SINTESIS KATALIS NiMo/γ-Al_2O_3 DENGAN IMPREGNASI ULTRASONIK UNTUK *HYDROTREATING REFINED, BLEACHED, AND DEODORIZED PALM OIL* (RBDPO) MENJADI BIOAVTUR

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INTISARI

Sintesis katalis bifungsional NiMo/γ-Al_2O_3 melalui metode impregnasi ultrasonik telah berhasil dilakukan. Penelitian ini bertujuan untuk mempelajari karakteristik dan kinerja katalis NiMo/γ-Al_2O_3 serta pengaruh susunan katalis dalam reaktor terhadap *yield* dan kualitas bioavtur dari proses *hydrotreating* dengan umpan *Refined, Bleached, and Deodorized Palm Oil* (RBDPO). Impregnasi logam dilakukan menggunakan larutan prekursor nikel(II) nitrat heksahidrat dan ammonium heptamolibdat tetrahidrat dengan teknik semprot dan iradiasi gelombang ultrasonik. Karakterisasi katalis dilakukan menggunakan XRD, FTIR, SEM-EDX *Mapping*, SAA, NH_3-TPD, dan XPS. Uji aktivitas *hydrotreating* dilakukan dalam reaktor *semi-batch* dengan sistem susun tunggal dan susun ganda pada suhu 200–550 °C di bawah tekanan atmosferik. Produk cair hasil reaksi dianalisis menggunakan GC-MS.

Hasil menunjukkan bahwa katalis hasil impregnasi ultrasonik memiliki luas permukaan spesifik 197,40 m^2/g, volume pori total 0,22 cm^3/g, rerata diameter pori 4,21 nm, dan total keasaman 1,40 mmol/g. Sistem katalis susun ganda menghasilkan konversi produk cair tertinggi sebesar 70,40% dan persentase hasil (*yield)* bioavtur sebesar 54,24%. Fraksi bioavtur hasil distilasi memiliki densitas relatif 0,78; viskositas kinematik 1,69 mm^2/s, dan titik beku −58,67 °C, sesuai dengan spesifikasi ASTM D7566.

Kata kunci: bioavtur, *hydrotreating*, NiMo/γ-Al_2O_3, ultrasonik, susun ganda.

ULTRASONIC IMPREGNATION OF NiMo/γ-Al_2O_3 CATALYST FOR HYDROTREATING OF REFINED, BLEACHED, AND DEODORIZED PALM OIL (RBDPO) INTO BIOJET FUEL

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ABSTRACT

The bifunctional NiMo/γ-Al_2O_3 catalyst was successfully synthesized using an ultrasonic-assisted impregnation method. This study aimed to investigate the characteristics and performance of NiMo/γ-Al_2O_3 catalysts and the effect of catalyst arrangement in the reactor on the yield and quality of biojet fuel from the hydrotreating of Refined, Bleached, and Deodorized Palm Oil (RBDPO). Metal impregnation was performed using nickel(II) nitrate hexahydrate and ammonium heptamolybdate tetrahydrate via spray method and ultrasonic irradiation. The synthesized catalyst was characterized using XRD, FTIR, SEM-EDX Mapping, SAA, NH_3-TPD, and XPS. Activity tests were conducted in a semi-batch reactor with single-bed and dual-bed configurations at 200–550 °C under atmospheric pressure. Liquid products were analyzed using GC-MS.

The results showed that the catalyst had a specific surface area of 197.40 m^2/g, total pore volume of 0.22 cm^3/g, average pore diameter of 4.21 nm, and total acidity of 1.40 mmol/g. The dual-bed configuration produced the highest liquid product conversion of 70.40% and a biojet fuel yield of 35.26%. The distilled biojet fraction had a relative density of 0.78, kinematic viscosity of 1.69 mm^2/s, and freezing point of –58.67 °C, all meeting the ASTM D7566 specifications.

Keywords: biojet fuel, hydrotreating, NiMo/γ-Al_2O_3, ultrasonic, dual-bed