Introduction

Palm olein is widely used as food oil with limited non-food uses also. It differs from other commercially available oils in its fatty acid and triacylglycerol composition. Since the oil palm is widely cultivated in Southern of Thailand and the palm olein is widely used as domestic food oil, so the price is low. Production of monoacylglycerol from palm olein is an alternative that increases advantages and value added of palm olein. Monoacylglycerol emulsifiers commonly employed in food, cosmetic and pharmaceutical industries can be catalyzed by lipases, biocatalysts that are becoming increasingly attractive in the enzyme market. Lipases catalyze hydrolysis and ester synthesis in the present of water. In view of yielding high value added products, the transesterification action seems more worthwhile than hydrolysis and ester synthesis. The applications of transesterification by glycerolysis of triacylglycerols using lipase have been carried out to produce monoacylglycerol due to its mild reaction conditions and position specific products (Tan and Yin, 2005; McNeill *et al.*, 1991; McNeill and Yamane, 1991). However, glycerolysis of triacylglycerols with lipase in the liquid phase typically yield only 30-50% of monoacylglycerol due to a flavored equilibrium (Bornscheuer, 1999). And the concentrations of two substrates (palm olein and glycerol) in glycerolysis were strictly interdependent. Therefore, it was impossible to perform a classic kinetic study by fixing the concentration of one substrate and changing the concentration of the other substrate. Here, computer simulation is useful tool to independently assess the effects of hypothetical changes in the concentrations of each substrate (palm olein and glycerol). In essence, this analysis permits one to examine various aspects associated with the dynamics and equilibrium of the glycerolysis reaction that cannot be investigated experimentally.

To identify the optimal conditions for lipase catalyzed glycerolysis reaction, it is essential to understand the kinetics of this reaction. Until now all kinetic mechanisms on lipase catalytic reactions are only based on hydrolysis of triacylglycerol (Taylor *et al.*, 1992; Padmini *et al.*, 1994) or esterification of fatty acid (Stamatis *et al.*, 1993; Lortie *et al.*, 1993; Rizzi *et al.*, 1992; Reyes, 1994; Zhang *et al.*, 2002; Xu *et al.*, 2005). Only a limited number of kinetic studies for glycerolysis using glycerol as acyl acceptor have been found in literature (Tan and Yin, 2005). However, the reported model is rather complicated and narrow range of application.

In the previous study, glycerolysis of palm olein in organic solvent systems for monoacylglycerol production by immobilized lipase was successfully done (Kaewthong and H-Kittikun, 2004). Here, in this paper the kinetic glycerolysis of palm olein for monoacylglycerol was studied. First, a simple model based on Ping-Pong Bi Bi was proposed to describe the reaction kinetics of hydrolysis and esterification then the kinetic model for glycerolysis was considered. The effect of enzyme, water, glycerol and palm olein concentrations on monoacylglycerol production was contributed in the model.