OVIVO Worldwide Experts in Water Treatment

Municipal BIOSOLIDS MANAGEMENT

OVIVO-PAQUES
AnammoPAQ® PROCESS
SUSTAINABLE NITROGEN REMOVAL

HOW WE CREATE VALUE

Cost-effective nitrogen removal from digester sidestreams (with or without THP) using Anammox

Compared to conventional nitrification and denitrification:

- 60% energy savings compared
- 100% reduction in supplemental organic carbon
- 90% reduction in sludge production
- 90% reduction in footprint
- 85% reduction in CO_2 emissions

Quick startup time with potential for full process optimization within 3 weeks

THE CHALLENGE

- Despite representing 1% to 3% of the flow to the mainstream, typical anaerobic digester sidestream contains 10% to 30% of the nitrogen load, with concentrations often in excess of 1,000 mg/L ammonia-N
- Sludge pre-treatment with THP can double the ammonia-N concentrations in the sidestream
- Stringent BNR limits on main stream
- Conventional nitrification and denitrification requires significant aeration energy and supplemental carbon

THE OVIVO SOLUTION

The AnammoPAQ® process is an elegant shortcut in the natural nitrogen cycle. The process utilizes Anammox bacteria which directly convert ammonium (NH_4^+) and nitrite (NO_2^-) into nitrogen gas. Paques developed the original 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 sidestream from sludge digestion), many other plants have been installed and are running successfully.

The AnammoPAQ® ADVANTAGE

- Proven technology with 15+ years operational experience
- 35+ AnammoPAQ® references worldwide
- Largest single unit can handle 10 metric tons of nitrogen/day (equivalent to sidestream from a 250 MGD municipal plant)!
- Robust system, handling high loading variations
- Up to 60% saving on operational costs
- Savings on excess sludge production
- No addition of organic carbon source (methanol) required
- Production of valuable Anammox biomass
- High loading rates leading to compact footprint
- Lowest O&M amongst competing systems

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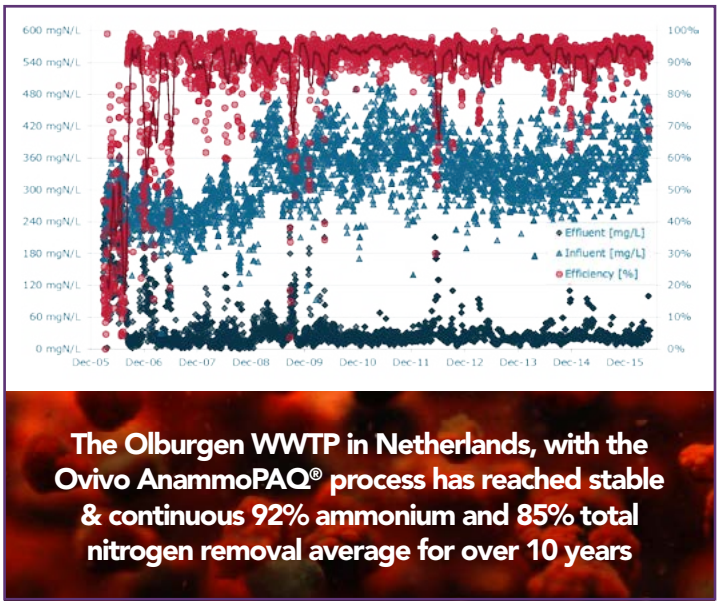
OPERATING PRINCIPLE

AnammoPAQ® is a continuos flow reactor system in which nitritation and anammox conversion occur simultaneously in a single process unit. 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 (NO_2^-) rather than nitrate (NO_3^-), 63% less oxygen (O_2) is required while eliminating the need for an external carbon source altogether. Optimal process control ensures retention of AOBs and Anammox bacteria while eliminating NOBs, leading to stable & robust operation.



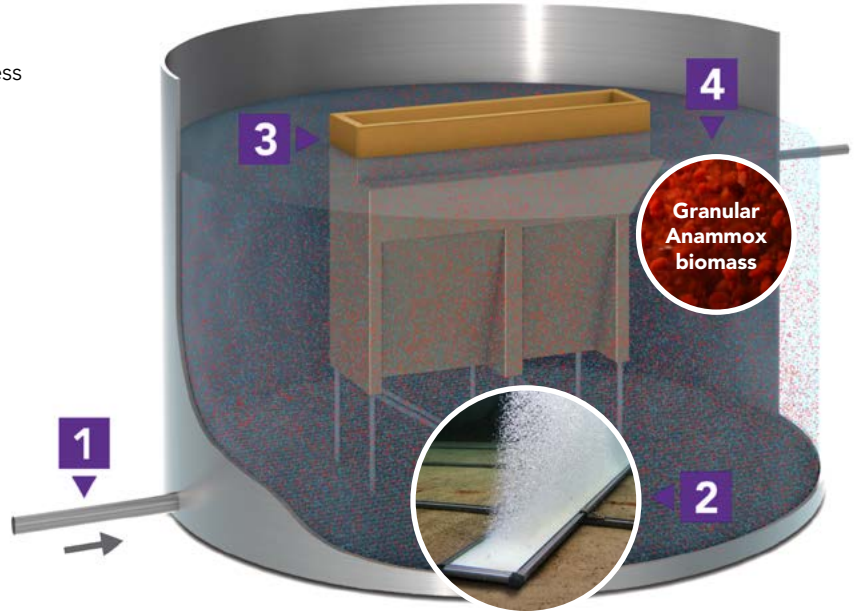
The Olburgen WWTP in Netherlands, with the Ovivo AnammoPAQ® process has reached stable & continuous 92% ammonium and 85% total nitrogen removal average for over 10 years

$$NH_4^+ + 1½\ O_2 \rightarrow NO_2^- + H_2O + 2H^+$$

$$NH_4^+ + NO_2^- \rightarrow N_2 + 2H_2O$$

HOW IT WORKS

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



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