

## CHAPTER I

### INTRODUCTION

Natural rubber is polymer that is obtained from tree in '*Hevea brasiliensis*' family. It is harvested in latex form. Almost dried component is cis-polyisoprene. It is a soft polymer that is used to modified toughness of stiff polymer. But, it's molecular structure cause poor miscibility between natural rubber phase and some polymers such as polyester. N. Bitinis and coworkers showed reduction of mechanical properties of, such as Young's modulus and tensile strength, when natural rubber was blended with polylactide because poor miscibility between natural rubber surface and polylactide(Bitinis, N. et al. 2011a). So, natural rubber surface must be modified to improve miscibility. Core-shell particles formation is a method for particle surface modification. The core-shell particles of rubber can improve toughness of stiff polymer without severe decreasing of mechanical properties. G.D. Cai and coworkers showed that core-shell particles of polybutadiene-graft-polystyrene improved toughness of polystyrene with slight reduction of tensile strength(Cai, G.D. et al. 2012). Admicellar polymerization is a method for core-shell particles by using surfactance as template of shell layer. This works study synthesis of core-shell particles by using natural rubber as core and polycaprolactone-copolylactide as shell. And study effect of shell layer factors, such as comonomers ratios and initiator to monomers ratios, on particle morphology and thermal properties.

Polylactide is a biodegradable polymer that can be synthesized from renewable resources. It has good mechanical properties, high tensile strength and Young's modulus, that can compared with conventional plastics. Furthermore, it is clear and biocompatible plastic, so it suits for many kinds of application, such as biomedical materials(Lasprilla, A.J.R. et al. 2011) and packaging. But, polylactide also is brittle plastic with low toughness. So, toughness modification is necessary for practical application of polylactide. Toughness modified approaches can be classified to 3 ways, stereochemistry, copolymerization and blending. Core-shell particle is a filler that is blended for toughness modification, especially, rubber core particle(Arends, C.B. 1996). The particles are made by polymerization of shell polymer onto surface

of rubber particle. Toughness of rubber particle causes improvement of polylactic acid's toughness. However, Blending with soft polymer also causes reduction of modulus and tensile strength. So, nanocomposite is introduced to compensate the reduced properties. N. Bitinis and coworkers found that modulus and tensile strength reduction of polylactide-natural rubber blend were compensated by incorporated blend with clay. But, clay addition also affect on elongation reduction(Bitinis, N. et al. 2011b). To improve toughness of PLA, the prepared core-shell particles of natural rubber and its nanocomposite with nanoclay are blended to PLA. The effect of particles factors, such as comonomers ratios and initiator to monomers ratios, and clay contents on morphology, thermal and mechanical properties of polylactide are observed.