Determination of optimal conditions for separation of metal ions through membrane dialysis using statistical experimental methods

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ABSTRACT

Statistical experimental methods were used to optimize the variable conditions of membrane dialysis process with a complex agent. Permselectivity of metal ions has been investigated in a two-compartment dialyzer with reflux flow. Cu^{+2}–Ni^{+2} ion system was chosen for the experimental investigation. Oxalic acid, malonic, acid and citric acid were selected as a complex agent used in the investigated solution in order to increase the discrepancy between transport fluxes of metal ions. The concentration ratio of complex agent to metal ions (X_1), pH value of investigated solution (X_2) and concentration of metal ions (X_3) were conducted to be optimized. The Box-Behnken design and response surface methodology were employed in the design of experiments and the analysis of results. The experimental results indicated that oxalic acid is a better complex agent in this study. For the case of oxalic acid as complex agent, the maximal permselectivity of metal ions was obtained when concentration ratio of complex agent to metal ions, pH value of solution and concentration of metal ions were 0.96, 5.48 and 0.011 (mol/m^3), respectively. The corresponding maximal permselectivity of metal ions is 11.91.

Keywords: Optimization; Complex agent; Dialysis; Permselectivity

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