Abstract

This report offers the research findings of a laboratory-based study on the removal of toxic Cr (VI) from synthetic wastewater using most abundant lignocellulosic agricultural waste, coir dust.

The efficiency of the removal of Cr (VI) by coir dust was investigated under different experimental conditions namely solution pH, initial Cr (VI) concentration and time dependency. Cr (VI) analyzes were carried out by UV-Visible spectrometric techniques at wavelength (λ_{max}) 540 nm. Color developing agent was 1,5 – Diphenylcarbazide. Data on the above experiments were analyzed using the "Origin" software.

Better combination for coir to Cr (VI) was 5 g/l and 50 mg/l of Cr (VI). Optimum pH value for maximum Cr (VI) removal was determined 3.7. The removal rate is increased with the initial Cr (VI) concentration and temperature increased at lower pH values. The removal of Cr (VI) by coir dust followed first order kinetics. Thermodynamic parameters of the activation state for removal of Cr (VI) on to coir dust have been derived from the temperature dependent kinetic data. The activation energy (E_a), Gibbs free energy (ΔG), entropy (ΔS), and enthalpy (ΔH), of the activation stage for Cr (VI) adsorption on to coir dust were calculated by Arrhenius, Eyring's models and $\Delta G = \Delta H - T\Delta S$ at 300 K. The calculated values for activation energy (E_a), Gibbs free energy (ΔG), entropy (ΔS), and enthalpy (ΔH) were 8.3 kJ/mol, 83 kJ/mol, -0.258 kJ/mol and 6 kJ/mol correspondingly. The activation energy for coir Cr (VI) system is very low. The ΔS value is negative and $-T\Delta S$ value is positive, which indicate that the activation state of Cr (VI) adsorption process is entropy-controlled.

The studies showed that this low cost coir dust could be used as an efficient adsorbent material for the removal of Cr (VI) from wastewater.