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Study on effect of different organic based products as a post-harvest treatment on shelf life and quality of guava (*Psidium guajava* L) Cv. Lucknow-49

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Abstract
Guava (*Psidium guajava* L.) is an important fruit crop grown under a wide range of tropical and subtropical regions in the world. The "Study on effect of different organic based products as a post-harvest treatment on shelf life and quality of guava (*Psidium guajava* L) Cv. lucknow-49" was conducted in Completely Randomized Design in three replications with ten treatments. The main aim of the study was to investigate the effects of different edible coating treatments like Aloe vera gel, Sodium alginate and Guar gum at varying concentrations on physico-chemical characteristics and shelf life of guava fruits. Observations are recorded under each treatment over a storage period of 12 days, after harvesting, starting from harvest day till 12th day during the winter season. Aloe vera gel (100%) and Guar gum (1.5%) coating was most effective in reducing weight loss, decay, shelf life, chlorophyl degradation, maintaining firmness, total soluble solids, titratable acidity, ascorbic acid, total sugars, reducing sugar, non-reducing sugar, TSS: acid ratio, B:C ratio than other treatments. Hence, it was concluded that dip treatment of 100% Aloe vera gel can be used for enhancing the shelf life and reducing postharvest losses in guava fruits.

Keywords: Guava, shelf life, quality, sodium alginate, guar gum, Lucknow-49

1. Introduction
Guava (*Psidium guajava* L.) is an important fruit crop grown under a wide range of tropical and subtropical regions in the world written in the format that should be used in your paper. In India, Guava is the fifth position after banana, mango, citrus and papaya in terms of area and production. The total area, production and productivity of guava in India is about 2.64 lakh hectares with 40.53 lakh tones production and 15.3 MT/ha productivity, The guava, being a climacteric fruit crop, during maturing exhibits peaks of respiratory and ethylene. Owing to high metabolic activities the quality of guava fruits during storage is rapidly deteriorated. That reduces the marketing value of the fruits. Fruits will, therefore, be put on the market directly after harvest. To solve these issues, certain steps should be taken to increase shelf life. Aloe vera is a well-known plant for its marvelous medicinal properties. It prolongs the conservation of fresh fruits. This natural product is safe and environmentally friendly. Aloe vera gel forms a protective layer against the oxygen and moisture of the air and inhibits the action of micro-organisms that causes food borne illnesses through its various antibacterial and antifungal compounds, it also prevents loss of moisture, retains firmness, controls respiratory rate and maturation (Jawadul *et al*., 2014) [5]. Alginate consists of good film forming property, transparent and soluble in water. Alginates have low permeability to oil and fats but have high permeability to water vapour (Valero *et al*., 2013) [21]. Guar gum is one of the most important thickeners and is a versatile material for many food applications due to its different physicochemical properties as well as its high availability, low cost and biodegradability.

2. Materials and Methods
2.1 experimental Location
The experiment was conducted at PG Laboratory, College of Horticulture, Sri Konda Laxman Telangana State Horticultural University, Rajendranagar, Hyderabad during the year 2020-2021

2.2 Collection of guava
Guava fruits Cv. LUCKNOW-49 used for research were procured from Centre of excellence

for Fruits Mulugu, Siddipet Dist. Guava fruits were selected for uniformity in size, shape and colour. Diseased, sunburn, bruised and injured fruits were discarded. The remaining fruits were randomized and divided into ten lots of 30 fruits for the following treatments in three replicates (Each replicate contained 10 individual fruits).

2.3 Experimental Design and Treatments

The experiment was laid out in completely randomized design (CRD) with three repetitions and consisting of ten treatments comprising of surface coatings. Aloe vera gel (60%, 80% & 100%), sodium alginate (2%, 2.5% & 3%), and guar gum (0.5%, 1% & 1.5%) at three concentrations each and control (without coatings) and stored at room temperature. In the experiment ten freshly harvested fruits were assigned per treatment per repetition. The fruits were stored at room temperature.

2.4 Collection of Plant Material and Preparation of Surface Coatings

Fresh Aloe vera leaves collected from Medicinal and Aromatic Plants Research Station. The leaves were washed to remove the dust, aloe vera gel matrix was separated from the outer cortex of leaves using knife and then the colorless hydro parenchyma was grinded in a blender and strained through muslin cloth to remove thick particles. Pectin 1 per cent was taken and mixed with water and in turn mixed with Aloe vera gel at different concentrations (60%, 80% & 100%) and heated to the required temperature to prepare the treatment solutions. Similarly, Sodium Alginate coating was prepared according to Rojas-Grau *et al*., (2007) [18]. 20, 25 and 30 grams of sodium alginate ($NaC_6H_7O_6$) was dissolved separately to make 2%, 2.5% and 3% in sterilized distilled water and heated at 70°C, until the 37 solution became clear. After cooling, glycerol ($C_3H_5(OH)_3$, 85% purity) was added as plasticizer to a final concentration of 1.5 g/100 ml solution. The final volume of solution was made to 1 liter. The solution was emulsified with sunflower oil (0.025 g/100 ml coating solution) at 24,500 rpm for five minutes, before pH adjustment to 5.6 by using 50% (w/v) citric acid ($H_3C_6H_5O_7$) prepared with 5, 10, 15 g of guar gum dissolved separately to make 0.5%, 1.0%, and 1.5% in 100 mL distilled water, formulation selected according to previous research reported by Ruelas-Chacón *et al.,* (2017) [23], The solution was stirred at 800 rpm at 60°C during 30 minutes on a magnetic stirrer/hot plate (Talboys, Thorofare, New Jersey, USA). Pomegranate fruits were immersed in in the guar gum coating solution for one minute and ambient Fruits were air-dried and all samples were stored at cold storage temperature respectively.

2.5 Physical and Quality analysis

2.5.1 Physiological loss in weight (%)

An electronic weighing balance, with accuracy of 0.01 g, was used to measure the weight of fruits. The physiological loss in weight was calculated as the difference between the initial weight and the weight at the time of measurement, and expressed as a percentage (% of initial weight).

2.5.2 Decay (%)

On the basis of number of spoiled fruits (unfit for human consumption) observed at every three days interval, the percentage decay was worked out and the spoiled fruits were removed.

2.5.3 Shelf Life (days)

The shelf life of a fruit is a period of time which starts from its harvesting and extends up to onset of rotting in the fruits. The criteria used to determine onset of rotting was visual appearance. The shelf life was calculated by counting the days required for the fruits to reach the last stage of ripening, but up to the stage of their marketability. The last stage of ripening was considered when the fruits became soft and wrinkles appeared on the surface of fruits

2.5.4 Fruit firmness (Kg/cm2)

Firmness was determined using fruit pressure tester (model BGS – 25 Make Biogen Scientific). Fruit pressure tester was set on zero error and the reading was noted down by pushing the hanger on the peeled surface. After every three days interval, five fruits were randomly selected from each lot and their firmness was determined by pressing the knob of the fruit pressure tester into the fruit. The average of these five fruits was the firmness of the whole lot and expressed in kg/cm^2.

2.5.5 DA Meter (Differential Absorbance)

The DA meter was developed by Prof. Costa's team from the University of Bologna. It is an instrument that, by means of its absorbency properties allows measuring the chlorophyll content in a fruit. The DA index measured with DA meter, is useful at many stages in production and consumption's cycle of fruit. The DA is an index of the chlorophyll in fruit and as a consequence of its ripeness state. This index decreases in value during the ripening process of the fruit until it reaches very low value when ripening is complete (Umesh and Kerry, 2017).

2.5.6 Total Soluble Solids (ºBrix)

TSS of the fruits was recorded by using hand refractometer (ERMA type, MSW-503) at room temperature and expressed in terms of degree Brix.

2.5.7 Titratable Acidity (%)

Sample was prepared by taking ten grams of fruit pulp and ground it by mortar and pestle. Juice was filtered from the ground pulp in a 100 ml volumetric flask and final volume was made up with distilled water. Then, 10 ml of this solution was taken for titration. Titratable acidity of guava fruits was calculated by titrating the pulp extract with N/10 NaOH as described by Ranganna (1986) using phenolphthalein as an indicator and was expressed in per cent (%).

2.5.8 Ascorbic acid content (mg/100g)

Sample was prepared by taking ten grams of fruit pulp and ground it by mortar and pestle. Juice was filtered from the ground pulp in a 100 ml volumetric flask and final volume was made up with distilled water. Then, 10 ml of this solution was taken for titration. Titratable acidity of guava fruits was calculated by titrating the pulp extract with N/10 NaOH as described by Ranganna (1986) using phenolphthalein as an indicator and was expressed in per cent (%)

2.5.9 Reducing Sugars (%)

The reducing sugars was determined by the method of "Lane and Eynon" method (AOAC, 2006). For the estimation of

reducing sugars, ten grams of fruit pulp was taken, ground well and transferred to 250 ml volumetric flask. To this 100 ml of distilled water was added. Then five ml of saturated lead acetate solution (45%) was added to it for the precipitation of unwanted material. It was mixed thoroughly and allowed to stand for 10 minutes before adding five ml of potassium oxalate (22%). This solution to precipitate the lead and the volume was made up to 250 ml using distilled water. The solution was then filtered through whattman's filter and the final volume was made to 100 ml with distilled water 25 ml of solution was processed for the estimation of total sugars and remaining 75 ml solution was titrated against boiling Fehling solutions (5 ml A + 5 ml B) using methylene blue as an indicator. The end point of this reaction was noted by the appearance of brick red colour and the results were expressed in percentage.

2.5.10 Total Sugars (%)

Modified Lane and Eynon method as described by Ranganna (1986) was used to determine total sugars content in the fruits. Fifty ml filtered juice was mixed with 100 ml distilled water and neutralized with 0.1 N NaOH solution using phenolphthalein as an indicator and the solution was allowed to stand for ten minutes. Then 8 ml of potassium oxalate solution was added and the volume was made up to 250 ml by adding distilled water. Five ml of the extract was taken in burette and titrated against 10 ml mixed Fehling solution (5 ml Fehling solution A + 5 ml Fehling solution B) using methylene blue as an indicator. The end point was indicated by decolourization of the solution. The following formula was used for determining the total sugars in fruits.

2.5.11 Non reducing sugars (%)

Non reducing sugars were calculated from the calculated values of total and reducing sugars of the fruit samples by using the following formula:

Non reducing sugars (%) =

Total sugars (%) – Reducing sugars (%)

2.6 Data Analysis

The design adopted was (CRD) completely randomized design and the data was analyzed in 3 replicates of samples and the results were presented as mean and standard deviation. The experimental data were subjected to ANOVA and using the established statistical analysis as per the procedure (window stat version 9.1) outlined by Murali Khetan (2012) [12]. Significance was tested by 'F' value at 5 percent level of significance. Differences at the 5% level ($p< 0.05$) were considered statistically significant.

3. Results and Discussion

3.1 Physiological Loss in Weight (%)

The data are presented in Table 1. The percent PLW values showed an increasing trend from 2nd day to 10th day during storage. There was a significant difference observed among the treatments with respect to PLW at room temperature conditions. On 2nd day, T_3: Aloe vera gel (100%) recorded least PLW (4.41%) followed by T_2: Aloe vera gel (80%) (5.22%), while highest PLW was recorded in T_{10}- Control (8.95%). Similar trend was observed on 4th day and 6th day, respectively. On 4th day, lowest PLW was observed in T_3: Aloe vera gel (100%) (6.21%) which was followed by T_2: Aloe vera gel (80%) (7.12%) and highest PLW was noticed in T_{10}: Control (10.12%). Similar result was observed with respect to PLW on 6th day. On 8th day, least PLW was recorded in T_3: Aloe vera gel (100%) (10.52%) followed by T_9: Guar gum (1.5%) (11.31%) and highest PLW was recorded in T_6: Sodium Alginate (3%) (16.72%). On 10th day T_3: Aloe vera gel (100%) recorded least PLW (11.71%) followed by T_9: Guar gum (1.5%) (12.11%) and highest PLW was recorded in T_6: Sodium Alginate (3%) (17.18%). Among all the treatments, fruits treated with T_3: Aloe vera gel (100%) showed minimum loss in physiological weight during storage compared to other. This might be due to the coating acting as a barrier to moisture loss from fruit surface. These findings are supported by the observations of Martinez *et al*., (2006) [9-10] in Aloe vera gel coated grapes, Meng, X *et al*., 2008 [13] and Wijewardane (2009) [22] in coated apple.

3.2 Decay (%)

The data pertaining to the Decay (%) of guava fruits treated with surface coatings is presented in the Table 1. No decayed fruit was found at the end of the storage period i.e., up to 4th days under all treatments, the decayed fruits were found after 6th, 9th and 12th days of storage in treatment. On 6th day, No decayed fruit was found at the end of the storage period i.e., up to 6th days under treatment T_3: Aloe vera gel (100%) (0.00%) followed by T_9: Guar gum (1.5%) (0.00%) and highest decay percent was recorded in T_{10}- Control (10.23%). On 8th day, least decay was recorded in T_3: Aloe vera gel (100%) (1.94%) followed by T_9: Guar gum (1.5%) (2.11%) and highest decay per cent was recorded in T_8: Guar gum (1%) (16.00%) followed by T_1: Aloe vera gel (60%) (15.00%). On 10th day, least decay percent was recorded in T_3: Aloe vera gel (100%) (15.00%) which was on par with T_9: Guar gum (1.5%) (15.00%) and highest was noticed in T_6: Sodium Alginate (3%) (25.00%) which was on par with T_1: Aloe vera gel (60%) and T_1: Aloe vera gel (80%). This might be due to spoilage of fruits by various fungi and inherent biochemical changes. These findings are well supported by OMRI 2003 in coated fruits, Salvador 2003 in coated apples and Nath *et al*. 2005 [15] in pear fruits.

3.3 Shelf life (days)

Highest shelf life of 9.97 days was recorded in T_3: Aloe vera gel (100%) which was followed by T_9: Guar gum (1.5%) (9.68 days) and T_2: Aloe vera gel (80%) (9.58 days) while lowest shelf life was recorded in T_{10}-Control (6.43 days). On 8th day, treatments *viz*., T_4: Sodium Alginate (2%), T_7: Guar gum (0.5%) & T_{10}- Control showed the end of shelf life and among the treatments. On 10th day, except T_1, T_2 T_3, T_6 and T_9 all other treatments showed the end of shelf life. This might be due to the reducing the microbial counts for both bacteria and fungi and increased the shelf life of fruits (Padmaja and Bosco, 2014) [16], Sharmin *et al*., (2015). Aloe vera gel forms a protective layer against the oxygen and moisture of the air and inhibits the action of micro-organisms that causes food borne illnesses through its various antibacterial and antifungal compounds, (Jawadul *et al*., 2014) [5].

3.4 Firmness (Kg/cm2)

Firmness of guava fruits showed a decreasing tendency with increase in storage period. On 2nd day, fruits treated with T_3: Aloe vera gel (100%) recorded highest firmness (3.76 Kg/cm2) and which was followed by T_6: Sodium Alginate

(3%) (3.68 Kg/cm^2) and least firmness was recorded in T_{10}-Control (3.24 Kg/cm^2). On 4th day, highest firmness was observed in T_3: Aloe vera gel (100%) (2.99 Kg/cm^2) which was followed by T_2: Aloe vera gel (80%) (2.88 Kg/cm^2), whereas least firmness was recorded in T_{10} -Control (2.42 Kg/cm^2). Similar result was observed on 6th day with respect to firmness of guava fruits. On 8th day, highest firmness was recorded in T_3: Aloe vera gel (100%) (2.37 Kg/cm^2) followed by T_6: Sodium Alginate (3%) (2.31 Kg/cm^2) while least firmness was noticed in T_8: Guar gum (1%) (1.85 Kg/cm^2). On 10th day of storage T_1: Aloe vera gel (100%) recorded highest firmness (1.26 Kg/cm^2) followed by T_1: Aloe vera gel (60%) (1.24 Kg/cm^2) while least firmness was recorded in T_9: Guar gum (1.5%) (1.10 Kg/cm^2). From the result, it is observed that highest firmness was observed with fruits treated with T_1: Aloe vera gel (100%). The retention of fruit firmness in different coatings of fruit might be due to their capability to reduce moisture from fruit surface thus maintaining the cell wall integrity, tissue rigidity and slower metabolic activity leading to slower ripening changes. Similar findings are well supported by Mahajan (2005) [11] in kinnow fruits, Chauhan (2005) [2] in coated apple, Martinaz-Romero (2006) [10] in coated cherry and Wijewardane and Guleria (2009) [22] in corn starch coated apple.

3.5 DA meter readings

The DA meter values showed a decreasing trend from 2nd day to 10th day at room conditions. On 2nd day, fruits treated with T_3: Aloe vera gel (100%) recorded highest value of DA meter readings (2.10) and was followed by T_9: Guar gum (1.5%) (2.06) while lowest DA reading was noticed in T_{10}-Control (1.81). On 4th day, highest DA meter reading was observed in T3: Aloe vera gel (100%) (2.05) which was on par with T_9: Guar gum (1.5%) (2.04) whereas least value of DA meter reading was recorded in T_{10} -Control (1.80). Similar result was observed on 6th day with respect to DA meter reading values of guava fruits. On 8th day, highest value of DA meter reading was recorded in T_3: Aloe vera gel (100%) (1.89) followed by T_9: Guar gum (1.5%) (1.82) while least value was noticed in T_2: Aloe vera gel (80%) (1.65). On 10th day of storage T_3: Aloe vera gel (100%) recorded highest DA meter reading value (1.76) while least value was recorded in T_9: Guar gum (1.5%) (1.73). Colour of fruits increasing during storage period in all treatments. This might be due to the loss of green colour with increase in the ripening of fruits during storage. Above data are well supported by Mitcham *et al*., (2001) [14] in retention of colour during storage of fruits, Bassetto *et al*., (2005) [1] in pear fruits, Mahajan and Singh (2008) in winter guava.

3.6 Total soluble solids (ºBrix)

The effect of surface coatings at ambient storage condition of guava on total soluble solids is presented in the Table 1. Total soluble solids increased with the storage period at room temperature from first day to 10th day. On 2nd day, highest TSS was recorded in T_3: Aloe vera gel (100%) (9.85ºB) which was followed by T_8: Guar gum (1%) (9.79 ºB), while lowest TSS was noticed in T_6: Sodium Alginate (3%) (9.37 ºB). On 4th day, highest TSS was recorded in T_3: Aloe vera gel (100%) (10.41ºB) which was followed by T_1: Aloe vera gel (60%) (10.35 ºB) and T_2: Aloe vera gel (80%) (9.35 ºB) while lowest TSS was noticed in T_8: Guar gum (1%) (10.08ºB). On 6th day, highest TSS was recorded in T_3: Aloe vera gel (100%) (11.82 ºB) which was on par with T_9: Guar gum (1.5%) (11.82 ºB) while lowest TSS was noticed in T_8: Guar gum (1%) (11.32 ºB) On 8th day, highest TSS was recorded in T_3: Aloe vera gel (100%) (11.57 ºB) followed by T_2: Aloe vera gel (80%) (11.48 ºB) while least value was noticed in T_8: Guar gum (1%) (10.98 ºB). On 10th day of storage T_3: Aloe vera gel (100%) recorded highest TSS value (11.41 ºB) followed by T_9: Guar gum (1.5%) (11.32 ºB) while least was noticed in T_6: Sodium Alginate (3%) (11.02 ºB). From the above results, it can be concluded that the fruits treated with Aloe vera gel (100%) showed superior over other treatments, TSS content of coated guava in both varieties was enhanced with increasing in storage period. This might be due to the conversion of existing polysaccharides into monosaccharide during storage. Above results are well supported by Singh and Mohammad (1997) [20] in rice starch coated guava.

3.7 Titratable acidity (%)

Results on titratable acidity of guava fruits stored at ambient temperature as influenced by surface coatings is presented in the Table 2. Titratable acidity of a fruits decreased with the storage period. On 2nd day, lowest titratable acidity was recorded in T_5: Sodium Alginate (2.5%) (0.71%) which was on par with T_3: Aloe vera gel (100%), T_8: Guar gum (1%) (0.73%) while highest titratable acidity was noticed in T_{10}: Control (0.78%). On 4th day, lowest titratable acidity was recorded in T_3: Aloe vera gel (100%) (0.70%) which was on par with T_5: Sodium Alginate (2.5%), T_4: Sodium Alginate (2%), T_1: Aloe vera gel (60%), T_9: Guar gum (1.5%) and T_7: Guar gum (0.5%) (0.71%) while highest titratable acidity was noticed in T_{10}: Control (0.76%). On 6th day, lowest titratable acidity was recorded in T_3: Aloe vera gel (100%) (0.65%) which was on par with T_9: Guar gum (1.5%), T_5: Sodium Alginate (2.5%) (0.66%) while highest titratable acidity was noticed in T_{10}: Control (0.73%). On 8th day, lowest titratable acidity was recorded in T_3: Aloe vera gel (100%) (0.61%) followed by T_9: Guar gum (1.5%) and T_1: Aloe vera gel (60%) (11.48%) while least value was noticed in T_8: Guar gum (1%) (0.63%). On 10th day of storage lowest acidity recorded in T_3: Aloe vera gel (100%) (0.55%) and highest in T_6: Sodium Alginate (3%) (0.66%) Titratable acidity of fruits decreases due to increase of soluble sugars during course of ripening. This decrease was observed less in fruits coated with surface coating compared to control due to edible coatings. T_3: Aloe vera gel (100%). Reduction of acidity might be due to the utilization of organic acid in respiratory process. A gradual decrease in acidity has also been reported by Josan *et al*., (1983) [6] and Wijewardane and Guleria (2009) [22] in potato starch coated apples.

3.8 Ascorbic acid content (mg/100g)

Results of ascorbic acid content in guava fruit as influenced by surface coatings is presented in the Table 2. On 2nd day there was significant difference observed among the treatments with highest ascorbic acid content in T_3: Aloe vera gel (100%) (253.8 mg/100g) which was on par with T_9: Guar gum (1.5%) (253.7 mg/100g) while lowest was noticed in T_2: Aloe vera gel (80%) (233 mg/100g). On 4th day there was significant difference observed among the treatments with highest ascorbic acid content in T_3: Aloe vera gel (100%) (213.7 mg/100g) which was on par with T_9: Guar gum (1.5%) (232.2 mg/100g) while lowest was noticed in T10- Control (226.7 mg/100g). On 6th day there was significant difference

observed among the treatments with highest ascorbic acid content in T_3: Aloe vera gel (100%) (232.2 mg/100g) which was followed by T_9: Guar gum (1.5%) (212.3 mg/100g) while lowest was noticed in T_{10}- Control (226.7 mg/100g). On 8th day, highest ascorbic acid content in T_3: Aloe vera gel (100%) (194.7 mg/100g) which was followed by T_9: Guar gum (1.5%) (194 mg/100g) while lowest was noticed in T_1: Aloe vera gel (60%) (190.3 mg/100g) On 10th day of storage T_3: Aloe vera gel (100%) recorded highest ascorbic acid content (169.5 mg/100g) followed by T_9: Guar gum (1.5%) (169 mg/100g) while lowest was noticed in T_1: Aloe vera gel (60%) (166.2 mg/100g) Among these treatments T_3: Aloe vera gel (100%) recorded significantly highest ascorbic acid content followed by T_9: Guar gum (1.5%) Loss of ascorbic acid was observed in all treatments during storage. This might be due to conversion of L-ascorbic acid into dehydro ascorbic acid. Similar results have been well supported by Mahajan *et al*., (2005) [11] in coated kinnow fruits, Jagdeesh (1994) [7] in corn starch coated guava fruits and Serrano *et al.*, (2006) [10] in Aloe vera gel coated grapes.

3.9 Total sugars (%)

Total sugar content increased with the storage period at room temperature from first day to tenth day. On 2nd day, highest total sugar content was recorded in T_3: Aloe vera gel (100%) (6.45%) which was followed by T_9: Guar gum (1.5%) (6.40%) while lowest total sugar content was noticed in T_1: Aloe vera gel (60%) (6.04%). On 4nd day, highest total sugar content was recorded in T_3: Aloe vera gel (100%) (7.9%) which was followed by T_9: Guar gum (1.5%) (7.86%) while lowest total sugar content was noticed in T_{10}: Control (7.11%) On 6th day, highest total sugar content was recorded in T_3: Aloe vera gel (100%) (8.70%) which was followed by T_3: Aloe vera gel (100%) (8.69%) while lowest total sugar content was noticed in T_{10}: Control (7.98%) On 8th day, highest total sugar content was recorded in T_3: Aloe vera gel (100%) (8.42%) followed by T_9: Guar gum (1.5%) (8.32%) and T_8: Guar gum (1%) (8.32%) while least value was noticed in T_1: Aloe vera gel (60%) (7.51%). On 10th day of storage T_3: Aloe vera gel (100%) recorded highest total sugar value (8.42%) followed by T_3: Aloe vera gel (100%) (8.32%) while least was noticed in T_1: Aloe vera gel (60%) (6.04%). Aloe vera gel (100%) was the best treatment with maximum total sugars during storage period. Increase in total sugar during storage might be due to the hydrolysis of starch into sugar. These findings are supported by the observations of Singh and Mohammad (1997) [20] in wax coated guava, Das and Medhi (1996) [3] in corn starch coated fruits and Dashora *et al*., (1999) [4] in edible oil coated ber.

Table 1: Effect of surface coating on different parametres on shelflife and quality of Guava (L-49)

	Treatment	**T_1: Aloe vera gel (60%)**	**T_2: Aloe vera gel (80%)**	**T_3: Aloe vera gel (100%)**	**T_4: Sodium Alginate (2%)**	**T_5: Sodium Alginate (2.5%)**	**T_6: Sodium Alginate (3%)**	**T_7: Guar gum (0.5%)**	**T_8: Guar gum (1%)**	**T_9: Guar gum (1.5%)**	**T_{10}: Control**	**S.Em ±**	**CD@5%**
PLW (%)	2nd	5.62	5.22	4.41	7.52	8.22	6.54	7.61	8.21	5.31	8.95	0.0052	0.0172
	4th	7.32	7.12	6.21	9.42	10.7	8.11	9.41	10.4	7.32	10.1	0.0051	0.0162
	6th	9.83	9.01	8.31	11.8	12.9	11.8	8.91	11.8	9.41	13.5	0.0053	0.0161
	8th	11.42	13.0	10.5	*	13.4	16.7	*	16.6	11.3	*	0.0032	0.0092
	10th	14.32	14.1	11.7	*	*	17.1	*	*	12.1	*	0.0024	0.0072
Decay (%)	2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0000
	4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0000
	6th	3.22	2.31	0.00	4.5	2.40	2.55	2.60	3.25	0.00	10.2	0.0024	0.0070
	8th	15.0	10.0	1.94	*	10.0	12.0	*	16.0	2.11	*	0.0035	0.0105
	10th	25.0	25.0	15.0	*	*	25.0	*	*	15.0	*	0.0038	0.0112
Shelf-life (Days)	Days	6.00	9.58	9.97	7.52	8.51	9.32	8.05	8.64	9.68	6.43	0.0049	0.0146
firmness (Kg/cm^2)	2nd	3.57	3.54	3.76	3.61	3.66	3.68	3.46	3.35	3.65	3.24	3.57	3.34
	4th	3.39	2.88	2.99	2.32	2.71	2.84	2.73	2.33	2.76	2.42	2.39	2.88
	6th	2.29	2.77	2.89	2.22	2.61	2.71	2.63	2.23	2.66	2.11	2.29	2.77
	8th	1.93	2.27	2.37	*	2.13	2.31	*	1.85	2.21	*	1.93	2.27
	10th	1.24	1.17	1.26	*	*	1.17	*	*	1.10	*	1.24	1.17
DA Meter	2nd	2.01	2.02	2.10	2.01	2.02	2.02	2.01	2.02	2.06	1.81	0.0052	0.017
	4th	1.19	1.98	2.05	2.00	2.02	1.05	2.00	2.01	2.04	1.80	0.0054	0.017
	6th	1.19	1.92	2.04	1.99	1.96	1.91	1.97	1.91	1.99	1.73	0.0052	0.017
	8th	1.71	1.65	1.89	*	1.61	1.63	*	1.70	1.82	*	0.0053	0.017
	10th	0	0	1.76	0	*	0	*	*	1.73	*	0.0021	0.007
TSS (^{0}Brix)	2nd	9.56	9.74	9.85	9.77	9.72	9.37	9.58	9.79	9.74	9.65	0.0061	0.0181
	4th	10.3	10.3	10.4	10.2	10.2	10.2	10.2	10.0	10.1	10.0	0.0057	0.0170
	6th	11.7	11.7	11.8	11.3	11.3	11.4	11.4	11.3	11.8	11.4	0.0057	0.0170
	8th	11.4	11.4	11.5	*	11.1	11.2	*	10.9	11.4	*	0.0057	0.0170
	10th	11.3	11.3	11.4	*	*	11.0	*	*	11.3	*	0.002	0.007

*End of shelflife

Table 2: Effect of surface coating on different parametres on shelflife and quality of Guava (L-49)

Treatment		T_1: Aloe vera gel (60%)	T_2: Aloe vera gel (80%)	T_3: Aloe vera gel (100%)	T_4: Sodium Alginate (2%)	T_5: Sodium Alginate (2.5%)	T_6: Sodium Alginate (3%)	T_7: Guar gum (0.5%)	T_8: Guar gum (1%)	T_9: Guar gum (1.5%)	T_{10}: Control	S.Em ±	CD@5%
Titratable Acidity (%)	2nd	0.76	0.74	0.73	0.74	0.71	0.75	0.75	0.73	0.74	0.78	0.0029	0.0087
	4th	0.71	0.73	0.70	0.70	0.70	0.74	0.71	0.72	0.71	0.76	0.0031	0.0093
	6th	0.69	0.70	0.65	0.68	0.66	0.71	0.68	0.70	0.66	0.73	0.0033	0.0098
	8th	0.63	0.67	0.61	*	0.63	0.69	*	0.66	0.63	*	0.0027	0.0082
	10th	0.60	0.64	0.55	*	*	0.66	*	*	0.57	*	0.0023	0.0069
Ascorbic Acid (mg/100g pulp)	2nd	253.3	233	253.8	253.3	253.3	253.7	253.3	253.4	253.7	250.8	0.0577	0.1703
	4th	253	229	232	231	232	230	229	229	232.2	226.7	0.0547	0.1615
	6th	209	210	213	210	208	207	207	210	212.3	204.1	0.0547	0.1645
	8th	190	192	194	*	191	192	*	193	194	*	0.0577	0.1703
	10th	166	166	169	*	*	166	*	*	169	*	0.0031	0.0093
Total Sugars (%)	2nd	6.04	6.08	6.45	6.19	6.22	6.25	6.14	6.27	6.40	6.09	6.04	6.08
	4th	7.52	7.66	7.90	7.37	7.40	7.42	7.66	7.76	7.86	7.11	7.52	7.66
	6th	8.61	8.66	8.70	8.60	8.62	8.66	8.66	8.68	8.69	7.98	8.61	8.66
	8th	7.51	7.62	8.42	*	7.76	7.91	*	8.22	8.32	*	7.51	7.62
	10th	6.04	6.08	6.32	*	*	6.20	*	*	6.22	*	6.04	6.08
Reducing Sugars (%)	2nd	3.34	3.54	3.64	3.32	3.38	3.43	3.34	3.59	3.61	3.24	0.0053	0.0158
	4th	3.32	3.42	4.08	3.51	3.70	3.82	3.32	3.82	3.92	3.21	0.0061	0.0181
	6th	4.14	4.41	4.79	4.22	4.32	4.46	4.52	4.62	4.72	3.92	0.0057	0.0170
	8th	3.72	4.23	4.31	*	4.23	4.26	*	4.18	4.26	*	0.0058	0.0173
	10th	3.11	3.22	3.52	*	*	3.42	*	*	3.50	*	0.0025	0.0076
Non-Reducing Sugars (%)	2nd	2.76	2.68	3.58	2.61	2.64	2.68	2.62	2.63	2.62	2.62	0.0053	0.0158
	4th	3.61	3.79	3.81	3.71	3.73	3.76	3.82	2.63	3.75	3.72	0.0055	0.0164
	6th	3.88	4.08	4.12	4.02	3.68	4.11	3.86	3.90	3.91	3.80	0.0057	0.0170
	8th	3.67	3.73	3.94	*	3.42	3.71	*	3.90	3.67	*	0.0061	0.0181
	10th	3.19	3.58	3.28	*	*	3.16	*	*	3.25	*	0.0025	0.0076

*End of shelflife

3.10 Reducing sugars (%)

On 2nd day, highest reducing sugar content was recorded in T_3: Aloe vera gel (100%) (3.64%) which was followed by T_9: Guar gum (1.5%) (3.61%) while lowest content was noticed in T_{10}-Control (3.24%). Similar trend was noticed with respect to reducing sugar content on 4th and 6th day respectively. On 8th day, highest reducing sugar content was recorded in T_3: Aloe vera gel (100%) (4.31%) followed by T_9: Guar gum (1.5%) (4.26%) while least value was noticed in T_1: Aloe vera gel (60%) (3.72%). On 10th day of storage T_3: Aloe vera gel (100%) recorded highest reducing sugar content (3.52%) followed by T_9: Guar gum (1.5%) (3.50%) while least was noticed in T_1: Aloe vera gel (60%) (3.11%). Reducing sugar increased with increasing in storage period. This might be due to the hydrolysis of polysaccharides and conversion of non-reducing sugar into reducing sugar. The results are well supported by Jagdeesh (1994) [7] in corn starch coated fruits, Singh and Mohammad (1993) in wax coated guava.

3.11 Non-reducing sugars (%)

On 2nd day, lowest non-reducing sugar content was recorded in T_4: Sodium Alginate (2%) (2.61%) which was on par with T_9: Guar gum (1.5%) (2.62%) and while highest content was noticed in T_1: Aloe vera gel (60%) (2.76%). On 4th day, lowest non-reducing sugar content was recorded in T_1: Aloe vera gel (60%) (3.61%) which was followed by T_4: Sodium Alginate (2%) (3.71%) and while highest content was noticed in T_7: Guar gum (0.5%) (3.82%). On 6th day, lowest non-reducing sugar content was recorded in T_5: Sodium Alginate (2.5%) (3.68%) which was followed by T_{10}: Control (3.80%) while highest content was noticed in T_3: Aloe vera gel (100%) (4.12%). On 8th day, lowest non reducing sugar content was recorded in T_6: Sodium Alginate (3%) (3.42%) followed by T_8: Guar gum (1%) (3.66%) while highest value was noticed in T_3: Aloe vera gel (100%) (3.94%). On 10th day, T_6: Sodium Alginate (3%) recorded lowest non reducing sugar content (3.16%) followed by T_1: Aloe vera gel (60%) (3.19%) while highest content was noticed in T_2: Aloe vera gel (80%) (3.58%). The total and reducing sugars were increased up to ripening there after showed a decline at the end of shelf life in all treatments. The initial raise in sugars may be due to conversion of starch into sugars, while later the decrease was due to consumption of sugars for respiration during storage. Similar trends of total and reducing sugars content were reported by Ramachandra and Ashok (1994) in ber cultivars.

4. Conclusion

With respect to surface coatings, T_3-Aloe vera gel (100%) recorded significantly superior results in terms of minimum PLW, decay percent and highest firmness, shelf life and quality parameter namely TSS, ascorbic acid content and was followed by T_9- Guar Gum (1.5%) which enhanced the shelf life and consumer acceptability of the stored guava fruits. It showed to be a good moisture barrier, thus preventing the water loss by transpiration.

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