Artificial neural network and genetic algorithms for modeling of removal of an azo dye on walnut husk

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Abstract

The study dealt with an evaluating kinetic aspect of removal of Basic Red (BR) 46 by walnut husk (WH). Artificial neural network (ANN), gene expression programming (GEP), logistic, and pseudo-second-order kinetic models were constructed to predict the removal efficiency of BR 46 on WH. Spectra of WH before and after the sorption process were obtained using FTIR–ATR. Functional groups such as hydroxyl, carbonyl, and carboxyl groups had a significant role on the interaction between WH and BR 46. Maximum sorption was determined as 66.45 mg g⁻¹. About 2,160 experimental mean sets were used to feed ANN structure. ANN was found to be the best model due to its lowest error and highest determination of coefficient values. ANN showed that contact time was the most efficient parameter, followed by initial dye concentration for the sorption process. GEP model successfully described the sorption kinetic process as functions of pH, adsorbent particle size, initial dye concentration, contact time, and temperature in a single equation. Results of thermodynamic parameters indicated that this process is being feasible, endothermic, and spontaneous. Results revealed that WH had a great potential to remove BR 46 from aqueous solution at different environmental conditions.

Keywords: Artificial neural network; Basic Red 46; Gene expression programming; Sorption; Walnut husk