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Iron(III) complex of an amino-functionalized poly(acrylamide)-grafted lignocellulosic residue as a potential adsorbent for the removal of chromium(VI) from water and industry effluents

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ABSTRACT

This study evaluated the effectiveness of a new adsorbent system (AM-Fe-PGCP), iron(III) complex of an amino-functionalized poly(acrylamide)-grafted coconut coir pith (CP) for the removal of chromium(VI) from aqueous solutions. The adsorbent was prepared through graft copolymerization of acrylamide onto CP in the presence of N,N′-methylenebisacrylamide using potassium peroxidisulphate initiator, followed by treatment with ethylenediamine and ferric chloride in acid (HCl) medium. The adsorbent was well characterized using FTIR, SEM, XRD, TG/DTG, surface area analyzer and potentiometric titrations. The ability of AM-Fe-PGCP to remove Cr(VI) from water and industrial effluent was tested using batch adsorption experiments. The effects of contact time, initial sorbate concentration, pH, dose of adsorbent and temperature were studied to optimize the conditions for maximum adsorption. The adsorption kinetics data were best described by the pseudo-second-order rate equation. The mechanism of sorption was found to be film diffusion controlled. Equilibrium isotherm data were analysed by the Langmuir and Freundlich equations. The best interpretation for the equilibrium data was given by the Langmuir isotherm and the maximum adsorption capacity was estimated to be 135.5 mg g^{-1} at 30°C. NaOH solution (0.1 M) was found to be capable of regenerating the spent adsorbent. Simulated industry wastewater sample was also treated by the AM-Fe-PGCP to demonstrate its efficiency in removing Cr(VI) from wastewater.

Keywords: Graft copolymers; Lignocellulosics; Adsorption; Chromium(VI); Thermodynamics; Desorption

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