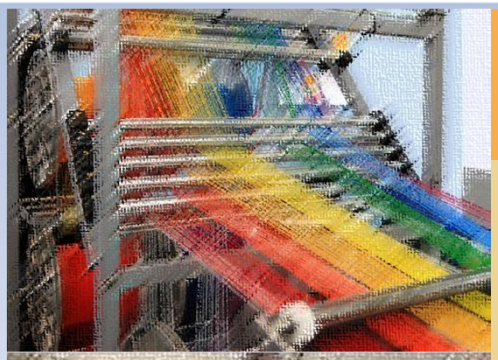
Development of A Biological Nutrient Removal Model for Anaerobic Anoxic Oxic Sequencing Batch Reactor (AnA^2/O^2 SBR)



Kinetics Modeling in Biological Wastewater Treatment Processes

In the field of advanced wastewater engineering, kinetics modeling is an inherent part of the operation and design of wastewater treatment system. The obtained mathematical models can be considered as heuristic models, used for finding out or discovering new information, thus continuously improving the system. The mathematical models thus are not static but dynamic and evolve in time with knowledge gained. The mathematical modeling of wastewater treatment plant (WWTP) processes can be utilized in the design and operation of WWTP, predicting the impact of changing wastewater characteristics, proposing the new operating conditions, developing and investigated the system response to a wide range of inputs without endangering the actual plant and expanding the knowledge base and research in order to be a new model based on the experience gained.

Anaerobic Anoxic Oxic Sequencing Batch Reactors; AnA^2/O^2 SBR

Anaerobic Anoxic Oxic Sequencing Batch Reactors (AnA^2/O^2 SBRs) process is one of the most interesting wastewater treatment plant (WWTP) because the SBRs can be operated under the anaerobic, anoxic and aerobic conditions through one-cycle operation without any addition of separate reactors, recycling line or clarifiers, which is capable for organics and nutrients removing from wastewater. Moreover, SBRs are simple, easy to operate, high flexibility, and low construction, and operation costs. While the AnA^2/O^2 SBR process could be operated under anaerobic condition with either anoxic or oxic phases, it could achieve high efficiency of organic matter, nitrogen and phosphorus removal simultaneously.

The model development

The model development for describing the biological behaviors of nitrogen and phosphorus removal was developed based on activated sludge model. Model calibration was carried out on the separate batch experiments for denitrification, nitrification, phosphorus release, and phosphorus uptake batch. Based on the sensitivity analysis results, the $\mu_{H,S}$, η_{NO2}, η_{NO3}, k_{STO}, $Y_{H,S}$, and $Y_{H,STO}$ had an influence on the denitrification process. The μ_{AOB}, μ_{NOB}, Y_{AOB} and Y_{NOB} had an influence on the nitrification process. The q_{PO4}, q_{PP}, Y_{PHA}, $K_{max,PAO}$ had an influence on the biological phosphorus removal. The presented model was verified by the experiment of AnA^2/O^2 SBR treating slaughterhouse wastewater. A high correlation between the measured and simulated results was obtained, suggesting the validity of the model. A Model was used to simulate the biological nutrient removal in AnA^2/O^2 SBR, it found that the main processes for COD, nitrogen, and phosphorus removal were occurring at Anoxic I and Oxic I periods. While, Anoxic II, and Oxic II were performed on the sludge stabilization.