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EVALUATION OF DIFFERENT CONTROL STRATEGIES OF THE WASTE WATER TREATMENT PLANT BASED ON A MODIFIED ACTIVATED SLUDGE MODEL NO. 3

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Abstract

The first part of this work presents the development and implementation in the Benchmark Simulation Model No 1 (BSM1) of a modified Activated Sludge Model No 3 (ASM3). The enhanced ASM3 presented in this study has three modifications compared to the original ASM3. The first modification is the representation of the simultaneous heterotrophic biomass growth on the primary substrate and on the internal storage products. Second, nitrification is modeled as a two-step process with nitrite as an intermediate product, bringing an increased degree of complexity to the mathematical model. Third, the denitrification process is modeled as a three step process with nitrite and nitric oxide as intermediates. The nitric oxide is introduced in the model to account for the inhibition of some enzymes that are responsible for the growth of the heterotrophic bacteria under aerobic conditions.

For a better representation of the real plant behavior, the secondary settler is modeled to be reactive. The built reactive settler model is the combination of the settler model described by Takács in 1991 and the enhanced ASM3.

The second part of this research consists of the investigation of five control strategies applied to the waste water treatment plant (WWTP). The control architectures studied in this research are multi-input-multi-output (MIMO) Model Predictive Controllers (MPC). The assessment of these strategies is made from three points of view: control performance, cost evaluation and quality of the effluent. The simulation results show that operational costs can be reduced using automatic control.

Key words: ASM3, BSM1, denitrification, MPC, nitrification, reactive secondary settler

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