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AN INVESTIGATION INTO ELIMINATION OF CYANIDE FROM UNDER PROCESS SOIBUM

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ABSTRACT
Comparative envisaging into way of elimination of cyanide for two methods of Soibum processing in laboratory as exudate draining (LPS-I) and exudate retaining (LPS-II) were studied. The rate of release of HCN ranges from 6.05 - 0.37 μg/hr/100g and 4.13 - 0.17 μg/hr/100g from the fermenting mash upto day 360 of LPS-I and LPS-II respectively. In LPS-I, HCN was also eliminated from the fermenting mash by dissolution as exudate that had been drained out and collected on intermittent days. The volume of exudation went on decreasing with time, but upto day 60, HCN was found to be increasingly extracted with successive later collection, total volume of exudate per 100 g of mash as on 360 days was 14.18 mL and its HCN content was recorded to be 4551.49 mg. The study reveals that LPS-I plays a major role of sooner elimination of HCN from the fermenting mash than LPS-II due to accumulation of exudate which holds a substantial amount of HCN since the onset of fermentation and this might impart to comparatively higher rate of HCN release from the fermenting mash.

INTRODUCTION

It is well known that bamboos are cyanogenic plants and bamboo shoots of different species possess varying amounts of cyanogenic glycoside called taxiphyllin (Schwarzmaier, 1977) which occurs at relatively higher amount in immature shoot tip (Nartey, 1980). Though cyanogenic, succulent shoots of edible bamboo species have been consumed as food both fresh and processed forms, more particularly in bamboo growing tropical and sub- tropical countries of the world. Since bamboo shoot is easily fermentable, people living in such places have been consuming fermented bamboo shoot as indigenous and favorite food since many centuries ago (Yamaguchi, 1983; Giri and Janmejay, 2000; Bhatt *et al.,* 2005a and 2005b). In Manipur, fermented bamboo shoot known as Soibum, has been considered as relishable dish by people since historical period. The lethal level of HCN is 60mg per man. But it has never reached as calculated out from the per capita consumption of fermented bamboo shoot. Two methods are usually adopted in the Soibum processing as exudate draining and exudate retaining. Giri and Janmejay (1994a) studied about the release of HCN from mash of Soibum undergoing fermentation with adoption of exudate retaining method. Soibum possesses very appreciably low amount of cyanide as compared with fresh succulent bamboo shoot. The present study is taken up for comparative envisaging into the degree of elimination of cyanide in the two methods by simulating in laboratory such as exudate draining method (LPS-1) and exudate retaining method (LPS-II).

MATERIALS AND METHODS

Succulent bamboo shoots of *Dendrocalamus giganteus* of uniform size and maturity were procured from different places of Imphal valley of Manipur. The scale leaves and outer hard coverings were removed manually and remaining portions were sliced into thinly and mixed uniformly. This mash was immediately subjected to fermentation for production of Soibum adopting the two traditional methods, but with slight modification of set up for following rate of release of HCN and its elimination with exudate particularly for exudate draining method.

Exudate draining method

Wooden box (1′ length, 8" breadth and 8" height) was used as fermentation chamber. Just above the upper surface of the basal wall, a pipe (2 cm bore diam.) was fixed passing through a side wall in a way keeping its one end inside the space of the chamber just above the surface of basal wall and the other end was attached with a stop cock. The inner surfaces of the walls of the chamber were lined with polythene sheet and a passage of inner portion of fermentation chamber with the attached pipe was made by exact perforation of polythene sheet. The stop cock was closed. Slices of 10 kg were filled into the chamber. The remaining part of the polythene sheet was folded upon the surface of the packed mash covering it

completely. A whole fitting exactly with a pipe of 1 cm bore diameter was made centrally through this polythene covering and after slight insertion of the pipe through the hole, the part between the periphery of the hole and side of the pipe was made air tight with the help of rubber and fevicol. A plank fitting with the horizontal dimension of the inner of chamber, but having a hole to pass out the pipe vertically was placed over the polythene covering. The upper pipe was then closed and the mash was uniformly pressed by placing weights over the plank. Such set up done in three replicates were left for natural fermentation at ambient temperature (20.79 ± 1.42°C).

Exudate retaining method

Clean and sterile earthen pot of10 kg capacity with narrow mouth was taken as fermentation chamber. The chamber was filled with the slices upto the capacity with frequent hand pressing. The mouth was closed with a thick sheet of polythene. A pipe (1 cm bore diam) was attached centrally through the polythene cover as above. Three replicates of such preparation were left at ambient temperature (20.79 ± 1.42°C) for natural fermentation but with closing of the pipe.

Determination of cyanide content of exudate

On certain intermittent days, exudate was collected by opening the lower pipe affixed particularly for exudate draining method. After every collection of exudate the pipe was kept closed for next collection. The volume was noted. The cyanide content of exudate was determined adopting the method given by Sadasivam and Manickam (1996). For exudate retaining method, total volume of liquid accumulated in the chamber during the span of 360 days incubation was measured and cyanide content of it was measured following the method. Standard used was KCN.

Determination of the rate of release of HCN

Determination of rate of release of HCN from fermenting mashes was done according to the method given by Sadasivam and Manickam (1996). For exudate draining method, it was done after collection of exudate. Whatman no. 1 filter paper (5 X 5 cm sq.) was saturated with alkaline picrate solution and dried in dark. Vertically affixed pipes were opened. Alkaline picrate saturated filter paper was kept horizontally one inch above end of the pipe for one hr. The released HCN was absorbed by the paper whose colour had been turned into reddish brown. The filter paper was removed and its colour was eluted in known volume of distilled water. Standard KCN was used for determining the amount of cyanide absorbed by the filter paper. Results taken in three replicates were analysed statistically adopting a suitable method (Stephen and Ruth, 2000).

RESULTS AND DISCUSSION

Table 1 presents the comparative rate of release of HCN on intermittent days into the nearby surrounding during the course of Soibum processing upto one year by exudate draining and exudate retaining methods. From the fermenting mash of the former method, upto day 5, there noted an increasing release of HCN, the values recorded on alternate days beginning from day 1 being 2.51 µg/hr/100 g, 3.33 μg/hr/100 g and 4.13 μg/hr/100 g. In this case, onwards day 5 the rate of release of HCN was found to be slowed down upto span of day 360, rather weakly and not gradually during last 10 months. Unlike this pattern of the rate of change of the release of HCN in the latter method, it was found that there was no increase in the rate of release of HCN in the initial period hike up from the mash under fermentation. In this case also, the rate of release of HCN declined weakly rather irregularly during last 10 months. Interestingly, it was recorded that through the processing course, rate of release of HCN from the fermenting mash of exudate retaining method exceeded that of exudate draining method except the parameter on day 5, the ranges of rates of release of HCN being 6.05 - 0.37 μg/hr/100g and 4.13 - 0.17 μg/hr/100g from the fermenting mashes of former and latter methods respectively (Table 1 and Fig. 1).

Table 1: Release of HCN from the mashes under incubation for Soibum production by different methods and its elimination with exudate

Intermitted days	Amount of HCN released from mash μg/hr/100g	Amount of HCN released from mash μg/hr/100g	Volume of exudate collected from mashes mL/100g		Amount of HCN eliminated with exudate mg/100g	
			**	*	**	*
1	2.51	6.05		5.52		232.64
3	3.33	4.72		3.29		287.04
5	4.13	3.33		2.02		310.06
10	1.56	2.37		1.62		370.83
20	1.34	2.04		1.04		411.11
30	0.89	1.58		0.25		447.22
60	0.42 ^{g}	1.42		0.11		480.56
90	0.40 ^{g}	1.25		0.08		450.00
120	0.34 ^{f}	1.20		0.05 ^{c}		394.41
150	0.32 ^{f}	1.07 ^{a}		0.05 ^{c}		202.78
180	0.25 ^{e}	1.07 ^{a}		0.04 $^{b/c}$		177.78
210	0.24 ^{e}	1.05 ^{a}		0.03 $^{a/b}$		165.28
240	0.23 $^{d/e}$	0.82		0.02 ^{a}		148.61
270	0.21 $^{c/d}$	0.67		0.02 ^{a}		135.42
300	0.20 $^{b/c}$	0.50 ^{b}		0.02 ^{a}		118.75
330	0.18 $^{a/b}$	0.48 ^{b}		0.01 ^{a}		112.75
360	0.17 ^{a}	0.37		0.01 ^{a}		106.25
			15.03 ^{t}	14.18 ^{t}	4604.37 ^{t}	4451.49 ^{t}

Mean is of three values; Means of column with same superscript are not significantly different ($p > 0.05$); *: Under exudate draining processing (LPS-I); **: Under exudate retaining processing (LPS-II) and t: total

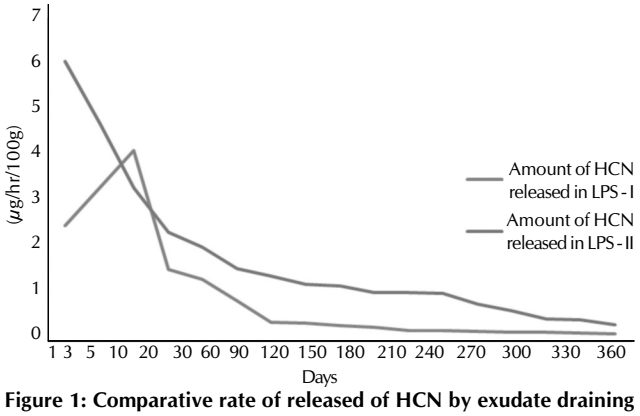

Figure 1: Comparative rate of released of HCN by exudate draining and exudates retaining methods during the course of Soibum processing up to one year

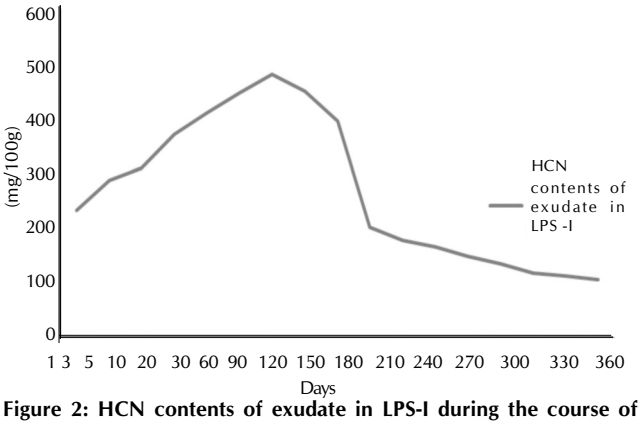

Figure 2: HCN contents of exudate in LPS-I during the course of Soibum processing upto one year

In accordance with the data of Table 1, it could be mentioned that HCN was also eliminated from the fermenting mash by dissoluting in the liquid that had been drained out particularly as exudate. The volume of exudation went on decreasing with time, but upto day 60 HCN was found to be increasingly extracted with successive later collections. From the data, it became conspicuous that draining of exudate played a major role for sooner elimination of HCN from the fermenting mash. In exudate retaining method, the accumulated exudate might hold a substantial amount of HCN since the onset of fermentation and this might impart to the comparatively higher rate of HCN release from the fermenting mash. For this method, total volume of exudate retained per 100 g of mash as on day 360 was 15.03 mL and its HCN content was recorded to be 4604.37 mg.

It is appraising that in any case, the exudate has not been consumed by the people as drink. It might be so because of exerting bitter sensation due to occurrence of substantial amount of cyanide. In fact, from the fermenting mash of exudate retaining method, only slices have been removed for consumption as Soibum. Thus Soibum constituted only fermented slices of bamboo shoots devoid of exudate. Natural lactic acid fermentation of sliced mash of bamboo shoots begins as soon as proper packing condition is given (Giri and Janmejay, 1998). With the utilization of sugars occurring in the mash, accumulation of acids continues upto about day 20 of incubation (Giri and Janmejay, 1998, 1994b). The accumulated acid catalyses degradation of taxiphyllin into glucose, benzaldehyde and hydrocyanic acid (Giri and Janmejay, 1994a). Moreover, since the cells may not be died immediately after packaging, specific plant α-glucosidase may also play role for freeing of HCN from taxiphyllin during initial period of fermentation course.

Relative to the values of days 5 and 10 of the exudate retaining method (Table 1), the corresponding values displayed by Giri and Janmejay (1994a) were noted to be of greater probability on reason of the measuring rate of release by transferring the test sample inside a conical flask and hanging alkaline picrate saturated filter paper of the dimension inside the flask. It shows HCN is less freely released from the compact fermenting mash. It is to be reminded that the present investigation measures the rate of release through a pipe of 1 cm bore.

In Nigeria, large scale fermentation of cassava created problem is the context of releasing huge amount of HCN into the surroundings of the fermentation installations (Nartey, 1980; Osuntokun, 1980). In Manipur, in exceptional case, Soibum processing is feasibly done in matter of low capital input at places farther from the inhabited areas where the raw materials are abundant. However, it is also done in the homestead areas of Chandel, Thoubal and Tamenglong districts. Herein, it can be mentioned that HCN is a respiratory poison (Dixon and Webb, 1965; Hunter and Yang, 2002). There is need for modification of traditional method for less risky Soibum processing.

The study thus proved that lactic acid fermentation of bamboo shoot has very appreciable significance for reduction of its cyanide content.

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