VEOLIA

STRUVIA™

Sustainable recycling of phosphorus from wastewater

WATER TECHNOLOGIES

Sustainable recycling of phosphorus: The stakes

Phosphorus, a component of DNA, is an essential nutrient for life and to the development of every living being. It is a key ingredient in the fertilizers used in agriculture and for animal feed.

It is primarily produced by mining, but resources are not limitless and no synthetic substitute currently exists, while demand is growing due to the pressure of worldwide population growth.

It is thus unsurprising that phosphorus is found in the wastewater generated by human activities.

A circular economy stakeholder and a creator of water treatment solutions, Veolia Water Technologies has developed Struvia™, a solution for recovery of phosphorus from effluents produced by various industrial and agricultural activities, or from municipal waste facilities, as struvite crystals[1]. This opens the way to a local reuse of phosphorus especially in agriculture.

The recovery of phosphorus is especially important considering declining phosphorus rock reserves and the continually rising price of phosphorus and with a population aware of environmental quality issues.

Europe is well aware of its dependency on imported phosphorus, along with the fact that natural phosphorus resources are not limitless[2]. Some countries, like Sweden, Switzerland, the Netherlands and soon Denmark, are moving towards applying new regulations concerning the recycling of this valuable fertilizer. Struvia is therefore an ideal solution for reclaiming phosphorus from waste water in these areas.

This recovery would also limit the release of phosphorus into the natural habitat, which causes euthrophication[3].

(1) Struvite: also known as Magnesium Ammonium Phosphate or MAP
(2) European Sustainable Phosphorous Conference 1, Bruxelles- 2013 & ESPC2, Berlin - 2015
(3) An imbalance in an aquatic environment

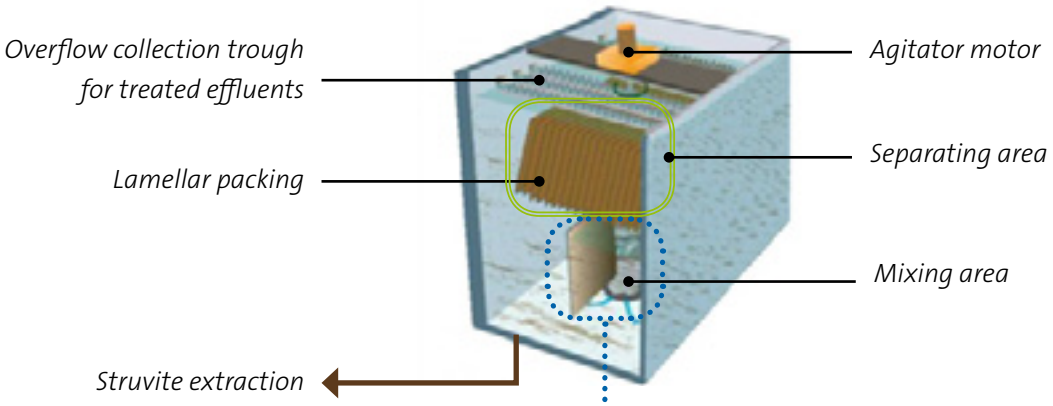
Operating principle

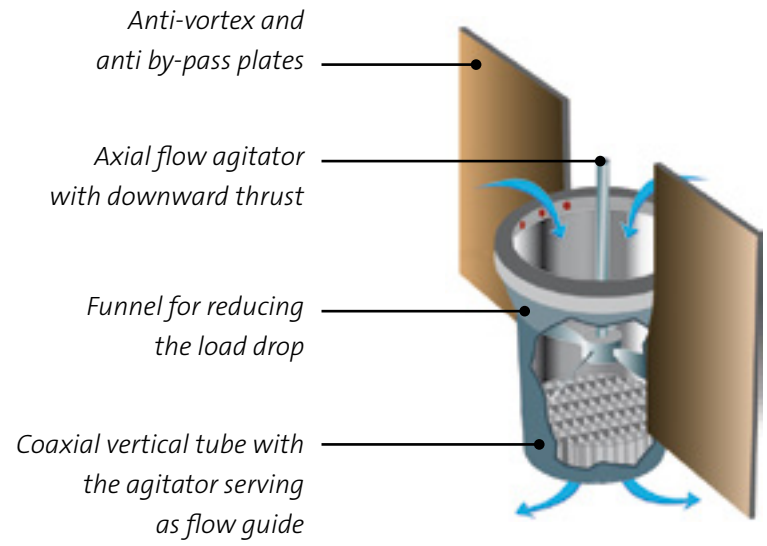
Effluent containing high concentrations of phosphorus, for example centrates generated from digested sludge dewatering, are fed to a continuous stirred tank reactor where rapid mixing is achieved using a special mixing system: Turbomix™. Struvite precipitation is initiated by increasing the pH and by addition of a magnesium salt.

An integrated lamella settler ensures the separation of the produced struvite prills and the treated effluent. Typically in municipal applications the treated effluent is returned to the head of the treatment works.

For industrial applications Struvia is applied on the waterline. The effluent can be discharged directly or further treated if required.

The struvite prills are then pumped and directed to a draining and storage facility before they are sent to the packaging unit.



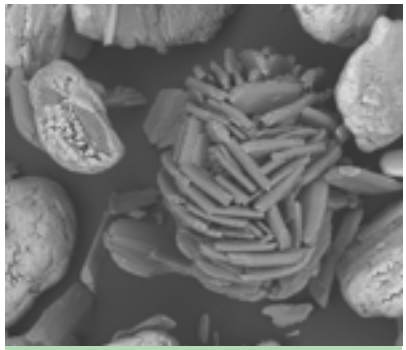


Turbomix is patented by Veolia Water Technologies.

It encourages crystallization and growth of struvite pellets and it allows for optimum use of reactive products with a short reaction time, hence limiting space requirement.

The advantages of the Struvia solution

Struvia prototype reactor at the Brussels-North WWTP



Struvite pellets produced in a Struvia reactor

Recovering phosphorus contained in wastewater leading to:

- A reduction in the production of sludge
- The production of sludge with a reduced phosphorus content (ideal for areas that are saturated in phosphorus and threatened by eutrophication)

Reduced operating costs for existing facilities

- Struvia prevent dysfonctions, over-costs and unplanned operation downtime caused by uncontrolled struvite precipitation that clogs pipes
- Struvite production reduces the need to inject precipitation triggering reactive products like iron or aluminum salts into the waste water treatment process.

An ideal solution for treating phosphorus laden effluents

- Limited space requirements
  - a single reactor with integrated lamella settler
  - no loop or recirculation pump
- Reduced maintenance
- Low investment and operating costs (combined with sales of struvite produced)

Draining then drying the struvite produced using a filter bag during tests at the Braunschweig WWTP in Germany, with phosphorus elimination efficiency levels higher than 85%

THE FUTURE USES OF THE PRODUCT

> In a circular economy approach, the customer (whether a municipal authority or an industrial operator) can decide to recycle struvite by incorporating it into fertilizer. The customer can choose to handle this reuse directly or entrust it to an operator like Veolia, through its specialized subsidiaries.

> With a view to involving local players and the population in sustainable development in their local area, the municipal authorities may choose to make the recovered struvite freely available.

Example of struvite incorporated in an organo-mineral fertilizer used in agriculture

P-REX, BRUSSELS-NORTH WWTP - A FIRST CONCLUSIVE PROJECT

A Struvia prototype unit was successfully implemented for the first time at the Brussels-North waste water treatment plant in 2013 and 2014, as part of the P-Rex program (this is a European program for the reuse of phosphorus from waste water). It has reached P-PO4 phosphorus removal efficiency levels higher than 85 % when treating centrate generated from digested sludge dewatering as well as validating the potential of the technology.

The Struvia solution

The Struvia technology has been developed by Veolia Water Technologies to facilitate the recovery and reuse of phosphorus. This allows municipal and industrial clients to turn a cost (purchase of metal salts and sludge disposal), into a benefit (sale of struvite as a fertilizer).

Struvia is adapted to all circular economy and sustainable development projects.

Samoens WWTP, France

MUNICIPAL

Struvia is of interest to public authorities and municipal installation operators:

At the treatment plants that handle residual municipal water and are equipped with biological phosphorus treatment followed by anaerobic sludge digestion, dewatering stage centrates contain highly concentrated phosphate that may uncontrollably precipitate as struvite crystals. The Struvia solution **ensures controlled struvite precipitation in a specialized reactor**. The product can then be packaged and sold. Struvite represents an ideal solution to the need for slow release ammonium phosphate.

APPLICATIONS

- Wastewater treatment plants equipped with digesters
- Water treatment plants equipped with biological dephopsphatation wishing to install sludge digestion
- Water treatment plants equipped with anaerobic digestion wishing to install biological phosphorus treatment
- Household waste methanization plants
- Territorial methanization sites

INDUSTRIAL

Struvia is also of interest to industrial and agricultural operators:

At industrial facilities, the naturally high phosphate concentration of a number of effluents means that the Struvia solution can be applied directly on the water line.

For industrial effluents that are treated by methanization (UASB, EGSB, Memthane), the ideal location for the Struvia reactor is downstream to the anaerobic treatment and upstream to the biological nitrogen using Nitrification-Denitrification or with an Anita™ Mox type deammonification process, for example.

APPLICATIONS

- In agriculture for treating livestock effluents
- In the Food & Beverage industry, in distilleries, dairies, breweries, slaughterhouses, potato processing and where fermentation effluents are treated to be reclaimed
- In agrichemicals, in producing fertilizers and biofuels

Resourcing the world

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