

Phosphorus Elimination / Recovery from Wastewater

Challenge

Worldwide, wastewater is regulated regarding its phosphorus concentration. In many cases, a maximum limit of <1 ppm total phosphorus is applied¹. This is regulated because phosphorus is one of the main causes of eutrophication in water bodies. This means that too much phosphorus in wastewater causes excessive algae and plant growth, which then in the long term leads to oxygen deficiency and loss of biodiversity in water bodies. Phosphate recovery is also becoming increasingly important in the wastewater treatment process. This requires operators to optimize their process in this respect.

Varying orthophosphate concentrations are common in the wastewater input of sewage treatment plants, which makes constant control mechanism of precipitation impossible. In addition, some of the organically bound phosphorus and polyphosphates are also converted into orthophosphate during the wastewater treatment process, which can influence the total orthophosphate concentration over time.

This conversion is even specifically optimized by some wastewater treatment plants to improve the overall balance of phosphorus recovery. For this reason, the orthophosphate concentration is the appropriate control parameter for optimizing the precipitation treatment.

Precise dosing of precipitants is extremely important for phosphorus elimination/recovery to ensure that over- or underdosing of orthophosphate (PO_4^{3-}) can be avoided during operation. Only targeted control of the precipitant dosage can increase the efficiency of this process and ensure complete precipitation of the orthophosphate. Furthermore, the costs of this treatment process can be minimized.

The key to cost-efficient precipitant dosing is robust online measurement analytics that can determine the orthophosphate parameter accurately and reproducibly.

¹ US Clean Water Act goes even further to <0.1 ppm

Solution

In modern wastewater treatment plants, orthophosphate is measured online in order to adjust the dosage of precipitants such as iron or aluminum salts. Orthophosphate precipitation typically takes place in three variants:

- Pre-precipitation (before the biological stage): Eliminates ortho-phosphate at an early stage.
- Simultaneous precipitation (in activated sludge): combining biological and chemical processes.
- Post-precipitation (after the biological stage): Reduces residual phosphate in the effluent water.

As you can see, no matter which option you choose, the sampling points are always very demanding. The high degree of contamination of the water at the sampling points requires well-functioning sample preparation (filtration) to ensure that the online measurement technology can also function properly. For this reason, Swan Analytical Instruments joined forces with experts from this field to combine a sample preparation system with the existing Swan orthophosphate analysis (AMI Phosphate Monitor with



Cleaning Module-II) in a very practical manner. With the help of ETL Verfahrenstechnik GmbH, an all-in-one system was developed that combines online analysis with sample preparation. For this purpose, the system was completely integrated into a climate chamber, which enables measurements directly at the basin in any weather and season. The system supplies filtrate for analysis continuously and maintenance-free for at least one month, which is extremely robust in such a measuring environment. Thanks to the

easily replaceable filter cartridges, which can also be reused after cleaning, monthly maintenance is also cost-saving and easy to carry out (< 3 minutes).

In short: online orthophosphate measurement is indispensable for modern wastewater treatment plants. It improves environmental protection and resource conservation, reduces operating costs and ensures compliance with legal requirements.

AMI Phosphate with Cleaning Module and Filtration

The all-in-one package from Swan for the safe and holistic precipitation of orthophosphates from wastewater.

- Continuous measurement of the orthophosphate concentration
 - 0.01 – 10.0 mg/L with AMI Phosphate-II
 - 0.1 – 50 mg/L with AMI Phosphate-HL
 - Free programmable measuring cycles, min. 10 min
- Complies with the ISO 6878 or APHA 4500P/C measuring principle
 - Zero measurement before each orthophosphate measurement
 - Accurate and robust against measurement interferences
- Full control over sample flow and reagents
 - Overflow cell ensures constant sample flow through the photometer
 - Fully automatic reagent handling
 - Level sensor for the reagent bottles
- Automatic cleaning module
 - Chemical cleaning of the photometer
 - Freely programmable cleaning intervals
 - Particularly important for bioactive samples
- Automatic filtration module
 - Maintenance-free for one month
 - Filter change in less than 3 minutes
 - Reusable filter cartridges

