FRUIT QUALITY PERFORMANCE AND SHELF LIFE OF TOMATO USING DIFFERENT LEVELS OF POTASSIUM ALUMINUM SULFATE

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DEDICATION

We wholeheartedly dedicate this fruition of work to the almighty god for his guidance, love, and spiritual support throughout the course of the paper. To my loving parents, Benita M. Maldepeña for the unyielding support to believe in my abilities as a student and as a son. Also, to my friends that gave me strength, touches of laughter, and support to keep on fighting.

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ABSTRACT

MALDEPEÑA, JAMES FRANCIS & ELLORIN, HENRY JR. 2025. <u>FRUIT QUALITY PERFORMANCE AND SHELF LIFE OF TOMATO USING DIFFERENT LEVELS OF POTASSIUM ALUMINUM SULFATE.</u> Thesis. College of Agriculture and Forestry, Misamis University – H.T. Feliciano St., Aguada, Ozamiz City, Misamis Occidental

This study investigated the effect of Potassium Aluminum Sulfate ($KAl(SO_4)_2$), commonly known as Tawas, on the shelf life and quality of tomatoes (Solanum lycopersicum L.) under ambient conditions (20–25 °C, 85–90% RH). A Completely Randomized Design (CRD) was employed with four treatments: T1 (control), T2 (25 g/L), T3 (50 g/L), and T4 (75 g/L), each replicated four times. Tomatoes were immersed in respective solutions for 25 minutes and observed over 21 days. Parameters assessed included decay percentage, weight loss, color development, and sensory attributes (appearance, aroma, texture). Results revealed that higher concentrations of potassium alum effectively reduced decay, with T4 (75 g/L) showing the lowest total decay (12.96%) compared to the control (21.82%). Weight loss analysis indicated that T3 (50 g/L) minimized moisture loss during the early storage period, while T2 (25 g/L) performed better in long-term storage. Color development was initially delayed by alum treatments but accelerated after 14 days, with T4 reaching the highest color score (4.92) by Day 21. ANOVA results indicated no significant difference ($p > 0.05$) among treatments for appearance, aroma, and texture. Findings suggest that potassium alum can extend tomato shelf life and reduce postharvest losses without compromising sensory quality. However, proper concentration is essential to optimize preservation efficiency.

Keywords ANOVA, Color development, Decay Percentage Ethylene decay, Moisture Loss

Chapter I

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is one of the most widely cultivated and consumed vegetable crops worldwide, valued for its nutritional benefits, versatility, and distinctive flavor. It ranks as the third most important vegetable crop globally and plays a significant role in the agricultural economy of many nations (Banjo & Nzei, 2022). Despite its economic and nutritional importance, tomatoes are highly perishable and prone to rapid deterioration after harvest due to physiological, biochemical, and microbial factors. In developing countries such as the Philippines, post-harvest losses of tomatoes are estimated at 45–60%, resulting in substantial economic setbacks and food security concerns (Wokoma, 2010).

Traditional methods of prolonging shelf life, such as refrigeration and controlled storage, require substantial investment that is often beyond the reach of smallholder farmers (Shehata, 2021). This limitation underscores the need for low-cost, practical alternatives to slow down ripening and reduce post-harvest losses. Among emerging solutions is the application of **Potassium Aluminum Sulfate ($KAl(SO_4)_2 \cdot 12H_2O$)**, commonly known as **Tawas**, which has shown promising results in preserving quality and extending the storage life of tomatoes. Tawas is widely recognized for its astringent and antimicrobial properties, which help maintain fruit firmness, inhibit microbial growth, and reduce enzymatic activities responsible for cell wall degradation and pigment breakdown (Lawrence, 2020; Quinet, 2019).

Studies suggest that potassium alum delays the ripening process by regulating ethylene activity, a key plant hormone associated with fruit maturation (Paul & Pandey, 2011). It also exhibits antioxidative properties that minimize oxidative stress, thereby maintaining the color, texture, and nutritional quality of tomatoes for an extended period (Cervilla et al., 2007). Additionally, its antifungal and antibacterial characteristics provide protection against pathogens responsible for post-harvest spoilage (Wyenandt, 2020; Frankl, 2015). These qualities make Tawas a potential low-cost and practical solution for post-harvest management, particularly in regions with limited access to modern storage technologies.

Despite these promising attributes, the application of Tawas for tomato preservation remains underexplored, with limited research evaluating its efficacy under different storage conditions and its implications for consumer safety and market acceptance. Addressing these gaps is essential to develop sustainable preservation techniques that reduce losses, maintain product quality, and improve farmers' income. Therefore, this study investigates the potential of Potassium Aluminum Sulfate as a post-harvest treatment to prolong the quality and shelf life of tomatoes, aiming to provide an economical and environmentally friendly approach for tomato preservation.

The focus of this research is to evaluate the effectiveness of Tawas in mitigating post-harvest losses and enhancing the marketability of tomatoes.

Objectives of the Study

The main purpose of this study is to use Alum to prolong the shelf-life of the tomato. Specifically, it aims to:

1. Identify the fruit quality performance and shelf life of tomato using the different levels of potassium aluminum sulfate.
2. Determine the significant difference between the deferent level of potassium aluminum sulfate in the fruit quality performance and shelf-life of tomato.
3. Determine which of the different levels of potassium aluminum sulfate will give the higher fruit quality and longer shelf life of tomato.

Hypothesis

This study will prove the following hypothesis.

Ho: There is no significant difference between the different levels of potassium alum in the fruit quality and shelf life of tomato.

Significance of the Study

This study would be a significant endeavor in promoting good work. This study will also be beneficial to the related agri-business. Prolonging the shelf life of tomatoes contributes to food security by reducing post-harvest losses. Longer shelf life allows for better management of the tomato supply chain. It provides flexibility in distribution, reduces waste, and ensures a more consistent and reliable tomato supply for consumers. This is particularly crucial given the global demand for tomatoes as a staple ingredient in various cuisines. In that way we can prevent the high rate of damage to fruit.

Scope and Limitation

This study aims to determine the effectiveness of preserving a fruit with the use of Potassium Alum or also known as "Tawas" with a very cheap price and very useful to the farmers, focuses only in prolonging the shelf-life of a tomato. The study used an experimental method and will be conducted at Misamis University, Ozamiz City.

Definition of terms

Tomato – A fruit of the plant species Solanum lycopersicum, commonly consumed as a vegetable in various culinary dishes.

Tawas – A white crystalline substance, typically in powdered form, used mainly as a natural deodorant and antiperspirant.

Potassium Aluminum Sulfate - A chemical compound with chemical formula $KAl(SO_4)_2$.

ShelfLife - The length of time a product can be stored without deterioration occurring.

Prolonging - Refers to the act of extending or lengthening the duration or existence of something.

Post -harvest - Refers to the activities and processes that take place after crops have been harvested from the field.

Antimicrobial - Refers to substances or agents that can inhibit the growth or destroy microorganisms, including bacteria, viruses, fungi, or protozoa.

Decay percentage - Refers to the measure of the extent to which a material has undergone deterioration or breakdown over a specific period.

Firmness - A measure of the texture of the tomato. Firmness is an important quality attribute that influences consumer acceptance and is indicative of the freshness and ripeness of the fruit.

Post-Harvest Losses - The degradation in quantity and quality of tomatoes after they have been harvested. Post-harvest losses can occur due to factors like microbial spoilage, mechanical damage.

Microbial Growth - The increase in number of microorganisms, such as bacteria, yeasts, and molds, on or within the tomato.

Post-Harvest Treatment - Any process or application used after harvesting to preserve the quality and extend the shelf life of tomato.

Antimicrobial Properties - Refers to the ability of potassium aluminum sulfate to inhibit or reduce the growth of microorganisms, thereby extending the shelf life of tomatoes by preventing spoilage.

Ethylene - A natural plant hormone involved in the ripening and senescence processes of tomatoes.

Chapter II

MATERIALS AND METHODS

This chapter explains the materials and methods used in the study such as the location of the study, factors and treatment, experimental procedure, experimental layout, gathering procedure and data analysis.

Materials

The materials used in the study are tomato, Tawas, water, weighing scale, basket, were prepared.

Tomato:

Total of thirty-two kilos of Tomato, the tomato would be use are stage 2-3.

Potassium Aluminum Sulfate:

1.2 Kilograms of total, the chemical for prolonging the shelf life.

Water:

For mixing the potassium aluminum sulfate.

Digital Weighing scale:

To gather the data of initial and final weight in grams of tomato.

Basket:

Total of sixteen basket, this would be a tomato container for starting the treatment.

Methods

Location of the Study. The study was conducted at the experimental area of Misamis University Ozamiz City, at Agriculture Laboratory. The research was took place in a safe environment, such as a room. The room temperature ranges from 20°c-25°c and relative humidity (RH) level between 85% and 90%. This provided the advantage of precise over environmental factors.

Factors and Treatments. There is only one factor considered in the study: the different levels of potassium aluminum sulfate with four treatments.

The treatments are following:

Table 1. Treatment and different level of Potassium Aluminum Sulfate

Treatment	Level of Potassium Aluminum Sulfate
T1	Control
T2	25g/l potassium alum
T3	50g/l potassium alum
T4	75/l potassium alum

Experimental Design. Experimental Design was used in the study using Completely Randomized Design (CRD) with four treatments and four replications. Random numbers generated from the scientific calculator were used in distribution of each treatment by ranking from lowest to highest.

Table 2. Random, Ranks and Treatment of Experimental Design

Random Numbers	Rank	Treatment
0.810	14	T1
0.125	1	T1
0.763	11	T1
0.418	6	T1
0.922	15	T2
0.435	8	T2
0.265	4	T2
0.923	16	T2
0.768	12	T3
0.224	3	T3
0.368	5	T3
0.423	7	T3
0.129	2	T4
0.572	10	T4
0.793	13	T4
0.561	9	T4

Figure 1. *Experimental Layout*

Preparation of Tomatoes. Thirty-two kilos of tomato were purchased from the same bunch and same source in Ozamiz City. It was transported to Misamis University on the experimental site. The tomato was purchased in stage 1-2 was showing a definite change in color from green to breaker with no damage.

Preparation of Potassium Aluminum Sulfate. One kilo and two hundred grams of unflavored Potassium Aluminum Sulfate powder were purchased in Annex, Ozamis City.

Experimental Procedure.Thirty-two kilos of tomato were used, using a weighing scale. The following solutions were prepared. Each treatment had different levels of potassium alum (25g/l, 50g/l, 75g/l and control). Treatment 1, composed of 8 kilos of tomato as the control only wash with tap water. Treatment 2, 8kilos of tomato will be immersed in 25g/l solution of Potassium aluminum sulfate for 25minutes. Treatment 3, 8kilos of tomato was immersed in 50g/l Potassium aluminum sulfate in 25 minutes. Treatment 4, 8kilo of tomato was immersed in 75g/l Potassium aluminum sulfate in 25minutes. Place the tomato in the basket once it has been submerged. The observation in 21days and every 7days thereafter.

Data Gathering Procedure.To obtain accurate results, observation will be done daily after treating potassium aluminum sulfate.

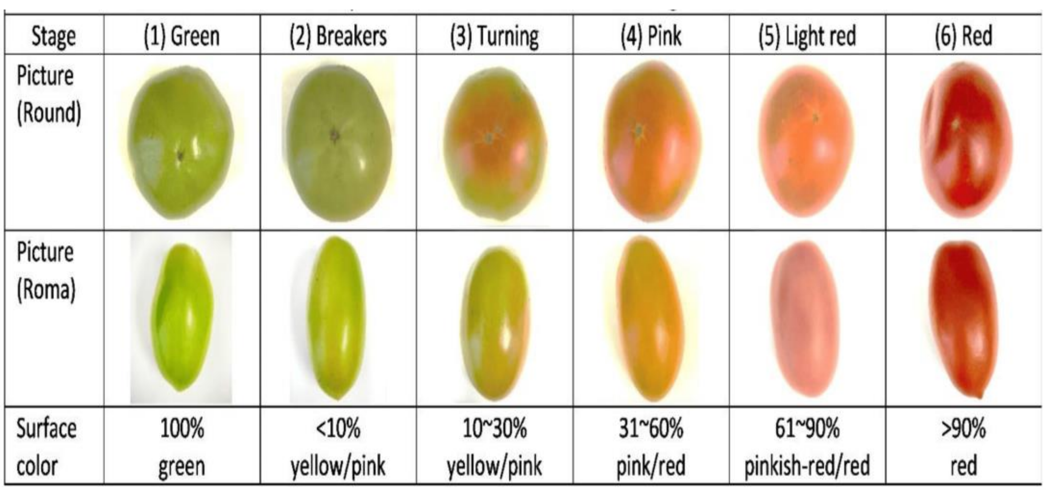
The following data will be needed to support the claims in this study are as follows:

A. Fruit Quality

1. Color of tomato per treatment during the 1st day, 7, 14, and 21 days.

Any changes in color of tomato will be the transition from green to red. Using a standardized color chart to ensure consistency in the observations.

Tomato color chart:



Stage	(1) Green	(2) Breakers	(3) Turning	(4) Pink	(5) Light red	(6) Red
Picture (Round)						
Picture (Roma)						
Surface color	100% green	<10% yellow/pink	10~30% yellow/pink	31~60% pink/red	61~90% pinkish-red/red	>90% red

Figure 1. Stages of Tomato Color Chart

2. Overall Skin Quality of tomato per treatmentduring1st, 7, 14, and 21 days.

To collect the data, a number of samples will be used in visual inspection and sensory to assign quality scores based on predefined criteria. This may include factors such as appearance, aroma and texture are typically considered in determining the overall quality score. The scale scores will be from 1 to 5 scores.

Overall fruit quality scale scores:

Very poor (1) – Tomatoes are severely damaged, with extensive bruising, mold, or decay. They are unmarketable and unfit for consumption.

Poor (2) – Tomatoes have noticeable defects or damage, such as moderate bruising or slight mold spots. They are still unmarketable and may not meet consumer expectations.

Fair (3) – Tomatoes are generally with minor imperfections. They are suitable for some consumer but may not meet market standards.

Good (4) - Tomatoes are visually appealing with few imperfections. They meet consumer expectations.

Excellent (5) - Tomatoes are near-perfect with no visible defects. They are highly desirable and meet premium market standards.

B. Shelf Life

3. Decay Percentage of tomato per treatment during the 1, 7, 14 and 21 days.

To determine the decay tomato, Tomatoes that show signs of decay or spoilage based on inspection. This includes tomatoes that are visibly moldy, excessively soft, or have strong off-odors. Lower decay percentages as indicators of treatments effectively reducing spoilage and extending tomato shelf life.

Decay Percentage Calculation:

$$PM\% = \left(\frac{Numbers\ of\ decay\ Tomatoes}{\text{Total Number of Tomatoes}}\right) \text{x}100$$

4. Weight loss of tomatoes per treatment during 7,14 21 day.

To assess the impact of deferent level of potassium aluminum sulfate on the quality and shelf life of tomatoes. The experiment involved treating tomatoes with different level of potassium aluminum sulfate and monitoring weight loss over a 21-days.

The formula for weight loss will be follows:

Initial weight (Wi) – Weight the sample before the process.

Final Weight (Wf) - Weight of the sample after the process is complete.

WLgrams= Wi-Wf

$$WL\% = \left(\frac{WLgrams}{\text{Wi}}\right) \text{x}100$$

Statistical Analysis. Using one way ANOVA to assess the differences in tomato quality among different treatments. The ANOVA test will provide an F-statistic and a p-value. A low p-value (typically less than 0.05) indicates that there are significant differences among the groups. If ANOVA indicates significant differences, post-hoc tests (Tukey's) can be performed to identify which specific groups differ from each other.

CHAPTER III

RESULTS AND DISCUSSION

A. Moisture Content of Tomatoes Under Four Potassium Aluminum Sulfate Treatments

Table 3. Moisture Content Reduction (g) of Tomatoes Under Four Potassium Aluminum Sulfate [$KAl(SO_4)_2$] Treatments Measured at 7-Day Intervals

Treatments	Initial Weight D1(g)	Weight in D7(g)	Weight in D14(g)	Weight in D21(g)
T1 (Control)	7,589	7,179	6,927	6,478
T2 (25%) KAl(SO4)2	7,453	6,893	6,754.	6,480
T3 (50% KAl(SO4)2	7,689	7,436	7,075	6,600
T4 (75%) KAl(SO4)2	7,500	7,068	6,808	6,341

Table 3. reveals significant differences in weight retention among treatments with varying concentrations of potassium aluminum sulfate [$KAl(SO_4)_2$]. The control (T1) exhibited the highest weight loss, with samples decreasing to 85.36% of their initial weight after 21 days. Treatments with alum generally slowed down weight loss. At 25% alum (T2), samples retained 86.94% of their initial weight, while the 50% alum treatment (T3) resulted in the highest retention at 85.86%. In contrast, the 75% alum treatment (T4) performed less effectively, with samples retaining only 84.55% of their initial weight. Although weight loss was reduced by alum application, the differences among treatments suggest a nonlinear

response, where moderate alum concentration (50%) was more effective than both lower (25%) and higher (75%) levels. This indicates that alum concentration influences preservation efficacy, but increasing concentration beyond an optimal point may not yield additional benefits and could even accelerate degradation.

A. Color of Tomatoes in Different Treatments at 7 days interval

Table 4.Annova Result of Color of Tomatoes in Different Treatments at Day-1

				Sum of Squares	df	Mean Square	F	Sig.
meanD1 T2	Between Groups	(Combined)		.336	4	.084	.946	.454
		Linear Term	Unweighted	.065	1	.065	.736	.399
			Weighted	.086	1	.086	.965	.335
			Deviation	.251	3	.084	.939	.437
	Within Groups			2.224	25	.089		
	Total			2.256	29			
meanD1 T3	Between Groups	(Combined)		.361	4	.090	.913	.472
		Linear Term	Unweighted	.023	1	.023	.229	.637
			Weighted	.006	1	.006	.063	.804
			Deviation	.355	3	.118	1.197	.331
	Within Groups			2.474	25	.099		
	Total			2.835	29			
meanD1 T4	Between Groups	(Combined)		.297	4	.074	.260	.901
		Linear Term	Unweighted	.027	1	.027	.096	.759
			Weighted	.006	1	.006	.022	.884
			Deviation	.291	3	.097	.340	.797
	Within Groups			7.138	25	.286		
	Total			7.435	29			

Table 4 shows the results of Day 1 that the different concentrations of alum had no significant effect on the color of tomatoes. For the 25% treatment, the p-value was 0.454, which is higher than 0.05, meaning there was no noticeable difference compared to the control. The same was true for the 50% treatment (p = 0.472) and even for the higher 75% treatment (p = 0.901). Since all of these values are greater than 0.05, the differences we see in tomato color at Day 7 are not statistically significant.

This means that during the Day 1, the color of the tomatoes remained fairly similar across all treatments, and the alum concentration did not yet have a measurable impact. Any visible changes in color may need more time to develop, which could become clearer in the later days of observation.

Table 5. ANOVA Result of Color of Tomatoes in Different Treatments at Day-7

				Sum of Squares	df	Mean Square	F	Sig.
meanD7 T2	Between Groups	(Combined)		.551	5	.110	.874	.513
		Linear Term	Unweighted	.263	1	.263	2.085	.162
			Weighted	.314	1	.314	2.494	.127
			Deviation	.237	4	.059	.469	.758
	Within Groups			3.024	24	.126		
	Total			3.575	29			
meanD7 T3	Between Groups	(Combined)		.180	5	.036	.337	.886
		Linear Term	Unweighted	.029	1	.029	.274	.605
			Weighted	.009	1	.009	.080	.780
			Deviation	.172	4	.043	.401	.806
	Within Groups			2.570	24	.107		
	Total			2.750	29			
meanD7 T4	Between Groups	(Combined)		.465	5	.093	.883	.508
		Linear Term	Unweighted	.078	1	.078	.744	.397
			Weighted	.105	1	.105	1.000	.327
			Deviation	.359	4	.090	.853	.506
	Within Groups			2.527	24	.105		
	Total			2.992	29			

Table 5 shows that on Day 7, the different concentrations of alum had no significant effect on the color of tomatoes. For the 25% treatment, the p-value was 0.513, which is greater than 0.05, indicating no noticeable difference compared to the control. The same result was observed for the 50% treatment (p = 0.886) and the 75% treatment (p = 0.508). Since all p-values are above 0.05, the variations in tomato color at Day 7 are not statistically significant. This suggests that during the first week, tomato color remained relatively consistent across all treatments, and alum concentration did not yet exert a measurable effect. Visible changes, if any, may require a longer period to become evident in the subsequent days of observation.

Table 6. Anova Result of Color of Tomatoes in Different Treatments at Day-14

				Sum of Squares	df	Mean Square	F	Sig.
meanD14 T2	Between Groups	(Combined)		.304	5	.061	.818	.549
		Linear Term	Unweighted	.065	1	.065	.867	.361
			Weighted	.007	1	.007	.094	.762
			Deviation	.297	4	.074	.999	.428
	Within Groups			1.787	24	.074		
	Total			2.092	29			
meanD14 T3	Between Groups	(Combined)		.838	5	.168	2.189	.089
		Linear Term	Unweighted	.015	1	.015	.199	.659
			Weighted	.040	1	.040	.518	.479
			Deviation	.798	4	.200	2.607	.061
	Within Groups			1.837	24	.077		
	Total			2.675	29			
meanD14 T4	Between Groups	(Combined)		1.011	5	.202	2.217	.086
		Linear Term	Unweighted	.061	1	.061	.669	.422
			Weighted	.033	1	.033	.362	.553
			Deviation	.978	4	.244	2.681	.056
	Within Groups			2.189	24	.091		
	Total			3.200	29			

Table 6 shows that on Day 14, the different concentrations of alum still had no significant effect on the color of the tomatoes. For the 25% treatment, the p-value was 0.549, which is greater than 0.05, indicating no noticeable difference compared to the control. The same was observed for the 50% treatment (p = 0.089) and the 75% treatment (p = 0.086). Since all these values are above 0.05, the differences in tomato color at Day 14 are not statistically significant. This suggests that by the second week, the tomatoes maintained a fairly similar color across all treatments, and the alum concentration had not yet shown a measurable impact. Any visible changes in color may require more time to develop, which could become more apparent in the later days of observation.

Table 7. ANOVA Result of Color of Tomatoes in Different Treatments at Day-21

				Sum of Squares	df	Mean Square	F	Sig.
meanD21 T2	Between Groups	(Combined)		2.156	8	.270	1.352	.273
		Linear Term	Unweighted	.586	1	.586	2.939	.101
			Weighted	.300	1	.300	1.504	.234
			Deviation	1.856	7	.265	1.331	.285
	Within Groups			4.185	21	.199		
	Total			6.342	29			
meanD21 T3	Between Groups	(Combined)		1.192	8	.149	1.242	.324
		Linear Term	Unweighted	.060	1	.060	.504	.485
			Weighted	.131	1	.131	1.088	.309
			Deviation	1.061	7	.152	1.264	.315
	Within Groups			2.519	21	.120		
	Total			3.710	29			
meanD21 T4	Between Groups	(Combined)		1.176	8	.147	.884	.546
		Linear Term	Unweighted	.414	1	.414	2.491	.129
			Weighted	.271	1	.271	1.631	.216
			Deviation	.905	7	.129	.777	.613
	Within Groups			3.493	21	.166		
	Total			4.669	29			

Table 7 shows that on Day 21, the different concentrations of alum still had no significant effect on the color of the tomatoes. For the 25% treatment, the p-value was 0.273, which is greater than 0.05, indicating no noticeable difference compared to the control. The same was true for the 50% treatment ($p = 0.324$) and the 75% treatment ($p = 0.546$). Since all these values are above 0.05, the differences in tomato color at Day 21 are not statistically significant. This suggests that by the third week, the tomatoes maintained a fairly similar color across all treatments, and the alum concentration had not yet produced a measurable impact. Any visible changes may require more time to develop, which could become more evident in the later days of observation.

Table. 8 Summary of ANOVA Result of Different Treatments of the Color of Tomatoes in 7day interval

Treatment	Day 1	Day-7	Day-14	Day-21	Overall	Interpretation
T1-Control	-	-	-	-	-	
T2(25%)KAl(SO4)2						
Df	4	5	5	8	12	
Mean of square	0.084	0.110	0.061	0.270	0.028	
F value	0.946	0.874	0.818	1.352	0.417	
P value	0.454	0.513	0.549	0.273	0.936	Not significant
T3 (50%)KAl(SO4)2						
Df	4	5	5	8	12	
Mean of square	0.090	0.036	0.168	1.149	0.019	
F value	0.913	0.337	2.189	1.242	0.752	
P value	0.474	0.886	0.089	0.324	0.936	Not significant
T4 (75%)KAl(SO4)2						
df	4	5	5	8	12	
Mean of square	0.74	0.093	0.202	0.147	0.066	
F value	0.260	0.883	2.217	0.884	4.102	
P value	0.901	0.513	0.086	0.546	0.004***	Highly significant

Table 8 summarizes the effects of different concentrations of $KAl(SO_4)_2$ on tomato color. The control group (T1) showed no changes, as expected, since it served as the baseline for comparison. At 25% concentration (T2), all observation days yielded p-values greater than 0.05, indicating no significant effect relative to the control. Similarly, the 50% concentration (T3) did not produce statistically significant results, although the p-value recorded on Day 14 (p = 0.089) came close to the threshold, suggesting a possible but inconclusive trend. In contrast, the 75% concentration (T4) demonstrated a highly significant overall effect (p = 0.004), even though significance was not consistent across individual days. These results suggest that lower concentrations of alum (25% and 50%) are insufficient to produce measurable changes, whereas a higher concentration (75%) is necessary to achieve a statistically significant impact.

B. TOMATOES QUALITY

Table 9. ANOVA Result of Tomatoes Appearance in 4 treatments at 7 days interval

		Sum of Squares	df	Mean Square	F	Sig.
MeanAP2	Between Groups	.958	6	.160	.971	.467
	Within Groups	3.783	23	.164		
	Total	4.742	29			
MeanAP3	Between Groups	1.452	6	.242	1.053	.418
	Within Groups	5.289	23	.230		
	Total	6.742	29			
MeanAP4	Between Groups	.729	6	.121	.706	.648
	Within Groups	3.956	23	.172		
	Total	4.685	29			

The ANOVA results in Table 9 show the analysis of tomato appearance across four treatments at 7-day intervals. For the three observation points (meanAP2, meanAP3, and meanAP4), the p-values (Sig.) are 0.467, 0.418, and 0.648, respectively. All these values are greater than the standard significance level of 0.05. This means that there is no statistically significant difference in tomato appearance among the treatments at any of the measured intervals.

Table 10. ANOVA Result of Tomato Aroma in 4 treatments at 7 days interval

		Sum of Squares	df	Mean Square	F	Sig.
MeanAR2	Between Groups	.579	5	.116	1.332	.284
	Within Groups	2.087	24	.087		
	Total	2.667	29			
MeanAR3	Between Groups	1.236	5	.247	1.767	.158
	Within Groups	3.356	24	.140		
	Total	4.592	29			
MeanAR4	Between Groups	1.082	5	.216	.792	.566
	Within Groups	6.554	24	.273		
	Total	7.635	29			

The ANOVA results in Table 10 evaluate the aroma of tomatoes across four treatments at three observation points (meanAR2, meanAR3, meanAR4) over 7-day intervals. The significance values (p-values) for these intervals are 0.284, 0.158, and 0.566, respectively, all of which are greater than the 0.05 threshold. This indicates that there is no statistically significant difference in tomato aroma among the treatments at any of the observation periods.

The F-values (1.332, 1.767, and 0.792) are relatively low, suggesting that the variation between treatment groups is minimal compared to the variation within groups. These findings mean that the treatments did not have a measurable effect on the aroma of the tomatoes during storage or observation periods, and any differences observed were likely due to chance or natural variability rather than the treatments applied.

This result suggests that regardless of the treatment applied, the aroma of tomatoes remained consistent across all groups throughout the evaluation period, implying that aroma stability was not influenced by the treatments under the given conditions. This could be relevant for storage or preservation practices, as it indicates that these treatments do not negatively or positively affect tomato aroma during the 7-day intervals.

Table 11. ANOVA Result of Tomato Texture in 4 treatments at 7 days interval

		Sum of Squares	df	Mean Square	F	Sig.
MeanTX2	Between Groups	1.263	7	.180	.481	.284
	Within Groups	8.247	22	.375		
	Total	9.510	29			
MeanTX3	Between Groups	2.229	7	.318	1.814	.158
	Within Groups	3.863	22	.176		
	Total	6.092	29			
MeanTX4	Between Groups	.444	7	.063	.211	.566
	Within Groups	6.600	22	.300		
	Total	7.044	29			

The ANOVA table 11 for tomato texture across four treatments at 7-day intervals shows three observation points (meanTX2, meanTX3, and meanTX4) with significance values of 0.838, 0.135, and 0.979, all of which are greater than the 0.05 significance level. This indicates that there is no statistically significant difference in texture among the treatments at any observation period.

The F-values (0.481, 1.814, and 0.211) are very low, meaning the variability between treatments is small compared to the variability within groups. This implies that the treatments applied did not cause a notable change in tomato texture during the evaluation periods.

Table 12. ANOVA Summary of Result of Tomato Quality in 4 treatments in 21 days

Treatment	Day 1	Day-7	Day-14	Day-21	Interpretation
T1-Control	-	-	-	-	
T2(25%)KAl(SO4)2					
Df	*9*	*8*	*11*	*10*	
Mean of square	*0.41*	*0.273*	*0.028*	*0.06*	
F value	*1.59*	*2.801*	*0.953*	*0.604*	
P value	*0.187*	*0.028*	*0.517*	*0.792*	*Not significant*
T3 (50%)KAl(SO4)2					
Df	*9*	*8*	*11*	*10*	
Mean of square	*0.042*	*.,035*	*0.041*	*0.077*	
F value	*0.822*	*0.807*	*1.189*	*0.955*	
P value	*0.603*	*0.604*	*0.36*	*0.51*	*Not significant*
T4 (75%)KAl(SO4)2					
df	*9*	*8*	*11*	*10*	
Mean of square	*0.011*	*0.019*	*0.06*	*0.061*	
F value	*0.255*	*0.531*	*1.423*	*0.428*	
P value	*0.187*	*0.82*	*0.244*	*0.909*	*Not significant*

Table 12. The results of the ANOVA revealed that most treatments of $KAl(SO_4)_2$ did not significantly affect tomato color quality across the observation period. At 25% concentration (T2),

a significant effect was observed only on Day 7 ($p = 0.028$), suggesting a short-term influence during the first week. However, this effect was not sustained, as the following observation days (Day 14 and Day 21) showed no significant differences compared to the control. The 50% (T3) and 75% (T4) concentrations consistently showed no significant effects at any observation day, with all p-values exceeding 0.05. Overall, the analysis indicates that alum treatments, regardless of concentration, did not produce consistent or lasting improvements in tomato quality, and the temporary effect seen at 25% concentration on Day 7 was not strong enough to establish a clear trend. This suggests that the different treatments applied did not produce noticeable or measurable changes in tomato appearance over time, and any minor differences observed are likely due to random variation rather than the treatments themselves.

In contrast Alum is known to influence enzymatic activities, oxidative processes, and cell membrane integrity. These interactions play a pivotal role in regulating physiological changes within the tomato, contributing to an extended shelf life and improved quality. (Amandi O, 2020). Additionally, the Potassium Aluminum Sulfate's role in tomato preservation is its impact on quality enhancement. Studies suggest that alum application can lead to improved color retention, reduced microbial contamination, and enhanced firmness, ultimately contributing to an overall better visual and sensory experience for consumers (Zhen, 2019). While acknowledging the positive contributions of Potassium Aluminum Sulfate, it is essential to address environmental considerations associated with its use. Balancing the benefits against potential environmental impacts is crucial for sustainable agricultural practices. Ongoing research explores methods to optimize alum application while minimizing any adverse effects on the ecosystem. (Eunice J, 2020).

CHAPTER IV

SUMMARY, CONCLUSION AND RECOMMENDATION

SUMMARY

All treatments showed progressive decay over the 21-day storage period; however, the application of potassium alum significantly reduced spoilage compared to the control. The highest concentration, T4 (75 g/L), recorded the lowest decay rate at 12.96%, followed by T3 (50 g/L) with 15.12% and T2 (25 g/L) with 19.50%, while the untreated control had the highest decay percentage at 21.82%. In terms of weight loss, T3 minimized moisture loss during the first 14 days of storage, whereas T2 performed better after 21 days, suggesting that moderate concentrations favor short-term storage while lower concentrations are more suitable for extended storage. Regarding color development, alum treatments initially delayed ripening but resulted in improved color scores by Day 21, with a p value of 0.004 significant. For quality, ANOVA results indicated no significant differences ($p > 0.05$) among treatments in appearance, aroma, and texture, showing that potassium alum does not negatively affect these attributes. Overall, potassium alum treatments, particularly at concentrations of 50–75 g/L, proved effective in prolonging tomato shelf life and reducing decay without compromising quality.

CONCLUSION

The application of Potassium Aluminum Sulfate (Tawas) significantly reduced decay and weight loss in tomatoes during a 21-day storage period, with higher concentrations (50–75 g/L) demonstrating superior preservation efficiency. While alum treatments delayed initial ripening, they promoted desirable color development at later stages without negatively affecting appearance, aroma, or texture. These findings confirm that potassium alum is an effective, low-cost alternative for extending tomato shelf life, especially in regions lacking modern storage facilities. However, proper concentration is crucial, as excessive alum may accelerate moisture loss over extended storage.

RECOMMENDATION

1. Based on the results, 50 g/L potassium alum is recommended for short- to medium-term storage, while 25 g/L may be more suitable for long-term preservation.
2. Encourage smallholder farmers to adopt potassium alum treatment as a low-cost method for reducing postharvest losses and improving tomato marketability.
3. Future Research:Conduct microbial analysis to validate alum's antimicrobial efficacy and explore consumer perception and market acceptance of alum-treated tomatoes..
4. Develop standard operating procedures (SOPs) for alum-based tomato preservation that can be scaled for local markets and supply chains.

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APPENDICES

APPENDIX A.

Photo Documentation

1. Preparing and weighing the tomatoes.

2. Weighing the potassium aluminum sulfate.

3. Submerging the tomatoes in the water and add the aluminum sulfate for it to mix together.

4. Setting up the experiment to the original experimental layout.

APPENDIX B.

Grammarly Result

APPENDIX C.
Turnitin Result

APPENDIC D
CURRICULUM VITAE

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