DOI :10.31357/fapsmst.2005.00521

# Protective measures for the current Latex protein allergy problem- solution to a serious threat to our Natural Rubber Industry

By

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Thesis submitted to the University of Sri Jayawardenepura for the award of the Degree of Master of Philosophy in Chemistry on Polymer Chemistry

2005

**DECLARATION BY AUTHOR**

The work described in this thesis was carried out by me under the supervision of Dr. W.M.G Seneviratne, and Dr. Laleen Karunanayake and a report on this has not been submitted in whole or in part to any University for another Degree / Diploma.

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## DECLARATION BY SUPERVISORS

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

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*Dedicated to my husband daughter Dulmini*

*&*

*Son Methmiran*

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## LIST OF ABBREVIATIONS

BCA - Bicinchoninic acid

B - Bromination

C - Chlorination

CL - Centrifuged Latex

DCL - Double Centrifuged Latex

DPNR- Deproteinized Natural Rubber

EP - Extractable Proteins

LATZ - Low Ammonia TMTD/ZnO stabilized

MC - Mild Chlorination

NR - Natural Rubber

PVA - Poly Vinyl Alcohol

RRIC - Rubber Research Institute Clone

TMTD - Tetra Methyl Thiurane Disulphate

Tb - Tensile strength

## ACKNOWLEDGEMENT

I owe a sense of gratitude to Dr. W.M.G Seneviratne and Dr. Laleen Karunanayake, my supervisors for their guidance, encouragement and constructive criticism extended throughout the cause of this study.

I am very much grateful to Dr. L.M.K Tillekeratne, Director RRISL for allowing me to carryout this study and his guidance.

I wish to express my sincere gratitude to Dr. Karnika de Silva for her guidance, encouragement extended to the course of this study.

This project was funded by National Science Foundation (Grant No. RG/99/C/07 ). Their financial support is gratefully acknowledged.

I wish to record my special thank to Mr. H.N.K.K Chandralal for his immeasurable support offered to me.

Many thanks and appreciations are also made to Mr. S.L.G. Rangith for his assistance in the lab work. Thanks are also due to the entire staff of Rubber Research Institute, Colombo office & laboratories, Rathmalna for their support.

Enormous thanks are due Ansell Lanka Company for irradiating the latex, Head Chemistry department University of Colombo for allowing me to carry out some laboratory work. Head plant science department for allowing me to take SEM photos and Atomic Energy Authority for supplying glove formers.

Finally, I am deeply grateful to my husband Ananda, for his understanding and constant encouragement.

**Protective measures for the current latex protein allergy problem - solution to a serious threat to our Natural Rubber Industry**

**Kalu Archchilage Kumudini Dilrukshi Chandresekera**

## ABSTRACT

Natural rubber latex based products being used extensively world wide. Along with the wide spread use of latex based products there is a great concern about allergies which are associated mainly with latex based products. This is caused in certain individuals due to the contact of leachable proteins of these products with their skin. Therefore, the objective of this investigation was to minimize the Extractable proteins (EP) in rubber articles during manufacture.

Various techniques and methodologies were examined for reduction of leachable proteins. The effects of the use of latices such as double centrifuged latex, gamma irradiated latex, enzymatic deproteinized latex, post vulcanized, sulphur prevulcanized and latex treated with poly vinyl alcohol in cast films and PVA incorporated laboratory made examination gloves were studied to ascertain their effect on the EP content. The reduction of leachable proteins and Tensile strength were studied for films leached using various leaching methodologies. Wet gel leaching and post–cure leaching were carried out for both chlorinated and unchlorinated products using cast and dipped product films. Solutions used as leaching medium were hot water, NaCl, commercially available washing liquid etc.

EP was measured using BCA protein assay method. Nature of molecular structure of PVA incorporated gloves were scrutinized using Fourier Transform Infra Red Spectrometer ( FTIR). Separation of extractable proteins was carried out using Sodium dodecyl sulphate poly Acrylamide gel electrophoresis (SDS-PAGE). The glove surface torpography was examined using scanning electron micrographs (SEM).

EP content was highly varied depending on the clone type. Double centrifugation effectively reduce EP in raw latex. However, EP content varied during the processing depending on compounding and other techniques adopted in the vulcanization. Papain treatment reduced EP in different types of clones in different ways. The rate of extraction of proteins was initially high and the most of the extractable proteins leached out within the first 20 minutes.

Irradiation of latex greatly enhanced the solubility of some proteins. Leaching of irradiated films gives lower EP. Lower levels of EP could be achieved by the incorporation of PVA into NR latex. Post cure leaching is far more effective than wet gel leaching for achieving lower EP content within short period of time. Hot water leaching of PVA incorporated gloves showed lower EP content of below 95 μg/g. PVA was capable of changing the glove surface, resulting easy donning, too.