CHAPTER I
INTRODUCTION

Polyesters are prepared by condensation between polyfunctional carboxylic acids and alcohols or polycondensation of hydroxycarboxylic acids. Typically, polyesters are produced by chemically catalysed reaction under elevated temperatures, strong acids and long reaction times. Competition between esterification, transesterification and hydrolysis limits the molecular weight of the products. Moreover, these processes are accompanied by the formation of undesirable by-products, such as cyclic esters.

Enzymatic syntheses of polyester are proposed to be an alternative strategy to overcome the difficulties of the chemical catalytic polyester synthesis. The unique properties of enzymatic system result in novel synthetic material with supramolecular architecture. Furthermore, it is also expected that enzyme catalytic system provides the stereoregular polyester which can be biodegradable polymer due to the digestion ability of some particular microbial.

Among enzyme-catalysed reactions, lipase performs hydrolysis at the ester bonds of carboxylic esters and glycosyl compounds in aqueous solution. The catalytic system of lipase, normally, occurs at the water-lipid interface at room temperature by encapsulating the substrate on the active site which is known as a metabolism of lipid. On the other hand, Kibanov (1986) discovered that crude enzyme powders could efficiently catalyse synthesis reactions in organic solvent systems, which brought the new possibilities for the use of lipase in ester and polyester synthesis. Wallace *et al.* (1989) showed that porcine pancreatic lipase (PPL) is a useful enzyme for polyester.

Despite the theoretical advantages, the use of lipase in industrial applications has been limited because of instability of enzymes, under the required operation conditions and/or difficulties in the separation of the enzymes from substrates and products. Enzyme immobilization simplifies the separation process of biocatalyst from the reaction and allows the continuous or intermittent uses over the period of time. Lipase immobilization has been performed by 3 major methods, i.e., attachment of insoluble materials, crosslinking, and entrapment.

Up to now, several enzymatic polyester syntheses have been reported, especially with the lipases of *Rhizomucor miehei* (fungus), *Pseudomonas fluorescens* (bacterium), and *Candida rugosa* (yeast). However, there are plenty of active enzymes present in tropical countries and it is still of interest to apply the various enzymes from plants, such as rice bran, soybean, etc., to study the possibility as an enzymatic catalyst for polymerization.

Recently, we studied crude Thai RBL as a catalyst in polyester synthesis and clarified it as a potential catalyst. In the present work, crude Thai RBL is applied as a catalyst into two systems of polyesterification, i.e., adipic acid and 1,4-butanediol, and adipic acid and poly(ethylene glycol) MW 200, under the suitable conditions of reaction temperature and time. The point of interest is also extended to improve the catalytic system by the immobilization of Thai RBL via physisorption and covalent bonding on fumed silica.