

SINTESIS SILIKA MESOPORI DARI LUMPUR LAPINDO TERIMPREGNASI LOGAM Pd SEBAGAI KATALIS HIDRORENGKAH MINYAK SAWIT BEKAS MENJADI *BIOFUEL*

Rizqi Muhamad Resa
17/412700/PA/18019

INTISARI

Telah dilakukan sintesis silika mesopori (SM) dari lumpur lapindo terimpregnasi logam Pd (Pd/SM) sebagai katalis untuk hidrorengkah minyak sawit bekas menjadi *biofuel*. Tujuan penelitian ini adalah mempelajari karakter katalis SM dan Pd/SM pada hidrorengkah minyak sawit bekas menjadi *biofuel*. Ekstraksi silika dari lumpur Lapindo dilakukan melalui refluks menggunakan HCl 6 M dan dilanjutkan dengan NaOH 6 M. Silika yang diperoleh kemudian dilakukan proses *templating* dengan surfaktan *cetyltrimethylammonium bromide* (CTAB) dengan rasio berat silika:CTAB = 1:0,65 menghasilkan SM. Logam Pd diimpregnasi ke dalam SM dengan metode impregnasi basah menggunakan larutan prekursor PdCl₂, kemudian dikalsinasi pada suhu 550 °C dengan aliran gas N₂ dilanjutkan reduksi dengan aliran gas H₂ masing-masing dengan laju alir gas 20 mL/menit selama 3 jam. Katalis SM dan Pd/SM yang telah disintesis dilakukan uji keasaman melalui adsorpsi gas NH₃ dengan metode gravimetri, dikarakterisasi dengan *Fourier Transform Infrared* (FTIR), *Surface Area Analyzer* (SAA), *X-Ray Diffraction* (XRD), *X-Ray Fluorescence* (XRF), *Scanning Electron Microscopy* (SEM), dan *Transmission Electron Microscopy* (TEM). Hasil hidrorengkah minyak sawit bekas berupa fraksi cair dianalisis menggunakan *Gas Chromatography-Mass Spectrometry* (GC-MS).

Hasil ekstraksi silika dari lumpur Lapindo, diperoleh kemurnian SiO₂ sebesar 81,55%. Luas permukaan spesifik SiO₂ sebesar 88,052 m²/g dan diameter pori rerata dari material SiO₂ sebesar 10,752 nm. SM memiliki luas permukaan spesifik sebesar 521,511 m²/g dan diameter pori rerata sebesar 4,781 nm. Pd/SM menunjukkan luas permukaan spesifik dan rerata diameter pori sebesar 580,074 m²/g dan 4,729 nm. Penambahan logam Pd pada silika mesopori (SM) meningkatkan nilai keasaman katalis dari 9,942 menjadi 10,726 mmol/g. Produk cair terbanyak hasil hidrorengkah minyak sawit bekas dicapai dengan menggunakan katalis Pd/SM (66,60% b/b) dengan selektivitas terhadap *biofuel* dalam bentuk senyawa hidrokarbon sebesar 53,53% b/b. Hasil penggunaan berulang katalis Pd/SM sebanyak 3 kali diperoleh selektivitas senyawa hidrokarbon dalam fraksi cair berturut-turut sebanyak 53,53; 63,24; dan 61,42% b/b. Katalis Pd/SM memiliki kegunaan kembali (*re-useability*) yang menjanjikan.

Kata kunci: *biofuel*, hidrorengkah, impregnasi, silika mesopori.

SYNTHESIS OF MESOPOROUS SILICA FROM LAPINDO MUD IMPREGNATED BY Pd METAL AS A HYDROCRACKING CATALYST OF WASTE PALM OIL INTO BIOFUEL

Rizqi Muhamad Resa
17/412700/PA/18019

ABSTRACT

Synthesis of mesoporous silica (SM) from lapindo mud impregnated by Pd metal as a catalyst for hydrocracking of waste palm oil into biofuel has been conducted. The purpose of this research was to learn characters of SM and Pd/SM as catalysts in hydrocracking of waste palm oil into biofuel. The Silica extraction from Lapindo mud was done by reflux using HCl 6 M and followed by NaOH 6 M. Silica from the exctraction process was templated by CTAB surfactant with weight ratio silica:CTAB equal to 1:0,65. The Pd metal was impregnated into the mesoporous silica (SM) using the wet impregnation method with PdCl₂ solution as a precursor, followed by the calcination at 550 °C with N₂ gas and reduction process with H₂ gas for each under gas flow rate of 20 cc/minute in 3 h. Synthesized SM and Pd/SM catalyst was tested for the acidity value through gravimetry method using ammonia gas (NH₃) and characterized by *Fourier Transform Infrared* (FTIR), *Surface Area Analyzer* (SAA), *X-Ray Diffraction* (XRD), *X-Ray Fluorescence* (XRF), *Scanning Electron Microscopy* (SEM), dan *Transmission Electron Microscopy* (TEM). The liquid product after the hydrocracking process was analyzed by *Gas Chromatography-Mass Spectrometry* (GC-MS).

The extraction result of silica from Lapindo mud resulted in a purity of 81.55%. The specific surface area of SiO₂ was 88.052 m²/g and the average pore diameter was 10.752 nm. SM has the specific surface area of 521.511 m²/g and average pore diameter of 4.781 nm. Pd/SM showed the specific surface area and the average pore diameter of 580.074 m²/g and 4.729 nm. The addition of Pd metal to the mesoporous silica (SM) increased the acidity value from 9.942 to 10.726 mmol/g. The largest liquid product from hydrocracking of waste palm oil was obtained by Pd/SM catalyst (66.60 wt%) with selectivity for biofuel in the form of hydrocarbon compound was 53.53 wt%. The results of the 3 times re-utilization of Pd/SM catalyst has the selectivity towards hydrocarbon compounds of 53.53, 63.24, and 61.42 wt%, respectively. The Pd/SM catalyst has a promising re-useability performance.

Keyword: *biofuel*, hydrocracking, impregnation, mesoporous silica.