Removal of Chromium(III) Form Aqueous Solutions by the Organic Ion Exchangers

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Abstract

Soil and water contamination by heavy metals like Cr, Cu, Pb, Mn, Hg, and Cd in soil as well as in water arising from the discharge of industrial effluents is one of the important environmental problems. Due to the greater stability these heavy metals cannot be degraded and removed from the environment. Their presence in aquatic life causes harmful effects to living organism [1]. Chromium, one of the above heavy metals has two stable oxidation states, Cr (III) and (VI). The presence of strong oxidants in soil and water can change Cr (III) to harmful Cr (VI). Therefore chromium(III) removal on three cation exchangers Amberlite. IRC-50 (Na^+), Amberlite. IR-120 (Na^+) and Amberlyst.15 (H^+) is studied as a function of time and concentration at different temperatures(293 K-333 K). The kinetic and equilibrium studies proved that affinity of these cation exchangers towards Cr(III) removal followed the order as Amberlyst. 15 (H^+) > Amberlite.IR-120 (Na^+) > Amberlite. IRC-50(Na^+). The pH is observed to increase during exchange on Amberlite.IR-120 (Na^+) and Amberlite.IRC-50 (Na^+) while decrease during exchange on Amberlyst.15 (H^+). The kinetic data is explained both by film and particle diffusion equations. Using the rate constant values, the activation energies are calculated from the well-known Arrhenius equation. The low activation energy confirmed the diffusional nature of the exchange process. Equilibrium data is explained with the help of Langmuir equation. Various thermodynamic parameters (ΔH_O, ΔS_O and ΔG_O) for Chromium (III) exchange on these exchangers are calculated. The ΔG_O values are found to be negative while both the ΔH_O and ΔS_O are positive.

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