

QUALITY ASSURANCE FOR CONSISTENCY

by

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Marketing has been defined as the process of producing the right product to sell to predetermined buyers whose needs are understood by the producer, and of course selling profitably. This, in essence, is producing to meet a demand rather than to sell what is produced. The advantages of this concept becomes more apparent where competition to sell is severe and the buyer is in a position to have a better selection to suit his requirements. To achieve this a product should be manufactured in the quality or specifications required by the consumers. These requirements of the consumers vary from individual to individual, firm to firm or from one geographical area to another, It is therefore, important to first obtain and study such information before deciding on the process flow line and the required quality control programme.

Today more than 80% of the Sri Lankan raw natural rubber is produced in the form of sheet and crepe rubber and are sold on visual grading. This is done according to the standards of quality fixed by the trade in consultation with the producers more than three decades ago and appear in what is called the Green Book. In this system of grading, rubber may be downgraded if one or more of the following are observe in sheet rubber: reaper marks, dark colour, rust, glossy surface, flat roller prints or air bubbles. In crepe rubber : dull colour, mottled appearance, streaks etc. Precautionary measures to eliminate all these defects are well documented, therefore need no further explanation.

Careful examination of this list indicate that all these defects are based on the visual appearance of the material. There is some justification for penalising for these visual defects, as they would not have occurred if standard method of manufacture has been followed. However, this system tells the buyer only one fact; that is, the rubber is manufactured under very carefully controlled hygenic conditions. We are now beginning to understand that the present day consumers ask for more information of the material than only the cleanliness in our manufacture. The recent report from Japan on our sheet rubber is a case in point. There are mixed views on this report, however, one thing is clear; the high - tech industry call for better control of the properties of the raw material. This is because the consistency is very vital in the properties of the final product which is well specified. It is also important to avoid undue scrap which leads to higher profitability.

The Japanese report claimed that the Sri Lankan sheet rubber is harder than that from Malaysia and Thailand. This statement has been made due to the higher Mooney viscosity value obtained for Sri Lankan sheet. Mooney viscosity relates to an inherent property of polymer molecule, which is the molecular weight. In the rubber product industry, the rubber should be milled down to a particular viscosity to achieve a good homogeneous mixing of the chemicals and if the viscosity of the starting raw material is higher, more energy is consumed in the milling operation. In an industry where economics in energy is searched continuously, this is not accepted.

The green strength of the mix is a property important in many factory processes and in bulding operations where distortion before vulcanization should be avoided. The most frequently quoted application where good green strength is needed is in the building of radial tyres. Higher viscosity rubbers give higher Green strength compounds. Further better extrudates are obtained if a rubber with higher viscosity is subjected to more milling. In other words, products with better properties may be obtained if started with a high viscosity rubber but at high cost of production.

There is a demand, therefore, for both low and high viscosity rubbers but obviously the demand for the rubber with low viscosity is higher. The major producers, therefore, had given more attention to manufacture rubber with low Mooney viscosity. But Sri Lanka not necessarily should follow the same pattern, being a small producer, we could continue to cater to the consumers requiring harder sheet rubbers once this market is identified.

It is well known that Mooney viscosity of rubber is a clonal characteristic which is the reason for high viscosities in Sri Lankan rubber than Malaysian and Thai sheets.

Country	Clone	Mooney Viscosity
Sri Lanka	PB 86	76
Malaysia	RRIM 600	57
Thailand	GT 1	65

Raw natural rubber tends to harden spontaneously by a phenomena called storage hardening, leading to a rubber which is difficult to process. This hardening of rubber could be almost completely suppressed by adding chemicals to latex prior to coagulation. The resulting rubber is called constant viscosity (CV) grades. This allows consistency in viscosity.

The Japanese report also complained that the moisture content of Sri Lankan sheet is higher than Malaysian or Thai sheets. Even though such a generalisation should always be challenged, the bad effects of high moisture on mastication and other properties should not be ignored. It is told that some sheet rubber (not necessarily from Sri Lanka) has moisture as high as 2.5% when reaching the final destinations. High moisture can be due to the higher thickness and irregular thickness of the sheets since the rate of drying depends on the thickness. The bad

conditions of the rollers, insufficient rolling capacity and the use of uneven and irregularly shaped coagulating pans are some of the causes for higher thickness or uneven thickness in the sheets. A survey carried out by the Rubber Research Institute in 1982 has revealed that about 55% of the rollers used by the small holders are defective. More than 1000 units of the 7500 visited did not have a smooth roller, hence used a bottle to press the coagulum which results in uneven thickness in the sheet. High moisture content can also result due to insufficient drying as a result of using defective smoke houses or inadequate smoking capacity. The same survey has revealed that a fair quantity of sheet is dried over a kitchen hearth or partially sun dried and sold for smoking in a smoke house. It is therefore, understood that this problem of high moisture in sheet is due to lack of good and sufficient facilities. It is advisable to set up centres such as GPC'S or encourage such private centres so that sheet could be manufactured with better supervision and with better facilities. The setting up of their own washing and drying facilities by the exporters should be encouraged as a final precaution to avoid shipment of undried sheets.

Drying of rubber to a moisture content below an acceptable level is a problem associated with all grades of dry rubbers. In the case of both crepe and block rubbers, an important factor in conditioning the rubber for proper drying is the shearing efficiency applied in the mills. Good creepers with the recommended groovings and gear ratios are essential in order that the rubber is sufficiently sheared. The number of passes given to rubber also determine the drying characteristics. The thickness of the crepe lacc and the crumb size in block rubber manufacture also play a major role in bringing about improvement in drying rate. All these are governed by the milling process, and condition of the mills.

Inconsistency is a complaint made against natural rubber very often. One may think that an introduction of a technical specification system as in block rubber will eliminate such an inconsistency. However, I would like to draw your attention to a paper titled "Mother nature can fool you" read at a conference in U. S. A. recently. Data were presented in this lecture comparing SMR CV - 60 rubber received from three different factories, over a period of four years. The comparison has been made on cure rate on an ACS -1 formulation. The study has demonstrated differences among the rubber from the three sources even though all fell into the TSR specifications. The difference from one source was so wide that the company who undertook this study decided to terminate business with this factory. This clearly indicate that what guarantees the consistency in processing characteristics in SMR scheme is not merely the test certificate but the size of these factories. However, the test certificate also does serve some purpose in allowing the consumer to choose its raw material so that claims are avoided or minimised. Therefore central factories is the best solution to inconsistency. But both State Plantation Corporation and Janatha Estates Development Board have made huge investments during the last few years to develop the crepe rubber factories of average size of 1.5 - 2.0 t per day. Therefore alternative methods for maintaining quality consistency should be looked into. However, the importance of centralisation should be kept in mind in future investment programmes.

All grades of natural rubber except latex crepe has only inherent property variations. But various steps undertaken by the pale crepe factories to achieve the white colour, contribute widely to variations in its properties. For example any variations in the amount of fractionation

and the addition of the bleaching agent affect almost all the properties of the rubber. Use of oxalic acid instead of formic acid in the coagulation tend to increase the rate of storage hardening. Number of passes and the gear ratios of the mills affect the crystallisation rate of the rubber. The temperature of drying may have an effect on the Mooney viscosity due to the different rates of storage hardening. Therefore more inconsistency in batches could be expected in crepe rubber than any other form inferring that the present method of selling it, only on visual grading, is most unsuitable.

One way of assuring quality consistency is by presenting tailor made crepe rubbers with the properties to suit the end users. For example, there are restrictions to the materials used in the rubber products in pharmaceutical and food industry. In the rubber that is used in this field, acetone extract value should be less than 3.5% w/w and it should be free from chemicals such as boric acid, para nitrophenol and sodium pentachlorophenate. Further high level of cleanliness and freedom from mould is of vital importance in this area. Even though the regulations control the acetone extract value at 3.5% w/w, much lower values could be obtained according to individual requirements. The crepe rubber that is prepared by taking a fraction but without bleaching, satisfy all these requirements and therefore could be promoted in this area. In the adhesive industry, natural rubber finds its application as a solution or suspension. However, to make a good impact in this field it is important to make consistency in properties in the rubber solutions; that is gel content and solution viscosity. By controlling the fractionation and bleaching, rubbers with gel content and solution viscosity values suitable to individual consumers could be prepared, once such information is received. The consistency in these properties could be further guaranteed by introducing constant viscosity. In other light coloured products such as rubber bands, transparent shoe soles, floor tiles etc., each application may have a different processing requirement. For example in a cut thread factory, a rubber with a uniform viscosity to control the die swell and good colour retention properties is important. A product such as surgical sheets which involves calendering into extremely thin sheeting with no specks or pinholes or other irregularities requires a rubber with zero gel content. In both the above applications, fractionated and bleached rubber will perform well. In the manufacture of floor tiles, long term colour matching is an important property. Another consumer may prefer less variations in cure properties than the uniformity in viscosity or colour, in which case a product with whole latex is the best. Rubbers with any specific cure rates could be prepared by chemical treatment for those consumers. Low moisture absorption and low susceptibility to mould could be exploited to promote DPNR in such applications. In addition to the quality requirements as discussed above, if the quantity requirements of the consumers are also known then it is possible to select more than one estate depending on the quantity, and lay down a method of manufacture so that a uniform product is obtained from those selected estates to a selected buyer.

It is not possible, anyhow, to sell all the 45,000 t of crepe rubber in this tailor made form at least in the foreseeable future. There are consumers who may prefer to buy according to the present system, their deciding factor is the price. For the rubber that is sold in the present system the inconsistency could be minimised by practising a standard method of the manufacture in all such factories.

The method of manufacture, that is fractionated and bleached (FB) or unfractionated and bleached (UFB) could be mentioned in the invoices to avoid mixing. It is also known that sole crepe cuttings behave differently to other latex crepes specially in the rate of mill breakdown which in turn affect the extrusion behaviour. Therefore, it is advisable to grade sole crepe cuttings under a different name and perhaps in a different physical form.

Another way that the already installed machinery could be utilised is to consider the possibility of blocking the laces in a central factory. Such a block rubber will fall into TSRL specifications, however if required a new scheme of specification as suggestion in table 1. could be worked out. The central factory should buy the laces on forward contracts from selected estates rather than in auctions so as to maintain the consistency. The crepe laces may be selected with or without fractionation as specified by the central factory. Addition of the bleaching agent could be avoided. (If necessary the acid for coagulation could be changed to the system used in the block rubber manufacture.)

Table 1. *A specification Scheme for latex crepe.*

	Latex Crepe (1 x, 1)	TSR - L
Dirt (%)	0.015	0.015
Ash (%)	0.10 - 0.15	0.20 - 0.30
Nitrogen (%)	0.20 - 0.35	0.35 - 0.45
Colour	1.0 - 1.5	3.5 - 6
Volatile matter (%)	0.20 - 0.30	0.25 - 0.45
Wallace plasticity	50	44

Sole crepe plays an important role in the Sri Lankan raw rubber industry. Analysis of sole crepe samples from some sole crepe factories are shown below. It is observed that the remilled sole crepe has a lower hardness and tend to have higher specific gravity than fresh samples. (Table 2)

Table 2. *Properties of fresh and remitted sole crepe*

Factory	Product	Hardness	Specific Gravity
1	Fresh	40	0.93
	1st cutting	33	0.93
2	Fresh	40	0.88
	1st cutting	35	0.91
	2nd cutting	32	0.92
3	Fresh	35	0.85
	1st cutting	30	0.89

The higher specific gravity which indicate better packing of the molecules may be the cause for differences in colour and hardness of the remilled sole crepe. Therefore until a method could be developed to eliminate this effect it is not advisable to include the remilled

sole crepe in the same pack. However if there is no visual difference in colour, there is no harm in using remilled sole crepe factories. In such case proper supervision is required to control the number of remilled laces in a matt to maintain uniformity.

This talk will not be complete if the steps in quality control in centrifuged latex is not mentioned. To maintain best quality in centrifuged latex-the following steps should be very carefully monitored and managed.

1. Proper preservation of latex both in the field and factory. Early addition of the preservative system will inhibit bacterial growth.
2. Latex of DRC below 25% is not satisfactory for processing into concentrated latex.
3. Removal of sludge is important to improve quality and efficiency of centrifuging.
4. If magnesium is present in latex it should be removed by chemical treatment.
5. It is important to check the quality of latex at various points of the process, specially the volatile fatty acid content.

Due to the importance in early addition of the preservative system to field latex, best quality centrifuged latex could be obtained if the latex of large estates are used. Use of very clean utensils through out the process is also very important to avoid bacterial contamination.

In the case of special rubbers it is important to enforce a control over the production and the marketing methods to ensure that the standards are maintained in exports. If this is not done, a single shipment below the requirements will destroy all the initial efforts. Such control should include registration of all the producers, production only under RRI supervision following uniform method of manufacture.

All what was said in assuring the quality of the rubber is of no use if few basic important steps are neglected. Therefore before concluding I will briefly mention them.

1. Use of clean utensils.
2. Use of clean good quality water and insufficient quantities.
3. Straining of latex through a proper mesh.
4. Use of good quality chemicals.
5. Milling the coagulum without delay.

6. **Maintenance of machinery and factory in proper conditions. Proper maintenance of machinery could only be realised by enforcing a programme of preventive maintenance. For example in a block rubber factory intensive cleaning of the drier on a routine basis is required to prevent black spots on the light coloured bales. Selection of proper fuel is also important in these machinery.**

The rubber that is prepared with all these precautions should be packed to avoid dirt and mould contaminations.

CONCLUSIONS

1. **It is important to first obtain and study the information regarding the required quality of the raw rubber by the overseas consumers.**
2. **The High – Tech industry now calls, for better control of the properties of the raw rubber than only the visual defects.**
3. **The high viscosity in Sri Lankan rubber is a clonal characteristic. This should be used to our advantage.**
4. **More emphasis should be given to extension work on processing aspects.**
5. **Clean utensils and machinery in good condition should be supplied and used.**
6. **Need for central processing should be kept in mind in future investment programmes.**
7. **More emphasis should be given for marketing of tailor made rubbers.**
8. **A standard method of manufacture for all types including new special rubbers should be followed.**