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Effect Of Edible Gum Coating,Glycerin And Calcium Lactate Treatment On The Post Harvest Quality Of Peach Fruit

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ABSTRACT
Effect of edible gum and calcium lactate treatment on the post-harvest quality of whole peach fruits stored for 32 days at 10^0C were investigated. Different concentrations of additives were prepared e.g. peaches in treatments AS_1 and AS_2 were dipped in (1%) and (2%) calcium lactate solution respectively for 20 minutes and coated with xanthan gum (1%) + glycerin (2.5%), whereas peaches in treatments AS_3 and AS_4 were dipped in (1%) and (2%) calcium lactate solution respectively for 20 minutes and coated with gum arabic (1%) + glycerin (2.5%) respectively. Treatment AS_0 was left as control. The fruits were packed in corrugated soft board cartons and stored for the whole period of one month at ambient temperature and analyzed physicochemically i.e. total soluble solid, pH, ascorbic acid, titratable acidity, sugar acid ratio, % weight loss, % decay index, firmness and sensory (color, flavor, texture and overall acceptability) at every 4 days of storage interval. Statistical analysis showed that storage intervals and treatments had significant ($P<0.05$) effect on the quality characteristics of the whole peach fruits throughout storage. Physicochemical analysis of peach fruits disclosed that (1%) and (2%) calcium lactate solution and edible coating of xanthan gum (1%) + glycerin (2.5%) treated fruits had little improvement on shelf life extension of peach fruit while (1%) and (2%) calcium lactate solution and edible coating of gum arabic (1%) + glycerin (2.5%) treated fruits had shown better improvement. There was an increasing trend in TSS (8.37 - 10.93^{o}brix), pH (3.83-4.32), sugar acid ratio (9.32-14.85), weight loss (0- 4.66 %), decay index (0 - 42.73%) and a decreasing trend in firmness (1.8-0.31 kg), acidity % (0.90 - 73%), ascorbic acid content (7.0 - 4.25 mg/100g). There was a gradual decrease in color (8.1- 4.0), texture (8.4-5.5), flavor (8.3 - 4.7) overall acceptability (8.3 - 4.7). The maximum mean value for TSS was observed in treatment AS_0 (10.02), pH AS_0 (4.198), acidity % AS_4 (0.86), sugar acid ratio AS_0 (13.18), ascorbic acid AS_4 (5.85), weight loss % AS_0 (4.08), firmness AS_4 (1.31), decay index % AS_0 (22.91), color AS_4 (7.17), texture AS_4 (7.51), flavor AS_4 (7.34) and overall acceptability AS_4 (7.34).

Key Words: Peach fruit

INTRODUCTION

Peach (Prunuspersica L.) belong to family Rossaceae extensively grown in moderate area of the world. About 200 B.C the peaches were obtained from the wild form of china. The Romans were growing peach about the time of Christ. They increase the production of peach throughout Europe, from where it was spread all over the world (Ferguson et al., 1978). Peach is one of the most important fruit grown in Pakistan.Specially in KhyberPakhtunkhwa peaches are grown in Peshawar, Swat, Hazara, Chitral, Gilgit, Hunza South and Northern Waziristan. Peach is tremendously important fruit of KhyberPakhtunkhwa, but its production is wasted due to insufficient preservation facilities of our province (Khattaket al., 2002). In Pakistan the total area under cultivation of peach is 15774 hectares with a total production of 83670 tons in 2009-2010. In this regard Punjab shares 83, Khyber Pakhtunkhwa 6191 and Baluchistan 9500 hectares with an annual production of 474, 57834 and 25362 tons respectively (Agri. Stat. of Pak.

2010-2011).

Peach contain moisture 86.9 g, protein 0.7 g, fat 0.2 g, carbohydrate 11.4 g, fiber 0.9 g, calcium 7 mg, 11mg iron, phosphorus 24 mg, zinc 0.1 mg, thiamine 0.02 mg, riboflavin 0.04 mg, niacin 0.7 mg, ascorbic acid 9 mg, beta-carotene 59 mg of 100 g of edible portion (Hussain, 2001). Peaches haveashortshelftimeunderroom temperature, because ofahighrespiratoryrateandrapidlymaturingprogression. Loss ofpulpfirmnessanddecayexpansionarethe major factorsthatlower thequalityofpost-harvestfruit. Therefore, the resultsgenerallycommercializedshortly afterbeing removed(Kluge etal., 1997). An edible coating (EC) is a thin layer of edible material formed as a coating on a food product, while an edible film (EF) is a preformed, thin layer, made of edible material, which once formed can be placed on or between food components (McHugh, 2000). Coating of peach surfaces with wax emulsions decreased water vapor and oxygen transmission, thus diminishing respiration rate and increasing shelf life of the fruit. (Erbil and Muftugil 1986).Edible coating are mainly used to improve food appearance and preservation of the fruit since they can provide selective barriers against respiration, moisture loss and decay. Additionally, coatings also provide more advantages than synthetic materials in terms of edibility, biocompatibility, being non-toxic and low cost. Currently, research has led to development of new environmentally friendly approaches based on biodegradable polymers, which not only convert the by-products of food industries into value-added film-forming components but also reduce packaging requirements (Ali et al., 2011). Coatings are used for fresh fruits and vegetables to retard moisture loss, improve appearance, provide a carrier for fungicides or growth regulators, and create a barrier for gas exchange between the commodity and the external atmosphere. The first commercial coatings were applied to citrus 60 years ago (Kaplan, 1986). Calcium plays an important role in fruit physiology as it stabilizes cell membranes and turgor pressure. It interacts with pectic acid in the cell walls of fruit and forms calcium pectate which stabilizes cell structure. It also maintains appearance of fruits and vegetables by inhibiting browning as it reduces leakage of polyphenol oxidase (PPO) and its substrates on cut and exposed surfaces. (Lara et al., 2004; Sams, 1999). Calcium has been extensively reviewed as both an essential element and its potential role in maintaining post-harvest quality of fruit and vegetable crops (Kirkby and Pilbeam, 1984) by contributing to the linkages between pectic substances within the cell walls. The presence of calcium ions increases the cohesion of cell walls (Demartyet al., 1984). It is also involved in reducing the rate of senescence and fruit ripening (Ferguson, 1984). In $CaCl_2$ treated fruits softening are delayed and storage life is increased compared to untreated fruits (Dimitrious and Pavlina, 2005).Due to high perishability the peach produced in Khyber Pakhtunkhwa are marketed rapidly. In peach about 20 to 30 % post-harvest losses occur. (Zeb and Khan 2008). The shelf life of peach fruit can be extended by post-harvest treatments, thus reducing commercial losses for packaging houses. Regulation is very severe, thus registered yields used in post-harvest are very limited. Then pre storage treatments offer a non-damaging physical treatment and a related strategy, that fits both customers and growers expectations (Couy, 1989 and Luire, 1998). The short post-harvest life of fresh peach is the main problem in marketing both at national and international levels. As the shelf life of fresh peach in Pakistan is very short and unluckily very little work has been done in this aspect. To minimize the huge loss of fruits this research was conducted to improve its post-harvest storage period so it can be transported to distant markets and thus return higher profits to all stake holders. The knowledge achieved will not only beneficial for the farmers but for food processing industries as well.

Materials and Methods

Preparation of Sample

The fruits were washed with tap water and surface dried over night with blow air of ceiling fan. Then the fruits were divided into five lots (AS_0, AS_1, AS_2, AS_3 and AS_4). AS_1 and AS_2 were treated with 1% and 2% calcium lactate solution

and edible coating of xanthan gum (1%) + glycerin (2.5%) , whereas AS_3 and AS_4 were treated with 1% and 2% calcium lactate solution and edible coating of gum arabic (1%) + glycerin (2.5%) respectively for a total time period of 20 minutes. They were surface dried under a fan blower. One lot (AS_0) was left without calcium lactate and edible coating treatment as control. All the fruit samples were kept in corrugated fiber board cartons at 10^0C in cold storage.(Ahmed et al., 2007). Fruits were placed in 3 or 4 layers after placing paper strip at base and newspaper sheets on side of wall. Each layer was separated with paper strips. Packed fruits were kept in cold storage at temperature of 0-10^0C with 85-90% relative humidity. The analyses of the peach fruits were studied at each 4 days interval of maximum one month storage period.

Physicochemical analysis

The Total soluble solid (TSS) of the samples was determined by Refractometer using recommended method of AOAC (2000). The weight loss (%) of the fruit samples was determined as described by Wang et al. (2005). The sugar/acid ratio of the treated fruits was calculated by using the standard method as described in AOAC (2000). Titratable acidity (%) of the samples was determined by using recommended method of AOAC (2000), by titrating the sample against standard alkali solution. Ascorbic acid content (mg/100g) of the samples was determined by the titramitric method as described in AOAC (2000). The (%) decay was assessed by measuring the extent of decayed area on each fruit, and was determined as: 0, no decay; 1, less than 1/4 decay; 2, 1/4–1/2 decay; 3, 1/2–3/4 decay. Decay index of the samples was determined as described by Wang et al. (2005). Firmness of the samples was determined by using recommended method of AOAC (2000). For this purpose penetrometer was used. After each four days interval three fruits randomly from each lot were selected and their firmness was determined by pressing the knob of the penetrometer into the fruit. The average of these three was the firmness of the whole lot. The samples wereorganoleptically evaluated for overall acceptability by a panel of 15 experienced judges in organoleptic evaluation at the storage interval of 4 days. The evaluation was carried out by using the 9 Point Hedonic Scale of Larmond (1977). **Statistical Analysis**

All the data was analyzed statistically by using CRD Complete Randomized Design (2 factorial without interaction) by Gomez and Gomez (1984) and means were separated by LSD test at 5% level of significance as described by Steel and Torrie (1997).

RESULTS AND DISCUSSION

Total soluble solids (TSS)

Total Soluble Solids means results of control and treated peaches were AS_0 (10.02), AS_1 (9.75), AS_2 (9.61), AS_3 (9.47) and AS_4 (9.19). Data disclosed that TSS progressively increased from (8.37) to (10.93) throughout storage period. Maximum mean value was recorded in sample AS_0 trailed by AS_1 while minimum mean value was recorded in sample AS_4 followed by AS_3. During storage maximum percent increase (40.81) was recorded in sample AS_0 while minimum percent increase (18.30) was obtained in sampleAS_4.(Table1)

Titratable acidity %

The Titratable acidity means results of control and treated peaches were AS_0 (0.769), AS_1 (0.794), AS_2 (0.834), AS_3 (0.837) and AS_4 (0.862). Data disclosed that Titratable acidity progressively decreased from (0.907) to (0.734) throughout storage period. Maximum mean value (0.862) was recorded in sample AS_4 trailed by AS_3 (0.837) while minimum mean value (0.769) was recorded in sample AS_0 followed by AS_1 (0.794). During storage maximum

percent decrease (19.18) was recorded in sample AS_0 while minimum percent decrease (13.97) was recorded in sample AS_4.(Table 2)

pH

pH means results of control and treated peaches were AS_0 (4.198), AS_1 (4.1433), AS_2 (4.1167), AS_3 (4.0389) and AS_4 (4.007). Data disclosed that pH progressively increased from (3.83) to (4.322) throughout storage period. Maximum mean results (4.198) were recorded in sample AS_0 trailed by AS_1 (4.143) while minimum mean value (4.007) was recorded in sample AS_4 followed by AS_3 (4.039). During storage maximum percent increase (15.58) was recorded in sample AS_4 while minimum percent increase (9.94) was recorded in sample AS_0.(Table 3)

Sugar acid ratio

Sugar acid ratio means results of control and treated peaches were AS_0 (13.18), AS_1 (12.48), AS_2 (11.66), AS_3 (11.48) and AS_4 (10.70). Data disclosed that Sugar acid ratio progressively increased from (9.32) to (14.85) throughout storage period. Maximum mean results (13.18) were recorded in sample AS_0 trailed by AS_1 (12.48) while minimum in mean value (10.70) was recorded in sample AS_4followed by AS_3 (11.48). During storage maximum percent increase (79.76) was recorded in AS_0 while minimum percent increase (34.33) in AS_4.(Table 4)

Ascorbic acid

Ascorbic acid means results of control and treated peaches were AS^0 (5.4211), AS_1 (5.5028), AS_2 (5.5293), AS_3 (5.7800) and AS_4 (5.8547). Data disclosed that ascorbic acid progressively decreased from (7.049) to (4.25) throughout storage period. Maximum mean value (5.85) was recorded in sample AS_4 trailed by AS_3 (5.780) while minimum mean value (5.421) was recorded in sample AS_0 followed by AS_1(5.530). During storage maximum percent decrease (42.45) was recorded in sample AS_0 while minimum percent decrease (35.07) was recorded in sample AS_4.(Table 5)

Weight loss (%)

The weight loss means results of control and treated peaches were AS_0 (4.0878), AS_1 (2.7583), AS_2 (2.4767), AS_3 (1.9623) and AS_4 (1.6851). Data disclosed that weight loss progressively increased from (0) to (4.66) throughout storage period. Maximum mean value (4.088) was recorded in sample AS_0 trailed by AS_1 (2.758) while, minimum mean value (1.685) was recorded in sample AS_4 followed by AS_3 (1.962). During storage maximum percent increase (6.4) was recorded in sample AS_0 while minimum percent increase (2.75) was recorded in sample AS_4(Table 6)

Firmness

Firmness means results of control and treated peaches were AS_0 (0.9889), AS_1 (1.0329), AS_2 (1.0778), AS_3 (1.1668) and AS_4 (1.3104). Data disclosed that firmness progressively decrease from (1.88) to (0.311) throughout storage period. Maximum mean results (1.31) were recorded in sample AS_4 trailed by AS_3 (1.17) while, minimum mean value (0.99) was recorded in sample AS_0 followed by AS_1(1.03). During storage maximum percent decrease (89.47) was recorded in sample AS_0 while minimum percent decrease (73.68) was recorded in sample AS_4(Table 7)

Decay Index (%)

Decay index means results of control and treated peaches were AS_0 (22.914), AS_1 (18.424), AS_2 (14.554), AS_3 (10.951) and AS_4 (7.700). Data disclosed that decay index progressively increased from (0) to (42.73) throughout storage period. Maximum mean results (22.91) were recorded in sample AS_0 trailed by AS_1 (18.42), while minimum mean value (7.70) was recorded in sample AS_4 followed by AS_3 (10.951). During storage maximum percent increase (57.8) was recorded in sample AS_0 while minimum percent increase (27.22) was recorded in sample AS_4(Table 8)

Overall acceptability

Overall acceptability means results of control and treated peaches were AS_0 (5.7478), AS_1 (6.5080), AS_2 (6.9361), AS_3 (7.1420) and AS_4 (7.3411). The mean values of the score of judges for overall acceptability significantly ($P<0.05$) decreased from(8.305) to (4.78). For treatments maximum mean value (7.34) was recorded in sample AS_4 trailed by AS_3 (7.14), while minimum mean value (5.75) was recorded in sample AS_0 followed by AS_1 (6.51). During storage maximum percent decrease (68.46) was recorded in sample AS_4 while minimum percent decrease (28.88) was recorded in sample AS_0.(Table 9)

Conclusion And Recommendation

On the basis of results achieved it is concluded that 1 percent calcium lactate treated fruits have little improvement, while 2 % calcium lactate maintain maximum firmness, TSS, ascorbic acid content, overall acceptability, increased sugar- acid ratio and reduced decay index and weight loss as compared to control of peach fruit.

Recommendations for further study:

- This research work planning can be repeated on other fruits as well.
- Other packaging materials are to be used instead of soft board cartons.
- Effect of other storage temperatures are to be studied for preservation of peach fruit.
- Other edible additives influence should be studied for peach fruit shelf life extension.

Table 1.Effect of calcium lactate and edible coating on TSS of peach fruits during storage.

Treatments	Storage Period (Days)									%Increase	Means
	Initial	4	8	12	16	20	24	28	32		
AS_0	8.38	8.62	9.10	9.64	10.0	10.13	10.98	11.37	11.80	40.811	10.02 a
AS_1	8.37	8.45	8.97	9.49	9.82	9.95	10.56	10.89	11.29	34.88	9.75 b
AS_2	8.38	8.44	8.90	9.25	9.77	9.85	10.34	10.62	10.95	30.66	9.61 bc
AS_3	8.37	8.49	8.85	9.10	9.61	9.69	10.18	10.35	10.63	27.00	9.47 c
AS_4	8.36	8.56	8.81	8.93	9.22	9.45	9.63	9.82	9.98	18.30	9.19 d
Means	8.37 f	8.51 f	8.93 e	9.28 d	9.68 c	9.81 c	10.33 b	10.61 a b	10.93 a		

Table2.Effect of calcium lactate and edible coating on acidity % of peach fruits during storage.

Treatments	Storage Period (Days)									% Decrease	Means
	Initial	4	8	12	16	20	24	28	32		
AS_0	0.885	0.849	0.837	0.775	0.763	0.745	0.704	0.7	0.691	19.18	0.769 d
AS_1	0.890	0.87	0.829	0.786	0.775	0.769	0.742	0.737	0.721	18.98	0.794 c
AS_2	0.909	0.896	0.89	0.87	0.827	0.819	0.791	0.759	0.743	18.26	0.833 b
AS_3	0.909	0.896	0.89	0.87	0.827	0.819	0.791	0.759	0.743	18.26	0.837 b
AS_4	0.900	0.927	0.917	0.895	0.875	0.835	0.817	0.8	0.8	13.97	0.862 a
Means	0.907 a	0.888 b	0.873 b	0.839 c	0.813 d	0.797 d	0.769 e	0.751e f	0.734f		

Table 3.Effect of calcium lactate and edible coating on pH of peach fruits during storage.

Treatments	Storage Period (Days)									%Increase	Means
	Initial	4	8	12	16	20	24	28	32		
AS_0	3.85	3.90	3.93	4.23	4.29	4.33	4.37	4.43	4.45	15.58	4.198a
AS_1	3.84	3.85	3.92	4.15	4.24	4.27	4.31	4.34	4.37	13.80	4.143b
AS_2	3.85	3.88	3.91	4.10	4.17	4.24	4.27	4.30	4.33	12.46	4.117b
AS_3	3.83	3.87	3.90	4.00	4.00	4.12	4.15	4.22	4.26	11.22	4.039c
AS_4	3.82	3.85	3.89	3.99	4.00	4.05	4.10	4.16	4.20	9.94	4.007c
Means	3.838 g	3.870 f g	3.910 f	4.094 e	4.140 d e	4.202 c d	4.240 b c	4.290 a b	4.322 a		

Table 4.Effect of calcium lactate and edible coating on sugar acid ratio of peach fruits during storage.

Treatments	Storage Period (Days)									%Increase	Means
	Initial	4	8	12	16	20	24	28	32		
AS_0	9.50	10.15	10.87	12.44	13.10	13.60	15.60	16.24	17.077	79.76	13.18 a
AS_1	9.40	9.71	10.82	12.07	12.67	12.94	14.23	14.78	15.66	66.60	12.48 a
AS_2	9.21	9.42	10.00	10.63	11.81	12.02	13.07	14.00	14.74	60.04	11.66 b
AS_3	9.20	9.48	9.94	10.45	11.62	11.83	12.87	13.64	14.31	55.54	11.48 b
AS_4	9.29	9.01	9.61	9.98	10.54	11.32	11.79	12.28	12.48	34.33	10.70 b
Means	9.32 h	9.55 h	10.23 g	11.11 f	11.95 e	12.34 d	13.51 c	14.18 b	14.85 a		

Table 5.Effect of calcium lactate and edible coating on vitamin C (mg/100g) of peach fruits during storage.

Treatments	Storage Period (Days)									%Decrease	Means
	Initial	4	8	12	16	20	24	28	32		
AS_0	7.02	6.55	6.23	5.74	5.26	4.97	4.68	4.30	4.04	42.45	5.421c
AS_1	7.03	6.60	6.29	5.80	5.32	5.03	4.70	4.45	4.19	40.39	5.503c
AS_2	7.05	6.85	6.54	6.08	5.80	5.45	4.99	4.76	4.50	36.17	5.529b
AS_3	7.05	6.56	6.30	5.92	5.44	5.15	4.75	4.52	4.26	39.57	5.780a
AS_4	7.07	6.95	6.58	6.21	5.86	5.56	5.17	4.93	4.59	35.07	5.855a
Means	7.049 a	6.702 b	6.388 c	5.950 d	5.536 e	5.232 f	4.858 g	4.592 h	4.25 0 i		

Table 6.Effect of calcium lactate and edible coating on weight loss % of peach fruits storage.

Treatments	Storage Period (Days)									%Increase	Means
	Initial	4	8	12	16	20	24	28	32		
AS_0	0	2.90	3.62	3.69	4.08	4.80	5.29	6.01	6.40	6.40	4.088a
AS_1	0	1.30	1.42	2.20	2.42	3.04	3.61	5.21	5.63	5.63	2.758b
AS_2	0	1.29	2.08	2.09	2.14	3.15	3.20	4.08	4.26	4.26	2.477bc
AS_3	0	1.43	1.46	1.68	1.95	2.02	2.91	2.97	4.00	4.00	1.962cd
AS_4	0	1.06	1.47	1.64	1.86	1.87	2.11	2.16	2.75	2.75	1.685d
Means	0 g	1.596 f	2.010 e f	2.260 e f	2.490 d e	2.976 c d	3.424 b c	4.086 a b	4.66 3 a		

Table 7.Effect of calcium lactate and edible coating on firmness (kg) of peach fruits during storage.

Treatments	Storage Period (Days)									%Decrease	Means
	Initial	4	8	12	16	20	24	28	32		
AS_0	1.9	1.8	1.6	1.2	0.9	0.6	0.4	0.3	0.2	89.47	0.99c
AS_1	1.8	1.7	1.6	1.2	1.1	0.7	0.5	0.4	0.3	83.33	1.03c
AS_2	1.8	1.7	1.7	1.3	1.2	0.9	0.4	0.3	0.3	83.33	1.08bc
AS_3	1.9	1.8	1.7	1.5	1.3	1.0	0.5	0.4	0.4	78.94	1.17b
AS_4	1.9	1.8	1.7	1.7	1.5	1.2	0.9	0.7	0.5	73.68	1.31a
Means	1.886 a	1.760 a b	1.660 b	1.380 c	1.200 d	0.880 e	0.54 f	0.42 f g	0.311 g		

Table 8 Effect of calcium lactate and edible coating on decay index % of peach fruits during storage.

Treatments	Storage Period (Days)									%Increase	Means
	Initial	4	8	12	16	20	24	28	32		
AS_0	0	0	0	6.79	23.44	28.89	39.42	49.89	57.80	57.80	22.91a
AS_1	0	0	0	5.87	15.66	21.23	32.32	40.66	52.10	52.10	18.42ab
AS_2	0	0	0	3.94	9.68	17.79	25.56	32.34	41.68	41.68	14.55bc
AS_3	0	0	0	0.00	6.50	12.80	20.25	25.69	31.60	31.60	10.95cd
AS_4	0	0	0	0.00	3.22	8.58	13.11	21.09	27.22	27.22	7.70d
Means	0 e	0 e	0 e	3.32 e	11.70 d	17.86 d	26.13 c	33.93 b	42.73a		

Table 9. Mean score of judges for overall acceptability of peach fruits during storage

Treatments	Storage Period (Days)									%Decrease	Means
	Initial	4	8	12	16	20	24	28	32		
AS_0	8.09	7.75	7.35	6.60	6.13	5.25	4.47	3.57	2.55	68.46	5.75 c
AS_1	8.10	7.76	7.59	7.13	6.50	6.10	5.68	5.05	4.56	43.70	6.51 b
AS_2	8.20	7.97	7.83	7.47	7.02	6.65	6.11	5.73	5.48	33.23	6.94 a
AS_3	8.20	8.12	8.01	7.65	7.22	6.84	6.56	6.00	5.60	31.66	7.14 a
AS_4	8.31	8.155	7.98	7.71	7.33	7.13	6.85	6.50	5.91	28.88	7.34 a
Means	8.31 a	7.95 a	7.75 a b	7.31 b c	6.84 c d	6.39 d e	5.93 e f	7.37 f	4.78 g		

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