REMOVAL OF COCOA BEAN ACIDITY BY IMPROVED PROCESSING

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ABSTRACT

Several methods of fermentation and drying were taken up to evolve a suitable technique yielding quality beans. The "maturation effect" resulted in lowering acidity. Fermentation boxes provided with side gaps for better aeration gave excellent results. Initial slow drying in artificial driers gave low acid beans though sundrying was the best method. The changes in micorflora during fermentation have been monitored. By improving processing methods it has been possible to mitigate the high acidity of locally produced cocoa beans.

INTRODUCTION

The cocoa bean production in India is anticipated to increase *Ca* 20,000 tons/annum by 1990. Though it should be possible that internal consumption may increase, the excess will have to be exported. The reported low quality of Indian cocoa beans especially high acidity (pH 4.6—5.0) makes it unacceptable in the world market. The cocoa bean of Malaysia also is reported to be more acidic, pH being 4.7 to 5.0 (Shepherd 1976). Defective harvesting, fermentation and drying are the main causes of acidity. Results of experiments derived to determinet he standard processing methods to overcome the problem of acidity are discussed in this paper.

MATERIALS AND METHODS

Fully ripe pods were harvested. Damaged and diseased pods were discarded. Wooden mallet was used to break-open the pods. Fresh beans, rejecting the placenta were immediately transferred to fermentation box. The box was filled leaving 2.5 cm from the top. The beans were covered on the top with fresh

banana leaves, over which one clean gunny bag was placed. The fermentation was carried out under covered space with proper drainage and aeration. Deatils of turning and other operation are given in table 1. The drying was done in hot blown electrical drier or under full sunshine.

90 ml. boiling water was added to 10 g ground sample and the pH was determined using an Elico pH meter. Fat was extracted in petroleum ether with *Ca* 40 washings.

The cocoa bean samples were collected at 24 hr intervals. Ten gram beans with pulp was transferred to 250 ml flask containing 100 ml sterile distilled water and shaken for 10 minutes. The dilution plating method was followed for enumeration of microflora. The media for yeast, acetobacter agar, tryptone and nutrient agar media were used for enumeration and isolation of yeasts, acetic acid bacteria and lactic acid bacteria respectively.

Results and Discussion

The results of processing procedures on final bean pH is summarised in Table 1. It is evident that providing sufficient aeration during fermentation and especially during later stages had beneficial effect. Temperature, moisture and aeration are important factors in fermentation processes as evaluated in our experiments. The "maturation effect" has been introduced by Liau (1976, 1978). The process involves the loss of acid from cocoa beans by keeping fermented beans warm, moist and with good air supply. Two methods are possible to create this condition viz; (i) box maturation by repeated turning (3–5 times) on 5th and 6th days to maintain a temperature around 40°C; (ii) Drier maturation by slow drying at 40°C for 4–8 hrs for first 2 days each. Eight hours drying reduced the mould growth. Among the two, the former method could be adopted due to its ease, convenience and economy.

A good quality bean with acceptable acidity level was obtained when side aeration in boxes was provided by gaps (0.5 cm) 5 cm apart. An ideal box size was 75 x 45 x 45 cm which can hold about 80 kg of wet beans. The size can be increased according

Table 1. pH values as affected by different processing methods

No.	Fermentation	Drying	pH	Mositure %
1.	Turning on 2nd and 4th days (total 7 days)	Continuous in drier	5.2	4.7
2.	—do—	Dried at 50°C for first 2 days followed by continuous drying (oven maturation)	5.6	8.5
3.	Turning on 2nd & 4th days. Box Maturation by turning 5 times on 5th and 6th days (Total 6 days)	Continuous oven drying	6.2	5.9
4.	Box Maturation (size 75 x 45 x 45cm side ventilation)	First two days 8 hrs drying in oven followed by continuous drying.	5.5	5.5
5.	—do—	Sundrying	5.7	5.7

Table 2. Microbial changes during fermentation (10^5 No/g bean)

Days	Yeast (10^5)	Bacteria (10^5)	Haemocytometer count for yeast (10^5)
0	—	—	—
1	29.2	22.3	49.43
2	32.0	30.6	22.20
3	13.3	11.6	15.84
4	12.4	18.5	13.60
5	15.8	10.6	24.44
6	15.5	1.3	16.00

Table 3. Ripe pod to bean ratios

No. of pods	Wt. of fresh pods (Kg)	Wt. of fresh beans (Kg)	% of Fresh beans to fresh wt. pods.	Wt. of fresh bean/pod (g)	No. of pods required to give 10 Kg beans.
461	175.3	52.1	30.2	113.0	89
Wt. of fermented dry beans (Kg)	% of dry bean on fresh pod Wt.	% dry bean on fresh bean wt.	No. of fresh pods required to give 1 Kg dry bean	Wt. of fresh pods required to give 1 Kg. dry beans (Kg)	Wt. fresh bean required to give 1 Kg dry bean (Kg)
37.1	8.5	28.3	32	11.7	3.6

to the requirement, but it is advisable to restrict height to 60 cm. (Shamsuddin *et al* 1978). Fermenting in a larger box with gap spaces at sides and bottom yielded dried beans with good pH values, and improved quality (Shamsuddin *et al* 1978).

The pods should be ripe for proper fermentation. It is not advisable to store pods for more than 4 days after harvest. Diseased/damaged pods should be discarded. There was no significant difference among cocoa genotypes in pH values of fresh beans and pulp. The fresh bean and pulp pH ranged from 6.3—6.9 and 3.6—4.2 respectively. The fat content was 50–56% in cocoa beans.

The microbiological enumeration showed yeast to be more active in the initial stages of fermentation. The quantitative relationship has been given in Table 2. Yeasts are involved in the conversion of pulp sugars to alcohol while further conversion to acetic acid and CO_2 is performed by bacteria. This process occurs only late during fermentation. The yeast flora showed a reduction after 4th day of fermentation. The rod shaped acetic acid bacteria in chains were observed during later stages indicating involvement in conversion of alcohol to acetic acid.

Conversion ratios (ripe pods to bean) are presented in Table 3. These would be of help to the growers and cocoa processing units as reference material.

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