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AVAILABILITY OF NATURAL RUBBER IN TECHNICALLY SPECIFIED FORMS BY 2000 A.D. AND THEIR OPTIMUM USE *

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INTRODUCTION

The rubber products manufacturing industry like any other industry in the country must face the realities of modern technology with a view to ensuring its healthy development. In this connection, it is important to mention that modern technology ensures quality both in respect of modern materials and consistency. It is only in appropriate to ensure that natural rubber (NR); which is the most important raw material used by the rubber products manufacturing industry in India, is made available to the industry as modern materials in technically specified forms guaranteeing quality and consistency in quality. Recognising this, the Rubber Board has been striving hard to modernise the processing and presentation of NR produced in the country, in order to make available NR as technically specified modern materials, guaranteeing quality and consistency in quality with the help and assistance of the Bureau of Indian standards. As a result, about 5.8% of the total NR produced in the country today is now processed and marketed as modern materials. The details regarding the various forms in which 297,300 M.T of NR produced in the country during 1989-90, is made available to the industry are given below:-

Forms of NR	Quantity in M.T	% of the total production
Conventionally processed and visually graded sheet rubber	207,180	69.69
Conventionally processed and visually graded crepe rubbers	36,050	12.12
Latex concentrates	36,910	12.42
Technically specified block rubber and Speciality rubbers	17,160	5.77
Total	297,300	100.00

From the above figures, it can be seen that there is a clear need for accelerating the efforts directed towards modernising processing and presentation methods of NR produced in the country with a view to ensuring that NR is made available to the rubber goods manufacturing industry in the country as modern materials guaranteeing quality and consistency in quality. Therefore, it is only appropriate to discuss the strategies being taken by the Rubber Board in increasing the availability of NR as technically specified modern materials with a view to finding out the availability by 2000 A.D and the areas where they can be profitably used as against conventionally processed and visually graded forms of NR.

PRODUCTION OF NR AS MODERN MATERIALS

As a result of the extensive and intensive R & D efforts of various research organisations in the major NR producing countries, a number of technological advances are made in the processing and

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presentation of NR as modern materials. The most important among these advances, is the development of new processing methods which allow NR to be presented as

* Well defined grades with levels of contaminants specified for each grade

* compact blocks, neatly wrapped with polythene combatible with rubber

* technically specified material of assured uniformity and consistency in quality

* small bales which can be easily handled, transported and stored

* an industrial raw material offering assured processability and value for money

The new process involves the conversion of the rubber in the latex and/or in the scrap forms, into granular forms, in contrast to the sheets or crepes of the conventional processes, principally as an aid to rapid and efficient drying, but with advantages also in that properties could more easily be controlled by chemical treatments. The granules after about four hours drying at about 100°c is pressed into small blocks and wrapped in light polythene. The resulting block rubbers are technically specified adopting the standards fixed by the Bureau of Indian Standards, which are evolved mainly taking into consideration the requirements of the rubber products manufacturers. The BIS have specified now six Indian standard Natural Rubber grades, namely ISNR-3CV, ISNR-3L, ISNR-5 ISNR-10, ISNR-20, AND ISNR-50. The specifications fixed for each grade are given below:-

Physical and Chemical requirements for NR

Sl.No.	Characteristic	Requirements for					
		ISNR 3CV	ISNR 3L	ISNR 5	ISNR 10	ISNR 20	ISNR 50
1.	Dirt content, % by mass, Max	0.03	0.03	0.05	0.10	0.20	0.50
2.	Volatile matter, % by mass, Max	0.80	0.80	0.80	0.80	0.80	0.80
3.	Ash. % by mass, Max	0.50	0.50	0.60	0.75	1.00	1.50
4.	Nitrogen, % by mass Max	0.6	0.6	0.6	0.6	0.6	0.6
5.	Initial plasticity	40+5	30(Min)	30(Min)	30(Min)	30(Min)	30(Min)
6.	Plasticity Retention Index (PRI), Min	60	60	60	50	40	30
7.	Colour (Lovibond scale), Max	–	6.0	–	–	–	–

Technical specification is done by taking samples from selected bales representing each lot and testing for the various parameters mentioned in the specification. After ascertaining the grade, the blocks are packed in high density polythene bags marked with the grade and net weight. Each bag contains two blocks of 25 kg each. It is obligatory on the part of the producer of any form of Technically Specified Natural Rubber (ISNR) to grade and market his produces in conformity with such standards as are specified by the BIS from time to time.

It is now widely accepted that TSR is the rubber for tommorrow. The Rubber Board has drawn up an ambitious programme to enhance the production of TSR in a phased manner so that by the turn of the century, 100,000 M.Tonne of NR will be in the form of TSR. While striving hard to achieve this target, it is equally important to take proper care to ensure that when TSR is produced in bulk, quality standards are continued to be scrupulously followed and further improvements and rationalisation are also brought about. To bring about this, the Rubber Board has already provided the required infrastructural facilities.

The measures include, technical control in the production of new process rubbers by individual processors. All the factories producing technically specified rubbers are inspected periodicall by the Specification Officers of the Board and officials of the Bureau of Indian standards and samples are drawn, tested and certified by the Rubber, Board. Also, all these units have either their own laboratory or arrangements for testing and certification by an approved outside laboratory. Thus, every bale of TSR marketed in the country will be guaranteed for its quality and the rubber goods manufacturers can take advantage of this position. Also the Board runs courses to train personnel in quality control of technically specified rubbers besides providing advisory services to assist producers in factory operation and laboratory testing and certification.

The development of new processes for production of the above referred technically specified rubbers, has also opened the door for further improvements in the processing and presentation of NR as speciality rubbers that can meet the special requirements of the rubber consumers. The important speciality rubbers thus developed and which are having great significance and relevance to the rubber based industrialisation of the country are the following:-

* General Purpose Rubbers
* Superior Processing and Process Aid Rubbers
* Grafted Rubbers
* Deprotenised Rubbers
* Cyclised Rubbers
* Oil Extcnded Rubbers
* Epoxidised Rubbers

The salient features of these speciality rubbers are the following:-

GENERAL PURPOSE RUBBERS

These are viscosity stabilised rubbers meant for large volume application such as in tyre, conveyor beltings and hose pipes manufacturing. These rubbers are produced from a blend of deliberately coagulated latex rubber (a minimum of 40% by weight) and field coagulum. The parameters suggested for this grade of rubber are as follows:-

Parameters		Specification limits
Dirt content	(%) max	- 0.10
Volatile matter	(%) max	- 0.80
Ash content	(%) max	- 0.75
PRI	min	- 50
Nitrogen	(%) max	- 0.60
Mooney Viscosity ML (1+4)	100°c	- 65±7
Accelerated storage hardening Δ P (max)		- 8units

SUPERIOR PROCESSING / PROCESS AID RUBBERS

These are rubbers prepared by coagulating a blend of prevulcanised rubber and normal latex. SP Rubbers contain 20% vulcanised rubber and 80% unvulcanised rubber whereas Process Aid rubbers generally marketed as PA-80, contains 80% vulcanised and 20% unvulcanised rubber. The advantage of SP Rubbers are in the manufacture of extruded and calendered products for obtaining better finish, lower die swell and higher dimensional stability.

GRAFTED RUBBERS

Grafted rubbers are produced as Methyl methacrylate and/or as styrene grafts. The Methyl methacrylate grafted rubbers are known as MG rubbers. These rubbers consist of polymethyl methacrylate chains grafted to the natural rubber molecule and are produced in two grades, MG-30 containing 30% and MG-49 containing 49% polymethyl methacrylate. They are mainly used as self- reinforcement elastomers and in adhesives. The styrene grafted rubbers consist of styrene molecules grafted to the NR molecule and the graft can be used in place of high styrene SBR type of synthetic rubber.

DEPROTENISED RUBBERS (DPNR)

DPNR is a highly purified form of NR with low non-rubber contents. Due to the low non-rubber contents, water absorption of DPNR is very low and hence its electrical properties are better.

CYCLISED RUBBERS

The hard resinous materials obtained when NR is treated with acidic reagents such as con.sulphuric acid, paratoluene sulphonic acid etc. is known as cyclised rubber. This material can be blended with NR to produce vulcanisates having high hardness and good technological properties.

OIL EXTENDED RUBBER (OENR)

Natural rubber extended by suitable type of petroleum oils like Naphthenic or aromatic oil, is known as OENR. OENR reduces or dispenses the use of peptisers in rubber compounding and reduces the crystallisation tendency of rubbers at low temperatures. Normally OENR contains 10-25 parts of oil.

EPOXIDISED NATURAL RUBBER (ENR)

ENR is a chemically modified form of natural rubber prepared by the in situ epoxidation of natural rubber in the latex stage using formic acid and hydrogen peroxide. Compared to natural rubber, ENR has high oil resistance, less air permeability, better wet skid resistance and low rolling resistance. The potential applications for ENR are in tyre industry for the manufacture of passenger car tread, motor cycle tyre tread, tubeless tyre inner liners, inner tubes, adhesives, oil seals, gaskets, etc.

FACILITIES AVAILABLE AT PRESENT FOR PRODUCTION OF TECHNICALLY SPECIFIED NR GRADES

There are at present 22 factories producing technically specified block rubber and during 1989-90 these factories produced a total quantity of 17160 M.Tonne of ISNR grades. Out of this 22 factories, 6 factories are in the co-operative sector, 3 in the public sector and 13 in the private sector. Also the installed capacity of these 22 units is estimated to be 37200 M.Tonne par annum and the average capacity utilization during the year 1989-90 was only about 46%. The poor capacity utilization is due to several factors such as lack of availability of raw materials, disruption of power supply, labour absenteeism and/or unrest.

Though the response for the adoption of the modern processing methods was initially poor in the country, the situation has changed in recent years and as per the information available, about 24 licences which include 5 public sector units and 19 private sector units, have already been issued by the Rubber Board during the last two year. The installed capacities proposed for these 24 units are estimated to be of the order of 37800 M.Tonne. Based on the licences already issued, it would appear that most of the new units may be set up in the next two to three years and thus there will be a total installed capacity of over 75,000 M.Tonne of TSR by 1994-95. Also assuming that atleast two new units each having an installed capacity of 2500 M.Tonne per annum would be set up during the 9th plan period, the installed capacity for production of TSR can be estimated to be of the order of 100,000 M.Tonne per year by 2000 A.D. The year- wise figures of production projected during the period 1990-'91 to 1990-2000 are given below:-

Estimated production of Technically Specified Rubbers from 1990-91 to 1999-2000

Year	Estimated production of TSR (in M.Tonne)
1990-91	20,000
1991-92	25,000
1992-93	37,000
1993-94	48,000
1994-95	56,000
1995-96	64,000
1996-97	73,000
1997-98	81,000
1998-99	90,000
1999-2000	100,000

Besides producing the ordinary grades of technically specified rubbers for which BIS standards are already available, it is to be mentioned that steps are also underway for the production of speciality rubbers in the country. Already two units have been set up for production of PA-80 rubbers and four of the co-operative factories have already started production of GP rubbers. A new factory of 10 tonne per day capacity of GP rubber also is being set up by a company sponsored by the Rubber Board and the Rubber Producers' Socleties and the factory may start production early 1991. In respect of other speciality rubbers already mentioned, the Rubber Board has already taken steps to standardise the procedure for their commercial production and production of sample quantities for supply to selected consumers. If the response to these speciality rubbers is found to be enthusiastic, new units for the production of all these speciality rubbers may be set up in the years to come and by 2000 A.D, it may be possible to make available atleast some 10,000 M.Tonne of speciality rubbers.

OPTIMUM USE OF TECHNICALLY SPECIFIED AND SPECIALITY RUBBERS

It is well established that technology improvement in the case of rubber goods manufacture centres around mostly on the designing of the rubber compound for each product and on the selection of the right type and grade of polymer for the right product. Since NR is the main polymer available in India for the manufacture of rubber products and bulk of the NR Produced in the country is made available as visually graded sheets and or crepes which lack uniformity, there is a case for making available well defined grades of NR with technical specifications to rubber goods manufacturers with provision of after sales services to enable them to take right decisions on the type and grade of NR to be used for individual applications. Recognising this fact, the Rubber Board has already taken steps for increasing the production of different grades of technically specified rubbers and speciality rubbers and made arrangements for the provision of after sales services to consumers wherever required. Rubber goods manufacturers can take advantage of these efforts by interacting closely with the Rubber Board. However, it is felt that it will be worthwhile to give some tips for the optimum use of different grades of technically specified rubbers and speciality rubbers for enabling the rubber goods manufactures to pick and choose the right type and grade of rubber for the right product. The tips for optimum use of the different grades are given below:-

ISNR-3CV

This grade of rubber can profitably be used in all applications where superior dynamic properties are required. For instance, in aero tyres, steel belted conveyors and engine mounting, the use of this grade of rubber can ensure reduction in energy consumption in mixing and compounding.

ISNR-3L

This grade of rubber being a pure light coloured material can be the best choice for the production of all coloured products particularly light coloured and transparent articles. The specific products for which this grade of rubber can be made optimum use of are pharmaceutical closures, high grades of footwears, hot water bottles and surgical sundries, chlorinated rubber, white side wall of tyres, rubber tubings and hospital sheetings.

ISNR-5

This grade of rubber can effectively substitute RMA IX & I in all applications with cost benefit. The specific areas where this can be profitably used are production of automobile tubings, high grade conveyor belts, and moulded and extruded products requiring high dynamic properties.

ISNR-10

This grade of rubber can effectively substitute RMA III and IV and EBC IX. The areas where this grade of rubber can be made optimum use are tread and carcass of automobile tyres, cycle tubes, conveyor belts, hoses, and black moulded and extruded products.

ISNR-20

This grade is preferred for the production of automobile tyre components particularly the tread and carcass due to techno-economic considerations. The specific areas where this grade of rubber can be made optimum use are the following:-

(1) production of the tread and carcass of automobile tyres

(2) Manufacture of off the road tyres, ADV tyres and cycle tyres

(3) Production of black coloured moulded and extruded products.

ISNR-50

This grade of rubber is preferred for use in the manufacture of cheap products requiring low service properties. The products where this grade of rubber can profitably be used are cheap footwear items, cycle tyres, hand made hoses, floor tiles and black moulded and extruded products requiring low service life.

GP RUBBERS

This grade of rubber is ideal for use in large volume applications. By the use of this grade of rubber in the production of tyres, the practice of blending of sheet grades with estate brown crepes, remilled crepes etc. for cheapening the compound, could be avoided. Since the viscosity of rubber is stabilized in GP rubbers, there is no need for premastication. Also the uniform consistency in viscosity enables better processability. The savings in energy by the use of GP rubber can be substantial. Also use of GP rubber reduces the need for continual factory process adjustments among batches resulting in a lower reject for the final product. The specific products where GP rubber can be used with cost benefits are (1) Automobile tyres (2) Conveyor belts, particularly steel belted conveyor and (3) Hoses.

SUPERIOR PROCESSING RUBBERS

The grades of rubber coming under this category, are preferred for the manufacture of extruded and calendered products because in such applications, better finish, lower die swell and higher dimensional stability are warranted. Therefore, for the manufacture of extruded and calendered items requiring better finish and dimensional stability these grades of rubber are recommended.

GRAFTED RUBBERS

These grades of rubbers can be used profitably as substitutes for high styrene rubbers and/or for use as self-reinforcement elastomers and also in the manufacture of adhesives.

CYCLISED RUBBERS

This rubber can be blended with NR to produce vulcanisates having high hardness and good technological properties.

OIL EXTENDED NATURAL RUBBER (OENR)

OENR can be profitably used for the production of tread of passenger car tyres since tyres produced from OENR based tread shows improved skid resistance.

DPNR

DPNR being a highly purified form of NR, is the ideal for electrical applications and for the production of medicinal stoppers where purity is very important.

EPOXIDISED RUBBER

Epoxidised natural rubber have high oil resistance and less air permeability and hence are preferred for use in oil seals, O-rings, gaskets, diaphrams and also in place of butyl rubber.

CONCLUSION

The technological advances already made in the production of NR in technically specified modern forms, geared to meet consumer requirements, are very relevant and important for the healthy development of the rubber products manufacturing industry in the country. Recognising the situation, the Rubber Board as a part of a planned modernisation programme, is striving for modernisation of processing and presentation of NR. As a result, it is expected that by 2000'A.D it will be possible to make availabale substantial quantities of technically specified rubbers and speciality rubbers for use of the rubber goods manufacturers in the country. The rubber goods manufacturing industry must appreciate this fact and should make sincere efforts directed towards translating the new developments and the efforts made by the Rubber Board into application, thereby helping the industry to make optimum use of the technological advances made in processing and presentation of NR

Rubberised Coir Industry

Soon after the IInd World War, the rubberised coir industry originated in Austria. In the following years it spread to other parts of Europe and the world. In India, the rubberised coir industry entered in the field of coir industry in the early 1960's. Now, in India, there are about 25 rubberised coir producing units. These units are producing about 8000 tonnes of rubberised coir products valued at nearly Rs. 33 crores.

Rubberised coir finds the following end applications.

a) Domestic upholstery – mattresses and cushions.

b) Industrial cushioning – Bus seats, Automobile cushioning, Railway seats.

c) Air filteration in Industries.

d) Industrial packaging.

e) Carpet underlays.

f) Acoustic insulation.

The domestic upholstery sector constitutes more than 75% of the sales of Rubberised Coir Industry. In India there is still ample scope to treble the sales of rubberised coir mattresses.

The Industrial cushioning sector constitutes about 15% of the total sale of rubberised coir products. It is mainly dominated by latex foam rubber and Ployurethane (PU) foam.

In the light of various independent surveys made by the industrialists, they found that there is still ample scope to increase the sales of rubberised coir products in India. According to them, the estimated potential demand is in between 20,000 tonnes and 30,000 tonnes valued at about Rs. 70 crores to Rs. 100 crores.

Rubberised Coir Industry is highly technologically intensive. Automatic machinery is completely used in the different process of manufacture.