

CHAPTER I

INTRODUCTION



The Purpose of the Investigation

Natural rubber (NR), one of the important natural products of Thailand has a wide range of applications [1,2]. Thai rubber cultivation began in early 1900, and the production increased constantly up to 1,717,859 metric tons in 1994. Approximately 95% of the production is exported in the dominant forms of Ribbed Smoked Sheet (RSS) and Standard Thai Rubber (STR). Only 5% is consumed locally by rubber based manufacturing industries, with more than 50% of its domestic consumption for tyre industries. At present, there are many rubber products factories in Thailand but the majority are in small scale production, which consumes raw rubber less than 5 metric tons per day each. The production of rubber products such as tyre, rubber bands, footwear, moulded goods and latex products (gloves, condoms, threads, etc.) is for local uses as well as for export. Thailand has set a target to increase local consumption of natural rubber in the manufacturing of rubber product for export.

Natural rubber is preferred polymer in many areas for the following reasons [3,4]: superior building tack, better green strength, better processing, high strength, hot tear resistance, retention of strength at elevated temperatures, high resilience, low hysteresis (low heat build-up), excellent dynamic properties, and general fatigue resistance. Since natural rubber is non-polar, its vulcanizates have little resistance to swelling in non-polar solvents. When in contact with mineral oils, benzene, and gasoline, the volume of natural rubber vulcanizates increases

several hundred percent. However, the resistance to swelling can be improved by incorporation of the Acrylonitrile-Butadiene Rubber (NBR) and Poly(vinyl chloride) or (PVC) into the natural rubber.

Natural rubber can be improved the properties by various method such as the blending with additives, copolymerized with vinyl monomers. Some of the most significant changes in structure and properties of polymers can be brought about by either block or graft copolymerization [5,6]. Natural rubber may be block or graft copolymerized with poly(methyl methacrylate), or methyl methacrylate monomer may be grafted onto natural rubber. Heveaplus MG (tradename of grafted natural rubber) or NR-MMA copolymer is one of the grafted natural rubber, the main advantage of Heveaplus MG lie in an ability to produce self-reinforced vulcanizates and in adhesive applications.

PVC is one of the most important and versatile commodity polymers. It is inherently flame retardant and chemical resistant, and has found numerous and varied applications, primarily because of its low price and capability of being modified. However, PVC compounds lack of elastic property and toughness which have in rubber such as natural rubber. The improvement of its elastic property and toughness by incorporation of a rubber-component into the plastic matrix. In contrast, PVC can improve the oil resistance (or chemical resistance) and flame resistance in natural rubber.

Over the years, a wide variety of chemical and physical reactions of natural rubber have been studied, but the modified natural rubber was not the important commercial products. Therefore, the objective of this research is to produce Thermoplastic Elastomer (TPE) from modified natural rubber and PVC by mechanical blending method. Graft copolymerization is the selective method for modification of natural rubber. The graft copolymer of methyl methacrylate onto natural rubber can be used as impact modifier and permanent plasticizers in PVC.

Objectives of the research work

The objectives of this research work were as follows;

- a) To investigate the suitable condition for the preparation of methyl methacrylate grafted natural rubber (NR-g-MMA).
- b) To study the effect of various parameters % conversion and % grafting :
 - i) The effect of methyl methacrylate content.
 - ii) The effect of reaction temperature.
 - iii) The effect of dry rubber content.
- c) To produce the polymer blends of the methyl methacrylate grafted natural rubber and poly(vinyl chloride) by using mechanical blending technique with the following parameters:
 - i) The effect of methyl methacrylate content in grafted natural rubber.
 - ii) The effect of the NR-g-MMA and plasticized PVC ratio.
 - iii) The effect of the plasticizer content in plasticized PVC.
- d) To study effect of the parameters on the properties of polymer blends such as 300% modulus, tensile strength, elongation at break, tear strength, abrasion resistance and oil resistance.

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย