Nanokomposit selulosa/CaO-gamma-fe2O3 dan gamma-fe2O3-selulosa/CaO berbasis selulosa jerami padi sebagai katalis untuk sintesis Fatty Acid Methyl Ester (FAME) dari minyak kelapa = Nanocomposites of cellulose/CaO-gamma-Fe2O3 and gamma-Fe2O3-cellulose/CaO based rice straw cellulose as catalyst for the Synthesis Fatty Acid Methyl Ester (FAME) from coconut oil

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Abstrak

Nanokomposit berbasis biopolimer yang didukung oleh oksida logam menarik untuk dikembangkan sebagai katalis untuk produksi biodiesel. Dalam penelitian ini, nanokomposit selulosa/CaO-gamma-Fe2O3 dan nanokomposit gamma-Fe2O3-selulosa/CaO berhasil disintesis dengan memanfaatkan limbah cangkang telur Gallus domesticus sebagai sumber CaO, maghemit (gamma-Fe2O3) disintesis melalui sol gel, dan jerami padi sebagai sumber sintesis nanoselulosa yang didukung oleh karakterisasi FTIR XRD, SEM, dan TEM. Nanokomposit selulosa/CaO-gamma-Fe2O3 dan gamma-Fe2O3-selulosa/CaO digunakan sebagai katalis dalam konversi minyak kelapa menjadi FAME. Kondisi optimum dengan jumlah katalis 9 mg, rasio metanol : minyak 12:1 pada suhu 60oC, nanokomposit selulosa/CaO-gamma-Fe2O3 mampu memberikan konversi 89,84 %. Konversi minyak kelapa menjadi produk menggunakan nanokomposit gamma-Fe2O3-selulosa/CaO pada suhu 60oC mencapai 90,67 % dalam kondisi optimum: rasio metanol:minyak 12:1, waktu reaksi 225 menit, dan jumlah katalis 6 mg. Energi aktivasi untuk reaksi menggunakan nanokomposit selulosa/CaO-gamma-Fe2O3 dan nanokomposit gamma-Fe2O3-selulosa/CaO diperoleh sebesar 19,11 kJ.mol-1 dan 17,45 kJ.mol-1. Parameter kinetika dari reaksi dievaluasi mengikuti persamaan pseudo-orde pertama. Komposisi FAME ditentukan dengan menggunakan kromatografi gas-spektroskopi massa. <hr>Nanocomposites of metal oxide supported by biopolymer are interesting to be developed as catalyst for biodiesel production. In this study, nanocomposites cellulose/CaO-gamma-Fe2O3 and gamma-Fe2O3-cellulose/CaO were successfully synthesized by utilizing Gallus domesticus eggshell waste as the source of CaO, maghemite (gamma-Fe2O3) was synthesized via sol-gel method and rice straw as the source of nanocellulose biopolymer in which their characterizations were conducted by FTIR, XRD, SEM, and TEM. The composition of fatty acid methyl ester was determined using gas chromatography-mass spectroscopy. Nanocomposites of cellulose/CaO-gamma-Fe2O3 and gamma-Fe2O3-cellulose/CaO were used as catalysts for the synthesis of fatty acid methyl esters (FAME) from coconut oil through transeterification reaction with methanol. The optimal conditions using cellulose/CaO-gamma-Fe2O3 catalyst were obtained of 9 mg amount catalyst, methanol to oil ratio of 12:1 at 60oC, the cellulose/CaO-gamma-Fe2O3 nanocomposite was able to give conversion of 89.84% within 300 min of reaction. Meanwhile, the conversion of coconut oil into fatty acid methyl ester using gamma-Fe2O3-cellulose/CaO nanocomposite at 60oC was obtained 90.67% under these condition 12:1 methanol to oil ratio for 225 min with 6 mg catalyst. The activation energy for reaction using cellulose/CaO-gamma-Fe2O3 nanocomposite and gamma-Fe2O3-cellulose/CaO nanocomposite was found to be 19,11 kJ. mol-1 and 17,45 kJ. mol-1 . The kinetic parameter of the reaction was also evaluated following the pseudo-first order equation.