



Preparation of chitosan-graft-benzo-15-crown-5 ether film for heavy metal ions separation

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ABSTRACT

Chitosan-graft-benzo-15-crown-5 ether (CTS-g-B15C5) for metal ion separation was prepared and optimized by Box-Behnken design (BBD). Results showed that the maximum immobilization amount (I_A) of crown ether grafting on chitosan (CTS) polymer was $4.93 \text{ mmol}\cdot\text{g}^{-1}$ under the optimal conditions, which is in good agreement with the result predicted by BBD ($4.97 \text{ mmol}\cdot\text{g}^{-1}$). Moreover, the CTS-g-B15C5 film exhibited an excellent adsorption ability and selectivity to different metal ions. The adsorption rates obtained by CTS-g-B15C5 film were 96.9% for Ag^+ and 94.3% for Pd^{2+} , which were higher than those obtained by CTS at the similar conditions. The order of adsorption ability on CTS-g-B15C5 was $\text{Ag}^+ > \text{Pd}^{2+} > \text{Pb}^{2+} > \text{Cu}^{2+} > \text{Ni}^{2+} > \text{Cr}^{3+}$, and the selectivity coefficients of CTS-g-B15C5 for metal ions were $K_{\text{Ag}^+/\text{Ni}^{2+}} = 5.40$, $K_{\text{Ag}^+/\text{Cr}^{3+}} = 8.59$, and $K_{\text{Pd}^{2+}/\text{Cr}^{3+}} = 8.44$, respectively. The results showed that CTS-g-B15C5 film could be used for separation of precious metals Ag^+ and Pd^{2+} . Furthermore, the CTS-g-B15C5 film could be reused after regeneration, and the adsorption rates for Ag^+ and Pd^{2+} kept up to 90% after being regenerated for five times, which suggests a good stability and potential application in heavy metal recycling field.

Keywords: Chitosan; Benzo-15-crown-5 ether; Heavy metal ion; Separation

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