Study on Optimization of Enzymatic Synthesis of Biodiesel By Response Surface Methodology

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ABSTRACT

Biodiesel, a diesel substitute, has become more attractive recently because of it's environmental benefits and the fact that it is made from renewable resources. Although chemical synthetical methods have been commercialize at the present day, chemical synthetical methods have by-products under the condition of high temperature and high pressure. In contrast, the reacting condition of enzymatic synthetical methods are mild, cheap, none by-products and due to natural. In hence, the biosynthesis of such esters by lipase-catalyzed chemical reactions under mild conditions became much current commercial interest. The ability for immobilized lipase from Rhizomucor miehei (Lipozyme IM-77) or Candida antarctica (Novozym 435) to catalyze the transesterification of soybean oil or canola oil and methanol was investigated in this study. Response surface methodology (RSM) and 5-level-5-factor central composite rotatable design (CCRD) were employed to evaluate the effects of synthesis parameters, such as reaction time (2-10 h and 4-20 h), temperature (25-65 oC), enzyme amount (0.2-1.0 BAUN; Batch acidolysis unit of novo and 0.1-0.5 g), substrate molar ratio of methanol to soybean oil and canola oil(1:2-1:4), and added water content (0-20%) on percentage weight conversion of soybean oil methyl ester or canola oil methyl esters by transesterification. The results showed that temperature and enzyme amount were effects on percent molar conversion of soybean oil methyl ester. Based on ridge max analysis, the optimum synthesis conditions with 92.2 and 99.4% weight conversion were: reaction time 6.3 and 12.4 h, temperature 36.5 and 38.1 oC, enzyme amount 0.9 BAUN and 0.42 g, substrate molar ratio of methanol to soybean oil and canola oil 3.4:1 and 3.5:1, and added water 5.8 and 7.2%.

Keywords : Lipase; Biodiesel; Immobilization; Optimization; Response surface methodology; Transesterification

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