



Quality upgradation of ungraded sheet rubber using a mechanical cleaning device

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The produce from rubber tree is processed and marketed into different forms such as ribbed smoke sheets, block rubber or technically specified rubber and concentrated latex. About 93% of total natural rubber produced in India is from Kerala and 86% of the Kerala's production is from small plantations having an area of less than one hectare. This indicates that the natural rubber plantation industry in India is dominated by smallholdings. Latex collected from these holdings is processed mostly into RSS, while the field coagulum is converted either into TSR or low grade crepe. One of the major consumer complaints is the poor quality of sheet rubber produced in smallholdings. Lack of consistency in quality has also been a matter of great concern. In spite of the best efforts made by the Rubber Board to organize group processing of smallholders latex, bulk of the latex produced in smallholdings continues to be processed by the growers themselves into poor quality sheet rubber, because of the peculiar socio-economic problems prevailing in these areas.

Though block rubber conforming to technical specifications has been claimed to be superior to the conventional forms of rubber, a comparison of field coagulum grade of block rubber and sheet rubber does not fully justify this claim, in spite of the fact that the former tends to be more expensive to produce. Now-a-days good quality sheet rubber is being preferred by rubber goods manufacturers in India. Therefore, it would be appropriate to allow smallholders to process their latex into sheet rubber while providing them with cost effective technology to improve its quality.

At present sun drying of sheets is very widely practiced in smallholdings. However, while practicing sun drying, the smallholders very often resort to unscientific and unhealthy practices such as laying sheets in the bare ground, on the bare roof of buildings, on public roads, compound wall etc. causing accumulation of dirt,

overheating and incomplete drying. Conventional methods of smoke drying are not often practiced mainly due to the high capital requirement and increasing cost of firewood. Moreover smallholders store sheet rubber for long periods with out taking proper care which causes fungal growth on the sheets.

Due to the above reasons, a reasonable portion of smallholders' sheet rubber is of inferior quality, often resulting off-grades. The major quality problems are incomplete drying, mould growth and surface contamination. These problems could be overcome, at least partially, if such sheets were properly cleaned and dried. For this purpose a semiautomatic sheet rubber cleaning machine was developed. The main features of the machine are

- a) Cleans both sides of the sheets by a single pass
- b) 20-30- sheets can be cleaned per minute
- c) No deformation to the bristles even after continuous operation
- d) Removes the fungus/dirt present in the grooves of the sheets
- e) Worn out bristles can be replaced six times
- f) Low power consumption
- g) Easy operation

Brief technical description of the machine and reprocessing

A photograph of the machine is given in Fig. 1. The machine consists of three sets of rolls (1) a pair of mild steel rolls having a specific design with a speed of 90 rpm, (2) a pair of brush rolls rotating at 300 rpm and (3) another pair of brush rolls running at 360 rpm. The rolls are arranged horizontally. The length of each roll is 70 cm. The brushes are made of nylon bristles of 2.5 cm in length and are fixed on a PVC/nylon roll which has a

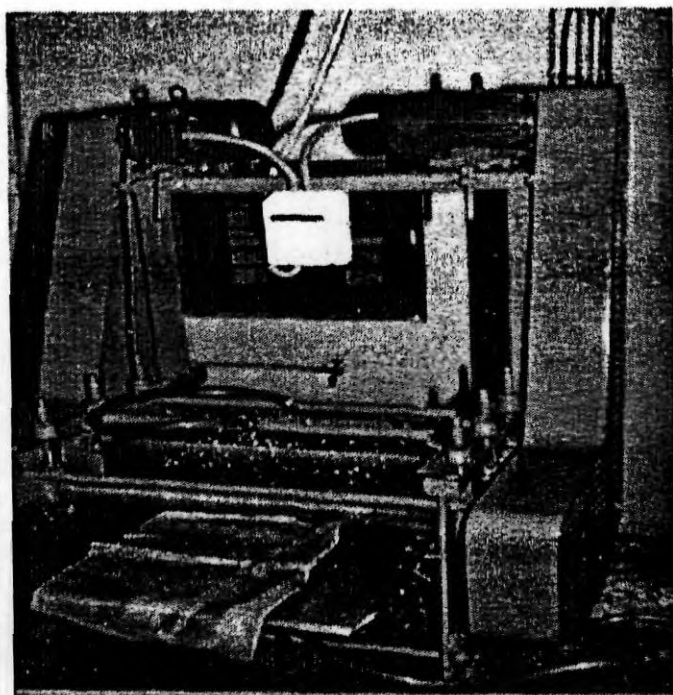


Fig. 1. Photograph of the sheet cleaning machine

steel shaft through its centre. The sheets are first fed to the cast iron rolls and as they come out they are pulled by the first set of brush rolls in a forced spray of water which is applied on the sheet from the bottom and top. This semi-cleaned sheet passes through the second set of brush rolls under the same conditions as in the previous case.

Table 1. Level of up-gradation of off-grade sheets before and after cleaning with the machine

Grade	Before cleaning	After cleaning
RSS 4, %	0	60.50
RSS 5, %	20.20	30.63
Off-grade	79.80	8.87

For easy movement of the sheets, the rolls are arranged, in a slanting manner. There is one 2HP motor which drives the entire bottom rolls whereas, the upper rolls are driven by V-belts. Rolls are arranged on a mild steel framework which is provided with stainless steel/aluminium feeding and receiving trays. Aluminium plates are also provided between each set of rolls to prevent the sheets from falling down. All the top rolls (both the cast iron and brush rolls) have an upper and lower movement facility to accommodate sheet of different thickness. As the sheets are stretched due to the speed difference between the rolls removal of fungus/dirt from the grooves of the sheets becomes easy. Cleaning of both the surfaces of sheets takes only two to three seconds, leading to an output of 20 to 30 sheets per minute depending on the setting of the rolls and size of sheets. The machine with

the above features has been patented by RRII (Indian Patent no. 201805 dated 08.08.2006). The evaluation of the sheet cleaning machine has been conducted at RRII by cleaning 500kgs of fungus affected sheets procured from GAICO, Kuravilangadu, Palai, S. India.

Table 2. Comparative data for cleaning one M.T. of off-grade sheet

No.	Parameter	RRII	M/s. Vembanadu Rubbers
1.	Time taken, minutes	84	218
2.	Labour required	7	5.5
3.	Water consumed, kL	2.4	2.2
4.	Power consumed kWh	4.18	10.84
5.	Firewood used, kg	150	182
6.	Process loss, %	1.7	0.40
7.	Level of up-gradation to RSS IV, %	60.5	78
8.	Lot + RSS V, %	39.5	22
9.	Direct cost for reprocessing (2+3+4+5+6) Rs.	3051	1903
10.	Net profit/ton Rs.	2387	3675

- @ Rs. 116.47, 0.10, 4.52 and 1.3 respectively for items 2 to 5
- RSS IV @ Rs 127, RSS V @ Rs 124.75 and lot @ Rs 119

The sheets were graded before and after the cleaning and the level of up-gradation is given in Table 1. It can be seen that up to 90 % of the off-grade sheets can be upgraded to RSS IV and RSS V grades by using this machine. To ensure the cleaning efficiency of the machine large scale evaluation was conducted with M/s. Vembanadu Rubbers, Ernakulam by cleaning 5.5 tones of off-grade sheets.

A comparison of the performance as evaluated at RRII and that done by M/s. Vembanadu Rubbers is given in Table 2. The process loss was due to the drying of sheet rubber after the cleaning process where the residual moisture originally present in the sheets was removed. In the comparative study also about 80-90% upgradation of off-grade rubber sheets could be upgraded by cleaning such sheets using the machine followed by smoke drying. Moreover a follow-up study conducted among the users of the machine (22 firms are now using the machine) shown that it is user friendly and profitable.

Conclusion

Among the marketable forms of natural rubber sheet rubber contributes a major share and it is produced mainly by smallholders. It was found that a reasonable share of smallholders' sheet rubber is of inferior quality because of the unscientific and unhealthy practices followed in the drying and storing of sheet rubber. For upgrading such off-grade sheets a mechanical cleaning device was developed and its performance was evaluated. The machine was patented by the Institute and a follow-up study among the users of the machine indicated that

by cleaning off-grade sheets using the machine 80-90% upgradation can be achieved.

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