Fabrication of highly microporous structure activated carbon via surface modification with sodium hydroxide

ABSTRACT

The aim of this study was to select the optimal conditions for the carbonization process followed by surface modification treatment with sodium hydroxide (NaOH) to obtain a highly microporous activated carbon structure derived from palm kernel shells (PKS) and coconut shells (CS). The effects of the carbonization temperature and NaOH concentration on the physiochemical properties, adsorption capability, specific surface area, surface morphology, and surface chemistry of PKS and CS were evaluated in this study. The results show that surface-modified activated carbons presented higher surface area values (CS: 356.87 m2 g−1, PKS: 427.64 m2 g−1), smaller pore size (CS: 2.24 nm, PKS: 1.99 nm), and larger pore volume (CS: 0.34 cm3 g−1, PKS: 0.30 cm3 g−1) than the untreated activated carbon, demonstrating that the NaOH surface modification was efficient enough to improve the surface characteristics of the activated carbon. Moreover, surface modification via 25% NaOH greatly increases the active functional group of activated carbon, thereby directly increasing the adsorption capability of activated carbon (CS: 527.44 mg g−1, PKS: 627.03 mg g−1). By applying the NaOH post-treatment as the ultimate surface modification technique to the activated carbon derived from PKS and CS, a highly microporous structure was produced.

Keyword: Concentration; Coconut shell; Palm kernel shell; Surface area; Adsorption; Post-treatment