

Model Based Stimulus Experiments to Improve Biological Wastewater Treatment Performance

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Abstract

The municipal wastewater treatment in a sustainable context requires a smart technology in which an optimal combination of the ecological status and energy demand can be achieved. The integration of electron conductive materials into a traditionally constructed wetland (CW) has been demonstrated as an emerging strategy for wastewater treatment [1, 2]. By exploiting the electron transfer capability of electro-active genus bacteria on electrically conductive materials, the configuration can be used to treat and disinfect urban wastewater from small communities at zero energy operation cost.

At the level of the engineering practice, CWs with and without a conductive bed have been carried out using the black-box concept. And most of the previous works were experimentally predominant. To accelerate the progress of system design, optimization and practical applications, the mathematical model in close combination with experiment plays an important role.

In this contribution, the 0D and 1D mathematical models of an electron conductive column, which operates under aerobic condition, were formulated. The model equations were implemented and solved numerically using Chemical Reaction Engineering and CFD Modules of COMSOL Multiphysics®. With the selected kinetics, parameters and working conditions, the stimulus input signals of NH₄⁺ loading were proposed to investigate the best scenario for nitrification of the aerobic column. This strategy is especially advantageous for water recycling and the subsequent anaerobic unit in which electro-active genus bacteria starts to play as a key role for denitrification process.

[1] A. Aguirre-Sierra, et al. Microbial electrochemical systems outperform fixed-bed biofilters in cleaning up urban wastewater. *Environ. Sci.: Water Res. Technol.* 2 (2016), 984-9932016.

[2] <http://imetland.eu/>

Figures used in the abstract

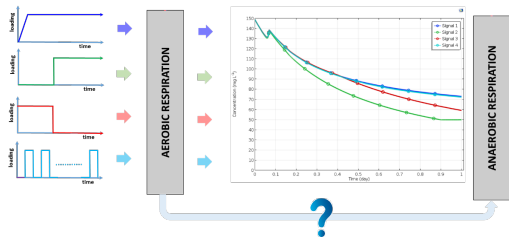


Figure 1: Stimulus experiments to optimize the nitrification in aerobic respiration column.