Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2017.20632

71 (2017) 52–61
April

Single and binary adsorption of iron and manganese in synthetic water using activated pumice composites: effect of monovalent and divalent ions, desorption and reuse isotherms

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Received 3 December 2016; Accepted 1 March 2017

ABSTRACT

Adsorption performance of Fe and Mn, using three different activated pumice composites at varying doses, pH, and the initial metal conditions, was investigated in the single and binary metal systems. Adsorption performance of Fe was found to be higher than Mn adsorption at all adsorption conditions. Consequently, maximum a 100% and a 64% of Fe and Mn removal was recorded, respectively. Adsorption efficiencies of activated pumice composites using HCl and HNO_3 were found to be close to each other that they were eventually higher than the results of H_2O_2 activated pumice. Removal of Fe or Mn decreased to some extent in the binary system compared with the single system at all activated pumice composites. Adsorption data sets well fitted Langmuir isotherm than Freundlich and Temkin isotherms. The presence of monovalent (Na^+) salt did not significantly change the removal of both Fe and Mn in the single and binary systems, while divalent (Mg^{2+} and Ca^{2+}) salts slightly decreased the removal efficiencies of Fe and Mn. High desorption and reuse efficiencies were obtained when 0.1 N HCl solution was used; however, the adsorption efficiency decreased after first recycling and reuse. In conclusion, adsorption of Fe and Mn using HCl activated pumice composite is a promising low-cost adsorbent in comparison with other low-cost adsorbents.

Keywords: Acid activated pumice; Iron; Manganese; Adsorption; Desorption; Isotherms; Single and binary systems; Surface modification; Reuse

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