

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

By

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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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“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.”



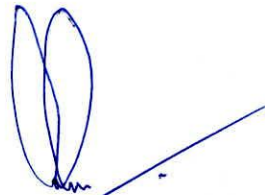
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Dedicated to my husband daughter Dulmini

&

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

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

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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 topography 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 $\mu\text{g/g}$. PVA was capable of changing the glove surface, resulting easy donning, too.