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Studies on Standardization of Enzyme Concentration and Process for Extraction of Tamarind Pulp, Variety Ajanta

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Abstract

The tamarind of Ajanta variety was used for the study. The experiment was conducted to standardize the concentration of enzyme i.e. Biotropicase L and the process for extraction of tamarind pulp and evaluate their chemical qualities. Four methods of extraction i.e. hot enzymatic, cold enzymatic, hot and cold extraction were used for extraction of pulp. Hot enzymatic extraction method gave the highest recovery of pulp but for suitability and availability of enzyme hot extraction method (flesh: water, 1:2, heating at 70°C for 10 minutes and soaking for 6 hours) was used for extraction of pulp from tamarind flesh. Among the different extraction methods the hot enzymatic extraction method yielded the highest pulp 92.4 per cent at 0.5 per cent concentration of enzyme in Ajanta while 1.5 per cent concentration of enzyme was given the highest recovery of pulp in case of Thailand and local market tamarind respectively than the cold enzymatic extraction method, Hot and cold extraction methods. Moreover the TSS of the extracted pulp was also higher in the hot enzymatic extraction method proved the Ajanta variety to be most promising sweet tamarind suitable for processing in to different commercial value added products.

Introduction

Looking to the fast increasing area under tamarind cultivation and also considering its therapeutically properties there is an urgent need to develop the processing technology of this perishable fruit into different commercial value added products having extended shelf life.

The main lacona is associated with the extraction of tamarind pulp. At present the pulp was extracted by the use of traditional processing techniques like soaking, maceration and straining. These techniques were not much suitable to improve the recovery of pulp, although numbers of studies have been carried out in abroad as well as in India on the extraction of tamarind pulp. Benero et al. [1] reported a method for the mechanical extraction of tamarind pulp from unpeeled fruit in which the pulp was removed from the broken shells and seeds after dilution with water (1:2 fruit: water). Pectic enzyme was used for depectinising pulp in extraction of pulp which was used for the production of tamarind concentrate [2]. Girdhari Lal et al. [3] described for preparation of pulp from fruits, steps like selection of fruits and extraction of pulp by rubbing fruits on 1mm mesh stainless steel sieve. Kotecha and Kadam [4] reported that pulp from matured and healthy tamarind pods were extracted by four methods viz. cold, hot, cold enzymatic and hot enzymatic extraction. Lakshmi et al. [5] used the combination of enzymes to get the maximum extraction of pulp from the pods. The investigation under presentation and efforts towards this vein was taken to standardize the concentration of enzyme i.e. Biotropicase L and the process for extraction of tamarind pulp and evaluate their chemical qualities for newly released Ajanta variety with comparison of Thailand and local variety.

Materials and Methods

The sweet cum sour tamarind variety 'Ajanta' was procured from 'Fruit Research Station (FRS) Marathwada Agricultural University, Aurangabad. The sweet tamarind from Thailand was procured from Rahuri. The sour tamarind was procured from local variety Parbhani. The enzyme 'Biotropicase L' was procured from Viraj Enterprises Science House, Parbhani. Ripe, healthy pods with uniform size, color and maturity was selected.

Extraction of pulp from tamarind fruits

Prior to extraction of pulp, firstly ripe tamarind pods of uniform maturity, having reddish brown color has to be selected. Then flesh of pod has to be separated manually from shell, fiber, rags and seeds. Extraction of pulp is the major problem in processing of tamarind because the pulp was tightly associated with the seeds. After cleaning the pods, preliminary trials were conducted to standardize the method of extraction of the pulp as per described by Kotecha and Kadam [4].

Cold extraction

In cold extraction method, flesh was soaked in the water. Ratio of flesh: water was varied to obtain maximum separation of pulp. Ratio was maintained as flesh: water as 1:2 for 6 Hrs. After soaking the mixture was homogenized and filtered to obtain fine pulp. According to the scientist Benero et al. [1] the extraction rate was maximum in 1:2 proportions, which gives highest total soluble solids and total sugars. The yield of pulp was calculated on fruit weight basis.

Hot extraction

In hot extraction method, flesh was soaked in the water and heated to a temperature of 70^{0}C for 10 minutes after addition of water and ratio was maintained as flesh: water as 1:2, followed by soaking for 6

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hrs. After soaking the mixture was homogenized and filtered to obtain fine pulp. The yield of pulp was calculated on fruit weight basis.

Cold enzymatic extraction

In cold enzymatic extraction flesh was soaked with enzyme 'Biotropicase L' in order to extract pulp. In this method flesh was soaked along with water in concentration of 1:2 as flesh: water. This mixture was incubated at 37^{0}C for 6 hrs with Biotropicase L enzyme. The concentration of enzyme for higher yield of pulp was standardized by varying concentration at the rate of 0.5 per cent, 1.0 per cent, 1.5 per cent and 2.0 per cent.

Hot enzymatic extraction

In hot enzymatic extraction tamarind flesh was soaked in the water and heated at 70^{0}C for 10 min after addition of water in the proportion of 1:2 as flesh: water. This mixture was cooled at room temperature because at high temperature enzyme gets inactivated. After cooling it was inoculated with Biotropicase L and these were incubated for 6 hrs. The concentration of enzyme for higher yield of pulp was standardized by varying concentration at the rate of 0.5 per cent, 1.0 per cent, 1.5 per cent and 2.0 per cent. After soaking period, mixture was homogenized and filtered to obtain fine pulp. Finally pulp yield was calculated. The pulp obtained by all above mentioned methods for each variety was analyzed for its yield and the method giving highest yield of pulp for each variety was selected as standard method for extraction of pulp from respected tamarind variety.

Results and Discussion

Effect of enzyme concentration on the yield of tamarind pulp

The preliminary trials were conducted to study the effect of enzyme concentration (0.5, 1.0, 1.5 and 2.0 per cent) on recovery of pulp from tamarind flesh.

The pulp was extracted after addition of water (flesh: water, 1:2) and also use of heat and Biotropicase L enzyme increased the recovery of pulp over cold process. The addition of water (flesh: water, 1:2) did not impair the quality of tamarind pulp [4]. Chopra and Singh [6] also reported that the flesh: water ratio of 1:2 and heating at 100^{0}C were found ideal for easy extraction of pulp from wood apple fruit. The data regarding the effect of enzyme concentration and method of extraction on recovery of pulp is presented in table 1. The results on the effect of extraction method on the yield of tamarind pulp revealed that the hot enzymatic extraction method recovered highest pulp over cold enzymatic extraction method at different enzyme concentrations (0.5 to 2.0 per cent). The highest yield of pulp may be due to complete removal of pulp adhering to the skin by heating treatment.

Among the hot enzymatic extraction method 0.5 per cent enzyme concentration obtained maximum recovery (92.4 per cent) of pulp and it was statistically significant over other concentrations of enzyme while 2.0 per cent had less recovery of pulp (80.5 per cent) in Ajanta. Moreover in hot enzymatic extraction method Ajanta variety yielded higher pulp (80.5 to 92.4 per cent) followed by Thailand (62.6 to 70.0 per cent) and local variety (53.3 to 62.6 per cent). Further in hot enzymatic extraction method 1.5 per cent concentration of enzyme recovered highest pulp in Thailand and local variety. In cold enzymatic extraction method similar recovery of pulp was observed with respect to varieties but the concentration of enzyme was varied. 1.5 per cent concentration of enzyme was recovered more pulp (78.6 per cent) in Ajanta as compared to Thailand (46.6 per cent) and local (48.0 per cent) variety at 2.0 per cent enzyme concentration. The combined effect of use of enzyme and heating in hot enzymatic extraction method recovered highest pulp over cold enzymatic extraction method.

The effect of enzyme and heating for highest pulp recovery over the cold process are in good agreement with the results reported by Kotecha et al. [4] that Biotopicase L enzyme increased pulp recovery over the cold process in which the effect of enzyme concentration (0.25, 0.50, and 0.75 per cent) on pulp recovery showed that 0.50 per cent concentration had given highest recovery of pulp from tamarind (86.10 per cent) in hot enzymatic extraction process.

Chemical composition of tamarind pulp

The data regarding the chemical composition of tamarind pulp extracted by hot enzymatic extraction method is tabulated in Table 2. The TSS of tamarind pulp used for preparation of commercial value added products was found to be 31^0 Brix in local tamarind followed by 27^0 Brix and 26^0 Brix in Ajanta and Thailand varieties respectively.

The tartaric acid was found in highest quantity (3.9 per cent) in local tamarind followed by 1.8 percent in Ajanta pulp and 1.1 per cent in Thailand pulp respectively which indicates that the Ajanta and Thailand varieties are comparatively sweeter than local variety. Kotecha et al. [4] observed the titratable acidity in fresh tamarind flesh of Local, Pratishthan and Number 263 cultivars ranged from 6.98 to 11.93 per cent.

The reducing sugar was found to be in the range of 16.6-17.7 per cent and the total sugar of Thailand variety was noted to be highest (43.8 per cent) as compared to local tamarind (34.6 per cent) and Ajanta (38.8 per cent) respectively. Thailand variety was found to be statistically significant over Ajanta and local variety with respect to

Enzyme concentration (%)	Extraction methods					
	Hot Enzymatic Extraction			Cold Enzymatic Extraction		
	Variety			Variety		
	Ajanta	Thailand	Local	Ajanta	Thailand	Local
0.5	92.4	62.6	57.3	75.5	44.0	40.0
1.0	86.7	64.0	61.0	76.5	45.2	42.6
1.5	86.1	72.0	62.6	78.6	45.3	46.6
2.0	80.5	66.6	53.3	74.6	46.6	48.0
S.E.	0.5768	0.3646	0.34785	0.5447	0.3567	0.39019
C.D. at 5% level	1.7268	1.0917	1.0413	1.6307	1.0678	1.168

Table 1: Effect of enzyme concentration on the yield of tamarind pulp.

Parameters	Variety			S.E.	CD at 5 %
	Ajanta	Thailand	Local		
TSS (^{0}Brix)	27	26	31	0.336	1.034
pH	2.6	4.2	1.9	0.125	0.385
Acidity (%)	1.5	0.9	3.3	0.046	0.144
Tartaric acid (%)	1.8	1.1	3.92	0.090	0.2783
Reducing Sugar (%)	17.7	17.7	16.6	0.344	1.059
Total Sugar (%)	38.8	43.8	34.6	0.514	1.584
Ascorbic acid (%)	3.9	3.0	5.4	0.179	0.552
Calcium (mg)	368	141	402	1.82	5.61
Iron (mg)	1.53	0.9	1.42	0.0233	0.0717

Table 2: Chemical composition of tamarind pulp.

total sugar content. Moreover Ajanta variety was also significant over local variety. Lewis and Neelkanthan [7] explained that the formation and breakdown of starch resulted in the accumulation of 30 to 40 per cent reducing sugars in harvested fruit giving it sweet taste.

The values of reducing and total sugars are in agreement with the reported values. Duke [8] explained the reducing sugar and total sugar content of tamarind pulp was ranged from 16.20 to 17.02 and 20.40 to 22.05 per cent and Ishola et al. [9] reported the reducing sugar and total sugar content as 25.0 to 45.0 and 41.77 per cent in flesh of tamarind.

Further the ascorbic acid was in highest quantity i.e. 5.4 per cent in local tamarind followed by 3.9 percent in Ajanta and 3.0 per cent that in Thailand variety respectively. In the present investigation the values of ascorbic acid contents were on lower side than the values reported in the literature. The ascorbic acid content of the pulp ranged from 4.55 to 5.20 mg/100 g [4].It has been reported that the ascorbic acid content ranged from 3.0 to 9.0 mg per 100 g flesh from tamarind pod [8]. A similar result was observed by Anonymous [10] and Ishola et al. [9]. Singh et al. [11,12] reported 5.27 mg/100 g ascorbic acid in seed free wood apple fresh.

Tamarind is good source of calcium but poor in iron. The calcium and iron content (mg %) of fresh pulp of Ajanta was 368 and 1.53mg which was higher than that in Thailand pulp (141 and 0.9mg) and lower than in local tamarind i.e. 395 and 1.41mg respectively. The calcium, phosphorous and iron content (mg %) of fresh pulp ranged from 402 to 405, 147 to 150 and 1.4 to 1.5 respectively [4]. Dried tamarind pulp contained 9mg% of iron 1.3 to 10.9, calcium 81 to 466 and phosphorous 86 to 190 Bhattacharya et al. [13] and Ishola et al. [9] reported the similar results close to the study. In the present investigation the values of tartaric acid and titratable acidity were on lower side than the values reported in the literature.

At last the chemical composition of tamarind pulp revealed that the sugar acid ratio of Ajanta and Thailand was found to be adequate for the processing of tamarind into different value added products.

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