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EFFECT OF ALOE VERA GEL COATING ON SHELF LIFE OF TOMATO

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ABSTRACT

The effect of Aloe vera gel coating on the shelf life of tomato fruits in storage was evaluated. The variety of tomato namely Pusa ruby was collected from puliyangudi market in Tenkasi district, washed and treated with Aloe vera coatings in concentrations of 0%, 5%, 10%, 15% and 20%. The tomato fruit were afterwards left in storage for a period of 21 days during which physical properties relating to tomato qualities were recorded appropriately. 0% and 15% concentrations of Aloe vera coating produced the highest and lowest decay values respectively on days 7, 11, 13 ,17, 19and 21. Marketability of the tomato fruits treated with Aloe vera at 15% concentration was higher than those treated with 5% ,10%, 20% and 0% respectively. Pusa ruby treated with 15% concentration of Aloe vera coating also had the highest fruit weight on days 1, 3, 5, 7,9, 11,19 and 21. Aloe vera is therefore an efficient bio-preservative and can be used as a successful alternative to synthetic preservatives.

Key words : Tomato, Aloe vera, Shel life , Post-Harvest loss

1. INTRODUCTION

Tomato (*Solanum Lycopersicum*) is one of the most important and widely consumed solanaceous fruit vegetables of the world. They are rich in minerals, vitamins, essential amino acids, sugars and dietary fibres. Tomato contains much vitamin B and C, iron and phosphorus. As a climacteric fruit, postharvest life of tomato is relatively short since many processes cause loss of quality and storability, including high respiration rates, transpiration, postharvest diseases and acceleration in ripening process and senescence (Zapata *et al.*, 2008).

Coating treatments are known to maintain the quality of stored fruit crops by suppressing moisture loss, improving the strength of peel tissues, retaining volatile components, controlling ripening by modifying CO_2 and O_2 concentrations inside the fruit (Alemzadeh A N & Feridon H., 2007), reduces shrivelling, wilting, and respiration rate of fruits and enhances the gloss and cosmetic appearance of fruits (El-Anany *et al*., 2009).

Aloe vera gel has been identified as a novel coating agent with good antimicrobial properties (Nejatzadeh-Barandozi., 2013). They protect the quality losses during ambient storage (Ergun and Satici., 2012). In recent years, the use of Aloe vera gel has gained much attention for use as a safe and environment-

friendly postharvest treatment. Aloe vera gel has been applied as edible coating material for raw produce including tomatoes (Chauhan *et al.*, 2015).

2. MATERIALS AND METHODS

2.1. MATERIALS

2.1.1. Sample Collection

Fully ripened tomato fruit varietY namely Pusa ruby was purchased from Puliyangudi markets respectively inTenkasi district. Puliyangudi is located on latitude 09º10'N and longitude 77º23'E.

2.1.2. Preparation of Aloe vera gel

Fully expanded, mature, healthy and fresh leaves of Aloe vera were collected from the plants using a sharp knife and washed with clean water then with sterile distilled water. The tapering point of the leaf top and the short sharp spines located along the leaf margins were removed by a sharp knife and then the knife was introduced into the mucilage layer below the green rind avoiding the vascular bundles. The top and bottom were removed and then the Aloe vera gel was obtained. After separating Aloe vera gel from the outer cortex, this colourless hydro parenchyma was blended to remove fibers and put in clean and sterilized glass bottles. These bottles were stored in the fridge at 4 - 8ºC until ready for use. The liquid obtained constituted fresh Aloe vera gel.

2.1.3. Preparation of Aloe vera Concentrations

Serial dilutions of the Aloe vera gel were prepared to give 5, 10, 15 and 20% respectively. To obtain gel concentration of 5%, 5 milliliters of Aloe vera gel was measured in a measuring cylinder and 95 milliliters of sterile distilled water was added. To obtain 10 % gel concentration, 10 milliliters of the gel was measured in a measuring cylinder and 90 milliliters of sterile distilled water was added. To obtain 15% gel concentration, 85 milliliters of sterile distilled water was added. To obtain 20% gel concentration, 80 milliliters of sterile distilled water was added.

2.1.4. Coating of Tomato in Aloe vera gel

The different varieties of the tomato fruits were washed in clean water to remove surface dirt and left to air dry. After drying, they were dipped completely in each gel forming concentration of 5, 10, 15 and 20% respectively for fifteen minutes. Following treatment, the tomato fruits were removed and arranged in plastic crates and stored at room temperature.

2.2. METHODS

2.2.1. Treatments

Treatments	Treatment Details
T_1	Tomato treated with Aloe vera gel @ 5%
T_2	Tomato treated with Aloe vera gel @ 10%
T_3	Tomato treated with Aloe vera gel @ 15%
T_4	Tomato treated with Aloe vera gel @ 20%
T_5	Control

2.2.2. Experimental details

2.2.2.1. Design

An experiment entitled "Effect of Aloe vera gel coating on shelf life of Tomato (*Solanum lycoperiscum)*" was conducted during June - July 2021. The experiment was laid out in a randomized block design and replicated thrice.

Randomized Block Design

Number of treatments : 5

Replications : 3

Total number of plots : 15

2.2.2.2. Field layout

R_1T_1	R_2T_5	R_3T_1
R_1T_2	R_2T_4	R_3T_2
R_1T_3	R_2T_3	R_3T_3
R_1T_4	R_2T_2	R_3T_4
R_1T_5	R_2T_1	R_3T_5

2.2.3. Bio-metric observations

2.2.3.1. Shelf life and Quality characters

2.2.3.1.1. Weight loss (%)

Tomato fruits were placed on a digital weighing balance and the readings were recorded. The calculations are made considering the difference between initial and final weight as the total weight loss.

$$\text{Weight loss (\%)} = \frac{\text{(Initial Weight- Final Weight)}}{\text{Initial Weight}} \times 100$$

2.2.3.1.2. Firmness

Firmness of fruits was determined by hand estimation using a numerical rating scale of 1 - 5. Where 1 = very poor, 2 = poor, 3 = acceptable, 4 = good and 5 = Excellent as reported by Zakki Yula Hosea *et al.*, (2017).

2.2.3.1.3. Decay (%)

The numbers of decaying fruits were counted on each day of storage and calculated using the formula.

$$Decay = \frac{Number\ of\ fruits\ decaying}{Total\ number\ of\ fruits\ in\ the\ plots} X\ 100$$

2.2.3.1.4. Shelf life

The number of days the tomato fruits still remained marketable and had eating quality during the storage period was recorded. It was decided based on appearance of the fruits.

2.2.3.1.5. Marketability (%)

Based on descriptive quality attributes such as level of visible lesion, shriveling, smoothness and shininess of fruit, the percentage of marketable fruits during the storage period were calculated using the formula reported by Zakki Yula Hosea *et al.*, (2017).

$$Marketability\ of\ tomato\ fruits = \frac{Number\ of\ marketable\ fruits}{Total\ number\ of\ fruits} X\ 100$$

2.2.3.1.6. Physiological and fungal decay

The physiological decay of tomatoes was inspected visually at the end of the storage, evaluating the skin dehydration level (D1, D2, D3 and D4) of the products D1 being up to 10% of dehydrated surface; D2, up to 30% of dehydrated surface; D3, more than 30% of dehydrated surface; and D4, excess ripening with visible fungal decay. Tomato fruits showing surface mycelial development were considered decayed. The tomato fruits that showed D3 or D4 dehydration levels were considered as deteriorated units. The results were expressed as percentage of damaged products.

3. RESULTS

3.1. Weight loss (%)

The minimum weight loss was recorded in **Treatment 3 (T_3)** which received the application of 15% Aloe vera gel. This was followed by the **Treatment 4 (T_4)** which received the application of 20% Aloe vera gel and the treatments **T_2** and **T_1**.

Treatments	1st day	3rd day	5th day	7th day	9th day	11th day	13th day	15th day	17th day	19th day	21st day
T_1	-	3.80	9.11	16.56	19.74	24.59	29.34	34.02	35.90	41.85	46.55
T_2	-	3.21	5.42	9.08	12.46	18.40	23.10	27.32	30.68	36.33	39.01
T_3	-	1.82	4.50	7.32	9.55	13.34	17.32	19.07	19.92	21.29	**24.41**
T_4	-	2.41	5.60	9.21	12.07	15.73	20.13	23.20	26.05	29.58	35.13
T_5 (CONTROL)	-	2.96	5.18	7.52	9.72	13.36	16.59	20.76	27.57	32.05	-

3.2. Firmness

The maximum firmness was recorded in **T_3** which received the application of 15% Aloe vera gel followed by **T_4** which received the application of 20% Aloe vera gel. The least was observed in **T_5** which were kept in controlled environment.

Treatments	1st day	3rd day	5th day	7th day	9th day	11th day	13thday	15th day	17th day	19th day	21st day
T_1	5	5	5	5	4	3	3	3	2	2	1
T_2	5	5	5	5	4	4	4	4	3	3	2
T_3	5	5	5	5	5	5	5	5	4	4	**3**
T_4	5	5	5	5	5	5	5	5	3	3	2
T_5 (CONTROL)	5	5	4	4	3	3	2	2	2	2	0

3.3. Decay Index (%)

The minimum decay index was recorded in **T_3** which received the application of 15% Aloe vera gel followed by the T_4 Which received the application of 20% Aloe vera gel. The maximum decay index recorded in T_5 which we are kept in controlled environment.

Treatments	1st day	3rd day	5th day	7th day	9th day	11th day	13th day	15th day	17th Day	19th day	21st day
T_1	0	0	10	20	30	30	40	40	60	60	70
T_2	0	0	10	20	40	40	40	40	50	50	60
T_3	0	0	0	10	20	20	30	30	40	40	**50**
T_4	0	0	0	10	20	30	30	40	50	50	60
T_5 (CONTROL)	0	20	20	30	40	50	50	60	80	80	100

3.4. Marketability (%)

The highly marketable fruits recorded in **T_3** which received the application of 15% Aloe vera gel followed by **T_4** which received the application of 20% Aloe vera gel. The least marketability observed in **T_5** which we are kept in controlled environment.

Treatments	1st day	3rd day	5th day	7th day	9th day	11th day	13th day	15th day	17th Day	19th day	21st day
T_1	100	80	50	40	40	30	30	10	0	0	0
T_2	100	80	60	50	50	40	40	20	0	0	0
T_3	100	90	80	70	70	60	60	40	**10**	0	0
T_4	100	80	80	60	60	50	50	30	0	0	0
T_5 (CONTROL)	100	80	50	40	40	30	30	10	0	0	0

3.5. Shelf Life

The maximum shelf life of fruits was recorded in **T_3** which received in the application of 15% Aloe vera gel followed by **T_4** which received in the application of 20% Aloe vera gel. The minimum shelf life was observed in **T_5** which are kept in controlled environment.

Treatments	1st day	3rd day	5th day	7th day	9th day	11th day	13th day	15th day	17th day	19th day	21st day
T_1	✓	✓	✓	✓	✓	-	-	-	-	-	-
T_2	✓	✓	✓	✓	✓	-	-	-	-	-	-
T_3	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	-
T_4	✓	✓	✓	✓	✓	✓	✓	✓	-	-	-
T_5 (CONTROL)	✓	✓	✓	✓	✓	-	-	-	-	-	-

3.6. Physiological disorder and Fungal decay

The minimum physiological and fungal decay was observed in treatment 3 (**T_3**) which received the application of 15% Aloe vera gel. This was followed by treatments T_4, T_2 and T_1.

Treatments	9th day	11th day	13th day	15th day	17th Day	19th day	21st day
T_1	D1	D1	D2	D2	D3	D3	D3
T_2	D1	D1	D1	D1	D2	D2	D3
T_3	-	-	D1	D1	D1	D1	**D2**
T_4	-	D1	D1	D1	D2	D2	D3
T_5 (CONTROL)	D2	D2	D2	D2	D3	D3	D4

D1 - 10% of dehydrated surface

D2 - up to 30% of dehydrated surface

D3 - more than 30% of dehydrated surface

D4 - excess ripening with visible fungal decay

4. DISCUSSION

The **tomato** is the edible, often red, berry of the plant *Solanum lycopersicum*, commonly known as a **tomato** plant. The species originated in western South America and Central America. The Nahuatl (Aztec language) word tomatl gave rise to the Spanish word tomate, from which the English word **tomato** derived. In order to prevent the postharvest losses of tomato it is beneficial to do edible coating. This would help to increase the shelf life of tomato fruits without any harmful effects. Aloe vera a is one among the edible coatings preferred for tomato fruits.

The present investigation was designed to "**Effects of Aloe vera gel coating on shelf life of tomato".** The result obtained are discussed below**.**

INFLUENCE OF ALOE VERA GEL COATING ON TOMATO

The results of the present investigation showed that the parameters *viz.*, weight loss, decay index, marketability, firmness, shelf life, physiological and fungal decay were significantly influenced by the edible coating of Aloe vera gel. The above mentioned attributes are considered to be the important factors to judge the shelf life of tomato. In the present experiment, various parameters were differentially influenced by different concentration of Aloe vera gel.

The ability of Aloe vera coating to lower the decay of tomato fruits as observed in this study is in agreement with the findings of Padmaja N *et al*., (2014) who reported that Jujube fruits coated with Aloe vera resulted in lowered decay due to the ability of Aloe vera to prevent the growth of fungi responsible for spoilage of fruits and reduction of shelf life. A similar observation was done by Jawandha *et al.,* (2014) and Arghya Mani *et al*., (2017).

Preservation of firmness as observed in this study correlates with the findings of Chrysargyris A *et al*., (2016) who reported that Aloe vera coating of tomatoes exerted a beneficial effect on fruit firmness such that, by the end of storage period, Aloe vera coating gave rise to fruits with higher values for firmness than untreated fruits and the differences were significant. Aloe vera treatment significantly reduced the firmness losses (more than 50%) during ambient storage compared with control fruits (Batisse *et al*., 1996; Vidrih *et al*., 1998

Increased marketability in tomato fruits as observed in this study is in line with the findings of Sai Lakshmi Marpudi *et al*., (2011) who reported that control fruits without coating have the least marketability while coated fruits have the maximum. A similar observation was done by Liamngee Kator *et al*., (2018) and Jaiswal Alok Kumar *et al*., (2018).

15% concentration of Aloe vera gel produced higher fruit weight than other concentrations on all the days of storage. Application of 0% concentration of Aloe vera, however, produced the lowest fruit weight. This observation is similar to earlier reports by Padmaja N *et al*., (2014) who stated that Aloe vera coated fruits had significantly lesser weight loss than those with no coating. The findings of this study are also similar to that of Martínez-Romero D *et al*., (2006) who reported that Aloe vera gel coating is an effective physical barrier and thus reduced weight loss and lowered the respiration rate during post-harvest storage of table grapes and cherries. Similar observation was reported by Kaur *et al.,* (2014), Arghya Mani *et al*., (2017), Ahmad MJ *et al.,* (2009) and Ochiki Sophia *et al*., (2015).

5. CONCLUSION

Aloe vera has potent preservative abilities and can be used as a successful bio-preservative and useful alternative to synthetic preservatives. Its harmless nature to both humans and the environment makes it far more advantageous than the average chemical preservative which often has dangerous side effects on health. Aloe vera, as an efficient preservative with emphasis on tomato which formed the basis of this study points to the wide prospects of the plant in the preservation of post-harvest fruits and vegetables in the future.

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