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Periodic Research

Physical Properties of Custard Apple (Annona Squamosa) Seeds

Abstract

Some physical properties of custard apple seed (Annona Squamosa) were evaluated as a function of moisture content. The average length, width, thickness and thousand seed mass were 13.58 mm, 7.75 mm, 5.48 mm and 312 g respectively, at 17.64 percent (d.b.) moisture content. The seed size was decreased from 8.31 to 8.11 mm whereas; sphericity was decreased from 0.614 to 0.611with decreased in the moisture content of 17.64 to 11.11 percent (d.b.). Studies were showed that the bulk density and true density were increased from 566.9 to 583.1 kg/m^3 and 952.38 to 1052.63 kg/m^3, respectively, whereas, the corresponding bulk porosity was increased from 40.47 to 44.60 percent with decrease in moisture content. The angle of repose and coefficient of friction were decreased with decrease in moisture content.

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Introduction

Custard Apple is a sweet fruit, which is widely grown across the world. It may be nearly round or oblate, with a deep or shallow depression at the base. The skin or covering of custard apple is thin but tough, which is usually yellow or brownish when ripe. Beneath the thin covering, a thick, cream-white layer of custard like, granular, flesh is present, which surrounds seeds. It is a popular fruit of the tropical states of India, with a very sharp and short season, lasting for about 3 months a year. It is usually eaten as a dessert fruit and finds immense applications in the preparations of beverages and ice creams (Chikhalikar et al, 2000).

The seeds are so hard that they may be swallowed whole with no ill effects but the kernels are very toxic. The seeds, leaves and young fruits are insecticidal. The leaf juice kills lice. Sap from cut branches is acrid and irritant and can severely injure the eyes (Morton, J. 1987).

Physical properties of custard apple seed as a function of moisture content are to be known for design and development of relevant machines for handling and processing. Today, much data have been published on the physical properties of grains and seeds by the researchers. However, there is scarce published literature on moisture variation on physical properties of the custard apple seeds. Therefore, study was undertaken with the objective to study the various physical properties of custard apple seeds.

Materials and Methods

The custard apple fruit was procured from local market and selected randomly for obtaining seed. Custard apple seeds were obtained from the ripened fruits by separating pulp. These seed sample immediately after separated from pulp were taken for the determination of physical properties. The properties of custard apple seed were determined at two moisture level i.e., a) 17.64 % (d.b.) and b) 11.11 % (d.b.). Earlier researcher have studied physical properties of grains at different moisture level by adding moisture whereas in the present experiment physical properties of custard apple seed were studied by removing moisture by sun drying. The moisture content of the seed sample was determined by following a standard oven method (AOAC, 2002). Seed dimensions were measured using Vernier caliper with a least count of 0.05/0.02 mm. Seed volume was determined by toluene displacement method. One thousand randomly selected sound seeds of custard apple was weighed on electronic top pan balance having least count of 0.01 g. Seed size, bulk density, true density, angle of Repose and sphericity were determined according to Mohsenin (1986)

Results and Discussion

Seed size

The data obtained for seed size of custard apple seeds at different moisture level are presented in Table 1. The seed size of custard apple seeds was found to be 8.31 mm and 8.11 mm at moisture content of 17.64 % (d.b.) and 11.11 % (d.b.), respectively. The percent decrease in seed size of custard apple seed was observed as 2.41 percent, for the corresponding decrease in their moisture contents from 17.64 to 11.11 percent (d.b.).

Table 1.
Physical properties of custard apple seeds at different moisture Content(d.b)

Moisture content %(db)	Seed size (mm)	Sphericity	Seed volume (mm3)	Thousand grain mass(g)	Bulk density (Kg/m3)	True density (Kg/m3)	Bulk porosity (%)	Angle of repose (degree)
17.64	8.31	0.614	642.85	312	566.9	952.38	40.47	27.81
11.11	8.11	0.611	611.00	236	583.1	1052.63	44.60	27.09
	2.41	0.49	4.95	24.36	2.85	10.52	10.21	2.59

The result showing decrease in seed size with the decrease in moisture content were in agreement with the earlier findings for pulses (Grover and Kumar, 1985), soybean (Kulkarni et al., 1993 and Deshpande et al., 1993), green gram (Nimkar and Chattopadhyay, 2000) and for black gram (Munde, 1999).

Sphericity

It was found that sphericity decreased with decrease in moisture content and it varied from 0.614 to 0.611. Similar results of the effect of grain moisture on sphericity have been reported for locust bean pods (Kayode Oje, 1993), Chickpea (Rai and Kumar, 1995) and for soybean (Unde and More, 1996).

Seed volume

The seed volume at moisture content of 17.64 and 11.11 per cent (d.b.) was 642.85 and 611mm^3, respectively, showing decrease 4.95 percent. Similar result of decrease in grain volume due to decrease in grain moisture content was reported for gram (Dutta et al., 1988), soybean (Deshpande et al., 1993).

Thousand Seed mass

It was observed that thousand seed mass decreased with the decrease in moisture content. The thousand seed mass was found to be 312 and 236 g at moisture content of 17.64 to 11.11 percent (d.b.), respectively.

Similar results of the effect of moisture on thousand grains mass have been reported for chickpea (Gupta and Prakash, 1990), soybean (Kulkarni et al. 1993, Deshpande et al. 1993), chickpea (Suryawanshi 1998), green gram (Nimkar and Chattopadhyay 2000), white lupin (Ogut 1998) and for black gram (Munde 1999).

Bulk density

Bulk density of custard apple seeds was found to be increased with decreased in moisture content. The percent increase in bulk densities for custard apple seed was 2.85 percent corresponding to their decrease in moisture contents from 17.64 to 11.11 percent (d.b.).

The increase in bulk density for custard apple seeds with decrease in moisture content indicated that the increase in mass owing to moisture gain in the seed sample was higher than the accompanying volumetric expansion of the bulk. Similar results have been reported for fababeans (Fraser et al. 1978), pigeonpea (Shepherd and Bhardwaj 1986), chickpea (Dutta et al. 1988; Gupta and Prakash 1990), green gram (Gupta and Prakash 1990), lentil (Carman 1996), soybean (Deshpande et al. 1993) and for white lupin (Ogut 1998).

True density

It revealed that the true density was increased with decreased in moisture content. The results indicate that the percent increase in true density values for custard apple seeds was 10.52 percent for their corresponding change of moisture contents from 17.64 to 11.11 percent (d.b.).

The increase in true density values for custard apple seeds with decrease in moisture content might be attributed due to the relatively lower true volume as compared to corresponding mass of the seed attributed due to adsorption of water.

Bulk porosity

The bulk porosity values were calculated from the experimentally determined bulk densities and true densities values of custard apple seed. Bulk porosity values of custard apple seed were found to be increased with decreased in moisture content. The results indicated that the increase in bulk porosity value of custard apple seed was 10.21 percent with corresponding decrease in moisture content from 17.64 to 11.11 percent (d.b.). The increase in bulk porosity value with decrease in moisture content may be attributed due to comparatively less decrease in seed mass than the corresponding higher decrease in true seed volume due to decrease in moisture content.

Similar observation of increase in bulk porosity with decrease in seed moisture content has been reported for green gram (Munde, 1999).

Angle of repose

The angle of repose was found to be 27.81 and 27.09° at moisture content of 17.64 to 11.11 percent (d.b.), respectively, showing 2.59 percent decreased with corresponding decrease in moisture content. At higher moisture content seeds tends to stick together resulting in better stability and less flowability, which increase the value of angle of repose.

Similar results on effect of seed moisture on angle of repose have been reported for fababean and pigeonpea (Visvanathan et. al. 1990), locust bean seeds (Kayode Oje 1993), chickpea (Rai and Kumar 1995), green gram (Nimkar and Chattopadhya, 2000) and for black gram (Munde 1999).

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