Prominent Pigment in Ripe Balsam Pear (*Momordica charantia* L.): ß-carotene in Fruit Pulp and Lycopene in Seed Aril

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**Abstract**

Normally, immature fruit of balsam pear is consumed as a vegetable. In this stage, pigments in pulp do not fully develop. Thus, in this research, pigment composition in ripe balsam pear was investigated. After harvest, mature-green balsam pear fruits were fully ripened on day 6 under ambient room condition (30-35°C; 62% RH). Pulp color changed from green to yellow while the lightness value (L*) slightly increased. The de-greening (*a*) value sharply rose whereas yellowing (*b*) value remarkably increased. Ripe balsam pear pulp contained high carotenoid content (1.7 mg/g FW) including 0.072 mg/g FW ß-carotene. Interestingly during fruit ripening, the color of seed aril changed from ivory to red. The main pigment in seed aril was lycopene. It was able to conclude that ripe balsam pear comprised richer nutrition value than those of immature fruit.

**Keywords:** chlorophyll, carotenoid, ß-carotene, lycopene

**Introduction**

Balsam pear or bitter guard (*Momordica charantia* L.), belonging to Cucurbitaceae family, is a native plant grown widely in Asia (Yamauchi, 1983). Most of plant parts such as tender leafy shoot, immature fruits are consumed as vegetable salad (Walters and Decker-Walters, 1988). Harvested balsam pear fruit, at mature green stage, exhibited climacteric pattern of respiration during ripening (Kays and Hayes, 1978) and carotenoids content in fruit pulp sharply increased when the fruit changing from green to yellow. It is well known that the ripe fruit pulp of balsam pear contains rich source of ß-carotene and lycopene (Rodriguez et al., 1976). Besides, the seed aril changed from white to bright red during fruit ripening (Morton, 1967). Since the red aril of balsam pear seed contained a high amount of lycopene (Bodhipadma et al., 2011), the aim of this study, thus, was to examine the inter-relationship between carotenoid and lycopene content in the fruit pulp and seed aril during fruit ripening of balsam pear.
Materials and Methods*

Mature green balsam pears were purchased from the local market in Bangkok, Thailand. The uniform fruits were soaked in 10 ppm Benlet solution. Three groups of fruit were placed in plastic baskets and stored at ambient room temperature (30-35°C). During storage, fruits were randomly sampling for determination of pigments and their enzyme. The peel color was measured using a Hunter Lab meter. The flesh firmness was measured by Effegi penetrometer. Chlorophyll content in fruit pulp was determined using the spectrophotometric method (Witham et al., 1971). Carotenoid content in fruit pulp was extracted and saponified with petroleum ether similar to the method of Georges and Olivier (1993). ß-carotene content was determined according to the methods of Davies (1976) and Ritter (1981). For lycopene contents in seed aril, the saponified solution was applied into the packed alumina column before determining by spectrophotometric method (Goodrich et al., 1993; Gross, 1991). Chlorophyllase activity was extracted and assayed similar to the method of Shimokawa et al. (1978).

Results and Discussions**

The mature-green balsam pear fruits were fully ripe on day 6 during storage at ambient temperatures (30-35°C). Balsam pear fruits loss their weight sharply and reached 5% without shriveling symptom after harvest for 2 days (Figure 1). Generally, fresh products show their wilting or shriveling symptoms at that point. Additionally, the pulp firmness gradually decreased along with the rising percentage of weight loss (Figure 1). For color changes, after harvest, the lightness value (L*) of fruit peel was 47.9 and slightly increased to 63.9 at fully ripe stage (Figure 2). The peel color stayed green until day 5 as a* value (- green or + red) then changed from -8.8 to -5.4 before sharply increased to 20.2. This indicated that more red color developed when fruit was fully ripening. The b* value (- blue or + yellow) steadily increased from 28.7 to 33.0 at day 4 and remarkably increased to 53.9 at day 6. This that more yellow color developed which made fruit peel shiny yellow-red color. It was also interesting that when fruit fully ripe, the seed aril color changed from white to brilliant red. As far as the pigment content in mature-green fruits was concerned, chlorophyll contents in pulp (Huang and Hsieh, 2016) sharply reduced from 0.2 mg/g FW to 0.027 mg/g FW at day 6 (Figure 3) while the chlorophyllase activity of fruit pulp increased from 0.004 to 0.010 unit/min/µg protein during fruit ripening period (Figure 3). Carotenoid contents in pulp dramatically increased from 0.316 to 1.7 mg/g FW during fruit ripening (Figure 4). At this stage, the fruit pulp color was yellowish orange. Likewise, ß-carotene contents in pulp of balsam pear slightly increased from 0.008 to 0.072 mg/g FW during fruit ripening (Figure 4). When balsam pear fruit was fully ripe, the color of seed aril changed from white to brilliant red. This occurred because of lycopene, the carotenoids responsible for red color of balsam pear seed aril.

Conclusion

In our experiment, the major pigment of the mature-green balsam pear fruit was chlorophyll. The fruit color became orange (mixed yellow-red color) from the result of carotenoid synthesis during fruit ripening. the result also supported this knowledge since the lycopene contents in seed aril (Bodhipadma et al., 2011) after harvest was 0.047 mg/gFW and increased to 0.202 mg/gFW at day 6 (Figure 4).
Literature cited**


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**Figure 1** Weight loss and firmness of balsam pear fruit after harvest.
Figure 2 Color value of balsam pear fruit after harvest.

Figure 3 Chlorophyll and chlorophyllase activity of balsam pear fruit after harvest.

Figure 4 Carotenoids, lycopene and β-carotene of balsam pear fruit after harvest.