

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 (ZnCl_2) 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 ZnCl_2 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 ratio of 1 : 2 (papaya seeds: ZnCl_2), 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 ($q_m=39.683\text{mg g}^{-1}$) and the pseudo-second-order ($q_e=29.36\text{mg g}^{-1}$). 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.