



Competitive adsorption of Li, K, Rb, and Cs ions onto three ion-exchange resins

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ABSTRACT

Adsorption is one of the effective methods to recover or remove alkali metal ions from aqueous solutions. Current studies on the adsorption of alkali metal ions are mainly focused on the adsorption of one alkali metal ion. However, under natural conditions, alkali metal ions are usually coexisted. During separation processes, they compete with each other. In this study, competitive and noncompetitive adsorption of Li, K, Rb, and Cs ions onto three ion-exchange resins (D001, LSC-100, and LSC-500) of sodium form was investigated in batch experiments at 25°C. Compared with the noncompetitive adsorption, competitive adsorption of different alkali metal ions present with larger differences, in general. The adsorption from single and multiple solutions presents similar preference. Under both the noncompetitive and competitive adsorption conditions, for D001 resin, the separation factor was found to follow the order of $\beta_{Cs/Li} > \beta_{Rb/Li} > \beta_{K/Li}$, on the contrary, for both LSC-100 and LSC-500 resins, it is $\beta_{Cs/Li} < \beta_{Rb/Li} < \beta_{K/Li}$. The affinity sequence was explained by considering the hydration energy changes, the electrostatic attractions and complexation between the alkali metal ions and the resins. The results obtained would be helpful for the understanding of the competitive adsorption processes and the recovery or removal of one or more alkali metal ions from aqueous solutions.

Keywords: Alkali metal ion; Ion-exchange resin; Competitive adsorption; Separation factor

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