

## SINTESIS DAN KARAKTERISASI NANOKOMPOSIT BENTONIT/MAGNETIT SERTA APLIKASINYA UNTUK PEMULIHAN SIFAT FISIKO-KIMIA MINYAK PELUMAS BEKAS

Anisa Isnaeni Rizki  
16/398539/PA/17500

### INTISARI

Penelitian nanokomposit bentonit/magnetit berbasis metode kopresipitasi telah dilakukan untuk mempelajari sintesis dan karakteristik bentonit/magnetit serta aplikasinya untuk pemulihan sifat fisiko-kimia minyak pelumas bekas. Dalam penelitian ini dilakukan aktivasi bentonit dengan HCl 2 M dan sintesis nanokomposit bentonit/magnetit dengan menggunakan campuran larutan  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  dan  $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$  (rasio 1:2) serta penambahan agen pengendap  $\text{NH}_4\text{OH}$  hingga pH 11 yang direaksikan pada suhu 85 °C. Hasil nanokomposit bentonit/magnetit dikarakterisasi menggunakan FTIR, XRD, SEM, VSM, dan SAA. Adapun minyak pelumas hasil pemulihan dianalisis terhadap beberapa sifat fisiko-kimia yang meliputi *specific gravity*, tingkat kejernihan warna, total angka asam (TAN), serta analisis kontaminan dengan FTIR dan kandungan logam dengan XRF.

Hasil penelitian menunjukkan bahwa komponen mineral utama bentonit adalah monmorilonit. Aktivasi asam terhadap bentonit mampu mengurangi mineral pengotor dan jumlah kation logam seperti Ca, Mg, Fe dan Al. Sedangkan nanokomposit bentonit/magnetit yang optimum diperoleh pada rasio konsentrasi molar sebesar 0,025:0,05 M yang menghasilkan luas permukaan spesifik yang tidak berbeda signifikan yaitu sebesar 197,7 m<sup>2</sup>/g dan volume total pori sebesar 0,31 cm<sup>3</sup>/g. Berdasarkan sifat fisik dan kimia minyak pelumas hasil pemulihan, uji kemampuan adsorpsi menunjukkan bahwa 2,5 g nanokomposit bentonit/magnetit mampu memulihkan 5 mL minyak pelumas bekas pada waktu optimum 90 menit. Minyak pelumas hasil pemulihan yang terbaik memiliki nilai tingkat kejernihan warna minyak 52,21 (kuning cerah), *specific gravity* 0,861, total angka asam 0,002 mg KOH g<sup>-1</sup> minyak serta penurunan kadar logam Fe, Cu, Ni dan Zn masing-masing mencapai sebesar 58,83%, 67,77%, 74,47% dan 95,90%. Adapun hasil analisis FTIR terhadap minyak pelumas hasil pemulihan menunjukkan bahwa senyawa kontaminan dalam minyak pelumas telah berkurang.

Kata kunci: adsorpsi, bentonit teraktivasi, minyak pelumas bekas, nanokomposit bentonit/magnetit, pemulihan

**SYNTHESIS AND CHARACTERIZATION OF BENTONITE/MAGNETITE  
NANOCOMPOSITES AND ITS APPLICATION FOR RECOVERY OF  
PHYSICO-CHEMICAL PROPERTIES OF USED LUBRICATING OILS**

Anisa Isnaeni Rizki  
16/398539/PA/17500

**ABSTRACT**

*Bentonite/magnetite nanocomposites have been prepared using coprecipitation method. Their application for restoring the physico-chemical properties of used lubricating oil has also been carried out. In this study, bentonite was activated with HCl 2 M, while the synthesis of bentonite/magnetite nanocomposite was performed using a mixture of FeSO<sub>4</sub>.7H<sub>2</sub>O and FeCl<sub>3</sub>.6H<sub>2</sub>O at a ratio of 1:2 along with the addition of NH<sub>4</sub>OH to reach pH 11. The reaction was carried out at 85 °C. The resulted powders were characterized using FTIR spectrophotometer, XRD, SEM, VSM, and SAA. The recovered lubricating oil was analyzed for some physico-chemical properties including specific gravity, color brightness, total acid number (TAN), metal content by XRF as well as contaminant analysis using FTIR.*

*The results showed that the main mineral component of bentonite was monmorillonite. Acid activation of bentonite can reduce impurity minerals and the number of metal cations such as Ca, Mg, Fe and Al. The optimum bentonite/magnetite nanocomposite was obtained at a molar concentration ratio of 0,025: 0,05 M with specific surface area of 197,7 m<sup>2</sup>/g and the total pore volume of 0,31 cm<sup>3</sup>/g. Based on the physical and chemical properties of the recovered lubricating oil, the adsorption ability test showed that 2,5 g of bentonite/magnetite nanocomposite was able to recover 5 mL of used lubricating oil at an optimum time of 90 min. The best recovered lubricant oil has a value of oil color brightness of 52,21 (bright yellow), specific gravity 0,861, a total acid number of 0,002 mg KOH g<sup>-1</sup> oil and a decrease in Fe, Cu, Ni and Zn metal content achieve 58,83; 67,77; 74,47 and 95,90%, respectively. The FTIR analysis of the recovered lubricating oil show that the contaminant compounds in the lubricating oil have decreased.*

*Keywords: adsorption, activated bentonite, used lubricating oil, bentonite/magnetite nanocomposite, recovery*