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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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25/07/08
Date

I certify that the above statement made by the candidate is true and that this thesis is suitable for submission to university for the purpose of evaluation.

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DEDICATION

TO

MY DEAR PARENTS

AND

LOVING TEACHERS

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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 petrifaction 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

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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. [1]

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. [1]

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^{th} largest exporter and the 8^{th} 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. It too much damaged 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 form the latex vessels of the *Hevea brasiliensis* tree. In principal, 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 exude 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