CHAPTER I

INTRODUCTION

1.1 Statement of Problem

Poly(L-lactide) (PLLA) (Fig. 1.1) has been of interest for use in biomedical and pharmaceutical applications since 1970s. Based on its suitable biodegradability, biocompatibility, mechanical strength, and shaping-and-molding properties, PLLA is utilized as implantable carriers for drug delivery systems [1,2] as well as for surgical repair materials [3-5]. However, the high crystallinity of the polymer interferes with controlled degradation, reducing compatibility with soft tissues presenting an obstacle to application as biodegradable soft plastics [6,7]. Many approaches have been used to overcome these problems in PLLA, for example, stereocopolymer of the enantiomeric pairs [8,9], block copolymerization with other polyethers [10,11], branched PLLA [12,13] or blended with other polymers [14,15]. The degradation rate could also be controlled by varying the crystallinity of the polymer.

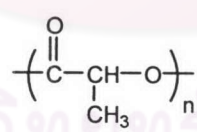

Figure 1.1 Polylactide or poly(lactic acid).

One promising approach to offer changes in the hydrophilicity, and degradation of PLLA is the introduction of hydrophilic segments. Monomer containing hydroxyl groups, such as glycidol (G) (Fig. 1.2), is considered to be a molecule that can be potentially used as a hydrophilic and living group for initiating polymerization. Recently, block or graft copolymers having hydrophobic and hydrophilic segments of polylactide and 1,5-dioxepan-2-one or polyoxyethylene have been reported to form various types of microstructures and have been applied as biomaterials [16,17].

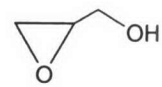

Figure 1.2 Glycidol or 1,2-epoxypropanol.

In this work we have attempted to synthesize copolymers consisting of LLA and glycidol (G) by ring-opening copolymerization. It is hypothesized that the copolymer obtained would consist of hydrophobic and hydrophilic segments that distributed differently depending on the types of initiators and polymerization methods. The outcome of this work should be a basis for understanding the copolymerization reaction for LLA and glycidol, leading to the development of PLLA copolymers for biomedical applications.

1.2 Objective

To synthesize L-lactide and glycidol copolymers by using different initiators and to determine the structure of the resulting polymers.

1.3 Scope of the Investigation

1. To synthesize poly(L-lactide-co-glycidol) by varying type of initiators *e.g.*, $Mg(OEt)_2$, $Al(O^iPr)_3$, $SnPh_4$, $Sn(Oct)_2$, $BF_3{\cdot}OEt_2$, and $SnCl_4$, mole ratio of LLA:G, order of monomer addition, temperature and time.

2. To characterize the structures of the resulting polymers by nuclear magnetic resonance spectroscopy (NMR).

3. To determine the molecular weights of poly(L-lactide-co-glycidol) by MALDI-TOF-MS and GPC.