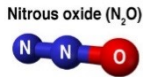
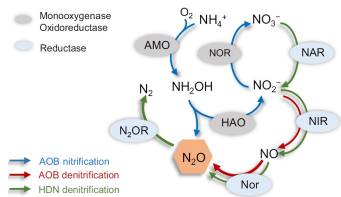
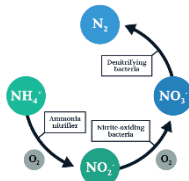


Introduction

N₂O is a greenhouse gas with a heat trapping ability almost 300 times that of CO₂. It originates from activities like agriculture or water treatment where it's the main carbon footprint contributor.



In wastewater it's production is associated to nitrogen removal a process that takes place in activated sludge tanks and is usually performed through nitrification and denitrification by ammonia oxidizing bacteria (AOB), Nitrite oxidizing bacteria (NOB) and heterotrophic denitrifiers (HDN). When conditions are suboptimal N₂O is produced.



The objective of this project is to monitor N₂O emission, identify the production pathways and propose solutions.

Methods

N₂O Monitoring

Performed with Unisense Environment N₂O wastewater sensors.



Emission Calculation

Based on liquid-gas transfer with on line calculated kLa. Used to calculate the emission factor (EF).

Other parameters

- | | |
|----------------------------|------------------|
| On line | Daily |
| • NH ₄ conc. | • Total Nitrogen |
| • NO ₂ conc. | • COD |
| • NO ₃ conc. | • TSS |
| • Airflow | |
| • Dissolved O ₂ | |

Experiments

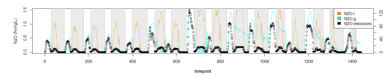
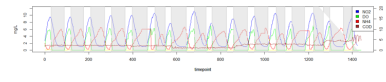
Three experiments were designed to evaluate alternative operational strategies in order to reduce emissions:

1. Continuous Aeration
2. Low DO setpoint
3. Minimize NO₂

Outcome

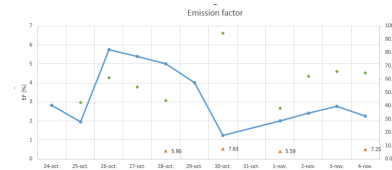
On line N₂O concentrations and emissions

Allowing us to identify N₂O production patterns.



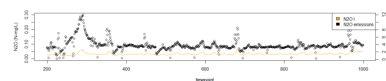
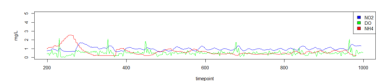
Daily emission factors

A comparable value that can be connected to influent conditions.



Promising experiment results

Bellow 1% EF with continuous aeration.



Perspectives

Gas phase sensor for direct emission

A sensor monitoring N₂O in the offgas would provide more trustworthy emission values.

Improve data quality

There is an aspiration to improve data collection of relevant parameters such as Total Nitrogen.

Full plant experiments

Current experiments have been run in one single Activated Sludge tank. Before implementation full plant experiments will be necessary.

Data implementation in a full plant model

The obtained results are being used to create a model of the plant able to predict, among other things, Nitrous Oxide emissions.

