Environmental Engineering and Management Journal *August 2014, Vol.13, No. 8, 1927-1938*
http://omicron.ch.tuiasi.ro/EEMJ/

"Gheorghe Asachi" Technical University of Iasi, Romania

REMOVAL OF HEXAVALENT AND TOTAL CHROMIUM FROM AQUEOUS SOLUTIONS BY PLUM (*P. domestica* L.) TREE BARK

Perla Vianey Lopez-Nuñez[1], Erick Aranda-García[1], María del Carmen Cristiani-Urbina[2], Liliana Morales-Barrera[1], Eliseo Cristiani-Urbina[1*]

[1]Departamento de Ingeniería Bioquímica, Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional, Prol. Carpio y Plan de Ayala s/n, Col. Sto. Tomás, México DF, 11340, México
[2]Universidad Autónoma de Chiapas, Campus I., Boulevard Belisario Domínguez km 1081 s/n, Tuxtla Gutiérrez, Chiapas, 29000, México

Abstract

The main purpose of the present work was to evaluate the potential of plum (*P. domestica* L.) tree bark (PDB) to remove Cr(VI) and total chromium from aqueous solutions in batch systems. Experimental data showed that the Cr(VI) and total chromium removal capacity was dependent on operating variables such as PDB particle size, PDB pretreatment, solution pH, initial Cr(VI) concentration, and contact time. The mechanism of Cr(VI) removal by PDB implies two simultaneous processes: 1) the reduction of Cr(VI) to Cr(III), and 2) the biosorption of chromium ions. Cr(VI) and total chromium removal rates were affected to a significant extent by PDB particle size. Hydrochloric acid pretreatment proved to be optimum to increase the total chromium biosorption capacity of PDB, whilst also reducing the time needed to reach equilibrium.
The optimum pH value for removal of Cr(VI) and total chromium was 1.0-2.0 and 2.0, respectively. Significant enhancement of Cr(VI) and total chromium removal was observed by increasing initial Cr(VI) concentration. The biosorption kinetic data of total chromium were best described by the pseudo-second-order model. Freundlich´s model exhibited the best fit to experimental equilibrium biosorption data. FTIR studies indicated that the main functional groups responsible for total chromium biosorption consist of the amide and carboxyl groups, which may interact with Cr(VI) anionic species and Cr(III) cationic species, respectively. The removal characteristics of Cr(VI) and total chromium exhibited by PDB make it potentially useful for the detoxification of Cr(VI)-polluted water and wastewater.

Key words: bioreduction, biosorption, hexavalent chromium, *Prunus domestica* bark

Received: February, 2014; Revised final: August, 2014; Accepted: August, 2014

∗ Author to whom all correspondence should be addressed: e-mail: ecristia@encb.ipn.mx; Phone number: +52 55 57296300 ext. 62454; Fax number: +52 55 57296000 ext. 46211