CHAPTER I
INTRODUCTION

Polyesters are known to prepare by condensation between polyfunctional carboxylic acids and alcohols or polycondensation among hydroxycarboxylic acids to obtain heterochain macromolecular compounds. The applications of polyesters can be found as fibers, plastics, coatings, and lubricants. Traditionally, polyesters are produced by chemically catalyzed reactions involving the elevated temperatures, strong acids and long reaction time. Since polycondensation is limited by equilibrium, competition between esterification or transesterification and hydrolysis controls the molecular weight of the products. Moreover, these processes are accompanied by the formation of undesired by-products, such as cyclic esters, water. It is necessary to remove the produced water by an inert carrier gas or azeotropic distillation. External catalysts of metal oxides including protonic acids, Lewis acids are known to promote the reactions effectively. However, the completion of catalyst removal are very much required in order to prevent discoloration and hydrolyzation of the products.

Biological synthesis of polymers are concerned to be an alternative route to overcome the difficulties of the traditional polyester synthesis ones. The advantages of using biological systems lead to novel synthetic material with supramolecular architecture. Moreover, biological synthesized polymers will also be readily biodegradable. Recently, enzymatic approach is of interest as a biological pathway for polyester synthesis refering to the hydrolysis equilibrium reaction of natural fatty acids by lipases. Deetz *et al.* (1988) demonstrated that enzymes can retain a layer of bound water in organic solvents and maintain catalytic activity to obtain a range of enatioselective and regioselective ester formation. Wallace *et al.* (1989) showed that porcine pancreatic lipase (PPL) is a useful enzyme for polyester formation as performed in the polymerization of bis(2,2,2-trichloroethyl) trans-3,4-epoxyadipate with 1,4-butanediol. Up to now, several cases have been reported as an enzymatic polyester synthesis, especially the system of *Rhizomucor miehei* (fungus), *Pseudomonas fluorescens* (bacterium), and *Candida regosa* (yeast). However, plenty of active enzymes are known to find in tropical countries and it is still of interest to study on various enzymes from plants such as rice bran, soybean etc.

The present work originally focuses on the Thai rice bran activity and the performance for enzymatic polyester synthesis. Here, lipase catalysis system is designed for direct polyesterification of adipic acid and 1,4-butanediol by the variation of reaction time, solvents, and temperatures to propose a novel approach by using the Thai rice bran lipase.