DEMON: sustainable and stable nitrogen removal

Over the last years, regulations for nitrogen removal by wastewater treatment plants (WWTPs) have become more strict. For this reason, more and more attention is being paid to side stream treatment of nitrogen-rich liquors. The innovative DEMON-technology allows for efficient removal of nitrogen from such liquors. The DEMON-process is based on the ability of deammonifying bacteria to convert ammonia and nitrite to nitrogen gas. The DEMON-technology plays an important role in the concept of the energy-neutral WWTP, and allows for removal of nitrogen for less than € 1 per kilogram of nitrogen.

Grontmij

planning connecting
respecting
the future

DEMON: sustainable and stable nitrogen removal

Demands for the effluent of wastewater treatment plants (WWTPs) are becoming more strict. For instance, in many European countries nitrogen and phosphorous have to be removed to lower effluent levels. Separate treatment of nitrogen-rich wastewater flows, such as the return liquor that is produced during dewatering of digested sludge, is gaining more and more attention. This so-called sidestream treatment results in a significant reduction of the nitrogen load to the main treatment works.

Traditional biological nitrogen removal is based on the so-called nitrate route: ammonia is oxidized to nitrite and subsequently to nitrate, and the latter is then reduced to nitrogen gas by using a carbon source (BOD). However, it is more efficient to follow the nitrite route, as is done in the SHARON process. This significantly reduces the BOD requirement, energy consumption, sludge production and CO_2 production.

The DEMON-technology

The innovative DEMON-technology allows for nitrogen removal in an even more efficient way. DEMON (short for DE-amMONnification) has been developed by the University of Innsbruck. In the first step of the process, part of the ammonia is oxidized to nitrite by nitrifying bacteria. A second group of bacteria, the deammonifying bacteria, has the ability to couple nitrite and the remaining part of the ammonia to produce nitrogen gas. The DEMON-process allows both nitrifying and deammonifying bacteria to co-exist in one single reactor volume, despite the completely different growth demands of these groups. The DEMON process efficiently removes nitrogen from high-strength ammonia wastewater, containing several hundreds to 2,000 milligrams of ammonia per litre. Examples of such wastewaters are return liquor, leachate, and liquors that are produced during digestion of solid organic waste.

Benefits

Important benefits of the process are:
- only 50% of the ammonia needs to be nitrified. Moreover, nitrite instead of nitrate is the end product of nitrification. This saves approximately 60% of the energy demand for aeration when compared to traditional nitrification;
- the DEMON-process does not require carbon source dosing, which makes the process very apt for treating wastewaters with a low BOD/N-ratio. The fact that no carbon source has to be purchased results in a significant cost reduction;
- deammonifying bacteria have a low growth velocity, resulting in a low sludge production and thereby low sludge disposal costs.

Full-scale DEMON-installations

At the moment, four full-scale DEMON-plants operate stably in Austria, Switzerland and Germany. The fifth plant, with a capacity of 1600 kg N/d the biggest so far, is currently being built in Apeldoorn, The Netherlands. Commissioning is expected in 2009.
The DEMON-plant at WWTP Strass, Austria, contributes to the fact that the w.w.t.p. as a whole produces more energy than it consumes. This proves that the DEMON-technology is an important part of a new concept: the energy-neutral wastewater treatment plant.
Application of the DEMON-process allows for nitrogen removal from concentrated liquors for less than € 1 per kilogram of nitrogen. The DEMON-process is patented by the University of Innsbruck. Grontmij has a license to introduce this technology in parts of Western Europe and the United States.

Grontmij, established in 1915, is a multidisciplinary consultancy and engineering firm employing over 8,000 professionals active in the environmental, water, energy, building, industrial and transportation sectors.

We aim to be the best local sevice provider in North-West Europe and provide added value throughout the entire process of designing, consulting, engineering, contracting and managing multidisciplinar projects.

Grontmij
De Holle Bilt 22
3732 HM De Bilt
T +31 (0)30 220 79 11
F +31 (0)30 220 24 68
info@grontmij.nl
www.grontmij.nl

Grontmij