IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 3 Issue 10, October 2016
ISSN (Online) 2348 – 7968 | Impact Factor (2015) - 4.332
www.ijiset.com

Determination of Some Physical Properties of Cashew Nut

Nejo, R, Oloko, S.A.*

Department Of Agricultural And Bio-Environmental Engineering, The federal polytechnic, ado-ekiti
Ekiti state, nigeria. GSM No: 08033766399 or 07038212120
E-mail: saoloko2003@yahoo.com
*corresponding Author

Abstract

Experiments were carried out to determine the dimensions of cashew nut, sphericity and nut densities as useful parameters in its handling and processing. The major, minor and intermediate diameters of the nut were found to vary from 2.4000 to 3.5000; 1.6000 to 2.3000 and 1.3000 to 1.9000cm respectively. Sphericity was calculated to be 72.46%; Nut density was also calculated to be 10.86 gm/cm. These parameters are useful in the design of handling and processing equipment for cashew nut.

1.0 INTRODUCTION

The engineering properties of bio-materials constitute an important and essential data for design of machines, structures, processes and controls. They are also useful in the analysis and determination of the efficiency of a machine or an operation, development of a new products and equipment and the final quality of products (Mohsenin, 1980). Size and shape are important in determing the method of separation and cleaning especially by pneumatic method, density and specific gravity are needed in calculating thermal diffusivity in heat transfer and Reynold's number in pneumatic and hydraulic handling or separation, and determination of terminal velocity (Mijinyawa and Omoikhoje, 2005).

These engineering properties are not only useful to the engineers but also to food scientists and processors, plant and animal breeders and other scientists who may exploit them in their various disciplines.

Cashew (Anacardium Occidentale) originated from the Northern part of South America. The cashew tree is a tropical evergreen tree that produces the cashew seed and the cashew apple (see Figure 1). It can grow as high as 14m but the dwarf cashew growing up to 6m, has prove more profitable, with earlier maturity and higher yields (en Wikipedia.org/wiki/cashew, 2015).

The cashew seed is served as a snack or used in recipes like other nuts such as chestnuts, hazel nuts, Brazil nuts, walnuts, pecans and almonds. The cashew apple is light reddish to yellow fruit whose pulp can be processed into a sweet, as tringent fruit drink or distilled into liquor.

Originally native to north eastern Brazil, the tree is now widely cultivated in Vietnam, Nigeria and India as a major production countries (fao.otg. 2013).

According to experts, one of the agro-commodities that offer a lot of money making opportunities for Small Medium Enterprises (SMEs), owing chiefly to the favourable government policy is cashew nuts, especially in the area of processing (Emeka, 2011).

The United Nations Conference on Trade and Development, in its report on investment opportunities in cashew nuts in Nigeria says “The cashew nut sub-sector has not suffered from unfavourable government policies. Currently, no taxes are charged on export, but rather, export incentives are available to exporters of cashew nuts. (Emeka, 2011).

According to the edition of the West Africa. Trade Hub Technical Report, No. 22h, published by the United States Agency for International Development, Nigeria has the largest potential market for cashew products in the region. The report says, “cashews are a well-developed products in Nigeria, found in a wide variety of venues not seen in other West Africa countries, including airlines and hotel mini-bars. The market for cashews is growing steadily in high-end segments of the Nigerian economy, due to record oil revenues and general economic growth”. (Emeka, 2011).

Investment opportunities in cashew processing are quite enormous, considering the entire value of cashew. The fruits can crushed into pulp and used for making fruit juice. This is one of the profitable ventures which have yet to be fully tapped in Nigeria. Also, cashew nuts can be converted into snacks with different flavours. This is another investment opportunity. When you crush the seeds, you can use it to produce a lot of things including fertilizer if you mix it with other things.

Although the processing of cashew and its products in an old practice for which traditional methods are more available, new methods will not only reduce the drudgery of handling but will expand the areas in which most of the products are effectively being utilized. Data on engineering properties of a biomaterial are dependent on a number of factors such as species, or variety and the climatic environment where it is cultivated. This makes it desirable that the engineering properties of locally cultivated varieties be determined. The engineering properties determined and reported in this paper are size, mass, shape and density of cashew nut cultivated in Ado-Ekiti under a rainforest climate of Western Nigeria. Figures 2 and 3 shows the young cashew nuts and cashew nuts as a snack respectively.

2.0. Materials and Methods

2.1 Collection of Samples

The samples used for this study were collected from the demonstration farm of the Department of Agricultural and Bio-Environmental Engineering, the Federal Polytechnic, Ado-Ekiti, Ekiti State, Nigeria.

2.2 Experimentation

The experimentation involved the measurements of the dimensions of the nuts, measurement of nut thickness, density of nuts. Fifty nuts were selected from the materials collected at random after having been cleaned and mixed for use in each of the experiments. A descriptive statistical method was used to obtain results for major, minor and intermediate diameters respectively.

2.2.1 Size and Shape of Nuts

The three major axes of the nuts were measured using a venier sliding caliper with a calibration of 1 cm. the mean, median, standard deviation and mode were calculated for each of the axes and this is shown in Table 1 and Table 2 shows the ANOVA of the data obtained. The sphericity of the nuts, which is an expression of the shape character of the nut relative to that of a sphere of the same volume, was calculated from the expression presented by Mohsenin (1986) and which has been also used by Alabadon (1996) and Orji (2001) as shown in equation (1).

$$Sphericity = \frac{Geometric\ mean\ diameter}{Major\ diameter}$$

$$= \frac{(abc)\ 1/3}{a} \ldots\ldots (1)\ (Mohsenin, 1980)$$

Where:

a = *Major diameter*

b = *Minor diameter*

c = *Intermediate diameter*

2.2.2 Nut Density

After the dimensions of the nuts were measured, their weights were determined using electronic weighing balance with a calibration of 1 gm while the volume was determined using the liquid displacement method. The density for the nut was calculated from the equation (2) below:

$$\text{Density} = \frac{\text{mass of sample}}{\text{Volume of sample}} \quad \ldots\ldots\ldots (2)$$ (Mijinyawa and Omoikhge, 2005)

3.0 Results and Discussion

3.1 Size and Shape:

The average magnitudes of the major, minor and intermediate were 2.8240cm, 1.9700cm and 1.5400cm respectively. The arithmetic and geometric mean diameters were therefore calculated using equations (3) and (4) as follows:

$$AMD = \frac{(a+b+c)}{3} \quad \ldots..(3)$$ *(Mohsenin, 1980)*

Where:

AMD = Arithmetic Mean Diameter
a = Major diameter
b = Minor diameter
c = Intermediate diameter

$$AMD = \frac{(2.8240 + 1.9700 + 1.5400)}{3}$$
$$= 2.1113 \text{ cm}$$

$$GMD = (axbxc)\ 1/3 \quad \ldots\ldots (4)$$ *(Mohsenin, 1980)*

Where:

GMD = Geometric Mean Diameter

$$GMD = (2.8240 \times 1.9700 \times 1.5400)1/3$$
$$= 2.0462 \text{ cm}$$

The sphericity was obtained using equation (1) as:

$$\text{Sphericity} = \frac{\text{Geometric mean diameter}}{\text{Major diameter}}$$
$$= \frac{2.0462}{}$$

$$= \frac{2.8240}{} = 72.46\%$$

This indicates a good closeness to the shape of a sphere size and shape are important parameters in the design of crackers.

3.2 **Density**

The average density of nut was …… Density is relevant in establishing the volume of happer in cracking machine.

4.0 Conclusion

The major, minor and intermediate of the nut were found to vary from 2.4000 to 3.5000; 1.6000 to 2.3000 and 1.3000 to 1.9000cm respectively. Sphericity was calculated to be 72.46% and Nut density to be 10.86 gm/cm. These parameters are useful in the design of handling and processing equipment for the cashew nut.

Table 1: **Some Physical Properties of Cashew Nut**

Observation

LSD

(I) Properties	(J) Properties	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Major	Minor	.85400*	.09359	.000	.6694	1.0386
	Intermediate	1.28400*	.09359	.000	1.0994	1.4686
	Weight	-2.87200*	.09359	.000	-3.0566	-2.6874
Minor	Major	-.85400*	.09359	.000	-1.0386	-.6694
	Intermediate	.43000*	.09359	.000	.2454	.6146
	Weight	-3.72600*	.09359	.000	-3.9106	-3.5414
Intermediate	Major	-1.28400*	.09359	.000	-1.4686	-1.0994
	Minor	-.43000*	.09359	.000	-.6146	-.2454
	Weight	-4.15600*	.09359	.000	-4.3406	-3.9714
Weight	Major	2.87200*	.09359	.000	2.6874	3.0566
	Minor	3.72600*	.09359	.000	3.5414	3.9106
	Intermediate	4.15600*	.09359	.000	3.9714	4.3406

*. The mean difference is significant at the 0.05 level.

Table 2: **ANOVA**

Observation

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	524.583	3	174.861	798.613	.000
Within Groups	42.915	196	.219		
Total	567.499	199			

Fig 1: Ripe cashew fruit

Fig 2: Young cashew nuts

Cashew nuts as a snack

Fig 3:

References

Alabadam, B.A. (1996): Physical Properties of Selected Biomaterials as related to their Post-Harvest Handling. Proceedings of the 1996 Annual Conference of the Nigerian Institution of Agricultural Engineers.Pp 328-331.

Emeka Ezekiel (2011): Exploring the Goldmine in Cashew Nuts Processing. The Punch, Newspaper, Monday, January 31. Pp.4.

Food and Agricultural Organization of United Nations (FAO) (2013): "Major Food and Agricultural Commodities and Producers-Countries by Commodity". fao.org. 2013. Retrived 6th September, 2015.

Mijinyawa, Y and Omoikhoje, S. (2005): Determination of some Physical Properties of Palm Kernel. Proceedings of the Nigerian Institution of Agricultural Engineers.Vol. 27 pp. 157-160.

Moshsenin, N.N. (1980): "Physical Properties of Plant and Animal Materials". (2nd Edn.). Gordon and Breach Science Publisher, New York. Pp. 51-70, 495-520.

Orji, C.U. (2001): Determination of some Physical Properties of Breadfruit Seeds (Treculla Africana). Proceedings of the 2001 Annual Conference of the Nigerian Institution of Agricultural Engineers. pp 262- 265.

Wikipedia (2015): Cashew. https://en.wikipedia. Org/wiki/cashew.Retrived 7th October,2015.