

CHAPTER I

INTRODUCTION

1.1 Statement of Problem

Carbon black (CB) has been used as filler in rubber industry due to its outstanding reinforcement and reduced cost. Adding carbon black powder into dried natural rubber (NR) is one of the important steps for incorporating carbon black in dried rubber. Moreover, CB can be spread in the air during the compounding process. Not only the air is contaminated but also some quantity of CB is lost. It presents problems like difficulty in maintenance of cleanliness in the factory and huge power consumption [1]. To overcome these problems, mixing CB with NR in the latex stage was introduced, with the purpose of reducing the spreading of CB in the air and the mixing time. Normally the CB filled latex is coagulated by acids, such as sulfuric acid, hydrochloric acid, and formic acid [2]. Beside the acid coagulation method, the latex can be coagulated by mechanical process such as stir, shake, and shear at high rates [3]. This latter choice is in fact interesting because no acid is involved in the process.

This work therefore has focused on the use of mechanical shear from the paddles of a high speed mixer to induce coagulation the mixture of CB and NR latex. Mechanical properties such as tensile strength, modulus, elongation at break and tear resistance of the NR/CB vulcanizates were studied as a function of the quantity and type of furnace CB. Four types of CB used in this study were N220 (intermediate super abrasion furnace), N330 (high abrasion furnace) used in tire industry, N550 (fast extrude furnace) used in extrude industry, and N660 (general purpose furnace). Each CB type was different in particle size, structure and surface area. It was expected that these parameters affected the CB distribution and mechanical properties of the composite. The use of fillers in latex products was generally limited, since they affected the mechanical properties adversely [4]. The composite preparation in this research was carried out as batch process by using a laboratory-sized high speed intensive mixer. By using the batch method,

carbon black would be distributed well as continuous process but the batch process was not complicate and not so expensive.

1.2 Objective

The aim of this project was to study methods of preparing NR/CB compound which contains carbon black inside the rubber matrix by mechanical coagulation process. The effects of different grades and contents of CB on the morphology and mechanical properties of the vulcanizates were evaluated.

1.3 Scope of Investigation

The stepwise investigation was carried out as follows:

1. Literature review for methods to prepare NR/CB compound from NR latex
2. Preparation of NR/CB compound from shear-induced coagulation by mechanical coagulation process by using an enclosed high speed mixer (batch process)
 - a) Types of CB: N220 (ISBF), N330 (HAF), N550 (FEF), and N660 (GPF).
 - b) Amounts of CB are 20, 30, 40, and 50 per 100 part of rubber (phr) in order to find a suitable portion.
3. Characterization of NR/CB composites
 - a) Mooney viscosity
 - b) Morphology by SEM
4. Characterization of the NR/CB vulcanizates for
 - a) Curing behavior
 - b) Mechanical properties
 - Tensile strength ASTM D412
 - Elongation at break ASTM D412
 - Modulus ASTM D412
 - Tear strength ASTM D412
 - Hardness Shore A ASTM D2240
5. Comparison between NR/CB vulcanizates prepared from NR latex and from conventional NR sheet (STR 5L) with the same CB type and content.
6. Summarizing the results and writing the thesis.