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Full Length Research Paper

Effect of calcium chloride on post-harvest shelf life of persimmon

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An experiment was conducted to evaluate the storage stability of persimmon (Diospyros *kaki)* fruit .The fresh fruit (controlled) was compared with treated 2% of $CaCl_2$ aqueous solution at Department of Agriculture and Food Technology Karakoram International University Gilgit in January 2012. Evaluation was made for changes in chemical and physical characteristics of the fruit during four storage intervals treated of 2% cacl2 and fresh fruit were subjected to following Physico chemical analysis TSS (^{0}brix), acidity %, ash content and moisture % were determined at four days interval during storage. pH was non-significantly affected during storage intervals, while TSS was recorded to be increased. Acidity % and ash was first increased and then decreased during storage. Fruits kept in cartoon boards showed considerable decrease in pH, TSS (^{0}brix) and acidity % while an increase was observed for moisture content.

Keywords: Persimmon, $CaCl_2$, storage intervals, physicochemical Analysis

INTRODUCTION

Persimmon fruit is obtained from a number of species of trees belonging to the genus *Diospyros* in the ebony wood family (Ebenaceae).The common names are Persimmon, Oriental Persimmon, Japanese persimmon, Kaki. Diospyros fruits means 'the fruit of the gods'. So, the family name is enough to describe the delicacy, beauty and flavor of the persimmon fruit. Persimmon colours range from light yellow-orange to dark red-orange. The color of the persimmon fruit changes according to the species. These fruits vary in size from 1.5 to 9cm (0.5 to 4 in) diameter and come in different shapes like spherical, acorn or pumpkin. The American persimmon (*Diospyros virginiana*) is native to the eastern United States. The fruit is also referred to as 'nature's candy. Persimmon (Diosypros kaki) is a good source of natural antioxidant, vitamins c, and dietary fiber which are probably involved in the reduction of degenerative human diseases (Dongowski (1994) due to their anti oxidative and free radical scavenging properties. Persimmons are one of them which are very sweetest in the taste. Aga khan Rural Support Program (AKRSP) for Pakistan has done some work on the production and marketing of fresh & dried fruits processing in different parts of Gilgit Baltistan, in which Gilgit, Hunza etc are the main areas where AKRSP play its vital role in the development of Agricultural Sector especially in fresh fruits processing &drying fruits. (AKRSP 1997). Calcium chloride dip has been used as a firming agent for whole and fresh-cut fruits. In melon cylinders stored at 5^{o}C, 1-5% calcium chloride increased firmness, with the higher concentration giving better improvement in firmness (Luna-Guzman *et*

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al., 1999). The treatments increased the calcium content of the tissues. Other studies also showed that calcium treatment retarded firmness loss consequently extending shelf life of apple In apple slices, calcium chloride dips at 0.2% was found to reduce enzymatic browning (Sapers *et al*., 1990). However, the inhibitory effect was diminished with storage duration and differed with apple cultivars.

MATERIAL AND METHOD

Sample Collection and Preparation

Fresh fruits of persimmon were purchased from local fruit market of Gilgit. Fruits were washed and sorted to remove dust particles and damaged fruits.

Calcium Chloride

Calcium chloride was available in food Laboratory Karakoram International University Gilgit.

Treatments

Cleaned sorted fruits were subjected to the following set of treatments.

T_0: Control

T_1: 2% $CaCl_2$ Aqueuse solution.

The fruits were treated with 2% $CaCl_2$ Aqueuse solution. Fruits were dipped for two to three minutes. They were air dried under the fan and kept in open card board trays and stored at room temperature. The different physico-chemical parameters were studied four days of interval till their spoilage.

PHYSICO-CHEMICAL ANALYSIS

pH and Titrateable acidity were determined by the recommended method of A.O.A.C (2000). Total soluble solids were determined at ambient temperature using electric refractometer by the recommended method of A.O.A.C (2000). Moisture content was determined by modification of vacuum oven method A.O.A.C (2000). Ash % was determined by dry ashing procedures using a high temperature muffle furnace capable of maintaining temperatures of between 500 and 600 ^oC.

RESULTS AND DISCUSSION

Total Soluble Solids

The result regarding the total soluble solids (TSS ^oBrix) of persimmon fruits are presented in Table:1. TSS were was decreased, the controlled was totally discard after 8th day, but the treated was acceptable.

Figure: 2 A shows that effect of treatment and controlled in storage interval on the pH of persimmon fruits during storage. The result are in agreements with the previous result of (Hussein *et al*.,2004) (khan *et al*..,2007) who also reported that there have a negligible difference in ph for fruit during storage.

The fruit was commercially matured on the 1st day with pH (5.50) with the passage of time they under goes many physiological, biological and structural changes so pH was increased.

On the 4th day of storage pH was slightly increased in both T_0 and T_1. In T_1 the ph was increased up to (5.80) whenever T_0 was slightly increased from T_1 was (6.00).

On the 8th day of storage control fruit was fully ripened and respiration may have been on its peak and showed highest pH value was (6.20) but in T_1 was slightly increased up to (6.10).

On the 12th and 16th day of storage T_0 was unacceptable and discard whenever T_1 was remain constant .on the 12th day the ph in T_1 was (5.90) and on the 16th day the ph was (5.50).

pH

The result regarding to the pH values of persimmon fruit are presented in table: 2. It was seen that there was increased in pH with the passage of time after 8th day pH significantly increased during storage after 4th day but increased in 8th days. (Mohla *et al*., 2000) and (khan *et al*., 2007) also reported and increased in TSS during storage interval.

Persimmon was commercially mature on the 1st day with low TSS (15.60 ^oBrix) but as time passed many biochemical, physical and structural changes.

On the 4th day TSS in controlled fruits T_0 was (17.50 ^oBrix) but in T_1 persimmon has significantly increased to (16.30 ^oBrix) TSS also increased with the passage of time.

On the 8th day of storage controlled fruits T0 was fully ripened and respiration may have been on its peaks and shows the highest TSS value (19.00 ^oBrix) but in treated fruit T_1 in ash content was slightly increased up to (17.90 ^oBrix).

On the 12th and 16th day T_0 was unacceptable and spoiled due to mold growth on it, whenever T_1 become acceptable on the 12th day of storage T_1 was (21.50 ^oBrix) on the 16th day T_1 was (23.80 ^oBrix).

Table 1. Effect of CaCl2 on TSS during storage at ambient temperature

	S0	S4	S8	S12	S16	Mean
T0	15.60f	17.50d	19.00c	0.00g	0.00g	**10.42B**
T1	15.60f	16.30e	17.90d	21.50b	23.80a	**19.00A**
Mean	**15.55C**	**16.90B**	**18.45A**	**10.75E**	**11.90D**	
LSD	**T=0.24**	**S=0.4**	**TS=0.55**			

- T0=control, T1=$CaCl_2$ 2%
- Means followed by the same alphabets are not significantly different from one another based on alpha =0.05.

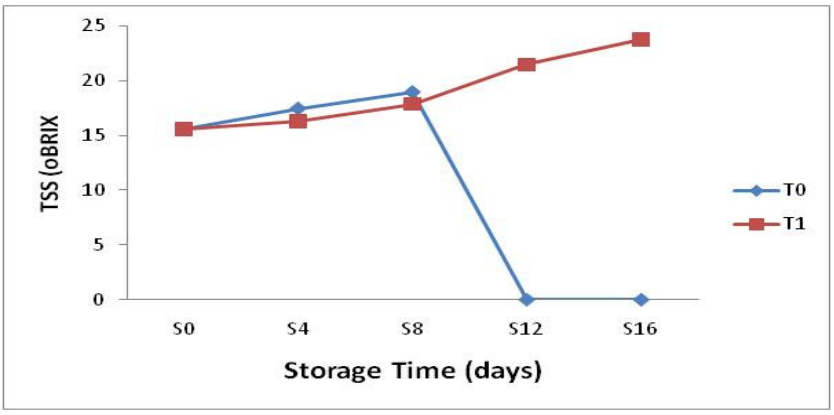

Figure1. A line sketch of TSS(oBrix) in persimmon during storage.

Table 2. Effect of $CaCl_2$ on pH during storage at ambient temperature.

Treatments	S0	S4	S8	S12	S16	Mean
T0	5.50b	6.00ab	6.20ab	0.00c	0.00c	**3.42B**
T1	5.50b	5.80ab	6.10ab	5.90ba	5.50b	**5.76A**
Mean	**5.50B**	**5.90A**	**5.85AB**	**2.95C**	**2.75C**	
LSD	**T=0.24**	**S=0.4**	**TS=0.55**			

- T0=control, T1=$CaCl_2$ 2%
- Means followed by the same alphabets are not significantly different from one another based on alpha =0.05.

Table 3. Effect of $CaCl_2$ on Ash during storage at ambient temperature

Treatments	S0	S4	S8	S12	S16	Mean
T0	1.59e	1.80c	1.82B	0.00f	0.00f	**1.04B**
T1	1.59e	1.75d	1.80c	1.83b	1.85a	**1.76A**
Mean	**1.60C**	**1.77B**	**1.81A**	**0.91D**	**0.92D**	
LSD	**T= 6.8**	**S=0.01**	**TS=0.015**			

- T0=control, T1=$CaCl_2$ 2%
- Means followed by the same alphabets are not significantly different from one another based on alpha =0.05.

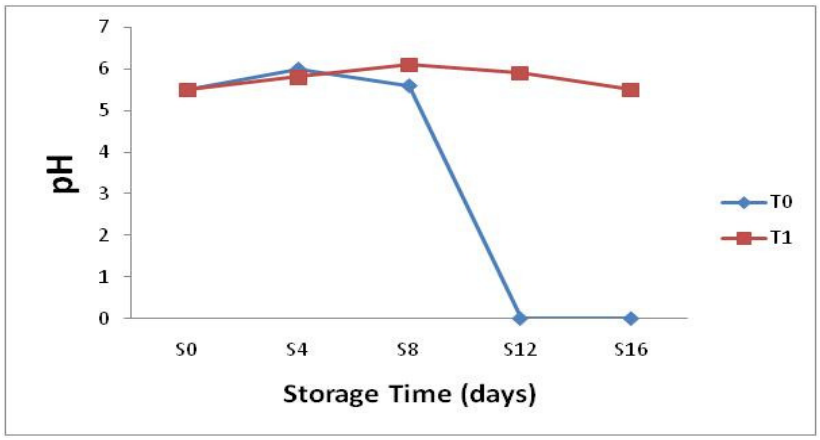

Figure 2. A line sketch of pH in persimmon during storage.

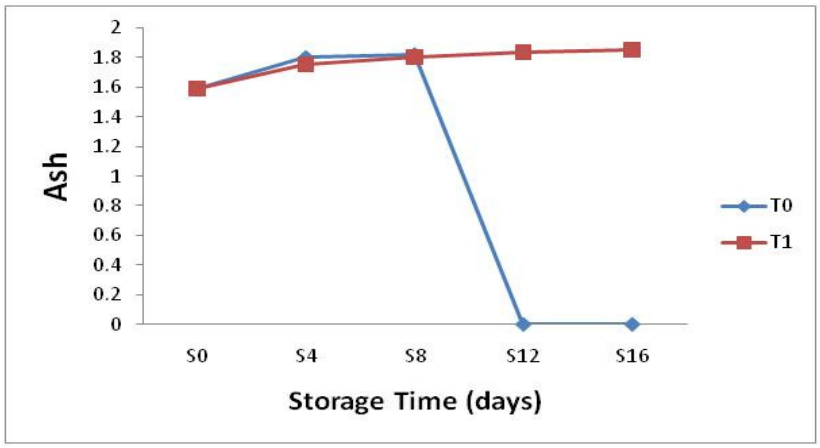

Figure 3. A line sketch of Ash in persimmon during storage.

Ash

The result regarding the ash value of persimmon fruits are presented in Table: 3. It was seen that there was an increased in the ash with the passage of time. Our result slightly differs from (Chaudry *et al.,* 1998) who reported ash percentage in fruit is 0.32-0.48%. The results are little bit different may be due to, geographical location, and climatic conditions.

On the 1st day of storage the ash content in both treated and untreated were (1.59)and with the passage of time they under goes many biochemical , physiological and structural changes so ash content was increased.

On the 4th day of storage the ash content was continuously increased in T_0 was (1.80) but in T_1 the ash content was slightly increased to (1.75).

On the 8th day of storage controlled fruits were fully ripened and respiration may have been on its peak and show the high pH value (1.82) but in treated fruits ash content was slightly increased up to (1.80).

On the 12th and 16th day of storage controlled fruits were unacceptable and spoiled because of mold grow on it, whenever the treated persimmon is able to use the ash content in 12th day was (1.83)and on 16th day T_1 was (1.85).

Moisture %

The result regarding moisture % of persimmon frits during storage present in table: 4. It can be seen that there was significant effect on moisture content was observed after 5 days both in controlled and treated persimmon fruit. (Hussein *et al.*, 2004) (khan *et al.*,2007) also studies an increased in moisture content.

Figure:4 shows the effect of treatment and storage intervals on the moisture of persimmon fruits. The

Table 4. Effect of $CaCl_2$ on Moisture % during storage at ambient temperature

Treatments	S0	S4	S8	S12	S16	Mean
T0	76.00b	78.00a	72.50e	0.00f	0.00f	**45.30B**
T1	76.00b	77.10a	75.40bc	74.70cd	73.80d	**75.40A**
Mean	**76.00B**	**77.55A**	**73.95C**	**37.35D**	**36.90D**	
LSD	**T=0.4**	**S=0.7**	**TS=0.9**			

- T0=control, T1=$CaCl_2$ 2%

Means followed by the same alphabets are not significantly different from one another based on alpha = 0.05.

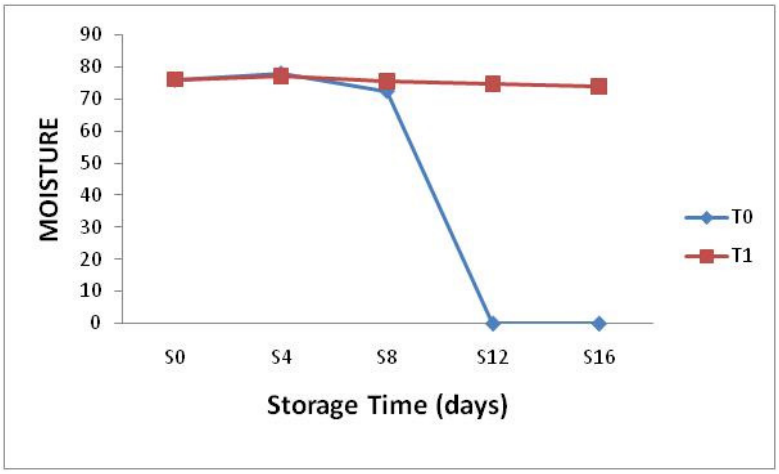

Figure 4. A line sketch of moisture in persimmon during storage.

persimmon fruit were commercially mature on the 1st day with the passage of time they under goes many physiological , biochemical and structural changes that's leads to ripening on the 1st day of storage the moisture level with in persimmon fruits was (76.00) both in controlled and treated fruits .

On the 4th day of storage highest moisture was recorded both in controlled and treated fruit highest moisture percentage in To was (78.00) but in T1 was recorded (77.10%) moisture level.

On the 8th day of storage (72.50) was observed in T_0 and treated persimmon with T_1 was observed (75.40%) moisture level

On the 12th and 16th day of storage the controlled fruits was unacceptable and discarded due to mold growth whenever the treated persimmon fruit remain stable and acceptable , T_1 was at their active respiration stage on the 12th day moisture level was (74.70%),and on 16th day of storage moisture level was (73.80%).

Titrateable Acidity

The result regarding titrateable acidity of persimmon frits present in Table: 5. The pattern change in acidity was unique, there was an increased in acidity percentage during the first four days of storage. This may be due to degradation of biochemical constituents of the un ripened fruits during respiration resulting in certain acids, which are then reduce after 5 days. Hussein (Hussein *et al*., 2004) (khan *et al*., 2007) also studies on total acidity of fruits.

Figure: 4 show the effect of treatment and storage intervals on the Titrateable acidity of persimmon fruits. The

Table 5. Effect of CaCl2 on TA during storage at ambient temperature

Treatments	S0	S4	S8	S12	S16	Mean
T0	1.80d	2.50a	1.60ef	0.00g	0.00g	**1.18B**
T1	1.80d	2.20b	2.00c	1.70de	1.50f	**1.84A**
Mean	**1.80B**	**2.35A**	**1.80B**	**0.85C**	**0.75C**	
LSD	**T=0.07**	**S=0.11**	**TS=0.15**			

- T0=control, T1=$CaCl_2$ 2%
- Means followed by the same alphabets are not significantly different from one another based on alpha =0.05.

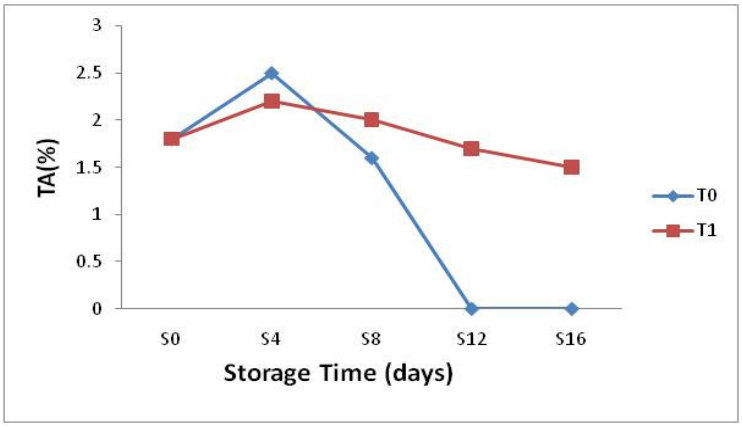

Figure 5. A line sketch of TA(%) in persimmon during storage.

persimmon fruit were commercially mature on the 1st day with Titrateable acidity of both T_0 and T_1 was (1.80).

On the 4th day of storage titrateable acidity was highest in T_0 was (2.50) and T_1 was (2.20).

On the 8th day of storage titrateable acidity in controlled T_0 persimmon fruit show a continuous decreased in titrateable acidity T_0 show the lowest acidity (1.60) bit T_1 was significantly increased (1.60).

On the 12th and 16th day of storage the controlled fruits were unacceptable and discarded due to mold growth whenever the treated persimmon fruit remain stable and acceptable, on the 12th day the acidity was (1.70) and on 16th day the T.A was (1.50) recorded.

CONCLUSION

This study revealed that several Physico -chemical quality changes of stored persimmon were depending on the presence or absence of preservatives. Calcium chloride has capability to prevent mould growth, retard ripening and aging with in fruits. The calcium chloride had significant effect on the quality of persimmon. In conclusion, application of 2% CaCl2 as a commercial postharvest treatment for persimmon under tropical storage conditions. Extension of the shelf life may be attributed mainly to the increased firmness and retarded ethylene production rates in CaCl2 treated fruits.

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