Phosphorus Recovery Project

Trial operation of the phosphorus recovery plant at the Felsalbe sewage treatment plant in Pirmasens, which is currently under construction, is scheduled for the beginning of 2020. The process was recently presented at a DWA meeting where it attracted avid interest.

Dr. Hagen Hürter, Head of the Waste Water Disposal of the City of Pirmasens and recently appointed Head of the Civil Engineering Department, presented the concept of phosphorus elimination and phosphorus recovery at the Pirmasens sewage treatment works during the 20th Symposium of Hesse/Rhineland Palatinate/Saarland Regional Group of the German Association for Water Management, Waste Water, and Waste (Deutschen Vereinigung für Wasserwirtschaft, Abwasser und Abfall e.V., DWA). Phosphorus recovery was already a topic of interest at Pirmasens long before the amendment of the German Sewage Sludge Ordinance (AbfKlärV) in 2017 which sets out details of future phosphorus recycling. Some ten years ago PFI initiated a research project with the goal of developing a process for the recovery of phosphorus from sewage sludge (reports can be found in earlier issues of our newsletter).

The main focus of the 20th DWA Symposium and one of the major tasks of municipal sewage treatment plants is the removal of phosphorus from waste water. The objective is to prevent excessive concentrations of this nutrient from causing excessive plant growth in the natural bodies of water receiving purified waste water. The phenomenon is also known as “algal bloom through eutrophication”; it generally leads to a reduction of the oxygen content and in the worst case to death of fish and other animals.

Fig. 1: Photo of the machine hall of the Felsalbe sewage treatment plant with new high-performance digestion system (on left). Two sedimentation tanks can be seen in the background.

Operators of sewage treatment plants therefore have to ensure that the concentration of phosphorus in “their” effluent complies with relatively low limits. That is why common use is made of chemicals such as aluminium or iron salts in the waste water treatment tanks; these salts form poorly soluble compounds with phosphorus. These compounds are subsequently separated off with the biological sludge and disposed of with the sewage sludge after degassing in the digestion tower.

For several years the Pirmasens wastewater disposal works has adopted the approach of removing phosphorus from waste water by biological elimination. To this end, bacteria naturally present in the clarification tanks are made to take up large amounts of phosphorus in their cells by targeted process control. Although this approach requires greater effort in the control and monitoring of wastewater treatment, it greatly reduces the amount of chemicals required and thus saves costs.

This approach also utilises the new process for phosphorus recycling because biologically bound phosphorus (Bio-P) can be more readily recovered from the separated sludge than chemically bonded phosphorus. To do this the sludge is first thoroughly digested in the new high-performance digestion system (Fig. 1 and 2), before being subjected to high-pressure thermal hydrolysis (Fig. 3). After recovery of ammonium, the phosphorus is separated by crystallisation as ammonium magnesium phosphate (MAP).

Fig. 2: Rear view of the machine hall with the new high-performance digestion system (centre), additional vessels for phosphorus recovery (left) as well as the existing digestion tower (right)

Most of the technical components required for the new process at the Felsalbe waste water treatment operation have already been produced. The vessels for high-performance digestion and for treatment and conditioning of the sludge have been erected and connected in the outdoor area. Considerable advances have also been made in the adjacent machine hall and in its basement.

In addition to the existing infrastructure of the sewage treatment operation, this is where the vessels, pipework, heat exchanger, and plant for high-pressure thermal hydrolysis and phosphorus recovery

are located. Coming weeks will see delivery and installation of the last components, such as the crystallisation vessel. All the components necessary for the new process are scheduled to be available by the end of the year.

At the beginning of 2020 all the components, starting with the high-performance digestion system, will come on stream and be integrated into the existing treatment process. In the course of next year the plant will start normal operation and the process will be evaluated and optimised.

Fig. 3: Heat exchanger of the high- pressure thermal hydrolysis unit in the basement of the machine hall

Funded by:

RheinlandPfalz
MINISTERIUM FÜR UMWELT, ENERGIE, ERNÄHRUNG UND FORSTEN

UMWELT INNOVATION PROGRAMM

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