Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5302

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (2):** 670-673 (2018)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Effect of Packaging Materials on Processing Quality of Cashew Nut (*Anacardium occidentale* L.)

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Received: 25.07.2017 | Revised: 20.08.2017 | Accepted: 26.08.2017

ABSTRACT

The study was conducted at Agricultural and Horticultural Research Station Ullal, Mangalore during February to May 2013 to find out the influence of different packaging material on storability and processing qualities of raw cashew nuts. Storing of nuts in gunny bags recorded highest bulk density (538.06 kgm3), physiological gain in weight (0.32 %), shelling percentage (31.04) and lowest bacterial count (8.80 cfu/g). Whereas, the nuts in lined polythene bag recorded lowest moisture content (10.24 %), fungal count (14.53 cfu/g) and highest true density (1090.93 kgm3).

Key words: *Cashew nut, Bulk density, True density, Porosity, Packaging material, Shelling percentage*

INTRODUCTION

Cashew is small to medium sized tree belonging to the family anacardiaceae[12] widely grown in tropical climate for the nutritional value of its nuts and apples[10]. It is a native of South American continent and originated in the country Brazil. It is a one of the most important commercial plantation and foreign exchange earning crop of India mainly grown for its nut. The cashew tree widely cultivated across the coastal regions of the tropics[7]. The three main cashew products traded in the international market are: raw cashew nuts, cashew kernels and cashew shell liquid[1]. Processing raw cashew nuts into kernel is generally a time consuming and labour intensive operation, involving heat treatment of nuts, shelling, peeling, grading and packaging, which has a greater role in determining the properties of the cashew nuts. The greater value of cashew nuts is lost due to spoilage after a period of time due to improper handling and storage conditions. The rate of spoilage is dependent on moisture content of stored nuts, relative humidity of the storage environment and permeability of packaging materials, ambient temperature and insect infestation. The moisture content and storage conditions bring about many characteristic changes in nuts during the storage period. However there was not much research work done on the packaging materials for storage of cashew nuts.

Cite this article: Lakshmana, Venkatesha Babu, L.N., Goudar, S.A., Effect of Packaging Materials on Processing Quality of Cashew Nut (*Anacardium occidentale* L.), *Int. J. Pure App. Biosci.* **6(2):** 670-673 (2018). doi: http://dx.doi.org/10.18782/2320-7051.5302

Hence, the present study was carried to determine the post harvest physical properties such as bulk density, moisture content, true density and porosity of the nuts and its effects on the development of microbial load on cashew nuts during storage.

MATERIAL AND METHODS

The experiment was conducted at Agricultural and horticultural research station Ullal, Mangalore during February to May 2013. The insect and disease free nuts were collected from the plantation of AHRS, Ullal. Nuts of uniform size, shape and free from injuries were selected, cleaned and used for experiment to determine their physical properties. In each experiment 25 quintols of raw cashew nuts were obtained from the plantation. The nuts were sun dried for three days by exposing the cashew nuts to direct sun light from morning 9.00 am to evening 4.00 pm. Soon after drying, the dried nuts were collected in gunny bag and polythene bags and stored for 90 days. These nuts were examined for their physical properties and quality parameters during different storage durations.

Bulk density was calculated from the mass and volume of the circular container with cashew nuts. The bulk density was calculated using the following equation (ρb).

$$\rho b = \frac{w}{v}$$

Where, ρb = Bulk density, W=weight of sample (g) and V=Volume of cylinder (cm^3)

The true volume, ($V=cm^3$), as a function of moisture content was determined using the liquid displacement method[11]. Toluene (C_7H_8) was ised instead of water, Then, the true density was calculated using the following equation.

$$\rho_t\,(gcm^3) = \frac{\text{mass of individual (g)}}{\text{volume of toluene displaced } (cm^3)}$$

where, ρ_{t} = True density

The porosity of the bulk is the ratio of the volume of internal pores in the particle to its bulk volume. The porosity of nut was calculated from the bulk and true density, using the following equation[9].

$$\mathfrak{E} = [1 - \frac{\rho b}{\rho t}]\ 100$$

Where, Ɛ = porosity (%), ρb = bulk density (kgm^{-3}), ρb = True density

The moisture content of nuts was determined using the toluene distillation method[13]. It was calculated on wet basis by using the following equation

$$\text{MC} = \frac{V}{W} \text{x } 100$$

Where, V= volume of water collected, W= Weight of sample, MC = Moisture content

The shelling percentage was calculated by using the following formulae

$$\text{Shelling percentage} = \frac{\text{kernel weight}}{\text{Nut weight}} \text{x } 100$$

The physiological loss in weight was calculated by weighing the nuts at 15 days interval and cumulative loss in weight was calculated and expressed in percentage.

$$\text{PLW} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \text{x } 100$$

The pour plate technique was used to obtain the microbial load on the cashew nut by counting the number of colonies on the media.

The data obtained from the experiment was statistically analysed by using appropriate ANOVA with the suitable transformation wherever necessary. The critical differences between the treatments were worked out at five % (0.05) significance.

RESULTS AND DISCUSSION

There was a significant difference for the physical and quality parameters of cashew nut during storage. As the days of storage progressed from 15 days to 90 days, there was decrease in bulk density. It was significantly high in nuts stored in gunny bags compared to lined polythene bags. It decreased from 544.62 kgm^3 at 15 days of storage to 538.06 kgm^3 at 90 days in nuts stored in gunny bag. In case of

nuts stored in lined polythene bag it decreased from 544.33 kgm^3 to 534.7 kgm^3. Significantly highest true density (1090.93 kgm^3) was recorded in nuts stored in lined polythene bags and lowest was found in nuts stored in lined polythene bags (1088.60 kgm^3) at the end of the storage period. The true density was found to be decreasing during storage period of 3 months due absorption of moisture by the nuts and increase in volume. The true density of the nuts was found to increase linearly with its volume expansion due to moisture gain[4].

Highest porosity (59.39 %) was recorded in nuts of gunny bag compared to lined polythene bags (58.65 %) at the end of the storage. The porosity was found to increase during the storage in all the treatments and also with increase in moisture content. This could be attributed to the expansion and swelling of the nuts[3]. Similar observations were reported for cocoa beans[5]. Among the packaging materials, the nuts stored in lined polythene bags recorded lower moisture content (10.24 %) than gunny bags (10.62) at the end of the storage period. Physiological gain of weight was maximum (0.32 %) in nuts of gunny bags and minimum (0.29 %) was in lined polythene bags. The higher PGW in gunny bags can be attributed to availability of adequate amount of permeability offered by the gunny bags for the exchange of gases/ moisture, while the lined polythene bags did not or offered little permeability for the exchange of gases or moisture. Similar results were reported by Esther Gyedu-Aukoto[6], Kosoko[8] and Akinoso[2].

The shelling percentage (31.04) was highest in nuts of gunny bag and lowest in the nuts stored in polythene bags (29.86 %). There was increase in the microbial count in both the storage materials. Highest fungal count (14.73 cfu/g) was recorded in gunny bag due to higher moisture content, compared to 14.53 cfu/g in lined polythene bags. Maximum bacterial count was observed in lined polythene bags (9.00 cfu/g), whereas minimum was recorded in nuts of gunny bag (7.80 cfu/g), at the end of the storage.

Among the packaging materials gunny bag had higher nut quality attributes *viz.* bulk density (538.06 kgm^3), PGW (0.32%), shelling percentage (31.01 %) and low bacterial load (8.80 %) at 90 days after storage.

Table 1: Effect of packaging material on Bulk density, True density and Porosity of cashew nut during 90 days of storage

Treatments	Bulk density (kgm^3)						True density (kgm^3)						Porosity (%)					
	Days of storage						Days of storage						Days of storage					
	15	30	45	60	75	90	15	30	45	60	75	90	15	30	45	60	75	90
P 1	544.62	543.6	542.73	532.22	530.73	538.06	1104.53	1104.13	1086.26	1087.73	1090.2	1088.6	52.48	53.15	54.38	54.98	56.88	59.39
P 2	544.33	543.26	541.73	532	530.66	534.7	1103	1103.2	1106.33	1106	1090.93	1090.93	52.69	53.47	54.26	54.6	56.4	58.65
SEm±	**0.209**	**0.054**	**0.657**	**0.122**	**0.076**	**0.117**	**0.133**	**0.188**	**0.076**	**0.188**	**0.054**	**0.196**	**0.019**	**0.01**	**0.018**	**0.018**	**0.021**	**0.152**
CD@5%	**NS**	**0.164**	**NS**	**NS**	**NS**	**0.354**	**0.401**	**0.568**	**0.232**	**0.568**	**0.164**	**0.591**	**0.059**	**0.032**	**0.054**	**0.054**	**0.065**	**0.458**

P1 =Gunny bag, P2=Lined polythene bag

Table 2: Effect of packaging material on Physiological loss in weight, Moisture content and Shelling percentage of Cashew nuts during 90 days of storage

Treatments	PLW (%) PGW (%)						Moisture content						Shelling (%)					
	Days of storage						Days of storage						Days of storage					
	15	30	45	60	75	90	15	30	45	60	75	90	15	30	45	60	75	90
P 1	1.31	1.16	1.05	1.08	0.81	0.32	10.76	10.5	10.37	10.47	10.52	10.62	30.02	31.05	31.92	32.5	30.97	31.04
P 2	PGW 1.09	0.93	0.68	0.52	0.37	0.29	10.55	10.16	10.21	10.32	10.23	10.24	29.88	30.96	31.8	31.87	30.56	29.86
SEm±	**0.016**	**0.011**	**0.029**	**0.011**	**0.196**	**0.008**	**0.043**	**0.019**	**0.022**	**0.057**	**0.094**	**0.031**	**0.078**	**0.065**	**0.078**	**0.059**	**0.038**	**0.007**
CD@5%	**0.049**	**0.034**	**0.089**	**0.033**	**NS**	**0.024**	**0.13**	**0.059**	**0.068**	**0.174**	**0.283**	**0.095**	**NS**	**NS**	**NS**	**0.179**	**0.117**	**0.023**

P1 =Gunny bag, P2=Lined polythene bag

Table 3: Effect of packaging material on Microbial load of cashew nuts during 90 days of storage

Treatments	Fungi (cfu/g)						Bacteria (cfu/g)					
	Days of storage						Days of storage					
	15	30	45	60	75	90	15	30	45	60	75	90
P 1	10.8	10	10.53	10.73	13.53	14.73	5.8	5.86	6.33	6.8	7.8	8.8
P 2	10.26	9.93	10.6	10.2	11..8	14.53	5.53	5.6	6.2	6.93	7.6	9
SEm±	**0.108**	**0.054**	**0.121**	**0.094**	**0.054**	**0.076**	**0.076**	**0.094**	**0.054**	**0.108**	**0.064**	**0.18**
CD@5%	**0.328**	**NS**	**NS**	**0.284**	**0.164**	**NS**	**0.232**	**NS**	**NS**	**NS**	**0.192**	**NS**

P1 =Gunny bag, P2=Lined polythene bag

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