P-REX
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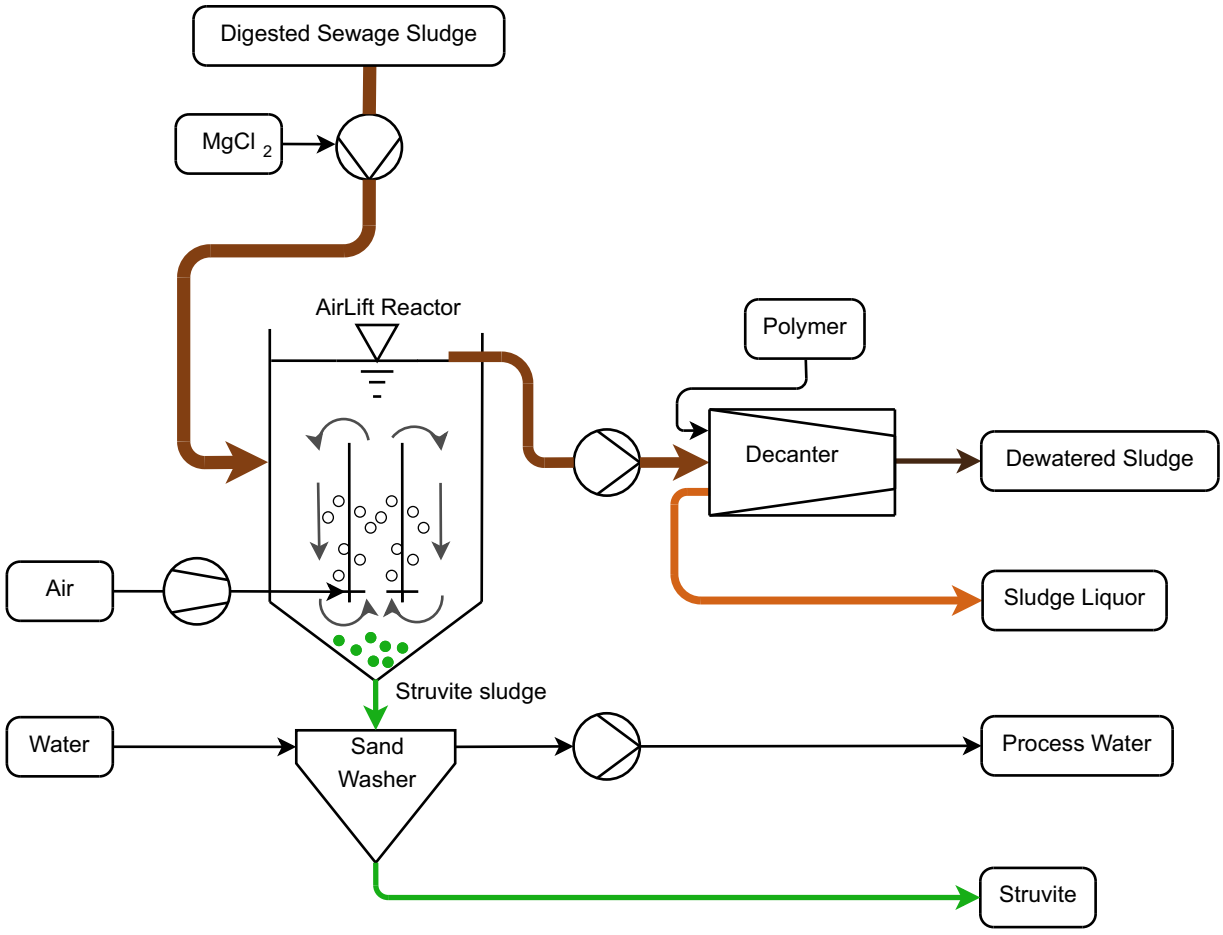
AirPrex®

Struvite crystallization in sludge

Short description

The Airprex® process was developed to prevent unwanted struvite incrustration after digestion in EBPR WWTP. It is currently operated at several WWTP in Germany and the Netherlands, installed directly after the digesters and prior to sludge dewatering. In the AirPrex® process pH increase is achieved by CO_2 stripping with intensive aeration. Additional Mg is added as $MgCl_2$ solution. Sedimented struvite crystals are harvested at the bottom of the reactor. The struvite product is crystallised within the wet sludge and can therefore show some organic and inorganic impurities. Washing and gentle drying of struvite improves the quality and provides a marketable fertilizer product. "Berliner Pflanze" is the first product of AirPrex® with official fertilizer approval and REACH registration.

Process scheme



This project has received funding from the European Union's Seventh Framework Programme for Research, Technological Development and Demonstration under the Grant Agreement no. 308645.

General Data

Type of Process	crystallisation
Type of Plant	airlift reactor
Input Material	sewage sludge after digestion
Product	struvite
P-concentration	21 % P_2O_5 of DM
P recovery performance[1]	7 % of P in sludge input

Supply

Average total electricity demand[1]	10.3 [kWh/kg $P_{recovered}$]
Average chemical demand[1] (as 100% concentrate)	14.5 [kg $MgCL_2$/kg $P_{recovered}$] 4.7 [molar ratio Mg:$P_{recovered}$] 2.1 [molar ratio Mg:$P_{dissolved}$]

Advantages

- Improvement of sludge dewatering (+2 to 5% DM)
- Savings of polymer in dewatering (up to 25%)
- Prevention of down-stream struvite precipitation (pipe clogging, damage of centrifuge)
- WWTP retrofit possible by implementation after digestion
- Proportional reduction of phosphorus and nitrogen return load from sludge liquor

Remarks

- Process is limited to WWTP with enhanced biological P removal and concentrations of more than 50 mg/L PO_4-P in sludge liquor
- Product yield can be enhanced by thermal or chemical hydrolysis prior to digestion (increase of PO_4-P concentration in liquor)

Patents and Licenses

Patent held by	Berliner Wasserbetriebe (BWB)
Licenses	CNP-Technology Water and Biosolids GmbH
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References

Berlin Wassmannsdorf

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Start of operation	2009
Annual struvite capacity	~ 600 - 1,000 tons

Mönchengladbach Neuwerk (Niersverband)

Start of operation	2009
Annual struvite capacity	~ 600 tons

Waternet, NL, RWZI Amsterdam-West

Start of operation	2014
Annual struvite capacity	~ 1,500 tons (projected)

[1]Process data related to reference sludge line defined in P-REX (digested sludge of wastewater treatment plant for 1 Mio inhabitant equivalents, dry matter (DM) content: 3%, P content: 4.2% of DM, PO_4-P in liquor: 200 mg/L (EBPR) or 10 mg/L (ChemP), Fe content: 2% (EBPR) or 6.6% (ChemP)).More information on modelling can be found in P-REX LCA report.

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