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Exploring the kinetics, thermodynamics, and isotherms of sodium naproxen uptake by oak-based activated carbon with ultrasonic enhancement

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ABSTRACT

The efficacy of ultrasonic technology for the uptake of sodium naproxen (SN) onto oak-based activated carbon (OAC) was examined in this study. SN is a widely used medication around the globe. The investigation of the uptake of SN by OAC involved the analysis of Fourier-transform infrared spectroscopy, X-ray diffraction, and scanning electron microscopy techniques. The rate of SN uptake by OAC followed the pseudo-second-order kinetic model with a rate constant of 2.78×10^{-2} g·mg^{-1}·min^{-1}. A multilayer uptake of 94.8% was found by Freundlich isotherm. The thermodynamic analysis indicated that the adsorption of SN onto OAC was endothermic in nature with $\Delta H°$ value of 10.88 kJ·mol^{-1}. Additionally, OAC was observed to be reusable for up to six regeneration cycles with a minimal decline of 26.43% in its adsorption capacity compared to the initial performance using sodium hydroxide as an eluent. Undoubtedly, the ultrasonic technique demonstrated remarkable efficiency in enhancing the uptake of SN by OAC.

Keywords: Activated carbon; Adsorption; Oak; Sodium naproxen; Ultrasonic

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