Environmental Engineering and Management Journal

January 2024, Vol. 23, No. 1, 1-9
http://www.eemj.icpm.tuiasi.ro/; http://www.eemj.eu
http://doi.org/10.30638/eemj.2024.001

"Gheorghe Asachi" Technical University of Iasi, Romania

REMOVAL OF COPPER FROM AQUEOUS SOLUTIONS BY ADSORPTION ON MAHOGANY TREE SAWDUST (*Swietenia mahagoni*) IN BATCH AND FIXED BED

Elif Çakır[1], Vahdettin Tosunoğlu[1], Recep Boncukcuoğlu[2], Baybars Ali Fil[3]*

[1]Atatürk University, Faculty of Engineering, Department of Environmental Engineering, 25240, Erzurum, Turkey
[2]Istanbul University, Faculty of Engineering, Department of Environmental Engineering, 34320, İstanbul, Turkey
[3]Balıkesir University, Faculty of Engineering, Department of Environmental Engineering, 10145, Balıkesir, Turkey

Abstract

Copper poses a major health risk when present in excessive amounts in drinking water and daily feeding. Mahogany chips were used in the batch and fixed bed reactors to study the removal of copper from synthetically prepared solutions. The experimental parameters were the initial solution pH, adsorbent dose, temperature, concentration, duration, volumetric flow rate and bed heights. It was found that pH (5), adsorbent dose (10 g/L), time (60 min) and temperature (250°C) were the best conditions for the batch reactor. A volume flow of 0.5 mL/min, a bed height (15 cm) and a concentration (50 mg/L) were determined as fixed bed parameters for maximum removal, since the breakthrough time increased with these settings. The results can be explained by the pseudo-second-order kinetic model used to study the kinetics of the batch reactor using the pseudo-first-order and pseudo-second-order models. The Yoon-Nelson and Thomas models received the fixed bed reactor kinetic data and the column reactor data were fitted to both models. Activation energy was calculated to be 40.747 kJ/mol at 75 mg/L initial concentration. As a result of experiments with pH: 5, 10 g/L adsorbent dosage for batch studies and 60 minutes for 25°C temperature, a copper removal of 65.7% was obtained using mahogany chips under optimal conditions. It was concluded that the mahogany tree shavings were a suitable biosorbent for copper removal from wastewaters.

Key words: batch reactor, copper removal, fixed bed reactor, mahogany tree shavings

Received: November, 2022; Revised final: May, 2023; Accepted: June, 2023; Published in final edited form: January, 2024

* Author to whom all correspondence should be addressed: e-mail: baybarsalifil2@gmail.com