CHAPTER I

INTRODUCTION

Consumption of synthetic polymers is rapidly increased for various segments of business and daily life since plastics are more economical than metals, woods, and glasses in terms of manufacturing costs, weight-to-strength ratio, and the amounts of energy and water consumption [1]. However, the disposal of the post-consumer plastics is becoming a serious problem because of their recalcitrance to microbial attach and they are not capable of self-decomposition. Although most plastics are now being burned or dumped in landfills after used, but both cases still lead to large environmental problems. Recently, an alternative method is to stimulate reuse and recycle of materials, which, however, is not an easy task and in many cases not even possible [2]. The problems are the difficulties in collecting and separating plastic waste [3]. Furthermore, the lower quantities of reused and recycled materials compared to virgin materials are obtained. This results in a limitation to further usage.

A possible solution to the plastic waste problem is the use of degradable plastics. The degradable plastic is a plastic that undergoes significant structural modifications (mainly reduction of molecular weight) when placed in suitable environments [4]. Biodegradable polymer is one type of this material and better suited for a number of applications such as shopping bags, food packaging, agricultural mulch film, and medicine applications. The various biodegradable polymers include bacterial polyester such as poly(β-hydroxybutyrate) and poly(lactic acid), water soluble polymers such as poly(vinyl alcohol) and poly(ethylene oxide), and natural polymers such as cellulose and starch. They are normally used to produce biodegradable plastics and other products [4-6]. However, it is not appropriate to use all degradable polymers as raw materials because generally these materials are more expensive than commodity plastics and most of them have limitations in processing and usage. Therefore,

biodegradable plastics are blended materials between biopolymer or degradable polymer and synthetic polymer. A large variety of these materials has been developed over the past 10-20 years. It has been realized that starch is a widely used biopolymer for this purpose [2, 4-11].

It has been observed that the degree of degradability of these blended materials relies significantly on the amount of added natural starch. However, the blended products often have lower mechanical properties than non-blended products. This is due to the immiscibility of hydrophilic starch and hydrophobic synthetic polymers. The compatibilizer is normally used to overcome this problem. Unfortunately, the cost of compatibilizers is usually higher than other materials in blending system and the specific equipment to increase the degree of dispersion is also needed [3, 7, 12-14].

Chemically attachment between starch and synthetic polymer via graft copolymerization is an optional method for producing biodegradable plastics. Polystyrene is among most dominant packaging materials in today's society and its monomer is capable to graft onto starch. Starch-*g*-polystyrene copolymers can be prepared by various techniques, where simultaneous ^{60}Co-irradiation of starch-styrene mixture is highly employed [11, 13-15]. The safety of controlling equipment and the pilot scale production become the serious problems.

Therefore, this research presents an alternative method for making starch graft copolymer based on cassava starch and styrene monomer prepared by using benzoyl peroxide as initiator via free radical graft copolymerization. The characterization techniques used in this research include Fourier Transform Infrared Spectroscopy (FT-IR), Thermogravimetric Analysis (TGA), Differential Scanning Calorimetry (DSC), Scanning Electron Microscopy (SEM), and Gel Permeation Chromatography (GPC). These techniques are used to analyze the samples in term of chemical structures, thermal properties, morphologies, and molecular weight distributions. The solubility and moisture absorption were also tested.