RIpening AND QUALITY OF MANGO FRUIT AS AFFECTED BY COATING WITH “SEMPERFRESH”

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Abstract

Mango fruit has a relatively short storage life of about 2 to 3 weeks at 10-13°C. In order to prolong the storage life of the cultivars “Haden” and “Keitt”, the fruits were coated with 3 concentrations of the edible film “Semperfresh” and then they were stored at 13°C. Fruits of the cultivar “Keitt” were treated with hot water at 46°C for 90 min before they were coated. Fruits were then evaluated for °Brix, pH, titratable acidity, firmness, color of the skin, weight loss, and vitamin C. All 3 concentrations applied to the cultivar “Haden” (0.8, 1.6, and 2.4%) affected fruit ripening. Titratable acidity, firmness, and green color were higher in treated fruits. Weight loss, °Brix, and pH were lower in treated fruits. The concentrations applied to the cultivar “Keitt” (0.7, 1.4, and 2.1%) had no effect on fruit firmness, weight loss, or vitamin C. “Semperfresh” had no effect on decay development in both cultivars.

1. Introduction

Mango (Mangifera indica L.) is one of the most important fruits produced in the state of Sinaloa. About 85% of the production is distributed in the internal market, and the rest is destined to export, especially to the USA (Ireta, 1988). The mango exported from the state of Sinaloa is about 45% of all the mango exported from Mexico. The cultivars produced in Sinaloa include “Haden”, “Kent”, “Keitt”, and “Tommy Atkins”.

The mango currently exported to the USA is treated with hot water (46.1°C for 75-90 min depending on the size of the fruit) for fruit fly control. This treatment accelerates fruit ripening and removes natural skin coatings. In addition to accelerated ripening and senescing, treated fruit lose more water than untreated fruit. The minimum storage temperature for mango is 10 to 13°C. At this temperature the fruit can be stored for 2 to 3 weeks. Controlled atmosphere (CA) storage with 5% O₂ and 5% CO₂ has been tested for “Keitt” mango without any significant advantage (Hatton and Reeder, 1965). However, “Tommy Atkins” mango from Sinaloa was shipped to Europe in modified atmospheres (MA). MA and CA are considered to be relatively expensive treatments. A relatively inexpensive method to modify the internal atmosphere of the fruit, and to slow down its metabolism, is to use a permeable edible film coating such as “Semperfresh”. This permeable coating reduces fruit gas exchange and water loss (Lowings and Cutts, 1982). It is a mixture of esters of mono- and di-glycerides with sucrose and carboxymethylcellulose. These were found to delay ripening and reduce water loss in “Julie” mangoes (Dhalla and Hanson, 1988).

A significant extension of the postharvest life of mango is important to permit transport, distribution and commercialization to distant export markets. Therefore, the objectives of this work were to study the effects of “Semperfresh” on quality of “Haden” and “Keitt” mangos during storage at 13°C.

2. Materials and methods

“Haden” and “Keitt” mangos were harvested in Aguarruto, Sinaloa at their physiological maturity. They were washed, and selected on the basis of size and absence of defects.

“Haden” mango were soaked in a solution of “Semperfresh” of one of 3 concentrations: 0.8, 1.6 or 2.4%. “Keitt” mangos were first treated with hot water at 46.1°C for 90 minutes, and then they were soaked in a “Semperfresh” concentration of 0.7, 1.4, or 2.1%. Fruits were then stored at 13°C for about one month, and evaluated periodically for total soluble solids (°Brix), pH, titratable acidity, firmness, vitamin C, skin color, and weight loss. “Haden” mangos were evaluated every 4 days and “Keitt” mangos every 7 days. Skin color was evaluated by measuring the “Hue” and “a” values using a Minolta CR-210 (Minolta, Osaka, Japan) on 2 points of the skin. Firmness was measured on 2 paired points using a penetrometer (Chatillon DF1-50) with a 6mm point. Total soluble solids (°Brix) was measured using a refractometer (Abbe American Optical). The pH was measured using a pH meter (Beckman model 40).

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3. Results

3.1 “Haden” mangoes

The total soluble solids (°Brix) of treated fruits were lower than that of the control. There were significant differences after 8 days of storage. But no significant differences were observed after 28 days of storage. The untreated fruits accumulated 16.5 °Brix after 12 days of storage, remained stable until 24 days of storage, after which it started to decrease. Treated fruits with 0.8% "Semperfresh" had 14.7 °Brix after 28 days of storage (Fig.1).

Titratable acidity decreased less in the treated fruits than in the control. Untreated fruits had a titratable acidity of 0.83 initially and 0.2% after 12 days of storage. Then it continued to decrease up to 0.08% at the end of the experiment (Fig.2). Fruits treated with 1.6 and 2.4% "Semperfresh" had a titratable acidity of 0.6 and 0.7% after 12 days of storage, respectively. After 32 days of storage fruits treated with 0.8 and 1.6% "Semperfresh" had 0.23% titratable acidity, while fruits treated with 2.4% "Semperfresh" had 0.54% titratable acidity.

After 8 days of storage the untreated fruit had a pH of 4.91 while the treated fruit had a pH of 4.0 to 4.22 (Fig.3). At the end of the experiment treated fruit had a pH of 4.31 to 4.7 while the untreated fruit had a higher pH of 5.7.

Flesh firmness of untreated fruits decreased very rapidly from 60 N to 11.4 N after 4 days of storage (Fig.4). The flesh firmness of treated fruits also decreased, but it was higher than in the untreated fruits after 8 days of storage. After 20 days of storage only fruits treated with 1.6 and 2.4% "Semperfresh" had higher flesh firmness than the untreated fruits.

Treated fruits had less water loss than the untreated mangoes (Fig.5). After 16 days of storage treated fruits lost 4.5 to 4.9% of their weight, while untreated fruits lost 7.5% of their weight.

Vitamin C decreased from 17.25 to 9 mg/100g in both treated and untreated "Haden" mangoes during storage (Fig.6). However, there were no significant differences between treatments. Dhalla and Hanson (1988) reported a decrease in vitamin C during postharvest storage of "Julie" mango.

The "Hue" value of skin color decreased from 118 to 73 after 16 days of storage in the untreated fruit, but decreased less in the treated mango (Fig.7). The "a" value increased during storage (Fig.8). Initially the mango had an "a" value of -17.5 (an intensive green color). After 8 days of storage the untreated fruit had an "a" value close to zero, while treated fruits had an "a" value of -12 to -17. This indicates that there were less green color loss in the treated fruits. An "a" value of zero was obtained after 20 days of storage for fruits treated with 0.8% "Semperfresh", after 26 days of storage for fruits treated with 1.6% "Semperfresh", and after 32 days of storage for fruits treated with 2.4% "Semperfresh". Yellow color did not develop uniformly in fruits treated with 2.4% "Semperfresh".

Anthracnosis developed in both treated and untreated fruits and determined the end of the storage period. Anthracnosis development was high between 30-32 days of storage.

3.2 “Keitt” mango

Flesh firmness was not affected by treatment with "Semperfresh" (Fig.9). Weight loss was less in treated than in untreated fruits, although it was non-significant (Fig.10). Vitamin C decreased from 21.5 to 7.5 mg/100g after 21 days of storage (Fig.11). However, "Semperfresh" had no effect. Anthracnosis was also developed in “Keitt” mango after 28 days in both treated and untreated fruits.

4. Discussion

Treatments with 0.8 to 2.4% "Semperfresh" retarded ripening and affected the quality attributes of "Haden" mango. Since the titratable acidity was higher in treated fruit, it is possible that the CO₂, accumulated internally in the fruit tissue caused acidosis after dissolving and forming carbonic acid. "Semperfresh" reduced water loss but it did not decrease the vitamin C content. The treated "Haden" mangoes were green and firm, but with high anthracnosis development, it is recommended to apply a treatment to control this disease. 0.7 to 2.1% "Semperfresh" did not retard ripening of "Keitt" mango treated with hot water, nor did affect their quality attributes. "Keitt" mango possibly was affected by hot water treatment so that the edible coating treatment had no effect as in "Haden" mango. Further studies using lower concentrations of this permeable edible film coating, especially for "Haden" mango, are necessary before its commercial use can be recommended.
References


Figure 1 - Total soluble solids (°Brix) of "Haden" mango treated with different concentrations of Semperfresh during storage at 13° C.

Figure 2 - Triticum Semperfi
Figure 2 - % Titratable acidity (as citric acid) in "Haden" mango treated with different concentrations of Semperfresh during storage at 13°C.
Figure 3 - pH of "Haden" mango treated with different concentrations of Semperfresh during storage at 13°C.
Figure 4 - Firmness (N) of "Haden" mango treated with different concentrations of Semperfresh during storage at 13°C.
Figure 5 - % Weight loss of "Haden" mango treated with different concentrations of Semperfresh during storage at 13° C.

Figure 6 - Vitamin storage
Figure 6 - Vitamin C content in Haden™ mango treated with different concentrations of Semperfresh during storage at 13°C.
Figure 7 - Hue value of skin of "Haden" mango

Figure 8 - "a" va during