Effect of Wax Coating on the Postharvest Quality of ‘Sai Nam Peung’ Mandarin Orange
(Citrus reticulata Blanco)

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Abstract

Shrivelling of the peel is a key factor for the commercial decline of orange. The application of food grade wax not only reduces water loss from the fruit but also improves the appearance of the fruit. Low temperature storage is the most effective method to maintain quality and extend shelf life of the fruit. Postharvest quality of mandarin orange (Citrus reticulata Blanco cv. ‘Sai Nam Peung’) was studied in relation to teva wax (18% food grade shellac, polyethylene) coating and cold storage for 1 month. We found that teva wax coating is significantly difference from no wax (control) in % weight loss, shelf life and glossiness of the fruit. However, the glossiness of all wax coated fruits are not significantly difference at day 21 and 28. Moreover, the combination of wax coating and cold storage is significantly difference from that in room temperature storage for % weight loss, shelf life and no chilling injury appearance during 1 month of storage. There are no significantly changes in T.S.S/ T.A ratio during storage.

Keywords: wax coating, cold storage, mandarin orange

Introduction

Citrus is a very ancient crop and known to occur over 4,000 years. It comprises numerous species. Over 215 species of genus Citrus, mandarin offer great variety (Mukhopadhyay, 2004). Wax coating on citrus fruit is often using to increase glossiness of the peel and to reduce fruit weight loss. Moreover, waxing of the fruits reduce chilling injury. However, it may cause off flavour development and peel disorder (Cohen, et al., 1990). Hagenmaier and Shaw, (1992) reported that the permeability of wax should be high for O₂, CO₂ and C₂H₄ and low for water vapour. Low temperature storage is most effective method to maintain quality and extend storage life, although it causes chilling injury. Susceptibility of chilling injury varies according to commodities, fruit maturity stage and season (Mukhopadhyay, 2004). The combination of low temperature storage and surface coating extend marketability by reducing water loss, protecting against contamination, establishing modified atmosphere in the fruit. In this experiment, the effect of teva wax (18% food grade shellac, polyethylene) and storage temperature on Sai-Nam-Paung mandarin orange (Citrus reticulata Blanco) are studied with emphasis on the postharvest quality.

Material and methods

Experiment was conducted during the first week of April 2007 and Teva wax 18% food grade (shellac, polyethylene) was used. In this study, mandarin fruits (Sai-num-paung) were harvested from the commercial orchard at Feng Amphore, in Chiang Mai Province. All the sample fruits used in this study were originated from the same orchard. Sai Nam Paung (sweet honey) mandarin oranges were washed with 200 ppm chlorax for 3-5 minutes followed by rinsing with water and drying on newspapers at the day of harvest. On the following day, the fruit were applied with Teva wax 18% food grade (shellac, polyethylene) wax by hand with over recommend concentration (500 kg of fruit / liter), recommend concentration (1000 kg of fruit / liter), under recommend concentration (1500 kg of fruit/liter) and control (no wax). The fruits were left to dry prior to cold storage. The fruits

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were stored at ambient temperature (day temperature 28.38 °C, night temperature 28.26 °C and relative humidity 67.70 % ) and at 5 °C for 1 month. Experiment was conducted by 2 x 4 factorial experiment in CRD design with 3 replications. % Weight loss, fruit height (mm), total soluble solid concentration (T.S.S)(Brix), titratable acidity (T.A)(%), pH, peel color changes (a, b, L ), glossiness (1, no glossiness, 2, slightly/ moderately glossiness, 3-good glossiness), off flavor appearance (1- no off flavour, 2- slightly off flavour, 3- strong off flavour) and storage shelf life(day) were investigated with 7 days interval for 1 month. Respiration rates (mg/kg/hr) were measured by CO₂ detector at day 28. All parameters of the fruits were analysed by statistically and mean comparisons were assessed by the Duncan’s Multiple Range Test (DMRT) at p ≤ 0.05 levels.

Result

The highest % weight loss was observed in control fruits at room temperature storage and the lowest % weight loss was found in the wax coated fruit with over recommend concentration, which stored at 5 °C. During 1 month, all fruits stored at 5 °C were lower in % weight loss than that of room temperature storage (Figure 1). Similar result was observed in fruit height loss. Respiration rate of wax coated fruit are lower than the respiration rate of no wax fruit. But we found that respiration rate of room temperature storage fruit are lower than that of cold storage at day 28 (Figure 4). Wax coated fruits are glossier than the control fruit during storage. The best glossiness was found in wax coated fruits, which used over recommended concentration until day14. But the glossiness of all wax coated fruits is not significantly difference at day 21 and 28. The glossiness of fruits storage at 5°C is more glossiness than the appearance of fruits storage at room temperature during 1 month (Figure 2). Slightly off flavor appearance occur during storage. We found that, off flavour appearance in wax coated fruits with over recommended concentration was the highest among all treatments at day 21 and 28 but not significantly different from other treatments (Figure 3). The storage life of fruits, which stored at 5 °C are longer than that of the room temperature storage fruit. Moreover, the storage life of wax coated fruit is longer than control fruit (Figure 5). Total soluble solid concentration, titratable acidity, pH and peel color of mandarin orange are not different during experiment (data not shown).

Discussion

Unwaxed fruits stored at room temperature were the highest % weight loss and wax coated fruits with over recommend concentration stored at 5 °C were the lowest % weight loss among all treatments during storage. Wax coated fruits had lower % weight loss than unwaxed fruits during storage. Our result confirm that the effectiveness of teva wax coating as moisture barrier by showing teva wax coated mandarins had lower % weight loss than uncoated (no wax) mandarins in storage. Mandarin fruits stored at 5 °C had lower % weight loss than that of room temperature stored fruits without any appearance of chilling symptoms. Previous finding by Ben-Yehoshua (1969) supported our result that lowering the temperature of storage from 20 °C to 12 °C extend storage life by reducing transpiration and delay the drying of the peel in orange. Furthermore, 5 °C is suitable temperature for storing of mandarin orange as recommended by Murata, (1997). By contrast, at lower temperatures (2 °C) the orange showed symptom of chilling injury, and objectionable pitting developed on the peel (Ben-Yehoshua, 1969).

Wax coated fruits are longer shelf life than control in both storage conditions. Moreover, fruits stored at 5 °C had shelf life longer than that stored at room temperature. Similar finding have reported that the use of low temperature storage in combination with edible coatings extended marketability on ‘Angeleno’ pulms by reducing in fruit weight (Navarro et al., 2005).
Figure 1 Effect of teva wax coating on the % weight loss of mandarin orange stored in room temperature (A) and 5 °C (B).

Figure 2 Effect of teva wax coating on the glossiness of mandarin orange stored in room temperature (A) and 5 °C (B).

Figure 3 Effect of teva wax coating on the off flavor of mandarin orange stored in room temperature (A) and 5 °C (B).

Figure 4 Effect of teva wax on the respiration rate of mandarin orange.

Figure 5 Effect of teva wax coating on the shelf life of mandarin orange.
The respiration rate of mandarin orange stored at room temperature is lower than that of the fruits store at 5 °C at day 28. This could be due to the fact that respiration rate of the cold storage fruits were measured outside of the cold storage. It caused temperature stress on the cold stored fruits. Moreover, the fruits at room temperature are terminated before the day of measuring (day 28).

The glossiness of all wax coated fruits is not difference after 2 weeks of storage. Slightly off flavor appearance in all fruits depend on concentration of wax coating occur during storage but not significantly different within treatments. Coating did not significantly affect on T.S.S/T.A ratio and pH of storage fruits during storage (data not shown).

**Summary**

Wax coating is usual practice in citrus industry for consumer preference and it also prevents shrinkage due to water loss. The appropriate temperature in cold storage is effective tool for keeping quality and storage life. In this study, we found that teva wax coating is effective to extend shelf life not only cold storage but also in room temperature storage. Moreover, storage temperature 5°C is effective to extend shelf life without chilling injury during 1 month. So, it is concluded that the combination of teva wax coating and storage temperature can be use for storage of mandarin orange for 1 month.

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**Literature cited**


