Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2018.21920

109 (2018) 90–103
March

Application of artificial neural network and random forest methods for modeling simultaneous adsorption of safranin-O and methyl violet dyes onto modified pine cone powder

Motahare Ashrafi, Ghadamali Bagherian*, Mansour Arab Chamjangali, Nasser Goudarzi

Faculty of Chemistry, Shahrood University of Technology, Shahrood, P.O. Box 36155-316, Iran, Tel. +98 23 32395441; emails: Gh_Bagherian@shahroodut.ac.ir (G. Bagherian), mot.ashrafi@gmail.com (M. Ashrafi), arabe51@yahoo.com (M. Arab Chamjangali), goudarzi10@yahoo.com (N. Goudarzi)

Received 25 August 2017; Accepted 17 January 2018

ABSTRACT

In the present work, a new carboxylate-functionalized pine cone was prepared using isopropylidene malonate in a solvent-free reaction. It was then characterized by the FT-IR, X-ray diffraction, scanning electron microscopy, and Brunauer–Emmett–Teller analysis techniques. The performance of the modified adsorbent was investigated for the removal of the safranin-O (SO) and methyl violet (MV) dyes from the single and binary solutions. The maximum adsorption capacity for SO and MV in the single solution was 208.0 and 225.0 mg/g, respectively, whereas these values were, respectively, 112.30 and 116.7 mg/g for the binary solution. This value is much higher than those reported by some other researchers. The kinetic studies revealed that this bio-sorption is a chemisorption process. In continuation, the experimental factors involving the initial solution pH, adsorbent dosage, dye concentration, and contact time were used as the input variables to the artificial neural network (ANN) and random forest (RF) models to predict the removal percentage of SO and MV in the binary mixture. The validation of these models was tested using a test set of 81 data points. The statistical parameters involved in the prediction of the removal percentage of the test set confirmed that the ANN model had a substantially better and a more accurate prediction with respect to the RF model.

Keywords: Random forest; Artificial neural network; Methyl violet; Safranin-O

* Corresponding author.