

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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Table of Contents Production Of Activated Carbon And Characterization From

1. Understanding the eBook Production Of Activated Carbon And Characterization From
 - The Rise of Digital Reading Production Of Activated Carbon And Characterization From
 - Advantages of eBooks Over Traditional Books
2. Identifying Production Of Activated Carbon And Characterization From
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Production Of Activated Carbon And Characterization From
 - User-Friendly Interface
4. Exploring eBook Recommendations from Production Of Activated Carbon And Characterization From
 - Personalized Recommendations
 - Production Of Activated Carbon And Characterization From User Reviews and Ratings

- Production Of Activated Carbon And Characterization From and Bestseller Lists
- 5. Accessing Production Of Activated Carbon And Characterization From Free and Paid eBooks
 - Production Of Activated Carbon And Characterization From Public Domain eBooks
 - Production Of Activated Carbon And Characterization From eBook Subscription Services
 - Production Of Activated Carbon And Characterization From Budget-Friendly Options
- 6. Navigating Production Of Activated Carbon And Characterization From eBook Formats
 - ePub, PDF, MOBI, and More
 - Production Of Activated Carbon And Characterization From Compatibility with Devices
 - Production Of Activated Carbon And Characterization From Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Production Of Activated Carbon And Characterization From
 - Highlighting and Note-Taking Production Of Activated Carbon And Characterization From
 - Interactive Elements Production Of Activated Carbon And Characterization From
- 8. Staying Engaged with Production Of Activated Carbon And Characterization From
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Production Of Activated Carbon And Characterization From
- 9. Balancing eBooks and Physical Books Production Of Activated Carbon And Characterization From
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Production Of Activated Carbon And Characterization From
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Production Of Activated Carbon And Characterization From
 - Setting Reading Goals Production Of Activated Carbon And Characterization From
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Production Of Activated Carbon And Characterization From
 - Fact-Checking eBook Content of Production Of Activated Carbon And Characterization From
 - Distinguishing Credible Sources

13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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