Food Science and Technology Notes

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DEFECTS OF SOFT SERVE AND DIRECT DRAW MILK SHAKES

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The mix manufacturer's task is not a simple one. He must provide a mix which will work equally well in freezers equipped with beaters which give considerable whipping action, those containing slow moving augers with minimum whipping action and those that have augers and provisions for applying air pressure. In addition, the mix must always be fresh, free of off-flavors, possess good keeping quality, be free of foam, have the right viscosity, exhibit no serum separation, be free of sediment, be in a sound container, be capable of being lavored correctly and must freeze properly to produce a finished product which has a good body and appearance. The job is made more difficult in the few cases where the freezer operators are lacking in skill and knowledge, and the result may be an abused freezer or an abused product and in the final analysis, dissatisfied customer. Fortunately, difficulties are usually encountered by fewer than 10% of the operators.

In the case of direct draw milk shakes, it is difficult to define an ideal product because of a wide variation in preference. It is conceivable that the same individual may prefer a smooth, heavy shake in the winter or when no solid food is consumed with the shake and a lighter shake when it is a part of a meal. During hot weather, an icy textured shake may be preferred. The choice of the type of shake may also be influenced by where it is consumed, whether out in the hot sunshine, an air conditioned car or dining room or in a car on a cold winter day.

The following values are given to illustrate some typical operating conditions and should be interpreted with some caution. The reason that firm values cannot be given stems from the fact that freezers with different characteristics are used, mix composition varies, flavored or unflavored direct draw milk shakes may be frozen and different characteristics of the product may be desired.

	Soft Serve	Direct Draw Milk Shake
Total Solids Content (%)	29-33	23-30
Overrun (%)	30-55	40-60
Drawing Temperature	16-20	26-28

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Quality problems may arise even when everything with regard to mix composition and freezing conditions appears to be perfect. There are several possible sources of problems.

It is generally understood that the mix in the hopper must be refrigerated. In the freezer design, the gas line may go from the evaporator around the hopper on its way to the condenser. During slack periods, there may not be enough refrigeration to maintain the mix at a temperature below 40°F. On the other hand, freezing the mix on the side of the hopper may result from excessive refrigeration. This can cause a partial destabilization of the mix and a partial blocking of the feeder tube by frozen mix particles which have become dislodged. Such blockage may cause high overrun or a freeze-up.

The product which remains in the freezer at the close of the working day and is drawn off to be frozen again the next day is termed "re-run." The drippings collected from the spigot during the day also fall in the "re-run" category. This material may be the source of much difficulty. The alternate freezing, thawing and refreezing may cause it to become destabilized and start the process of buttering out. The re-run may not give up its air and cause excess foam in the hopper with an attendant high overrun. Careless handling of re-run may cause it to become contamination with bacteria and act as a source of contamination for the mix, freezer and the finished product.

A good way to use the product remaining in the freezer at the end of the day would be to package and harden it. However, if this is not possible, the melted product should be mixed with 2/3 or 3/4 of fresh mix and added to the hopper during the busiest part of the day. During the thawing process and subsequent storage, the temperature of the re-run should not be allowed to rise above 40°F.

The acceptability of soft serve and direct draw milk shakes depends to a great extent on the amount of air which is incorporated into the product. The operator must control the amount of product in the freezer to give him the desired overrun. In some cases, he may have to allow more mix to enter the freezer, while in other cases, an overloaded barrel may have to be relieved by removing some product. The prime charge at the beginning of the freezing process should be used properly and overrun should be checked at frequent intervals.

Steps should be taken to avoid unnecessary agitation of the product in the freezer. Conditions which may be responsible are too low temperature setting during slack periods, low refrigerant supply, dull blades and an overloaded barrel. Excessive whipping will give rise to a soft and eventually, buttery product. A high ambient temperature and blowing air against the uninsulated front of the freezer will also increase agitation time.

A rigid schedule should be followed for cleaning and sterilizing. The freezer should be disassembled at the end of each working day and thoroughly cleaned until free of all deposits. At the beginning of the working day, it should be sterilized. All utensils, such as buckets, stirring rods, drip pans and flavor extract measures should be cleaned and sterilized in the same manner. Mix, product, flavoring, color, drippings and re-run should not come in contact with surfaces which have not been properly cleaned and sterilized.

The flavoring and color used is quite important in promoting consumer acceptance. Both quality and uniformity of flavor should be considered. It is undesirable to make frequent changes in the type and intensity of these materials. Color variation may occur as a result of a failure to control the overrun.

Changes in the product should be made only after thorough study, lest they prove to be costly. Many operators, and some rightly so, fancy themselves to be self made "experts" and will find ways which in their mind will improve the product or cut costs. It is seldom that improvements just happen without thorough research and cost reduction all too frequently is made at the expense of quality.

The following tables contain a summary of the defects, their causes and their prevention.

DEFECTS OF SOFT-SERVE

Defect	Source of Defect	Causes and Prevention
Cooked Flavor	Mix processing	a) Use of ingredients in mix which have received a high heat treatment b) "Burn-on" on pasteurization equipment c) High temperature processing of mix
Foamy Mix	Mix formulation	a) Over emulsification b) Excessive amount of buttermilk solids
Fruity Flavor	Post pasteurization contamination of mix with psychrophilie bacteria	a) Inadequate sterilization of all surfaces with which the mix may come in contact after pasteurization b) Failure to maintain mix storage temperature at 40°F or lower c) Water supply contaminated with psychrophilic bacteria d) All other conditions given under sour e) Excessive age of the mix
Grainy, Buttery	Mix composition	a) Excessive amounts of emulsifiers, particularly poly's and mono and diglyceryl oleates b) High acid content of the mix
Grainy, Buttery	Freezer operation	a) Excessive cycling of freezer b) Lack of refrigerant c) High ambient temperature d) High temperature ow water coolant e) Temperature setting too low f) Overloaded barrel g) Excessive use of rerun h) Dull freezer blades
Grainy, Buttery	Mix processing	Improper homogenization
Gray Discoloration	Artificial color	Artificially colored vanilla preparation used
Heavy Body	Freezer operation	a) Overloaded freezer barrel at start of freezing b) Mix orifice too large c) Air tube partially plugged d) Freezing temperature too low
High Flavor	Flavoring	a) Highly fortified flavor extracts b)

Defect	Source of Defect	Causes and Prevention
High Overrun	Freezer operation	a) High drawing temperature b) Insufficient amount of mix in the hopper c) Failure to use correct prime charge d) Excess aerated mix (rerun) in the hopper e) Mix orifice too small or partially blocked
High Viscosity Mix	Mix formulation and processing	a) High total solids b) Overstabilized c) Superheating effect imparted inadvertently or by design d) Developed acidity in mix constituents e) Improper salt balance f) Homogenization conditions
Icy Texture	Faulty freezer operation	a) Slow freezing because of overloaded barrel b) Slow freezing because of lack of refrigerant c) Slow freezing because of dull blades
Icy Texture	Mix composition	a) Low solids content b) Inadequate stabilization
Lacks Flavor	Flavoring	a) Flavor extract of insufficient strength b) Insufficient quantity used
Lacks Sweetness	Freezer operation	Dilution of mix with water of milk
Lacks Sweetness	Mix composition	a) Sugar content too low b) Too high replacement of sucrose with low sweetening value sweetening agents
Neutralizer Flavor	Mix ingredients	Developed acidity in mix ingredients
Oxidized Flavor	Fat oxidation	a) Copper contamination of milk and cream used in mix making b) Copper contamination of the mix c) Old ingredients in the mix
Poor Meltdown	Same as wheying off, but may be further aggravated by the destabilization effect resulting from excessive whipping in the freezer. (See also grainy, buttery)	
Rancid Flavor	Enzyme action	a) Use of dairy ingredients in the mix with a high degree of rancidity b) Incomplete pasteurization c) Mixing of raw pasteurized milk products
Rapid Meltdown	Freezer operation	a) High drawing temperature b) Failure to purge product which has partially melted in the spigot c) Conditions listed under Wet Appearing Product
Rapid Meltdown	Mix composition	a) Low solids content b) Inadequate stabilization c) Low freezing point - due to high salt and sugar content

Defect	Source of Defect	Causes and Prevention
Salty Flavor	Mix composition	a) Incorporation of too much salt into the mix b) Nonfat milk solids content too high
Sour	Cleaning operations	a) Failure to wash equipment daily b) Failure to wash equipment properly c) Failure to wash all surfaces that come in contact with the product or ingredients which are added to the product
Sour	Handling of drip pan	a) Failure to wash and sterilize drip pan b) Failure to empty drip pan at frequent intervals and allow the product to warm up
Sour	Handling of rerun	a) Mixing rerun with fresh supply b) Adding rerun during slack periods
Sour	Hygienic practices	a) Contact of any part of the body with any surfaces that come in contact with the mix or finished product b) Contact of any part of the body or clothing with the mix, ingredients or finished product c) Contamination of mix with perspiration, other materials falling from person or surroundings and condensate from surroundings
Sour	Mix processing	Failure to insure that mix in its final container is at a temperature of 40°F or lower immediately after filling
Sour	Mix storage	a) Failure to maintain mix temperature at 40°F or lower b) Failure to maintain walk-in cooler temperature below 40°F c) Failure to maintain the temperature of the mix in the hopper at 40°F or lower, especially during slack periods d) Storing mix too long
Sour	Sterilization	a) Failure to remove all organic deposits prior to sterilization b) Failure to sterilize just prior to starting the equipment c) Inadequate concentration of sanitizing agent
Stale Flavor	Prolonged storage	a) Use of milk powder that has developed a stale flavor b) Use of powdered mix that has developed a stale flavor c) use of sterile mix that has developed a stale flavor
Too Sweet	Mix composition	Sugar content too high
Unclean Flavor	Bacterial contamination	a) Poor quality ingredients in the mix b) Any of the conditions listed under Fruity Flavor

Defect	Source of Defect	Causes and Prevention
		c) Any of the conditions listed under Sour Flavor
Uneven Consistency, Lumpy Mix	Mix formation	Excess of certain types of stabilizers
Unnatural Color	Artificial color	a) Wrong coloring used b) Excessive coloring used c) Insufficient coloring used (may use vanilla as diluant for more accurate measure)
Unnatural Flavor	Choice of flavoring materials	a) Erroneous use of wrong flavoring b) Poor choice of flavoring c) Imitation flavoring
Wet Appearing Product	Mix formulation	a) Excessive sugar content b) Improper stabilization and emulsification c) Excessive use of salt or salts d) Low serum solids content e) Low total solids content
Wet Appearing Product	Freezer operation	a) Overloading the freezer barrel b) Gradual seepage of mix into barrel particularly during periods of slack business c) Too large prime charge when starting freezer d) Too high drawing temperature e) Excessive overrun f) Product melting in spigot g) Mix which remains in freezer for a long period of time will eventually break down h) Mix allowed to freeze to sides of hopper may cause a similar stabilization i) Dilution of mix with milk or water
Wheying Off - Syneresis	Mix composition	a) Type of stabilizer b) Amount of stabilizer c) High milk solids not fat content d) High acid content
Wheying Off - Syneresis	Mix processing	a) Too high homogenization pressure b) Air incorporation at the filler

DEFECTS OF DIRECT DRAW MILK SHAKES

Defect	Source of Defect	Causes and Prevention
Color Defects	Same as Soft-Serve	
Cooked Flavor	" " "	
Fruity Flavor	" " "	
Grainy, Buttery	Essentially the same as Soft-Serve	
High Flavor	Same as Soft-Serve	

Defect	Source of Defect	Causes and Prevention
High Overrun	Freezer operation	a) Lack of mix in hopper b) Improper use of prime charge c) Mix orifice partially blocked or too small d) Excess amount of rerun in hopper e) Frozen shake rising through mix orifice into hopper f) High drawing temperature g) Excess time on spindle
Icy Texture	Freezer operation	Low drawing temperature
Icy Texture	Mix composition	Low solids content inadequate stabilization
Lacks Flavor	Same as Soft-Serve	
Lacks Sweetness	" "	"
Neutralizer Flavor	" "	"
Oxidized Flavor	" "	"
Poor Secondary Whip	Mix composition	a) Excess of emulsifiers b) Excess of buttermilk solids
Rancid Flavor	Same as Soft-Serve	
Salty Flavor	" "	"
Sandy	Mix composition	Lactose crystallization due to high serum solids content after prolonged stay of mix in freezer
Slick, Chalky, Feathery, Pudding, Poor Mouth Feel	Mix composition	Excess stabilizers, such as gums, combined with high overrun and high drawing temperature
Sour Flavor	Same as Soft-Serve	
Stale Flavor	" "	"
Too Sweet	" "	"
Too Thick	Freezer operation	Too low drawing temperature
Unclean Flavor	Same as Soft-Serve	
Unnatural Flavor	" "	"
Unstable Foam in Finished Shake	Mix composition	a) Excess of emulsifiers b) Excess of buttermilk solids
Warm Mouth Feel	Freezer operation	a) High overrun b) High drawing temperature

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