NATURAL RUBBER AND THE SYNTHETICS

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If one traces the history of the rubber industry it can be seen that upto 1940 there was no synthetic rybber (SR). SR was produced only after the Second World War as a matter of necessity when the flow of natural rubber (NR) to the western countries was interrupted. The demand for rubber became greater and greater with industrial progress and the development of the pneumatic tyre led to the development of the transport industry and with this the demand for tyres was increased tremendously. NR alone was not sufficient to meet the increasing demand for rubber for all uses and a concerted research effort made by West Germany and U.S.A. to produce a synthetic equivalent of NR paid rich dividends. They were able to synthesise a general prupose SR which could be used in the manufacture of tyres.

Rubber is a polymeric material (a chain of repeating units of the same elements in the same proportions) consisting of molecules of one or more monomers (single blocks going to form the polymer) joined together in a long chain in an orderly manner. NR is a homo polymer of cis-isoprene and is synthesised in the rubber tree utilising basic molecules such as carbon dioxide and water in the presence of the sun's energy. The energy used up in the production of NR is much less than in the production of SR. A plantation of rubber trees also enriches the environment by producing oxygen and quite naturally provides other side benefits. As a tree cover it helps in soil conservation providing shade, increasing rainfall and other beneficial climatic effects. Not so long ago, the potential of the rubber tree to provide timber, after adeouate treatment. for the manufacture of furniture and other utilities was discovered in Sri Lanka and popularized in other NR producing countries, specially Malaysia, where it has been accepted as a major breakthrough in rubber cultivation. The slogan now quite often repeated in Malaysia and Thailand particularly is: 'Grow rubber trees for rubber and timber'.

Rubber wood, when properly dried burns well and is therefore a very attractive fuel wood as altenative(sources of fuel are more expensive. It is interesting to note that 80% of all households in Sri Lanka still cook with firewood, in spite of the popularity of kerosene oil and gas in the main cities.

As opposed to this let us look at the SR manufacturing industry. The raw material for the production of SR comes mainly from a petroleum base which is expected to run out with time, whereas NR is produced by a tree and can continue to be produced, so that it is a replaceable raw material. In the process of manufacture of SR, the right monomers (building blocks) have to be selected. The monomers must then be joined together or polymerised under the right conditions to produce the synthetic product with the right package of properties. Research has paved the way for the synthesis of polymers with similar or different monomeric material to give polymers having desirable properties. Thus, we have today, a range of synthetic rubbers to chose from. If one wants to make an oil seal or a petrol hose NR is not the ideal material. Nitrile rubber is more suited in an oily environment. If the rubber product should withstand extremes of heat and cold the silicone rubber is preferable. These are called special rubbers and being special they are very expensive. There are general purpose synthetic rubbers such as SBR (styrene-butadiene-rubber), PB (polybutadiene) and PI (cis polyisoprene) which can be used in place of NR for general purpose applications, including the manufacture of tyres. These are not so expensive as the special purpose synthetic rubbers. In synthetic cis polyisoprene there is a synthetic analogue of NR but it does not have all the desirable properties of the natural product. The preferred product is the natural product in

this instance, but the synthetic rubber manufacturing industry, being one where the product is used by its own parent company (a captive market), the choice of the rubber for conversion into a product is not exclusively governed by price and other favourable considerations. The parent company will use it for the production of tyres or other products it is entrusted in, even if the material is not ideal for those products. This is one of the key factors why NR has found it difficult to compete with SR, as it is not quality alone that counts.

NR is a versatile product. The properties can be changed by chemical modification. It can be made less rubbery and more plastic by a process called cyclisation which is simple and does not involve a large capital investment. Recent research has shown that certain desireable properties such as oil resistance, oxidation resistance and reduced permeability to gases can be achieved by simple chemical modification of the polymer. These are not pipe dreams but they will be realities during this decade. The ingenuity of the rubber tree *(Hevea brasiliensis)* to produce a perfectly engineered natural product with tremendous potential for further modification to encompass a wide sphere of application is truly great, and it is upto the research worker to work out the techniques which will ultimately be of greater benefit to mankind.

If one considers the total rubber (NR and SR) that is produced and consumed in the world today, the contribution of NR is only about 4.5 million tonnes (30%). It must be stated that every kilogram of NR produced has been sold and, considering both technical and economic merit, NR's share has been assessed at about 40%. The difference between the 30% consumed and the 40% which is the potential for its use, represents the choice of the user on the basis of the capitve market. This figure fluctuates from country to country. In Europe, North America and Japan it is about 75% and 25% between SR and NR but in the S.E. Asian Region it is about 50% : 50% and in the important NR producing countries it is about 10% : 90%.

The demand for total rubber will grow as the world becomes more affluent and the question that should be asked is whether the NR supplies could meet this demand. It is important to note that NR and SR have to be used very often in mixes, where the properties of one support the other *i.e.* they are complementary materials. The complimentary role played by NR should be made more effective and its relationship with SR should be both harmonious and productive as neither the SR industry nor the NR industry can afford to weaken this relationship without serious consequences to the socio-economic climate of the world at large. If this is accepted there is no reason why NR and SR should not co-exist for a long time to come. In the absence of one or the other, the total rubber goods producing industry will suffer, because of the lack of certain properties inherent in the missing material.