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Interfacial thermodynamics and kinetics of sorption of diclofenac on prepared high performance flower-like MoS₂

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ABSTRACT

Flower-like MoS₂ with numerous wrinkled nanosheets was prepared via a facile hydrothermal method. The surface morphology and microstructure of the obtained materials were characterized using X-ray diffraction data (XRD), scanning electron microscopy (SEM), and transmission electron microscopy (TEM). Additionally, the compositions of the flower-like MoS₂ were further revealed by an energy dispersion spectrometer (EDX) and X-ray photoelectron spectrometry (XPS). The obtained MoS₂ was used as an adsorbent to remove diclofenac (DCF, C₁₄H₁₀Cl₂NO₂Na) from aqueous solutions and presented excellent performance for removing DCF. The sorption kinetics, isotherms and effect of solution pH on the sorption were evaluated in batch sorption experiments. The sorption characteristics of the interactions between DCF and MoS₂ in water were analyzed using a pseudo-second-order model, an intraparticle diffusion model and Boyd model to determine the sorption rate-determining steps. It was concluded that the sorption of DCF on MoS₂ was fitted better by the pseudo-second-order model and that external diffusion governed the sorption process of DCF onto the MoS₂. The interfacial interaction free energies between DCF and MoS₂ in the sorption process can be calculated based on the extended Derjaguin–Landau–Verwey–Overbeek (XDLVO). The flower-like MoS₂ presenting excellent performance for removing DCF, could be a better choice of treating DCF-containing wastewaters.

Keywords: MoS₂; Diclofenac; Sorption; kinetics

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