

## **CHAPTER V**

### **CONCLUSION**

The research work described in this thesis can be summarized below.

#### **5.1 The Preparation of Grafted Natural Rubber**

The grafting of styrene and methyl methacrylate onto natural rubber seed particles was prepared by core-shell emulsion polymerization. The rubber macroradical reacted with styrene and methyl methacrylate monomers to form graft copolymer. The particle structure of grafted natural rubber is the core-shell type. The optimum condition of graft copolymerization was found. The grafted products were characterized.

From this work, the grafted natural rubber formed the completed closed shell of the amount of styrene and methyl methacrylate monomers (25 : 75) 100 parts by weight per 100 parts of natural rubber. The appropriate conditions were 1.5 parts by weight of emulsifier, 1.5 parts by weight of initiator, and 70°C of the reaction temperature for 8 hours.

The influences of the principal factors on the percent grafted natural rubber, degree of monomer conversion (DC), grafting efficiency (GE), and graft ratio (GR) are listed in Table 5.1

**Table 5.1** Effect of various factors on the percent grafted natural rubber (GNR), degree of monomer conversion (DC), grafting efficiency (GE), and graft ratio (GR)

Factors	GNR	DC	GE	GR
Emulsifier content ↑	↓	↑	↓	↓
Initiator content ↑	↑	↑	↑	↑
Reaction temperature ↑	↑	↑	↑	↑

↑ : increase                      ↓ : decrease

The grafted natural rubber properties were strongly influenced by the reaction temperature. The maximum percent grafted natural rubber, degree of monomer conversion, grafting efficiency, and graft frequency were 57.6, 79.5, 65.3, and 1,303 respectively, at reaction temperature of 70°C. The copolymer composition of grafted natural rubber (NR-g-S/MMA) was determined by NMR method and Elemental analysis. At the reaction temperature of 70°C, the ratios of styrene, isoprene, and methyl methacrylate in the grafted natural rubber were 15.5 : 55.1 : 29.4 (by NMR method) and 18.0 : 57.4 : 24.6 (by Elemental analysis).

## 5.2 The Production of PVC/Grafted Natural Rubber Product Blends

The grafted NR product could be used as an impact modifier for PVC resin to form PVC/grafted NR product blends by mechanical blending and compression molding. The good mechanical properties of blends was obtained at 10 and 15 phr of the grafted NR product.

### **Suggestion**

1) The presence of non-rubber contaminants such as, proteins, etc., could affect the graft copolymerization of styrene and methyl methacrylate onto natural rubber. These contaminants, which may act as catalyst inhibitors can stop the roles of free-radicals. Therefore, the elimination of non-rubber contaminants such as proteins from natural rubber before graft copolymerization should be further studied.

2) Graft copolymerization of styrene and methyl methacrylate onto natural rubber at high temperatures and pressures in the medium pressure reactor.

3) The effect of different processing methods.



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