



Impact of the selected indicators of the wastewater quality and operating parameters of the biological reactor on the simulation of sludge sedimentation: probabilistic approach

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ABSTRACT

A probabilistic model was used to simulate the short- and long-term reliability of the treatment plant in relation to the sedimentation of activated sludge. In this model, it was assumed that the quantity and quality of wastewater flowing into the treatment plant and weather conditions are stochastic. While, the control variables are: the activated sludge concentration, the oxygen concentration in the nitrification chamber and the coagulant dose. The model includes the possibility of failure of wastewater quality analyzers, which are also of random nature. The probabilistic model presented in the paper consists of three components. The first of them is a classification model to identify the sedimentation capacity of activated sludge. The second component consists of generators of quantity, quality of wastewater, as well as weather conditions based on the Monte Carlo method. The third component is a failure generator for wastewater quality analyzers at the inlet to a wastewater treatment plant. Using the developed probabilistic model at work, a number of bioreactor optimization strategies were analyzed in a long-term (1 y) perspective. The analyzes carried out confirmed that the proposed probabilistic model is a valuable tool for optimizing the operation of wastewater treatment plants and allows the assessment of the impact of dynamic changes in the reactor control variables on the reliability of the facility's operation in long-term and short-term.

Keywords: Wastewater treatment plant; Sludge volume index; Probabilistic model; Reliability

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