

# Sintesis Material Hibrid Silika-Organosilika Terfungsionalisasi Sulfonat dan Uji Aplikasinya pada Reaksi Esterifikasi Asam Lemak dengan Gliserol = Synthesis of Hybrid Materials Silica-Organosilica Functionalized by Sulfonate and Testing Its Application in the Esterification Reaction of Fatty Acids with Glycerol

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## Abstrak

Tujuan dari penelitian ini adalah mensintesis dan meneliti kemampuan katalitik katalis berbasis material hibrid silika-organosilika terfungsionalisasi sulfonat dengan mereaksikan secara sol-gel, prekursor silika dengan prekursor Periodic Mesoporous Organosilica dan diaplikasikan sebagai katalis reaksi esterifikasi asam lemak bebas dengan gliserol. Material ini berhasil disintesis didukung dengan karakterisasi menggunakan Fourier transform infrared (FT-IR), Field Emission Scanning Electron Microscopy with Energy Dispersive X-Ray Spectroscopy (FESEM-Edx), X-ray diffraction (XRD), dan Surface Area Analyzer (SAA). Untuk meneliti kemampuan katalitik katalis ini, maka dibandingkan dengan kelima jenis katalis lain yaitu SBA-15, SBA-15-PrSO<sub>3</sub>H dengan tiga macam variasi, dan Ph-PMO-PrSO<sub>3</sub>H. Dalam membandingkan kemampuan katalitik keenam jenis katalis ini dilakukan reaksi esterifikasi dengan kondisi yang telah ditetapkan, yaitu pada suhu 200oC, waktu reaksi selama 120 menit dengan persen berat katalis sebesar 1%. Didapatkan nilai persen konversi asam terbaik dengan menggunakan material hibrid, dimana didapatkan persen konversi sebesar 34,37%. Kemudian, dengan menggunakan katalis hibrid diselidiki keadaan optimum reaksi (perbandingan molar reaktan, selang waktu dan persen jumlah katalis). Didapatkan kondisi optimum reaksi pada variabel rasio molar reaktan (gliserol: asam oleat) terbaik pada rasio (4:1) dengan yield 34,37%, variasi selang waktu 300 menit menghasilkan yield optimum sebesar 39,23% dan jumlah katalis sebesar 5% berat reaktan yang menghasilkan yield 86,53%.

.....The purpose of this study was to synthesize and investigate the catalytic ability of a sulfonate functionalized silica-organosilica hybrid based catalyst by reacting sol-gel, silica precursors with Periodic Mesoporous Organosilica precursors and applied as a catalyst for the esterification of free fatty acids with glycerol. This material was successfully synthesized supported by characterization using Fourier transform infrared (FT-IR), Field Emission Scanning Electron Microscopy with Energy Dispersive X-Ray Spectroscopy (FESEM-Edx), X-ray diffraction (XRD), and Surface Area Analyzer (SAA). . To examine the catalytic ability of this catalyst, it was compared with five types of catalysts, namely SBA-15, SBA-15-PrSO<sub>3</sub>H with three variations, and Ph-PMO-PrSO<sub>3</sub>H. In comparing the catalytic ability, this type of catalyst was subjected to an esterification reaction with predetermined conditions, namely at a temperature of 200oC, a reaction time of 120 minutes with a catalyst percentage of 1%. The best acid conversion percentage value was obtained using a hybrid material, where the conversion percentage was 34.37%. Then, using a hybrid catalyst provides the optimal reaction state (molar reaction ratio, time lapse and percentage of catalyst). The optimum reaction conditions were obtained at the best reactant (glycerol: oleic acid) molar ratio variable at a ratio (4:1) with a yield of 34.37%, a variation of the time interval of 300 minutes produced an optimum yield of 39.23% and the amount of catalyst was 5% by weight. reactants which yield 86.53% yield.