Agricultural Sci. J. 42 : 1 (Suppl.) : 345-348 (2011) ว. วิทย. กษ. 42 : 1 (พิเศษ) : 345-348 (2554)

Effects of Sodium Metabisulfite on Postharvest Quality and Storage Life of Vietnamese Longan cv. Long

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Abstract

Effects of sodium metabisulfite ($Na_2S_2O_5$) on postharvest quality and storage life of Vietnamese longan fruit cv. Long during storage period was studied by soaking fruits in 2.5 or 5 or 7.5% sodium metabisulfite solution. The fruits were dipped for 5 or 10 minutes in each solution at room temperature and then stored at 5±1ºC. The results showed that soaking for 10 minutes in 7.5% sodium metabisulfite solution could maintain L* and b* values and did not show browning on the fruit pericarp when compared to the other treatments and the control. Moreover, the quality of treated longan was not different from that of the fresh longan.

Keywords: longan, pericarp browning, fruit decay

Introduction

Longan fruit (*Dimocarpus longan* Lour.) is one of the most economically important fruits and it is considered a traditional fruit of Vietnam (Nguyen *et al*., 2001). In 2009, about 610,000 tons was produced (The Electric Newspaper of Communist Party of Vietnam, 2009). 'Nhan' is a local term for longan in Vietnam. The most popular cultivar in the North is 'Nhan Long' (cv.Long) which produces large fruit with small seed (80 to 100 fruits/kg) (FAO, 2004). It has not only high quality but also high economic value (Nguyen *et al*., 2001). The quantity of domestic and export longan fruit has been limited by its highly perishable nature, short storage life and susceptibility to postharvest diseases, as well as rapid pericarp browning during storage (Tongdee, 2001; Jiang *et al*., 2002). For many years in Vietnam, the recommended methods to control postharvest decay and prevent pericarp browning of 'Long' longan fruit has been using some treatments such as sulfur dioxide fumigation (Nguyen *et al*., 2001), dipping in benlate solution (Tran, 1999), chitosan coating and dipping in carbendazim solution (Nguyen *et al*., 2001). All of the results showed that 'Long' longan fruit shelf life was limited by visual appearance (the color changed to dark brown), there was a reduction of sensory values, the development of disease and fungus. Besides, all of the results also showed that 'Long' longan fruit can be prolonged the shelf life with good quality for 5 to 6 days at room temperature and 20 days at 10ºC . Generally, postharvest loss was about 10-20%. There is a need to have a suitable treatment for 'Long' longan fruit.

The main purpose of this study was to find out the best treatment to reduce postharvest decay, prevent pericarp browning, and maintain the quality of fresh 'Long' longan fruit during storage period at low temperature.

Material and methods

Longan fruits cv. Long in the harvesting crop of 2010 in a farmer orchard of Hung Yen province were used in this research. Longan fruits were harvested in the morning and then they were packaged in plastic baskets and transported to the laboratory within 2-3 hours. Uniform fruits were collected and treated by soaking in 2.5 or 5 or 7.5% sodium metabisulfite solution for 5 or 10 minutes at room temperature compared with non soaked fruit (control). The fruits were dewatered for 10 minutes and packaged in PP bags with 0.5 kilograms of fruits per bag. Longan bags were stored at 5±1ºC in a cold room and were sampled at 7-day intervals analysis. Pericarp color was measured by a colorimeter (Konica Minolta, Japan). Total soluble solids content was determined by a

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digital refractometer (PAL-1, Atago, Japan). Sensory properties were assessed by a board of taster. Fruit decay is recorded by the percentage of fruit decay. The statistical analysis was carried out using SPSS version 13 and Duncan's multiple range test to analyse significant differences among the treatments.

Experimental formulas in this study were E_0: control, E_1 and E_2: 2.5% Sodium Metabisulfite (SMB) for 5 or 10 minutes, E_3 and E_4: 5% SMB for 5 or 10 minutes, E_5 and E_6: 7.5% SMB for 5 or 10 minutes.

Results and discussion

Changes in visual appearance and storage life

The changes in visual appearance of 'Long' longan fruits during storage period are shown in the Table 1. The percentage of pericarp browning area, fruit decay and the quality of flesh expressed as flesh color caused of the limitation of fruit storage life at 5ºC in E_0 - E_5 treatments, except the fruits of E_6 treatment had the best storage quality and the longest storage life for 28 days.

Table 1 The changes in visual appearance of 'Long' longan fruit during the storage period at 5ºC

Treatment	Storage life(days)	Cause of storage life limitation
E_0	7	100% pericarp browning area, 7.5% fruit decay, flesh color was unacceptable
E_1	7	51 - 75% pericarp browning area, flesh color was unacceptable
E_2	14	51 - 75% pericarp browning area, 8.3% fruit decay, flesh color was unacceptable
E_3	14	51 - 75% pericarp browning area, 3.7% fruit decay, flesh color was still acceptable
E_4	21	26 - 50% pericarp browning area, 5.3% fruit decay, flesh color was acceptable
E_5	21	26 - 50% pericarp browning area, 12.7% fruit decay, flesh color was unacceptable
E_6	28	1 - 25% pericarp browning area, 0% fruit decay, flesh color was acceptable

Changes in L and b* values:*

The L* value (whiteness) of the pericarp of 'Long' longan fruit treated with various concentrations of sodium metabisulfite solutions compared with the control is shown in the Table 2. After 28 days in storage, the L* value ranged between 36.9 and 51.2. The fruits soaked in 7.5% SMB for 5 or 10 minutes had higher L* value than fruits in the other treatments and the control. This means that these treatments tended to inhibit browning on the pericarp of fruit better than other treatments because of high L* value means the color of longan pericarp is in white area ($p=0.05$). Overall, the L* value tended to increase from E_1 treatment to E_6 treatment compared to the control ($p=0.05$). This means that the chemical concentrations used in this experiment influenced the change of L* value. Therefore, the chemical used in this research could inhibit significantly browning reaction on the longan pericarp ($p=0.05$).

Table 2 The L* value of the pericarp of 'Long' longan fruit during the storage period at 5ºC[1]

Treatment	7 days	14 days	21 days	28 days
E_0	42.3 d	40.3 f	42.7 f	36.9 d
E_1	47.0 c	44.6 e	48.6 c	45.9 b
E_2	46.8 c	49.7 bc	46.4 de	43.6 c
E_3	46.7 c	47.4 d	45.3 e	47.4 b
E_4	50.7b	51.7 ab	47.8 cd	48.2 b
E_5	47.7 c	48.8 cd	50.7 b	50.9 a
E_6	54.4 a	52.5 a	52.8 a	51.2 a

[1]Means within a column with the same letter are not significantly different by Duncan's multiple range test (p=0.05)

The b* value (yellowness) of the pericarp of 'Long' longan fruit treated with various concentrations of sodium metabisulfit solutions compared with the control is shown in the Table 3. After 28 days in storage, the b* value ranged between 17.0 and 31.3. The fruits soaked in 7.5% SMB for 5 or 10 minutes had higher b* value than fruits in the other treatments. This also means that these treatments tended to inhibit browning on the pericarp of fruit better than other treatments because of high b* value means the color of longan pericarp is in yellow area (p=0.05). Overall, the b* value tended to increase from E_1 treatment to E_6 treatment compared to the control (p=0.05). This means that the chemical concentrations used in this experiment also affected the change of b* value. Hence, the chemical used in this experiment provided browning inhibition on the pericarp (p=0.05).

Table 3 The b* value of the pericarp of 'Long' longan fruit during the storage period at 5ºC[1]

Treatment	7 days	14 days	21 days	28 days
E_0	21.3 d	19.1 e	20.9 e	17.0 d
E_1	25.2 c	23.4 d	25.5 cd	22.5 bc
E_2	27.3 c	30.4 b	23.9 d	21.1 c
E_3	27.3 c	26.7 c	23.2 de	24.8 b
E_4	30.6 b	32.1 ab	28.0 c	28.6 a
E_5	25.5 c	30.9 b	31.1 b	30.0 a
E_6	33.5 a	34.8 a	32.2 b	31.3 a

[1]Means within a column with the same letter are not significantly different by Duncan's multiple range test (p=0.05)

Changes in total soluble solids content

The changes in total soluble solids content (TSS) of the fruits treated with various concentrations of sodium metabisulfite are shown in the Figure 1. After 28 days in storage at 5ºC, the TSS value ranged between 16.6 and 20.3 ºBrix and was not significantly different (p=0.05). These TSS contents were close to those of the fresh longan (17 and 21 ºBrix) and also were close to the report of Tran (1999) and Nguyen *et al*., (2001) (data not shown). It could be assumed that these concentrations of SMB used in this research had no effect on the change of total soluble solids content of 'Long' longan fruit.

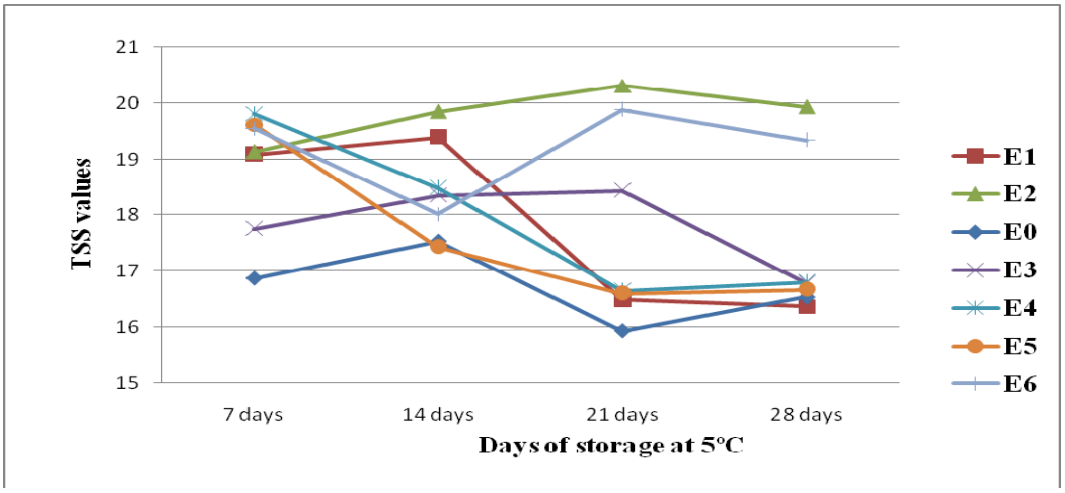

Figure 1 The changes in TSS of 'Long' longan fruits after storage at 5ºC.

Conclusions

The treatment of soaking 'Long' longan in 7.5% sodium metabisulfite solution for 10 minutes and storage at 5ºC could maintain L* and b* values, and the fruits did not show browning on the fruit pericarp throughout 28 days of storage when compared to the fruits in the other treatments and the control. Moreover, the flesh quality of longan expressed as flesh color and total soluble solids content did not show any difference when compared with the fresh longan.

Acknowledgement

This study was financially supported by the Agricultural Science and Technology Project (AST), Ministry of Agriculture and Rural Development, Vietnam.

References

FAO. 2004. Fruits of Vietnam. [Online]. Available source: http://www.fao.org/docrep/008/ad523e/ad523e00.htm#contents (March 17th, 2010).

Jiang, Y. M., Z. Zhang, D. C. Joyce, and S. Ketsa. 2002. Postharvest biology and handling of longan fruit (*Dimocarpus longan* Lour.). *Postharvest Biology and Technology*. 26: 241-252.

Nguyen, C. H., K. P. Hoang, H. H. Le, and K. D. Nguyen. 2001. Study for technology improvement in handling of longan and persimmon fruits. *Research Results of Vietnam Institute of Postharvest Technology*. 1: 186-200.

The Electric Newspaper of Communist Party of Vietnam. 2009. [Online]. Available source: http://www.cpv.org.vn (November 2nd, 2009).

Tongdee, S. C. 2001. Longan. pp. 335-345. *In*: S. K. Mitra (ed.). *Postharvest Physiology and Storage of Tropical and Subtropical Fruit*. CAB International, UK.

Tran, T. T. 1999. Technique on Care and Cultivation of Longan Tree. pp. 87-92. Agricultural Publishing House, Vietnam.