byoflex

With the **ByoFlex®-system** ammonia is stripped and recovered from highly contaminated substrates

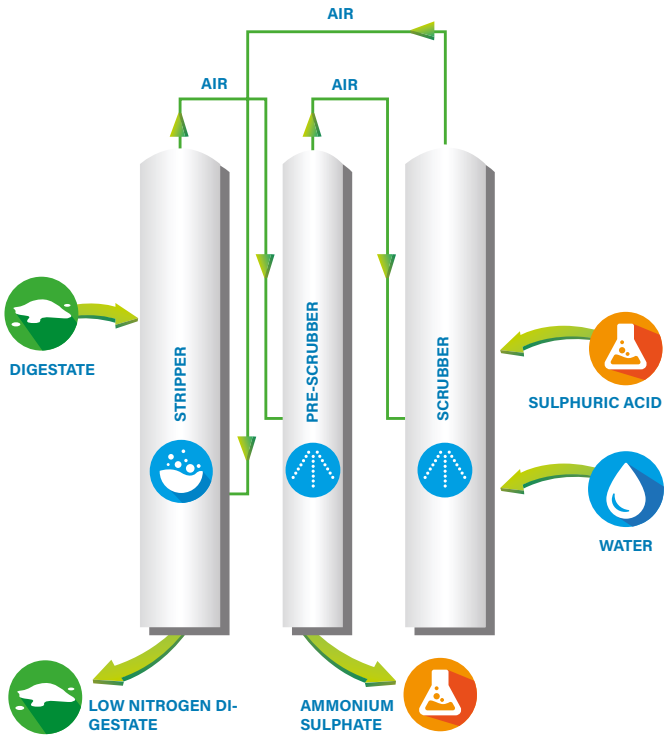
Experts in N-stripping & recovery

byosis

Introduction

The ByoFlex® system is a one-of-a-kind system. Through years of practical experience, the ammonia stripper has been developed for highly concentrated difficult substrates such as digestate or heavily polluted wastewater. Compared to traditional ammonia strippers the system is robust and has a patented, unique design that ensures that there is hardly any clogging of the internal parts. Therefore, the stripper can also treat substrates up to 15% dry matter (suspended and dissolved) without separation or filtration. Cleaning is easy and requires little labour and time.

Process



The substrate is pumped into the top of the stripper, where air is blown through the substrate in counterflow mode. Ammonia (NH3) is captured by the air. The air, (partially) saturated with water vapor and NH3, is blown through a series of 2 scrubbers. There, NH3 is washed from the air with sulphuric acid and water to form ammonium sulphate. With the ByoFlex®-system a transparent, liquid, pH-neutral ammonium sulphate with 8% nitrogen and 40% dry matter is produced, which is a high-quality fertilizer. The clean, yet moist, air is returned to the stripper. All columns operate at nearly the same temperature.

In a wet environment the gaseous ammonia (NH3) is in equilibrium with ammonium (NH4+). At higher temperatures or higher pH-values the equilibrium shifts to ammonia that can be captured by the air.

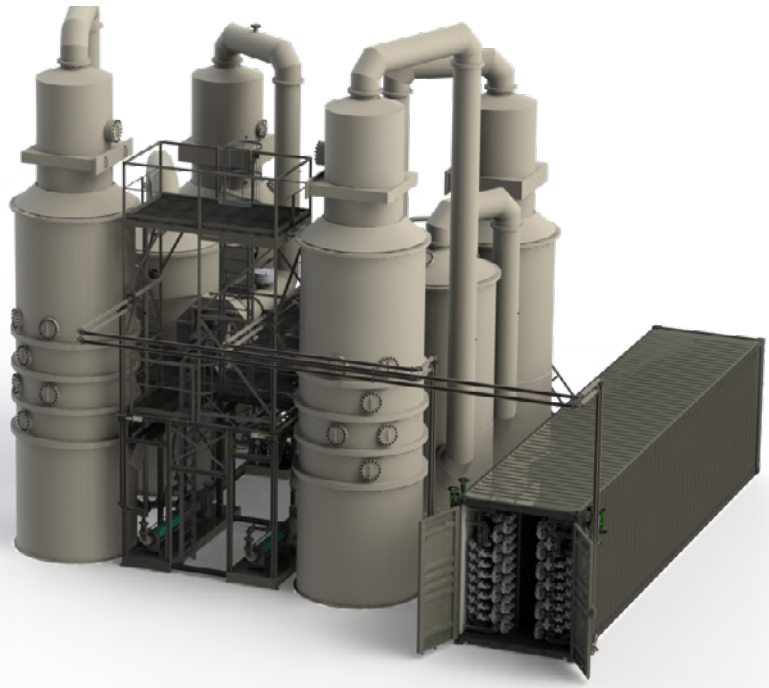
These 2 parameters are vital for the design of the stripper.

Prior to entering the stripper, the substrate is either:

a. Heated in a tube-in-tube heat exchanger to elevated temperatures.
b. Raised in pH with an alkaline agent or after an optional CO2-stripping

Or a combination of both. Alternative acids (like ammonium nitrate) can also be used to make other products. Ask us about the possibilities.

The treated substrate leaves the stripper, with low ammonium values, but at almost the same temperature as the incoming fluid. If desired, this heat can be recovered by exchanging incoming and outgoing streams to and from the stripper. Byosis has developed a special type tube-in-tube heat exchanger that is 100% modular and demountable and can be used for heating, heat recovery or cooling.

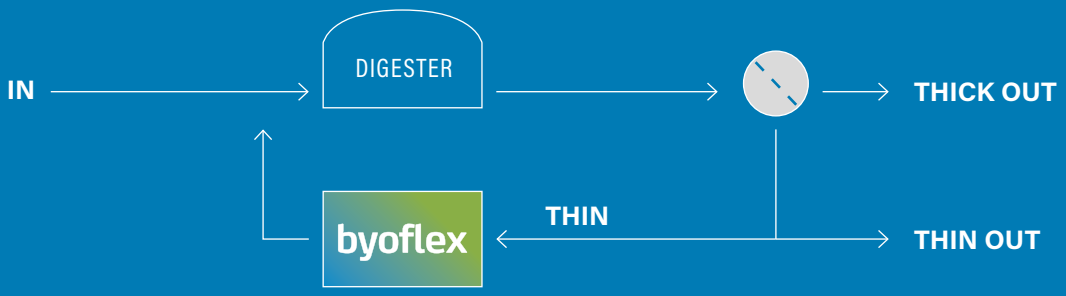


Ways to use...

CONTROL THE AMMONIUM LEVEL INSIDE THE DIGESTER

When the stripper is installed in a recycle over a digester, it is possible to control the ammonium level in a digester by continuously removing part of the ammonium and using the stripped effluent to dilute the fresh incoming material. This can be done with separated and even non-separated substrate.

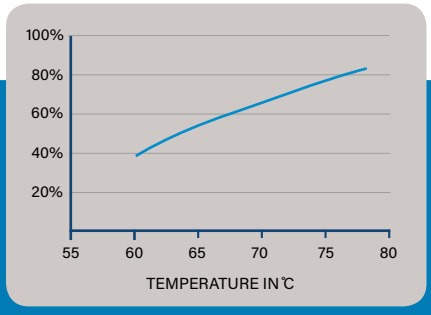
Using ByoFlex® in this set-up enables to feed nitrogen-rich materials to a digester, such as poultry manure or food waste, without adding water. This can significantly reduce the cost of the raw material sourcing and/or the disposal costs for a biogas plant, because the volume of effluent to be processed or disposed of is considerably reduced. This improves the revenue model of a biogas plant considerably.



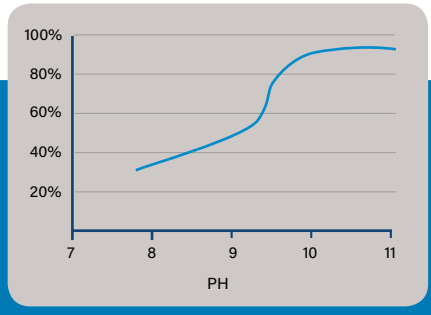
Stripping results

The stripping efficiency is highly dependent on the temperature of the substrate, pH level and electrical energy consumed. In many cases a N-NH4 recovery of 70-75% leads to the an optimum between OPEX- and CAPEX-costs, but higher removal percentages are possible. It may require the use of additional chemicals, higher temperatures or increased electrical energy consumption. A specific situation determines the design. In most cases, the payback time can be less than 2-3 years!

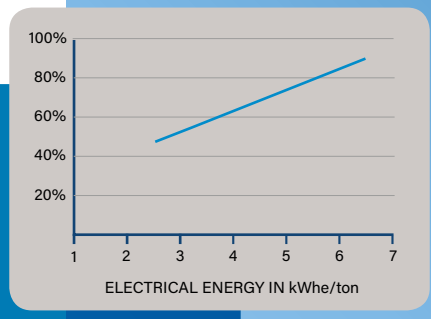
Temperature
N-NH4 removed - PH 8; 5 kWhe/ton



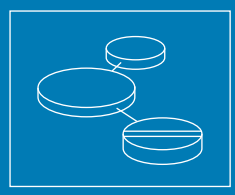
PH
N-NH4 removed - 50℃; 5 kWhe/ton



Electrical energy
N-NH4 removed - pH8; 75℃



EFFLUENT IN → byoflex → **FURTHER TREATMENT**



EFFLUENT TREATMENT

The system can also be used as (part of a) wastewater treatment system to meet specific nitrogen (ammonia) limits and - in a broader sense - effluent criteria.

As an example, the ByoFlex®-system can be used as a pre-treatment system for further processing of the substrates. Especially in combination with biological treatment systems such as MBR or 'classical' nitrification/denitrification. Nitrogen elimination is often the limiting factor in dimensioning these systems and determines the size of the treatment facility, the amount of sludge that is produced and the need for a carbon source for the bacteria. By reducing the ammonium content of the effluent in a ByoFlex®-system these systems can be built more compactly, with significant lower OPEX-costs.

Case studies

TULLY AD PLANT BALLYMENA

The Tully Centralised Anaerobic Digestion Plant uses the ammonia stripping technology ByoFlex® to allow the plant to use, as feedstock, up to 100% poultry litter. It is one of the first anaerobic digestion plants in the world able to do so.

The plant processes 40.000 tons of poultry litter each year to produce biogas and a high-quality organic fertilizer.

Features:

- Delivery 2×10 m3/hr ByoFlex®-system; commissioned in 2017
- Integrated control system of stripper to maximize operational flexibility
- Up to 75% reduction of ammonia from the thin fraction after a decanter
- Already pasteurized liquid is taken in; no extra heat source needed
- Production of ammonium sulphate with 8% N and 9% S; pH neutral
- Reliable, flexible, with low operating and maintenance costs
- Services contract with remote monitoring, trouble shooting, spare parts delivery and periodic inspections

3B ENERGIE PLANT BAD BENTHEIM

At the biogas plant of 3B-Energie GmbH, the ByoFlex®-system is installed to recover ammonium from the thin fraction of a digestate. This enables 3B-Energie to spread more fluid to the surrounding fields with more flexibility as to how and when to spread. In this livestock-rich environment there is a surplus of nutrients of animal origin.

The plant processes 40.000 tons of substrates each year. The system was expanded in 2018 with a lime dosing unit, a flocculation unit, a phosphate reactor and a decanter to further increase the stripping efficiency, reduce the DM plus phosphate level of the thin fraction. Phosphate is also a limiting parameter in the area (surrounding fields) in addition to nitrogen.

Features:

- Delivery 5 m3/hr system ByoFlex®-system for digestate and condensate; commissioned in 2017
- Engineering of interfaces
- Integrated control system of stripper, decanter, flocculation system, bulk storage vessels and lime unit
- Production of ammonium sulphate with 8% N and 9% S; pH neutral, meeting the requirements of the German Manure Regulation (DüMV)
- Up to 95% reduction of ammonium from the thin fraction
- Up to 75% reduction of phosphates; thin fraction after decanter with less than 2½ % DM
- Heat recovery by washing the exhaust gases (and condensate) after a high-load dryer
- Production of ammonium nitrate instead of, or in addition to, ammonium sulphate

About us

Byosis stands for practical, feasible and customer specific solutions. Whether the input material is crops, agricultural residues, industrial waste, green waste, sludge, municipal waste or highly contaminated wastewater, Byosis offers solutions to recover the nutrients and significantly improve the efficiency and capacity of your process.

Byosis has a thorough know-how of technology, engineering, maintenance and operations. Our expertise is wastewater, digestate and off-gas treatment. Besides the ByoFlex®-stripper we offer gas scrubbers for NH3- and H2S-washing (ByoScrub), containerized biofilter solutions for residual odor reduction, pasteurization units in accordance with PAS-110 or EU-1069/2009 regulations (ByoPast) and our specially designed modular tube-in-tube heat exchangers. Package units that we can use in combination with a ByoFlex®- or ByoPast-system include separators, decanters, dryers (belt and drum) and MBR/RO.

OUR SERVICES CONSIST OF:

- Feasibility studies with process simulation tools
- Basic engineering services and interface engineering
- Lab experiments or pilot tests with a substrate or process set-up
- Troubleshooting and optimizing of existing systems and installations
- System integration of package units from third party suppliers
- Turnkey supply of systems (skid-mounted, containerized)
- On-site inspections and training of local staff
- Remote monitoring for expert advice and troubleshooting

Are you looking for a specific solution? Challenge Us!

CONTACT US AT:

The Green East
Drosteweg 8
8101 NB Raalte

+31 851 30 23 82
info@byosis.com
www.byosis.com