Stadtentwässerung Pforzheim

Operational experience with the N_2O Wastewater Controller from Unisense Environment

The mechanical-biological WWTP with anaerobic sludge stabilization in Pforzheim is designed for 250.000 P.E. (Fig.1). The composition of the wastewater in Pforzheim is strongly influenced by high nitrate loads coming from the discharge of several companies for metal recycling. The nitrate loads vary considerably both during the day and over the week.

In order to ensure keeping within the prescribed nitrogen limits for the effluent, a discontinuous addition of external carbon source in the upstream denitrification zone and if necessary even in the downstream denitrification zone is mandatory in Pforzheim.

Fig. 1: *Aerial view of WWTP Pforzheim in 2016*

By adding a carbon source for the biological carbon and nitrogen removal, the formation and emission of CO_2 and also nitrous oxide (the most relevant greenhouse gases that are released from the biological wastewater treatment) increases significantly. As carbon sources, substrates including the active substance of acetate, glycol, glycerol are dosed in Pforzheim. In addition, sludge water (supernatant water from the thickening of primary sludge) is used as a carbon source daily.

In the course of climate change and the holistic view of emissions from wastewater treatment plants, **the optimization and exploration of nitrous oxide formation** is in a research project - NoNitriNox planning and operation of resource and energy efficient wastewater treatment with targeted prevention of environmentally hazardous emissions - funded by the BMBF (Funded program: "Intelligent and multifunctional infrastructure systems for a sustainable water supply and sanitation (INIS) ") in focus. Project participants are Ing. Büro IFAK, University of Stuttgart, Weber Ingenieure, WWTP Pforzheim WWTP Steinlach Wiesaz.

To determine the formation rate of nitrous oxide in the denitrification and the nitrification zone a N_2O sensor from the company Unisense Environment A/S is used among others.

Fig. 2: *Calibration of the sensors by Mr. Stefan Kühling. (Specialist for wastewater engineering at the WWTP Pforzheim)*

The N_2O Wastewater System has now been in use for over one year for the detection of nitrous oxide concentrations in the dissolved phase in Pforzheim.

It has been proven by means of the measurement that the nitrous oxide formation is actually favored in the denitrification by the addition of the carbon source or by the addition of the sludge water.

With the new Unisense N_2O Wastewater Controller that includes calibration and evaluation on the instrument, the handling has become much simpler and user friendly (Fig.2). Therefore the use of an external evaluation device is thus no longer required.

All relevant measurements in Pforzheim to assess the nitrous oxide formation are integrated in the process control system (PLC) and are available as 15-minute values (Fig. 3).

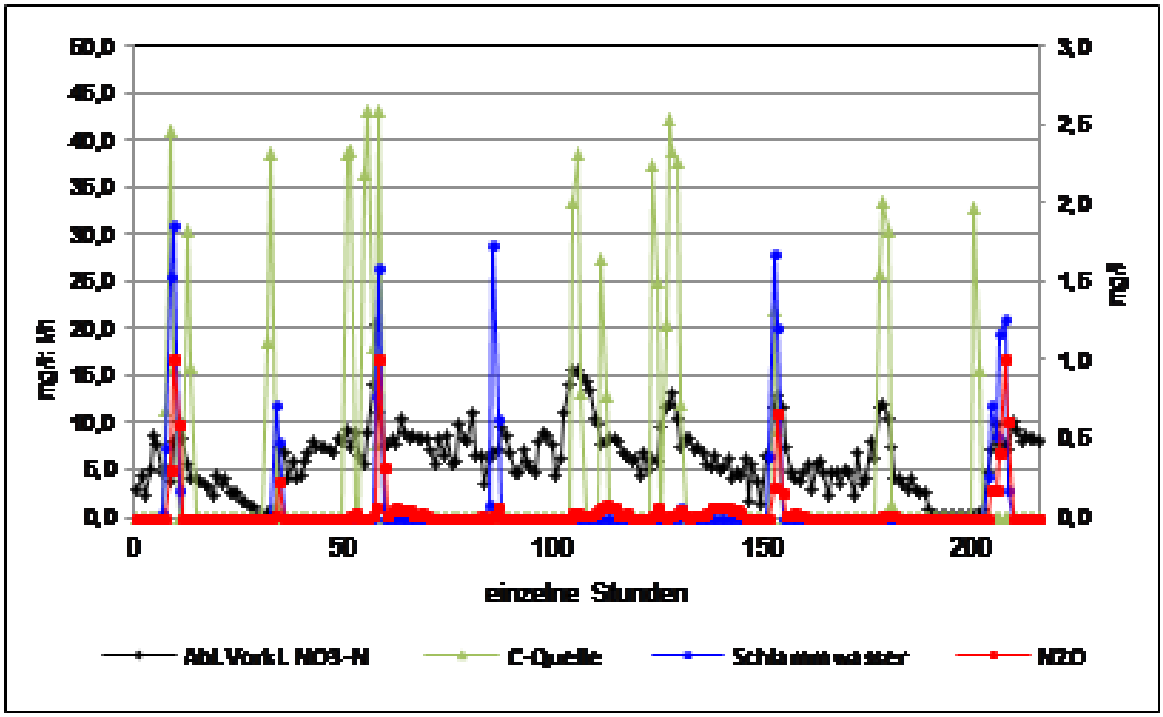

Fig. 3: Graphical representation of nitrous oxide formation in the denitrification zone.

According to the insigt from the nitrous oxide measurements at the WWTP Pforzheim an optimization of the sludge water dosing can be made already. At present, the addition of the sludge water occurs unregulated (compared to the controlled addition of the carbon source) and caused fairly high N_2O formation.

Furthermore, the N_2O Wastewater Controller from Unisense Environment is used to create the process profiles (N_2O formation in the aqueous phase) in the nitrification tank.

Publication of the results is carried out within the framework of the research project NoNitriNox.

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