Biochemical Changes During Storage of Arecanut (*Areca catechu* L.)

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Abstract

Changes in biochemical constituents during storage of arecanuts were studied. Protein, fat, phenols, sugars and arecoline contents decreased significantly during storage. When whole dried nuts with husk were stored for one year, the contents of protein, fat, total phenols, reducing sugars and total sugars decreased to a lesser extent while a slight increase in ortho dihydroxy phenols and alkaloids was noticed as compared to dehusked nuts similarly stored.

Introduction

Arecanut is one of the most important commercial crops of India. The edible endosperm of areca fruit is widely used as a masticatory in India and south East Asia either alone or as a constituent of the quid along with betel leaves, lime and tobacco. It is consumed either raw or after processing. After harvesting, the whole ripe nuts are sun-dried by spreading them in a single layer for 35-40 days. Subsequently they are stored in gunny bags or wooden boxes either as whole nuts or in the dehusked form, until sold (Mathew et al., 1963). Improper storage leads to spoilage and a reduction in the market value and render it unsuitable as a masticatory (Nambiar et al., 1972; Koti Reddy and Nambiar, 1979).

Shivasankar and Govindarajan (1963) and Virakthamath (1963) had carried out studies on the humidity - moisture relationships in processed arecanuts, but have not studied the biochemical changes during storage. In the present study, the changes in some biochemical constituents during storage spread over an year were studied.

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Materials and Methods

Arecanuts which were sun-dried and stored for one year were used along with freshly harvested and dried nuts in these studies. The following biochemical constituents viz., total protein, fat, total phenols, ortho dihydroxy phenols, total sugars, reducing sugars and alkaloids, mainly arecoline were studied for their changes during storage. The experiment was replicated thrice and the data were statistically analysed using the completely randomised design.

Estimation of protein

The nuts were ground to a fine powder and 100mg samples were digested with concentrated H_2SO_4 and the total nitrogen was estimated using microkjeldahl digestion method. The crude protein content was calculated using the conversion factor 6.25 (Anonymous, 1975.)

Estimation of fat

Samples weighing 5g each were defatted using chloroform in a soxhlet extractor for 14 hr. The solvent was evaporated and the residual weight represented the total fat content.

Estimation of total phenols and ortho dihydroxy phenols

Five hundred mg powdered sample was repeatedly washed with hot 80 per cent alcohol and made up to 100 ml. Aliquots were taken from this alcohol extract for the determination of total phenols using Folin-ciocattean reagent (Bray et al., 1954) and ortho dihydroxy phenols by the method described by Mahadevan (1966).

Estimation of total sugars and reducing sugars

Five ml of the alcohol extract was evaporated and dissolved in 2 ml distilled water. Aliquots were taken for the estimation of total sugars by the phenol-sulphuric acid method(Dubois et al., 1956) and reducing sugars by the copper-reduction method (Nelson, 1944). Prior to this, the extract was clarified free of phenols using lead acetate and potassium oxalate as described by Peech et al., (1955), since tests showed that phenols interfered with the estimation of sugars.

Estimation of arecoline

Since the major alkaloid present in arecanut is arecoline, the same was estimated by the rapid distillation method described by Nambudiri (1968). The powdered sample (2.5g) was steam-distilled along with 5 ml 0.3 N NaOH and the distillate was collected in a receiver containing 0.02 N H_2SO_4. This was then titrated against 0.02 N NaOH using methyl red as indicator. One ml of 0.02 N NaOH is equivalent to 0.003108g of arecoline.

Isolation of fungi

For the isolation of the fungi, potato dextrose agar medium was used. Nuts showing different degrees of discolouration were selected for isolation.

Results and Discussion

Data given in Table 1 show that in stored nuts, there was a significant decrease in all the constituents studied as compared to fresh nuts. The total protein content decreased by 22.19 and 30.27 per cent in

Table 1. Biochemical constituents in stored areca nuts

Constituents	Fresh Nuts	Stored nuts with husk	Stored nuts without husk	Percentage decrease / increase			C. D. (P=0.05)
				Col. 1 & 2	Col. 1 & 3	Col. 2 & 3	
	(1)	(2)	(3)				
Protein	7.50	5.83	5.23	22.19	30.27	10.38	0.6020
Phenols	7.63	5.86	5.01	23.20	34.34	14.51	0.3597
O. D. phenols	1.09	0.61	0.73	44.34	32.94	+20.49	0.0799
Total sugars	4.99	3.64	2.46	24.01	50.70	32.42	0.4195
Reducing sugars	0.97	0.81	0.62	16.32	35.93	23.44	0.0813
Arecoline	0.43	0.22	0.26	47.86	39.91	+15.39	0.0507
Total fat	17.06	12.79	9.08	25.02	46.74	28.96	1.6149

Results expressed as g / 100 g dry weight

+ . Per cent increase

stored nuts with and without husk respectively. A reduction of 10.38 per cent in protein content occurred when the nuts were dehusked as compared to whole nuts.

Phenol content decreased significantly by 23.20 and 34.34 per cent in stored nuts with and without husk respectively. Comparing nuts with and without husk, a decrease of 14.5 per cent in phenols was observed in the latter during storage. Though ortho dihydroxy phenols registered a significant decrease of 44.34 per cent and 32.94 per cent respectively in stored nuts with and without husk there was an increase of 20.49 per cent in dehusked nuts as compared to whole dried nuts.

The total sugars showed a reduction of 24.01 per cent and 50.7 per cent respectively in nuts with and without husk, during storage. A reduction of 32.42 per cent more was observed in dehusked nuts. Storage of nuts caused a decrease of 16.32 per cent and 35.32 per cent respectively in nuts with and without husk with regard to reducing sugars. Here a reduction of 23.44 per cent was observed in dehusk ed nuts as compared to whole dried nuts.

Eventhough there was a reduction in the arecoline content to the extent of 47.86 per cent and 39.91 per cent in stored nuts, an increase of 15.39 per cent was observed in dehusked nuts as compared to whole nuts during storage. Total fat also registered a significant decrease of 25.02 per cent and 46.74 per cent during storage. However, the fat content was more in nuts stored with husk as compared to dehusked ones, the decrease in latter being 28.96 per cent.

The storage of areca render them susceptible to attack by fungi. The predominant fungi isolated were *Aspergillus niger, A. flavus, A. terreus, A. fumigatus, Chaetomium* sp. and *Botryodiplodia* sp. The reduction in the various constituents may be due to the fungal activity or due to the normal biochemical changes taking place in nuts during storage. The reduction in the fat content is possibly due to the auto-oxidation of lipids with passage of time. During storage, the oxidative enzymes may become active causing a reduction in the phenol content, thereby making it more susceptible to attack by fungi. However, lesser decrease was noticed in nuts stored with husk, except in the case of other dihydroxy phenols and arecoline. Hence it is certain that the quality can be better maintained by storing the nuts with the husk intact.

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Discussion

S Shivashankar:

What is the initial moisture content of the nuts? At what stage it got fungal infection?

B Chempakam:

The initial moisture content comes up to 8.1 to 8.4 per cent. The stages of infection by the fungi was not studied.

Abi Cheeran:

What is the basis for per cent calculation of different contents?

B Chempakam:

The data were calculated on dry weight basis.