Surface Modification and Characterization of Coconut Shell-Based Activated Carbon Subjected to Acidic and Alkaline Treatments

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Abstract

Activated carbon derived from agricultural biomass has been increasingly recognized as a multifunctional material for various applications according to its physicochemical characteristics. The application of activated carbon in adsorption process mainly depends on the surface chemistry and pore structure which is greatly influenced by the treatment method. This study aims to compare the textural characteristics, surface chemistry and surface morphology of coconut shell-based activated carbon modified using chemical surface treatments with hydrochloric acid (HCl) and sodium hydroxide (NaOH). The untreated and treated activated carbons were characterized for their physical and chemical properties including the Fourier transform infrared (FTIR) spectroscopy, scanning electron microscopy (SEM) and textural characterization. The FTIR spectra displayed bands confirming the presence of carboxyl, hydroxyl and carbonyl functional groups. The Brunauer–Emmett–Teller (BET) surface area of the untreated activated carbon was 436 m^2/g whereas the surface area of the activated carbon modified using 1M NaOH, 1M HCl and 2M HCl was 346, 525 and 372 m^2/g, respectively. SEM micrographs showed that many large pores in a honeycomb shape were clearly found on the surface of 1M HCl sample. The pore structure of the activated carbon treated with 2M HCl and NaOH was partially destroyed or enlarged, which decreased the BET surface area. The modification of the coconut shell-based activated carbon with acidic and alkaline treatments has successfully altered the surface functional groups, surface morphology and textural properties of the activated carbon which could improve its adsorptive selectivity on a certain adsorbate.

Keywords: *Activated carbon, Surface modification, Surface characteristics, Surface morphology.*

1. Introduction

Activated carbon is the most commonly used adsorbent in separation and purification processes due to its large adsorptive capacity. Activated carbon has been proven effective in removing a wide variety of organic and inorganic pollutants dissolved in aqueous media or from gaseous environment [1-5]. Nevertheless, the wide use of commercial activated carbon conventionally derived from non-renewable precursors such as coal, is limited by the unjustified application for pollution

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