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EFFECT OF EDIBLE COATING TO EXTEND THE SHELF LIFE OF GUAVA VAR.L-49 STORED AT ROOM TEMPERATURE

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Abstract

The present investigation was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University. The experiment was conducted in a Completely Randomized Design with 10 treatments with three replications. The treatment consisted of three organic edible coatings *viz*., Corn flour, Wheat flour and Cassava flour @ 2 per cent, 4 per cent and 6 per cent and a perfect control was maintained. The results of the study revealed that edible coating of guava fruits with corn flour @ 6 per cent significantly increase the shelf life, reduced the physiological loss in weight and spoilage percentage and also improve the biochemical parameters such as, total soluble solids, total sugar content and favorable effect on retaining the titrable acidity and ascorbic acid content of guava fruit stored at room temperature.

Key words *:* Guava, Edible coating, cassava flour, wheat flour , corn flour.

Introduction

Guava (*Psidium guajava*) is a tropical and subtropical fruit crop belonging to the family Myrtaceae. It is one of the most common and major fruits of India and is considered as fourth important fruit in area and production after mango, banana and citrus. In India, guava fruit is commonly called as "poor man's apple'. Guava fruits are the best relished and the ripe fruit has a characteristic odour due to the presence of carbonyl compounds. It is an excellent source of vitamin C (200 to 300 mg/100g of edible portion and it ranks third in vitamin C content after barbados cherry and anola. The fruits can also be consumed by diabetics and the people suffering with kidney and liver related problems. The fruits are consumed as fresh as well as successful and commercialized fruit very frequently used in food industry. Guava is a fruit best suited for jelly making as it has good pectin content and is richly used in soft drinks, ice creams, flavored tea, jam and other processed product.

Post harvest loss of fruits and vegetables is a serious problem due to rapid deterioration during harvesting, transportation, handling and storage condition in tropical regions (Gatto, *et al.,* 2011; Terry and Joyce, 2004). About 35-40 percent of fruits and vegetables are lost during post harvest conditions (Kumar and Bhatnagar, 2014). Fresh fruits and vegetables are alive beings which have high moisture content (75-95 %) and which continue to respiration, thereby producing heat and water at the expense of reserve food (Mishra and Gamage, 2007). After harvesting, fresh fruits and vegetables cannot replenish water or carbohydrates, the fresh produce use stored sugar or starch in respiration process and will stop when such reserve become finished. As a result, ageing begins and culminating fruits and vegetables to death and decay (FAO, 1993), so maintaining the quality of fresh fruits and vegetables is a big challenge.Studies have been carried out in the past to improve the shelf life of guava using wax emulsion, growth regulators and many chemical compounds such as GA_3, 2, 4-D, calcium compounds and polyamines, which are inhibiting bio synthetic pathway of ethylene which are classified as non - specific ethylene inhibitors. Furthermore many chemical agents in current use are losing favour with both industry and public which have long term toxical implications.

A 1998 WHO report has recommended that new research should be carried out to develop new treatments for decontaminating fruits and vegetables. Although the wax emulsion and other chemical compounds extent the shelf life of guava, there is a need to develop an alternative low cost edible coating material for shelf life extension using generally recognized as safe substances (GRAS). An edible coating is a thin layer that is deposited on the surface of a fruit and is co-consumed. It is used to improve handling properties, prevent moisture loss, increase the shelf life and to reduce the need of packaging material during transport. Edible coatings act as protective barrier at low to

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intermediate relative humidity because the Polymers make effective hydrogen bonds. Ideal edible coatings have good eating properties, acceptable colour, odour, taste, flavor and texture and also act as barrier for microbes. The use of edible coating has gained importance in reducing the moisture loss and maintaining firmness of fruits and vegetables (Farooqhi *et al.,* 1988 and Chouhan *et al.,* 2005). Hence in the view of above facts an attempt has been made to identify the suitable edible coating material and optimum concentration to extend the shelf life of guava fruits stored at room temperature.

Materials and Methods

An experiment was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University. The experiment was laid out by following the principles of Completely Randomized Design (CRD) with 10 treatments which were replicated thrice. The treatments comprised of three edible coating materials *viz.*, cassava flour, wheat flour and corn flour at different concentrations (2, 4 and 6 %) along with a control. The guava var. L-49 fruits of uniform size, disease and bruise free at colour breaker stage were picked randomly from all the four directions of the plants with the help of secateur. The fruits were collected in plastic crates and shifted to laboratory, the fruits were separated and washed with distilled water. There after fruits were divided into requisite lot for further handling.The edible coating materials were prepared from 40, 80 and160 g of cassava flour, wheat flour and corn flour were dissolved in 2 liter of distilled water and the mixtures were heated at 70° C with constant stirring until gelation (20-30 minutes) of the solution. After that the coating solutions were allowed to cool down to room temperature (23.4°C) (Campos *et al.,*2011). For the coating treatment, fruits were immersed in the coating solution for 3 minutes and then allowed to drain and dry after that the initial fruit weight was measured in the balance and kept under room condition for recording the further observations and the data were analysed statistically (Panse and Sukhatma, 1978).

Results and Discussion

It can be inferred from the data given in the table.1 that the shelf life (days) was varied significantly, among the various edible coating treatments the shelf life was maximum (9.61 days) in the fruits coated with corn flour 6 per cent (T_9) which was 117.91 per cent increase over control and was followed by the fruits coated with wheat flour 6 per cent (T_6) which extend the shelf life up to (8.68 days) which was 96.83 per cent higher over control. The shelf life of fruit was minimum (4.41 days) in the control (T_{10}).

The data on the effect of edible coating on physiological loss in weight (%) and fruit spoilage per cent of fruits on 3rd, 5th 7th and 9th day after treatments are presented in the table 1. Significant differences on physiological loss in weight and the fruits were found to be look fresh and the best and it registered the least mould formation fruit spoilage per cent was observed due to the influence of different edible coating treatments. Among the treatments the minimum percentage of physiological loss in weight and the fruit spoilage per cent were observed in the fruits coated with corn flour 6per cent (T_9) and registered the values of 14.86, 3.55, 13.55 and 14.58 per cent and 1.09, 12.70, 32.31 and 53.48 per cent respectively. The next best treatment was the fruits coated with wheat flour 6 percent (T_6) and registered the physiological loss in weight of 15.24, 6.81, 14.01 and 18.42 per cent and 4.65, 19.27, 40.56 and 60.31 percent respectively. The maximum physiological loss in weight and fruit spoilage per cent of (20.25, 15.98, 31.18 and 42.71 % and 5.11, 45.60, 73.60, and 87.68 % respectively) were recorded in the control (T_{10}).

The reduction in weight loss and extention of shelf life was probably due to the effect of these coatings as semi permeable barrier against oxygen, carbon dioxide, moisture and solute movement there by reducing respiration, water loss and oxidation reaction rates as suggested by Baldwin *et al*., 1995 in mango. Further, Yaman and Bayoindirli 2002 opined that, basic mechanism of weight loss from fresh fruits and vegetables is by vapour pressure at different locations, although respiration also causes a weight reduction in fruits and vegetables. The edible coating at lower concentrations and control increases the weight reduction and the highest concentration of corn flour, has marked reduction in weight loss. Wijewardane and Guleria 2009 also suggested that the decrease in weight loss might be due to the edible coating as a barrier to moisture loss from fruit surface. The starch based coatings could also be effective due to high amylase content, which helps to decrease water vapour permeability and weight loss there by retain fruit firmness for longer period. The decrease in spoilage percent might be due to the effect of coating on delaying senescence, which makes the commodity more vulnerable to pathogenic infection as a result of celluar or tissue integrity (Tanada- Palmu and Grosso, 2002). This is in agreement with the findings of Oluwaseun *et al.* (2013), Dey *et al.* 2014 in sapota and Ghosh *et al*., 2015 in Assam lemon.

The perusal of data in table 2, shows that the effect of edible coating on the TSS (°brix) and total sugar (%) content were significant at 3rd, 5th and 7th day after treatment. Among the various treatments, on 3rd day of treatment the TSS and total sugar content was maximum in the control (T_{10}) which registered the values of 10.26 °brix and 7.03 per cent. This was followed by the fruits coated with cassava flour 2 per cent (T_1) and registered the value of 10.25 °brix and 7.01 per cent. The least value of 8.35 °brix and 6.49 per cent respectively was observed in the fruits coated with corn flour 6 per cent. This trend was changed at 5th and 7th day after treatment. The maximum TSS content of 10.35 and 8.02 °brix and total sugar content of 5.45 and 5.03 per cent respectively were recorded in the fruits coated with corn flour 6 per cent, which was followed by the fruits coated with wheat flour 6 per cent (T_6) which recorded the values of 9.82 and 7.79° brix and of 5.2 and 4.67 per cent respectively and the lowest TSS and total sugar content was registered in the control (T_{10}) with the values of 7.63 and 6.81 °brix and 3.73 and 2.97 per cent respectively.

The increase in the TSS content in control during early days (3rd day after treatment) maybe due to high respiration, that might have hastened the hydrolysis process in the control and the fruits coated treatments increased the TSS content during the later storage period of 5th day after treatment may possibly due to hydrolysis of starch into sugars as on complete hydrolysis of starch in a slow and steady process may leads to the TSS peak at 5th day after treatment. No further increase occurs and subsequently a decline in TSS content is predictable as they along with other organic acids are primary substrate for respiration (Wills *et al.*, 1980). The change in sugar content was occurred due to utilization of sugar as a respiratory substrate. The reducing sugar content was found to be higher in uncoated fruits during early stage of the storage period might be due to a decrease in the acidity and resulted physiological changes and rapid conversion of starch to sugar as a result of moisture loss, as previously reported by Neeta B. Gol and Ramana Rao (2014) in mango.

The analysis of data presented in the table 3 shows that the effect of edible coating on the titrable acidity content (%) and ascorbic acid content (mg/100g) were significant at 3rd, 5th and 7th day after treatment. The different edible coating tried, the control (T_{10}) recorded the maximum titrable acidity (0.39 %) and ascorbic acid content (145.73 mg/100g), the cassava flour 2 per cent treated (T_1) was at par with the control and recorded the value of (0.38%) and (145.63 mg/ 100g) respectively. The minimum titrable acidity (0.32%) and ascorbic acid content (133.56 mg/ 100g) were registered in the treatment T_9 (fruits coated with corn flour 6 per cent) on the 3rd day after treatment. The reverse trend was noticed in the titrable acidity on 5th and 7th day after treatment in which the fruits coated with corn flour 6 per cent (T_9) adjudged the best and recorded the maximum acidity content of 0.38 and 0.29 per cent and 147.71 and 118.93mg/100g respectively. This was followed by the fruits coated with wheat flour 6 per cent (T_6) and registered the values of 0.36 and 0.27 per cent and 143.28 and 109.12 mg/100g respectively. The least acidity content of 0.25 and 0.18 per cent and 125.95 and 69.27 mg/100 g respectively were recorded in the control (T_{10}).

The titrable acidity is directly related to the concentration of organic acids present in the fruits, the level of titrable acidity declining during storage might be due to the metabolic changes or the use of organic acid in the respiratory process as suggested by Echeverkia and Valich (1989). In this regard Yaman and Bayoindirli (2002), opined that the rate of respiration reduced by edible coating may delay the utilization of organic acids present in the fruits. The results are in close conformity with the findings of El. Anany *et al*. 2009 in apple. Further, Neeta B. Gol and Ramana Rao (2011) also reported that the coating slowed the changes in pH and titrable acidity by effectively delaying fruit senescence in banana and this was probably because corn flour coating acted as a gas barrier, inhibiting oxygen from entering the fruit, thus reducing the oxidation of ascorbic acid. Similar findings were obtained by Aguiar *et al*. (2011) in mango. The ascorbic acid content is lost at later stage due to the activities of phenol oxidase and ascorbic acid oxidase enzymes during storage. This is in agreement with the findings of Ghosh *et al.* (2015) in Assam lemon.

Conclusion

Based on the findings of the present study, it can be concluded that fruits coating with corn flour 6 per cent has extended the shelf life of guava fruits stored at room temperature and maintain the quality parameters positively.

References

Aguiar R.P., Miranda M.R.A, Lima A.M.P, Mosca J.L., Moreira R.A and Eneas-Filho. 2011. Effect of a galactomannan coating on mango postharvest physicochemical quality parameters and physiology. *Fruits,* **66**: 269– 278.

Baldwin, E.A., Burns, J.K., Kazokas W., Brecht, J.K., Hagenmaier, R.D., Bender, R.J. and Peris, E. 1995. Effect of two edible coatings with different permeability characteristics on mango (*Mangifera indica* L.) ripening during storage. *Postharvest Biol. Technol.,* **17**: 215-26.

Campos, C.A, Gerschenson, L.N and Flores, S.K. 2011. Development of edible films and coatings with antimicrobial activity. *Food Bioprocess Technol.,* **4:** 849–875.

Chouhan S.K. , Thakur, K.S. and Kaushal , B.B.L. 2005. Effect of post harvest coating treatments on the storage behaviour of starking delicious apple fruits under evaporative cool chamber. *Acta Hort.,* **696**: 473-478.

Dey.K, A. Ghosh, N. Bhowmick, and A. Ghosh 2014. Physio- chemical properties of sapota (*Manilkara achras* (Mill) Fosb.) fruits coated with corn starch. *J. Crop and Weed,* **10(2)**: 43-49.

Echeverria E and Valich J. 1989. Enzymes of sugar and metabolism in stored Valencia organs. *J.Amer. Soc. Hort. Sci.,* **114:** 445–449.

FAO. 1993. Prevention de pérdidas de alimentos poscosecha: Frutas, hortalizas, raíces y tubérculos. Roma, Organización de las Naciones Unidas para la Agricultura y la Alimentación.

Farrooqhi, W.A. ,Salih, A.M. and Zain –Ul-Abdin 1988. Effect of wax coatings on the physiological and biochemical aspects of Kinnow Fruit. *Pakistan J.Sci. Ind. Re*s., **31**: 142-145.

Gatto, M. A., Ippolito, A., Linsalata, V., Cascarano, N. A., Nigro, F., Vanadia, S. and Venere, D. D. 2011. Activity of extracts from wild edible herbs against postharvest fungal diseases of fruit and vegetables. *Postharvest Bio. Technol.,* **61(1):** 72-82.

Ghosh, A., K. Dey, and N. Bhowmick. 2015. Effect of corn starch coating on storage life and quality of Assam lemon (*Citrus limon* Burn.). *J. Crop and Weed,* **11(1):** 101-107.

Kumar, S. and Bhatnagar, T. 2014. Studies to enhance the shelf life of fruits using Aloe vera based herbal coatings: A review. *Int. J. Agric. Food Sci. Technol.,* **5:** 211–218.

Mishra, V. K and Gamage, T. V. 2007. Postharvest Physiology of Fruits and Vegetables. M. S. Rahman, (Ed.), Handbook of Food Preservation, 2nd ed., Boca Raton, pp. 19–48.

Neeta B., and T.V. Ramana Rao 2014. Influence of zein and gelatin coatings on the postharvest quality and shelf life extension of mango. *Fruits,* **69**:101-115.

Neeta B.Gol, and T.V. Ramana Rao 2011. Banana fruit ripening as influenced by edible coatings, *Int. J. Fruit. Sci.,* **11:**119-135.

Oluwaseun, A.C, A. Arowora Kayode, B. Fawole Oluyemisi, B. and Adetunji.(2013) Quality and Shelf Life of Fresh-Cut Pineapple (*Ananas Comosus* L. Merril cv "P´erola"). *J. Food. Sci.,* **76**: 1.

Panse, V.G .and Sukathame, P.V, 1978. Statistical Methods for agricultural workers. ICAR, New Delhi.

Tanada-palmu, P.S and Grosso. 2002. Edible wheat gluten flims, development, mechanical and barrier properties and application to strawberries. *B. Ceppa, Curitiba,* **20**: 291-308

Terry, L. A. and Joyce, D. C. 2004. Elicitors of induced disease resistance in postharvest horticultural crops: a brief review**.** *PHT Bio.Technol,* **32:** 1-13.

Wijewadane RMNA, and Gulerias.P.S. 2009. Effect of post harvest coating treatments on apple storage quality. *J.food Sci. Technol.,* **46(6)**: 549-553.

Wills, R. B. H., Bembridge, P. A. and Scott, K. J. 1980. Use of flesh firmness and other objective tests to determine consumer acceptability of delicious apples. *Aust. J. Exp. Agri. Ainm.,* **20:** 252-256.

Yaman, O. and Bayoindirli, L. 2002. Effects of an edible coating and cold storage on shelf-life and quality of cherries. *Lebnsm. Wiss. Und. Technol.,* **35:** 46-150.

Table 1: Effect of edible coating on shelf life (days) , physiological loss in weight (%) and Fruit spoilage (%) of guava var.L-49.

Treatments	Shelf life (Days)	% over control	Fruit weight loss (%)				Fruit spoilage (%)			
			3rd day	5th day	7th day	9th day	3rd day	5th day	7th day	9th day
T_1 - cassava flour @ 2 %	5.36	21.54	19.46	14.82	24.62	42.62	4.99	39.05	65.39	80.88
T_2 - cassava flour @ 4%	6.53	48.07	16.23	12.05	20.22	30.26	4.90	25.92	48.91	67.26
T_3 - cassava flour @ 6%	7.78	76.42	15.29	10.82	15.32	22.14	4.72	19.28	40.55	60.41
T_4 - wheat flour @ 2%	5.55	25.85	17.98	13.95	21.62	34.78	4.85	32.51	57.16	74.09
T_5 - wheat flour @ 4%	6.68	51.47	15.80	11.85	20.21	28.45	4.94	25.88	48.82	67.22
T_6 - wheat flour @ 6%	8.68	96.83	15.24	6.80	14.01	18.42	4.65	19.27	40.56	60.31
T_7 - corn flour @ 2%	5.65	28.12	17.11	12.69	21.41	31.61	4.94	25.98	48.97	67.32
T_8 - corn flour @ 4%	6.86	55.56	15.45	11.05	19.29	26.34	4.79	19.37	40.61	60.41
T_9 - corn flour @ 6%	9.61	117.91	14.86	3.55	13.55	14.58	1.09	12.70	32.31	53.48
T_{10} - control	4.41	0.00	20.25	15.98	31.18	42.71	5.11	45.60	73.60	87.68
S.Ed	**0.29**	**-**	**0.31**	**0.78**	**0.92**	**1.68**	**0.002**	**1.91**	**2.45**	**1.84**
CD (P=0.5)	**0.62**		**0.67**	**1.65**	**1.93**	**3.53**	**0.005**	**4.02**	**5.16**	**3.88**

Table 2: Effect of edible coating on TSS and Total sugar content (%) of guava var.L-49.

Treatments	TSS °Brix				Total sugar content (%)			
	1st day	3rd day	5th day	7th day	1st day	3rd day	5th day	7th day
T_1 - cassava flour @ 2 %	7.21	10.25	8.26	6.95	5.44	7.01	4.15	3.37
T_2 - cassava flour @ 4%	7.32	9.89	8.73	7.17	5.46	7.02	4.51	3.71
T_3 - cassava flour @ 6%	7.22	9.09	9.25	7.47	5.45	6.66	4.84	4.18
T_4 - wheat flour @ 2%	7.31	10.24	8.27	6.96	5.46	7.01	4.17	3.39
T_5 - wheat flour @ 4%	7.20	9.87	8.74	7.18	5.44	7.02	4.53	3.73
T_6 - wheat flour @ 6%	7.29	8.81	9.82	7.79	5.46	6.49	5.21	4.67
T_7 - corn flour @ 2%	7.23	9.91	8.29	6.98	5.44	6.89	4.18	3.4
T_8 - corn flour @ 4%	7.33	9.46	8.76	7.21	5.46	6.81	4.54	3.74
T_9 - corn flour @ 6%	7.35	8.35	10.35	8.02	5.45	6.49	5.45	5.03
T_{10} - control	7.27	10.26	7.63	6.81	5.46	7.03	3.73	2.97
S.Ed	**-**	**0.11**	**0.14**	**0.07**	**-**	**0.04**	**0.09**	**0.12**
CD (P=0.5)	**NS**	**0.21**	**0.29**	**0.14**	**NS**	**0.07**	**0.19**	**0.27**

Table 3: Effect of edible coating on Acidity (%) and Ascorbic Acid (mg/100g) in guava var.L-49.

Treatments	Acidity (%)				Ascorbic Acid (mg/100g)			
	1st day	3rd day	5th day	7th day	1st day	3rd day	5th day	7th day
T_1 - cassava flour @ 2 %	0.28	0.38	0.28	0.21	128.78	145.63	130.59	78.19
T_2 - cassava flour @ 4%	0.28	0.36	0.31	0.23	128.89	143.02	134.42	89.21
T_3 - cassava flour @ 6%	0.29	0.33	0.33	0.25	129.11	139.51	139.25	98.91
T_4 - wheat flour @ 2%	0.29	0.38	0.28	0.21	128.83	145.43	130.69	78.29
T_5 - wheat flour @ 4%	0.29	0.36	0.31	0.23	128.92	142.82	134.62	89.31
T_6 - wheat flour @ 6%	0.29	0.32	0.36	0.27	129.02	136.79	143.28	109.12
T_7 - corn flour @ 2%	0.28	0.37	0.28	0.21	129.73	143.12	130.89	78.49
T_8 - corn flour @ 4%	0.28	0.35	0.31	0.23	129.85	140.91	134.72	89.51
T_9 - corn flour @ 6%	0.28	0.32	0.38	0.29	128.67	133.56	147.71	118.93
T_{10} - control	0.29	0.39	0.25	0.18	129.04	145.73	125.95	69.27
S.Ed	**-**	**0.005**	**0.008**	**0.007**	**-**	**0.62**	**1.15**	**2.49**
CD (P=0.5)	**NS**	**0.011**	**0.017**	**0.015**	**NS**	**1.24**	**2.30**	**4.98**