Influence of Some Parameters on Membrane-Free Electrodeionization for the Purification of Wastewater Containing Nickel Ions

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Green and efficient treatment of wastewater containing heavy metal is greatly desired. Thus, in this study, membrane-free electrodeionization, which allows the electrical regeneration of the packed resins without the use of membranes and chemicals, was performed for the removal of nickel ions from wastewater. In this MFEDI system, an improved stack configuration was used to prevent nickel hydroxide precipitation and phosphonic acid resin was adopted for adjusting the pH to neutral. The operation parameters (including current density, flow rate during electrical regeneration, and initial nickel concentration) were evaluated in relation to the electrical regeneration of the exhausted resins, the water recovery ratio as well as the energy consumption. The results showed that, the increase of current density and flow rate resulted in better electrical regeneration effect, while the initial nickel concentration had no obvious influence on this process. Their optimal values for energy consumption and water recovery ratio were as follows: current density of 300 A/m², flow rate of 10.6 L/h, and initial nickel concentration below 10 mg/L. Under these conditions, the water recovery ratio, energy consumption, pH of the concentrate stream, and conductivity of the dilute stream were, respectively, 87.5%, 4.0 kWh/m³, 5.9–7.5, and below 0.3 µs/cm.

Keywords: Membrane-free electrodeionization; Electrical regeneration; Precipitation; Nickel containing wastewater; Purification

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