

Adsorption of Iodine from Aqueous Solution on Modified Silica Gel with Cyclodextrin Derivatives

Authors : Raied, Badr Al-Fulaiti, E. I. El-Shafey

Abstract : Cyclodextrin (CD) derivatives (α CD, β CD, γ CD and hp- β CD) were successfully immobilized on silica gel surface via epichlorohydrin as a cross linker. The ratio of silica to CD was optimized in preliminary experiments based on best performance of iodine adsorption capacity. Selected adsorbents with ratios of silica to CD derivatives, in this study, include Si- α CD (3:2), Si- β CD (4:1), Si- γ CD (4:1) and Si-hp- β CD (4:1). The adsorption of iodine (I₂/KI) solution was investigated in terms of initial pH, contact time, iodine concentration and temperature. No significant variations was noticed for iodine adsorption at different pH values, thus, initial pH 6 was selected for further studies. Equilibrium adsorption was reached faster on Si-hp- β CD than other adsorbents with kinetic adsorption data fitting well pseudo second order model. Activation energy (E_a) was found to be in the range of 12.7 - 23.4 kJ/mol. Equilibrium adsorption data were found to fit well the Langmuir adsorption model with lower uptake as temperature rises. Iodine uptake follows the order: Si-hp- β CD (714 mg/g) > Si- α CD (625 mg/g) > Si- β CD (555.6 mg/g) > Si- γ CD (435 mg/g). Thermodynamic study showed that iodine adsorption is exothermic and spontaneous. Adsorbents reuse exhibited excellent performance for iodine adsorption with a decrease in iodine uptake of ~ 2- 4 % in the third adsorption cycle.

Keywords : adsorption, iodine, silica, cyclodextrin, functionalization, epichlorohydrin

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