Highly effective adsorption of synthetic phenol effluent by a novel activated carbon prepared from fruit wastes of the Ceiba speciosa forest species

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Abstract:
Fruit wastes of the Ceiba speciosa forest species were employed as raw material for preparing activated carbon towards removing phenol from water. Concave cavities spread over the entire material surface were observed from characterization results, resulting in a high surface area, 842 m2 g−1. Adsorption isotherm and kinetic studies were performed under the best conditions of pH (7) and adsorbent dosage (0.83 g L−1). An increase in temperature from 298 K to 328 K disfavored the phenol adsorption, decreasing from 156.7 to 145 mg g−1 for the best-fit model, Langmuir. The thermodynamic results indicated that the phenol adsorption was spontaneous, favorable, and exothermic. The phenol concentration decay shows that the equilibrium is reached at 120 min. The pore volume and surface diffusion model (PVSDM) was employed satisfactorily to describe the phenol decay behavior. The surface diffusion coefficient values were in the range of 10−9 cm2 s−1. The external and the internal mass transfer were the rate-controlling mechanisms. Therefore, the application of fruit wastes from Ceiba speciosa as raw material for preparing activated carbon proved very efficient towards removing phenol from an aqueous medium. The activated carbon is an alternative material to suppress water contamination due to phenol-derived species.

Keywords

Non-edible fruit, Adsorbent, Adsorption modeling, PVSDM