

EFFECT OF PLANT NATURAL EXTRACT COATINGS ON POST HARVEST QUALITY AND SHELF LIFE OF TOMATO

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Abstract: The aim of this research is to study the application of plant natural extracts Aloe vera and neem for extending the storage period of tomato. The effect of different formulations of Aloe vera and neem based herbal extract coatings on tomatoes stored at refrigerated condition (4°C) was investigated. PLW, Firmness, total soluble solids, sensory characteristics were analyzed at regular intervals during the storage period. Tomatoes in control showed a rapid deterioration with an estimated shelf life period of 18 days. On the contrary, the coatings on tomatoes extended the shelf life up to 36 days. From the results, it was concluded that the use of Aloe vera and neem based plant natural extract coating leads to increased tomato shelf-life.

Keywords: *Aloe vera*, Neem extract, Coatings, Shelflife, Tomato

INTRODUCTION

Tomato is a climacteric fruit and continues to ripen after harvest (Liu *et al.*, 2009). For fresh tomatoes, the two quality attributes that are most important to buyers and consumers are texture/firmness and skin color. Texture is influenced by flesh firmness and skin strength. Softening during storage, distribution and ripening of tomatoes can be a major problem because it may increase their susceptibility to damage. There is increasing consumer concern about the eating quality of tomatoes. After harvest, ripening continues and tomatoes can overripe very rapidly. This can result in loss of quality and restricted shelf life (Batu, 2004). Edible coatings can provide an additional protective coating for fresh produce and can also give the same effects as modified atmosphere storage in modifying internal gas composition (Park *et al.*, 1994). By regulating the transfer of moisture, oxygen, carbon dioxide, aroma, and taste compounds in a food system, edible coatings have demonstrated the capability of improving food quality and prolonging shelf life of fresh produce (Castillo and Serrano, 2005). An ideal coating is defined as one that can extend storage life of fresh fruit without causing anaerobiosis, and that reduces decay without affecting the quality of the fruit (Sonti, 2003), keeping it in the view the present study was undertaken with an objective to investigate the effectiveness of plant extracts of Aloe vera and neem leaves on post harvest quality of tomatoes.

MATERIAL AND METHOD

Freshly harvested tomato (*Lycopersicon esculentum*) (Desi Variety) were procured from the local market of Noida. Fruits of same maturity were selected on

the basis of absence of injuries, uniform, unripe green stage color.

Fresh leaves of *Aloe vera* and Neem were obtained from the Noida International University, Greater Noida, U.P.

To improve the efficiency of *Aloe vera* gel coating, different concentration of neem extract is mixed with *Aloe vera* gel formulation in case of tomato.

Preparation of *Aloe vera* Extract

40 gm of *Aloe vera* gel matrix was separated from the outer cortex of leaves and this colorless hydroparenchyma was ground in a blender. The resulting mixture was filtered to remove the fibers. The liquid obtained constituted fresh *Aloe vera* gel. The gel matrix was pasteurized at 70°C for 45 minutes. (Marpudi *et al.*, 2011)

Preparation of Neem Extract

Freshly harvested Neem leaves were washed air dried then passed through grinder to make a homogeneous paste. The paste was added in water 10% and 20% solution. The solution was centrifuged and supernatant was collected for further use. Dried neem leaves were ground and centrifuged for 10 mins. The supernatant so obtained is mixed with pasteurized gel matrix of *Aloe vera* Gel.

Different treatments of *Aloe vera* gel is applied over tomatoes are kept under open condition at 4°C

- 1-40% pure *Aloe vera* Gel (Pure AG)
- 2-40% Aloe Gel with citric acid (4.5-4.6g/L-1) (AG+CA)
- 3-40% Aloe Gel+10%Neem+ citric acid (4.5-4.6g/L-1) (AG+10%Neem+CA)
- 4-40% Aloe Gel+20%Neem plus citric acid (4.5-4.6g/L-1) (AG+20%Neem+CA)
- 5-40% Aloe Gel +10% Neem

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6-40% Aloe Gel+20%Neem

Application of Herbal Coating on tomato fruits

Tomato fruits were washed thoroughly with potable water and air dried to remove excess moisture. Fruits were then dipped in plant extracts preparation. Detail of the treatments has been given below. For each treatment 15 fruits were taken. After treatment fruits were stored under refrigerated conditions at 4°C. Observations were taken at intervals of 0,6,12,18,24,30,36 days. Various parameters were analyzed at 0,6,12,18,24,30,36 days.

Physiological Loss in Weight (PLW)

The fresh weights of all the replicates was determined daily and compared to control fruits. Water loss was calculated in terms of PLW by the following equation: $(A-B)/A \times 100$, where, A is the initial weight of fruits (0 d) and B is the fruit weight after the storage period.

Change in peel color

The change in peel color of all the replicates was determined and compared to control fruits. Change in peel color of fruits were observed based on lagorio tomato guide

Peel Color Rating done on the basis of 6 Point Scoring Scale.

1= Green 2= Breaker 3= Turning 4=Pink 5=Light Red 6= Red.

Total Soluble Solids

Total soluble solids were determined for both control and coated fruits by using Abbe's hand refractometer.

Texture Analysis

Firmness of the fruits were measured with the help of penetrometer.

Sensory Evaluations: A panel of seven judges was made to evaluate fruit from 6 treatments at different intervals and the average scoring was made for each quality attribute as per nine point hedonic scale.

***Statistical Analysis:** The data obtained from the experiments were analysed using SPSS software (version 16) to compare control and coated fruit samples.

RESULT AND DISCUSSION**Visual Characteristics**

The effect of different formulations of *Aloe vera* gel coating was observed. Physiological loss in weight during 4°C temperature storage was found to be significantly different from control at the end of 36 days storage.

The effect of selected edible coating on PLW was observed. During 36 days storage *Aloe vera* gel coated tomatoes maintained their shelf life up to 30 days whereas all control got deteriorated by 18 days. The PLW was calculated and 36% loss is observed in case of AG+10%Neem+CA during 36 days whereas there is 21.6% of loss in control on 18 days only. Peel color rating was observed to stage 6 (Red) on 36th day of storage for AG+CA and AG+10% Neem+CA whereas control showed complete stage 6 of red peel color in 18 days only (Table 1 & 2). It has been observed that the rate of physiological loss in weight was slowed down after 18 days of storage in case of AG+CA and AG+10% Neem+ CA leading to enhanced shelf life.

Table 1. Effect of different plant extracts on physiological loss in weight of fresh tomatoes

Treatments	Days After Treatment [DAT]							% PLW	S.D	Mean
	0	6	12	18	24	30	36			
Control	63.94	60.25	55.15	50.12	-	-	-	21.60	6.02	57.30
Pure AG	88.38	85.94	83.51	82.29	81.08	78.65	-	11.00	3.47	83.30
Pure AG+CA	63.65	61.17	56.58	51.45	48.32	44.65	44.65	36.70	8.62	52.20
Pure AG+10%Neem+CA	63.66	61.17	57.58	52.45	52.45	44.65	40.33	36.60	8.65	52.50
Pure AG+20%Neem+CA	64.48	62.82	60.04	56.12	51.33	51.33	-	34.40	8.31	56.00
Pure AG+10%Neem	71.24	67.99	65.85	63.11	59.94	57.21	-	19.60	5.19	64.20
AG+20%Neem	74.42	72.47	68.99	65.85	60.34	-	-	18.90	5.58	68.40

Table 2. Effect of different plant extracts on peel color rating of fresh tomatoes

Treatments	Days After Treatment [DAT]							S.D	Mean
	0	6	12	18	24	30	36		
Control	1	3	4	6	-	-	-	2.08	3.50
Pure AG	1	2	3	4	5	6	-	1.87	3.50
Pure AG+CA	1	2	3	4	5	5	6	1.79	3.71

Pure AG+10%Neem+CA	1	2	3	4	5	5	6	1.79	3.71
Pure AG+20%Neem+CA	1	2	3	4	5	6	-	1.87	3.50
Pure AG+10%Neem	1	2	3	4	4	6	-	2.06	3.66
AG+20%Neem	1	2	3	4	6	-	-	1.92	3.20

Table 3. Effect of different plant extracts on total soluble solids (°Brix) of fresh tomatoes

Treatments	Days After Treatment [DAT]							S.D	Mean
	0	6	12	18	24	30	36		
Control	4.73	4.26	4.13	4.06	-	-	-	0.30	4.29
Pure AG	4.73	4.60	4.80	4.86	4.66	4.26	-	0.21	4.65
Pure AG+CA	4.60	4.60	4.80	4.86	4.80	4.60	4.13	0.24	4.62
Pure AG+10%Neem+CA	4.46	4.53	4.40	4.86	4.66	4.20	4.33	0.21	4.49
Pure AG+20%Neem+CA	4.66	4.40	4.53	4.60	4.13	3.66	-	0.37	4.33
Pure AG+10%Neem	4.33	4.46	4.26	4.66	4.60	4.40	-	0.15	4.45
AG+20%Neem	4.00	4.46	4.26	4.80	4.60	-	-	0.30	4.42

Physiochemical Characteristics

TSS of control during red stage on 18th day was 4.06° Brix, whereas for the different formulations of *Aloe vera* gel coated fruit on the same day Pure AG, Pure AG+CA, Pure AG+10%Neem+CA was 4.86° Brix and for Pure AG+20%Neem+CA, PureAG+10%Neem, Pure AG+20%Neem was 4.60, 4.66 and 4.80° Brix observed on 18thday (Table3). There was a gradual decrease in the TSS of the Pure AG+20%Neem+CA, Pure AG+10%Neemcoated

tomatoes observed on 18th day. The TSS was 4.13°Brix for Pure AG+CA and 4.33°Brix for PureAG+10% Neem+ CA on 36th day. The decrease in the TSS after 18th day may be due to the break-up of carbohydrates and pectin, partial hydrolysis of protein, and decomposition of glycosides into subunits during respiration causing a decrease of total soluble solids. Similar results were also reported by Torgul and Arslan (2004)

Table 4. Effect of different plant extracts on firmness (kg/cm²) of fresh tomatoes

Treatments	Days After Treatment [DAT]							S.D	Mean
	0	6	12	18	24	30	36		
Control	7.26	6.53	1.96	0.96	-	-	-	3.17	4.17
Pure AG	8.43	5.36	4.53	3.20	2.73	1.53	-	2.42	4.29
Pure AG+CA	8.43	5.50	4.53	3.30	2.83	2.20	1.40	2.38	4.02
Pure AG+10%Neem+CA	8.33	6.33	4.60	3.40	2.83	2.13	1.30	2.48	4.13
Pure AG+20%Neem+CA	7.33	5.33	3.53	2.20	1.00	0.76	-	2.58	3.35
Pure AG+10%Neem	8.20	6.83	4.46	2.16	1.63	0.53	-	3.06	3.96
AG+20%Neem	7.60	5.30	3.53	1.23	0.50	-	-	2.92	3.63

Fruit firmness for both control and coated tomatoes gradually decreased during the storage period. During the ripening process, cell wall-modifying activity of several enzymes, including polygalacturonase, pectin-methyl-esterase, endomannase, and galactosidases, and glucanases, causes softening of the whole fruit by altering the texture due to degradation of the structural

components necessary to reinforce the cell wall and the adhesion of cells. The firmness of control during its red stage on the 18th day was 0.96 kg/cm², whereas for the coated fruit of different formulations of *Aloe vera* i.e. pure AG,AG+CA, AG+10% Neem +CA, AG + 20% Neem + CA, AG+10% Neem, AG+20% Neem on the same day was 3.20, 3.30, 3.40, 2.20, 2.16, 1.23 respectively. On 36th day only

AG+CA and AG+10% Neem+CA survived with firm texture having 1.4 and 1.3kg/cm² respectively (Table4).

Table 5. Effect of different plant extracts on sensory evaluations of fresh tomatoes

Treatments	Days After Treatment [DAT]							S.D	Mean
	0	6	12	18	24	30	36		
Control	5.75	5.00	3.25	1.50	-	-	-	1.89	3.87
Pure AG	6.75	6.25	5.25	4.75	3.00	2.25		1.77	4.70
Pure AG+CA	8.25	7.25	6.25	5.50	4.25	2.75	1.25	2.48	5.07
Pure AG+10%Neem+CA	7.25	7.50	6.50	6.25	4.25	3.25	2.00	2.12	5.28
Pure AG+20%Neem+CA	6.75	6.75	5.50	4.25	3.25	2.25	-	1.76	4.70
Pure AG+10%Neem	6.25	6.00	5.50	4.25	3.25	2.25	-	1.60	4.58
AG+20%Neem	6.00	5.25	4.25	3.25	2.25	-	-	1.50	4.20

*Storage Condition-Refrigerated (4°C)

Sensory Characteristics

Sensory Analysis of Control and different formulations of *Aloe vera* coated tomatoes was judged in 6 days interval of 36 days storage. On 18th day of storage, on the basis of appearance, firmness, taste and over all acceptability rating score of control was 1.5 ie nearer to like very much which is showing the full ripe stage ie 6(red)of tomato on the other hand different formulations of *Aloe vera* coated tomatoes rating score was 4.75, 5.50, 6.25, 4.25, 4.25, 3.25 respectively for Pure AG, Pure AG+CA, PureAG+10%Neem+CA, PureAG+20%Neem+CA, PureAG+10%Neem, PureAG+20%Neem which comes in the range of like slightly to dislike slightly, this is because of the reason due to effect of coating the fast respiration is slowed down(Table5). Hence on 18th day also they are towards ripening comparative to control which got full ripe with stage 6(Red) tomatoes. On 36th day of storage only AG+CA and AG+10%Neem+CA coated tomatoes survived with rating score 1.25 and 2 which is in the range of like extremely to like very much.

The results have proved the ability of different formulations of *Aloe vera* in extending shelflife of tomatoes stored at refrigerated condition(4°C).Pure *Aloe vera* gel and *Aloe vera* gel with 20% neem extract coated tomatoes maintained at pH-4, kept at 4^o C showed delayed ripening, fresh and extended the shelf life upto 30 days whereas control got deteriorated within 18days.Pure *Aloe vera* gel with 10% neem extract along with citric acid and *Aloe vera* with citric acid only coated tomatoes maintained at pH-4, kept at 4^o C showed delayed ripening and extended the shelf life up to 30 and 36 days respectively whereas control got deteriorated within 18 days.Neem extract formulation is also effective but concentration should not be in more since 20% neem concentration is not giving much appealing acceptability in sensory evaluation.

CONCLUSION

On the basis of above findings, it can be concluded that shelf life of tomatoes can be increased using plant natural extracts based coating and its quality can be maintained using lesser concentration of neem extract.The effectiveness of Aloevera can be increased using citric acid along with neem extract since it showed significant role in retarding microbial infection.*Aloe vera* gel with citric acid coated tomatoes maintained at pH-4,stored at refrigerated condition showed delayed ripening, fresh and extended the shelf life upto 36days whereas control got deteriorated within 18days.

REFERENCES

- Abirami, L.S.S.** (2009). Efficacy of chitosan and natural plant extracts on the growth of selected fungal pathogens and control of anthracnose disease of papaya .*M.Sc thesis, Sri Sathya Sai University, PrashanthiNilayam.*
- Adetunji, C.O, Fawole, O.B, Arowora, K.A, Nwaubani, S., Ajayi, E.S, Oloke, J. K, Majolagbe, O.M, Ogundele, B. A, Aina, J.A., Adetunji, J.B.** (2012). “ Effects of Edible Coatings from *Aloe Vera* Gel on Quality and Postharvest Physiology of AnanasComosus (L). Fruit During Ambient Storage”, *Global Journal of Science Frontier Research*, **12 (5)**.39-43.
- Arowora, K.A., Williams, J.O., Adetunji, C.O., Fawole, O.B., Afolayan, S.S., Olaleye, O.O., Adetunji, J.B. and Ogundele, B.A** (2013). Effects of Aloe vera Coatings on Quality Characteristics of Oranges Stored Under Cold Storage *Greener Journal of Agricultural Sciences* ;**Vol. 3 (1)** pp. 039-047.
- Asghari M, Ahadi L and Riaie S** (2013): Effect of salicylic acid and edible coating based Aloe vera gel treatment on storage life and postharvest quality of

grape (*Vitisvinifera* L. cv. GizeUzum) *Intl J Agri Crop Sci.* **Vol. 5 (23)**: 2890- 2898.

Athmaselvi, K.A, P. Sumitha, and B. Revathy (2013): Development of Aloe vera based edible coating for tomato; *Int. Agrophys.* **27**, 369-375

Batu, A. (2004). Determination of acceptable firmness and colour values. *J. Eng., 61*, 471-475 of tomatoes.

Castillo, S. and Serrano, M. (2005). Novel edible coating based on Aloe vera gel to maintain table grape quality and safety. *J. Agric. Food Chem., 53*, 7807-7813.

Liu, L.H; Zabarar, D; Bennett, L.E; Agues, P. and Woonton, B.W. (2009). Effects of UV-C, red light and sun light on the carotenoid content and physical qualities of tomatoes during post harvest storage. *Food Chem., 115*, 495-500.

Marpudi, S.L; Abirami, L.S.S; Pushkala, R. and Srividya, N. (2011). Enhancement of storage life and quality maintenance of papaya fruits using Aloe vera

based antimicrobial coating, *Indian Journal of Biotechnology* **Vol. 10**:83-89.

Martinez-Romero, et al. (2006). Post harvest cherry quality and safety maintenance by Aloe vera treatment. A new edible coating, *Post harvest Biol Technol*, **39**:93-100

Mohamadreza Asghari1, HojjatKhalili, Yusof Rasmi, Mohammad, Arash (2013). Influence of Postharvest Nitric oxide and Aloe vera Gel Application on Sweet Cheery Quality Indices and Storage Life; *International Journal of Agronomy and Plant Production.* **Vol. 4 (9)**: 2393-2398.

Sonti, S. (2003). Consumer perception and application of edible coatings on fresh-cut fruits and vegetables. *MSc. Thesis, Osmania University, Hyderabad, India.*

Togrul, H. and Arslan, N. (2004). Carboxymethyl cellulose from sugar beet pulp cellulose as a hydrophilic polymer in coating of mandarin. *J. Food Eng., 62*, 271-279.

