Abstrak

Telah dilakukan sintesis γ-Al_2O_3 mesopori dari lumpur lapindo dengan tujuan menentukan pengaruh variasi suhu sonikasi dalam sintesis alumina mesopori pada metode sol-gel dan menentukan kapasitas dan kinetika adsorpsi alumina mesopori sebagai adsorben *congo red*. Penelitian ini dilakukan secara bertahap, ekstraksi Al_2O_3 dilakukan dengan metode refluks, sintesis Al_2O_3 mesopori dilakukan dengan metode sol-gel dengan variasi suhu sonikasi (kontrol ;55; 60; 65; dan 70 (℃)) dan diaplikasikan sebagai adsorben *congo red*. Hasil ekstraksi dilakukan karakterisasi dengan *X-ray Fluorescence Spectroscopy* (XRF), hasil sintesis γ-Al_2O_3 dikarakterisasi dengan *Forier Transform Infra-red* (FTIR), *X-Ray Diffraction* (XRD), *Gas Sorption Analyzer* (GSA), dan dilakukan uji keasaman. Berdasarkan hasil dari penelitian dan karakterisasi yang dilakukan, diperoleh kandungan Al_2O_3 dari lumpur lapindo sebesar 69,97%, analisis FTIR dan XRD memperoleh kerangka γ-Al_2O_3 mesopori dengan fase amorf dari semua variasi. Hasil GSA menunjukkan permukaan dan volume pori tertinggi yaitu 372,824 $m^2.g^{-1}$ dan 0,8078 $cm^3.g^{-1}$. Adsorpsi menunjukkan hasil sintesis AM 60 memiliki kapasitas adsorpsi dan keasaman tertinggi yaitu sebesar 3,6532 $mg.g^{-1}$ dan 13,2761 $mmol.g^{-1}$. Waktu kontak optimum adsorpsi *congo red* adalah 15 menit dengan kapasitas adsorpsi sebesar 1,037037 $mg.g^{-1}$ dan kinetika adsorpsi menunjukkan model pseudo orde 2 dengan konstanta laju reaksi sebesar 0,006303 $g.mg^{-1}.menit^{-1}$.

Kata kunci: lumpur lapindo, γ-Al_2O_3 mesopori, sol-gel, adsorpsi, *congo red*

Abstract

The synthesis of mesoporous γ- Al_2O_3 from Lapindo mud has been carried out with the aim of determining the effect of sonication temperature variations in the synthesis of mesoporous alumina using the sol-gel method and assessing the adsorption capacity and kinetics of mesoporous alumina as an adsorbent for congo red. This research was conducted in stages, with the extraction of Al_2O_3 performed using the reflux method, and the synthesis of mesoporous Al_2O_3 carried out using the sol-gel method with variations in sonication temperature (control; 55; 60; 65; and 70 (℃)), which was then applied as an adsorbent for Congo red. The extraction results were characterized using X-ray Fluorescence Spectroscopy (XRF), while the synthesized γ- Al_2O_3 was characterized using Fourier Transform Infrared (FTIR), X-Ray Diffraction (XRD), Gas Sorption Analyzer (GSA), and acidity tests. Based on the results of the research and characterization conducted, the Al_2O_3 content from lapindo mud was found to be 69.97%, and FTIR and XRD analyses revealed the framework of mesoporous γ-Al_2O_3 with an amorphous phase across all variations. The GSA results show the highest surface area and pore volume, which are 372.824 $m^2.g^{-1}$ and 0.8078 $cm^3.g^{-1}$, respectively. Adsorption shows that the synthesis of AM 60 has the highest adsorption capacity and acidity, which are 3.6532 mg.g-1 and 13.2761 $mmol.g^{-1}$, respectively. The optimum contact time for the adsorption of Congo red is 15 minutes, with an adsorption capacity of 1.037037 $mg.g^{-1}$, and the adsorption kinetics follow a pseudo second-order model with a reaction rate constant of 0.006303 $g.mg^{-1}.min^{-1}$.

Keywords : Lapindo mud, mesoporous γ- Al_2O_3, sol-gel, adsorption, congo red