Nanokomposit nanoselulosa-SO3H/CaO-La2O3 sebagai katalis bifungsional untuk produksi biodiesel dari Waste Cooking Oil (WCO) = Nanocellulose SO3H/CaO La2O3 nanocomposite as a bifunctional catalyst for biodiesel production from Waste Cooking Oil (WCO)

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Abstrak

Pada penelitian ini telah dilakukan sintesis nanokomposit nanoselulosa–SO3H/CaO–La2O3 yang diaplikasikan sebagai katalis bifungsional untuk reaksi transesterifikasi waste cooking oil (WCO) menjadi biodiesel. Sintesis katalis menunjukkan keberhasilan yang didukung dengan karakterisasi FTIR, XRD, BET, SEM, TEM dan TGA. Presentase produk optimum sebesar 84,13% diperoleh menggunakan katalis nanokomposit nanoselulosa–SO3H/CaO–La2O3 dengan rasio molar CaO terhadap La2O3 5:1, rasio massa nanoselulosa–SO3H terhadap CaO–La2O3 2:1 dengan jumlah katalis yang digunakan 3%, waktu reaksi 120 menit, dan rasio molar iopolym : minyak sebesar 9:1. Kandungan asam lemak biodiesel hasil sintesis dianalisa menggunakan GC-MS, yang dan produk utamanya adalah senyawa iopo oleat dan iopo palmitat. Sifat fisik biodiesel hasil sintesis sesuai dengan standar SNI dan ASTM, dengan massa jenis (40 oC) 0,8706 g/mL, Asam lemak bebas (FFA) 0,381%, dan bilangan asam 0,757 mg KOH/g. Studi kinetika menunjukkan bahwa reaksi transesterifikasi WCO menjadi biodiesel menggunakan katalis nanoselulosa–SO3H/CaO–La2O<3 mengikuti pseudoorde-pertama, dengan konstanta laju reaksi 0.017 menit–1<

.....H/CaO–La2O3 nanocomposites were synthesized as bifunctional catalysts for the transesterification reaction of waste cooking oil (WCO) to biodiesel. The catalyst synthesis showed success which was supported by the characterization of FTIR, XRD, BET, SEM, TEM and TGA. The optimum biodiesel yield of 84.13% was obtained using a nanocellulose–SO3H/CaO–La2O3 nanocomposite catalyst with a molar ratio of CaO to La2O3, 5:1, a mass ratio of nanocellulose–SO3H to CaO–La2O3 (2:1) with a catalyst amount of 3% , a reaction time of 120 minutes, and a molar ratio of methanol: oil, 9:1. The fatty acid content of the synthesized biodiesel was analyzed using GC-MS, which showed that the main product are methyl oleate and methyl palmitate compounds. The physical properties of the synthesized biodiesel were in accordance with the SNI and ASTM standards, with a density (40oC) 0.8706 g/mL, free fatty acids (FFA) 0.381%, and acid number of 0.757 mg KOH/g. The kinetics study showed that the transesterification reaction of WCO into biodiesel using a nanocellulose– SO3H/CaO–La2O3 catalyst followed a pseudo-first order, with a reaction rate constant of 0.017 min1.