

EFFECT OF OZONE AND PERFORATED PACKAGING ON "CANINO" APRICOT CV. FRUITS QUALITY DURING COLD STORAGE

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Abstract

The present investigation was carried out during 2011, 2012 seasons on "Canino" apricot cv. to characterize physiological response of fruits to Ozone for sterilization and packaging in perforated (PET) container (1200 Milliliter) and polypropylene perforated (P.P.) bags to control breathing. Fruits were stored at 0°C and relative humidity (RH) 90% to investigate. Weight loss percentage, decay percentage, texture, fruit color, total soluble solids, total acidity, total sugar and total carotenes. It was found that all used treatments did not give any effects color index during cold storage. After 21 days of cold storage the Ozone treatment and perforated bags (10 holes) recorded the least value of weight loss and decay while the control treatment recorded the highest value of weight loss and decay in both seasons. Ozone and Perforated bags (10 holes) increased total soluble solids gradually during period. Ozone and Perforated bags (6 holes) decreased the acidity % gradually during storage period. No phototoxic injuries in tissues were observed in Ozone treated fruits and Perforated bags (10 holes). The best results of apricot were obtained from treatments with Ozone and packed in perforated polypropylene bags that have (10 holes) stored at 0°C and 90% RH, in both seasons.

Key Words: Texture – apricot- Ozone- Perforated bags - polypropylene bags.

INTRODUCTION

Apricots are the most desirable stone fruits in Egypt. It ranks the second after peach of a total acreage of 17600 feddans producing about 105500 tons (Ministry of Agriculture Statistics, 2005). Apricot is a climacteric fruit presenting a moderate respiration (Hardenburg *et al.*, 1986) and have a very pronounced ethylene rise (Amoros *et al.*, 1989). Apricot (*Prunus armeniaca* L.) belongs to Rosaceae family. It plays an important role in maintenance of human health, because the fruit contains carotene and lycopene pigments that protect the heart and eyes, as well as disease fighting effects of fibers that prevent digestive condition called diverticulosis and having antipyretic, antiseptic, properties. (Egea *et al.*, 2007). They are able to scavenge reactive oxygen species due to their electron donating properties. Antioxidant content is an important parameter with respect to increasingly fruit and vegetable quality. Generally, low storage temperatures are used to extend fruit postharvest life. Joseph *et al.*, (1999). Therefore practical method of packaging and the effect of Ozone are

necessary to improve the postharvest quality of apricots. The influence of electron-beam ionization on ethylene metabolism and quality parameter in apricot (*Prunus armeniaca* L.) and (Fernando *et al.*, 2004). On the other hand Agulheiro , A. C.; and C. Ventura (2005) found that polypropylene film bags affect quality of 'Rainha Claudia Verole' plums stored at 2°C and 95%RH. Polyethylene film bags reduced weight loss of fruits compared to untreated control fruit.

The results for textural properties and visual assessments prove that film bags can be used to store for more than 24 days. Hakank karaca *et al.*, 2012). It was reported that, gaseous Ozone treatment during storage of table grape has a great potential for degrading contemporary fungicides related to table grape production. However, Ozone has recently been evaluated for this purpose and it can be used in the cold storage atmosphere to prolong grape storage life after harvest (Smilanick *et al.*, 2010) and since it has been shown that Ozone can oxidize many pesticides. The influence of Ozone gas on residues on fruits is of interest. The residues levels are important for regulatory and marketing purposes. It was stated that these results are in line with those obtained by Smilanick, J.L. (2011).

The present study was carried out to investigate, the effect of Ozone on quality characteristics of "Canino" apricot cv. Fruits during cold storage and to extend fruit postharvest life, in both seasons.

MATERIALS AND METHODS

This investigation was carried out during two successive seasons (2011 and 2012) on fruits of "Canino" apricot cv. at a private Orchard at Cairo, Alex. Desert Road, 6th October governorate. Fruits were picked during the maturity stage (green color covering ½ to ¾ fruit surface (*Mc Guire, R.G (1992)*). Fruits were sorted, chosen and divided into six principal groups. Fruits after harvest were continuously exposed to (1200 Milliliter of Ozone for 15 minute. then all fruits sorted, selected and divided into six principal groups, the first group of fruits were harvested but without treatments (control). Then, the five groups of fruits were treated with ozone, and stored at 0°C and 90% RH. for 21, days.. Three replicates from each bag were taken and examined every 7 days for quality parameters.

The following data were recorded: treated fruits were divided into six groups as follows:

- 1- T1: Fruits were washed with water (control)
- 2- T2: Fruits were packed in polyethylene Terphthalate bags (PET) that have holes by Laser).

- 3- T3: Fruits were packed in perforated bags (PET) that have 6 holes).
 4- T4: Fruits were packed in, perforated bags (PET) that have 10 holes).
 5- T5: Fruits were packed in (perforated polypropylene bags (P.P.) that have 6 holes).
 6- T6: Fruits were packed in (perforated polypropylene bags (P.P.) that have 10 holes).

the All treated fruits with ozone were packed in bags perforated polypropylene bags (thin 10/micron), each bag containing 5 fruits. These bags were held in carton boxes, each box containing 6 bags. Every treatment consisted of six boxes, contained 36 bags, (36 fruits in 3 replicates) all bags were held in cold stored at 0°C for 21 days. All treatments were rearranged in a complete randomized block design and stored at 0°C and (RH) 90 for 21 days. Fruits were examined at 0,7,14 and 21 days).

Physical and chemical properties of apricot during storage were estimated as follows

I- Physical properties:-

- 1) Weight loss percentage:** was calculated as the difference between fruit weight at the start of storage and fruit weight at the inspection date as the following equation:

$$\text{Loss in fruit weight \%} = \frac{\text{Initial weight} - \text{Weight at t:ime of sampling}}{\text{The initial weight of fruit}} \times 100$$

- 2) Decay Percentage:** The discarded fruits included all the injured or spoiled fruits resulting from fungus or bacteria, shriveling and other various defects, were calculated and expressed as decay percentage.

- 3 Pulp texture:** was recorded by Lara texture analyzer instrument using a penetrating cylinder of 1 mm of diameter, for a fixed distance (5 mm) inside the pulp of fruits, d by a constant speed 2 mm per sec., and the peak of resistance was recorded per gram.

- 4) Fruits color (Hue angle):** surface color of fruit was measured using a colorimeter (CR 200 Minolta, Ramsey, NJ) which provided CIE L*, a* and b* value. Negative a* values indicate green and higher positive a* values red color. Higher positive b* value indicate a more yellow skin color and Negative b*values color. The values were then used to calculate hue degree ($h_0 = \arctangent \ b / a^*$) where 0 o =red-purple, 90 o = yellow; 180 = bluish- green and 270 o = blue (Mc Guire, R.G (1992). (L c / h value) which indicates the intensity or color saturation.

II.Chemical properties:

- 1) Total soluble solids percentage (T.S.S. %):** of the edible pulp was estimated by abbey digital refractometer. Three different readings for each replicate were recorded and the average was calculated (A.O.A.C., 1990).

2) Total acidity percentage: of the flesh was determined as malic acid by titration with a solution of 0.1 N (NaOH), using phenolphthalein as an indicator. The average amount of sodium hydroxide used in each titration was recorded and total acidity was calculated as gm / 100 gm fresh weight (A.O.A.C., 1990).

3) Sample extraction of Total sugars:-

Total sugars: The sugars were extracted from the juice according Dubois, *et al.*, (1956). The contents were pointed out from a glucose standard curve as gm per 100 ml fresh juice.

4) Total carotene content: Carotene was determined according to Saric *et al.*, (1967).

Statistical analysis:

Obtained data were statistically analyzed according to Snedecor and Cochran (1990) Means for treatment were compared by the less significant difference (L.S.D.) at 5% level of probability in two seasons of the experiment.

RESULTS AND DISCUSSION

I - Physical properties:-

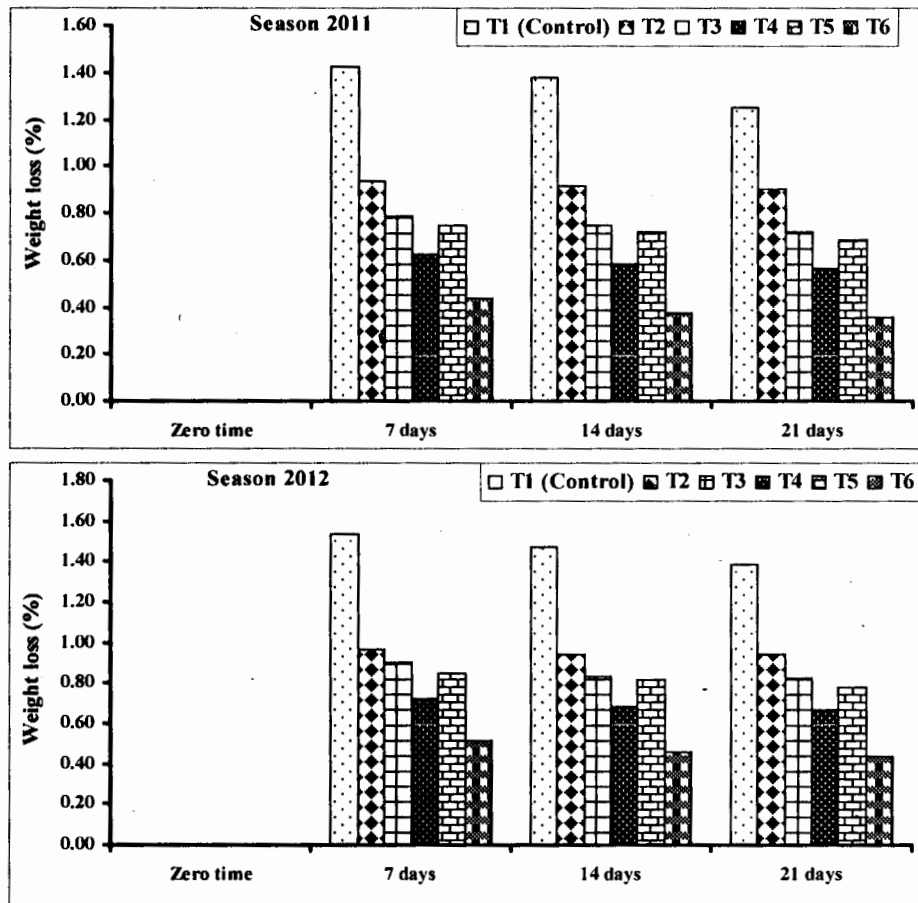
1- Weight loss percentage:

Results present in Table (1) and Fig. (1) showed the effect of some storage types pre-packing treatments package types, samples packaged in perforated polypropylene (p.p.) bags or packaged in perforated bags (PET) bags on weight loss percentage of "Canino" cv. stored at 0°C and 90 % RH in 2011 and 2012 seasons. Ozone treated fruits (especially those packed in bags that have 10 holes, T6. showed the lowest weight loss, that recorded (0.40 and,0.48%) after 21 day during storage gradually. These, results are in partial agreement with those found by Palool. *et al.*, (2003). Generally a gradual increase in weight loss was shown towards the end of the storage periods. Rocculi *et al.*, (2004) reported that weight loss percentage significantly increased with the progress of storage periods. Ozone treated fruits showed the lowest weight loss after 21 day during storage, in both studied harvests, similar weight losses were shown in Table (1) and Fig. (1) .However, the lowest weight loss percentage was recorded by Ozone, (0.293, 0353) while control was recorded the highest weight loss percentage whereas treated fruit showed the lowest weight loss was recorded (1.43, 0.098%), according to Liew and Prang (1994) It was observed that in strawberry, a reduction of weight loss observed with Ozone that related to a better main tannins of fruit texture (Nadas *et al.*, 2003).

Table (1): Effect of Ozone Treatments and some storage package kinds on weight loss % of "Canino" apricot cv. fruits stored at 0°C, RH 90 % 2011and 2012seasons.

Treatment	Period	Weight loss (%)					Zero time	7days	14 days	21 days	Means (T)
		Zero time	7days	14 days	21 days	Means (T)					
2011 season						2012 season					
T1 (Control)		0.000	1.427	1.377	1.253	1.408	0.000	1.533	1.473	1.387	1.512
T2		0.000	0.937	0.913	0.903	0.947	0.000	0.963	0.943	0.943	0.972
T3		0.000	0.787	0.747	0.717	0.780	0.000	0.900	0.837	0.827	0.883
T4		0.000	0.627	0.583	0.563	0.616	0.000	0.723	0.683	0.673	0.715
T5		0.000	0.743	0.717	0.683	0.741	0.000	0.847	0.817	0.777	0.838
T6		0.000	0.437	0.377	0.357	0.397	0.000	0.517	0.463	0.433	0.478
Means (D)		0.000	0.826	0.786	0.746		0.000	0.914	0.869	0.840	
LSD =0.05 For.			LSD (T) = 0.005				LSD (T) = 0.008				
			LSD (D) = 0.004				LSD (D) = 0.006				
			LSD (TXD) = 0.011				LSD (TXD) = 0.015				

Figure (1): Effect of Ozone treatments and some storage package kinds d on weight loss % of "Canino" apricot cv. fruits stored at 0°C, RH 90 % 2011 and 2012 seasons.



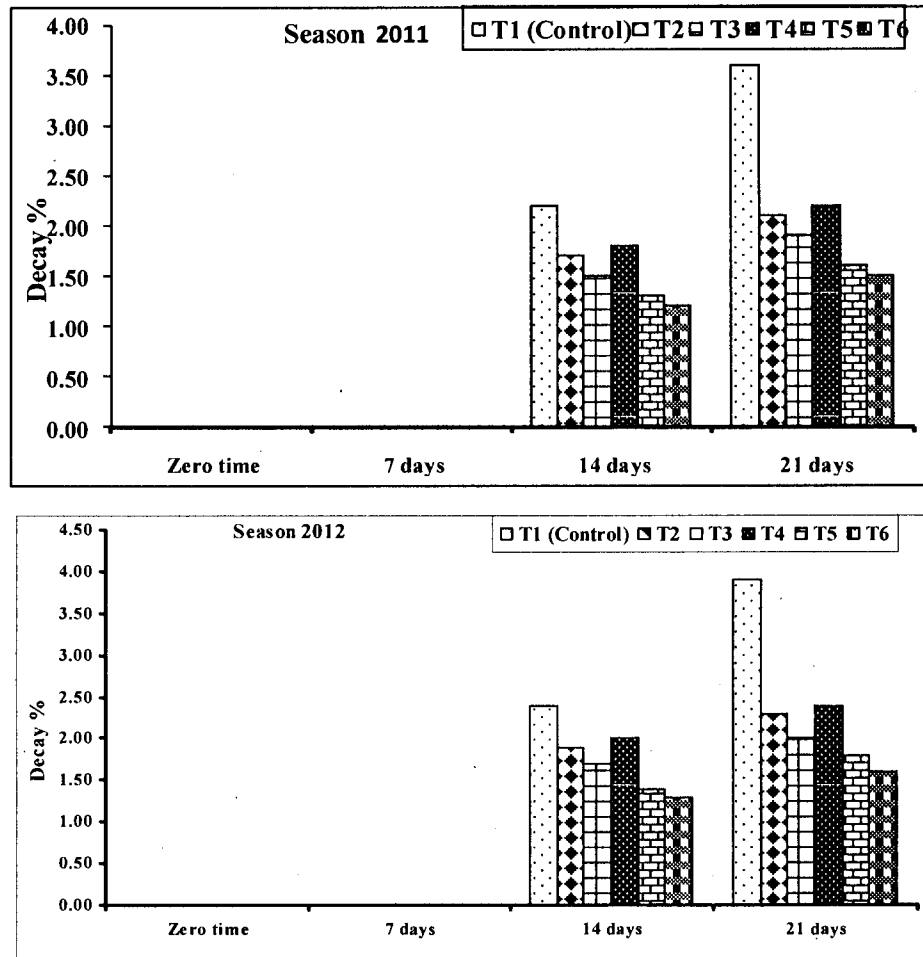
2- Decayed Percentage:

Percentage of decayed fruits increased with prolonging storage period in both seasons, reaching its maximum after 21 day in Table (2) and Fig. (2) Although there were significant difference among all fruit ages in decay percentage until 14 days of storage period, the decayed fruits at age of 21 days were significantly higher than those at age of 2 weeks during storage period. On the other hand, there were no significant difference between fruits at age of 21 day at the end of storage period in both seasons. Concerning the effect of storage types, it was found that the higher percentage of the decayed fruits had held at control fruits (1.5. 1.6 %), respectively, while the lowest value was recorded (0.68.0.73%) by Ozone treated and packed in perforated polypropylene bags that have 10 holes (T6) during cold storage at 0°C and 90% RH in the both seasons, respectively. Paloo L. *et al.*, (2002), reported that Ozone exposure on decay development and physiological responses of peaches and table grapes in cold storage. In addition, these results who stated that are in line with those obtained by Turk (1993), Collins and Tisdell (1995), who stated that the principal cause of deterioration in fruits held at room temperature, treatments T2 and T3 in 1st season as well as T4,T2 and T3 and T6.

Table (2): Effect of Ozone treatments and some storage package kind on Decay % "Canino" apricot cv. during stored at 0C, RH 90 % 2011and 2012 seasons.

Decay %											
Treatment	Period	Zero time	7days	14 days	21 days	Means (T)	Zero time	7 days	14 days	21 days	Means (T)
T1 (Control)		0.00	0.00	2.20	3.60	1.45	0.00	0.00	2.40	3.90	1.58
T2		0.00	0.00	1.70	2.10	0.95	0.00	0.00	1.90	2.30	1.05
T3		0.00	0.00	1.50	1.90	0.85	0.00	0.00	1.70	2.00	0.93
T4		0.00	0.00	1.80	2.20	1.00	0.00	0.00	2.00	2.40	1.10
T5		0.00	0.00	1.30	1.60	0.73	0.00	0.00	1.40	1.80	0.80
T6		0.00	0.00	1.20	1.50	0.68	0.00	0.00	1.30	1.60	0.73
Means (D)		0.00	0.00	1.62	2.15		0.00	0.00	1.78	2.33	
LSD =0.05 For.		LSD (T) = 0.02					LSD (T) = 0.03				
		LSD (D) = 0.01					LSD (D) = 0.02				
		LSD (TXD) = 0.03					LSD (TXD) = 0.05				

Figure (2): Effect of Treatments Ozone and some storage package kinds on decay % of "Canino" apricot cv. fruits stored at 0°C, RH 90 % 2011 and 2012 seasons.



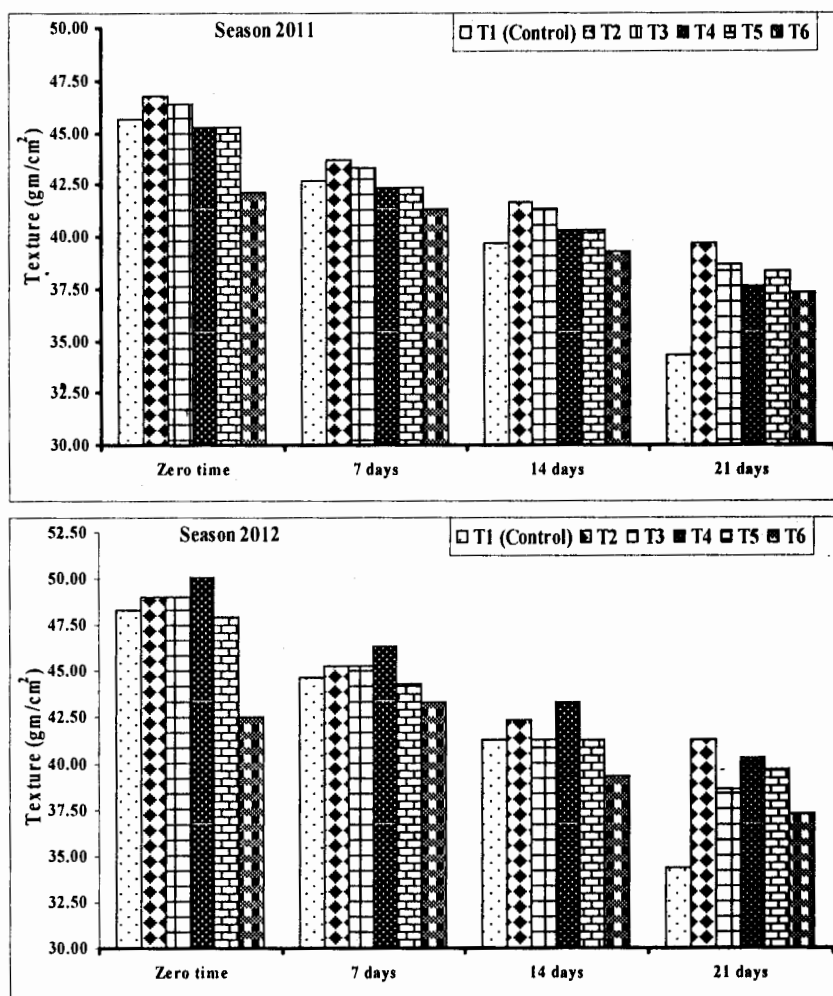
3- Texture percentage (g/cm²):

Concerning the texture, data in Fig. (3) indicated that, a gradual decrease in texture was shown towards the end of the storage period. However, significant difference were detected between all pre-packing treatments during storage period in both seasons. Control and (T6) fruits recorded the less texture of apricot while fruits treated with Ozone and packed in (P.P and P.E.T) gave the highest values during cold storage at 0°C and 90 % RH in the both seasons. In this present study, in both harvest dates a gradual decrease of texture fruit was observed throughout storage at 0°C Fig. (3) and this softening is being more marked after astringency treatment. Texture was similar in control fruits more than Ozone treated fruits throughout the whole experiment. The highest value was recorded by Ozone treated (42.93, 45.03%) while the least value was recorded by control (40.58, 42.17%) and stored at 0°C and 90-95% RH in both seasons. In previous studies, higher texture was found in citrus and cucumbers treated with Ozone compared with control (Nadas, *et al.*, 2000; Skog and Chu 2001).

Table (3): Effect of Ozone treatments and some storage package kinds on fruit texture (g/cm^2) of "Canino" apricot cv. during stored at 0°C , RH 90 % 2011 and 2012 seasons.

Treatment	period	texture (g/cm^2)									
		Zero time	7days	14 days	21 days	Means (T)	Zero time	7days	14 days	21 days	Means (T)
2011 season						2012 season					
T1 (Control)		45.67	42.67	39.67	34.33	40.58	48.33	44.67	41.33	34.33	42.17
T2		46.74	43.67	41.67	39.67	42.93	49.05	45.33	42.33	41.33	44.51
T3		46.38	43.33	41.33	38.67	42.43	49.05	45.33	41.33	38.67	43.6
T4		45.31	42.33	40.33	37.67	41.41	50.14	46.33	43.33	40.33	45.03
T5		45.31	42.33	40.33	38.33	41.58	47.97	44.33	41.33	39.67	43.33
T6		42.1	41.33	39.33	37.33	40.02	42.56	43.33	39.33	37.33	40.64
Means (D)		45.25	42.61	40.44	37.67		47.85	44.89	41.50	38.61	
LSD =0.05 For.		LSD (T) = 0.43					LSD (T) = 45.67				
		LSD (D) = 0.35					LSD (D) = 46.74				
		LSD (TXD) = 0.85					LSD (TXD) = 46.38				

Figure (3): Effect of Ozone treatments and some storage package kinds on texture (g/cm^2) of "Canino" apricot cv. fruits stored at 0°C , RH 90 % 2011 and 2012 seasons .



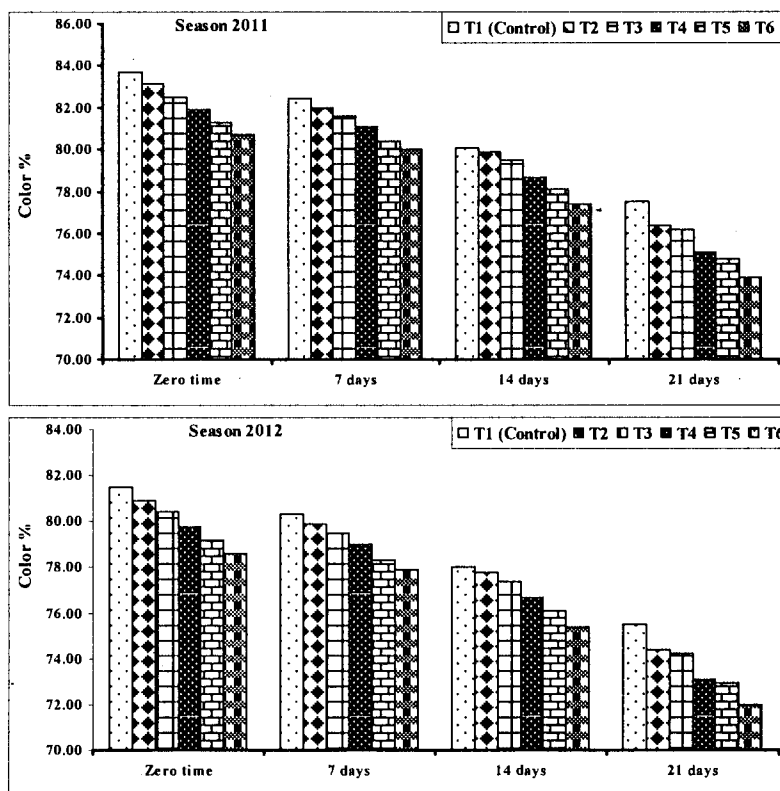
4-Skin Color Angle :

As shown in Fig. (4) illustrated that color development (L C/H value) of fruits treated with all used treatments compared with control in both seasons. Regarding the interaction between the effect of treatments and storage period, at the end of cold storage period 21 days at 0°C and 90% RH, the highest value of fruit color was recorded (83.7, 81.5) in control fruit (unpacked), at the beginning of treatments (T1XD1) while, control fruits recorded the least value of fruit color was a (78.0, 76.0) in perforated polypropylene bags that have 10 holes T6 and stored for 21 days in the two seasons, respectively. (The results are in agreement with those of Agulherio, *et al.*, (2005). Who found that normal color change on the surface of plums was influenced by the storage time and not by plastic bags. Alejandra Salvador, *et al.*, (2006), observed that Ozone did not affect color index (CI). Kenawy, Ola, M. (2008), who noticed that the effect storage of Florida Prince at 0°C and postharvest treatments with polypropylene enhanced the quality characters, and improved fruit color.

Table (4): Effect of Ozone treatments and some storage package kinds on color % "Canino" apricot cv. fruits stored at 0°C, RH 90 % 2011 and 2012 seasons .

Color %										
period	Zero time	7days	14 days	21 days	Means (T)	Zero time	7days	14 days	21 days	Means (T)
Treatment										
2011 season					2012 season					
T1 (Control)	83.70	82.40	80.10	77.50	80.90	81.50	80.30	78.00	75.50	78.80
T2	83.10	82.00	79.90	76.40	80.40	80.90	79.90	77.80	74.40	78.30
T3	82.50	81.60	79.50	76.20	80.00	80.40	79.50	77.40	74.20	77.90
T4	81.90	81.10	78.70	75.10	79.20	79.80	79.00	76.70	73.10	77.10
T5	81.30	80.40	78.10	74.80	78.70	79.20	78.30	76.10	72.90	76.60
T6	80.70	80.00	77.40	73.90	78.00	78.60	77.90	75.40	72.00	76.00
Means (D)	82.20	81.30	79.00	75.70		80.10	79.10	76.90	73.70	
LSD =0.05	LSD (T) = 0.80				LSD (T) = 0.60					
For.	LSD (D) = 0.70				LSD (D) = 0.50					
	LSD (TXD) = 1.60				LSD (TXD) = 1.20					

Figure (4): Effect of Ozone treatments Ozone and some storage package kinds on color % of Canino apricot cv. fruits stored at 0°C, RH 90 % 2011 and 2012 seasons.



II. Chemical properties:

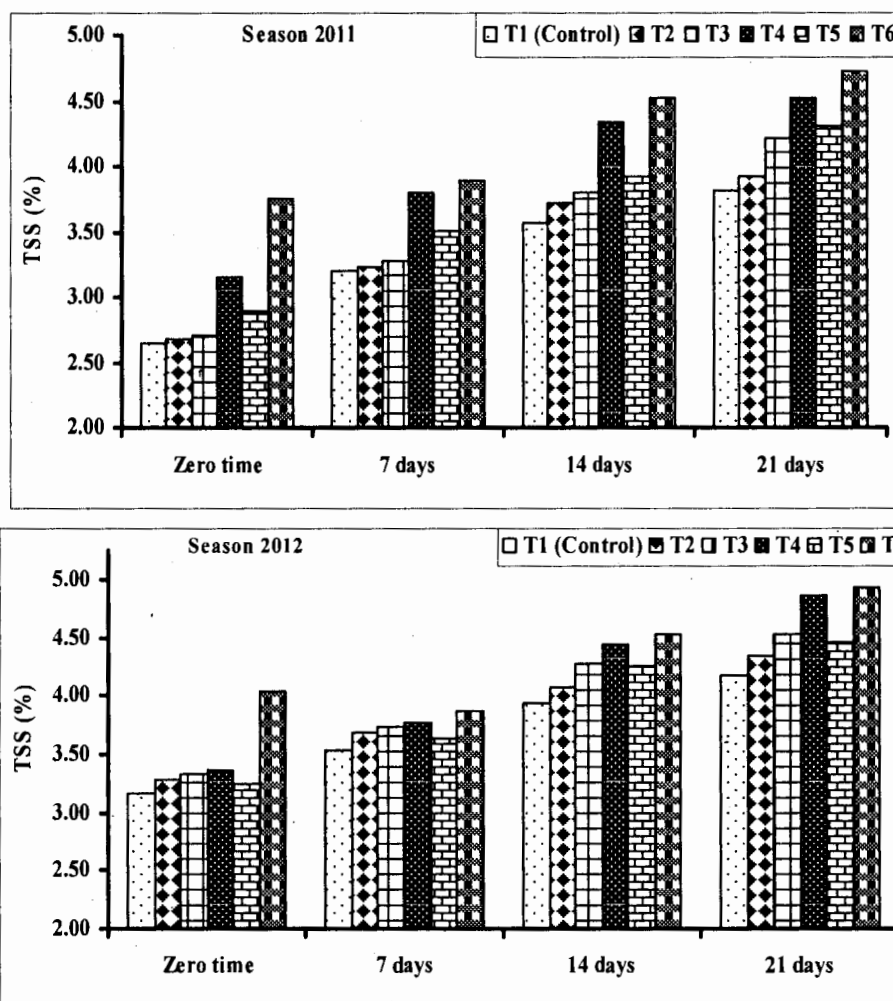
1-Total soluble solids percentage:

Table (5) and Fig.(5) illustrate that T.S.S% increased gradually throughout the course of the investigation and reached the highest percentage after 21 days was recorded (16.87 and 17.70) (T6XD4) in 2011 and 2012 seasons respectively. Also fruits treated with Ozone and packed in perforated polypropylene bags that have 10 holes (T6), reached the highest percentage than control in both seasons of "Canino" that stored at 0°C and 90% RH. The maximum value close to 21 days was recorded (16.87 and 17.70) (T1XD1) interactions. In Ozone treated, the least value was recorded (12.2, 14.23%) with the interactions (T6XD4). No difference was observed between Ozone treated fruits and control fruits in both seasons. Nadas, *et al.* (2000). Arnal and Del Rio 2004 said that the highest T.S.S value were recorded by Ozone treated (16.16, 16.85) while the least T.S.S value (12.40, 14.38) was recorded by control after 21 days and stored at 0°C in both seasons. The results are in harmony by Mshraky *et al.*, 2009 who presented that T.S.S. % of apricot increased gradually throughout the course of the investigation.

Table (5): Effect of Ozone treatments and some storage package kinds on TSS (%) of "Canino" apricot cv. fruits stored at 0°C, RH 90 % 2011 and 2012 seasons.

Treatment	period	TSS (%)									
		Zero time	7days	14 days	21 days	Means (T)	Zero time	7days	14 days	21 days	Means (T)
2011 season						2012 season					
T1 (Control)		12.20	12.14	12.53	12.73	12.40	14.23	14.32	14.40	14.56	14.38
T2		13.52	13.46	14.12	14.57	13.91	15.03	15.12	15.42	15.53	15.27
T3		13.68	13.62	14.37	15.82	14.37	15.22	15.31	15.56	15.85	15.48
T4		14.43	14.37	16.58	16.73	15.53	15.49	15.58	16.67	17.21	16.24
T5		14.58	14.52	15.30	15.90	15.07	15.47	15.56	16.13	16.79	15.98
T6		16.68	14.48	16.60	16.87	16.16	16.67	16.27	16.77	17.70	16.85
Means (D)		14.18	13.76	14.92	15.44		15.35	15.36	15.82	16.27	
LSD =0.05 For.		LSD (T) = 0.05					LSD (T) = 0.06				
		LSD (D) = 0.04					LSD (D) = 0.05				
		LSD (TXD) = 0.10					LSD (TXD) = 0.11				

Figure (5): Effect of Ozone treatments and some storage package kinds on TSS (%) of "Canino" apricot cv. fruits stored at 0°C, RH 90 % 2011 and 2012 seasons.



2- Total Acidity percentage (T.A %):

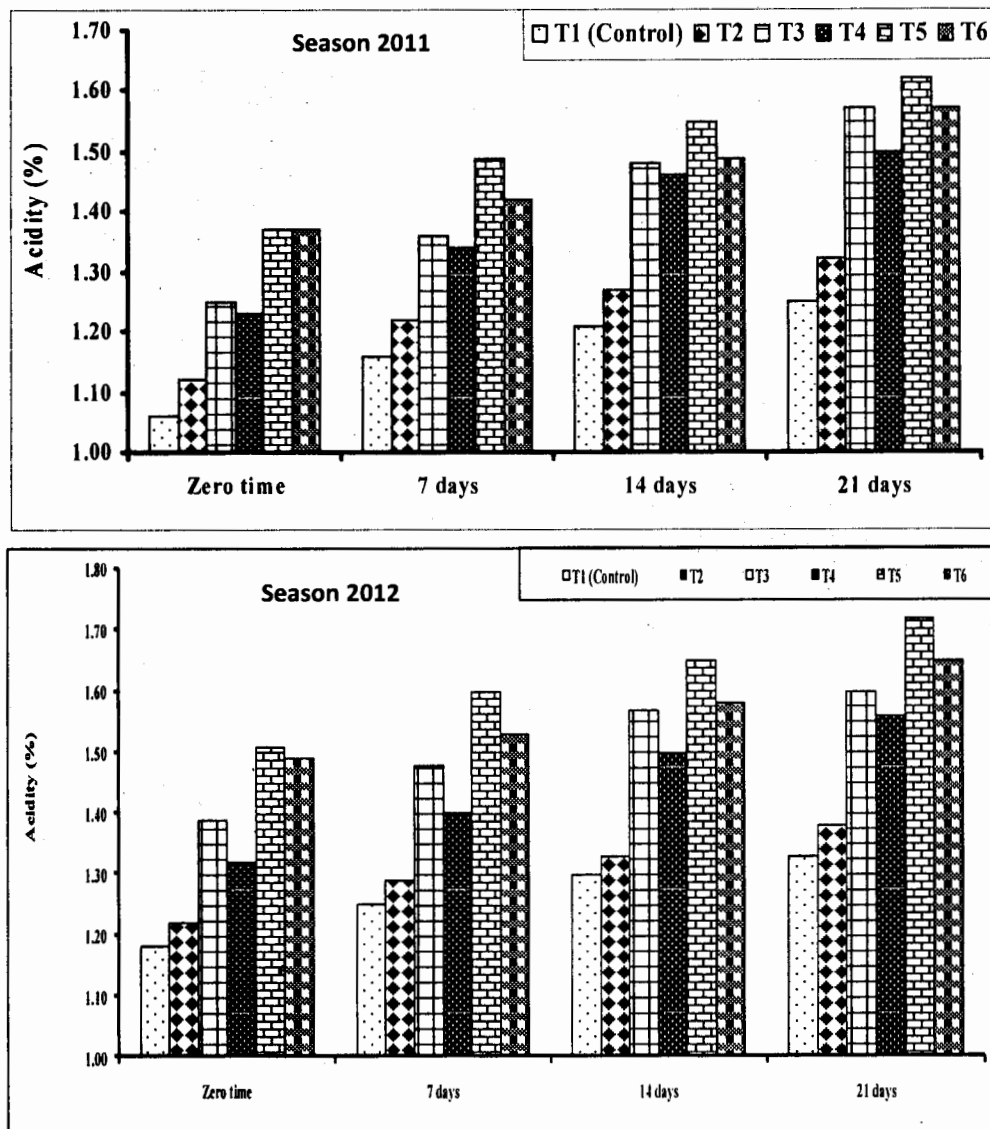
Table (5) and Fig. (6) cleared that T. A % significantly increased throughout As well as from (0.449 to 0.471) 0.549% to 0.515 at the 2nd season, respectively. as storage period progressed from 0 to 7 and 14 to 21 days. On the other hand, all studied treatments significantly decreased total acidity percentage in both seasons, T2, T3 and T4 significantly decreased T.A. but T5 and T6 increased T.A. This increase may be due to polypropylene bags (P.P.). Moreover the most effective interactions for decreasing total acidity in "Canino" apricot cv. fruits were T3XD1 (0.321 %) and T4XD1 (0.312) at the 1st season, while were T2XD1 (0.432%) and T3XD1 (0.321 %)(0.428%) at the 2nd seasons of study.

These results agree with Babalar *et al.*, (1998) and El-Oraby and Ekbal (2006), who found that, the decrease of acid percentage during storage period at all storage temperature could be due to the destruction of organic acids through oxidation and consumption of these acids as an organic substrate in respiration processes of the fruits tissues, but high storage period raised respiration rate.

Table (6): Effect of Ozone treatments and some storage package kinds on total acidity (%) of "Canino" apricot cv. fruits stored at 0°C, RH 90 % 2011 and 2012 seasons.

acidity (%)										
period	Zero	7day	14	21	Means	Zero	7day	14	21	Means
Treatment	time	s	days	days	(T)	time	s	days	days	(T)
2011 season					2012 season					
T1 (Control)	0.346	0.424	0.457	0.490	0.429	0.437	0.466	0.522	0.584	0.502
T2	0.305	0.374	0.385	0.415	0.370	0.432	0.460	0.507	0.517	0.479
T3	0.321	0.394	0.417	0.438	0.392	0.428	0.456	0.494	0.534	0.478
T4	0.312	0.383	0.424	0.454	0.393	0.445	0.474	0.514	0.553	0.497
T5	0.324	0.397	0.407	0.438	0.392	0.457	0.487	0.525	0.542	0.503
T6	0.340	0.395	0.418	0.464	0.404	0.496	0.484	0.529	0.563	0.518
Means (D)	0.325	0.395	0.418	0.450		0.449	0.471	0.515	0.549	
LSD =0.05	LSD (T) = 0.003				LSD (T) = 0.004					
For.	LSD (D) = 0.002				LSD (D) = 0.003					
	LSD(TXD) = 0.006				LSD(TXD) = 0.009					

Figure (6): Effect of Ozone treatments and some storage package kinds on total acidity (%) of "Canino" apricot cv. fruits stored at 0°C, RH 90 % 2011 and 2012 seasons.



3 – Total Sugars percentage:

Table (7) and Fig.(7) indicated that total sugars significantly and gradually during storage period. Also, all treatments significantly increase total sugars than in control (3.31 and 3.7 %) in both seasons respectively. Perez and *et al.*, (1999) reported that sugars and organic acids concentration in strawberry were lower in Ozone treatments than in control samples, while T6 x D4 T6 increase was the highest interactions in the two studied seasons (4.73 and 4.93).

4– Total Carotene percentage:

Table (8) and Fig.(8) showed that all the studied treatments significantly increased carotene where the most effective treatment was (1.501 and 1.62 %)

through 2011 and 2012 seasons respectively. Also, "Canino" apricot content of carotene significantly and gradually increased in both seasons. However, this phenomenon may reflect the fact that apricot fruit quality improves through storage period to be better and taste nutritious. These results agree with Ruiz *et al.*, (2005), Marty *et al.*, (2005) and Uzelac *et al.*, (2007) who noticed that, the main carotene in apricot are (Beta) carotene, lanthin, carotene, lycopene and lutein. texture, T.S.S. total sugars and carotene. However, T.S.S. acidity, total sugars and carotene content of apricot fruits increased gradually with the progress of storage period at 0°C and (RH) 90. Therefore, Ozone could be considered a tool to maintain quality of apricot during storage.

Table (7): Effect of Ozone treatments and some storage package kinds on total sugars (%) of "Canino" apricot cv. fruits stored at 0°C, RH 90 % in 2011 and 2012 seasons.

total sugars (%)										
period	Zero time	7days	14 days	21 days	Means (T)	Zero time	7days	14 days	21 days	Means (T)
Treatment										
2011 season					2012 season					
T1 (Control)	2.65	3.20	3.57	3.81	3.31	3.16	3.54	3.94	4.18	3.70
T2	2.67	3.23	3.72	3.93	3.39	3.28	3.68	4.07	4.34	3.84
T3	2.71	3.27	3.80	4.21	3.50	3.33	3.74	4.27	4.53	3.97
T4	3.15	3.80	4.34	4.52	3.95	3.36	3.77	4.44	4.87	4.11
T5	2.90	3.51	3.93	4.31	3.66	3.25	3.64	4.25	4.46	3.90
T6	3.75	3.89	4.53	4.73	4.22	4.04	3.87	4.53	4.93	4.34
Means (D)	2.97	3.48	3.98	4.25		3.40	3.71	4.25	4.55	
LSD =0.05	LSD (T) = 0.05				LSD (T) = 0.02					
For.	LSD (D) = 0.04				LSD (D) = 0.02					
	LSD (TXD) = 0.11				LSD (TXD) = 0.04					

Figure (7): Effect of Ozone Treatments and some storage package kind on total sugars (%) of "Canino" apricot fruits stored at 0°C, RH 90 % in 2011and 2012seasons.

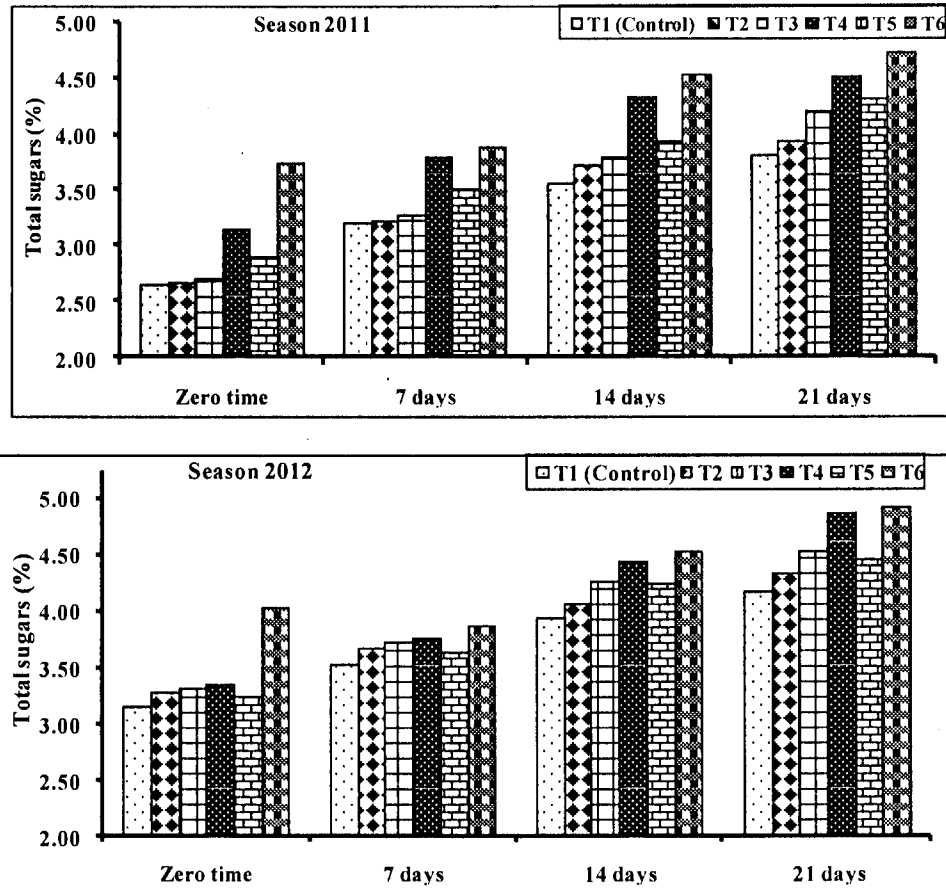
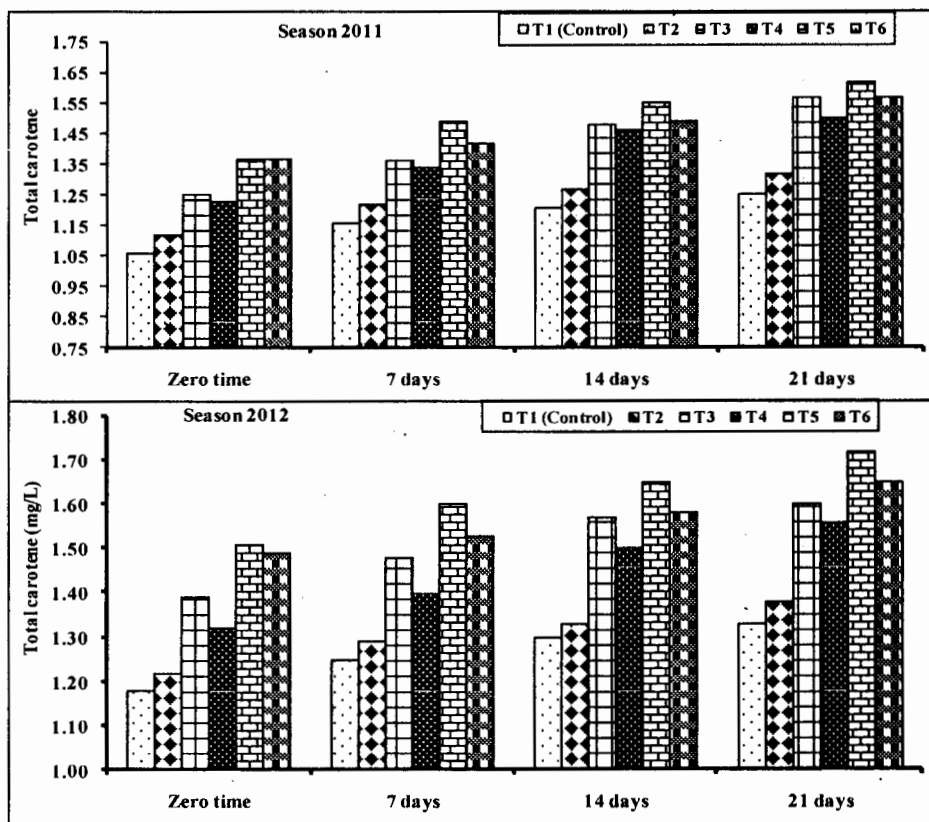


Table (8): Effect of Ozone treatments and some storage package kind on fruit total carotene (m/L) of "Canino" apricot cv. during stored at 0°C, RH 90 % 2011and 2012 seasons.

Treatment	period	total carotene (m/L)					Zero time	7days	14 days	21 days	Means (T)
		Zero time	7days	14 days	21 days	Means (T)					
2011 season						2012 season					
T1 (Control)		1.06	1.16	1.21	1.25	1.17	1.18	1.25	1.30	1.33	1.27
T2		1.12	1.22	1.27	1.32	1.23	1.22	1.29	1.33	1.38	1.31
T3		1.25	1.36	1.48	1.57	1.42	1.39	1.48	1.57	1.60	1.51
T4		1.23	1.34	1.46	1.50	1.38	1.32	1.40	1.50	1.56	1.45
T5		1.37	1.49	1.55	1.62	1.50	1.51	1.60	1.65	1.72	1.62
T6		1.37	1.42	1.49	1.57	1.46	1.49	1.53	1.58	1.65	1.56
Means (TD)		1.23	1.33	1.41	1.47		1.35	1.42	1.49	1.54	
LSD =0.05		LSD (T) = 0.01					LSD (T) = 0.01				
For.		LSD (D) = 0.01					LSD (D) = 0.01				
		LSD (TXD) = 0.02					LSD (TXD) = 0.02				

Figure (8): Effect of Ozone treatments and some storage package kind on total carotene % of "Canino apricot cv. fruits stored at 0°C, RH 90 % 2011 and 2012 seasons.



CONCLUSION

All the treatments of Ozone and perforated packaging (p.p.) successfully Decreased weight loss, decay percentage and acidity .On the other hand, they increased fruit texture, T.S.S. total sugars and carotene. However, T.S.S. acidity, total sugars and carotene content of apricot fruits increased gradually with the progress of storage period at 0°C and (RH) 90. Therefore, Ozone could be considered a tool to maintain quality of apricot during storage. T.S.S. acidity, total sugars and carotene content of apricot fruits increased gradually with the progress of storage period at 0°C and (RH) 90. Therefore, Ozone could be considered a tool to maintain quality of apricot during storage. For 21 days by deploying ripening and senescence stages.

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تأثير استخدام الأوزون والعبوات المثقبة على جودة المشمش أثناء التخزين المبرد

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المستخلص

أجريت هذه الدراسة خلال موسم ٢٠١١ ، ٢٠١٢ على ثمار المشمش صنف " كانينو " المعرفة مدى استجابة الثمار المعاملة بالأوزون بغرض التعقيم والتعبئة في علب مثقبة من ال PET (١٢٠٠ مللتر) وأكياس مثقبة من البولي بوريالين بغرض التحكم في التنفس ومن ثم جودة الثمار وتم التخزين على صفر⁰ م ورطوبة نسبية ٨٥-٩٠%. وتمثلت الصفات التي تم تقييمها هي (نسبة الفقد في الوزن ، نسبة التالف في الثمار، الصلابة في الثمار و اللون ، نسبة المواد الصلبة الذائبة، نسبة الحموضة، نسبة السكريات الكلية و نسبة الكاروتينات). وفيما يتعلق بنوع العبوة بينما تفوقت عبوات البولي بوريالين المثقب والمعالجة بالأوزون والمحتوية على ١٠ تقوب بالمقارنة بباقي المعاملات. فيما يتعلق باللون فإن كل المعاملات المستخدمة لا تعطى أي تأثير على اللون أثناء التخزين بينما بعد ١٢ يوم سجلت المعاملة بغاز الأوزون أقل نسبة فقد في الوزن و أقل نسبة تالف في الثمار بينما سجل الكنترول أعلى نسبة فقد في الوزن وأعلى نسبة من التالف في الثمار. وسجلت المعاملة بالأوزون زيادة في نسبة المواد الصلبة الذائبة، انخفاض نسبة الحموضة ولم يلاحظ عدوى فطرية أو مواد سامة في أنسجة الثمار المعاملة بالأوزون.

وخلاصة القول أن ثمار المشمش صنف كانينو المعاملة بالأوزون ومعبأة في عبوات من بولي بوريالين المثقب (١٠ تقوب) والمخزنة على درجة الصفر المنوي هي الأفضل .