A CASE STUDY

INTERNATIONAL JOURNAL OF PROCESSING AND POST HARVEST TECHNOLOGY
Volume 2 | Issue 2 | December, 2011 | 125-128

Effect of different packaging materials on shelf life of sapota fruit

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SUMMARY : Sapota is good source of digestible sugar, calcium and Vit.C. Sapota is the highly perishable fruit. It is consumed either table fresh or in terms of processed products. The freshly harvested fruits were packed in different packaging materials and kept at room temperature for further study. The roundness value 0.86, sphericity 87.58 per cent and specific gravity as 1.10 where as the chemical properties includes 18.13 °Brix TSS, 0.27 per cent acidity, 8.14 per cent total sugar and 25.15 per cent ascorbic acid in the fresh sapota fruit. The shelf life of sapota with different packaging materials was tested in terms of PLW, TSS, acidity, total sugar and ascorbic acid placed at room temperature. The sapota fruit stored in polyethylene bag with 1.2 per cent ventilation prolonged the shelf life of sapota up to 9th day of storage.

How to cite this paper: Awasarmal, A.B., Soni, S.B. and Divekar, S.P. (2011). Effect of different packaging materials on shelf life of sapota fruit, ***Internat. J. Proc. & Post Harvest Technol.,*** **2** (2) : 125-128.

Research chronicle : Received : *10.01.2011;* **Sent for revision :** *21.03.2011;* **Accepted :** *20.05.2011*

KEY WORDS : Sapota, Kalipatti, PLW, TSS, Room temperature

The origin of sapota is the tropical region of Central and South America. Sapota is good source of digestible sugar ranges from 12 to 18 per cent. The 100 gram of sapota has compositions like 73.7g moisture, 21.4g carbohydrate, 0.7g protein, 1.1g fat, 28mg calcium, 0.03mg carotene, 0.02mg thiamine, 0.03mg riboflavin, 0.2mg nicene and 6mg Vit.C. (Anonymous, 2006). A Kalipatti variety of the sapota having oval shape with sweet and mildly fragment was selected for the present study due to its good quality and overall acceptability. Sapota is the highly perishable fruit. It is consumed either table fresh or by processing into products like sapota leather, wine, dried sapota, etc. (Aradhya *et al.,* 2006). As the sapota has a very short storage life, it needs to be preserved until reaches to the market and food processing plant for further processing. The shelf life of sapota depends on different factors like packaging material and atmospheric temperature. The extension in storage life is possible by checking respiration and microbial activity in the sapota fruit. To fulfil this requirement a study was conducted to see the effect of packaging material on shelf life of sapota fruit.

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EXPERIMENTAL METHODS

The sapota fruit variety Kalipatti was used for this study. The freshly harvested fruits were packed in different packaging materials and kept at room temperature for further study. The physical and chemical properties of fresh sapota were determined while performing the present experiment.

Physical properties of sapota:

The physical properties of sapota were determined by using standard formulae (Mohesenin, 1986)

$$\text{Roudness} = \frac{A_p}{A_c}$$

were,

A_p = Largest projected area of an object in natural rest position

A_c = Area of smallest circumscribing circle

$$\text{Sphericity} = \frac{D_i}{D_c}$$

were,

Di = Diameter of largest inscribing circle

Dc = Diameter of smallest circumscribing circle

The specific gravity:

$$\text{Specific gravity} = \frac{\text{Weight in air X specific gravity of water}}{\text{Weight of displaced water}} \text{x100}$$

The physiological loss in weight (PLW)

$$PLW = \frac{\text{Weight of material before storage - Weight of material after storage}}{\text{Weight of material before storage}} \times 100$$

The above formulae were used for determination of physical properties of sapota where as the chemical properties were determined by the standard procedure (Raganna, 1991)

The formula used for the determination of acidity was as follows:

$$\text{Acidity (\%)} = \frac{\text{Titre 1 N of NAOH X Volume makeup}}{\text{Aliquot of sample x Weight of volume os sample taken x 1000}} \times 100$$

The formula used for the determination of ascorbic acid was as follows:

$$\text{W t of Vit - C (mg/g)} = \frac{\text{Sample reading - Blank reading}}{\text{Std. ascorbic acid- blank reading}} \times 100 \times \frac{\text{Vol. of extract Con.}}{\text{Vol. taken of titration}} \times \frac{\text{ascorbic acid}}{\text{Wt. of sample}}$$

The formula used for the determination of total sugar was as follows:

Total sugar (%)= mg of invert sugar X dilution X dilution X 100 as invert sugar titer X wt. of sample X 100

The total soluble solids (TSS) was determined by a had refractometer.

Treatment details:

No.	Treatment	Notation
1.	Control	T_1
2.	Polyethylene bag (100 gauge)	T_2
3.	Film wrap	T_3
4.	Wax coating	T_4

The control:

The sapota sample without any application of packaging material were stored at room temperature in the laboratory of the Department of Agril. Process Engineering, College of Agril. Engineering and Technology, Parbhani (M. S.), India.

Polyethylene bag:

The 100 gauge thickness polyethylene bags having 1.2 per cent ventilations were used for the sapota packaging. The ventilation is required for the respiration of the sapota. (Waskar and Nikam, 1996).

Film wrap:

The film wrap (sling film) was used for wrapping individual fruit.

Wax coating:

The liquid wax was applied on individual fruit.

Observation:

The packaged samples were kept for the storage study in the Agril. Process Engineering laboratory. The observations related to chemical properties of sapota fruit were recorded at every three-day interval.

EXPERIMENTAL FINDINGS AND ANALYSIS

The results are summarized below according to objectives of the study:

Physical properties of sapota fruit:

The different physical properties like, roundness, sphericity and specific gravity of sapota fruit were measured. The roundness value 0.86, sphericity 87.58 per cent and specific gravity as 1.10. where as the chemical properties included 18.13 °Brix TSS, 0.27 per cent acidity, 8.14 per cent total sugar and 25.15 per cent ascorbic acid in the fresh sapota fruit. The shelf life of sapota with different packaging material was tested in terms of PLW, TSS, acidity, total sugar and ascorbic acid placed at room temperature.

Table 1 : Physical properties of sapota fruit

Property	Values	SD
Length(mm)	70.08	2.770
Width (mm)	66.06	3.040
Diameter(mm)	53.28	6.380
Roundness	0.86	0.030
Sphericity(%)	87.58	4.280
Specific gravity	1.10	0.001

Table 2 : Chemical properties of fresh sapota

Property	Values	SD
TSS (°Brix)	18.13	0.031
Acidity (%)	0.27	0.023
Total sugar (%)	8.14	0.024
Ascorbic acid (mg/100g)	25.15	0.570

Effect of packaging material on the PLW of sapota fruit:

The sapota placed in the polyethylene bag had PLW

as 3.26 per cent, 24.20 per cent and 31 per cent on 3rd, 6th and 9th day of storage, respectively. The PLW value was less in the polyethylene bag compared to the film wrap packaging material. This may be due to the reduction in the rate of respiration and evaporation of the sapota fruit in the polyethylene as a packaging material. (Waskar *et al.,* 1999). The total spoilage in the sapota sample was 24 per cent on the 9th day of the storage.

Table 3 : Effect of packaging materials on changes in PLW of sapota fruit

	PLW(%)		Days
Treatments	3	6	9
Initial	0.00	0.00	0.00
T_1	7.26	35.80	spoiled
T_2	3.26	24.20	31.00
T_3	6.10	32.30	spoiled
T_4	2.51	16.00	spoiled
Mean	1.78	27.08	7.75

The film wrapping done around the sapota fruit showed the PLW values as 6.10 per cent and 32.30 per cent for 3rd ad 6th day of storage, respectively. The PLW value was less in the polyethylene bag compared to the film wrap packaging material. The rate of PLW was higher in the fruits wrapped with the help of film (Mudhe, 2006). Total 35 per cent samples were spoiled on the 7th day of storage.

The wax coated sapota indicated PLW as 2.51 and 16 per cent on 3rdand 6th day of storage, respectively. The PLW value was less in the polyethylene bag compared to the film wrap packaging material. The PLW of sapota was lower compared to the other treatments. It may be due to the reduction in the rate evaporation and respiration under wax coating condition (Waskar *et al.,* 1999).

The value of PLW of the control sample was 7.26 per cent on 3rd day of storage and 35.80 per cent on the 6th day of the storage. The value of PLW was increased with increase in the storage period of the sapota fruit. The sample without packaging material and higher temperature caused evaporation losses so as the value of PLW. The spoilage of sapota fruit were measured on the 6th of storage which was about 50 per cent.

The value of PLW of sapota fruit of wax-coated treatment was lower compared to the other packaging materials. The samples in polyethylene also shown lower value of PLW compared to the film wrap and wax coating.

Effect of packaging material on the TSS of sapota fruit:

The sapota placed in the polyethylene bag had TSS as 21.09, 26.00 and 20.90-degree brix on 3rd, 6th and 9th day of storage, respectively. The TSS value was at its peak on 6th day of storage. This value decreased thereafter. The rate of decrease in TSS was found in this treatment. The rate of decrease in respiration causes the rate of decrease in TSS increase. (Waskar *et al.,* 1999). The total spoilage in the sapota sample was 24 per cent on the 9th day of the storage.

Table 4 : Effect of packaging material on change in TSS of sapota fruit

TSS (degree brix)		Days	
Treatments	3	6	9
Initial	18.13	18.13	18.13
T_1	22.00	25.33	Spoiled
T_2	21.09	26.00	18.40
T_3	21.88	27.82	Spoiled
T_4	20.20	24.60	Spoiled
Mean	21.29	25.94	4.60

The film wrapping done around the sapota fruit showed the TSS values as 21.88 and 27.82-degree brix on 3rd ad 6th day of storage, respectively. Similar results were obtained by Mudhe (2006).

The wax coated sapota indicated TSS as 20.20 and 24.60 degree brix on 3rdand 6th day of storage, respectively. The TSS value was increased up to 6th day of storage. The wax coated sample showed low rate of increase TSS because the low rate of conversion of starch into soluble carbohydrates. This in turn reduced the value of TSS. The adverse effect of wax on chemical composition of fruit was reported by Arevalo *et al.*(1999).

The value of TSS of the control sample was 22.00-degree brix on 3rd day of storage and 25.35-degree brix on the 6th day of the storage. The higher amount of TSS was because high rate of respiration. In absence of packaging material, the rate of respiration was higher (Waskar *et al.,* 1999)

Effect of packaging material on the acidity of sapota fruit:

The sapota placed in the polyethylene bag had acidity as 0.18, 0.15 and 0.03 per cent on 3rd, 6th and 9th day of storage, respectively.

The higher level of acidity was obtained in the polyethylene packed fruits compared to the other packaging treatment. Similar results were reported by Gautam and Chadawat (1990).

The film wrapping done around the sapota fruit showed the acidity values as 0.18 and 0.11 per cent for 3rd ad 6th day of storage, respectively. The value of acidity decreased with the increase in the storage 2 period. storage

Table 5 : Effect of packaging materials on changes in acidity of sapota fruit

Acidity (%)	Days		
Treatments	3	6	9
Initial	0.27	0.27	0.27
T_1	0.18	0.08	Spoiled
T_2	0.18	0.15	0.01
T_3	0.18	0.11	Spoiled
T_4	0.18	0.10	Spoiled
Mean	0.18	0.11	0.00

period decreased. Similar results were obtained by Mudhe (2006).

The wax coated sapota indicated acidity as 018 and 0.10 per cent on 3rdand 6th day of storage, respectively. The acidity value decreased with the increase in storage period. Similar results were obtained by Mudhe (2006).

The value of acidity of the control sample was 0.18 per cent on 3rd day of storage and 0.08 per cent on the 6th day of the storage. The decrease in acidity may be due to conversion of acids into sugar and utilization of organic acid during respiration. This was also reported by *Waskar et al.,* 2005.

Table 6 : Effect of packaging materials on changes in total sugar of sapota fruit

Total sugar (%)	Days		
Treatments	3	6	9
Initial	8.14	8.14	8.14
T_1	9.70	16.00	Spoiled
T_2	9.20	16.30	12.70
T_3	11.40	16.60	Spoiled
T_4	9.70	14.30	Spoiled
mean	10.00	15.80	3.18

Effect of packaging material on the ascorbic acid of sapota fruit:

The sapota placed in the polyethylene bag had ascorbic acid as 14.62, 7.0 and 4.60 mg per 100g of sample on 3rd, 6th and 9th day of storage, respectively.

The ascorbic acid decreased as the storage period increased. The decrease in ascorbic acid may be attributed to the enhanced activity of oxidative enzymes which may oxidise the ascorbic acid causing reduction.

The film wrapping done around the sapota fruit showed the ascorbic acid values as 14.37 and 7.80 mg per 100 g of sample for 3rd ad 6th day of storage, respectively. The sudden decrease in the ascorbic acid was observed in the beginning of the storage thereafter the gradual decrease was observed.

The wax coated sapota indicated ascorbic acid as 14.78 and 6.70 mg per 100 g of sample on 3rdand 6th day of storage, respectively. The ascorbic acid value was decreasing through out the storage period.

Table 7 : Effect of packaging materials on changes in ascorbic acid of sapota fruit

Ascorbic acid	Days		
Treatments	3	6	9
Initial	25.15	25.14	25.14
T_1	9.70	8.80	Spoiled
T_2	9.20	7.00	4.60
T_3	11.40	7.80	Spoiled
T_4	9.70	6.70	Spoiled
Mean	14.66	7.58	1.15

The value of ascorbic acid of the control sample was 14.88 mg per 100 g of sample on 3rd day of storage and 8.80 mg per 100 g of sample on the 6th day of the storage. The ascorbic acid decreased as increase in storage period. Similar results were reported by Ingle *et al.* (1982).

Conclusion:

The sapota fruit stored in polyethylene bag with 1.2 per cent ventilation prolonged the shelf life of sapota up to 9th day of storage compared to other packaging materials.

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