

# MANUFACTURE OF LOW PROTEIN NATURAL RUBBER (LPNR) BY PINEAPPLE JUICE (OR BROMELAIN) TREATMENT OF *HEVEA* LATEX

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Low protein natural rubber (also known as Deproteinized natural rubber - DPNR) is a new grade of natural rubber with a low protein content and is now well known to possess improved technological and dynamic properties. Low heat build up is one of the main advantages in LPNR which makes it ideal for tyre manufacture. Deproteinization has also been reported to be essential in the manufacture of cyclized rubber by p-toluene sulphonic acid method using natural rubber. The method of manufacture of DPNR by using papain treatment has already been reported in detail (see RRISL Bulletin 18, 1993).

Recent studies have shown that pineapple juice (PAJ) which contains a proteolytic enzyme known as bromelain, can also be used in the manufacture of LPNR from *Hevea* latex. PAJ treatment of latex also gives a rubber with properties comparable to that of papain treated rubber. PAJ treated rubber is more suitable for cyclized rubber manufacture than papain treated rubber because of its faster cyclization reaction and the lighter colour of the final product. The purpose of this article is to give details of the PAJ treatment of *Hevea* latex that can be used as an alternative to papain treatment when papain is in short supply.

**Preparation of the enzyme:-** Bromelain, extracted from pineapples or crude pineapple juice can be used for treatment of latex. The use of pineapple juice is easier and cheaper. PAJ is prepared by macerating fully ripe pineapples (*Ananas comosus*) and the fresh yellowish liquid is used for treatment of latex. However, the juice can be kept in a refrigerator for 1 - 2 weeks without any preservatives prior to use. A volume of 300 - 350 ml of PAJ can be obtained from an ordinary size fruit.

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**Addition of PAJ:-** Field latex is diluted (1:1) with water prior to the addition of PAJ. 50 ml of PAJ is added to one gallon of latex. All additions are based on this eg. 2 gallons of latex will require 100 ml of PAJ. No acid is added for coagulation. Latex after the addition of PAJ is left overnight for coagulation and for the enzyme to act on latex proteins and render them soluble.

**Milling and presentation:-** The coagulum which is slightly porous and comparatively hard is milled in the following morning as done for other types of rubber. It can be milled in to thin lace, if the final LPNR is to be presented to market in thin lace or crepe form. The coagulum is passed through the hammer mill of the final product is to be presented in the block form. A flow diagram showing the manufacture of LPNR by PAJ treatment is given in Fig. 1.

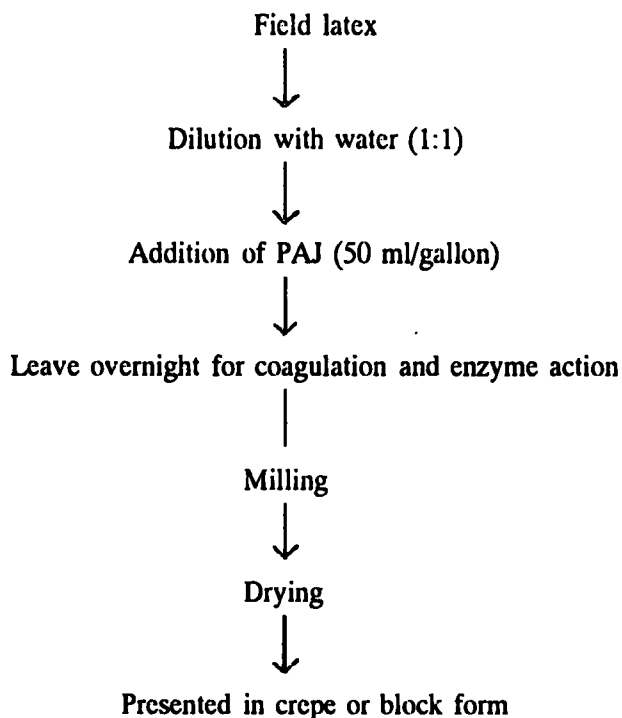


Fig. 1. Flow diagram showing the method of manufacture of LPNR by PAJ treatment of latex

**Drying:-** The drying of PAJ treated rubber takes longer than usual, it may take 1-2 days extra in the case of thin laces. However, the drying of PAJ treated rubber is comparatively faster than that of papain treated rubber. In the case of block rubber manufacture, the standard bed size of rubber granules will have to be reduced to half normal in order to improve the drying at a temperature of 110°C for 4-5 h.

**Specifications:-** The specifications laid down for DPNR are given in Table 1 with typical values obtained for PAJ treated rubber.

Table 1. *Properties of PAJ treated rubber*

	Producer limit	Typical value	Range
Dirt, % wt	00.02*	00.01	00.01 - 00.02
Ash, % wt	00.15*	00.20	00.17 - 00.26
Nitrogen % wt	00.15*	00.15	00.13 - 00.18
Volatile matter % wt	00.50*	00.50	00.46 - 00.62
Wallace plasticity	30.00**	55.00	51.00 - 60.00
PRI	60.00**	72.00	58.00 - 84.00

\* maximum

\*\* minimum

**Handling of PAJ:-** PAJ is much safer than papain, as it is in the liquid form and has no risk of inhalation. However, the use of gloves is recommended in preparation of PAJ from pineapples, specially when maceration is done manually, without using a mechanical macerator. The use of suitable boots by labourers who do the milling, is also recommended.

**Calculation of dry weight:-** It is customary to calculate the dry weight of rubber from the wet weight of the coagulum. In normal acid coagulated rubber, 85% of the wet weight of the coagulum is taken as rubber, the balance being water. However, this basis does not hold true for for DPNR as it contains 16% more water in the wet coagulum compared to acid coagulated rubber. Therefore, the calculation of dry weight of DPNR should be based on 69% rubber and 31% water. The use of conventional 85% rubber, 15% water for DPNR would lead to unaccountable losses in rubber in factory records although no rubber is actually lost.

## REFERENCES

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