Parametric experiments and kinetic studies on the removal of nickel using strong acid cation exchange resin 001 × 7

Natarajan Rajamohan

Faculty of Engineering, Department of Chemical Engineering, Sohar University, Sohar P.C.:311, Sultanate of Oman, email: natrajmohan@gmail.com (N. Rajamohan)

Received 25 March 2014; Accepted 26 August 2014

ABSTRACT

In this research study, the feasibility of removal of nickel ions was evaluated by utilizing a strong acid cation exchange resin 001 × 7. Parametric experiments were performed in a shaker in order to determine the effect of process variables like pH, resin dose, initial metal concentration, agitation speed and temperature on the metal removal efficiency and uptake. It was observed that 88% of metal removal was achieved at optimal pH 5.0 at an initial metal concentration of 100 mg/L. With higher resin dose, the removal efficiency increased and higher concentrations of metal required more equilibrium time for maximum removal. The experimental data were fitted to two kinetic models and pseudo-first-order model was found to fit well based on the values of correlation coefficient. The pseudo-first-order rate constant was found to be $2.1 \times 10^{-4}$ g/mg min for an initial nickel concentration of 100 mg/L. An inverse relation was found to exist between pseudo-first-order rate constant and initial metal concentration. The initial exchange rate and rate constant of the pseudo-second-order model were also evaluated. Fourier transform infrared spectroscopy studies were performed to verify the ion exchange mechanism.

Keywords: Cation resin; Nickel; Kinetics