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A mesoporous biochar from bio-invasion alligator weed for adsorption of rhodamine B from aqueous solution

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ABSTRACT

Alligator weed, a malignant invasive weed worldwide, was used to prepare a low-cost and effective alligator weed biochar (AWBC) that adsorbs rhodamine B from aqueous solution. Scanning electron microscopy revealed that AWBC has a rough surface with a highly porous structure, a high surface area (736.3 m^2/g) and an abundant array of micropores and mesopores. The average pore size was 4.05 nm, which is predicted to improve the activated carbon adsorption performance of macromolecules and small molecule particles. Phosphorus-containing groups, C–H, C–O, and C=C moieties were present on the AWBC surface. Kinetic data obtained from three pollutants that were adsorbed by AWBC fit with a pseudo-second-order kinetic model ($R^2 > 0.99$), and this was considered as the rate-limiting factor for adsorption. The batch equilibrium data fitted well to the Langmuir isotherm ($R^2 > 0.99$), revealing monolayer adsorption and an adsorption capacity of 286 mg/g ($R^2 > 0.99$). Negative ΔG values confirmed the spontaneity of the adsorption process, and positive ΔH and ΔS values indicated endothermic and irreversible adsorption.

Keywords: Alligator weed; Biochar; Rhodamine B; Adsorption

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