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Quality Evaluation of Osmosed Jackfruit Bulb Slices

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A B S T R A C T

The present study was carried out to determine the quality and sensory parameters of osmotic dewatered jackfruit bulb slices at optimized condition. The quality parameters like colour, hardness, ascorbic acid content and sensory parameters like appearance, odour, taste and overall acceptability were studied. The results showed that the osmotic dewatering process has significant effect on the quality and sensory parameters respectively. The significant being positive in both the quality and sensory parameters are observed. The osmotic dewatering process has proved to be one of the best processing technique without compromising on the quality.

Introduction

Jackfruit (*Artocarpus heterophyllus* L.) the largest tree-borne fruit, is a native of South and Southeast Asia. India, Bangladesh, and Thailand are the largest producers of jackfruit in the global village. India is the global leader in jackfruit production in the global village. Jackfruit, popularly known as "poor man's fruit" is the most under-utilized fruit. The largest jackfruit producing states in the country are Tripura, Odisha, Assam, West Bengal, Chhattisgarh, Jharkhand, Madhya Pradesh, Tamil Nadu, Andhra Pradesh, Kerala, Telangana, Karnataka. Jackfruit is the national fruit of Bangladesh and Kerala has declared it as its state fruit (George, 2018). The area under cultivation and production of jackfruit in India is 1,87,000 ha and 18,57,000 MT for the year 2018-2019 (Indiast at, 2019). Jackfruit is available round the year in Panruti of Tamil Nadu, Idukki district of Kerala and Tumku rof Karnataka (Down To Earth, 2018).

According to the UN Food and Agricultural Organization, 75% of the jackfruit produced in India, gets spoiled due to the lack of proper processing facilities (Worldatlas, 2017). The jackfruit produced during peak season if processed fetches revenue to the farmers by selling them in the glut season. Thus the development of value added products from jackfruit have become inevitable.

Osmotic dewatering process is the novel food processing operation to dehydrate the fruits, vegetables and meat products. Osmotic dewatering process is a partial water removal process. The osmotic dewatering process aids in reduced weight of the product, reduction in the consumable space during transportation, increased shelf life and a retained quality of the product (Sahu *et al.,* 2017). The water loss and the solid gain are the two important mass transfer operations generally occur in the osmotic dehydrated process. Thus osmotic dewatering process has added advantages over general drying of jackfruit.

In India, majority of the food processing industries engages osmotic dehydration technique to remove moisture from fruits and vegetables because osmotic dehydration methods retains the flavour, colour, texture and shelf-life of processed product (Sutar and Gupta, 2007).

Osmotic dehydration is generally used as a pre-treatment by many food processors prior to freezing, freeze drying, vacuum drying and air drying (Nanjundaswamy *et al.,* 1978). The rate of transfer of water from material to the solution depends upon several factors such as solution concentration, temperature, shape and size of the material and method of agitation.

Therefore an attempt was made to determine the quality of osmotic dewatered jack fruit bulb slices. The quality parameters were determined at the optimized condition of osmotic dewatering process. Thus, the osmotic dewatered jackfruit bulb slices quality was compared to that of the fresh one.

Materials and Methods

Raw material

Matured jackfruits, obtained from local market were washed in running water to eliminate dirt or dust adhered to it. The jackfruits were cut manually using a SS knife and the bulbs were separated manually without the application of any edible oil. The seeds were parted from the bulb manually by vertical slitting using a knife. The bulbs were cut into uniform square shape (2×2 cm) slices with average thickness of 4.5 mm.

Physico-chemical analysis

Moisture content of fresh jackfruit bulb slices was determined by AOAC (2005). Total soluble solids (TSS) were measured by hand refractometer (Atago, Tokyo) by grinding the slices in mortar with pestle. The pH and titratable acidity of fresh fruit were determined by the methods given by Ranganna (1986). Sampling was done in triplicate.

Preparation of osmotic solution

Commercial sugar was used as solute in the osmotic solution. The osmotic solution of contributed are 60 °B at a temperature of 57 °C and immerged for 160 min. Preservatives like citric acid (0.3% w/v, food grade) and potassium metabisulfite (1% w/v, food grade) were added to the osmotic solution. Experiments were conducted at fruit to solution ratio of 1:4.

Osmotic dewatering process

Twenty five grams of jackfruit bulb slices were immerged in osmotic solution contained in stainless steel container. The container is kept in thermostat-controlled oven. The movement of water and sugar was analysed by calculating water loss (WL) and solid gain (SG). After osmotic dehydration process, the jackfruit slices were taken out of the solution, rubbed gently with muslin cloth to remove the adhered solute on their surfaces and were weighed immediately. The slices were

weighed and moisture content was determined by using vacuum oven (AOAC 2005).

Hardness

The hardness of the fresh and osmotic dewatered samples was determined by Texture analyser (Brookfield Engineering Labs, Inc., USA) compression tests. It was equipped with 12.7 mm dia. stainless steel ball probe (TA18) (Fig. 1) operated at pre-test speed of 1 mm s^{-1}, test speed and post-test of 0.5 mm s^{-1}. Load cell of 5 kg was used to fracture the slice.

Colour

Colour of fresh and treated slices was measured using Hunter Lab Color Flex spectrophotometer (Hunter Lab Associates Laboratory, USA). The measurement was done with an illuminate observer combination of D65/10°. The surface colour was quantified in terms of L^*, a^* and b^* values of CIELAB colour space. The CIELAB colour space is organised in a cube form, where L^* axis runs from top to bottom with minimum value of 0, representing black and maximum of 100 representing white. The axis $-a^*$, $+a^*$ goes from green to red and the axis $-b^*$, $+b^*$ goes from blue to yellow. The samples were placed over the port. The instrument was standardised with white and black ceramic tiles before starting the measurement. The colour of sample was measured by measuring L^*, a^* and b^* values. The total colour difference is calculated by below given equation,

$$\Delta E = \sqrt{\left((L - L^s)^2 + (a - a^s)^2 + (b - b^s)^2\right)} \quad \ldots(1)$$

where,

L, a, b = chromaticity values for fresh jackfruit bulb slice

L^*, a^*, b^* = chromaticity values for treated fruit jackfruit bulb slice

Ascorbic acid content

Ascorbic acid content (Fig. 2) of the samples was determined by the method described by AOAC (2005).

Sensory evaluation

Sensory evaluation of samples was carried out for consumer acceptance and preference using 10 untrained panelists selected at random. Appearance, flavour, overall acceptability of the samples were rated using a 9-point Hedonic scale (Beckley *et al.,* 2012).

Sensory evaluation was carried out at ambient conditions in a comfortable and quiet area without disturbance under fluorescent lighting. Water was supplied to cleanse palate between samples. Four sensory attributes stated below were considered for the study (Table 1).

Results and Discussion

Physio-chemical analysis

The total soluble solids (TSS), pH and titratable acidity of fresh jackfruit bulb slices were recorded as 28 °B, 5.2 and 2.4, respectively. The initial moisture content of the jackfruit bulb slices was recorded around 200% (d.b.). Moisture content of jackfruit bulb slices after osmotic dehydration was around 100% (d.b.).

The values pertaining to the quality parameters were represented in the Table 2. Hardness, yellow chromaticity, total colour difference, ascorbic acid content, appearance, odour, taste, overall acceptability of fresh and osmotic dewatered jackfruit bulb slices were tabulated.

Table.1 Score card for sensory attributes during sensory evaluation

Sensory attributes	Opinion	Score
Appearance	Like extremely	9
	Like very much	8
Odour	Like moderately	7
	Like slightly	6
Taste	Neither like nor dislike	5
	Dislike slightly	4
Overall acceptability	Dislike moderately	3
	Dislike very much	2
	Dislike extremely	1

(Source: Beckley *et al.*, 2012)

Table.2 Score values for quality parameters of fresh and osmotic dewatered jackfruit bulb slices

Quality parameter	Fresh sample	Osmotic dewatered sample
Hardness (N)	37±1	50±1
Yellow chromaticity (b^*)	48.60±1.33	49.69±5.48
Total colour difference (ΔE)	-	2.86±4.15
Ascorbic acid content (mg/100 g)	9.82±0.18	5.56±0.51
Appearance	7.2±0.6	6.9±0.9
Odour	8.1±0.7	8.0±1.1
Taste	6.6±0.7	8.0±0.9
Overall acceptability	6.8±1.0	7.0±0.8

Fig.1 SS ball probe fitted to texture analyzer

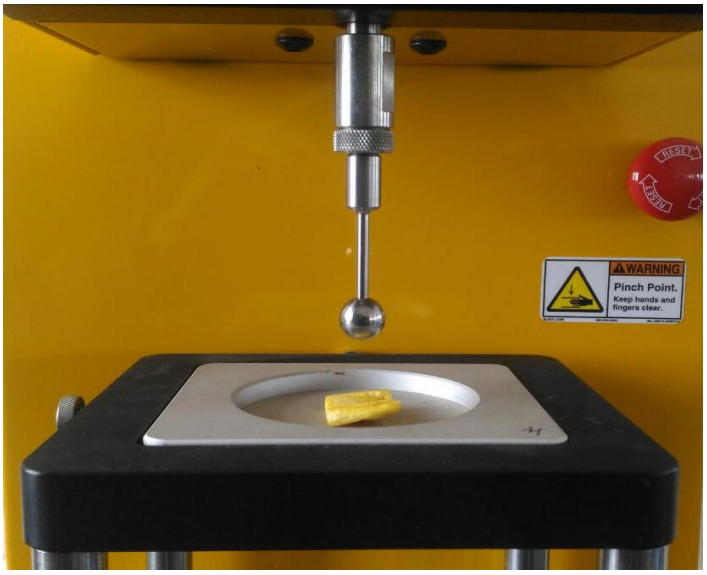
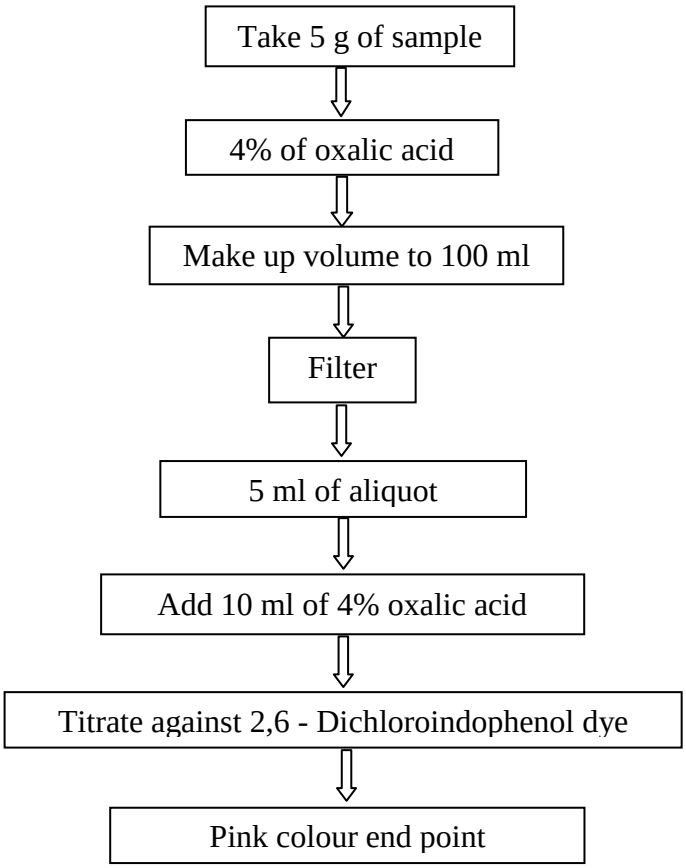


Fig.2 Flow chart for estimation of ascorbic acid



Hardness

The hardness of the fresh jackfruit bulb slices and osmotic dewatered sample were 37±1 and 50±1 respectively. The increase in the hardness might be due to the diffusion of sugar into the jackfruit slice, which made it firm in texture. Similar results were drawn by Knezevic *et al.,* (2013) in case of pork meat.

Colour

The yellow chromaticity (b^*) values for fresh and osmotic dehydrated jackfruit bulb slices were 48.60±1.33 and 49.69±5.48 respectively. The improvement in yellow colour might be due to the reason that the sugar on heating contributes creamy yellow appearance. The layer of sugar coated on jackfruit bulb slices, during the diffusion process, might have helped in colour enhancement. These results are in agreement with strawberries (Garcia-Noguera *et al.,* 2014)

Ascorbic acid content

The ascorbic acid content of fresh and osmotic dehydrated jackfruit bulb slices were 9.82±0.18 and 5.56±0.51 respectively. This clearly indicates that the osmotic dewatering process aids in ascorbic acid loss during diffusion process. Similar results were observed in case of pears (Nadia *et al.,* 2013) and majority of the fruits and vegetables (Santos and Silva, 2008).

Sensory evaluation

The appearance, taste, odour and overall acceptability of fresh and osmotic dehydrated

jackfruit bulb slices were 7.2±0.6, 6.6±0.7, 8.1±0.7, 6.8±1.0 and 6.9±0.9, 8.0±0.9, 8.0±1.1, 7.0±0.8 respectively. The increase in taste perception is due to the increased sugar content during solid gain phenomena of osmotic dewatering process. There is slight improvement in appearance, this might be due to the yellow colour of the sugar solution. There is no change in odour, because, the jackfruit has strong fragrance. The overall acceptability of osmotic dewatered jackfruit bulb slices is greater when compared to fresh jackfruit bulb slices. The odour and taste quality perceptions are in agreement with Azoubel *et al.,* (2009) in the case of cashew apple, but the appearance perception is contradictory with the present investigations.

In conclusion, the osmotic dewatering process has shown significant effect on the quality of jackfruit bulb slices. The quality parameters like hardness, ascorbic acid content, colour, appearance, taste, odour and overall acceptability were determined. The osmotic dewatering process showed positive effect on the hardness, colour, appearance, taste and negative effect on ascorbic acid content. The overall acceptability of the osmotic dewatered jackfruit bulb slices was recorded high. Thus the osmotic dewatering process aids in a superior quality product. Thus osmotic dewatering or osmotic dehydration technique can be adopted on wide variety of perishable foods.

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