Study on ion-exchange behavior of Cu$^{2+}$ and Ni$^{2+}$ with a high-efficiency resin

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ABSTRACT

A hydrogen type 732 cation-exchange resin (732-CR) was investigated for its ion-exchange behavior with Cu$^{2+}$ and Ni$^{2+}$ in aqueous solutions. The ion-exchange isotherm studies show a well fit with the Langmuir model, indicating a monolayer sorption mechanism and a maximum ion-exchange capacity ($q_m$) of 1.736 mmol·g$^{-1}$ for Cu$^{2+}$ and 2.876 mmol·g$^{-1}$ for Ni$^{2+}$ at 308 K, respectively. The hydrated structures were proposed to explain the difference in $q_m$ between Cu$^{2+}$ and Ni$^{2+}$. The results show a two-shell six-coordinated-hydrate with eight water molecules for Cu$^{2+}$ and an octahedral six-coordinated-hydrate with six water molecules for Ni$^{2+}$ are the effective components for ion exchange. The thermodynamic parameters were calculated to show that the ion-exchange process is favorable, exothermic and spontaneous.

Keywords: Ion exchange; Heavy metal ion; 732 cation-exchange resin; Hydrated structure

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