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Research Article

PHYSICO CHEMICAL ANALYSIS OF SAPOTA (*MANILKARA ZAPOTA*) COATED BY EDIBLE ALOE VERA GEL

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Abstract

The physical and chemical characteristics of the fruit have immense significance as they ultimately affect the quality of processed products prepared from them. Over ripening of Sapota (*Manilkara zapota*) fruits at the post-harvest stage usually results in dramatic decline in quality. In the present study, physico chemical analysis (which includes Weight loss, Colour, Texture, TSS, pH, TA and Ascorbic acid content) of edible Aloe vera gel coated Sapota fruits packed in LDPE and stored at 15 ± 2℃ were studied at regular intervals of 5 days i.e., 0^{th},5^{th}, 10^{th},15^{th} and 20^{th} days. The dip treatment of Aloe vera gel coating 1:2, 7 minutes had best retained the physico chemical characteristics than the other treatments performed and was found to be the most effective treatment in maintaining the fruit quality attributes along with the shelf life extension of about 20 days.

Key words: Sapota; Aloe vera gel; edible coating; physico chemical; shelf life

Introduction

The physical and chemical characteristics of the fruit have immense significance as they ultimately affect the quality of processed products prepared from them. Sapota is a climacteric (Broughton *et al.,* 1979) fruit originated from Tropical America. India is the leading producer of Sapota in the world with a production of 14.95 lakh tonns in the year 2012-13 (Indian Horticulture Database, 2013, Ministry of Agriculture) but the export constitutes very minor fraction as fruit ripens within 9 days at ambient (27±3°C) temperatures and spoils within 13 days after harvest (Mohamed *et al.*,1996). So far many attempts had been made to extend the shelf life which include Calcium salts dip treatment (Onanong, 1989; Chittham *et al.,* 2002), GA (Kadu and Gajipara, 2009), Waxol (Bojappa and Venkatesh Reddy, 1990) and hot water (Brito and Narendra, 2002) treatments. But these were not able to increase the storage life to appreciable level as the MAP (Mohamed *et al.,* 1996) does which was expensive and need technical expertise. In the current study Aloe vera gel dip treatment was used to preserve the Sapota. Hence the objective is to study the effect of edible Aloe vera gel in maintenance of physico chemical characteristics of Sapota.

Aloe vera gel has been used as an edible coating in fruits (Valverde *et al.,* 2005; Khuyen *et al.,* 2008; Romero *et al.,* 2006; Ahmed *et al.,* 2009), which would be an innovative and interesting means for commercial application and an alternative to the use of postharvest treatments. *Aloe vera* has been used for centuries for its medicinal and therapeutic properties (Vogler and Ernst, 1999; Capasso *et al.,* 1998) anti-inflammatory (Hamman, 2008) and antimicrobial activities (Chen *et al.,* 2010) apart from the antioxidant capacity (Miranda *et al.,* 2009).

Pectin has wide applications in a variety of food formulations as jellying and thickening agent. Since it sets into jelly in sugar-acid solution, it is regularly used in the preparation of jams, jellies and marmalades. On account of its ever-increasing use and demand, pectin has become an indispensable ingredient in food industry. Low density poly ethylene has wide applications in the food industry as packaging material to avoid weight loss (Mohamed *et al.,* 1996), dust, contamination of microorganisms.

Edible coatings play an important role in the quality, safety, transportation, storage, and display of a wide range of fresh and processed foods (Lin and Zhao, 2007; Baldwin *et al.,* 1995). Edible films and coatings, while preventing moisture loss and maintaining quality, prevent spoilage and microbial contamination of foods (Park, 1999). They act as barriers to moisture and oxygen during processing, handling (Díaz-Pérez *et al.,* 2001) and storage and do not solely retard food deterioration but also enhance its safety due to their natural biocide activity or the incorporation of antimicrobial compounds (Vargas *et al.,* 2008).

Materials and Methods

Plant Material and Experimental Design

The fresh fruits were selected to obtain homogeneous batches based on color, size and absence of injuries. The Aloe vera juice of food grade was obtained from PSSGT EXPORT, Tuticorin, Tamil Nadu.

Process of edible coating for Sapota

The optimized Aloe vera gel (aloe vera juice mixed with 1.5% pectin at 60°C for gelation) was taken in three different concentrations i.e., 1:1(200 ml of Water: 200 ml of aloe vera gel), 1:2 (133.3 ml of Water: 266.6 ml of aloe vera gel) and 1:3 (100 ml of Water: 300 ml of aloe vera gel) with distilled water in increasing concentration of aloe vera gel and three different dipping periods for each concentration, thus giving rise to two variants i.e., concentration of aloe juice and dipping time (Padmaja and Bosco, 2014). The untreated fruits were regarded as control. The treatments (ST6,ST7,ST9,ST10) (Table-1) which got less shrinkage and better visual aspect when compared to control (ST1) were selected for the final process of edible coating to assure the repeatability followed by physico chemical analysis for checking the maintenance of quality throughout the shelf life period.

Table 1: Optimized *Aloe vera* gel treated Sapota (*Manilkara zapota*)

Treatment No:	Ratio of water to Aloe vera	Duration in minutes
ST1	CONTROL	-
ST6	1:2	5
ST7	1:2	7
ST9	1:3	5
ST10	1:3	7

Physical analysis

Weight loss

Weights of individual fruit of Sapota in the LDPE were recorded on zeroth day and after every five days and weight loss per centage was calculated.

Colour

Color was determined using the Hunter Lab System. The values were recorded for each fruit for the following individual L*, a*, and b* parameters.

Firmness

Flesh firmness of fruits was determined using a texture analyzer in terms of penetration test. A needle probe of 2 mm diameter was allowed to penetrate into the fruit upto 6 mm. A load cell of 50 kg; pretest speed of 1.5 mm/sec; test speed of 1.0 mm/ sec and post- test speed of 10 mm/sec was maintained. The force required to penetrate the fruit skin surface to a depth of 6mm was expressed in kilogram.

Chemical Analysis

Total Soluble Solids Concentration

The TSS was determined by a Hand Refractometer of 0-32° Brix. Three fruits for each treatment were homogenized and the degree Brix was measured.

pH Value

The pH value was measured by means of digital pH meter and the values were recorded.

Titrable acidity

10 g of fruit homogenate was taken and made up to 100ml with distilled water. From this an aliquot of 30 ml was taken and titrated against 0.05 N NaOH with Phenolphthalein as indicator in triplicates. From the titre value as per centage of Titrable acidity was calculated.

Ascorbic Acid

The Ascorbic acid content was determined by 2, 6 dichlorophenol indophenol visual titration method as suggested by Ranganna, 1999. The dye is blue in alkaline solution and red in acid solution was reduced by ascorbic acid.

Statistical Analysis

Data for the physical & chemical parameters were subjected to analysis of variance (ANOVA). Sources of variation were time of storage and treatments. Results were compared for the treatments and storage time which were significant at $P<0.05$. All analyses were performed with SPSS software package.

Results and Discussion

Parameters related to Physical Characteristics of Sapota Quality

Weight loss

Weight loss increased during cold storage of Sapota, but it was significantly greater in control than in *Aloe*-pectin treated Sapota fruits (Fig. 1). At the end of storage, control fruits lost the weight by 17.24 per cent whereas the loss of weight in *Aloe*- pectin treated Sapota fruits was significantly less. The reduced weight loss in the coated

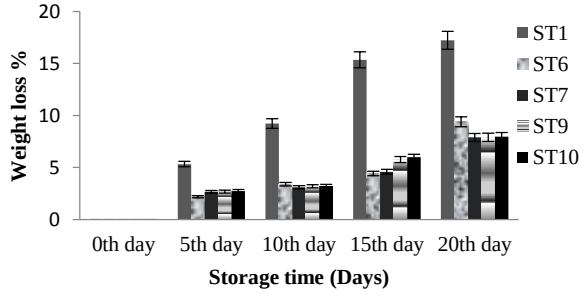

Fig. 1: Effect of Aloe vera treatment on changes of weight loss % of Sapota stored at a temperature of 15±2°C

[Weight loss was more in control Sapota while in the aloe treated ones it was controlled better on the 20th day of shelf life.]

fruit may be ascribed to the ability of the coating film to block all lenticels (pores) and stem-end scar in the coated fruit, which may have resulted in reduced transpiration (Khuyen *et al.*, 2008; Li *et al.*, 2009; Padmaja and Bosco, 2014; Romero *et al.*, 2006). ST7 was found to be the optimum concentration when compared to others in controlling the weight loss. The mean of the treatments showed less weight loss per cent in ST7 and less deviated from the standard. P<0.05 obtained for both treatment and storage, it shows that there was significant difference between the treatments with storage time.

Colour

Colour was measured in 'L', 'a', 'b' parameters. 'L' value of control decreased from 48.62 to 25.9 while it was better maintained in aloe treated ones with less amount of decrease (Fig. 2). The colour of outer peel of Sapota was shifting to dark brown. However this colour change to dark occurred within ten days in control than that of treated ones and this edible coating could prevent the treated Sapota fruit from becoming darker (Hamman, 2008; Romero *et al.*, 2006). The mean of the treatments shows that the L value was maintained better in ST6 and ST7 and less deviated from the standard. As the P>0.05 for treatment, there was no significant difference for L value between the treatments while P<0.05 for storage time which shows that there was significant difference between the treatments with increase in storage period.

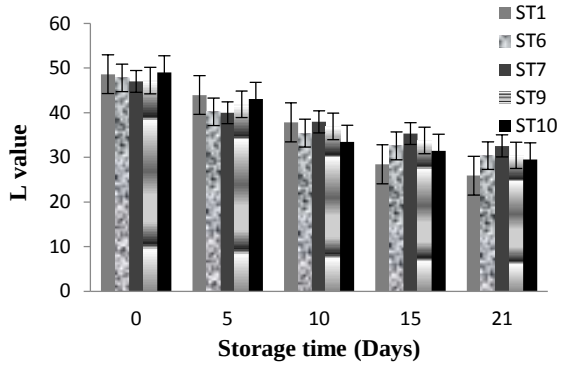

Fig. 2: Effect of Aloe vera treatment on changes of of "L" value of Sapota stored at a temperature of $15\pm2°C$

["L" – value was maintained better in aloe treated ones especially in ST6 and ST7 than that of the control Sapota]

'a' value was increasing for all the treatments while it shows a greater increase from 6.44-11.16 in control (Fig. 3). The colour of outer peel of Sapota was shifting to reddish brown. However this colour change towards red was more in control than that of treated ones and this edible coating could prevent the Sapota fruit from becoming more reddish brown (Padmaja and Bosco, 2014; Romero *et al.*, 2006). The mean of the treatments shows that the 'a' value was maintained better in ST6 and ST7 and less deviated from the standard when compared to control. As the P<0.05, it shows that there was significant difference between the treatments as well as storage time.

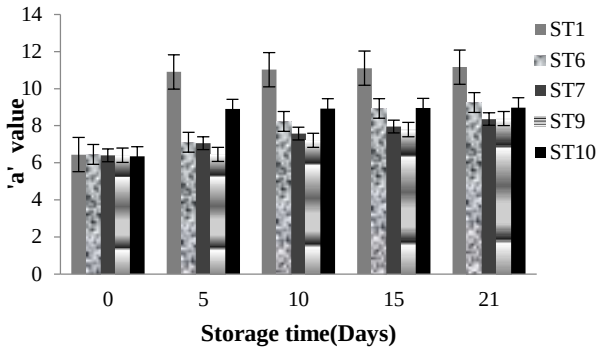

Fig. 3: Effect of Aloe vera treatment on changes of of 'a' – value of Sapota stored at a temperature of $15\pm2°C$

[Color change towards red ("a") was better controlled in the aloe treared Sapota while the control showing the peak value]

'b' value shows a decreasing trend of values for both control and treated Sapota. The degree of decrease was more in control ranging from 31.97- 14.1 than aloe treated ones as shown in the (Fig. 4). The mean of the treatments shows that 'b' value was maintained better in ST6 and ST7 and less deviated from the standard with when compared to control.

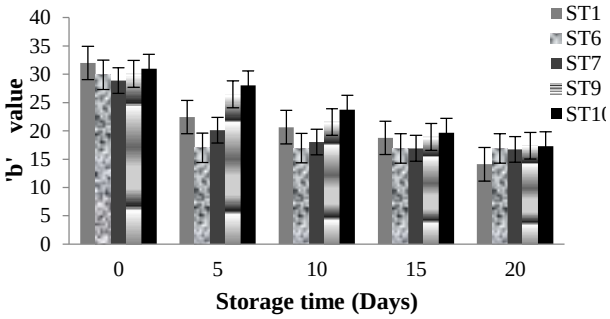

Fig. 4: Effect of Aloe vera treatment on changes of 'b' – value of Sapota stored at a temperature of $15\pm2°C$

["b" – value was maintained better in aloe treated ones especially in ST6 and ST7 than that of the control Sapota]

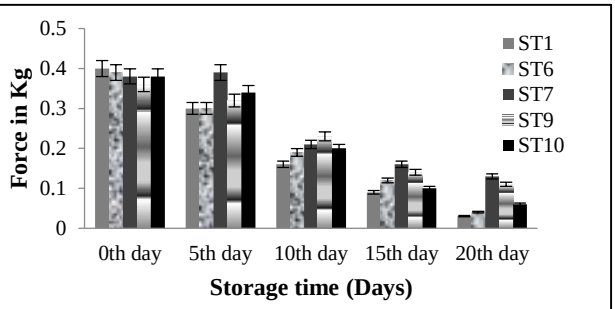

Fig.5: Effect of Aloe vera treatment on changes of textural changes of Sapota stored at a temperature of $15\pm2°C$

[Control Sapota lost its firmness by the 20th day of shelf life while the aloe trated ones were able to maintain as shown in the figure**]**

As the P<0.05, it shows that there was significant difference between the treatments as well as storage time.

Firmness

With respect to firmness, Sapota control softened during cold storage, but to a greater extent in control than in *Aloe*-pectin treated Sapota (Fig.5). At the end of cold storage, control Sapota showed flesh firmness levels of 0.03 kg; in *Aloe*-pectin treated Sapota these firmness levels were significantly higher. The firmness was also negatively correlated with storage duration for all treatments and it was too much lost in the control when compared to *Aloe*-pectin treated ones as it lost more moisture content during storage (Valverde *et al.*, 2005, Hamman,2008; Padmaja and Bosco, 2014) The treated ones also exhibited direct correlation with weight loss in maintaining the firmness. The mean of the treatments shows that firmness was maintained better in ST6 and ST7 and less deviated from the standard when compared to control. P<0.05, it shows that there was significant difference between the treatments as well as storage time.

Chemical Parameters of Sapota Quality

Total Soluble solids

TSS concentration significantly increased during cold storage in control Sapota, from levels at zeroth day of 19 to 24° Brix. This trend was continued in the aloe- pectin treated fruits during 20 days of storage (Fig.6).The total soluble solids increases in all the fruits as the fruit ripens (Abbas and Fandi, 2002) the complex carbohydrates were converted to simple sugars. But this increase could be prevented to some extent with the help of aloe-pectin edible coating (Valverde *et al.*, 2005).The mean of the treatments shows that total soluble solids was maintained better in ST6 and ST7 and less deviated from the standard when compared to other treatments. P>0.05 in treatment, there was no significant difference for values between the treatments while P<0.05 for storage time which shows that there was significant difference between the treatments with increase in storage period.

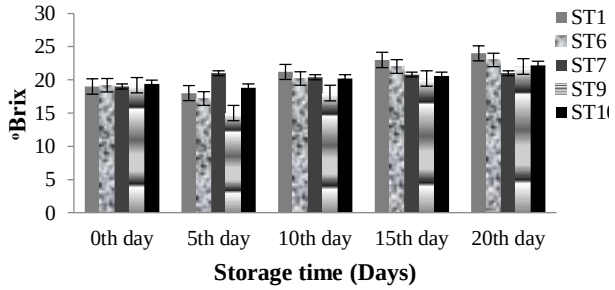

Fig. 6: Effect of aloe vera treatment on changes of Total soluble solids (TSS) of Sapota stored at a temperature of $15\pm2°C$

[TSS tends to increase in both control and aloe treated ones but the treatments ST6 and ST7 were able to control this effect as shown in the Fig. 6]

pH value

pH of Sapota steadily increased from 5.6- 5.97 in control while that increasing trend exists in the aloe-pectin treated

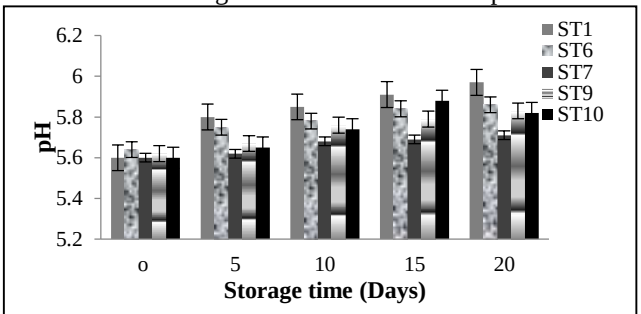

Fig. 7: Effect of aloe vera treatment on changes of pH value of Sapota stored at a temperature of $15\pm2°C$

[pH tesnds to increase in both control and aloe treated sapota but it was better maintained in ST7]

Sapota also but less than that of control (Fig. 7). The similar trend was observed when fruit ripens the pH value increases and when it was over ripened the pH value decreases due to turning sour to fermentation sugars (Mohamed *et al.*, 1996; Brito and Narain, 2002). The increased trend of pH value was due to decrease in acidity and increase in soluble sugars during ripening. But as there was less amount of decrease in acidity and TSS the pH value of aloe-pectin treated ones shows less pH value than that of control. The mean of the treatments shows that was maintained better in ST7 and less deviated from the standard. P<0.05 for storage time which shows that there was significant difference between the treatments with increase in storage period.

Titrable Acidity

Acidity of Sapota decreased from 1.92-0.74 in control while that decreasing trend exists in the aloe-pectin treated Sapota also but less than that of control (Fig.8) (Brito and Narain, 2002; Padmaja and Bosco, 2014; Romero *et al.*, 2006). The TA was decreasing due to increase of soluble sugars during the course of ripening (Abbas and Fandi, 2002). This decrease was observed less in treated ones as compared to control as they have less TSS due to edible coating. The mean of the treatments shows that Titrable Acidity was maintained better in ST7 and ST9 and less deviated from

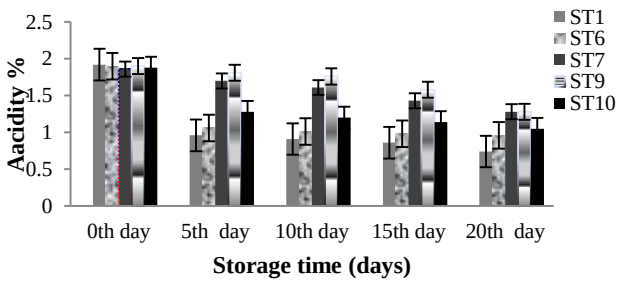

Fig. 8: Effect of aloe vera treatment on changes of Titrable Acidity of Sapota stored at a temperature of $15\pm2°C$

[Titrable acidity showed a decresing trend in both control and aloe treated sapota but it was better maintained in ST7 & ST9]

the standard. P <0.05 for storage time which shows that there was significant difference between the treatments with increase in storage period.

Ascorbic Acid

Ascorbic acid of Sapota decreased from 13.2-5.34 in control while that decreasing trend exists in the aloe-pectin treated Sapota also but less than that of control value as shown in the (Fig. 9) (Mohamed *et al.*, 1996; Brito and Narain, 2002; Serrano *et al.*, 2006; Padmaja and Bosco, 2014). This decrease trend of Ascorbic acid was due to increase in total soluble sugars present in the fruit. But this trend was more pronounced in control due to lack of barrier while in treated ones the ascorbic acid was not reduced as that of control. The mean of the treatments shows that Ascorbic Acid was maintained better in ST7 and ST9 and less deviated from the standard. P<0.05 shows that there was significant difference between the treatments with increase in storage period.

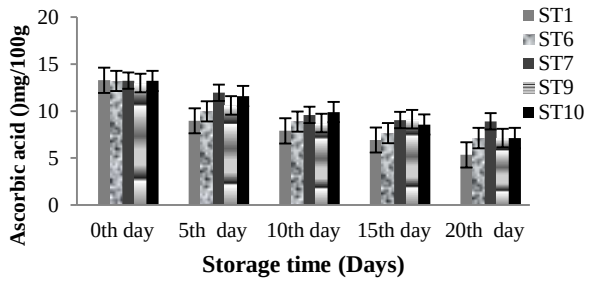

Fig.9: Effect of aloe vera treatment on changes of Ascorbic Acid of Sapota stored at a temperature of 15±2°C

[Ascorbic acid showed a decresing trend in both control and aloe treated sapota but it was better maintained in ST7 & ST9]

Conclusion

Among the 9 dip treatments performed with aloe vera gel for Sapota, 1:2, 7 minutes dip treatment had best retained the physico chemical characteristics than the other treatments performed and was found to be the most effective treatment in maintaining the fruit quality attributes along with the shelf life extension of about 20 days.

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