

## THE INFLUENCE OF PROCESSING AND STORAGE ON HYDROGEN CYANIDE AND TANNIN CONTENTS OF PARA-RUBBER SEED AND ITS PRODUCTS\*

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### ABSTRACT

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Para-rubber seed and its products, including the autoclaved and fermented oil meals, were assayed for HCN content at post-harvest intervals from 1 week to 9 months of storage at room temperature. The tannin content of all these products was also estimated after 3 months of storage.

Rubber seed and its kernels contained 638 and 749 mg HCN/kg, respectively, 1 week after harvest; these values gradually diminished to 25.3 and 26.7 mg/kg, respectively, after 9 months storage. The rate of reduction in HCN levels was fast for the first 2 months of storage and slower later. The HCN levels in other rubber seed products also declined during storage. Thus, storage at room temperature for a minimum period of 2 months appeared to be an effective method of reducing the HCN content of rubber seed and its products to safe levels.

The tannin levels in rubber seed and its products were low (0.42–0.53%) and within the safety levels for incorporation in livestock feeds. Moreover, the tannins were confined to the shell portion of the rubber seeds. Thus decortication appeared to be a satisfactory method for eliminating the tannins in rubber seeds, but increased the HCN levels slightly.

Oil extraction and autoclaving failed to reduce the HCN and tannin levels, but fermentation successfully reduced both HCN and tannin levels in the rubber seed and its products.

### INTRODUCTION

Para-rubber (*Hevea brasiliensis*) seed contains the cyanogenetic glycoside linamarin, which on hydrolysis yields highly toxic hydrogen cyanide (HCN). Bredemann (1931) found that rubber seed products contained about 0.02%

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HCN. Georgi et al. (1932) noticed that the HCN content of fresh rubber kernels was high, but diminished rapidly during storage. The liberated HCN can be driven off by heat or fermentation. The HCN can also be detoxified by the enzyme rhodanase.

Saponins and alkaloids are absent from rubber seed meal (Anon., 1929). The presence of tannins, if any, in rubber seed products has not yet been explored. Hence, the present investigation was undertaken to determine the HCN and tannin contents of rubber seed and its products. An attempt has also been made to assess the effectiveness of storage and of processing methods, such as decortication, oil extraction, autoclaving and fermentation, in reducing the HCN and tannin contents of rubber seed and its products.

## MATERIALS AND METHODS

### *Processing*

A portion of the para-rubber seeds collected were decorticated manually. The seeds (undecorticated) and kernels (decorticated) were extracted in a rotary press to remove the oil. Portions of the resultant undecorticated and decorticated rubber seed oil meals (URSOM and DR SOM, respectively) were subjected to either autoclaving or fermentation. Autoclaving was carried out at a pressure of 1.1 kg per cm<sup>2</sup> for 15 min and was followed by oven drying at 80°C. Fermentation was achieved by soaking the oil meals in tap water (1 : 3) for 24 h. The excess water was then drained off and the oil meal was sun-dried. A commercially available decorticated rubber seed oil meal (CDRSOM) was also purchased and a portion of it was subjected to autoclaving or fermentation as described above. All the above products were stored at room temperature (22–38°C) for further assay.

### *HCN and tannin estimation*

Representative samples of rubber seeds (full fat undecorticated rubber seed meal — FFURSM) and kernels (full fat decorticated rubber seed meal — FFDRSM) were analysed in duplicate for their HCN content by the alkaline titration method (Association of Official Analytical Chemists, 1975) 1 week after harvest. Subsequently, their HCN content was estimated after 2 weeks and 1, 2, 3, 4, 6 and 9 months of storage at room temperature. Similarly, the HCN content of URSOM, DR SOM and their autoclaved (AURSOM and ADRSOM) and fermented (FURSOM and FDRSOM) products was estimated after 1, 2, 3, 4, 6 and 9 months of post-harvest storage. The HCN content of CDRSOM, autoclaved CDRSOM (ACDRSOM) and fermented CDRSOM (FCDRSOM) was estimated after 4, 6 and 9 months of post-harvest storage.

The tannin content of representative samples of these rubber seed products after 3 months storage was estimated in duplicate by the permanganometric method of the Association of Official Analytical Chemists (1975). For all these products, the duration of storage was taken from the time of harvest rather than from the time of processing.

## RESULTS

### *HCN content*

The HCN contents of rubber seed and its products as influenced by processing and storage are presented in Table I. One week after harvest, FFURSM contained 638.2 mg HCN/kg, which gradually diminished to 25.3 mg/kg after 9 months of storage at room temperature. Similarly, the HCN content of FFDRSM was also reduced from 749 mg/kg at 1 week to 26.7 mg/kg after 9 months of storage. A similar diminishing trend in HCN levels on storage was also observed in the case of other rubber seed products. Georgi et al. (1932) and Nadarajah (1969) have obtained similar results.

Among the rubber seed products, FFDRSM had the highest, and the fermented oil meals (FURSOM, FDRSOM and FCDRSOM) the lowest, HCN values, irrespective of the period of storage. Conn (1973) observed a similar reduction in HCN content by fermentation. On the other hand, none of the oil meals (extracted) and autoclaved rubber seed oil meals had lower HCN contents than the corresponding unextracted seeds or kernels and non-autoclaved oil meals, respectively.

### *Tannin content*

As shown in Table I the tannin levels in FFURSM, URSOM and AURSOM were 0.42, 0.51 and 0.53%, respectively, which were relatively low and within the safety levels (Chang and Fuller, 1964; Blackeslee and Wilson, 1979). Other rubber seed products were practically free from tannins. Table I shows that tannins were not detected in the decorticated and fermented products, thus indicating that small quantities of tannins were present in the shell portion only and none in the rubber kernels and fermented products. Panda et al. (1969) also concluded that tannins in feeds could be effectively removed by soaking in water and fermentation.

## DISCUSSION

Proper storage at room temperature was an effective method of reducing the HCN content of rubber seed and its products. The HCN levels diminished at a rapid rate during the first 2 months of storage and reached safe levels. Later, the rate of reduction in HCN levels was rather slow. Similar results were obtained by Georgi et al. (1932) and Anon. (1974).

Decorticated products had slightly more HCN than the undecorticated products, thereby indicating that HCN was more concentrated in the kernels than in the shells. Thus decortication was not an effective method of reducing the HCN content of rubber seeds.

Extraction of oil (rotary pressing) from rubber seeds and kernels also failed to reduce the HCN levels in the resultant oil meals. This was in agreement with the finding of Anon. (1974).

TABLE I  
HCN and tannin contents of rubber seed and its products as influenced by processing and storage

Product <sup>1</sup>	HCN content (mg/kg)										Tannins (% DM)
	Storage period <sup>2</sup>										
	1 week	2 weeks	1 month	2 months	3 months	4 months	6 months	9 months			
FFURSM	638.2	352.8	114.9	54.2	49.7	38.2	32.9	25.3	0.42		
FFDRSM	749.0	407.4	126.3	60.3	58.7	44.6	33.0	26.7	0.00		
URSOM	—	—	119.7	62.4	63.8	48.2	33.8	28.1	0.51		
AURSOM	—	—	118.4	64.2	60.5	58.4	35.2	28.5	0.53		
FURSOM	—	—	2.6	2.8	1.8	1.8	1.5	1.6	0.00		
DRSOM	—	—	125.3	72.7	74.9	54.8	34.7	28.4	0.00		
ADRSOM	—	—	123.8	68.3	68.5	52.0	33.0	32.6	0.00		
FDRSOM	—	—	1.8	2.8	1.2	1.6	2.4	1.8	0.00		
CDRSOM	—	—	—	—	—	49.6	48.3	45.2	0.00		
ACDRSOM	—	—	—	—	—	47.2	46.7	40.6	0.00		
FCDRSOM	—	—	—	—	—	2.0	1.8	1.6	0.00		

<sup>1</sup> For an explanation of the products' codes see the text.

<sup>2</sup> Storage period was the period between the time of harvest and the time of assay.

Autoclaving of URSOM and CDRSOM also failed to reduce their HCN levels. Contrary to this observation, fermentation of rubber seed oil meals by soaking them in water effectively reduced their HCN levels. Conn (1973) arrived at similar conclusions.

Tannins were present in small quantities in rubber seeds and other un-decorticated products except the fermented oil meal. Thus decortication and fermentation appeared to be effective methods of removing the tannins in rubber seed and its products, while autoclaving and oil extraction were ineffective.

Further, it might be concluded that newly harvested rubber seeds and their products contain high levels of HCN, which can be reduced to safer levels (Jalaludin and Yin, 1972) merely by storage at room temperature under dry conditions for about 2 months, without any processing. Since the tannins were present in rubber seed and its products in small quantities in the shell portion only, they did not pose a problem for the utilisation of rubber seed and its products in livestock feeds.

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