Session: Tools & modelling

Zero-dimensional modelling and bacterial characterization of an aerobic granular sludge reactor

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A laboratory aerobic granular sludge (AGS) sequencing batch reactor (SBR) removing soluble organic substrate, nitrogen and phosphorous was fed with artificial wastewater and modelled using a zero-dimensional approach. Model development was supported by bacterial characterization using 16S rRNA gene amplicon high-throughput sequencing. The mathematical model was based on the activated sludge model nr. 2d (ASM2d) and extended with both two-step nitrification as implemented in the wastewater treatment plant simulator Sumo19 (Dynamita SARL) and ammonia nitrogen adsorption and desorption according to the Langmuir model. The model developed for the AGS was thus based on a model formulated for conventional activated sludge. The anaerobic filling and aerobic reaction phases were dynamically simulated. The mean simulated soluble chemical oxygen demand (11.0 mg_{COD}/l) was offset to the measured data (37.2 mg_{COD}/l). This was attributed to the formation of soluble microbial products, which were not considered in the model. The measured ammonia nitrogen, nitrite nitrogen, nitrate nitrogen, ortho-phosphate phosphorous, and dissolved oxygen concentrations were very well reproduced by the model (all Pearson's r values ≥ 0.9479). However, anoxic (denitrification) processes by ordinary heterotrophic organism during the aeration phase had to be introduced, which underpinned the importance of anoxic zones in the granules under oxic bulk conditions.