

PREPARATION AND CHARACTERIZATION OF SO₄/ZrO₂ AND SO₄/TiO₂ CATALYSTS FOR ESTERIFICATION OF LOW-GRADE CRUDE COCONUT OIL UNDER VARIATION OF TEMPERATURES

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ABSTRACT

Preparation of SO₄/ZrO₂ and SO₄/TiO₂ catalysts have been carried out and applied for esterification of Low-Grade Crude Coconut Oil (LGCCO). The catalysts were synthesized using wet impregnation method with a variation of H₂SO₄ concentrations (0.50; 0.75; 1.0 M) and calcination temperatures (400; 500; 600 °C). The catalysts were characterized using NH₃ base adsorption (total acid site), Fourier-Transform Infra Red Spectroscopy (FTIR), X-Ray Diffractometer (XRD), Scanning Electron Microscope-Energy Dispersive Spectroscopy (SEM-EDS), and Gas Adsorption Analyzer (GSA). Meanwhile, the esterification products were characterized using Gas Chromatography-Mass Spectrometer (GC-MS).

The results of catalyst characterization showed that the highest total acidity for SO₄/ZrO₂ catalyst was 2.302 mmole g⁻¹ and SO₄/TiO₂ catalyst was 6.427 mmole g⁻¹. These results were obtained in the optimum condition of 1.0 M H₂SO₄ and calcination temperature of 500 °C. The esterification reaction was done under optimum condition of 55 °C and 5% catalyst weight for 150 minutes. It successfully decreased the free fatty acid (FFA) of LGCCO by 68.41% for 1.0 M SO₄/ZrO₂-500 catalyst and 73.76% for 1.0 M SO₄/TiO₂-500 catalyst.

Keywords: SO₄/TiO₂, SO₄/ZrO₂, Esterification, and FFA

PREPARASI DAN KARAKTERISASI KATALIS SO_4/ZrO_2 DAN SO_4/TiO_2 UNTUK ESTERIFIKASI *LOW-GRADE CRUDE COCONUT OIL* DENGAN VARIASI TEMPERATUR

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INTISARI

Preparasi katalis SO_4/ZrO_2 dan SO_4/TiO_2 telah dilakukan dan diaplikasikan pada reaksi esterifikasi *Low-Grade Crude Coconut Oil* (LGCCO). Sintesis katalis dilakukan menggunakan metode impregnasi basah dengan variasi konsentrasi H_2SO_4 (0,50; 0,75; 1,0 M), serta kalsinasi pada variasi temperatur (400; 500; 600 °C). Karakterisasi katalis menggunakan adsorpsi basa NH_3 (total situs aktif), *Fourier-Transform Infra Red* (FTIR), *Scanning Electron Microscope-Energy Dispersive Spectroscopy* (SEM-EDS), dan *Gas Adsorption Analyzer* (GSA). Produk esterifikasi dikarakterisasi dengan *Gas Chromatography-Mass Spectrometer* (GC-MS).

Hasil dari karakterisasi katalis menunjukkan bahwa total keasamaan SO_4/ZrO_2 2,302 mmol g^{-1} dan SO_4/TiO_2 6,427 mmol g^{-1} . Hasil yang diperoleh didapatkan dengan kondisi optimal 1,0 M H_2SO_4 dan temperatur kalsinasi 500 °C. Reaksi esterifikasi dilakukan dengan kondisi optimal 55 °C, dan 5% berat katalis, selama 150 menit. Penurunan kadar lemak bebas telah berhasil dilakukan sebesar 68,41% untuk katalis 1,0 M SO_4/ZrO_2 -500 dan 73,76% untuk katalis 1,0 M SO_4/TiO_2 -500.

Kata kunci : SO_4/TiO_2 , SO_4/ZrO_2 , Esterifikasi, dan Asam Lemak Bebas