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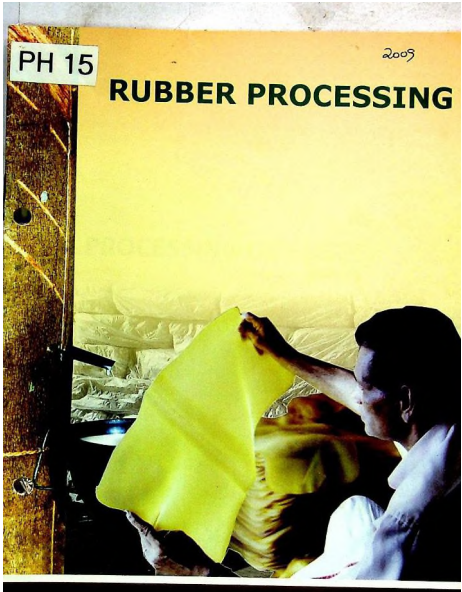
RUBBER PROCESSING



THE RUBBER BOARD
(MINISTRY OF COMMERCE & INDUSTRY
GOVT. OF INDIA)

PROCESSING OF RUBBER

RUBBER BOARD
(Ministry of Commerce & Industry, Govt. of India)

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PROCESSING OF RUBBER

The main crop from the rubber tree is latex, a milky white dispersion of rubber in water, which is harvested by tapping. The latex that flows out is channelled into an attached container. Coconut shells and polythene cups are used as container in most Indian estates. Latex collected in the cups is transferred to clean buckets, two or three hours after tapping. Around eighty percent of the crop from plantation is in the form of latex. The latex which gets dried up on the tapping panel (tree lace) and the collection cups (shell scrap) also form part of the crop and are collected by the tapper in a basket just before tapping. The latex spilt and/or overflowed on the ground, when gets dried up, is also collected as scrap (earth scrap) once in a month or so. Normally, 15 to 25% of the total crop constitute tree lace, shell scrap and earth scrap, together called field coagulum rubbers.

The different forms of crop are highly susceptible to degradation due to bacterial contamination on keeping. Therefore it is essential to process them into forms that allow safe storage and marketing.

MARKETABLE FORMS OF NATURAL RUBBER

The important forms, in which the crop can be processed and marketed are 1. sheet rubbers, 2. crepe rubbers, 3. preserved field latex and latex concentrates, and 4. block rubber. The crop collected in the form of latex can be processed into any of the above forms. But the crop collected as field coagulum can be processed only into crepe or block rubber.

CHOICE OF PROCESSING METHOD

The choice of the method of processing to be employed by individual plantations should depend on the following considerations.

DEPENDING UPON THE DRYING METHOD, SHEET RUBBERS ARE CLASSIFIED INTO TWO

1. Available crop - The maximum expected average daily production during the peak period when all the areas in the plantations start yielding. The method chosen should be such that processing can be carried out most economically.

2. The investment capacity - The investment required for the minimum capacity factory for each of the processes varies considerably. Therefore it is important to choose the processing method depending on the ability of the planter for the capital investment required.

3. Availability of technical man power - Some of the processes require control operations and laboratory tests. For starting such processes the possibility of getting adequate technical man power required also should be taken into consideration.

4. Market demand - The present and potential demand for each of the various marketable forms of rubber.

It is considered desirable to have facilities for processing into more than one marketable form to enable switching over based on demand.

PROCESSING INTO SHEET RUBBER

Latex is coagulated in suitable containers into thin slabs of coagulum and sheeted through a set of smooth rollers followed by a grooved set, and dried to obtain sheet rubber. Depending upon the drying method, sheet rubbers are classified into two: ribbed smoked sheets and air dried sheets (pale amber unsmoked sheets). A major quantity of rubber in India (about 71%) is marketed in the sheet form at present, as it is the

oldest and the simplest method of processing latex into a marketable form.

For processing into sheet rubber, the latex collected is brought to the processing factory before pre-coagulation sets in. In cases where the latex is prone to pre-coagulation an anticoagulant, Sodium sulphite* is used. A few drops of the anticoagulant are added to collection cups at the time of tapping, if necessary. The rest of the required quantity is added into the collection buckets when they are half full. Anticoagulants should not be poured into empty collection buckets.

LATEX IS STRAINED THROUGH 40 AND 60 MESH STAINLESS STEEL SIEVES

Latex brought to the factory is strained through 40 and 60 mesh stainless steel sieves. The volume of latex is measured with a standard vessel and calibrated rod. The dry rubber content (drc) is estimated with a metrolac which is a special type of hydrometer calibrated to read drc directly. The drc thus obtained is only approximate and for accurate determination, laboratory methods are employed.

Latex is diluted in bulking tanks to a standard consistency of 1/2 kg of dry rubber for every 4 litres of diluted latex (12.5% drc). The diluted latex is allowed to stand in the bulking tank for a fixed time (usually 15 to 20 minutes) to sediment the heavy dirt particles.

The table below gives the quantity of water required to dilute field latex before coagulation.

* Prepare stock solution by dissolving 500g Sodium Sulphite in 10 litres of water. 1 litre of stock solution is required for every 100 litres of field latex. (0.05% on latex)

Table

Volume of water to be added for diluting latex for pan coagulation (in litres)

DRC %	Volume of field latex (in litres)									
	1	2	3	4	5	6	7	8	9	10
25	1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000
26	1.080	2.160	3.240	4.320	5.400	6.480	7.560	8.640	9.720	10.800
27	1.160	2.320	3.480	4.640	5.800	6.960	8.120	9.280	10.440	11.600
28	1.240	2.480	3.720	4.960	6.200	7.440	8.680	9.920	11.160	12.400
29	1.320	2.640	3.960	5.280	6.600	7.920	9.240	10.560	11.880	13.200
30	1.400	2.800	4.200	5.600	7.000	8.400	9.800	11.200	12.600	14.000
31	1.480	2.960	4.440	5.920	7.400	8.880	10.360	11.840	13.320	14.800
32	1.560	3.120	4.680	6.240	7.800	9.360	10.920	12.480	14.040	15.600
33	1.640	3.280	4.920	6.560	8.200	9.840	11.480	13.120	14.760	16.400
34	1.720	3.440	5.160	6.880	8.600	10.320	12.040	13.760	15.480	17.200
35	1.800	3.600	5.400	7.200	9.000	10.800	12.600	14.400	16.200	18.000
36	1.880	3.760	5.640	7.520	9.400	11.280	13.160	15.040	16.920	18.800
37	1.960	3.920	5.880	7.840	9.800	11.760	13.720	15.680	17.640	19.600
38	2.040	4.080	6.120	8.160	10.200	12.240	14.280	16.320	18.360	20.400
39	2.120	4.240	6.360	8.480	10.600	12.720	14.840	16.960	19.080	21.200
40	2.200	4.400	6.600	8.800	11.000	13.200	15.400	17.600	19.800	22.000

eg. Consider a field latex of 36% drc and let the volume of latex be 8 litres. The volume of water to be added to the latex for dilution to a standard consistency of 1/2 kg per 4 litres of diluted latex will be 15.04 litres. Thus the total volume of diluted latex would be 23.04 litres (8 litres of field latex plus 15.04 litres of water).

FORMIC ACID OR ACETIC ACID IS GENERALLY USED FOR COAGULATION

The diluted latex is drawn out from the bulking tank without disturbing the sedimented impurities into coagulation pans or tanks. Four litres of latex is usually transferred to each pan.

COAGULATION

Formic acid or acetic acid is generally used for coagulation. The quantity of acid required for satisfactory coagulation depends on various factors like the amount and type of anticoagulant used, the duration of coagulation, the season and the nature of the latex. A general indication of acid requirement for coagulation is given in the table below.

Acid requirement for coagulation of 4 litres of diluted latex containing 1/2 kg rubber

	Acetic acid	Formic acid
1. For next day sheeting	3ml diluted to 300 ml with water	1.5 ml diluted to 300 ml with water
2. For same day sheeting	4 ml diluted to 400 ml with water	2 ml diluted to 400 ml with water

However, the acid requirement may slightly change under varying conditions and can be fixed up by experience. Only diluted acid should be used for coagulation and it should be thoroughly mixed with latex.

Coagulants like catalyst AC and sulphuric acid are also being used by planters. Catalyst AC is a dry powder and a comparatively safe coagulant. Normally 100 ml of a 5 per cent solution of this chemical is enough for making 1/2 kg sheets.

days of smoking is generally sufficient under normal conditions, but during the rainy season five to six days are required for satisfactory drying.

THE RUBBER MUST BE DRY, CLEAN, STRONG, SOUND AND EVENLY SMOKED

GRADING

The completely dried sheets are removed to the packing shed where they are carefully inspected and graded according to the standards as per IS-15361-2003. This standard provides for six grades of ribbed smoked sheets, viz. RSS 1X, RSS 1, RSS 2, RSS 3, RSS 4 and RSS 5.

RSS 1X

The grade must be produced under conditions where all processes are carefully and uniformly controlled.

Each bale must be packed free of mould but very slight traces of dry mould on wrappers or bale surfaces adjacent to wrapper found at time of delivery will not be objected to, provided there is no penetration of mould inside the bale.

Oxidized spots or streaks, weak, heated, undercured, over-smoked, opaque and burnt sheets are not permissible.

The rubber must be dry, clean, strong, sound and evenly smoked, and free from blemishes, specks, resinous matter (rust), blisters, sand, dirty packing and any other foreign matter. Small pinhead bubbles, if scattered, will not be objected to.

No Master or Official International Sample has been established for this grade.

RSS 1

Each bale must be packed free of mould but very slight traces of dry mould on wrappers or bale surfaces adjacent to wrapper found at time of delivery will not be objected to provided there is no penetration of mould inside the bale.

Oxidized spots or streaks, weak,

RUBBER MUST BE DRY, CLEAN, STRONG AND FREE OF BLEMISHES

heated, undercured, over-smoked, opaque and burnt sheets are not permissible.

The rubber must be dry, clean, strong, sound and free from blemishes, resinous matter (rust), blisters, sand, dirty packing and any other foreign matter, except slight specks as shown in the sample. Small pin head bubbles, if scattered, will not be objected to.

RSS 2

Slight resinous matter (rust) and slight amounts of dry mould on wrappers, bale surfaces and interior sheets, found at time of delivery will not be objected to. Should "Rust" or "Dry Mould" in an appreciable extent appear on more than 5% of the bales sampled, it shall constitute grounds for objection.

Small bubbles and slight specks of bark to the extent as shown in the sample will not be objected to.

Oxidized spots or streaks, weak, heated, under-cured, over-smoked, opaque and burnt sheets are not permissible.

The rubber must be dry, clean, strong sound and free from blemishes, blisters, sand, dirty packing and all other foreign matter other than specified above as permissible.

RSS 3

Slight resinous matter (rust) and slight amounts of dry mould on wrappers, bale surfaces and interior sheets, found at time of delivery will not be objected to. Should "Rust" or "Dry Mould" in an appreciable extent appear on more than 10% of the bales

sampled, it shall constitute grounds for objection.

Slight blemishes in color, small bubbles and small specks of bark permissible to the extent shown in the sample.

Oxidized spots or streaks, weak, heated, undercured, over-smoked, opaque and burnt sheets are not permissible.

WEAK, HEATED, UNDER-CURED SHEETS ARE NOT PERMISSIBLE.

The rubber must be dry, strong and free of blemishes, blisters, sand, dirty packing and all other foreign matter other than specified above as permissible.

RSS 4

Slight resinous matter (rust) and slight amounts of dry mould on wrappers, bale surfaces and interior sheets, found at time of delivery will not be objected to. Should "Rust" or "Dry Mould" in an appreciable extent appear on more than 20% of the bales sampled, it shall constitute grounds for objection.

Medium size bark particles, bubbles, translucent stains, slightly sticky and slightly over-smoked rubber are permissible to the extent as shown in the sample.

Oxidized spots or streaks, weak, heated, under-cured, over-smoked (in excess of the degree shown in the sample), and burnt sheets are not permissible.

The rubber must be dry, firm and free of blemishes, blisters, sand, dirty packing and all other foreign matter other than specified above as permissible.

RSS 5

Slight resinous matter (rust) and slight amounts of dry mould on wrappers, bale surfaces and interior sheets, found at time of delivery will not be objected to. Should "Rust" or "Dry Mould" in an appreciable extent appear on more than 30% of the bales sampled, it shall constitute grounds for

AIR DRIED SHEETS MAY FETCH A BETTER PRICE COMPARED TO SMOKED SHEETS

objection.

Large bark particles, bubbles and small blisters, stains, over-smoked, slightly sticky rubber, and blemishes of the amount and size shown in the sample are permissible. Slightly under-cured rubber is permissible.

Weak, heated, burnt, oxidized spots or streaks are not permissible.

The rubber must be dry, firm, free of blisters, except to the extent shown in the sample. Dirty packing, sand, and all other foreign matter other than specified above is not permissible.

The grading of sheets is carried out by visual examination. Normally this is accomplished by holding sheets against light, when the most obvious defects become apparent.

PACKING

The sheets after grading, are packed in bales of 50 kg. In the international market bale weight is usually 111.11 kg. The grades are marked on the bales and marketed (under revision by BIS).

AIR-DRIED SHEET

This is a light coloured sheet prepared in the same way as ribbed smoked sheets but dried in a shed or tunnel in hot air instead of smoke. As colour of the sheets is an important consideration, use of sodium bisulphite which inhibits enzymic discolouration and lightens the colour is necessary. Usually a calculated volume of a solution of sodium bisulphite is added in the bulking tank so as to get 1.20 g of it in a kg of dry rubber. Air dried sheets may fetch a better price compared to smoked sheets as they can be used as substitutes for pale latex crepe.

DEFECTS IN SMOKED SHEETS

The common defects in smoked sheets, their causes and suggested preventive measures are summarised below:

Defects	Causes	Prevention
1. Small sand, dirt, or foreign particles in the sheet	Due to improper bulking and sieving	Practise proper bulking in suitable tanks for the sedimentation of the dirt and use proper sieves.
2. Small bubbles along the edges of rubber sheets	Due to (1) insufficient mixing of the acid with latex and (2) insufficient acid for coagulation	Ensure thorough mixing of acid with latex. Use adequate quantity of acid.
3. Pinhead bubbles in clusters all over the sheets.	Caused by bacterial growth	The latex tanks and coagulating pans should be cleaned regularly, preferably with a small quantity of disinfectant solution (Lysol or formalin).
4. Small white specks and irregular bubbles.	Mainly due to precoagulated latex.	Use anticoagulants in the field.
5. Blisters and large bubbles	Rapid drying in the smoke house	Resort to gradual drying by regulating the temperature.
6. Burnt and oxidized sheets	High temperature drying and flame directly reaching the sheet	Sheets have to be initially dried at 40-45°C and then at 60°C until completely dry.
7. Weak sheets	High dilution of field latex and sheeting before maturation. Use of latex from slaughter tapping.	Dilute the field latex to 12.5% drc sheet the coagulum after obtaining sufficient strength.
8. Mould	Improper drying and storage under moist conditions	Dry the sheets after dipping in paranitrophenol solution. Proper drying and storing in dry atmosphere.
9. Rust	Improper washing of the coagulum during and after sheeting.	Wash the coagulum during and after sheeting.
10. Stickiness	High dosage of coagulant and high temperature drying and drying in sunlight alone.	Use only sufficient quantity of acid and dry at the specified temperature
11. Discolouration	Atmospheric oxidation during coagulation.	Use sodium bisulphite solution before coagulation.

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