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Fabrication and charaterization of PAN/Zn-MOF fibrous composites for dye removal

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The existence of dyes as contaminants in wastewater sources from the textile industry can lead to serious health problems if not treated properly. Furthermore, the release of dye effluents into the aqueous environment can pose serious problems for human health and the environment [1-3]. Herein, the separation of dyes over two isoreticular nanoporous Zn(II)-MOFs known as TMU-17 and TMU-17-NH2 owing to the effect of amine groups on the adsorption capacity was investigated, which can effectively and selectively adsorb Methyl Orange (MO) and Congo Red (CR) as anionic dyes. In addition, polyacrylonitrile (PAN) polymer was used to fabricate metal-organic framework (MOF) nanofibrous mat as a membrane to remove organic pollutants. To verify the structures, the samples were investigated by FTIR, XRD, SEM, and TGA measurements. Liquid phase adsorption experiments were performed to determine the maximum adsorption capacity. Varied conditions such as initial dye concentration, contact time, pH, and temperature were assessed. The Langmuir and Freundlich adsorption models were utilized to explain the equilibrium isotherm and isotherm constant computation. Three kinetic models such as pseudo-first-order, pseudo-second-order, and intra-particle diffusion equations were employed to investigate the adsorption performance. The adsorption results completely fitted the pseudo-second-order kinetic model. Additionally, CR and MO adsorption isotherms have fitted with the Langmuir model. Maximum equilibrium adsorption capacities of 143.27 and 877.19 mg g^{-1} for MO and CR were determined. High selective adsorption for MO and CR over other dyes is also represented. Over 90% of adsorption ability was preserved after five adsorption-desorption cycles. This work shows that the samples could be used as efficient adsorbents for removal of pollutants dyes from wastewater.

Keywords: Metal-Organic Framework; Electrospun membranes; Adsorption; Separation

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