Copyrolysis of KOH and a Fe-Zn bimetallic oxide to produce functionalized magnetic biochar for effective phenol removal from water

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Abstract: In this study, impregnation combined with KOH activation with different mixing methods was used to prepare magnetic porous biochar. The effects of the synthetic method on the biochar physicochemical properties and adsorption performance were extensively explored. The results showed that treatment of a Fe-Zn oxide with KOH activation provided excellent adsorption properties with adsorption capacity of 458.90 mg/g due to well-developed microporous structure and rich-in O-containing functional groups as well as exposed oxidizing functional groups (Fe_2O_3 and FeOOH). The Langmuir-Freundlich and PSO models accurately fit the phenol adsorption. Neutral conditions (pH=6) and lower ionic strengths were beneficial, but high valent cations (e.g., Mg^{2+}) at high concentrations inhibited phenol removal. In addition, the predominant adsorption processes were physisorption and chemisorption. Correlation analyses and characterization data confirmed that pore filling, π-π interactions and surface complexation were the dominant driving forces and mechanisms for phenol adsorption.

Keywords: Magnetic porous biochar; Bimetallic oxides; Phenol removal; Adsorption mechanism; Reusability