SINTESIS, KARAKTERISASI, DAN APLIKASI KATALIS SILIKA TEREMBAN LOGAM NiMo PADA KONVERSI MINYAK GORENG SAWIT BEKAS MENJADI BIOGASOLIN

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INTISARI

Telah dilakukan penelitian mengenai sintesis, karakterisasi, dan aplikasi katalis silika teremban logam NiMo pada konversi minyak goreng sawit bekas menjadi biogasolin. Penelitian ini bertujuan untuk mengetahui pengaruh pengembanan logam Ni dan Mo pada silika terhadap aktivitas katalitik silika, mengetahui konsentrasi optimum logam teremban pada katalis silika, serta mengetahui suhu optimum dalam reaksi hidrorengkah minyak goreng sawit bekas menjadi bahan bakar fraksi gasolin menggunakan katalis Ni-Mo/SiO_2. Prosedur penelitian dimulai dari sintesis katalis silika yang dilakukan dengan ekstraksi silika dari abu sekam padi menggunakan metode sol-gel. Sintesis katalis Ni-Mo/SiO_2 dilakukan melalui metode impregnasi basah dengan logam Ni dan Mo menggunakan variasi konsentrasi logam Ni dan Mo (1, 2, dan 3% terhadap berat silika). Karakterisasi katalis SiO_2 dan Ni-Mo/SiO_2 dilakukan menggunakan beberapa analisis yaitu, uji keasaman dengan metode gravimetri, *Fourier Transform Infra-Red* (FTIR), *Scanning Electron Microscopy* (SEM-EDS), *X-Ray Diffraction* (XRD), *Surface Area Analyzer* (SAA). Konversi minyak goreng bekas menjadi biogasolin dilakukan melalui proses hidrorengkah menggunakan variasi suhu (400, 425, dan 450 ℃) serta variasi rasio berat katalis:minyak (1:100, 2:100, dan 3:100).

Hasil penelitian menunjukkan katalis silika mengalami peningkatan nilai keasaman setelah dilakukan pengembanan logam Ni dan Mo. Nilai keasaman katalis SiO_2, Ni-Mo/SiO_2 1%, Ni-Mo/SiO_2 2%, dan Ni-Mo/SiO_2 3% berturut-turut adalah 1,879; 3,2881; 4,3450, dan 3,9927 mmol/g. Berdasarkan hasil karakterisasi SAA, katalis Ni-Mo/SiO_2 2% memiliki memiliki luas permukaan dan volume pori tertinggi, yaitu berturut-turut sebesar 205,51 m^2/g dan 0,876 cm^3/g. Pada proses hidrorengkah minyak goreng sawit bekas menjadi biogasolin diperoleh produk cair dengan persen massa tertinggi pada variasi suhu 450 ℃, yakni sebesar 18,7% dengan persen selektivitas terhadap fraksi gasolin sebesar 11,40%. Uji aktivitas katalis dengan variasi rasio berat katalis:minyak menunjukkan nilai persen massa produk cair tertinggi pada variasi rasio 1:100 dengan persen selektivitas terhadap fraksi gasolin sebesar 14,20%.

Kata kunci: biogasolin, impregnasi Ni dan Mo, katalis silika, minyak goreng sawit bekas.

SYNTHESIS, CHARACTERIZATION, AND APPLICATION OF CATALYST NiMo SUPPORTED ON SILICA FOR CONVERSION OF USED COOKING OIL INTO BIOGASOLINE

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ABSTRACT

Research has been done on synthesis, characterization, and application of catalyst NiMo supported on silica for conversion of used cooking oil into biogasoline. This study aims to determine the effect of metal supported of Ni and Mo on silica on the catalytic activity of silica, determine the optimum concentration of metal supported on silica catalyst, and determine the optimum temperature in the hydrocracking reaction of used cooking oil into gasoline fraction fuel using Ni-Mo/SiO_2 as a catalyst. The research procedure started with the synthesis of silica catalyst which was carried out by extracting silica from rice husk ash using the sol-gel method. The synthesis of the Ni-Mo/SiO_2 catalyst was carried out through a wet impregnation method with Ni and Mo metals using various concentrations of Ni and Mo metals (1, 2, and 3% to silica weight). The characterization of the Ni-Mo/SiO_2 catalyst was accomplished using several analyzes, namely acidity test using the gravimetric method, Fourier Transform Infra-Red (FTIR), Scanning Electron Microscopy (SEM-EDS), X-Ray Diffraction (XRD), and Surface Area Analyzer (SAA). The conversion of used cooking oil into biogasoline was carried through a hydrocracking process using temperature variations (400, 425 and 450 ℃) and variations in the weight ratio of catalyst:oil (1,100, 2:100, and 3:100).

The results showed that the acidity value of the silica catalyst increased after the addition of Ni and Mo metals. The acidity values of SiO_2, Ni-Mo/SiO_2 1%, Ni-Mo/SiO_2 2%, and Ni-Mo/SiO_2 3% catalysts were 1,879; 3,2881; 4,3450 and 3,9927 mmol/g. Based on the results of the SAA characterization, the Ni-Mo/SiO_2 2% catalyst had the highest surface area and pore volume, namely 205,51 m^2/g and 0,876 cm^3/g respectively. In the hydrocracking process of used cooking oil into biogasoline, a liquid product with the highest mass percentage was obtained at a temperature variation of 450 ℃, which was 18,7% with a selectivity percentage for the gasoline fraction of 11,40%. Catalyst activity test with variations in the weight ratio of catalyst:oil showed the highest value of liquid product mass percentage in a 1:100 ratio variation with a selectivity percentage to the gasoline fraction of 14,20%.

Keywords: biogasoline, Ni and Mo impregnation, silica catalyst, used cooking oil.