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Particle size measurement and analysis of jamun (*Eugenia jambolana*) seed powder

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Abstract

The present study emphasizes on the measuring the particle size of Jamun seed powder (dried at different temp. 50, 70 and 90°C). Sieve analysis technique is used in the present study for estimation of weight percentage of micron sized (light weight flyable) powder particles. This study was undertaken to evaluate the effect of different drying temperatures viz. 50, 70 and 90°C on the quality of Jamun seed powder. The fruits were procured from the vicinity of university campus at Dr. B.S.K.K.V., Dapoli or procured from local market and was subjected to pretreatments. After procuring the fruits from the market were washed thoroughly with clean tap water. Then pulp and seeds are separated by using pulper. After separation of the seeds were washed. Then removal of surface moisture of the seed was done using blotting paper or dry clean cloth. Samples of uniform size were spread evenly in single layer on aluminium trays of tray dryer and dried at a temperature of 50, 70 and 90 °C. After making a powder by using hammer mill, the average size of particle in a ground powder is determined 0.432 to 0.491 mm. Data obtained is useful in deciding the parameters for processing of 'Jamun' seed.

Keywords: Jamun fruit, drying, *Eugenia jambolana*, quality parameters

Introduction

The whole tree of Jamun is known for its medicinal properties. The tree fruits once in a year and the berries are sweetish sour to taste. The ripe fruits are used for health drinks, making preserves, squashes, jellies and wine (Warrier, *et al.*, 1996) ^[4]. It is therefore used very extensively in traditional methods of medicine like Ayurveda and Unani. This study could be a beneficial source to the dieticians/nutritionist to consider Jamun seed as best nutraceutical with natural curing. Jamun seeds reduce blood sugar levels and glucosuria in diabetic patients and also used in various alternative healing methods in Unani. It's having good nutritive values, rich in carbohydrates, accompanied by enough protein, ash, crude fibers and very less fat. Jamun fruit seeds and pulp have been reported to serve various purposes in diabetic patients, such as lowering blood glucose levels and delaying diabetic complications including neuropathy and cataracts (Helmstadter. 2008; Sagrawat *et al.* 2006) ^[1, 2].

Jamun or Indian Black berry is considered as a traditional medicine that helps in controlling diabetes. Specially, jamun has an action on the pancreas, the main organ responsible for causing diabetes. The jamun seeds contain a type of glucose called Jamboline, which checks the conversion of starch into sugar in cases of increased production of glucose, the main reason behind your high sugar levels. It has anticancer and anti-viral properties. The seeds are claimed to contain alkaloid, jambosine, and glycoside jambolin or antimellin, which halts the diastatic conversion of starch into sugar.

Materials and Methods

The study was undertaken to evaluate the effect of different drying temperatures vic. 50, 70 and 90°C on the quality of Jamun seed powder. The fruits were procured from the vicinity of university campus at Dr. B.S.K.K.V., Dapoli or procured from local market and was subjected to pretreatments. After procuring the fruits from the market were washed thoroughly with clean tap water. Then pulp and seeds are separated by using pulper. After separation of the seeds were washed. Then removal of surface moisture of the seed was done using blotting paper or dry clean cloth. Physical properties of randomly taken seeds were also measured using vernier calliper which is given in the Table 1. Then 15g of sample was kept for moisture content determination by using hot air oven at 110°C for 24 hrs. Samples of uniform size were spread evenly in single layer on aluminium trays of tray dryer and dried at a temperature of 50, 70 and 90°C.

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Before that the tray dryer adjust at a temperature of 50°C. After getting 50°C temperature to check the temperature a probe of thermometer is inserted in the dryer. After getting the temperature of 50°C the tray no. 1, 2 and 3 were kept inside the dryer for drying. Then the Jamun seed sample of known weight was kept in the tray dryer in a single layer with three replications. The samples were weighed after every 10 minutes up to 2 hrs. Then the samples were weighed after every 30 minutes interval for 2 hrs. After that the samples were weighed after 60 minutes and drying was continued till the weight of samples was stabilized. After drying, sample was crushed into powder using a hammer mill as shown in Figure 2. After making a powder, the average size of particle in the average size of particle in a ground powder is determined. Then by using colour flex machine L, a, b factors were tested. The important constituents of Jamun seed powder were determined at different temperatures.

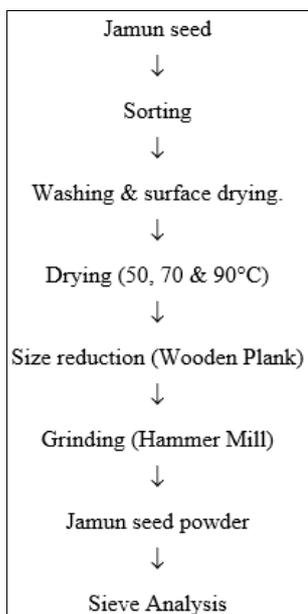


Fig 1: Flow Diagram for making Jamun seed powder



Fig 2: Hammer Mill

Procedure for sieve analysis

A representative weighed sample is poured into the top sieve

which has the largest screen opening of 1.8mm. Each lower sieve in the column has smaller openings than the one above. At the base is a round pan, called the receiver. The column is typically placed in a mechanical shaker. The shaker shakes the column, usually for 15-20 minutes. After the shaking is complete the material on each sieve is weighed. The weight of the sample of each sieve is then divided by the total weight to give a percentage retained on each sieve. The size of the average particles on each sieve then being analysis to get the cut-point or specific size range captured on screen (Sonaye and Baxi, 2012) [3].

To find the percent of aggregate passing through each sieve, first find the percent retained in each sieve. To do so, the following equation is used.

$$\% \text{ Retained} = W_{\text{sieve}} / W_{\text{total}} * 100\%$$

Results and Discussion

Physical properties were determined which is given in the Table 1. It is observed from Table 1 that the average moisture content of Jamun seed is 43.97% (db=78.49%). It is also observed that the sphericity and Length-breadth ratio is 0.67 and 1.77 respectively. The average value of bulk density, true density and porosity is 690 kg/m³, 1320 kg/m³ and 23.48% respectively.

Table 1: Physical properties of Jamun seed

Sr. No.	Moisture content, % (wb)	Sphericity	L/B ratio	Bulk Density, kg/m ³	True Density, kg/m ³	Porosity, %
1	43.97	0.67	1.77	690	1320	23.48
		(Oval shape)				

Table 2: Drying of Jamun seed at different temperatures

Sr. No.	Drying time (min)	Moisture content present in Jamun seed (% db)		
		50°	70°	90°
1	0	72.41	72.41	72.41
2	60	54.02	47.52	37.35
3	120	44.83	37.65	18.07
4	180	37.93	22.35	10.84
5	240	32.18	14.12	4.82
6	300	27.59	8.825	4.76
7	360	24.14	6.415	4.76
8	420	20.69	5.69	4.76
9	480	19.54	5.505	4.76
10	540	17.82	5.26	4.76
11	600	13.51	4.93	
12	660	9.20	4.93	
13	720	8.05	4.93	
14	780	6.90	4.93	
15	840	5.75	4.93	
16	900	4.60		
17	960	4.60		
18	1020	4.60		

It is observed from the Table 2 that the Jamun seeds with initial moisture content of 72.41 % (db) was dried to final moisture content of 4.60 % (db) in 14.50 hours at 50°C temperature using tray dryer. The Jamun seeds with initial moisture content of 76.47 % (db) was dried to final moisture content of 4.74 % (db) in 9.7 hours at 70°C temperature using tray dryer. The Jamun seeds with initial moisture content of 80.72 % (db) was dried to final moisture content of 4.76 % (db) in 4.55 hours at 90°C temperature using tray dryer Fig 3.

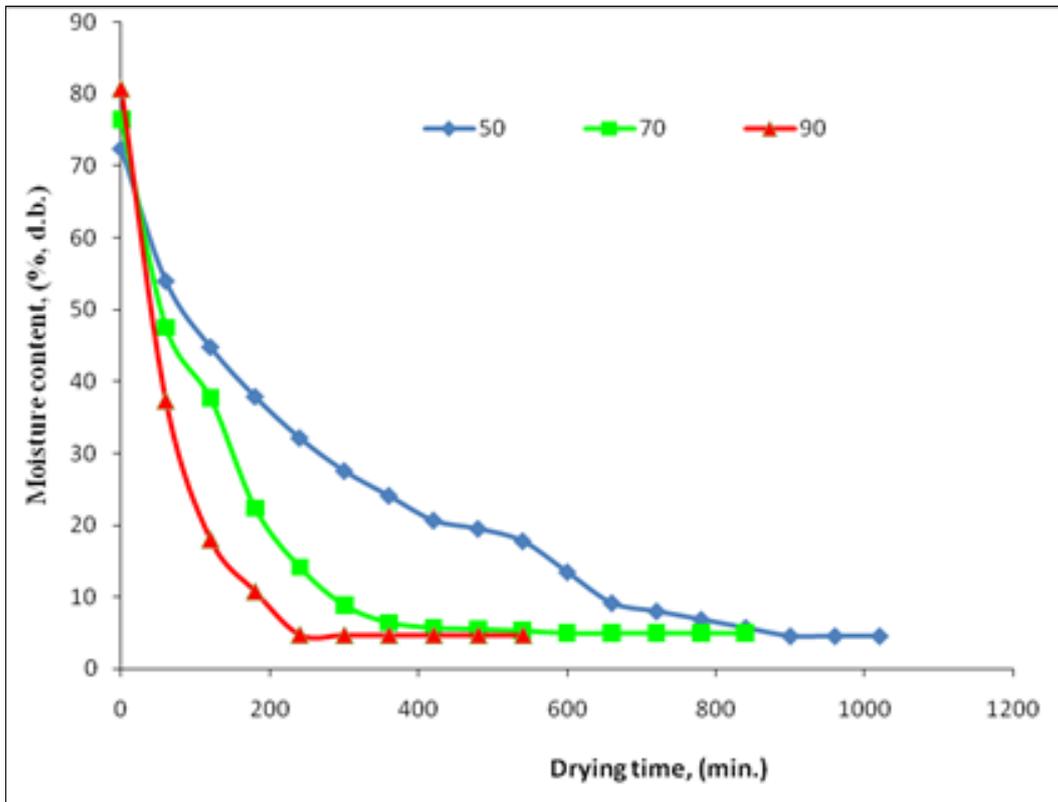


Fig 3: Drying time vs moisture content (%db)

Table 3: Sieve analysis results of Jamun seeds powder at different temperatures

Sr. No.	IS Sieve No.	% material retained		
		50°C	70°C	90°C
1	100	0.96	1.44	2.08
2	70	4.08	6.4	5.28
3	50	62.32	49.68	41.44
4	40	9.2	10.64	18.08
5	30	3.68	11.12	6.64
6	20	7.6	9.76	7.6
7	15	8	7.28	11.92
8	Pan	4.16	3.68	6.96

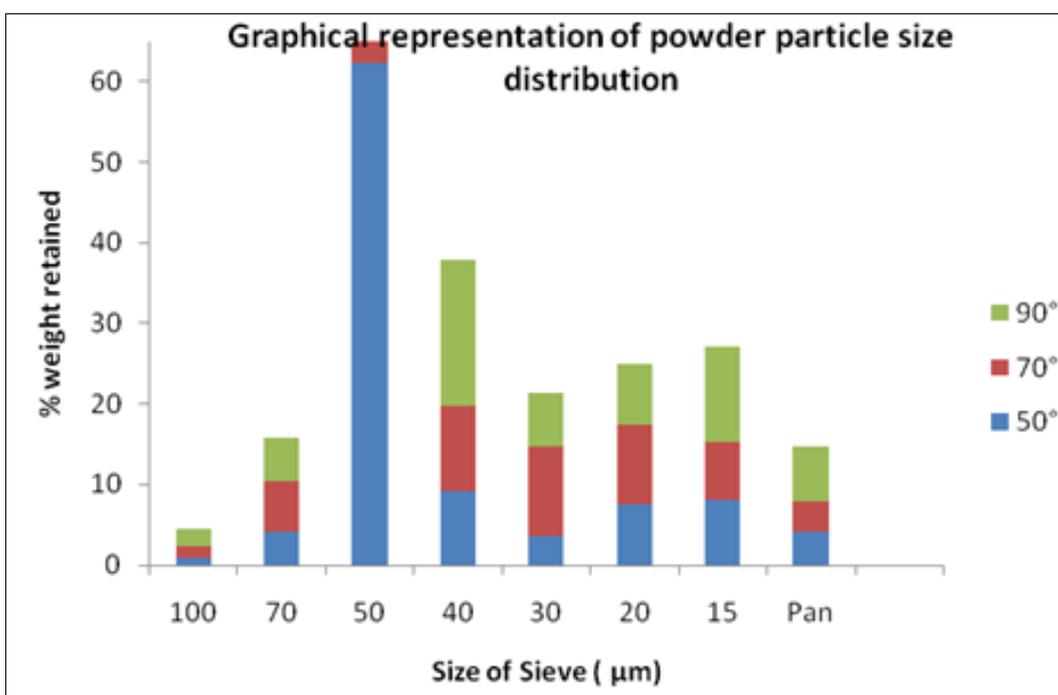


Fig 4: Graphical representation of powder particle size distribution

Table 4: Fineness modulus of Jamun seed powder

Sr. No.	Treatment	R1	R2	R3	Average Fineness modulus
1	50°C	4.16	4.12	4.14	4.14
2	70°C	4.2	3.9	3.9	4.0
3	90°C	3.75	3.70	3.73	3.73

It is observed from the Table 5 that average particle size of Jamun seed powder found to be 50°, 70° and 90 °C temperature is 491, 469 and 432µ and the fineness modulus of 4.14, 4.0 and 3.73 respectively when grinded in hammer mill as shown in Table 4. The graphical representation of particle size distribution is as shown in Figure 4.

Table 5: Average Particle size of Jamun seed powder by Sieve shaker (50, 70 and 90 °C)

Sr. No.	Treatment	R1	R2	R3	Average size, mm
1	50°C	0.491	0.493	0.491	0.491
2	70°C	0.469	0.468	0.470	0.469
3	90°C	0.432	0.430	0.433	0.432

It is observed from the Table 6 and Table 7 that the colour of Jamun seed powder in respect of Lightness and Yellowness is better at 70°C (YI= 72.64) as compared to other two temperatures. Colour difference of Jamun seed powder



Fig 5: Colour of Jamun seed powder prepared by different temperatures

The constituents of Jamun seed at different temperatures at different drying temperatures are given in Table 8.

Table 8: Constituents of Jamun seeds at different temperatures

No.	Constituents	50°C	70°C	90°C
1	Protein	9.163	8.550	7.681
2	Nitrogen, (%)	3.54	3.437	3.291
3	Calcium, mg	0.616	0.621	0.593
4	Phosphorus, (%)	0.399	0.397	0.352
5	Potashium, (%)	0.365	0.36	0.357
6	Magnesium, mg	0.309	0.293	0.302

Conclusions

The Jamun seeds with initial moisture content of 72.41% (db) was dried to final moisture content of 4.60 % (db) in 14.50 hours at 50°C temperature using Tray dryer. The Jamun seeds with initial moisture content of 72.41 % (db) was dried to final moisture content of 4.74 % (db) in 9.7 hours at 70°C temperature using Tray dryer. The Jamun seeds with initial moisture content of 72.41 % (db) was dried to final moisture content of 4.76 % (db) in 4.55 hours at 90°C temperature using tray dryer. Average Particle size of Jamun seed powder found to be 50°, 70° and 90 °C temperature is 491, 469 and 432µ respectively when grinded in hammer mill. The colour of Jamun seed powder in respect of Lightness and Yellowness is better at 70°C (YI= 72.64) as compared to other two temperatures. The value of Calcium (0.621mg) is also better as

prepared at different temperatures are as shown in Figure 5.

Table 6: Colour of Jamun seed powder prepared by different temperatures

Sr. No.	Treatment	L*	a*	b*	YI D1925(2/C)	WI CIE
1	50°C	51.9	7.32	18.72	74.86	-160.05
		52.44	7.23	18.84	74.43	-158.79
		51.5	8.03	18.69	76.27	-161.28
Average		51.95	7.53	18.75	75.19	-160.04
		56.12	7.77	19.37	71.99	-145.78
		56.41	7.46	19.89	72.84	-150.4
2	70°C	55.91	7.84	19.6	73.08	-149.27
		56.15	7.69	19.62	72.64	-148.48
		51.15	8.27	18.59	77.12	-161.67
Average		50.71	8.15	18.76	78.16	-166.26
		50.95	8.12	18.69	77.35	-164.19
		50.94	8.18	18.68	77.54	-164.04

Table 7: Colour of Jamun seed powder prepared by different temperatures

Sr. No.	Treatment	L*	a*	b*
1	50°C	51.95	7.53	18.75
2	70°C	56.15	7.69	19.62
3	90°C	50.94	8.18	18.68

compared to other two temperatures. It is observed from the Table 4 The value of Calcium (0.621mg/lit) is also better as compared to other two temperatures.

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