Optimization of Enzymatic Synthesis of Cetyl Octanoate in SupercriticalCarbon DioxideOptimization of Enzymatic Synthesis

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ABSTRACT

Esters are very important compounds in food, cosmetic and pharmaceutical industries. Applications of commercial, chemically synthesized esters are limited because they are produced at high temperatures in toxic solvents which leave traces in the products. Enzymatic synthesis can be performed under mild reaction conditions, which are compared to the chemical synthesis to minimize side reaction and will not cause environmental pollution. However, the enzyme reaction in general will continue to use organic solvents. Many organic solvents are toxic. Therefore, non-conventional solvents like supercritical fluids can be used to replace the conventional organic solvents. Supercritical carbon dioxide (SC-CO2) are nontoxic, nonflammable and low cost, the capacity to manage solubility of solutes with pressure, which can result in easy separations obviating the need for downstream processing. SC-CO2 possess liquid-like solubility resulting in it functioning as an effective reaction solvent having gas-like diffusivity that overcomes mass transfer limitations in enzyme-catalyzed reactions, resulting in increased reaction rate. In this research, we use SC-CO2 as the solvent. And use lipase to catalyst the cetyl octanoate synthesis. Response surface methodology (RSM) and 3-factor-3-level Box-Behnken design were employed to evaluate the effect of synthesis parameter, such as reaction pressure (1200-1800 psi), temperature (35-75 ° C) and enzyme amount (5-15%). The results shows that reaction temperature and enzyme amount were significant effects on the percent molar conversion. Base on the analysis of ridge max, the optimum condition for cetyl octanoate synthesis were: reaction time 20 min, reaction pressure 1482.44 psi, reaction temperature 63.70 ° C and enzyme amount 11.20%. The maximum predict yield was 97.55±1.11%. The actual experimental yield was 99.47±0.05%. In this research can prove that esterification can increase reaction rate in SC-CO2 system, and used less reaction time and enzyme amount. If the combination of bioreactors, designed for large-scale continuous system, and believe the industrialization of production will be able to help save costs and increase production.

Keywords : Supercritical carbon dioxide (SC-CO2) ; Cetyl octanoate ; Esterificantion ; Lipase ; Response surface methodology (RSM)

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