Adsorption ability of chelating resin Purolite S930 for removal of metal complex azo dye from aqueous solutions

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ABSTRACT

The abilities of the macroporous chelating resin containing iminodiacetic groups (Purolite S930) and the weak basic anion exchanger Purolite A847 to remove the chromium complex dye (LnCr) from aqueous solutions in the batch system have been compared depending on the dye concentration, pH, reaction time and temperature. The maximum capacities (qeq) for Purolite S 930 at pH = 2 and pH = 7 (1.5 and 2.0 mg/g, respectively) were lower as compared with the qeq for Purolite A847 (2.1 and 2.25 mg/g, respectively). The thermodynamic parameters (negative values of ΔS°, ΔG°) and values of activation energy (Ea) have revealed that LnCr dye removal using both resins is an exothermic, spontaneous ion exchange in conjunction with physical adsorption (ΔH° from –4.3 to –17.29 kJ mol−1). The FTIR spectra of unloaded and LnCr dye loaded anion exchanger Purolite A847 confirms the ion exchange and physical adsorption mechanisms. Isotherms and kinetic modeling studies demonstrate that the experimental data obtained for dye LnCr sorption on both resins well fit the Langmuir and Freundlich isotherms and pseudo second-order rate and intraparticle diffusion models. The rate of dye adsorption on both adsorbents is controlled by the co-acting of external mass transfer at the beginning of the process and then by intraparticle diffusion.

Keywords: Chromium complex dye; Sorption; Chelating resin; Weakly basic anion exchanger