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Nanostructured activated carbon xerogels for removal of methomyl pesticide

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ABSTRACT

Three nanoporous activated carbon xerogels were synthesized by chemical activation of resorcinol–formaldehyde xerogel (RFX) with activating agents such as monoethanol amine (CX-MEA), phosphoric acid (CX-HPO), and potassium hydroxide (CX-KOH), respectively. The effect of activating agents on the internal porosity, structure, and surface functional groups was investigated using N_2 gas adsorption–desorption, FTIR, scanning electron microscopy/energy dispersive X-ray analyzer, and TEM techniques. High values of surface area and total pore volume of 1,146 and 1,700 m^2/g, 0.9446 and 1.668 cm^3/g were found in the carbon xerogels CX-HPO and CX-KOH, respectively. The capacity of the produced carbons to remove the methomyl pesticide by adsorption from aqueous solution was explored. It was found that the adsorption capacity increased sharply with the increase in the surface area and mesopore volume. Equilibrium adsorption data were analyzed by Langmuir, Freundlich, and Temkin isotherm models. The batch studies were best fitted to Langmuir and Temkin isotherms, attaining a maximum adsorption capacity (Q_m = 125 mg/g) of methomyl onto CX-KOH. Adsorption kinetic studies were employed and the adsorption process was found to follow the pseudo-second-order kinetic model. The values of calculated Gibbs free energy (ΔG°) showed that the adsorption of methomyl is a feasible, spontaneous, and endothermic process.

Keywords: Nanostructured materials; Activated carbon xerogels; Surface characteristics; Adsorption; Methomyl pesticide

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