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 CaCl₂ 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 (⁰brix), 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 (⁰brix) and acidity % while an increase was observed for moisture content.

Keywords: Persimmon, CaCl₂, 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 (Diospyros 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°C, 1-5% calcium chloride increased firmness, with the higher concentration giving better improvement in firmness (Luna-Guzman et
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.

- T₀: Control
- T₁: 2% CaCl₂ aqueous solution.

The fruits were treated with 2% CaCl₂ aqueous solution. Fruits were dipped for two to three minutes. They were air dried under the fan and kept in open cardboard 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 °C.

**RESULTS AND DISCUSSION**

**Total Soluble Solids**

The result regarding the total soluble solids (TSS °Brix) of persimmon fruits are presented in Table:1. TSS were 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 °Brix) but as time passed many biochemical, physical and structural changes.

On the 4th day TSS in controlled fruits T₀ was (17.50 °Brix) but in T₁ persimmon has significantly increased to (16.30 °Brix) 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 °Brix) but in treated fruit T₁ in ash content was slightly increased up to (17.90 °Brix).

On the 12th and 16th day T₀ was unacceptable and spoiled due to mold growth on it, whenever T₁ become acceptable on the 12th day of storage T₁ was (21.50 °Brix) on the 16th day T₁ was (23.80 °Brix).

**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 T₁: 2% CaCl₂ aqueous solution.

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

On the 4th day of storage controlled fruit pH was slightly increased in both T₀ and T₁. In T₁ the ph was increased up to (5.80) whenever T₀ was slightly increased from T₁ 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 T₁ was slightly increased up to (6.10).

On the 12th and 16th day of storage T₀ was unacceptable and discard whenever T₁ was remain constant .on the 12th day the ph in T₁ was (5.90) and on the 16th day the ph was (5.50).
Table 1. Effect of CaCl\textsubscript{2} on TSS during storage at ambient temperature

<table>
<thead>
<tr>
<th>Treatments</th>
<th>S0</th>
<th>S4</th>
<th>S8</th>
<th>S12</th>
<th>S16</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>15.60f</td>
<td>17.50d</td>
<td>19.00c</td>
<td>0.00g</td>
<td>0.00g</td>
<td>10.42B</td>
</tr>
<tr>
<td>T1</td>
<td>15.60f</td>
<td>16.30e</td>
<td>17.90d</td>
<td>21.50b</td>
<td>23.80a</td>
<td>19.00A</td>
</tr>
<tr>
<td>Mean</td>
<td>15.55C</td>
<td>16.90B</td>
<td>18.45A</td>
<td>10.75E</td>
<td>11.90D</td>
<td></td>
</tr>
<tr>
<td>LSD</td>
<td>T=0.24</td>
<td>S=0.4</td>
<td>TS=0.55</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- T0=control, T1=CaCl\textsubscript{2} 2%
- Means followed by the same alphabets are not significantly different from one another based on alpha =0.05.

![Figure 1](image.png)

Figure 1. A line sketch of TSS(oBrix) in persimmon during storage.

Table 2. Effect of CaCl\textsubscript{2} on pH during storage at ambient temperature.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>S0</th>
<th>S4</th>
<th>S8</th>
<th>S12</th>
<th>S16</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>5.50b</td>
<td>6.00ab</td>
<td>6.20ab</td>
<td>0.00c</td>
<td>0.00c</td>
<td>3.42B</td>
</tr>
<tr>
<td>T1</td>
<td>5.50b</td>
<td>5.80ab</td>
<td>6.10ab</td>
<td>5.90ba</td>
<td>5.50b</td>
<td>5.76A</td>
</tr>
<tr>
<td>Mean</td>
<td>5.50B</td>
<td>5.90A</td>
<td>5.85AB</td>
<td>2.95C</td>
<td>2.75C</td>
<td></td>
</tr>
<tr>
<td>LSD</td>
<td>T=0.24</td>
<td>S=0.4</td>
<td>TS=0.55</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- T0=control, T1=CaCl\textsubscript{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\textsubscript{2} on Ash during storage at ambient temperature

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

- T0=control, T1=CaCl\textsubscript{2} 2%
- Means followed by the same alphabets are not significantly different from one another based on alpha =0.05.
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 T₀ was (1.80) but in T₁ 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 T₁ 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

<table>
<thead>
<tr>
<th>Treatments</th>
<th>S0</th>
<th>S4</th>
<th>S8</th>
<th>S12</th>
<th>S16</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>76.00b</td>
<td>78.00a</td>
<td>72.50e</td>
<td>0.00f</td>
<td>0.00f</td>
<td>45.30B</td>
</tr>
<tr>
<td>T1</td>
<td>76.00b</td>
<td>77.10a</td>
<td>75.40bc</td>
<td>74.70cd</td>
<td>73.80d</td>
<td>75.40A</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>76.00B</td>
<td>77.55A</td>
<td>73.95C</td>
<td>37.35D</td>
<td>36.90D</td>
<td></td>
</tr>
<tr>
<td><strong>LSD</strong></td>
<td>T=0.4</td>
<td>S=0.7</td>
<td>TS=0.9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 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 1$^{st}$ day with the passage of time they undergo many physiological, biochemical and structural changes that leads to ripening on the 1$^{st}$ day of storage the moisture level with in persimmon fruits was (76.00) both in controlled and treated fruits.

On the 4$^{th}$ day of storage highest moisture was recorded both in controlled and treated fruit highest moisture percentage in T0 was (78.00) but in T1 was recorded (77.10%) moisture level.

On the 8$^{th}$ day of storage (72.50) was observed in T0 and treated persimmon with T1 was observed (75.40%) moisture level.

On the 12$^{th}$ and 16$^{th}$ day of storage the controlled fruits was unacceptable and discarded due to mold growth whenever the treated persimmon fruit remain stable and acceptable, T1 was at their active respiration stage on the 12$^{th}$ day moisture level was (74.70%), and on 16$^{th}$ day of storage moisture level was (73.80%).

**Titrateable Acidity**

The result regarding titrateable acidity of persimmon fruits 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
persimmon fruit were commercially mature on the 1\textsuperscript{st} day with Titrateable acidity of both T\textsubscript{0} and T\textsubscript{1} was (1.80).

On the 4\textsuperscript{th} day of storage titrateable acidity was highest in T\textsubscript{0} was (2.50) and T\textsubscript{1} was (2.20).

On the 8\textsuperscript{th} day of storage titrateable acidity in controlled T\textsubscript{0} persimmon fruit show a continuous decreased in titrateable acidity T\textsubscript{0} show the lowest acidity (1.60) bit T\textsubscript{1} was significantly increased (1.60).

On the 12\textsuperscript{th} and 16\textsuperscript{th} 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 12\textsuperscript{th} day the acidity was (1.70) and on 16\textsuperscript{th} 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\% CaCl\textsubscript{2} 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 CaCl\textsubscript{2} treated fruits.

LITERATURE CITED

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