Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2021.27043

221 (2021) 260–269
May

Arsenite adsorption on biochar-based nano copper oxide composites using Mediterranean cypress cones: equilibrium, kinetic and thermodynamic studies

Imad Hamadneh[a,*], Ahmed Al-Mobydeen[b], Fayza Hannoon[a], Afnan Abu Jaber[a], Rula Albuqain[c], Shorouq Alsotari[c], Ammar H. Al-Dujaili[d]

[a]*Department of Chemistry, Faculty of Science, University of Jordan, Amman 11942, Jordan, Tel. +962 775500003; email: i.hamadneh@ju.edu.jo (I. Hamadneh), Tel. +962798408852; email: fayza96_7annoon@yahoo.com (F. Hannoon), Tel. +962775904574; email: afnanabujaber44@yahoo.com (A.A. Jaber)*
[b]*Department of Chemistry, Faculty of Science, Jerash University, Jerash 26150, Jordan, Tel. +962798962089; email: ahmeddd_mob@yahoo.com*
[c]*Cell Therapy Center (CTC), The University of Jordan, Amman 11942, Jordan, Tel. +962798738536; email: buqaien@yahoo.com (R. Albuqain), Tel. +962796605076; email: shalsotari@gmail.com (S. Alsotari)*
[d]*Hamdi Mango Center for Scientific Research, University of Jordan, Amman, P.O. Box: 11942, Jordan, Tel. +962796629774; email: ah.aldujaili@gmail.com*

Received 15 August 2020; Accepted 14 January 2021

ABSTRACT

The removal of arsenite using biochar (BC) and biochar-CuO nanocomposite (BC-CuO-NC) from cypress cones biomass was systematically investigated. The copper oxide (CuO) nanoparticles (NP's) were synthesized using aqueous cypress cones extract. The BC was obtained by the pyrolysis of cypress cones biomass at 550°C and then impregnated with CuO-NP's to produce BC-CuO-NC. Arsenite adsorption into BC and BC-CuO-NC was studied using the batch technique at different pH, contact time, adsorbent dose, and temperature conditions. BC-CuO-NC demonstrated better adsorption efficiency than BC to 5–6 pH arsenite with a 55.58% removal percentage and a 10 min balance period. Compared with the Dubinin–Radushkevich isotherm equation, the Langmuir and Freundlich isotherm equations fit well with the experimental results. According to the Langmuir model, the saturated adsorption capacity of BC and BC-CuO-NC for arsenite can reach 22.831 and 36.765 mg/g, respectively. Kinetic studies have shown that the adsorption arsenite on BC and BC-CuO-NC was defined in pseudo-second-order. The determined thermodynamic parameters of the adsorption cycle were spontaneous, exothermic, and the random increase was observed.

Keywords: Biosorption; Biochar; Arsenite; Nanocomposite; Mediterranean cypress cones; Isotherm

* Corresponding author.