

PAQUES



Hi, I'm Ana.  
I remove your  
nitrogen!



# ANAMMOX

## Sustainable nitrogen removal

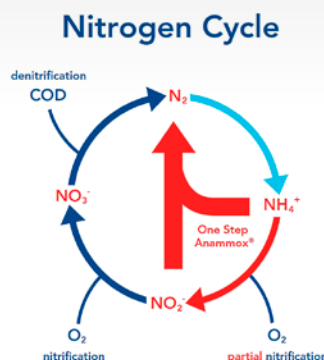
The ANAMMOX process is a very cost-effective and sustainable way of removing ammonium from effluents and ammonia from waste gas.

revitalizing resources

# Cost-effective and sustainable nitrogen removal

The ANAMMOX process is a very cost-effective and sustainable way of removing ammonium from effluents. Compared to conventional nitrification/denitrification savings on operational costs can reach up to 60%, while CO<sub>2</sub> emission is reduced.

The ANAMMOX conversion is an elegant shortcut in the natural nitrogen cycle. Anammox bacteria convert ammonium (NH<sub>4</sub><sup>+</sup>) and nitrite (NO<sub>2</sub><sup>-</sup>) into nitrogen gas. Paques developed the process for commercial purposes in cooperation with Delft University of Technology and the University of Nijmegen. Since the first full-scale plant started up in 2002 (treatment of the rejection water of a sludge digestion of a municipal WWTP), many other ANAMMOX plants were implemented.



## About ANAMMOX

- Proven technology, > 18 years operational experience
- > 65 ANAMMOX references worldwide
- Small footprint
- Robust system, handling high loading variations
- Saving on operational costs up to 60%
- Savings on excess sludge production
- Easy process control in one single continuously operated reactor unit
- No addition of organic carbon source (methanol) required

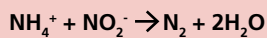
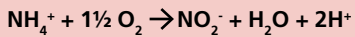
# ANAMMOX

## Operation principle

The ANAMMOX reactor is a reactor system in which nitrification and anammox conversion occur simultaneously in one single process unit.

The natural nitrogen cycle involves various biological processes. Nitrification is the process where ammonium is oxidised to nitrite and nitrification is the process in which ammonium is fully oxidised to nitrate. Denitrification is the process which converts nitrate with addition of an organic carbon source to nitrogen gas. Anammox (anaerobic ammonium oxidation) conversion is an elegant short-cut in the natural nitrogen cycle where ammonium and nitrite are converted to nitrogen gas.

As the anammox process involves removal of ammonium over nitrite ( $\text{NO}_2^-$ ) rather than nitrate ( $\text{NO}_3^-$ ) less oxygen ( $\text{O}_2$ ) is required.

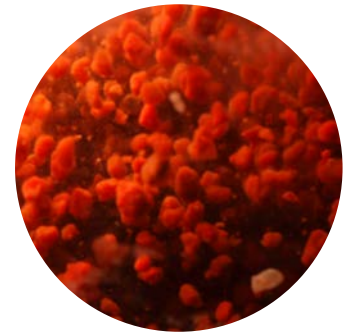


## Applications

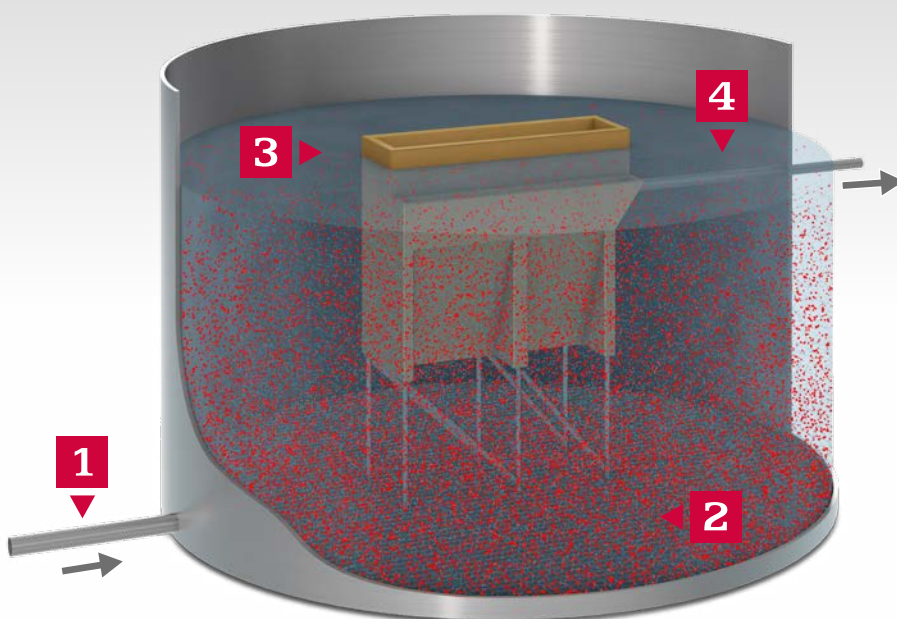
The ANAMMOX process can be used for the removal of ammonium from nitrogen rich effluents.

### These effluents are found in:

- Municipal waste water treatment (sludge rejection water)
- Organic solid waste treatment (landfills, composting, digestion)
- Food industries
- Manure processing industry
- Fertiliser industry
- (Petro) chemical industry
- Metallurgical industry
- Semi-conductor industry



Anammox bacteria converting ammonium and nitrite into nitrogen gas.



## ANAMMOX, how it works

- 1 Ammonia-rich influent
- 2 Aerators for mixing and ammonia removal process
- 3 ANAMMOX separator for biomass retention
- 4 Effluent exits the reactor



## Paques: leading in biological wastewater and gas treatment

For more than 40 years, Paques has been the world's leading company in the field of development and construction of cost-effective purification systems for water, wastewater and gases, based on innovative biotechnology. With over 3,000 reference installations worldwide, Paques has helped companies and municipalities succeed at to one of the major challenges of today: to reduce their water and carbon footprints and reclaim valuable resources.

The biogas produced by wastewater treatment plants can be used as green energy in boilers or gas engines. Beyond our headquarters in The Netherlands, Paques has subsidiaries and/or production locations in Brazil, China, India, Malaysia, Thailand and the United States. In many other countries, Paques is represented by licensed partners. This ensures our local presence and the best service for our clients worldwide.

Contact one of our branch offices:



**North America**  
**Salem (NH), USA**  
t + 1 (781) 362 4636  
e [info.usa@paquesglobal.com](mailto:info.usa@paquesglobal.com)

**Latin America**  
**Piracicaba, Brazil**  
t +55 (19) 3429 0600  
e [info.br@paquesglobal.com](mailto:info.br@paquesglobal.com)

**Europe (HQ)**  
**Balk, The Netherlands**  
t +31 (0) 51460 8500  
e [info@paquesglobal.com](mailto:info@paquesglobal.com)

**India**  
**Chennai, India**  
t +91 44 2827 3781  
e [info.in@paquesglobal.com](mailto:info.in@paquesglobal.com)

**China**  
**Shanghai, China**  
t +86 (0) 21 3825 6088  
e [info@paques.com.cn](mailto:info@paques.com.cn)

**Asia Pacific**  
**Kuala Lumpur, Malaysia**  
t +603 2169 6331  
e [info\\_my@paquesglobal.com](mailto:info_my@paquesglobal.com)