

Studi esterifikasi sorbitol dan asam palmitat dengan pelarut t-butanol dan metil isobutil keton menggunakan lipase *Candida rugosa* E.C.  
3.1.1.3 terimobilisasi pada nanopartikel Fe<sub>3</sub>O<sub>4</sub>-Kitosan = Study of esterification between sorbitol and palmitic acid using t-Butanol and methyl isobuthyl ketone as solvent using lipase candida rugosa E.C.  
3.1.1.3 immobilized on Fe<sub>3</sub>O<sub>4</sub>-Chitosan nanoparticles

Desi Putri Indah Purnamasari, author

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Abstrak

Ester asam palmitat-sorbitol dapat disintesis dengan reaksi esterifikasi menggunakan lipase *Candida rugosa* terimobilisasi pada nanopartikel Fe<sub>3</sub>O<sub>4</sub>-kitosan. Nanopartikel Fe<sub>3</sub>O<sub>4</sub>-kitosan disintesis dengan metode kopresipitasi, selanjutnya digunakan sebagai material support dalam imobilisasi lipase. Nanopartikel F<sub>3</sub>O<sub>4</sub> dan Fe<sub>3</sub>O<sub>4</sub>-kitosan dikarakterisasi menggunakan Fourier Transform Infra Red (FTIR), Vibrating Sample Magnetometer (VSM), Transmission Electron Microscopy (TEM), dan Field Emission Scanning Electron Microscopy (FESEM). Hasil analisis dengan TEM menunjukkan ukuran nanopartikel F<sub>3</sub>O<sub>4</sub> dan Fe<sub>3</sub>O<sub>4</sub>-kitosan sebesar 12 nm dan 15 nm. Hasil analisis dengan VSM menunjukkan nilai magnetization saturation nanopartikel F<sub>3</sub>O<sub>4</sub>, dan Fe<sub>3</sub>O<sub>4</sub>-kitosan sebesar 112 dan 85,7 emu/gram. Persen loading lipase terimobilisasi yang didapat adalah 68,15 %. Aktivitas hidrolisis lipase terimobilisasi adalah 4,88 U/mL dengan aktivitas spesifik 1,39 U/mg dan efisiensi imobilisasi sebesar 3,53 %. Pada reaksi esterifikasi sorbitol dan asam palmitat, dilakukan beberapa variasi, yaitu rasio molar sorbitol : asam palmitat, waktu inkubasi, dan pelarut. Variasi rasio molar sorbitol : asam palmitat yang digunakan sebesar 1:30, 1:60, dan 1:90 (mmol/mmol). Variasi waktu inkubasi yang digunakan adalah 8, 12, dan 16 jam. Metil isobutil keton dan t-butanol digunakan sebagai pelarut. Persen konversi asam palmitat tertinggi diperoleh dengan pelarut t-butanol pada rasio molar 1:30 (mmol/mmol) dan waktu inkubasi 16 jam, dengan persen konversi sebesar 17,95 %.

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Sorbitol-palmitic acid ester can be synthesized through an esterification reaction using *Candida rugosa* lipase immobilized on Fe<sub>3</sub>O<sub>4</sub>-chitosan nanoparticles. The Fe<sub>3</sub>O<sub>4</sub>-chitosan nanoparticles were synthesized using coprecipitation method and later were used as material support for the immobilized lipase. The F<sub>3</sub>O<sub>4</sub> and Fe<sub>3</sub>O<sub>4</sub>-chitosan nanoparticles were characterized using Fourier Transform Infra Red (FTIR), Vibrating Sample Magnetometer (VSM), Transmission Electron Microscopy (TEM), and Field Emission Scanning Electron Microscopy (FESEM). Analysis of TEM showed that the size of F<sub>3</sub>O<sub>4</sub> dan Fe<sub>3</sub>O<sub>4</sub>-chitosan nanoparticles were 12 nm and 15 nm in diameter respectively. Analysis of VSM showed that the magnetization saturation value of F<sub>3</sub>O<sub>4</sub> dan Fe<sub>3</sub>O<sub>4</sub>-chitosan nanoparticles were 112 and 85.7 emu/gram respectively. The loading percentage of immobilized lipase obtained was 68.15%. The hydrolysis activity of immobilized lipase obtained was 4.88 U/mL with the specific activity of 1.39 U/mg and efficiency of immobilization was 3.53%. Some variations were made in the esterification reaction between sorbitol and palmitic acid such as molar ratio, time of incubation, and solvents. The molar ratio were variated as 1:30, 1:60, and 1:90 (mmol/mmol). The time of incubation were variated as 8, 12, and 16 hour. tbutanol and methyl isobutyl ketone were used as solvents. The highest conversion percentage value obtained using t-butanol as solvent, at the molar ratio of 1:30 (mmol/mmol), and time of incubation 16 hours with the value

of 17.95%.