

More than 15 full scale installations in Europe

Apeldoorn (NL)

The Apeldoorn plant is used as the central sludge treatment facility for the Waterboard Veluwe. Two digesters process sludge from various treatment plants. A third digester is used for treatment of industrial biosolids. Centrate production is up to 1200 m³ per day equivalent to a maximum ammonia load of 1600 kg nitrogen per day. The DEMON process started in 2009.

Nieuwegein (NL)

The WWTP Nieuwegein acts as a central sludge treatment facility for several smaller wastewater treatment plants operated by the Waterboard De Stichtse Rijnlanden. Sludge is digested and dewatered using belt presses. Filtrate production is up to 420 m³ per day equivalent to a maximum load of 450 kg nitrogen per day. The DEMON process started in 2011.

Amersfoort (NL)

DEMON Amersfoort is designed for a centrate production of 720 m³ per day equivalent to 700 kg of nitrogen per day. The plant is operated by the Waterboard Vallei en Eem. Construction of the DEMON process will start in 2011.



International DEMON Reference sites

Capacity	NH4 removal efficiency	Liquor source
480 m ³ /d, 600 kg/day NH4-N	90 – 95%	Mesophilic digested sludge
300 m ³ /d, 400 kg/day NH4-N	> 90%	Mesophilic digested sludge
250 m ³ /d, 250 kg/day NH4-N	> 90%	Mesophilic digested sludge
250 m ³ /d, 500 kg/day NH4-N	> 90%	Mesophilic digested sludge
100 m ³ /d, 80 kg/day NH4-N	> 90%	Mesophilic digested sludge
250 m ³ /d, 250 kg/day NH4-N	> 90%	Mesophilic digested sludge
330 m ³ /d, 990 kg/day NH4-N	> 98%	Biogas production
400 m ³ /d, 192 kg/day NH4-N	> 90%	Mesophilic digested sludge
160 m ³ /d, 160 kg/day NH4-N	> 90%	Mesophilic digested sludge
50 m ³ /d, 50 kg/day NH4-N	> 90%	Mesophilic digested sludge

See www.grontmij.com/DEMON for more info.

Grontmij is a leading sustainable design and management consultancy active in the growth markets of water, energy, transportation and sustainable planning and design. At the core of our business is the principle of sustainability by design which is a leading value proposition for our customers. Our value chain of services stretches from major renewable water and energy infrastructure through designing efficient and environmentally-sensitive mobility and transportation network to shaping our urban and green living spaces.

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Sustainable nitrogen removal with deammonification

DEMON



planning connecting
respecting
the future

85% Removal Efficiency on Ammonia without the use of chemicals

DEMON (an acronym for deammonification) is a cost effective technology for the removal of nitrogen from wastewater. Bacteria convert ammonia into harmless nitrogen gas at very low cost.

DEMON achieves an ammonia removal efficiency of more than 85% without the use of chemicals. With the use of Caustic Soda the efficiency may be increased to over 98%.

DEMON is a two step process combining partial nitrification and deammonification in a single reactor. Process control is based on DO, time and minute variations in pH, resulting in a very simple and stable process operation.

The fully automated process can cope with large fluctuations in flow and load. The DEMON reactor is a very simple system with a minimum number of equipment. The process can be applied in existing tanks if available.



60% Saving on Energy

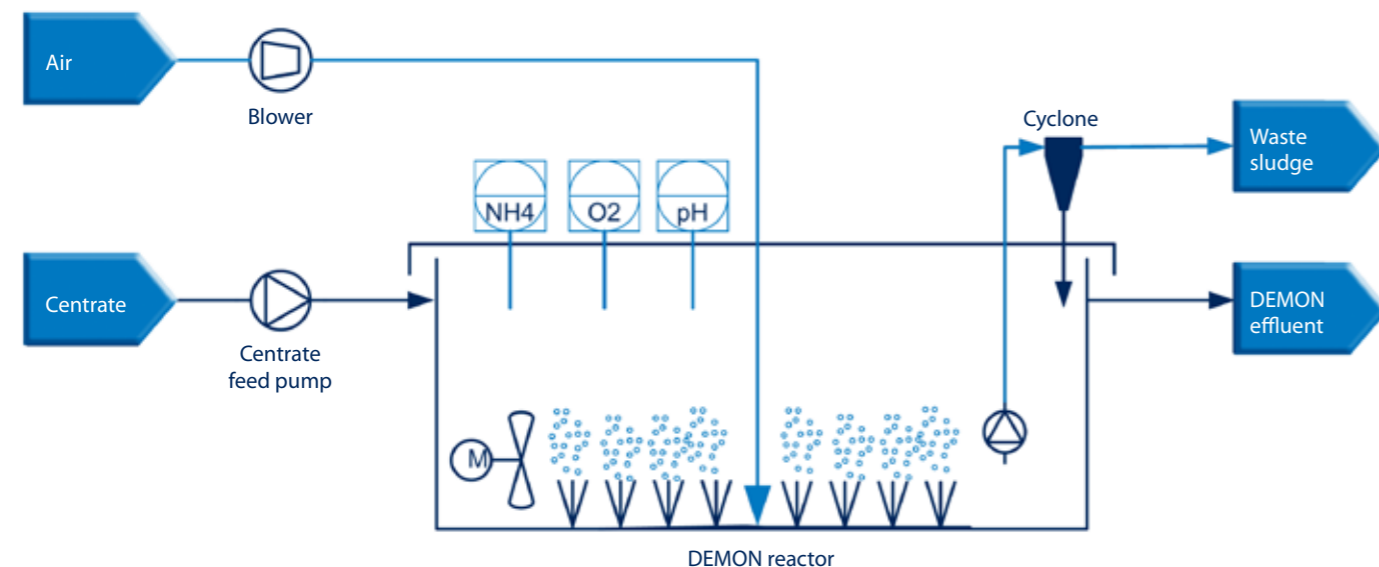
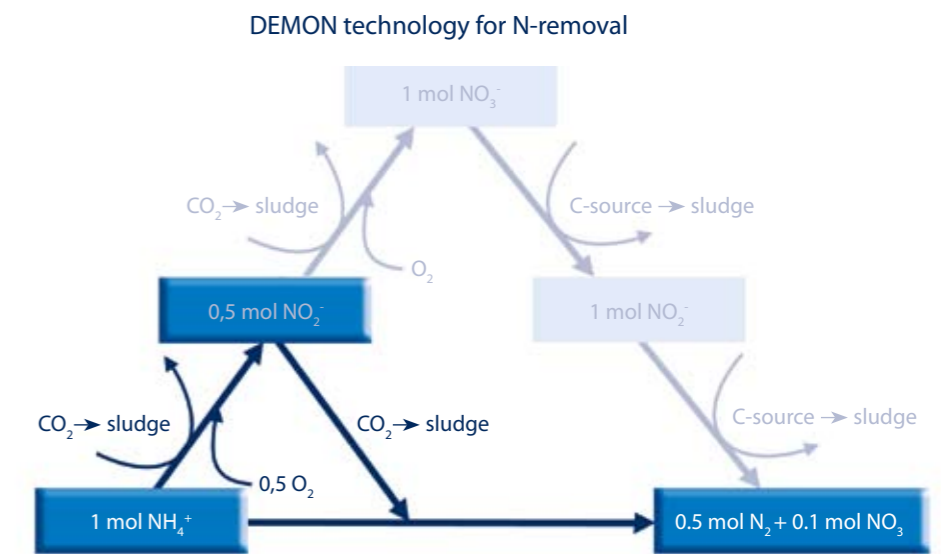
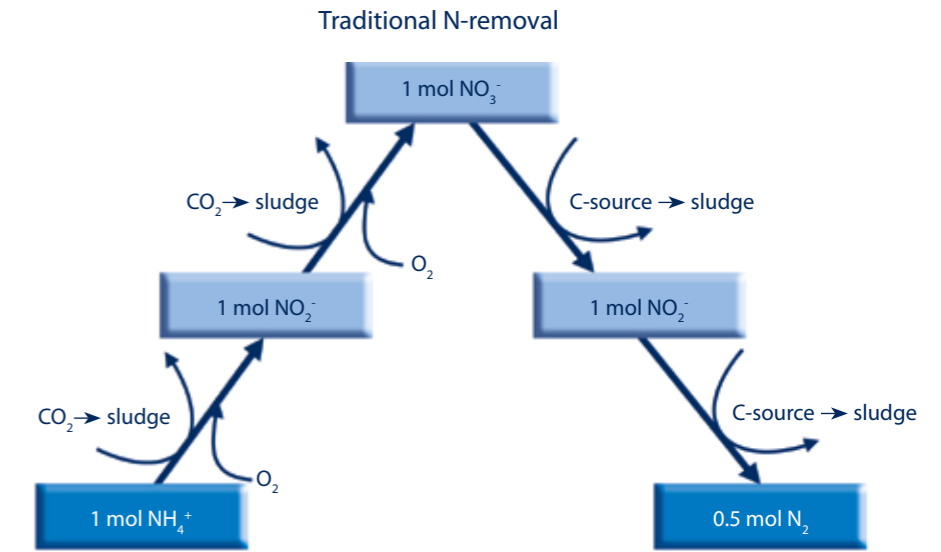
Traditional biological nitrogen removal is based on full oxidation of ammonia to nitrate and subsequent denitrification of nitrate to nitrogen gas. This process requires an organic carbon source for denitrification, and sludge production is high.

DEMON, with its trademark red sludge, represents a shortcut in the nitrogen cycle. The process comprises 2 steps:

1. half the available ammonia is oxidised to nitrite and then
2. residual ammonia combined with nitrite is anaerobically transformed to nitrogen gas.

This results in a significant reduction in oxygen demand of the process (approximately 60%).

Deammonification occurs without the addition of an external carbon source. An added advantage of the process is a very low sludge production, as the biomass yield on the nitrogen conversion is low.



'Low energy use was the main reason for Waterboard "de Stichtse Rijnlanden" to select the DEMON process.'

Proven Technology for High Strength Ammonia Liquors

DEMON was first applied on sludge liquors in Strass (Austria) in 2003. Now the technology is successfully applied for treatment of sludge liquors, digestate from biowaste and landfill leachate at more than 15 locations in Europe.

DEMON is applicable for different types of liquors containing a wide range of ammonia concentrations. Relatively weak liquors as well as centrate containing several grams per liter of ammonia nitrogen can be effectively treated using the DEMON process.

DEMON Technology: Robust and Simple in Operation

The process control philosophy for DEMON is deceptively simple. To create favourable conditions for partial nitrification and deammonification, aeration is coupled to pH. Aeration causes a drop in pH, due to nitrifying activity. Feed of influent cause a pH rise, due to the available alkalinity. These pH variations are used to control aeration in such a way that the aeration pattern is adjusted to load and high (possibly toxic) nitrite concentrations are avoided. This results in a very robust process.

No Chemicals

By greatly reducing the need for oxygen, the energy costs for aeration are kept to a minimum. In comparison to traditional N removal: oxygen input is reduced by 60%.

No chemicals are used in the process, resulting in a very low sludge production, further reducing costs for sludge handling.

Indicative costs for the treatment of sludge liquors are € 0,50 to € 1,- per kg of nitrogen removed.