SYNTHESIS OF ACTIVATED CARBON FROM COCONUT SHELL USING KOH BY MICROWAVE-ASSISTED FOR ADSORPTION OF ACETIC ACID

Muhammad Jusuf Faturrahman
16/396004/PA/17345

ABSTRACT

Synthesis of activated carbon from coconut shells using KOH by microwave-assisted adsorption of acetic acid have been carried out. The objective of this research was to determine the adsorption capacity of an activated carbon towards acetic acid under the variation of reaction time and acetic acid concentration. Coconut shell was cleaned, crushed and sieved to produce coconut shell powder. The powder was activated with KOH in a variation of 3, 6 and 9% KOH towards coconut powder weight then microwaved for 15 min. in 1000W to produce ACK3, ACK6 and ACK9, respectively. Characterization of the activated carbon samples was conducted using X-ray Diffraction (XRD), Fourier Transform Infrared Spectroscopy (FT-IR), Surface Area Analysis by Brunauer-Emmett-Teller (SAA-BET), and Scanning Electron Microscopy (SEM). The activated carbons adsorption capacities were determined using acetic acid under variation of its concentration and reaction time.

The coconut shell powder passed 1 mm sieve mesh. The XRD analysis revealed consistent presence of graphite and the orthorhombic crystal structure across all samples, as elemental composition analysis confirmed that the samples consisted of more than 83% carbon. The ACK3 exhibited a specific surface area of 186.7 m^2/g, a pore volume of 0.236 cm^3/g, and a pore diameter of 1.533 nm. ACK6 showed a specific surface area of 18.1 m^2/g, a pore volume of 0.046 cm^3/g, and a pore diameter of 1.695 nm. ACK9 displayed a specific surface area of 31.8 m^2/g, a pore volume of 0.212 cm^3/g, and a pore diameter of 1.681 nm. All samples exhibited Type 1 isotherms, indicating the presence of micropores. Additionally, SEM-EDS analysis revealed the detection of carbon, oxygen and potassium in ACK9. The ACK3, ACK6 and ACK9 showed the adsorption capacity towards acetic acid of 30.674 mmol/g , 15.58 mmol/g and 0.2207 mmol/g , respectively.

Keywords: Coconut Shell, Activated Carbon, KOH, Microwave Synthesis, Adsorption, Acetic Acid

SINTESIS TERBANTU GELOMBANG MIKRO UNTUK KARBON AKTIF DENGAN KOH DARI LIMBAH TEMPURUNG KELAPA DAN APLIKASINYA UNTUK PENYERAPAN ASAM ASETAT

Muhammad Jusuf Faturrahman
16/396004/PA/17345

INTISARI

Sintesis karbon aktif dari tempurung kelapa menggunakan KOH dengan adsorpsi asam asetat berbantuan gelombang mikro telah dilakukan. Penelitian ini bertujuan untuk mengetahui daya adsorpsi karbon aktif terhadap asam asetat pada variasi waktu reaksi dan konsentrasi asam asetat. Tempurung kelapa dibersihkan, dihaluskan dan diayak untuk menghasilkan tepung tempurung kelapa. Serbuk diaktivasi dengan KOH dengan variasi KOH 3, 6 dan 9% terhadap berat serbuk kelapa kemudian di microwave dengan daya 1000 Watt selama 15 menit untuk menghasilkan ACK3, ACK6 dan ACK9. Karakterisasi sampel karbon aktif dilakukan dengan menggunakan X-ray Diffraction (XRD), Fourier Transform Infrared Spectroscopy (FT-IR), Surface Area Analysis by Brunauer-Emmett-Teller (SAA-BET), dan Scanning Electron Microscopy (SEM). Kapasitas adsorpsi karbon aktif ditentukan menggunakan asam asetat dengan variasi konsentrasi dan waktu reaksi.

Serbuk tempurung kelapa lolos saringan mesh 1 mm. Analisis XRD mengungkapkan keberadaan grafit dan struktur kristal ortorombik yang konsisten di semua sampel, karena analisis komposisi unsur memastikan bahwa sampel terdiri dari lebih dari 83% karbon. ACK3 menunjukkan luas permukaan spesifik 186,7 m^2/g, volume pori 0,236 cm^3/g, dan diameter pori 1,533 nm. ACK6 menunjukkan luas permukaan spesifik 18,1 m^2/g, volume pori 0,046 cm^3/g, dan diameter pori 1,695 nm. ACK9 menampilkan luas permukaan spesifik 31,8 m^2/g, volume pori 0,212 cm^3/g, dan diameter pori 1,681 nm. Semua sampel menunjukkan isoterm Tipe 1, yang menunjukkan adanya mikropori. Selain itu, analisis SEM-EDS mengungkapkan deteksi karbon, oksigen, dan kalium dalam ACK9. ACK3, ACK6 dan ACK9 masing-masing menunjukkan kapasitas adsorpsi terhadap asam asetat 30.674 mmol/g , 15.58 mmol/g dan 0.2207 mmol/g.

Kata kunci: Tempurung Kelapa, Karbon Aktif, KOH, Sintesis Mikrowave, Adsorpsi