Removal of chlorinated phenol from aqueous solution utilizing activated carbon derived from papaya (Carica papaya) seeds

Abstract

Activated carbons (ACs) were prepared from papaya seeds with different dry weight impregnation ratios of zinc chloride (ZnCl2) to papaya seeds by using a two-stage self-generated atmosphere method. The papaya seeds were first semi-carbonized in a muffle furnace at 300 °C for 1 h and then impregnated with ZnCl2 before activation at 500 °C for 2 h. Several physical and chemical characteristics such as moisture, ash, pH, functional groups, morphological structure and porosity of prepared ACs were studied and presented here. AC2, with the impregnation ration of 1 : 2 (papaya seeds: ZnCl2), yielded a product that had the highest adsorption capacity, 91.75%, achieved after 180min contact time. The maximum Brunauer, Emmett and Teller (BET) surface area of AC2 was 546m2/g. Adsorption studies indicated that AC2 complied well with the Langmuir isotherm (qm=39.683mg g⁻¹) and the pseudo-second-order (qe=29.36mg g⁻¹). This indicated that chemisorption was the primary adsorption method for AC2. The intraparticle diffusion model proved that the mechanism of adsorption was separated into two stages: the instantaneous stage and the gradual adsorption stage. Overall, this work demonstrated the suitability of using papaya seeds as a precursor to manufacture activated carbon.