**Novel zirconium based metal organic framework/biochar composite from green pea peels for anionic dye decontamination**

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**Abstract**

In order to dimension the catastrophic effect of contaminated water, smart technology-based wastewater treatment processes are mandatory for safe water and sanitation. Zirconium based metal organic frame material supported with biochar are green choices for futuristic adsorbents for water decontamination with versatility, simplicity, high surface reactivity, and efficacy. The decolorization of the anionic Congo Red (CR) from an aqueous solution was successfully achieved onto the novel fabricated green pea peels biochar (GPBC) and UiO66 green pea peels biochar nanocomposite (UiO66/GPBC). The physicochemical properties of prepared material were compared using EDX, TEM, XRD, BET, FTIR, and point of zero charge. The role of dye adsorption parameters of initial concentration, GPBC and UiO66/GPBC dosage, and solution pH and temperature beside the contact time were evaluated. The results revealed that UiO66/GPBC demonstrated better performance for anionic CR dye removal that recorded as 99.2% compared to 88% using GPPBC under optimized environment conditions. The examination of adsorption equilibrium isotherm displayed the validity of Freundlich and Langmuir model for description the dye decolorization onto both UiO66/GPBC and GPBC respectively as best fitted models. Moreover, the kinetics studies disclosed pseudo-second-order (PSO) for both studied materials. The monolayer sorption capacities were 158.24 mg/g for UiO66/GPBC and 58.77 mg/g for GPBC, both exhibiting competitive performances with other carbon-based adsorbents available in the literature. The thermodynamic studies disclosed favorable, spontaneous, and endothermic processes. The synthesized UiO66/GPBC and GPBC are excellent adsorbents recommended for large-scale production in the removal of anionic dyes from wastewaters.

***Keywords****: zirconium MOF; adsorption process; ecofriendly nanomaterials; Kinetic models; anionic dye*

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