NATURAL RUBBER – TECHNOLOGIST'S POINT OF VIEW

by

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Rubber Technologists broadly divide rubbers, technically referred to as elastomers, into two groups; General Purpose Elastomers (GP) and Special Purpose (SP) Elastomers. GP rubbers are those used in the manufacture of tyres and consists of Natural Rubber (NR) Styrene Butadiene Rubber (SSR) and polybutadiene rubber (BR). It is possible to produce a tyre, out of 100% NR or SBR, however since strength properties are inadequate, BR is invariably used in blends with either SBR, NR or both.

Tyres consume 70%, 50% and 85% of NR, SBR and BR respectively, produced in the world today. It is also interesting to note that a major proportion of NR that goes into tyres, consists of TSR 20 and RSS. It is very seldom seen that TSR L grades are used. However, there is a demand for Costant Viscosity (CV) rubbers for certain components in tyres.

When it comes to future needs of the tyre industry the past experience shows that economic statistical analysis for future trends are woefully inadequate to predict the needs of this industry or simply they do not correlate at all. This is not limited only to rubber but also to all other commodities eg. iron, cotton, wool or even coffee. Most economists predicted the end of the road for iron with the advent of other metals and composites like Glass Reinforced Polyester (GRP) and also for cotton and wool with the advent of synthetics. But look what has happended now. They have made a come back. What these economists fail to understand is that rubber, like iron and cotton is a basic commodity. An industry called the polymer industry was built up on the strength of Natural Rubber. The versatality of this material led to products which were new and applications unheard of. But process development led to products that took away some of the functions of NR.

But there are certain others that one cannot do without NR. However, one has to bear in mind new producers are entering the market and old ones are modernising. Therefore, just like what happened to the iron and steel industry in the west can happen to the NR producer who does not want to change or to put quality first.

If one takes the tyre industry, let us ask the question what are the consumers demanding for? They are not asking us to produce new forms of rubbers to replace the old ones. But on

the contrary they want us to produce and process the rubbers in the same old manner as sheet or TSR. I say old for TSR because the process was introduced 22 years ago. But what is needed is quality and that itself can sell all your rubbers with the least effort.

Let us examine the status of NR vis–a–vis the synthetic general purpose rubbers. Here we have to compare NR with its formidable opponent SBR. In order to compare SBR with NR it is necessary to select a few basic factors. These factors we have selected are important in tyre performance and manufacture. These are

Wear Resistance
Heat build up
Groove Cracking resistance
Chipping resistance
Ageing resistance
Mixing, Raw Tack and Fast curing properties

Fig. 1 shows that SBR out performs NR in four important qualities including high temperature curing (NR = 100). With the advent of BR performance of both rubbers could be further improved, by blending (Fig. 2) As a result cross ply all synthetic passenger tyres were successfully made. However, developments did not significantly improve the processing properties of SR and hence the incorporation of at least 15% NR in all SR tyres was mandatory even for crossply.

Then came the development of radial ply tyres. The essential feature here was that the tread was made to increase high performance, stability and traction. The side wall was made to absorb more shock and vibrarion by more flexing. In the side was SBR/BR blends used in crossply tyres were replaced by NR/SBR or NR/BR blends. Thus the demand for NR increased with the increase in popularity of radials.

And now that radial tyres are becoming increasingly used in truck tyres also, the position of NR in this industry is suitable for the present and immediate future. However, due to the high performance and longer lasting characteristics of radials the consumption of NR does not show a significant increase even when radialisation is taking place at a significant pace.

This position of NR in the field of radical tyre technology has been further strengthened due to two significant changes which I believe are often overlooked.

1. The use and popularity of steel belted radials in both passenger and truck tyres.

2. The increase in popularity in the use of re-treads (for trucks).

The steel belt require almost 100% NR compounds for good adhesion and retrading calls for faultless carcusses which is mainly determined by state of the side walls of the tyre. In both these instances the quality of NR counts and determined the life span. As is common knowledge that moisture is poison for steel, rubber with low volatile matter is the answer. The

Fig. 1.

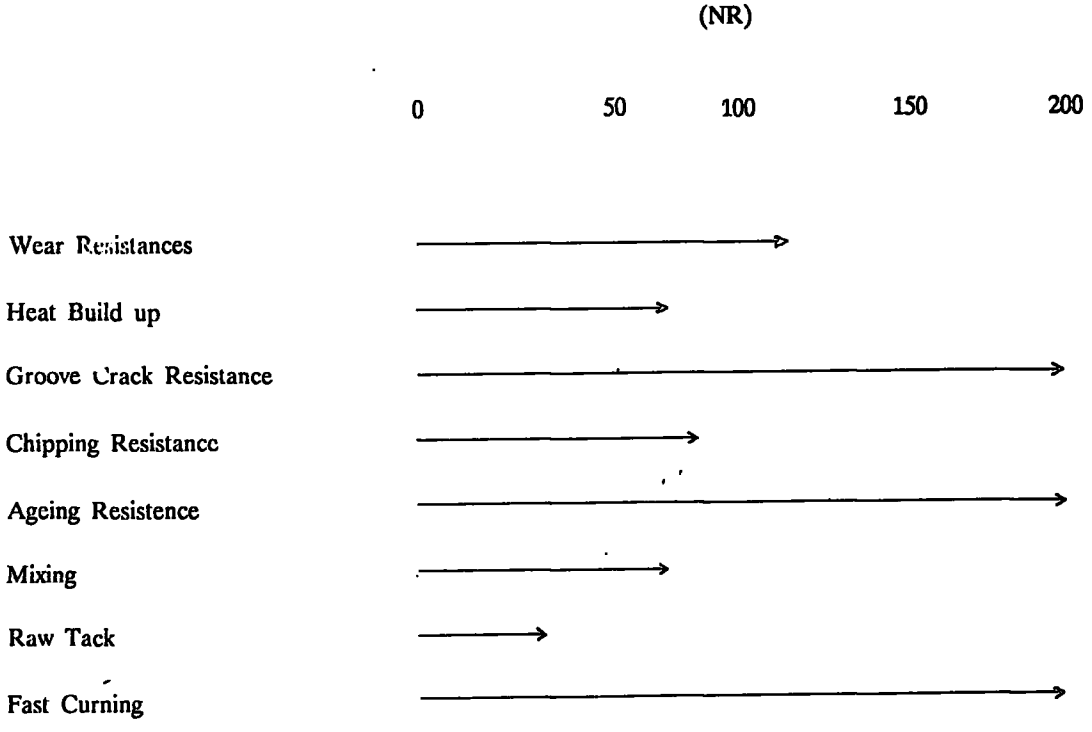
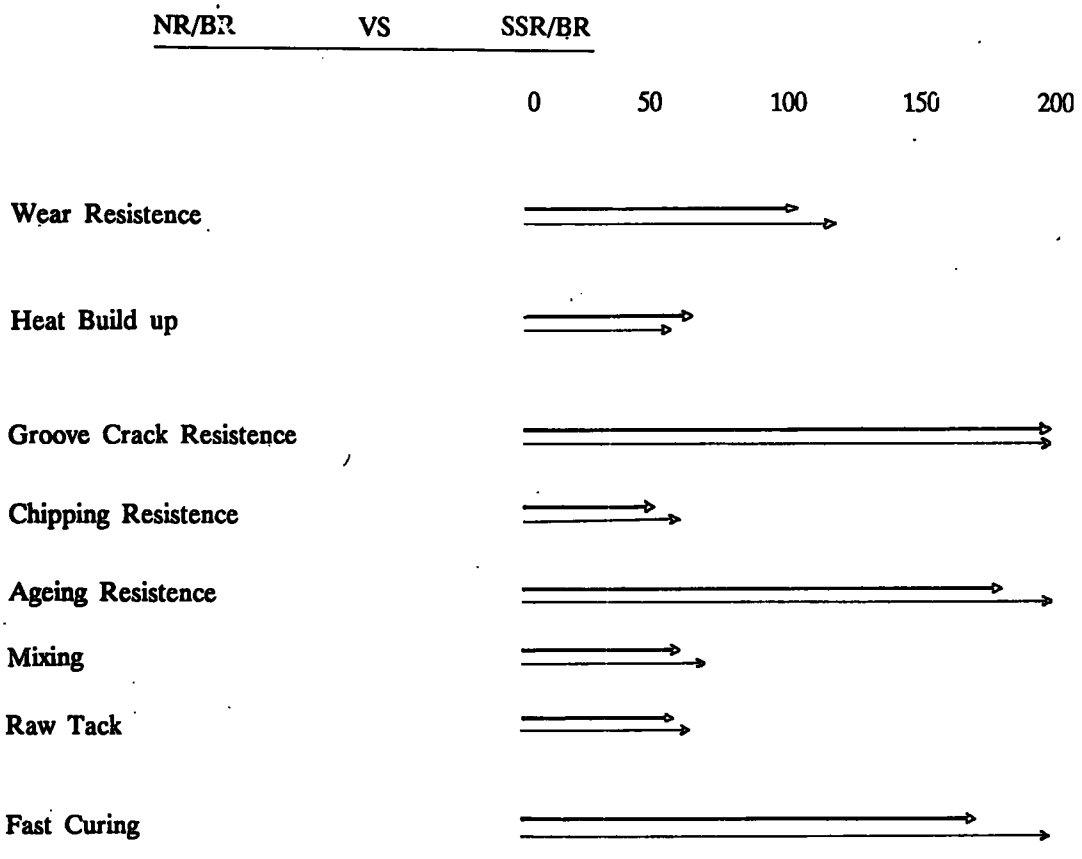

(NR)
0
50
100
150
200
Wear Resistances
Heat Build up
Groove Crack Resistance
Chipping Resistance
Ageing Resistence
Mixing
Raw Tack
Fast Curning

Fig. 2.


NR/BR VS SSR/BR
0
50
100
150
200
Wear Resistence
Heat Build up
Groove Crack Resistence
Chipping Resistence
Ageing Resistence
Mixing
Raw Tack
Fast Curing
NR/BR
50 : 50
SBR/BR
75 : 25

performance of the carcuss is determined by the side walls and hence fatigue resistance of rubber plays a significant role. In general, fatigue resistance of NR is superior to SBR under cyclic deformation. However, there is reason to believe that different grades of NR show significant differences in their performance under fatigue. Indirect evidence for this comes from the following choice of retreads in USA for most preferred tyre casings.

This is published on the European journal Oct 1987 issue under the heading 'US Favour Foreign Casings Table 1.

Table 1. *US Favours Foreign Casings (Most Retreadable Radial Truck Tyres)*

1987 Rank	Vote	Brand	1986 Rank
1	153	Bridgestone	1
2	147	Michelin	2
3	45	Yokohama	5
4	29	Goodyear	3
5	21	Kelly	4
6	19	General	9
7	18	Firestone	8
8	16	Continental	–

Though it is not stated in this journal the reason for this choice I believe it is due to the fact that the first three prefer sheet rubber in their production. If we analyse the buying pattern of the Japanese, they have bought in 1982, 220000 M Tons of RSS (RSS 3) compared to 20000 tonnes of TSR from Thailand. Thus, in my opinion, RSS has the edge over TSR 20, the general tyre grade rubber, probably due to superior fatigue resistance. Furthermore high temperature curing of tyre is gaining acceptance (low cost of production). This is also facilitated by the use of steel in tyres due to its high thermal conductivity. For high temperat ure curing the preferred choice is high PRI rubber and RSS is obviously the best choice. Considering these facts I believe that the demand for RSS is going to last till NR plays a prominent role in the tyre sector, and the supplier should make certain that the consumer is supplied with low volatile matter (moisture) containing, dirt free high PRI rubber for a healthy future for Rib bed Smoked Sheet.

Coming to crepe of course one has to bear in mind that it is not used in the tyre industry. This alone categorises it as a special purpose rubber. Special purpose rubbers are specially made for special applications where optimum use of their inherent characteristics is utilised.

What are the inherent characteristics of pale rubbers ?

1. Light colour.
2. Excellent Tack
3. High Tensile Strength
4. High Tear strength
5. Non Toxicity and
6. Low temperature flexibility (coupled with high tack, tear and tensile strength)

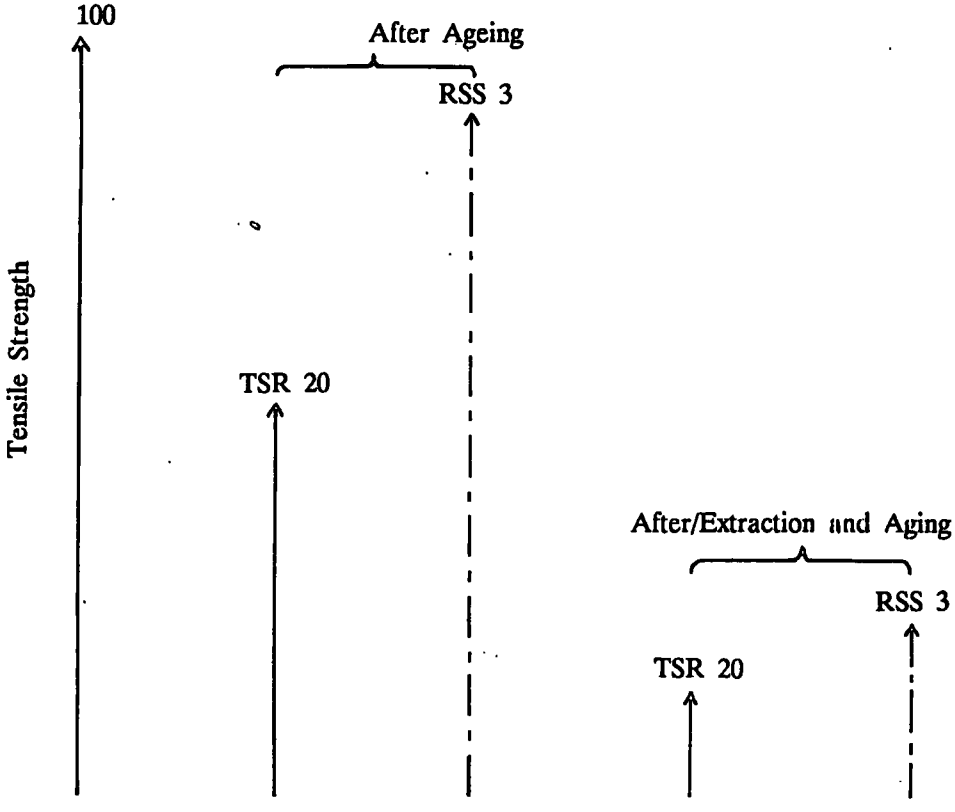
Effect of Non Rubber in NR on Ageing Properties

Bridgestone Corporation, Japan

Tocotrienol

&

Protein



These properties make it an ideal rubber for specific applications as in pharmaceutical products, infant requirements, adhesives and others. However, variability in production processes give rise to difficulties in the use of latex crepe during product manufacture. A very good example is sports shoe manufacture. Sports shoe is a product that comes off the assembly line. All components, canvass upper, sole, foxing tape, toe cap, insoles etc, are put together in an assembly line similar to an auto production line, glued and autoclave vulcanised to get the shoe. This involved large-scale manufacture of each of the components. To deliver the goods, soles based on latex crepe are often cured in 3 minutes. But it so happens, with crepe rubber that due to differences in cure characteristics batch to batch attention has to be given to produce acceptable quality. There are two main defects observed with crepe rubber based, out soles.

1. Undercure and
2. Colour matching

Undercure leads to oversize soles, streched while the sole is pulled from the hot mould and colour matching becomes a problem specially with respect to light coloured and transparent soles.

With respect to how a special purpose rubber such as latex crepe should be marketed, one can quote Nitrile Rubber (NBR). Nitrile Rubber is a special purpose rubber developed for applications where oil resistance is important. This rubber is presented in different forms to satisfy needs of the consumer. Some of these forms are :

1. Low Acrylonitrile,
2. High Acrylonitrile,
3. Antioxidant bound,
4. Powdered NBR, and
5. Carboxylated NBR, to name a few

These grades of the same rubber have a demand depending on the purpose of application. The first two, is by the end use requirement of either low or high oil resistance, the third to satisfy high temperature performance and powdered NBR to improve blending, with (for example) PVC. What is obvious here is that, even a special purpose rubber like NBR which has no competitor in sight, has been modified to suit the consumer. Thus one who (NBR producer) is going to succeed is the one who is in touch with the reality and in this instance the needs and changing requirements of the customer.

A special grade of rubber therefore should be marketed to satisfy customers' requirements and only then can the producer demand a better price for his rubber. We, as latex crepe rubber producers, have not consulted the consumer and have not attempted to produce what he needs. For example I recommended in December 1983 that certain changes should be made in the presentation grading and product type of crepe to aleviate imminent problems.

EXTRACT FROM REPORT ON MARKETING LATEX CREPE RUBBER IN WESTERN EUROPE DECEMBER 1983

RECOMMENDATIONS

(i) A suitable coding system be adopted to differentiate between Unfractionated and Fractionated latex crepe.

(ii) The incorporation of remilled crepe in the latex crepe classification as in the Green Book should be reviewed.

(iii) All efforts should be made to publicise the inherent advantages of our latex crepe rubbers, especially in the Food and Pharmaceutical applications by highlighting the following factors.

(a) Ease of achieving low acetone extract values due to fractionation.

(b) Use of high viscosity clonal latices.

(c) Distinct advantages of colour and its retention due to unique raw rubber processing techniques applied in the latex crepe industry.

(iv) Attempt, should be made to develop and promote new forms of rubbers outside the Green Book.

Eg.

(a) Unfractionated constant viscosity crepe.

(b) Fractionated constant viscosity crepe.

(c) Deproteinised crepe.

(d) Low Mooney Rubbers or Peptized rubbers.

(e) Fractionate unbleached crepe.

(f) Special grade of fast curing rubber (such a grade was available in block form from first fraction rubber of Peenkanda Estate some years ago.)

(g) Presentation of different grades in granular form.

(v) Every emphasis should be made to provide the consumer with uniform quality latex crepe grades. This can be achieved (at least to a certain extent) if an attempt is made with the assistance of brokers and shippers,

(a) to identify the major consumers and their requirements.

(b) to promote liaison by direct dialogue between such consumer and a producer in Sri Lanka.

(vi) Such direct link between consumer and producers can be implemented and effectively promoted by technical and technical evaluation of raw material on behalf of the consumer. This calls for modernisation of processing and testing facilities at the RRISL.

(vii) The presentation and packaging methods should be up-dated to,

(a) Provide clean dirt free rubber to the consumer.

(b) Increase the weight to volume ratio not only to reduce the freight costs, but also with the intention of providing a standard packaging for latex crepe rubber.

If these recommendations are implemented I am certain that we can

(a) Not only sell more latex crepe, but sell it at a higher price,

(b) sell latex crepe rubber as a prime grade of rubber, which it is and make it the basic for developing the strategy for the sale of all Sri Lanka rubber.

On the other hand if these suggestions are not implemented the present indications are that we will lose a great part of our latex crepe market. This has happened to some extent already.

Unfortunately, not much attention was paid to this report at the time. However, some of these recommendations are still valid and together with suggestions that would be at this forum let us hope we are still not late to revive this industry.

Finally I wish to thank the Secretary General Mr Sepala Illangakoon and the Planters Association of Ceylon for giving this opportunity to present my views at this forum.