

NATURAL RUBBER: A MORE SAFER MATERIAL THAN SYNTHETIC RUBBER

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Planting *Hevea* rubber is an ecological friendly form of land use in natural rubber producing countries. A wide spread luxuriant ever-green plantation of rubber provides all the advantages of a tropical rain forest sustaining the greatest productivity and most efficient soil and moisture conservation systems (Samarappuli, 1996). The amount of nutrients re-cycled in rubber areas is almost similar to that in the forest eco-system (Tillekeratne & Samarappuli, 1995). Natural rubber being a pure hydro carbon containing less than 5% non-rubber constituents mainly proteins, lipids and carbo-hydrates and hence the wastage of major nutrients viz. N, P, K and Mg from the rubber plantation due to latex harvesting is extremely negligible compared to any other agricultural crop (Samarappuli & Yogaratnam, 1995).

Rubber can therefore be considered as the most important agricultural crop both ecologically and economically; grown in the rubber producing countries particularly in Asia. From the point of view of Sri Lanka where the percentage of forest reserves have declined to even below 22% (FSMP, 1995), maintenance of rubber plantations is essential to sustain the environmental stability. In Sri Lanka, where the rubber plantation is widely spread, earthslips and soil erosions have been prevented to a great extent by the rubber plantation in existence for over a century.

Although there had been no adverse complaints from the users of rubber products during the last century from anywhere in the world, with the growth of the latex gloves industry, vastly in mid 1980's complaints are now coming in that there are certain allergies caused by leachable proteins in the rubber products when they are constantly used for long periods of time. However, countries of Asian origin, have not observed any ill effects caused by such proteins although they use such products largely in their day to-day activities more than in European countries. The rubber products that have been used during this period have mainly been infant items such as bottle teats, cot sheets, children's toys and other consumable items used frequently by both children and adults.

There are two (02) main types of allergies reported to be caused by rubber products particularly surgical and examination gloves. They are:

- a) allergic contact eczema (also called type iv response).
- b) contact urticaria (also known as type I response).

However, neither of these allergies is caused by rubber itself. Although type iv response has been known for centuries when vulcanized rubber has been used, and was attributed purely to the presence of accelerator residues in the product. The accelerators causing this problem are identified as thiurams, MBT ZINC di-alkyl dithiocarbamates and dibetanaphthile phenylenediamine. However, proportion of persons reacting to accelerator residue is very low and below 1% of the population. Further, this problem has not caused any severe damages to anyone, except for the irritation caused to those who suffer from it. In order to avoid this problem, peroxide curing method has been discovered as far back as 1930. Later even much better methods based on hydroperoxides and a reducing agent have also been developed and these products did not have the accelerator residues of the above type and hence they were completely free from causing inconvenience to users. Radiation vulcanization is another means by which this allergy could be easily eliminated even in the case of infant products.

The second type known as contact urticaria or type I allergy is believed to be caused by water soluble proteins (EP) and this problem appears to be of recent origin. This has been reported to be a potentially serious problem causing even deaths and it's effect is similar in nature to the systematic reactions to insects or snake sting suffered by certain people. However, complaints of this nature have not been reported from Sri Lanka until now. Further, even though the people working in rubber factories are used to carry bundles of rubber both wet and dry for storage or drying on their bare shoulders and also most of them have the habit of resting and napping on bare-rubber mats in the factories during their rest times; there is not a single case of dermatological problems of the above two types reported by them according to the health records maintained in Estate Dispensaries.

In order to eliminate this problem, action is now being taken by the gloves manufacturers to double centrifuge latex after dilution to minimize soluble protein content and also to wash the end-product with chlorine water prior to packing; which reduces leachable protein levels well below the FDA and USA accepted level of 50 ppm. This can also be eliminated by the use of radiation vulcanized latex instead of sulfur vulcanization. However, there are slight modifications needed in this process of radiation vulcanization to improve the tensile properties of the end-products and to improve their aging qualities.

N-nitrosamines, commonly known as Nitrosamines formed from certain secondary amines used as accelerators of vulcanization of NR have been shown to be carcinogenic. Nitrosoamines are wide spread in the environment, and occur in many food stuffs and beverages and not only in rubber products. Volatile Nitrosamines can be readily detected at extremely low concentrations down to 1ppb and their limits have therefore been included in recent safety legislations. However, it is known that this problem is caused purely by the vulcanizing ingredients, particularly

accelerators. This problem have been completely done away by using accelerators such as Zinc dibenzyl dithiocarbamate or any other dicarbamate that yields non volatile nitrosamines. The only source leading to the formation of nitrosamine now in use, particularly in the latex industry is TMTD. However, the amount of TMTD used to preserve LATZ latices is so small that the volatile nitrosoamines level in the latex products thus produced does not go above the legal limits. But, the NR latex concentrate producers must go for the use of non secondary amine based bactericides as latex preservatives to eliminate this problem completely.

Plastics on the other hand are made from petroleum by-products viz. monomers which are either toxic or carcinogenic or both, eg. vinyl chloride, the monomer used in PVC, is known to be a potent chemical, causing liver cancer. Hence, human exposure to this gas is now limited by law in most countries. Similarly, monomers such as acrylonitrile, butadiene, chlorobutene etc. are also poisonous chemicals and they are mainly carcinogens. Further isocyanates used in polyurethanes are among the most toxic chemicals used in industry. Even styrene used in SBR manufacture cause asthmatic response linked to its inhalation.

Disposal of used or waste plastics of the above types are also of extremely high risky.

Incineration products of most of these materials are highly toxic and can even cause instant death. In European countries, most of the deaths caused by fires have been attributed to the suffocation of the victims to toxic gases released by burning plastics and not due to burns. Most hazardous materials which are commonly found in litter dumping yards are the waste PVC utensils such as pipes, buckets, and films. Incineration of PVC, release the acid gas hydrogen chloride as well as the highly toxic substances known as dioxins and hence the green piece movement is describing PVC as an environmental poison. Among the other synthetic plastics, nitrile rubber and polyurethane liberates hydrogen cyanide on burning whilst neoprene produces hydrogen chloride. These vapors are highly toxic and can even cause instant death due to inhalation. In spite of this, in Sri Lanka these materials are now being used in very large scale in the industry and our traditional natural rubber based foam rubber mattresses and cushions are replaced to a great extent by polyurethane foam. Natural rubber on the other hand being mainly a pure hydrocarbon, releases only water and carbondioxide during burning. However, there is a need to remove carefully and treat other gases, such as oxides of sulphur released by burning vulcanized rubber.

Problem of disposing litter

Rubber in rubber products is re-cycled mostly in the process of manufacture of inferior quality products. Use of reclaimed rubber is on the increase all over the

world. Buffing dust of tyres rejected from retreading factories are incorporated in microcellular shoe sole formulations and in rubber items like carpets. Only the carcasses containing the canvass and the bead-wires which are bio-degradable are thrown away normally. However, projects are underway to utilize this material as the fuel in generation of steam in factories and also in kilns making bricks and tiles. Even the rubber component of these rejected natural rubber based items degrade faster than plastics as they contain nearly 4.5% by weight of natural proteins which absorb moisture thereby accelerating the process of bio-degradation.

Plastics on the other hand, specially films of polyolefin and polypropylene have already become a major threat to the environment in many countries. Dumping grounds where these waste materials have been dumped are covered with plastic films and styro pack which are degrading extremely slowly. Hence, already in Sri Lanka in many urban areas local Government Authorities are severely running short of dumping ground for litter. In the places where quarries and other natural pits have been covered with plastic and polythene waste are not only not available for further litter dumping, but also are completely out of cultivation of any crops for the next two decades at least. Most of these plastics and polythene used widely as packing materials melts into a solid when burnt. But in order to evaporate it completely into carbon dioxide and water even when the polymer is free of toxic additives, a large amount of heat has to be utilized (Fig. 1).



Fig. 1. Polythene menace in the litter

It is therefore, clear that natural rubber is not only ecologically friendly from the point of view of it being a forest tree providing rainforest cover and minimizing green-house effect by converting carbondioxide gas into oxygen; but the natural rubber produced by the *Hevea* tree is far more environmental friendly than the plastics used widely in both developed and developing countries in the world. Therefore, Asian countries must take initiative now itself to reduce the consumption of polyolefins for wrapping purposes and go for cellulose based degradable wrapping material such as paper bags and jute bags for the purpose. Further Asian countries must utilize more natural rubber based products for domestic purposes, such as latex foam pillows, mattresses, cushions, toys and other rubber appliances rather than going for cheaply available environmentally non friendly plastic utensils in order to solve the growing litter problem in the countries while saving the future generations from the growing threat from incurable ailments such as cancer. This will not only ensure health safely for the people but also provide a healthy environment for the people to live and more lands available for cultivation as well.

ACKNOWLEDGEMENTS

The author wish to thank Dr Nihal Samarappuli and Dr N Yogaratnam for helping him in many ways while writing this paper.

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