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Modeling Fentonic advanced oxidation process decolorization of Direct Red 16 using artificial neural network technique

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ABSTRACT

The present work has focused on the modeling of C.I. Direct Red 16 (DR16) decolorization using Fentonic reagents in a batch reactor. The reactor was equipped with an air bubbling for mixing and a water-flow coil for temperature regulating. Dye concentration was analyzed by measuring its absorbance at λ_{max} = 526 nm. An artificial neural network (ANN) model was developed to predict the behavior of the process. Six operational parameters and decolorization efficiency were employed as inputs and output of the network, respectively. A three layer feed-forward network with back-propagation algorithm was developed. Application of 10 neurons in the hidden layer and 300 iterations for the network calibration prevents overfitting by the model. The K-fold cross-validation method was employed for performance evaluation of the developed ANN model. The results showed high correlation coefficient (R^2 = 0.9984) and low mean square error (MSE = 1.56×10^{-4}) for testing data. Sensitivity analysis indicates the order of operational parameters relative importance on the network response as: pH ≈ time > $[H_2O_2]$ > [Fe(II)] > $[DR16]_0$ > temperature.

Keywords: Fenton process; Direct Red 16; ANN modeling; Feed forward; Cross-validation; Sensitivity analysis

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