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Effect of non-destructive edible coating materials and refrigerated storage on quality and shelf life of bell pepper (*Capsicum annuum*)

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ABSTRACT

Bell pepper (*Capsicum annuum* L.) has high nutritional value but the high water content makes it susceptible to water loss and shrivelling, limiting the storage life. The present investigation was carried out at the post-harvest physiology laboratory of Dr Y S Parmar University of Horticulture and Forestry, Nauni, Himachal Pradesh in 2017–18 to evaluate the effect of various edible coatings on the quality of capsicum fruits. Comparative mean analysis by Tukey's test ($P<0.05$) revealed that the coated fruits exhibited lesser variations in various physico-chemical characteristics during storage while, 50% and 25% starlight coating and 15% *Aloe vera* leaf extract resulted in delayed senescence and were effective in maintaining the postharvest quality of green bell pepper fruits.

Keywords: Bell pepper, Plant extracts, Refrigerated storage, Shelf life, Wax coating

Bell pepper (*Capsicum annuum* L.) of Solanaceae family, is a vegetable with high nutritional value, containing vitamin C (150–180 mg/100g), vitamin E, vitamin A (12% of total pigment), phenolics and flavonoids, carotenoids and alkaloids (Johnson 2009 and Loke *et al*. 2008). Beyond the basic nutrition, it also exhibits anticancerous activity (Bae *et al*. 2012, Litoriya *et al*. 2014, Hwang *et al.* 2009). Capsicum has a very high water content which makes it susceptible to flaccidity, shrivelling, wilting, decay etc. and ultimately reduced marketability (Edusei *et al*. 2012). The rate of deterioration, however, depends on several external factors including storage temperature, relative humidity, air speed, atmospheric composition and sanitation procedures (Kader 2005, Ghidelli *et al.* 2014, Manolopoulou *et al.* 2012). In the recent years, an urge to eat healthy and chemical free food has impelled the researchers to think of better, natural and effective alternatives to increase shelf life and prevent post-harvest losses. Plant extracts are known to contain some principal substances exhibiting growth regulating, fungicidal and insecticidal properties (Gniewosz and Synowiec 2011) which can be exploited for retaining freshness and enhancing the shelf life of fresh produce. *Aloe vera*, garlic, mint leaf extracts and edible wax coatings have been reported to be effective in retaining freshness and enhancing the shelf life in different fruits. Keeping this in view, the present study was carried out to test the applicability and potential of various coatings to retain storage quality of bell pepper fruits under refrigerated conditions.

MATERIALS AND METHODS

Raw material: Freshly harvested bell peppers were procured from the local farmers, properly packed in suitable containers and immediately transported to the post-harvest physiology laboratory, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan, Himchal Pradesh. Only healthy, fresh, uniform sized and disease-free fruits were selected for application of various post-harvest treatments.

Plant extracts applications: The fruits were coated with different concentrations of mint leaf, garlic and *Aloe vera* extracts prepared as per the method described by Gakhukar (1996). Aqueous solutions were prepared by overnight soaking a known weight of each of the plant in an equal quantity of water. The extracts were separated with a muslin cloth, magnetically stirred to homogenize and diluted to the required concentrations i.e mint leaf extract (MLE) and garlic extract (GE) (10, 20 and 30%); *Aloe vera* gel, (AVG) (5, 10 and 15%); and starlight wax (SWE) (Pontes Industria de Cera Lida, Brazil) (10, 25 and 50%) and applied as a coating treatment. After coating the fruits were air dried and packed in corrugated fibre board (CFB) cartons and were stored at 10±2°C for periodic observations after 7 days.

Physicochemical analysis: Total soluble solids (TSS) were recorded with the help of an Erma hand refractometer. Ascorbic acid content was determined as per standard

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AOAC method (Ranganna 1986) using 2, 6-dichlorophenol indophenol dye. Sugars (total and reducing) were estimated by Lane and Eynon method (Lane and Eynon 1923). Total phenols were estimated with Folin- Ciocalteau reagent (Bray and Thorpe 1954). Capsaicin content was determined by the colorimetric method (Sadasivam and Manickam 1978). Respiration rate was measured with the help of Gas data analyzer (GFM series 30-1/2/3, GAS Data Ltd. Conventry UK) and was expressed as ml CO_2/kg/h.

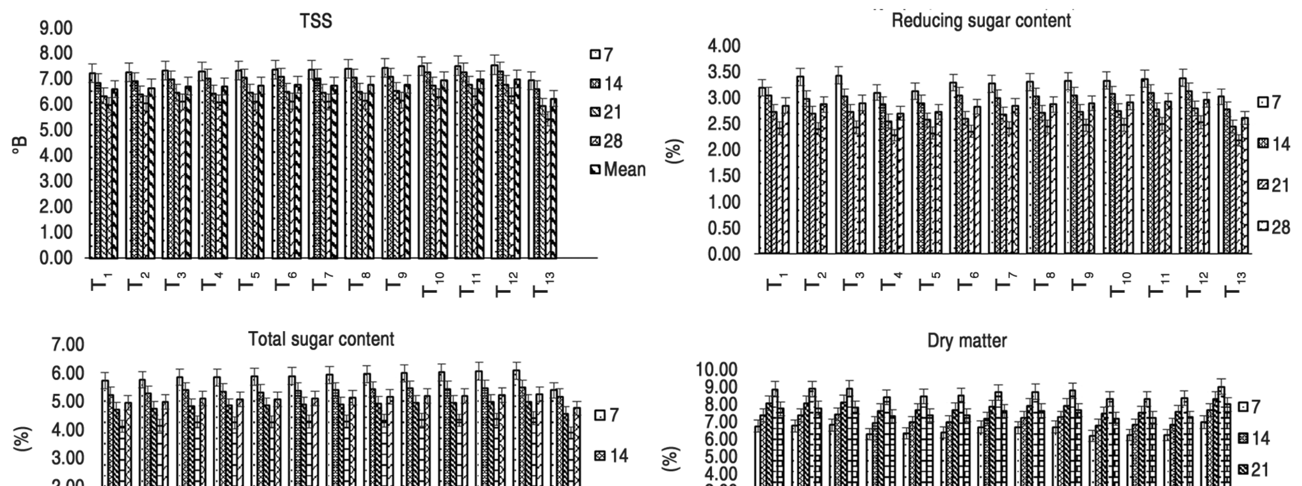
Statistical analysis: The data for changes in physicochemical attributes were analyzed at each storage interval (7, 14, 21 and 28 days) by two way analysis of variance (two way ANOVA) using IBM SPSS Statistics program (Somers, NY, USA). The multiple least square means comparisons were carried out using Tukey's test at P=0.05.

RESULTS AND DISCUSSION

Effect on physiological loss in weight (PLW) and dry matter content: Physiological loss in weight (PLW) increased linearly with an increase in storage period up to 28 days. The control fruit recorded the highest mean PLW (4.68%) while, fruits coated with 50% SWE resulted in lowest PLW (3.91%). Multiple least squares means comparison revealed nonsignificant differences in PLW of fruits coated with 15% AVG, 10% and 20% SWE and 30% GLE. Different coating formulations might act by creating a modification in the internal atmosphere of the fruits by adhering to the pores on fruit skin. The dry matter content exhibited a gradual and linear increase during storage up to 28 days (Fig 1). The control fruits after 28 days of refrigeration reported the highest dry matter content (7.96%), while coating the fruits with 10% SWE reduced dry matter content to minimum. Different coatings restrict the weight loss which might be the possible explanation for slow and gradual increase in dry matter content of such fruits (Tadesse 2000). Our finding are in agreement with results reported by Yeganah *et al.* (2013) in grapes.

Effect on total soluble solids (TSS), reducing and total sugar content: There was a gradual decrease in TSS content of the fruits as the storage period advanced (Fig 1). The maximum mean TSS (6.90°B) was recorded in fruits coated with 50% SWE while, control fruits recorded the minimum mean TSS content (6.19ºB). The stored metabolites are generally utilized during storage due to respiration while the decreased rate of respiration might have reduced the rate of utilization of these metabolites and hence their higher retention in the treated fruits (Behra *et al.* 2004). Total and reducing sugars content followed a close linearity with the TSS content (Fig 1). The maximum mean reducing and total sugar content was recorded in fruits coated with 50% and 25% SWE; 15% AVG and 30% MLE being equally effective. The initial increase in sugars of the fruits coated with different plant extracts might be due to loss of water from the fruits and conversion of complex polysaccharides and pectic substances into sugars (mono and disaccharides). While, a decline during later phase of storage can be attributed to metabolic breakdown and senescence of fruits. Similar observations have been recorded earlier by Ochoa-Reyes *et al.* (2013) and Bhardwaj and Sen (2003).

Effect on ascorbic acid, titratable acidity (TA) and total phenols: Significant decline in ascorbic acid content with advancement in storage was reported for all the treatments (Table 1). This decline was minimum in the fruits coated with 50% SWE and such fruits recorded maximum mean ascorbic acid content of 110.44 mg/100 g. Mean



T_1, Mint Leaf Extract (MLE) 10%, T_2, MLE 10%, T_3, MLE 30%; T_4, Garlic Extract (GE) 10%, T_5, GE 20%, T_6, GE 30%; T_7, *Aleo vera* Gel (AVG) 5%, T_8, AVG 10%, T_9, AVG 15%; T_{10}, Starlight Wax (SW) 10%, T_{11}, SW 25%, T_{12}, SW 50%; T_{13}, Control.

Fig 1 Changes in TSS, reducing sugar, total sugar and dry matter content of capsicum during storage under refrigerated conditions.

Table 1 Effect of different coatings and refrigerated storage conditions (10±2°C temperature and 90–95% RH) on physiological loss in weight (PLW), titratable acidity and ascorbic acid of capsicum.

Treatment	PLW (%)					Titratable acidity (%)					Ascorbic acid (mg/100g)				
	7	14	21	28	Mean	7	14	21	28	Mean	7	14	21	28	Mean
T_1: MLE (10 %)	3.81 ± 0.08^{b}	4.19 ± 0.09^{b}	4.37 ± 0.10^{b}	4.78 ± 0.08^{b}	4.29 ± 0.05^{b}	0.29 ± 0.01^{c}	0.25 ± 0.01^{d}	0.21 ± 0.01^{d}	0.18 ± 0.01^{c}	0.24 ± 0.01^{c}	113.08 ± 0.67^{c}	105.83 ± 1.06^{e}	96.50 ± 0.74^{f}	90.57 ± 0.89^{f}	101.50 ± 0.87^{g}
T_2: MLE (20 %)	3.78 ± 0.04^{b}	4.11 ± 0.06^{b}	4.30 ± 0.04^{bc}	4.72 ± 0.04^{bc}	4.23 ± 0.01^{c}	0.31 ± 0.03^{c}	0.27 ± 0.01^{c}	0.23 ± 0.01^{bc}	0.21 ± 0.01^{b}	0.26 ± 0.01^{b}	113.43 ± 0.26^{c}	106.12 ± 0.87^{d}	98.82 ± 0.45^{e}	93.92 ± 0.91^{e}	103.07 ± 0.44^{f}
T_3: MLE (30 %)	3.62 ± 0.09^{d}	3.94 ± 0.12^{acd}	4.24 ± 0.07^{c}	4.64 ± 0.05^{ecd}	4.11 ± 0.03^{d}	0.35 ± 0.02^{ab}	0.30 ± 0.03^{b}	0.25 ± 0.02^{a}	0.23 ± 0.01^{b}	0.28 ± 0.03^{b}	114.83 ± 0.01^{b}	108.44 ± 0.56^{c}	103.12 ± 0.67^{c}	96.18 ± 0.72^{c}	105.64 ± 0.56^{de}
T_4: GE (10 %)	3.74 ± 0.06^{cb}	4.10 ± 0.10^{bc}	4.33 ± 0.09^{bc}	4.77 ± 0.07^{b}	4.24 ± 0.06^{b}	0.26 ± 0.01^{b}	0.22 ± 0.01^{ed}	0.21 ± 0.02^{d}	0.18 ± 0.02^{c}	0.22 ± 0.02^{dc}	113.42 ± 0.01^{c}	106.23 ± 0.76^{d}	97.84 ± 0.32^{e}	92.87 ± 0.57^{e}	102.59 ± 0.45^{f}
T_5: GE (20 %)	3.69 ± 0.04^{c}	4.02 ± 0.08^{c}	4.26 ± 0.09^{c}	4.67 ± 0.08^{cd}	4.16 ± 0.06^{d}	0.29 ± 0.01^{bc}	0.25 ± 0.02^{d}	0.24 ± 0.01^{c}	0.23 ± 0.02^{b}	0.25 ± 0.01^{b}	113.73 ± 1.10^{c}	108.52 ± 0.86^{c}	100.07 ± 1.12^{d}	95.23 ± 0.84^{dc}	104.39 ± 0.88^{ed}
T_6: GE (30 %)	3.55 ± 0.06^{de}	3.93 ± 0.06^{d}	4.17 ± 0.05^{c}	4.60 ± 0.11^{cd}	4.06 ± 0.01^{e}	0.34 ± 0.02^{b}	0.27 ± 0.01^{c}	0.25 ± 0.01^{c}	0.25 ± 0.01^{a}	0.28 ± 0.01^{b}	115.98 ± 0.01^{ab}	109.84 ± 1.02^{b}	104.34 ± 1.05^{c}	97.52 ± 0.89^{c}	106.92 ± 0.78^{c}
T_7: AVG (5%)	3.61 ± 0.04^{d}	3.90 ± 0.04^{d}	4.12 ± 0.03^{dce}	4.72 ± 0.06^{b}	4.09 ± 0.10^{ed}	0.32 ± 0.01^{bc}	0.29 ± 0.02^{bc}	0.25 ± 0.01^{c}	0.21 ± 0.01^{b}	0.27 ± 0.01^{b}	111.29 ± 0.01^{c}	108.21 ± 0.45^{c}	100.97 ± 0.81^{d}	96.97 ± 0.67^{c}	104.36 ± 1.23^{ed}
T_8: AVG (10%)	3.53 ± 0.05^{de}	3.82 ± 0.12^{e}	4.04 ± 0.11^{e}	4.59 ± 0.08^{d}	4.00 ± 0.05^{e}	0.34 ± 0.01^{b}	0.32 ± 0.01^{b}	0.27 ± 0.01^{b}	0.25 ± 0.02^{c}	0.30 ± 0.01^{b}	112.62 ± 0.81^{c}	108.53 ± 0.67^{c}	104.31 ± 0.45^{c}	99.32 ± 0.77^{b}	106.20 ± 0.78^{c}
T_9: AVG (15%)	3.46 ± 0.06^{e}	3.77 ± 0.12^{f}	3.98 ± 0.07^{e}	4.47 ± 0.09^{e}	3.92 ± 0.05^{g}	0.37 ± 0.02^{ab}	0.34 ± 0.01^{ab}	0.32 ± 0.03^{a}	0.27 ± 0.01^{a}	0.33 ± 0.01^{a}	114.92 ± 0.58^{b}	110.84 ± 1.04^{b}	106.57 ± 0.69^{b}	103.64 ± 0.71^{a}	108.99 ± 0.68^{ba}
T_{10}: SW (10 %)	3.57 ± 0.05^{d}	3.94 ± 0.08^{d}	4.15 ± 0.09^{cde}	4.63 ± 0.03^{d}	4.07 ± 0.08^{e}	0.32 ± 0.02^{bc}	0.24 ± 0.02^{d}	0.22 ± 0.01^{d}	0.19 ± 0.02^{c}	0.24 ± 0.01^{cb}	113.12 ± 0.01^{c}	109.92 ± 0.98^{b}	104.64 ± 0.32^{c}	96.69 ± 0.46^{c}	106.09 ± 0.78^{c}
T_{11}: SW (25 %)	3.50 ± 0.03^{e}	3.86 ± 0.07^{e}	4.07 ± 0.06^{e}	4.50 ± 0.05^{ef}	3.98 ± 0.03^{f}	0.30 ± 0.02^{c}	0.30 ± 0.01^{b}	0.26 ± 0.01^{bc}	0.22 ± 0.02^{b}	0.27 ± 0.01^{cb}	115.42 ± 0.96^{b}	110.24 ± 1.21^{b}	106.92 ± 1.20^{b}	103.98 ± 1.02^{a}	109.14 ± 0.93^{a}
T_{12}: SW (50 %)	3.43 ± 0.07^{e}	3.77 ± 0.12^{f}	4.00 ± 0.04^{e}	4.44 ± 0.07^{f}	3.91 ± 0.08^{hg}	0.39 ± 0.03^{b}	0.36 ± 0.03^{b}	0.33 ± 0.02^{a}	0.30 ± 0.03^{a}	0.34 ± 0.02^{a}	116.74 ± 1.01^{a}	112.56 ± 1.12^{a}	108.20 ± 0.77^{ab}	104.27 ± 0.96^{a}	110.44 ± 1.12^{a}
T_{13}: Control	4.03 ± 0.12^{a}	4.45 ± 0.09^{a}	4.92 ± 0.12^{a}	5.32 ± 0.14^{a}	4.68 ± 0.03^{a}	0.25 ± 0.01^{d}	0.24 ± 0.01^{d}	0.19 ± 0.03^{c}	0.17 ± 0.01^{c}	0.21 ± 0.01^{e}	112.20 ± 0.01^{d}	104.95 ± 0.78^{e}	95.73 ± 0.86^{f}	87.82 ± 0.67^{g}	100.18 ± 1.09^{g}

MLE, Mint Leaf Extract; GE, Garlic Extracts; AVG, *Aloe vera* gel; SW, Starlight Wax. Average pooled data of two consecutive years (2015–16 and 2016–17). Values are mean ± SD. The values followed by the same lowercase letter and parameter are not significantly different (Tukey's new multiple range test at $P<0.05$).

Table 2 Effect of different coating treatments and refrigerated storage conditions (10±2°C temp. and 90–95 % RH) on capsaicin content (%) total phenols (mg/100g) and respiration rate (mL of CO2/kg/h) of capsicum

Treatment	Storage interval in days														
	Capsaicin content (%)					Total phenols (mg/100g)					Respiration rate (ml of CO2/kg/h)				
	7	14	21	28	Mean	7	14	21	28	Mean	7	14	21	28	Mean
T_1: MLE (10 %)	0.70 ± 0.02^{d}	0.66 ± 0.03^{c}	0.59 ± 0.04^{d}	0.51 ± 0.01^{d}	0.62 ± 0.02^{d}	51.32 ± 0.12^{e}	48.52 ± 0.23^{e}	45.64 ± 0.37^{f}	42.72 ± 0.18^{h}	47.35 ± 0.31^{g}	19.87 ± 0.12^{b}	19.37 ± 0.05^{b}	18.57 ± 0.05^{bc}	18.03 ± 0.04^{b}	18.96 ± 0.01^{bc}
T_2: MLE (20 %)	0.74 ± 0.01^{c}	0.70 ± 0.02^{bc}	0.63 ± 0.01^{cd}	0.54 ± 0.01^{d}	0.65 ± 0.01^{cd}	52.46 ± 0.54^{d}	49.68 ± 0.31^{d}	46.76 ± 0.75^{e}	43.78 ± 0.31^{f}	48.17 ± 0.42^{e}	19.85 ± 0.09^{b}	19.31 ± 0.06^{c}	18.51 ± 0.07^{c}	17.99 ± 0.05^{b}	18.90 ± 0.09^{c}
T_3: MLE (30 %)	0.78 ± 0.02^{b}	0.73 ± 0.04^{bc}	0.68 ± 0.03^{bc}	0.60 ± 0.02^{b}	0.70 ± 0.03^{ab}	54.66 ± 0.31^{b}	50.79 ± 0.57^{c}	47.86 ± 0.23^{d}	45.10 ± 0.34^{dc}	49.60 ± 0.34^{c}	19.82 ± 0.11^{b}	19.24 ± 0.03^{d}	18.46 ± 0.02^{c}	17.97 ± 0.01^{cb}	18.86 ± 0.05^{c}
T_4: GE (10 %)	0.72 ± 0.02^{d}	0.68 ± 0.04^{c}	0.60 ± 0.01^{cd}	0.54 ± 0.03^{d}	0.64 ± 0.04^{cd}	51.05 ± 0.32^{fe}	47.06 ± 0.51^{f}	44.38 ± 0.21^{g}	41.44 ± 0.23^{g}	45.98 ± 0.33^{h}	19.33 ± 0.04^{d}	18.82 ± 0.04^{e}	18.03 ± 0.01^{e}	17.47 ± 0.02^{ef}	18.41 ± 0.07^{f}
T_5: GE (20 %)	0.76 ± 0.03^{b}	0.74 ± 0.01^{ab}	0.63 ± 0.02^{cd}	0.57 ± 0.03^{cd}	0.67 ± 0.01^{b}	52.92 ± 0.21^{d}	48.92 ± 0.34^{e}	45.99 ± 0.33^{f}	43.56 ± 0.21^{f}	47.75 ± 0.19^{f}	19.30 ± 0.05^{d}	18.74 ± 0.07^{f}	17.95 ± 0.02^{f}	17.43 ± 0.08^{f}	18.38 ± 0.06^{f}
T_6: GE (30 %)	0.80 ± 0.02^{a}	0.77 ± 0.03^{ab}	0.66 ± 0.03^{bc}	0.60 ± 0.01^{b}	0.71 ± 0.03^{ab}	54.56 ± 0.60^{b}	49.79 ± 0.12^{d}	47.23 ± 0.16^{d}	44.42 ± 0.33^{e}	48.93 ± 0.27^{d}	19.27 ± 0.08^{ed}	18.70 ± 0.08^{f}	17.87 ± 0.02^{g}	17.41 ± 0.05^{f}	18.35 ± 0.02^{f}
T_7: AVG (5%)	0.67 ± 0.02^{e}	0.62 ± 0.01^{d}	0.58 ± 0.02^{d}	0.53 ± 0.03^{d}	0.60 ± 0.01^{e}	53.01 ± 0.32^{c}	48.23 ± 0.41^{d}	45.38 ± 0.18^{f}	43.44 ± 0.42^{f}	47.52 ± 0.39^{f}	19.45 ± 0.11^{c}	18.96 ± 0.08^{g}	18.15 ± 0.04^{de}	17.60 ± 0.06^{d}	18.54 ± 0.03^{d}
T_8: AVG (10%)	0.70 ± 0.04^{d}	0.64 ± 0.02^{c}	0.62 ± 0.02^{cd}	0.56 ± 0.02^{cd}	0.63 ± 0.02^{d}	54.20 ± 0.44^{b}	50.36 ± 0.22^{c}	47.47 ± 0.32^{d}	45.54 ± 0.63^{c}	49.39 ± 0.35^{c}	19.43 ± 0.06^{c}	18.90 ± 0.03^{g}	18.08 ± 0.08^{e}	17.57 ± 0.05^{d}	18.52 ± 0.04^{d}
T_9: AVG (15%)	0.72 ± 0.01^{d}	0.69 ± 0.02^{b}	0.65 ± 0.03^{c}	0.62 ± 0.02^{b}	0.69 ± 0.03^{b}	55.98 ± 0.56^{a}	52.52 ± 0.34^{b}	49.66 ± 0.19^{b}	46.72 ± 0.63^{b}	51.42 ± 0.47^{a}	19.40 ± 0.04^{c}	18.82 ± 0.02^{h}	18.00 ± 0.09^{e}	17.55 ± 0.05^{d}	18.49 ± 0.02^{d}
T_{10}: SW (10 %)	0.73 ± 0.01^{c}	0.68 ± 0.05^{c}	0.65 ± 0.03^{bc}	0.57 ± 0.01^{cd}	0.66 ± 0.02^{bc}	53.32 ± 0.37^{c}	49.52 ± 0.23^{d}	46.67 ± 0.12^{e}	44.74 ± 0.45^{e}	48.56 ± 0.52^{e}	19.18 ± 0.07^{f}	18.66 ± 0.07^{i}	17.88 ± 0.02^{g}	17.33 ± 0.01^{gh}	18.26 ± 0.03^{gh}
T_{11}: SW (25 %)	0.76 ± 0.02^{b}	0.74 ± 0.03^{a}	0.67 ± 0.04^{bc}	0.59 ± 0.02^{cb}	0.69 ± 0.03^{b}	54.90 ± 0.45^{b}	51.70 ± 0.51c	48.78 ± 0.26^{c}	45.65 ± 0.43c	50.67 ± 0.34^{b}	19.15 ± 0.03^{f}	18.56 ± 0.11^{j}	17.77 ± 0.03^{h}	17.30 ± 0.05^{h}	18.23 ± 0.06^{gh}
T_{12}: SW (50 %)	0.80 ± 0.03^{a}	0.78 ± 0.04^{a}	0.73 ± 0.03^{a}	0.66 ± 0.04^{a}	0.72 ± 0.02^{ab}	56.22 ± 0.52^{a}	53.36 ± 0.42^{a}	50.49 ± 0.23^{a}	47.58 ± 0.23^{a}	51.91 ± 0.53^{a}	19.12 ± 0.02^{f}	18.48 ± 0.02^{k}	17.60 ± 0.01^{i}	17.27 ± 0.04^{h}	18.21 ± 0.08^{h}
T_{13}: Control	0.61 ± 0.02^{f}	0.54 ± 0.01^{e}	0.50 ± 0.02^{e}	0.46 ± 0.03^{e}	0.53 ± 0.02^{f}	50.46 ± 0.32^{g}	46.25 ± 0.52^{g}	43.34 ± 0.21^{h}	40.24 ± 0.22^{i}	45.07 ± 0.42^{i}	20.45 ± 0.01^{a}	19.86 ± 0.06^{a}	19.14 ± 0.04^{a}	18.76 ± 0.07^{a}	19.54 ± 0.04^{a}

MLE, Mint Leaf Extract; GE, Garlic Extracts; AVG, *Aloe vera* gel; SW, Starlight Wax. Average pooled data of two consecutive years (2015–16 and 2016–17). Values are mean ± SD. The values followed by the same lowercase letter and parameter are not significantly different (Tukey's new multiple range test at $P<0.05$)

separation also revealed nonsignificant differences amongst the fruits coated with 25% SWE and 15% AVG. The loss in ascorbic acid during storage might be due to its metabolic degradation or enzymatic oxidation of L-ascorbic acid to dehydroascorbic acid by oxidizing enzymes like ascorbic acid oxidase, peroxidase, catalase and polyphenol oxidase. The results are in agreement with the findings of Plaza *et al.* (2006), Deepa *et al.* (2007) and Ghasemnazhad *et al.* (2011) in bell peppers. The titratable acidity (TA) decreased gradually with advancement in storage periods under all treatments (Table 2), however fruits treated with 50% SWE and 15% AVG exhibited the lowest decrease in TA and consequently retained highest mean titrable acidity, 0.34% and 0.33%, respectively. Similar findings have been reported earlier by Sharma and Thakur (2017) in pear fruits coated with starlight fruit conserve wax emulsion. The fruits coated with 50% SWE and 15% AVG retained the highest mean phenolic contents of 51.91 mg/100 g and 51.41 mg/100 g, respectively. The continuous decline in phenolic content of the fruits might be due to oxidation of polyphenols by polyphenol oxidase and peroxidases or due to polymerization of simple polyphenols. The results of the present investigation are in agreement with those reported in sweet cherry by Asghari *et al*. (2013) and in apples by Chauhan *et al*. (2011).

Effect on capsaicin content and respiration rate: The capsaicin content was highest in the freshly harvested fruits and continued to decline with advancement in storage (Table 2). The mean separation shows that there was a nonsignificant difference in capsaicin content of the fruits treated with 50% and 25% starlight wax and 15% *Aloe vera* gel which recorded 0.72%, 0.69% and 0.69% capsaicin content, respectively, after 28 days of refrigeration. After the harvest as the ripening begins, the capsaicin concentration has been reported to decrease and can be expected to decrease with further ripening and senescence. The reduced amount of capsaicin is mainly due to the formation of secondary compounds rather than their disappearance. The results of the present investigation are in agreement with Reyes-Escogido *et al.* (2011) and Sharma and Thakur (2017).

It is clear from the data shown in Table 2 that a gradual decline in respiration rate of bell pepper fruits was observed under all treatments during the storage for 28 days. Comparative mean analysis of the respiration rate revealed that the respiration rate of fruits treated with 10%, 25% and 50% SW was nonsignificant with respective mean respiration rates of 18.21, 18.23 and 18.26 ml CO_2/kg/h. Whereas, the uncoated control fruits exhibited the highest respiration rate of 19.54 ml CO_2/kg/h after 28 days of storage. Coatings usually restrict permeation of gases through the skin of the fruits and generally increases the internal CO_2 and decreases the internal O_2 levels of fruits which reduces their subsequent respiration. In mango fruit, the decline in respiration rate, fruit weight, and titratable acidity were all effectively inhibited by chitosan coating.

Coating the capsicum fruits with starlight wax coating @50 and 25% along with 15% *Aloe vera* gel can maintain the fruit quality and minimize the deterioration during 28 days storage at 10±2ºC. These treatments can restrict capsicum metabolism and delay the senescence leading to improved storability of the fruits.

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