**Conditioning and Dewatering Behavior of ATAD Sludges**

**Saurabh Agarwal**

Committee Chairman: Dr. John T. Novak
Environmental Engineering

## Abstract

**Autothermal thermophilic aerobic digestion (ATAD) of sludge has been used to produce class A biosolids. With stringent EPA guidelines, more and more municipalities are looking to use this process for digestion of sludge. However the large polymer costs associated with dewatering these sludges has made the use of this technology unfavorable. Several studies have been conducted in the past which have looked into the mechanism leading to such a poor dewatering of sludge. Some of these studies have attributed the release of protein and polysaccharide during the high temperature digestion to be responsible for the poor dewatering. However the exact mechanism leading to the poor dewatering is still not totally clear. Laboratory scale studies were conducted to evaluate the mechanism leading to the poor dewatering of these sludges and also to be able to economically condition these sludges. ATAD sludge samples were collected from ATAD processing facilities in Ephrata, PA, Cranberry, PA, Titusville, FL and College Station, TX. The research included experiments evaluating the protein and polysaccharide concentrations in solution, cations and anions, iron and aluminum, zeta potential and capillary suction time. It was found that during digestion large amounts of protein and polysaccharide were released which were in the colloidal range, and the dewatering of each of these sludges became poorer as the amount of protein and polysaccharide in the solution increased. The release of protein and polysaccharide was related to the monovalent to divalent cation ratio and the iron and aluminum concentration in the sludge. Also during the digestion process, the pH of the sludge increased appreciably and the divalent cations precipitated out. The zeta potential**

**of the ATAD digested sludge was also found to be positive. Different chemical coagulants were used to condition the sludge, but even with high polymer doses the dewatering of the sludge was not satisfactory. A combination of iron (or cationic polymer) followed by anionic polymer was found to improve the dewatering to a desired level. The use of this combination of sludge conditioning also provides an economical solution to the problem of dewatering. The role of iron in improving the dewatering of the sludges was found to be important, with the sludge dewatering being better for sludges with a high iron content. The combination of high pH, divalent cation precipitation, iron deficiency and biopolymer release all contribute to the poor dewatering of ATAD sludge.**