

POST HARVEST OPERATIONS

MANUFACTURE OF RSS AND CREPE RUBBER

By

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GENERAL

Natural rubber latex derived from *Hevea brasiliensis* is a complex biological system containing, apart from rubber hydrocarbon, sugars, proteins, lipids, carotenoids, mineral salts, enzymes and numerous other nitrogenous substances. The latex particles are surrounded by a protective layer of proteins and lipids.

Immediately upon tapping and during collection, latex becomes contaminated by bacteria. They multiply rapidly under tropical conditions at the expense of the non-rubber constituents of latex producing acids which causes pre-coagulation of latex.

Utensils used during the collection of latex should be kept clean to minimise bacterial contamination.

Anticoagulants

Latex from young trees, from trees of certain clones and from freshly opened tapping cuts after resting show a tendency to pre-coagulate prior to arrival at the factory. This can be arrested by the addition of anticoagulants both in the field and the collecting centres. The preferred anticoagulants are sodium sulphite and ammonia. Sodium sulphite is more suitable in crepe manufacture.

Preparation and dosage of anticoagulant solutions

Anticoagulants may be diluted and stored in solution. Stock solutions of sodium sulphite are not stable indefinitely and should be made up daily prior to use.

The stock solutions of ammonia and sodium sulphite are prepared and used as follows;

(a). Ammonia

Ammonia is available in steel cylinders. The stock solution is prepared by bubbling 1 kg of ammonia gas carefully and slowly into 100 litres of water to give a 1% solution. The addition of 200 ml of the 1% solution to 18 litres of latex gives a latex with an ammonia content of 0.01%.

(b). Sodium sulphite

The stock solution is made by dissolving 1 kg of the anhydrous chemical in 30 litres of water. The addition of 300 ml of this solution to every 20 litres of latex gives a sodium sulphite content of approximately 0.05%.

Straining of latex

The latex is normally strained through a 40 and 60 mesh Monel metal sieve. Straining removes sand, dirt, bark, leaves and small pieces of precoagulum. Well preserved latex will pass through the mesh much more easily than poorly preserved or unpreserved latex. Care should be taken to ensure that there are no splits or holes in the mesh and that it is not detached from the frame. When the sieve is blocked it should be thoroughly washed before it is reused and after using the sieve must be cleaned and washed before the latex could dry up on the sieve.

Weighing

The most rapid and common method used in the field is the hydrometric (or metrolac) method. In this method, two parts by weight of water are added to one part by weight of the field latex. The diluted latex is poured into an aluminium jar standing in a coagulating pan until latex overflows. Any foam or froth on the surface of latex is removed and the metrolac is immersed slowly into the diluted latex. The reading on the stem at a level with the surface of the latex is noted. Verification is done by pushing the metrolac down slightly and noting the reading again when it stops moving. The DRC of the latex is obtained by multiplying the reading by three. A ready reckoner or metrolac chart is widely used to read the weight of dry rubber in latex.

Metrolac method is quick but not very accurate. A trial coagulation has to be carried out if a very accurate estimation is required.

Bulking tanks

Bulking tanks are usually rectangular and their capacity should be such that it is more than the total volume of the highest daily crop that is anticipated plus the volume of water to be added in the standardization process.

The depth of the tank should not be more than 1.2 m as otherwise a long time would be taken for the sediment in the latex to settle to the bottom. The tank should not be more than 1.8 m wide as otherwise it will be difficult to mix the latex efficiently. The inside of the tank should be lined with white glazed tiles.

Coagulating tanks

The coagulating tanks should be so situated that the latex can flow into them by gravity from the bulking tank after passing through a box strainer.

The coagulating tanks are usually masonry tanks lined with glazed porcelain tiles or aluminium tanks. Aluminium partitions positioned by means of a frame resting on top of the tanks may be provided to divide the coagulum into slabs.

Coagulating pans

In RSS manufacture coagulating pans made out of 21 gauge Aluminium sheets are normally used in small scale production. The average dimension of a pan is 400 x 300 x 65 mm. The coagulating pan is capable of holding, 5 litres of diluted latex.

Standardisation of latex

A simple formula can be used to determine the quantity of water required to dilute the latex to bring down the DRC of latex to the required level.

The formula is;

$$V_w = V_f \frac{(d_f - 1)}{d_s}$$

Where V_w = Volume of water required for dilution.

V_f = Volume of field latex.

d_f = DRC of field latex.

d_s = DRC of standardised latex.

The latex should be diluted to a standard DRC prior to coagulation. In RSS manufacture latex is normally diluted to 12.5% DRC and in crepe manufacture the degree of dilution is determined on whether a fraction is removed or not. Where a fraction is taken, it is recommended that the latex be diluted to a standard rubber content of 215 g per litre (21.5% DRC) in bulking tank. The final dilution will then be 200 g per litre (20% DRC), after the addition of the recommended quantities of sodium bisulphite, bleaching agent and the coagulant. If a fraction is not taken in crepe manufacture the final dilution is brought down to 150 g per litre (15% DRC).

Enzymatic discolouration

Sodium metabisulphite or sodium bisulphite is added in the factory to the latex to prevent enzymatic discolouration especially in the manufacture of pale crepe. The maximum dosage permitted is 500 g per 100 kg dry rubber added as a 1% solution.

Fractional coagulation

This is necessary only in crepe manufacture to obtain a water white crepe by removing the yellow fraction. Usual procedure is to add the sodium metabisulphite into the bulking tank and allow the fraction to separate out on its own. Some agitation is necessary to assist the fractionation with good quality latex fraction removed should be controlled around 8 to 12%.

Bleaching agents

In crepe manufacture, fractionation alone will not give a water white crepe. After separating the 1st fraction the latex is transferred from the bulking tank to the coagulating tank and prior to coagulation with acid the latex is treated with a bleaching agent. Apart from tolyl mercaptan which is dissolved in an aromatic type of solvent which has to be emulsified prior to addition into latex a new finding of the RRI is a water soluble bleaching agent, which is easily mixed with the latex. This is devoid of handling and toxicity problems normally encountered with tolyl mercaptan. Normally a 5% emulsion of tolyl mercaptan is prepared by mixing,

10 parts tolyl mercaptan 35% solution	}	Emulsion.
01 part of emulsifier		
189 parts of water		

2 to 3 litres of this emulsion is required to bleach 100 kg of dry rubber.

In the case of soluble bleaching agent,

10 parts of soluble bleaching agent (or sodium salt of tolyl mercaptan) prepared as a 35% solution is dissolved in 190 parts of water, 2 to 3 litres of the solution is required to bleach 100 kg of dry rubber.

Coagulation

Formic acid is the preferred coagulant for both RSS and crepe manufacture. Coagulation is achieved by the addition of formic acid (85 to 90%) at the rate of about 350 to 450 ml per 100 kg of dry rubber. The acid is added as a 1% solution with brisk stirring.

Milling

RSS manufacture

In the RSS manufacture the coagulum is passed, after hand pressing, through a set of rollers, a smooth roller and a diamond roller. The final thickness of the sheet should not be more than 3 mm.

When handling large crops, a power operated battery of rollers is used. This battery consists of 3 to 4 pairs of smooth rollers and one pair of spirally grooved rollers mounted as a unit on line ahead formation. The rollers are geared together and driven by a 5 - 7 HP motor.

Crepe manufacture

Milling operations in crepe manufacture requires the following types of mills,

- (a). Horizontally grooved rollers for washing and breaking the coagulum.
- (b). Smooth rollers for preparing the thin lace.
- (c). Horizontally grooved rollers for blanketing.

Additional rollers such as diamond or spiral grooved mills are required to produce a far superior wet lace with a much more even texture and a minimum of perforations.

The approximate number of millings necessary for blanket crepe, thin crepe and sole crepe manufacture is given in Table 1.

Table 1. *Milling operations for crepe rubber manufacture.*

Type of mill	Blanket crepe	Thin crepe	Sole crepe
Straight grooved mill	5	4	4
Diamond or spiral grooved mill	—	3	7
Smooth mill	1	1	2
Straight grooved mill	2	—	—
Laminator	—	—	2

The sheets are dripped, prior to drying in a smoke house. The sheets are hung on round reapers. Reapers and racks in the smoke house should be periodically wiped. The most convenient method is to clean 1/5th of the reapers daily before placing the new sheets. The temperature in the smoke houses should be maintained between 50°C to 55°C at all times. A smouldering fire is preferable to a brightly burning fire without smoking. Each sheet is completely turned after every 12 hours during the drying operation. Drying should not be delayed for more than 5 to 6 days.

Smoke houses basically are of two types;

- (a). Smoke houses that are operated by internal pit furnaces or trolley box furnaces.
- (b). Smoke houses which are operated by external furnaces.

Smoke houses should be provided with adequate ventilation. A ceiling should be provided and the space between the ceiling and the roof should be adequately sealed. Adequate precautions should be taken against fire risks specially in the case of internally fired pits. A baffle plate of heavy gauge metal or galvanised iron, slightly larger in size than the opening of the pit, should be fixed about 25 cm above the pit so as to spread the smoke and the heat. There should be a minimum space of 2 metres between the fire and the bottom of the nearest sheet.

Crepe laces can be dried by natural air or hot air.

Natural air drying of crepe rubber presents no difficulties in fine weather. Lace crepe of average thickness (dry weight 600 g per sq. meter) usually dries in 4 to 6 days. In wet weather, drying is delayed and surface mould will develop under adverse conditions.

A system of warm air drying in a multi storey building heated by hot water radiators is satisfactory under local conditions. The source of heat is a slow combustion fuel stove. The number of radiators and their capacity will depend on the weight of the rubber handled by the drying tower. The temperature of drying is kept around 35°C and crepe of standard thickness can be dried in about 3 to 4 days. The correct temperature should be maintained through out the night to enable the drying to be completed within 3 to 4 days.

Pale crepe

After drying the laces are spread on a table to remove any dirt specks. About seven of these mats are placed one over the other to overlap and folded to form a long strip of laces of three layers. The above preformed strips are passed through the blanketing mill to get a resulting blanket of 22 to 25 mm in thickness. The blankets are allowed to cool for at least 5 hours. The roll nip is adjusted to get a final blanket of approximately 18 mm in thickness. These blankets are then cut to standard size and packed in 50 kg bales.

Sole crepe

For the manufacture of sole crepe the width of the thin lace is quite important to reduce the cuttings. Normally it should not exceed 54 mm.

The dry laces are carefully examined on the laminating table for any specks of dirt. Each lace is built up one on top of the other to obtain the required thickness. A heavy hand operated roller is passed over the finished sole crepe laces to keep the lamination intact. The hand laminated sole crepe is then passed through a laminator to give the finished sole crepe which is then cut into size and packed in wooden boxes. Each sheet is separated from the other with polythene or grease proof paper.