CHAPTER I

INTRODUCTION

1.1 Statement of Problems

The global consumption of vulcanized elastomers has grown to a yearly production level of about 17.2 million tons [1]. Approximately 40% of that is natural rubber with the remaining 60% consisting of various synthetic rubbers. Vulcanization is required to give rubber its characteristics such as high elasticity and strength. Once rubbers are cross-linked, they do not melt or dissolve. The presence of these networks thus creates a tremendous problem at the end of a product's life. The recycling and reutilization of cross-linked elastomers are difficult preposition because of these three dimensional chemical network.

Wastes from natural rubber products have become increasingly problematic due to their non-degradability in environment. Gloves are non-recycled garbage after being used. While expired tires are usually discarded by an incineration which in turn causes air pollution. The development of natural rubber that can degrade under ambient sunlight irradiation is believed to be an environmental-friendly approach for disposal of natural rubber wastes. In addition, such a concept offers an alternative to value-added rubber products that can be used for some applications requiring a short lifetime rubber such as soil cover sheet used in agriculture.

Titanium dioxide (TiO_2) is a well-known inorganic pigment. It cannot only exhibit a protective effect but also behaves as an oxidation catalyst sensitizing the photochemical breakdown of organic matters. As a result of its chemical inertness, non-photocorrosivity and nontoxicity, TiO_2 is considered as one of the most suitable photocatalyst used for waste treatment and controlled degradation of polymers.

This research aims to control degradation of natural rubber by incorporating titanium dioxide. The photocatalytic degradation under accelerating condition is investigated. The ability of TiO_2 to enhance the durability or to catalyze the photo-oxidation of natural rubber in solution and unvulcanized natural rubber sheet is monitored by following molecular weight decay as a function of time and TiO_2 composition. To assess the feasibility of developing photodegradable vulcanized natural rubber, mechanical properties of vulcanized natural rubber incorporated with TiO_2 are investigated. The chemical composition and morphology of the degraded natural rubber are characterized by FT-IR and SEM, respectively.

1.2 Objectives

1. To study the degradation of natural rubber in solution and as a solid form in the presence of TiO_2 under ultraviolet light.
2. To study an effect of TiO_2 composition on the rate of natural rubber degradation.

1.3 Scope of the Investigation

1. Literature survey for related research work.
2. To study the degradation of natural rubber in the presence of TiO_2 in solution by following number-average molecular weight using gel permeation chromatography (GPC) after exposure to UV light under accelerated condition.
3. To prepare unvulcanized natural rubber sheets filled with TiO_2
4. To study the degradation of unvulcanized natural rubber sheet filled with TiO_2 by following number-average molecular weight using gel permeation chromatography (GPC) after exposure to UV light under accelerated condition and sunlight.
5. To prepare vulcanized natural rubber sheets filled with TiO_2.

6. To determine mechanical properties of vulcanized natural rubber sheets filled with TiO_2 after exposure to UV light under accelerated condition and sunlight according to ASTM method.
7. To summarize the results.