CHAPTER V

CONCLUSIONS

OH-terminated polylactic acid glycolysates (GPLAs) with different structures and molecular weights (2,000 – 44,000 g/mol) are successfully prepared from glycolysis of PLA resin. The materials are then used as crosslinkers for epoxidised natural rubber (ENR). Effect of GPLA sizes on curing efficiency and chemical structure of the cured ENR products is examined. The weight ratio of GPLA/ENR at 1:2 is proven as the optimum composition for reactive crosslinking of ENR.

Effect of GPLA size on curing efficiency and chemical structure of the cured products is examined. In a chemical curing method, small-sized G2 (GPLA with Mn 2,000 g/mol) molecules are prefered in the production "crosslinked" structure, because of their high chain mobility, compared to the bigger sized counterparts.

For practical industrial use, a reactive crosslinking process is developed, and its curing characteristics are examined. Physical properties of the GPLA-cured ENR products developed by the reactive crosslinking method are strongly influenced by GPLA's chain lengths and GPLA/ENR compositions. The largest crosslinker (G44, Mn 44,000 g/mol) shows the highest elastic torque during its crossliniking reaction with ENR. The highest crosslinking efficiency (lowest tan δ values), in all GPLAs systems, are observed when a 33 wt% of GPLAs is employed, indicating an optimum feed composition. The G44 crosslinker is, therefore, used in an improvement of tensile strength and breaking energy of ENR. Elongation at break of the GPLA-cured ENR products is enhanced for more than 3 times of that consisting of uncured ENR. These properties enhancements are derived from several origins. The "simple blend" fraction is a major phase compatibility enhancement of the crosslinked rubber domains, whereas PLA matrix and "grafted" and "crosslinked" fractions act as hard phase for modulus improvement.

Selected GPLA-cured ENR products are subsequently used as a toughening agent for commercial PLA resin, by a melt blending technique. At the same composition, an incorporation of G44-cured ENR and G10-cured ENR results in higher tensile strength, compared to those of G2-cured and uncured ENR blends, due to their

relatively higher contents of "crosslinked" structure. The G44-cured ENR material has high efficiency in toughening of PLLA resin, by presenting as the smallest rubber particles (2-3 μm).