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THE EFFECT OF CONTENTS OF TOTAL PHENOLIC COMPOUNDS OF BAMBOO VEGETABLE ON THE QUALITY OF SOIBUM

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The individual edible bamboo shoots of different contents of total phenolic compounds, conveniently expressed in percentages, were fermented to bring a relationship with the grades of Soibum produced. Initial mashes possessing 0.061-0.051% were found to exhibit deeper lactic fermentation as compared to that of contemporary mashes possessing 0.036-0.026%. In an attempt to decipher this unexpected outcome by following the course of fermentation initiated from two sorts of mashes examined to have about 0.030% and 0.050%, it was observed that the former value exhibited weaker control over the growth of yeasts to get lactic fermentation relatively unfavoured compared to the role of the latter value. At the end of one month, the former mash had 176 X 10^6/g lactic and 356 X 10^5/g yeast counts while the respective counts in the latter mash were 190 X 10^6/g and 217 X 10^5/g/. Lower % value was seemed to provide situations for the production of best quality. But mash possessing 0.082% exhibited weakest fermentation leading to the production of unacceptable Soibum.

Keywords : Bamboo vegetable; Contents of phenolic compounds; Fermentation; Soibum; Yeasts.

Introduction

Use of immature and soft bamboo shoots as vegetable and in the forms of fermented foods produced by traditional and industrial methods, more particularly in bamboo growing Asian countries is well known. With regard to the use of bamboo as favourite food by the people of Manipur, a north east state of India, a report[1] details that out of the annual 7.03 lakh tons of soft and immature sticks endowed by native bamboo forests spreading over an area of 3,268. 43 sq. km., about 30% is harvested for use as vegetable and through traditional fermentation. A food habit of several lakh Indian people of Manipur and neighbouring states, making peculiar from the rest of the country, is seen with the use of Soibum and like substances as human diets, all produced from bamboo vegetable through traditional fermentation and among these Soibum remains as most popular on account of its substantial production and consumption and inclusion in varieties of delicious dishes since ancient times.

There is growing world wide interest in the development of fermented foods as evident on cucumber fermentation[2]. However, since scientific attempt already done on the development of Soibum fermentation[3,4] has little prospect, there is need of further efforts to become known the conditions indispensable for the production of best Soibum.

In a study it was found that lowering of the presence of phenolic compounds, in case bamboo vegetable has higher amount of the compounds, washing serves as a successful prefermentative treatment for the production of acceptable Soibum[4]. The present study looks on a way for the production of best Soibum by prevailing traditional method with the selection of raw materials based on the contents of total phenolic compounds.

Materials and Methods

To begin elementary part of the study, immature and soft shoots (about 20 cm in diameter and 15 cm height) of *Bambusa tulda* and *Dendrocalamus giganteus*, collected from different places were treated with thin slicing for preparation of their individual pre-fermentative mashes but after manual removal of outer hard covering. Each of the mashes, ten

in number, was examined for the content of total phenolic compounds[5] and fermented in assortment at room temperature (24±6°C), providing compact packing inside 500 ml beakers and airtight sealing with polythene paper as ultimate prefermentative adoptation. The overall changes of pH, lactic acid[6], volatile acids[7] and titratable acidity[8] taking place in a fermentation period of 30 days were determined.

Further study consisted of preparation of two sorts of initial mashes, categorically taken different by having about 0.030%(I) and 0.050%(II) values[5], assorted fermentation of the mashes as above, comparison of fermentation course by intermittent determinations of pH, lactic acid[6], volatile acids[7] and titratable acidity[8], total soluble sugars[9], esters[10], volatile phenols extracted by steam distillation[5] and counting of total lactics and yeasts (microscopically) done upto day 30 of fermentation.

Results and Discussion

Results of elementary part of the study (Table 1) indicate that regarding the changes of pH, lactic and titratable acids, 0.036-0.026% values are seemed to be more offensive to lactic fermentation than do by 0.061-0.051% values as unexpected and the changes are considerably retarded by 0.082% value. However, results of Table 2 which indicate the events taking place during the course of assorted fermentation are ameliorative for the ascription of roles played by different % values originally possessed by initial mashes.

Lee and Yang[11] reported that in culture medium, certain phenolic compounds increasingly depress lactic fermentation with the amounts treated. In natural Soibum fermentation such correlation for lactics could not be conspicuous without analysing the intermittent changes taking place during the first week of fermentation period. It was made mention from the situation that the indications of lactic fermentation such as changes of pH, lactic and titratable acids, seemed upto day 6, had greater dimensions in mash I as compared to that did by mash II. The disturbance to the correlation, which did not relax once started, could be envisaged from the interference virtually exerted by non lactic cultures such as yeasts.

Table 1. Relationship between contents of total phenolic compounds and overall changes of pH, lactic, titratable and volatile acids during the fermentation for one month.

Mashes	Contents of total phenolic compounds %	Drop in pH	Lactic acid formed %	Titratable acid formed %	Volatile acids evoluted mg/100g
1	0.026	1.34	0.70	0.97	130
2	0.028	1.21	0.70	0.99	124
3	0.030	1.37	0.73	1.03	120
4	0.032	1.23	0.76	0.93	133
5	0.034	1.35	0.75	1.00	120
6	0.036	1.35	0.79	1.00	118
7	0.051	1.55	0.93	1.19	114
8	0.052	1.41	0.97	1.12	114
9	0.061	1.54	0.90	1.10	107
10	0.082	0.98	0.56	0.76	73

Contents of total phenolic compounds are for initial mashes.
Values of titratable and volatile acids are expressed as equivalents of lactic and formic acids respectively.
Each of the data represents mean of triplicating determinations.

Table 2. Comparison on the courses of two assorted fermentations initiated from mashes having different contents of total phenolic compounds.

Parameters	Mashes	Days								
		0	2	5	6	10	15	20	25	30
pH	I	5.07	4.11	ND	3.97	3.80	3.75	3.84	3.67	3.79
	II	4.91	4.80	ND	3.92	3.75	3.66	3.60	3.60	3.60
Lactic acid	I	0.01	0.18	ND	0.29	0.46	0.61	0.78	0.83	0.81
%	II	0.02	0.15	ND	0.23	0.58	0.67	0.89	0.87	0.86
Titratable acid*	I	0.03	0.46	ND	0.66	0.78	0.93	1.05	1.06	1.07
%	II	0.03	0.28	ND	0.48	0.75	1.23	1.15	1.22	1.20
Volatile acids*	I	1	ND	83	ND	126	95	134	178	128
mg/100g	II	1	ND	81	Nd	124	94	72	142	107
Total soluble	I	1.67	0.41	ND	0.27	0.15	0.07	0.10	0.10	0.11
sugars %	II	1.35	0.87	ND	1.14	0.54	0.45	0.35	0.17	0.14
Esters	I	ND	ND	ND	ND	44	ND	ND	ND	89
mg/100g	II	ND	ND	ND	ND	38	ND	ND	ND	75
Volatile phenols	I	2	ND	5	ND	5	3	7	9	9
mg/100g	II	2	ND	4	ND	4	3	4	4	4
Total lactics	I	39	69	186	ND	254	283	293	297	176
X 10^6/g	II	35	53	176	ND	280	370	381	383	190
Total yeasts	I	3	106	365	ND	231	254	307	374	356
X 10^5/g	II	2	14	45	ND	74	111	197	211	217

*: As in table 1.
Prefermentative mashes I and II possess about 0.030% and 0.050% of total phenolic compounds respectively.
Each of the values represents mean of triplicating determinations.
ND: Not determined.

The yeasts became apparent as soon as lactic fermentation started. Tables 1 and 2 reveal that formation of volatile acids and phenols, esters and yeast growth decrease as the % values become higher. On narration of certain reports[12-15]; *Saccharomyces, Pichia, Hanseniaspora, Candida* and *Torulopsis* sps appeared in Soibum fermentation[16], could be taken as yeast cultures bringing the correlation by individual and associative activities in the formation of the above mentioned products. Thus unlike the lactics, it is obvious that yeasts potentially enable amidst the competition for nutrients with lactics, growing in the entire fermentation obeying the correlation. An obligatory what the yeasts would have done to achieve it, was enhanced intake of soluble sugars in mash I fermentation thereby making the lactics deficient of sugars to deviate from their correlation, not later than 1st week. The report of Ticha et al[17]. agrees with this postulation. However, as evident by Tables 1 and 2, the main changes in Soibum fermentation are due to lactic fermentation and the agents for this are *Leuconostoc mesenteroides, Lactobacillus corneformis, L. brevis* and *Streptococcus lactis*[16].

The comparative data analysis further ascribed that at the toxicity exercised by 0.050%, the remarkably checked yeast growth has enable the lactics to aptly perform lactic fermentation by steady magnification of activities to get formed lactic and titratable acids at relatively higher amounts with slower utilization of sugars. On the other hand, lessening of toxicity by 0.020%, permitted intensified growth of both lactics and yeasts from the earliest time, with speeding utilization of soluble sugars, perhaps leaving no time to witness their Saccharolytic activity[16], by

apparent rise of soluble sugars as was on day 6 in case of mash II fermentation. Hence it was probed that the correlation for lactics later became outrule as a result of stronger interference exercised by yeasts to them and the factor responsible for this was assumed to be low % content in initial mash. From all these, it could be predicted that had there been no yeasts, the lactic fermentation of 0.030% mash would be ever incompatible. But the roles of yeasts noteworthy to mention in the production of best Soibum are the control upon too much acidity increase and appreciable formation of flavouring compounds such as volatile phenols and esters. This view had support from an earlier study[18]. However, in order the natural Soibum fermentation to be genuine, the upperhand got by lactics (Table 2) is very crucial because yeast overgrowth may initiate spoilage by raising pH which allows fungal growth[3].

A common case observed was deactivation of lactics after arrival at their maximum activities which took about 25 days. In mash I Yeasts did similarly but they somehow continued multiplication upto day 30 in mash II. On the completion of 30 days fermentation, the least duration afforded before the start of disposal for consumption, mash I had 176 X 10^6/g lactic and 356 X 10^5/g yeast counts while the respective counts in mash II were 190 X 10^6/g and 217 X 10^5/g. It was thus affirmed that the mash received optimum yeast involvement gave Soibum of best quality at shorter preparation period.

The study points out that selection of initial mash of lower % value is an technical prefermentative operation fruitful to the production of best Soibum attributed by organoleptic properties such as taste and flavour. Gradation of Soibum depending upon the contents of phenolic compounds in the initial mashes gets supportive viewpoint from equivalency of nutritional values among different cultivars of bamboo vegetable[19,20] which would favour the cultures equally in the mashes subjected to fermentation.

It is opined that extension of scientific efforts to the traditional fermentation for setting the relevant yeasts at optimum activities at the earliest would have impact to the production of best Soibum in its youngest age.

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