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Modeling of expanded granular sludge bed reactor using artificial neural network

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HIGHLIGHTS

- The performance of the EGSB reactor was modeled by an artificial neural network.
- The topologic architecture of the artificial neural network was optimized by response surface methodology.

Abstract:

In present study, a three-layer backpropagation neural network (BPNN) model was developed to predict the performance of an expanded granular sludge bed (EGSB) reactor. Six related variables such as influent chemical oxygen demand (COD) concentration, hydraulic retention time (HRT), alkalinity (ALK) concentration, pH, volatile fatty acid (VFA) concentration and oxidation reduction potential (ORP), were selected as inputs of the model. All input values were converted to the range (-1, 1) before passing them into the network. Activation function of hidden layer and output layer were "tansig" and "purelin" individually. Several comparisons were conducted to obtain an optimal network structure. *Dividerand* function was chosen to divide the operating data into training group, testing group and validation group. The Levenberg Marquardt algorithm (trainlm) was found as the best of the ten training algorithms. Other model parameters such as number of neurons in the hidden layer (X_1), initial adaptive value (X_2) and initial value of weights and biases (X_3) were optimized using response surface methodology (RSM). The optimum conditions for minimum mean squared error (*MSE*) were as follows: X_1 (12), X_2 (6.0) and X_3 (1.0). The precision of optimum ANN model was assessed by means of various statistics such as *MSE*,

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