CHAPTER V

CONCLUSION AND SUGGESTION

5.1 Conclusion

5.1.1 Preparation of Grafted Natural Rubber

The grafting of methyl methacrylate onto natural rubber was prepared by emulsion polymerization. The rubber macroradical reacted with methyl methacrylate to form graft copolymer. The effects of initiator concentration, reaction temperature, monomer concentration, and reaction time on graft copolymer were investigated. The results can be summarized as follows.

Effect of initiator concentration

The percentage conversion increased as the initiator concentration increased. For increasing initiator concentration up to 0.75 phr the percentage grafted natural rubber and percentage grafting efficiency increased while further increasing initiator concentration, the percentage grafted natural rubber and percentage grafting efficiency were decreased.

Effect of reaction temperature

The higher reaction temperature resulted in a higher percentage conversion. In addition, the effect of reaction temperature on percentage grafted natural rubber and percentage grafting efficiency, both decreased with temperature, when the polymerization temperature was higher than 55°C.

Effect of monomer concentration

The percentage conversion also increased with increasing monomer concentration. The percentage grafted natural rubber and percentage grafting efficiency reached maximum at monomer concentration of 100 phr and thereafter decreased with monomer concentration.

Effect of reaction time

It can be seen that as the reaction time increased there was an increase in the percentage conversion, percentage grafted natural rubber, percentage grafting efficiency and reached a maximum value at reaction time of 8 hr.

Appropriate condition for the preparation of grafted natural rubber could be drawn as follows.

- Rubber content : 100 phr
- Monomer concentration : 100 phr
- Initiator concentration : 0.75 phr
- Reaction temperature : 55°C
- Reaction time : 8 hours

Grafting properties of grafted natural rubber are also presented as followed.

- Conversion : 75.9%
- Grafting efficiency : 64.1%
- Graft Properties
  - Grafted natural rubber : 57.9%
  - Free NR : 26.6%
  - Free PMMA : 15.4%

The functional groups in the grafted natural rubber was characterized by FT-IR spectroscopy. The appearance of new peaks in the FT-IR spectrum of grafted natural rubber was at around 1148 cm^{-1} and 1733 cm^{-1}, due to the ether linkage and

carbonyl group in PMMA grafted on natural rubber backbone. The glass transition temperature of grafted natural rubber determined by DMTA technique was –47.02° C. From TEM micrographs of grafted natural rubber, the natural rubber seed latex showed mainly a spherical morphology with a thin PMMA film, therefore a thin layer of grafting PMMA covered the natural rubber seed particles.

5.1.2 The Production of Grafted Natural Rubber/PMMA Blends

Effects of the different grafted natural rubber types on the mechanical properties were investigated. The hardness of grafted natural rubber increased with increasing MMA concentration. The results show that graft modification substantially improved the hardness of rubber. This grafted natural rubber for applications which required a hard rubber with optimum retention of properties such as tensile properties and tear strength. In this research, the grafted natural rubber with MMA 60 phr and 100 phr was selected to prepare the thermoplastic elastomers. The grafted natural rubber/PMMA blends were prepared by mechanical blending and compression molding. The mechanical properties are summarized as follows:

- The hardness and stress at maximum load increased with increasing PMMA content in grafted natural rubber blends.
- The strain at maximum load decreased with increasing PMMA content in grafted natural rubber blends.
- The tear strength of GNR60/PMMA blends increased with increasing PMMA content. For GNR100/PMMA blends with PMMA content above 30%, tear strength decreased with increasing PMMA content.

For SEM photographs, the fracture surface of GNR100/PMMA blends is smoother than GNR60/PMMA blends, because of the better grafting properties of GNR100 than GNR60. GNR100 blends had the better interfacial adhesion between the two phase of the blends than GNR60 blends. Therefore the increase of grafting properties, improve the strength of the GNR/PMMA blends.

5.2 Suggestion for Future Work

In the area of modification of natural rubber latex and polymer blends, it should be studied further in the following aspects:

1. To modify the NR by elimination of nonrubber contaminants such as proteins from natural rubber before graft copolymerization.
2. To study the properties of the recycling of GNR/PMMA blends.
3. To study the mechanical properties of unvulcanized GNR/PMMA blends compare with vulcanized GNR/PMMA blends.