Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2017.21599

97 (2017) 285–294
November

Cyanide adsorption from aqueous solution using mesoporous zeolite modified by cetyltrimethylammonium bromide surfactant

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Received 28 June 2017; Accepted 1 November 2017

ABSTRACT

The purpose of this study was the modification of zeolite with the cationic surfactant of cetyltrimethylammonium bromide for enhancing the adsorption of cyanide (CN^-) from aqueous solution. Hence, the batch tests were conducted under different conditions for CN^- removal by the surfactant-modified zeolite (SMZ). The effect of pH (3–10), SMZ dosage (0.25–5 g/L), CN^- concentration (50, 100, and 200 mg/L), and contact time (5–400 min) was evaluated. More than 95% of cyanide was removed at the conditions of pH of 10, the initial cyanide concentration of 100 mg/L, the SMZ dosage of 4 g/L, and the contact time of 250 min. The analysis of kinetics adsorption showed that cyanide ions adsorption onto the SMZ clearly followed the pseudo-second-order model. The isotherm adsorption data were mostly matched by Langmuir model with maximum adsorption capacity of 49.57 mg/g. The fresh and used SMZ was fully characterized by Brunauer–Emmett–Teller, Barrett–Joyner–Halenda, loss of ignition, X-ray powder diffraction, scanning electron microscope, Fourier transform infrared spectroscopy, and pH of zero point charge (pH_{zpc}). The surface study indicated that the adsorbent is mesoporous and crystalline. The adsorption–desorption study was done using three reagents of HNO_3, HCl, and NaOH. A metal plating wastewater was successfully treated using SMZ. Accordingly, the SMZ was found to be an effective adsorbent for the removal of different concentrations of cyanide from aqueous solution.

Keywords: Cyanide; Cetyltrimethylammonium bromide; Zeolite; Mesoporous; Metal plating wastewater; Desorption

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