Desalination and Water Treatment
www.deswater.com

(2013) 1–8

doi: 10.1080/19443994.2013.812992

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Removal of Pb (II) from aqueous solution by adsorption using activated carbon developed from *Apricot stone*: equilibrium and kinetic

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Received 13 April 2013; Accepted 2 June 2013

ABSTRACT

Activated carbons were developed from Apricot stone, by chemically treating with sulfuric acid. Batch adsorption experiments were performed to find out the effective lead removal at different metal ion concentrations, adsorbent size, and dosage. Adsorption of Pb^{2+} ion was strongly affected by pH. Apricot stone exhibited the highest lead adsorption capacity at pH 6.0. Isotherms for the adsorption of lead on Apricot stone were evaluated with the Langmuir, Freundlich adsorption isotherm models. The equilibrium data fitted well to the Langmuir and Freundlich isotherm models. Adsorption kinetics data were modeled using the pseudo-first and pseudo-second-order models. The results indicate that the second-order model best describes adsorption kinetic data. The estimated maximum capacities of lead ions adsorbed by Apricot stone activated with sulfuric acid were 21.38 mg g^{-1}. This high uptake showed Apricot stone activated carbon as among the best adsorbents for Pb(II).

Keywords: Lead removal; Adsorption; Isotherm; Activated carbon; Apricot stone

1. Introduction

Methods applied for removal of heavy metals from wastewater include chemical precipitation [1], solvent extraction [2] ultra-filtration [2], biochemical treatment [3], ion exchange [4], and adsorption [5–8]. Of these, adsorption, which is considered as a third stage of waste treatment, proved its advantage over the other processes because of its cost-effectiveness and the high-quality of treated effluent it produces. Adsorption is the process by which a solid adsorbent can attract a component in water to its surface and form an attachment via a physical or chemical bond, thus removing the component from the fluid phase.

Activated carbon is the most effective adsorbent used; however, other different cheaper adsorbents are used or under investigations. Of these, peat was used to adsorb different heavy metals [9] and marine algae can adsorb Cd^{2+} and Pb^{2+} [10]. Different low-cost materials include clays, maize cob, deoiled soya, bagasse, palm fruit bunch which were used to remove dyes and heavy metals from water [11,12]. Also, microorganisms were found to be effective in the removal of heavy metal [13].

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