

ABSTRACT

Environmentally friendly treatment methods for heavy metals prior to discharge are considered favourable so as to protect ecosystems. The performance of modified zeolite from two different sources (South African and the USA) for the adsorption of Ni^{2+} , Cd^{2+} and Pb^{2+} from synthetic industrial effluent contaminated with metal concentration levels at 50, 150 and 500mg/L was assessed. The selectivity of the zeolite for the adsorption of Ni^{2+} , Cd^{2+} and Pb^{2+} was investigated at mixed feed solutions containing all three ions in equal concentrations and single component concentrations containing only one of the ions. The homoionic forms of the zeolite were made Na^+ , K^+ and Ca^{2+} . Batch experiments were then conducted to measure the uptake of metals by the zeolites. The zeolites were characterised using XRD and BET. The South Africa clinoptilolite has a higher surface area and pore volume ($17.52\text{m}^2/\text{g}$ and $0.047\text{cm}^3/\text{g}$ respectively) than the USA zeolite ($12.26\text{m}^2/\text{g}$ and $0.028\text{cm}^3/\text{g}$ respectively) for the Na^+ homoionic form. According to the equilibrium studies, the selectivity sequence can be given as $\text{Pb}^{2+} > \text{Cd}^{2+} > \text{Ni}^{2+}$, with good fits being obtained using Langmuir and Freundlich adsorption isotherms for low metal concentrations as compared to higher concentrations. The adsorption was found to depend on the homoionic form of the zeolite and to a lesser extent the source of the zeolite. The selectivity of a particular zeolite for a particular heavy metal can be altered by the homoionic form of the zeolite. Generally, the adsorption capacity of the USA clinoptilolite is higher than the capacity of the RSA clinoptilolite revealing the potential of clinoptilolite in industrial effluent treatment.