Kittipon Kasipar 2009: Statistical Application to obtain the Optimum Condition of Biodiesel production from Sunflower Oil and Immobilized Lipase. Doctor of Engineering (Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering. Thesis Advisor: Associate Professor Penjit Srinopakun, Ph.D. 140 pages.

This research was divided into three parts. The first part applied the Two-way ANOVA method to optimize the immobilization condition of *Pseudomonas fluorescne*'s Lipase on chitosan bead by an entrapment technique. The maximum immobilized Lipase activity of 396 unit/g was obtained from the following conditions; 1:150 weight fraction of the chitosan solution and Lipase, 1.5% w/v of the chitosan powder and acetic acid solution (1.5% v/v).

The second part was carried out to determine the optimum condition for the biodiesel production using the prepared immobilized Lipase. The experimental factors namely the reaction temperature, the methanol to oil molar ratio, the percentage of water, the percentage of immobilized Lipase and the percentage of co-solvent were screened using Plankett Burman experimental design. The statistical results showed that the reaction temperature, the methanol to oil molar ratio and the percentage of immobilized Lipase were the important experimental factors on the immobilized Lipase biodiesel production. Then the Box Behnken response surface method was used to obtain the optimum condition of the biodiesel production which was 30°C, 6:1 of methanol to oil molar ratio and 50% wt of the immobilized Lipase. The fatty acid methyl ester suggested by the statistical method at the optimum biodiesel production condition was 30.7%. As expected, the result from the statistical model agreed well with the experimental result. The mean mass percent of methyl ester from this condition was ranging from 14.81 to 31.40 at 98.5% confidential level.

The third part was applying an initial rate method to attain the kinetic model of transesterification reaction between the sunflower oil and methanol at the optimum immobilization and biodiesel production conditions. From the experiment, it is shown that the reaction rate followed the Ping Pong Bi Bi mechanism with competitive inhibition by methanol. Then the kinetic parameters were determined by the EXCEL computer program and the graphical method. Interestingly, the values estimated from the EXCEL program were more realistic than the graphical method. The K_m values acquired from the EXCEL program for sunflower oil and methanol were 12.81 mmol and 68.36 mmol, respectively. Nevertheless, the competitive inhibition by methanol was evident with the high inhibition constant of K_i value at 13.84 mmol.

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