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IMPACT OF OIL-BASED COATINGS ON THE SHELF LIFE OF TOMATO FRUIT (*SOLANUM LYCOPERSICUM* L.)

Abhishek Rai and Dashrath Bhati*

Department of Horticulture, School of Agriculture, ITM University Gwalior, Gwalior - 474 001 (Madhya Pradesh), India.

*Corresponding author E-mail : bhati.dashrath.1@gmail.com

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ABSTRACT

Tomatoes (*Solanum lycopersicum* L.) are susceptible to rapid deterioration post-harvest due to physiological changes and microbial activity. The present study aimed to study the effect of selected oil-based coating on the postharvest quality and shelf life of tomatoes. The experiment was conducted under ambient conditions. The unconventional oil-based coatings were applied on the tomatoes and treatments were as follows control (T_0); marigold flower extract (T_1); neem oil (T_2), mint oil (T_3), tulsi oil (T_4) and Castor oil (T_5). The coated tomatoes were stored for 12 days and physical and biochemical parameters were. Parameters such as weight loss, firmness, decay percentage, total soluble solids (TSS), titratable acidity, and ascorbic acid content were recorded at 0 day; 3rd day; 9th day and 12th days. Results indicate significant differences among treatments in preserving tomato quality. Mint oil treatment (T_3) consistently demonstrated superior performance, maintaining lower weight loss (3.49 g), higher firmness (5.39 kg/cm²), and reduced decay percentage (2.20% at day 3) compared to other treatments and the control. Moreover, tomatoes treated with Mint oil exhibited enhanced TSS content (8.45°Brix on day 12) and preserved ascorbic acid levels (19.11 mg/100g on day 12), indicating improved nutritional quality over time. The findings suggest that Mint oil's antimicrobial and antioxidant properties played a crucial role in delaying physiological changes and preserving fruit quality.

Key words : Shelf life, Quality enhancement, Storage, Coating, Preservation.

Introduction

Tomato (*Solanum lycopersicum* L.), a prominent member of the Solanaceae family, is one of the most economically important and widely cultivated vegetable crops worldwide, with a production volume exceeding 180 million metric tons globally (FAO, 2022). In India, tomatoes occupy a critical position in horticultural production systems, covering an estimated 818 thousand hectares and yielding approximately 20,550 thousand metric tons annually, as documented in the Horticultural Statistics at a Glance (2019–20). Specifically, Madhya Pradesh contributes significantly to national production, cultivating tomatoes on 86.53 thousand hectares and producing 2,478.30 thousand metric tons. The crop's widespread cultivation is attributed to its adaptability to diverse agro-climatic conditions, short production cycles,

and high consumer demand.

Tomatoes are recognized for their nutritional richness and health-promoting phytochemicals. The fruits are excellent sources of vitamin C (ascorbic acid), vitamin A (as β -carotene), potassium and dietary fiber, as well as bioactive secondary metabolites including lycopene, phenolics, and flavonoids (García-Hernández *et al.*, 2021). Lycopene, in particular, is a carotenoid pigment with well-documented antioxidant properties that have been associated with reduced risks of chronic degenerative diseases such as cardiovascular disorders, prostate cancer, and macular degeneration (Martínez-Valdivieso *et al.*, 2020). From a nutritional standpoint, 100 grams of ripe tomato provides approximately 20–25 kcal energy, 15–20 mg vitamin C and 1–2 mg lycopene, contributing substantially to daily dietary antioxidant intake.

The pulp and juice are also valued for their digestive benefits, enhancing gastric secretion and functioning as mild intestinal antiseptics, while traditional systems of medicine have documented their use in managing digestive and circulatory ailments.

Despite their high nutritive and commercial value, tomatoes are among the most perishable horticultural commodities due to their climacteric respiration pattern and delicate texture. Postharvest deterioration begins immediately after harvest and is driven by a combination of physiological, biochemical and microbiological processes that affect the appearance, firmness, flavour, and nutritional quality of the fruits (Hasan *et al.*, 2023). Transpiration leads to rapid moisture loss, while respiration results in the depletion of carbohydrate reserves and heat accumulation, accelerating senescence. Additionally, mechanical injuries sustained during harvesting, grading, or transport create entry points for opportunistic pathogens, further compromising fruit integrity. It is estimated that postharvest losses in tomato production systems in developing countries can reach 25–40%, representing substantial economic losses and reduced availability of nutritious food (Kader, 2005; FAO, 2022).

Efforts to mitigate these losses and extend the shelf life of tomatoes have focused on optimizing harvesting practices, temperature and humidity management, and packaging innovations. Refrigeration is commonly employed to slow metabolic processes; however, tomatoes are highly susceptible to chilling injury when stored below 10–12 °C, manifesting as surface pitting, uneven ripening, and increased decay incidence (Zhu *et al.*, 2021). Consequently, there is a growing need to develop postharvest interventions that can maintain fruit quality under ambient or moderately cool storage conditions without relying exclusively on low temperatures or synthetic chemical treatments.

Among innovative postharvest technologies, the application of edible coatings has gained prominence as a promising and sustainable strategy to preserve freshness and prolong shelf life. Edible coatings are thin layers of edible materials applied to the surface of fruits and vegetables, forming semi-permeable films that modify the internal atmosphere by reducing gas exchange, respiration rate, and water vapor transmission (Dhall, 2013). These coatings can delay ripening, reduce oxidative reactions, and limit microbial proliferation while maintaining visual and sensory attributes. Biopolymers commonly used in edible coating formulations include polysaccharides (e.g., chitosan, alginate, pectin), proteins (e.g., casein, whey protein) and lipids (e.g., beeswax, carnauba wax), which

can be used alone or in combination to optimize functional properties (Guerra *et al.*, 2021).

Recent research has demonstrated that integrating plant-derived bioactive compounds such as essential oils into edible coatings can further enhance their preservative efficacy. Essential oils are complex mixtures of volatile terpenoids and aromatic compounds extracted from various parts of plants, exhibiting potent antimicrobial, antioxidant, and antifungal activities (Burt, 2004). Among the essential oils evaluated for postharvest preservation, mint (*Mentha* spp.), neem (*Azadirachta indica*) and merigold flower extracts have shown particularly promising results. For example, mint oil contains menthol and menthone, which disrupt microbial cell membranes and inhibit spoilage organisms (Hasan *et al.*, 2023). Neem oil is rich in azadirachtin and other limonoids with broad-spectrum antifungal and insect-repellent activity (Verma *et al.*, 2022). Moringa leaf extract, in addition to its antimicrobial action, provides antioxidants that delay oxidative deterioration and maintain nutritional quality (García-Hernández *et al.*, 2021).

The application of essential oil-based edible coatings creates a synergistic barrier effect that controls water loss, suppresses microbial growth and delays the progression of senescence-associated physiological changes. Ramos-Grajales *et al.* (2020) reported that tomatoes coated with alginate films enriched with oregano and thyme essential oils exhibited significantly lower respiration rates and microbial counts during storage. Similarly, Guerra *et al.* (2021) demonstrated that essential oil-incorporated chitosan coatings effectively maintained firmness, color, and ascorbic acid content while reducing decay incidence in various fresh produce. These findings align with the broader trend of integrating natural bioactive compounds into postharvest treatments to meet consumer preferences for residue-free and minimally processed fruits.

Besides prolonging shelf life, the adoption of natural edible coatings can contribute to sustainability by reducing reliance on synthetic fungicides and preservatives, which often pose environmental and regulatory challenges. In India and other developing countries, such innovations hold particular promise for small-scale producers and supply chain actors, who face infrastructural constraints that limit access to cold storage and controlled atmosphere facilities. By enabling longer storage and marketing windows under ambient conditions, edible coatings can help reduce food losses, increase profitability, and improve the livelihoods of farming communities (Kader, 2005; Hasan *et al.*, 2023).

Nevertheless, successful implementation of these technologies requires a nuanced understanding of the interactions between coating formulations, essential oil concentrations, application methods, and the physiological responses of the fruit. Excessive concentrations of essential oils may lead to undesirable sensory impacts, while suboptimal coating properties can impair gas exchange or promote anaerobic respiration. Therefore, research efforts continue to focus on optimizing formulations that balance antimicrobial efficacy, film integrity and sensory acceptance.

In this context, the present study was undertaken to evaluate the comparative effectiveness of selected natural treatments—including mint oil, neem oil, and moringa leaf extract—in maintaining the postharvest quality and extending the shelf life of tomato fruits. The study aims to contribute to the growing body of evidence supporting natural preservation strategies and to provide practical recommendations for producers and supply chain actors seeking cost-effective and sustainable approaches to reduce postharvest losses.

Materials and Methods

The present investigation was conducted during the academic year 2023–2024 in the Postgraduate Laboratory of the Department of Horticulture, School of Agriculture, ITM University, Gwalior, Madhya Pradesh, India. The experimental site is situated at 26.2124°N latitude and 78.1772°E longitude with an elevation of 478 meters above mean sea level. The region experiences a semi-arid to subtropical climate, characterized by extremely hot summers and cold winters. The average annual rainfall is approximately 700 mm, mostly received between July and September. The experiment was designed to assess the effect of various natural oil-based coatings on the shelf life and postharvest quality of tomato (*Solanum lycopersicum* L.) stored under ambient conditions.

Freshly harvested, healthy, and physiologically mature tomato fruits of uniform size and shape were procured from the local vegetable market in Gwalior. All fruits were visually inspected to ensure freedom from mechanical injury, blemishes, and microbial infections. The selected tomatoes were washed thoroughly with tap water to remove surface dirt and air-dried under shade before the coating application. The experiment was laid out in a Completely Randomized Design (CRD) comprising six treatments and three replications. Each treatment consisted of 75 fruits and the treatments were: T₀ (Control – no coating), T₁ (100% marigold flower extract), T₂ (100% neem oil), T₃ (100% mint oil), T₄ (100% tulsi oil) and T₅ (100% castor oil).

The preparation of marigold flower extract involved collecting fresh marigold petals, which were then cleaned to remove dust and debris. A total of 300 grams of petals were crushed using a mortar and pestle along with a small amount of acetone, which acted as a solvent to extract the bioactive compounds effectively. The mixture was filtered using muslin cloth followed by Whatman filter paper to obtain a concentrated extract. The final volume of marigold extract used for the coating was approximately 100 ml. The neem, mint, tulsi, and castor oils were procured in their pure commercial form from certified organic suppliers and were used without further dilution or modification to retain their natural bioactive potency.

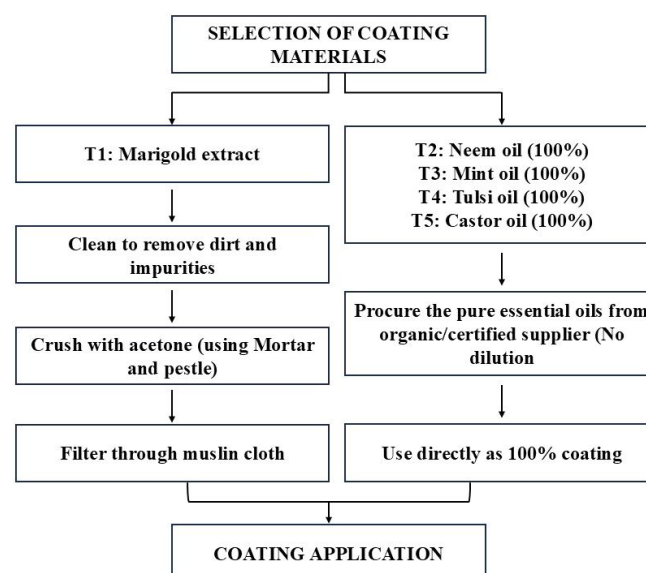


Fig. 1 : Flowchart of preparation and application of coating material.

Prior to coating application, the sorted tomatoes were randomly grouped and assigned to their respective treatments. The fruits were dipped individually in the respective coating solutions for one minute to ensure uniform coverage. The dipping was done at room temperature, and the fruits were allowed to air dry using a high-speed fan until the coatings formed a visible film over the surface. Once dried, the coated tomatoes were placed in clean, labeled paper cartons and stored under ambient laboratory conditions maintained at approximately $25 \pm 2^\circ\text{C}$ temperature and $55 \pm 5\%$ relative humidity for 12 days.

Observations were recorded on day 0 and at 3-day intervals thereafter—on days 3, 6, 9 and 12 of storage. At each observation point, a representative sample of 10 fruits from each replication was selected for analysis. The evaluation involved both physical and biochemical quality parameters.

The physical attributes measured included fruit weight, polar and equatorial diameters, weight loss, firmness, and decay percentage. Fruit weight was recorded using an electronic balance and diameters were measured using a digital Vernier caliper. Firmness was assessed with the help of a digital fruit firmness tester fitted with a flat-ended 8 mm probe. For decay assessment, fruits were visually examined for signs of spoilage, such as rotting or microbial growth and the extent of decay was expressed as a percentage of the total fruits sampled.

The biochemical parameters analysed included total soluble solids (TSS), titratable acidity, pH, ascorbic acid content, and moisture percentage. TSS was determined using a hand refractometer and expressed in degrees Brix. Titratable acidity and ascorbic acid content were estimated by standard titration methods as per AOAC (1970). Fruit pH was measured using a calibrated digital pH meter. Moisture content was estimated by drying homogenized pulp samples in a hot air oven at a constant temperature until a stable weight was achieved.

The fruit pulp required for biochemical analysis was prepared by homogenizing the tomato samples using a blender. All parameters were measured in triplicate for accuracy and reliability. Both control and treated fruits were subjected to the same measurement protocols to ensure uniformity in data collection.

All the data generated were statistically analysed using analysis of variance (ANOVA) appropriate for a Completely Randomized Design. The treatment means were compared using the critical difference at the 5% level of significance. This methodological framework allowed for the comprehensive evaluation of the effects of different oil-based coatings on the physicochemical and sensory quality of tomatoes stored under ambient conditions.

Results and Discussion

Effect of different oil-based coatings on the physical parameters of tomato

The results revealed that all treatments significantly influenced the postharvest shelf life of tomato fruits over the 12-day storage period. The untreated control exhibited the highest cumulative weight loss, decreasing from 39.3 g on day 0 to 31.56 g on day 12, indicating pronounced moisture loss and faster deterioration. In contrast, fruits treated with

mint oil retained the highest weight, followed closely by neem oil and marigold flower extract, suggesting that these natural treatments effectively reduced transpiration and respiration losses and delayed senescence. The progressive reduction in polar and equatorial diameters was similarly observed across treatments, with control fruits showing the greatest shrinkage and loss of turgor pressure, while mint oil and neem oil treatments minimized dimensional reduction and preserved firmness more effectively. These observations are consistent with earlier findings by Dhall (2013) and recent studies by Guerra *et al.* (2021) and Ramos-Grajales *et al.* (2020), which demonstrated that essential oils and plant-based coatings form semi-permeable barriers that modulate internal gas exchange, inhibit microbial proliferation, and maintain fruit quality during storage. The superior performance of mint oil may be attributed to its potent antimicrobial and

Table 1 : Effect of different oil-based coatings on fruit weight (g), equatorial and polar diameter (cm) of tomato.

Weight loss (%)					
Treatments	0 Day	3 Day	9 Day	12 Day	
Control (T ₀)	0.00	7.48	18.09	19.70	
Marigold Flower Extract (T ₁)	0.00	4.88	8.23	10.99	
Neem Oil (T ₂)	0.00	4.29	9.05	10.44	
Mint Oil (T ₃)	0.00	4.76	7.36	8.03	
Tulsi Oil (T ₄)	0.00	3.30	12.03	12.64	
Castor Oil (T ₅)	0.00	1.60	7.44	9.97	
CD (0.05)	-	0.58	0.67	1.09	
S.Em (±)	-	0.19	0.22	0.35	
Equatorial diameter (cm)					
Treatments	0 Day	3 Day	6 Day	9 Day	12 Day
T ₀ : Control	5.16	4.96	4.9	4.84	4.08
T ₁ : Marigold flower extract	5.29	5.15	5.05	4.98	4.89
T ₂ : Neem oil	5.3	5.19	5.12	5.07	4.91
T ₃ : Mint oil	5.31	5.25	5.19	5.1	5.01
T ₄ : Tulsi oil	5.29	5.17	5.1	5.04	4.87
T ₅ : Castor oil	5.3	5.18	5.11	5.05	4.9
CD (0.05)	NS	0.17	0.23	0.15	0.44
S.Em (±)	0.06	0.06	0.08	0.05	0.14
Polar diameter (cm)					
Treatments	0 Day	3 Day	6 Day	9 Day	12 Day
T ₀ : Control	4.99	4.84	4.78	4.75	4.68
T ₁ : Marigold flower extract	5.04	4.85	4.83	4.8	4.74
T ₂ : Neem oil	5.11	4.93	4.87	4.83	4.74
T ₃ : Mint oil	5.18	5.14	4.99	4.94	4.87
T ₄ : Tulsi oil	5.05	4.94	4.83	4.77	4.72
T ₅ : Castor oil	5.09	4.91	4.81	4.72	4.7
CD (0.05)	NS	0.2	0.17	0.12	0.1
S.Em (±)	0.05	0.06	0.07	0.04	0.03

Table 2 : Effect of different oil-based coatings on weight loss, firmness, and decay or spoilage % of tomato.

Treatments	Weight loss (g)				Fruit firmness (kg/cm ²)					Decay %			
	3 day	6 day	9 day	12 day	0 day	3 day	6 day	9 day	12 day	3 day	6 day	9 day	12 day
T ₀ : Control	2.94	4.85	7.11	7.74	5.26	4.68	4.38	4.06	3.81	3.43	4.95	6.17	9.99
T ₁ : Marigold flower extract	2.07	3.05	3.49	4.66	5.45	4.74	4.48	4.12	3.99	2.53	3.27	5.27	8.04
T ₂ : Neem oil	1.85	2.98	3.9	4.5	5.33	4.79	4.52	4.17	4.01	2.5	3.19	5.24	7.46
T ₃ : Mint oil	2.07	2.77	3.2	3.49	5.39	4.82	4.31	4.2	4.12	2.2	3.05	5.17	7.32
T ₄ : Tulsi oil	1.4	3.2	5.11	5.37	5.37	4.73	4.46	4.11	3.98	2.6	4.06	5.34	8.17
T ₅ : Castrol oil	0.67	2.21	3.11	4.17	5.19	4.71	4.38	4.12	3.9	2.73	4.13	5.47	8.23
CD (0.05)	0.58	1.77	2.67	3.09	NS	0.2	0.23	0.26	0.24	0.62	0.81	0.77	1.82
S.Em (±)	0.19	0.27	0.22	0.35	0.07	0.17	0.19	0.23	0.18	0.2	0.31	0.25	0.59

antioxidant properties, as highlighted by Hasan *et al.* (2023), who reported that mint and neem essential oils significantly extend the shelf life of tomatoes by reducing microbial spoilage and delaying oxidative processes. Furthermore, the effectiveness of Merigold flower extract aligns with the findings of Verma *et al.* (2022), who showed that Merigold flower extract treatments can help maintain cellular integrity and slow physiological deterioration. Overall, the results of this study underscore the potential of natural plant-derived coatings as sustainable, eco-friendly alternatives to synthetic preservatives for enhancing postharvest quality and extending the marketable life of tomatoes, thereby contributing to reduced postharvest losses and improved consumer acceptability.

The experimental results indicated significant variations in weight loss and decay percentage among treatments over the twelve-day observation period. By the twelfth day, the control treatment (T₀) showed the highest weight loss of 7.74 g, followed by Marigold flower extract (100%), Neem oil (100%) Marigold flower extract (100%), Neem oil (100%) treatments with losses of 4.66 g and 4.50 g, respectively. Mint oil treatment (T₃) exhibited the least weight loss with 3.49 g, followed closely by castor oil (T₅) with 4.17 g. This suggests that T3 effectively preserved fruit weight compared to other treatments. he significant variation in weight loss among treatments could be attributed to the antimicrobial and antioxidant properties of the applied treatments. Mint oil (T₃), known for its antimicrobial activity (Saeed *et al.*, 2010 and Pirozzi *et al.*, 2020), likely inhibited microbial growth on the tomato surface, thereby reducing decay and weight loss. Similarly, castor oil (T₅) has been reported to possess antimicrobial properties (Prashant *et al.*, 2020), which may have contributed to its effectiveness in maintaining fruit weight compared to other treatments.

On the 3th day of observation, the highest firmness

was observed in the tomato treated with mint oil (T₃), measuring 5.39 kg/cm². This treatment also maintained the highest fruit firmness on the 6th day (4.31 kg/cm²), 9th day (4.20 kg/cm²) and the 12th day (4.12 kg/cm²), of observation. Conversely, the fruits kept under the control (T₀) consistently exhibited the minimum fruit firmness throughout all observation days. On the third day of observation, the highest firmness was observed in tomatoes treated with mint oil (T₃), measuring 5.39 kg/cm². This treatment maintained the highest fruit firmness on the ninth day (4.20 kg/cm²) and the twelfth day (4.12 kg/cm²). Conversely, the control treatment (T₀) consistently exhibited the minimum fruit firmness throughout all observation days. The significant retention of fruit firmness in tomatoes treated with mint oil (T₃) can be attributed to its reported antimicrobial and antioxidant properties. Mint oil is known for its ability to inhibit microbial growth and oxidative stress (Kumar *et al.*, 2021), which are key factors contributing to fruit softening and decay. By maintaining a firmer texture over the observation period, mint oil likely preserved the structural integrity of the tomatoes, thereby reducing the rate of softening and maintaining higher firmness levels compared to untreated fruits (control, T₀).

On the 3th day of observation, the highest fruit decay or spoilage % was observed in the T₀; control, measuring 9.99% at 12 days. The treatment (T₃), mint oil, has recorded the lowest decay or spoilage % during the observation. This treatment also maintained the highest fruit decay on the 3rd day (2.20%), 6th (3.05%) and the 9th day (5.17%), and on the 12th day (7.46%) during observation. Conversely, the fruits kept under the Neem oil treatment (T₂) consistently exhibited the second most low second decay % throughout all observation days. The observed reduction in fruit decay or spoilage percentage in tomatoes treated with mint oil (T₃) compared to the control (T₀) and Neem oil (T₂) treatments

Table 3 : Effect of different oil-based coatings on TSS and Titratable acidity of tomato.

Treatments	Total Soluble Solids (°Brix)					Titratable Acidity (%)				
	0 day	3 day	6 day	9 day	12 day	0 day	3 day	6 day	9 day	12 day
T ₀ : Conrol	5.19	5.41	6.01	6.55	6.72	1.04	0.86	0.74	0.67	0.51
T ₁ : Marigold flower extract	5.18	5.48	5.95	6.72	7.59	1.16	0.98	0.87	0.79	0.64
T ₂ : Neem oil	5.27	6.34	6.77	7.58	8.45	1.21	1.03	0.91	0.84	0.81
T ₃ : Mint oil	5.22	6.26	7.01	7.5	8.37	1.25	1.07	0.96	0.88	0.85
T ₄ : Tulsi oil	5.07	4.85	5.12	6.09	6.96	1.19	1.01	0.91	0.82	0.75
T ₅ : Castor oil	5.18	5.06	5.87	6.3	7.17	1.13	0.95	0.81	0.76	0.71
CD (0.05)	NS	0.77	0.66	0.84	1.1	NS	0.16	0.27	0.23	0.21
S.Em (±)	0.48	0.34	0.29	0.27	0.36	0.09	0.15	0.18	0.28	0.21

can be attributed to the antimicrobial properties of mint oil. Mint oil is known for its strong antimicrobial activity, which helps inhibit the growth of spoilage-causing microorganisms on the tomato surface (Das *et al.*, 2021). This antimicrobial effect likely contributed to lower decay rates and better preservation of fruit quality over the observation period

Effect of oil-based coating on biochemical parameters of tomato

Across various treatments and observation days, significant differences were noted in total soluble solids (TSS) content. By the 12th day, the highest TSS content was observed in tomatoes treated with Mint oil (T₃), reaching 8.45°Brix. This treatment consistently maintained the highest TSS values on the 3rd day (6.26°Brix), 6th (7.01 °Brix), and 9th day (7.50°Brix). In contrast, the control treatment (T₀) consistently exhibited the lowest TSS content throughout the observation period. These findings underscore the effectiveness of Mint oil (T₃) in enhancing TSS accumulation in tomatoes compared to other treatments. The observed higher total soluble solids (TSS) content in tomatoes treated with Mint oil (T₃) compared to other treatments can be attributed to several factors. Mint oil is known to contain bioactive compounds such as phenolic compounds and flavonoids, which can enhance metabolic activities and secondary metabolite synthesis in plants, including the accumulation of sugars and TSS (Aisyah *et al.*, 2022). These compounds may stimulate pathways related to sugar synthesis or inhibit enzymes involved in sugar breakdown, thereby leading to increased TSS levels in treated fruits. Additionally, mint oil's potential antioxidant properties may play a role in maintaining fruit quality and metabolic processes, indirectly contributing to higher TSS accumulation (Prashant *et al.*, 2020).

The mean values of titratable acidity (%) measured at days 0, 3, 6, 9 and 12 post-treatments are summarized in Table 3. Initially, no significant differences were

observed among treatments on day 0. However, from day 0 through day 12, Mint oil treatment (T₃) consistently exhibited the lowest titratable acidity levels compared to other treatments: 1.25%, 1.07%, 0.96%, 0.88%, and 0.85% on days 0, 3, 6, 9, and 12, respectively. Conversely, the control treatment (T₀) consistently showed the highest titratable acidity content across all observation days, ranging from 1.04% to 0.51%. This trend suggests that Mint oil (T₃) effectively mitigates the increase in titratable acidity over time, potentially through its antioxidant properties which can help regulate biochemical processes and maintain fruit quality (Arefin *et al.*, 2010).

In the context of ascorbic acid content, significant differences were observed among treatments on various observation days. By the 12th day, tomatoes treated with mint oil coating (T₃) exhibited the highest levels of ascorbic acid at 19.11 mg/100g. This treatment consistently maintained the highest ascorbic acid levels on the 3rd day (23.13 mg/100g), 6th day (22.05 mg/100g), and 9th day (20.90 mg/100g) of observation. Conversely, tomatoes treated with Neem oil coating (T₂) consistently showed the second-highest levels of ascorbic acid throughout the experiment. The control treatment (T₀) consistently exhibited the lowest levels of ascorbic acid across all observation days. This pattern highlights the efficacy of mint oil (T₃) in preserving ascorbic acid content in tomatoes, potentially attributed to its antioxidant properties, which can stabilize ascorbic acid against degradation. He observed higher levels of ascorbic acid in tomatoes treated with mint oil (T₃) compared to other treatments can be attributed to several factors. Mint oil is known to contain bioactive compounds such as phenolic compounds and flavonoids, which have antioxidant properties and can help preserve ascorbic acid content in fruits (Pirozzi *et al.*, 2010). These compounds may scavenge free radicals and inhibit enzymatic oxidation processes that degrade ascorbic acid, thereby maintaining higher levels in treated tomatoes.

Table 4 : Effect of different oil-based coatings on pH and Ascorbic acid content (mg/100gm) of tomato.

Treatments	pH					Ascorbic Acid content (mg/100gm)				
	0 day	3 day	6 day	9 day	12 day	0 day	3 day	6 day	9 day	12 day
T ₀ : Control	4.16	4.22	4.28	4.38	4.57	23.56	21.29	20.05	19.15	16.33
T ₁ : Marigold flower extract	4.17	4.25	4.32	4.43	4.51	24.4	22.13	21.16	19.99	17.8
T ₂ : Neem oil	4.18	4.26	4.33	4.44	4.52	25.11	22.84	21.75	20.7	18.46
T ₃ : Mint oil	4.19	4.28	4.34	4.48	4.5	25.4	23.13	22.05	20.99	19.11
T ₄ : Tulsi oil	4.17	4.27	4.32	4.52	4.56	24.51	22.24	21.17	20.1	18.39
T ₅ : Castor oil	4.17	4.26	4.31	4.42	4.51	24.33	22.06	21.37	19.92	17.93
CD (0.05)	NS	0.14	0.22	0.18	0.21	NS	1.74	1.07	1.69	2.46
S.Em (±)	0.11	0.31	0.37	0.23	0.34	1.1	0.63	0.81	0.55	0.48

Conclusion

The research findings highlight mint oil as a highly effective treatment for enhancing the post-harvest quality of tomatoes. Mint oil, known for its antimicrobial and antioxidant properties, significantly reduced weight loss in tomatoes compared to untreated samples. Additionally, tomatoes treated with mint oil exhibited lower rates of decay or spoilage throughout the study. This suggests that mint oil's antimicrobial activity played a crucial role in preventing microbial degradation and extending the shelf life of tomatoes.

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