

Sorption and desorption of zinc by clinoptilolite and clinoptilolite-tridymite

ABSTRACT

Industrial wastes and mining related activity are main sources of zinc contamination in soils and groundwater. The quality of soil, crop and water will also be affected by high concentrations of heavy metals. The adsorption behaviour of clinoptilolite (natural Iranian zeolite) and clinoptilolite-tridymite (Chinese zeolite) at different pHs has been studied in order to find out its applicability in agriculture as soil amendment. To elucidate zinc adsorption, batch experiment at constant pH was used. The mineralogical composition, specific surface area and CEC, were investigated by X-ray diffraction (XRD), BET-N₂ sorption analysis and Na-acetate method, respectively. The data indicate that Iranian and Chinese zeolites contained 93.21 %, 58.83 % Clinoptilolite-Na, respectively, but high amount of tridymite (28.04 %) was also present in the Chinese zeolite. The Zn sorption isotherm data for both Iranian zeolite and Chinese zeolite were fitted to the Langmuir and Freundlich models. The sorption results at different pH showed that sorption at constant pH=5 and 7 can best be fitted to the Langmuir equation. It was found that q_{max} of Iranian zeolite was higher than Chinese zeolite at both pHs. According to the findings, the binding strength of Zn adsorption in Chinese Zeolite was 0.01, 0.03 (L mg⁻¹) at pH 5 and pH 7 whereas KL for the Iranian zeolite was 0.02 (L mg⁻¹) at both pHs. It is revealed that the affinity of Chinese zeolite for zinc adsorption was higher at pH=7. The results indicate that the zinc desorption percent at highest loading rates for Iranian zeolite were 36.1%, 41.5%, while for Chinese zeolite were 45.81%, 36.3% at pH value 5 and 7, respectively.

Keyword: pH study; Soil amendment; Zeolites; Zinc