

SINTESIS DAN KARAKTERISASI KATALIS CoNiW/ZSM-48- γ -Al₂O₃ UNTUK REAKSI ISOMERISASI N-ALKANA DALAM HYDROTREATED VEGETABLE OIL

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INTISARI

Sintesis katalis heterogen berbasis logam Co, Ni, dan W yang diembankan pada ZSM-48- γ -Al₂O₃ untuk reaksi isomerisasi n-alkana dalam *Hydrotreated Vegetable Oil* (HVO) telah dilakukan. Penelitian ini ditujukan untuk melakukan sintesis katalis, mengetahui pengaruh logam Co, Ni, dan W terhadap karakteristik katalis, dan mengetahui kinerja katalis dalam pengaruh suhu. Katalis ini terdiri dari situs asam ZSM-48- γ -Al₂O₃ yang disintesis melalui metode sol-gel dan situs logam yang ditambahkan melalui metode impregnasi kering dengan prekursor logam berupa Co(NO₃)₂.6H₂O, Ni(NO₃)₂.6H₂O, dan (NH₄)₆[H₂W₁₂O₄₀]. Karakterisasi katalis dilakukan untuk mengetahui kadar logam dengan XRF, fase kristal dan aglomerasi dengan XRD, luas permukaan dan ukuran pori dengan SAA, suhu reduksi dengan TPR-H₂, dan keasaman dengan TPR-NH₃. Uji kinerja katalis dilakukan dengan reaktor *fixed-bed* kontinyu dengan variasi suhu 315, 330, dan 345 °C, tekanan H₂ 68 bar, rasio H₂/HC (laju alir) 400 Nm³/m³, dan LHSV (waktu kontak reaktan) 1 h⁻¹. Analisis produk isomerisasi dilakukan terhadap persentase distribusi hidrokarbon, konversi nC₁₆-nC₁₈, dan selektivitas iC₁₆-iC₁₈ menggunakan GC-SimDis, titik tuang menggunakan *pour point* ASTM D97, dan densitas menggunakan piknometer 25 mL.

Pengembangan dapat disintesis melalui metode sol-gel dan fase γ -Al₂O₃ terbentuk setelah kalsinasi 550 °C. Penambahan logam dapat dilakukan melalui metode impregnasi kering. Katalis Co₍₂₎NiW dengan kadar logam Co, Ni, dan W sebesar 1,36; 2,84; dan 11,2 %. Luas permukaan dan diameter pori katalis Co₍₂₎NiW sebesar 215,1 m²/g dan 31,7 Å. Suhu reduksi katalis Co₍₂₎NiW sebesar 550 dan 758 °C. Keasaman total katalis Co₍₂₎NiW sebesar 0,978 mmol/g. Hasil uji kinerja katalis Co₍₂₎NiW untuk isomerisasi n-alkana dalam HVO dilakukan terhadap variasi suhu 315, 330, dan 345 °C. Konversi HVO yang dihasilkan untuk setiap suhu reaksi sebesar 10,08; 25,03; dan 44,42 %. Selektivitas iC₁₆-iC₁₈ untuk setiap suhu reaksi sebesar 32,46; 37,88; dan 44,58 %.

Kata kunci: isomerisasi, impregnasi kering, katalis bifungsional, *hydrotreated vegetable oil*

**SYNTHESIS AND CHARACTERIZATION OF CoNiW/ZSM-48- γ -Al₂O₃
CATALYST FOR N-ALKANE ISOMERIZATION REACTION IN
HYDROTREATED VEGETABLE OIL**

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ABSTRACT

Synthesis of heterogeneous catalyst based on Co, Ni, and W metals loaded on ZSM-48- γ -Al₂O₃ for n-alkane isomerization reaction in Hydrotreated Vegetable Oil (HVO) has been carried out. This study aims to synthesis of catalyst, determine the effect of Co, Ni, and W metals on catalyst characteristics, and determine the catalyst performance under the influence of temperature. This catalyst consists of ZSM-48- γ -Al₂O₃ acid sites synthesized through sol-gel method and metal sites added through dry impregnation method with metal precursors of Co(NO₃)₂·6H₂O, Ni(NO₃)₂·6H₂O, and (NH₄)₆[H₂W₁₂O₄₀]. Catalyst characterization was conducted to determine metal content with XRF, crystal phase and agglomeration with XRD, surface area and pore size with SAA, reduction temperature with TPR-H₂, and acidity with TPD-NH₃. Catalyst performance test conducted with fixed-bed continuous reactor with temperature variations of 315, 330, and 345 °C, H₂ pressure of 68 bar, H₂/HC ratio (flow rate) of 400 Nm³/m³, and LHSV (reactant contact time) 1 h⁻¹. Isomerization product analysis was carried out on hydrocarbon distribution, nC₁₆-nC₁₈ conversion, and iC₁₆-iC₁₈ selectivity percentage using GC-SimDis, pour point using ASTM D97, and density using 25 mL pycnometer.

Catalyst support synthesized through sol-gel method and γ -Al₂O₃ phase is formed after calcination at 550 °C. Addition of metals conducted through dry impregnation. The Co₍₂₎NiW catalyst has metal loading of 1,36; 2,84; and 11,2 %. Surface area and pore diameter are 215.1 m²/g and 31,7 Å. Co₍₂₎NiW catalyst reduction temperature are 550 and 758 °C. Co₍₂₎NiW total acidity is 0,978 mmol/g. The results of the Co₍₂₎NiW catalyst performance test for n-alkane isomerization in HVO were carried out at temperature variations of 315, 330, and 345 °C. The conversion of HVO produced for each reaction temperature was 10.08; 25.03; and 44.42 %. The selectivity of iC₁₆-iC₁₈ for each reaction temperature was 32.46; 37.88; and 44.58 %.

Keywords: bifunctional catalyst, dry impregnation, isomerization, hydrotreated vegetable oil