CHAPTER I
INTRODUCTION

Mixing of two or more polymers of different chemical compositions offers a powerful way of tailoring performance and economic relationship using existing materials. Consequencely, the area of polymer blends has become important for both scientific investigation and commercial product development.

Chitin is one of the most abundant polysaccharides found in crustacean shells. The structure of chitin consists of β-(1→4)-2-deoxy-D-glucopyranose units. Chitosan is a N-deacetylated derivative of chitin, which consists of 2-amino-2-deoxy-D-glucopyranose through a β(1→4) linkage. This polymer is known to be non-toxic, odorless, biocompatible with living tissues, and enzymatically biodegradable. Due to these advantages, the extensive attention has been paid to chitosan in various applications such as biomedical material, biodegradable packaging, metal capture from wastewater, nutrition, and cosmetic (Kumar, 2000).

However, applications of chitosan are limited by its low solubility in most organic solvents. In order to solve this problem, chemical modification to introduce hydrophobic nature to chitosan such as phthaloylation, alkylation, and acylation reaction is required by substituted phthaloyl, alkyl, and acyl groups to the amino group at C_2 position and the primary and secondary hydroxyl groups at the C_6 and C_3 positions, respectively (David and Hon, 1996).

Moreover, chemical modification of chitosan has received more attention not only for improving solubility but also for achieving some expected novel properties. For example, Zong *et al.* (2000) synthesized a series of acylated chitosans by reacting chitosan with hexanoyl, decanoyl, and lauroyl chlorides and characterized the chemical and solid-state structures of acylated chitosans. These acylated chitosans exhibited a good solubility in organic solvents such as chloroform, benzene, pyridine, and THF. Transparent films were obtained from these solutions. The obtained films are softer than that of chitosan and become more sticky and elastic at room temperature with increasing chain length of the acyl substituents. N-acylchitosan has been investigated in a form of membrane (Seo *et al.*, 1995), fiber

(Hirano *et al.*, 1998), and film (Xu *et al.*, 1996). In addition, Lee *et al.* (1995) indicated that the N-hexanoyl chitosan showed the best blood compatibility compared with N-propionyl, N-butyryl, and N-pentanoyl. Therefore, hexanoyl chitosan is an interesting chitosan derivative for biomedical applications.

Recently, polycaprolactone (PCL), an aliphatic polyester, has become an important biodegradable and biocompatible polymer. This has been found frequent applications as environmentally friendly packaging and biomedical materials that are suture (Benzwada *et al.*, 1995), bone repairing material (Corden *et al.*, 1999), microparticle for drug delivery system (Chen *et al.*, 2000). Up to now, there are many researches that were done for optimization of the properties of PCL. The improvement of film properties has generally been achieved by blending. For example, Zhang *et al.* (1995) studied morphological structure and hydrolytic degradation of PCL/polylactide (PLA) and PCL/polyhydroxybutyrate (PHB) blend films. It was found that PCL/PLA and PCL/PHB blends were immiscible and increasing PLA or PHB content increased the rate of hydrolytic degradation of the blend films. Koenig and Huang (1995) studied the mechanical properties of PCL/starch derivatives blend films. They reported that the modulus of the blend films increased with increasing the starch derivative contents. Averous *et al.* (2000) attempted to overcome the weakness properties of wheat thermoplastic starch which are low resilience, high moisture sensitivity, and high shrinkage by blending wheat thermoplastic starch with PCL. The result revealed that the weakness properties of wheat thermoplastic starch were improved even at low PCL content. Olabarrieta *et al.* (2001) prepared PCL/chitosan and PCL/whey-protein-isolate blend films and investigated the morphology, water vapor transmission rate, and oxygen permeability of these blend films. The result showed that phase separation was occurred. At low PCL content, water vapor transmission rate and oxygen permeability of both PCL/chitosan and PCL/whey-protein-isolate blend were decreased.

In this research, blend films of H-chitosan and PCL were prepared by solution casting technique. Chloroform was used as a co-solvent. The effect of blend compositions on morphology, thermal properties, mechanical properties, and oxygen barrier property was investigated.