Heterotrophic Population Dynamics during Nitritation/Anammox Treatment of Urine

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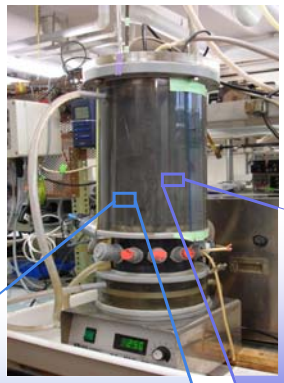
Decentralised Nitrogen Removal

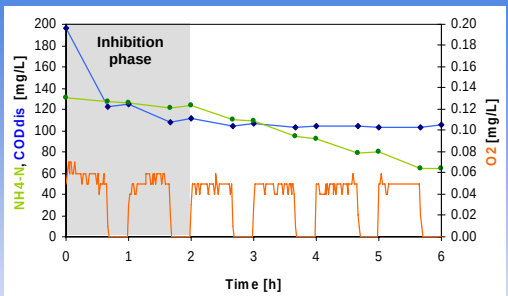
Nitrogen loads from untreated wastewater contribute substantially to the deterioration of coastal ecosystems worldwide. Small decentralised reactors would be more efficient and affordable for many coastal cities than the current approach of sewers and centralised treatment facilities.



Single-Stage Nitritation/Anammox Treatment of Urine

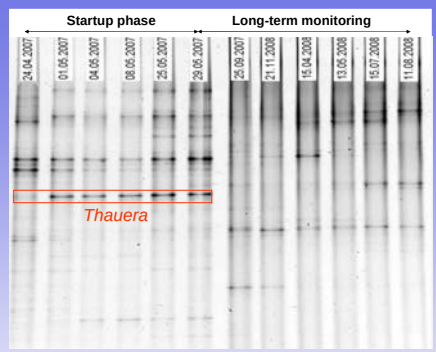
A lab-scale sequencing batch reactor was operated for nitrogen removal from urine by nitritation/anammox. Urine contains also large amounts of organic matter. This can have several effects on the overall process performance. Expected are an increased nitrogen removal and competition for nitrite. We also observed possible destabilisation by increased nitrite or nitric oxide concentrations and degradation of toxic organic compounds.

Inhibition by Organic Substrate



Ammonium oxidation is inhibited in the beginning of the cycle until the organic substances are degraded. Inhibition of ammonia oxidation is reported in literature for many organic compounds (e.g. benzoic acid, phenol and p-cresol). We suppose that the inhibition is caused by a mixture of several compounds.

Population Dynamics



Samples were analysed by PCR amplification and DGGE combined with band sequencing of near full length 16s rDNA clone libraries. Sequencing of the main bands indicated that heterotrophic bacteria dominated.

Startup phase

On 24.4.07 the reactor was switched from digester supernatant to urine. One of the bands which comes to dominance could be identified as belonging to the genus *Thauera*. Members of this genus are well known to be capable of degrading aromatic compounds.

Long-term monitoring phase

Even though urine contains much more organic substances than digester supernatant the diversity of the bacteria decreases. This could present a risk for process stability.

Conclusions

Biological nitrogen removal processes are known to be prone to instabilities and chaotic behaviour. Usually, the autotrophic bacteria are considered to be responsible for these problems. With this work we will help to better understand the important role of the heterotrophic bacteria. Heterotrophic activity can improve the nitrogen removal but also be an important cause for process instabilities. A better understanding of the influence of the heterotrophic bacteria on the overall process is crucial for further process optimisation.

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