PROCESSING AND FERMENTATION OF COCONUT TODDY

Coconut toddy fermented for 12 hr after collection contains maximum number of bacteria and yeasts compared to the fresh and 24 hr fermented samples. Processing of toddy was done by mixing with carbon granules, followed by clarification by centrifugation, pasteurisation and bottling. Processed toddy did not contain any viable cells of bacteria or yeasts. Processed samples were clear and retained the natural colour and appearance. Significant difference was observed in the total sugar content between fresh and fermented toddy. Preservation did not substantially alter the alcohol content. Protein content of processed toddy was higher.

Coconut toddy is a popular alcoholic beverage for the lower socio-economic classes in India. The method of obtaining toddy consists a series of operations in the spathe of the coconut palm, that result in oozing of

TABLE 1. INFLUENCE OF THE PROGRESS OF FERMENTATION AND PROCESSING IN COCONUT TODDY*

Treatment to toddy	Optical density	Conductivity (μ mho)	Titratable acidity (ml of 0.1 N KOH/100 ml)	Free sugars (% w/v)	Total sugars (% w/v)	Alcohol (% w/v)	Protein (mg/100 ml)
Fresh	1.73	0.65	15.33	2.73	9.19	2.87	189.6
Fresh (processed)	0.56	0.76	12.26	3.13	9.57	2.52	101.4
12 hr fermented	1.67	0.71	18.85	2.51	3.51	4.21	160.8
12 hr fermented (processed)	0.64	0.85	15.01	2.76	3.86	3.61	83.6
24 hr fermented	1.41	0.77	24.31	1.57	2.23	7.42	154.3
24 hr fermented (processed)	0.68	0.89	22.74	1.81	2.44	6.31	81.4
Period of collection							
Fresh	1.14	0.70	13.79	2.93	9.38	2.69	145.5
12 hr fermented	1.16	0.78	16.90	2.64	3.68	3.91	122.2
24 hr fermented	1.04	0.83	23.53	1.68	2.34	6.86	117.9
Significance	H.S.	H.S.	H.S.	H.S.	H.S.	H.S.	H.S.
C.D.	0.04	0.02	1.11	0.13	0.56	0.30	14.0
Effect of treatment							
Pre-treated	1.60	0.71	19.48	2.27	4.97	4.83	168.2
Post-treated	0.63	0.83	16.67	2.57	5.28	4.14	88.8
Significance	H.S.	H.S.	H.S.	H.S.	N.S.	N.S.	N.S.
C.D.	0.04	0.012	0.90	0.102	—	—	—

H.S. = Highly significant; *Mean values of 14 samples

sweet toddy from the cut surface. Commercial toddy available in the market has an undesirable odour. Under natural conditions, toddy is fermented by native microflora consisting of yeasts and bacteria. Some of them produce ethyl alcohol while others produce aldehydes, higher alcohols and acetic acid[1]. A process has been developed for removing the undesirable odours and for controlling the fermentation. Details of the process with the results of the investigations on the influence of processing and fermentation of coconut toddy are presented in this report.

In the pretreatment of the process, toddy was mixed with activated carbon granules at 5 per cent level in a tank and kept gently mixed for a period of 30 min. The carbon mixed toddy was clarified in a solid bowl basket centrifuge at 1000 g and pasteurised in a double pipe heat exchanger at a temperature of 80-82°C. The hot toddy was bottled either directly or collected in a balance tank and bottled subsequently. The sealed bottles were again processed in an autoclave for 30 min with steam at atmospheric pressure. Coconut toddy collected in the early morning was considered as fresh toddy which was allowed to ferment at room temperature for 12 and 24 hr. Total bacterial and yeast counts in the processed and unprocessed samples were determined by plating on nutrient agar and glucose yeast extract agar media respectively. The pH was determined using a pH meter (Systronics). The absorbance was determined at 430 mμ using a Beckman DU 2—Spectrophotometer. The conductivity was measured with a Mullard Conductivity Bridge. Titratable acidity was determined by titration against 0.1 N potassium hydroxide. Free and total sugars were estimated by Hane's method[2]. The alcohol content was determined by the method described in AOAC[3]. For estimating the ash content, aliquots were evaporated to dryness before igniting in a muffle furnace to constant weights at 450°C. Protein was determined by Micro kjeldhal method[4]. The removal of odour of the toddy was judged on the basis of sensory evaluation. The group of individuals from the station who evaluated the toddy were selected on the basis of aptitude. The scores for the extent of odour were 1-3, 4-6 and 7-9 for slight, strong and very strong odours, respectively.

The number of bacteria and yeasts was comparatively highest in samples of toddy fermented for 12 hr. In ten samples the number of bacteria in millions/ml ranged from 28 to 134 (mean 96) in fresh toddy, 84 to 291 (mean 179) after 12 hr fermentation and 30 to 173 (mean 115) after 24 hr fermentation. The number of yeasts ranged from 29 to 64 (mean 48) in fresh toddy, 99 to 273 (mean 198) after 12 hr fermentation and 26 to 80 (mean 54) after 24 hr fermentation. The processed samples of toddy did not contain any viable cells of either yeast or bacteria. There was a reduction in pH with the progress of fermentation, but there was no difference between the

processed and unprocessed samples (pH range, 3.74-3.42).

The difference in the clarity as determined by absorbance between the processed and unprocessed toddy was high which can be attributed to the removal of microorganisms during processing. A relatively low optical density was recorded with the 24 hr fermented toddy compared to the fresh and 12 hr fermented samples (Table 1) which may be the result of a shift in the absorption maximum due to formation of certain by products. The increase in conductivity observed as a result of fermentation or processing of toddy (Table 1) may be either due to the release of ionizable matter otherwise bound by organic substances or due to the mineralization of organic substances as a result of fermentation.

The significant increase in the titratable acidity during the course of fermentation (Table 1) is suggestive of the presence of acids formed possibly as byproducts. Processing of toddy on the other hand resulted in the decrease of titratable acidity attributable to the removal of part of these acids during processing. Free and total sugars gradually decreased as the fermentation progressed (Table 1) with a concomitant increase in alcohol content. The conversion of sugar to alcohol beyond the theoritical limit may be attributed to the presence of polysaccharides in toddy which get converted to alcohol. The higher content of free sugar noticed in the processed toddy compared to the unprocessed samples (Table 1) may be the result of hydrolysis of certain constituents during the processing of toddy.

The fall in protein content was noticed as a result of fermentation and processing (Table 1). While this decrease during fermentation is the result of microbial activity the influence of the process may also chemically alter the protein content. The score of sensory evaluation of unprocessed toddy was significantly higher than the processed toddy at each intervals (mean score range 1.20-1.30 for processed toddy and 5.75-6.10 for the preprocessed toddy). Within the processed samples or within the unprocessed samples panelists were unable to find out significant differences.

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PROXIMATE COMPOSITION AND NUTRITIVE VALUE OF *PHASEOLUS MUNGOREOUS*, A CROSS BETWEEN *PHASEOLUS MUNGO* AND *PHASEOLUSAUREUS*

A comparative study of biochemical composition of *Phaseolus mungoreous*, a cross between *Phaseolus mungo* (M_{1-1}) and Phaseolus aureus (T_1) was carried out. These pulses were analysed for proximate composition and essential amino acid content. The amphidiploid contained a maximum of 27.93% protein as compared to its parents. Nutritive value based on amino acid contents indicated that pulse grains are a good source of lysine, but are deficient in tryptophan followed by sulphur amino acids.

Legumes are of importance as a chief source of protein food. They are characterised by a relatively high content of protein, an even greater content of carbohydrates and low level of oil[1].

Singh and Singh[2] reported the protein content of the hybrids, the crosses between 24-2×hybrid-4 and P. 23-67×Jalgaon 781. The results of Rao and Subramanian[3] indicate that pulses are good source of lysine, valine and aromatic amino acids but are deficient with respect to tryptophan and sulphur amino acids. Pulse breeders of this University have developed a cross, *Phaseolus mungoreous* between *Phaseolus mungo* (var. M_{1-1}) and *Phaseolus aureus* (var. T_1). In the present investigation this cross has been examined for its biochemical composition and nutritional quality.

Samples of the parents viz. *Phaseolus mungo* (M_{1-1}) and *Phaseolus aureus* (T_1) and the cross *Phaseolus mungoreous* (amphidiploid) for this study were obtained from the Department of Genetics, Haryana Agricultural University, Hissar.

The samples were analysed for moisture, ash, crude protein, true protein, crude fibre, ether extract and calcium according to AOAC methods[4], and phosphorus was determined by the modified method of Bartlett[5]. Tryptophan was determined by the colorimetric method[6] and methionine according to the method of Horn *et al.*[7] Other amino acids viz. leucine, isoleucine, valine, threonine and tyrosine were determined by paper