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Effect Of Aloevera Extract As Edible Coating On The Quality Of Tomato Fruit (*Solanum Lycopersicum*) Cultivars Virza F1

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Abstracts. The decrease in nutritional value and shelf life of tomato fruit after harvest is due to the fact that tomato fruit still carries out metabolic processes such as respiration and transpiration. One of the effortsto maintain the nutritional value and shelf life of tomato fruit includes edible coating using Aloevera extract. Research on aloevera extract was conducted at the Faculty of Agriculture Laboratory, UGJ Cirebon in July 2024. The research method used is the experimental method, with a complete randomized design (CRD), six treatments of aloevera extract concentration and repeated four times. Variables measured included weight loss, total soluble solids content, vitamin C, moisture content and shelf life. Tests were conducted using analysis of variance and DMRT test.The results showed that different concentrations of aloevera extract gave differences to weight loss, total soluble solids content, vitamin C content, water content and shelf life of tomato fruit. Tomatoes that are notcoated with aloevera extract produce the highest weight loss and vitamin C content. The longest average shelf life of tomato fruit was obtained in the treatment of aloevera extract concentrations of 80% and 100% with an average shelf lifeof 17.50 and 18.25 days, respectively.

Keywords: aloevera, *edible coating*, tomato fruit quality.

INTRODUCTION

Tomatoes (*Solanum lycopersicum*) are one of the fruit vegetables that humans needto fulfill their daily needs. This is because tomatoes contain vitamins and minerals that are very useful for maintaining health and preventing disease. However, tomatoes are an agricultural commodity that is highly perishable after harvest. Therefore, efforts need to be made to extend the shelf life of tomatoes. According to Tetelepta et al. (2019) the rate of lossand damage to tomatoes reaches 20% to 50% of the total harvest. Furthermore, Purwadi et al. (2007) *in* Alimba Abdi & Kadir (2017) stated that tomato fruit after perfect maturity will quickly becomedamaged or rotten, namely

after 3-4 days of storage at room temperature so that without specialhandling the shelf life of tomato fruit is relatively short or short.

To increase the shelf life of tomatoes, one postharvest procedure is to apply edible coating ingredients (Wisudawaty et al., 2020). Edible coating is a thin layerof food surfaceprotection that functions as a mass transfer inhibitor such as moisture, oxygen, fat, and solutes. The components that make up edible coatings can be divided into three types, including hydrocolloids, lipids, and composites (Singh and Packirisamy 2022; Hidayat et al. 2023). According to Raghav, et al, (2016), the main requirements in making edible coatings are odorless, tasteless and do not change the characteristics of the original product.

When applied to tomato fruit, an edible coating helps preserve the fruit's hardness, vitamin C content, and total lycopene acid content while also reducing fruit weight loss (Tetelepta, et al. 2019; Ningtyas, et al. 2023). Edible coatings that can be used as a natural food mixture include using aloevera gel *(Aloevera)* which is used specifically for preservingvegetables and fruit. Preservation with aloevera gel *(Aloevera)* in addition to being environmentally friendly and harmless to health, aloevera gel *(Aloevera)* has great economic value because Aloevera plants (*Aloevera)* are easily obtained and bred as medicinal plants or ornamental plants (Fauziah et al., 2020; Karmida., Hayati, R. & Marliah,2022; Mufidah et al., 2022). 2022).

Aloevera gel has the potential to be applied to Edible Coating technology because it can inhibit the production of CO_2 and O_2 gases. It is also known that the gel contains antimicrobial substances that can be a functional component that can inhibit damage to post-harvest products (Passafiume et al., 2020).

Aloevera contains polysaccharides, namely glucomannan, antimicrobial and anti-inflammatory, which can be used as an edible dressing material. The polysaccharide content contained in Aloevera can inhibit fluid loss from the peel surface, so that the rate ofdecay can be reduced and can maintain freshness in the fruit. Edible coating from Aloeveragel is easy to apply because it has a natural structure as a gel (Natawijaya et al., 2023).

Various studies have shown that Aloevera contains several bioactives that can heal tissue wounds. Hence the application of Aloevera gel as an edible coating to improve the quality and shelf life of tomatoes.

LITERATURE

Since edible coatings can form a barrier between the product and the environment, it has been recognized that they have the potential to increase the shelf life of foods, especiallyfresh fruits (Xin et al., 2017). The coatings are tiny, naturally occurring layers of raw ingredients applied directly to the fruit's surface. In addition to acting as a barrier against chemical, physical, and microbiological changes, the materials may also include additives that boost the product's safety and shelf life (Nicolau-Lapeña et al., 2021 *in* Nasution et al., 2023). Furthermore, edible coatings can help preserve the fresh fruit's freshness by lowering microbial contamination, halting the impacts of browning and shrinkage, and preserving thefruit's antioxidant content, vitamins, and firmness to delay the fruit's aging process (Maringgal et al., 2020)..

Materials that can be used to make edible coatings are derivatives of polysaccharides, proteins and fats. Aloevera plants are believed to contain more than 75 bioactive compounds. One of them is glucomannan or pectic acid which is a derivative of polysaccharide compounds. This component in the form of glucomannan in Aloevera is veryuseful in inhibiting post-harvest damage to agricultural products because it has antimicrobialand antioxidant properties (Azmi et al., 2023).

The results of research Aminudin, et al, (2014) showed that edible coating treatment of Aloevera gel and storage temperature can affect the quality and shelf life of cucumber. With a concentration of 100% and 50% combined with low temperature storage (8-10^{o}C) was able to reduce the decline in internal (weight, pH, TPT) and external (hardness, rottenness, color) quality of cucumber during 9 days storage with the condition of cucumberremains fresh. As for room temperature storage (27-29^{o}C), the best treatment is for cucumbers without coating which can last up to 6 days.

Fauziah, et al, (2020) claimed that strawberries, apples, and carrots have different preservation qualities when Aloevera edible covering is applied. Aloevera gel's polysaccharide content has can CO_2 and O_2 from transferring intopostharvest goods. Furthermore, the results of research by Irene, et al, (2022) show that the concentration of Aloevera gel that can extend the shelf life of tomato fruit to 14 days is 5% and 10%, showing changes in the condition of tomato fruit from rosy color to red and cell turgor (elasticity) in good condition, while Aloevera gel with a concentration of 20% has a shelf life of 7 days.

Aloevera application as an eggplant edible coating can reduce weight loss by 13.16% (Hartass et al., 2020). According to additional research, the best edible coating material for treating tomato fruit is Aloevera extract at 100% concentration and soaking it for 45 minutes.This indicates that the vitamin C content of tomato fruit is affected by shelf life, and that the best treatment for tomatoes is 30% Aloevera gel concentration at low temperature storage (10ºC), which is still approved by consumers on day 21 (Marwina & Agustina, 2016).

The results of research by Ningtyas, et al, (2023) found that the best treatment for tomatoes with 30% Aloevera gel concentration treatment at low temperature storage of 10ºCwas still accepted by consumers until day 21. for weight loss analysis, analysis of hardness percentage and vitamin C analysis is in the treatment of 30% Aloevera gel concentration. Inline with the research results.

The results of Bisfain's research, (2020) showed that the best concentration at room temperature in the weight loss parameter was 30% with a dipping time of 30 seconds at cold temperatures, namely a concentration of 60% with a dipping time of 60 seconds. Meanwhile,the parameters of color and total soluble solids have no significant effect on storage. The moisture content was relatively small at about 1% increase for 15 days.

METHODS

This research was conducted at the Faculty of Agriculture Laboratory of Swadaya Gunung Jati University, this research was conducted in July 2024. The materials used are tomato fruit of Virza F1 variety, Aloevera plants, citric acid, iodine, distilled water. While the tools are scales, blender, stopwatch, plastic container, measuring cup, label paper, stirringrod, knife, basin, fine sieve, dropper pipette, oven, aluminum cup, and Erlenmeyer.

The research method used is the experimental method, with a one-factor Completely Randomized Design (CRD) The treatment tested consisted of six levels of Aloevera extract concentration (0%, 20%, 40%, 60%, 80% and 100%), each repeated four times, totaling 24 experimental units. In each treatment, 5 tomato samples were used, which were harvested with 80% maturity.

Observations were made on days 1, 4 and 7 which included weight loss, total soluble solids content, vitamin C content, moisture content and shelf life. The experimental data were analyzed using the F test in the analysis of variance, if the treatment tested showed a significant

effect then the test was continued with the DMRT test (Duncan Multiple Range Test) at a real level of 5%. Data analysis was carried out with the help of MS Excel 2019.

DISCUSSION

Weight Loss

The analysis showed that the concentration of edible coating alovera had a significant effect on weight loss on the 4th and 7th storage days. On day 1, the fresh weightof day 0 andday 1 were relatively the same so that the weight loss on day 1 was not analyzed. Table 1 shows that there was an increase in weight loss from day 4 to day 7.

On the 4th day of observation, the average weight loss of tomato fruit stored using edible coating was 5.14% smaller than the weight loss without edible coating (control) of 12.66%. The same thing happened on the 7th day of observation, the average weight loss of tomato fruit stored using edible coating was 7.21% smaller than the weight loss without edible coating (control) of 15.61%.

Table 1. Weight Loss

No.	Treatment	Weight Loss (%)	
		Day 4	Day 7
1	A (control)	12,66b	15,61b
2	B (20%)	5,64a	8,27a
3	C (40%)	5,25a	7,37a
4	D (60%)	5,17a	7,11a
5	E (80%)	4,92a	6,86a
6	F (100%)	4,69a	6,44a

Description Mean numbers accompanied by the same letters in the column indicate that they are not significantly different based on the Duncan Multiple Range Test

Table 1 also shows that tomato fruit not coated with Aloevera extract significantly experienced higher weight loss than when the fruit was coated with Aloevera extract. Fromthe results of this study, tomato fruit coated with Aloevera extract at various concentrationsproduced weight loss that was not significantly different. Tomato fruit coated with Aloevera extract, almost all pores on the surface of the fruit are closed. This allows anaerobic respiration to occur

and CO_2 produced in the respiration process isinhibited from leaving because the pores of the fruit are covered by a layer of Aloevera extract.

Weight loss is a condition brought on by the post-harvest fruits' respiration and transpiration, a biological process in which oxygen is absorbed to burn the fruit's organic materials for energy and then combustion residues are released in the form of evaporated water and carbon dioxide gas. (Alexandra and Nurlina, 2014 *in* Sulistyowati, et al. (2019).
Tomato fruit is a type of climacteric fruit where the respiration rate will increase after entering the ripening phase and increase ethylene production (Bapat et al., 2010 *in* Gumaranet. al. 2023). The presence of ethylene in the fruit will cause accelerated ripening so that theshelf life of the fruit will be shorter Wulandari, et al. (2022).

Winarno (1993) *in* Kalsum, et al. (2018) outlined how water loss from evaporation and carbon loss from respiration cause weight loss in fruits and vegetables during storage, damaging the product and lowering its quality. Meindrawan, et al. (2017) claimed that by slowing down the rate of water vapor passage, coating can reduce the amount of water lost from fruit. According to Novita et al. (2012) *in* Kalsum et al. (2018) weight loss in tomato fruit tends to increase with the length of storage.

Furthermore, Lestari et al. (2013) *in* Gumaran, et al. (2023) explained that during storage the process of transpiration and respiration cannot be inhibited so that the fruit experiences an increase in weight loss. Symptoms of water loss in tissues are caused by changes in ambient air vapor pressure. The transpiration process causes loss of cell turgor which resultsin softening of tomato fruit. A similar statement was also conveyed by Roiyana et al. (2012)*in* Andriani, et al, (2018) that an increase in the respiration rate in tomatoes can cause weight loss in the fruit. Increased respiration rates will cause the breakdown of compounds such ascarbohydrates in the fruit and produce CO_2, energy and water that evaporate through the surface of the tomato peel and cause weight loss.

Total Soluble Solids

The tomato fruit's maturity stage can be determined by looking at its total soluble solids content. Total soluble solids in ripe tomato fruit are typically higher than those in immature tomato fruit.

Table 2 of Total Soluble Solids Analysis

No.	Treatment	Total Soluble Solids (% Brix)		
		Day 1	Day 4	Day 7
1	A (control)	3,50a	4,25a	4,50 a
2	B (20%)	3,50a	3,75a	3,75 a
3	C (40%)	3,75a	3,50a	4,00 a
4	D (60%)	3,50a	3,75a	4,25 a
5	E (80%)	3,50a	3,75a	4,25 a
6	F (100%)	3,00a	3,50a	3,50 a

Description Mean numbers accompanied by the same letters in the column indicate thatthey are not significantly different based on the Duncan Multiple Range Test

The average total soluble solids on day 1 of storage was 3,42%, on day 4 was 3.79% and on day 7 was 4,04% Brix. This figure shows the tendency of a increase in total soluble solids content with increasing length of storage. The results of this study are in accordance with the results of research by Marwina, et al, (2016) who obtained the levels of total soluble solids in tomato fruit during storage ranging from 1.10%Brix - 4.90%Brix.

In accordance with the statement of Amal et al. (2010) *in* Rusmanto, et al. (2017) that tomato fruit that is edible coating can reduce the rate of respiration, so that it can delay the use of total sugar in enzymatic reactions and respiration. According to Willes (2000) in Kulsum (2018) that in the ripening process during fruit storage, starch is completely hydrolyzed into sucrose which then turns into reducing sugars as a substrate in respiration. The general tendency that occurs in fruit during storage is an increase in sugar content whichis then followed by a decrease.

Vitamin C Content

Compared to tomato fruit that isn't coated with Aloevera gel, tomato fruit coated in thegel has a lower vitamin C concentration. Based on three measurements, tomato fruit coveredwith Aloevera gel had an average vitamin C content of 3.69%, compared to 5.36% for uncoated fruit.

Table 3. Vitamin C Content Analysis Results

No.	Treatment	Vitamin C ($^{mg}/_{g}$)			
		Day 1	Day 4		Day 7
1	A (control)	7,69b	4,80	b	3,61 b
2	B (20%)	4,93a	3,92	ab	2,90 a
3	C (40%)	4,64a	3,92	ab	3,07 a
4	D (60%)	4,93a	3,92	ab	2,78 a
5	E (80%)	4,79a	4,00	ab	2,92 a
6	F (100%)	3,19a	3,05	a	2,42 a

Description: Mean numbers accompanied by the same letters in the column indicate thatthey are not significantly different based on the Duncan Multiple Range Test

Vitamin C levels were lower in tomatoes coated with Aloevera gel, presumably Aloevera gel can reduce the occurrence of oxidation reactions so that vitamin C can be maintainedduring storage. The results of this study are in line with research conducted by Natawijaya, et al, (2023) which showed that the decrease in vitamin C content during storage occurred intomatoes in all treatments. The highest decrease in vitamin C content occurred in tomatoes without edible coating application. This means that the coatingapplied to tomatoes is able tomaintain vitamin C content better than the control. Furthermore, Darmawan, et al. (2022) stated that edible coating of Aloevera gel can inhibitethylene in ripening and inhibit the degradation of starch into sugar so that vitamin C can be retained. Aisyah, et al. (2022) added that the low value of the decrease in vitamin C content in tomatoes treated with ediblecoatings is thought to be due to the coating being able to inhibit the diffusion of O_2 into the fruit tissue. O_2 compounds play an important rolein the degradation process of ascorbic acidor vitamin C into dehydroascorbic acid and H_2O_2 . Furthermore, the H_2O_2 formed can causeautooxidation which will trigger damage and decrease the vitamin C content in the fruit.

Table 3 also shows that vitamin C content decreases with increasing length ofstorage.This is in accordance with the statement of Winarno (2002) *in* Verawati et al. (2020), oxidation reactions cause damage to vitamin C and vitamin C is also easilydissolved in water.

Water Content

The results of the analysis of tomato fruit moisture content showed that different

concentrations of Aloevera extract resulted in differences in moisture content in the three observation periods. On day 1, day 4 and day 7, the water content of tomato fruit not coated with Aloevera gel was higher than the water content of tomato fruit coated with Aloevera gel.

Table 4. Results of Moisture Content Analysis

No.	Treatment	Water Content (%)					
		Day 1		Day 4		Day 7	
1	A (control)	67,65	a	63,30	a	49,64	a
2	B (20%)	70,66	b	65,67	b	55,94	b
3	C (40%)	72,12	bc	66,63	bc	57,12	bc
4	D (60%)	73,45	cd	67,56	bc	57,20	bc
5	E (80%)	73,94	d	67,93	bc	60,11	cd
6	F (100%)	74,07	d	68,01	c	62,33	d

Description: Mean numbers accompanied by the same letters in the column indicate thatthey are not significantly different based on the Duncan Multiple Range Test

Following harvest, fruits and vegetables will experience physicochemical changes brought on by metabolic activities including transpiration and respiration, which cause waterloss. Stress from water loss makes tissues more prone to cell membrane breakdown. The fruit peel may become softer, wrinkled, and lose its brightness as a result of excessive waterloss (Gumaran, et. al. 2023).

The presence of Aloevera gel layer water loss through the transpiration process can be suppressed, so that the water content in tomato fruit coated with Aloevera can be maintained. According to Embuscado and Huber (2009) in Abdi, et. el. (2017), Edible film can be added to or used in place of the outer layer to keep food from losing its water contentand to regulate the emission of gases including ethylene, CO_2, and O_2.

Table 4 also shows that the moisture content decreased with the length of storage. Itis suspected that the ongoing process of evaporation and transpiration causes the water content in tomato fruit to decrease.

Shelf Life

After harvesting, tomato fruits still carry out metabolic processes, such as respiration using

food reserves contained in the fruit. As a result of this metabolic process, the food reserves in the fruit will continue to decrease and cannot be replaced because the fruit has separated from the tree. The ongoing metabolic process in tomato fruit will accelerate the loss of nutritional value of the fruit and accelerate the ripening process.

Efforts made to inhibit the metabolic process of tomato fruit include cold storage, packaging in plastic and coating with edible coatings. The purpose of these efforts is to extend the shelf life of tomato fruit.

The outcomes demonstrated a statistically significant difference in tomato fruit's shelflife between tomato fruit covered with Aloevera gel and tomato fruit that was not. Tomato fruit had an average shelf life of 15.25 to 18.25 days.

Table 5. Shelf-life Analysis Results

No.	Treatment	Shelf Life (days)
1	A (control)	15,25a
2	B (20%)	16,50b
3	C (40%)	16,50b
4	D (60%)	16,50b
5	E (80%)	17,50c
6	F (100%)	18,25c
Description	Mean numbers accompanied by the same letters in the column indicate that they are not significantly different based onthe Duncan Multiple Range Test	

Tomato fruit without any Aloevera gel coating had the lowest average shelf life, whereas tomato fruit coated with Aloevera gel at concentrations of 80% and 100% had the highest shelf life. The relatively low shelf life of tomato fruit not coated with Aloevera gel is thought to be because in uncoated fruit the respiration process runs relatively faster than respiration in tomato fruit coated with Aloevera gel. Kalsum, et al. (2018) stated that coatingis done by providing a layer on the surface of the fruit. Coating helps in inhibiting the processof respiration and transpiration so that it can slow down damage such as decay in tomato fruit.

Utama & Antara (2013) *in* Wulandari, et al, (2022) mentioned that the respiration ratein climacteric fruit will increase when the fruit begins to enter the ripening phase. When respiration increases, ethylene production will also increase. The presence of ethylene makesthe ripening

process faster and the shelf life of tomato fruit becomes short, while theimpactof ethylene is to change the color of tomatoes from green to red through the mechanism of chlorophyll degradation. Furthermore, according to Widyastuti, (2014) *in* Kusumawati et al. (2018) edible coating Aloevera can maintain quality and extend the shelf life of cucumber fruit for 9 days

CONCLUSIONS

Different concentrations of Aloevera extract gave differences in weight loss, total soluble solids content, vitamin C content, water content and shelf life of tomato fruit. Tomatoes that are not coated with Aloevera extract produce the highest weight loss and vitamin C content. The longest average shelf life of tomato fruit was obtained in the treatment of Aloevera extract concentrations of 80% and 100% with an averages helf life of 17.50 and 18.25 days, respectively.

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