

Pilot plant large-scale phosphorus recovery (MAP) from sewage sludge of wastewater treatment plants with simultaneous elimination of phosphate by iron salts

Phosphorus is almost exclusively recovered by exploiting geological deposits, leading to a reduction of mineral rocks and thus is contradictory to the understanding of sustainability. Therefore, alternatives to the production of phosphorus from phosphate ore have been investigated since some years. Considering the organic municipal wastes in Germany, it is obvious that the highest potential for recovery is in sewage sludge.

The direct application of sewage sludge on agriculture is debatable, as the sludge is a sink for the organic and inorganic pollutants contained in the wastewater. The federal land Baden-Württemberg follows up the spreading of sewage sludge for agricultural application due to reasons of prevention and sustainable protection of soil and groundwater. In addition, research has shown that the phosphorus contained in the sludge is partially hardly available for plants, which results in debatable efficiency of fertilizer.

At the Institute of sanitary engineering, water quality and solid waste management of the University of Stuttgart in cooperation with the IB iat-engineering consultancy, Stuttgart, the so-called „Stuttgart Process“ has been developed for phosphorus recovery from anaerobically stabilised sludge as magnesium ammonium phosphate (MAP, Struvite). The process is distinguished by the fact that municipal sewage sludge from wastewater treatment plants with simultaneous phosphate elimination with iron salts could be used without any changes in the process of wastewater purification (e.g. bio-P mode). The resulting product MAP can be applied, for example, directly as fertilizer in agriculture.

The procedure has been developed in the years 2003 and 2004 and tested in laboratory scale. Based on these experiments, a semi-technical pilot plant (reactor volume approx. 1 m³) has been operated after the „Stuttgart Process“ for phosphorus recovery. It has been shown that the process can run in half technical scale with stable characteristics.

The interest in the large-scale implementation of technologies for phosphorus recovery has increased in particular due to shortage of natural easily available phosphorous deposits and with the increasing phosphorus prices.

For the technical implementation of the „Stuttgart Process“ one of the wastewater treatment plants of the association of treatment plants of the region Offenburg has been selected as the location of the pilot plant. The expansion capacity of the wastewater treatment plant is about 200,000 P.E., with about 160,000 connected P.E. The pilot plant is dimensioned by the plant designer in a way to treat a partial flow of sewage sludge with an approximate equivalent of 5,000-10,000 P.E. Iron salts are used as precipitants agents for the elimination of phosphorous in the wastewater treatment plant. The pilot plant is installed in a building which was for-

merly used for drying sewage sludge. The operation of the pilot plant is in batch system. A charge is about 11 m³ digested sludge as the starting basis for the further steps. The pilot plant consists of two batch tanks, a sedimentation tank and a chamber filter press as well as holding tanks and dosing equipment for the operational resources. In the batch tank 1 dissolution of sewage sludge is carried out. After the dissolution step, solid / liquid separation takes place. The dissolved digesting sludge is mixed with a stock solution of polymer and process water in the feeding line leading to the chamber filter press. The digested slurry filtrate from the chamber filter press is transferred to the batch tank 2. The complexation, the neutralisation and the phosphorus precipitation of digested slurry filtrate will be carried out in batch tank 2. After the precipitation, the P recycle is retrieved and dried in a further step in the process.

On the 18th of November 2011, the official commissioning of the MAP pilot plant was launched by the Minister of Environment, Franz Untersteller.

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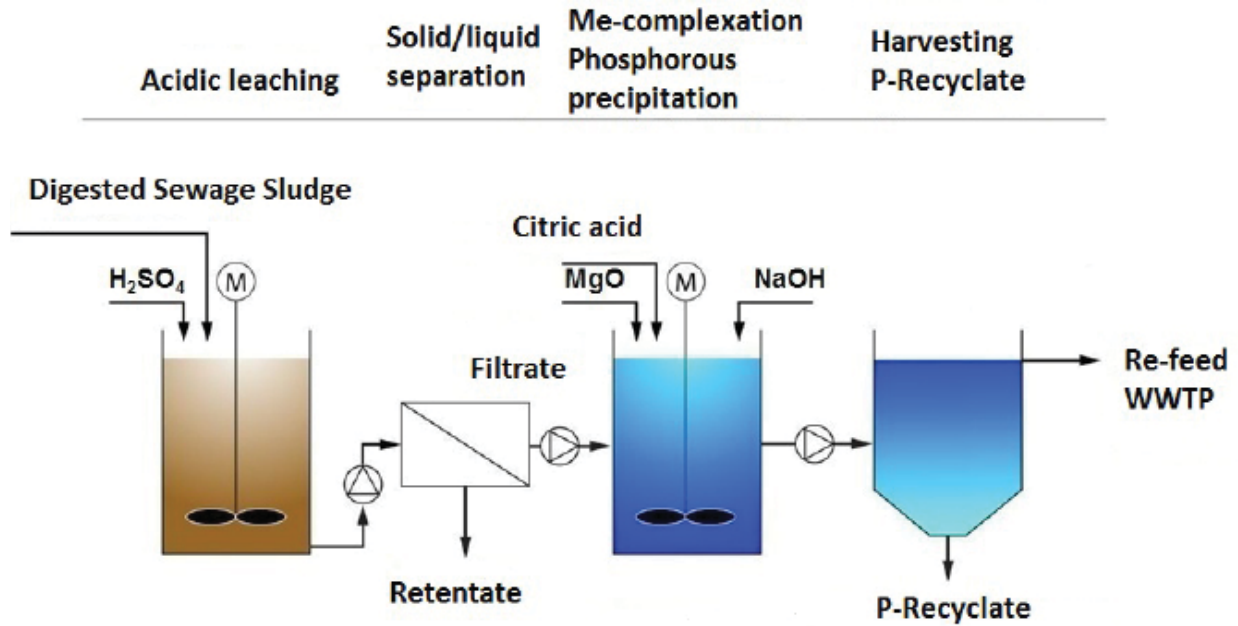
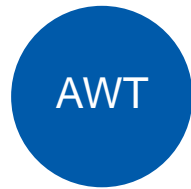
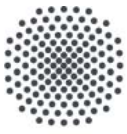


Figure: Process scheme „Stuttgart procedures“ of the MAP pilot plant to the phosphorus recovery system on the WWTP Offenburg