AMMONIA RECOVERY, TYPE NAR
Maximizing the value of digestate
AMMONIA RECOVERY
From biological oxidation to resource recovery

TODAY’S CHALLENGES IN THE MARKET
Waste treatment facilities for digestate and manure are facing multiple challenges, especially when high ammonia concentrations occur in the feedstock, resulting in a number of technical challenges:

1. **Decrease in biogas production** due to ammonia inhibition. Anaerobic digestion is sensitive to high N concentration and can be a major problem for a biogas plant, treating digestate, manure or sludge.
2. **High discharge cost** after the dewatering of digestate or manure, because of high N concentrations in the centrate water and environmental pollution.
3. **High CAPEX and OPEX**, when aerobic treatment is required to purify the centrate water. The reduction of the COD during anaerobic digestion often results in a COD/N ratio which is too low for further aerobic nitrogen removal. Conventionally, an additional dosing of a carbon source is used to optimize the ratio.

These challenges are faced by ‘green field’ or existing digestion plants. Customers are anxiously searching for a robust, proven, cost effective and fit for purpose solution to optimize their plant and maximize the value of their digestate.

MAXIMIZING THE VALUE OF DIGESTATE
Several technologies claim effective removal of ammonia from digestate. However, all of these technologies consume a lot of energy and only oxidize the ammonia, without creating a valuable product. By removing ammonia, the treated water can be used for:
- diluting the substrate to enable more co substrates,
- lowering the ammonium concentration of the substrate or
- improving COD/N ratio of the centrate water

The NAR is an innovative and stable process which is anticipating today’s challenges in the market and producing ammonium sulphate, to maximize the value of digestate. The market potential for this biobased fertilizer varies per geographical location, but proves to be commercially attractive.

CUSTOMER BENEFITS
True game changing innovation with a ROI based on the ammonia concentrations in the feedstock to:

1. Lower substrate costs.
2. Heighten the TSS/COD load in the digester.
3. Enhance biogas income (reduction of N toxicity).
4. Save on additional biological treatment cost.
5. Lowering discharge cost.
6. Produce a valuable product, a biobased fertilizer (up to 120 euro / ton varies per geographical location).

HOW IS THE SYSTEM BEING APPLIED?
The NAR is a proprietary chemical process based on the stripping of ammonia. The process is designed to treat digestate, or manure, and consists of a heat exchanger, a CO2 stripper tank, an ammonia stripper and a scrubber. In order to prevent clogging of the stripping column, pre-treatment of the digestate such as a cloth screen, screw press or centrifuge is required. In the CO2 stripper tank the liquid is heated up and fresh air is injected in to the liquid to strip CO2. A heat exchanger on the effluent flow reduces the heat requirement of the system.

WHY NIJHUIS AMMONIA RECOVERY?
The Nijhuis mission with this next level of ammonia recovery is ‘doing more with less’. The NAR has a proven ammonia removal efficiency of 80-90%, with the lowest energy consumption. Dilution of the substrate creates a higher biogas production by minimizing toxicity. Less additional co-substrates are required to mix the high ammonia substrates.

Depending on the liquid digestate disposal, the NAR system will lower the discharge cost. In the case of additional biological treatment no additional carbon source is required, therefore less energy is required, which results in huge savings on OPEX and CAPEX. Finally the stripped ammonia is recovered as ammonium sulphate which requires no oxidation of the ammonia and can be sold as a biobased fertilizer.

- Ammonia removal efficiency of > 80%
- Ammonium sulphate of 25-40%

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The Nijhuis Ammonia Recovery system has been delivered to one of the leading turkey processing companies in the United Kingdom to address their digestate treatment requirements and to turn their (waste) water facility into a resource efficient solution. The customer was facing high nitrogen concentrations in the feedstock entering the anaerobic treatment system. After having installed a Nijhuis pre-treatment and biological treatment system for the wastewater, the customer also wanted to generate energy with their digestate. Soon after the anaerobic treatment installation was up and running, Nijhuis was challenged to deal with the high N in the feedstock.

System configuration and solution
The decanter centrifuge is dewatering the digestate coming out of the digester into a liquid and cake fraction. As the cake will be discharged, the liquid fraction (centrate water) will enter a heat exchanger, resulting in stripping the ammonia under high temperature. The ammonia gas is treated by the Nijhuis Ammonia Recovery system which ensures a biobased fertilizer. The improved COD/N ratio of the centrate water out of the NAR results in OPEX savings on the additional biological treatment of the water.

Results
After installing the system, the NAR has been optimized in order to meet the optimal process settings, process stability and the efficient removal of NH4-N, removing more than 80% of total nitrogen. The ammonia removal and recovery system would not only prevent this inhibition and increase biogas production, but also recover the valuable nutrient nitrogen. Results have shown that ammonium sulphate can be produced at any desirable concentration between 25-40%.

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<tr>
<th>Results of the Nijhuis Ammonia Recovery system for a turkey processing company</th>
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<tr>
<td><strong>Flow</strong></td>
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<td><strong>NH₄-N influent</strong></td>
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<td><strong>NH₄-N effluent</strong></td>
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<td><strong>N removed</strong></td>
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<td><strong>Ammonium sulphate</strong></td>
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