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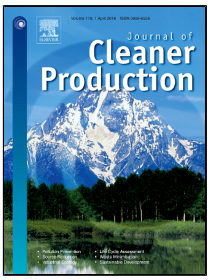

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A Simulation-Based Real-Time Control System for Reducing Urban Runoff Pollution through A Stormwater Storage Tank

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Abstract: Due to the lack of automatic control for urban drainage systems in China, urban stormwater runoff pollution cannot be addressed effectively. To remedy this disadvantage, a theoretical framework of real time control (RTC) system was established. The key indicator identification and pollution load estimation of stormwater runoff pollution were investigated to provide control parameters (such as amount, duration, and intensity of rainfall). Stormwater storage tank (SST) is the main component of the RTC system. In order to enhance the efficiency of SST, a simulator was developed. A back propagation neural network (BPNN) was adopted to predict the turbidity of SST. The developed BPNN contained input, implicit and output layers. A simulation device of SST was proposed to provide the input data for the developed BPNN. Also, several RTC parameters of water quality (e.g., turbidity, ammonia nitrogen, total phosphorus and chemical oxygen demand) of SST were investigated by an experimental simulation. Then turbidity was chosen as the key RTC parameter. The turbidity prediction of the developed BPNN included two types, one was based on a single variable (i.e., flow quantity) at the inlet of SST to predict the turbidity at the inlet of SST. The other was based on multiple variable (i.e., flow quantity, ammonia nitrogen, total phosphorus and chemical oxygen demand) at the inlet of SST to predict the turbidity at the outlet of SST. Based on the training and verification processes of the experimental data, the results indicated that the developed BPNN performed well ($R > 0.94$) in predicting turbidity of SST. The developed BPNN was incorporated into a RTC system as a simulator, which can thus help efficient decision making for facilitating water storage and pollution reduction of stormwater storage tanks.

Keywords: Stormwater storage tank (SST); Real-time control (RTC); Stormwater runoff pollution; Turbidity; Back propagation neural network (BPNN).

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