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Impregnasi ZnO dan CaO pada Fumed Silica untuk Katalis Transesterifikasi Tripalmitin
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IMPREGNASI ZnO DAN CaO PADA *FUMED SILICA* UNTUK KATALIS TRANSESTERIFIKASI TRIPALMITIN

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INTISARI

Penelitian ini mempelajari impregnasi ZnO dan CaO pada *fumed silica* untuk katalis transesterifikasi tripalmitin. Katalis disintesis melalui 3 rute impregnasi berbeda dan reaksi transesterifikasi tripalmitin dengan metanol untuk menghasilkan metil palmitat dilakukan dengan metode ultrasonikasi. Sifat fisikokimia katalis dikarakterisasi dengan XRD, FTIR, FESEM-EDX *Mapping*, SAA-BET, CO_2-TPD, dan NH_3-TPD.

Penelitian ini diawali dengan sintesis CaO dari cangkang telur ayam yang dikalsinasi pada suhu 1000 ºC selama 5 jam. *Fumed silica* diaktivasi menggunakan larutan NaOH 1,0 M dan larutan CH_3COOH 1,0 M. Padatan seng nitrat heksahidrat digunakan sebagai prekursor ZnO. Katalis dibuat melalui tiga rute impregnasi berbeda, yaitu pertama impregnasi CaO pada penyangga *fumed silica* lalu dilanjutkan impregnasi ZnO, kedua impregnasi ZnO pada *fumed silica* lalu diimpregnasikan CaO, dan ketiga ko-impregnasi dengan mencampurkan semua prekursor secara bersamaan. Katalis kemudian dikarakterisasi, uji aktivitas terhadap transesterifikasi tripalmitin, dan *reusability.*

Hasil penelitian menunjukkan bahwa rute impregnasi terbukti memengaruhi sifat fisikokimia katalis. Katalis CaO-ZnO/FST yang dibuat melalui rute ko-impregnasi memiliki sifat kebasaan dan keasaman tertinggi. Pengujian optimasi menunjukkan bahwa katalis CaO-ZnO/FST menghasilkan konversi tripalmitin tertinggi yaitu 79,67% pada kondisi waktu reaksi 100 menit, massa katalis 25 mg, dan suhu reaksi 50 ºC. Pengujian *reusability* menunjukkan penurunan aktivitas katalis dari 79,67% menjadi 52,65% pada siklus kedua, dan menjadi 36,84% pada siklus ketiga.

Kata kunci: *fumed silica*, kalsium oksida, rute impregnasi, transesterifikasi, tripalmitin

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IMPREGNATION OF ZnO AND CaO ON FUMED SILICA AS CATALYST OF TRIPALMITIN TRANSESTERIFICATION

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ABSTRACT

This study investigates the impregnation of ZnO and CaO on fumed silica as catalyst of tripalmitin transesterification. The catalysts were synthesized via three different impregnation routes, and the transesterification of tripalmitin with methanol to produce methyl palmitate was carried out using an ultrasonication method. The physicochemical properties of the catalysts were characterized through XRD, FTIR, FESEM-EDX mapping, SAA-BET, CO_2-TPD, and NH_3-TPD.

This study began with the synthesis of CaO from chicken eggshells calcined at 1000 °C for 5 hours. Fumed silica was activated using 1.0 M NaOH solution, and 1.0 M CH_3COOH solution. Zinc nitrate hexahydrate was used as the ZnO precursor. The catalysts were prepared via three different impregnation routes, first, co-impregnation by mixing all precursors simultaneously; second, impregnation of CaO onto a fumed silica support followed by ZnO impregnation; and third, impregnation of ZnO onto fumed silica followed by CaO impregnation. The catalysts were then characterized, tested for activity in the transesterification of tripalmitin, and evaluated for reusability.

The results of the study showed that the impregnation route affected the physicochemical properties of the catalysts. The CaO-ZnO/FST catalyst prepared via the co-impregnation route exhibits the highest basicity and acidity. Optimization testing showed that the CaO/ZnO/FST catalyst produced the highest tripalmitin conversion, which was 79.67% under conditions of a reaction time of 100 minutes, a catalyst mass of 25 mg, and a reaction temperature of 50 °C. Reusability testing showed a decrease in catalytic activity from 79,67% to 52,65% in the second cycle, and to 36,84% in the third cycle.

Keywords: calcium oxide, fumed silica, impregnation route, transesterification, tripalmitin