Impact of packaging material on shelf life and quality of Sapota- A Review

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Sapota (*Acharus zapota* L.) is a long-lived, evergreen tree. South Mexico, Central America and West Indies are considered to be origin of Sapota. Sapotaceae is the family of sapota fruit. In India, it is cultivated at large scale which promotes India to be the largest producer in the World. Yet, it is considered as minor crop in India. The fruit is also known by the names as 'a small potato', 'a small tomato', 'a round kiwi fruit', or 'a soft elongated tan egg'. It is cultivated in many parts of India which includes satates like T.N, Maharsthra, A.P, Gujarat, W.B, U.P, Punjab and Haryana. Estimated are under sapota is 1,20,740 hac. with annual production of 14.6 lakh tones. The fruit is best eaten when the flesh is ripe and. it is exceptionally sweet and very tasty, with what can be described as a malty flavour, the scent of honey, jasmine, lily of the valley and that of brown sugar, texture of cinnamon, apple and pear.

Keywords: Sapota, Shelf life, Post harvest, Quality, Packaging.

Sapota is a climacteric fruit crop. At ambient condition, it takes about 6 to 7 days for ripening of fruits. The shelf life of sapota totally depends on the storage conditions. The storage life is minimum at ambient room temperature because of its perishable nature. All around the world, there is loss of 30-40% in harvested fruits and this loss is even more in some developing nations (**Panhwar, 2006**). Minimizing the post-harvest loss can ensure food safety, in terms of quantity as well as quality (**Joshua and Sathiamoorthy, 1993**). Qualitative losses are hard to measure than the quantitative losses of fresh fruits (**Kitinoja and Kader, 2015**). Post-harvest treatments play a significant role in extending shelf life of the fruits (**Deka *et al*., 2006**). Generally, in harvested fruits, there is loss in many qualitative and quantitative aspects which leads to poor marketability of fruits. These losses directly target the taste, flavour and appearance of the fruits (**Aquino *et al*., 2001**). Researches have been done in order to overcome these problems and extend the shelf life of fresh produce. The levels of CO2 and O2 inside package altered due to fruit respiration and permeability of the film, resulted in recommendation of modified atmosphere packaging (MAP) for fresh fruit storage (**Geeson *et al*., 1981).** Minimizing the post harvest losses can ensure the food safety in terms of quantity and quality that is preferred by the entire inhabitant on our planet. With respect to above statement, the investigations related to packaging and their impact of quality parameters and storability of sapota fruit were critically accessed in this review under various conceptual facts.

Impact of packaging on physical parameters of fruits

Flores and Riva (1975) reported that sapota fruit is highly perishable if stored at room temperature and could not be kept for eight days. But, **Kumbhar and Desai (1986)** observed that shelf-life of sapota fruits increased at room temperature for up to eleven days, when fruit was treated with 75 ppm GA and packed in polyethylene bags of 100 guage.

Randhawa *et al*. (1982) observed that the loss in weight is about 3.6% in pear, after stored for 55 days when it wraps with polyethylene. The loss in weight was minimum in Patharnak and Le conte pears, when wrapped with low density polyethylene films

Kumbhar and Desai (1986) observed that the cumulative total weight loss during the course of storage of sapota was considerably high in open fruit. After 11 days of storage, the weight loss in polyethylene packed fruit was 46.3 % as against 72.1% in open fruit. A significant reduction in the weight loss was observed in 75 ppm GA treated fruit packed in polyethylene bag after 11 days, the loss was 11.89 % as against 90.2% in untreated open fruit.

Banik *et al*. (1988) studied the effect of polyethylene bags with permanganate-silica gel at 10–12°C on sapota. It was observed that fruits could be stored well up to 18 days with minimum spoilage (30 percent) while other treatments were not responsive after 12 days of storage. Untreated fruits survived for only 9 days of storage.

Mann *et al*. (1990) observed that the highest weight loss after 30 days of storage of Bartlett pear was in fruits wrapped in polyethylene when kept at room temperature; while as the minimum loss (0.2%) was recorded in polyethylene wrapped fruits kept in cold storage conditions.

Miller *et al*. (1988) studied that the effect of film wrapping in various fruits. The polyethylene wrapping reduced structure loss, retard softening and maintained characteristic freshness and less decay per cent during extended period of storage and marketing.

Kariyanna *et al*. (1993) reported the effect of packaging material on sapota. When polyethylene bag (150 guage and 1% vents) was used, the physiological loss in weight decreased significantly. Also, due to the fungal rot spoilage was reported maximum. The spoilage problem could be overcome by treating fruits with bavistin @500ppm before packaging. Fruit packed in polyethylene bag possessed better effect as compared to other treatments.

Yuen *et al*. (1993) studied the effect of cling film wrapping on mango fruit variety 'kensington pride' and observed that after 10 days that mango had attractive appearance and good eating quality.

Singh (1993) reported that minimum spoilage on first harvest dates and it noted that simultaneous increase in spoilage with the enhancement of harvest dates in Patharnakh and Le Conte pears. The minimum and maximum spoilage was reported after 30 and 90 days of cold storage in all the LDPE and HDPE films in pear respectively.

Ladaniya *et al*. (1997) reported that the decay loss was minimum in Nagpur mandarin shrink wrapped fruit and maximum in unwrapped fruit during storage**.**

Raghav and Gupta (2000) studied the effect of individually wrapped kinnow fruits. They found that, fruits can be stored for 84 days with less loss in quality and PLW. Whereas, the unwrapped control fruits survived for 40 days at ambient conditions. Also, they found that wax is quite effective in prolonging the shelf life of fruits.

Nanda *et al*. (2001) studied the quality of pomegranate fruits cv. Ganesh by wrapping them with shrink film. Fruits were wrapped with 2 types of shrink films: BDF-2001 and D-955. The fruits were kept at different temperature range at 8, 15 and 25°C. The pomegranates wrapped with shrink film was unbroken for 12, 8 and 4 weeks, whereas, non-wrapped fruits may well be hold on for seven, five and one week underneath similar storage conditions

Nain *et al*. (2002) conducted an experiment of wrapping 'Dashehari' mangoes in cling films. It was observed that the favourable effect of the film on the physiological loss in weight (PLW) and decay loss in fruits. They also reported that cling film wrapped fruits had better retention of acidity and ascorbic acid content as compared to others.

Hussain *et al*. (2004) conducted an experiment of forty five days storage to check the impact of uni-packaging with polythene on citrus fruits. They reported that vital impact was found in fruits for prolonging the period and maintenance of external look, taste and texture.

Salari *et al*. (2008) studied the effect of packaging material on Iranian dates throughout storage. These dates were packed at coatings like synthetic resin, plastic and plastic wrap. These dates were hold on for 6 month at 3 totally different temperatures (25, 5 and -18°C) and their chemical properties (moisture, pH, acidity, total sugars, reducing sugars, Brix, lightness worth and redness to spectral colour ratio) were analyzed after 2 month intervals. For storing, 2 month letter and PP causes a decrease in °Brix, total and reducing sugars.

Singh *et al*. (2009) studied the effect of shrink wrapping materials on peaches. To enhance the shelf life in cool chamber (5±1°C, 90-95% RH), 50 µ LDPE and 20 µ LDPE film was used. The physiological loss in weight (PLW) was minimum (0.65%) in 50µ LDPE and 0.7% in 20µ LDPE as compared to control (45.26%) after 42 days of storage. The total soluble solids increased and the titrable acidity decreased in all the treatments during storage period. The shelf life of the fruits in cool chamber extended up to 42 days by individual heat shrink wrapping with 20µ LDPE film.

Pongener *et al*. (2010) assessed the impact of packaging films on peach fruits under supermarket conditions. Harvested fruits were packed in paper moulded tray and tightly stretch wrapped with various types of films. Packaging films used for this experimentation were LDPE, HDPE, Shrink and Cling film. The packed fruits and un-packed fruits were kept at storage conditions of 20-21°C and 90-95% RH. After every 2 days, fruits were analyzed for physical and chemical parameters. In findings, it was concluded that shrink film is most effective for extending the shelf life and maintaining superior quality of peach fruits up to 8 days. Whereas, un-wrapped control fruits reported marketable quality for 4 days only.

Pongener *et al*. (2011) studied the effect of various packaging films on the shelf life of peach fruits under cold storage conditions. The shrink film was found to be the best among all the films as it maintained the quality of fruits upto 28 days of storage. The quality traits such as TSS, total sugars, and titrable acidity were found to be highest in shrink film stored fruits. The control fruits maintained marketable quality up to 14 days.

khan *et al*. (2013) studied the effect of yellow, white and transparent polyethylene packaging on storage for life extension of plum fruit stored at ambient temperature (25±°C) and refrigeration temperature (1-4°C). Maximum weight loss (5.79) and decay index (22.11) were found in control and minimum weight loss (1.64) and decay index (4.73) were found in transparent colored packaging at refrigerated temperature.

Effect of packaging on quality parameters of fruits

Selvaraj and Pal (1984) reported that total titrable acidity in sapota, which was high in 30-day old samples, declined and reached minimum in ripe fruit. Malic acid was the major acid in all developmental stages. The amount of titrable acidity of sapota decreased as storage period advanced.

Kumbhar and Desai (1986) reported that the percentage of acidity decreased from 0.27 to 0.04 during ripening in sapota. The decrease was slow in polyethylene packed fruit as against open fruit and in treated fruit as against the untreated fruit. GA showed slow decrease in acidity than IBA.

Kumbhar and Desai (1986) reported that TSS content of sapota fruits was increased from harvest until ripening and later a decrease in TSS as the fruits started senescing. A similar view was also shared by **Gautham and Chundawat (1990)** in sapota fruits.

Greg and Santi (1987) reported that the maximum TSS content was observed in unwrapped tomato fruit as compared to individual shrink wrapped fruit with increase storage period. The maximum TSS was observed in untreated fruits i.e. 12.30% after 90 days of storage at 19±8°C due to higher rate of evapotranspiration **(Singhrot *et al*. 1987).**

Kumbhar and Desai (1986) reported that a rise in total soluble solids (TSS) in open sapota fruit at room temperature up to 6th day and after that decrease. In polyethylene packed fruits, TSS increased up to 9th days and then decreased with increase storage period. Similarly, in the untreated and the treated fruits with different chemicals, the values of TSS increased up to 6th and 9th day, respectively and then decreased. The untreated open sapota fruit showed fast rise and fast decrease in TSS with increase storage period.

Shende (1993) observed that TSS content of cv. Kalipatti at maturity and at ripe stage ranged between 21.5-22.4° Brix and 23.8-24.16° Brix, respectively.

Nikam and Waskar (1995) reported that initially TSS increase and fall afterwards irrespective of storage conditions. However, the rate of increase of TSS was found to be faster at room temperature. They reported that higher temperature and low humidity (31.67 to 30.85°C and 22.57 to 34.97% RH) enhanced ripening of fruits so that there is faster utilization of soluble solids thus, resulting in shorter shelf life of sapota fruits.

Slaughter *et al*. (1998) reported that the acidity per cent slowly decreased in the Bartlett pear fruit packed in polyethylene film bags as compared to unwrapped fruit. **Rao and Chundawat (1988)** reported that sapota fruit keeps well for 5-7 days under ordinary conditions. Ethylene production, respiration and catalase activity in sapota cv. Kalipatti were rapid at ambient temperature of 29-31°C.

Hayat *et al*. (2000) reported that the maximum TSS content was found in control and minimum TSS content was found in apples packed in polyethylene bags during 60 days of storage. It was also observed that TSS increased during storage period.

Pongener *et al.* 2011 studied the impact of polyethylene films on peach fruits. It was found that TSS increased slowly upto 28 days in packed fruits and by end of 35 days of storage, sharp decline in TSS was observed.

Hussain *et al*. (2001) reported that when apple fruits wrapped in polyethylene wrap of thickness 0.01cm, there was less decrease in acidity per cent than control. They also found that acidity percentage decreased as storage period increased.

Jindal *et al.* (2005) reported that polythene wrapped sapota fruits retained maximum ascorbic acid content as compared to control due to low PLW accompanied by low respiration and transpiration losses.

Sudha *et al*. (2007) reported that the individually wrapped sapota fruits retained maximum ascorbic acid content which was attributed to lesser availability of O2 and thus lesser oxidation of ascorbic acid content.

Randhawa *et al*., (2009) studied the effect of HDPE film along with use of edible oil and wax as surface coating material for assessing shelf life of kinnow. Results of the study concluded that, fruits recorded the highest palatability rating after 45 days storage at ambient conditions. Maximum juice content and minimum spoilage of fruits were recorded with the treatment of neem oil with HDPE film. Untreated control recorded maximum TSS and PLW.

Shahid and Abbasi (2011) assessed the impact of wax on sweet orange cv. Blood red. In this findings, he concluded that treatment with was 5% showed positiveness in qualitative traits such as pH, acidity, sugars, and vitamin C content of fruits.

According to Mahajan *et al.*, (2013) reported that the kinnow fruits treated with Niprofresh showed a significant loss of qualitative traits.

Jawandha *et al*., (2014) assessed the effect of bavistin, wax coating and packaging material on Barsmasi lemon. Healthy fruits were treated with 0.1% bavistin solution and then wax coating was done on them. Later they were packed in HDPE and LDPE bags. In the findings, it was revealed that the quality of fruits in regard to juice content and acidity was better in fruits treated with bavistin 0.1% and packed in LDPE bags.

Mahajan and Singh (2014) studied the effect of shrink film on kinnow fruits. He found that, shelf life and quality retained by packed fruits extended upto 20 days. In control, the fruits survived only for 10 days.

Jhalegar *et al*., (2015) treated the kinnow fruit with various wax coating materials. He used citrashine, P-104 and niprofresh for experimentation. The results concluded that, coating prolonged the shelf life and maintained quality of fruits up to 60 days.

Conclusion

Packaging is the process which results in the reduction of respiration rate, ripening process, ethylene sensitivity, ethylene production and also minimizes the softening of texture. Due to all these activities the shelf life of the product is extended. Therefore, for the fresh marketing of fruits use of various packaging materials is a common practice. Packaging helps in extending shelf life by minimizing shrinkage, weight loss, and other quality parameters. Finding of suitable and proper packaging technique with suitable storage conditions can help to extend shelf life and marketability of sapota.

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