CHEMICAL PRECIPITATION PHOSPHORUS REMOVAL IN WASTEWATER TREATMENT

The removal of phosphorus from wastewater via chemical precipitation is accomplished with the addition of a metal salt coagulant, typically aluminum or iron. Both Aluminum inorganic metal salts and ferric metal salts will react with phosphorus in the wastewater, form a precipitate and are removed with the settleable solids. While both metal salts can reduce phosphorus, there are several advantages and/or disadvantages to the chemicals used and consideration should take into account the impact on a specific wastewater plant.

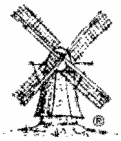
Comparison of Aluminum vs Iron Coagulants for phosphorus precipitation

1. Chemical Dose – To complete the precipitation reaction it takes:

A. 0.9 pounds of Aluminum to react with one pound of phosphorus
B. 1.8 pounds of Iron (Ferric) to react with one pound of phosphorus

*Therefore, you will create LESS chemical solids when using Aluminum based coagulants to remove equal amounts of phosphorus. The amount of Aluminum based coagulant is also lower on an active metals basis vs the Iron salts to reach your “P” removal goals.

2. *PH impact of coagulation -* Certain metal salt coagulants will reduce the alkalinity and the pH of the wastewater. This can cause problems and/or require the addition of another chemical to boost the pH prior to discharge or digestion. Ferric Chloride will reduce pH more than Alum or Polyaluminum Chloride. In systems where pH control is an important factor, Holland Company recommends the use of either Polyaluminum Hydroxychloride (PACL) or Sodium Aluminate. PACL will have a negligible impact on pH while Sodium Aluminate will actually add a small amount of alkalinity.



3. Obtaining Very Low Levels of Phosphorus - Studies have proven that the use of Aluminum based coagulants will achieve lower levels of phosphorus vs Iron salts. This is an important consideration as new lower limits (0.2 mg/l or less) are being required

4. UV Disinfection Impact - The addition of ferric chloride or ferric sulfate as the coagulant has a negative effect on the UV system. The ferric ion interferes with the UV wavelength and can "Coat" the UV light crystal, causing increased power consumption to overcome the reduced efficiency. This is Not a problem with aluminum based coagulants.

5. Clarifier Performance enhancement - The addition of Alum or Polyaluminum Chloride has the secondary benefit of enhanced clarifier settling efficiency. Lower turbidity and TSS will help plants meet permit limits, improve the quality of the effluent and most importantly, capture the insoluble phosphorus containing solids that might otherwise escape the clarifier and enter the plant effluent

6. Chemical Handling / Safety - Alum and Polyaluminum Chloride (PACL) are easier to handle and store vs Ferric Chloride. The ferric is very corrosive, requires special pumps and feed equipment and will "Stain" plant systems and equipment an orange/brown color.

7. Re-release of chemically bound phosphorus - Under anoxic conditions, Iron phosphate compounds are more likely to release the bound phosphorus back into the system or even release the phosphorus from residuals that were land applied, causing downstream higher phosphorus levels. Aluminum phosphate precipitates are more strongly bound and therefore will not re-release.

8. Additional Heavy Metal Impurities - Certain grades of ferric chloride, ferric sulfate and ferrous sulfates contain higher levels of heavy metal impurities. This needs to be reviewed prior to using the lower cost impure grades of ferric

For more information
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Typical Chemical Treatment Feed Options

1. Chemical treatment to the raw/primary influent wastewater
2. Dual feed to influent/ effluent of biological plants
3. Post secondary treatment before polishing filters