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Adsorption of Zn(II) onto Turkish soil: equilibrium, kinetic and thermodynamic studies

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ABSTRACT

Study on the adsorption of Zn(II) onto soil is important since it relates to the bioavailability, potential toxicity of this metal and improving remediation strategies. In the present study, sorption of Zn onto soil was investigated in batch reactors with a maximum contact time of 180 min. Adsorption tests of Zn(II) were carried out using a solution concentration of 1.22 mM at initial pH = 5 and soil dosage of 1:20. The Langmuir and Freundlich models were applied to describe equilibrium isotherms. Sorption isotherms were well described by the Freundlich equation and Dubinin–Radushkevich (D–R) isotherm model was also applied to the equilibrium data. The mean free energy of adsorption (10.33 kJ mol^{-1}) indicated that the adsorption of Zn(II) onto soil may have been carried out via chemical ion-exchange mechanism. Kinetics of sorption was characterized using Lagergren-first-order, pseudo-second-order and intraparticle diffusion models. The sorption kinetics was well described by pseudo-second-order model within the reaction times in this study. Thermodynamic parameters, free energy ($\Delta G°$), enthalpy ($\Delta H°$) and entropy ($\Delta S°$) of adsorption were also calculated.

Keywords: Soil; Zinc; Adsorption; Isotherm model; Thermodynamics; Kinetics