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A NEW SIMPLE MODEL FOR THE PREDICTION OF WASTE SLUDGE FLOW RATE IN THE STEADY-STATE COMPLETELY MIXED ACTIVATED SLUDGE PROCESS

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Abstract

A new simple empirical model is proposed to describe the waste sludge volumetric flow rate in the steady-state completely mixed activated sludge process. The model is derived based on the nonlinear regression analysis by using the Richardson's extrapolation method and the Levenberg–Marquardt algorithm. The application of the model has been explored for a wide range of eleven fundamental biological design variables and tested against a total of 1500 additional computational scenarios and real wastewater plant data. All predictions are proven to be satisfactory with very high determination coefficients of about 0.97 and 0.99, respectively, for the forecast of waste sludge flow rate. Compared with the theoretical approach, the proposed model offers a quite simple and practical mathematical structure incorporating easily obtainable parameters, which are routinely ascertained in the activated sludge-based treatment plants. Besides obviating the need for time-consuming theoretical procedure, the developed equation facilitates the calculations and can be used for any distinct cases of waste sludge withdrawal. Computational results demonstrate that the proposed equation is accurate enough to be used in estimation of waste sludge production and sufficiently simple to be used with a hand-held calculator.

Key words: activated sludge, biological treatment, completely mixed reactor, empirical model, statistical analysis, waste sludge flow rate

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