Preparation and characterization of charcoal from feathers and its application in trimethoprim adsorption

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ABSTRACT

Feathers were utilized to prepare charcoal which could be used for the adsorption of the antibiotic trimethoprim (TMP). The physicochemical properties of the feather-derived charcoal were determined. The feather-derived charcoal had a surface area of 805.4 m²/g and a well-developed microporous structure. The contents of acidic and basic functional groups on feather-derived charcoal were 1.36 and 1.76 mmol/g, respectively, and pH_pzc = 7.52. We studied the influences of adsorbent dose, initial TMP concentration, agitation time, temperature, pH, and ionic strength on the adsorption. The desorption properties of TMP-sorbed feather-derived charcoal were also tested. The adsorption kinetics accorded with the pseudo-second-order kinetic equation, and the overall rate of adsorption was mainly controlled by intra-particle diffusion. The adsorption isotherms for the TMP-feather-derived charcoal system are explained better by the Freundlich isotherm at lower temperature (293 K) while the Langmuir isotherm gave a better fit at higher temperature (313 K). It is considered that a combination of hydrophobic interactions and ion exchange as well as electrostatic interaction was the adsorption mechanisms.

Keywords: Feather-derived charcoal; Trimethoprim; Adsorption; Mechanism; Desorption

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