Desalination and Water Treatment
www.deswater.com
doi: 10.5004/dwt.2023.30211

316 (2023) 419–430
December

Predictive model based on artificial neural network for estimating the adsorption of nickel and lead on a natural and synthetic support

Hézia Bouarar[a], Mounir Bouhedda[b,*], Hakima Cherifi[a]

[a]*Laboratory of Biomaterials and Transport Phenomena (LBMPT), University of Medea, Nouveau Pôle Urbain, Medea 26000, Algeria, emails: bouarar.hizia@univ-medea.dz (H. Bouarar), ha_cherifi@yahoo.fr (H. Cherifi)*
[b]*Laboratory of Advanced Electronic Systems (LSEA), University of Medea, Nouveau Pôle Urbain, Medea 26000, Algeria, email: bouhedda.m@gmail.com*

Received 20 June 2023; Accepted 5 December 2023

ABSTRACT

In this study, the adsorption process of nickel and lead on natural supports, specifically bentonite and activated carbon, was modeled using an artificial neural network (ANN). The primary objective was to quantify the adsorption yield of the adsorbed metal. The developed ANN model was validated to assess its effectiveness in predicting experimental data sets. For both nickel and lead, the mean square error of the model was calculated to be 3.72×10^{-4}, indicating a highly accurate model. In addition, the trained ANN was used to predict the influence of several parameters, including pH, contact time, initial metal concentration, temperature, material, and adsorbent concentration, on the adsorption of these metals using the two different adsorbents. The ANN was well constructed and optimized using a 6-10-1 topology. The performance of the model was evaluated using test data, which showed high correlation coefficients for (R^2) values of 0.99430 and 0.99439 for the validation and test data, respectively. These results indicate the robustness and accuracy of the ANN model in predicting the adsorption behavior of nickel and lead on bentonite and activated carbon.

Keywords: Adsorption; Activated carbon; Artificial neural network; Bentonite; Lead; Modeling; Nickel; Prediction

* Corresponding author.