

ABSTRACT

OPTIMIZATION OF TRANSESTERIFICATION REACTION PRODUCTS FROM KALIKI CASTOR SEED OIL (*Ricinus communis* L.) USING ZEOLITE-A CATALYST WITH RESPONSE SURFACE METHODOLOGY (RSM) STUDY

By

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In this research, the synthesis of zeolite-A has been carried out from rice husk silica raw materials and food grade aluminum foil using the hydrothermal method for 72 hours at a temperature of 100 °C, then calcined at a temperature of 550 °C for 6 hours. The zeolite-A samples obtained were then characterized using X-Ray Diffraction (XRD), Scanning Electron Microscope (SEM), Particle Size Analyzer (PSA), Fourier Transform Infrared (FTIR), and Brunauer-Emmett-Teller (BET). The zeolite-A obtained was used as a catalyst in the transesterification reaction process of Kaliki castor bean oil to produce biodiesel. The optimum conditions for the transesterification reaction were then evaluated using Response Surface Methodology (RSM) by observing 3 factorial levels that influence the conversion results such as the amount of catalyst (2,5%; 5%; and 7,5%), the ratio of methanol to oil (3:1; 4,5:1; and 6:1), and reaction time (15, 37.5 and 60 minutes). The transesterification reaction was carried out using the reflux method at a reaction temperature of 70 °C. The resulting research showed that the optimum conditions were obtained at 7,5%, with a methanol to oil ratio of 6:1 and a reaction time of 60 minutes with a conversion yield of 100%. The methyl ester obtained from the transesterification product under optimum conditions was analyzed using the GC-MS technique, and the main component was 90,70% methyl ricinoleate.

Key words: Biodiesel, kaliki castor seed oil, Response Surface Methodology, transesterification, zeolite-A.

ABSTRAK

OPTIMALISASI PRODUK REAKSI TRANSESTERIFIKASI DARI MINYAK BIJI JARAK KALI KI (*Ricinus communis L.*) MENGGUNAKAN KATALIS ZEOLIT-A DENGAN STUDI *RESPONSE SURFACE METHODOLOGY* (RSM)

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Pada penelitian ini, telah dilakukan sintesis zeolit-A dari bahan baku silika sekam padi dan alumunium foil food grade dengan menggunakan metode hidrotermal selama 72 jam pada suhu 100 °C, selanjutnya dikalsinasi pada suhu 550 °C selama 6 jam. Sampel zeolit-A yang diperoleh, kemudian dikarakterisasi menggunakan *X-Ray Diffraction* (XRD), *Scanning Electron Microscope* (SEM), *Particle Size Analyser* (PSA), *Fourier Transform Infrared* (FTIR), dan *Brunauer-Emmett-Teller* (BET). Zeolit-A yang diperoleh digunakan sebagai katalis dalam proses reaksi transesterifikasi minyak biji jarak kaliki untuk menghasilkan biodiesel. Kondisi optimum pada reaksi transesterifikasi selanjutnya dilakukan evaluasi menggunakan *Response Surface Methodology* (RSM) dengan mengamati *3 level factorial* yang mempengaruhi hasil konversi seperti jumlah katalis (2,5%; 5%; dan 7,5%), nisbah metanol terhadap minyak (3:1; 4,5:1; dan 6:1), dan waktu reaksi (15, 37,5 dan 60 menit). Reaksi transesterifikasi dilakukan dengan metode refluks pada suhu reaksi 70 °C. Hasil penelitian menunjukkan bahwa kondisi optimum yang diperoleh pada 7,5% (1,87 gram), dengan nisbah metanol terhadap minyak 6:1 dan waktu reaksi yang digunakan 60 menit dengan hasil konversi sebesar 100%. Metil ester yang diperoleh dari produk transesterifikasi pada kondisi optimum dilakukan analisis dengan teknik GC-MS, diperoleh komposisi utamanya yaitu metil ricinoleat sebesar 90,70%.

Kata kunci: Biodiesel, minyak Biji Jarak Kaliki, *Response Surface Methodology*, transesterifikasi, zeolit-A.