

PEMBUATAN BIODIESEL DARI MINYAK JARAK DIBANTU *MICROWAVE* TERKATALIS ZIRKONIA TERSULFATASI DAN CaO/ZIRKONIA

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INTISARI

Penelitian ini bertujuan untuk mengetahui efektifitas dan selektivitas katalis dalam pembuatan biodiesel. Katalis zirkonia tersulfatasi dibuat melalui metode impregnasi basah sedangkan katalis kalsium oksida/zirkonia dibuat melalui metode impregnasi basah dan berbantuan gelombang mikro. Katalis sulfida zirkonia dan kalsium oksida/zirkonia dalam berbagai konsentrasi, rasio, dan kalsinasi diuji dengan metode titrasi untuk mendapatkan keasaman dan kebasaan tertinggi. Keasaman dan kebasaan tertinggi diperoleh pada katalis 0.5 M SZ-500 °C dan rasio %b/b total 1:0.2 CZ 800 °C. Karakterisasi material dan produk dilakukan menggunakan FTIR, XRD, SSA, SEM EDX, GC-MS, *bomb calorimeter*, dan ¹H-NMR.

Hasil karakterisasi menunjukkan katalis 0.5 M SZ 500 °C dan CZ 800 °C mempunyai kestabilan yang optimum terlihat dari kristalinitas yang tinggi, luas permukaan yang cukup besar, serta mempunyai perolehan keasamaan dan kebasaan tertinggi yaitu 7.16 mmol NH₃ g⁻¹ dan 87.76 mmol/g. Hal ini berkaitan langsung dengan situs aktif katalis dalam reaksi esterifikasi dan transesterifikasi perolehan biodiesel. Perolehan produk biodiesel menggunakan ¹H-NMR, GC-MS dan *Bomb calorimeter* menunjukkan hasil yang sangat baik. Berdasarkan pengujian hasil produk setelah pemurnian ¹H-NMR konversi metil ester mendekati 100%. Hal tersebut juga didukung oleh instrument GC-MS dimana perolehan luas area metil ester tertinggi 93.91% merupakan metil ricinoleic acid. Rendemen biodiesel yang diperoleh yaitu 58.13%. Biodiesel yang diperoleh juga menghasilkan nilai kalor sebesar 7141.75 cal/g, produk ini dapat digunakan dalam mesin diesel stasioner.

Kata kunci: Katalis Zirkonia tersulfatasi (SO₄/ZrO₂), Katalis kalsium oksida/zirkonia (CaO/ZrO₂), transesterifikasi, *microwave*, biodiesel

MICROWAVE ASSISTED-PREPARATION OF BODIESEL FROM CASTOR
OIL WHICH WAS CATALYZED BY SULFATED ZIRCONIA AND
CaO/ZIRCONIA

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ABSTRACT

The aim of the research was to determine the effectiveness and selectivity of catalysts in the manufacture of biodiesel. The sulfated zirconia catalyst was prepared by the wet impregnation method while the calcium oxide/zirconia catalyst was prepared through the wet impregnation and microwave-assisted method. The sulfated zirconia and calcium oxide/zirconia catalyst in various concentrations, ratios, and calcinations were tested by titration method to get highest acidity and basicity. The sample of 0.5 M SZ 500 °C and total %w/w ratio of 1: 0.2 CZ 800 °C reach the highest acidity and the basicity with number 7.16 mmol NH₃ g⁻¹, 87.76 mmol/g. These directly related to the active site of the catalyst in the esterification and transesterification reaction of the biodiesel. Materials and product characterizations were carried out using FTIR, XRD, SAA, SEM EDX, GC-MS, bomb calorimeter, and ¹H-NMR.

The characterization results showed that catalyst 0.5 M SZ 500 °C and 1: 0.2 CZ 800 °C had optimum stability seen from high crystallinity and large surface area. The biodiesel products characterized by using ¹H-NMR, GC-MS and Bomb calorimeter showed excellence results. Based on the ¹H-NMR test after product purification, the conversion of methyl ester is closed to 100%. This was also supported by the GC-MS instrument where the highest area of methyl ester acquisition was 93.91%, which was methyl ricinoleic acid. The yield of biodiesel obtained was 58.13%. The obtained biodiesel also produced a calorific value of 7141,75 cal/g, this product can be used in stationary diesel engines.

Keywords: sulfated zirconia catalyst (SO₄/ZrO₂), kalsium oksida/zirkonia (CaO/ZrO₂) catalyst, transesterification, microwave, biodiesel