Effect of Packaging Material and Storage Period on Physico-Chemical Attributes of Osmotic Dehydrated Ripe Sapota Slices

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Abstract

The experiment was carried out with the aim to standardize the processing technique for preparation of osmotic dehydrated ripe sapota slices and to study the changes in nutritional and chemical composition of osmotic dehydrated ripe sapota slices during storage. This investigation was carried out in the laboratory of post-harvest technology, College of Horticulture, Dr. Y.S.R. Horticultural University, Rajendranagar, Hyderabad, India, during the year 2014-2015. Sapota were packed in two different packaging materials (aluminium foil covers and 150-gauge polypropylene bags) and stored at two conditions (ambient and refrigerated) for the period of four months. Various physico-chemical parameters like moisture (%), loss or gain in weight (%), microbial count (cfu/g) and organoleptic evaluation were analysed at 15 days interval for 4 months. Dried slices packed in aluminium foil covers and stored at refrigerated temperature resulted to no microbial contamination till the 90th day of storage period, while all other treatments showed more or less microbial contamination on 90th day storage. Dehydrated sapota slices packed in aluminium foil covers and stored at refrigerated condition were found to be best followed by 150-gauge polypropylene bags and stored at refrigerated condition in retaining various attributes like minimal moisture gain, weight gain and organoleptic properties and lesser microbial growth when compared to the other packaging materials and storage conditions during the four months storage period.

Keywords
Sapota, Osmotic dehydration, Ambient temperature, Refrigerated temperature.

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Introduction

Sapota (Achras zapota L.) is one of the most important tropical fruit. Sapota fruit is a good source of digestible sugar, virtually a treasure of minerals such as iron and calcium. The fruits have an appreciable amount of protein, fat, fibre, calcium, phosphorus, iron, carotene and vitamin C and also rich in bio-iron. It is growing in an area of 177.0 thousand hectares with a production of 1744.3 million tonnes (Indian Horticulture Database- 2014, NHB). It has been observed that when there is a bumper production of sapota, the fruit goes as waste for want of suitable preservation facilities. In sapota, post-harvest losses ranged from 25-30 per cent. Sapota is generally consumed as a fresh fruit. Ripened sapota
cannot be stored for more than a day or two as it is highly perishable in nature, ripens faster and becomes unfit for consumption very soon. Among the various preservation methods, drying is the most convenient and simplest method throughout the world. Besides preserving seasonal commodities, dehydrated fruit products have inherent advantages, such as prolonged shelf life, higher degree of resistance to bacterial attack and lower transportation, handling and storage costs. The methods and the variables of drying, influence both the quality and physicochemical characteristics of the dried products (Krokida and Maroulis, 1997).

Osmotic dehydration has received greater attention in recent years as an effective method with retention of their initial fruit characteristics viz. colour, aroma, and nutritional compounds. Osmotic parameters like sugar gain and water loss are correlated with osmosis time. It involves the dehydration of fruit slices in two stages, removal of water using sugar syrup as osmotic agent and subsequent dehydration in the drier where osmotic content is further reduced to about 15% to make the product shelf stable.

The shelf life of dehydrated ripe sapota slices depends on different factors like packaging material and storage temperature. The extension in storage life is possible by checking increase in moisture, retention of physico chemical attributes and preventing microbial activity etc. Hence, there is a need to develop a low cost technology for processing sapota fruits into value added products. Therefore, the present investigation was carried out to study the changes in physico-chemical composition of osmotic dehydrated ripe sapota slices during storage.

Materials and Methods

The investigation was carried out in the laboratory of post-harvest technology, College of Horticulture, Dr. Y.S.R. Horticultural University, Rajendranagar, Hyderabad, India, during the year 2014-2015.

Three Packaging materials Aluminum foil covers (T_1), 150 gauge Polypropylene bags (T_2), Control [without package] (C_1), and two Storage conditions Ambient temperature [25±2°C] (S_1) and Refrigerated temperature [8 - 10°C] (S_2) were included in this investigation. There were altogether six treatments. The experiment was laid out in CRD with factorial concept with four replications.

The observation on Moisture content (%), Loss or gain in weight (%), Microbial load (cfu/ml) and Oganoleptic evaluation were taken at 15 days interval for 4 months. Different parameters taken are as follows

**Moisture (%)**

Moisture content of fresh fruit as well as dehydrated slices was determined on percentage basis.

Dehydrated sapota slices weighing 10 grams were taken in a pre-weighed china dish and kept in a hot air oven at 70°C for 48 hours and then the weight was recorded using electronic balance. The dry weight was recorded until a constant weight was attained.

Moisture content was determined on fresh weight basis (Ranganna, 1986).

\[
\text{Moisture} = \frac{\text{Loss in weight of sample on drying (g)}}{\text{Weight of sample taken (g)}} \times 100
\]

**Gain in weight (%)**

Loss or gain in weight of Dehydrated slices (g)

\[
\text{Gain in weight} = \frac{\text{Loss or gain in weight}}{\text{Weight of fresh slices (g)}} \times 100
\]
Microbial load (cfu/ml)

Total bacterial count

For estimation of microbial count in different sample products, dilution plate method was followed (Cruik Shank et al., 1975). 1 gram of sample was thoroughly mixed in 9 ml of sterile water. 1 ml of sample was transferred through a sterile pipette to a screw cap tube containing 9 ml of sterile water. This gave dilution of $10^{-2}$. Similarly serial dilutions were made, 1 ml of the serially diluted sample was placed in the sterile petridish to which cooled plate count agar medium was added and mixed thoroughly with the suspension and then allowed to set and then incubated at 28± 2°C for 48 hours. Individual colonies were counted by using digital colony counter (light box and pen method) and multiplied with the dilution factor to get the microbial population in 1 ml of sample.

\[
\text{CFU/ml} = \frac{\text{Number of colonies per ml plate}}{\text{Total dilution factor}}
\]

Total mould count

Dilution plate method was followed for estimation of mould population as mentioned above in the total bacterial count (Cruik Shank et al., 1975). Potato dextrose agar medium was used for estimating the yeast and mould population. Samples were diluted in the sterile water before plating.

Organoleptic evaluation

Dried slices prepared under varied pretreatments was evaluated for sensory characteristics viz., colour, appearance, texture, flavour, taste and overall acceptability at Hedonic 9-point rating scale (Amerine et al., 1965). Each attribute was given a separate score of 9 points. From the quality point of view, higher product scoring was treated as more acceptable. The sensory attributes were evaluated as per the format of hedonic 9-rating scale given below.

Packaging and storage

The dehydrated sapota slices were packed in aluminium foil covers and 150-gauge polypropylene bags respectively and were sealed using heat impulse sealer. The packages were stored under ambient temperature (25±2°C) and refrigerated temperature (8-10°C) respectively for 4 months.

Statistical analysis

The data were subjected to statistical analysis as per the procedure outlined by Panse and Sukhatme (1985). The experiment design was Complete randomized design with factorial concept. Three replicates were maintained for each analysis, and the data from the four replicates were processed by one-way analysis of variance using the least significant test to determine the level of significance at \( P > 0.05 \).

Results and Discussion

Slices were soaking in invert sugar 60°Brix for 8 hours of osmotic dehydrated ripe sapota slices and stored in different packaging materials. Slices were packed in two different packaging materials (aluminium foil covers and 150-gauge polypropylene bags) storage at ambient as well as refrigerated temperature (8-10°C).

Moisture (%)

The data pertaining to the influence of packaging materials and storage period on moisture (%) of osmotic dehydrated ripe sapota slices are presented in table 1.
As it was shown in the Table 1 the moisture in the dehydrated slices were significantly affected by the treatments, storage periods and their interactions.

During the 4 months of storage period, with the increase in duration of storage period, the mean moisture content slightly increased significantly from the initial (8.00) to 120th day (10.17). The highest mean moisture content (10.17) was observed in dehydrated slices on 120 days of storage period closely followed by 105 days storage period (10.07) and was on par with 90 days storage period (10.03), whereas, lowest mean moisture (8.37) pickup was observed on 15th day of storage period followed by 30th day storage period (8.94).

Results revealed that dehydrated slices packed in aluminium foil covers absorbed minimum moisture during storage as compared to 150-gauge polypropylene bags. The changes in moisture content may be due to differences in water vapour permeability of the packaging film and aluminium foil having very low water vapour transmission rate. Similar findings were reported in dehydrated apple rings by Sharma and Kausal (2006) and banana chips and jackfruit chips by Molla et al., (2009).

Increase in moisture during storage period was attributed to slight pickup of moisture by osmo-dehydrated sapota slices. Analogous observation was reported by Mehta and Tomar (1980) in guava and papaya, Heikel et al., (1972) in dried mango sheets.

There was a progressive increase in moisture content of the packed upon storage. This might be due to absorption of moisture from the atmosphere by the packaging materials. Similar observation were made by Sagar and Khurdiya (1998) in dehydrated ripe mango slice, Sharma and Kausal (2006) in apple rings and banana chips and jackfruit chips by Molla et al., (2009).

**Gain in weight (%)**

It is evident from the Table 2 that there were significant differences in gain in weight due to different treatments, storage period and their interactions.

Among the treatments, it was observed that the lowest mean gain in weight (1.92) was recorded in the dehydrated slices packed in aluminium foil covers stored at ambient temperature (T1S1) followed by 150-gauge polypropylene bags stored at ambient temperature (2.02). Whereas, the highest mean gain in weight (2.75) was observed in both controls i.e. dehydrated slices stored at refrigerated temperature (8-10°C) without package (C1S2) followed by C1S1- dehydrated slices stored at ambient temperature without package (2.51) during the 4 months of storage period.

**Bacterial count (cfu/g)**

The data in the table 3 indicates that there were significant changes in the bacterial contamination of dehydrated slices due to treatments, storage period and the interactions between them.

Significant changes in bacterial contamination were found due to the interactions between the days of storage and treatments. As the storage period increased, the bacterial contamination increased irrespective of the treatments. No bacterial contamination was noticed on the 15th day of storage in all the treatments. On 30th and 45th day of storage, no contamination was observed in packed dehydrated slices except in controls-C1S1 (4.37 and 9.62) and C1S2 (2.50 and 6.12) respectively. However treatments T1S2 and T2S2 showed no contamination till the 90th
and 75th day of storage respectively over other treatments. On 120th day of storage, control treatments (C1S1 and C1S2) both exhibited maximum bacterial contamination, the highest contamination was observed in control C1S1 (57.75) followed by control C1S2 (45.50). The minimum bacterial contamination was observed in aluminium foil covers stored at refrigerated temperature (15.37) followed by 150-gauge polypropylene bags stored at refrigerated temperature (22.50).

Mould count (cfu/g)

The data in the table 4 indicates that there were significant changes in the mould contamination of dehydrated ripe sapota slices due to treatments, days of storage and the interactions between them.

Significant changes were found due to the interactions between the days of storage and treatments. The mould count (Cfu/ml) was not found (0.00) throughout the storage period in all the treatments except in the control treatments at each successive interval of storage period. However, on the 120th day of storage period, the mould contamination was observed in control treatments which were 2.00 and 1.25 in control C1S1 and C1S2 respectively. Lowest microbial load was observed in slices packed in aluminium foil covers as compared to 150-gauge polypropylene bags indicating them to be ideal material for long term storage of dehydrated sapota slices. Similar finding were recorded by Krishnaveni et al., (1999) in jackfruit bars and Evelin Mary et al., (2007) in banana powder. The storage stability may be attributed to the preservative effect of KMS and the low permeability of the packaging material to oxygen and water resulting in slower degradation of dehydrated slices hence enhancing the shelf-life.

Effect of packaging materials and storage conditions on organoleptic evaluation of osmotic dehydrated ripe sapota slices during storage

Colour

The data regarding colour of dehydrated sapota slices represented in the table 5 recorded significant variation among the treatments, duration of storage and interaction between them.

There was a significant decline in mean colour score from the initial (7.67) to 120th day (5.84) of storage period. The colour score recorded on 15th day was on par with 30th day of colour score (7.47). It was observed that as the storage period increased, there was a decrease in colour score irrespective of the treatment.

Hedonic 9- point rating scale

| Sl. No. | Sensory Attributes | Code A | Code B | Code C | Code D | Code E | Code F | Code G | Code H | Code I |
|--------|-------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1.     | Colour            |        |        |        |        |        |        |        |        |        |
| 2.     | Appearance        |        |        |        |        |        |        |        |        |        |
| 3.     | Texture           |        |        |        |        |        |        |        |        |        |
| 4.     | Taste             |        |        |        |        |        |        |        |        |        |
| 5.     | Flavor            |        |        |        |        |        |        |        |        |        |
| 6.     | Overall Acceptability |   |        |        |        |        |        |        |        |        |

Score: 9- Like extremely, 8- Like very much, 7- Like moderately, 6- Like slightly, 5- Neither like nor dislike, 4- Dislike slightly, 3- Dislike moderately, 2- Dislike very much, 1- Dislike extremely

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Table 1: Effect of packaging materials and storage conditions on moisture (%) content of osmotic dehydrated ripe sapota slices during storage

| Treatments | Days of storage | Mean |
|------------|----------------|------|
|            | 15 days | 30 days | 45 days | 60 days | 75 days | 90 days | 105 days | 120 days |
| T1S1       | 8.03    | 8.47    | 8.73    | 8.96    | 9.04    | 9.48    | 9.51     | 9.59    | 8.97    |
| T1S2       | 8.03    | 8.53    | 8.72    | 9.02    | 9.28    | 9.76    | 9.96     | 10.07   | 9.17    |
| T2S1       | 8.04    | 8.78    | 8.94    | 9.00    | 9.45    | 9.85    | 9.78     | 9.86    | 9.21    |
| T2S2       | 8.08    | 8.85    | 9.00    | 9.02    | 9.57    | 10.15   | 10.07    | 10.18   | 9.36    |
| C1S1       | 9.03    | 9.46    | 9.66    | 9.77    | 9.92    | 10.37   | 10.39    | 10.50   | 9.89    |
| C1S2       | 9.03    | 9.58    | 9.92    | 9.72    | 10.15   | 10.57   | 10.72    | 10.80   | 10.06   |
| Mean       | 8.37    | 8.94    | 9.16    | 9.25    | 9.57    | 10.03   | 10.07    | 10.17   |         |

F-test S.Em±CD at (0.05%)  
For treatments (T) ** 0.015 0.042  
For days (D) ** 0.017 0.048  
For D x T ** 0.042 0.119

Initial value- 8.00

Table 2: Effect of packaging materials and storage conditions on gain in weight (%) in osmotic dehydrated ripe sapota slices during storage

| Treatments | Days of storage | Mean |
|------------|----------------|------|
|            | 15 days | 30 days | 45 days | 60 days | 75 days | 90 days | 105 days | 120 days |
| T1S1       | 0.00    | 0.88    | 1.30    | 1.85    | 2.45    | 2.64    | 3.02     | 3.20    | 1.92    |
| T1S2       | 0.11    | 1.15    | 1.50    | 2.07    | 2.56    | 2.94    | 3.34     | 3.56    | 2.15    |
| T2S1       | 0.00    | 0.94    | 1.42    | 1.94    | 2.57    | 2.79    | 3.20     | 3.32    | 2.02    |
| T2S2       | 0.23    | 1.43    | 1.71    | 2.30    | 2.72    | 3.10    | 3.45     | 3.70    | 2.33    |
| C1S1       | 0.21    | 1.55    | 1.91    | 2.58    | 3.03    | 3.36    | 3.57     | 3.91    | 2.51    |
| C1S2       | 0.27    | 1.94    | 2.50    | 2.77    | 3.17    | 3.58    | 3.76     | 4.02    | 2.75    |
| Mean       | 0.14    | 1.31    | 1.72    | 2.25    | 2.75    | 3.07    | 3.39     | 3.62    |         |

F-test S.Em±CD at (0.05%)  
For treatments (T) ** 0.013 0.038  
For days (D) ** 0.015 0.044  
For D x T ** 0.038 0.108

Initial value- 0.00

Table 3: Effect of packaging materials and storage conditions on bacterial count (cfu/ml) in osmotic dehydrated ripe sapota slices during storage

| Treatments | Days of storage | Mean |
|------------|----------------|------|
|            | 15 days | 30 days | 45 days | 60 days | 75 days | 90 days | 105 days | 120 days |
| T1S1       | 0.00    | 0.00    | 0.00    | 0.00    | 0.00    | 11.12   | 19.25    | 32.25    | 7.82    |
| T1S2       | 0.00    | 0.00    | 0.00    | 2.12    | 6.12    | 15.75   | 24.75    | 35.00    | 10.46   |
| T2S1       | 0.00    | 0.00    | 0.00    | 0.00    | 0.00    | 10.12   | 15.50    | 22.50    | 6.01    |
| T2S2       | 0.00    | 4.37    | 9.62    | 16.00   | 24.75   | 35.75   | 44.25    | 57.75    | 24.06   |
| C1S1       | 0.00    | 2.50    | 6.12    | 12.50   | 17.00   | 24.50   | 36.25    | 45.50    | 18.04   |
| C1S2       | 0.00    | 1.14    | 2.62    | 5.10    | 7.97    | 16.20   | 25.00    | 34.72    |         |
| Mean       | 0.00    | 1.14    | 2.62    | 5.10    | 7.97    | 16.20   | 25.00    | 34.72    |         |

F-test S.Em±CD at (0.05%)  
For treatments (T) ** 0.224 0.627  
For days (D) ** 0.259 0.724  
For D x T ** 0.635 1.775

Initial value- 0.00
Table 4 Effect of packaging materials and storage conditions on mould count (cfu/ml) in osmotic dehydrated ripe sapota slices during storage

| Treatments | Days of storage | Mean |
|------------|----------------|------|
|            | 15 days | 30 days | 45 days | 60 days | 75 days | 90 days | 105 days | 120 days |
| T1S1       | 0.00    | 0.00    | 0.00    | 0.00    | 0.00    | 0.00    | 0.00      | 0.00       |
| T1S2       | 0.00    | 0.00    | 0.00    | 0.00    | 0.00    | 0.00    | 0.00      | 0.00       |
| T2S1       | 0.00    | 0.00    | 0.00    | 0.00    | 0.00    | 0.00    | 0.00      | 0.00       |
| T2S2       | 0.00    | 0.00    | 0.00    | 0.00    | 0.00    | 0.00    | 0.00      | 0.00       |
| C1S1       | 0.00    | 0.00    | 0.00    | 0.00    | 0.00    | 2.00    | 0.25      |            |
| C1S2       | 0.00    | 0.00    | 0.00    | 0.00    | 0.00    | 1.25    | 0.15      |            |
| Mean       | 0.00    | 0.00    | 0.00    | 0.00    | 0.00    | 0.00    | 0.00      | 0.00       |

F-test S, Em±CD at (0.05%)  
For treatments (T) ** 0.024 0.068  
For days (D) ** 0.028 0.078  
For D x T ** 0.069 0.193  

Initial value - 0.00

Table 5 Effect of packaging materials and storage conditions on colour of osmotic dehydrated ripe sapota slices during storage

| Treatments | Days of storage | Mean |
|------------|----------------|------|
|            | 15 days | 30 days | 45 days | 60 days | 75 days | 90 days | 105 days | 120 days |
| T1S1       | 7.51    | 7.47    | 7.44    | 7.40    | 7.40    | 7.02    | 6.90      | 6.57       |
| T1S2       | 7.64    | 7.60    | 7.59    | 7.55    | 7.50    | 7.22    | 7.05      | 6.72       |
| T2S1       | 7.49    | 7.48    | 7.43    | 7.39    | 7.39    | 6.95    | 6.80      | 6.07       |
| T2S2       | 7.61    | 7.58    | 7.54    | 7.50    | 7.44    | 7.07    | 6.90      | 6.57       |
| C1S1       | 7.33    | 7.35    | 7.29    | 7.19    | 6.45    | 5.75    | 5.00      | 4.50       |
| C1S2       | 7.40    | 7.36    | 7.30    | 7.20    | 6.51    | 5.90    | 5.25      | 4.70       |
| Mean       | 7.51    | 7.47    | 7.43    | 7.37    | 7.11    | 6.65    | 6.32      | 5.84       |

F-test S, Em± CD at (0.05%)  
For treatments (T) ** 0.015 0.042  
For days (D) ** 0.017 0.049  
For D x T ** 0.043 0.120  

Initial value-7.67

Table 6 Effect of packaging materials and storage conditions on appearance of osmotic dehydrated ripe sapota slices during storage

| Treatments | Days of storage | Mean |
|------------|----------------|------|
|            | 15 days | 30 days | 45 days | 60 days | 75 days | 90 days | 105 days | 120 days |
| T1S1       | 7.33    | 7.00    | 6.51    | 6.07    | 5.86    | 5.54    | 5.45      | 5.35       |
| T1S2       | 7.33    | 7.05    | 6.74    | 6.52    | 6.13    | 5.71    | 5.63      | 5.60       |
| T2S1       | 7.33    | 6.89    | 6.51    | 6.00    | 5.68    | 5.49    | 5.41      | 5.38       |
| T2S2       | 7.33    | 7.00    | 6.67    | 6.29    | 6.00    | 5.61    | 5.60      | 5.50       |
| C1S1       | 7.00    | 6.47    | 5.84    | 5.37    | 4.75    | 4.47    | 3.95      | 3.57       |
| C1S2       | 7.00    | 6.54    | 6.00    | 5.56    | 5.05    | 4.37    | 4.00      | 3.70       |
| Mean       | 7.22    | 6.82    | 6.38    | 5.97    | 5.58    | 5.20    | 5.00      | 4.85       |

F-test S, Em±CD at (0.05%)  
For treatments (T) ** 0.021 0.059  
For days (D) ** 0.024 0.068  
For D x T ** 0.059 0.167  

Initial value-7.33
### Table 7: Effect of packaging materials and storage conditions on texture of osmotic dehydrated ripe sapota slices during storage

| Treatments | Days of storage | Mean |
|------------|-----------------|------|
|            | 15 days | 30 days | 45 days | 60 days | 75 days | 90 days | 105 days | 120 days |
| T1S1       | 6.55    | 6.32    | 6.12    | 6.00    | 5.82    | 5.67    | 5.57    | 5.40    | 5.93    |
| T1S2       | 6.66    | 6.57    | 6.50    | 6.36    | 6.15    | 6.05    | 5.92    | 5.70    | 6.24    |
| T2S1       | 6.50    | 6.30    | 6.00    | 5.85    | 5.72    | 5.55    | 5.37    | 5.15    | 5.80    |
| T2S2       | 6.60    | 6.41    | 6.32    | 6.15    | 6.02    | 5.85    | 5.67    | 5.52    | 6.07    |
| C1S1       | 6.10    | 5.65    | 5.37    | 5.00    | 4.55    | 4.30    | 3.87    | 2.62    | 4.68    |
| C1S2       | 6.17    | 5.76    | 5.45    | 5.07    | 4.72    | 4.42    | 4.10    | 3.57    | 4.91    |
| Mean       | 6.43    | 6.17    | 5.96    | 5.74    | 5.50    | 5.30    | 5.08    | 4.66    |

**F-test S.E.m± CD at (0.05%)**

- For treatments (T) ** 0.046 0.130
- For days (D) ** 0.053 0.150
- For D x T ** 0.131 0.368

Initial value: 6.67

### Table 8: Effect of packaging materials and storage conditions on taste of osmotic dehydrated ripe sapota slices during storage

| Treatments | Days of storage | Mean |
|------------|-----------------|------|
|            | 15 days | 30 days | 45 days | 60 days | 75 days | 90 days | 105 days | 120 days |
| T1S1       | 8.00    | 7.89    | 7.79    | 7.75    | 7.60    | 7.50    | 7.20    | 7.00    | 7.59    |
| T1S2       | 8.00    | 7.94    | 7.90    | 7.82    | 7.70    | 7.58    | 7.51    | 7.27    | 7.71    |
| T2S1       | 8.00    | 7.88    | 7.79    | 7.71    | 7.58    | 7.45    | 7.07    | 6.84    | 7.54    |
| T2S2       | 8.00    | 7.90    | 7.82    | 7.80    | 7.63    | 7.56    | 7.38    | 7.12    | 7.65    |
| C1S1       | 7.65    | 7.50    | 7.40    | 7.00    | 6.12    | 5.50    | 5.00    | 4.25    | 6.30    |
| C1S2       | 7.70    | 7.53    | 7.42    | 7.15    | 6.25    | 5.57    | 5.20    | 4.52    | 6.42    |
| Mean       | 7.89    | 7.77    | 7.69    | 7.54    | 7.14    | 6.86    | 6.56    | 6.17    |

**F-test S.E.m±CD at (0.05%)**

- For treatments (T) ** 0.018 0.052
- For days (D) ** 0.021 0.060
- For D x T ** 0.052 0.148

Initial value: 8.00

### Table 9: Effect of packaging materials and storage conditions on flavour of osmotic dehydrated ripe sapota slices during storage

| Treatments | Days of storage | Mean |
|------------|-----------------|------|
|            | 15 days | 30 days | 45 days | 60 days | 75 days | 90 days | 105 days | 120 days |
| T1S1       | 6.67    | 6.55    | 6.47    | 6.40    | 6.35    | 6.21    | 6.05    | 5.87    | 6.32    |
| T1S2       | 6.67    | 6.62    | 6.55    | 6.48    | 6.43    | 6.33    | 6.21    | 6.05    | 5.95    |
| T2S1       | 6.60    | 6.46    | 6.41    | 6.36    | 6.24    | 6.05    | 5.89    | 5.65    | 6.21    |
| T2S2       | 6.66    | 6.57    | 6.50    | 6.43    | 6.41    | 6.25    | 6.00    | 5.62    | 6.30    |
| C1S1       | 6.42    | 6.12    | 5.47    | 5.02    | 4.87    | 4.57    | 4.41    | 4.00    | 5.11    |
| C1S2       | 6.40    | 6.12    | 5.62    | 5.20    | 5.00    | 4.67    | 4.50    | 4.12    | 5.20    |
| Mean       | 6.57    | 6.41    | 6.17    | 5.98    | 5.88    | 5.68    | 5.51    | 5.20    |

**F-test S.E.m± CD at (0.05%)**

- For treatments (T) ** 0.013 0.038
- For days (D) ** 0.015 0.044
- For D x T ** 0.038 0.108

Initial value: 6.67
Table.10 Effect of packaging materials and storage conditions on overall acceptability of dehydrated ripe sapota slices during storage

| Treatments | Days of storage | Mean |
|------------|----------------|------|
|            | 15 days | 30 days | 45 days | 60 days | 75 days | 90 days | 105 days | 120 days |
| T₁S₁       | 7.33    | 7.07    | 6.95    | 6.78    | 6.60    | 6.41    | 6.33    | 6.00    | 6.68    |
| T₁S₂       | 7.33    | 7.20    | 7.07    | 7.00    | 6.83    | 6.63    | 6.48    | 6.32    | 6.86    |
| T₂S₁       | 7.33    | 7.00    | 6.91    | 6.67    | 6.52    | 6.37    | 6.30    | 5.92    | 6.63    |
| T₂S₂       | 7.33    | 7.17    | 7.00    | 6.84    | 6.71    | 6.51    | 6.41    | 6.21    | 6.77    |
| C₁S₁       | 7.00    | 6.50    | 6.35    | 6.02    | 5.42    | 5.00    | 4.72    | 4.25    | 5.65    |
| C₁S₂       | 7.05    | 6.67    | 6.40    | 6.12    | 5.50    | 5.10    | 4.85    | 4.50    | 5.77    |
| Mean       | 7.22    | 6.93    | 6.78    | 6.57    | 6.26    | 6.00    | 5.85    | 5.53    |         |

F-test S.E.m± CD at (0.05%)

| For treatments (T) | **   | 0.014 | 0.041 |
| For days (D)       | **   | 0.017 | 0.047 |
| For D x T          | **   | 0.041 | 0.117 |

Initial value-7.33
T₁S₁ -Aluminium foil covers + Storage at ambient temperature.
T₂S₁-150 gauge Polypropylene bags + Storage at ambient temperature.
T₁S₂-Aluminium foil covers + Storage at refrigerated temperature (8-10°C).
T₂S₂ -150 gauge Polypropylene bags + Storage at refrigerated temperature (8-10°C).
C₁S₁-Control without package + Storage at ambient temperature.
C₁S₂-Control without package+Storage at refrigerated temperature (8-10°C).

Appearance

The data regarding the appearance of dehydrated sapota slices presented in the table 6 recorded significant variation among the treatments, duration of storage and interaction between them.

Among the treatments best mean appearance score (6.34) was observed in dehydrated slices packed in aluminium foil covers and stored at refrigerated temperature (T₁S₂) followed by packed in 150-gauge polypropylene bags and stored at refrigerated temperature (T₂S₂) (6.25) while least mean appearance score 5.17 was found in control with ambient temperature (C₁S₁) followed by with refrigerated temperature 5.28 (C₁S₂).

There was a significant decline in mean appearance score from the initial (7.33) to 120th day (4.85) of storage period. It was observed that as the storage period increased, there was a decrease in appearance score irrespective of the treatment.

Texture

The data pertaining to texture score of dehydrated sapota slices presented in the table 7 recorded significant variation among the treatments, duration of storage and interaction between them.

Among the treatments best mean texture score (6.24) was observed in dehydrated slices packed in aluminium foil covers and stored at refrigerated temperature (T₁S₂) followed by packed in 150-gauge polypropylene bags and stored at refrigerated temperature (T₂S₂) (6.07) while least mean texture score (4.68) was found in control with ambient temperature (C₁S₁) followed by (4.91) control with refrigerated temperature (C₁S₂).

There was a significant decline in mean texture score from the initial (6.67) to 120th day (4.66) of storage period. It was observed that with increase in storage period, there was a decrease in texture score irrespective of the treatments.
**Taste**

The data pertaining to taste score of dehydrated sapota slices represented in the table 8 recorded significant variation among the treatments, duration of storage and interaction between them.

Among the treatments best mean taste score (7.71) was observed in dehydrated slices packed in aluminium foil covers and stored at refrigerated temperature ($T_1S_2$) followed by packed in 150-gauge polypropylene bags and stored at refrigerated temperature ($T_2S_2$) (7.65) while least taste score (6.30) was found in control with ambient temperature ($C_1S_1$) followed by (6.42) control with refrigerated temperature ($C_1S_2$).

**Flavour**

The data pertaining to flavour score of dehydrated sapota slices presented in the table 9 recorded significant variation among the treatments, duration of storage and interaction between them.

Among the treatments best mean flavour score (6.40) was observed in dehydrated slices packed in aluminium foil covers and stored at refrigerated temperature ($T_1S_2$) followed by packed in aluminium foil covers and stored at ambient temperature ($T_1S_1$) (6.32) and which was on par with $T_2S_2$ (6.30) while least flavour score (5.11) was found in control with ambient temperature ($C_1S_1$) followed by (5.20) control with refrigerated temperature ($C_1S_2$).

There was a significant decline in mean flavour score from the initial (6.67) to 120$^{th}$ day (5.20) of storage period.

It was observed that as the storage period increased, there was a decrease in flavor score irrespective of the treatment.

**Overall acceptability**

The data regarding overall acceptability score of dehydrated ripe sapota slices represented in the table 10 recorded significant variation among the treatments, duration of storage and interaction between them.

Among the treatments best mean overall acceptability score (6.86) was observed in dehydrated slices packed in aluminium foil covers and stored at refrigerated temperature ($T_1S_2$) followed by packed in 150-gauge polypropylene bags and stored at refrigerated temperature ($T_2S_2$) (6.77) while least overall acceptability score (5.65) was found in control with ambient temperature ($C_1S_1$) followed by (5.77) control with refrigerated temperature ($C_1S_2$).

There was a significant decline in mean overall acceptability score from the initial (7.33) to 120$^{th}$ day (5.53) of storage period. It was observed that as the storage period increased, there was a decrease in mean overall acceptability score irrespective of the treatment.

There was a gradual decrease in score during the 4 months storage for colour, appearance, texture, taste, flavor and overall acceptability in all samples at ambient as well as at refrigerated storage temperature. Osmotic dehydrated sapota slices prepared using invert sugar and fructose sugar syrup gave first and second rank with highest taste score. Similar trend was observed after 4 months in slices stored at ambient and refrigerated temperature.

Refrigerated storage obtained higher score for sensory properties than those stored at ambient condition. Similar results were reported by Gawade and Waskar (2003), Deol and Bhullar (1972), Gouda et al., (1975) and Thonta and Patil (1988) for dried figs.
The organoleptic score is varied with the treatment and packaging during storage. Osmotic followed by solar dehydrated slices packed in aluminium foil covers and stored at refrigerated temperature scores highest overall acceptability than the other treatments. The lower scores for 150-gauge polypropylene bags and stored at ambient temperature may be due to higher moisture absorption and gas permeability characteristics of the polypropylene bags. Similar results were reported by Vijayanand et al., (2000) while working on guava fruit bar.

Sensory quality of dehydrated ripe sapota slices was significantly affected during four months of storage period. Overall sensory score of slices showed a decreasing trend with advance in storage period, could be due to enzymatic and non-enzymatic oxidation process, which might have caused for reduction in sensory score of the slices. Similar findings were reported in guava slices by Mehta and Tomar (1980). Gurumeenakshi et al., (2005) also reported gradual decrease in colour and appearance of osmotic followed by solar dried papaya slices during storage. Loss of flavor during storage was also reported in papaya slices (Aruna et al., 2000).

The texture and taste score also decreased and this could be also due to the same effect. The decrease in overall acceptability of osmotic followed by solar dried sapota slices during storage was significantly evident and could be because of reduction score of all sensory parameters of sapota slices. Gurumeenakshi et al., (2005) also reported similar results on osmo-dried papaya.

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