RUBBER MACHINERY AND THEIR MAINTENANCE

By

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The total production of natural rubber in Sri Lanka is about 140,000 MT per annum. Sri Lanka produces smoke sheet, latex crepe (pale crepe and sole crepe), scrap crepe, block rubber and small percentage of centrifuged latex. The main feature of Sri Lanka's natural rubber production has been its large percentage of latex crepe rubber output. About 27 — 32% of the total natural rubber production in Sri Lanka has always been latex crepe rubber.

Latex crepe rubber is mainly produced in about ninety factories owned by Sri Lanka State Plantation Corporation and Janatha Estate Development Board. The factories are distributed in six regions ;

1. State Plantation Corporation ;

   (a) Kalutara region — 28 factories,
   (b) Galle region — 07 factories,
   (c) Ratnapura region — 18 factories,
   (d) Matale region — 01 factory.

2. Janatha Estate Development Board ;

   (a) Avissawella region — 20 factories,
   (b) Kegalle region — 15 factories.

All these factories process latex of the estates owned by the organization. In addition to these there are twenty three factories owned by private individuals/companies and Sri Lanka (Ceylon) Rubber Manufacturing Company Limited. All these factories process small holder latex. The scrap from the estates are processed by these factories using a separate scrap line while there are about forty private factories processing scrap into scrap crepe. However, most of the small holder latex is processed into smoke sheets in small processing units. Block rubber is processed in seven large factories, two of them owned by the Sri Lanka (Ceylon) Rubber Manufacturing Company Limited. The raw rubber industry therefore has a fairly high investment and major portion of this is on machinery. Industry in general tends to overlook the substantial savings possible through more effective control of plant maintenance. The objective of a preventive maintenance programme, therefore, is to prevent breakdown of machines costing high repair costs and delaying production by carrying out minor replacements and repairs at regular intervals.

In the sheet rubber manufacture, hand rollers or Gathrie rollers are used and in crepe rubber factories two roll mills of different roller surfaces (smooth, horizontal grooved, diamond/spiral grooved) are used. (In addition the sole crepe manufacture involves laminators and scrap crepe manufacture involves a scrap wisher). Two roll mills used in crepe industry are either 26" X 14" or 32" X 16" is size. Block rubber manufacture involves crepers, pre-breakers, hammer mills, granulators etc,

This article is based on the mills used in crepe factories which basically consists of two close grained cast iron rolls mounted on four bearing blocks with bushes. The two rolls complete with bearing blocks are mounted on two side frames which are secured on a common base plate. The verticle movement of the rolls are eliminated by the use of the two top bars on either side. The primary drive of these mills is by means of a wedge belt transmitor or torque arm speed reduction gear unit. The bull gear wheel drive for further speed reduction is either of double helical or straight spur type. The inter-roll or end gears are the straight spur type wheels. To achieve uniformity in the product, it is recommended to construct factories of capacities above 5 MT per day. In such factories it is advisable to have a coagulum crusher as the first mill. This is used for size reduction and it is best positioned in front of the coagulating troughs, and may be movable. The flutes of the rollers are one inch deep and the capacity is about 1500 Kgs/hr. The remaining machines contain straight grooved, (mascerator), diamond or spiral (intermediate) and smooth rollers. The grooves are 3 mm wide and 3 mm deep and 12·5 mm apart. The U groove is preferable to a V groove due to the better grip in U groove roller and the cutting effect of the V groove. The gear ratio, back roll speed of the mills used in the blanket crepe and sole crepe manufacture, number of passes, width and the thickness of the output are given in tables 1 and 2.

The rubber mills should never be started on load as it burns out the starter contacts and adversely affects the starter component. At the end of the days working, the pressure should be released by unscrewing the pressure screws until there is a 16 mm (1/16") clearance at the nip of the rolls. The mills should be started following day, only with a clearance at above 16 mm (1/16") and the pressure should be applied to get the required thickness only after inserting the rubber into the nip of the rolls. The above starting procedure should be followed even in the case of a power failure. The rolls should be thoroughly washed after the days work to remove all the traces of acid. If a mill is not being used for a period of time it will be prudent to apply grease to the surface of all moving parts to avoid corrosion.

The most important activity within preventive maintenance scheme is planned lubrication. It is important to ensure the use of right type and quantity of lubricant. Moving parts of a machine are not smooth but minutely rough because of inherent characteristics of the machine tools used to make them. In service the surfaces are coated with a film of lubricant. These films must be ruptured before contact can occur between surfaces leading to wear of them. The rupture of the film lubricant could be prevented by lubricating regularly. Some mills contain a system for lubricating the pressure screws, in which case, it should be lubricated once a week. In cases where such provision is not made, the pressure screws should be released once a week and grease should be applied into the bush and on the screw. If there is an upward and downward movement of 31 mm (1/8 of an inch) between the pressure screws and the bushes, considerable wear is evident and the pressure screws and bushes need renewal. Fracture pads should be used with the pressure screws, if not, there is a possibility of damage to the side frames and journals of the rolls if excessive pressure is used. If an uneven pressure is applied, not only it will give a lace of uneven thickness, but the roll surfaces become tapered.

The roll bearings should be greased every four hours during the period the mill is in operation and every two hours when the bearings are newly rebushed, for about two weeks till the bearing surface is conditioned. The increase intensity of the lubrication may not consume more grease since the less gap between the surfaces. Inadequate lubrication causes heating of the bearings. It is important to check for any hardened lubricants which will prevent any grease getting into the surfaces.

The end gears should be lubricated with grease before commencing work daily, If not, the wear on the profile of the teeth is accelarated. Bottoming of the end gears is caused by the reduction of the roll diameters and shifting of the centres due to wear. As a result, the top of the gear tooth comes in contact with the root of the tooth on both end gears. This is a serious situation which can result in damaging the side frame or fracture of the roll journals. Roller marks on rubber are also due to this. If bottoming of the end fears are experienced it is time for refacing and grinding of the rolls, skimming and polishing of journals, adjusting end gears to the new roll centres and rebushing roll bearings. It is essential to check the end gear locating key once in fortnight to ensure they are securred.

The driving gear should be greased daily before commencing work. It is essential to check the driving gear locating key monthly to ensure that it is secured. When the teeth of the double helical gears are worn to a knife edge, it is time to replace the set of grears. When the driving spur gear tooth flank are considerably worn and noisy in operation, the gears are beyond re-use and a set of double helical gear should be fitted.

The ball bearings should be greased once in two months and self oil bearings should be topped up daily. Wear on the lay shaft bearings can be indentified if there is approximately 31 mm (1/8") play when the shaft is lowered with a crow bar adjacent to the bearing being tested.

Tension of the belts should be checked regularly. Belt should be free of oil. The water requirements in the mills during the latex crepe manufacture is 540 litres (120 gallons) / hr in a mascerator or intermediate mill and 720 litres (160 gallons) / hr in a smooth mill. This water is used for cooling the rolls and also to wash off the serum substances and excessive chemicals from rubber. It is essential that adequate water is supplied for cooling of the rolls and the internal pipes should be checked for clogging and corrosion at least once a month. If the factory is facing water shortages, the water from the internal cooling system may be recycled after proper cooling. Repairs and renewals should be promptly carried out as there can be discolouration of rubber if excessive heat is generated by the rolls. The water from a two inch pipe line should not be fed into more than three mills. The spray pipes should be opened before the milling commences.

The motors to the mills should be totally enclosed and is normally fan cooled type. For 26" X 14" mills a motor of 25 HP is sufficient.

The factory should keep a separate process line to manufacture scrap crepe since the sand and dirt in the scrap can damage the roller surfaces. Grooved pattern and roll surface of the latex crepe line should be inspected periodically. When a new mill or rolls are supplied to the factory it should be used to mill yellow fraction for about two weeks and condition it before using for first fraction. In the process of milling, the most important factor to be borne in mind is to avoid friction in the rolls as far as possible specially on the smooth mill. Loose bolts or fixtures of any sought should be tightly secured to ensure they do not fall in into the nip of the rolls while in operation and damage the roll surface.

Drying of crepe rubber is done either in natural air or in drying towers. It is recommended to dry sole crepe laces and thin lace crepe only in drying towers of which the capital investment is over one million rupees. The conventional drying tower consists of a boiler and a series of radiators. For efficient drying the factory officers should carefully monitor the air inlets and outlet of the tower, the firewood feeding by the labourers, any leaks in the boiler and radiators etc. It is useful to check the radiators for blocking every three months. The water that is used in the system should be cleaned for suspended material.

The factory management should gather and study all information related to maintenance for each and every mill and list the maintenance job for each mill. It is very important to maintain records of lubrication and repairs etc.