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**SS Survase**
PG Student, RCSM College of Agriculture, Kolhapur, Maharashtra, India

**Dr. VK Garande**
Professor, Department of Horticulture, ZARS, Ganeshkhind, Pune, Maharashtra, India

**Dr. RD Pawar**
Assistant Professor, Department of Horticulture, RCSM College of Agriculture, Kolhapur, Maharashtra, India

**Dr. PN Sonawane**
Senior Research Assistant, Department of Horticulture, MPKV, Rahuri, Maharashtra, India

**Corresponding Author:**
**SS Survase**
PG Student, RCSM College of Agriculture, Kolhapur, Maharashtra, India

# Effect of different edible coatings on Physico-chemical composition and sensorial qualities of fresh cut red pumpkin

**SS Survase, Dr. VK Garande, Dr. RD Pawar and Dr. PN Sonawane**

**Abstract**

**Aim:** The main aim of present investigation was to study the effect of different edible coatings on physico-chemical composition and sensorial qualities of fresh cut red pumpkin under various storage conditions.

**Methodology:** The present study was laid out in completely randomized design with dipping treatments of edible coatings such as $T_1$ = Untreated control, $T_2$ = Xanthan gum 0.50%, $T_3$ = Chitosan 1%, $T_4$ = Gaur gum 0.25%, $T_5$ = Ascorbic acid 0.50%, $T_6$ = Glycerol 1% and $T_7$ = Sodium benzoate 0.05% with three replications. The pre-treated samples of fresh cut red pumpkin of *cv*. Arka Chandan were packed in polyethylene bags of 200 gauge with 2% vents and stored at ambient temperature (AT) and refrigerator storage (RS) i.e. 5 ± 1 $^0$C and 90% RH. The observations on physico-chemical composition, sensorial qualities and total microbial count were recorded as per the standard analytical procedures.

**Results:** The data revealed that, the lowest PLW, acidity, total microbial count were recorded in $T_2$ (2.50%, 91.27%, 0.58%, 7.47 log cfu/g, followed by $T_3$ (2.87%, 0.65%, 5.72, 8.26 log cfu/g, respectively) while the maximum retention of TSS, firmness, ascorbic acid and total minerals and score for colour, flavour, taste, appearance, overall acceptability (6.07 Brix, 3.88 kg/cm$^2$, 8.58 mg/100g, 417.02 mg/100g, 8.00, 8.04, 8.25, 8.26, 8.16, respectively) followed by $T_3$ (5.91 ˚Brix, 3.73 kg/cm$^2$, 8.47 mg/100g, 416.73 mg/100g, 7.83, 7.94, 8.14, 8.16, 8.03, respectively) of fresh cut red pumpkin on 12$^{th}$ day of storage at refrigerator storage.

**Interpretation:** The dipping treatment of xanthan gum @0.50% ($T_2$) and chitosan @1% ($T_3$) were found effective for better retention of physico-chemical composition, sensorial qualities and reduced total microbial count of fresh cut red pumpkin up to twelve days at refrigerator storage.

**Keywords:** Edible coatings, fresh cut red pumpkin, physico-chemical composition, sensorial qualities and total microbial count

## Introduction

Red pumpkin is one of the well-known edible plants and has substantial medical properties due to the presence of unique natural edible substances. It contains several phyto-constituents suchas alkaloids, flavonoids and palmitic, oleic and linoleic acids. Medicinal properties including anti-diabetic, anti-oxidant, anti-carcinogenic, anti-inflammatory and other have been well documented. The nutritional composition of red pumpkin fruit (per 100g of edible portion) is moisture 92.60 g, 1.40 g protein, 0.10 g fat, 0.60 g minerals, 0.70 g crude fibre, 4.6 g carbohydrates, 25 Kcals energy, 10 mg calcium, 30 mg phosphorous and 0.44 g iron (Gopalan *et al.*, 2010) [8]. Pumpkin is commonly grown in the states of Orissa, Uttar Pradesh, Karnataka, Kerala, Jharkhand, Tamil Nadu, Jammu & Kashmir, Chattisgarh, etc. In India, area and production of red pumpkin was 78 thousand hectares and 1714 thousand metric tonnes, respectively with average productivity of 9.72 t/ha (Anon., 2018) [3].

Use of edible coatings to minimize undesirable changes due to minimal processing has been reported for several commodities. They can provide a partial barrier to water vapour and gas exchange, thus delaying shrinkage of cut produce and creating a modified atmosphere around the commodity. Coatings are also useful as carriers of additives, such as antioxidants, acidulants, fungicides and preservatives (Sharma *et al*., 2019) [19]. Minimally processed vegetables (MPV) are products that go through a process that usually involves trimming, peeling, cutting, washing, and disinfecting while retaining the characteristics of fresh food (Kester and Fennema, 1986) [11]. Chitosan is described in terms of degree of de-acetylation and average molecular weight and their importance resides in their antimicrobial properties in conjunction with their cation capacity and their film-forming properties.

Selection of the fruits

⇓

Washing in running water

⇓

Cutting into two halves

⇓

Removal of peel, seeds and inedible portion

⇓

Making the pieces of 2.5 x 2.5 cm size

⇓

Dipping in edible coating solution for 5 minutes

⇓

Removal of free moisture from the pieces

⇓

Packing in polyethylene bags of 200 gauge with 2% vents

⇓

Sealing the bags with hand pouch sealing machine

⇓

Labelling and Storage

Edible coatings generate modified atmosphere by creating a semipermeable barrier against $O_2$, $CO_2$, moisture and solute movement, thus reducing respiration, water loss, and oxidation reaction rates. The combination of xanthan gum and guar gum are classified as a thickening agent and chitosan is classified as an agent which may represent antimicrobial alternatives as edible coating on preservation of minimally processed products. Recently, there has been an increasing market demand for minimally processed fruits and vegetables due to their fresh like character, convenience and human health benefits. Chitosan has been reported to maintain the quality of cut pumpkin (Qi *et al.*, 2011) [17] while xanthan gum has been effective in the preservation of minimally processed red pumpkin (Pizato *et al.*, 2013) [16]. Minimally processed red pumpkin has gained great acceptance by consumers who want the quality of fresh products and convenience of a ready-to-eat product. The fruits of red pumpkin are large in size which pose the difficulty for its utilization for small families. Therefore, the present investigation on use of edible coatings for retaining the qualities of fresh cut red pumpkin during storage is very useful for the small-scale processors for making the availability of red pumpkin in ready-to-use or ready-to- cook form. This will ultimately help the famers to get the better prices for red pumpkin in the market. Information with respect to use of different coatings for enhancing the shelf life and quality of fresh cut red pumpkin *cv.* Arka Chandan is very scanty. Hence, the present investigation was undertaken to study the effect of edible coatings on physico-chemical composition and sensorial qualities of fresh cut red pumpkin under different storage conditions.

## Materials and Methods

The present investigations were undertaken at Post-harvest Technology Laboratory of Horticulture Section, Rajarshee Chhatrapati Shahu Maharaj College of Agriculture, Kolhapur during summer, 2019-2020 with dipping treatments of different edible coatings. The fully ripened, sound, healthy and fresh fruits of red pumpkin *cv.* Arka Chandan collected from local market were used for present investigation. The selected fruits were washed under running water and disinfected by dipping in sodium hypochlorite solution (100 ppm) for 2 minutes. All tools and equipment were sanitized with sodium hypochlorite solution (150 ppm) prior to processing. The stalk of fruit was removed with a sharp stainless-steel knife and then cut longitudinally in thick slices and seeds were removed from the cavity with the help of stainless steel (SS) spoon. These slices were again cut into approximate 2.5 × 2.5 x 2.5 cm cubes. The pieces/cubes were dipped in edible coatings such as xanthan gum @ 0.50%**,** chitosan @ 1%, gaur gum @ 0.25%, ascorbic acid @ 0.50%, glycerol @ 1% and sodium benzoate @ 0.05% for five minutes along with untreated control. The treated fresh cut red pumpkin pieces of 250 g were packed in consumer food grade polyethylene bags of 21.5×15 cm size having 200 gauge with 2% vent. The samples were stored at two different storage conditions i.e. ambient temperature (AT) and refrigerator storage (RS) at 5 ± 1 $^{0}$C and 90% RH for further study. The observations on physiological loss in weight (PLW, %), firmness (kg $cm^{-1}$), total soluble solids ($^{0}$Brix), titratable acidity (%), ascorbic acid and total mineral contents (mg $100^{-1}$), sensorial score for colour, flavor, appearance, taste, overall acceptability and total microbial count of fresh cut red pumpkin were recorded at the time of preparation and at an alternate day till the end of storage life. The total soluble solids, titratable acidity, ascorbic acid and total mineral contents (mg $100^{-1}$) were estimated by the standard procedures of A.O.A.C. (2010) [2]. The sensorial score for colour, flavor, appearance, taste, overall acceptability was recorded by using nine-point hedonic scale (Amerine *et al.*, 1965) [1] by the panel of seven judges. The microbial growth on minimally processed red pumpkin was observed as total plate count (TPC) and were recorded by the method suggested by Luna-Guzman and Barrett (2000) [13] and Silveira *et al.* (2011) [21]. The data was reported as an average value of replicates with standard deviation and analysis of variance (ANOVA) was performed using IBM SPSS statistics 22 (Windows 8.1, Statistical analysis). The level of significance for all the tests was α = 0.05 (Panse and Sukhatme, 1985) [15].

## Results and Discussion

### Physico-chemical composition of fresh red pumpkin

The physico-chemical composition of red pumpkin *cv.* Arka Chandan fruits had 4.78 kg of weight, 1.220 kg of skin weight, 282.00 g of seed weight, 3.235 kg of edible portion 68.55 of percentage edible portion, 92.00% of moisture, 6.70 of pH, 0.38% of titratable acidity, 7.00 $^{0}$Brix of TSS, 9.0 mg $100g^{-1}$ of ascorbic acid, 419.01 mg $100g^{-1}$ of total mineral contents.

### A. Physico-chemical composition of fresh red pumpkin

The physiological loss in weight (PLW) of fresh-cut red pumpkin exhibited increasing trend throughout the storage period irrespective of storage conditions and coating treatments. The data presented in Table 1 clearly indicated that, significantly highest PLW of fresh cut red pumpkin was recorded by $T_1$ treatment (3.50%) at the end of 2$^{nd}$ day of storage at ambient temperature. Among the pre-treatments of edible coatings, treatment $T_2$ recorded the least PLW of (2.32%) closely followed by $T_3$ (2.47%) at ambient temperature. Similarly, the least PLW was also recorded by $T_2$ (0.85, 1.01, 1.67, 2.02, 2.33 and 2.50%) closely followed by $T_3$ (1.17, 1.21, 1.80, 2.33, 2.63 and 2.87%) on 2$^{nd}$, 4$^{th}$, 6$^{th}$, 8$^{th}$, 10$^{th}$ and 12$^{th}$ day of storage under refrigerator conditions. The rate of PLW of fresh cut red pumpkin was found to be lower in the samples treated with edible coatings as compared with the untreated control and stored under refrigerated conditions might be due to edible coatings which had the ability to control the moisture loss and providing other functions and consequently showed the less PLW. After harvesting plant products lose the water supply provided by the plant and respiratory metabolism coupled with respiration leads to a water deficit that favors quantitative and qualitative losses minimal processing due to the mechanical stress generated as well as accelerating the rate of water loss (Thompson, 2003) [22]. Lima *et al.* (2019) [12] noticed that the edible coatings have the ability to control the moisture loss and providing other functions and consequently show the less weight loss of the minimally processed red pumpkin. The results of present findings are in close conformity with findings reported by Habibunnisa *et al.* (2001) [9], William *et al*. (2017) [24] and Huynh & Nguyen (2020) [10] in minimally processed red pumpkin.

The firmness was of fresh cut red pumpkin exhibited a decreasing trend throughout the storage period irrespective of pre- treatments of edible coatings and storage conditions. The firmness of 4.80 kg cm$^{-2}$ which was found to be decreased and reached to 3.84 and 4.23 kg cm$^{-2}$) in $T_1$ at the end of 2$^{nd}$ day of storage under ambient temperature and refrigerated storage conditions, respectively (Table 1). The continuous decrease with respect to firmness was noticed in $T_2$ (4.34, 4.25, 4.13, 4.00 and 3.88 kg cm$^{-2}$) closely followed by $T_3$ (4.24, 4.16, 4.05, 3.90 and 3.73 kg cm$^{-2}$) at 4$^{th}$, 6$^{th}$, 8$^{th}$, 10$^{th}$ and 12$^{th}$ day of storage, respectively under refrigerated conditions. The results of present findings are in close conformity with findings of Sasaki *et al*. (2006) [18] who observed that the firmness of fresh-cut squash was significantly influenced by different organic or inorganic dipping (coating) treatments irrespective of storage temperature, however maximum retention of firmness was recorded in treatment of 0.50% xanthan gum. This might be due to the cell binding properties of xanthan gum which improved the firmness by maintaining turgor, membrane integrity and inhibit lipase activity of fresh-cut pumpkin. Similar results were also recorded by Luna-Guzman & Barrett (2000) [13] who observed that, the edible coating maintained fresh cuit cantaloupes firmness throughout the storage period & Cortez-Vega & Borges (2018) [6] reported that the treatments with edible coatings resulted in the largest reduction in the values of firmness of minimally processed pumpkin at 4 $^0$C at the end of 12$^{th}$ day of storage.

**Table 1:** Effect of edible coatings and storage conditions Physico-chemical constituents of fresh cut red pumpkin at different storage conditions.

| Treat-ments | Physico-chemical composition of fresh cut red pumpkin | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLW (%) | | | Firmness (kg/cm$^2$) | | | TSS ($^0$Brix) | | | Acidity (%) | | | Ascorbic acid (mg/100g) | | | Total mineral contents (mg/100g) | | |
| | Storage conditions | | | Storage conditions | | | Storage conditions | | | Storage conditions | | | Storage conditions | | | Storage conditions | | |
| | Initial | AT on 2$^{nd}$ day | RS on 12$^{th}$ day | Initial | AT on 2$^{nd}$ day | RS on 12$^{th}$ day | Initial | AT on 2$^{nd}$ day | RS 12$^{th}$ day | Initial | AT on 2$^{nd}$ day | RS 12$^{th}$ day | Initial | AT on 2$^{nd}$ day | RS 12$^{th}$ day | Initial | AT on 2$^{nd}$ day | RS 12$^{th}$ day |
| T1 | 0.00 | 3.50 | 5.03 | 4.80 | 3.84 | 3.26 | 7.00 | 6.32 | 5.16 | 0.38 | 0.70 | 0.79 | 9.00 | 7.26 | 7.95 | 419.01 | 409.05 | 414.98 |
| T2 | 0.00 | 2.32 | 2.50 | 4.80 | 4.14 | 3.88 | 7.00 | 6.55 | 6.07 | 0.38 | 0.45 | 0.58 | 9.00 | 8.31 | 8.58 | 419.01 | 414.53 | 417.02 |
| T3 | 0.00 | 2.47 | 2.87 | 4.80 | 4.06 | 3.73 | 7.00 | 6.50 | 5.91 | 0.38 | 0.47 | 0.64 | 9.00 | 8.23 | 8.47 | 419.01 | 413.31 | 416.73 |
| T4 | 0.00 | 2.62 | 3.84 | 4.80 | 4.01 | 3.60 | 7.00 | 6.41 | 5.75 | 0.38 | 0.77 | 0.65 | 9.00 | 8.00 | 8.09 | 419.01 | 411.36 | 416.02 |
| T5 | 0.00 | 2.50 | 3.49 | 4.80 | 3.94 | 3.64 | 7.00 | 6.33 | 5.67 | 0.38 | 0.53 | 0.71 | 9.00 | 7.96 | 8.07 | 419.01 | 412.02 | 416.97 |
| T6 | 0.00 | 2.52 | 3.85 | 4.80 | 4.01 | 3.52 | 7.00 | 6.28 | 5.49 | 0.38 | 0.49 | 0.68 | 9.00 | 7.93 | 8.00 | 419.01 | 412.40 | 416.56 |
| T7 | 0.00 | 2.50 | 3.67 | 4.80 | 3.92 | 3.34 | 7.00 | 6.30 | 5.52 | 0.38 | 0.72 | 0.63 | 9.00 | 8.15 | 8.39 | 419.01 | 413.04 | 416.76 |
| SE± | -- | 0.057 | 0.037 | -- | 0.022 | 0.024 | -- | 0.079 | 0.039 | -- | 0.014 | 0.007 | -- | 0.037 | 0.115 | -- | 0.315 | 0.391 |
| CD at 1% | -- | 0.240 | 0.280 | -- | 0.090 | 0.03 | -- | NS | 0.17 | -- | 0.06 | 0.03 | -- | 0.16 | 0.48 | -- | 1.33 | 1.35 |

$T_1$ = Control, $T_2$ = Xanthan gum 0.50%, $T_3$ = Chitosan 1%, $T_4$ = Gaur gum 0.25%, $T_5$ = Ascorbic acid 0.50%, $T_6$ = Glycerol 1%, $T_7$ = Sodium benzoate 0.05%.

AT = Ambient temperature and RS = Refrigerator storage (5 ± 1 $^0$C and 90% RH).

At the end of 2$^{nd}$ day of storage, at ambient temperature, TSS content was non-significantly influenced by the dipping treatments of edible coatings (Table 1). Under refrigerated storage conditions, the maximum retention of TSS was observed in $T_2$ (6.76, 6.66, 6.50, 6.31 and 6.07 $^0$B) followed by $T_3$ (6.62, 6.52, 6.46, 6.03 and 5.91 $^0$B) on 4$^{th}$, 6$^{th}$, 8$^{th}$, 10$^{th}$, and 12$^{th}$ day of storage, respectively. Under refrigerated storage conditions, the minimum retention of TSS content in $T_1$ (6.34 $^0$B) closely followed by $T_7$ (6.49 $^0$B). The edible coatings have the ability to slowed down the decreasing rate of total soluble solids which resulted in the more retention of TSS content of fresh cut red pumpkin irrespective of storage conditions. The rate of decrease was more in the samples stored at ambient temperature than the refrigerated storage. However, there was a clear relationship between the TSS content of the samples in the presence of different coatings and with higher temperature and respiration rate, there are more substrates being consumed (Cortez-Vega & Borges (2018) [6]. The probable reduction in TSS content might be due to the minimal processing that when injuring the fruit promoted greater sugar degradation i.e. being used as a substrate in the respiratory metabolism since the transpiration rate was higher in minimally processed and vacuum-packed pumpkins at the end of 12$^{th}$ day of storage at 10 $^0$C (Silva *et al*., 2009) [20]. The results of present finding are in accordance with findings reported by Zhang *et al*. (2004) [26] in cucumber, Viana (2009) [23] in fresh cut pineapple, Mohamed *et al.* (2013) [14] in minimally processed prickly pear and Lima *et al.* (2019) [12] in minimally processed pumpkin. The controversial results were also reported by Chitarra & Chitarra (2005) [5] who stated that, total soluble solids tend to increase during fruit storage/ripening either by sugar synthesis, starch degradation and water loss that concentrates these compounds.

The data presented in Table 1 clearly indicated that, the least acidity recorded by $T_6$ (0.46%) closely followed by $T_2$ (0.49%) whereas the highest values for acidity was noticed in T 4 (0.77%) closely followed by $T_7$ (0.72%) at the end of 2$^{nd}$

day of storage under ambient temperature. Among the various pre-treatments of edible coatings, the least acidity was recorded in $T_2$ (0.43, 046, 048, 0.51, 054 and 0.58%) whereas the highest acidity was recorded in $T_5$ (0.52, 0.57, 0.60, 0.65, 0.68 and 0.71%) at 2nd, 4th, 6th, 8th, 10th and 12th day of storage, respectively under refrigerated storage. The total titratable acidity of fresh cut fresh-cut pumpkin was significantly higher in ambient temperature as compared to refrigerator storage. The acidity of content exhibited an increasing trend throughout storage period irrespective edible coating treatments and storage conditions. This increase in acidity content might be due to microbial growth on the processed pumpkin and also due to organic acids present in pumpkin. Chitarra & Chitarra (2005) [5] also reported that, the acidity in fruits and vegetables might be due to organic acids which are dissolved in the vacuoles of the cell, either in free form, as combined with salts, esters, glycosides. The results of present findings are in close conformity with findings of Habibunnisa *et al*. (2001) [9] & Silva *et al.* (2009) [20] in minimally processed pumpkins and Chien *et al.* (2007) [4] in sliced mango during storage at low temperature.

The data shown in Table 1 clearly indicated that, among the various pre-treatments of edible coatings, the maximum retention of ascorbic acid content was noticed in $T_2$ (8.31 and 8.58 mg $100g^{-1}$) closely followed by $T_3$ (8.23 and 8.47 mg $100g^{-1}$) whereas the minimum retention of ascorbic acid was noticed in $T_6$ (7.93 and 8.00 mg $100g^{-1}$) at the end of 2nd day and 12th day of storage under ambient temperature and refrigerated storage conditions, respectively. It was further noticed that, the minimum decrease in ascorbic acid was observed in the samples stored under refrigerator storage conditions than ambient temperature subjected to xanthan gum and chitosan might be due to low temperature and coatings avoided the direct exposure to the air. The results of present findings are in accordance with results reported by Habibunnisa *et al.* (2001) [9] & William *et al.* (2017) [24] who noticed that the xanthan gum and chitosan reported the minimum changes in vitamin C content of minimally processed pumpkin at low temperature.

The data presented in Table 1 revealed that, the total mineral content of minimally processed red pumpkin was significantly influenced by the various coating treatments and storage conditions. The total mineral content of fresh cut v red pumpkin was 419.01 mg $100g^{-1}$ and exhibited a decreasing trend throughout the storage period irrespective of pre-treatments of edible coatings and storage conditions and reached to 409.05 and 414.98 mg $100g^{-1}$ in untreated control on 2nd and 12th day of storage under ambient temperature and refrigerator storage, respectively. Among the various pre-treatments of edible coatings, the maximum retention of total mineral content was noticed in $T_2$ (414.53 and 417.02 mg $100g^{-1}$) closely followed by $T_3$ (413.31 and 416.73 mg $100g^{-1}$) whereas the minimum values were noticed in $T_4$ (411.36 and 416.02 mg $100g^{-1}$) at the end of 2nd day and 12th day of storage under ambient temperature and refrigerated storage conditions, respectively. The total mineral content of fresh cut red pumpkin was significantly low in ambient temperature as compare to refrigerator storage. The results of present findings are in close conformity with findings of Cortez-Vega & Borges (2018) [6] who reported the xanthan gum acts as a thickening agent which recorded the best results in the coating of minimally processed red pumpkin reduces the rate of degradation of mineral content. Huynh & Nguyen (2020) [10] observed that the protection of chitosan against total mineral depletion could be due to the selective permeability of chitosan acetic complex. The coating layer formed by chitosan dissolved in acetic solution gives high permeability to oxygen but sufficiently low absorption and release activity to carbon dioxide. Such properties limited the contact of total minerals with oxygen, a potent oxidizing agent, hence retained significantly higher total mineral content in coated samples.

**B. Sensorial qualities of fresh cut red pumpkin**

The highest shelf life of 12 days was recorded in all edible coated samples during refrigerator storage conditions while only 2 days at ambient temperature. ed pumpkin samples recorded. The maximum sensorial score for colour (8.16 and 8.00), flavor (8.44 and 8.04), taste (8.00 and 8.15), appearance (8.28 and 8.26) and overall acceptability (8.35 and 8.16) was recorded by the treatment $T_2$ i.e. xanthan gum @ 0.50% closely followed by $T_3$ i.e. chitosan @ 1% (8.10 & 7.83, 8.21 & 7.84, 7.90 & 8.00, 8.15 & 8.16 and 8.17 & 8.03, respectively) whereas the least score was noticed in $T_1$ i.e. untreated control (6.37 & 6.6.85, 6.88 & 6.78, 7.06 & 6.45, 6.38 & 6.40 and 6.90 & 6.78, respectively) at the end of storage life under ambient temperature and refrigerator storage, respectively. The better retention of sensorial attributes of fresh cut red pumpkin was found at refrigerator storage (RS) than ambient temperature (AT). The results of present findings are in accordance with results reported by Cortez-Vega & Borges (2018) [6] who reported the xanthan gum acts as a thickening agent which presented the best results in the coating of minimally processed red pumpkin by retaining colour, flavour, taste, appearance ultimately increase the overall acceptability of the pumpkin sample. Huynh & Nguyen (2020) [10] who reported the score for overall acceptability with chitosan treatment retained best acceptability throughout the storage time i.e. 12th day whereas, no dipping treatments recorded the poor acceptance.

**C. Total microbial count of fresh cut red pumpkin**

The data with respect to total microbial count of fresh cut red pumpkin have been presented in Table 2. The data revealed that, the total microbial count was significantly influenced by various coating treatments and storage conditions. The total microbial count of fresh cut red pumpkin was 6.10 cfu $g^{-1}$ which was increased after dipping treatments of edible coatings. The total microbial count was found maximum in $T_1$ (15.11 cfu $g^{-1}$) followed $T_6$ (10.36 cfu $g^{-1}$) by $T_5$ (10.33 cfu $g^{-1}$) on 2nd day of storage at ambient temperature, where initially it was 7.30 and 7.92 cfu $g^{-1}$, respectively. The minimum increase in total microbial count was recorded by $T_2$ (8.25 cfu/g) closely followed by $T_3$ (9.18 cfu $g^{-1}$) on 2nd day of storage at ambient temperature. The total microbial count of minimally processed red pumpkin was significantly higher in the samples stored at ambient temperature as compare to refrigerator storage. Under refrigerated storage conditions, treatment $T_1$ recorded the highest total microbial count at the end of 12th day of storage (12.78 cfu $g^{-1}$) where initially it was (7.64 cfu $g^{-1}$). The total microbial count found to be minimum in $T_2$ (7.47 cfu $g^{-1}$) closely followed by $T_3$ (7.52 cfu $g^{-1}$) on 12th day of storage under refrigerated storage conditions, where initially it was (6.01 and 6.21 cfu $g^{-1}$, respectively). Lima *et al*. (2019) [12] also stated that the untreated control recorded the maximum total microbial count during storage. The results of present findings are in close conformity with the results reported by Pizato *et al*. (2013) [16] in minimally processed peaches, Mohamed *et al*. (2013) [14] in prickly pear and Yurdugul (2016) [25] in peeled banana.

**Table 2:** Effect of edible coatings and storage conditions sensorial qualities and total microbial count of fresh cut red pumpkin at different storage condition.

| Treat-ments | Sensorial qualities and total microbial count of fresh cut red pumpkin | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Colour | | | Flavour | | | Taste | | | Appearance | | | Overall acceptability | | | Total microbial count (log cfu/g) | | |
| | Storage conditions | | | Storage conditions | | | Storage conditions | | | Storage conditions | | | Storage conditions | | | Storage conditions | | |
| | Initial | AT on 2nd day | RS on 12th day | Initial | AT on 2nd day | RS on 12th day | Initial | AT on 2nd day | RS 12th day | Initial | AT on 2nd day | RS 12th day | Initial | AT on 2nd day | RS 12th day | Initial | AT on 2nd day | RS 12th day |
| T1 | 8.60 | 6.37 | 6.85 | 8.70 | 6.88 | 6.78 | 8.70 | 7.06 | 6.45 | 8.80 | 6.38 | 6.40 | 8.70 | 6.90 | 6.78 | 9.87 | 15.11 | 12.78 |
| T2 | 8.60 | 8.16 | 8.00 | 8.70 | 8.44 | 8.04 | 8.70 | 8.00 | 8.15 | 8.80 | 8.28 | 8.26 | 8.70 | 8.35 | 8.16 | 6.65 | 8.25 | 7.47 |
| T3 | 8.60 | 8.10 | 7.83 | 8.70 | 8.21 | 7.94 | 8.70 | 7.90 | 8.00 | 8.80 | 8.15 | 8.16 | 8.70 | 8.17 | 8.03 | 7.38 | 9.18 | 8.26 |
| T4 | 8.60 | 7.81 | 7.01 | 8.70 | 7.54 | 7.50 | 8.70 | 7.77 | 7.76 | 8.80 | 7.40 | 7.73 | 8.70 | 7.73 | 7.83 | 7.77 | 9.41 | 7.52 |
| T5 | 8.60 | 7.80 | 7.18 | 8.70 | 7.51 | 7.68 | 8.70 | 7.50 | 7.69 | 8.80 | 7.20 | 7.75 | 8.70 | 7.81 | 7.33 | 7.92 | 10.33 | 9.24 |
| T6 | 8.60 | 7.67 | 7.03 | 8.70 | 7.04 | 7.32 | 8.70 | 7.60 | 7.52 | 8.80 | 7.59 | 7.61 | 8.70 | 7.62 | 7.25 | 7.30 | 10.36 | 8.41 |
| T7 | 8.60 | 7.87 | 7.23 | 8.70 | 7.56 | 7.23 | 8.70 | 7.19 | 7.92 | 8.80 | 7.80 | 7.90 | 8.70 | 8.00 | 7.72 | 8.50 | 9.31 | 9.70 |
| SE± | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.159 | 0.119 | 0.310 |
| CD at 1% | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.67 | 0.49 | 0.31 |

$T_1$ = Control, $T_2$ = Xanthan gum 0.50%, $T_3$ = Chitosan 1%, $T_4$ = Gaur gum 0.25%, $T_5$ = Ascorbic acid 0.50%, $T_6$ = Glycerol 1%, $T_7$ = Sodium benzoate 0.05%.
AT = Ambient temperature and RS = Refrigerator storage (5 ± 1 $^0$C and 90% RH).

From the present study, it is concluded that fresh cut red pumpkin pre-treated with xanthan gum @ 0.50% i.e. $T_2$ packed in 200 gauge polyethylene bag with 2% vents and stored at refrigerator storage (5 ± 1 $^0$C) recorded the minimum physiological loss in weight with maximum retention of physico-chemical composition with more stability in firmness, highest retention of ascorbic acid and total mineral contents resulted in maximum overall acceptability with least acidity and total microbial count at the end of 12th day of storage.

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