

Development of Modified Power Operated Lac Scraper

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ABSTRACT

Lac is the hardened resin secreted by the tiny lac insect (*Kerria lacca* Kerr). It is the only resin of animal origin. Lac insects thrive only on certain trees called lac hosts. *Butea monosperma* (Palas), *Zizyphus mauritiana* (Ber) and *Schleichera oleosa* (Kusum) are the major lac hosts used for lac cultivation in India. India is the largest producer of lac. Indian lac is considered to be the best in quality. Apart from India, Thailand, Myanmar, Indonesia, Vietnam and China also produce lac. In India about 3 million farmers mostly tribal are involved in the lac cultivation spread over states of Jharkhand, West Bengal, Madhya Pradesh, Chhattishgarn, Maharastra, Andhra Pradesh, Gujarat and Orissa. Lac cultivation involves five major operations i.e., pruning, inoculation, used up broodlac (*phunki*) removal, harvesting and lac scraping. Mostly lac cultivation operations are carried out manually with the aid of locally manufactured traditional tools. Manual lac scraping is very slow and a tedious process. In one of the method farmers sit on the ground in a group and scrap lac with the traditional tools like small scraping knife (*dauli*) and sickle. In other method, farmers remove lac encrustation by beating lac sticks with bamboo stick. One person scrapes 10-15 kg of lac in a day. As scraping is done on the ground, unwanted foreign materials like sand, soil, wooden twigs etc. find their way into scraped lac, fetching less price to farmers and creating problems during lac processing in industry. In order to increase the output and reduce the drudgery of lac farmers a simple power operated lac scraper was designed and developed modifying the earlier developed machine. In the earlier machine V-belt and V-pulley type speed reduction mechanism in two steps was used, which made machine voluminous. To make the machine compact, a gearbox instead of V-belt and V-pulley was used to reduce the 1450 rpm speed at motor shaft to 30-40 rpm at scraping roller shaft. Machine consisted of scraping rollers, separating screen, feed hopper, drive mechanism and machine frame. The machine scrapes lac under action of shear and compressive forces. One person operates the machine and scrapes 10.6 kg lac stick in an hour with scraping efficiency of 92 per cent. The machine gets power from 0.5 H.P. single phase AC motor. The capacity of the developed machine is more than the capacity of earlier developed Hand Operated and Pedal Operated Lac Scraper and at par as compared with Power Operated Lac Scraper. It is suitable for villages having electricity.

Lac cultivation is simple and involves five major operations i.e. pruning, inoculation, used up broodlac (*phunki*) removal, harvesting and lac scraping. Mostly lac

cultivation operations are carried out manually with the aid of locally manufactured traditional tools. Manual lac scraping is very slow and tedious process. Generally it is done

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in a group on the ground with the traditional tools like small scraping knife (*duali*) and sickle. In other method, farmers remove lac encrustation by beating lac sticks with bamboo stick. One person scrapes 5-10 kg of lac stick in a day. As scraping is done on the ground, unwanted foreign materials like sand, soil, wooden twigs etc. find their way into scraped lac, fetching reduced return to farmers and creating problems during lac processing.

A manual lac scraping machine was developed at Agricultural Engineering Department, Birsa Agricultural University, Ranchi (Pandey & Majumdar, 1997). However it could not become popular due to its limited capacity and functional limitations. An electric operated lac scraper-cum-grader was developed at CIPHET, Ludhiana (Anon., 1998). Machine does three operations i.e. lac scraping, crushing and grading at a time. Its capacity is 20 kg/hr and costs Rs. 25,000. Lac growing farmers are mostly tribal and their economic condition is poor. Prasad *et al.*, 2000

and Prasad *et al.*, 2001 reported that high cost and non-availability of electricity in rural area are bottleneck in gaining its popularity among lac growing farmers. Prasad *et al.*, 2001 and Prasad *et al.*, 2002 designed and developed Hand Operated and Pedal Operated roller type lac scrapers. Later a Motor operated lac scraper suitable for villages having electric supply was developed (Anon., 2003). In this machine motor speed of 1450 rpm at its shaft is reduced to 30-40 rpm at scraping roller shaft using V-belt and V- pulley type speed reduction mechanism in two steps. In this type of speed reduction mechanism bigger size pulleys are fitted which makes machine voluminous. In order to make a compact machine it was modified introducing gearbox type speed reduction mechanism. Details of the machine are described in the following sections.

Considering the above fact a modified Power Operated Lac Scraper was designed and developed. Detail of the machine is described in the following sections.

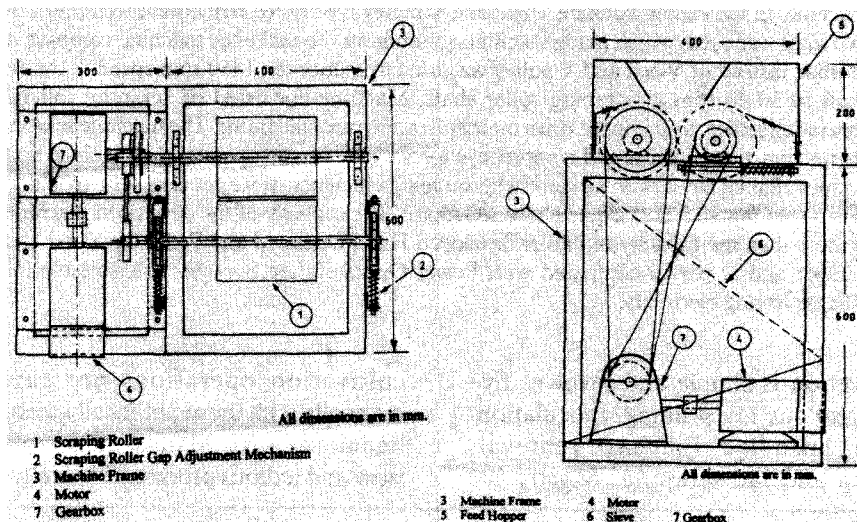


Fig.1 Modified lac scrapper

MATERIALS AND METHODS

A modified Power Operated Lac Scraper was designed and developed (Fig. 1). The machine consisted of a pair of scraping rollers, separating screen, feeding hopper, drive mechanism and machine frame. The developed machine scrapes lac under action of shear and compressive force and crush sticklac under compressive force. The constructional details of the machine are described below.

Scraping rollers are the main component of the machine and comprise of two corrugated mild steel rollers each having a diameter of 125 mm and 200 mm long. One of the rollers is fixed and other one is spring loaded, and thus adjustable. The rollers rotate in opposite direction at a speed differential 1:1.66 between them. In idle condition, the gap between fixed and adjustable rollers remains 2 mm. During operation gap is adjusted automatically according to the diameter of lac sticks and permit entry of lac sticks between rollers. In this way, the sticks are caught in between the rollers and lac is scraped by means of compression and searing actions.

A sieve is fitted at inclination of 45° under the two scraping rollers to receive the scraped lac and stick. Most of the lac encrustation, which pass through the sieve, fall on inclined pan which guides the received material towards the outlet of the machine. The scraped lac encrustation which do not pass through the sieve and the sticks, slide down the sieve and come out of the machine.

Feed hopper is fitted at the upper portion of the machine and is used to feed and guide the lac sticks between scraping rollers safely.

The drive mechanism comprises of a gearbox, V-groove pulleys and V-belt to transmit power from handle to fixed and spring-loaded rollers. The drive mechanism

reduces the 1450 rpm speed at motor shaft to 30-40 rpm at scraping roller shafts. The gearbox gets drive from motor shaft through a coupling. From gearbox power is transmitted to scraping roller through V-belt and V-groove pulley. The machine is driven by 0.5 H.P. single phase A.C. electric motor and for its operation only one person is required.

The basic structure of machine i.e. angle frame on which various components are fixed is made from mild steel angle iron (35x35x5 mm). The feed hopper frame is made up of mild steel flat (25x5 mm).

The machine scrapes lac under the action of shear and compressive forces. The compressive force acts due to compression of spring where as shear force acts due to differential speed of rollers. Machine was tested using *Rangeeni* lac stick (used up broodlac or *phunki*). A labourer employed in the institute farm operated machine. A basket filled with lac stick was kept on a platform raised to the level of feeding hopper for the convenience of the operator. The capacity of the machine as scraper was measured by calculating weight of lac stick scraped/unit time. The scraping loss was measured in terms of percentage of lac encrustation remained unscraped and were carried along with lac stick.

Observations were recorded for determination of scraping capacity of the machine & scraping loss.

RESULTS AND DISCUSSIONS

The data obtained from the experiments were analysed. The scraping capacity of the machine was found to be 10.6 kg lac stick per hour. It means, if machine is operated by a person for 8 hours in a day, from 85 kg of

Table 1. Comparison of construction and performance of developed machine and the Power Operated Lac Scraper.

S. No.	Parameter	Power Operated Lac Scraper	Modified Power Operated Lac Scraper
1	Overall Size (Length x Widthx Height)	850 x 800 x 820 mm	700 x 500 x 800 mm
2	Drive Mechanism	V-belt and V-pulley	V-belt and V-pulley
3	Speed Reduction Mechanism	V-belt and V-pulley	Gearbox
4	Capacity of the machine	10.2 kg/hr	10.6 Kg/hr
5	Scraping Efficiency	91 %	92 %

lacstick, lac can be scraped. However in traditional method one farmer scraps only about 10-15 kg of lac sticks in a day of 8 working hours. It means, with the use of machine scraping can be done 6 times faster as compared to traditional method. Further in machine scraping chances of soil, sand and unwanted material being included in the scraped lac is reduced.

The construction and performance of the machine were compared with the earlier developed Power Operated Lac Scraper (Anon., 2002-03), which is presented in the Table 1.

Above comparison reveals, that the size of the modified machine, due to introduction of gearbox, was considerably reduced. However, the performance of the modified machine was at par with the earlier machine in terms of capacity and efficiency.

CONCLUSIONS

The scraping capacity of Hand Operated Lac Scraper-cum-crusher was found to be 10.6 kg/hr. The scraping loss was 5 % after two pass. Its crushing capacity was 10 kg/hr. Only one person is required to operate the machine. The machine requires electrical power for operation and it is suitable for villages having electricity.

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