CHAPTER I
INTRODUCTION

In recent years, the environmental concerns result in new opportunities for the industrial production of biodegradable polymers based on renewable resources. The governments in many countries have supported domestic industrials to use biodegradable polymers as a raw material by cutting down its taxes (Douglas, B. E. *et al.*,1995). Therefore, the application of these biopolymer materials is growing very fast.

Poly (lactic acid) (PLA) is one of promising biodegradable polymers with good mechanical properties such as tensile strength for industrial applications. However, PLA has been limited for wide applications because of brittleness and low heat distortion temperature. In order to improve those properties of PLA, blending PLA with other polymers is efficient and economic method to tailor new materials with an advantageous combination of end-use properties (Arakawa, K. *et al.*, 2006). For example, Poly(ethylene terephthalate), Ethylene vinyl acetate copolymer, Polycaprolactone are blended with PLA to improve its properties.

Nowadays, blends of PLA with engineering plastics such as PC which has an excellent toughness, clarity, and high thermal resistance are interesting in industrial applications such as mobile phones, laptops, and auto parts. However, PLA and PC are normally immiscible. That causes the mechanical properties such as impact and tensile strength of PLA/PC blend are low because of high interfacial tension and low interfacial adhesion between two phases. To improve mechanical properties and interfacial adhesion of the PC/PLA blend, additional compatibilizers are used to improve miscibility of the blend. Poly(styrene-co-acrylonitrile)-g-maleic anhydride (SAN-g-MAH), Poly(ethylene-co-octene) rubber-maleic anhydride (EOR-MAH) and poly(ethylene-co-glycidyl methacrylate) (EGMA) (Lee, J. K., 2011) were the examples of additional compatibilizers in PC/PLA blend. Khowanit, M. *et al.*, (2012) found that the ethylene methyl acrylate copolymers (EMA) can dramatically improve the impact strength of PLA/PC blends but the thermal properties such as heat distortion temperature (HDT) was not significant improved.

Reactive processing is a cost-effective way to improve miscibility of polymer blends. Terminal groups react with the terminal group of other polymers in the extruding process during melt reactions to block or graft copolymer by using reactive compatibilizers. There have been used many types of reactive compatibilizers for many pairs of polymer blends such as Dibutyltin oxide (DBTO) in PE/PBT blend (Pesneau, I. *et al.*, 1996), Ethylene acrylic acid copolymer (EAA) in PE/PA6 blend (Filippi, S., 2002). Masaki, H. *et al.*,(2008) reported that isocyanate groups of lysine triisocyanate (LTI) can react with both terminal hydroxyl or carboxyl groups of polymers. Ethylene acrylic acid copolymer (EAA) in the presence of Dibutyltin oxide (DBTO) was used in PC/PE blend. Acrylic acid in EAA can react with hydroxyl group of PC or polycarbonate groups of PC helping by DBTO as a transesterification catalyst (Yin, B. *et al.*, 2002). Chang, F.C. *et al.*,(1991) reported that Styrene Glycidyl Methacrylate copolymers was the suitable reactive compatibilizer to improve the miscibility of polystyrene/nylon 6,6 blends. Epoxide ring in this compatibilizer can react with both hydroxyl and carbonyl groups. In general, PC has hydroxyl and phenyl groups at each side of end groups and PLA has hydroxyl and carboxyl groups at each side of end groups. Therefore, LTI, Styrene Glycidyl Methacrylate copolymers and EAA in the presence of DBTO have promising potential to improve the mechanical and thermal properties of PC/PLA blend.

PC/PLA (70/30 %weight) blend has the highest mechanical properties such as tensile strength and flexural strength compared to all ratio of the PC/PLA blends suggesting PC70 is the optimum composition to do further emperiment. PC70G0.5 is the best type and amount because it has high tensile strength and accepted other mechanical properties. HDT of PC70G0.5 was higher than other compositions closed to neat PC. Moreover, PC70G0.5 provided excellent mechanical properties as same as commercially available product. HDT of PC70G0.5 was higher than those of the previous work and commercially available product suggesting this material is suitable for automotive and mobile device applications.