Title: Chemical Conditioning of Municipal Wastewater Sludges Using Polyaluminum Chloride

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Objectives:

The primary goal is to evaluate polyaluminum chloride (PAlC) for use in conditioning wastewater sludges. Specific objectives are:

(1) to evaluate PAlC for improving sludge thickening and dewatering operations,
(2) to compare the performance of PAlC against alum and selected organic polymers,
(3) to determine mechanisms of conditioning for PAlC,
(4) to identify fundamental biological and chemical properties with the aim of predicting the performance of thickening and dewatering operations, and
(5) to evaluate the costs of using PAlC.

Procedures:

PAlC is a polymeric form of aluminumm (probably, $Al_{13}O_4(OH)_{24}^{7+}$) that is used in Japan and Europe as a coagulant in potable water treatment practice. There is some research underway in the United States examining it for the same purpose. It is prepared from aluminum chloride and will be done so in the laboratory studies of this research. Its performance will be compared against alum and selected, commercially available organic polymers. The organic polymers will be chosen based on their widespread use in practice, charge characteristics, and molecular weight.

Initial experiments will make use of sludge collected from the Amherst wastewater plant - i.e., mixed primary and activated sludge collected at the plant prior to chemical conditioning and vacuum filtration. Later studies will examine other types of wastewater sludges.

The ability of PAlC to condition sludge will be evaluated through batch thickening experiments and specific resistance tests (dewatering ability). Results will be compared to experiments conducted with alum and organic polymers. Fundamental sludge properties will be measured including surface properties (surface charge by microelectrophoretic mobility measurements) and particle size distributions (Coulter Counter/Channelyzer). These measurements are important in determining sludge conditioning mechanisms and because of their potential use in predicting the performance of sludge thickening and dewatering operations.

Expected Results:

Expected results include an evaluation of PAlC in conditioning municipal wastewater sludges, performance comparisons to alum and organic polymers, determination of sludge conditioning mechanisms, identification of properties to predict sludge thickening and dewatering performance, and an evaluation of costs.

No research studies are known regarding the use of PAlC as a sludge conditioning chemical, yet its properties suggest major advantages over metal salts (alum and ferric salts) and organic polymers. Unlike alum which is used at high dosages thus adding solids to the sludge being conditioned, PAlC might be used, depending on the conditioning mechanism, at much lower dosages. This might avoid or, at least, minimize precipitation of $Al(OH)_3$, which would also improve sludge dewatering properties.

The cost of sludge treatment and disposal is a large fraction of the total cost of municipal wastewater treatment. No cost analysis is available on the use of PAlC in sludge conditioning; however, significant cost savings might be realized. PAlC would be more expensive than alum on a unit weight basis, but lower dosages might be used. Its cost could be an order of magnitude less than commercially available organic polymers. Results will be presented in a technical report.

Cost: $42,000