Nutrient Recovery

Struvite Harvesting

SCHWING BIOSET

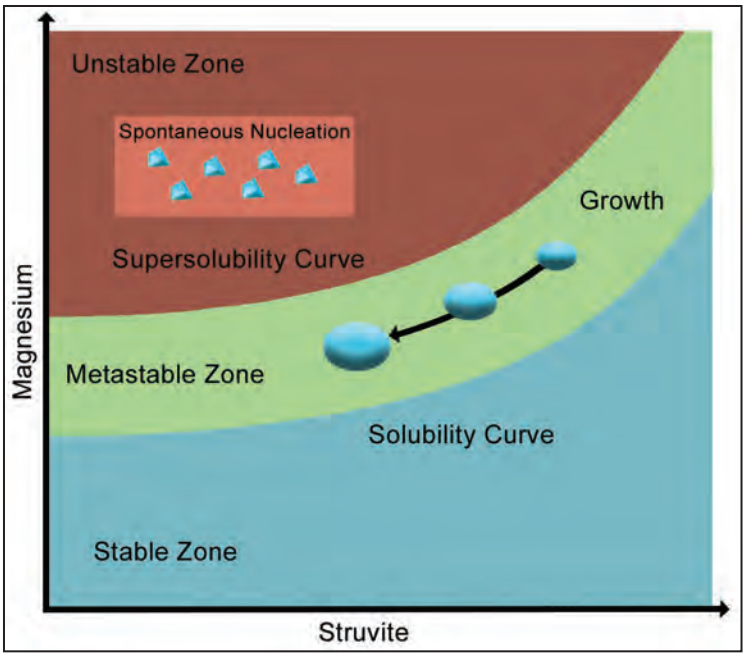
Struvite Recovery

Schwing Bioset's harvesting technology recovers orthophosphate (PO_4-P) and ammonia nitrogen (NH_4-N) from your biosolids stream to form pure struvite ($NH_4MgPO_4 \cdot 6H_2O$) crystals. The crystals are uniform, typically 1-3 mm in size, and are easily settled in the Crystallizer to be harvested.

For every one pound of orthophosphate that is removed, an additional half pound of ammonia nitrogen is also removed. Minimum removal of 80% of the orthophosphate present in the solution can be converted to pure struvite, enabling maximum efficiency and recovery within your plant.

This is true up-cycling of your waste stream. Valuable struvite is recovered for re-use as a fertilizer, while the phosphorus and nitrogen loads that are returned to the head of the plant are greatly reduced, allowing more efficient operations and enabling plants to meet increasingly strict daily effluent limits. Added benefits include the prevention of struvite scaling and accumulation within the plant and improved dewatering performance in applications where biological phosphorus removal is used.

Crystallization Chart



Performance You Can Count On

Benefits of Struvite Recovery

- Avoid scaling and clogging of pipes, pumps, dewatering and other equipment
- Reduce accumulations in tanks that cause shut downs for removal
- Improve dewaterability of Biosolids by re-balancing mono and divalent cation ratios
- Create a valuable product from your waste stream
- Offset dwindling worldwide phosphate reserves
- Help prevent algal blooms in sensitive waterways
- Market the harvested product under trade name Bio-Stru®
- Harvested struvite can be marketed independently by the municipality or through Schwing Bioset's marketing channels

Features of Schwing Bioset Technology

- Process can be applied on either digestate, centrate, or a combination of both
- pH adjustment and struvite precipitation are accomplished in separate vessels for stable and precise process control
- Offers continuous operation in a small footprint
- Fully-automated process controls
- Low operating and maintenance expenses
- Accommodates variable dewatering schedules as all configurations operate continuously or intermittently in batch mode

Nutrient Management by Schwing Bioset

If left untreated, Magnesium Ammonium Phosphate (MAP), better known as struvite, can build up inside pipes, pumps, valves, tanks, and other equipment, reducing a wastewater plant's capacity and resulting in expensive maintenance issues. Schwing Bioset, Inc., with technology under license from NuReSys, can help your plant run more efficiently, preventing unwanted struvite formation by recovering phosphate and nitrogen from wastewater. This "up-cycling" of your waste stream is the model for wastewater plants of the future. It creates a crystalline fertilizer product that can be harvested from the process and marketed, and at the same time removing those loads from the streams returning to the head of the plant.

Proper struvite control and recovery begin with managing the pH of the liquor streams to influence the reaction of magnesium with the phosphorus in the solution. This is accomplished in our Air Stripper. Once ideal pH conditions are created, the Magnesium (Mg) will precipitate the soluble orthophosphate ions in the form of struvite. Adding additional Mg in the form of Magnesium Chloride ($MgCl_2$) to the Crystallizer allows for the continual precipitation of struvite from the waste stream, which in turn consumes orthophosphate and ammonia nitrogen, and allows the micro-crystals to grow into larger, harvestable prills.

Three primary configurations of the technology are available, each designed and configured to solve specific issues encountered in wastewater treatment plants.

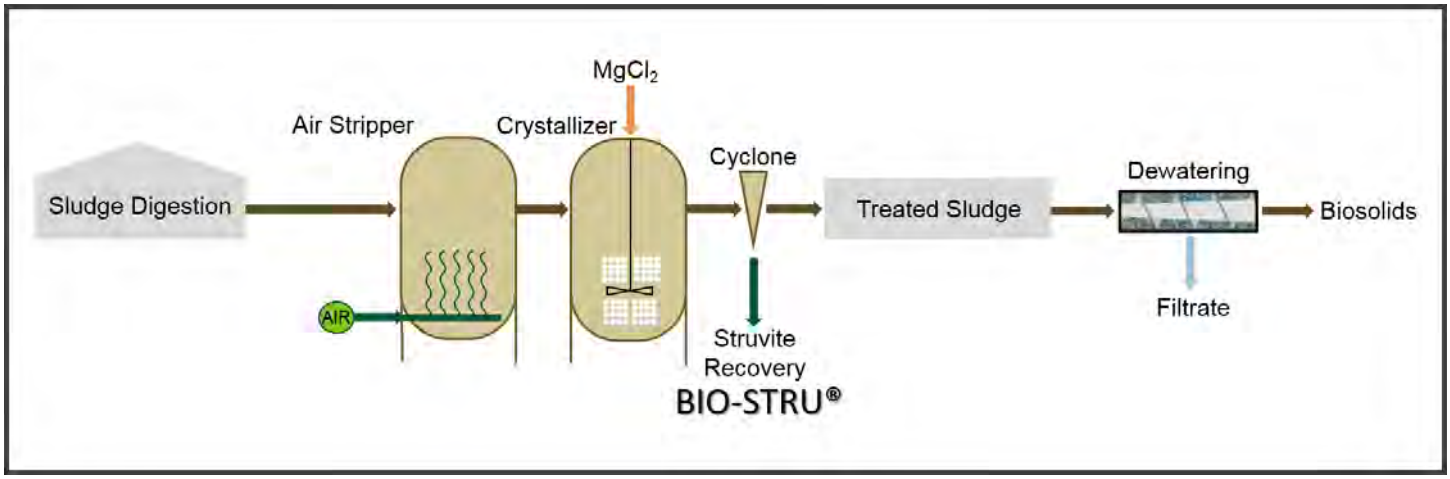
Prevent struvite deposits while creating a marketable fertilizer product

Bio-Stru® is Produced Under License From

NuReSys®

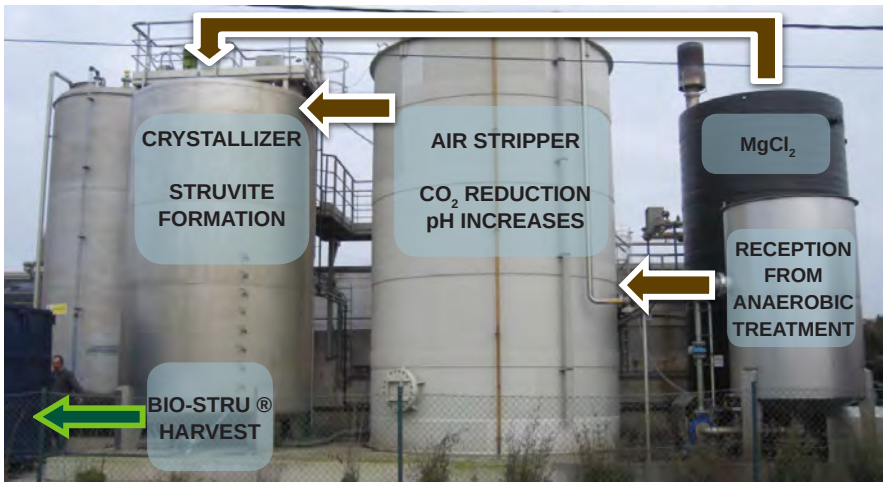
Digestate Solution

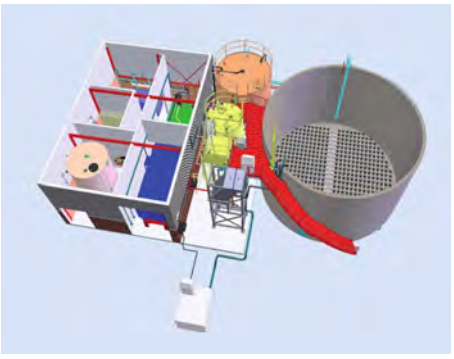
Both the Air Stripper and Crystallizer are applied on the digestate stream recovering struvite before it can cause fouling in downstream equipment. An additional benefit is an improvement in dewatering performance and a reduction in polymer use as a result of rebalancing the ratio of the monovalent and divalent cations present in the biosolids. While theoretical results may be higher, typical "real world" results range from 1-3% improvement in the dried solids (DS) content of the biosolids, plus an additional 1% of DS gained by unrecovered struvite collecting in the biosolids.



General Process Overview

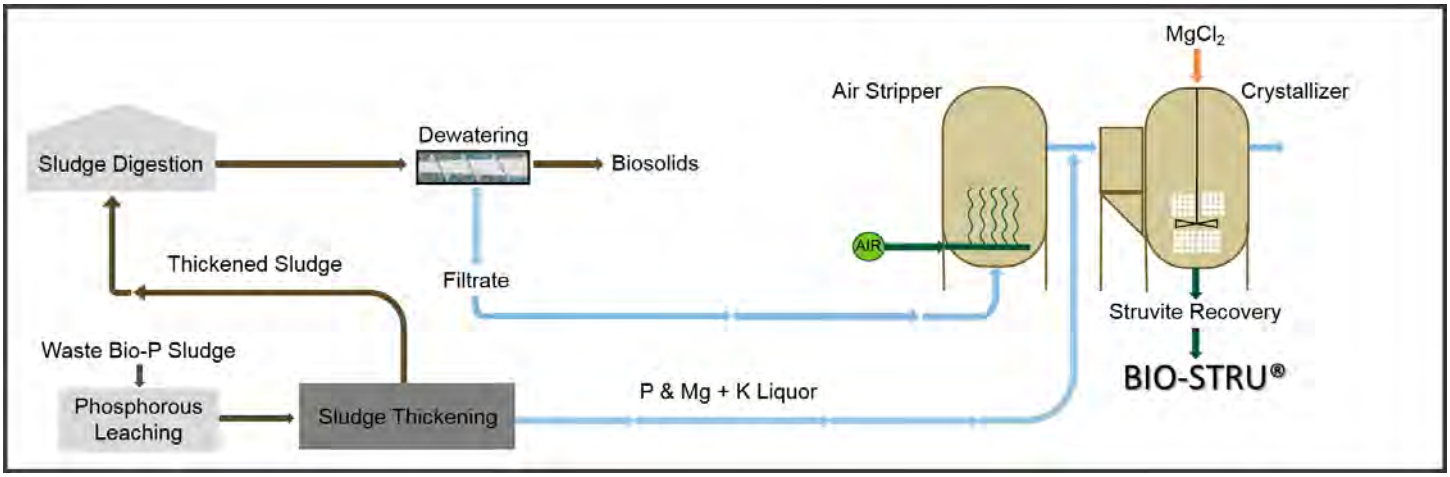
1. Digestate or Centrate is pumped to the Air Stripper.
2. In the Air Stripper, CO_2 is removed, which raises the pH to the desired process condition.
3. Overflow from the Air Stripper proceeds to the Crystallizer.
4. $MgCl_2$ is added in accordance with PO_4-P concentration and solids content of the treated wastewater stream.
5. In the Crystallizer, a Continuously Stirred Tank Reactor (CSTR), the Mg reacts with the soluble orthophosphate ions and nitrogen, allowing the struvite crystals to form and grow.
6. Harvested struvite prills are removed from the bottom of the Crystallizer.





Centrate Solution

Both the Air Stripper and Crystallizer are located after dewatering and process the centrate/filtrate from the dewatering device. While this solution has the benefits of minimizing equipment sizes, minimizing chemical dosages, and increasing prill harvesting efficiency, by being located after dewatering it cannot help with struvite formation in upstream pipes and equipment or influence dewatering performance.



Decades of Experience

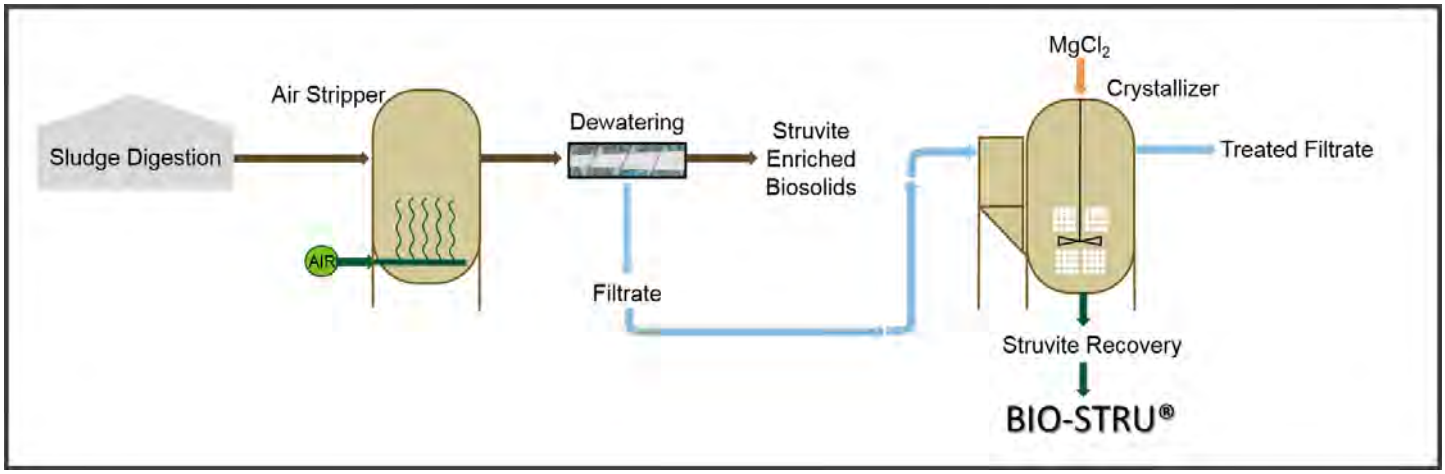
The Schwing Bioset *Advantage*

For over 30 years the Schwing name has been synonymous with quality, reliability, performance, and after-market support. Let our engineers work with your team to solve your specific operation issues to reduce maintenance and improve the overall performance of your plant.

We look forward to welcoming your utility to our long list of satisfied customers. Call one of our representatives today and learn more about the Schwing Bioset ***Advantage***.

Hybrid Solution

The Hybrid solution optimizes struvite management within a wastewater plant. By locating the Air Stripper in the digestate line, the pH can be manipulated to form micro-crystals of struvite with the Magnesium that is naturally occurring in the stream. This controlled precipitation prevents accumulation in areas that will cause downtime and maintenance costs. The Crystallizer is located after dewatering on the centrate/filtrate stream such that smaller equipment, lower chemical dosages, and a more efficient prill formation and harvesting process can be implemented.



A Name You Can Trust

Schwing Bioset Solutions for Water and Wastewater

Piston Pumps for Solids
High-pressure positive displacement piston pumps with lowest life cycle costs to efficiently transport biosolids through pipelines.

Class A Bioset Process
Advanced alkaline stabilization technology that is totally enclosed and PFRP approved to operate at 55C.

Screw Press Dewatering
High-performance dewatering with low energy and maintenance requirements and the widest range of model sizes available.

Container Wagons
Evenly load containers with ground accessible service points, minimal maintenance requirements, and full automation.

Membrane Bioreactors (MBRs)
Microfiltration systems with end-free hollow fiber membranes.

Sliding Frames & Storage Silos
Truck receiving, truck loading, or intermediate storage of dewatered solids with lowest cost of ownership.

Class A Fluid Bed Drying
Thermal drying technology operating under inert conditions with high thermal efficiencies and low maintenance requirements.

Phosphorus Removal / Struvite Recovery
Remove nutrients from wastewater, improve dewatering, reduce scaling, and create a struvite end product.

Residuals Management
Offered through a partnership with our resource recovery company to transport, market, and beneficially reuse residuals.

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Printed on Recycled Paper

PB-SR-1218