

Abstract: Aluminum sulfate reacts with phosphates to create aluminum phosphate and a sulfate. The conversion of the phosphate to aluminum phosphate is very important because this allows the phosphate to be easily extracted. This manipulation is used today in industrial waste treatment sights. The removal of phosphates is very important for if phosphates are not removed, they plague bodies of water by feeding algae which clog the surface waters and eventually effect every living and nonliving thing in that environment.

Chemical Process: The reactions which occur are the following:

Aluminum sulfate(alum) in combination with wastewater can flocculate phosphorus. The Flocculation that happens with aluminum sulfate addition is the formation of aluminum phosphate particles that attach themselves to one another and become heavy and settle to the bottom of a clarifier. The aluminum sulfate and phosphorus mixture can then be withdrawn, thereby removing the phosphate or phosphorus from the wastewater flow.

Industrial Applications: The application of this reaction to the industrial world consists of a set of processes to filter out the phosphate. The setup is the following:

Purpose: Restrict phosphates to aluminum phosphates for easier disposal of phosphorus.

The first step in phosphorus removal is the Rapid Mix. In this stage, alum and waste or water runoff(known as effluent) is blended together as rapidly as possible with the use of a high-speed mixer called a "flash mixer." After this instant mixing, a slower moving process called coagulation and flocculation follows to allow the formation of a floc. These processes occur in a Flocculation Chamber. This floc consists of suspended and colloidal matter, mainly including the aluminum phosphate. Next, the effluent travels to a clarifier in which sedimentation occurs. The heavier aluminum phosphate settles to the bottom then pumps at the bottom of the clarifier pump out the aluminum phosphate via pipes. This aluminum phosphate is then disposed. Currently, there are no economical uses for aluminum phosphate.

Also, this chemical process is similar to the process used by laundry detergents. Many detergents contain synthetic phosphates, called tripolyphosphates(TTPs). These chemicals cling to grease and dirt particles(alum in the previous example), keeping them in suspension until the wash water is flushed out of the washing machine.

Impact on Society: This reduction in phosphorus is very important. This

added phosphorus disrupts the natural cycle of phosphorus. One result of this is an algal blooms, or exponential growth in algae. When algal blooms occur, the surface of a freshwater lake is clouded with an almost finite amount of bacteria because of an increase in a nutrient. In this case an increase in phosphate, a favorite for algae. This deprives the bottom of the lake by cutting off light. A dense mat of algae choke off the lake. Also, phosphates are nutrients for plantlife. When fall approaches, or when phosphate levels are decreased, the algae die and fall to the bottom, changing the bottom from a silt, sand and clay bottom to a sand gravel and rock bottom. When the plants die, they are degraded by aerobic bacteria, which can deplete dissolved oxygen, killing aquatic organisms. As oxygen levels drop, anaerobic bacteria resume the breakdown and produce noxious products. All of this impairs navigation, fishing, swimming and recreational boating.

Total phosphorus removal through filters after using alum as a filtering aid achieves 70 to 95 percent efficiency. Phosphates must be filtered out before the water or wastes are dumped back into bodies of water.

Glossary

Flocculation: The gathering together of fine particles to form larger particles.

Effluent: Wastewater or other liquid -- raw, partially or completely treated -- flowing from a basin, treatment process, or treatment plant.

Coagulation: The use of chemicals that cause very fine particles to clump together into larger particles. This makes it easier to separate the solids from the liquids by setting, skimming, draining or filtering.

Floc: Groups or clumps of bacteria and particles or coagulants and impurities that have come together and formed a cluster.

Colloidal: Very small and finely divided. Referring to solids. Does not dissolve and remains dispersed in a liquid for a long time due to small size.

Algal blooms: Rapid growth of algae in surface waters due to increase in inorganic nutrients.

Bibliography

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