	***	***	***	***	0.00
	Minus 30	0.14	0.09	0.22	0.14	0.08	0.23	1.84	-6.52	3.09	***	***	***	***	***	***	***	0.00
	Total	**3.80**	**35.73**	**39.53**	**3.91**	**34.31**	**38.22**	**2.84**	**-3.98**	**-3.32**	***	***	***	***	***	***	***	0.00
																Sum SSQ =		**0.11**

PERFORMANCE COMPARISON

Description Test No. 2 - Teeter Bed (3x1 mm)
Comments Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	Conc Wt % Feed	Tail Wt % Feed	Feed Wt % Feed	Conc Ash %	Tail Ash %	Feed Ash %	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)
Plus 7	9.04	7.93	16.97	4.58	79.33	39.50	53.29	46.71	84.04	93.82
7x8	12.65	7.24	19.89	5.08	94.92	37.78	63.59	36.41	97.02	91.46
8x12	18.39	12.07	30.47	6.14	83.37	36.75	60.37	39.63	89.58	89.91
12x18	16.86	10.99	27.85	7.55	88.39	39.45	60.54	39.46	92.44	88.41
18x30	2.72	1.51	4.23	11.11	85.16	37.49	64.37	35.63	91.54	80.92
Minus 30	0.48	0.10	0.58	29.87	84.70	39.16	83.06	16.94	95.74	36.64
Total	60.16	39.84	100.00	6.50	86.12	38.22	60.16	39.84	91.05	89.78

COMPOSITE (COMPARE WITH SPIRALS)

Size Class (Mesh)	Conc Wt % Feed	Tail Wt % Feed	Feed Wt % Feed	Conc Ash %	Tail Ash %	Feed Ash %	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)
Plus 7	9.04	7.93	16.97	4.58	79.33	39.50	53.29	46.71	84.04	93.82
7x12	31.04	19.32	50.36	5.71	87.70	37.16	61.64	38.36	92.49	90.53
12x18	16.86	10.99	27.85	7.55	88.39	39.45	60.54	39.46	92.44	88.41
Minus 18	3.21	1.61	4.82	13.94	85.13	37.69	66.64	33.36	92.04	75.35
Total	60.16	39.84	100.00	6.50	86.12	38.22	60.16	39.84	91.05	89.78

PERFORMANCE COMPARISON

Description Test No. 2 - Teeter Bed (3x1 mm)

Comments Mass balanced data and performance comparision of teeter bed with spirals

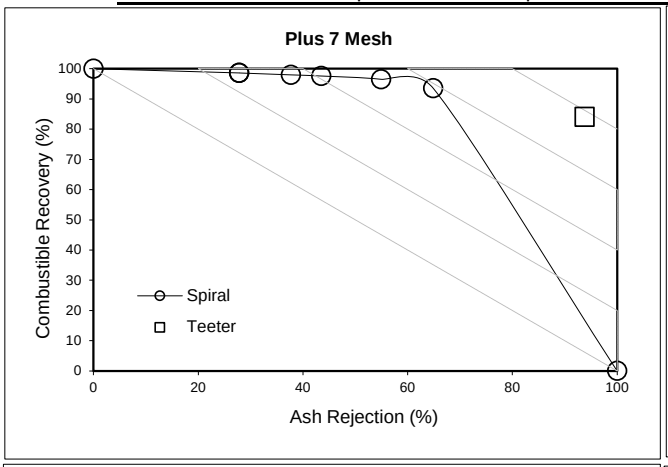
Size Class (Mesh)	Teeter Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 7	84.04	0.00	93.49	96.49	97.58	97.96	98.59	98.60	100.00	
7x12	92.49	0.00	75.93	92.96	95.98	96.84	97.70	97.71	100.00	
12x18	92.44	0.00	52.88	81.72	91.53	94.02	95.87	95.88	100.00	
Minus 18	92.04	0.00	47.24	71.43	85.20	89.87	93.12	93.24	100.00	
Total	91.05	0.00	72.68	89.95	94.71	96.05	97.22	97.23	100.00	

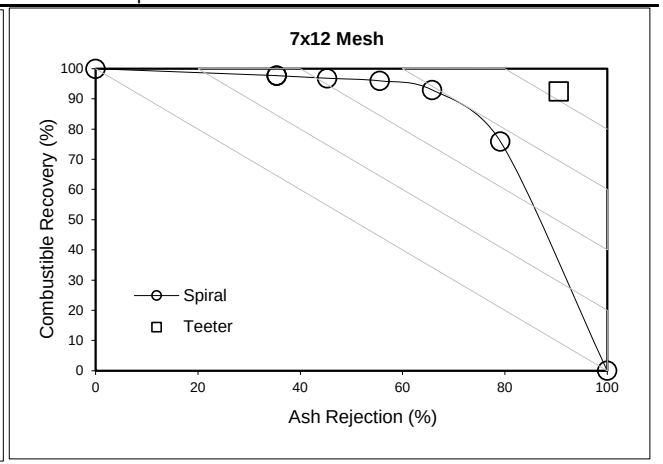
Size Class (Mesh)	Teeter Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 7	93.82	100.00	64.90	54.95	43.52	37.74	27.83	27.83	0.00	
7x12	90.53	100.00	79.11	65.80	55.54	45.27	35.40	35.40	0.00	
12x18	88.41	100.00	87.97	77.57	66.21	56.71	49.21	49.20	0.00	
Minus 18	75.35	100.00	38.09	27.86	22.02	19.68	17.72	17.01	0.00	
Total	89.78	100.00	72.52	60.80	50.76	42.56	34.29	34.19	0.00	

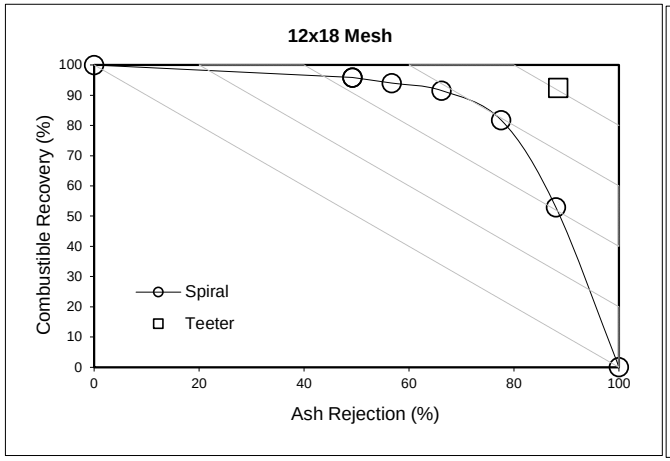
PERFORMANCE COMPARISON

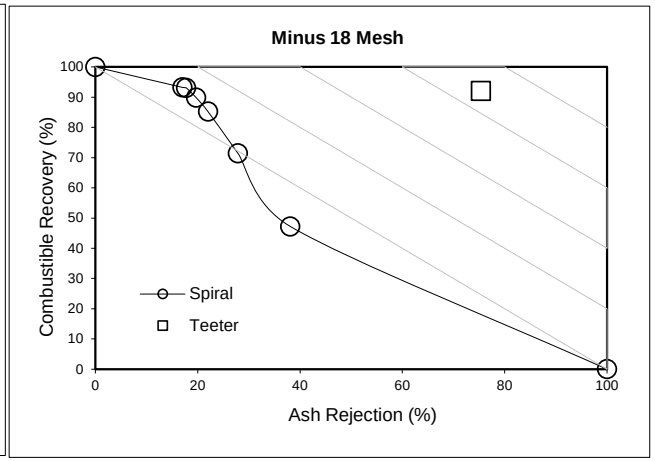
Description Test No. 2 - Teeter Bed (3x1 mm)

Comments Mass balanced data and performance comparision of teeter bed with spirals





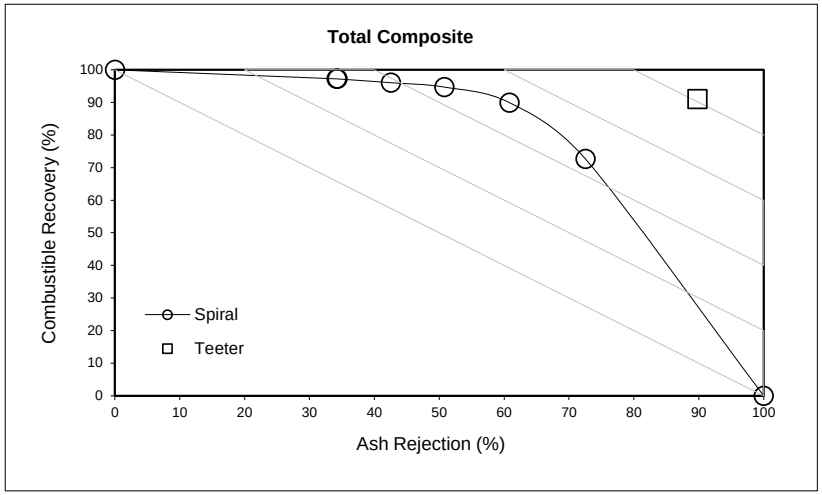




PERFORMANCE COMPARISON

Description Test No. 2 - Teeter Bed (3x1 mm)

Comments Mass balanced data and performance comparision of teeter bed with spirals



Teeter Bed Data/HydroFloat (Mass Balancing)

Description: Test No. 3 - Teeter Bed (3x1 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

	Size Class (Mesh)	Measured Values			Estimated Values			% Change in Measured Values			Relatvie Error in Measured Values			Weighted Sum of Squares			Total	X
		Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	SSQ F+C+T	Const F-C-T
Mass % Stream	Plus 7	19.17	21.41	20.37	18.82	22.24	19.97	-1.87	3.86	-1.98	1	1	1	0.00	0.00	0.00	0.00	***
	7x8	15.86	18.12	17.53	16.05	18.56	16.89	1.14	2.47	-3.62	1	1	1	0.00	0.00	0.00	0.00	***
	8x12	30.06	32.05	31.52	30.18	32.59	30.99	0.41	1.69	-1.67	1	1	1	0.00	0.00	0.00	0.00	***
	12x18	28.98	25.06	26.06	29.43	23.27	27.36	1.54	-7.12	5.00	1	1	1	0.00	0.01	0.00	0.01	***
	18x30	4.81	3.13	3.60	4.35	3.09	3.93	-9.47	-1.35	9.02	1	1	1	0.01	0.00	0.01	0.02	***
	Minus 30	1.11	0.24	0.92	1.17	0.25	0.86	5.81	3.77	-6.74	1	1	1	0.00	0.00	0.00	0.01	***
	Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**0.00**	**0.00**	**0.00**	***	***	***	***	***	***	***	***
Ash % Stream	Plus 7	4.82	80.21	36.00	4.84	83.30	34.25	0.44	3.85	-4.87	1	1	1	0.00	0.00	0.00	0.00	***
	7x8	5.41	83.25	34.88	5.42	84.06	34.50	0.10	0.97	-1.09	1	1	1	0.00	0.00	0.00	0.00	***
	8x12	6.23	83.17	33.42	6.23	83.16	33.46	0.03	-0.01	0.11	1	1	1	0.00	0.00	0.00	0.00	***
	12x18	7.18	88.26	25.48	7.03	80.32	28.01	-2.08	-9.00	9.93	1	1	1	0.00	0.01	0.01	0.02	***
	18x30	10.08	90.84	32.69	10.14	92.26	31.87	0.59	1.57	-2.50	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 30	22.30	86.98	35.81	24.58	89.73	30.87	10.25	3.17	-13.79	1	1	1	0.01	0.00	0.02	0.03	***
	Total	**6.47**	**84.08**	**32.13**	**6.46**	**82.99**	**32.22**	**-0.13**	**-1.29**	**0.27**	***	***	***	***	***	***	***	***
Mass (TPH)	Plus 7	12.83	7.08	20.37	12.48	7.48	19.97	-2.74	5.71	-1.98	***	***	***	***	***	***	***	0.00
	7x8	10.62	5.99	17.53	10.65	6.25	16.89	0.25	4.30	-3.62	***	***	***	***	***	***	***	0.00
	8x12	20.12	10.60	31.52	20.03	10.97	30.99	-0.48	3.51	-1.67	***	***	***	***	***	***	***	0.00
	12x18	19.40	8.28	26.06	19.53	7.83	27.36	0.65	-5.46	5.00	***	***	***	***	***	***	***	0.00
	18x30	3.22	1.03	3.60	2.89	1.04	3.93	-10.27	0.41	9.02	***	***	***	***	***	***	***	0.00
	Minus 30	0.74	0.08	0.92	0.78	0.08	0.86	4.88	5.62	-6.74	***	***	***	***	***	***	***	0.00
	Total	**66.94**	**33.06**	**100.00**	**66.35**	**33.65**	**100.00**	**-0.88**	**1.78**	**0.00**	***	***	***	***	***	***	***	0.00
Ash (TPH)	Plus 7	0.62	5.68	7.33	0.60	6.23	6.84	-2.31	9.79	-6.75	***	***	***	***	***	***	***	0.00
	7x8	0.57	4.99	6.11	0.58	5.25	5.83	0.35	5.31	-4.67	***	***	***	***	***	***	***	0.00
	8x12	1.25	8.81	10.53	1.25	9.12	10.37	-0.44	3.49	-1.56	***	***	***	***	***	***	***	0.00
	12x18	1.39	7.31	6.64	1.37	6.29	7.66	-1.45	-13.97	15.43	***	***	***	***	***	***	***	0.00
	18x30	0.32	0.94	1.18	0.29	0.96	1.25	-9.74	1.98	6.30	***	***	***	***	***	***	***	0.00
	Minus 30	0.17	0.07	0.33	0.19	0.07	0.27	15.62	8.96	-19.60	***	***	***	***	***	***	***	0.00
	Total	**4.33**	**27.80**	**32.13**	**4.29**	**27.93**	**32.22**	**-1.01**	**0.47**	**0.27**	***	***	***	***	***	***	***	0.00
																Sum SSQ =		**0.09**

PERFORMANCE COMPARISON

Description: Test No. 3 - Teeter Bed (3x1 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	Conc Wt % Feed	Tail Wt % Feed	Feed Wt % Feed	Conc Ash %	Tail Ash %	Feed Ash %	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)
Plus 7	12.48	7.48	19.97	4.84	83.30	34.25	62.52	37.48	90.48	91.16
7x8	10.65	6.25	16.89	5.42	84.06	34.50	63.02	36.98	91.00	90.11
8x12	20.03	10.97	30.99	6.23	83.16	33.46	64.61	35.39	91.04	87.96
12x18	19.53	7.83	27.36	7.03	80.32	28.01	71.37	28.63	92.17	82.09
18x30	2.89	1.04	3.93	10.14	92.26	31.87	73.54	26.46	96.99	76.61
Minus 30	0.78	0.08	0.86	24.58	89.73	30.87	90.35	9.65	98.57	28.05
Total	66.35	33.65	100.00	6.46	82.99	32.22	66.35	33.65	91.56	86.70

COMPOSITE (COMPARE WITH SPIRALS)

Size Class (Mesh)	Conc Wt % Feed	Tail Wt % Feed	Feed Wt % Feed	Conc Ash %	Tail Ash %	Feed Ash %	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)
Plus 7	12.48	7.48	19.97	4.84	83.30	34.25	62.52	37.48	90.48	91.16
7x12	30.67	17.22	47.89	5.95	83.49	33.82	64.05	35.95	91.03	88.74
12x18	19.53	7.83	27.36	7.03	80.32	28.01	71.37	28.63	92.17	82.09
Minus 18	3.66	1.12	4.79	13.21	92.07	31.69	76.56	23.44	97.28	68.10
Total	66.35	33.65	100.00	6.46	82.99	32.22	66.35	33.65	91.56	86.70

PERFORMANCE COMPARISON

Description: Test No. 3 - Teeter Bed (3x1 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals

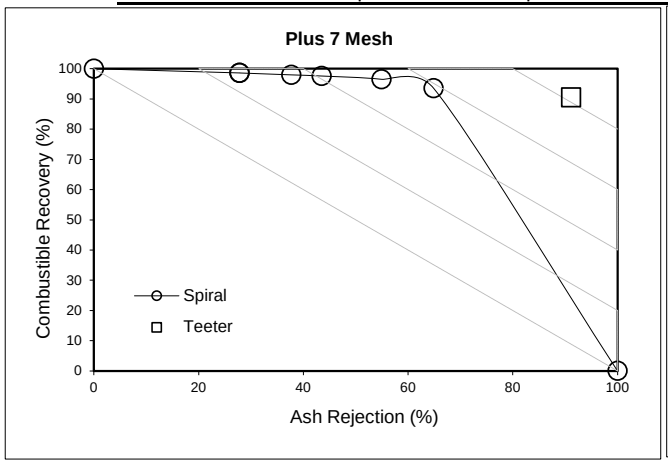
Size Class (Mesh)	Teeter Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 7	90.48	0.00	93.49	96.49	97.58	97.96	98.59	98.60	100.00	
7x12	91.03	0.00	75.93	92.96	95.98	96.84	97.70	97.71	100.00	
12x18	92.17	0.00	52.88	81.72	91.53	94.02	95.87	95.88	100.00	
Minus 18	97.28	0.00	47.24	71.43	85.20	89.87	93.12	93.24	100.00	
Total	91.56	0.00	72.68	89.95	94.71	96.05	97.22	97.23	100.00	

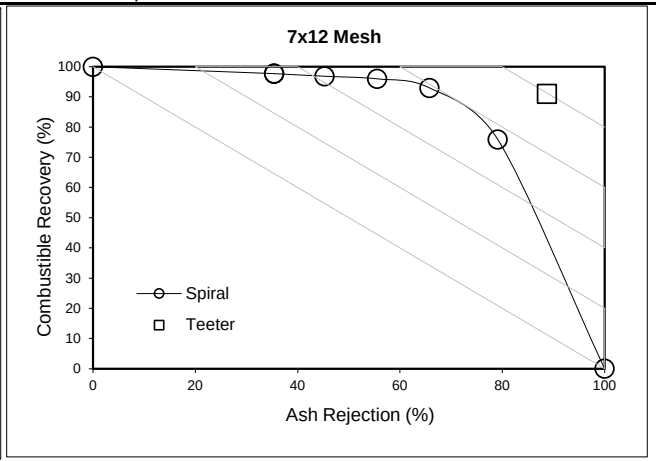
Size Class (Mesh)	Teeter Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 7	91.16	100.00	64.90	54.95	43.52	37.74	27.83	27.83	0.00	
7x12	88.74	100.00	79.11	65.80	55.54	45.27	35.40	35.40	0.00	
12x18	82.09	100.00	87.97	77.57	66.21	56.71	49.21	49.20	0.00	
Minus 18	68.10	100.00	38.09	27.86	22.02	19.68	17.72	17.01	0.00	
Total	86.70	100.00	72.52	60.80	50.76	42.56	34.29	34.19	0.00	

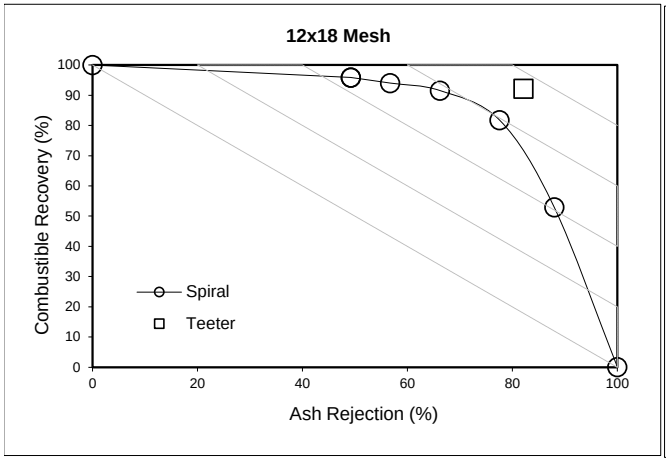
PERFORMANCE COMPARISON

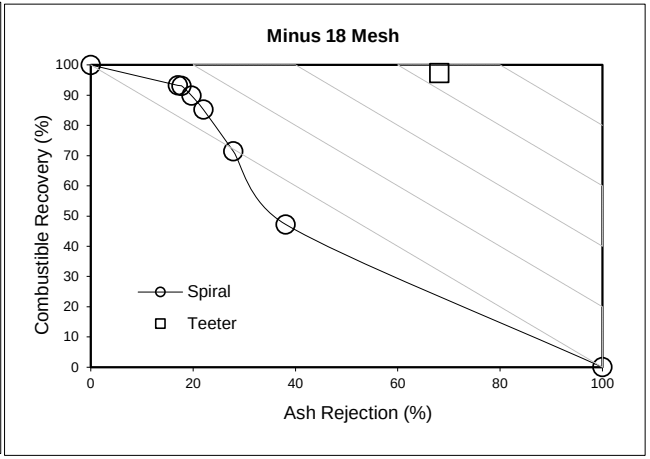
Description: Test No. 3 - Teeter Bed (3x1 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals





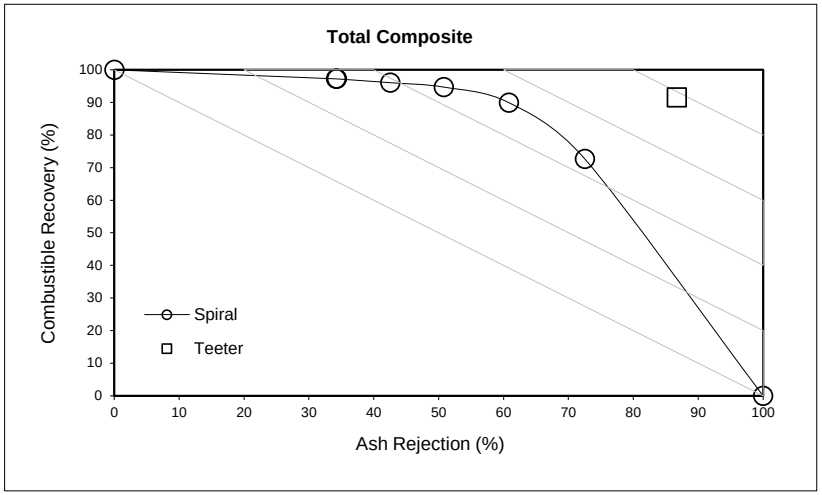




PERFORMANCE COMPARISON

Description: Test No. 3 - Teeter Bed (3x1 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals



Teeter Bed/HydroFloat Data (Mass Balancing)

Description: Test No. 4 - Teeter Bed (3x1 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

	Size	Measured Values			Estimated Values			% Change in Measured Values			Relatvie Error in Measured Values			Weighted Sum of Squares			Total	X
	Class (Mesh)	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	SSQ F+C+T	Const F-C-T
Mass % Stream	Plus 7	13.17	18.15	15.37	13.55	18.03	15.27	2.89	-0.68	-0.63	1	1	1	0.00	0.00	0.00	0.00	***
	7x8	19.50	24.52	22.63	21.05	23.49	21.98	7.93	-4.22	-2.85	1	1	1	0.01	0.00	0.00	0.01	***
	8x12	28.52	31.07	30.80	28.99	31.83	30.08	1.65	2.46	-2.33	1	1	1	0.00	0.00	0.00	0.00	***
	12x18	30.99	23.36	26.58	29.69	23.84	27.44	-4.18	2.05	3.23	1	1	1	0.00	0.00	0.00	0.00	***
	18x30	6.35	2.59	3.95	5.61	2.52	4.43	-11.63	-2.69	12.01	1	1	1	0.01	0.00	0.01	0.03	***
	Minus 30	1.48	0.30	0.67	1.11	0.29	0.79	-24.71	-4.47	19.19	1	1	1	0.06	0.00	0.04	0.10	***
	Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**0.00**	**0.00**	**0.00**	***	***	***	***	***	***	***	***
Ash % Stream	Plus 7	9.56	85.72	41.01	9.50	83.50	43.09	-0.59	-2.59	5.06	1	1	1	0.00	0.00	0.00	0.00	***
	7x8	10.50	87.44	33.89	10.23	78.89	38.42	-2.60	-9.78	13.38	1	1	1	0.00	0.01	0.02	0.03	***
	8x12	11.74	87.17	42.25	11.73	87.25	42.45	-0.05	0.09	0.47	1	1	1	0.00	0.00	0.00	0.00	***
	12x18	14.05	88.99	41.53	14.20	90.40	39.65	1.07	1.59	-4.53	1	1	1	0.00	0.00	0.00	0.00	***
	18x30	19.12	90.10	34.99	19.17	90.44	34.79	0.24	0.38	-0.58	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 30	30.43	85.46	34.99	29.17	84.43	36.88	-4.16	-1.20	5.40	1	1	1	0.00	0.00	0.00	0.00	***
	Total	**12.67**	**87.47**	**39.64**	**12.46**	**85.43**	**40.51**	**-1.68**	**-2.33**	**2.19**	***	***	***	***	***	***	***	***
Mass (TPH)	Plus 7	8.42	6.55	15.37	8.34	6.93	15.27	-0.94	5.88	-0.63	***	***	***	***	***	***	***	0.00
	7x8	12.47	8.84	22.63	12.96	9.03	21.98	3.91	2.10	-2.85	***	***	***	***	***	***	***	0.00
	8x12	18.24	11.20	30.80	17.85	12.23	30.08	-2.14	9.22	-2.33	***	***	***	***	***	***	***	0.00
	12x18	19.81	8.42	26.58	18.28	9.16	27.44	-7.74	8.79	3.23	***	***	***	***	***	***	***	0.00
	18x30	4.06	0.94	3.95	3.46	0.97	4.43	-14.92	3.74	12.01	***	***	***	***	***	***	***	0.00
	Minus 30	0.94	0.11	0.67	0.68	0.11	0.79	-27.52	1.84	19.19	***	***	***	***	***	***	***	0.00
	Total	**63.94**	**36.06**	**100.00**	**61.56**	**38.44**	**100.00**	**-3.72**	**6.61**	**0.00**	***	***	***	***	***	***	***	0.00
Ash (TPH)	Plus 7	0.80	5.61	6.30	0.79	5.79	6.58	-1.52	3.14	4.39	***	***	***	***	***	***	***	0.00
	7x8	1.31	7.73	7.67	1.33	7.12	8.45	1.21	-7.88	10.15	***	***	***	***	***	***	***	0.00
	8x12	2.14	9.76	13.01	2.09	10.67	12.77	-2.18	9.33	-1.87	***	***	***	***	***	***	***	0.00
	12x18	2.78	7.50	11.04	2.60	8.28	10.88	-6.75	10.52	-1.45	***	***	***	***	***	***	***	0.00
	18x30	0.78	0.84	1.38	0.66	0.88	1.54	-14.71	4.13	11.36	***	***	***	***	***	***	***	0.00
	Minus 30	0.29	0.09	0.23	0.20	0.09	0.29	-30.53	0.61	25.63	***	***	***	***	***	***	***	0.00
	Total	**8.10**	**31.54**	**39.64**	**7.67**	**32.84**	**40.51**	**-5.35**	**4.13**	**2.19**	***	***	***	***	***	***	***	0.00
																Sum SSQ =		**0.18**

PERFORMANCE COMPARISON

Description Test No. 4 - Teeter Bed (3x1 mm)

Comments Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	Conc Wt % Feed	Tail Wt % Feed	Feed Wt % Feed	Conc Ash %	Tail Ash %	Feed Ash %	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)
Plus 7	8.34	6.93	15.27	9.50	83.50	43.09	54.62	45.38	86.84	87.95
7x8	12.96	9.03	21.98	10.23	78.89	38.42	58.93	41.07	85.92	84.31
8x12	17.85	12.23	30.08	11.73	87.25	42.45	59.33	40.67	90.99	83.60
12x18	18.28	9.16	27.44	14.20	90.40	39.65	66.61	33.39	94.69	76.14
18x30	3.46	0.97	4.43	19.17	90.44	34.79	78.08	21.92	96.79	56.98
Minus 30	0.68	0.11	0.79	29.17	84.43	36.88	86.04	13.96	96.56	31.96
Total	61.56	38.44	100.00	12.46	85.43	40.51	61.56	38.44	90.59	81.07

COMPOSITE (COMPARE WITH SPIRALS)

Size Class (Mesh)	Conc Wt % Feed	Tail Wt % Feed	Feed Wt % Feed	Conc Ash %	Tail Ash %	Feed Ash %	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)
Plus 7	8.34	6.93	15.27	9.50	83.50	43.09	54.62	45.38	86.84	87.95
7x12	30.80	21.26	52.06	11.10	83.70	40.75	59.16	40.84	88.77	83.88
12x18	18.28	9.16	27.44	14.20	90.40	39.65	66.61	33.39	94.69	76.14
Minus 18	4.14	1.08	5.22	20.82	89.83	35.11	79.30	20.70	96.75	52.98
Total	61.56	38.44	100.00	12.46	85.43	40.51	61.56	38.44	90.59	81.07

PERFORMANCE COMPARISON

Description Test No. 4 - Teeter Bed (3x1 mm)

Comments Mass balanced data and performance comparision of teeter bed with spirals

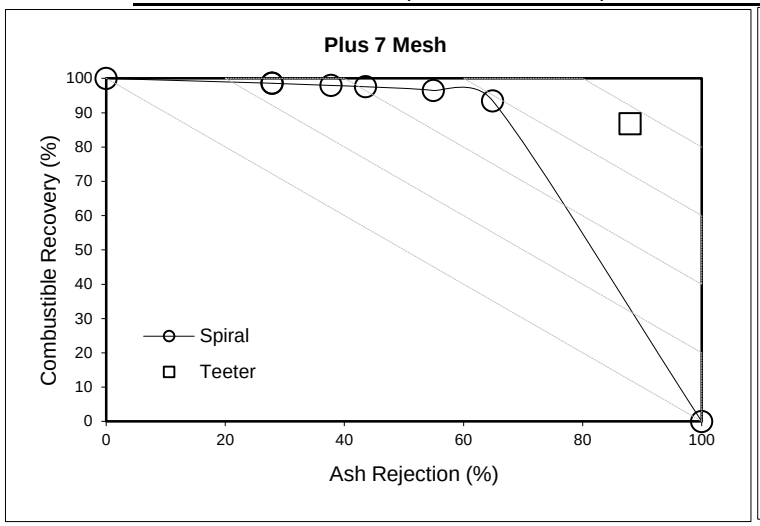
Size Class (Mesh)	Teeter Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 7	86.84	0.00	93.49	96.49	97.58	97.96	98.59	98.60	100.00	
7x12	88.77	0.00	75.93	92.96	95.98	96.84	97.70	97.71	100.00	
12x18	94.69	0.00	52.88	81.72	91.53	94.02	95.87	95.88	100.00	
Minus 18	96.75	0.00	47.24	71.43	85.20	89.87	93.12	93.24	100.00	
Total	90.59	0.00	72.68	89.95	94.71	96.05	97.22	97.23	100.00	

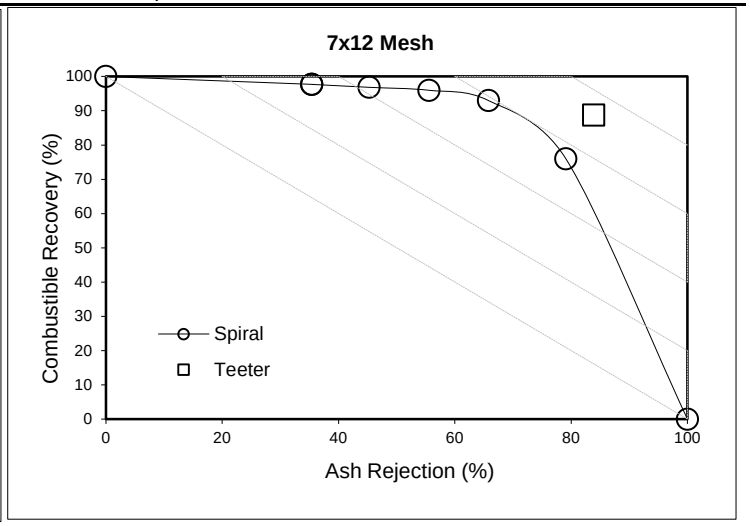
Size Class (Mesh)	Teeter Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 7	87.95	100.00	64.90	54.95	43.52	37.74	27.83	27.83	0.00	
7x12	83.88	100.00	79.11	65.80	55.54	45.27	35.40	35.40	0.00	
12x18	76.14	100.00	87.97	77.57	66.21	56.71	49.21	49.20	0.00	
Minus 18	52.98	100.00	38.09	27.86	22.02	19.68	17.72	17.01	0.00	
Total	81.07	100.00	72.52	60.80	50.76	42.56	34.29	34.19	0.00	

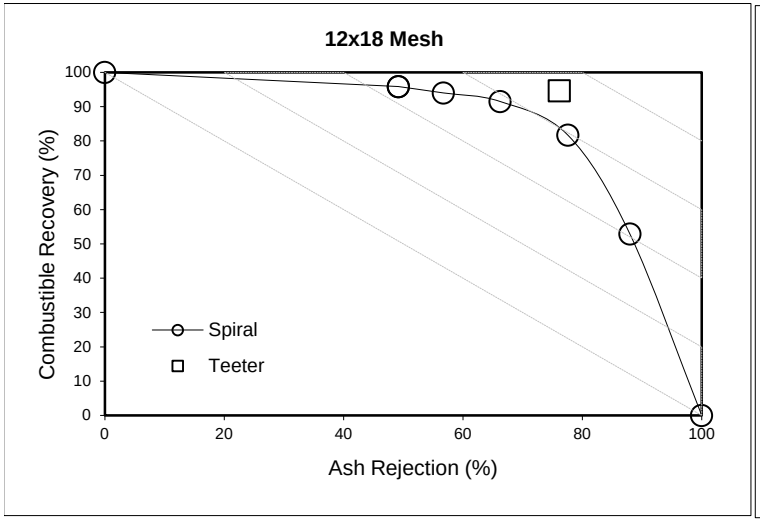
PERFORMANCE COMPARISON

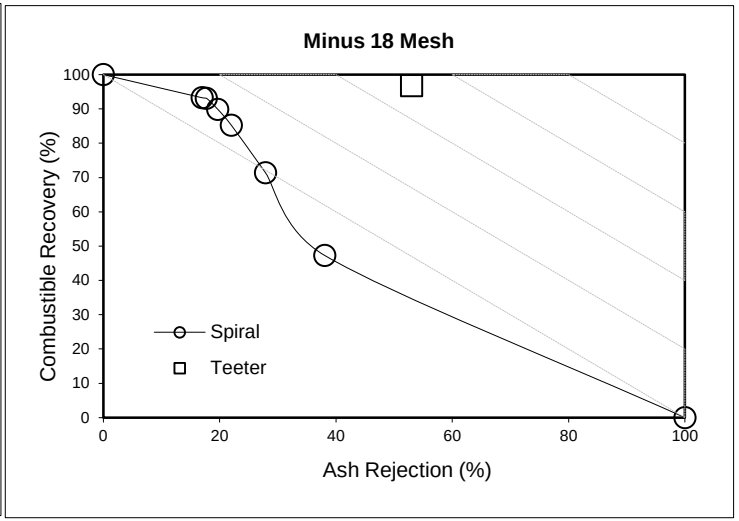
Description Test No. 4 - Teeter Bed (3x1 mm)

Comments Mass balanced data and performance comparision of teeter bed with spirals





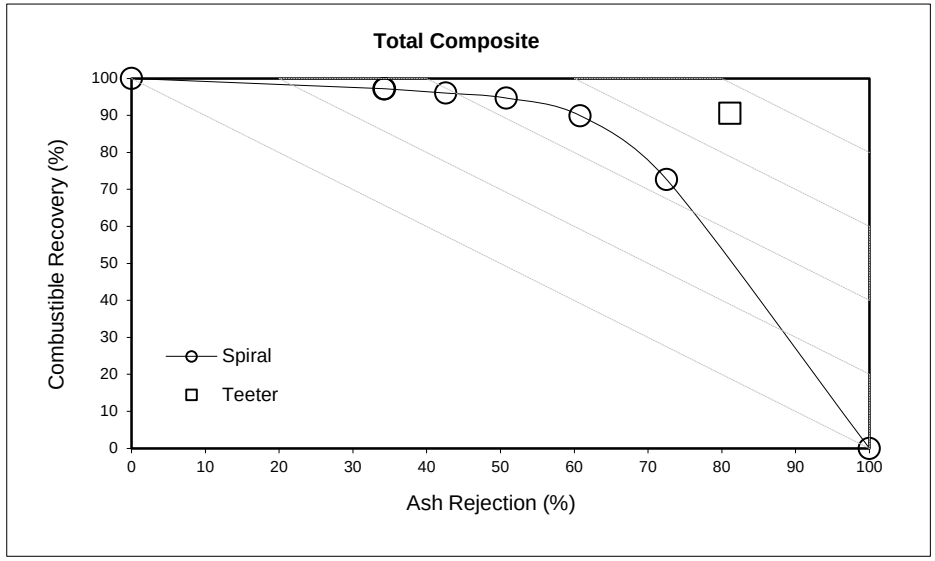




PERFORMANCE COMPARISON

Description Test No. 4 - Teeter Bed (3x1 mm)

Comments Mass balanced data and performance comparision of teeter bed with spirals



Teeter Bed/HydroFloat Data (Mass Balancing)

Description: Test No. 5 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

	Size	Measured Values			Estimated Values			% Change in Measured Values			Relatvie Error in Measured Values			Weighted Sum of Squares			Total	X
	Class (Mesh)	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	SSQ F+C+T	Const F-C-T
Mass % Stream	Plus 12	16.42	28.80	19.41	15.89	29.46	19.69	-3.24	2.32	1.47	1	1	1	0.00	0.00	0.00	0.00	***
	12x18	22.26	36.51	22.48	20.91	35.89	25.10	-6.08	-1.68	11.66	1	1	1	0.00	0.00	0.01	0.02	***
	18x30	23.30	24.08	23.39	23.94	23.46	23.80	2.73	-2.56	1.78	1	1	1	0.00	0.00	0.00	0.00	***
	30x50	26.25	9.97	22.30	25.91	10.53	21.60	-1.29	5.62	-3.13	1	1	1	0.00	0.00	0.00	0.00	***
	50x100	11.18	0.64	10.97	12.67	0.64	9.30	13.29	0.27	-15.22	1	1	1	0.02	0.00	0.02	0.04	***
	Minus 100	0.59	0.01	1.45	0.69	0.01	0.50	17.17	0.01	-65.60	1	4	1	0.03	0.00	0.43	0.46	***
	Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**0.00**	**0.00**	**0.00**	***	***	***	***	***	***	***	***
Ash % Stream	Plus 12	4.06	83.96	37.87	4.04	84.09	37.58	-0.48	0.16	-0.77	1	1	1	0.00	0.00	0.00	0.00	***
	12x18	6.35	85.80	37.81	6.37	85.74	38.15	0.39	-0.07	0.90	1	1	1	0.00	0.00	0.00	0.00	***
	18x30	12.23	87.29	32.34	12.00	87.16	32.74	-1.90	-0.15	1.25	1	1	1	0.00	0.00	0.00	0.00	***
	30x50	12.40	91.04	26.64	13.30	91.27	23.94	7.28	0.25	-10.13	1	1	1	0.01	0.00	0.01	0.02	***
	50x100	21.71	89.20	24.10	21.71	89.21	23.00	-0.02	0.01	-4.54	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 100	23.07	24.32	24.32	23.42	24.65	23.42	1.50	1.38	-3.68	1	1	1	0.00	0.00	0.00	0.00	***
	Total	**10.75**	**86.17**	**32.35**	**11.20**	**86.19**	**32.20**	**4.25**	**0.02**	**-0.47**	***	***	***	***	***	***	***	***
Mass (TPH)	Plus 12	11.72	8.25	19.41	11.44	8.25	19.69	-2.36	0.01	1.47	***	***	***	***	***	***	***	0.00
	12x18	15.89	10.46	22.48	15.05	10.05	25.10	-5.23	-3.90	11.66	***	***	***	***	***	***	***	0.00
	18x30	16.63	6.90	23.39	17.23	6.57	23.80	3.66	-4.75	1.78	***	***	***	***	***	***	***	0.00
	30x50	18.73	2.85	22.30	18.65	2.95	21.60	-0.40	3.24	-3.13	***	***	***	***	***	***	***	0.00
	50x100	7.98	0.18	10.97	9.12	0.18	9.30	14.32	-2.00	-15.22	***	***	***	***	***	***	***	0.00
	Minus 100	0.42	0.00	1.45	0.50	0.00	0.50	18.23	-2.25	-65.60	***	***	***	***	***	***	***	0.00
	Total	**71.35**	**28.65**	**100.00**	**72.00**	**28.00**	**100.00**	**0.91**	**-2.26**	**0.00**	***	***	***	***	***	***	***	0.00
Ash (TPH)	Plus 12	0.48	6.93	7.35	0.46	6.94	7.40	-2.83	0.16	0.69	***	***	***	***	***	***	***	0.00
	12x18	1.01	8.97	8.50	0.96	8.62	9.58	-4.87	-3.96	12.66	***	***	***	***	***	***	***	0.00
	18x30	2.03	6.02	7.56	2.07	5.73	7.79	1.70	-4.89	3.05	***	***	***	***	***	***	***	0.00
	30x50	2.32	2.60	5.94	2.48	2.69	5.17	6.86	3.50	-12.94	***	***	***	***	***	***	***	0.00
	50x100	1.73	0.16	2.64	1.98	0.16	2.14	14.30	-1.99	-19.07	***	***	***	***	***	***	***	0.00
	Minus 100	0.10	0.00	0.35	0.12	0.00	0.12	20.00	-0.90	-66.87	***	***	***	***	***	***	***	0.00
	Total	**7.67**	**24.68**	**32.35**	**8.07**	**24.13**	**32.20**	**5.19**	**-2.23**	**-0.47**	***	***	***	***	***	***	***	0.00
																Sum SSQ =	**0.55**	

PERFORMANCE COMPARISON

Description: Test No. 5 - Teeter Bed (3x0.15 mm)
Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	Conc Wt % Feed	Tail Wt % Feed	Feed Wt % Feed	Conc Ash %	Tail Ash %	Feed Ash %	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)
Plus 12	11.44	8.25	19.69	4.04	84.09	37.58	58.10	41.90	89.32	93.75
12x18	15.05	10.05	25.10	6.37	85.74	38.15	59.97	40.03	90.77	89.98
18x30	17.23	6.57	23.80	12.00	87.16	32.74	72.40	27.60	94.73	73.47
30x50	18.65	2.95	21.60	13.30	91.27	23.94	86.35	13.65	98.43	52.02
50x100	9.12	0.18	9.30	21.71	89.21	23.00	98.08	1.92	99.73	7.46
Minus 100	0.50	0.00	0.50	23.42	24.65	23.42	99.31	0.69	99.32	0.73
Total	72.00	28.00	100.00	11.20	86.19	32.20	72.00	28.00	94.30	74.95

PERFORMANCE COMPARISON

Description: Test No. 5 - Teeter Bed (3x0.15 mm)
Comments: Mass balanced data and performance comparision of teeter bed with spirals

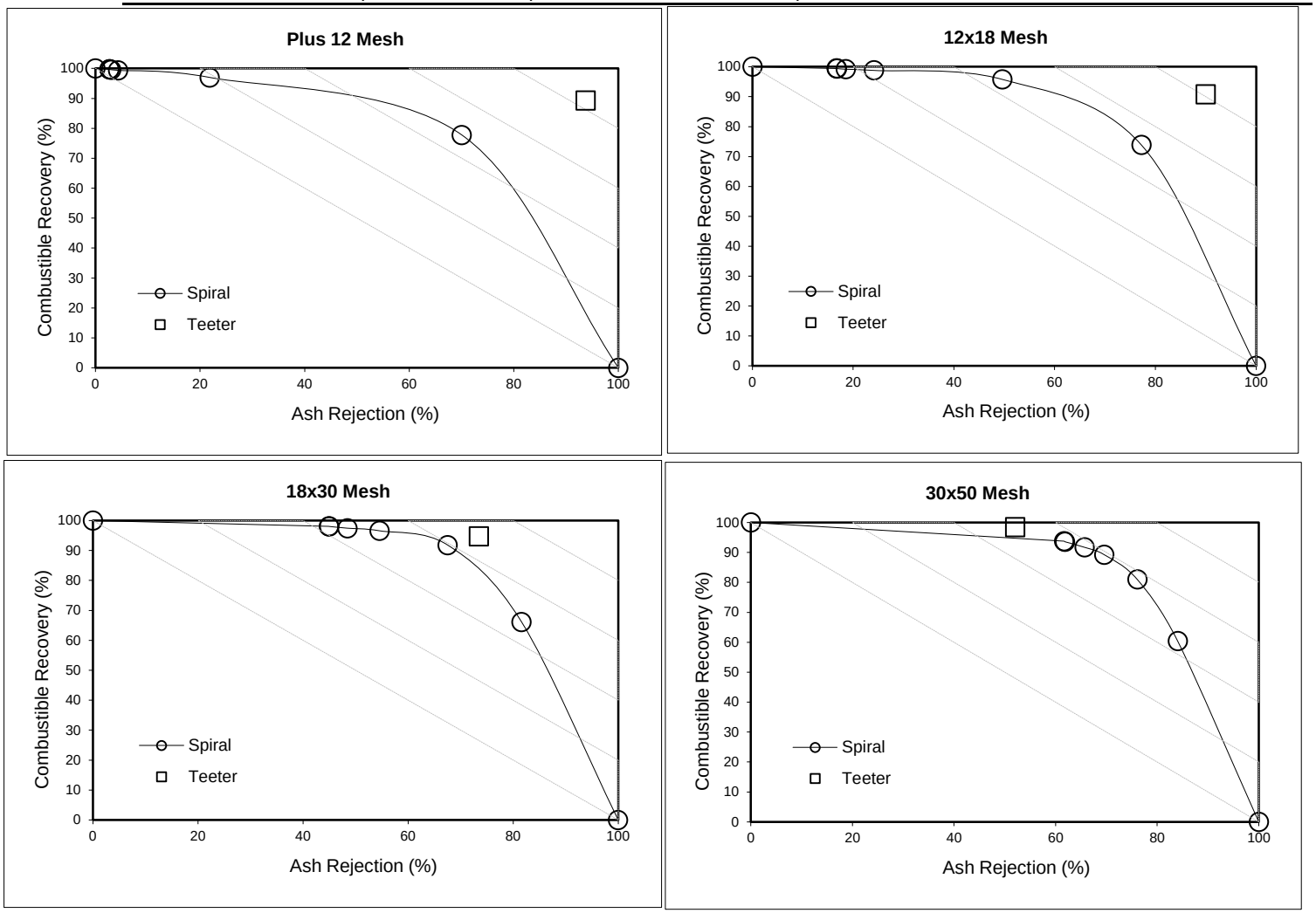
Size Class (Mesh)	Teeter Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 12	89.32	0.00	77.80	97.01	99.37	99.58	99.70	99.70	100.00	
12x18	90.77	0.00	73.81	95.78	98.78	99.17	99.40	99.42	100.00	
18x30	94.73	0.00	66.13	91.84	96.58	97.45	98.04	98.07	100.00	
30x50	98.43	0.00	60.38	80.96	89.24	91.71	93.56	93.77	100.00	
50x100	99.73	0.00	67.05	79.97	86.23	88.66	91.31	92.03	100.00	
Minus 100	99.32	0.00	77.93	89.36	92.92	94.11	95.62	96.34	100.00	
Total	94.30									

Size Class (Mesh)	Teeter Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 12	93.75	100.00	70.04	21.82	4.32	3.03	2.67	2.67	0.00	
12x18	89.98	100.00	77.24	49.59	24.11	18.53	16.77	16.71	0.00	
18x30	73.47	100.00	81.61	67.52	54.59	48.46	44.98	44.92	0.00	
30x50	52.02	100.00	84.04	76.09	69.57	65.70	61.85	61.64	0.00	
50x100	7.46	100.00	70.24	62.78	57.10	53.97	48.60	47.14	0.00	
Minus 100	0.73	100.00	35.74	24.87	20.63	18.65	15.67	13.69	0.00	
Total	74.95									

PERFORMANCE COMPARISON

Description: Test No. 5 - Teeter Bed (3x0.15 mm)

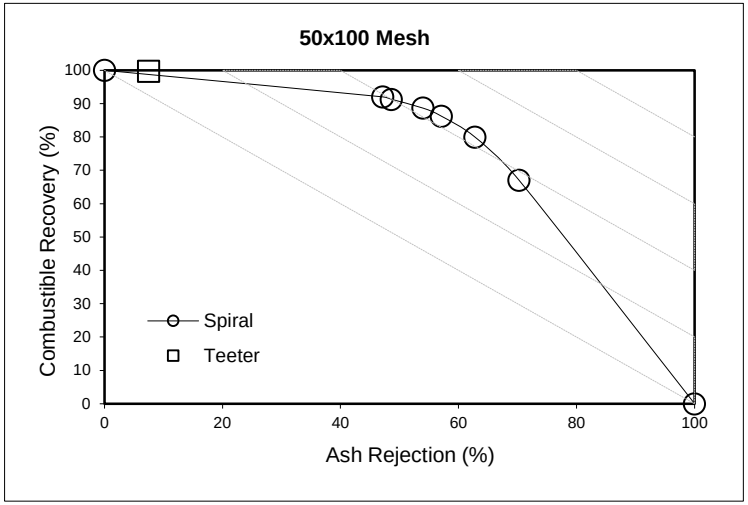
Comments: Mass balanced data and performance comparision of teeter bed with spirals

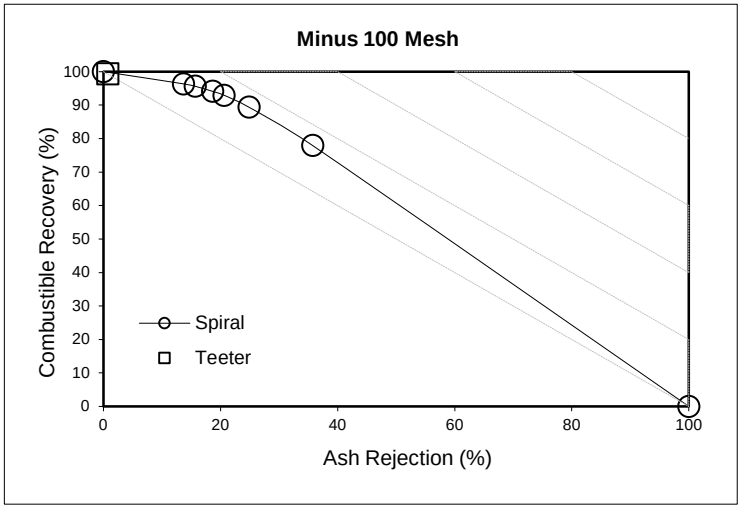


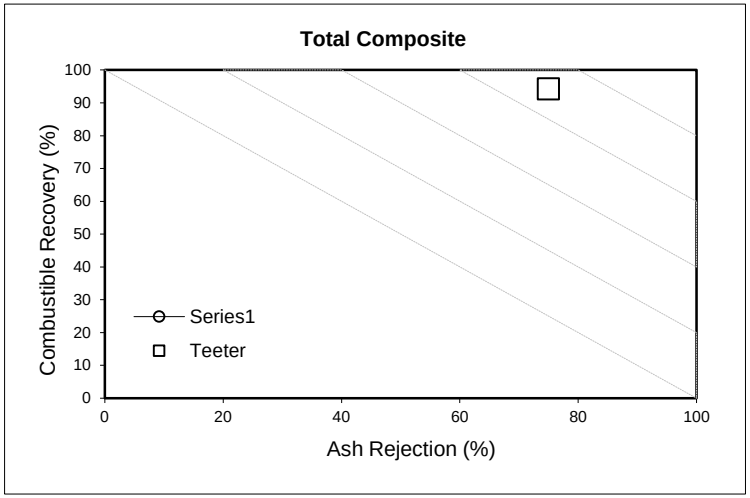
PERFORMANCE COMPARISON

Description: Test No. 5 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals







Teeter Bed/HydroFloat Data (Mass Balancing)

Description: Test No. 6 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

	Size Class (Mesh)	Measured Values			Estimated Values			% Change in Measured Values			Relatvie Error in Measured Values			Weighted Sum of Squares			Total	X
		Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	SSQ F+C+T	Const F-C-T
Mass % Stream	Plus 12	18.18	29.40	19.58	16.51	30.86	20.57	-9.15	4.95	5.04	1	1	1	0.01	0.00	0.00	0.01	***
	12x18	23.69	36.74	25.89	23.50	36.30	27.12	-0.80	-1.20	4.73	1	1	1	0.00	0.00	0.00	0.00	***
	18x30	23.29	21.87	22.76	22.95	21.50	22.54	-1.44	-1.69	-0.97	1	1	1	0.00	0.00	0.00	0.00	***
	30x50	24.29	11.29	21.87	25.28	10.62	21.14	4.09	-5.91	-3.37	1	1	1	0.00	0.00	0.00	0.01	***
	50x100	9.91	0.68	8.77	10.97	0.70	8.07	10.69	3.15	-8.04	1	1	1	0.01	0.00	0.01	0.02	***
	Minus 100	0.65	0.01	1.12	0.79	0.01	0.57	20.61	0.18	-49.31	1	1	1	0.04	0.00	0.24	0.29	***
	Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**0.00**	**0.00**	**0.00**	***	***	***	***	***	***	***	***
Ash % Stream	Plus 12	4.98	81.99	38.66	5.18	82.32	37.91	3.92	0.40	-1.95	1	1	1	0.00	0.00	0.00	0.00	***
	12x18	7.01	83.30	36.26	6.67	83.34	35.70	-4.85	0.05	-1.55	1	1	1	0.00	0.00	0.00	0.00	***
	18x30	12.44	86.01	35.02	14.24	86.01	33.61	14.51	0.00	-4.04	1	1	1	0.02	0.00	0.00	0.02	***
	30x50	14.56	91.01	24.03	13.67	90.89	24.65	-6.10	-0.14	2.57	1	1	1	0.00	0.00	0.00	0.00	***
	50x100	23.46	89.06	25.06	23.08	89.07	24.70	-1.63	0.01	-1.43	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 100	27.10	24.32	24.32	27.09	24.27	27.07	-0.05	-0.19	11.31	1	1	1	0.00	0.00	0.01	0.01	***
	Total	**11.50**	**84.41**	**32.66**	**11.89**	**84.43**	**32.41**	**3.41**	**0.03**	**-0.76**	***	***	***	***	***	***	***	***
Mass (TPH)	Plus 12	12.90	8.53	19.58	11.84	8.73	20.57	-8.21	2.29	5.04	***	***	***	***	***	***	***	0.00
	12x18	16.81	10.66	25.89	16.85	10.27	27.12	0.23	-3.70	4.73	***	***	***	***	***	***	***	0.00
	18x30	16.53	6.35	22.76	16.46	6.08	22.54	-0.42	-4.18	-0.97	***	***	***	***	***	***	***	0.00
	30x50	17.24	3.28	21.87	18.13	3.00	21.14	5.17	-8.29	-3.37	***	***	***	***	***	***	***	0.00
	50x100	7.04	0.20	8.77	7.87	0.20	8.07	11.83	0.53	-8.04	***	***	***	***	***	***	***	0.00
	Minus 100	0.46	0.00	1.12	0.56	0.00	0.57	21.86	-2.36	-49.31	***	***	***	***	***	***	***	0.00
	Total	**70.98**	**29.02**	**100.00**	**71.72**	**28.28**	**100.00**	**1.03**	**-2.53**	**0.00**	***	***	***	***	***	***	***	0.00
Ash (TPH)	Plus 12	0.64	7.00	7.57	0.61	7.18	7.80	-4.61	2.70	2.99	***	***	***	***	***	***	***	0.00
	12x18	1.18	8.88	9.39	1.12	8.56	9.68	-4.63	-3.66	3.11	***	***	***	***	***	***	***	0.00
	18x30	2.06	5.46	7.97	2.34	5.23	7.58	14.02	-4.18	-4.96	***	***	***	***	***	***	***	0.00
	30x50	2.51	2.98	5.26	2.48	2.73	5.21	-1.24	-8.42	-0.89	***	***	***	***	***	***	***	0.00
	50x100	1.65	0.18	2.20	1.82	0.18	1.99	10.01	0.54	-9.36	***	***	***	***	***	***	***	0.00
	Minus 100	0.13	0.00	0.27	0.15	0.00	0.15	21.79	-2.55	-43.58	***	***	***	***	***	***	***	0.00
	Total	**8.16**	**24.49**	**32.66**	**8.53**	**23.88**	**32.41**	**4.48**	**-2.50**	**-0.76**	***	***	***	***	***	***	***	0.00
																Sum SSQ =		**0.37**

PERFORMANCE COMPARISON

Description: Test No. 6 - Teeter Bed (3x0.15 mm)
Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	Conc Wt % Feed	Tail Wt % Feed	Feed Wt % Feed	Conc Ash %	Tail Ash %	Feed Ash %	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)
Plus 12	11.84	8.73	20.57	5.18	82.32	37.91	57.57	42.43	87.92	92.14
12x18	16.85	10.27	27.12	6.67	83.34	35.70	62.14	37.86	90.19	88.39
18x30	16.46	6.08	22.54	14.24	86.01	33.61	73.02	26.98	94.32	69.05
30x50	18.13	3.00	21.14	13.67	90.89	24.65	85.79	14.21	98.28	52.41
50x100	7.87	0.20	8.07	23.08	89.07	24.70	97.54	2.46	99.64	8.87
Minus 100	0.56	0.00	0.57	27.09	24.27	27.07	99.50	0.50	99.48	0.45
Total	71.72	28.28	100.00	11.89	84.43	32.41	71.72	28.28	93.49	73.68

PERFORMANCE COMPARISON

Description: Test No. 6 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals

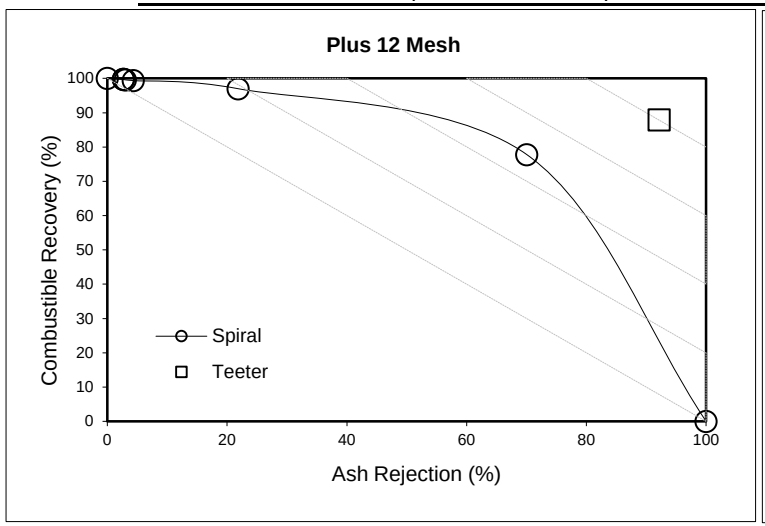
Size Class (Mesh)	Teeter Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 12	87.92	0.00	77.80	97.01	99.37	99.58	99.70	99.70	100.00	
12x18	90.19	0.00	73.81	95.78	98.78	99.17	99.40	99.42	100.00	
18x30	94.32	0.00	66.13	91.84	96.58	97.45	98.04	98.07	100.00	
30x50	98.28	0.00	60.38	80.96	89.24	91.71	93.56	93.77	100.00	
50x100	99.64	0.00	67.05	79.97	86.23	88.66	91.31	92.03	100.00	
Minus 100	99.48	0.00	77.93	89.36	92.92	94.11	95.62	96.34	100.00	
Total	93.49									

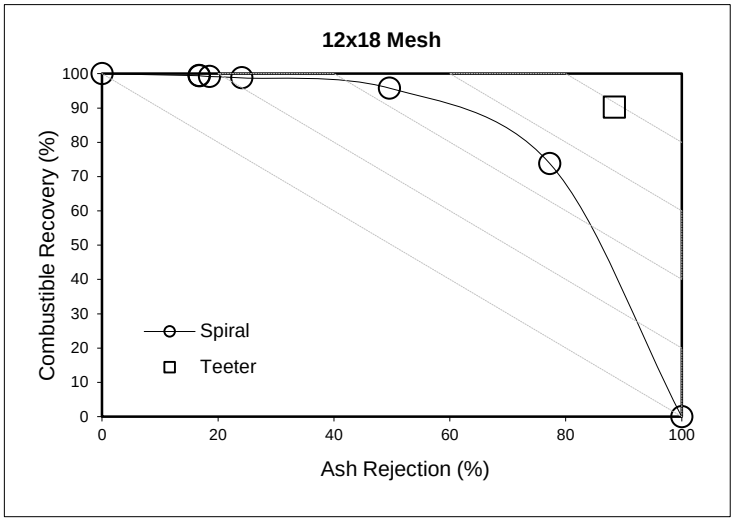
Size Class (Mesh)	Teeter Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 12	92.14	100.00	70.04	21.82	4.32	3.03	2.67	2.67	0.00	
12x18	88.39	100.00	77.24	49.59	24.11	18.53	16.77	16.71	0.00	
18x30	69.05	100.00	81.61	67.52	54.59	48.46	44.98	44.92	0.00	
30x50	52.41	100.00	84.04	76.09	69.57	65.70	61.85	61.64	0.00	
50x100	8.87	100.00	70.24	62.78	57.10	53.97	48.60	47.14	0.00	
Minus 100	0.45	100.00	35.74	24.87	20.63	18.65	15.67	13.69	0.00	
Total	73.68									

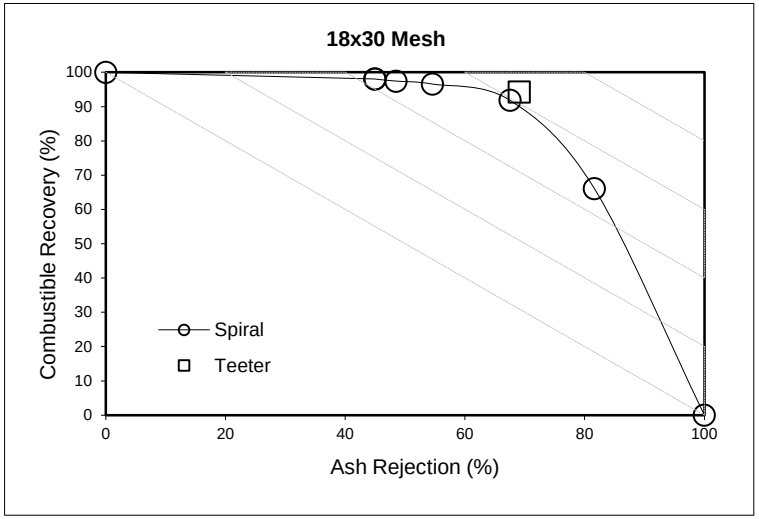
PERFORMANCE COMPARISON

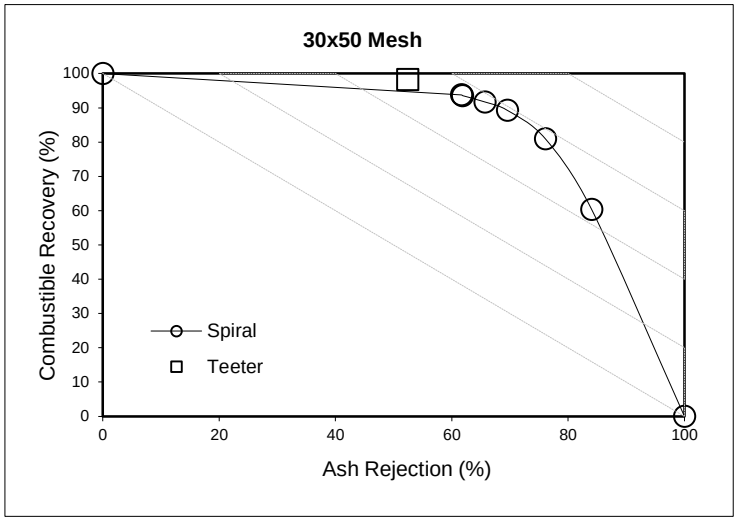
Description: Test No. 6 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals





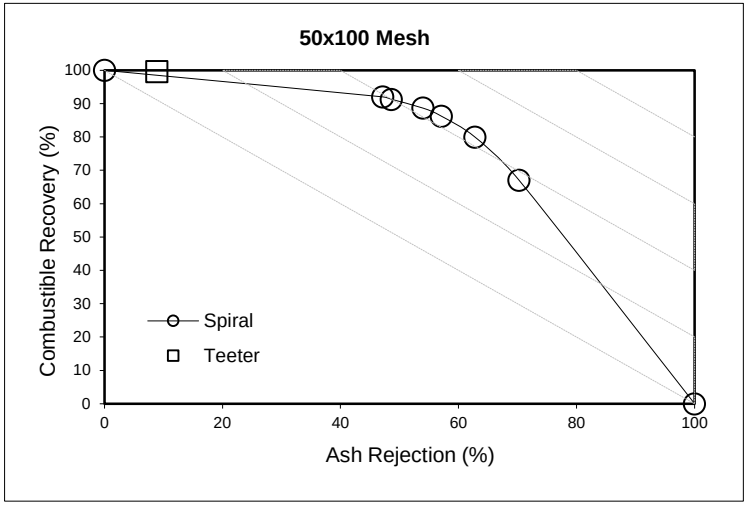


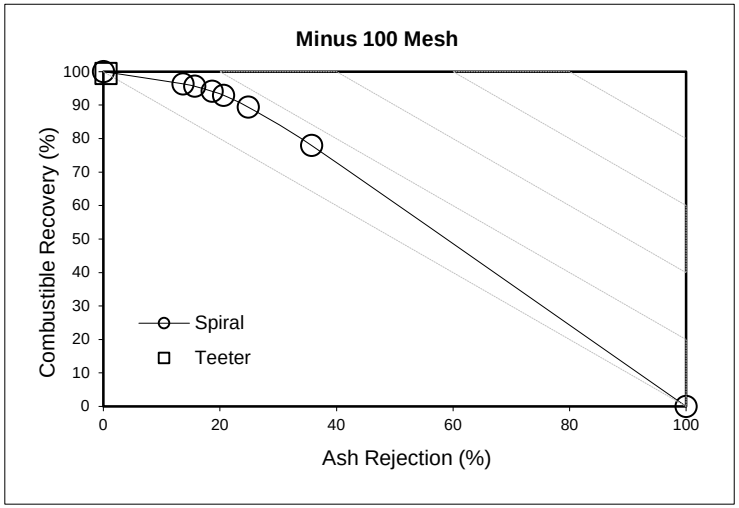


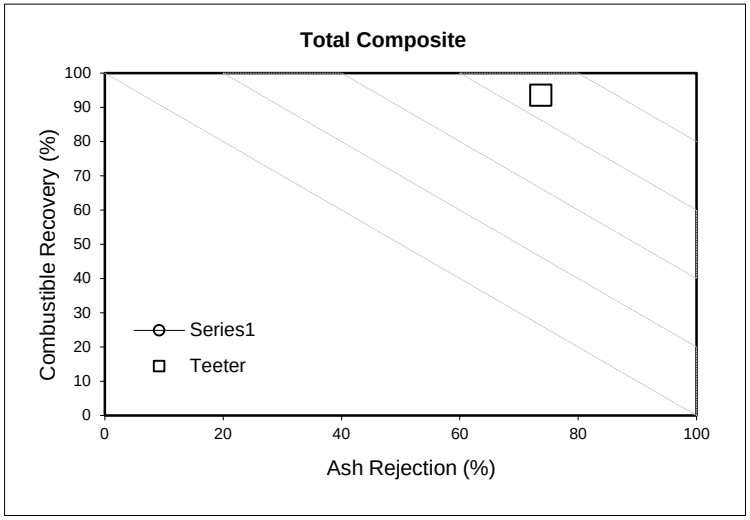
PERFORMANCE COMPARISON

Description: Test No. 6 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals







Teeter Bed/HydroFloat Data (Mass Balancing)

Description: Test No. 7 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

	Size	Measured Values			Estimated Values			% Change in Measured Values			Relatvie Error in Measured Values			Weighted Sum of Squares			Total	X
	Class (Mesh)	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	SSQ F+C+T	Const F-C-T
Mass % Stream	Plus 12	15.65	35.84	19.58	16.74	32.96	21.59	6.94	-8.05	10.25	1	1	1	0.00	0.01	0.01	0.02	***
	12x18	20.77	37.43	25.89	23.46	37.27	27.60	12.96	-0.42	6.57	1	1	1	0.02	0.00	0.00	0.02	***
	18x30	24.03	20.50	22.76	22.02	22.40	22.13	-8.36	9.27	-2.76	1	1	1	0.01	0.01	0.00	0.02	***
	30x50	26.03	6.02	21.87	25.20	7.16	19.80	-3.16	18.97	-9.45	0.5	1	0.5	0.00	0.04	0.00	0.04	***
	50x100	12.63	0.20	8.77	11.55	0.20	8.15	-8.57	-0.78	-7.07	1	1	1	0.01	0.00	0.01	0.01	***
	Minus 100	0.90	0.01	1.12	1.03	0.01	0.72	15.00	0.00	-35.14	0.01	5	0.01	0.00	0.00	0.00	0.00	***
	Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**0.00**	**0.00**	**0.00**	***	***	***	***	***	***	***	***
Ash % Stream	Plus 12	4.09	83.14	38.66	4.08	82.50	39.89	-0.33	-0.77	3.19	1	1	1	0.00	0.00	0.00	0.00	***
	12x18	5.42	86.20	36.26	5.33	85.46	37.71	-1.72	-0.86	4.00	1	1	1	0.00	0.00	0.00	0.00	***
	18x30	9.18	86.25	35.02	9.70	86.84	33.06	5.72	0.68	-5.59	1	1	1	0.00	0.00	0.00	0.01	***
	30x50	12.00	90.84	24.03	13.36	91.23	21.78	11.35	0.43	-9.35	1	1	1	0.01	0.00	0.01	0.02	***
	50x100	20.12	86.66	25.06	24.08	86.82	24.54	19.70	0.19	-2.07	0.5	1	1	0.01	0.00	0.00	0.01	***
	Minus 100	29.07	24.32	24.32	24.86	24.30	24.86	-14.48	-0.08	2.21	1	1	1	0.02	0.00	0.00	0.02	***
	Total	**9.90**	**85.39**	**32.66**	**10.47**	**85.20**	**32.83**	**5.84**	**-0.22**	**0.54**	***	***	***	***	***	***	***	***
Mass (TPH)	Plus 12	10.93	10.81	19.58	11.73	9.86	21.59	7.30	-8.75	10.25	***	***	***	***	***	***	***	0.00
	12x18	14.51	11.29	25.89	16.44	11.15	27.60	13.33	-1.18	6.57	***	***	***	***	***	***	***	0.00
	18x30	16.78	6.18	22.76	15.43	6.70	22.13	-8.05	8.44	-2.76	***	***	***	***	***	***	***	0.00
	30x50	18.18	1.81	21.87	17.66	2.14	19.80	-2.84	18.07	-9.45	***	***	***	***	***	***	***	0.00
	50x100	8.82	0.06	8.77	8.09	0.06	8.15	-8.27	-1.53	-7.07	***	***	***	***	***	***	***	0.00
	Minus 100	0.63	0.00	1.12	0.72	0.00	0.72	15.38	-0.77	-35.14	***	***	***	***	***	***	***	0.00
	Total	**69.85**	**30.15**	**100.00**	**70.08**	**29.92**	**100.00**	**0.33**	**-0.76**	**0.00**	***	***	***	***	***	***	***	0.00
Ash (TPH)	Plus 12	0.45	8.98	7.57	0.48	8.14	8.61	6.94	-9.45	13.77	***	***	***	***	***	***	***	0.00
	12x18	0.79	9.73	9.39	0.88	9.53	10.41	11.38	-2.03	10.83	***	***	***	***	***	***	***	0.00
	18x30	1.54	5.33	7.97	1.50	5.82	7.32	-2.80	9.18	-8.20	***	***	***	***	***	***	***	0.00
	30x50	2.18	1.65	5.26	2.36	1.95	4.31	8.19	18.58	-17.92	***	***	***	***	***	***	***	0.00
	50x100	1.77	0.05	2.20	1.95	0.05	2.00	9.80	-1.35	-9.00	***	***	***	***	***	***	***	0.00
	Minus 100	0.18	0.00	0.27	0.18	0.00	0.18	-1.33	-0.84	-33.71	***	***	***	***	***	***	***	0.00
	Total	**6.91**	**25.74**	**32.66**	**7.34**	**25.49**	**32.83**	**6.19**	**-0.98**	**0.54**	***	***	***	***	***	***	***	0.00
																Sum SSQ =		**0.17**

PERFORMANCE COMPARISON

Description: Test No. 7 - Teeter Bed (3x0.15 mm)
Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	Conc Wt % Feed	Tail Wt % Feed	Feed Wt % Feed	Conc Ash %	Tail Ash %	Feed Ash %	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)
Plus 12	11.73	9.86	21.59	4.08	82.50	39.89	54.33	45.67	86.70	94.45
12x18	16.44	11.15	27.60	5.33	85.46	37.71	59.59	40.41	90.56	91.58
18x30	15.43	6.70	22.13	9.70	86.84	33.06	69.72	30.28	94.05	79.54
30x50	17.66	2.14	19.80	13.36	91.23	21.78	89.18	10.82	98.79	45.29
50x100	8.09	0.06	8.15	24.08	86.82	24.54	99.27	0.73	99.87	2.58
Minus 100	0.72	0.00	0.72	24.86	24.30	24.86	99.59	0.41	99.58	0.40
Total	70.08	29.92	100.00	10.47	85.20	32.83	70.08	29.92	93.41	77.64

PERFORMANCE COMPARISON

Description: Test No. 7 - Teeter Bed (3x0.15 mm)
Comments: Mass balanced data and performance comparision of teeter bed with spirals

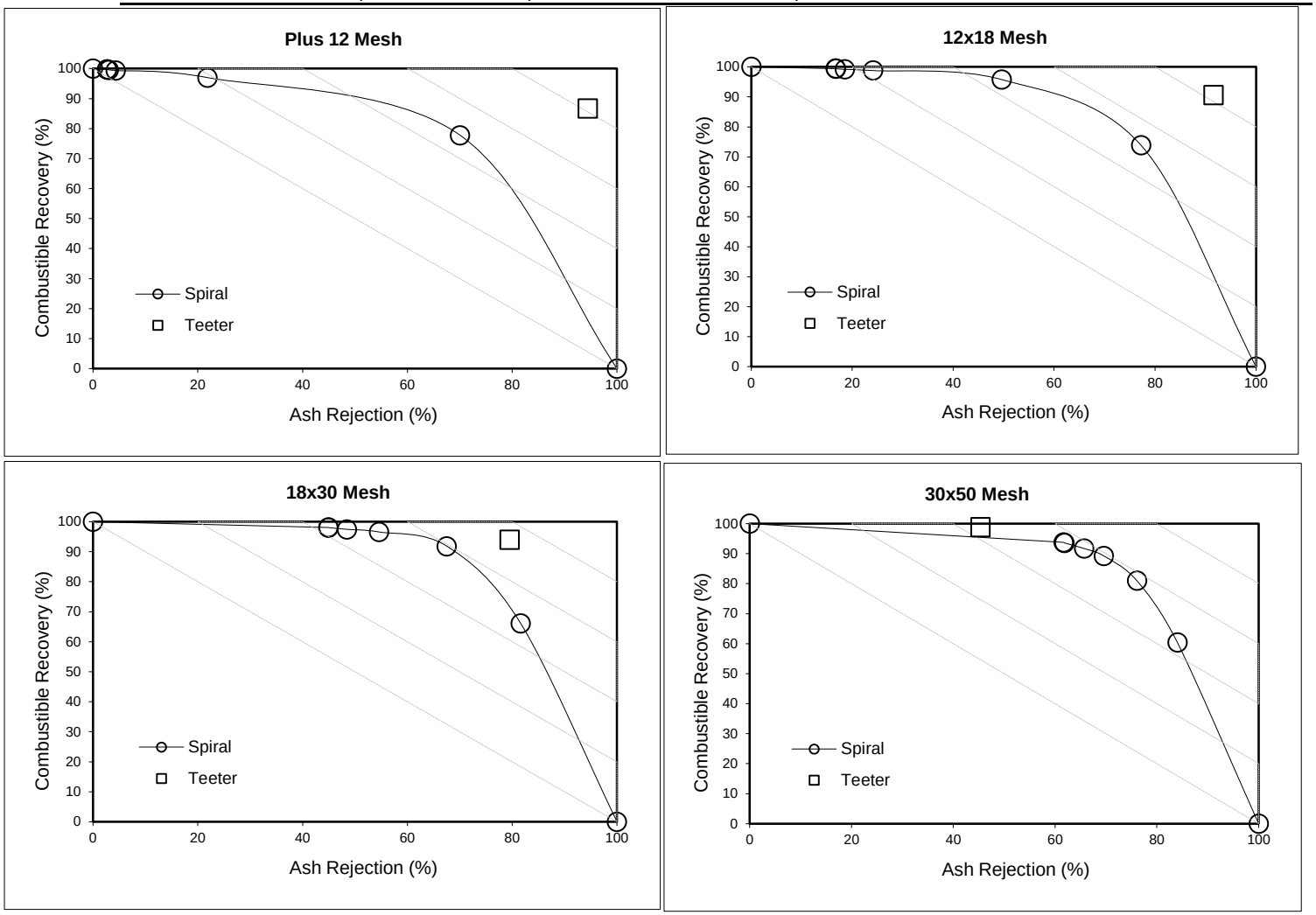
Size Class (Mesh)	Teeter Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 12	86.70	0.00	77.80	97.01	99.37	99.58	99.70	99.70	100.00	
12x18	90.56	0.00	73.81	95.78	98.78	99.17	99.40	99.42	100.00	
18x30	94.05	0.00	66.13	91.84	96.58	97.45	98.04	98.07	100.00	
30x50	98.79	0.00	60.38	80.96	89.24	91.71	93.56	93.77	100.00	
50x100	99.87	0.00	67.05	79.97	86.23	88.66	91.31	92.03	100.00	
Minus 100	99.58	0.00	77.93	89.36	92.92	94.11	95.62	96.34	100.00	
Total	93.41									

Size Class (Mesh)	Teeter Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 12	94.45	100.00	70.04	21.82	4.32	3.03	2.67	2.67	0.00	
12x18	91.58	100.00	77.24	49.59	24.11	18.53	16.77	16.71	0.00	
18x30	79.54	100.00	81.61	67.52	54.59	48.46	44.98	44.92	0.00	
30x50	45.29	100.00	84.04	76.09	69.57	65.70	61.85	61.64	0.00	
50x100	2.58	100.00	70.24	62.78	57.10	53.97	48.60	47.14	0.00	
Minus 100	0.40	100.00	35.74	24.87	20.63	18.65	15.67	13.69	0.00	
Total	77.64									

PERFORMANCE COMPARISON

Description: Test No. 7 - Teeter Bed (3x0.15 mm)

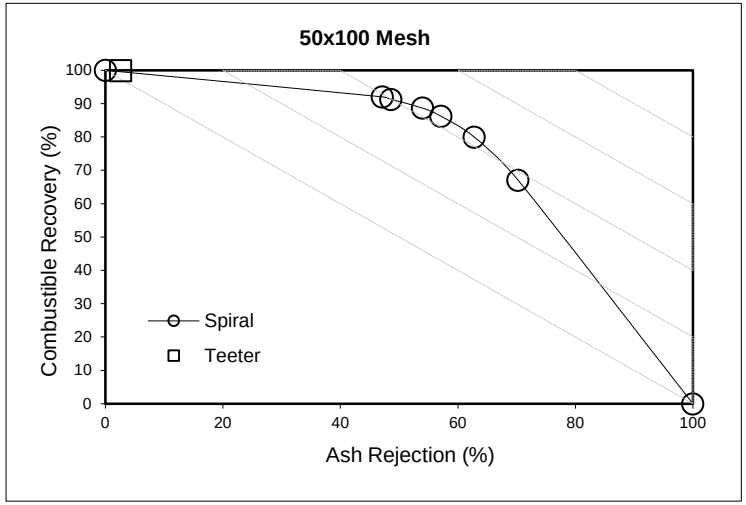
Comments: Mass balanced data and performance comparision of teeter bed with spirals

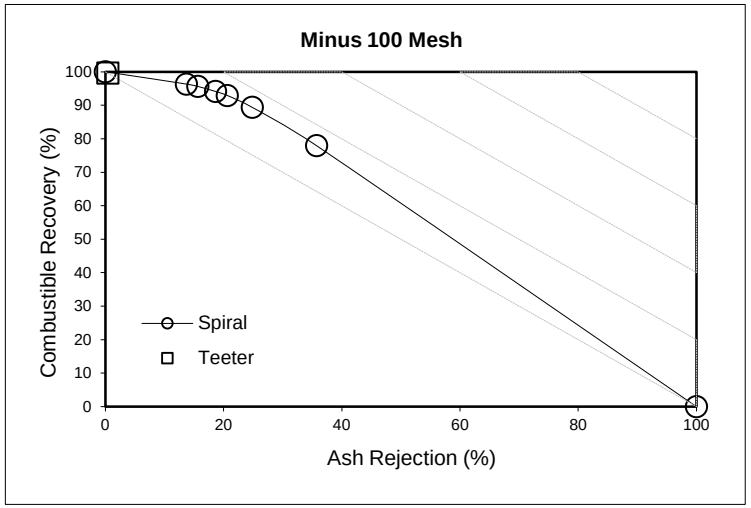


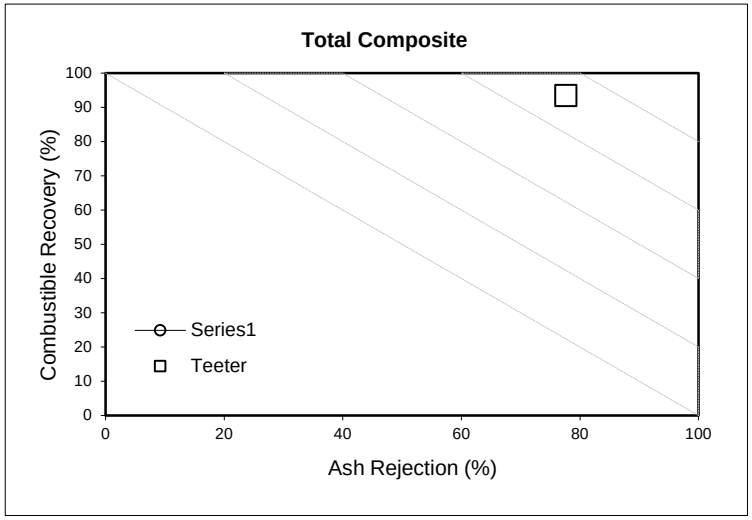
PERFORMANCE COMPARISON

Description: Test No. 7 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals







Teeter Bed/HydroFloat Data (Mass Balancing)

Description: Test No. 8 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

	Size	Measured Values			Estimated Values			% Change in Measured Values			Relatvie Error in Measured Values			Weighted Sum of Squares			Total	X
	Class (Mesh)	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	SSQ F+C+T	Const F-C-T
Mass % Stream	Plus 12	15.21	24.98	20.58	17.90	23.41	19.24	17.72	-6.27	-6.55	0.6	1	1	0.01	0.00	0.00	0.02	***
	12x18	22.18	38.66	24.73	20.41	40.26	25.21	-7.98	4.14	1.95	1	1	1	0.01	0.00	0.00	0.01	***
	18x30	23.91	23.78	23.96	23.83	23.93	23.85	-0.37	0.63	-0.47	1	1	1	0.00	0.00	0.00	0.00	***
	30x50	27.28	12.14	21.27	26.15	11.95	22.72	-4.15	-1.53	6.78	1	1	1	0.00	0.00	0.00	0.01	***
	50x100	11.10	0.43	9.09	11.35	0.43	8.71	2.23	-0.31	-4.16	0.4	1	0.4	0.00	0.00	0.00	0.00	***
	Minus 100	0.31	0.01	0.36	0.36	0.01	0.28	15.46	0.14	-23.79	1	1	1	0.02	0.00	0.06	0.08	***
	Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**0.00**	**0.00**	**0.00**	***	***	***	***	***	***	***	***
Ash % Stream	Plus 12	5.50	86.22	26.63	5.56	84.82	28.89	1.05	-1.62	8.47	1	1	1	0.00	0.00	0.01	0.01	***
	12x18	7.90	87.08	43.28	7.95	89.22	39.33	0.64	2.46	-9.12	1	1	1	0.00	0.00	0.01	0.01	***
	18x30	11.53	89.77	30.73	11.63	90.01	30.65	0.88	0.27	-0.27	1	1	1	0.00	0.00	0.00	0.00	***
	30x50	15.13	92.03	23.76	14.97	91.53	24.71	-1.06	-0.55	4.00	1	1	1	0.00	0.00	0.00	0.00	***
	50x100	19.32	90.59	20.18	21.78	91.25	22.61	12.74	0.72	12.03	0.5	1	0.5	0.00	0.00	0.00	0.01	***
	Minus 100	22.30	24.32	24.74	23.33	24.35	23.34	4.61	0.11	-5.67	1	1	1	0.00	0.00	0.00	0.01	***
	Total	**11.69**	**88.11**	**30.53**	**11.86**	**88.66**	**30.43**	**1.47**	**0.62**	**-0.32**	***	***	***	***	***	***	***	***
Mass (TPH)	Plus 12	11.46	6.16	20.58	13.57	5.66	19.24	18.46	-8.05	-6.55	***	***	***	***	***	***	***	0.00
	12x18	16.71	9.53	24.73	15.48	9.74	25.21	-7.41	2.15	1.95	***	***	***	***	***	***	***	0.00
	18x30	18.02	5.86	23.96	18.06	5.79	23.85	0.25	-1.28	-0.47	***	***	***	***	***	***	***	0.00
	30x50	20.56	2.99	21.27	19.83	2.89	22.72	-3.55	-3.40	6.78	***	***	***	***	***	***	***	0.00
	50x100	8.36	0.11	9.09	8.60	0.10	8.71	2.87	-2.21	-4.16	***	***	***	***	***	***	***	0.00
	Minus 100	0.24	0.00	0.36	0.27	0.00	0.28	16.18	-1.77	-23.79	***	***	***	***	***	***	***	0.00
	Total	**75.35**	**24.65**	**100.00**	**75.82**	**24.18**	**100.00**	**0.62**	**-1.90**	**0.00**	***	***	***	***	***	***	***	0.00
Ash (TPH)	Plus 12	0.63	5.31	5.48	0.75	4.80	5.56	19.70	-9.54	1.37	***	***	***	***	***	***	***	0.00
	12x18	1.32	8.30	10.70	1.23	8.69	9.92	-6.81	4.67	-7.34	***	***	***	***	***	***	***	0.00
	18x30	2.08	5.26	7.36	2.10	5.21	7.31	1.13	-1.02	-0.74	***	***	***	***	***	***	***	0.00
	30x50	3.11	2.75	5.05	2.97	2.65	5.61	-4.57	-3.93	11.06	***	***	***	***	***	***	***	0.00
	50x100	1.62	0.10	1.83	1.87	0.09	1.97	15.98	-1.50	7.37	***	***	***	***	***	***	***	0.00
	Minus 100	0.05	0.00	0.09	0.06	0.00	0.06	21.54	-1.66	-28.11	***	***	***	***	***	***	***	0.00
	Total	**8.81**	**21.72**	**30.53**	**8.99**	**21.44**	**30.43**	**2.10**	**-1.30**	**-0.32**	***	***	***	***	***	***	***	0.00
																Sum SSQ =	**0.15**	

PERFORMANCE COMPARISON

Description: Test No. 8 - Teeter Bed (3x0.15 mm)
Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	Conc Wt % Feed	Tail Wt % Feed	Feed Wt % Feed	Conc Ash %	Tail Ash %	Feed Ash %	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)
Plus 12	13.57	5.66	19.24	5.56	84.82	28.89	70.57	29.43	93.72	86.42
12x18	15.48	9.74	25.21	7.95	89.22	39.33	61.38	38.62	93.14	87.59
18x30	18.06	5.79	23.85	11.63	90.01	30.65	75.74	24.26	96.51	71.25
30x50	19.83	2.89	22.72	14.97	91.53	24.71	87.28	12.72	98.57	47.13
50x100	8.60	0.10	8.71	21.78	91.25	22.61	98.81	1.19	99.87	4.80
Minus 100	0.27	0.00	0.28	23.33	24.35	23.34	99.13	0.87	99.14	0.91
Total	75.82	24.18	100.00	11.86	88.66	30.43	75.82	24.18	96.06	70.45

PERFORMANCE COMPARISON

Description: Test No. 8 - Teeter Bed (3x0.15 mm)
Comments: Mass balanced data and performance comparision of teeter bed with spirals

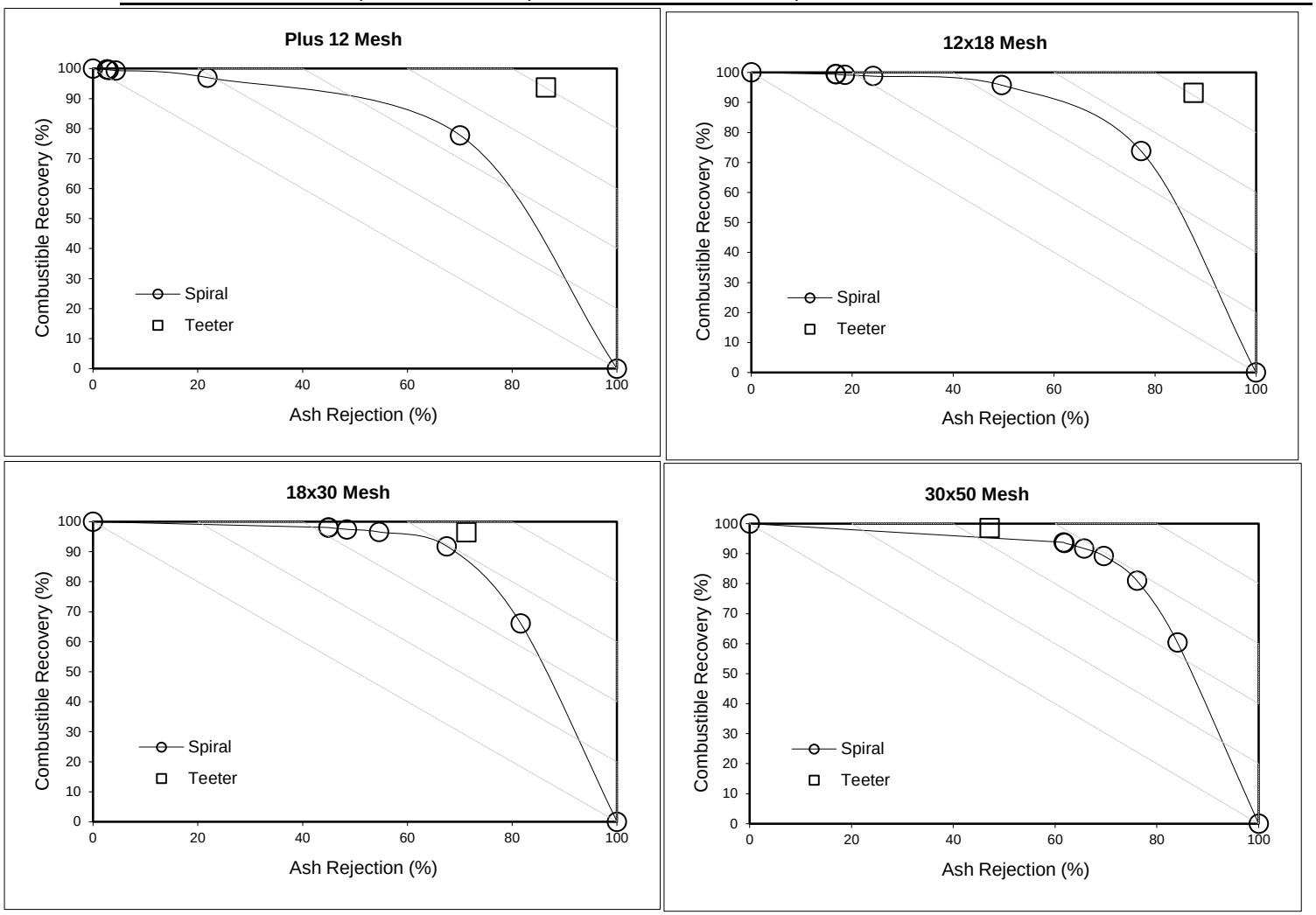
Size Class (Mesh)	Teeter Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 12	93.72	0.00	77.80	97.01	99.37	99.58	99.70	99.70	100.00	
12x18	93.14	0.00	73.81	95.78	98.78	99.17	99.40	99.42	100.00	
18x30	96.51	0.00	66.13	91.84	96.58	97.45	98.04	98.07	100.00	
30x50	98.57	0.00	60.38	80.96	89.24	91.71	93.56	93.77	100.00	
50x100	99.87	0.00	67.05	79.97	86.23	88.66	91.31	92.03	100.00	
Minus 100	99.14	0.00	77.93	89.36	92.92	94.11	95.62	96.34	100.00	
Total	96.06									

Size Class (Mesh)	Teeter Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 12	86.42	100.00	70.04	21.82	4.32	3.03	2.67	2.67	0.00	
12x18	87.59	100.00	77.24	49.59	24.11	18.53	16.77	16.71	0.00	
18x30	71.25	100.00	81.61	67.52	54.59	48.46	44.98	44.92	0.00	
30x50	47.13	100.00	84.04	76.09	69.57	65.70	61.85	61.64	0.00	
50x100	4.80	100.00	70.24	62.78	57.10	53.97	48.60	47.14	0.00	
Minus 100	0.91	100.00	35.74	24.87	20.63	18.65	15.67	13.69	0.00	
Total	70.45									

PERFORMANCE COMPARISON

Description: Test No. 8 - Teeter Bed (3x0.15 mm)

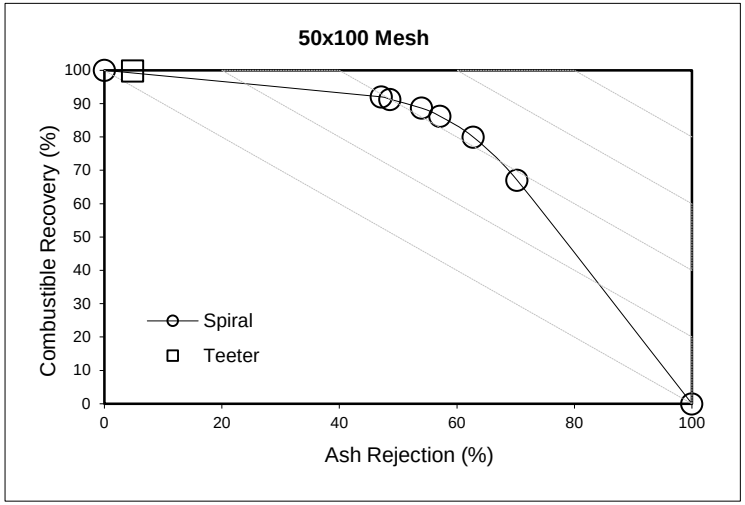
Comments: Mass balanced data and performance comparision of teeter bed with spirals

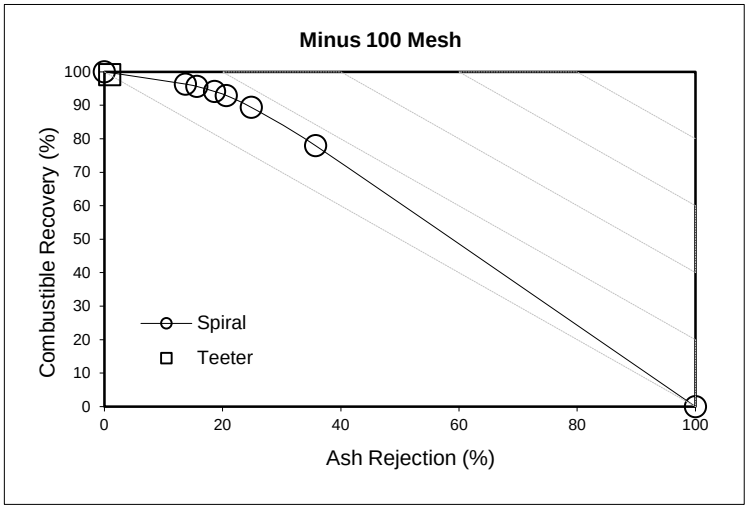


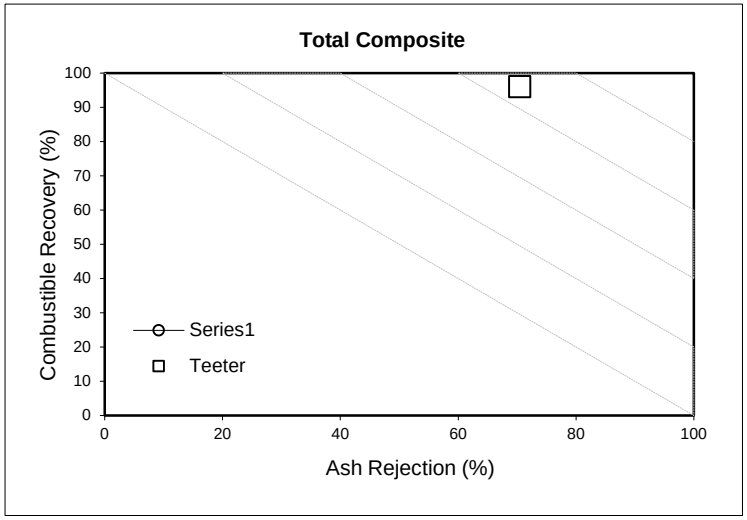
PERFORMANCE COMPARISON

Description: Test No. 8 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals







Teeter Bed/HydroFloat Data (Mass Balancing)

Description: Test No. 9 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

	Size	Measured Values			Estimated Values			% Change in Measured Values			Relatvie Error in Measured Values			Weighted Sum of Squares			Total	X
	Class (Mesh)	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	SSQ F+C+T	Const F-C-T
Mass % Stream	Plus 12	16.48	20.93	19.41	16.28	23.86	17.98	-1.20	14.00	-7.36	1	1	1	0.00	0.02	0.01	0.03	***
	12x18	21.45	36.35	24.86	22.46	33.86	25.02	4.70	-6.85	0.63	1	1	1	0.00	0.00	0.00	0.01	***
	18x30	24.79	29.32	22.93	23.78	28.36	24.81	-4.08	-3.27	8.18	1	1	1	0.00	0.00	0.01	0.01	***
	30x50	25.20	13.01	23.50	25.43	13.53	22.76	0.93	3.99	-3.15	1	1	1	0.00	0.00	0.00	0.00	***
	50x100	11.83	0.39	9.12	11.81	0.39	9.25	-0.18	0.25	1.41	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 100	0.24	0.01	0.17	0.23	0.01	0.18	-5.27	-0.08	4.78	1	1	1	0.00	0.00	0.00	0.01	***
	Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**0.00**	**0.00**	**0.00**	***	***	***	***	***	***	***	***
Ash % Stream	Plus 12	5.54	85.26	32.46	5.66	86.52	29.71	2.09	1.48	-8.48	1	1	1	0.00	0.00	0.01	0.01	***
	12x18	7.73	86.60	27.14	7.41	85.11	30.98	-4.20	-1.72	14.16	1	1	1	0.00	0.00	0.02	0.02	***
	18x30	12.81	88.76	30.60	12.68	88.62	32.14	-1.03	-0.16	5.03	1	1	1	0.00	0.00	0.00	0.00	***
	30x50	17.10	91.34	28.14	17.67	91.58	27.51	3.31	0.26	-2.23	1	1	1	0.00	0.00	0.00	0.00	***
	50x100	18.17	90.25	20.56	18.64	90.27	19.32	2.60	0.03	-6.02	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 100	23.67	24.32	23.91	23.73	25.07	23.75	0.26	3.07	-0.68	1	1	1	0.00	0.00	0.00	0.00	***
	Total	**12.26**	**87.58**	**28.60**	**12.35**	**87.33**	**29.16**	**0.70**	**-0.28**	**1.97**	***	***	***	***	***	***	***	***
Mass (TPH)	Plus 12	12.91	4.54	19.41	12.63	5.35	17.98	-2.13	17.86	-7.36	***	***	***	***	***	***	***	0.00
	12x18	16.80	7.88	24.86	17.43	7.59	25.02	3.72	-3.71	0.63	***	***	***	***	***	***	***	0.00
	18x30	19.42	6.36	22.93	18.45	6.36	24.81	-4.97	0.00	8.18	***	***	***	***	***	***	***	0.00
	30x50	19.73	2.82	23.50	19.73	3.03	22.76	-0.01	7.50	-3.15	***	***	***	***	***	***	***	0.00
	50x100	9.26	0.08	9.12	9.16	0.09	9.25	-1.11	3.63	1.41	***	***	***	***	***	***	***	0.00
	Minus 100	0.19	0.00	0.17	0.18	0.00	0.18	-6.15	3.29	4.78	***	***	***	***	***	***	***	0.00
	Total	**78.31**	**21.69**	**100.00**	**77.58**	**22.42**	**100.00**	**-0.94**	**3.38**	**0.00**	***	***	***	***	***	***	***	0.00
Ash (TPH)	Plus 12	0.72	3.87	6.30	0.71	4.63	5.34	-0.08	19.60	-15.22	***	***	***	***	***	***	***	0.00
	12x18	1.30	6.83	6.75	1.29	6.46	7.75	-0.63	-5.36	14.88	***	***	***	***	***	***	***	0.00
	18x30	2.49	5.64	7.02	2.34	5.63	7.97	-5.95	-0.16	13.62	***	***	***	***	***	***	***	0.00
	30x50	3.37	2.58	6.61	3.49	2.78	6.26	3.30	7.78	-5.30	***	***	***	***	***	***	***	0.00
	50x100	1.68	0.08	1.88	1.71	0.08	1.79	1.46	3.66	-4.70	***	***	***	***	***	***	***	0.00
	Minus 100	0.05	0.00	0.04	0.04	0.00	0.04	-5.91	6.46	4.07	***	***	***	***	***	***	***	0.00
	Total	**9.60**	**18.99**	**28.60**	**9.58**	**19.58**	**29.16**	**-0.25**	**3.09**	**1.97**	***	***	***	***	***	***	***	0.00
															Sum SSQ =		**0.09**	

PERFORMANCE COMPARISON

Description: Test No. 9 - Teeter Bed (3x0.15 mm)
Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	Conc Wt % Feed	Tail Wt % Feed	Feed Wt % Feed	Conc Ash %	Tail Ash %	Feed Ash %	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)
Plus 12	12.63	5.35	17.98	5.66	86.52	29.71	70.26	29.74	94.30	86.62
12x18	17.43	7.59	25.02	7.41	85.11	30.98	69.66	30.34	93.46	83.35
18x30	18.45	6.36	24.81	12.68	88.62	32.14	74.37	25.63	95.70	70.66
30x50	19.73	3.03	22.76	17.67	91.58	27.51	86.68	13.32	98.45	44.34
50x100	9.16	0.09	9.25	18.64	90.27	19.32	99.05	0.95	99.89	4.43
Minus 100	0.18	0.00	0.18	23.73	25.07	23.75	98.77	1.23	98.79	1.30
Total	77.58	22.42	100.00	12.35	87.33	29.16	77.58	22.42	95.99	67.14

PERFORMANCE COMPARISON

Description: Test No. 9 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals

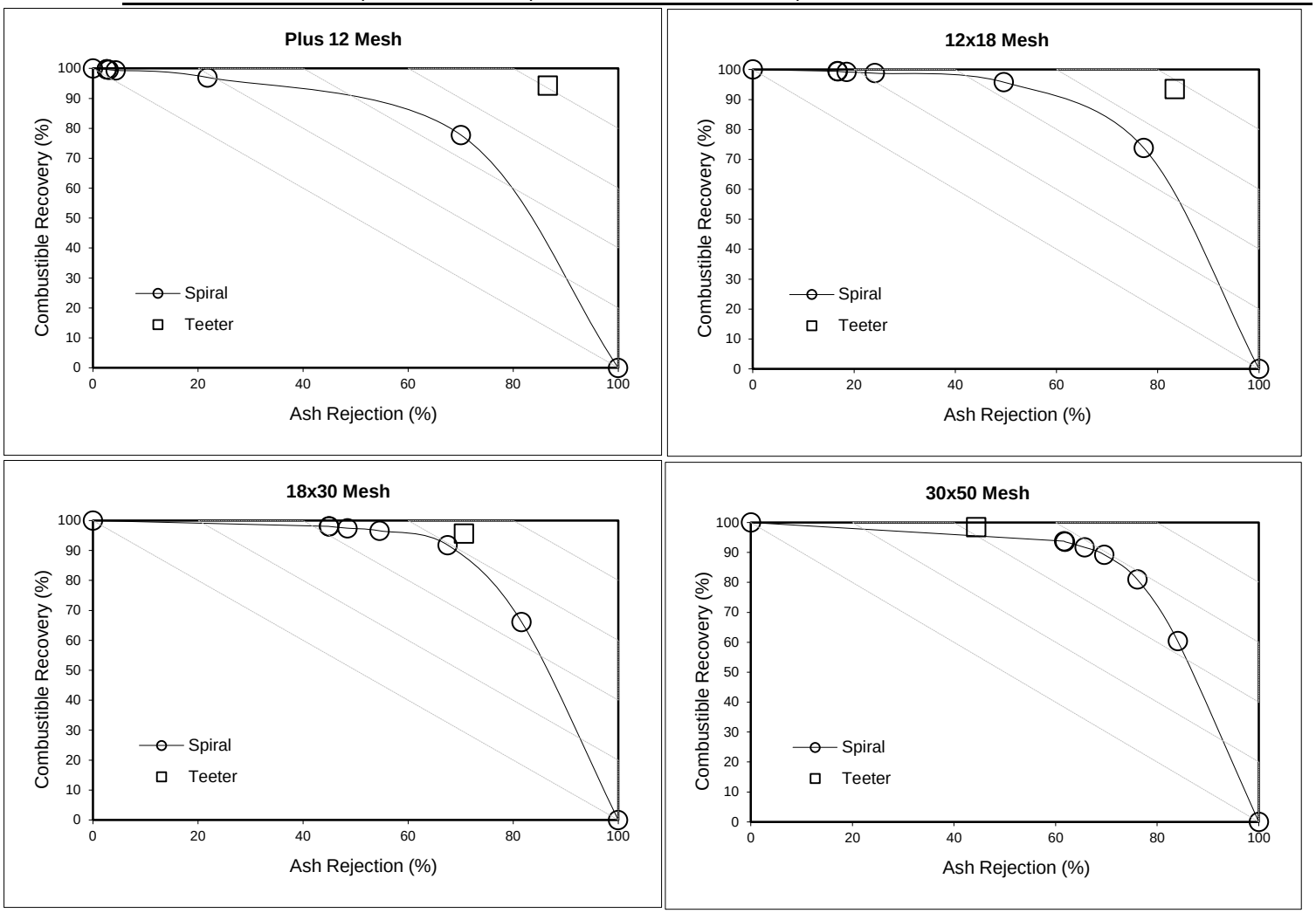
Size Class (Mesh)	Teeter Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 12	94.30	0.00	77.80	97.01	99.37	99.58	99.70	99.70	100.00	
12x18	93.46	0.00	73.81	95.78	98.78	99.17	99.40	99.42	100.00	
18x30	95.70	0.00	66.13	91.84	96.58	97.45	98.04	98.07	100.00	
30x50	98.45	0.00	60.38	80.96	89.24	91.71	93.56	93.77	100.00	
50x100	99.89	0.00	67.05	79.97	86.23	88.66	91.31	92.03	100.00	
Minus 100	98.79	0.00	77.93	89.36	92.92	94.11	95.62	96.34	100.00	
Total	95.99									

Size Class (Mesh)	Teeter Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 12	86.62	100.00	70.04	21.82	4.32	3.03	2.67	2.67	0.00	
12x18	83.35	100.00	77.24	49.59	24.11	18.53	16.77	16.71	0.00	
18x30	70.66	100.00	81.61	67.52	54.59	48.46	44.98	44.92	0.00	
30x50	44.34	100.00	84.04	76.09	69.57	65.70	61.85	61.64	0.00	
50x100	4.43	100.00	70.24	62.78	57.10	53.97	48.60	47.14	0.00	
Minus 100	1.30	100.00	35.74	24.87	20.63	18.65	15.67	13.69	0.00	
Total	67.14									

PERFORMANCE COMPARISON

Description: Test No. 9 - Teeter Bed (3x0.15 mm)

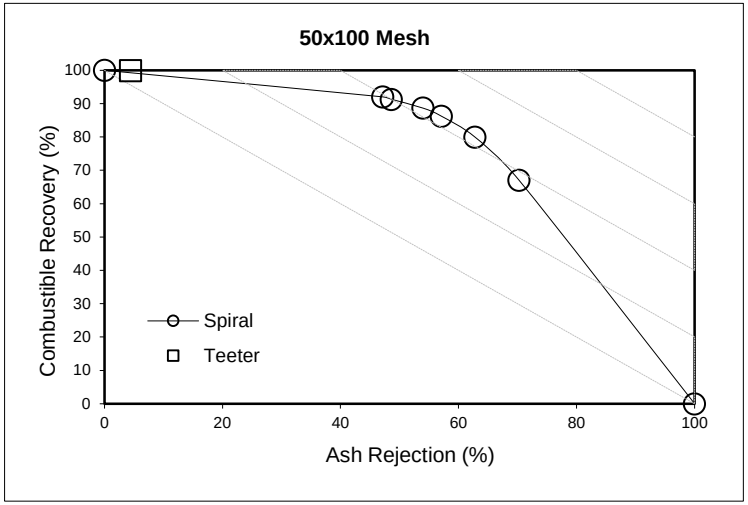
Comments: Mass balanced data and performance comparision of teeter bed with spirals

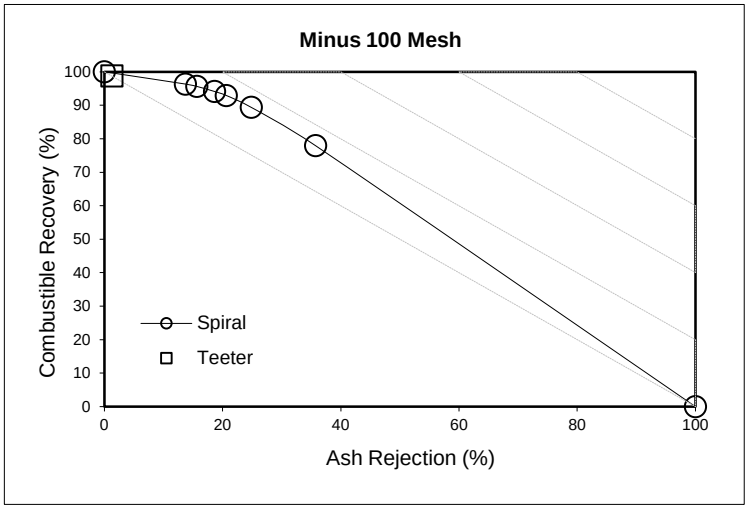


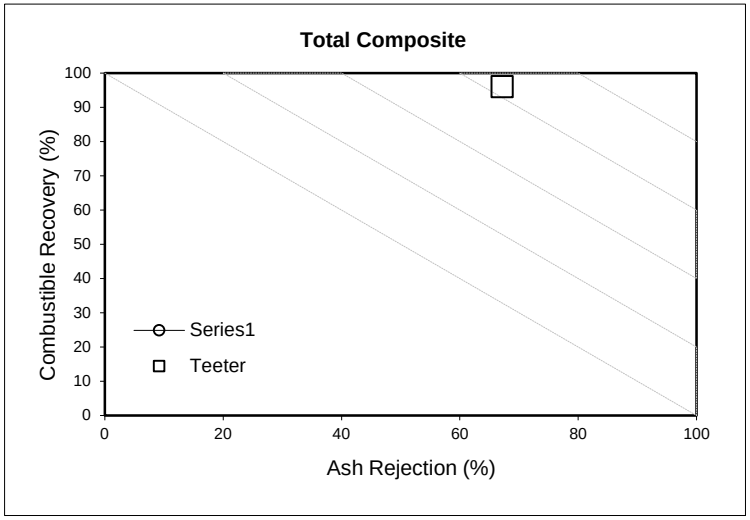
PERFORMANCE COMPARISON

Description: Test No. 9 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals







Teeter Bed/HydroFloat Data (Mass Balancing)

Description: Test No. 10 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

	Size Class (Mesh)	Measured Values			Estimated Values			% Change in Measured Values			Relatvie Error in Measured Values			Weighted Sum of Squares			Total	X
		Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	SSQ F+C+T	Const F-C-T
Mass % Stream	Plus 12	16.37	23.00	19.41	16.35	24.78	18.15	-0.15	7.77	-6.50	1	1	1	0.00	0.01	0.00	0.01	***
	12x18	22.21	36.79	24.86	23.17	34.50	25.59	4.33	-6.24	2.93	1	1	1	0.00	0.00	0.00	0.01	***
	18x30	23.65	24.86	22.93	23.12	24.86	23.49	-2.26	-0.01	2.43	1	1	1	0.00	0.00	0.00	0.00	***
	30x50	26.61	14.87	23.50	25.92	15.38	23.67	-2.61	3.45	0.69	1	1	1	0.00	0.00	0.00	0.00	***
	50x100	10.99	0.47	9.12	11.26	0.47	8.96	2.47	-0.13	-1.76	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 100	0.17	0.01	0.17	0.19	0.01	0.15	10.82	0.17	-14.22	1	1	1	0.01	0.00	0.02	0.03	***
	Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**0.00**	**0.00**	**0.00**	***	***	***	***	***	***	***	***
Ash % Stream	Plus 12	5.85	88.12	32.46	5.89	88.98	30.11	0.73	0.97	-7.23	1	1	1	0.00	0.00	0.01	0.01	***
	12x18	8.09	86.40	27.14	7.94	85.17	30.17	-1.91	-1.42	11.15	1	1	1	0.00	0.00	0.01	0.01	***
	18x30	13.67	84.36	30.60	13.81	84.51	29.78	0.99	0.18	-2.67	1	1	1	0.00	0.00	0.00	0.00	***
	30x50	15.27	91.36	28.14	15.79	91.69	26.32	3.40	0.36	-6.47	1	1	1	0.00	0.00	0.00	0.01	***
	50x100	21.56	90.40	20.56	20.78	90.39	21.55	-3.64	-0.01	4.84	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 100	24.09	24.39	23.91	24.00	24.40	24.00	-0.39	0.02	0.38	1	1	1	0.00	0.00	0.00	0.00	***
	Total	**12.46**	**87.04**	**28.60**	**12.47**	**86.97**	**28.38**	**0.07**	**-0.08**	**-0.77**	***	***	***	***	***	***	***	***
Mass (TPH)	Plus 12	12.83	4.97	19.41	12.86	5.29	18.15	0.22	6.34	-6.50	***	***	***	***	***	***	***	0.00
	12x18	17.40	7.96	24.86	18.22	7.36	25.59	4.71	-7.48	2.93	***	***	***	***	***	***	***	0.00
	18x30	18.53	5.38	22.93	18.18	5.31	23.49	-1.90	-1.33	2.43	***	***	***	***	***	***	***	0.00
	30x50	20.85	3.22	23.50	20.38	3.28	23.67	-2.25	2.09	0.69	***	***	***	***	***	***	***	0.00
	50x100	8.61	0.10	9.12	8.86	0.10	8.96	2.84	-1.45	-1.76	***	***	***	***	***	***	***	0.00
	Minus 100	0.13	0.00	0.17	0.15	0.00	0.15	11.22	-1.15	-14.22	***	***	***	***	***	***	***	0.00
	Total	**78.37**	**21.63**	**100.00**	**78.65**	**21.35**	**100.00**	**0.36**	**-1.32**	**0.00**	***	***	***	***	***	***	***	0.00
Ash (TPH)	Plus 12	0.75	4.38	6.30	0.76	4.71	5.47	0.95	7.38	-13.27	***	***	***	***	***	***	***	0.00
	12x18	1.41	6.88	6.75	1.45	6.27	7.72	2.72	-8.80	14.40	***	***	***	***	***	***	***	0.00
	18x30	2.53	4.54	7.02	2.51	4.49	7.00	-0.93	-1.15	-0.31	***	***	***	***	***	***	***	0.00
	30x50	3.18	2.94	6.61	3.22	3.01	6.23	1.07	2.45	-5.82	***	***	***	***	***	***	***	0.00
	50x100	1.86	0.09	1.88	1.84	0.09	1.93	-0.90	-1.47	2.99	***	***	***	***	***	***	***	0.00
	Minus 100	0.03	0.00	0.04	0.04	0.00	0.04	10.79	-1.13	-13.90	***	***	***	***	***	***	***	0.00
	Total	**9.77**	**18.83**	**28.60**	**9.81**	**18.57**	**28.38**	**0.44**	**-1.40**	**-0.77**	***	***	***	***	***	***	***	0.00
																Sum SSQ =		**0.08**

PERFORMANCE COMPARISON

Description: Test No. 10 - Teeter Bed (3x0.15 mm)
Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	Conc Wt % Feed	Tail Wt % Feed	Feed Wt % Feed	Conc Ash %	Tail Ash %	Feed Ash %	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)
Plus 12	12.86	5.29	18.15	5.89	88.98	30.11	70.85	29.15	95.40	86.14
12x18	18.22	7.36	25.59	7.94	85.17	30.17	71.22	28.78	93.89	81.26
18x30	18.18	5.31	23.49	13.81	84.51	29.78	77.40	22.60	95.02	64.12
30x50	20.38	3.28	23.67	15.79	91.69	26.32	86.13	13.87	98.44	48.33
50x100	8.86	0.10	8.96	20.78	90.39	21.55	98.88	1.12	99.86	4.69
Minus 100	0.15	0.00	0.15	24.00	24.40	24.00	98.56	1.44	98.57	1.46
Total	78.65	21.35	100.00	12.47	86.97	28.38	78.65	21.35	96.12	65.43

PERFORMANCE COMPARISON

Description: Test No. 10 - Teeter Bed (3x0.15 mm)
Comments: Mass balanced data and performance comparision of teeter bed with spirals

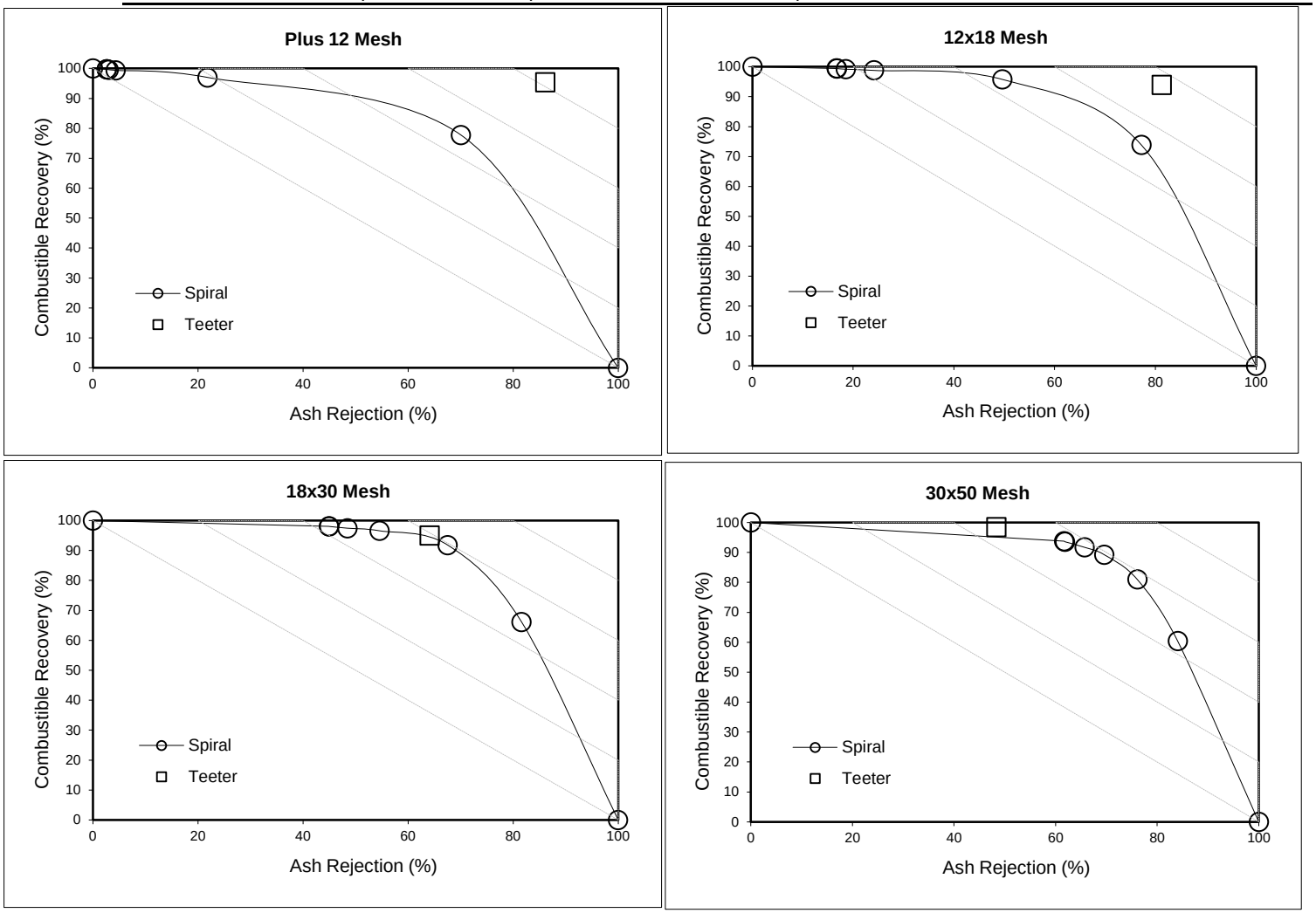
Size Class (Mesh)	Teeter Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 12	95.40	0.00	77.80	97.01	99.37	99.58	99.70	99.70	100.00	
12x18	93.89	0.00	73.81	95.78	98.78	99.17	99.40	99.42	100.00	
18x30	95.02	0.00	66.13	91.84	96.58	97.45	98.04	98.07	100.00	
30x50	98.44	0.00	60.38	80.96	89.24	91.71	93.56	93.77	100.00	
50x100	99.86	0.00	67.05	79.97	86.23	88.66	91.31	92.03	100.00	
Minus 100	98.57	0.00	77.93	89.36	92.92	94.11	95.62	96.34	100.00	
Total	96.12									

Size Class (Mesh)	Teeter Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 12	86.14	100.00	70.04	21.82	4.32	3.03	2.67	2.67	0.00	
12x18	81.26	100.00	77.24	49.59	24.11	18.53	16.77	16.71	0.00	
18x30	64.12	100.00	81.61	67.52	54.59	48.46	44.98	44.92	0.00	
30x50	48.33	100.00	84.04	76.09	69.57	65.70	61.85	61.64	0.00	
50x100	4.69	100.00	70.24	62.78	57.10	53.97	48.60	47.14	0.00	
Minus 100	1.46	100.00	35.74	24.87	20.63	18.65	15.67	13.69	0.00	
Total	65.43									

PERFORMANCE COMPARISON

Description: Test No. 10 - Teeter Bed (3x0.15 mm)

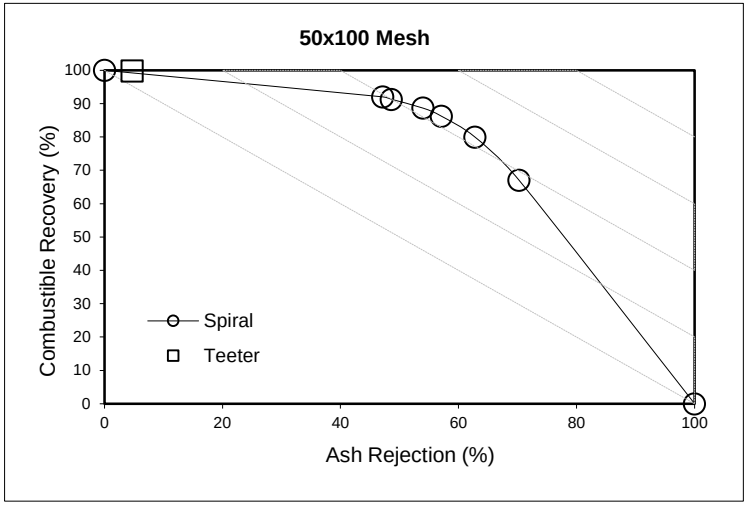
Comments: Mass balanced data and performance comparision of teeter bed with spirals

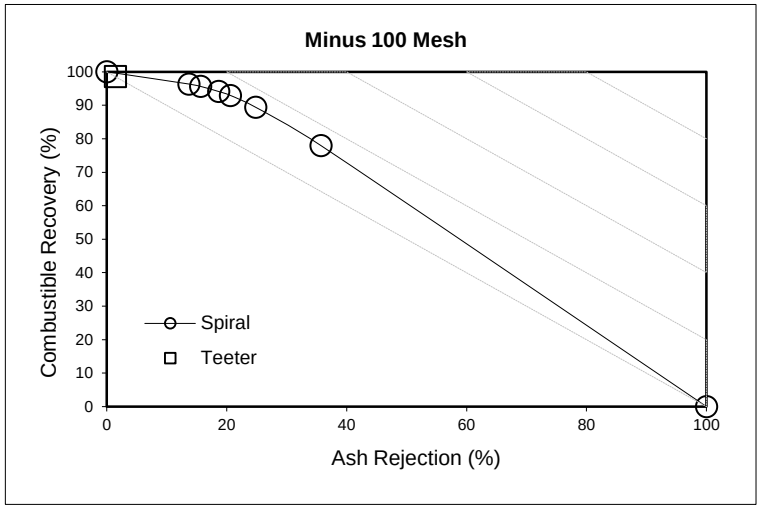


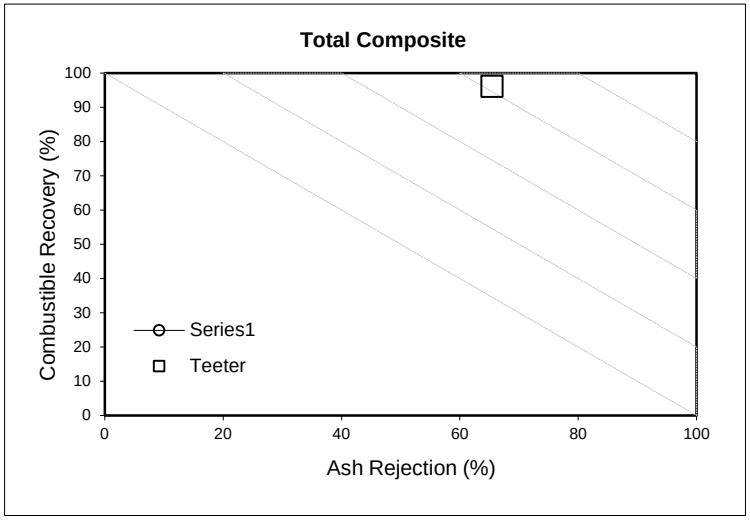
PERFORMANCE COMPARISON

Description: Test No. 10 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals







Teeter Bed/HydroFloat Data (Mass Balancing)

Description: Test No. 11 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

	Size	Measured Values			Estimated Values			% Change in Measured Values			Relatvie Error in Measured Values			Weighted Sum of Squares			Total	X
	Class (Mesh)	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	SSQ F+C+T	Const F-C-T
Mass % Stream	Plus 12	14.87	27.31	20.35	15.66	27.50	18.89	5.26	0.69	-7.18	1	1	1	0.00	0.00	0.01	0.01	***
	12x18	21.08	35.52	24.53	21.27	34.51	24.88	0.89	-2.85	1.41	1	1	1	0.00	0.00	0.00	0.00	***
	18x30	25.73	24.82	24.12	24.26	25.94	24.72	-5.72	4.54	2.50	1	1	1	0.00	0.00	0.00	0.01	***
	30x50	26.53	11.71	21.70	26.62	11.40	22.46	0.34	-2.62	3.51	1	1	1	0.00	0.00	0.00	0.00	***
	50x100	11.68	0.64	9.19	12.08	0.64	8.96	3.40	-0.11	-2.54	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 100	0.11	0.01	0.11	0.12	0.01	0.09	10.99	0.39	-14.75	1	1	1	0.01	0.00	0.02	0.03	***
	Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**0.00**	**0.00**	**0.00**	***	***	***	***	***	***	***	***
Ash % Stream	Plus 12	4.34	82.47	34.43	4.31	82.03	35.19	-0.66	-0.53	2.21	1	1	1	0.00	0.00	0.00	0.00	***
	12x18	5.75	85.66	34.71	5.75	85.02	35.75	-0.06	-0.75	2.99	1	1	1	0.00	0.00	0.00	0.00	***
	18x30	9.79	85.70	35.23	10.02	87.13	32.10	2.31	1.67	-8.88	1	1	1	0.00	0.00	0.01	0.01	***
	30x50	13.94	90.75	23.49	13.68	90.58	24.33	-1.87	-0.19	3.57	1	1	1	0.00	0.00	0.00	0.00	***
	50x100	22.56	90.62	22.18	21.72	90.71	23.06	-3.74	0.10	3.97	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 100	28.05	23.91	23.91	26.10	23.43	26.02	-6.97	-2.00	8.81	1	1	1	0.00	0.00	0.01	0.01	***
	Total	**10.74**	**85.42**	**31.18**	**10.62**	**85.41**	**31.03**	**-1.10**	**-0.01**	**-0.48**	***	***	***	***	***	***	***	***
Mass (TPH)	Plus 12	10.80	7.48	20.35	11.38	7.50	18.89	5.38	0.38	-7.18	***	***	***	***	***	***	***	0.00
	12x18	15.31	9.72	24.53	15.46	9.42	24.88	1.01	-3.14	1.41	***	***	***	***	***	***	***	0.00
	18x30	18.69	6.79	24.12	17.64	7.08	24.72	-5.61	4.23	2.50	***	***	***	***	***	***	***	0.00
	30x50	19.27	3.20	21.70	19.35	3.11	22.46	0.46	-2.92	3.51	***	***	***	***	***	***	***	0.00
	50x100	8.48	0.18	9.19	8.78	0.17	8.96	3.51	-0.42	-2.54	***	***	***	***	***	***	***	0.00
	Minus 100	0.08	0.00	0.11	0.09	0.00	0.09	11.12	0.09	-14.75	***	***	***	***	***	***	***	0.00
	Total	**72.63**	**27.37**	**100.00**	**72.71**	**27.29**	**100.00**	**0.11**	**-0.30**	**0.00**	***	***	***	***	***	***	***	0.00
Ash (TPH)	Plus 12	0.47	6.17	7.01	0.49	6.16	6.65	4.69	-0.15	-5.13	***	***	***	***	***	***	***	0.00
	12x18	0.88	8.33	8.52	0.89	8.00	8.89	0.95	-3.87	4.44	***	***	***	***	***	***	***	0.00
	18x30	1.83	5.82	8.50	1.77	6.17	7.93	-3.44	5.97	-6.61	***	***	***	***	***	***	***	0.00
	30x50	2.69	2.91	5.10	2.65	2.82	5.47	-1.42	-3.10	7.20	***	***	***	***	***	***	***	0.00
	50x100	1.91	0.16	2.04	1.91	0.16	2.07	-0.36	-0.32	1.32	***	***	***	***	***	***	***	0.00
	Minus 100	0.02	0.00	0.03	0.02	0.00	0.02	3.37	-1.91	-7.24	***	***	***	***	***	***	***	0.00
	Total	**7.80**	**23.38**	**31.18**	**7.72**	**23.31**	**31.03**	**-0.98**	**-0.31**	**-0.48**	***	***	***	***	***	***	***	0.00
																Sum SSQ =	**0.08**	

PERFORMANCE COMPARISON

Description: Test No. 11 - Teeter Bed (3x0.15 mm)
Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	Conc Wt % Feed	Tail Wt % Feed	Feed Wt % Feed	Conc Ash %	Tail Ash %	Feed Ash %	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)
Plus 12	11.38	7.50	18.89	4.31	82.03	35.19	60.27	39.73	88.98	92.62
12x18	15.46	9.42	24.88	5.75	85.02	35.75	62.16	37.84	91.18	90.01
18x30	17.64	7.08	24.72	10.02	87.13	32.10	71.36	28.64	94.57	77.74
30x50	19.35	3.11	22.46	13.68	90.58	24.33	86.15	13.85	98.28	51.56
50x100	8.78	0.17	8.96	21.72	90.71	23.06	98.05	1.95	99.76	7.66
Minus 100	0.09	0.00	0.09	26.10	23.43	26.02	97.05	2.95	96.95	2.66
Total	72.71	27.29	100.00	10.62	85.41	31.03	72.71	27.29	94.23	75.11

PERFORMANCE COMPARISON

Description: Test No. 11 - Teeter Bed (3x0.15 mm)
Comments: Mass balanced data and performance comparision of teeter bed with spirals

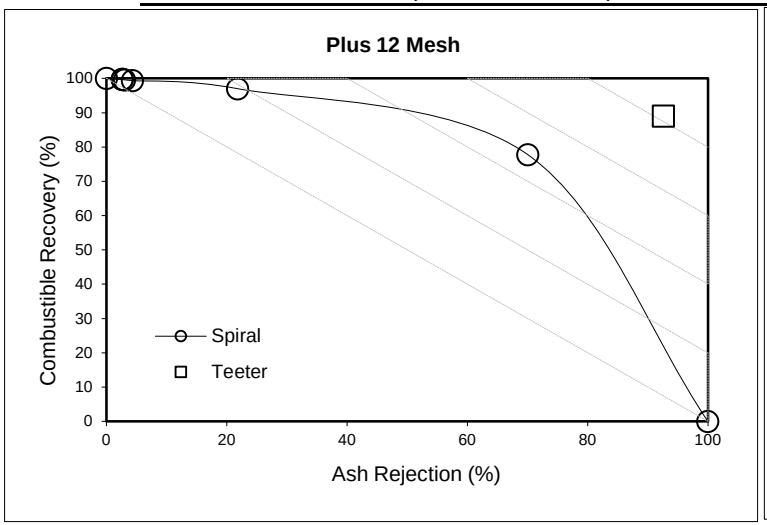
Size Class (Mesh)	Teeter Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 12	88.98	0.00	77.80	97.01	99.37	99.58	99.70	99.70	100.00	
12x18	91.18	0.00	73.81	95.78	98.78	99.17	99.40	99.42	100.00	
18x30	94.57	0.00	66.13	91.84	96.58	97.45	98.04	98.07	100.00	
30x50	98.28	0.00	60.38	80.96	89.24	91.71	93.56	93.77	100.00	
50x100	99.76	0.00	67.05	79.97	86.23	88.66	91.31	92.03	100.00	
Minus 100	96.95	0.00	77.93	89.36	92.92	94.11	95.62	96.34	100.00	
Total	94.23									

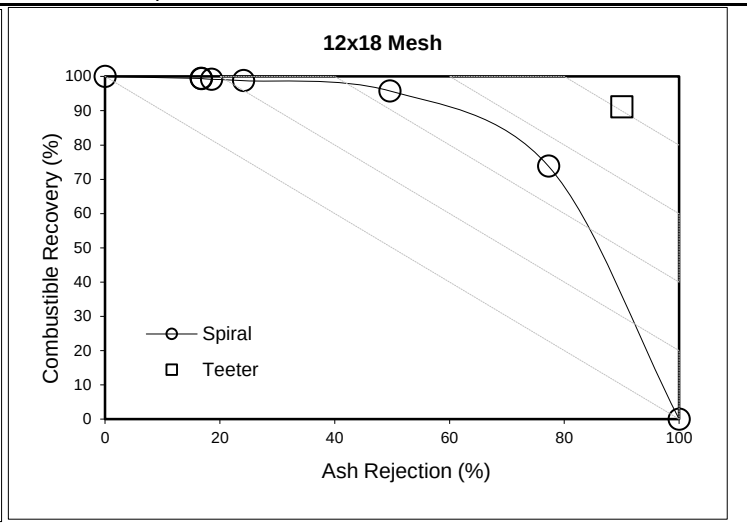
Size Class (Mesh)	Teeter Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 12	92.62	100.00	70.04	21.82	4.32	3.03	2.67	2.67	0.00	
12x18	90.01	100.00	77.24	49.59	24.11	18.53	16.77	16.71	0.00	
18x30	77.74	100.00	81.61	67.52	54.59	48.46	44.98	44.92	0.00	
30x50	51.56	100.00	84.04	76.09	69.57	65.70	61.85	61.64	0.00	
50x100	7.66	100.00	70.24	62.78	57.10	53.97	48.60	47.14	0.00	
Minus 100	2.66	100.00	35.74	24.87	20.63	18.65	15.67	13.69	0.00	
Total	75.11									

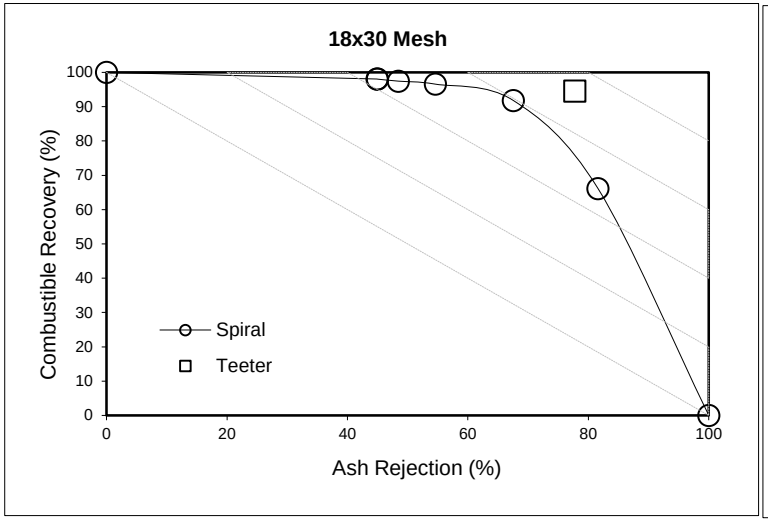
PERFORMANCE COMPARISON

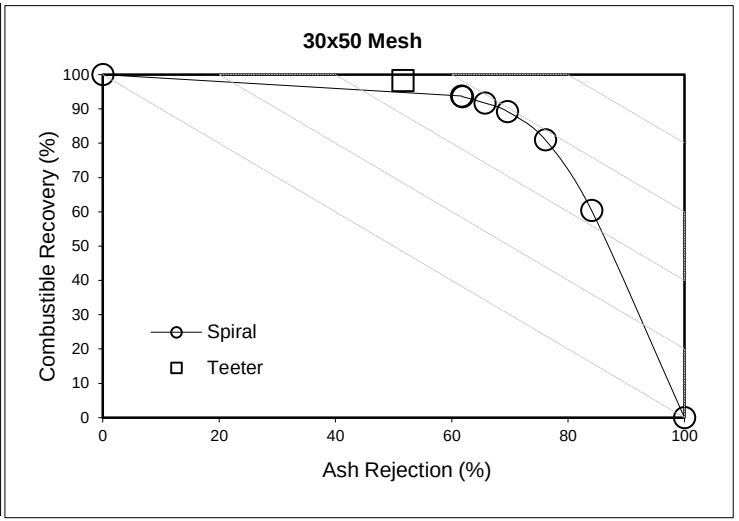
Description: Test No. 11 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals





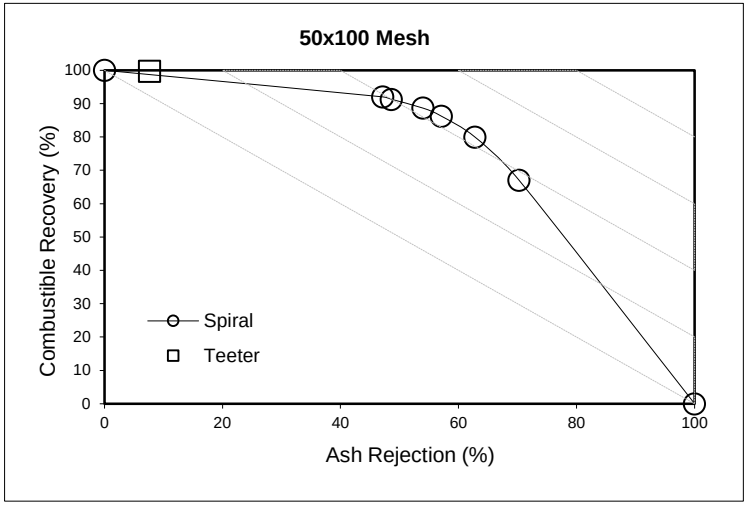


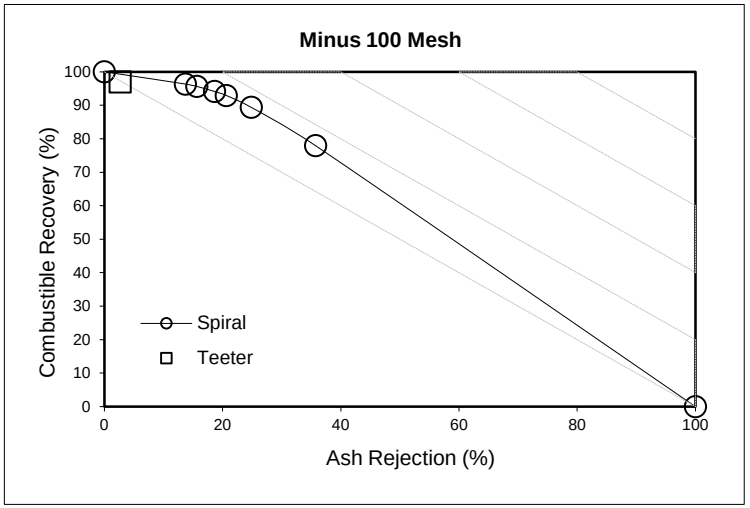


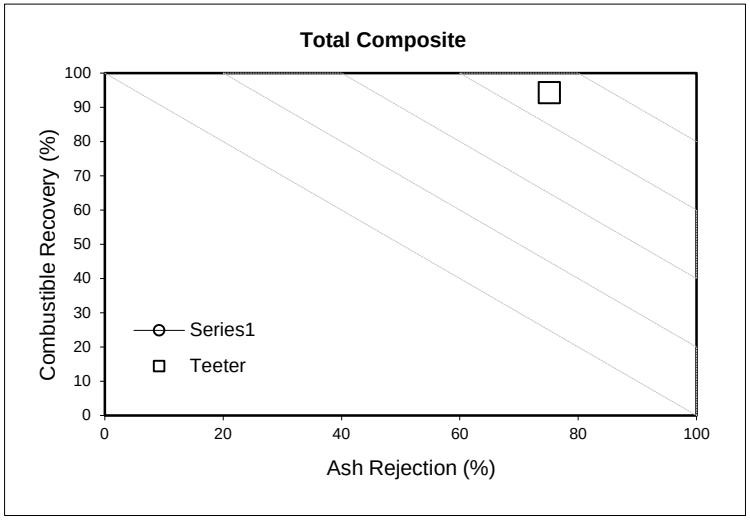
PERFORMANCE COMPARISON

Description: Test No. 11 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals







Teeter Bed/HydroFloat Data (Mass Balancing)

Description: Test No. 12 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

	Size	Measured Values			Estimated Values			% Change in Measured Values			Relatvie Error in Measured Values			Weighted Sum of Squares			Total	X
	Class (Mesh)	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	SSQ F+C+T	Const F-C-T
Mass % Stream	Plus 12	14.14	23.93	20.35	15.09	24.94	17.96	6.74	4.21	-11.72	1	1	1	0.00	0.00	0.01	0.02	***
	12x18	21.74	37.99	24.53	21.54	36.62	25.94	-0.92	-3.61	5.71	1	1	1	0.00	0.00	0.00	0.00	***
	18x30	24.14	24.97	24.12	23.86	25.46	24.33	-1.14	1.95	0.87	1	1	1	0.00	0.00	0.00	0.00	***
	30x50	28.27	12.67	21.70	27.26	12.55	22.97	-3.59	-0.98	5.84	1	1	1	0.00	0.00	0.00	0.00	***
	50x100	11.63	0.42	9.19	12.18	0.42	8.75	4.75	0.27	-4.75	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 100	0.08	0.01	0.11	0.07	0.01	0.05	-18.59	0.04	-52.74	0.001	1	0.001	0.00	0.00	0.00	0.00	***
	Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**0.00**	**0.00**	**0.00**	***	***	***	***	***	***	***	***
Ash % Stream	Plus 12	4.40	82.69	34.43	4.40	79.87	34.93	0.02	-3.41	1.44	1	1	1	0.00	0.00	0.00	0.00	***
	12x18	6.16	85.33	34.71	6.14	78.43	35.88	-0.31	-8.09	3.36	1	1	1	0.00	0.01	0.00	0.01	***
	18x30	10.67	86.60	35.23	10.76	87.34	34.11	0.83	0.86	-3.19	1	1	1	0.00	0.00	0.00	0.00	***
	30x50	11.54	91.03	23.49	11.53	87.24	23.58	-0.04	-4.16	0.39	2	0.1	1	0.00	0.00	0.00	0.00	***
	50x100	19.43	89.79	22.18	20.21	90.15	21.19	4.03	0.40	-4.45	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 100	28.82	23.91	23.91	26.00	23.79	25.88	-9.78	-0.52	8.23	1	1	1	0.01	0.00	0.01	0.02	***
	Total	**10.08**	**85.75**	**31.18**	**10.18**	**82.21**	**31.16**	**0.94**	**-4.13**	**-0.06**	***	***	***	***	***	***	***	***
Mass (TPH)	Plus 12	10.20	6.67	20.35	10.70	7.27	17.96	4.89	8.88	-11.72	***	***	***	***	***	***	***	0.00
	12x18	15.68	10.59	24.53	15.27	10.67	25.94	-2.64	0.71	5.71	***	***	***	***	***	***	***	0.00
	18x30	17.41	6.96	24.12	16.91	7.42	24.33	-2.85	6.52	0.87	***	***	***	***	***	***	***	0.00
	30x50	20.39	3.53	21.70	19.32	3.66	22.97	-5.26	3.46	5.84	***	***	***	***	***	***	***	0.00
	50x100	8.38	0.12	9.19	8.63	0.12	8.75	2.94	4.76	-4.75	***	***	***	***	***	***	***	0.00
	Minus 100	0.06	0.00	0.11	0.05	0.00	0.05	-20.00	4.52	-52.74	***	***	***	***	***	***	***	0.00
	Total	**72.12**	**27.88**	**100.00**	**70.87**	**29.13**	**100.00**	**-1.73**	**4.48**	**0.00**	***	***	***	***	***	***	***	0.00
Ash (TPH)	Plus 12	0.45	5.52	7.01	0.47	5.80	6.27	4.91	5.17	-10.45	***	***	***	***	***	***	***	0.00
	12x18	0.97	9.04	8.52	0.94	8.37	9.30	-2.94	-7.44	9.26	***	***	***	***	***	***	***	0.00
	18x30	1.86	6.03	8.50	1.82	6.48	8.30	-2.05	7.44	-2.34	***	***	***	***	***	***	***	0.00
	30x50	2.35	3.22	5.10	2.23	3.19	5.42	-5.30	-0.85	6.26	***	***	***	***	***	***	***	0.00
	50x100	1.63	0.11	2.04	1.74	0.11	1.86	7.09	5.18	-8.99	***	***	***	***	***	***	***	0.00
	Minus 100	0.02	0.00	0.03	0.01	0.00	0.01	-27.82	3.98	-48.85	***	***	***	***	***	***	***	0.00
	Total	**7.27**	**23.91**	**31.18**	**7.21**	**23.95**	**31.16**	**-0.81**	**0.16**	**-0.06**	***	***	***	***	***	***	***	0.00
															Sum SSQ =		**0.06**	

PERFORMANCE COMPARISON

Description: Test No. 12 - Teeter Bed (3x0.15 mm)
Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	Conc Wt % Feed	Tail Wt % Feed	Feed Wt % Feed	Conc Ash %	Tail Ash %	Feed Ash %	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)
Plus 12	10.70	7.27	17.96	4.40	79.87	34.93	59.55	40.45	87.49	92.50
12x18	15.27	10.67	25.94	6.14	78.43	35.88	58.86	41.14	86.16	89.92
18x30	16.91	7.42	24.33	10.76	87.34	34.11	69.51	30.49	94.14	78.07
30x50	19.32	3.66	22.97	11.53	87.24	23.58	84.09	15.91	97.34	58.87
50x100	8.63	0.12	8.75	20.21	90.15	21.19	98.60	1.40	99.82	5.96
Minus 100	0.05	0.00	0.05	26.00	23.79	25.88	94.34	5.66	94.18	5.20
Total	70.87	29.13	100.00	10.18	82.21	31.16	70.87	29.13	92.47	76.85

PERFORMANCE COMPARISON

Description: Test No. 12 - Teeter Bed (3x0.15 mm)
Comments: Mass balanced data and performance comparision of teeter bed with spirals

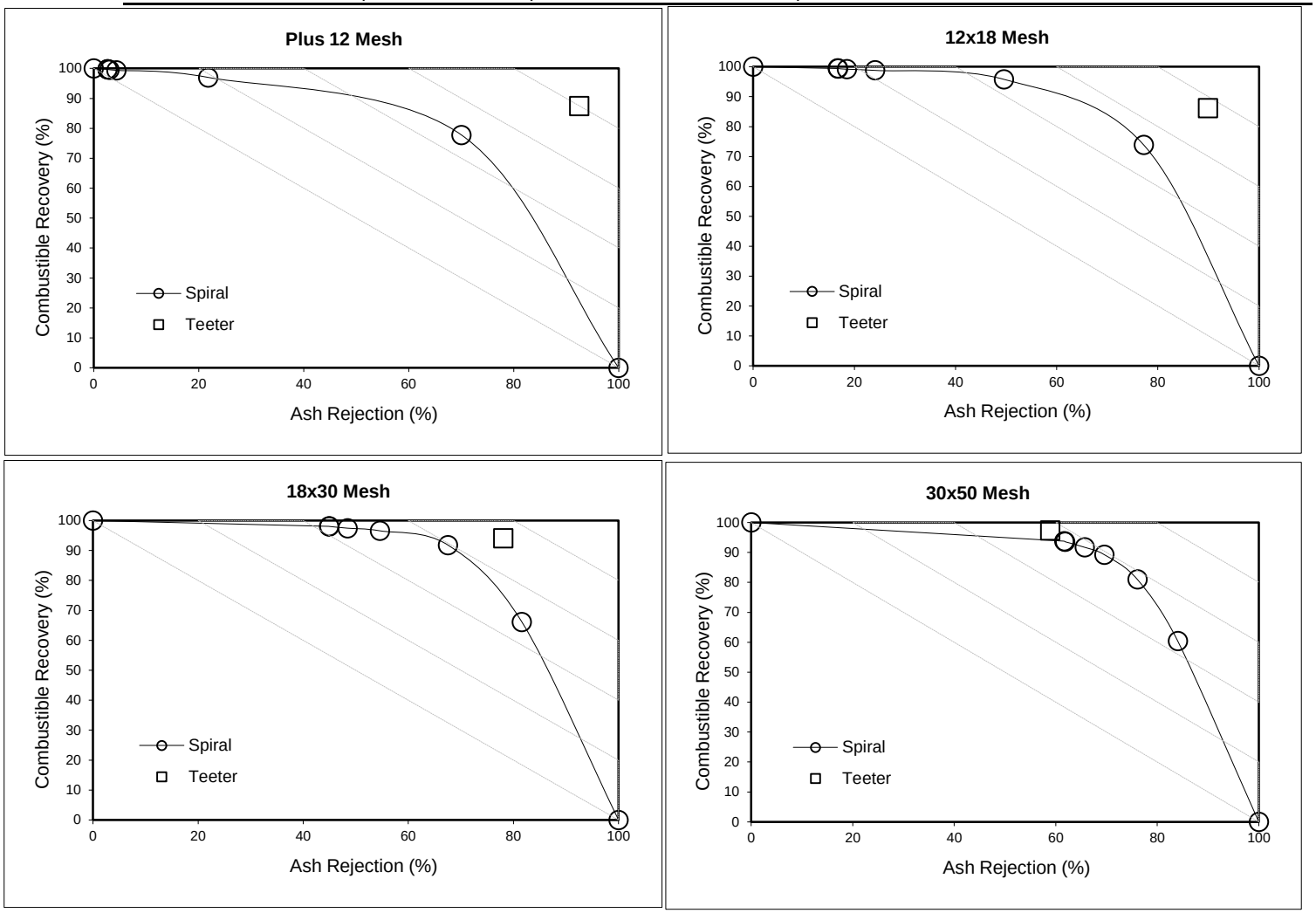
Size Class (Mesh)	Teeter Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 12	87.49	0.00	77.80	97.01	99.37	99.58	99.70	99.70	100.00	
12x18	86.16	0.00	73.81	95.78	98.78	99.17	99.40	99.42	100.00	
18x30	94.14	0.00	66.13	91.84	96.58	97.45	98.04	98.07	100.00	
30x50	97.34	0.00	60.38	80.96	89.24	91.71	93.56	93.77	100.00	
50x100	99.82	0.00	67.05	79.97	86.23	88.66	91.31	92.03	100.00	
Minus 100	94.18	0.00	77.93	89.36	92.92	94.11	95.62	96.34	100.00	
Total	92.47									

Size Class (Mesh)	Teeter Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 12	92.50	100.00	70.04	21.82	4.32	3.03	2.67	2.67	0.00	
12x18	89.92	100.00	77.24	49.59	24.11	18.53	16.77	16.71	0.00	
18x30	78.07	100.00	81.61	67.52	54.59	48.46	44.98	44.92	0.00	
30x50	58.87	100.00	84.04	76.09	69.57	65.70	61.85	61.64	0.00	
50x100	5.96	100.00	70.24	62.78	57.10	53.97	48.60	47.14	0.00	
Minus 100	5.20	100.00	35.74	24.87	20.63	18.65	15.67	13.69	0.00	
Total	76.85									

PERFORMANCE COMPARISON

Description: Test No. 12 - Teeter Bed (3x0.15 mm)

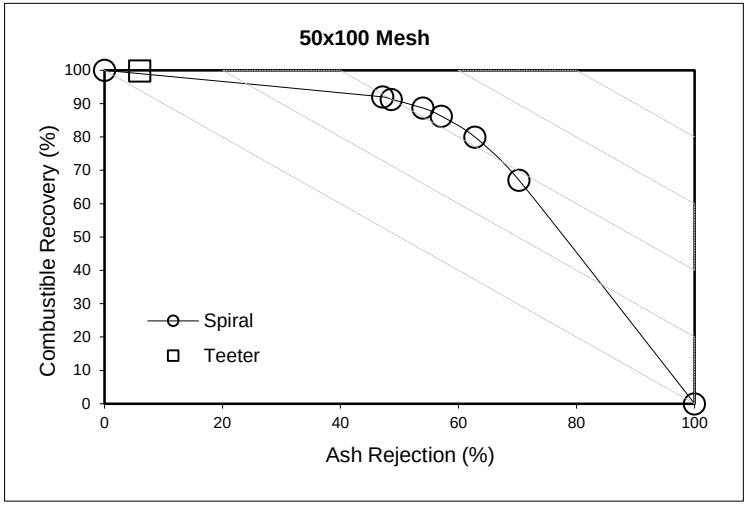
Comments: Mass balanced data and performance comparision of teeter bed with spirals

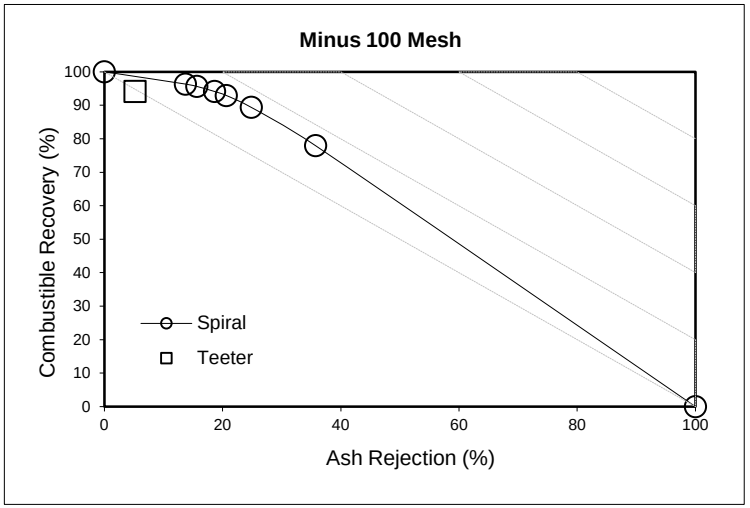


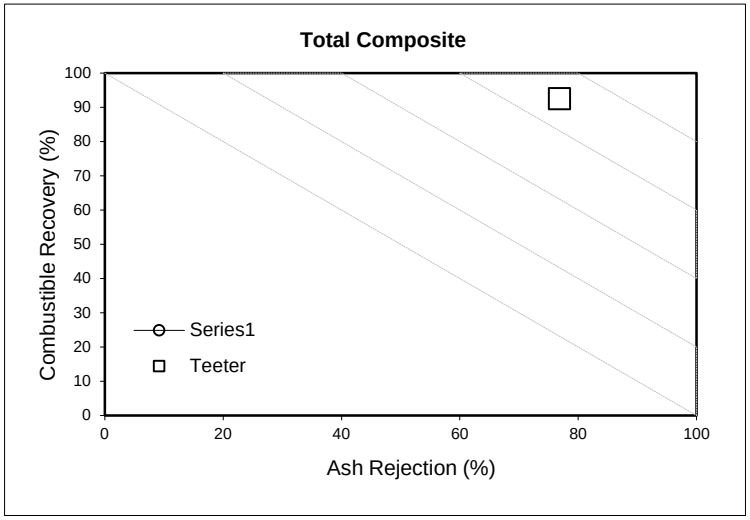
PERFORMANCE COMPARISON

Description: Test No. 12 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals







Teeter Bed/HydroFloat Data (Mass Balancing)

Description: Test No. 12 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

	Size	Measured Values			Estimated Values			% Change in Measured Values			Relatvie Error in Measured Values			Weighted Sum of Squares			Total	X
	Class (Mesh)	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	Conc C	Tail T	Feed F	SSQ F+C+T	Const F-C-T
Mass % Stream	Plus 12	20.13	32.26	21.77	21.45	29.31	24.06	6.56	-9.12	10.49	1	1	1	0.00	0.01	0.01	0.02	***
	12x18	21.97	37.09	26.98	20.96	37.73	26.52	-4.61	1.72	-1.70	1	1	1	0.00	0.00	0.00	0.00	***
	18x30	23.82	20.73	22.23	22.73	22.03	22.50	-4.60	6.26	1.18	1	1	1	0.00	0.00	0.00	0.01	***
	30x50	23.45	9.04	21.17	24.11	10.03	19.44	2.84	11.02	-8.17	1	1	1	0.00	0.01	0.01	0.02	***
	50x100	10.57	0.88	7.77	10.69	0.89	7.44	1.06	1.05	-4.33	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 100	0.06	0.01	0.07	0.07	0.01	0.05	16.46	1.37	-29.61	1	1	1	0.03	0.00	0.09	0.11	***
	Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**0.00**	**0.00**	**0.00**	***	***	***	***	***	***	***	***
Ash % Stream	Plus 12	4.94	84.71	36.28	4.86	84.39	37.00	-1.65	-0.37	1.99	1	1	1	0.00	0.00	0.00	0.00	***
	12x18	6.91	87.28	45.05	6.96	87.34	44.89	0.72	0.07	-0.36	1	1	1	0.00	0.00	0.00	0.00	***
	18x30	10.36	87.09	37.37	11.81	87.41	36.37	14.02	0.36	-2.69	1	1	1	0.02	0.00	0.00	0.02	***
	30x50	13.40	90.50	31.69	14.72	90.53	27.70	9.86	0.04	-12.59	1	1	1	0.01	0.00	0.02	0.03	***
	50x100	19.34	90.96	22.49	19.65	90.98	22.48	1.63	0.02	-0.03	1	1	1	0.00	0.00	0.00	0.00	***
	Minus 100	23.91	23.91	23.91	23.65	23.91	23.67	-1.07	0.00	-1.00	1	1	1	0.00	0.00	0.00	0.00	***
	Total	**10.18**	**86.73**	**36.84**	**10.85**	**86.84**	**36.06**	**6.58**	**0.12**	**-2.12**	***	***	***	***	***	***	***	***
Mass (TPH)	Plus 12	13.12	11.23	21.77	14.33	9.72	24.06	9.26	-13.43	10.49	***	***	***	***	***	***	***	0.00
	12x18	14.32	12.91	26.98	14.01	12.51	26.52	-2.19	-3.11	-1.70	***	***	***	***	***	***	***	0.00
	18x30	15.53	7.22	22.23	15.19	7.31	22.50	-2.18	1.22	1.18	***	***	***	***	***	***	***	0.00
	30x50	15.28	3.15	21.17	16.11	3.33	19.44	5.44	5.75	-8.17	***	***	***	***	***	***	***	0.00
	50x100	6.89	0.31	7.77	7.14	0.29	7.44	3.62	-3.74	-4.33	***	***	***	***	***	***	***	0.00
	Minus 100	0.04	0.00	0.07	0.05	0.00	0.05	19.41	-3.44	-29.61	***	***	***	***	***	***	***	0.00
	Total	**65.18**	**34.82**	**100.00**	**66.83**	**33.17**	**100.00**	**2.53**	**-4.74**	**0.00**	***	***	***	***	***	***	***	0.00
Ash (TPH)	Plus 12	0.65	9.51	7.90	0.70	8.21	8.90	7.46	-13.76	12.70	***	***	***	***	***	***	***	0.00
	12x18	0.99	11.27	12.15	0.97	10.93	11.90	-1.49	-3.04	-2.06	***	***	***	***	***	***	***	0.00
	18x30	1.61	6.29	8.31	1.79	6.39	8.18	11.53	1.59	-1.54	***	***	***	***	***	***	***	0.00
	30x50	2.05	2.85	6.71	2.37	3.01	5.39	15.84	5.79	-19.74	***	***	***	***	***	***	***	0.00
	50x100	1.33	0.28	1.75	1.40	0.27	1.67	5.31	-3.72	-4.36	***	***	***	***	***	***	***	0.00
	Minus 100	0.01	0.00	0.02	0.01	0.00	0.01	18.13	-3.43	-30.32	***	***	***	***	***	***	***	0.00
	Total	**6.64**	**30.20**	**36.84**	**7.25**	**28.80**	**36.06**	**9.28**	**-4.62**	**-2.12**	***	***	***	***	***	***	***	0.00
																Sum SSQ =		**0.22**

PERFORMANCE COMPARISON

Description: Test No. 12 - Teeter Bed (3x0.15 mm)
Comments: Mass balanced data and performance comparision of teeter bed with spirals

PERFORMANCE BY PRODUCT AND SIZE

Size Class (Mesh)	Conc Wt % Feed	Tail Wt % Feed	Feed Wt % Feed	Conc Ash %	Tail Ash %	Feed Ash %	Clean Yield (%)	Reject Yield (%)	Comb. Rec. (%)	Ash Rej. (%)
Plus 12	14.33	9.72	24.06	4.86	84.39	37.00	59.58	40.42	89.99	92.18
12x18	14.01	12.51	26.52	6.96	87.34	44.89	52.81	47.19	89.16	91.81
18x30	15.19	7.31	22.50	11.81	87.41	36.37	67.52	32.48	93.57	78.07
30x50	16.11	3.33	19.44	14.72	90.53	27.70	82.88	17.12	97.76	55.95
50x100	7.14	0.29	7.44	19.65	90.98	22.48	96.03	3.97	99.54	16.05
Minus 100	0.05	0.00	0.05	23.65	23.91	23.67	93.31	6.69	93.33	6.76
Total	66.83	33.17	100.00	10.85	86.84	36.06	66.83	33.17	93.17	79.89

PERFORMANCE COMPARISON

Description: Test No. 12 - Teeter Bed (3x0.15 mm)
Comments: Mass balanced data and performance comparision of teeter bed with spirals

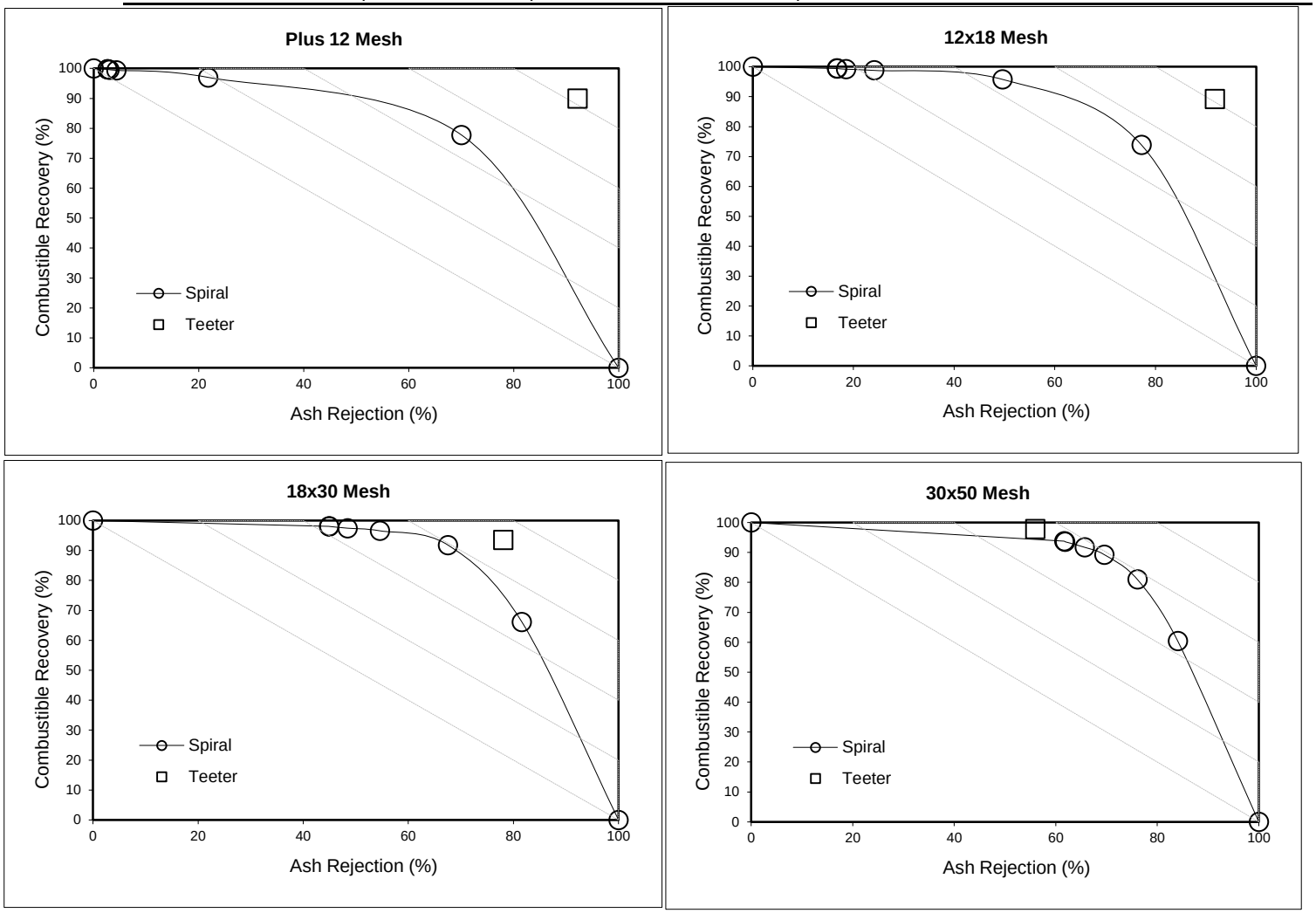
Size Class (Mesh)	Teeter Rec. (%)	Spiral Rec. P0	Spiral Rec. P1	Spiral Rec. P2	Spiral Rec. P3	Spiral Rec. P4	Spiral Rec. P5	Spiral Rec. P6	Spiral Rec. P7	
Plus 12	89.99	0.00	77.80	97.01	99.37	99.58	99.70	99.70	100.00	
12x18	89.16	0.00	73.81	95.78	98.78	99.17	99.40	99.42	100.00	
18x30	93.57	0.00	66.13	91.84	96.58	97.45	98.04	98.07	100.00	
30x50	97.76	0.00	60.38	80.96	89.24	91.71	93.56	93.77	100.00	
50x100	99.54	0.00	67.05	79.97	86.23	88.66	91.31	92.03	100.00	
Minus 100	93.33	0.00	77.93	89.36	92.92	94.11	95.62	96.34	100.00	
Total	93.17									

Size Class (Mesh)	Teeter Rej. (%)	Spiral Rej. P0	Spiral Rej. P1	Spiral Rej. P2	Spiral Rej. P3	Spiral Rej. P4	Spiral Rej. P5	Spiral Rej. P6	Spiral Rej. P7	
Plus 12	92.18	100.00	70.04	21.82	4.32	3.03	2.67	2.67	0.00	
12x18	91.81	100.00	77.24	49.59	24.11	18.53	16.77	16.71	0.00	
18x30	78.07	100.00	81.61	67.52	54.59	48.46	44.98	44.92	0.00	
30x50	55.95	100.00	84.04	76.09	69.57	65.70	61.85	61.64	0.00	
50x100	16.05	100.00	70.24	62.78	57.10	53.97	48.60	47.14	0.00	
Minus 100	6.76	100.00	35.74	24.87	20.63	18.65	15.67	13.69	0.00	
Total	79.89									

PERFORMANCE COMPARISON

Description: Test No. 12 - Teeter Bed (3x0.15 mm)

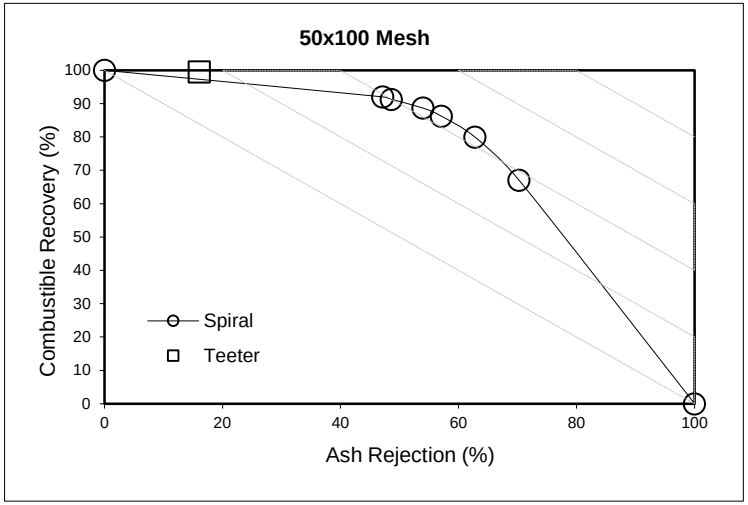
Comments: Mass balanced data and performance comparision of teeter bed with spirals

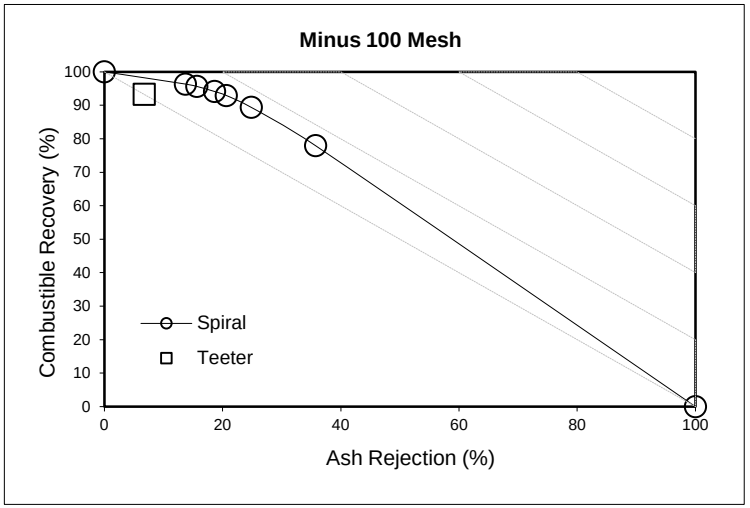


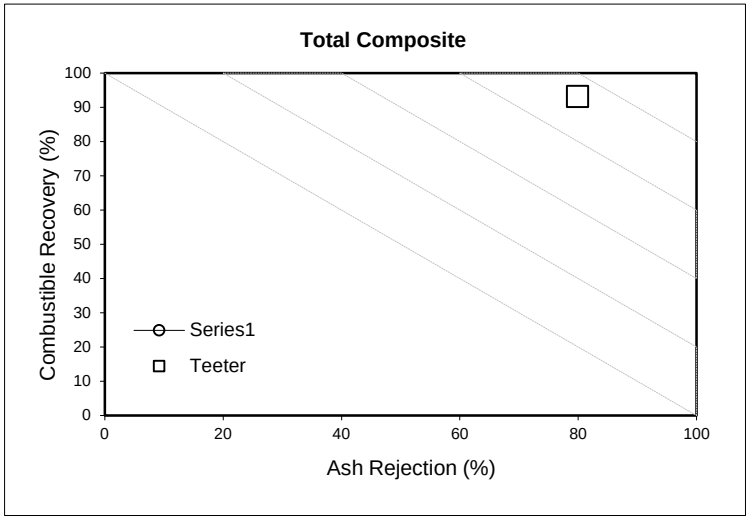
PERFORMANCE COMPARISON

Description: Test No. 12 - Teeter Bed (3x0.15 mm)

Comments: Mass balanced data and performance comparision of teeter bed with spirals







APPENDIX I – Flotation Circuit Results (Coarse Coal Feed Stock, 1 x 0.15 mm)

FLOTATION (RELEASE ANALYSIS)

Description: 1 x 0 mm Nominal Particle Size
Comments: Flotation Tests (Coarse Coal Feed)

PERFORMANCE BY PRODUCT AND SIZE (Release)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+18	2.58	1.61	0.45	0.17	2.64				7.46
18x30	3.43	3.74	1.36	0.45	5.82				14.80
30x50	26.36	4.43	1.18	0.38	4.29				36.64
50x100	11.54	3.06	0.78	0.28	2.25				17.90
100x200	4.53	1.45	0.49	0.23	1.78				8.47
200x325	0.88	0.39	0.17	0.16	1.48				3.08
Minus 325	1.06	0.74	0.39	0.29	9.17				11.65
Total (Calc.)	50.38	15.42	4.83	1.95	27.43				100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+18	6.03	9.39	17.30	24.54	72.51				31.43
18x30	6.32	12.41	24.10	31.81	77.23				38.15
30x50	8.22	13.48	25.52	30.39	89.50				19.15
50x100	10.41	14.53	26.52	39.28	90.62				22.33
100x200	11.29	17.11	41.24	62.48	88.71				31.65
200x325	16.83	26.25	51.35	71.69	88.70				57.23
Minus 325	10.52	13.81	24.96	50.88	91.91				76.33
Total (Calc.)	8.95	13.69	27.00	41.56	86.06				32.34

FLOTATION (KINETIC TEST)

Description: 1 x 0 mm Nominal Particle Size
Comments: Flotation Tests (Coarse Coal Feed)

PERFORMANCE BY PRODUCT AND SIZE (Timed Kinetics)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+18	4.51	0.63	0.12	0.01	5.89				11.16
18x30	15.19	1.46	0.25	0.06	8.53				25.50
30x50	18.54	1.56	0.27	0.03	5.73				26.13
50x100	13.15	0.99	0.23	0.03	2.93				17.33
100x200	5.61	0.59	0.19	0.01	1.92				8.32
200x325	1.11	0.25	0.11	0.05	1.36				2.88
Minus 325	1.64	0.54	0.38	0.20	5.93				8.69
Total (Calc.)	59.75	6.02	1.57	0.38					100.01

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings	0			
+18	4.27	6.74	10.91	0.01	63.58				35.76
18x30	6.00	10.52	16.26	0.01	70.31				27.87
30x50	7.29	13.75	18.63	0.01	84.58				24.73
50x100	8.74	17.78	31.71	0.01	89.58				23.20
100x200	11.50	29.87	54.75	0.01	88.15				31.45
200x325	18.33	42.53	57.78	0.01	88.26				54.76
Minus 325	15.34	28.06	52.99	0.01	88.96				67.70
Total (Calc.)	7.87	16.95	35.16	0.01					31.65

Release Analysis

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+18	34.65	56.19	62.24	64.55	100.00	100.00	100.00	100.00
18x30	23.21	48.46	57.65	60.66	100.00	100.00	100.00	100.00
30x50	71.94	84.04	87.27	88.30	100.00	100.00	100.00	100.00
50x100	64.43	81.54	85.89	87.45	100.00	100.00	100.00	100.00
100x200	53.39	70.51	76.35	79.01	100.00	100.00	100.00	100.00
200x325	28.62	41.36	46.95	52.01	100.00	100.00	100.00	100.00
Minus 325	9.09	15.41	18.74	21.23	100.00	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	Tailings			
+18	6.03	7.32	8.29	8.87	31.43	31.43	31.43	31.43
18x30	6.32	9.49	11.82	12.81	38.15	38.15	38.15	38.15
30x50	8.22	8.98	9.59	9.83	19.15	19.15	19.15	19.15
50x100	10.41	11.27	12.05	12.53	22.33	22.33	22.33	22.33
100x200	11.29	12.70	14.88	16.49	31.65	31.65	31.65	31.65
200x325	16.83	19.73	23.49	28.18	57.23	57.23	57.23	57.23
Minus 325	10.52	11.87	14.19	18.50	76.33	76.33	76.33	76.33

Combustable Recovery								
Mesh #	P1	P2	P3	P4	Tailings			
+18	47.48	75.95	83.25	85.79	100.00	100.00	100.00	100.00
18x30	35.16	70.91	82.19	85.52	100.00	100.00	100.00	100.00
30x50	81.67	94.62	97.60	98.48	100.00	100.00	100.00	100.00
50x100	74.32	93.15	97.26	98.48	100.00	100.00	100.00	100.00
100x200	69.29	90.06	95.07	96.53	100.00	100.00	100.00	100.00
200x325	55.65	77.62	83.97	87.32	100.00	100.00	100.00	100.00
Minus 325	34.36	57.38	67.91	73.08	100.00	100.00	100.00	100.00

Ash Rejection								
Mesh #	P1	P2	P3	P4	Tailings			
+18	93.35	86.92	83.58	81.78	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
18x30	96.16	87.94	82.14	79.63	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
30x50	69.13	60.61	56.31	54.68	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
50x100	69.96	58.83	53.66	50.92	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
100x200	80.95	71.70	64.09	58.84	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
200x325	91.58	85.74	80.73	74.39	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Minus 325	98.75	97.60	96.52	94.86	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Kinetic Test

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings	0		
+18	40.43	46.06	47.17	47.26	100.00	100.00	100.00	100.00
18x30	59.57	65.30	66.30	66.54	100.00	100.00	100.00	100.00
30x50	70.94	76.93	77.97	78.08	100.00	100.00	100.00	100.00
50x100	75.91	81.61	82.95	83.12	100.00	100.00	100.00	100.00
100x200	67.40	74.52	76.80	76.94	100.00	100.00	100.00	100.00
200x325	38.48	47.12	51.03	52.67	100.00	100.00	100.00	100.00
Minus 325	18.87	25.07	29.50	31.74	100.00	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	Tailings			
+18	4.27	4.57	4.72	4.71	35.76	35.76	35.76	35.76
18x30	6.00	6.40	6.55	6.52	27.87	27.87	27.87	27.87
30x50	7.29	7.79	7.94	7.93	24.73	24.73	24.73	24.73
50x100	8.74	9.37	9.73	9.71	23.20	23.20	23.20	23.20
100x200	11.50	13.25	14.49	14.46	31.45	31.45	31.45	31.45
200x325	18.33	22.77	25.45	24.66	54.76	54.76	54.76	54.76
Minus 325	15.34	18.49	23.67	21.99	67.70	67.70	67.70	67.70

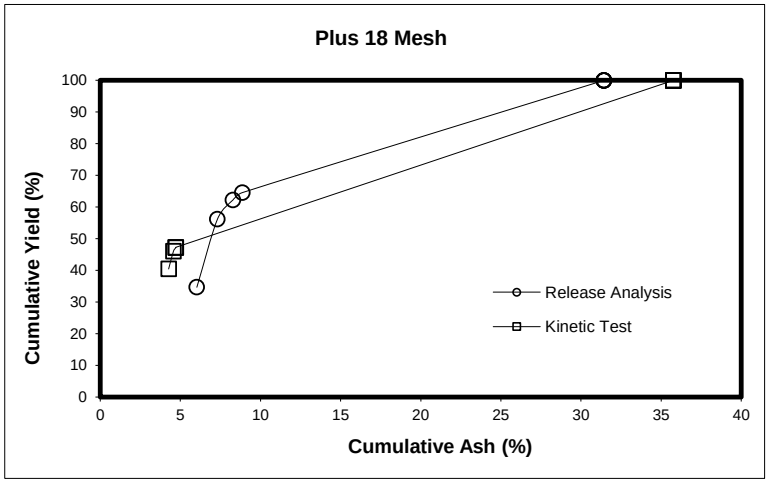
Combustable Recovery								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+18	60.25	68.41	69.96	70.10	100.00	100.00	100.00	100.00
18x30	77.63	84.74	85.90	86.23	100.00	100.00	100.00	100.00
30x50	87.38	94.23	95.36	95.51	100.00	100.00	100.00	100.00
50x100	90.19	96.30	97.49	97.71	100.00	100.00	100.00	100.00
100x200	87.02	94.30	95.81	96.01	100.00	100.00	100.00	100.00
200x325	69.46	80.43	84.08	87.72	100.00	100.00	100.00	100.00
Minus 325	49.46	63.27	69.71	76.67	100.00	100.00	100.00	100.00

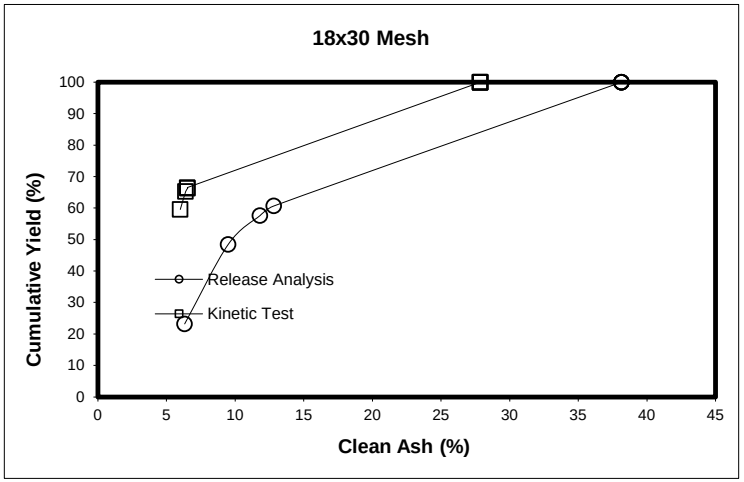
Ash Rejection								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+18	95.17	94.11	93.77	93.77	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
18x30	87.18	85.01	84.43	84.43	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
30x50	79.08	75.76	74.97	74.97	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
50x100	71.40	67.02	65.20	65.20	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
100x200	75.36	68.60	64.63	64.63	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
200x325	87.12	80.41	76.28	76.28	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Minus 325	95.72	93.16	89.69	89.69	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

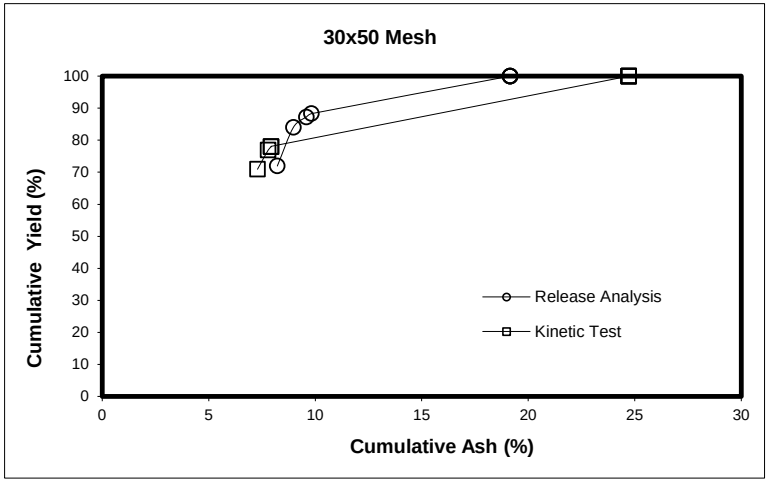
PERFORMANCE COMPARISON

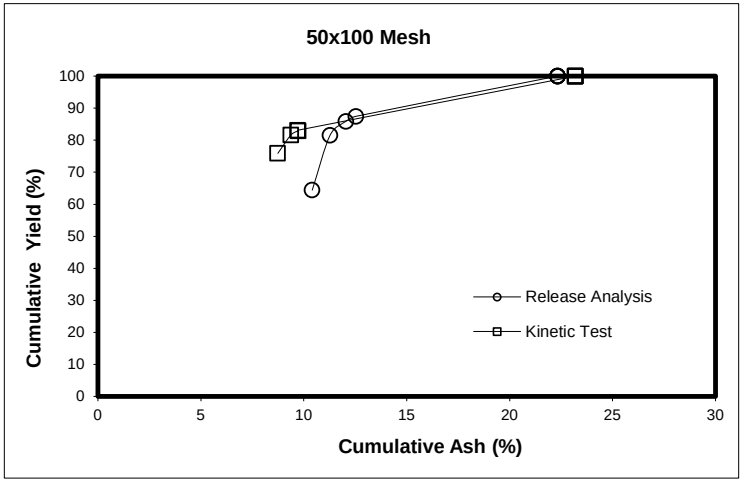
Description: 1 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Coarse Coal Feed)





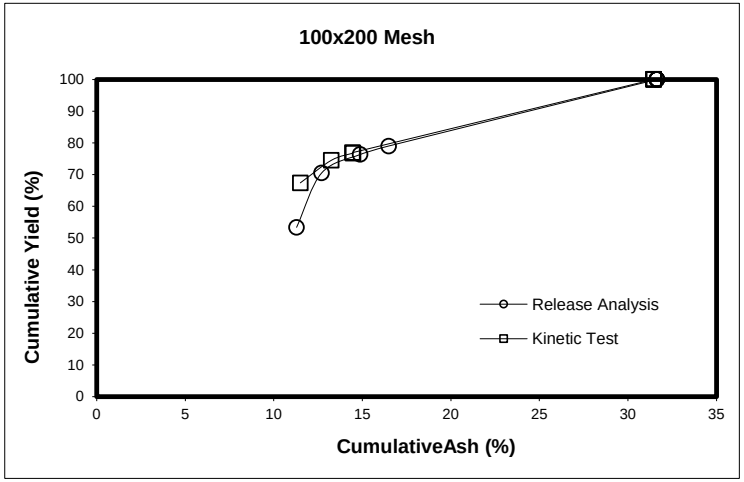


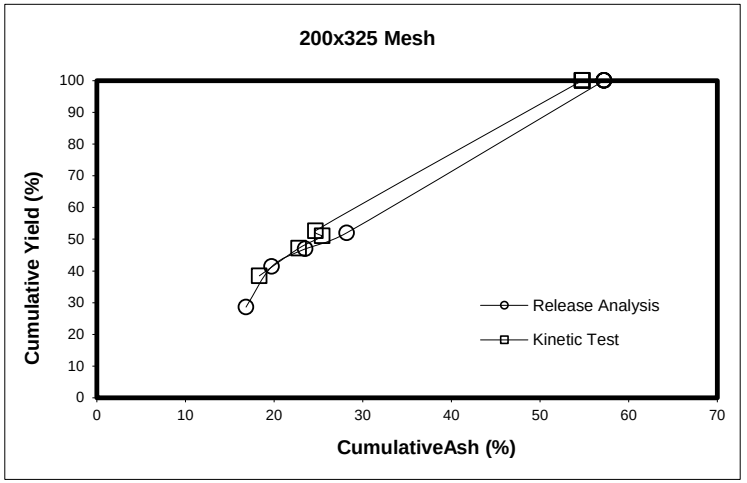


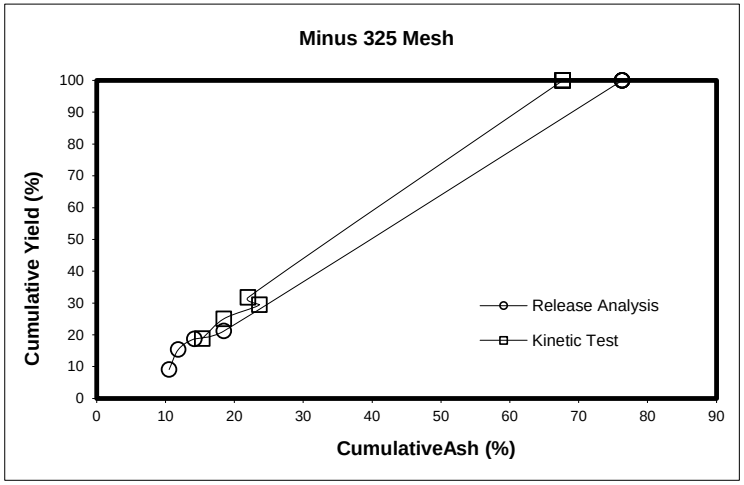
PERFORMANCE COMPARISON

Description: 1 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Coarse Coal Feed)



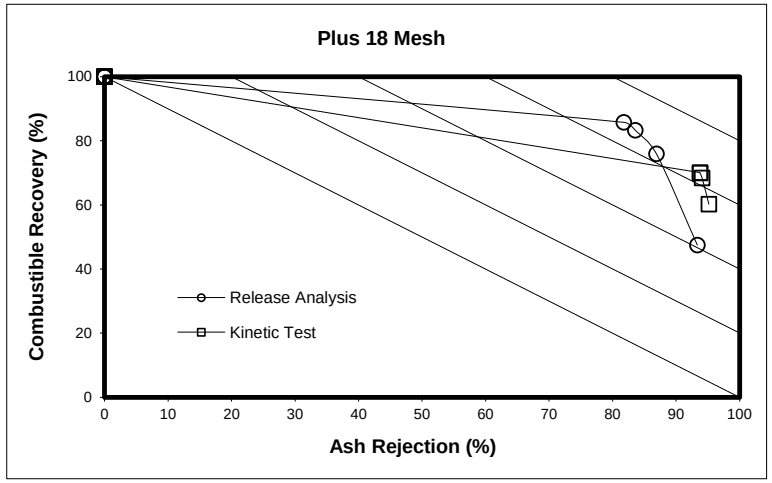


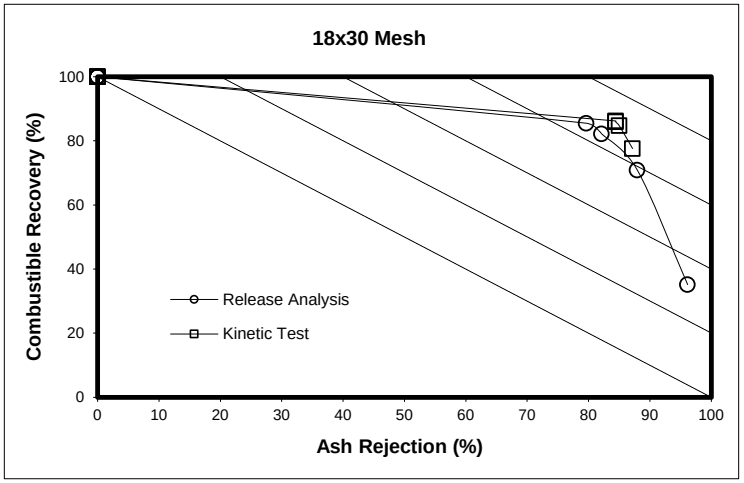


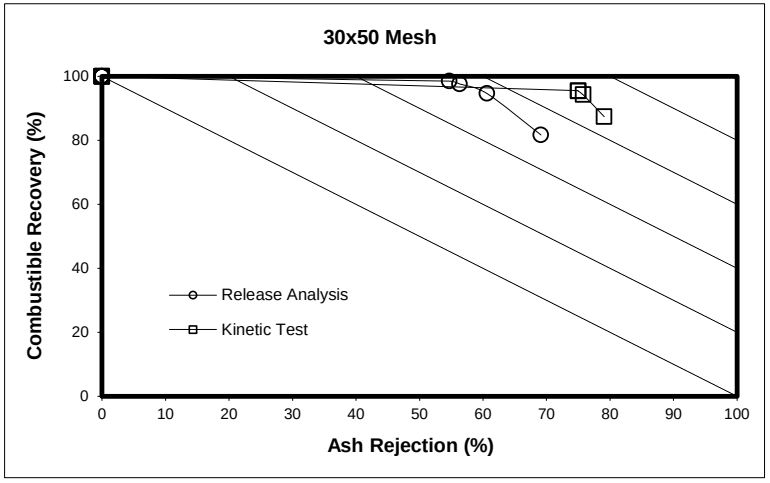
PERFORMANCE COMPARISON

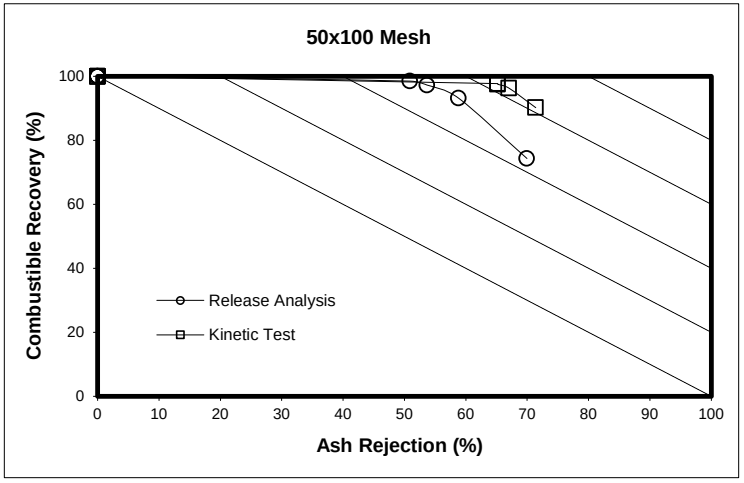
Description: 1 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Coarse Coal Feed)





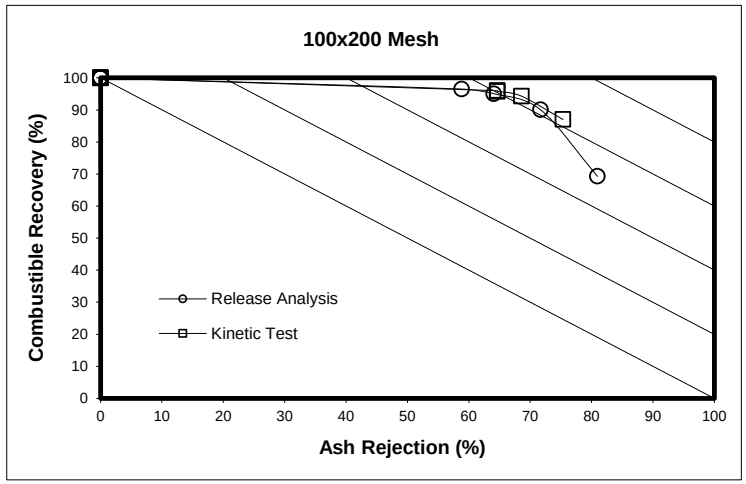


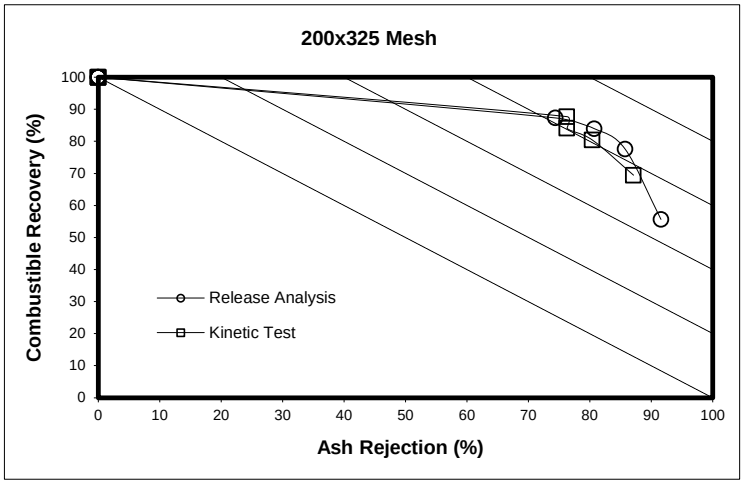


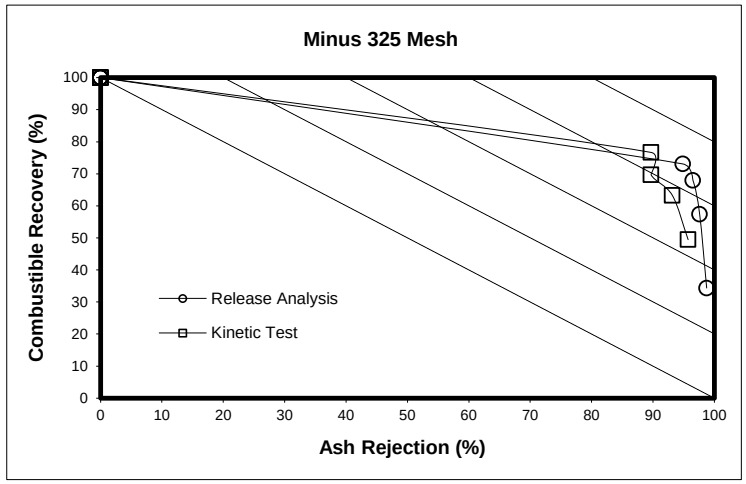
PERFORMANCE COMPARISON

Description: 1 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Coarse Coal Feed)







FLOTATION (RELEASE ANALYSIS)

Description: 1 x 0 mm Nominal Particle Size
Comments: Flotation Tests (Coarse Coal Feed)

PERFORMANCE BY PRODUCT AND SIZE (Release)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+18	2.58	1.61	0.45	0.17	2.64				7.46
18x30	3.43	3.74	1.36	0.45	5.82				14.80
30x50	26.36	4.43	1.18	0.38	4.29				36.64
50x100	11.54	3.06	0.78	0.28	2.25				17.90
100x200	4.53	1.45	0.49	0.23	1.78				8.47
200x325	0.88	0.39	0.17	0.16	1.48				3.08
Minus 325	1.06	0.74	0.39	0.29	9.17				11.65
Total (Calc.)	50.38	15.42	4.83	1.95	27.43				100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+18	6.03	9.39	17.30	24.54	72.51				31.43
18x30	6.32	12.41	24.10	31.81	77.23				38.15
30x50	8.22	13.48	25.52	30.39	89.50				19.15
50x100	10.41	14.53	26.52	39.28	90.62				22.33
100x200	11.29	17.11	41.24	62.48	88.71				31.65
200x325	16.83	26.25	51.35	71.69	88.70				57.23
Minus 325	10.52	13.81	24.96	50.88	91.91				76.33
Total (Calc.)	8.95	13.69	27.00	41.56	86.06				32.34

FLOTATION (KINETIC TEST)

Description: 1 x 0 mm Nominal Particle Size
Comments: Flotation Tests (Coarse Coal Feed)

PERFORMANCE BY PRODUCT AND SIZE (Timed Kinetics)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	Tailings					
+18	5.27	0.42	0.05	3.50					9.24
18x30	8.28	0.82	0.17	7.43					16.71
30x50	30.67	0.82	0.12	5.14					36.75
50x100	13.97	0.60	0.13	2.25					16.95
100x200	6.39	0.43	0.11	1.81					8.73
200x325	1.51	0.24	0.08	1.12					2.95
Minus 325	2.35	0.50	0.26	5.56					8.68
Total (Calc.)	68.44	3.82	0.92	26.82					100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	Tailings	0	0			
+18	5.42	13.18	20.93	74.57					32.07
18x30	7.04	26.59	25.73	76.78					39.23
30x50	9.23	30.49	27.42	87.73					20.74
50x100	9.05	43.66	42.91	91.01					21.41
100x200	13.75	55.20	61.56	88.96					31.93
200x325	22.27	63.86	80.01	87.89					52.18
Minus 325	19.55	45.05	66.57	90.69					68.04
Total (Calc.)	9.70	36.58	48.66	83.95					31.00

Release Analysis

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+18	34.65	56.19	62.24	64.55	100.00	100.00	100.00	100.00
18x30	23.21	48.46	57.65	60.66	100.00	100.00	100.00	100.00
30x50	71.94	84.04	87.27	88.30	100.00	100.00	100.00	100.00
50x100	64.43	81.54	85.89	87.45	100.00	100.00	100.00	100.00
100x200	53.39	70.51	76.35	79.01	100.00	100.00	100.00	100.00
200x325	28.62	41.36	46.95	52.01	100.00	100.00	100.00	100.00
Minus 325	9.09	15.41	18.74	21.23	100.00	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	Tailings			
+18	6.03	7.32	8.29	8.87	31.43	31.43	31.43	31.43
18x30	6.32	9.49	11.82	12.81	38.15	38.15	38.15	38.15
30x50	8.22	8.98	9.59	9.83	19.15	19.15	19.15	19.15
50x100	10.41	11.27	12.05	12.53	22.33	22.33	22.33	22.33
100x200	11.29	12.70	14.88	16.49	31.65	31.65	31.65	31.65
200x325	16.83	19.73	23.49	28.18	57.23	57.23	57.23	57.23
Minus 325	10.52	11.87	14.19	18.50	76.33	76.33	76.33	76.33

Combustable Recovery								
Mesh #	P1	P2	P3	P4	Tailings			
+18	47.48	75.95	83.25	85.79	100.00	100.00	100.00	100.00
18x30	35.16	70.91	82.19	85.52	100.00	100.00	100.00	100.00
30x50	81.67	94.62	97.60	98.48	100.00	100.00	100.00	100.00
50x100	74.32	93.15	97.26	98.48	100.00	100.00	100.00	100.00
100x200	69.29	90.06	95.07	96.53	100.00	100.00	100.00	100.00
200x325	55.65	77.62	83.97	87.32	100.00	100.00	100.00	100.00
Minus 325	34.36	57.38	67.91	73.08	100.00	100.00	100.00	100.00

Ash Rejection								
Mesh #	P1	P2	P3	P4	Tailings			
+18	93.35	86.92	83.58	81.78	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
18x30	96.16	87.94	82.14	79.63	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
30x50	69.13	60.61	56.31	54.68	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
50x100	69.96	58.83	53.66	50.92	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
100x200	80.95	71.70	64.09	58.84	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
200x325	91.58	85.74	80.73	74.39	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Minus 325	98.75	97.60	96.52	94.86	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Kinetic Test

Cumulative Yield								
Mesh #	P1	P2	P3	P4	P5	0		
+18	57.06	61.56	62.08	100.00	100.00	100.00	100.00	100.00
18x30	49.57	54.46	55.50	100.00	100.00	100.00	100.00	100.00
30x50	83.45	85.69	86.02	100.00	100.00	100.00	100.00	100.00
50x100	82.43	86.00	86.74	100.00	100.00	100.00	100.00	100.00
100x200	73.20	78.07	79.29	100.00	100.00	100.00	100.00	100.00
200x325	51.15	59.18	61.97	100.00	100.00	100.00	100.00	100.00
Minus 325	27.13	32.87	35.88	100.00	100.00	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+18	5.42	5.99	6.11	32.07	32.07	32.07	32.07	32.07
18x30	7.04	8.80	9.11	39.23	39.23	39.23	39.23	39.23
30x50	9.23	9.78	9.85	20.74	20.74	20.74	20.74	20.74
50x100	9.05	10.48	10.76	21.41	21.41	21.41	21.41	21.41
100x200	13.75	16.34	17.03	31.93	31.93	31.93	31.93	31.93
200x325	22.27	27.92	30.26	52.18	52.18	52.18	52.18	52.18
Minus 325	19.55	24.00	27.57	68.04	68.04	68.04	68.04	68.04

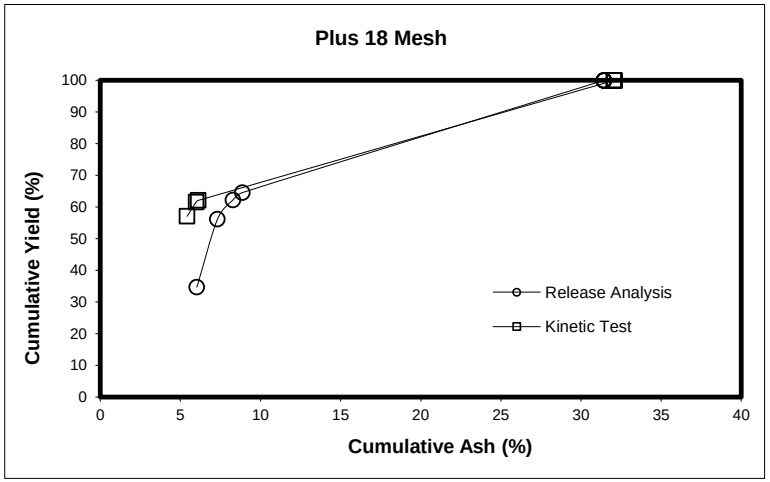
Combustable Recovery								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+18	79.45	85.20	85.80	100.00	100.00	100.00	100.00	100.00
18x30	75.82	81.72	83.00	100.00	100.00	100.00	100.00	100.00
30x50	95.57	97.53	97.84	100.00	100.00	100.00	100.00	100.00
50x100	95.39	97.94	98.48	100.00	100.00	100.00	100.00	100.00
100x200	92.75	95.95	96.64	100.00	100.00	100.00	100.00	100.00
200x325	83.13	89.20	90.37	100.00	100.00	100.00	100.00	100.00
Minus 325	68.30	78.17	81.32	100.00	100.00	100.00	100.00	100.00

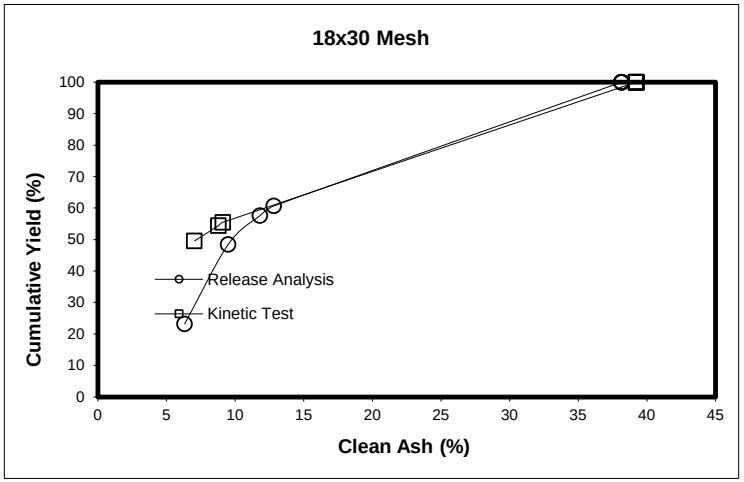
Ash Rejection								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+18	90.36	88.51	88.17	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
18x30	91.10	87.79	87.11	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
30x50	62.86	59.58	59.14	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
50x100	65.15	57.88	56.39	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
100x200	68.47	60.05	57.70	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
200x325	78.17	68.34	64.06	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Minus 325	92.20	88.41	85.46	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

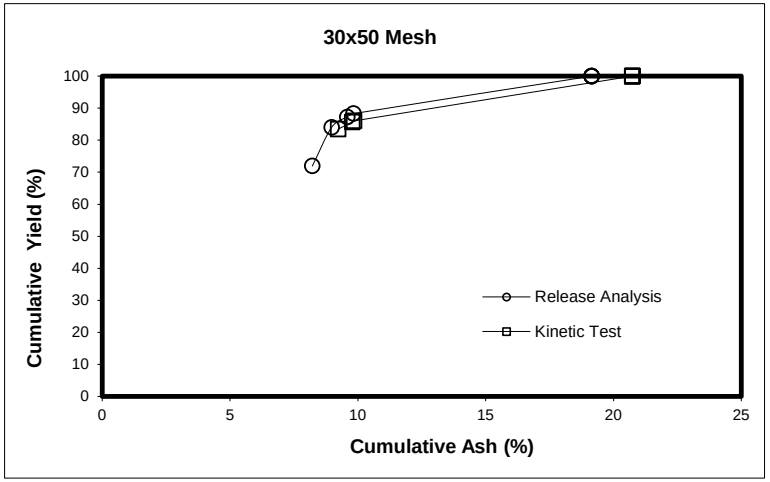
PERFORMANCE COMPARISON

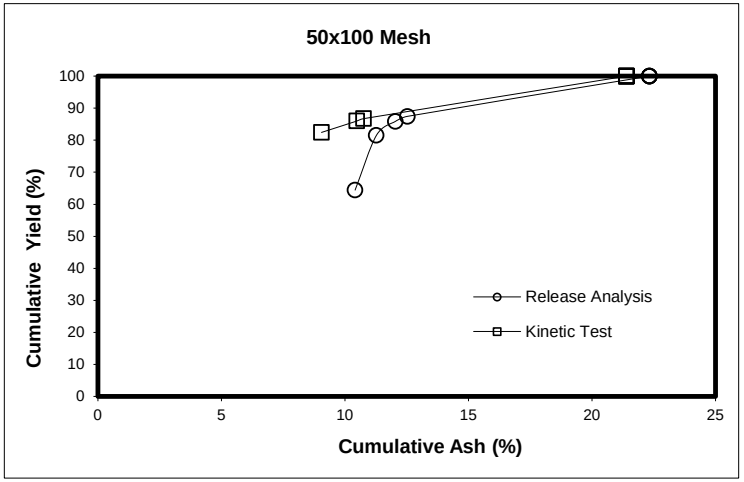
Description: 1 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Coarse Coal Feed)





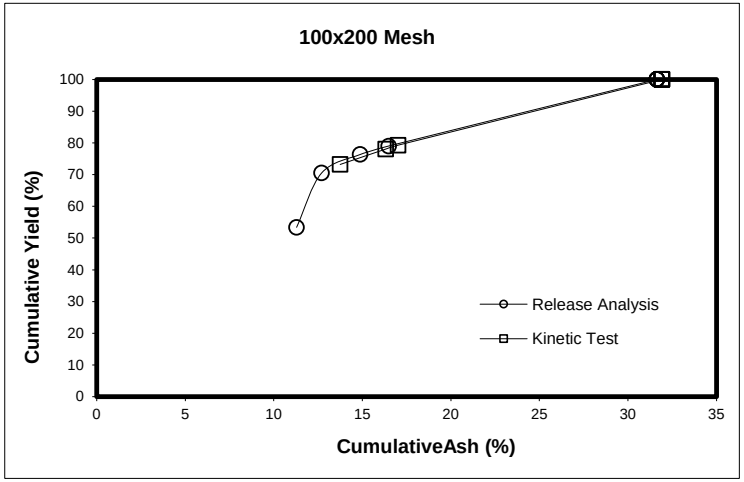


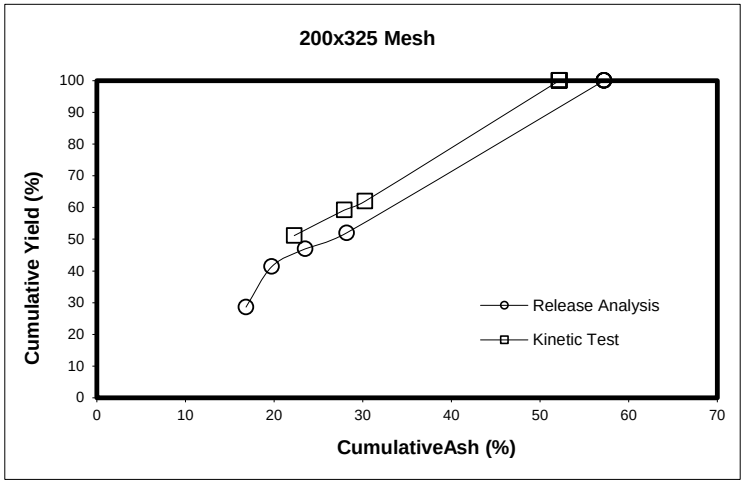


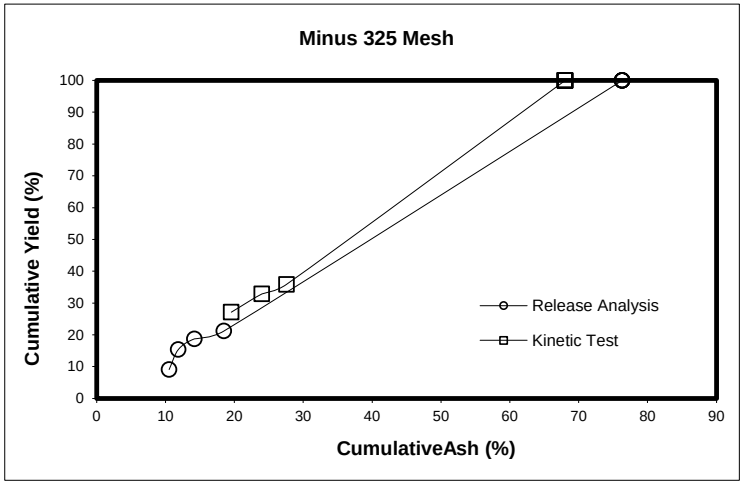
PERFORMANCE COMPARISON

Description: 1 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Coarse Coal Feed)



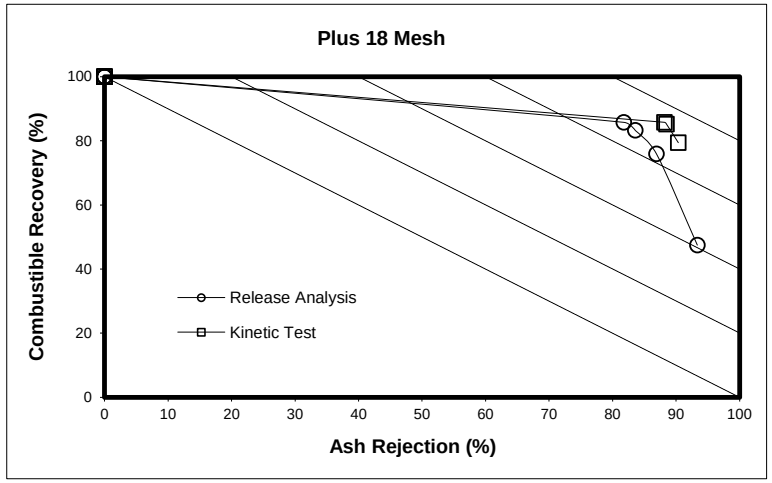


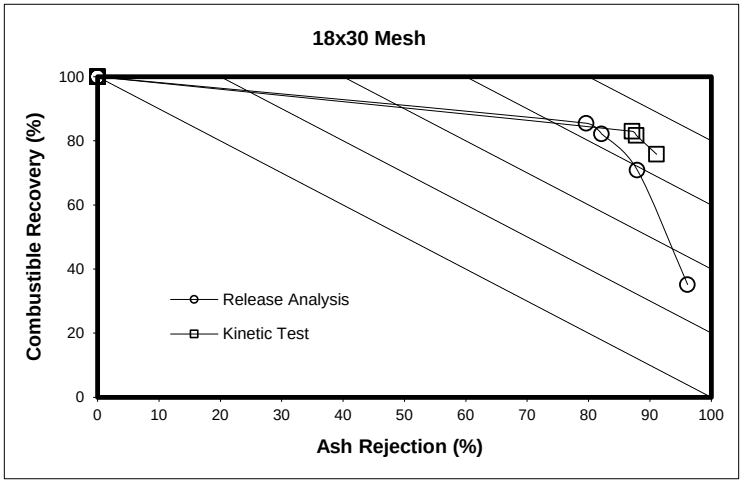


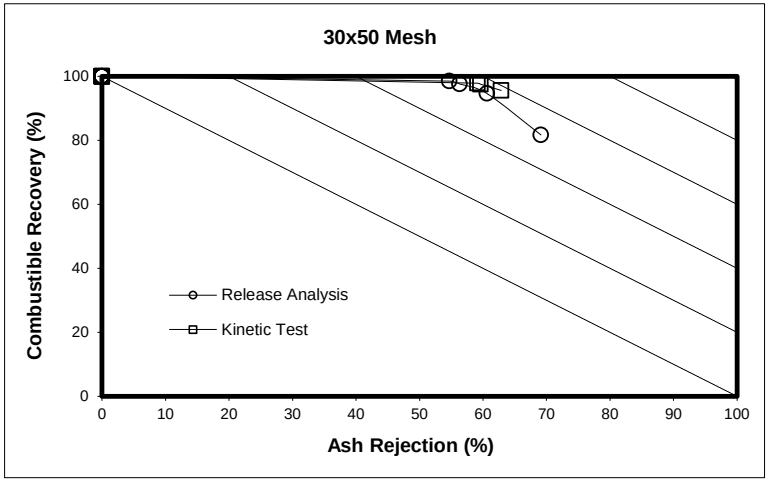
PERFORMANCE COMPARISON

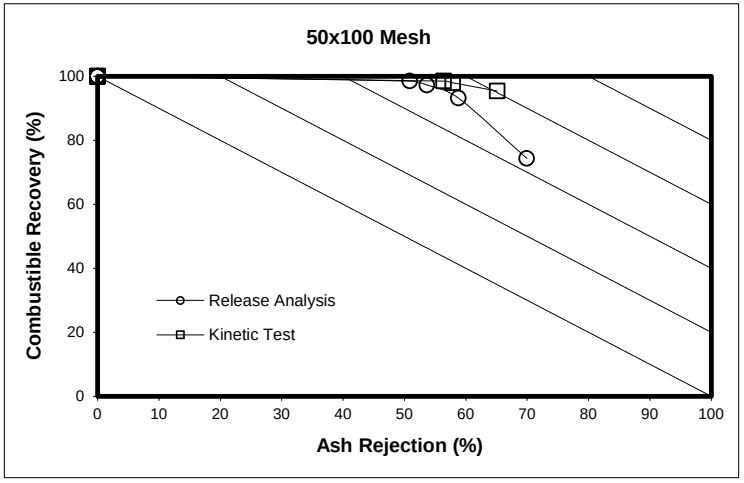
Description: 1 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Coarse Coal Feed)





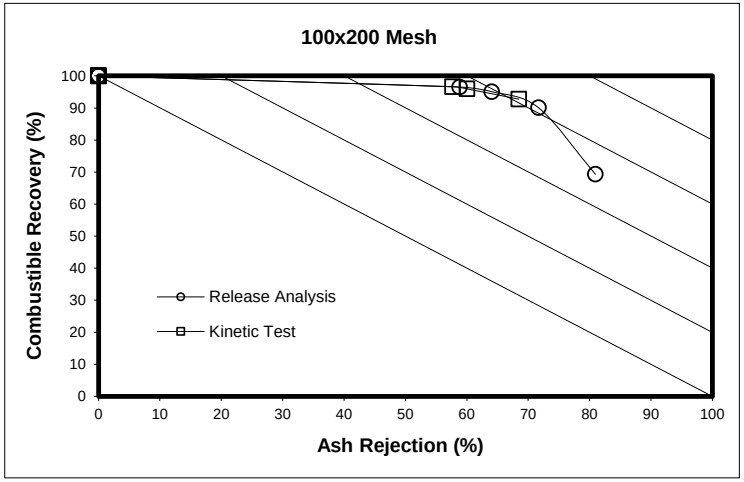


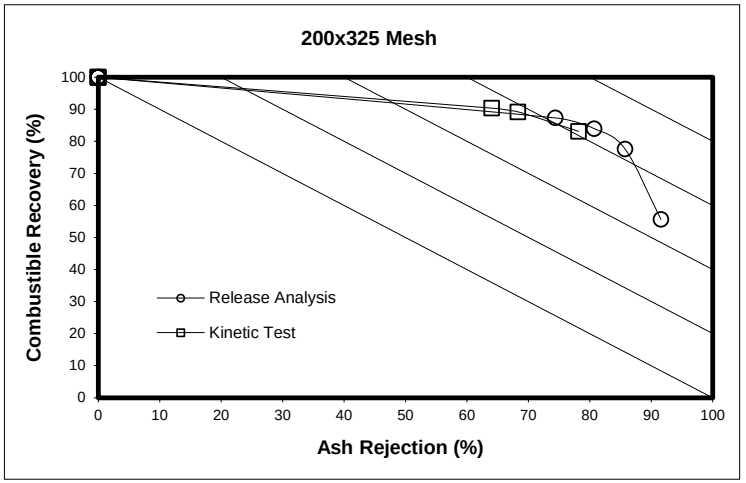


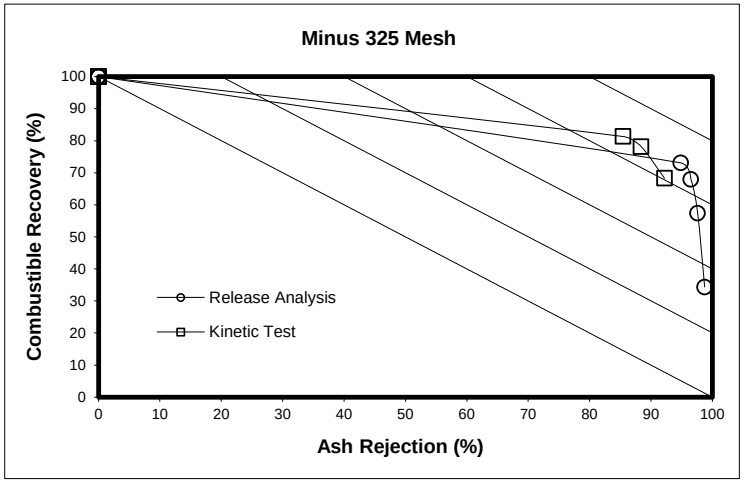
PERFORMANCE COMPARISON

Description: 1 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Coarse Coal Feed)







APPENDIX J – Flotation Circuit Results (Fine Coal Feed Stock 0.15 x 0 mm)

FLOTATION (RELEASE ANALYSIS)

Description: 0.15 x 0 mm Nominal Particle Size
Comments: Flotation Tests (Ultra Fine Coal Feed)

PERFORMANCE BY PRODUCT AND SIZE (Release)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+100	0.07	0.04	0.10	0.17	0.56				0.95
100x200	0.24	0.40	1.28	2.76	1.69				6.36
200x325	0.38	0.61	1.51	2.58	1.43				6.51
Minus 325	2.13	2.67	5.30	6.93	69.15				86.19
Total (Calc.)	2.82	3.71	8.20	12.44	72.83				100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+100	3.21	3.22	2.97	2.89	4.94				4.15
100x200	3.49	3.62	3.84	4.03	6.41				4.58
200x325	5.01	5.00	5.48	6.06	19.09				8.63
Minus 325	6.71	7.47	7.88	11.78	87.86				72.32
Total (Calc.)	6.12	6.61	6.75	8.75	83.99				63.23

FLOTATION (KINETIC TEST)

Description: 0.15 x 0 mm Nominal Particle Size
Comments: Flotation Tests (Ultra Fine Coal Feed)

PERFORMANCE BY PRODUCT AND SIZE (Timed Kinetics)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+100	0.05	0.00	0.00	0.00	0.07	0.83			0.95
100x200	0.29	0.21	0.23	0.07	0.93	4.62			6.34
200x325	0.61	0.40	0.44	0.39	1.39	3.85			7.07
Minus 325	2.95	4.44	1.54	3.40	6.63	66.67			85.64
Total (Calc.)	3.91	5.05	2.21	3.85					100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+100	0.05	0.03	0.08	0.03	3.33	5.18			4.74
100x200	3.51	3.53	3.45	3.61	3.73	5.37			4.90
200x325	5.15	5.09	5.00	5.28	5.87	13.46			9.81
Minus 325	20.75	23.15	33.61	31.00	38.88	84.15			72.28
Total (Calc.)	16.74	20.92	24.82	27.96					62.95

Release Analysis

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+100	7.83	12.02	22.64	40.88	100.00	100.00	100.00	100.00
100x200	3.72	9.97	30.08	73.49	100.00	100.00	100.00	100.00
200x325	5.80	15.10	38.35	78.03	100.00	100.00	100.00	100.00
Minus 325	2.47	5.57	11.73	19.76	100.00	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	Tailings			
+100	3.21	3.21	3.10	3.01	4.15	4.15	4.15	4.15
100x200	3.49	3.57	3.75	3.92	4.58	4.58	4.58	4.58
200x325	5.01	5.00	5.29	5.68	8.63	8.63	8.63	8.63
Minus 325	6.71	7.13	7.52	9.26	72.32	72.32	72.32	72.32

Combustable Recovery								
Mesh #	P1	P2	P3	P4	Tailings			
+100	7.91	12.13	22.89	41.37	100.00	100.00	100.00	100.00
100x200	3.76	10.07	30.34	74.00	100.00	100.00	100.00	100.00
200x325	6.02	15.69	39.75	80.55	100.00	100.00	100.00	100.00
Minus 325	8.34	18.70	39.18	64.80	100.00	100.00	100.00	100.00

Ash Rejection								
Mesh #	P1	P2	P3	P4	Tailings			
+100	93.94	90.69	83.09	70.39	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
100x200	97.17	92.22	75.35	37.12	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
200x325	96.63	91.24	76.47	48.60	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Minus 325	99.77	99.45	98.78	97.47	0.00	0.00	0.00	0.00

Kinetic Test

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+100	5.58	5.97	5.97	5.97	13.23	100.00	100.00	100.00
100x200	4.65	7.89	11.44	12.48	27.14	100.00	100.00	100.00
200x325	8.60	14.21	20.45	25.90	45.54	100.00	100.00	100.00
Minus 325	3.45	8.63	10.43	14.40	22.15	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	0.05	0.05	0.05	0.05	1.85	4.74	4.74	4.74
100x200	3.51	3.52	3.50	3.51	3.63	4.90	4.90	4.90
200x325	5.15	5.13	5.09	5.13	5.45	9.81	9.81	9.81
Minus 325	20.75	22.19	24.16	26.05	30.53	72.28	72.28	72.28

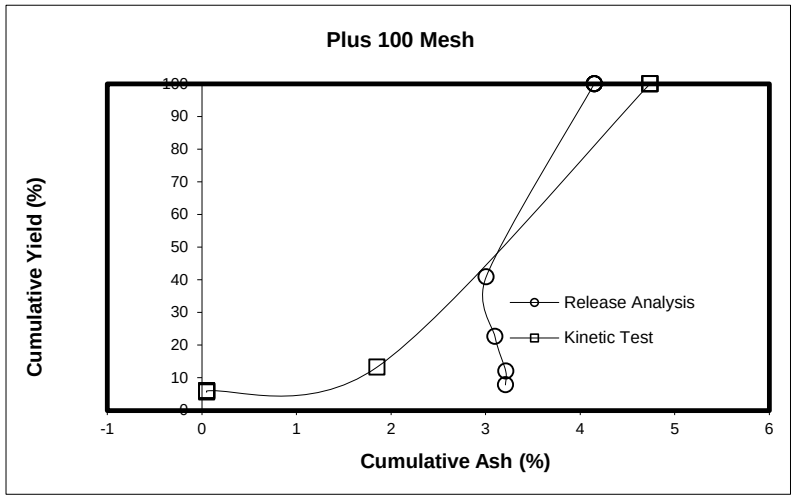
Combustable Recovery								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	5.85	6.26	6.26	6.26	13.63	100.00	100.00	100.00
100x200	4.72	8.00	11.61	12.66	27.51	100.00	100.00	100.00
200x325	9.05	14.95	21.52	27.24	47.74	100.00	100.00	100.00
Minus 325	9.86	24.23	28.54	38.42	55.49	100.00	100.00	100.00

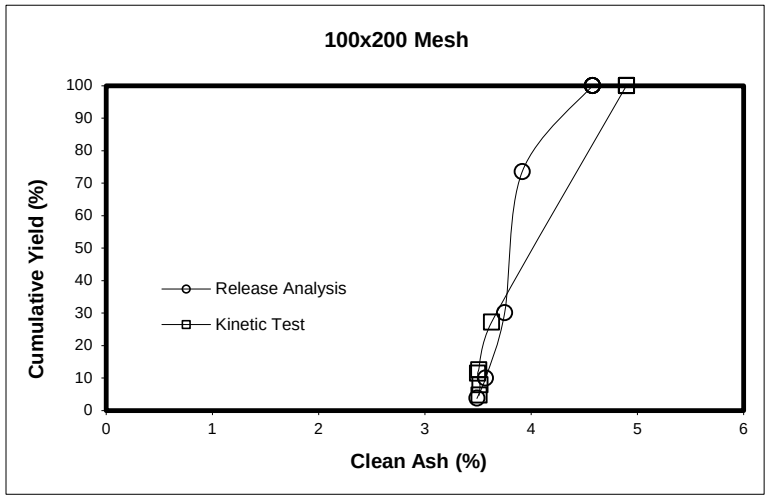
Ash Rejection								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	99.94	99.94	99.94	99.94	94.84	#DIV/0!	#DIV/0!	#DIV/0!
100x200	96.67	94.33	91.83	91.07	79.89	#DIV/0!	#DIV/0!	#DIV/0!
200x325	95.48	92.58	89.40	86.46	74.71	#DIV/0!	#DIV/0!	#DIV/0!
Minus 325	99.01	97.35	96.51	94.81	90.64	#DIV/0!	#DIV/0!	#DIV/0!

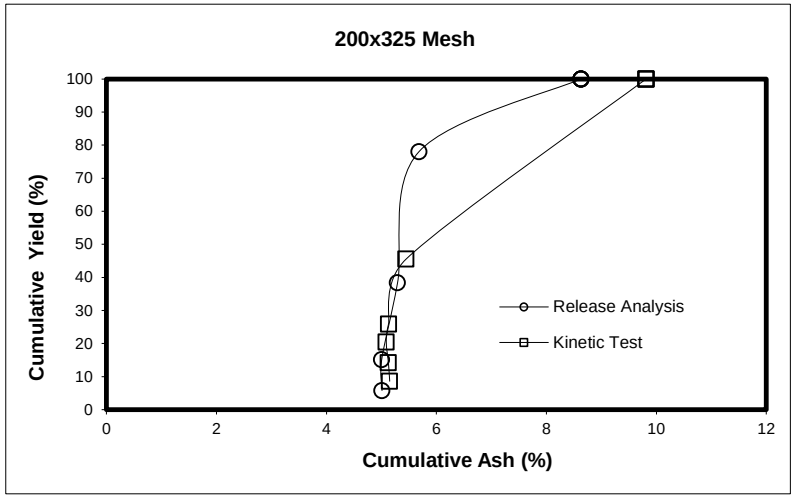
PERFORMANCE COMPARISON

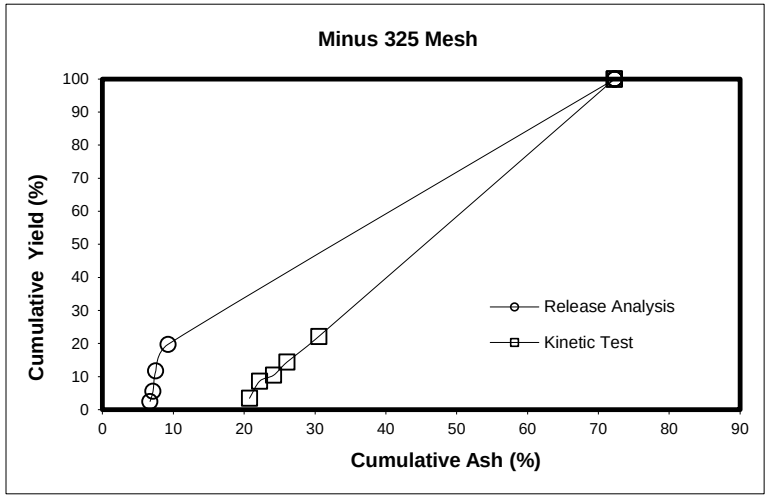
Description: 0.15 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Ultra Fine Coal Feed)





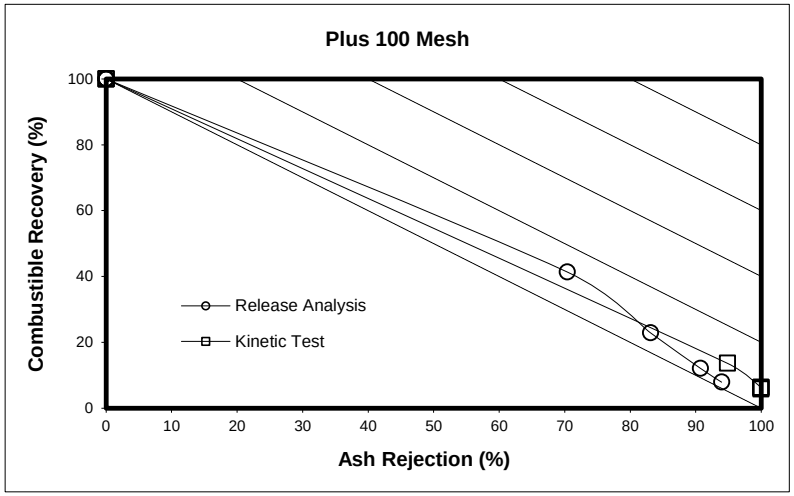


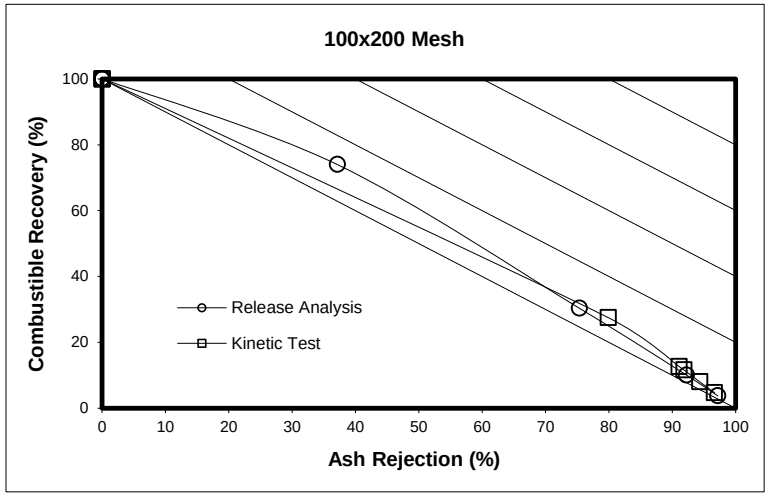


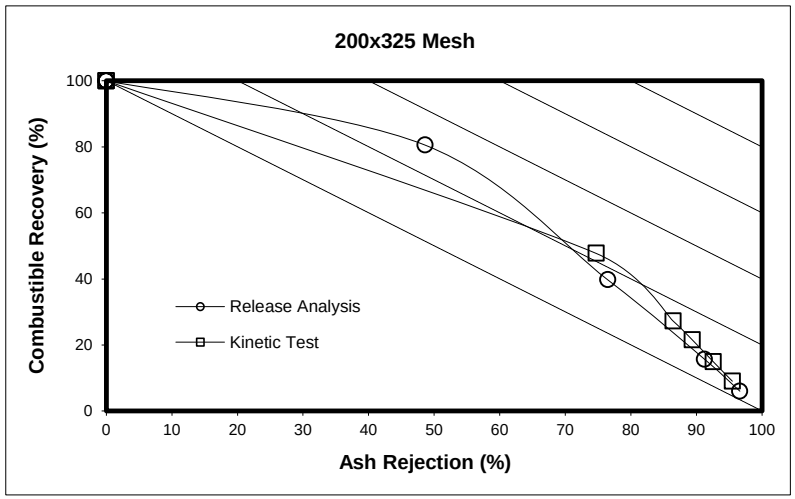
PERFORMANCE COMPARISON

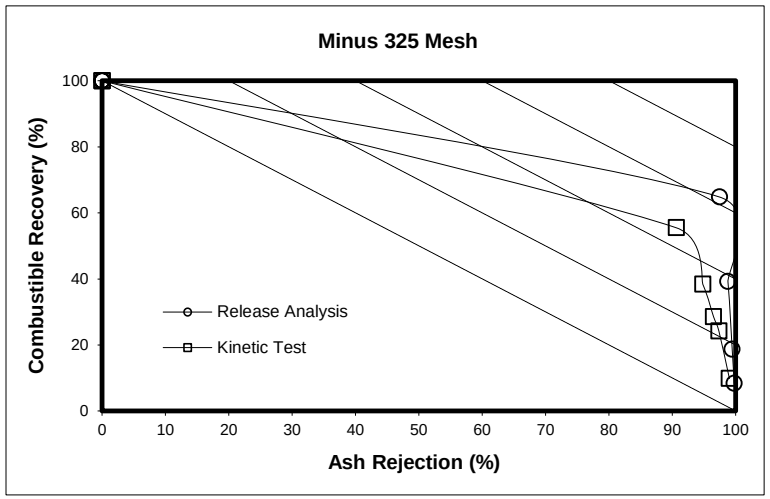
Description: 0.15 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Ultra Fine Coal Feed)









FLOTATION (RELEASE ANALYSIS)

Description: 0.15 x 0 mm Nominal Particle Size
Comments: Flotation Tests (WOC UF)

PERFORMANCE BY PRODUCT AND SIZE (Release)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+100	1.02	0.60	0.28	0.06	0.36				2.32
100x200	6.63	5.19	3.14	0.69	0.67				16.31
200x325	5.39	3.69	2.92	1.57	0.89				14.45
Minus 325	4.68	5.22	3.84	3.25	49.93				66.92
Total (Calc.)	17.71	14.69	10.18	5.57	51.85				100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+100	3.17	3.35	3.43	4.96	9.59				4.30
100x200	3.76	4.24	4.69	5.84	14.40				4.62
200x325	5.51	6.34	7.35	10.61	47.52				9.22
Minus 325	9.05	9.60	11.83	18.71	90.26				70.31
Total (Calc.)	5.66	6.64	8.11	14.68	87.99				49.24

FLOTATION (KINETIC TEST)

Description: 0.15 x 0 mm Nominal Particle Size
Comments: Flotation Tests (WOC UF)

PERFORMANCE BY PRODUCT AND SIZE (Timed Kinetics)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+100	0.27	0.10	0.16	0.22	0.72	0.49			1.95
100x200	3.54	2.43	2.72	1.73	3.98	0.77			15.17
200x325	4.42	2.22	2.66	1.88	2.18	1.12			14.48
Minus 325	5.90	4.35	4.84	4.22	5.24	43.85			68.40
Total (Calc.)	14.13	9.10	10.37	8.06					100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+100	3.15	3.35	3.34	3.27	3.62	9.34			4.91
100x200	3.65	3.79	4.05	4.22	4.95	10.53			4.50
200x325	5.36	5.87	6.56	7.83	10.49	42.26			9.61
Minus 325	17.53	19.96	23.28	43.19	57.07	89.87			69.08
Total (Calc.)	9.97	12.03	13.65	25.46					49.42

Release Analysis

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+100	43.82	69.57	81.79	84.40	100.00	100.00	100.00	100.00
100x200	40.62	72.42	91.66	95.90	100.00	100.00	100.00	100.00
200x325	37.28	62.80	83.01	93.87	100.00	100.00	100.00	100.00
Minus 325	6.99	14.79	20.53	25.39	100.00	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	Tailings			
+100	3.17	3.24	3.27	3.32	4.30	4.30	4.30	4.30
100x200	3.76	3.97	4.12	4.20	4.62	4.62	4.62	4.62
200x325	5.51	5.85	6.21	6.72	9.22	9.22	9.22	9.22
Minus 325	9.05	9.34	10.04	11.70	70.31	70.31	70.31	70.31

Combustable Recovery								
Mesh #	P1	P2	P3	P4	Tailings			
+100	44.34	70.34	82.68	85.26	100.00	100.00	100.00	100.00
100x200	40.99	72.91	92.14	96.32	100.00	100.00	100.00	100.00
200x325	38.80	65.14	85.76	96.46	100.00	100.00	100.00	100.00
Minus 325	21.42	45.17	62.21	75.52	100.00	100.00	100.00	100.00

Ash Rejection								
Mesh #	P1	P2	P3	P4	Tailings			
+100	67.67	47.59	37.83	34.83	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
100x200	66.91	37.69	18.15	12.78	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
200x325	77.73	60.18	44.08	31.58	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Minus 325	99.10	98.04	97.07	95.78	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Kinetic Test

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+100	13.74	18.69	26.68	38.02	74.92	100.00	100.00	100.00
100x200	23.32	39.33	57.28	68.69	94.95	100.00	100.00	100.00
200x325	30.55	45.88	64.24	77.23	92.26	100.00	100.00	100.00
Minus 325	8.62	14.99	22.06	28.23	35.89	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	3.15	3.20	3.24	3.25	3.43	4.91	4.91	4.91
100x200	3.65	3.71	3.81	3.88	4.18	4.50	4.50	4.50
200x325	5.36	5.53	5.82	6.16	6.87	9.61	9.61	9.61
Minus 325	17.53	18.56	20.07	25.13	31.95	69.08	69.08	69.08

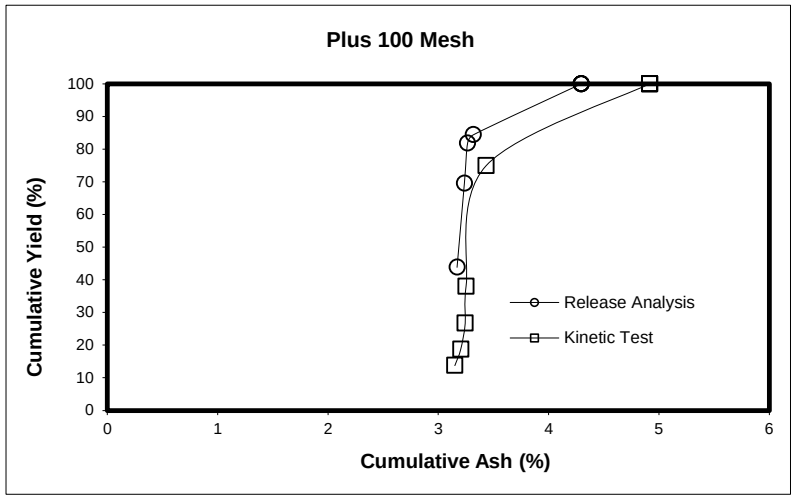
Combustable Recovery								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	13.99	19.03	27.15	38.68	76.09	100.00	100.00	100.00
100x200	23.53	39.66	57.69	69.14	95.27	100.00	100.00	100.00
200x325	31.99	47.95	66.93	80.17	95.06	100.00	100.00	100.00
Minus 325	23.00	39.47	57.02	68.36	79.00	100.00	100.00	100.00

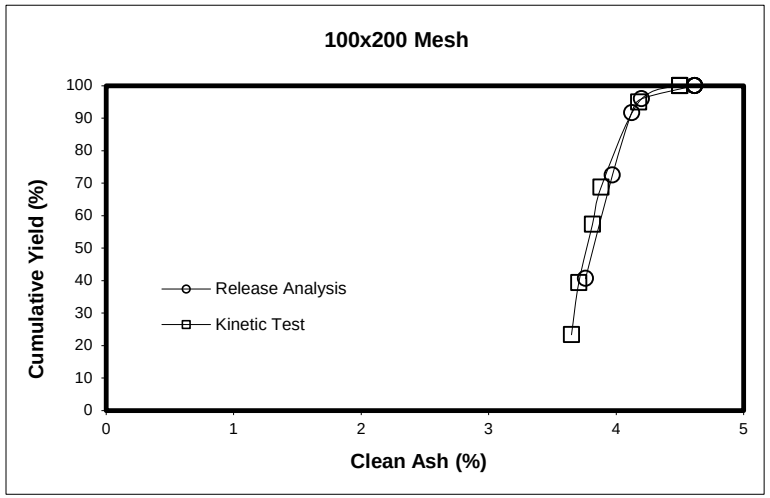
Ash Rejection								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	91.19	87.82	82.39	74.84	47.66	#DIV/0!	#DIV/0!	#DIV/0!
100x200	81.08	67.58	51.43	40.72	11.82	#DIV/0!	#DIV/0!	#DIV/0!
200x325	82.95	73.59	61.05	50.46	34.05	#DIV/0!	#DIV/0!	#DIV/0!
Minus 325	97.81	95.97	93.59	89.73	83.40	#DIV/0!	#DIV/0!	#DIV/0!

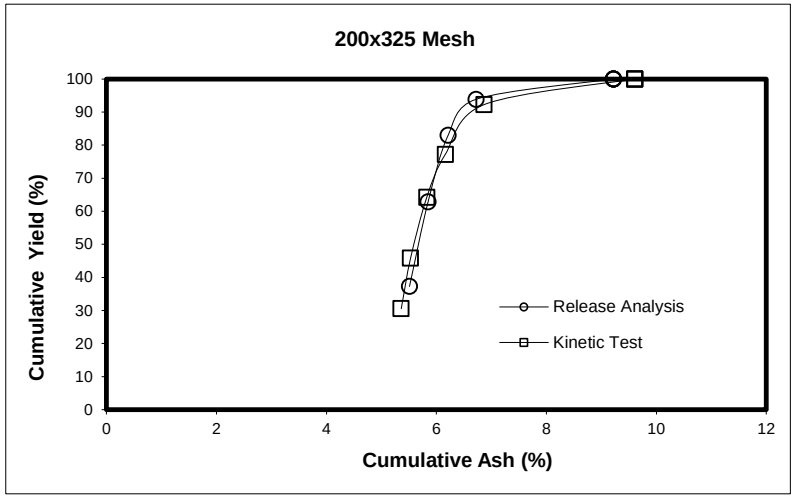
PERFORMANCE COMPARISON

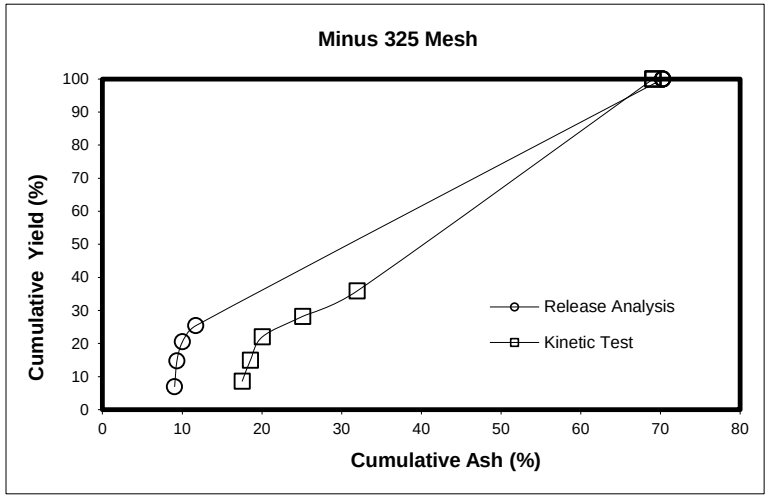
Description: 0.15 x 0 mm Nominal Particle Size

Comments: Flotation Tests (WOC UF)





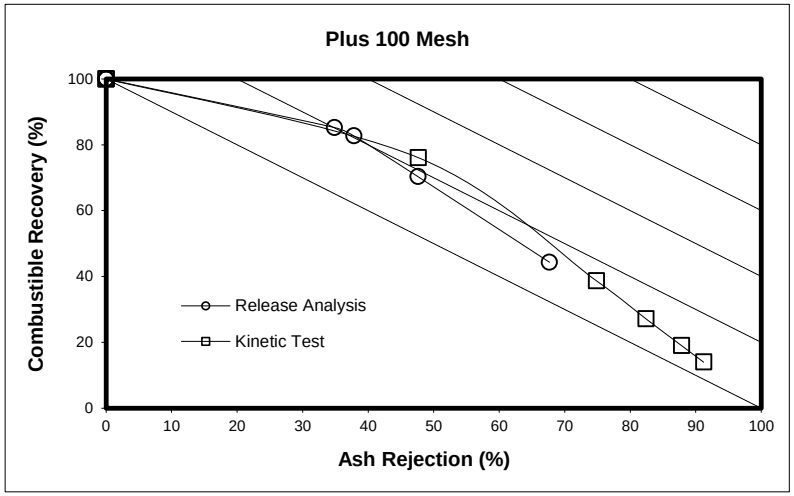


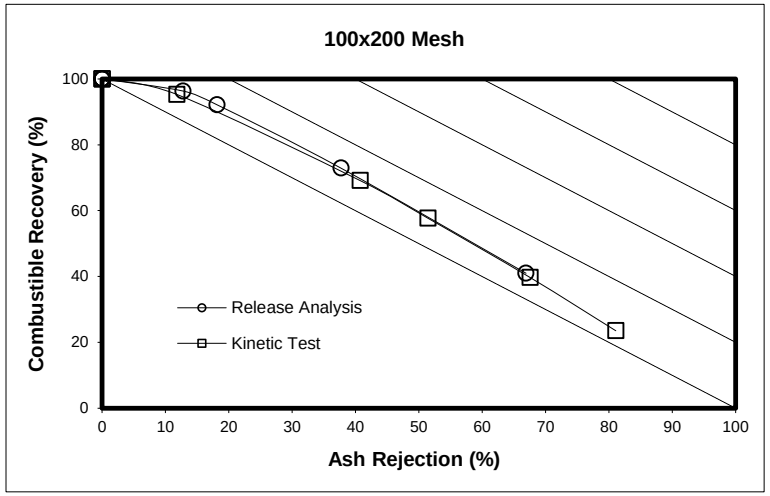


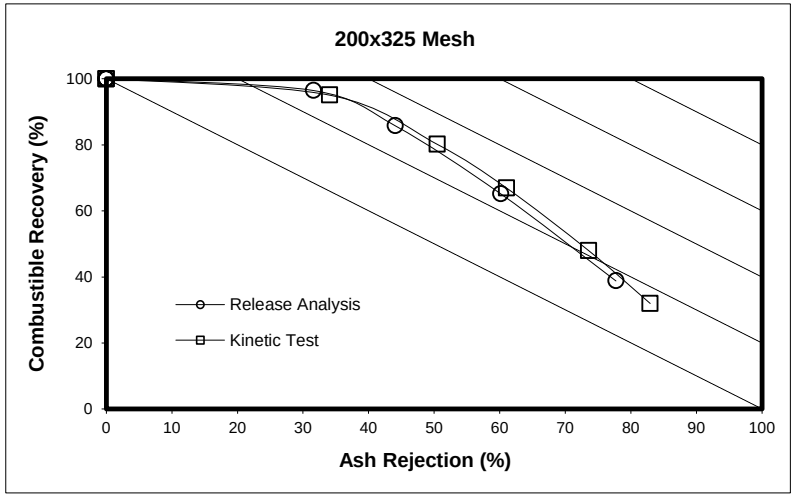
PERFORMANCE COMPARISON

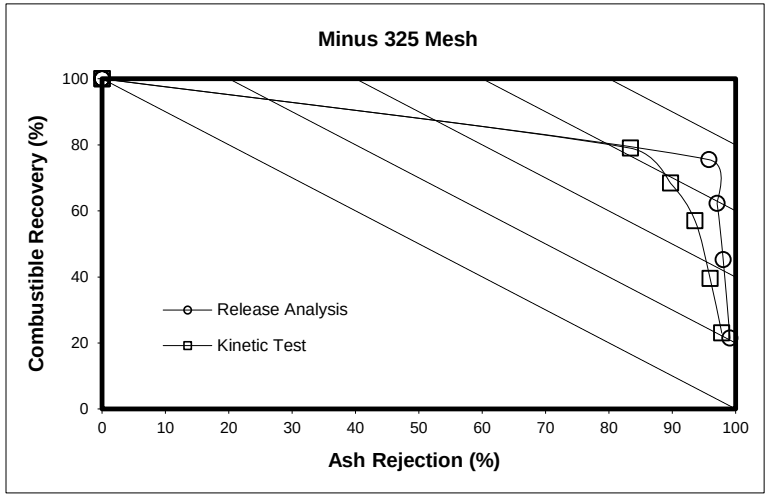
Description: 0.15 x 0 mm Nominal Particle Size

Comments: Flotation Tests (WOC UF)









FLOTATION (RELEASE ANALYSIS)

Description: 0.15 x 0 mm Nominal Particle Size
Comments: Flotation Tests (Spiral Clean)

PERFORMANCE BY PRODUCT AND SIZE (Release)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+100	0.64	0.32	0.05	0.04	1.06				2.11
100x200	6.12	3.74	1.70	0.48	2.23				14.27
200x325	6.48	3.29	1.93	0.79	1.59				14.08
Minus 325	6.40	5.57	3.75	1.54	52.29				69.54
Total (Calc.)	19.64	12.92	7.43	2.85	57.17				100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+100	2.56	2.63	3.51	4.14	3.78				3.24
100x200	3.30	3.73	4.10	4.53	5.66				3.92
200x325	5.13	5.27	6.44	8.91	16.84				6.87
Minus 325	7.65	8.70	11.95	20.74	89.49				69.80
Total (Calc.)	5.30	6.24	8.67	14.49	82.62				50.13

FLOTATION (KINETIC TEST)

Description: 0.15 x 0 mm Nominal Particle Size
Comments: Flotation Tests (Spiral Clean)

PERFORMANCE BY PRODUCT AND SIZE (Timed Kinetics)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+100	0.59	0.23	0.07	0.04	0.17	0.97			2.08
100x200	5.00	3.31	1.77	0.41	0.87	2.36			13.71
200x325	6.01	2.84	1.83	0.82	0.76	1.35			13.60
Minus 325	7.96	6.25	5.02	3.88	4.77	42.73			70.61
Total (Calc.)	19.55	12.63	8.69	5.15					100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+100	2.99	3.05	3.53	3.67	3.14	3.66			3.35
100x200	3.61	3.95	4.11	3.97	4.02	5.15			4.06
200x325	5.54	5.87	6.63	7.10	7.80	15.06			6.92
Minus 325	20.36	22.18	33.36	53.84	68.22	89.72			68.49
Total (Calc.)	11.00	13.39	21.54	42.00					49.93

Release Analysis

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+100	30.18	45.43	47.87	49.70	100.00	100.00	100.00	100.00
100x200	42.91	69.15	81.03	84.41	100.00	100.00	100.00	100.00
200x325	46.03	69.39	83.12	88.73	100.00	100.00	100.00	100.00
Minus 325	9.20	17.20	22.59	24.80	100.00	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	Tailings			
+100	2.56	2.58	2.63	2.69	3.24	3.24	3.24	3.24
100x200	3.30	3.46	3.56	3.60	3.92	3.92	3.92	3.92
200x325	5.13	5.18	5.39	5.61	6.87	6.87	6.87	6.87
Minus 325	7.65	8.14	9.05	10.09	69.80	69.80	69.80	69.80

Combustable Recovery								
Mesh #	P1	P2	P3	P4	Tailings			
+100	30.39	45.73	48.17	49.98	100.00	100.00	100.00	100.00
100x200	43.19	69.48	81.33	84.69	100.00	100.00	100.00	100.00
200x325	46.89	70.65	84.45	89.94	100.00	100.00	100.00	100.00
Minus 325	28.13	52.32	68.03	73.83	100.00	100.00	100.00	100.00

Ash Rejection								
Mesh #	P1	P2	P3	P4	Tailings			
+100	76.13	63.74	61.09	58.75	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
100x200	63.85	38.87	26.43	22.53	0.00	0.00	0.00	0.00
200x325	65.65	47.74	34.88	27.60	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Minus 325	98.99	97.99	97.07	96.41	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Kinetic Test

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+100	28.51	39.75	43.30	45.30	53.47	100.00	100.00	100.00
100x200	36.44	60.57	73.46	76.47	82.82	100.00	100.00	100.00
200x325	44.15	65.02	78.45	84.47	90.05	100.00	100.00	100.00
Minus 325	11.27	20.13	27.24	32.72	39.48	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	2.99	3.01	3.05	3.08	3.09	3.35	3.35	3.35
100x200	3.61	3.75	3.81	3.82	3.83	4.06	4.06	4.06
200x325	5.54	5.65	5.81	5.91	6.02	6.92	6.92	6.92
Minus 325	20.36	21.16	24.35	29.29	35.96	68.49	68.49	68.49

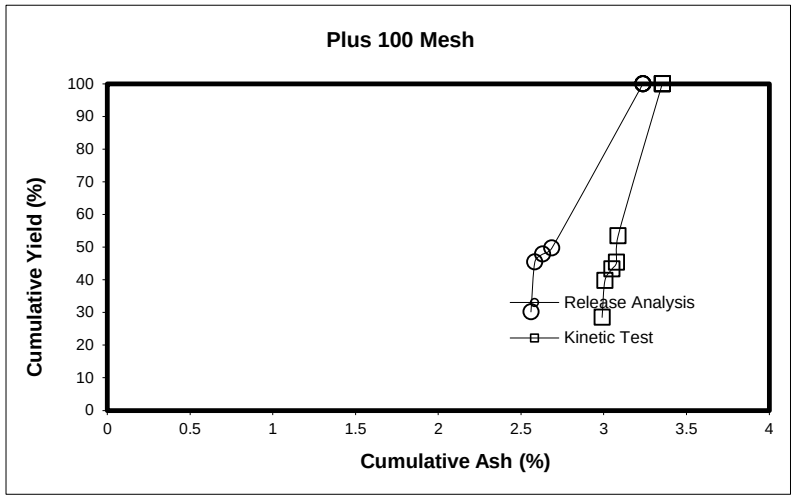
Combustable Recovery								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	28.61	39.90	43.43	45.43	53.61	100.00	100.00	100.00
100x200	36.61	60.77	73.65	76.66	83.02	100.00	100.00	100.00
200x325	44.81	65.91	79.39	85.40	90.92	100.00	100.00	100.00
Minus 325	28.49	50.36	65.40	73.44	80.26	100.00	100.00	100.00

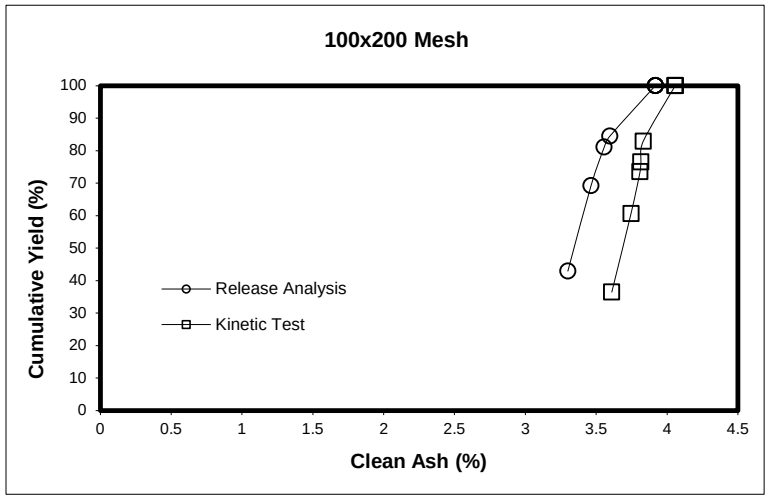
Ash Rejection								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	74.58	64.35	60.62	58.43	50.79	#DIV/0!	#DIV/0!	#DIV/0!
100x200	67.58	44.09	31.04	28.09	21.80	#DIV/0!	#DIV/0!	#DIV/0!
200x325	64.66	46.97	34.11	27.93	21.65	#DIV/0!	#DIV/0!	#DIV/0!
Minus 325	96.65	93.78	90.32	86.01	79.27	#DIV/0!	#DIV/0!	#DIV/0!

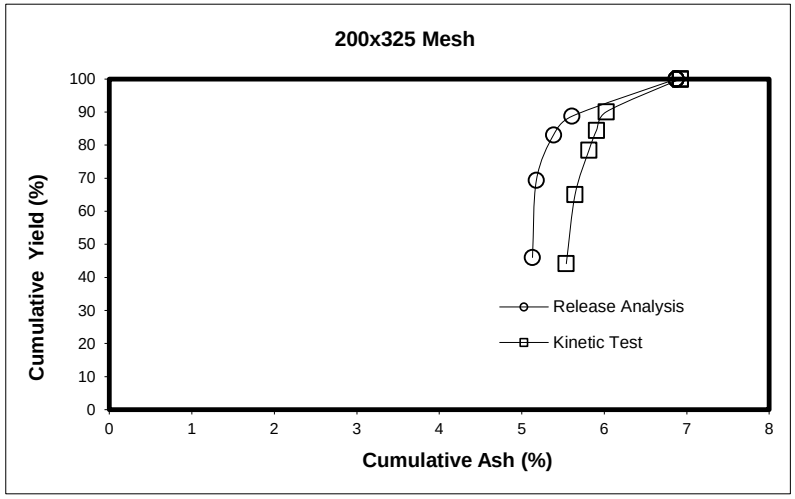
PERFORMANCE COMPARISON

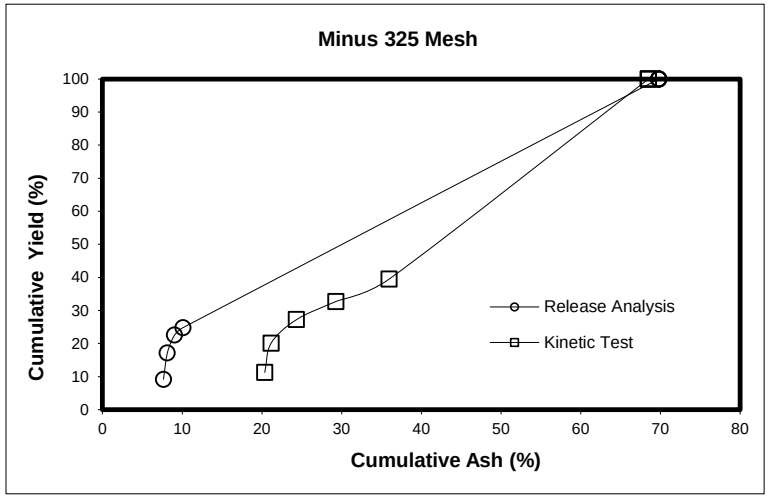
Description: 0.15 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Spiral Clean)





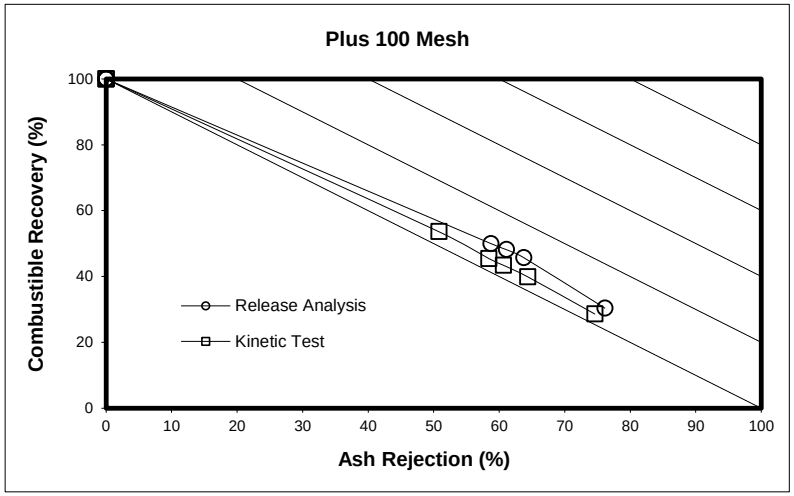


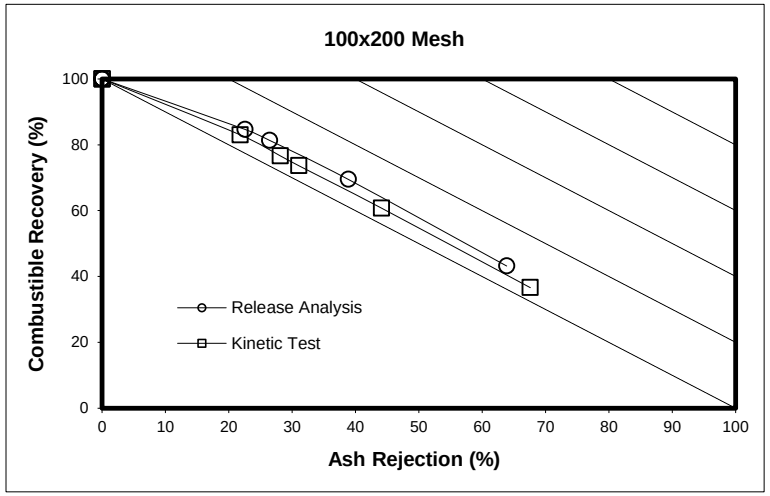


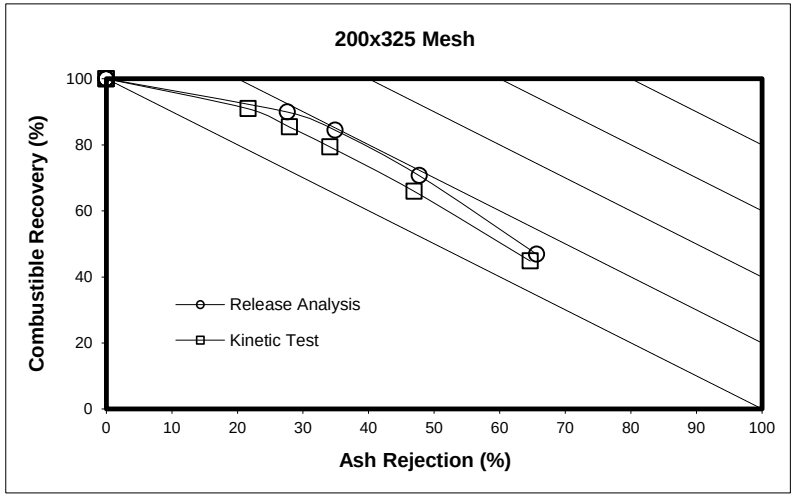
PERFORMANCE COMPARISON

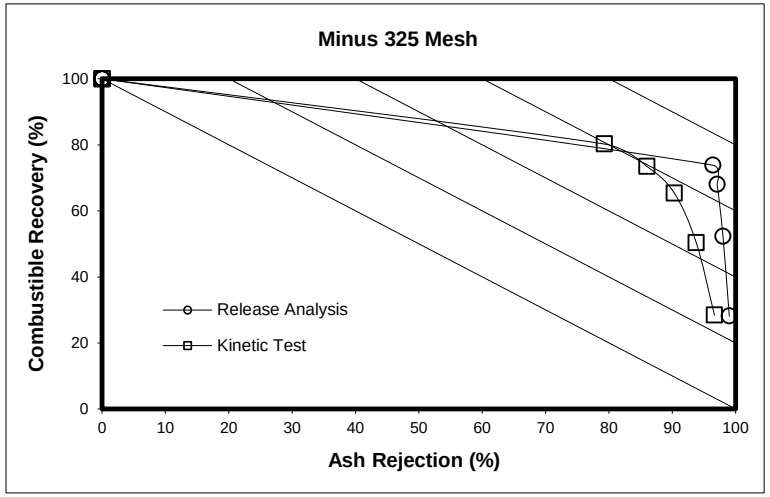
Description: 0.15 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Spiral Clean)









FLOTATION (RELEASE ANALYSIS)

Description: 0.15 x 0 mm Nominal Particle Size
Comments: Flotation Tests (Spiral Clean)

PERFORMANCE BY PRODUCT AND SIZE (Release)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+100	0.64	0.32	0.05	0.04	1.06				2.11
100x200	6.12	3.74	1.70	0.48	2.23				14.27
200x325	6.48	3.29	1.93	0.79	1.59				14.08
Minus 325	6.40	5.57	3.75	1.54	52.29				69.54
Total (Calc.)	19.64	12.92	7.43	2.85	57.17				100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+100	2.56	2.63	3.51	4.14	3.78				3.24
100x200	3.30	3.73	4.10	4.53	5.66				3.92
200x325	5.13	5.27	6.44	8.91	16.84				6.87
Minus 325	7.65	8.70	11.95	20.74	89.49				69.80
Total (Calc.)	5.30	6.24	8.67	14.49	82.62				50.13

FLOTATION (KINETIC TEST)

Description: 0.15 x 0 mm Nominal Particle Size
Comments: Flotation Tests (Spiral Clean)

PERFORMANCE BY PRODUCT AND SIZE (Timed Kinetics)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+100	0.59	0.23	0.07	0.04	0.17	0.97			2.08
100x200	5.00	3.31	1.77	0.41	0.87	2.36			13.71
200x325	6.01	2.84	1.83	0.82	0.76	1.35			13.60
Minus 325	7.96	6.25	5.02	3.88	4.77	42.73			70.61
Total (Calc.)	19.55	12.63	8.69	5.15					100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+100	2.99	3.05	3.53	3.67	3.14	3.66			3.35
100x200	3.61	3.95	4.11	3.97	4.02	5.15			4.06
200x325	5.54	5.87	6.63	7.10	7.80	15.06			6.92
Minus 325	20.36	22.18	33.36	53.84	68.22	89.72			68.49
Total (Calc.)	11.00	13.39	21.54	42.00					49.93

Release Analysis

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+100	30.18	45.43	47.87	49.70	100.00	100.00	100.00	100.00
100x200	42.91	69.15	81.03	84.41	100.00	100.00	100.00	100.00
200x325	46.03	69.39	83.12	88.73	100.00	100.00	100.00	100.00
Minus 325	9.20	17.20	22.59	24.80	100.00	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	Tailings			
+100	2.56	2.58	2.63	2.69	3.24	3.24	3.24	3.24
100x200	3.30	3.46	3.56	3.60	3.92	3.92	3.92	3.92
200x325	5.13	5.18	5.39	5.61	6.87	6.87	6.87	6.87
Minus 325	7.65	8.14	9.05	10.09	69.80	69.80	69.80	69.80

Combustable Recovery								
Mesh #	P1	P2	P3	P4	Tailings			
+100	30.39	45.73	48.17	49.98	100.00	100.00	100.00	100.00
100x200	43.19	69.48	81.33	84.69	100.00	100.00	100.00	100.00
200x325	46.89	70.65	84.45	89.94	100.00	100.00	100.00	100.00
Minus 325	28.13	52.32	68.03	73.83	100.00	100.00	100.00	100.00

Ash Rejection								
Mesh #	P1	P2	P3	P4	Tailings			
+100	76.13	63.74	61.09	58.75	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
100x200	63.85	38.87	26.43	22.53	0.00	0.00	0.00	0.00
200x325	65.65	47.74	34.88	27.60	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Minus 325	98.99	97.99	97.07	96.41	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Kinetic Test

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+100	28.51	39.75	43.30	45.30	53.47	100.00	100.00	100.00
100x200	36.44	60.57	73.46	76.47	82.82	100.00	100.00	100.00
200x325	44.15	65.02	78.45	84.47	90.05	100.00	100.00	100.00
Minus 325	11.27	20.13	27.24	32.72	39.48	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	2.99	3.01	3.05	3.08	3.09	3.35	3.35	3.35
100x200	3.61	3.75	3.81	3.82	3.83	4.06	4.06	4.06
200x325	5.54	5.65	5.81	5.91	6.02	6.92	6.92	6.92
Minus 325	20.36	21.16	24.35	29.29	35.96	68.49	68.49	68.49

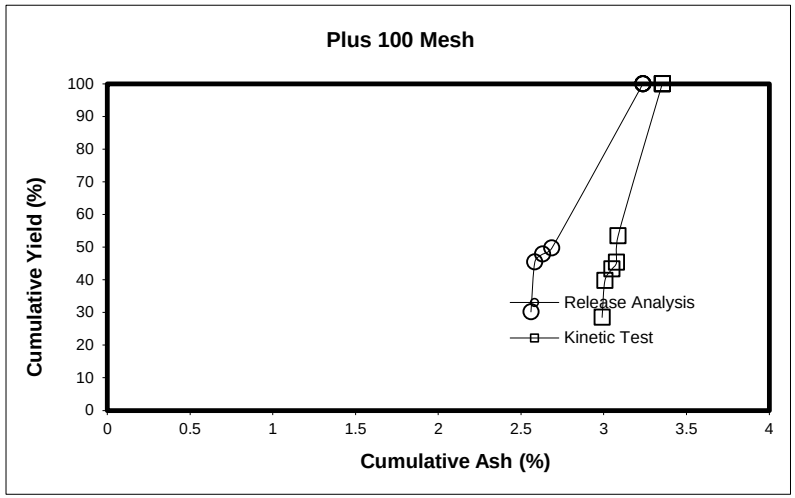
Combustable Recovery								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	28.61	39.90	43.43	45.43	53.61	100.00	100.00	100.00
100x200	36.61	60.77	73.65	76.66	83.02	100.00	100.00	100.00
200x325	44.81	65.91	79.39	85.40	90.92	100.00	100.00	100.00
Minus 325	28.49	50.36	65.40	73.44	80.26	100.00	100.00	100.00

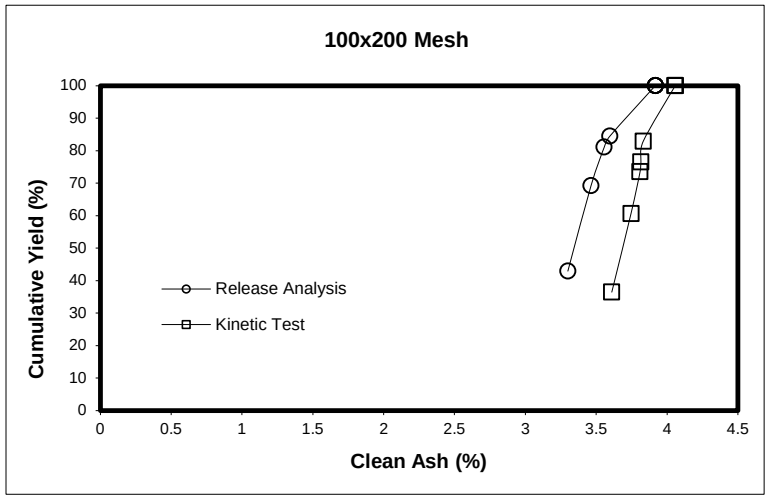
Ash Rejection								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	74.58	64.35	60.62	58.43	50.79	#DIV/0!	#DIV/0!	#DIV/0!
100x200	67.58	44.09	31.04	28.09	21.80	#DIV/0!	#DIV/0!	#DIV/0!
200x325	64.66	46.97	34.11	27.93	21.65	#DIV/0!	#DIV/0!	#DIV/0!
Minus 325	96.65	93.78	90.32	86.01	79.27	#DIV/0!	#DIV/0!	#DIV/0!

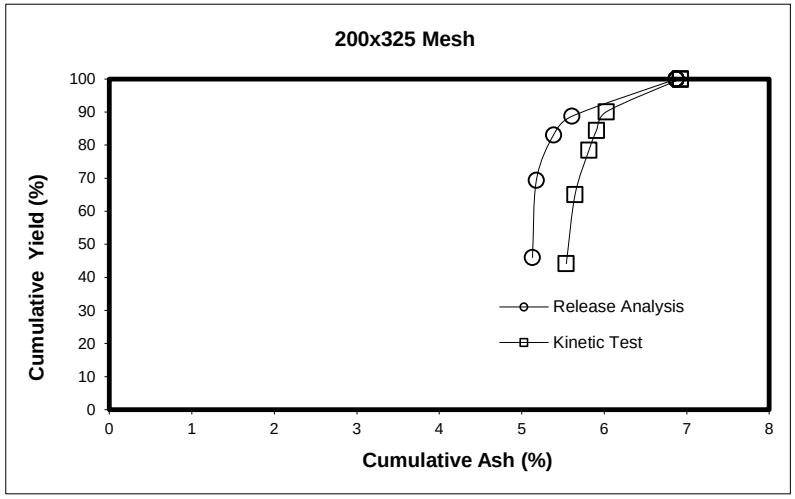
PERFORMANCE COMPARISON

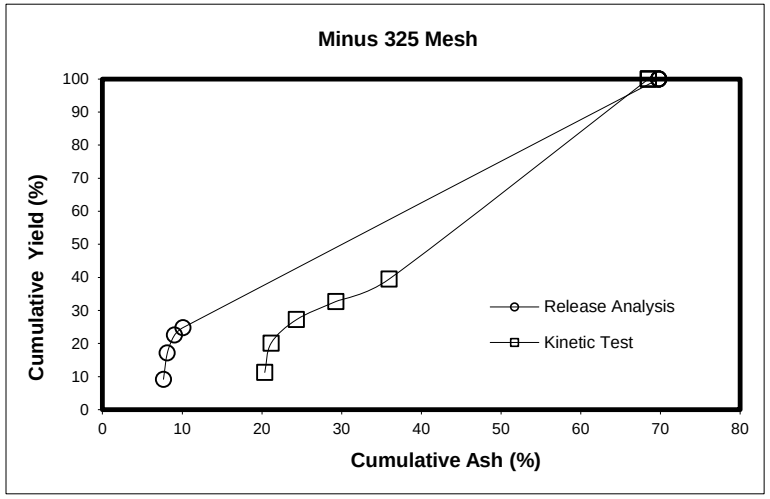
Description: 0.15 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Spiral Clean)





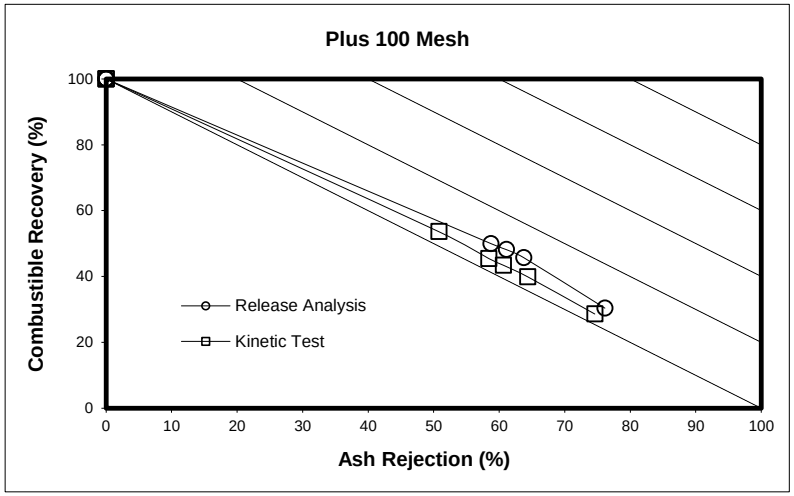


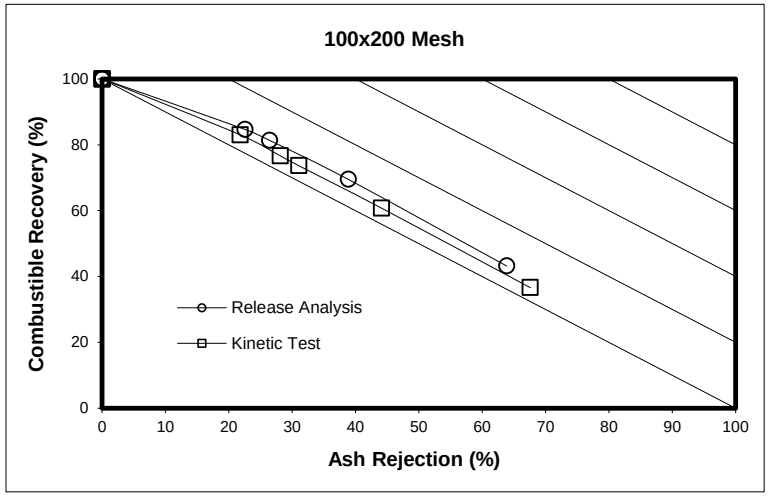


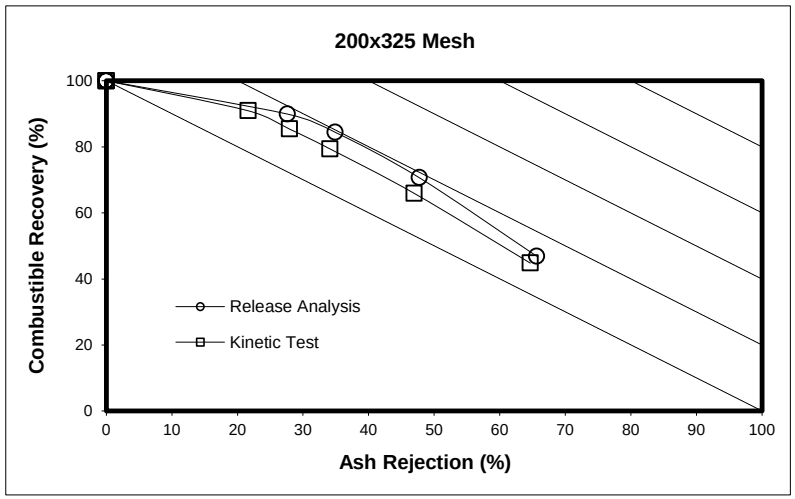
PERFORMANCE COMPARISON

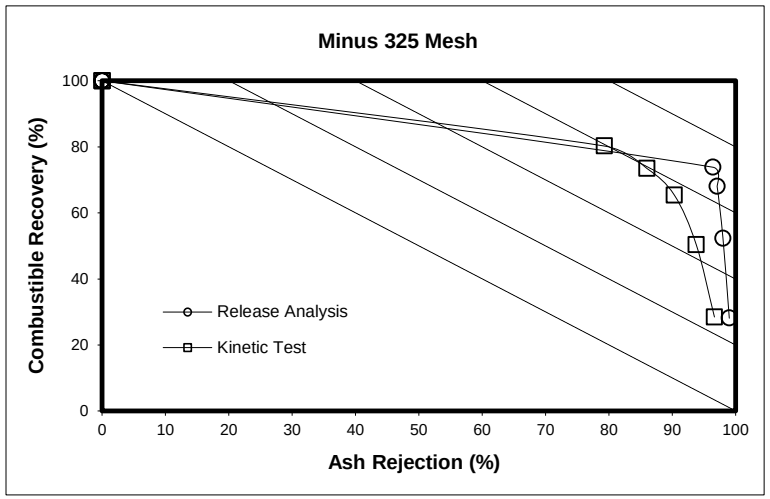
Description: 0.15 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Spiral Clean)









FLOTATION (RELEASE ANALYSIS)

Description: 0.15 x 0 mm Nominal Particle Size
Comments: Flotation Tests (Spiral Clean)

PERFORMANCE BY PRODUCT AND SIZE (Release)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+100	0.82	0.15	0.06	0.02	1.23				2.28
100x200	6.97	2.53	1.84	0.27	2.82				14.43
200x325	6.29	2.44	1.94	0.81	1.88				13.36
Minus 325	7.25	4.40	3.54	1.69	53.05				69.94
Total (Calc.)	21.34	9.52	7.38	2.79	58.97				100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+100	2.58	2.51	3.47	0.01	3.59				3.12
100x200	3.34	3.50	4.02	4.91	5.79				3.96
200x325	4.97	5.16	6.06	8.11	13.75				6.59
Minus 325	7.50	8.34	10.33	17.62	87.84				68.88
Total (Calc.)	5.21	6.15	7.58	13.50	79.81				49.70

FLOTATION (KINETIC TEST)

Description: 0.15 x 0 mm Nominal Particle Size
Comments: Flotation Tests (Spiral Clean)

PERFORMANCE BY PRODUCT AND SIZE (Timed Kinetics)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+100	0.93	0.23	0.07	0.02	0.00	0.52			1.76
100x200	8.69	2.93	1.06	0.14	0.46	0.86			14.15
200x325	8.46	2.70	1.33	0.46	0.44	0.61			13.99
Minus 325	10.12	5.91	4.14	2.95	4.56	42.42			70.09
Total (Calc.)	28.19	11.76	6.60	3.57					100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+100	2.82	2.90	3.68	0.04	0.03	3.91			3.16
100x200	3.65	4.15	4.23	4.11	4.46	5.98			3.97
200x325	5.53	6.12	7.12	7.79	8.13	16.18			6.41
Minus 325	20.75	23.18	38.39	54.85	70.01	90.25			68.70
Total (Calc.)	10.32	14.13	26.26	46.46					49.67

Release Analysis

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+100	35.95	42.48	45.10	46.08	100.00	100.00	100.00	100.00
100x200	48.32	65.84	78.61	80.47	100.00	100.00	100.00	100.00
200x325	47.13	65.38	79.91	85.95	100.00	100.00	100.00	100.00
Minus 325	10.37	16.66	21.73	24.15	100.00	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	Tailings			
+100	2.58	2.57	2.62	2.57	3.12	3.12	3.12	3.12
100x200	3.34	3.38	3.49	3.52	3.96	3.96	3.96	3.96
200x325	4.97	5.02	5.21	5.42	6.59	6.59	6.59	6.59
Minus 325	7.50	7.82	8.40	9.33	68.88	68.88	68.88	68.88

Combustable Recovery								
Mesh #	P1	P2	P3	P4	Tailings			
+100	36.15	42.72	45.33	46.34	100.00	100.00	100.00	100.00
100x200	48.64	66.24	79.00	80.84	100.00	100.00	100.00	100.00
200x325	47.94	66.48	81.08	87.03	100.00	100.00	100.00	100.00
Minus 325	30.82	49.36	63.96	70.36	100.00	100.00	100.00	100.00

Ash Rejection								
Mesh #	P1	P2	P3	P4	Tailings			
+100	70.26	64.99	62.09	62.08	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
100x200	59.27	43.80	30.84	28.54	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
200x325	64.44	50.13	36.77	29.33	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Minus 325	98.87	98.11	97.35	96.73	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Kinetic Test

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+100	52.68	65.74	69.59	70.45	70.45	100.00	100.00	100.00
100x200	61.39	82.10	89.59	90.61	93.89	100.00	100.00	100.00
200x325	60.44	79.74	89.21	92.53	95.66	100.00	100.00	100.00
Minus 325	14.44	22.86	28.77	32.98	39.48	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	2.82	2.84	2.88	2.85	2.85	3.16	3.16	3.16
100x200	3.65	3.78	3.81	3.82	3.84	3.97	3.97	3.97
200x325	5.53	5.67	5.83	5.90	5.97	6.41	6.41	6.41
Minus 325	20.75	21.65	25.08	28.88	35.66	68.70	68.70	68.70

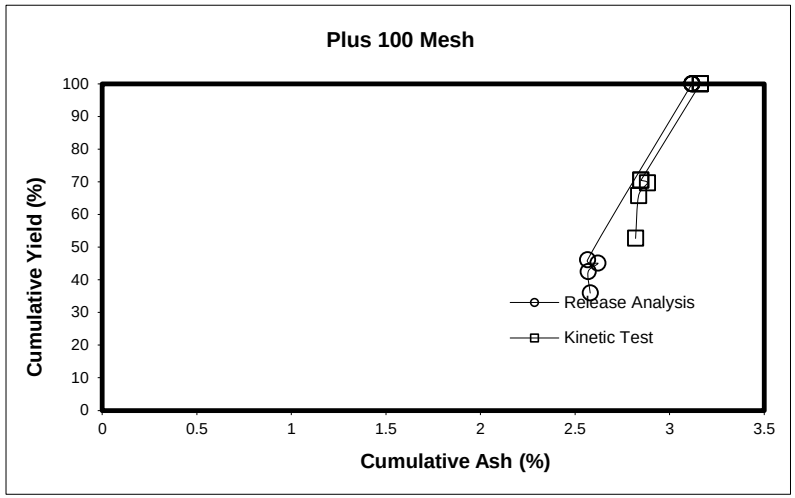
Combustable Recovery								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	52.86	65.96	69.79	70.68	70.68	100.00	100.00	100.00
100x200	61.60	82.26	89.74	90.75	94.02	100.00	100.00	100.00
200x325	61.01	80.37	89.77	93.04	96.11	100.00	100.00	100.00
Minus 325	36.55	57.22	68.85	74.92	81.15	100.00	100.00	100.00

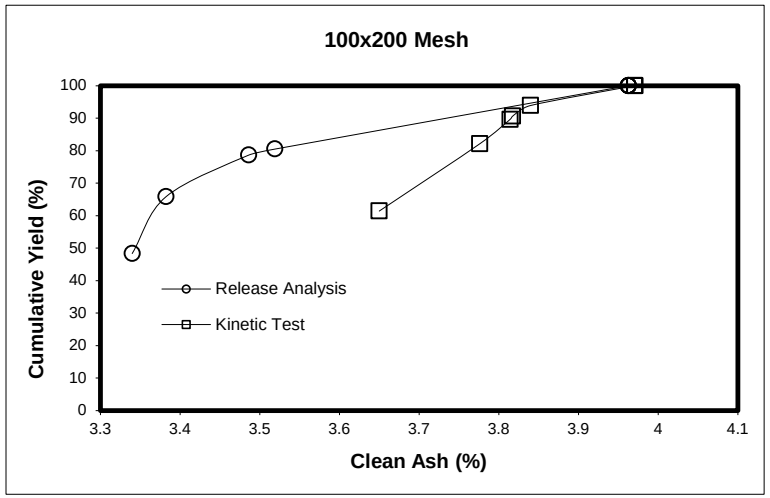
Ash Rejection								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	53.02	41.04	36.55	36.54	36.54	#DIV/0!	#DIV/0!	#DIV/0!
100x200	43.56	21.92	13.94	12.89	9.20	#DIV/0!	#DIV/0!	#DIV/0!
200x325	47.88	29.47	18.96	14.93	10.96	#DIV/0!	#DIV/0!	#DIV/0!
Minus 325	95.64	92.80	89.49	86.14	79.51	#DIV/0!	#DIV/0!	#DIV/0!

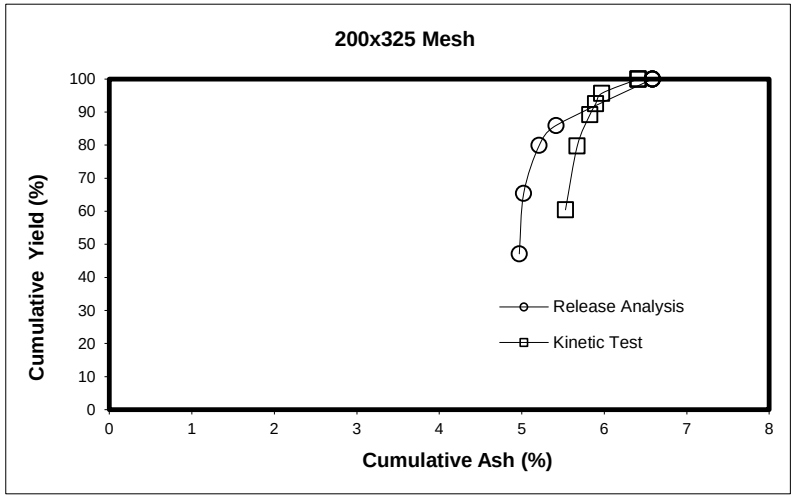
PERFORMANCE COMPARISON

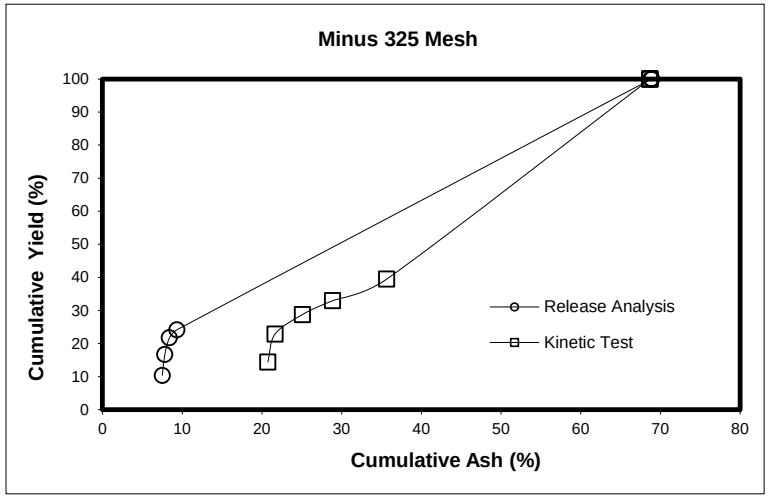
Description: 0.15 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Spiral Clean)





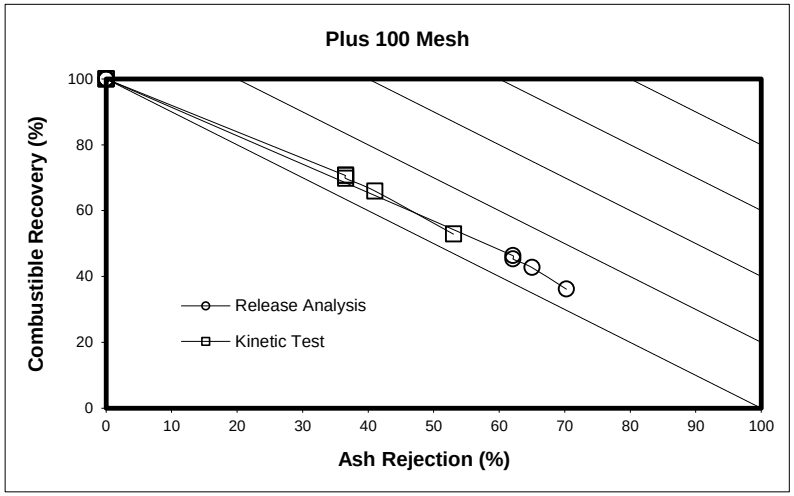


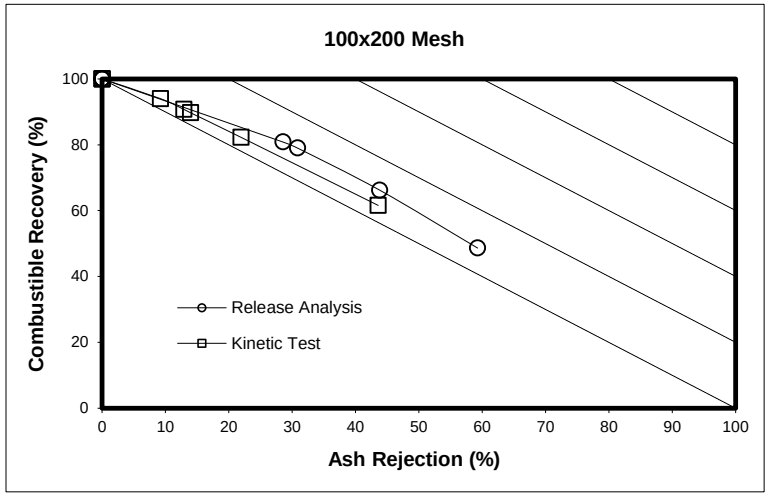


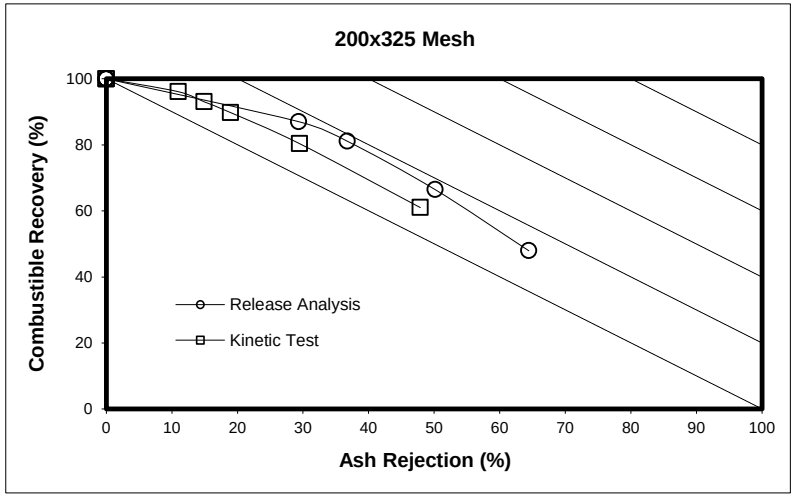
PERFORMANCE COMPARISON

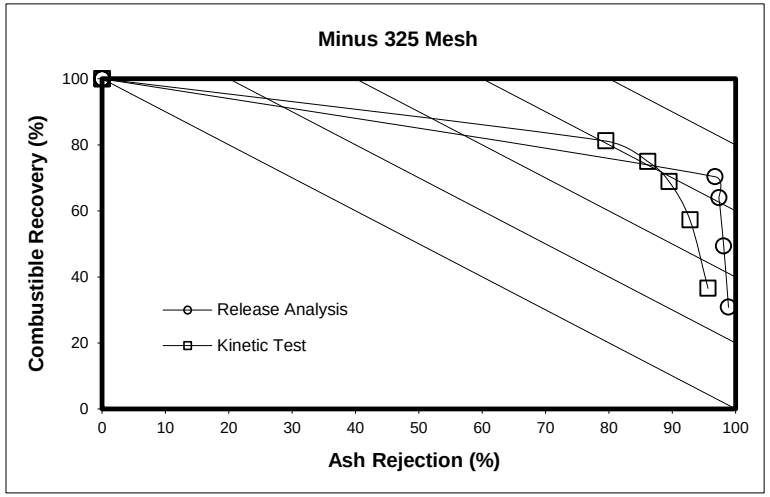
Description: 0.15 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Spiral Clean)









FLOTATION (RELEASE ANALYSIS)

Description: 0.15 x 0 mm Nominal Particle Size
Comments: Flotation Tests (Spiral Clean)

PERFORMANCE BY PRODUCT AND SIZE (Release)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+100	0.26	0.24	0.03	0.01	1.83				2.37
100x200	3.28	3.58	2.23	0.89	4.46				14.42
200x325	3.93	3.45	2.64	1.72	2.33				14.07
Minus 325	3.63	5.38	3.76	3.16	53.21				69.14
Total (Calc.)	11.10	12.65	8.65	5.77	61.83				100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+100	2.46	2.46	2.93	3.87	3.87				3.56
100x200	3.22	3.49	3.82	4.43	5.43				4.14
200x325	4.76	5.03	5.70	7.43	14.74				6.98
Minus 325	7.09	7.84	9.32	14.15	88.13				69.96
Total (Calc.)	5.01	5.74	6.78	10.64	76.90				50.03

FLOTATION (KINETIC TEST)

Description: 0.15 x 0 mm Nominal Particle Size
Comments: Flotation Tests (Spiral Clean)

PERFORMANCE BY PRODUCT AND SIZE (Timed Kinetics)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+100	0.44	0.17	0.05	0.01	0.17	1.00			1.84
100x200	5.50	2.61	1.78	0.48	1.80	2.23			14.41
200x325	5.94	2.29	1.88	1.01	1.30	1.28			13.71
Minus 325	8.26	4.64	4.80	3.58	5.83	42.93			70.04
Total (Calc.)	20.15	9.71	8.51	5.09					100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+100	2.99	2.99	3.66		3.14	4.16			3.64
100x200	3.62	3.83	4.00	4.08	4.19	5.63			4.10
200x325	5.42	5.86	6.56	6.89	8.30	17.48			7.16
Minus 325	18.20	16.96	33.37	46.76	66.12	89.67			68.41
Total (Calc.)	10.12	10.57	21.12	34.67					49.55

Release Analysis

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+100	10.84	20.95	22.11	22.54	100.00	100.00	100.00	100.00
100x200	22.73	47.51	62.94	69.08	100.00	100.00	100.00	100.00
200x325	27.93	52.47	71.24	83.46	100.00	100.00	100.00	100.00
Minus 325	5.26	13.04	18.48	23.04	100.00	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	Tailings			
+100	2.46	2.46	2.48	2.51	3.56	3.56	3.56	3.56
100x200	3.22	3.36	3.47	3.56	4.14	4.14	4.14	4.14
200x325	4.76	4.89	5.10	5.44	6.98	6.98	6.98	6.98
Minus 325	7.09	7.54	8.06	9.27	69.96	69.96	69.96	69.96

Combustable Recovery								
Mesh #	P1	P2	P3	P4	Tailings			
+100	10.96	21.19	22.36	22.79	100.00	100.00	100.00	100.00
100x200	22.94	47.90	63.37	69.49	100.00	100.00	100.00	100.00
200x325	28.60	53.65	72.68	84.84	100.00	100.00	100.00	100.00
Minus 325	16.26	40.13	56.55	69.59	100.00	100.00	100.00	100.00

Ash Rejection								
Mesh #	P1	P2	P3	P4	Tailings			
+100	92.52	85.54	84.59	84.11	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
100x200	82.31	61.40	47.16	40.59	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
200x325	80.95	63.27	47.94	34.93	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Minus 325	99.47	98.60	97.87	96.95	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Kinetic Test

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+100	23.86	32.97	35.88	36.43	45.72	100.00	100.00	100.00
100x200	38.18	56.31	68.65	72.00	84.50	100.00	100.00	100.00
200x325	43.37	60.06	73.79	81.18	90.68	100.00	100.00	100.00
Minus 325	11.80	18.42	25.27	30.38	38.71	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	2.99	2.99	3.04	3.00	3.03	3.64	3.64	3.64
100x200	3.62	3.69	3.74	3.76	3.82	4.10	4.10	4.10
200x325	5.42	5.54	5.73	5.84	6.10	7.16	7.16	7.16
Minus 325	18.20	17.75	21.99	26.16	34.75	68.41	68.41	68.41

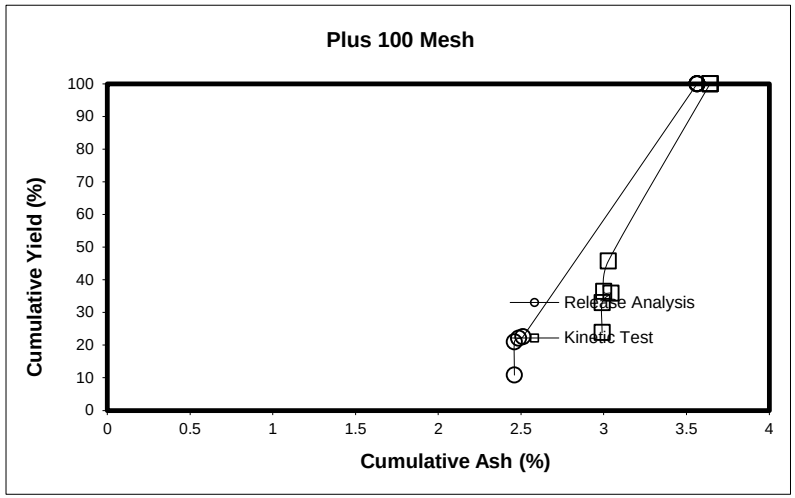
Combustable Recovery								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	24.02	33.19	36.11	36.67	46.01	100.00	100.00	100.00
100x200	38.37	56.55	68.90	72.26	84.74	100.00	100.00	100.00
200x325	44.18	61.10	74.92	82.33	91.71	100.00	100.00	100.00
Minus 325	30.55	47.95	62.41	71.03	79.96	100.00	100.00	100.00

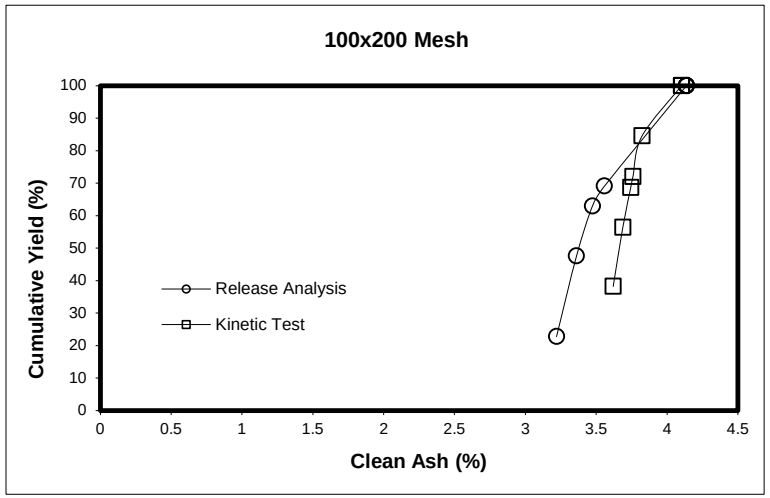
Ash Rejection								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	80.41	72.93	70.01	70.01	62.00	#DIV/0!	#DIV/0!	#DIV/0!
100x200	66.32	49.40	37.37	34.04	21.27	#DIV/0!	#DIV/0!	#DIV/0!
200x325	67.16	53.49	40.90	33.79	22.78	#DIV/0!	#DIV/0!	#DIV/0!
Minus 325	96.86	95.22	91.88	88.38	80.34	#DIV/0!	#DIV/0!	#DIV/0!

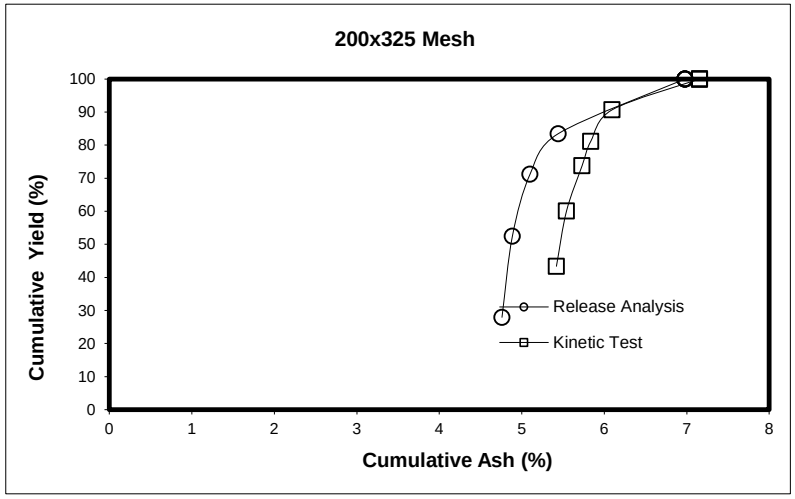
PERFORMANCE COMPARISON

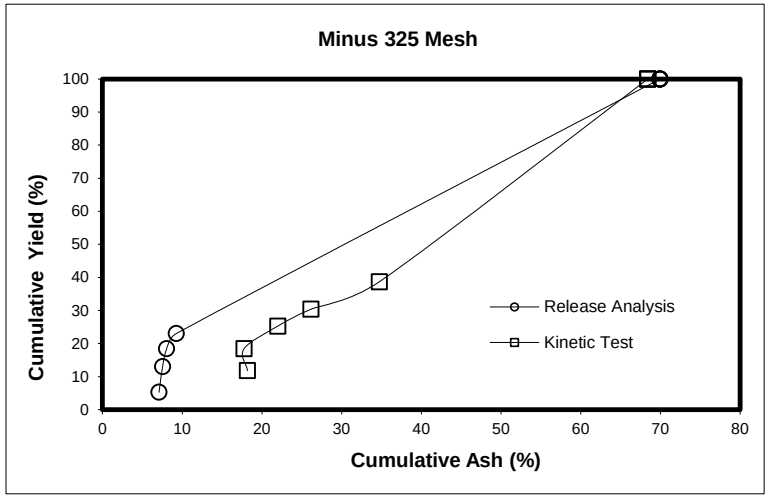
Description: 0.15 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Spiral Clean)





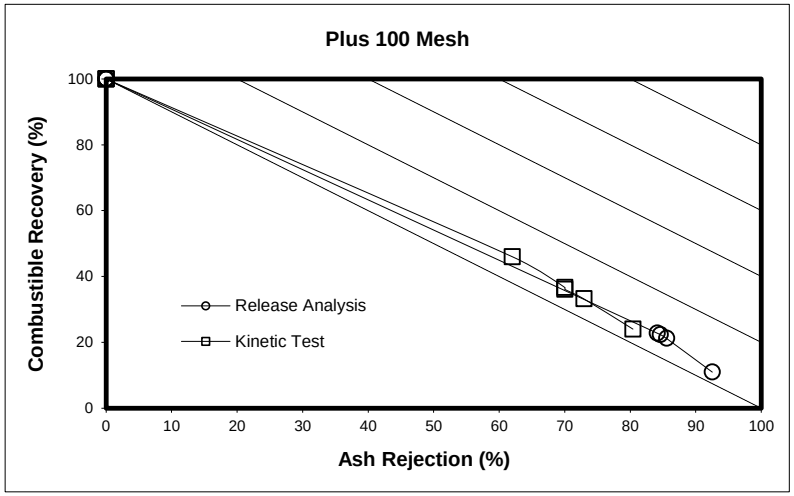


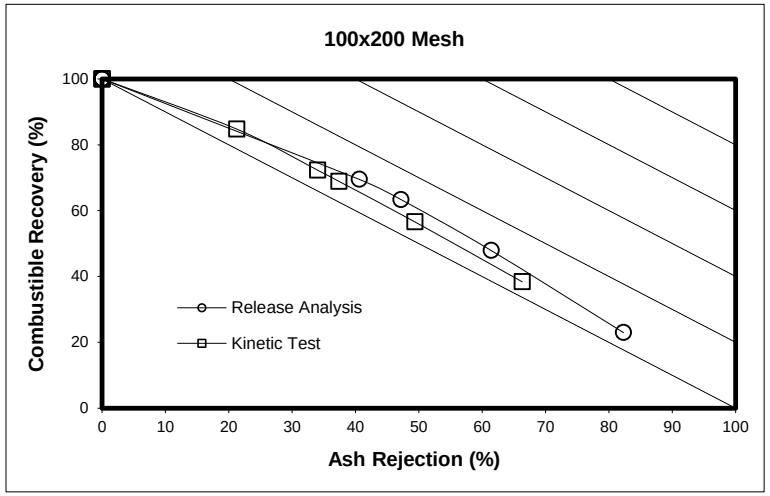


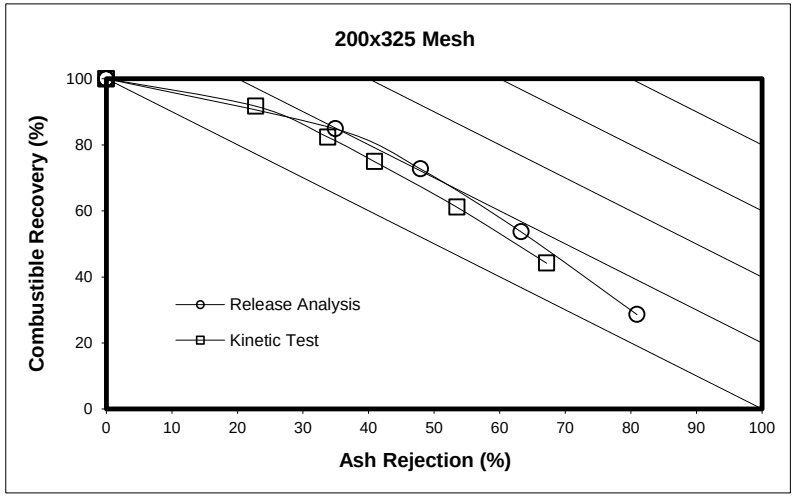
PERFORMANCE COMPARISON

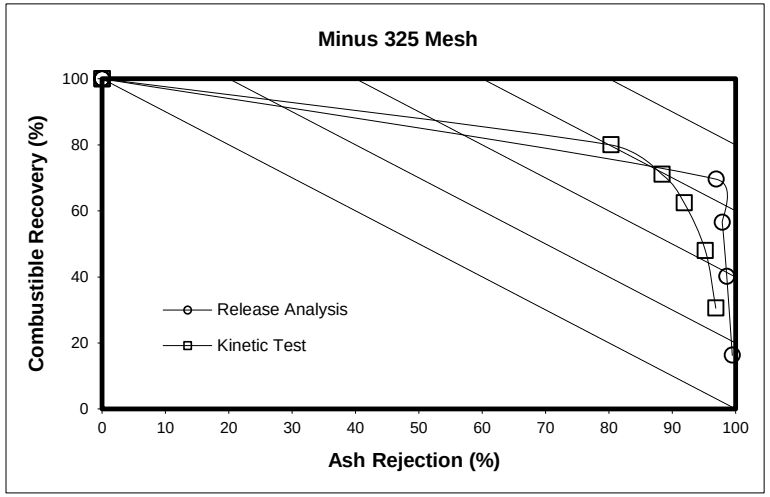
Description: 0.15 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Spiral Clean)









FLOTATION (RELEASE ANALYSIS)

Description: 0.15 x 0 mm Nominal Particle Size
Comments: Flotation Tests (Spiral Clean)

PERFORMANCE BY PRODUCT AND SIZE (Release)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+100	0.32	0.44	0.33	0.21	0.51				1.81
100x200	2.10	4.51	3.90	2.40	1.05				13.97
200x325	1.74	3.89	3.33	3.51	1.23				13.70
Minus 325	4.44	6.10	4.52	2.47	52.99				70.52
Total (Calc.)	8.61	14.95	12.08	8.59	55.77				100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+100	2.87	2.94	3.13	3.48	5.33				3.69
100x200	3.41	3.67	3.94	4.61	7.77				4.18
200x325	5.07	5.40	6.30	8.26	21.99				7.80
Minus 325	7.58	8.31	10.56	16.63	89.19				69.47
Total (Calc.)	5.88	5.99	7.04	9.52	85.42				50.71

FLOTATION (KINETIC TEST)

Description: 0.15 x 0 mm Nominal Particle Size
Comments: Flotation Tests (Spiral Clean)

PERFORMANCE BY PRODUCT AND SIZE (Timed Kinetics)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+100	0.60	0.19	0.07	0.00	0.03	0.79			1.68
100x200	5.93	2.89	1.65	0.68	1.01	1.86			14.02
200x325	6.42	2.07	1.85	1.28	1.14	1.18			13.94
Minus 325	7.65	5.11	4.12	4.14	6.11	43.23			70.36
Total (Calc.)	20.60	10.27	7.68	6.10					100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+100	3.02	3.05	3.66			4.28			3.59
100x200	3.66	3.95	3.97	4.03	4.30	5.71			4.09
200x325	5.56	5.76	6.35	7.01	8.70	20.41			7.35
Minus 325	19.03	19.93	25.57	40.47	67.77	90.12			68.65
Total (Calc.)	9.94	12.25	16.12	29.39					49.96

Release Analysis

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+100	17.72	41.93	60.35	72.11	100.00	100.00	100.00	100.00
100x200	15.07	47.37	75.28	92.49	100.00	100.00	100.00	100.00
200x325	12.71	41.11	65.43	91.04	100.00	100.00	100.00	100.00
Minus 325	6.29	14.95	21.36	24.86	100.00	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	Tailings			
+100	2.87	2.91	2.98	3.06	3.69	3.69	3.69	3.69
100x200	3.41	3.59	3.72	3.88	4.18	4.18	4.18	4.18
200x325	5.07	5.30	5.67	6.40	7.80	7.80	7.80	7.80
Minus 325	7.58	8.00	8.77	9.88	69.47	69.47	69.47	69.47

Combustable Recovery								
Mesh #	P1	P2	P3	P4	Tailings			
+100	17.87	42.27	60.80	72.58	100.00	100.00	100.00	100.00
100x200	15.19	47.66	75.64	92.77	100.00	100.00	100.00	100.00
200x325	13.09	42.23	66.94	92.42	100.00	100.00	100.00	100.00
Minus 325	19.06	45.06	63.84	73.39	100.00	100.00	100.00	100.00

Ash Rejection								
Mesh #	P1	P2	P3	P4	Tailings			
+100	86.23	66.95	51.34	40.26	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
100x200	87.69	59.31	32.98	13.98	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
200x325	91.73	72.06	52.41	25.26	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Minus 325	99.31	98.28	97.30	96.47	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Kinetic Test

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+100	35.62	47.16	51.27	51.47	53.03	100.00	100.00	100.00
100x200	42.31	62.93	74.71	79.55	86.77	100.00	100.00	100.00
200x325	46.04	60.91	74.15	83.31	91.51	100.00	100.00	100.00
Minus 325	10.87	18.14	23.99	29.88	38.56	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	3.02	3.03	3.08	3.07	2.98	3.59	3.59	3.59
100x200	3.66	3.76	3.79	3.80	3.84	4.09	4.09	4.09
200x325	5.56	5.61	5.74	5.88	6.13	7.35	7.35	7.35
Minus 325	19.03	19.39	20.90	24.75	34.44	68.65	68.65	68.65

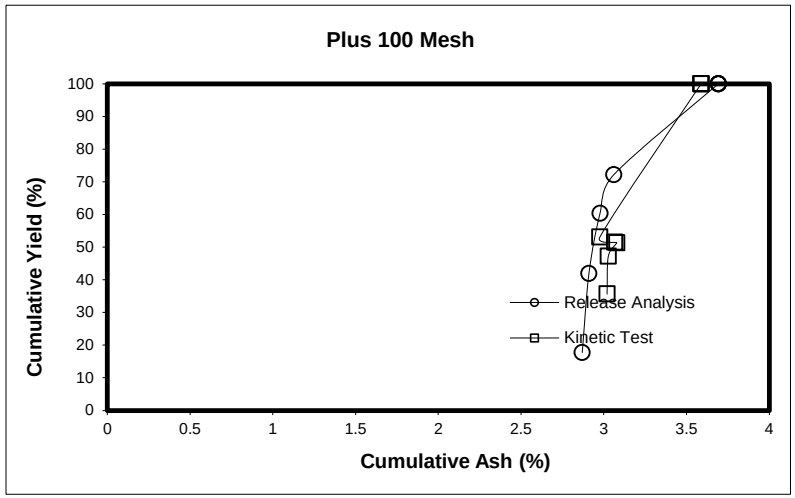
Combustable Recovery								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	35.83	47.44	51.54	51.75	53.37	100.00	100.00	100.00
100x200	42.50	63.15	74.94	79.79	86.99	100.00	100.00	100.00
200x325	46.93	62.05	75.44	84.62	92.71	100.00	100.00	100.00
Minus 325	28.08	46.64	60.54	71.71	80.64	100.00	100.00	100.00

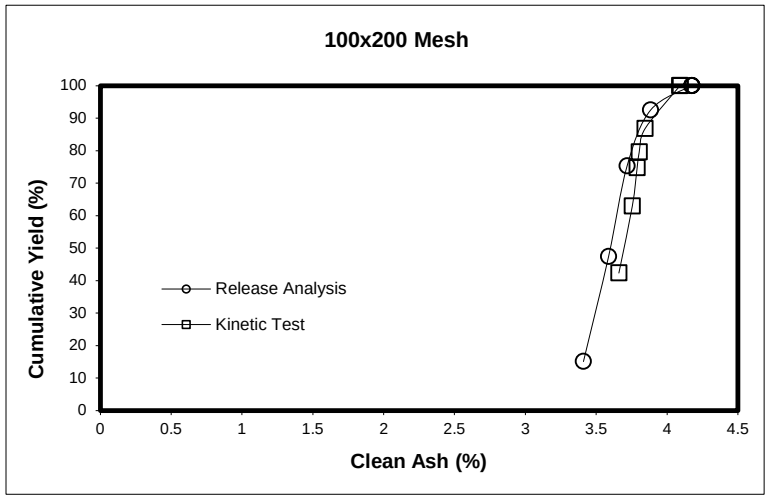
Ash Rejection								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	70.02	60.21	56.02	56.02	56.02	#DIV/0!	#DIV/0!	#DIV/0!
100x200	62.15	42.25	30.82	26.05	18.47	#DIV/0!	#DIV/0!	#DIV/0!
200x325	65.15	53.49	42.04	33.31	23.59	#DIV/0!	#DIV/0!	#DIV/0!
Minus 325	96.99	94.88	92.70	89.23	80.65	#DIV/0!	#DIV/0!	#DIV/0!

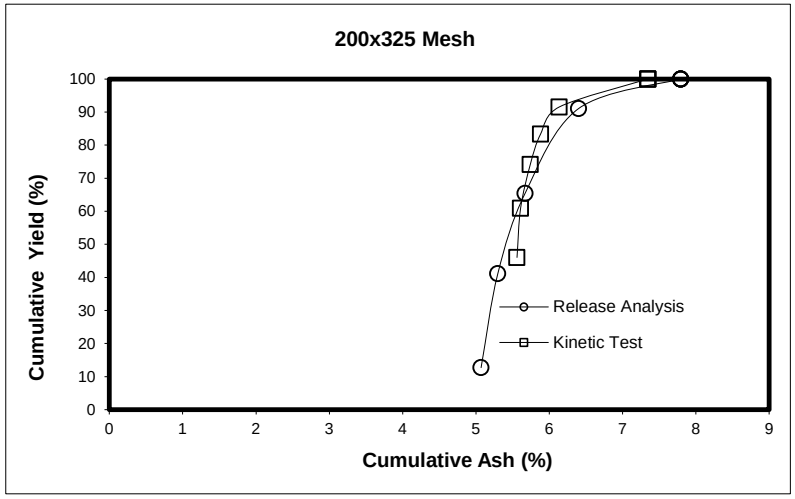
PERFORMANCE COMPARISON

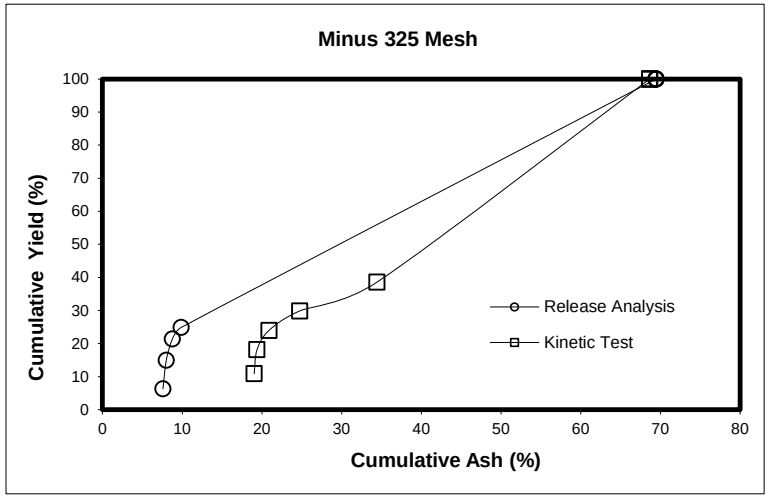
Description: 0.15 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Spiral Clean)





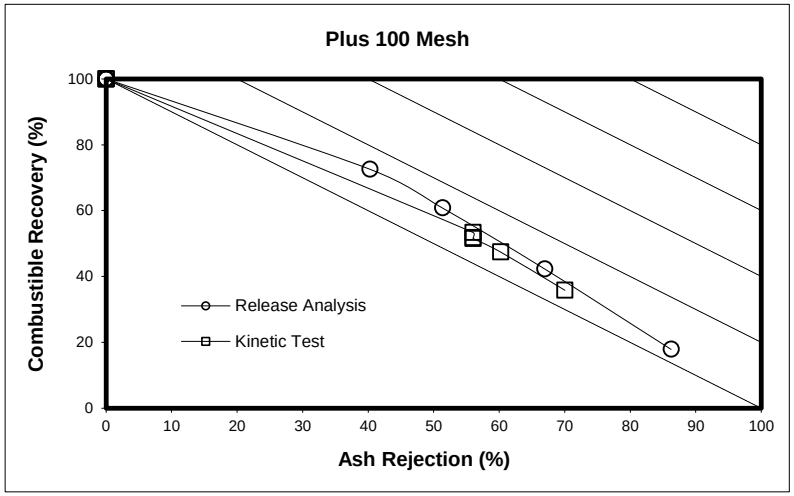


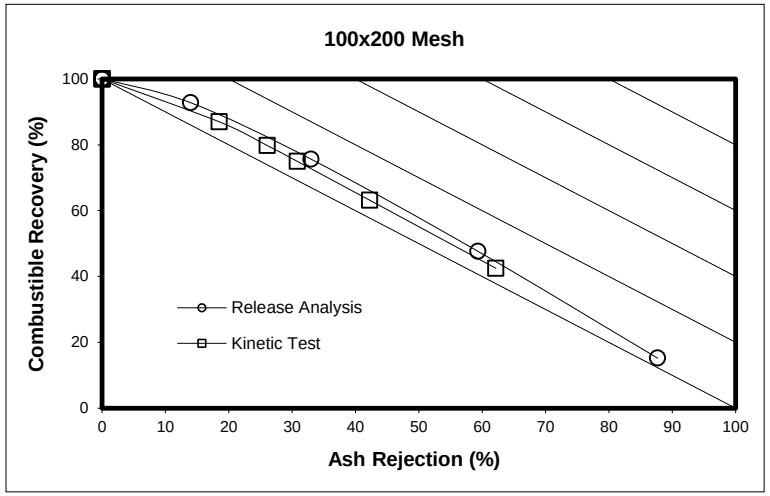


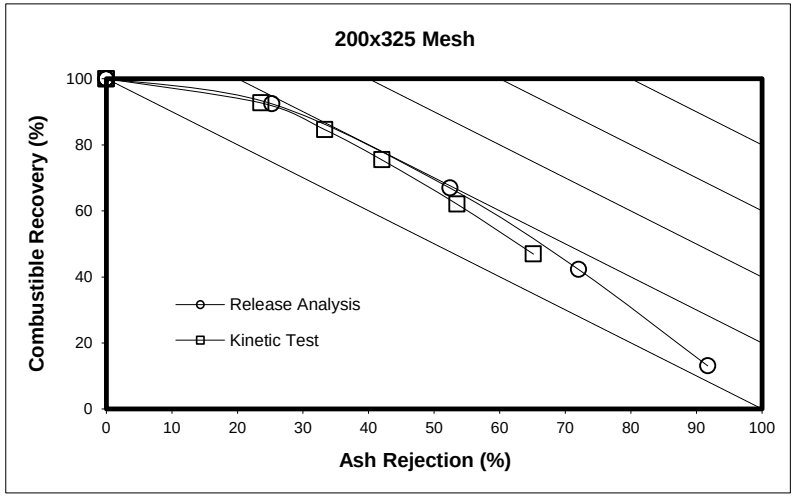
PERFORMANCE COMPARISON

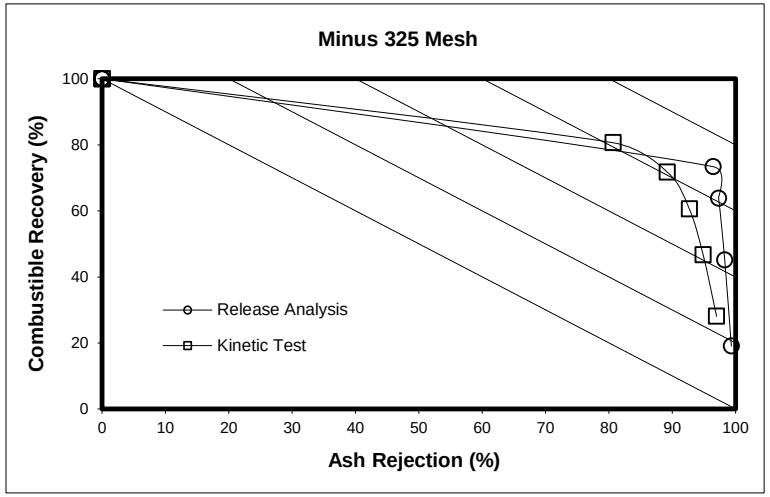
Description: 0.15 x 0 mm Nominal Particle Size

Comments: Flotation Tests (Spiral Clean)









APPENDIX K – Flotation Circuit Results (High Sulfur Feed Stock)

FLOTATION (RELEASE ANALYSIS)

Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios
Comments: High Sulfur Feed, Test with Frother only

PERFORMANCE BY PRODUCT AND SIZE (Release)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+60	0.06	0.07	0.20	0.26	3.35				3.95
60x100	3.37	3.26	3.47	2.39	6.19				18.68
100x200	8.56	6.16	5.18	2.76	7.11				29.77
200x325	3.35	1.80	1.24	0.63	8.79				15.82
-325	2.83	1.57	1.29	1.28	24.81				31.78
Total (Calc.)	18.18	12.87	11.38	7.32	50.25				100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+60	6.36	4.62	4.24	4.82	13.17				11.90
60x100	6.86	7.57	7.15	8.03	17.42				10.69
100x200	11.08	11.13	12.16	16.21	64.07				24.41
200x325	22.47	24.83	31.95	40.04	85.38				59.15
-325	20.96	26.06	30.47	37.98	87.85				74.50
Total (Calc.)	13.92	13.93	14.72	18.99	70.40				42.76

Sulfur Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+60	2.94	3.08	2.90	2.97	3.36				3.30
60x100	3.16	3.28	3.31	3.18	3.39				3.29
100x200	3.73	4.03	4.46	4.55	4.28				4.13
200x325	8.61	9.63	11.31	11.73	8.06				8.76
-325	9.50	11.74	12.49	13.08	7.40				8.24
Total (Calc.)	5.42	5.56	5.74	6.16	6.31				5.98

Release Analysis

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+60	1.55	3.41	8.56	15.14	100.00	100.00	100.00	100.00
60x100	18.05	35.50	54.07	66.88	100.00	100.00	100.00	100.00
100x200	28.76	49.45	66.85	76.13	100.00	100.00	100.00	100.00
200x325	21.17	32.57	40.43	44.43	100.00	100.00	100.00	100.00
-325	8.92	13.85	17.91	21.93	100.00	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	Tailings			
+60	6.36	5.41	4.71	4.76	11.90	11.90	11.90	11.90
60x100	6.86	7.21	7.19	7.35	10.69	10.69	10.69	10.69
100x200	11.08	11.10	11.38	11.97	24.41	24.41	24.41	24.41
200x325	22.47	23.30	24.98	26.33	59.15	59.15	59.15	59.15
-325	20.96	22.78	24.52	26.99	74.50	74.50	74.50	74.50

Cumulative Sulfur								
Mesh #	P1	P2	P3	P4	Tailings			
+60	2.94	3.02	2.95	2.96	3.30	3.30	3.30	3.30
60x100	3.16	3.22	3.25	3.24	3.29	3.29	3.29	3.29
100x200	3.73	3.86	4.01	4.08	4.13	4.13	4.13	4.13
200x325	8.61	8.97	9.42	9.63	8.76	8.76	8.76	8.76
-325	9.50	10.30	10.80	11.22	8.24	8.24	8.24	8.24

Combustable Recovery								
Mesh #	P1	P2	P3	P4	Tailings			
+60	1.65	3.66	9.26	16.36	100.00	100.00	100.00	100.00
60x100	18.82	36.88	56.19	69.37	100.00	100.00	100.00	100.00
100x200	33.82	58.16	78.37	88.65	100.00	100.00	100.00	100.00
200x325	40.17	61.16	74.25	80.11	100.00	100.00	100.00	100.00
-325	27.64	41.96	53.02	62.79	100.00	100.00	100.00	100.00

Ash Rejection								
Mesh #	P1	P2	P3	P4	Tailings			
+60	99.17	98.45	96.61	93.95	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
60x100	88.41	76.05	63.62	54.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
100x200	86.94	77.51	68.84	62.68	0.00	0.00	0.00	0.00
200x325	91.96	87.17	82.93	80.22	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
-325	97.49	95.77	94.11	92.06	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Sulfur Rejection								
Mesh #	P1	P2	P3	P4	Tailings			
+60	98.62	96.88	92.36	86.44	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
60x100	82.66	65.27	46.57	34.17	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
100x200	74.00	53.78	35.00	24.78	0.00	0.00	0.00	0.00
200x325	79.19	66.65	56.51	51.15	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
-325	89.71	82.68	76.53	70.14	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

FLOTATION (KINETIC TEST)

Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios
Comments: High Sulfur Feed, Test with Frother only

PERFORMANCE BY PRODUCT AND SIZE (Timed Kinetics)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+60	0.45	0.50	0.64	0.67	0.84	1.49			4.59
60x100	7.15	5.23	3.45	1.43	0.91	0.84			19.00
100x200	13.80	6.27	3.41	1.20	0.61	5.14			30.43
200x325	2.90	1.57	0.89	0.59	0.46	8.81			15.21
-325	3.80	2.10	1.46	1.89	1.63	19.89			30.76
Total (Calc.)	28.10	15.67	9.86	5.76					100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+60	4.55	5.42	5.57	6.60	7.20	28.59			13.40
60x100	6.40	7.66	8.80	13.10	17.17	51.33			10.19
100x200	10.75	13.55	17.22	30.65	50.69	80.29			25.38
200x325	24.25	28.77	36.19	53.68	67.91	87.19			64.31
-325	32.16	37.09	39.49	64.23	79.71	87.16			72.88
Total (Calc.)	13.83	16.01	18.54	36.85					42.48

Sulfur Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+60	3.02	3.09	3.20	3.23	3.35	3.66			3.35
60x100	3.22	3.40	3.53	3.64	3.81	3.32			3.39
100x200	4.14	4.33	5.02	6.17	6.27	2.63			4.14
200x325	9.10	10.29	11.50	13.47	15.02	5.60			7.68
-325	9.11	13.16	11.83	12.96	10.34	7.82			8.98
Total (Calc.)	5.07	5.76	5.98	8.17					5.99

Kinetic Test

Cumulative Yield								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+60	9.78	20.58	34.61	49.11	67.44	100.00	100.00	100.00
60x100	37.63	65.14	83.27	90.79	95.58	100.00	100.00	100.00
100x200	45.36	65.97	77.18	81.11	83.11	100.00	100.00	100.00
200x325	19.07	29.37	35.23	39.09	42.10	100.00	100.00	100.00
-325	12.35	19.19	23.94	30.07	35.36	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+60	4.55	5.01	5.23	5.64	6.06	13.40	13.40	13.40
60x100	6.40	6.93	7.34	7.82	8.28	10.19	10.19	10.19
100x200	10.75	11.63	12.44	13.32	14.22	25.38	25.38	25.38
200x325	24.25	25.84	27.56	30.14	32.84	64.31	64.31	64.31
-325	32.16	33.92	35.02	40.98	46.77	72.88	72.88	72.88

Cumulative Sulfur								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+60	3.02	3.06	3.12	3.15	3.20	3.35	3.35	3.35
60x100	3.22	3.30	3.35	3.37	3.39	3.39	3.39	3.39
100x200	4.14	4.20	4.32	4.41	4.45	4.14	4.14	4.14
200x325	9.10	9.52	9.85	10.20	10.55	7.68	7.68	7.68
-325	9.11	10.55	10.80	11.24	11.11	8.98	8.98	8.98

Combustable Recovery								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+60	10.78	22.57	37.87	53.51	73.15	100.00	100.00	100.00
60x100	39.22	67.50	85.91	93.19	97.60	100.00	100.00	100.00
100x200	54.25	78.13	90.57	94.22	95.54	100.00	100.00	100.00
200x325	40.46	61.03	71.51	76.51	79.22	100.00	100.00	100.00
-325	30.90	46.75	57.36	65.44	69.40	100.00	100.00	100.00

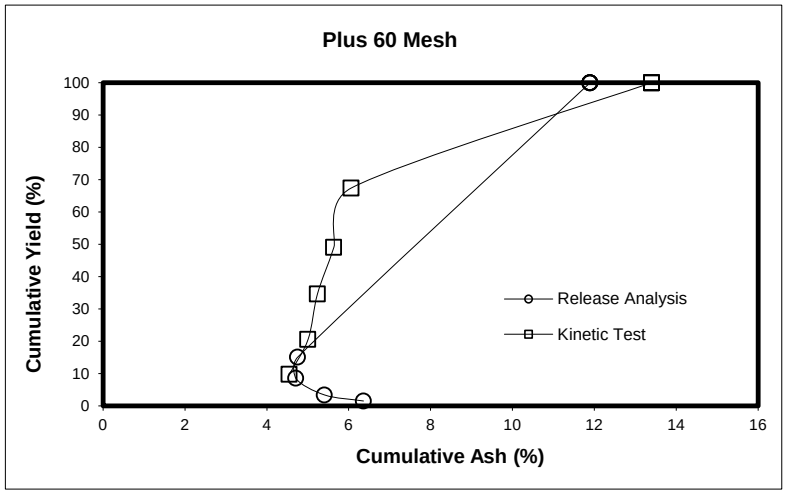
Ash Rejection								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+60	96.68	92.31	86.48	79.33	69.49	#DIV/0!	#DIV/0!	#DIV/0!
60x100	76.36	55.68	40.02	30.35	22.28	#DIV/0!	#DIV/0!	#DIV/0!
100x200	80.79	69.78	62.18	57.43	53.44	0.00	0.00	0.00
200x325	92.81	88.20	84.90	81.68	78.50	#DIV/0!	#DIV/0!	#DIV/0!
-325	94.55	91.07	88.49	83.09	77.31	#DIV/0!	#DIV/0!	#DIV/0!

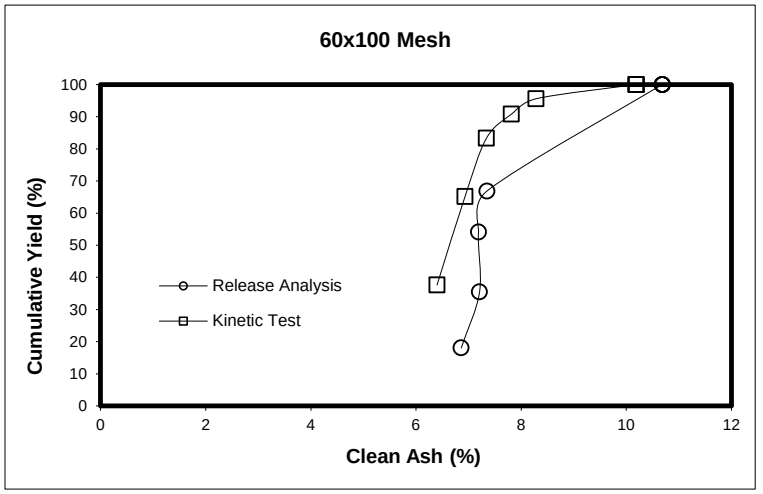
Sulfur Rejection								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+60	91.18	81.21	67.83	53.85	35.54	#DIV/0!	#DIV/0!	#DIV/0!
60x100	64.26	36.67	17.79	9.71	4.33	#DIV/0!	#DIV/0!	#DIV/0!
100x200	54.70	33.18	19.60	13.76	10.73	0.00	0.00	0.00
200x325	77.42	63.63	54.85	48.10	42.21	#DIV/0!	#DIV/0!	#DIV/0!
-325	87.48	77.48	71.21	62.37	56.29	#DIV/0!	#DIV/0!	#DIV/0!

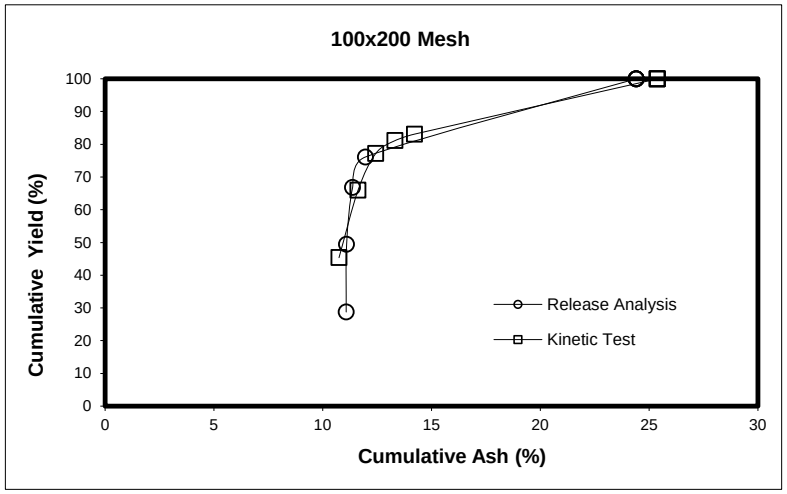
PERFORMANCE COMPARISON

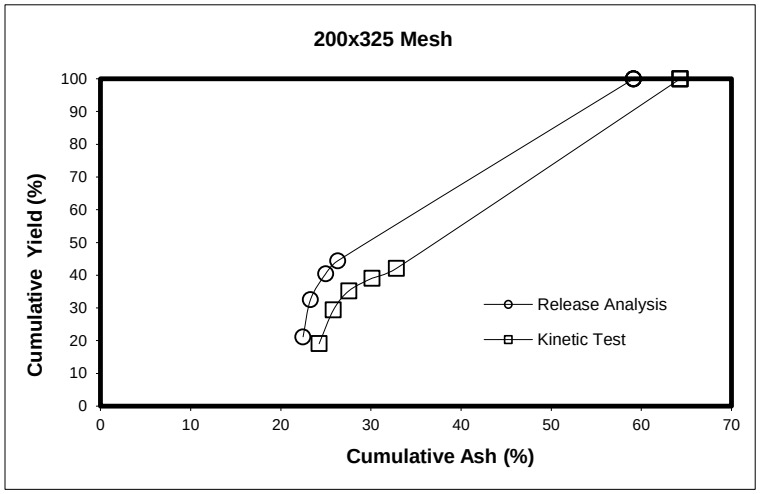
Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

Comments: High Sulfur Feed, Test with Frother only





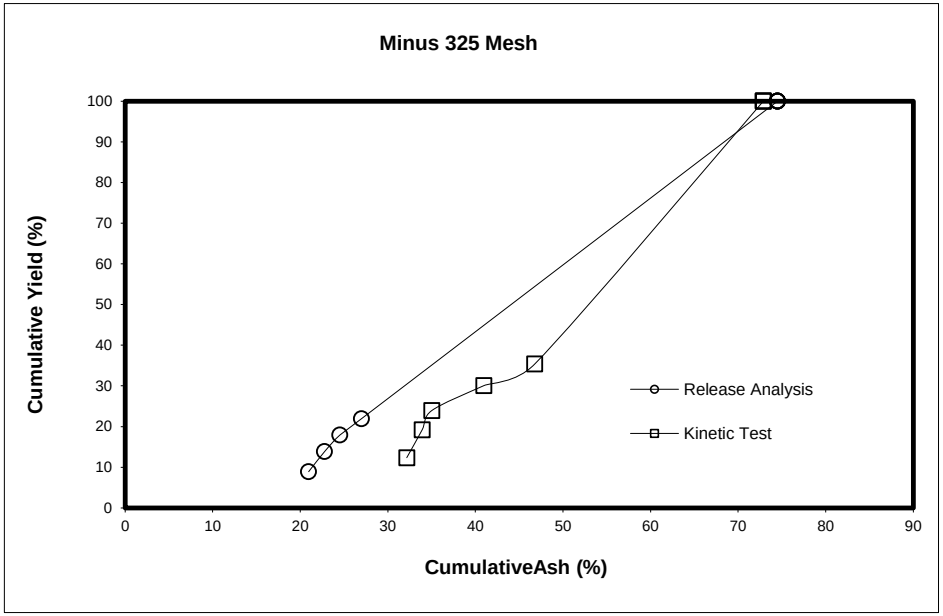




PERFORMANCE COMPARISON

Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

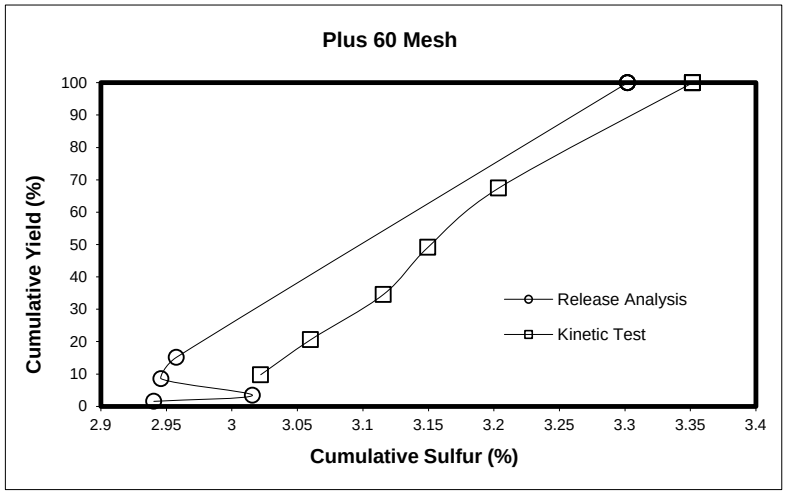
Comments: High Sulfur Feed, Test with Frother only

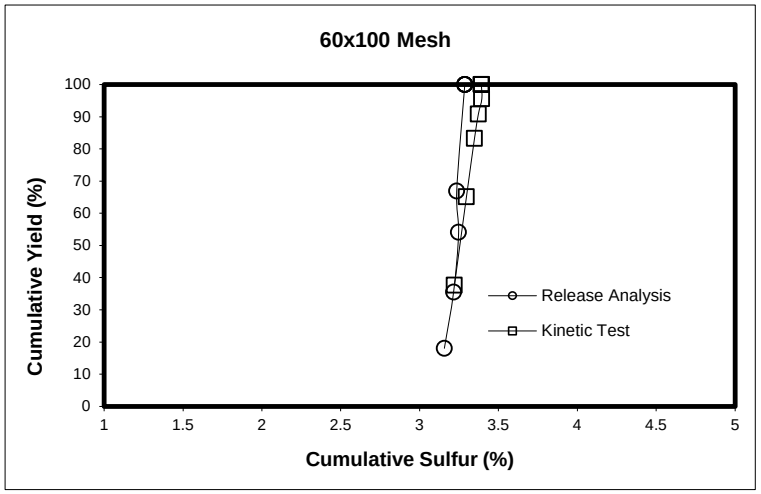


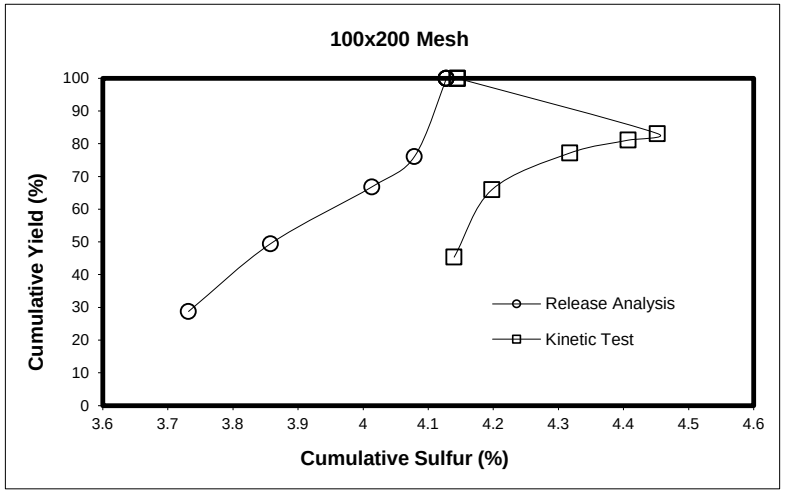
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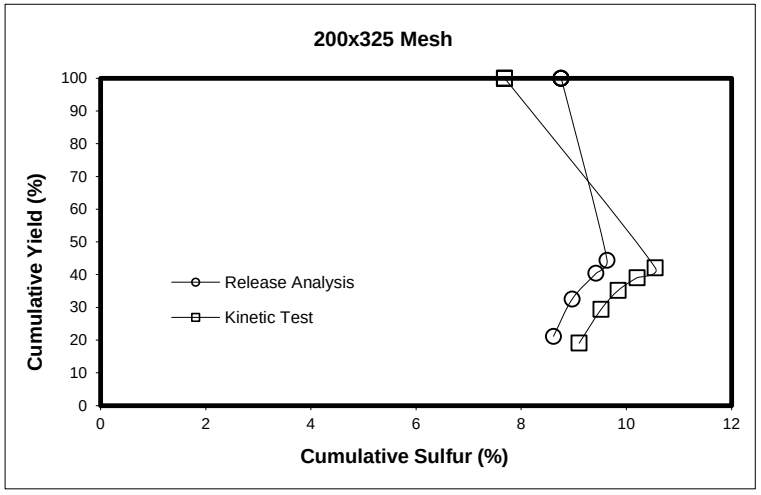
Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

Comments: High Sulfur Feed, Test with Frother only





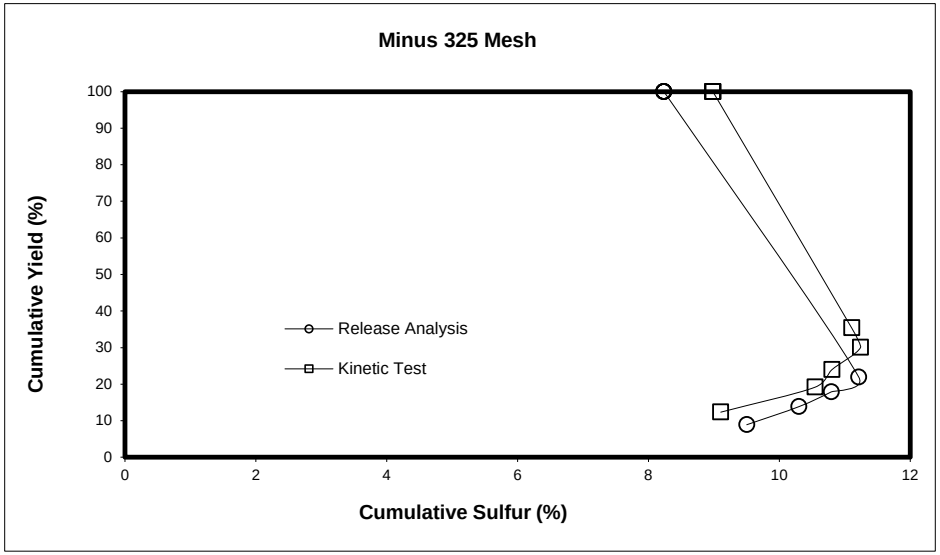




PERFORMANCE COMPARISON

Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

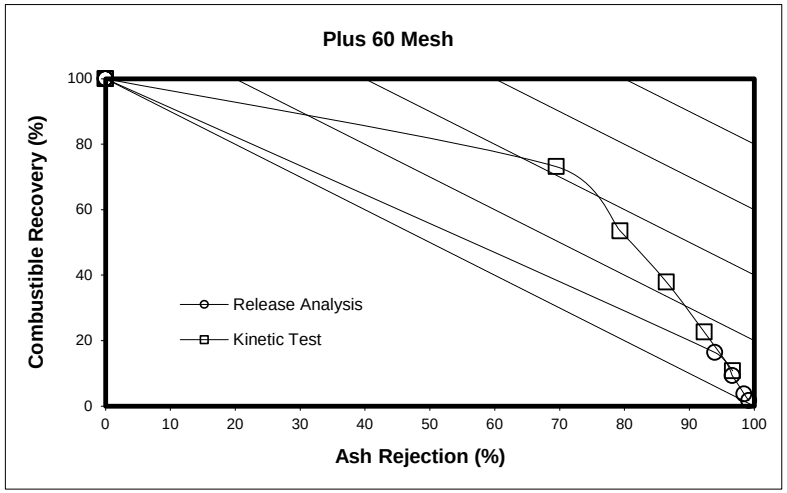
Comments: High Sulfur Feed, Test with Frother only

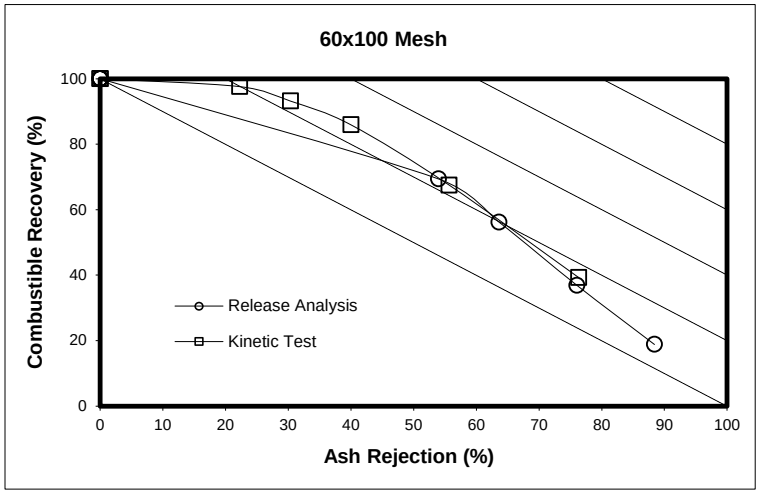


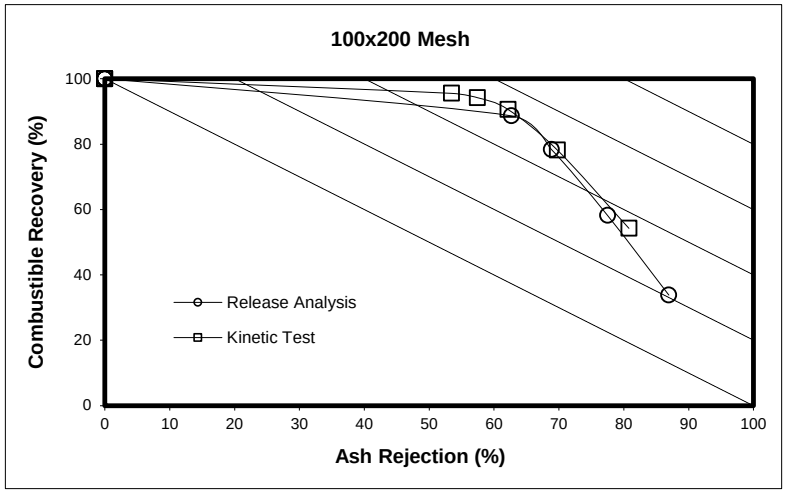
PERFORMANCE COMPARISON

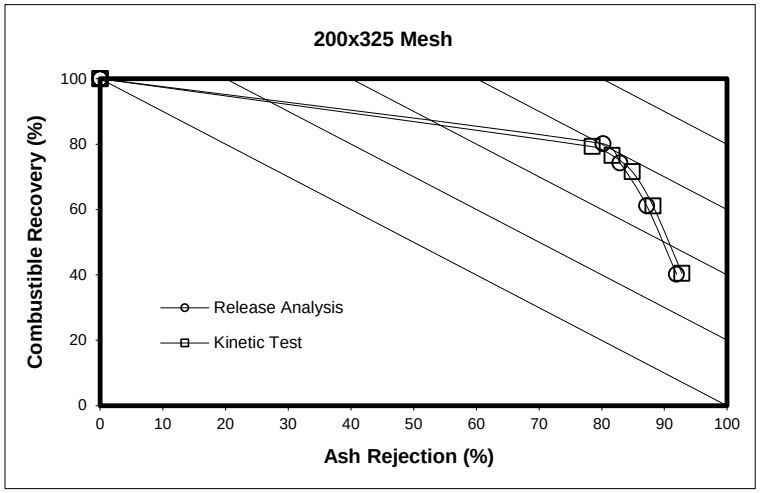
Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

Comments: High Sulfur Feed, Test with Frother only





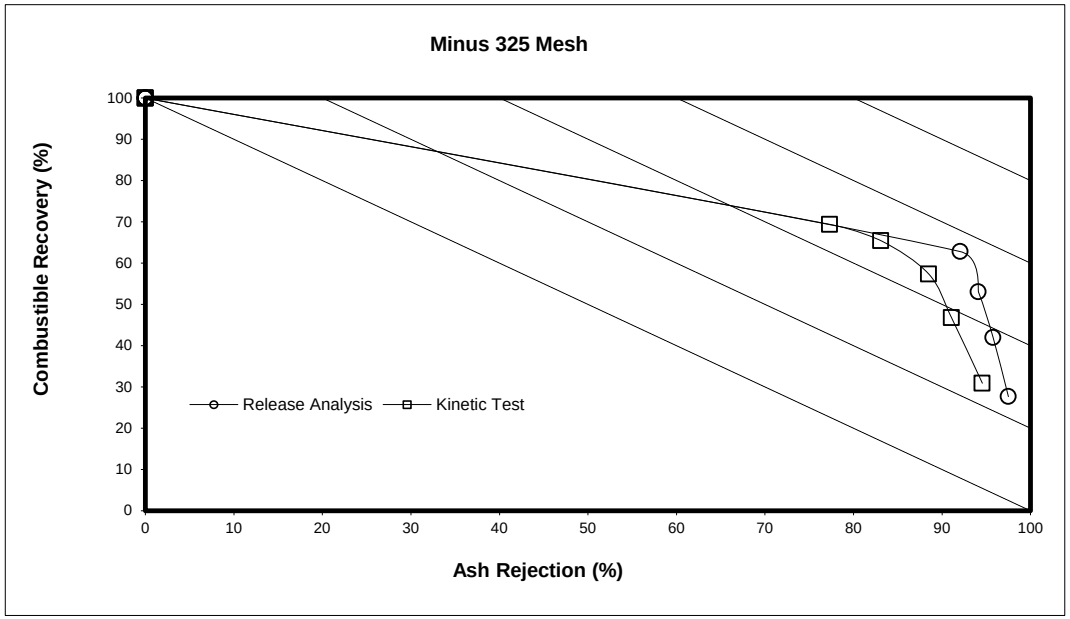




PERFORMANCE COMPARISON

Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

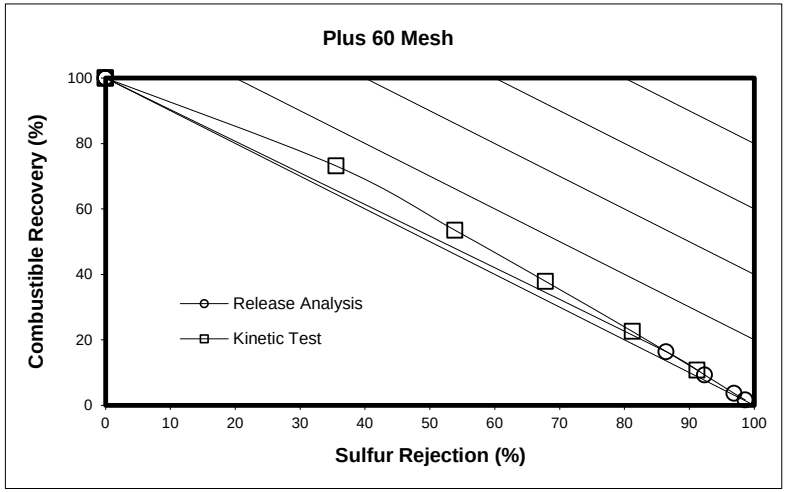
Comments: High Sulfur Feed, Test with Frother only

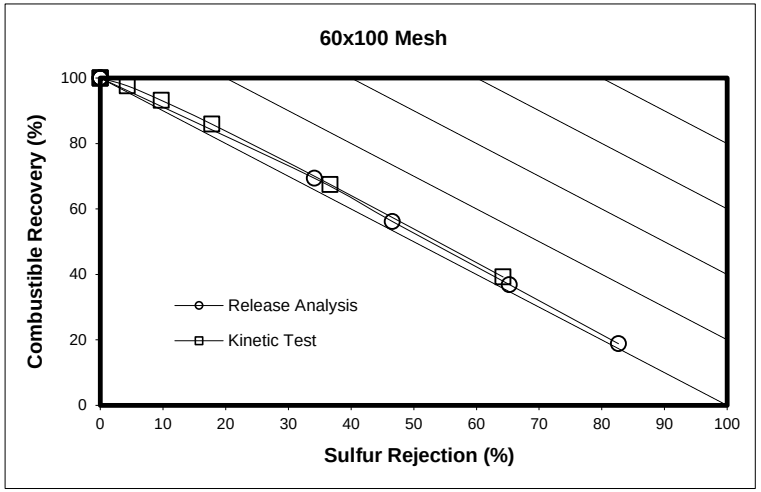


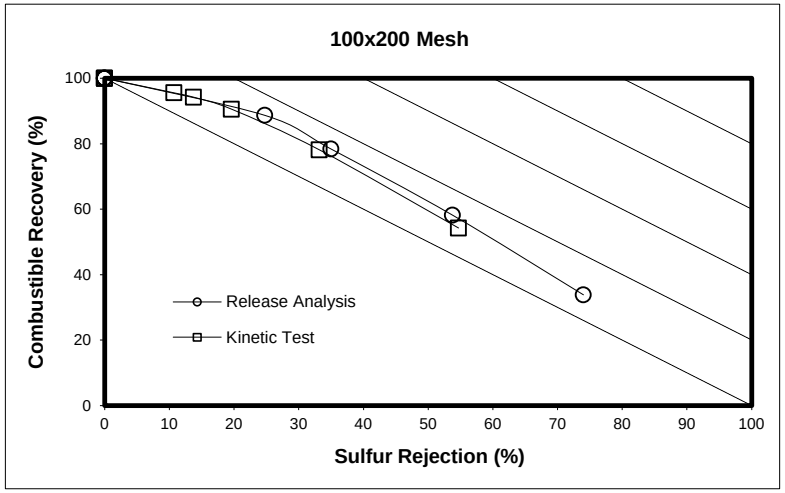
PERFORMANCE COMPARISON

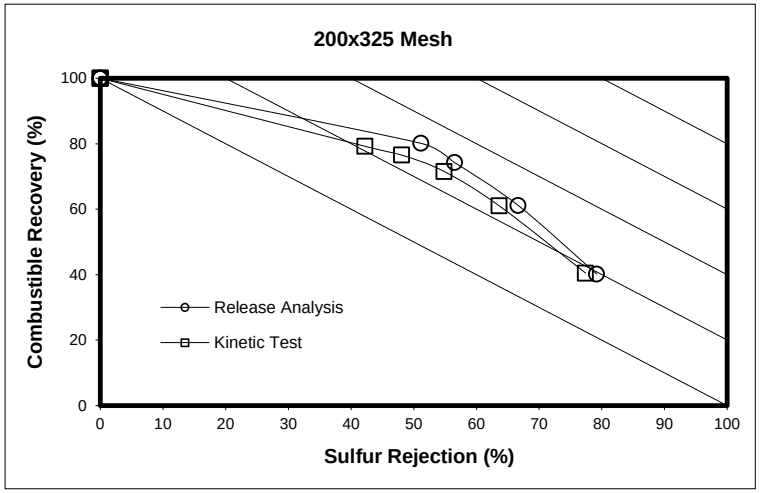
Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

Comments: High Sulfur Feed, Test with Frother only





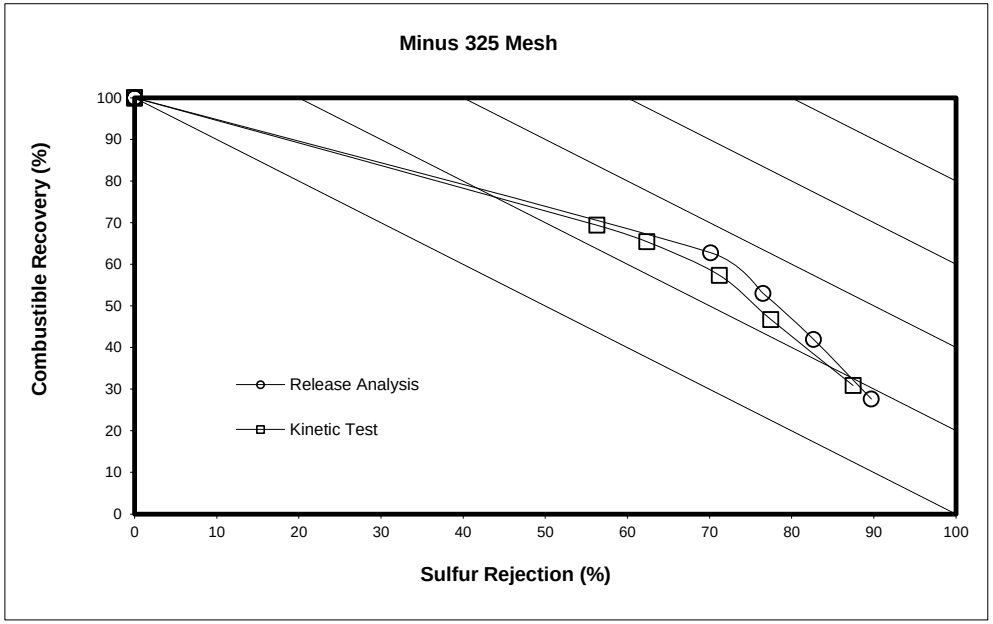




PERFORMANCE COMPARISON

Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

Comments: High Sulfur Feed, Test with Frother only



FLOTATION (RELEASE ANALYSIS)

Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios
Comments: High Sulfur Feed Flotation Test

PERFORMANCE BY PRODUCT AND SIZE (Release)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+60	1.48	0.50	0.35	0.84	0.70				3.87
60x100	9.17	3.89	2.39	2.78	0.73				18.95
100x200	13.08	5.71	3.62	2.26	4.29				28.96
200x325	3.39	1.46	1.14	0.71	5.50				12.19
-325	2.91	1.71	1.52	1.48	28.41				36.03
Total (Calc.)	30.02	13.28	9.02	8.07	39.61				100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+60	6.20	6.48	5.90	6.91	32.39				11.07
60x100	6.57	8.39	8.29	10.88	46.72				9.33
100x200	11.23	13.63	14.55	23.94	74.05				22.41
200x325	24.67	29.28	32.78	45.96	85.89				54.81
-325	21.32	23.24	26.48	41.15	87.72				74.80
Total (Calc.)	12.05	14.79	16.87	22.75	84.26				42.32

Sulfur Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+60	3.16	3.11	3.07	3.12	3.81				3.25
60x100	3.26	3.27	3.21	3.36	2.77				3.25
100x200	4.17	4.15	4.18	4.62	4.67				4.27
200x325	8.47	9.22	9.98	11.09	5.76				7.63
-325	9.24	9.78	10.94	15.99	7.05				7.89
Total (Calc.)	4.82	5.14	5.75	6.68	6.48				5.75

Release Analysis

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+60	38.30	51.31	60.39	82.03	100.00	100.00	100.00	100.00
60x100	48.38	68.89	81.48	96.17	100.00	100.00	100.00	100.00
100x200	45.16	64.88	77.39	85.19	100.00	100.00	100.00	100.00
200x325	27.79	39.80	49.13	54.91	100.00	100.00	100.00	100.00
-325	8.06	12.82	17.05	21.16	100.00	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	Tailings			
+60	6.20	6.27	6.22	6.40	11.07	11.07	11.07	11.07
60x100	6.57	7.11	7.29	7.84	9.33	9.33	9.33	9.33
100x200	11.23	11.96	12.38	13.44	22.41	22.41	22.41	22.41
200x325	24.67	26.06	27.34	29.30	54.81	54.81	54.81	54.81
-325	21.32	22.03	23.13	26.64	74.80	74.80	74.80	74.80

Cumulative Sulfur								
Mesh #	P1	P2	P3	P4	Tailings			
+60	3.16	3.14	3.13	3.13	3.25	3.25	3.25	3.25
60x100	3.26	3.26	3.25	3.27	3.25	3.25	3.25	3.25
100x200	4.17	4.16	4.16	4.20	4.27	4.27	4.27	4.27
200x325	8.47	8.70	8.94	9.17	7.63	7.63	7.63	7.63
-325	9.24	9.44	9.81	11.01	7.89	7.89	7.89	7.89

Combustable Recovery								
Mesh #	P1	P2	P3	P4	Tailings			
+60	40.40	54.08	63.69	86.34	100.00	100.00	100.00	100.00
60x100	49.85	70.57	83.31	97.75	100.00	100.00	100.00	100.00
100x200	51.67	73.62	87.40	95.05	100.00	100.00	100.00	100.00
200x325	46.33	65.12	79.00	85.92	100.00	100.00	100.00	100.00
-325	25.17	39.66	51.99	61.59	100.00	100.00	100.00	100.00

Ash Rejection								
Mesh #	P1	P2	P3	P4	Tailings			
+60	78.55	70.94	66.09	52.59	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
60x100	65.93	47.49	36.30	19.17	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
100x200	77.37	65.38	57.26	48.93	0.00	0.00	0.00	0.00
200x325	87.49	81.08	75.50	70.65	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
-325	97.70	96.22	94.73	92.46	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Sulfur Rejection								
Mesh #	P1	P2	P3	P4	Tailings			
+60	62.82	50.39	41.81	21.08	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
60x100	51.48	30.89	18.44	3.26	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
100x200	55.99	36.85	24.61	16.19	0.00	0.00	0.00	0.00
200x325	69.14	54.63	42.42	34.02	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
-325	90.55	84.66	78.80	70.46	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

FLOTATION (KINETIC TEST)

Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios
Comments: High Sulfur Feed Flotation Test

PERFORMANCE BY PRODUCT AND SIZE (Timed Kinetcs)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+60	1.92	0.83	0.19	0.03	0.55	0.45			3.96
60x100	12.62	5.19	1.32	0.16	0.40	0.48			20.18
100x200	14.91	6.70	2.03	0.33	0.38	4.67			29.01
200x325	3.88	2.00	0.92	0.26	0.44	7.53			15.03
-325	3.93	2.72	1.90	1.40	1.31	20.55			31.82
Total (Calc.)	37.25	17.45	6.37	2.17					100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+60	6.52	6.87	7.39	9.81	11.71	61.35			13.67
60x100	8.09	9.88	10.39	10.42	22.85	73.83			10.56
100x200	12.80	16.25	19.37	28.11	60.47	81.49			25.90
200x325	28.59	33.19	45.46	60.39	73.49	88.35			62.04
-325	36.61	35.37	42.87	68.33	77.98	88.65			73.60
Total (Calc.)	15.03	18.83	27.96	56.32					42.93

Sulfur Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+60	3.18	3.27	3.28	4.17	3.66	3.35			3.30
60x100	3.35	3.51	3.33	3.19	3.67	2.17			3.37
100x200	4.30	4.71	4.60	5.15	5.72	2.40			4.14
200x325	10.05	10.66	11.54	12.43	12.91	5.41			8.02
-325	12.06	11.40	12.83	9.53	12.78	6.86			8.61
Total (Calc.)	5.34	6.01	7.76	8.68					5.96

Kinetic Test

Cumulative Yield								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+60	48.34	69.32	74.04	74.74	88.52	100.00	100.00	100.00
60x100	62.56	88.30	94.86	95.65	97.64	100.00	100.00	100.00
100x200	51.39	74.49	81.49	82.62	83.92	100.00	100.00	100.00
200x325	25.82	39.10	45.24	46.96	49.90	100.00	100.00	100.00
-325	12.34	20.90	26.88	31.28	35.40	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+60	6.52	6.63	6.67	6.70	7.48	13.67	13.67	13.67
60x100	8.09	8.61	8.73	8.75	9.04	10.56	10.56	10.56
100x200	12.80	13.87	14.34	14.53	15.24	25.90	25.90	25.90
200x325	28.59	30.15	32.23	33.26	35.63	62.04	62.04	62.04
-325	36.61	36.10	37.61	41.93	46.12	73.60	73.60	73.60

Cumulative Sulfur								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+60	3.18	3.21	3.21	3.22	3.29	3.30	3.30	3.30
60x100	3.35	3.39	3.39	3.39	3.39	3.37	3.37	3.37
100x200	4.30	4.43	4.44	4.45	4.47	4.14	4.14	4.14
200x325	10.05	10.26	10.43	10.50	10.65	8.02	8.02	8.02
-325	12.06	11.79	12.02	11.67	11.80	8.61	8.61	8.61

Combustable Recovery								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+60	52.34	74.98	80.04	80.77	94.86	100.00	100.00	100.00
60x100	64.29	90.23	96.80	97.59	99.31	100.00	100.00	100.00
100x200	60.47	86.58	94.19	95.29	95.98	100.00	100.00	100.00
200x325	48.57	71.96	80.78	82.57	84.62	100.00	100.00	100.00
-325	29.62	50.58	63.52	68.80	72.23	100.00	100.00	100.00

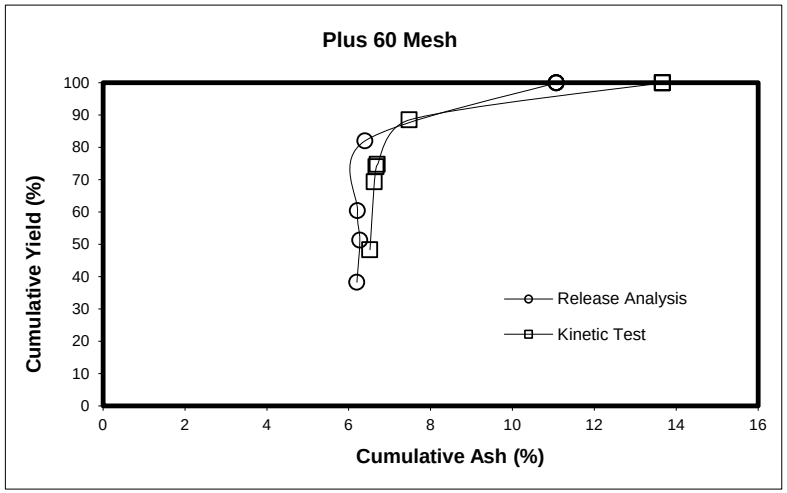
Ash Rejection								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+60	76.94	66.39	63.84	63.33	51.53	#DIV/0!	#DIV/0!	#DIV/0!
60x100	52.08	28.01	21.55	20.77	16.46	#DIV/0!	#DIV/0!	#DIV/0!
100x200	74.60	60.10	54.87	53.64	50.61	#DIV/0!	#DIV/0!	#DIV/0!
200x325	88.10	81.00	76.50	74.83	71.34	#DIV/0!	#DIV/0!	#DIV/0!
-325	93.86	89.75	86.26	82.18	77.82	#DIV/0!	#DIV/0!	#DIV/0!

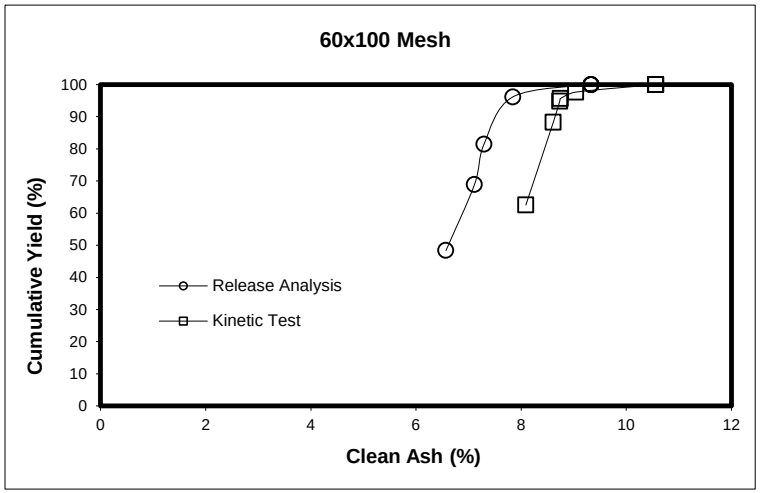
Sulfur Rejection								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+60	53.41	32.57	27.87	26.98	11.68	#DIV/0!	#DIV/0!	#DIV/0!
60x100	37.79	10.93	4.44	3.69	1.52	#DIV/0!	#DIV/0!	#DIV/0!
100x200	46.59	20.31	12.54	11.13	9.34	#DIV/0!	#DIV/0!	#DIV/0!
200x325	67.66	50.02	41.19	38.53	33.80	#DIV/0!	#DIV/0!	#DIV/0!
-325	82.71	71.37	62.45	57.58	51.47	#DIV/0!	#DIV/0!	#DIV/0!

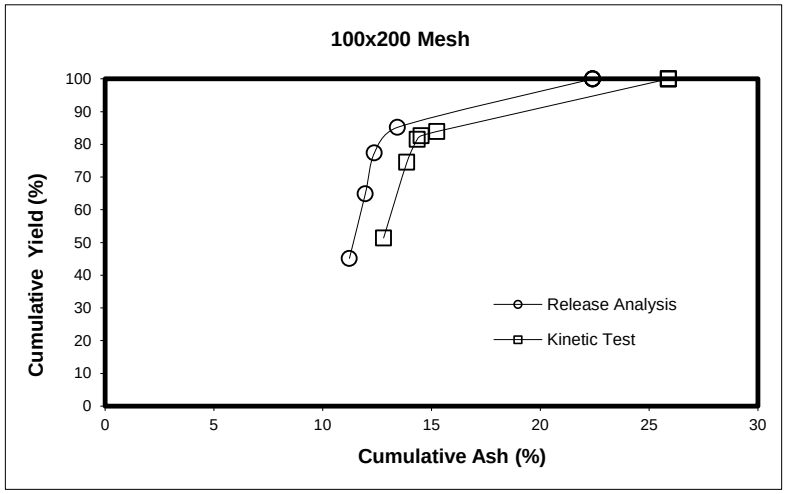
PERFORMANCE COMPARISON

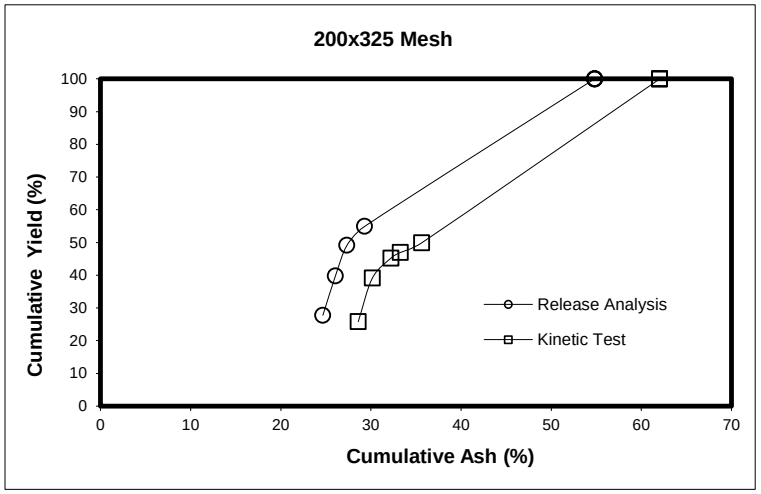
Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

Comments: High Sulfur Feed Flotation Test





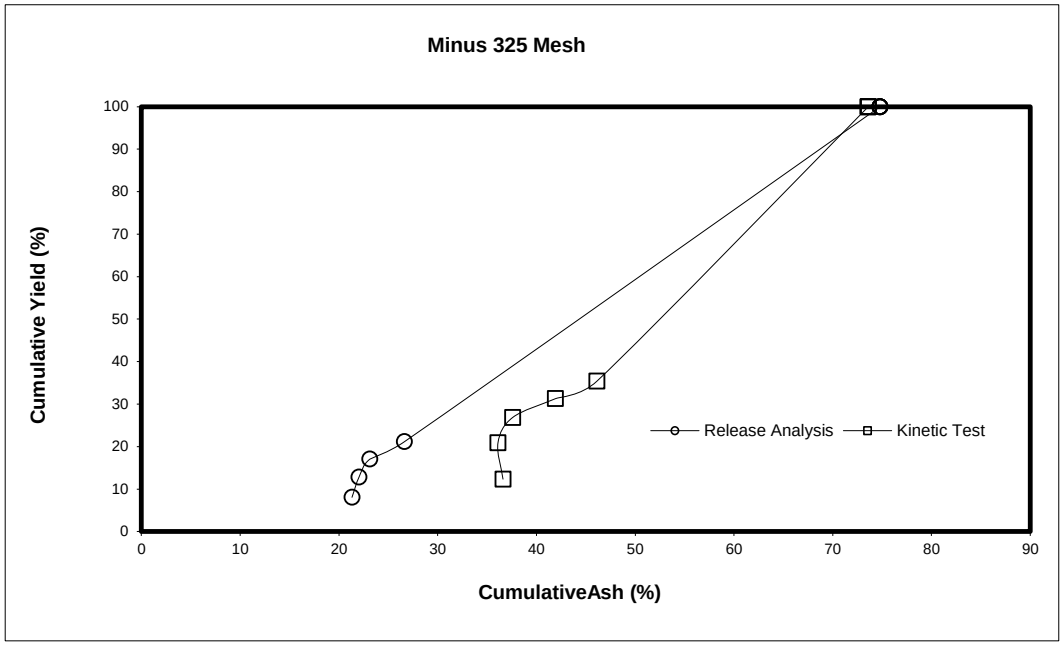




PERFORMANCE COMPARISON

Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

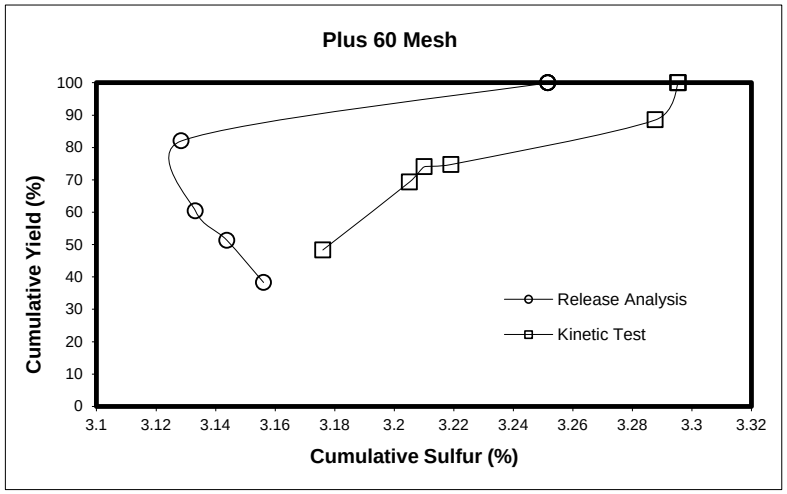
Comments: High Sulfur Feed Flotation Test

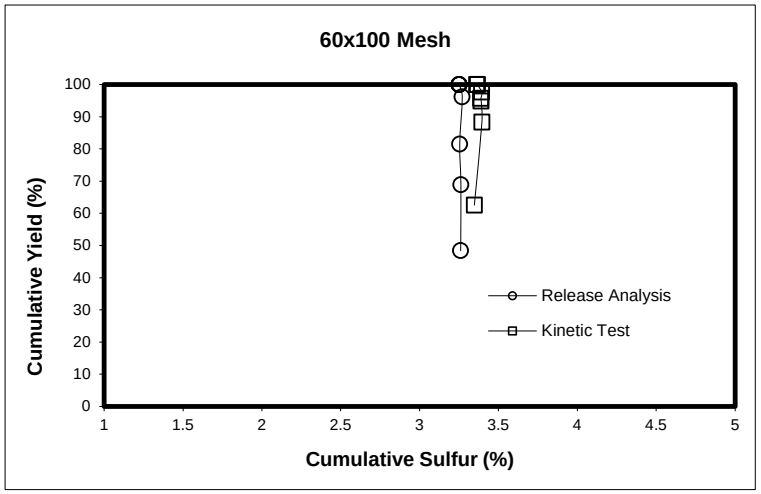


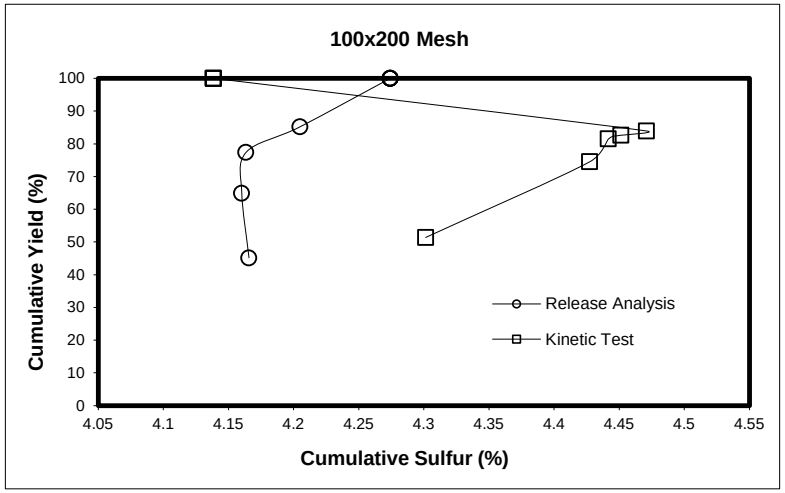
PERFORMANCE COMPARISON

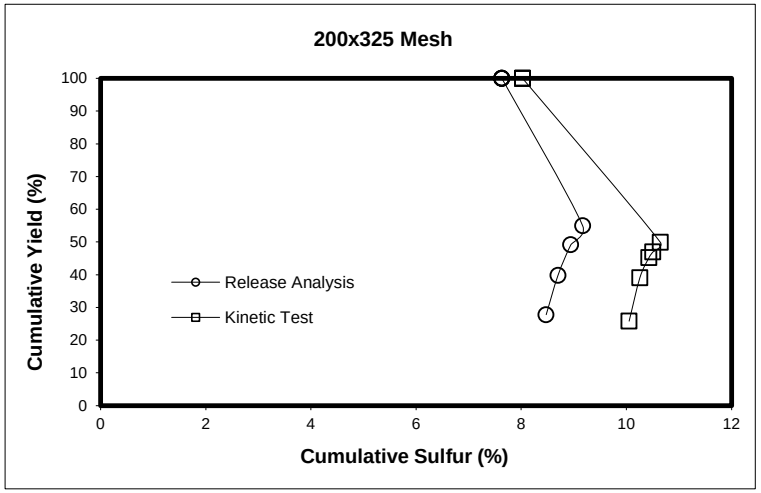
Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

Comments: High Sulfur Feed Flotation Test





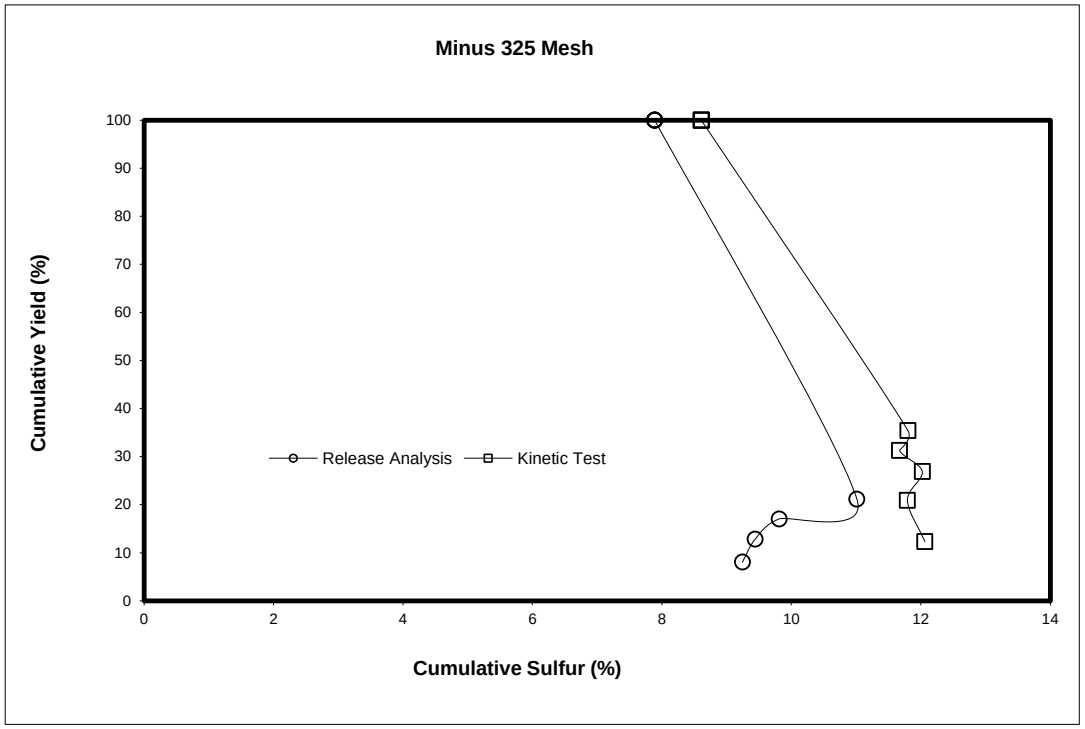




PERFORMANCE COMPARISON

Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

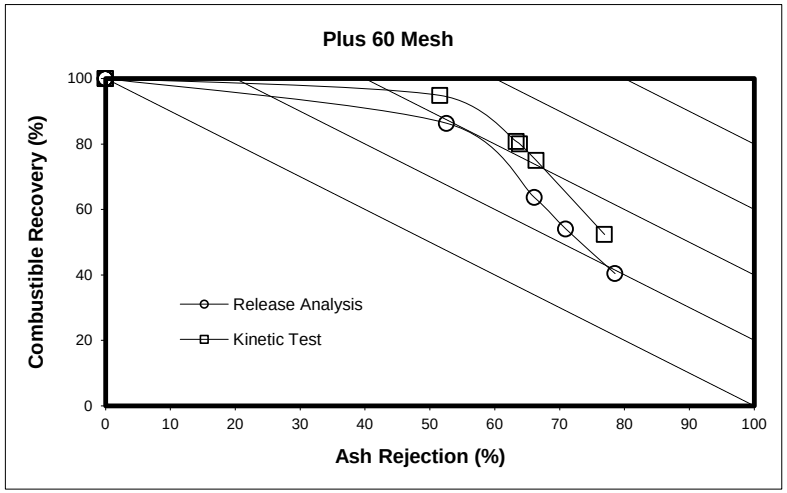
Comments: High Sulfur Feed Flotation Test

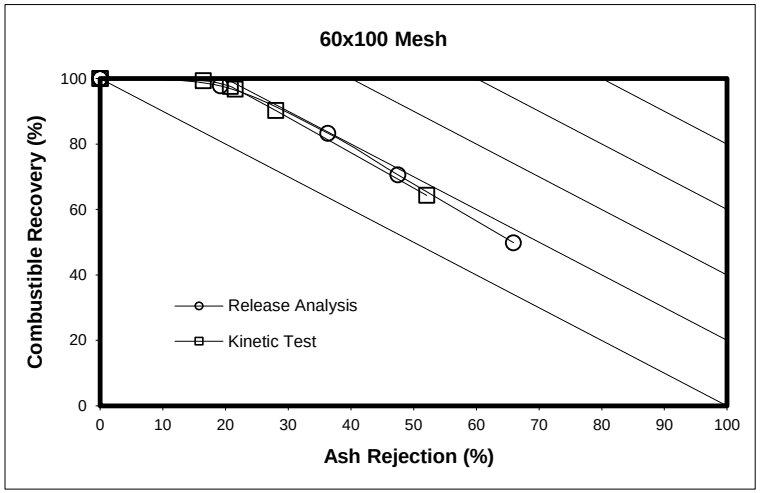


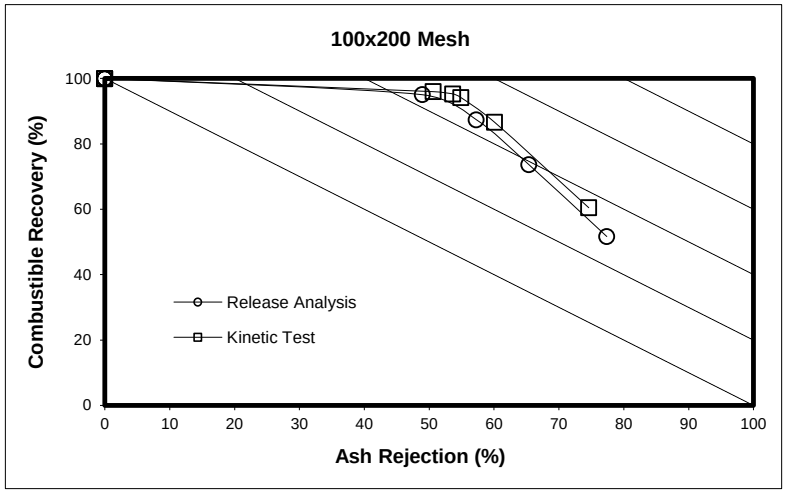
PERFORMANCE COMPARISON

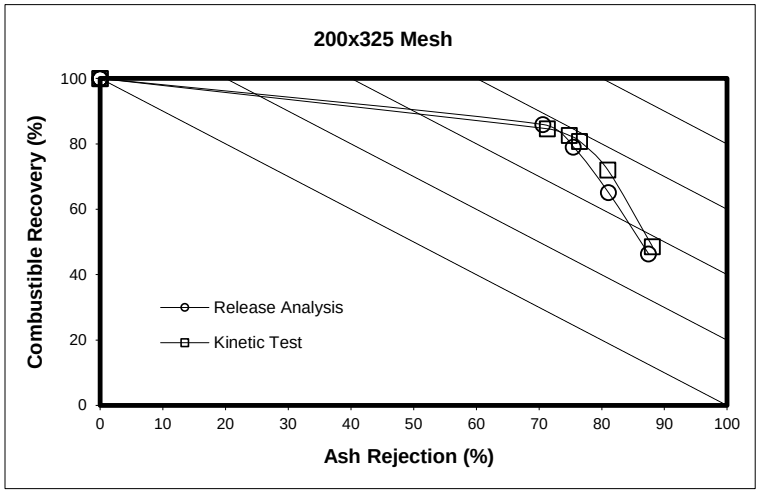
Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

Comments: High Sulfur Feed Flotation Test





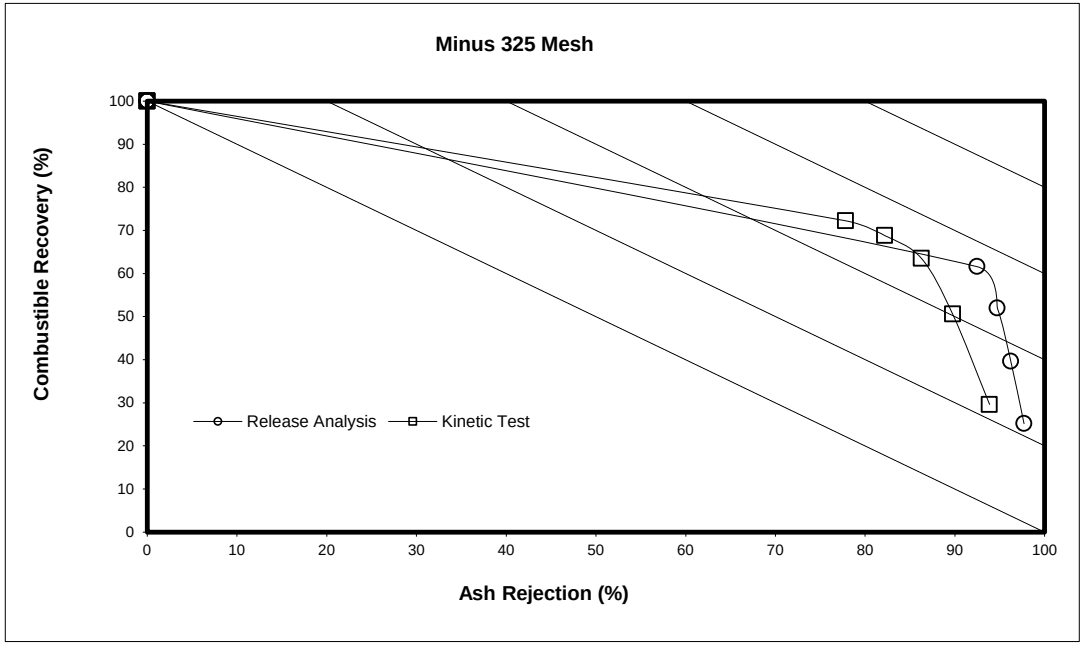




PERFORMANCE COMPARISON

Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

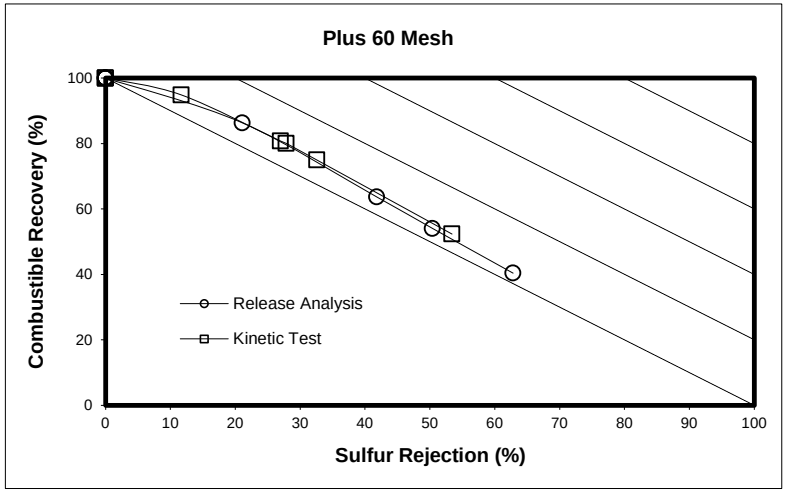
Comments: High Sulfur Feed Flotation Test

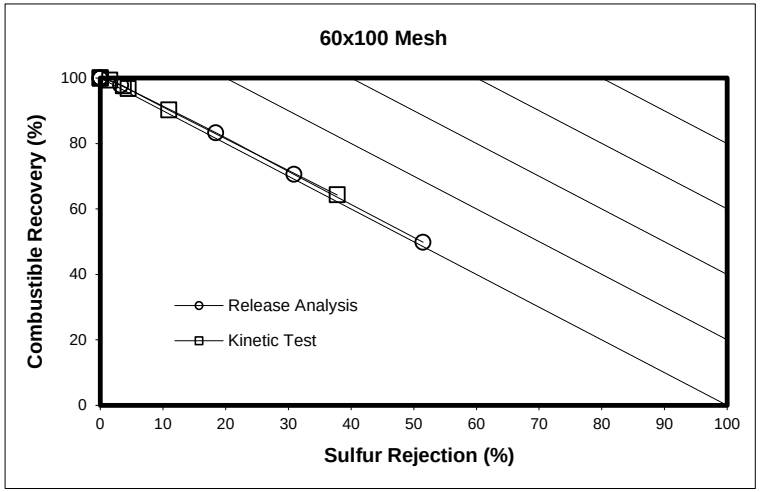


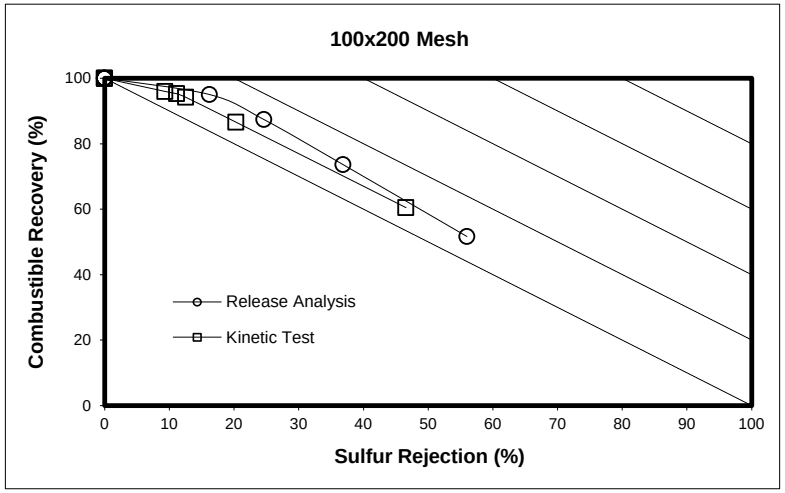
PERFORMANCE COMPARISON

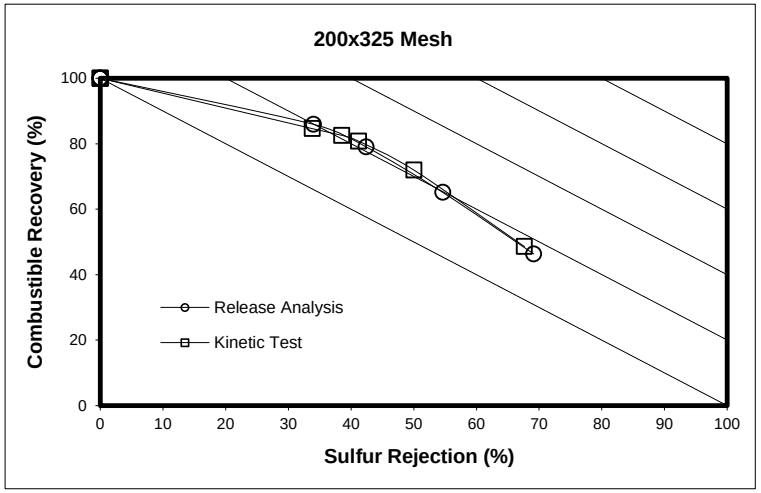
Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

Comments: High Sulfur Feed Flotation Test





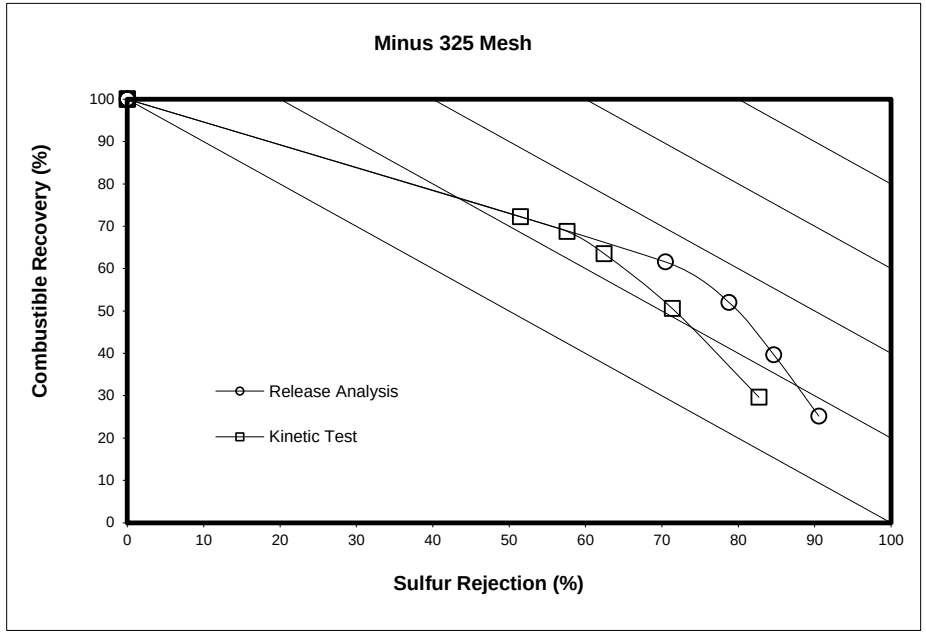




PERFORMANCE COMPARISON

Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

Comments: High Sulfur Feed Flotation Test



FLOTATION (RELEASE ANALYSIS)

Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios
Comments: High Sulfur Feed, Test with Frother only

PERFORMANCE BY PRODUCT AND SIZE (Release)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+100	22.72	8.77	3.02	0.11	0.14				34.75
100x200	15.76	6.55	2.23	0.06	0.79				25.39
200x325	3.37	1.72	0.63	0.04	2.42				8.17
-325	3.11	2.19	1.30	0.69	24.40				31.69
Total (Calc.)	44.96	19.23	7.17	0.90	27.74				100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+100	5.84	6.11	6.42	0.00	0.00				5.92
100x200	10.62	11.85	11.94	0.00	64.25				12.70
200x325	23.79	27.12	28.24	0.00	78.93				41.00
-325	21.67	24.73	26.97	0.00	88.81				73.32
Total (Calc.)	9.96	12.06	13.77	0.00	86.81				31.87

Sulfur Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	Tailings				
+100	3.02	3.00	2.98	2.96	2.66				3.01
100x200	3.43	3.31	3.29	3.23	0.39				3.29
200x325	5.95	6.09	6.30	10.49	2.76				5.09
-325	9.06	9.74	10.40	19.31	3.88				5.40
Total (Calc.)	3.80	4.15	4.71	15.87	3.68				4.01

Release Analysis

Cumulative Yield								
Mesh #	P1	P2	P3	P4	Tailings			
+100	65.37	90.61	99.29	99.60	100.00	100.00	100.00	100.00
100x200	62.09	87.89	96.66	96.89	100.00	100.00	100.00	100.00
200x325	41.17	62.20	69.92	70.45	100.00	100.00	100.00	100.00
-325	9.82	16.73	20.83	23.00	100.00	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	Tailings			
+100	5.84	5.92	5.96	5.94	5.92	5.92	5.92	5.92
100x200	10.62	10.98	11.07	11.04	12.70	12.70	12.70	12.70
200x325	23.79	24.92	25.28	25.09	41.00	41.00	41.00	41.00
-325	21.67	22.93	23.73	21.49	73.32	73.32	73.32	73.32

Cumulative Sulfur								
Mesh #	P1	P2	P3	P4	Tailings			
+100	3.02	3.01	3.01	3.01	3.01	3.01	3.01	3.01
100x200	3.43	3.40	3.39	3.39	3.29	3.29	3.29	3.29
200x325	5.95	6.00	6.03	6.07	5.09	5.09	5.09	5.09
-325	9.06	9.34	9.55	10.47	5.40	5.40	5.40	5.40

Combustable Recovery								
Mesh #	P1	P2	P3	P4	Tailings			
+100	65.43	90.61	99.25	99.58	100.00	100.00	100.00	100.00
100x200	63.56	89.62	98.46	98.72	100.00	100.00	100.00	100.00
200x325	53.18	79.16	88.55	89.45	100.00	100.00	100.00	100.00
-325	28.83	48.34	59.55	67.70	100.00	100.00	100.00	100.00

Ash Rejection								
Mesh #	P1	P2	P3	P4	Tailings			
+100	35.48	9.42	0.00	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
100x200	48.08	24.00	15.76	15.76	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
200x325	76.11	62.20	56.88	56.88	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
-325	97.10	94.77	93.26	93.26	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Sulfur Rejection								
Mesh #	P1	P2	P3	P4	Tailings			
+100	34.43	9.25	0.66	0.35	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
100x200	35.32	9.36	0.59	0.37	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
200x325	51.85	26.68	17.13	16.03	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
-325	83.51	71.03	63.14	55.35	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

FLOTATION (KINETIC TEST)

Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios
Comments: High Sulfur Feed, Test with Frother only

PERFORMANCE BY PRODUCT AND SIZE (Timed Kinetics)

Weight (%)

Sample ID	Dry Weight Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+100	25.96	7.10	1.62	0.24	0.00	0.06			34.98
100x200	17.84	5.29	1.31	0.18	0.00	0.71			25.32
200x325	3.96	1.37	0.39	0.04	0.02	2.40			8.17
-325	4.38	2.64	1.88	1.34	2.17	19.12			31.53
Total (Calc.)	52.14	16.40	5.20	1.79					100.00

Ash Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+100	4.84	4.55	6.07	6.39	0.00	0.00			4.84
100x200	6.62	12.22	12.39	12.14	0.00	65.74			9.77
200x325	24.08	28.31	35.10	0.00	0.00	81.74			42.08
-325	30.97	35.16	47.60	63.77	82.69	90.02			73.07
Total (Calc.)	9.10	13.94	24.82	49.75					30.64

Sulfur Content (%)

Sample ID	Dry Ash Percent in Size and Product Class								Total
	P1	P2	P3	P4	P5	Tailings			
+100	2.90	2.87	2.98	2.77	0.00	2.82			2.90
100x200	3.25	3.30	3.29	3.15	0.00	1.28			3.21
200x325	5.46	5.95	6.71	7.42	0.00	2.95			4.86
-325	8.34	9.18	9.83	6.06	4.86	3.36			5.14
Total (Calc.)	3.67	4.28	5.81	5.36					3.84

Kinetic Test

Cumulative Yield								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	74.21	94.52	99.15	99.84	99.84	100.00	100.00	100.00
100x200	70.45	91.34	96.52	97.22	97.22	100.00	100.00	100.00
200x325	48.45	65.20	69.95	70.38	70.64	100.00	100.00	100.00
-325	13.89	22.28	28.23	32.48	39.36	100.00	100.00	100.00

Cumulative Ash								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	4.84	4.78	4.84	4.85	4.85	4.84	4.84	4.84
100x200	6.62	7.90	8.14	8.17	8.17	9.77	9.77	9.77
200x325	24.08	25.17	25.84	25.68	25.59	42.08	42.08	42.08
-325	30.97	32.55	35.72	39.39	46.97	73.07	73.07	73.07

Cumulative Sulfur								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	2.90	2.89	2.90	2.90	2.90	2.90	2.90	2.90
100x200	3.25	3.26	3.26	3.26	3.26	3.21	3.21	3.21
200x325	5.46	5.58	5.66	5.67	5.65	4.86	4.86	4.86
-325	8.34	8.66	8.91	8.53	7.89	5.14	5.14	5.14

Combustable Recovery								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	74.21	94.58	99.16	99.83	99.83	100.00	100.00	100.00
100x200	72.92	93.24	98.26	98.94	98.94	100.00	100.00	100.00
200x325	63.50	84.23	89.55	90.30	90.74	100.00	100.00	100.00
-325	35.61	55.80	67.38	73.10	77.53	100.00	100.00	100.00

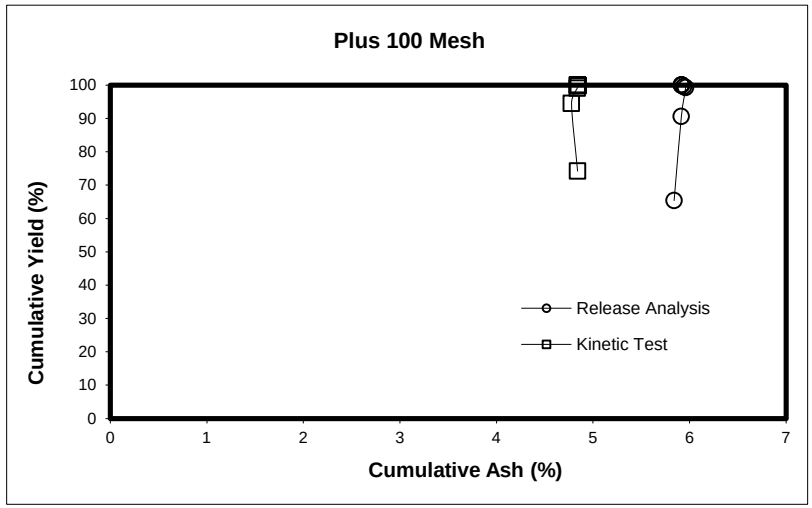
Ash Rejection								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	25.80	6.72	0.90	0.00	0.00	#DIV/0!	#DIV/0!	#DIV/0!
100x200	52.28	26.16	19.60	18.73	18.73	#DIV/0!	#DIV/0!	#DIV/0!
200x325	72.27	61.00	57.04	57.04	57.04	#DIV/0!	#DIV/0!	#DIV/0!
-325	94.11	90.08	86.20	82.49	74.70	#DIV/0!	#DIV/0!	#DIV/0!

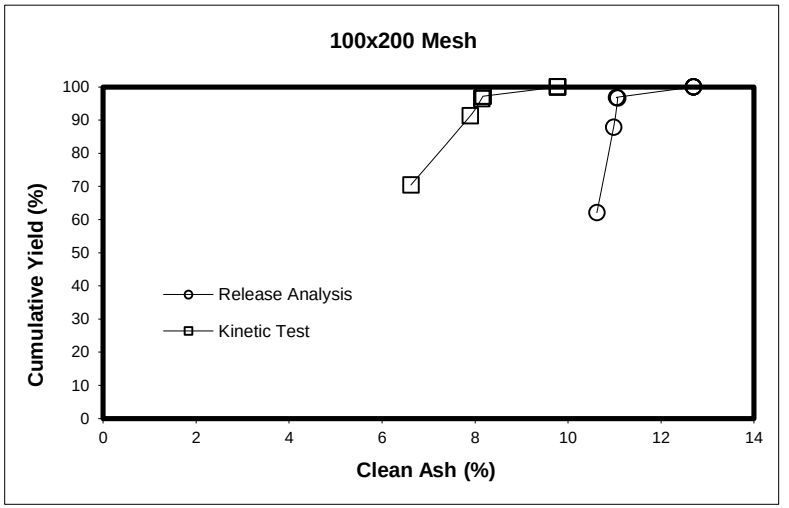
Sulfur Rejection								
Mesh #	P1	P2	P3	P4	P5	Tailings		
+100	25.71	5.59	0.81	0.16	0.16	#DIV/0!	#DIV/0!	#DIV/0!
100x200	28.65	7.12	1.80	1.11	1.11	#DIV/0!	#DIV/0!	#DIV/0!
200x325	45.59	25.07	18.52	17.86	17.86	#DIV/0!	#DIV/0!	#DIV/0!
-325	77.46	62.49	51.11	46.10	39.59	#DIV/0!	#DIV/0!	#DIV/0!

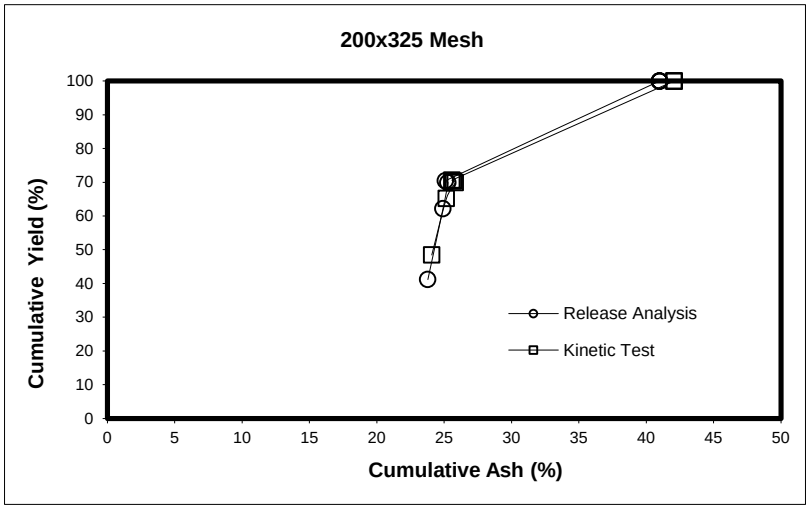
PERFORMANCE COMPARISON

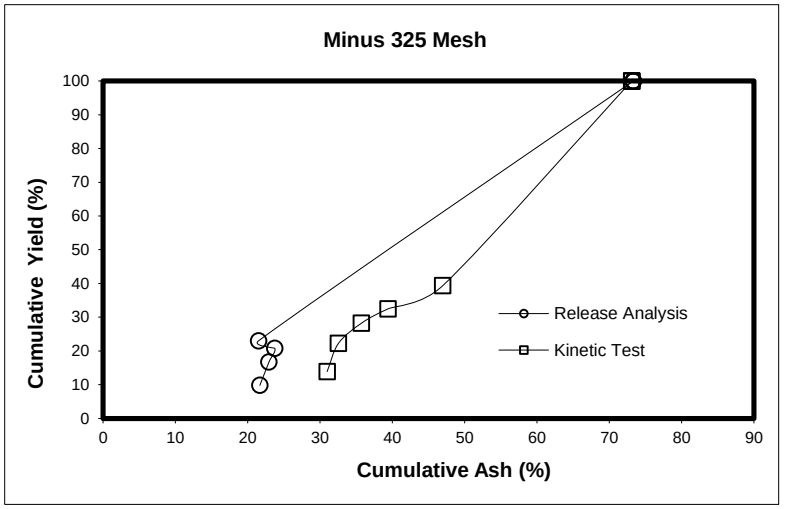
Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

Comments: High Sulfur Feed, Test with Frother only





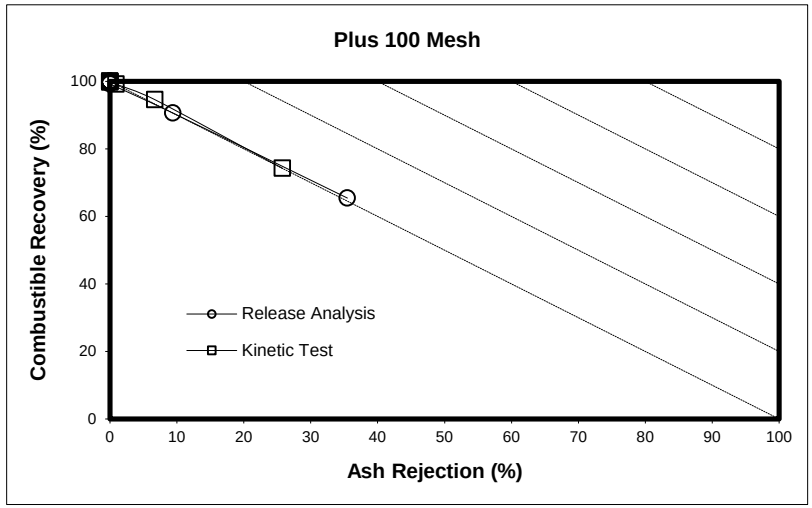


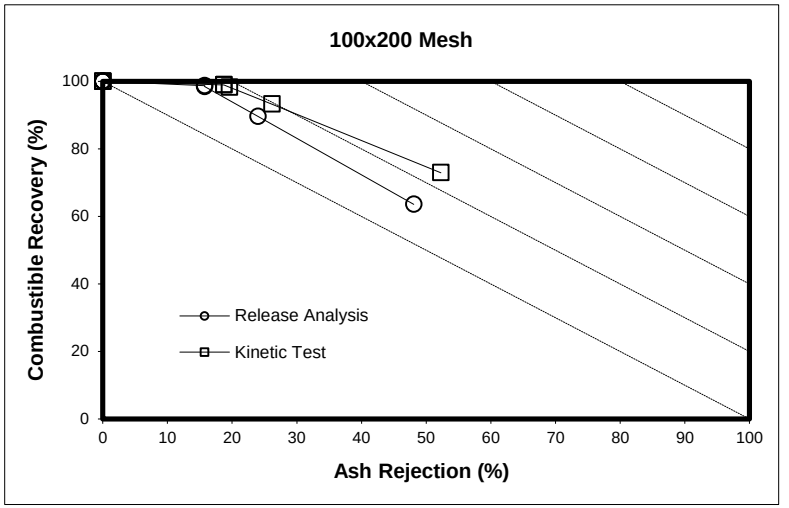


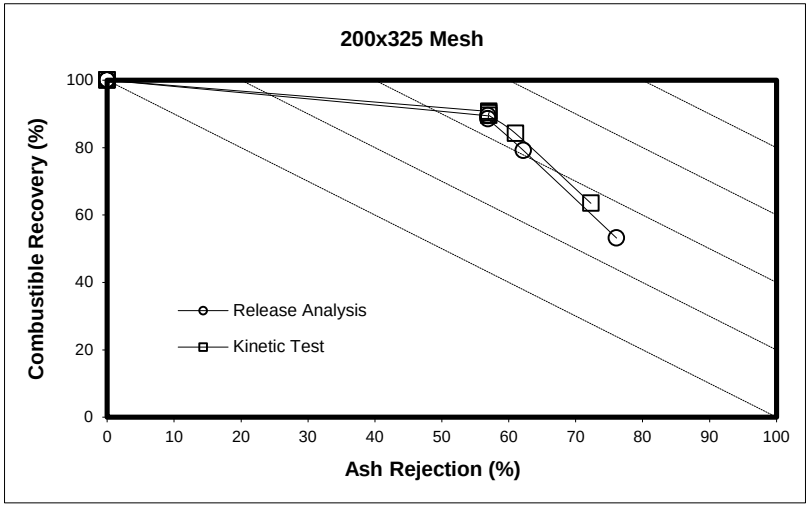
PERFORMANCE COMPARISON

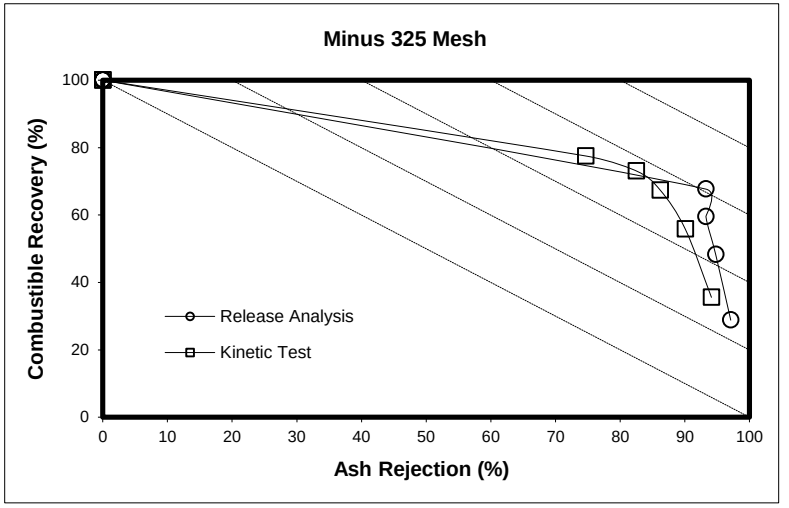
Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

Comments: High Sulfur Feed, Test with Frother only





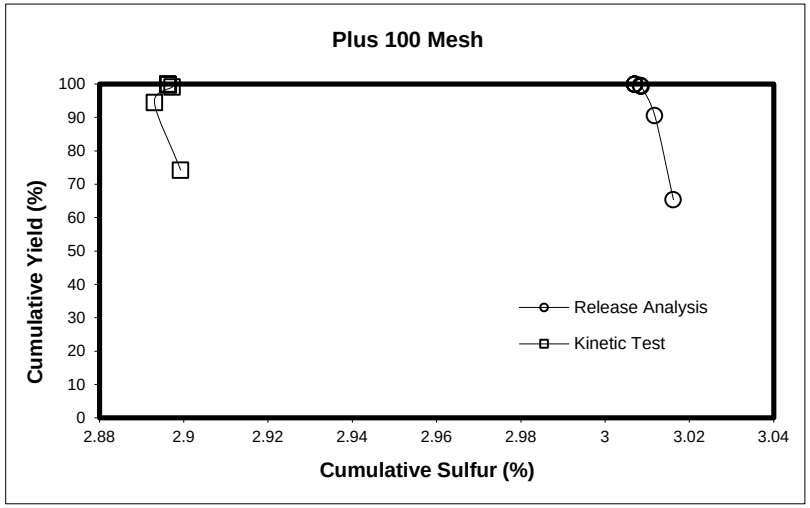


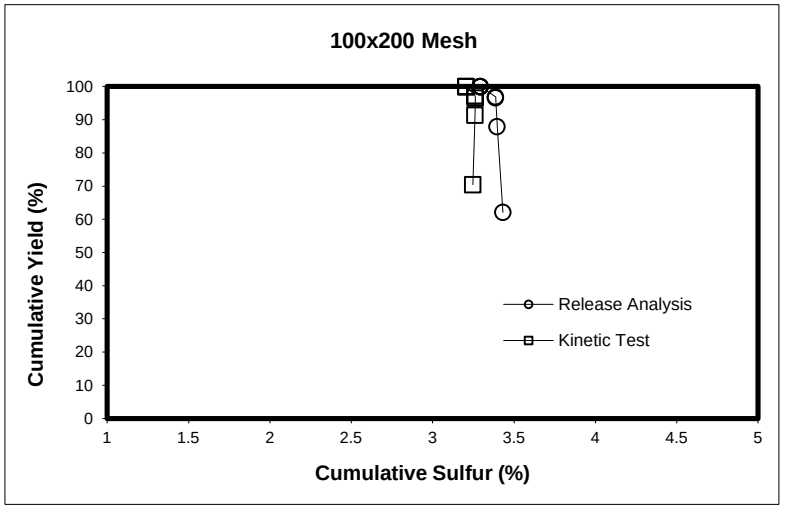


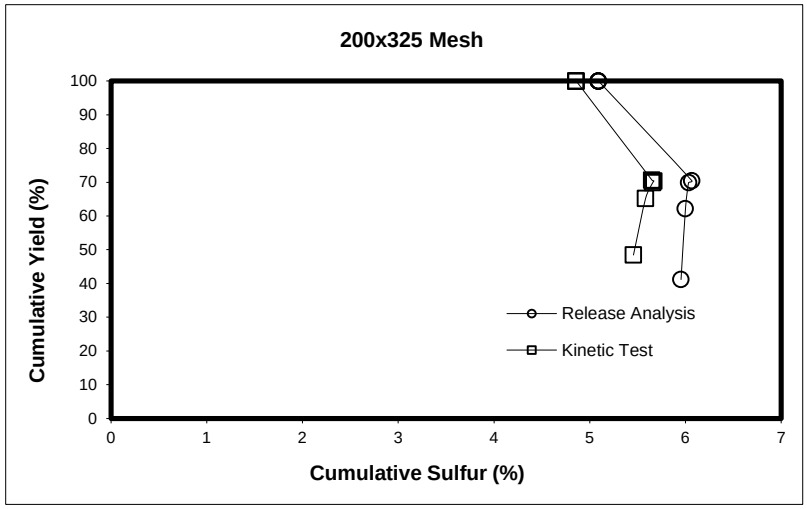
PERFORMANCE COMPARISON

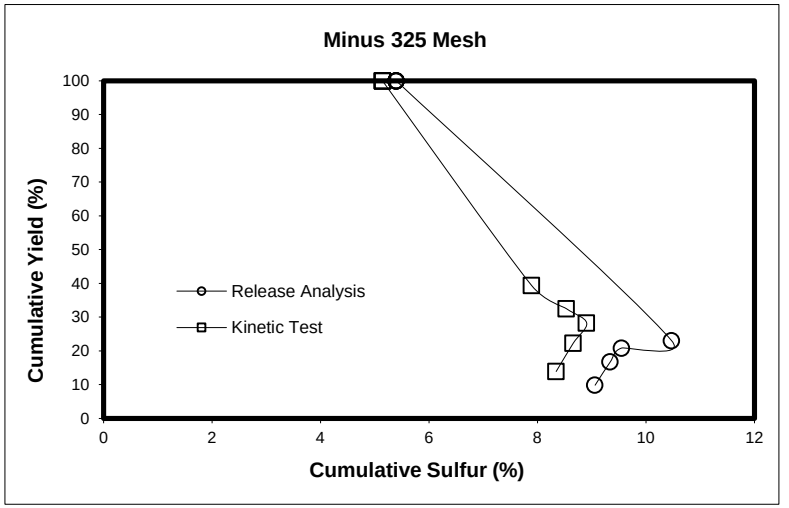
Description: 0.15 x 0 mm Nominal Particle Size (Sieve U/F) - Illinios

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PERFORMANCE COMPARISON

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