

Full Length Research Paper

Production and characterization of activated carbon from a bituminous coal by chemical activation

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In this study, the use of a bituminous coal for the production of activated carbons with chemical activation was investigated. The effects of process variables such as chemical reagents, activation temperature, impregnation ratio and carbonization temperature were investigated to optimize these parameters. The resultant activated carbons were characterized in terms of iodine number, BET surface area, and total and micropore volumes. Acidic surface groups were established by Fourier Transmittance Infrared Spectroscopy (FTIR) technique.

Key words: Activated carbons, activation, BET surface area, Fourier Transmittance Infrared Spectroscopy (FTIR).

INTRODUCTION

Activated carbon can be defined as carbonaceous material having high porosity and internal surface area and cannot be characterized by any distinctive chemical formula. Commercial production of activated carbon is performed by pyrolysis and activation of wood, petroleum coke, anthracite and bituminous coals which have high carbon contents. In addition, agricultural wastes and by-products, hulls of almonds, hazelnuts, and coconuts, and stones of olives, apricots and peaches are also used in activated carbon production (Arol and Yalcin, 1993; Bansal et al., 1988; Ottawa et al., 1997; Stavropoulos and Zabanlotu, 2005; Amaya et al., 2007; Solano et al., 2000; Robau-Sanchez et al., 2005; Evans et al., 1999; Zondio and Vetez, 2007; Dongel et al., 1998).

The problems of the ecosystem are increasing with developing technology. Heavy metal pollution is one of the main problems due to their toxicity to human life

(Badmus et al., 2007). Organic pollutants and phenol and its derivatives found in industrial waste waters and as a main components in plastics are considered to have toxic effects on human health even when present in small concentrations (Yener and Aksu, 1999; Qadeer and Akhtar, 2005; Qadeer and Rehan, 2002). Toxic metal compounds coming to the earth's surface not only reach the earth's waters (seas, ponds, lakes, and reservoirs), but can also contaminate underground water in trace amounts by leaking from the soil after rain and snow (Qadeer and Rehan, 2002; Uzun and Guzel, 2000). Therefore, the elimination of toxic metal compounds from water and waste water is important. Activated carbons, with their high porosity, are extensively used in industrial purification and chemical recovery operations (Teker and Imamoglu, 1999; Lillo-Rodenas et al., 2005; Lozano-Castello et al., 2001). Currently, natural gas storage has been attracting interest among researchers in the materials and adsorption field. Microporous activated carbons were found to be suitable materials for natural gas storage (Azevedo et al., 2007). High surface area, high surface reactivity, suitable pore distribution and mechanical strength are the desired properties for an activated carbon. Depending on the usage, activated carbons are available as powder, granulated and pressed (laminated) sticks in various sizes and shapes (Arol and Yalcin, 1993).

Basically, there are two different processes for the preparation of activated carbon, the so-called physical

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Abbreviations: BET, Brunauer, Emmett and Teller (1938) method to measure specific surface area of solids according to physical adsorption of gas molecules on a solid surface, m^2/g ; V_{tot} , total pore volume, cm^3/g ; V_{mic} , micropore volume, cm^3/g ; V_{mes} , mesopore volume, cm^3/g ; TGA, thermal gravimetric analysis; TG, thermal gravimetry; DTG, derivative thermal gravimetry; and FTIR, Fourier Transform Infrared Spectrum Analysis.

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