

## **SINTESIS KOMPOSIT ARANG AKTIF-Fe<sub>3</sub>O<sub>4</sub> SEBAGAI ADSORBEN BENSIN DALAM CAMPURAN BENSIN-AIR**

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### **INTISARI**

Telah dilakukan sintesis komposit arang aktif-Fe<sub>3</sub>O<sub>4</sub> untuk adsorpsi bensin dari campuran bensin-air. Tujuan dari penelitian ini adalah sintesis komposit berbasis arang aktif yang bersifat magnetis sebagai adsorben bensin dan pengaruh variasi waktu kontak serta massa adsorben terhadap kapasitas adsorpsi komposit. Tempurung kelapa kering diarsang menggunakan oven *microwave* (MW) menghasilkan arang aktif (AA). Komposit arang aktif-Fe<sub>3</sub>O<sub>4</sub> disintesis dengan teknik kopresipitasi menggunakan bahan utama FeCl<sub>3</sub>.6H<sub>2</sub>O, FeCl<sub>2</sub>.4H<sub>2</sub>O, dan AA pada suhu 80 °C kemudian ditambahkan larutan NH<sub>4</sub>OH pekat hingga pH 12. Komposit arang aktif-Fe<sub>3</sub>O<sub>4</sub> (AA-M) yang diperoleh dikarakterisasi menggunakan FTIR, XRD, SEM-EDX, SAA, dan uji kualitatif dengan mendekatkan magnet eksternal pada komposit hasil sintesis. Bensin yang digunakan adalah bensin perdagangan dari Pertamina (Pertalite, selanjutnya disebut B). Uji kapasitas adsorpsi komposit AA-M dilakukan dengan cara mencampurkan bensin (B), air (A), AA-M dengan variasi waktu kontak (1, 2, 3, 4, 5, 10, 15 menit) dan massa AA-M (60, 70, 80, 90, 100, 110, 120 mg). Sudut kontak AA-M dengan tiga jenis cairan, yakni A, B, dan campuran BA, diuji menggunakan *plugin* Drop Analysis LB-ADSA pada aplikasi ImageJ. Kajian kinetika adsorpsi dilakukan dengan uji adsorpsi B dalam campuran BA pada variasi waktu.

Hasil karakterisasi FTIR dan XRD menunjukkan bahwa komposit AA-M telah berhasil disintesis. Spektra FTIR AA-M menunjukkan puncak pada bilangan gelombang 500 dan 598 cm<sup>-1</sup> yang menandakan vibrasi ikatan Fe-O. Difraksi AA-M menunjukkan puncak pada 2θ 30,16 °; 35,5 °; 43,48 °; 53,6 °; 57,28 °; dan 62,78°. Komposit AA-M dapat ditarik oleh magnet eksternal. Sudut kontak antara komposit AA-M dengan A dan campuran BA berturut-turut 84,156 ° dan 72,928 °, sedangkan dengan B, tidak membentuk sudut. Hal tersebut menandakan komposit AA-M memiliki sifat hidrofobik. Kapasitas adsorpsi komposit AA-M terhadap B dari campuran BA adalah 1252,22 mg g<sup>-1</sup> selama waktu kontak 4 menit dan massa adsorben 90 mg. Adsorpsi B dari campuran BA mengikuti model kinetika adsorpsi order dua semu dari Ho dan McKay dengan nilai konstanta laju adsorpsi 0,0012 g mg<sup>-1</sup> menit<sup>-1</sup>.

Kata kunci: adsorpsi, arang, bensin, magnetit

## **SYNTHESIS OF ACTIVATED CARBON-Fe<sub>3</sub>O<sub>4</sub> COMPOSITE AS GASOLINE ADSORBENT IN GASOLINE-WATER MIXTURE**

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### **ABSTRACT**

Synthesis of activated carbon-Fe<sub>3</sub>O<sub>4</sub> composite as gasoline adsorbent from water-gasoline mixture has been done in this research. The objective of this research was to synthesize magnetic activated carbon as gasoline adsorbent and to study the influence of adsorption time and mass of adsorbent toward adsorption capacity. Dried coconut shell was pyrolyzed using microwave oven (MW) to produce activated carbon (AA). Activated carbon-Fe<sub>3</sub>O<sub>4</sub> composite was synthesized from FeCl<sub>3</sub>·6H<sub>2</sub>O, FeCl<sub>2</sub>·4H<sub>2</sub>O, and coconut shell charcoal by co-precipitation method at temperature of 80 °C and then NH<sub>4</sub>OH concentrated solution was added until pH 12. The obtained activated carbon-Fe<sub>3</sub>O<sub>4</sub> composite (AA-M) was characterized using FTIR, XRD, SEM-EDX, SAA, and qualitatively tested using external magnet. Gasoline used in this research was commercial gasoline by Pertamina (Pertalite, hereinafter referred to as B). Certain amount of gasoline (B), water (A), and AA-M was mixed for adsorption capacity tests with adsorption time (1, 2, 3, 4, 5, 10, 15 min) and mass of adsorbent (60, 70, 80, 90, 100, 110, 120 mg) variations. Contact angles of AA-M with three different kinds of liquid, including A, B, and BA mixture, was calculated using Drop Analysis LB-ADSA plugin in ImageJ application program. Adsorption kinetics study was carried out by means of a time variation adsorption test on the adsorption of B from the BA mixture.

The results of FTIR and XRD characterization showed that AA-M composites were successfully synthesized. FTIR spectra of AA-M showed peaks at 500 and 598 cm<sup>-1</sup> that indicate vibration of Fe-O bond. AA-M diffraction at 2θ 30.16 °, 35.5 °, 43.48 °, 53.6 °, 57.28 °, and 62.78 °. Qualitative magnetism test showed that AA-M composite has shown magnetic properties. Analysis results showed that contact angles between AA-M composite with A and BA mixture sequentially was 84.156 ° and 72.928 °, while with B did not form an angle, showed the hydrophobic properties of the composite. Adsorption capacity of AA-M composite for B adsorption from BA mixture was 1252.22 mg g<sup>-1</sup> for adsorption time 4 min and mass of adsorbent 90 mg. B adsorption from BA mixture followed adsorption kinetic pseudo-second order model from Ho and McKay with adsorption rate constant 0.0012 g mg<sup>-1</sup> min<sup>-1</sup>.

**Keywords:** adsorption, charcoal, gasoline, magnetite