

APLIKASI NiMo/SILIKA (NiMo/SiO₂) MESOPORI SEBAGAI KATALIS HIDRORENGKAH MINYAK GORENG BEKAS MENJADI BIOAVTUR

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INTISARI

Sintesis, karakterisasi, dan aplikasi katalis NiMo/SiO₂ berdimensi mesopori sebagai katalis hidrorengkah minyak goreng bekas menjadi bioavtur telah dipelajari. Penelitian ini bertujuan untuk mempelajari sintesis dan karakterisasi katalis NiMo/SiO₂ berdimensi mesopori serta aktivitas dan selektivitasnya saat diaplikasikan sebagai katalis hidrorengkah minyak goreng bekas menjadi bioavtur. Katalis SiO₂ disintesis dari prekursor TEOS dengan metode sol-gel menggunakan NaHCO₃ sebagai pencetak pori. SiO₂ yang diperoleh kemudian diimpregnasi dengan logam Ni dan Mo dengan variasi logam NiMo 1, 2, dan 3% secara koimpregnasi dengan direfluks selama 4 jam. Semua katalis yang diperoleh diuji keasamannya secara gravimetri dengan gas amonia dan dikarakterisasi menggunakan *Fourier Transform Infrared (FTIR)*, *X-Ray Diffraction (XRD)*, *Scanning Electron Microscope (SEM-EDS Mapping)*, *Surface Area Analyzer (SAA)*, dan *Atomic Absorption Spectrophotometer (AAS)*. Katalis dengan keasaman tertinggi diuji aktivitas dan selektivitasnya pada proses hidrorengkah minyak goreng bekas menjadi bioavtur dengan variasi temperatur reaksi 375, 400, 425, dan 450 °C dan variasi rasio katalis:umpan 1, 2, dan 3%. Semua produk hidrorengkah dianalisis dengan GC-MS.

Hasil karakterisasi menunjukkan bahwa katalis SiO₂ dan NiMo/SiO₂ telah berhasil disintesis. Nilai keasaman tertinggi diraih oleh katalis NiMo/SiO₂ terimpregnasi 2% NiMo sebesar 14,65 mmol/g dengan luas permukaan sebesar 549,89 m²/g, rerata diameter pori 4,82 nm dan volume pori 0,66 cc/g. Uji selektivitas dan aktivitas katalis NiMo/SiO₂ paling asam memberikan aktivitas tertinggi pada 425 °C dan rasio katalis:umpan 1% dengan produk cair sebesar 42,8% dengan selektivitas fraksi bioavtur sebesar 39,48%.

Kata kunci: bioavtur, hidrorengkah, minyak goreng bekas, NiMo, silika mesopori

APPLICATION OF NiMo/MESOPOROUS SILICA (NiMo/SiO₂) AS CATALYST FOR HYDROCRACKING OF WASTE COOKING OIL INTO BIOAVTUR

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ABSTRACT

Synthesis, characterization, and application of mesoporous NiMo/SiO₂ catalyst have been studied. This research aims to study the synthesis and characterization of mesoporous NiMo/SiO₂ along with its activity and selectivity as hydrocracking catalyst of waste cooking oil into bioavtur. The SiO₂ catalyst was synthesized from TEOS precursor by sol-gel method using NaHCO₃ as template. The obtained SiO₂ was then impregnated with Ni and Mo metal varied at 1, 2, and 3 wt% by reflux coimpregnation method for 4 hours. All obtained catalysts acidity were determined gravimetrically using ammonia gas and characterized using *Fourier Transform Infrared (FTIR)*, *X-Ray Diffraction (XRD)*, *Scanning Electron Microscope (SEM-EDS Mapping)*, *Surface Area Analyzer (SAA)*, and *Atomic Absorption Spectrophotometer (AAS)*. Catalyst with highest acidity was then had its activity and selectivity determined in hydrocracking process of waste cooking oil into bioavtur at temperature variation of 375, 400, 425, dan 450 °C and catalyst-to-feed ratio 1, 2, and 3%. All the hydrocracking products were analyzed using GC-MS.

The characterization results showed that SiO₂ and NiMo/SiO₂ catalysts were successfully synthesized. The highest acidity was achieved by NiMo/SiO₂ impregnated at 2% NiMo metals content with 549.89 m²/g of surface area, 4.82 nm of mean pore diameter, and 0.66 cc/g of pore volume. Activity and selectivity test showed that the highest catalyst activity was achieved at 425 °C and catalyst-to-feed ratio at 1%, giving 42.8% liquid yield and a selectivity of 39.48% for the bioavtur fraction.

Keywords: bioavtur, hydrocracking, NiMo, mesoporous silica, waste cooking oil