UNISENSE ENVIRONMENT

Hoogheemraadschap van Schieland en de Krimpenerwaard

Case Study: Influence of positioning of N_2O Wastewater Sensors

Kralingseveer WWTP, the Netherlands

Kralingseveer is a domestic wastewater treatment plant with a capacity of 360,000 PE. It is located in the municipality of Capelle aan den Ijssel, near Rotterdam, the Netherlands.

What to kN_2Ow about measuring N_2O?

The Unisense Environment N_2O Wastewater Sensor provides the ability to directly monitor N_2O concentrations in wastewater, which is essential for quantifying and mitigating its greenhouse gas contribution. The design and influent vary between wastewater treatment plants, highlighting the need to monitor N_2O emission from individual plants. It is also important to ensure the correct placement of the N_2O sensor to obtain representative data of N_2O emissions.

measure to kN_2Ow

Kralingseveer WWTP implemented N_2O monitoring in their aeration tanks. One sensor was placed in the aerated zone, and another was placed in the unaerated zone at each compartment (Fig. 1). N_2O emissions predominantly occur in aerated zones due to air stripping, and the N_2O emission was assumed to be more variable in the aerated zone compared to the unaerated zone. To quantify and understand the variation in N_2O emissions in the aerated zone, the WWTP monitored various spots within the aerated zone for a week. Meanwhile, they kept the sensor in the unaerated zone in the same position (Fig. 1).

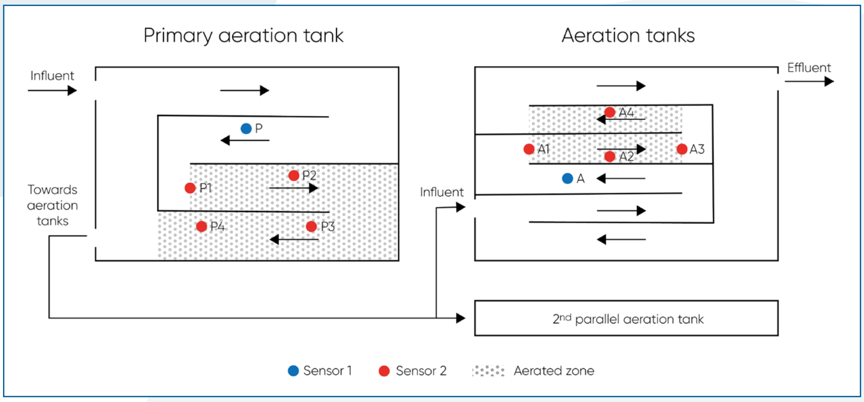

Figure 1: The plant consists of a primary aeration tank followed by two aeration tanks. The mixed liquor flows to the primary aeration tank, which has an anoxic zone followed by an aerated zone where most of the nitrification/denitrification takes place. The influent then flows to the aeration tanks where it is aerated again.

Scounting Campaign to Identify Sensor Placements

The WWTP chose the best representing spots by monitoring four different spots from the beginning to the end of the aerated zone in both the primary aeration tank and the aeration tank. Monitoring showed that N_2O emissions were highest at the beginning of the aerated zone and lowest at the end (Fig. 2A). In the aerated tank, they observed that the N_2O emission was highest in the second half of the aerated zone (Fig. 2B). Overall, emission was higher in the aerated zone compared to the unaerated zone.

The scouting campaign led to a position representing an average value for long term monitoring in each aerated zone. In the primary aeration tank, they chose a position between P2 and P3, and a position between A2 and A3 in the aeration tank.

The Aerated Zone Accounted for about 90% of N_2O Emissions

The primary aeration tank with a higher load produced higher N_2O emission compared to the secondary aeration tanks. In both sections, the N_2O emis¬sions were higher in the aerated zone and accounted for about 90% of the N_2O emissions, highlighting the importance of focusing on the aerated zone. The scouting campaign showed that the position of the N_2O Wastewater Sensor in the aerated zone yielded differences in the measured N_2O emissions. Ideally, it would be useful to have one sensor as a reference sensor when another sensor changes position.

The N_2O emissions varied by only 23% in the primary tank, and all positions provided a good estimate of the N_2O emission. However, the variation in the aeration tank was higher (50%), and the trend of increasing emission towards the end of the aerated zone could indicate a COD limitation, which has been shown to increase N_2O emission. In that case, a representative position needs to be more carefully selected. Learn more in our technote on carbon dosage.

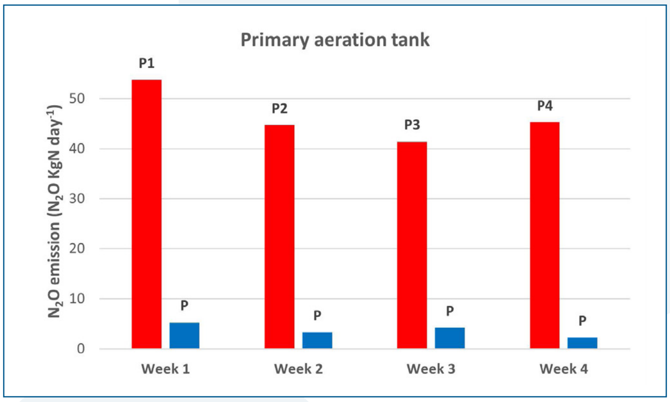

Figure 2A

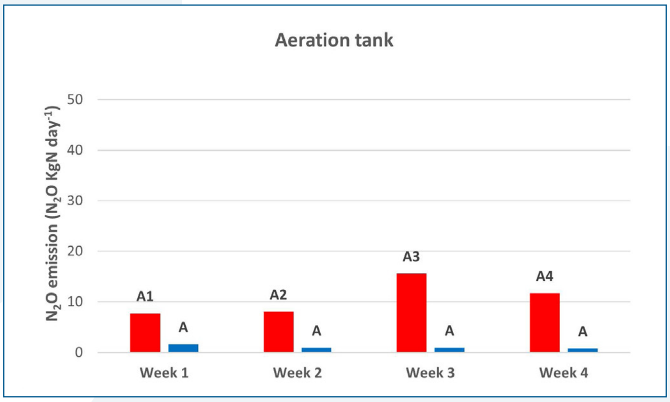

Figure 2B

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Nitrous Oxide process sensor for online wastewater treatment optimization, low-cost greenhouse gas reduction, and reliable sustainability accounting

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