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Impact of edible coating on quality and storage life of Mango cv. Amrapali (*Mangifera indica* L.)

Lalit Kumar, Saket Mishra, Vijay Bahadur and Shashi Kant Ekka

Abstract
During the academic years 2022-2023, a study was conducted at the Post Harvest Laboratory, Department of Horticulture, NAI, SHUATS, Prayagraj (U.P.). In a Completely Randomized Design, nine treatments with different levels of CMC, Chitosan, Guar gum, and *Aloe vera* were replicated three times. The experiment's primary objective was to determine the effect of edible coating materials on the physical and qualitative traits of Mango cv. Amrapali. According to the findings of this study, Treatment T_3 (Carboxymethyl Cellulose- 4%) was found best with [3.23 (4 days), 5.75 (8 days) and 8.88 (12 days)] % physiological weight loss %, [2.51 (4 days), 4.43 (8 days) and 6.96 (12 days)] % reduction in fruit length (%), [3.85 (4 days), 7.24 (8 days) and 10.87 (12 days)] % reduction in fruit diameter (%), [109.78 (4 days), 94.66 (8 days) and 85.59 (12 days)] g Pulp Weight (g), [10.61 (4 days), 14.76 (8 days) and 15.82 (12 days)] ° Brix TSS (° Brix), [0.39 (4 days), 0.33 (8 days) and 0.29 (12 days)] % Treatable acidity (%), [4.11 (4 days), 5.81 (8 days) and 6.51 (12 days)] pH, [42.63 (4 days), 38.64 (8 days) and 36.66 (12 days)] (mg/100 gm) Ascorbic Acid (mg/100gm),[0.00 (4 days), 3.33 (8 days) and 23.33 (12 days)] % Spoilage %, [9.25 (4 days), 11.12 (8 days) and12.22 (12 days)] % Total Sugar %, [2.39 (4 days), 3.44 (8 days) and 4.28 (12 days)] % Reducing Sugar % and [6.52 (4 days), 6.73 (8 days) and 8.15 (12 days)] % non-Reducing Sugar %.

Keywords: Mango CV, Amrapali, chitosan, guar gum, *Mangifera indica* L., *Aloe vera* gel

Introduction
Mango (*Mangifera indica* L.) is the climacteric fruit of the Anacardiaceous family (2n=4x=40). This is the most notable tropical fruit, also known as the "king of fruit." This fruit belongs to the genus mangifera, which has three primary species in India: *Mangifera indica* with edible fruits and *M. sylvatica* and *M. caloneura* with inedible fruits. (De Candolle, 1904) [7] *Mangifera indica* L. is indigenous to the Indo-Burma (Myanmar) region. Asia is the leading mango fruit producer, accounting for 76.9% of global output, followed by North America with 17.33%. (Sauco, 2002) [17]. India is a major mango producer and one of the world's foremost mango-producing nations its annual output exceeds 18 million metric tons (Saxena & Gandhi, 2015) [18]. Estimates place the total area under mango fruit cultivation in India at 2,163,000 hectares, with an annual output of 20,335,640 metric tons and Uttar Pradesh accounting for 23.64% of India's production with 4,807,830 metric tons. (NHB, 2020). Mangoes are rich in carotenoids, vitamin C, organic acids, carbs, and minerals. Its 100g fresh fruit pulp includes 70 Kcal calories, 17 g carbs, 0.5 g protein, 0.27 g total fat, 1.80 g dietary fiber, 27.7 mg vitamin C, 765 IU vitamin A, 1.12 mg vitamin E, 4.2 µg vitamin K, 445 µg carotene-β, and 17 µg carotene-α (USDA National Nutrient database).

India has hundreds of mango types, but only a few are commercially viable owing to climatic preferences. 'Amrapali' mangoes have the most β-carotene. The 'Amrapali' fruit's bright orange flesh, golden peel, and hardness make it ideal for export and processing (Seshadri, 2019) [19] This cultivar is suited for high-density, annual-pruned orchards (Pandey and Singh, 2008) [14]. Its main negative is that it spoils faster. Due to its short storage life and fast ripening, mango, a "climacteric fruit," loses 20-30% annually. It lasts 4–8 days at ambient temperature and 2-3 weeks at 13°C cold storage (Carrillo *et al.*, 2000) [5]. In 2019, farmers and merchants lost 30–60% of production due to inefficient processing, handling, and storage (Kaur *et al.*, 2019) [8]. Controlled atmosphere storage extends fruit storage life, but it is expensive and uneconomical (Bender *et al.*, 2000; Noomhorm and Tiasuwan 1995) [3]. Thus, a physical barrier like a surface edible coating can regulate water vapor and gas permeability, postpone ripening, and prevent insect and microbial development. Climacteric respiration makes mangoes mature quickly within 5-15 days of picking.

Fruits' limited post-harvest life inhibits long-distance transport. These delicious fruits are also perishable, decay-prone, and sensitive to low temperatures (below 13 °C). There is significant potential for extending the storage life of mango through the use of various coating materials. However, very little research has been conducted on the use of distinct mango coatings. On the use of carboxyl methyl cellulose (CMC), guar gum, Chitosan, and *Aloe vera* gel coating materials in mango, almost no research has been conducted. Keeping in view the above facts this experiment titled "Impact of edible coating on quality and storage life of Mango cv. Amrapali (*Mangifera indica* L.)" was designed and carried out.

Materials and Methods

On 11 June 2022, ripe and uniformly sized Mango cv. Amrapalies were harvested at random from each tree and stored in the laboratory from the ripe to completely ripe stage. All observations regarding the physical and biochemical parameters of ripe, uniformly-sized fruits were utilized in this study. To eliminate field heat, reduce the microbial population, and remove soil particles from the surface of uniform fruits, they were cleansed with tap water. In the academic year 2022-23, the experiment was conducted in the post-harvest laboratory of the Department of Horticulture at the Sam Higginbottom University of Agriculture, Technology, and Sciences in Allahabad. The experimental site is situated on the left side of the Allahabad-Rewa Road, close to the Yamuna River, about 8 kilometers from the city of Allahabad. It is located at 25.57°N latitude and 81.51°E longitude. The fruits were treated with different edible coating materials, i.e., T_1: Control, T_2: Carboxymethyl Cellulose- 2%, T_3: Carboxymethyl Cellulose- 4%, T_4: Guar gum- 2%, T_5: Guar gum- 4%, T_6: Chitosan- 2%, T_7: Chitosan- 4%, T_8: Aloevera- 2%, T_9: Aloevera- 4%. In 1000 ml of water, 20 g and 40 g of CMC were dissolved to create a 2% and 4% solution, respectively. They were correctly dissolved by continuously heating and agitating the solution. To create 2% and 4% chitosan solutions, 20g and 40g of chitosan powder were added to an aqueous solution of 2% acetic acid (20 ml in 1000 ml of water) as the solvent. To improve the coating's adhesion, 0.1% Tween 80 was applied. (Contreras-Oliva *et al.*, 2012) [6]. Also, 2% and 4% guar gum solutions were prepared by dissolving 20g and 40g of laboratory-grade guar gum powder in 1000 ml of distilled water, respectively. At 40 degrees Celsius, the solution was heated and agitated until it became clear. Separated from the leaf's outer cortex, this colorless hydro parenchyma of *Aloe vera* gel matrix was pulverized in a blender and subsequently incorporated into the experiment. Filtration was used to extract the fibers from the resultant mixture. Then, 20 ml and 40 ml of *Aloe vera* gel were added to 1,000 ml of water and blended to produce 2% and 4% solutions, respectively.

The experiment utilized a Completely Randomized Design (Panse and Sukhatme, 1985) [15] with three replications for each of the nine treatment combinations. Physical attributes like Physiological weight loss %, Reduction in fruit length (%), Reduction in fruit diameter (%) & Pulp weight (g) and quality attributes like TSS (ºBrix), Titratable acidity %, pH, ascorbic acid mg/100g of pulp, spoilage %, reducing sugar % and Total sugar % were successfully taken at 0, 4, 8 and 12 days after storage.

Results and Discussion

The physical and quality characteristics of Mango cv. Amrapali (Mangifera indica L.) were studied statistically. According to the results, the incorporation of various treatments significantly improved all characteristics. Since F Cal > F Tab, the evidence indicates that the variances were statistically significant except at 0 days.

Physical attributes

Physiological weight loss %: According to data (Table 1), it was observed that the treatment T_3 (Carboxymethyl Cellulose- 4%) was found best and effective. It was observed significantly the minimum physiological weight loss % i.e., [3.23 (4 days), 5.75 (8 days) and 8.88 (12 days)] % whereas effect of treatment T_1 (Control) was found significantly the least effective with highest physiological weight loss % i.e., [5.82 (4 days), 10.60 (8 days) & 16.28 (12 days)] %.

Pulp Weight (g): The result regarding pulp weight (g) is shown in (Table 1) where the difference within treatments was found significantly different except at 0 days of storage. From the data it was found that treatment T_3 (Carboxymethyl Cellulose- 4%) recorded the maximum i.e., 109.78 g of pulp weight where-as minimum pulp weight of 106.15 g was recorded in T_1 (Control).

Reduction in fruit length %: The perusal of result (Table 2) shows that the differences were significant except at 0 days which was found non-significant. Treatment T_3 (Carboxymethyl Cellulose- 4%) was found best effective with significantly the minimum reduction in fruit length % i.e., [2.51 (4 days), 4.43 (8 days) & 6.96 (12 days)] % whereas treatment T_1 (Control) was found to be significantly least effective with maximum reduction in fruit length % i.e., [3.80 (4 days), 6.77 (8 days) & 10.56 (12 days)] %.

Reduction in fruit diameter %: The differences in effect of edible coating materials on reduction in fruit diameter % was found to be significant except at 0 days of storage. The minimum reduction in fruit diameter % (Table 2) [3.85 (4 days), 7.24 (8 days) & 10.87 (12 days)] % was recorded under treatment T_3 (Carboxymethyl Cellulose- 4%). However, the maximum reduction in fruit diameter % i.e., [5.51 (4 days), 10.35 (8 days) & 15.72 (12 days)] % was recorded in T_1 (Control).

Quality Attributes

Total Soluble Solids (ºBrix): According to the results found in the experiment (Table 3) it was found that the differences were significantly different except at 0 days which was found non-significant. Mango's Total Soluble Solids (ºBrix) increased throughout time when the fruit was kept in storage. T3 (Carboxymethyl Cellulose- 4%) was found best effective and recorded significantly the lowest Total Soluble Solids (ºBrix) i.e., [10.61 (4 days), 14.76 (8 days) & 15.82 (12 days)] ºBrix whereas treatment T_1 (Control) was found with maximum Total Soluble Solids (ºBrix) i.e., [13.04 (4 days), 18.10 (8 days) & 19.27 (12 days)] ºBrix.

Titratable Acidity (%): The differences in effect of different coating materials on Acidity (%) were found to be significant except at 0 days of storage. The Acidity (%) of mango gradually decreased with increase in no of days of storage.

The maximum Acidity (%) is shown in Table 4 [0.39 (4 days), 0.33 (8 days) & 0.29 (12 days)] % was recorded under treatment T_3 (Carboxymethyl Cellulose- 4%). However, the minimum Acidity (%) [0.29 (4 days), 0.24 (8 days) & 0.20 (12 days)] % was recorded in T_1 (Control).

PH: The result regarding pH is depicted in (Table 4) The pH increased progressively with increasing storage time, which was statistically significant except for the first day. From the data it was derived that treatment T_3 (Carboxymethyl Cellulose- 4%) recorded the minimum pH [4.11 (4 days), 5.81 (8 days) and 6.51 (12 days)] where-as the highest pH [4.62 (4 days), 6.50 (8 days) & 6.92 (12 days)] was recorded in T_1 (Control).

Ascorbic Acid (mg/100g of pulp): The differences in effect of different coating materials on Ascorbic Acid (mg/100g of pulp) were found to be significantly effective except at 0 days of storage. The ascorbic acid content of mango gradually minimized with increase in no of days of storage. The maximum Ascorbic Acid (Table 3) [42.63 (4 days), 38.64 (8 days) & 36.66 (12 days)] mg/100g of pulp was recorded under treatment T_3 (Carboxymethyl Cellulose- 4%) where-as the least Ascorbic Acid [37.02 (4 days), 32.92 (8 days) & 30.97 (12 days)] mg/100g of pulp was recorded in T_1 (Control).

Spoilage (%): The data for Spoilage (%) is shown in Table 2 was significantly different except at 0 days after storage. Treatment T_3 (Carboxymethyl Cellulose- 4%) had the lowest spoilage (%) [0.00 (4 days), 3.33 (8 days) and 23.33 (12 days)] %, where-as T_1 (Control) had the highest spoilage [18.89 (4 days), 24.44 (8 days), and 68.89 (12 days)] %.

Reducing sugar %: The results regarding Reducing sugar % is shown in Table 5 from the result it was depicted that treatment T_3 (Carboxymethyl Cellulose- 4%) recorded the minimum reducing sugar [2.39 (4 days), 3.44 (8 days) and 4.28 (12 days)] % where-as the highest reducing sugar i.e., [3.59 (4 days), 4.87 (8 days) and 5.92 (12 days)] % was recorded in T_1 (Control).

Non-Reducing sugar %: The data for non- Reducing sugar % is shown in Table 2 was significantly different except at 0 days after storage. Treatment T_3 (Carboxymethyl Cellulose- 4%) had the lowest non-Reducing sugar % [6.52 (4 days), 6.73 (8 days) and 8.15 (12 days)] %, where-as T_1 (Control) had the highest non- Reducing sugar % [9.78 (4 days), 9.91 (8 days), and 11.29 (12 days)] %.

Total sugar %: The results regarding total sugar % is shown in Table 5 from the result it was depicted that treatment T_3 (Carboxymethyl Cellulose- 4%) recorded the minimum total sugar [9.25 (4 days), 11.12 (8 days) and 12.22 (12 days)] % where-as the highest total sugar i.e., [13.89 (4 days), 15.72 (8 days) and 16.91 (12 days)] % was recorded in T_1 (Control).

Discussion

Mango cv. Amrapali's physical and qualitative traits were significantly altered by all treatments, however treatment T_3 (Carboxymethyl Cellulose- 4%) had the significant effect and found best. Pulp weight (g) and physiological weight (%) loss during the complete storage duration is one of the most critical criteria in assessing the post-harvest quality of fruits and vegetables. Changes in pulp weight can have a significant effect on pulp quality. Over time, the mango lost more and more of its weight. This is mostly attributable to the fruit's continual loss of moisture through transpiration and, to a lesser extent, a sped-up decay process with age. T_3 (Carboxymethyl Cellulose-4%) prevented the highest amount of pulp weight (in g) loss (as a percentage of initial weight) and kept the most pulp weight (as a percentage of initial weight) during the course of storage. Due to its semipermeable nature, CMC prevents the passage of oxygen, carbon dioxide, water, and solutes; yet, edible coatings may slow its weight loss. Water loss and a slower rate of oxidation reactions may have resulted from this decrease in respiration rate (Baldwin *et al.*, 1999) [2].

Weight loss is not the only thing caused by respiration and transpiration; the fruit's length and width are also diminished by these processes. Coated fruits shrank less than uncoated fruits because the anti- senescent effect of coatings prevented ethylene biosynthesis and slowed the action of enzymes responsible for ripening, blocking cell degradation and thereby reducing moisture loss and respiratory gas exchange (Sudha *et al.*, 2007) [21]. Both Saowakon *et al.* (2017) [16] working with Rambutan and Ali *et al.* (2022) [1] working with mango came to similar conclusions.

The quality of the fruit is a major impact in how long it will keep and whether or not people would buy it before it spoils. TSS, reducing sugar, non-reducing sugar, and total sugar all increased as the fruit ripened across all treatments in this experiment. Starch was broken down into soluble carbohydrates, which fueled initial expansion of these attributes (Bhattarai and Gautam, 2006) [4]. These characteristics of Mango cv. Amrapali fruits grew gradually and slowly throughout storage in the presence of Treatment T_3 (Carboxymethyl Cellulose- 4%), in contrast to the quick rise seen in the presence of the control. The presence of CMC in the coating may have slowed down respiratory and metabolic processes, postponing the need for organic acids. These results are consistent with those of Medeiros *et al.* (2012) [12] for pears, Mantilla *et al.* (2013) [10] for fresh-cut pineapple, and Souza *et al.* (2015) [20] for fresh-cut mangoes.

The ascorbic acid (mg/100g of pulp), pH & acidity % is an important parameter for the fruit quality and therefore, maintenance of desirable amount of pH in fruits during storage is necessary. The pH of the Mango cv. Amrapali fruit pulp increased during storage owing to decrease in acidity of the fruits in all the treatments. The continuous increase in pH till the end of shelf life of the fruits could be attributed to the continuous fall in the acidity as reported by the Souza *et al.* (2015) [20] in fresh cut mangoes. Application of treatment CMC @ 4% reduced the rate of increase in the pH and decrease in acidity % and ascorbic acid content of fruit as compared to control. Coated fruits may have a higher acidity and lower pH because carbon dioxide builds up inside the fruit tissues when carbonic acid is dissolved and farmed, Causing acidosis. These results are in conformation with Moalemiyan *et al.*, 2012 [13] on mango, Marpudi, *et al.*, 2011 [11] on papaya and Maftoonazad and Ramaswamy (2015) [9] on avocado.

Table 1: Impact of edible coating on physiological weight loss % and pulp weight (g) of Mango cv. Amrapali (*Mangifera indica* L.)

S. No.	Treatments	Physiological Weight Loss %				Pulp Weight (g)			
		0 days	4 days	8 days	12 days	0 days	4 days	8 days	12 days
1	T1	0.00	5.82	10.60	16.28	103.77	106.15	90.28	80.88
2	T2	0.00	3.68	6.70	10.32	103.10	108.81	93.55	84.39
3	T3	0.00	3.23	5.75	8.88	103.33	109.78	94.66	85.59
4	T4	0.00	4.53	8.08	12.46	102.64	107.48	91.82	82.64
5	T5	0.00	4.28	7.46	11.52	103.31	108.16	92.71	83.56
6	T6	0.00	3.96	7.06	10.86	103.00	108.36	92.99	83.81
7	T7	0.00	3.36	5.88	9.03	103.98	109.50	94.42	85.27
8	T8	0.00	5.12	8.96	13.77	102.79	106.55	90.65	81.42
9	T9	0.00	4.81	8.27	12.71	102.99	107.28	91.52	82.36
F-Test		NS	S	S	S	NS	S	S	S
CV			3.18	2.72	2.72	0.56	0.20	0.31	0.36
S.E. (m) (±)			0.08	0.12	0.12	0.33	0.13	0.16	0.17
CD (5%)			0.23	0.36	0.36	NS	0.38	0.49	0.51
CD (1%)			0.32	0.49	0.49	NS	0.52	0.66	0.71

T_1: Control, T_2: Carboxymethyl Cellulose- 2%, T_3: Carboxymethyl Cellulose- 4%, T_4: Guar gum- 2%, T_5: Guar gum- 4%, T_6: Chitosan- 2%, T_7: Chitosan- 4%, T_8: *Aloe vera*- 2%, T_9: *Aloe vera*- 4%.

Table 2: Impact of edible coating on physiological weight loss % and pulp weight (g) of Mango cv. Amrapali (*Mangifera indica* L.)

S. No.	Treatments	Reduction in Fruit Length %				Reduction in Fruit Diameter %			
		0 days	4 days	8 days	12 days	0 days	4 days	8 days	12 days
1	T1	0.00	3.80	6.77	10.56	0.00	5.51	10.35	15.72
2	T2	0.00	2.73	4.83	7.54	0.00	4.19	7.91	11.70
3	T3	0.00	2.51	4.43	6.96	0.00	3.85	7.24	10.87
4	T4	0.00	3.16	5.62	8.84	0.00	4.84	9.20	13.68
5	T5	0.00	3.03	5.39	8.41	0.00	4.63	8.71	13.08
6	T6	0.00	2.87	5.12	8.00	0.00	4.42	8.35	12.48
7	T7	0.00	2.57	4.53	7.06	0.00	3.96	7.46	11.19
8	T8	0.00	3.45	6.14	9.58	0.00	5.30	10.00	14.97
9	T9	0.00	3.30	5.82	9.08	0.00	5.07	9.51	14.32
F-Test		NS	S	S	S	NS	S	S	S
CV			2.25	2.39	2.24		2.45	2.29	2.45
S.E. (m) (±)			0.04	0.07	0.11		0.07	0.12	0.19
CD (5%)			0.12	0.22	0.32		0.19	0.34	0.55
CD (1%)			0.16	0.30	0.44		0.27	0.47	0.75

T1: Control, T2: Carboxymethyl Cellulose- 2%, T3: Carboxymethyl Cellulose- 4%, T4: Guar gum- 2%, T_5: Guar gum- 4%, T_6: Chitosan- 2%, T_7: Chitosan- 4%, T_8: *Aloe vera*- 2%, T_9: *Aloe vera*- 4%.

Table 3: Impact of edible coating on TSS (°Brix), Treatable acidity (%) and pH of Mango cv. Amrapali (*Mangifera indica* L.)

S. No.	Treatments	TSS (°Brix)				Treatable acidity (%)				pH			
		0 days	4 days	8 days	12 Days	0 days	4 days	8 days	12 days	0 days	4 days	8 days	12 days
1	T1	7.00	13.04	18.10	19.27	0.50	0.29	0.24	0.20	3.48	4.62	6.50	6.92
2	T2	6.96	10.90	15.18	16.25	0.48	0.37	0.31	0.27	3.48	4.19	5.90	6.57
3	T3	6.89	10.61	14.76	15.82	0.47	0.39	0.33	0.29	3.55	4.11	5.81	6.51
4	T4	6.77	11.84	16.39	17.45	0.45	0.35	0.29	0.25	3.46	4.38	6.11	6.69
5	T5	6.92	11.71	16.20	17.32	0.47	0.35	0.30	0.26	3.45	4.32	6.04	6.65
6	T6	6.78	11.21	15.57	16.63	0.46	0.36	0.30	0.26	3.47	4.26	5.97	6.61
7	T7	6.96	10.78	15.01	16.11	0.46	0.39	0.33	0.29	3.47	4.13	5.83	6.53
8	T8	6.79	12.44	17.23	18.30	0.48	0.33	0.28	0.24	3.49	4.50	6.25	6.77
9	T9	6.91	12.33	17.04	18.14	0.49	0.34	0.28	0.24	3.50	4.44	6.18	6.73
F-Test		NS	S	S	S	NS	S	S	S	NS	S	S	S
CV		1.93	1.29	1.21	1.24	4.23	1.64	3.13	3.62	1.15	0.46	0.49	0.30
S.E. (m) (±)		0.08	0.09	0.11	0.12	0.01	0.00	0.01	0.01	0.02	0.01	0.02	0.01
CD (5%)		NS	0.26	0.34	0.37	NS	0.01	0.02	0.02	NS	0.03	0.05	0.03
CD (1%)		NS	0.35	0.46	0.50	NS	0.01	0.02	0.02	NS	0.05	0.07	0.05

T_1: Control, T_2: Carboxymethyl Cellulose- 2%, T_3: Carboxymethyl Cellulose- 4%, T_4: Guar gum- 2%, T_5: Guar gum- 4%, T_6: Chitosan- 2%, T_7: Chitosan- 4%, T_8: *Aloe vera*- 2%, T_9: *Aloe vera*- 4%.

Table 4: Impact of edible coating on Ascorbic Acid (mg/100g) and Spoilage (%) of Mango cv. Amrapali (*Mangifera indica* L.)

S. No.	Treatments	Ascorbic Acid (mg/100g)				Spoilage (%)			
		0 days	4 days	8 days	12 days	0 days	4 days	8 days	12 days
1	T1	44.87	37.02	32.92	30.97	0.00 (0.00)	18.89 (0.45)	24.44 (0.52)	68.89 (0.98)
2	T2	44.33	41.89	37.85	35.86	0.00 (0.00)	0.00 (0.00)	5.56 (0.24)	30.00 (0.58)
3	T3	44.54	42.63	38.64	36.66	0.00 (0.00)	0.00 (0.00)	3.33 (0.18)	23.33 (0.50)
4	T4	45.54	40.19	36.23	34.26	0.00 (0.00)	6.67 (0.26)	14.44 (0.39)	48.89 (0.77)
5	T5	44.21	40.77	36.78	34.79	0.00 (0.00)	4.44 (0.21)	12.22 (0.36)	44.44 (0.73)
6	T6	45.06	41.34	37.34	35.34	0.00 (0.00)	0.00 (0.00)	6.67 (0.26)	33.33 (0.62)
7	T7	44.87	42.42	38.39	36.39	0.00 (0.00)	0.00 (0.00)	5.56 (0.24)	27.78 (0.55)
8	T8	45.65	39.05	35.15	33.14	0.00 (0.00)	12.22 (0.36)	17.78 (0.43)	58.89 (0.87)
9	T9	45.53	39.62	35.62	33.62	0.00 (0.00)	11.11 (0.34)	15.56 (0.40)	55.56 (0.84)
F-Test		NS	S	S	S	NS	S	S	S
CV		1.33	0.59	0.68	0.78	-	17.90	11.04	6.53
S.E. (m) (±)		0.35	0.14	0.14	0.15	-	0.02	0.02	0.02
CD (5%)		NS	0.41	0.43	0.46	-	0.05	0.06	0.07
CD (1%)		NS	0.56	0.59	0.63	-	0.08	0.09	0.09

T_1: Control, T_2: Carboxymethyl Cellulose- 2%, T_3: Carboxymethyl Cellulose- 4%, T_4: Guar gum- 2%, T_5: Guar gum- 4%, T_6: Chitosan- 2%, T_7: Chitosan- 4%, T_8: *Aloe vera*- 2%, T_9: *Aloe vera*- 4%.

Table 5: Impact of edible coating on Reducing Sugar (%), non- Reducing Sugar (%) and Total Sugar (%) of Mango cv. Amrapali (*Mangifera indica* L.)

S. No	Treatments	Reducing Sugar (%)				Non-Reducing Sugar (%)				Total Sugar (%)			
		0 days	4 days	8 days	12 Days	0 days	4 days	8 days	12 days	0 days	4 days	8 days	12 Days
1	T1	1.6	3.59	4.87	5.92	4.06	9.78	9.91	11.29	5.87	13.89	15.72	16.91
2	T2	1.61	2.55	3.61	4.48	4.08	6.94	7.09	8.54	5.91	9.85	11.65	12.8
3	T3	1.65	2.39	3.44	4.28	4.17	6.52	6.73	8.15	6.04	9.25	11.12	12.22
4	T4	1.67	2.84	3.95	4.87	4.22	7.73	7.87	9.29	6.11	10.97	12.77	13.92
5	T5	1.61	2.74	3.85	4.76	4.08	7.46	7.63	9.08	5.91	10.59	12.42	13.6
6	T6	1.64	2.64	3.72	4.6	4.15	7.2	7.35	8.78	6	10.22	12.02	13.15
7	T7	1.67	2.45	3.49	4.36	4.24	6.68	6.85	8.31	6.14	9.49	11.29	12.44
8	T8	1.61	3.03	4.19	5.15	4.09	8.26	8.39	9.82	5.92	11.73	13.53	14.71
9	T9	1.68	2.94	4.08	5	4.26	7.99	8.15	9.53	6.17	11.35	13.18	14.28
F-Test		NS	S	S	S	NS	S	S	S	NS	S	S	S
CV		2.16	1.57	1.45	1.58	2.16	1.57	1.63	1.58	2.16	1.57	1.45	1.43
S.E. (m) (±)		0.02	0.03	0.03	0.04	0.05	0.07	0.07	0.07	0.08	0.1	0.11	0.11
CD (5%)		NS	0.08	0.1	0.11	NS	0.21	0.22	0.2	NS	0.29	0.31	0.34
CD (1%)		NS	0.1	0.13	0.14	NS	0.28	0.3	0.27	NS	0.4	0.43	0.46

T_1: Control, T_2: Carboxymethyl Cellulose- 2%, T_3: Carboxymethyl Cellulose- 4%, T_4: Guar gum- 2%, T_5: Guar gum- 4%, T_6: Chitosan- 2%, T_7: Chitosan- 4%, T_8: aloe era- 2%, T_9: aloe era- 4%

Conclusion

The current study concludes that the best benefit was observed with Treatment T_3: Carboxymethyl Cellulose- 4%. The Physiological weight loss %, Reduction in fruit length (%), Reduction in fruit diameter (%) & Pulp weight (g) all show improvement when treatment T_3 was applied.

TSS (ºBrix), Treatable acidity %, pH, ascorbic acid mg/100g of pulp, spoilage %, reducing sugar % and Total sugar % were also shown to be statistically superior for Treatment T_3: Carboxymethyl Cellulose- 4%.

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