Adsorption of zinc (II) onto MnO₂/CS composite: equilibrium and kinetic studies

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ABSTRACT

In this work, manganese dioxide/chitosan (MnO₂/CS) was used to remove Zn(II) from an aqueous sample over a concentration range of 30–100 mg/L, adsorption time of 15–180 min, and pH of 2–5. The maximum sorption (>80%) was achieved at pH 4 after 80 min with an initial concentration of 50 mg/l and 0.1 g of MnO₂/CS. The experiment data were analyzed using the non-linear Freundlich, Langmuir, Redlich–Peterson, Sips, Temkin and Dubinin–Radushkevich (D–R) isotherm models. Langmuir isotherm offers maximum sorption capacity (qₘ) of 24.21 mg/g (RMSE = 1.575 and χ = 0.8034), while the Temkin and Dubinin–Radushkevich (D–R) isotherm models indicated that adsorption followed a physical process. Furthermore, kinetic studies showed that the adsorption processes partially followed the pseudo-second-order equation. In addition, intra-particle diffusion model was used to ascertain the sorption process mechanism. MnO₂/CS has also been used to remove Zn(II) from the wastewater produced by the galvanized iron manufacturing industry.

Keywords: MnO₂/chitosan composite; Adsorption; Zinc; Equilibrium; Kinetic; Galvanized iron