



Removal of Cr(VI) from aqueous solution using brick kiln chimney waste as adsorbent

Sajjad Hussain^{a,*}, Saima Gul^a, Sabir Khan^b, Habib-ur Rehman^c, Mohammad Ishaq^c, Adnan Khan^c, Fazal Akbar Jan^c, Zia Ud Din^d

^a*Instituto de Química de São Carlos, Universidade de São Paulo, CP 780, CEP, São Carlos 13560 970, SP, Brazil
Tel. +55 16 33739709; email: sajjad@iqsc.usp.br*

^b*Instituto de Química, Universidade Estadual de Campinas, CP 6154, CEP, Campinas 13083 970, SP, Brazil*

^c*Institute of Chemical Sciences, University of Peshawar, Peshawar 25120, Pakistan*

^d*Departamento de Química, Universidade Federal de São Carlos, São Carlos, SP, Brazil*

Received 20 April 2013; Accepted 18 August 2013

ABSTRACT

Heavy metals are toxic to aquatic flora and fauna even in relatively low concentrations. Chromium is a commonly occurring toxic metal in ecosystems. This study aims the adsorption of Cr(VI) on a novel low-cost carbonaceous material under different experimental conditions such as contact time, initial concentration of metal ions, pH, and temperature. The adsorbent was characterized by using scanning electron microscopy and energy-dispersive X-ray spectroscopy. The equilibrium data were fitted well with Langmuir and Freundlich isotherms. Adsorption kinetics of Cr(VI) ions onto chimney waste adsorbent were analyzed by pseudo-first-order and pseudo-second-order models. The adsorption process is favored by acidic pH and followed the second-order kinetics. Various thermodynamic parameters like activation energy (E_a), Gibbs free energy change (ΔG°), enthalpy change (ΔH°), and entropy change (ΔS°) were calculated. The results showed that the carbonaceous material obtains from bricks kiln chimneys can be efficiently used for Cr(VI) removal from wastewater.

Keywords: Adsorption; Chromium; Heavy metals; Langmuir; Kinetics

*Corresponding author.