

**THE EFFECT OF PARTICLE SIZE OF ZnO**

**PRESERVATION FOR  
NATURAL RUBBER LATEX**

By

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Declaration

The work on this thesis was carried out by me under the supervision of Dr. Susantha Siriwardane of the Rubber Research Institution of Sir Lanka and a report on this thesis has not been submitted to any University for Another degree.

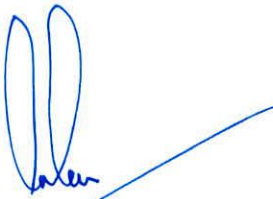
  
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*DEDICATION*

*TO*

*MY DEAR PARENTS*

*AND*

*LOVING TEACHERS*

# CONTENTS

Contents.....	iv
List of Figures.....	vii
List of Tables.....	ix
Acknowledgement.....	x

## ABSTRACT

## CHAPTER 01 2

### INTRODUCTION

1.1. A BRIEF HISTORY OF NATURAL RUBBER LATEX .....	3
1.1.1. Latex is not a sap. ....	5
1.1.2. Methods of latex rubber tapping.....	5
1.2. RUBBER LATEX .....	6
1.2.1 Introduction.....	6
1.3. CHEMICAL COMPOSITION OF NATURAL RUBBER LATEX.....	7
1.3.1. Major constituents of principle phases .....	7
1.3.2. Constituents of inorganic matter.....	7
1.3.3. Overall composition of the rubber phase.....	8
1.3.4. The natural rubber hydrocarbon. ....	9
1.4. PRESERVATION OF NATURAL RUBBER LATEX.....	10
1.4.1. Mechanism of spontaneous coagulation of natural rubber latex. ....	10
1.4.1.1.The preservation for natural rubber latex .....	12
1.5. LOW-AMMONIA PRESERVATION SYSTEM.....	13

1.5.1. .	Pentachlorophenate lattices.....	13
1.5.2.	Zinc dialkyldithiocarbamate lattices.....	15
1.5.3.	Boric acid lattices .....	15
1.6 .	CONCENTRATION OF NATURAL RUBBER LATEX	16
1.7.	TETRAMETHYL THIURAM DISULFIDE .....	18
1.8.	ZINC OXIDE.....	19
1.9.	PARAMETERS THAT CAN BE USED TO MEASURE THE STABILITY OF NR LATEX.....	21
1.9.1.	Volatile fatty acid numbers (VFA).....	21
1.9.2.	Potassium hydroxide (KOH) number .....	22
1.9.3.	Total solids content (T.S.C) of latex.....	23
1.9.4.	Dry rubber content (D.R.C) of latex.....	23
1.9.5.	Alkalinity of latex .....	24
1.9.6.	pH of latex. ....	24
1.9.	OBJECTIVE.....	25
<b>CHAPTER 02.....</b>		<b>25</b>
<b>EXPRIMENTAL</b>		
2.	METHODOLOGY .....	27
2.1.	DETERMINATION OF TOTAL SOLID CONTENT (TSC).....	29
2.2.	DETERMINATION OF TOTAL HARDNESS.....	30
2.3.	DETERMINATION OF MAGNESIUM CONTENT IN FIELD LATEX .....	31
2.4.	DETERMINATION OF PH OF LATEX.....	32
2.5.	DETERMINATION OF DRY RUBBER CONTENT (DRC) .....	33

2.6.	DETERMINATION OF VOLATILE FATTY ACID NUMBER (VFA).....	34
2.7.	DETERMINATION OF ALKALINITY OF FIELD LATEX.....	35
2.8.	KOH NUMBER (OF LATEX).....	36
2.9.	PREPARATION OF DRY FILM.....	38
2.10.	EXPERIMENTAL DRAWING .....	40
 <b>CHAPTER 03</b> .....		<b>42</b>
3.	RESULTS AND DISCUSSION.....	42
3.1.	DISCUSSION.....	51
3.2.	CONCLUSIONS.....	55
<b>FUTURE WORK</b> .....		<b>56</b>
 <b>REFERNCE</b> .....		<b>57</b>

## LIST OF FIGURES

FIG 01.	Variation of volatile fatty acid number .....42 with storage time (Days) for preservation of natural rubber latex without use ZnO
FIG 02.	Variation of volatile fatty acid number .....43 with storage time (Days) for different particle size of ZnO used in preservation of natural rubber latex
FIG - 03	Variation of KOH number .....44 with storage time (Days) for different particle size of ZnO used in preservation of natural rubber latex
FIG - 04	Variation of modulus 100%.....45 for green film prepared by different particle size of ZnO used preserve natural rubber latex
FIG - 05	Variation of modulus 300%.....46 for green film prepared by different particle size of ZnO used preserve natural rubber latex
FIG - 06	Variation of modulus 500%.....47 for green film prepared by different particle size of ZnO used preserve natural rubber latex

FIG - 07	Variation of tensile strength .....	48
	for green film prepared by different particle size of ZnO used preserve natural rubber latex	
FIG - 08	Variation of elongation at break% .....	49
	for green film prepared by different particle size of ZnO used preserve natural rubber latex	
FIG - 09	Variation of force at break .....	50
	for green film prepared by different particle size of ZnO used preserve natural rubber latex	



## LIST OF TABLES

<b>Table 01</b>	Typical composition of fresh natural rubber latex .....	06
<b>Table 02</b>	Composition of inorganic matter.....	07
<b>Table 03</b>	Typical composition of rubber particle in fresh natural rubber latex .....	08
<b>Table 04</b>	Different particle size of ZnO commercially available .....	18

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## ABSTRACT

Natural rubber latex is the contents (sap) of a specialized type of cell in the *Hevea brasiliensis* tree, namely, the latex vessels. As such it is a complex biochemical system. It is therefore not surprising that obvious chemical changes occur shortly after the latex leaves the tree. To prevent spontaneous coagulation a petrification processes occurring that preservation are necessary.

This study present low ammonia preservation of natural rubber latex with different particle size of ZnO / TMTD. Commercially available red zeal ZnO, white zeal ZnO, active ZnO and nano ZnO were used to study the effectiveness of different particle size of ZnO for low ammonia preservation system.

VFA number is an important measure of the level of deterioration and stability of the latex. Thus, the VFA number of the latex was used to measure the preservation activities.

VFA results have suggested that the nano particle size of ZnO introduced preservation system enhances the preservation activity. It's therefore of interest to investigate the activity of preservative in nano particle size preservation system held for longer periods of storage. KOH number also confirmed that the decrease the particle size of ZnO increases the stability of latex.

Mechanical properties of latex film prepared by different particle size of ZnO using preserved rubber latex shown different level. It was found that nano particle size of ZnO preserved latex film showed improved mechanical properties compared to other different particle size of ZnO preserved latex

# **CHAPTER 01**

## CHAPTER 01

### 1. INTRODUCTION

#### 1.1. A BRIEF HISTORY OF NATURAL RUBBER LATEX

Natural rubber producing countries are located (95%) in Southeast Asia. Brazil introduced the world with the rubber tree, *Heave brasiliensis*. The Brazil no longer plays any significant role in the world natural rubber trade. Rubber seeds were exported from the lower Amazon area of Brazil to London U.K by Henry Wickham, a local planter working for the British government, in 1876.<sup>(1)</sup>

Seeds were germinated at the tropical herbarium in Kew gardens, London later that year. From these, seedlings were exported to Sri Lanka in 1877, 22 seedlings were sent from Sri Lanka to Singapore, where they grew strongly, and the technique of tapping was developed.

By 1900, most of the techniques and agricultural practices required to establish large plantations had been developed. One key technique was bud grafting. This is essentially a cloning technique, which ensures that genetically identical trees can be produced in unlimited numbers. The rubber industry is often interest on high –yielding clones, produced by bud grafting.<sup>(1)</sup>

Over the next 40 or 50 years, the Bruisers in Malaysia and the Dutches in Indonesia cleared large areas of rainforest to create rubber plantations. Simultaneously, local

farmers identified the opportunities of rubber cultivation, and planted small groves of trees to supplement their own income.

This gives rise to two types of rubber plantations in most producing countries; the estates of plantations and the smallholdings. Smallholdings tend to produce dry rubber while estates are essentially large-scale farms, with professional management where both dry rubber and latex are produced.

Rubber manufacture has been an important role of Sri Lanka's economy since the very early 1930's. As the world's 6<sup>th</sup> largest exporter and the 8<sup>th</sup> largest natural rubber producing country, Sri Lanka proceed many types, forms and grades, such as ribbed smoked sheet (RSS); pale crepe, sole crepe, brown crepe, technically specified rubber (TSR), centrifuged latex and specialty rubbers, Sri Lanka being the major world supplier of crepe rubber.

Sri Lanka has a winning combination of premier quality rubber, an abundance of highly trained chemists, technologists, engineers and technicians and technologically advanced manufacturing systems and sophisticated equipment, which collectively enables Sri Lanka to offer products at competitive prices.

Sri Lankan rubber makes its way to sophisticated markets such as Europe and America, having no trouble adhering both to international standards and manufacturer's supply schedules.

The range encompasses industrial products such as hoses, tubes, conveyer belts, auto parts and solid tires, while latex based products include industrial household, medical and surgical gloves and rubber thread and general rubber products include door mats, rubber bands, sports goods, footwear and footwear components. The industry is well established and well equipped with facilities for testing, quality control, research and development.

### **1.1.1. Latex is not a sap.**

Latex is often described as the sap of the Hevea tree. This is not an accurate description. The sap runs deeper inside the tree, beneath the cambium. Latex runs in the latex ducts, which are in a layer immediately outside the cambium. If the cambium is cut, then the tree is damaged, because the cambium is the layer where all the growth takes place. If too much damage is done to the cambium; the tree stops growing and prevents producing latex.

### **1.1.2. Methods of rubber latex tapping**

Tapping is meant the process by which latex is obtained from the latex vessels of the *Hevea brasiliensis* tree. In principle, because the latex is under considerable osmotic pressure in the latex vessels, it is merely necessary to sever the vessels for the latex to exude spontaneously. As the latex exudes and the vessels empty, the osmotic pressure decreases and the flow gradually subsides until the latex flows slowly that it coagulates by evaporation before it has run far. The coagulum which forms effectively plugs the severed vessels, so that the flow soon ceases altogether. The vessels now gradually fill up again with latex, until the equilibrium osmotic pressure is once again attained. If the