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RESEARCH PAPER

Effect of Edible Coating on the Storage Behaviour of Sapota (*Achras sapota* L.) var. Cricket Ball

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ABSTRACT

Edible coating prepared with the mixer of soybean chunk and wheat grass powder were applied in cricket ball variety of sapota with the end goal of preserving its quality. Preparation of coating was done by measuring the soybean chunks extracts, accordingly based on the treatments i.e. 10, 20, 40, 60 and 80ml/L and mixing it with 1 gm of wheat grass powder which was constant for all the treatments was carried out. Soybean being rich in protein and wheat grass powder, a good source of antioxidants could be used as an alternative for synthetic plastic in food applications which can also be consumed along with the products, thereby, contributing to the reduction of environmental pollution. The post-harvest losses during storage of sapota fruit (variety cricket ball) could be effectively reduced with the application of edible coating up to a period of 12 days under ambient storage conditions. The treatment combination of soyabean chunk extract of 60gm/L with wheat grass powder of 1% (T_4) gave the best result in terms of lowest spoilage percentage and physiological loss in weight. Since, sapota fruit is highly perishable and could only be stored for a period of maximum 3-4 days after ripening, therefore extending the storage period up to 12 days could be an effective alternative to get regulated market supply thus, reducing the market glut.

Keywords: Edible, coating, soyabean, wheat germ

Sapota (*Manilkara zapota* L.), family Sapotaceae occupies one of the major fruit crops grown in India, Mexico, Guatemala and Venezuela (Kulkarni *et al.* 2007). Immature sapota has high amount of tannin (pro-anthocyanadins) which are very astringent. During ripening, tannin gets eliminated with just a low level remaining in the skin. Due to the perishable nature of the fruit, the texture and quality gets deteriorated up to 25-30% in 3 to 4 days at room temperature (Siddiqui, 2014). Consumer preference and marketing quality deteriorates rapidly once it is fully ripened as the fruit become soggy and due to this reason fresh fruits cannot be stored for indefinite period. Therefore, sapota fruit needs prudent use of post-harvest treatments followed by its ideal storage conditions in order to manage it appropriately and also for regulated market supply. Different post-harvest treatments like calcium chloride or paraffin liquid which comes under chemical treatments and edible coatings such as guar gum, gum acacia, chitosan could be used to extend the shelf-life of sapota. An alternative source for packaging could also be natural polymers due to their appetizing and environment friendly nature (Siracusa *et al.* 2008). Edible coatings and films have come to light as a substitute for synthetic plastic for food applications and have gained considerable attention at present

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day because of their advantages over synthetic films. Since, edible films could be consumed along with the products it is now preferred over the traditional synthetics films (Bharti *et al.* 2020). There is no package to discard and even if the films are not consumed along with the products they could still bestow to the reduction of environmental pollution. These films are extracted exclusively from renewable, edible ingredients so are anticipated to degrade more readily than those made from polymeric materials (Dhanapal *et al.* 2012). Enhancement of the sensory properties of packaged foods could be carried out by the application of various components such as flavourings, colourings, sweeteners etc. Their demand and usage based on their natural polymers and food grade additives has been constantly expanding in the food industry (Bourtoom, 2008). The operability and workability of edible films mainly depend on their barrier, mechanical and colour properties, which in turn depend on film constitution and its formation process.

The most important parameters in case of edible coating is the technique of application on the product, and the capacity of the coating to adhere to the surface (Shiekh *et al.* 2013). Food coating can be carried out by dipping or spraying, forming a thin film on the food surface which acts as a semi-permeable membrane, this in turn check the moisture loss or/and suppress the gas transfer (Lin and Zhao, 2007). These edible films also function as carriers for antimicrobial and antioxidant agents. There is no study on use of the edible coatings on sapota, hence this study was carried out and the results are reported here.

MATERIALS AND METHODS

Soybean chunks extract were prepared after boiling and crushing in water. Preparation of coating was done by measuring the soybean chunks extracts accordingly based on the treatments i.e. 10, 20, 40, 60 and 80ml/L and mixing it with 1 gm of wheat grass powder which is constant for all the treatments (T_1: Soybean extract 10ml/L and wheat grass powder 1gm; T_2: Soybean extract 20ml/L and wheat grass powder 1gm; T_3: Soybean extract 40ml/L and wheat grass powder 1gm; T_4: Soybean extract 60ml/L and wheat grass powder 1gm; T_5: Soybean extract 80 ml/L and wheat grass powder 1gm; T_6: Control). Matured and uniform size sapota fruits variety cricket ball was selected for the treatments where dipping was done for 10 minutes. Fruits were allowed to dry for 30 min at room temperature (25^0C) and air dried, and kept it for storage. Each treatment was analysed for physico-chemical parameters i.e. fruit length, breadth, TSS, total sugar, titratable acidity and pH where the observations were taken in 4 days interval checking the spoilage percentage as well as the physiological loss in weight of the treated fruits during storage under ambient room condition (average maximum temperature of 25°C and minimum temperature of 12°C). Fruit length and breadth were measured by using manual vernier calliper. Chemical analysis was carried as per the standard method reported by Mazumdar and Majumder (2003). During the storage period, fruits of each replication were calculated according to the extent of spoilage. After that percent of spoilage were calculated. Sapota fruits were weighed at zero time of the storage and at 4 days intervals during the storage period. Fruits weight was recorded, then the percentage of weight loss was calculated according to the following equation

Physiological loss in weight (%) = $(W_I - W_S) / W_I \times 100$

Where,

W_I = fruit weight at initial period; W_s = fruit weight at sampling period

RESULTS AND DISCUSSION

The investigation revealed that storage of sapota fruit variety cricket ball after treating with various amount of soybean extract and wheat grass powder could be stored for a period of 12 days. Soybean is rich in protein and wheat grass powder is a good source of antioxidants. Such ingredients were selected as they are natural and has no harmful effect to human health. Depending on the investigation we can interpret that the edible coating made up of various amount of soybean extract and wheat grass powder has a clear effect on the shelf life of cricket ball variety

of sapota which lowers the weight loss as well as reduces spoilage during the entire storage period. The edible coating showed no particular effect on the chemical parameters such as TSS (^{0}B), total sugar, titratable acidity and pH of the fruits as illustrated in table 1. However, Physiological loss in weight (PLW), length and breadth showed a gradual decrease indicating the effect of the treatments. During storage of sapota fruits, as the storage period progressed the physiological loss in weight (PLW) increased in all the treatments. After 12 days of storage of sapota fruits there were significant differences among all the days of observations. The maximum physiological loss in weight was observed in T_6 (control), whereas the minimum was recorded in T_4 i.e. fruits coated with 60ml/L of soybean extract and 1% of wheat grass as depicted in table 1. Due to the effects of these coatings the reduction in weight loss was probably observed as a semi-permeable barrier would have been created against oxygen, carbon dioxide, moisture and solute movement, thereby reducing respiration, water loss and oxidation reaction rates (Baldwin *et al*. 1999). Fruits coated with 60ml/L of soybean extract and 1% of wheat grass (T_4) had minimum weight loss during storage as compared to the fruits under control, and weight loss increased gradually during the storage period. The results obtained indicated that such coatings reduced weight loss and acts as barrier against water loss. The basic mechanism of weight loss from fresh fruit and vegetables is by vapor pressure at different locations (Yaman and Bayoindirli, 2002), although weight reduction could also be due to respiration (Pan and Bhowmilk, 1992). The increase in TSS and sugar content during storage may possibly be due to hydrolysis of starch into sugars as on complete hydrolysis of starch no further increase occurs and subsequently, a decline in these parameters is predictable as they along with other organic acids are primary substrate for respiration (Wills *et al.* 1980). Due to an increase in malic enzyme and pyruvate decarboxylation reaction the decrease in titratable acids were observed during ripening and storage during the climacteric period. Mahmud *et al.* (2008) also observed a higher acidity in papaya fruits treated with Calcium chloride during storage probably due to delay in ripening process. The spoilage percent revealed that storage of sapota fruit variety cricket ball after treating with various amount of soybean extract and wheat grass powder thus, reduces the post-harvest losses during storage up to some extent. As illustrated in Fig. 1, it was observed that sapota fruits with no treatment i.e. T_6 (control) showed maximum percent spoilage (71.1%) as compared to those coated with soybean extract and wheat grass powder in all the observations during the storage periods. Among the treatments

Table 1: Effect of different treatments on physiological loss in weight (%), TSS (^{0}B), total sugar (%), titratable Acidity (%) and pH of sapota fruit var. cricket ball during storage

	PLW (%)		**TSS (^{0}B)**		**Total sugar (%)**		**Titratable Acidity (%)**		**pH**	
	0 D	**12 D**	**0 D**	**12 D**	**0 D**	**12 D**	**0 D**	**12 D**	**0 D**	**12 D**
T_1	0	37.22	18.63	20.41	2.98	7.76	0.043	0.027	3.90	4.01
T_2	0	23.18	18.80	21.55	2.35	7.93	0.030	0.025	3.57	3.95
T_3	0	28.01	19.07	22.06	2.85	7.96	0.057	0.038	3.95	4.02
T_4	0	21.45	18.68	21.75	3.06	8.18	0.030	0.028	3.51	3.92
T_5	0	31.01	18.67	21.79	2.78	8.30	0.043	0.036	3.56	3.98
T_6	0	39.69	18.88	23.20	3.81	7.65	0.047	0.027	3.60	3.89
CD(0.05)		**7.879**		**NS**		**NS**		**0.128**		**NS**
SEm (±)		**2.747**		**0.428**		**0.131**		**0.045**		**0.223**

T_1: Soybean extract 10ml/L and wheat grass powder 1gm; T_2: Soybean extract 20ml/L and wheat grass powder 1gm; T_3: Soybean extract 40ml/L and wheat grass powder 1gm; T_4: Soybean extract 60ml/L and wheat grass powder 1gm; T_5: Soybean extract 80ml/L and wheat grass powder 1gm; T_6: Control; D = Days of Storage

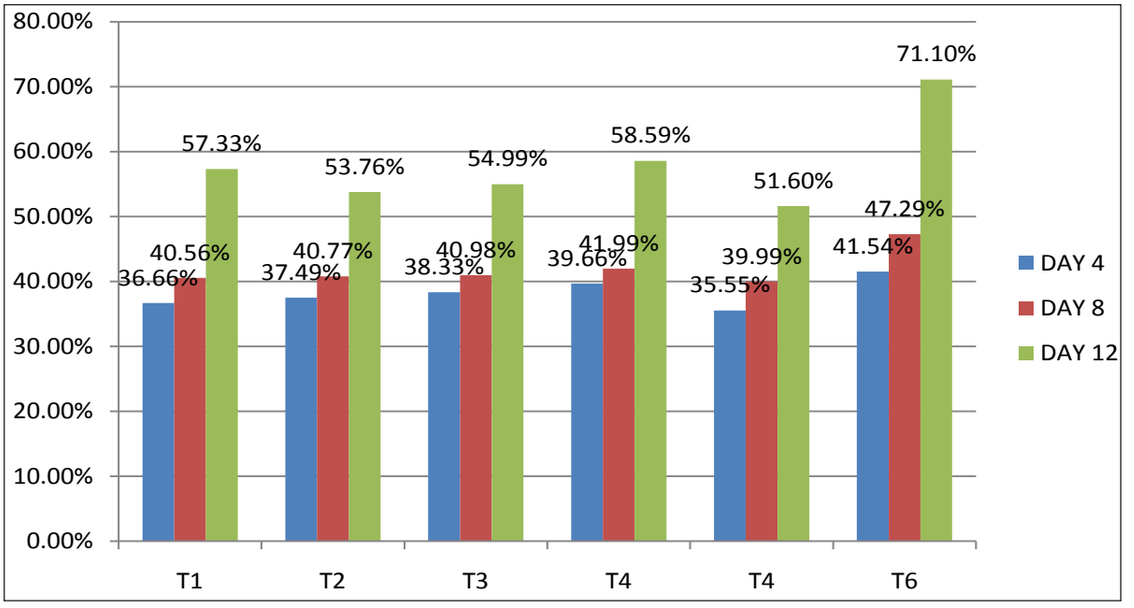

Fig. 1: Effect of different treatments on spoilage percent of sapota fruits during storage

T_1: Soybean extract 10ml/L and wheat grass powder 1gm; T_2: Soybean extract 20ml/L and wheat grass powder 1gm; T_3: Soybean extract 40ml/L and wheat grass powder 1gm; T_4: Soybean extract 60ml/L and wheat grass powder 1gm; T_5: Soybean extract 80ml/L and wheat grass powder 1gm; T_6: Control

Table 2: Processing Cost

Particulars	Quantity	Unit cost (₹)	Amount (Rs)
Cost of raw materials			
Fruits	31Kgs	20/-Kg	620/-
Soybean	200 gms	20/-100gms	40/-
Wheat grass powder	6 gms	270/-100gms	16.2/-
Miscellaneous cost			100/-
Total			774/-
Cost of processed 31 Kg of fruits			774/-
Cost of processing Kg of fruit			25/-

T_4 (soybean extract 60ml/L and wheat grass powder 1gm) gave the least percent spoilage (51.6%) during the storage period.

Keeping these points in mind it can be stated that coating prepared with 60ml/L of soybean extract and 1% of wheat grass is having a significant effect on the shelf-life as well as the physical appearance of the fruits without effecting its chemical composition, which will be directly increasing the keeping quality along with an increased market value besides easing the transporting of such fruit which is known for its excellent amount of carbohydrates, tannin and antioxidant with a huge amount of moisture content. The processing cost of such coating is cheap and cost of one kg of fruits comes about ₹ 25 per Kg of fruits (Table 2) which is affordable and is also made up of natural and easily available materials which have effect on the health of consumers.

CONCLUSION

The storage study has clearly shown that the post-harvest losses during storage of sapota fruit variety

cricket ball could be effectively reduced with the application of edible coating up to a period of 12 days under ambient storage condition. The treatment combination of soyabean chunk extract of 60 gm/L with wheat grass powder of 1% (T_4) gave the best result in terms of lowest spoilage percentage and physiological loss in weight while the chemical parameters showed no particular effect, irrespective of the treatments. Since sapota fruit is very perishable and could only be stored for a period of maximum 3-4 days after ripening, extending the storage period up to 12 days could be an alternative to get regulated market supply thus, reducing market glut.

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