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An analysis of the sensitivity of fixed bed adsorption for diazinon removal: experimental and modeling studies

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ABSTRACT

In this paper, a novel microcrystalline sodalite was synthesized. In addition, the structural characterization of this zeolite was done using the X-Ray Fluorescence (XRF), X-ray diffraction, scanning electron microscope (SEM), and Fourier Transform Infrared Spectroscopy (FTIR) analyses. Cu_2O nanoparticles (30–60 nm) were loaded on the zeolite and utilized as an adsorbent to remove diazinon in fixed bed column. The SEM energy-dispersive X-ray of modified zeolite shows that the amount of copper loading on the zeolite was equal to 4.5 wt%. The thermodynamic parameters ΔH, ΔS, and ΔG were evaluated in batch system. Thermodynamic parameters indicated that the sorption of diazinon onto zeolite was feasible, spontaneous, and exothermic under studied conditions. The effect of bed depth (5–15 cm), initial concentration (50, 75, and 100 mg/L), and flow rate (0.5, 1, and 1.5 mL/min), as important variable parameters, was investigated on the column performance. Given the external mass transfer resistance and the axial dispersion with non-linear isotherm, a general model was used to predict the breakthrough curves of the fixed bed for diazinon sorption. The numerical calculation of the model equations was done by the Computational Fluid Dynamics (CFD) software. There was a good agreement between the experimental data and the predicted theoretical breakthrough curves.

Keywords: Diazinon; Zeolite; Fixed bed column; Breakthrough curve; CFD software

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