Original Research Article

Effect of transport packages on quality and consumer perceptions of Angelica (*Angelica sinensis* Oliv.) for handling to destination

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ABSTRACT

Angelica (*Angelica sinensis* Oliv.) is a Chinese herb which is currently planted in the North and the East of Thailand and has high potential both in domestic and Asian market. Generally, root of Angelica is used widely as raw material in pharmaceutical and nutritious food. The Angelica from the farm at Doi Pakcham in Chiangmai province which was harvested at 150 days after planting and packed by plastic crates to packing house. Then they were stored in three transport packages which were (1) foam boxes with ice (2) foam boxes and (3) corrugated boxes with holes for 10 kg transported to the Thailand Institute of Scientific and Technological Research laboratory and stored at 5°C with 90-95% relative humidity in order to investigate types of transport packages which affected the physical properties and quality of Angelica for longer shelf-life. The results showed that the foam boxes was suitable for containing Angelica, having weight loss lower than those of the foam boxes with ice and corrugated boxes with holes respectively. In addition, the determinations of sensory characteristics of Angelica were actuated by 10 panelists who evaluated every 1, 3, 5 and 7 days with respect to overall acceptability (freshness, color and entirety) using by 9-point hedonic scale. The result show Angelica in foam box and foam box with ice were fresh while Angelica in corrugated box was rather dried. There was the vapor from ice, the germination root of Angelica and mold when packed in foam box with ice to maintain after 7- day storage. In addition, the Angelica packed in corrugated box was shrived according to water and gas permeability around the box to maintain after 5-day storage. However, the Angelica contained in foam boxes received the best acceptable score up to 10-day storage, followed by the foam boxes with ice and corrugated boxes with holes.

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INTRODUCTION

Angelica (*Angelica sinensis* Oliv.) is a Chinese herb which is currently planted in the North and the East of Thailand and has high potential both in domestic and Asian market. Generally, root of Angelica is used widely as raw material in pharmaceutical and nutritious food as it is effective in stimulating and maintains blood flow, absorbing cholesterol and reducing swelling in women and the elderly consumers. As fresh produce, Angelica was not acceptable to trader and consumer when packed in improper packaging and kept in unsuitable storage conditions (Fredderick, 1991). Different types of packages and duration of storage could be detrimental to physical property changes of Angelica. There are many researchers studied the effect of packaging on the qualities of fresh produces, such as : the effects of packaging films on shelf life of fresh celery and the effect of three renewable bioplastics and biodegradable material on quality and shelf life of celery due to difference in film permeability (Rizzo, 2009; Chike *et al.*, 2009) Nevertheless, the temperature during storage and transportation are the important factors which affected the physical properties and quality of the produces (Nitiya, 2005). The temperature was the important factor which affected the physical properties and quality of the produces for shorter shelf-life for distribution when it was distributed at high temperature (Nitiya, 2005). However, it was suggested that vegetable should be stored at its optimum storage temperature to avoid chilling injury (Den, 1999). Therefore, the objective of this research was to investigate difference types of transport packages which affected the physical properties and quality of Angelica in order to determine weight loss and the sensory characteristics for longer shelf-life of Angelica.

MATERIALS AND METHODS

The Angelica from the Doi Pakcham farm in Chiangmai province harvested at 150 days after planting was packed in a plastic basket and transported to packing house. Then all of Angelica was cleaned by the water and dried (as shows in Figure 1). They were transported by truck to the Thailand Institute of Scientific and Technological Research laboratory. The Angelica were packed in 3 various transport packages (Figure 2) as follows: 1) a foam box, outer size 272×460×250 mm. , 2) a foam box with ice, outer size 272×460×250 mm. and 3) a corrugated box (Specification: KA230/3CA125/KA170) with 4% holes, outer size 300×495×105 mm.

All samples were stored at 5°C with 90-95% relative humidity and then determined their physical properties during 0, 1, 3, 5 and 7 days as follows:

(1) Weight loss was performed by weighing preliminary weight and every 3 days during storage to evaluate % weight loss

$$\% \text{ weight loss} = \frac{(\text{initial weight} - \text{current weight})}{\text{initial weight}} \times 100$$

(2) Sensory characteristics were actuated by 10 panelists who were laboratory panels in packaging, post-harvest and food technology and evaluated with respect to freshness, color, entirety and overall acceptability by 9-point hedonic scale and Analysis of Variance (ANOVA) was performed using SPSS V.11.0 for window software. The results determine statistically significant difference at 95% confidence level between treatments.

Packed in plastic basket from farm

Rinsed with water

Dried and grading

Figure 1 Cleaning and grading of Angelica

(A) a foam box   **(B) a foam box with ice**   **(C) a corrugated box**
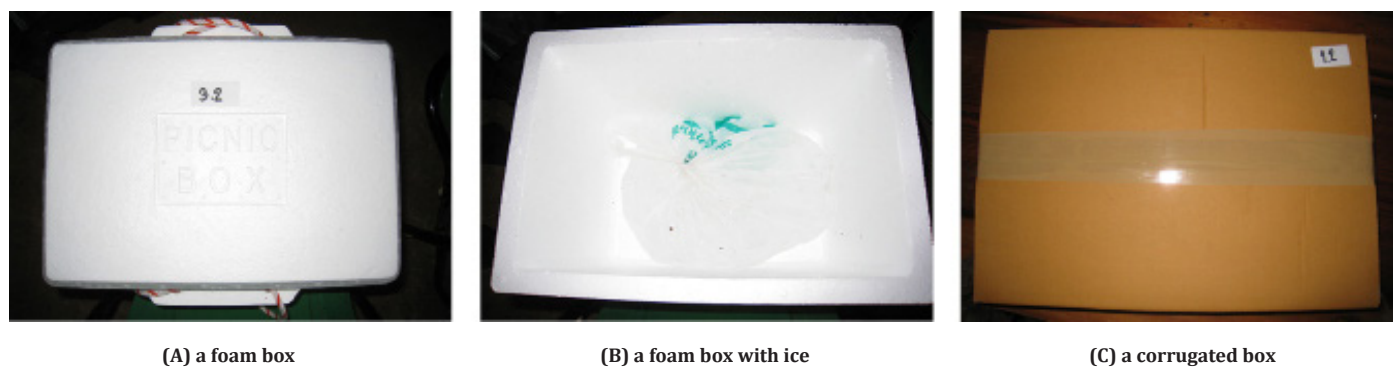
Figure 2 Three types of transport packages used in this study

RESULTS

The Angelica was packed in various transport packages which were able to maintain the quality of the produce as shown in Figure 3-5. The results of the quality of the produce as follow:

Weight loss

The percentage of weight loss increased in all types of packages, during storage at 5°C with 90-95% relative humidity. It was found that the fresh Angelica packed in the foam box for 3 days was the

Figure 3 Angelica was packed in foam box

Figure 4 Angelica was packed in foam box with ice

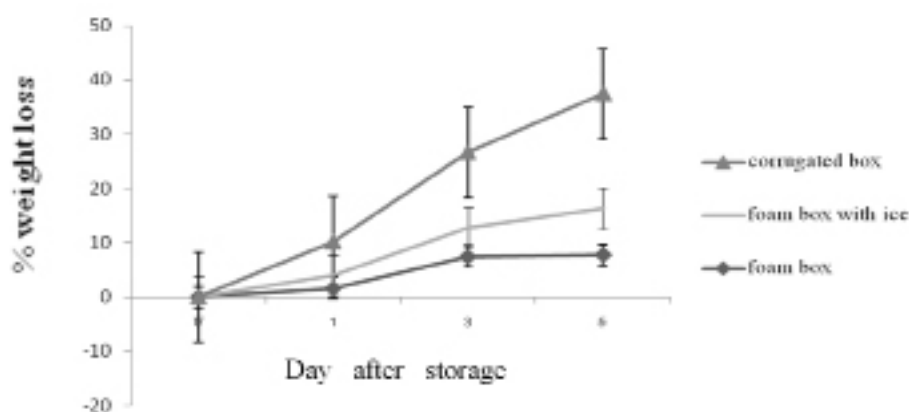**Figure 5** Angelica was packed in corrugated box

Figure 6 The changes of weight loss (%) of fresh Angelica packed in various transport packages and stored at 5°C with 90-95% relative humidity

most suitable for containing to retard weight loss of Angelica, having the least 5.20% weight loss compared to 7.47% and 13.91% of the foam box with ice and corrugated box respectively with statistically significant difference at 95% confidence level (Figure 6).

The consumer perception

Determinations of sensory characteristics of Angelica packed in various transport packages are shown in Figure 7.

Freshness:

The Angelica in foam box received acceptable highest scores of freshness (5.75) with statistically significant difference to foam box with ice (5.33) and corrugated box with hole (4.91). The panelists recommended the freshness of Angelica in foam box and foam box with ice were fresh while Angelica in corrugated box was rather dried.

Color:

The Angelica in foam box received the best acceptable scores (5.66)

of color without statistically significant difference, when compared to both foam box with ice (5.33) and corrugated box with hole (5.0). The panelists recommended the color of a few Angelica leaves in foam box with ice had brown rot.

Entirety:

The experimental results on entirety evaluation showed that the Angelica in foam box received the best acceptable score (5.58), followed by foam box with ice (5.16) and, corrugated box (4.58), respectively. It was found that the Angelica in foam box received acceptable scores without statistically significant difference to all types of packages.

Overall acceptability:

The Angelica in foam box received the best acceptable score (5.5), followed by foam box with ice (4.83) and, corrugated box (4.3) respectively. However, it was found that the acceptable scores of overall acceptability in all containers showed without statistically significant difference respectively.
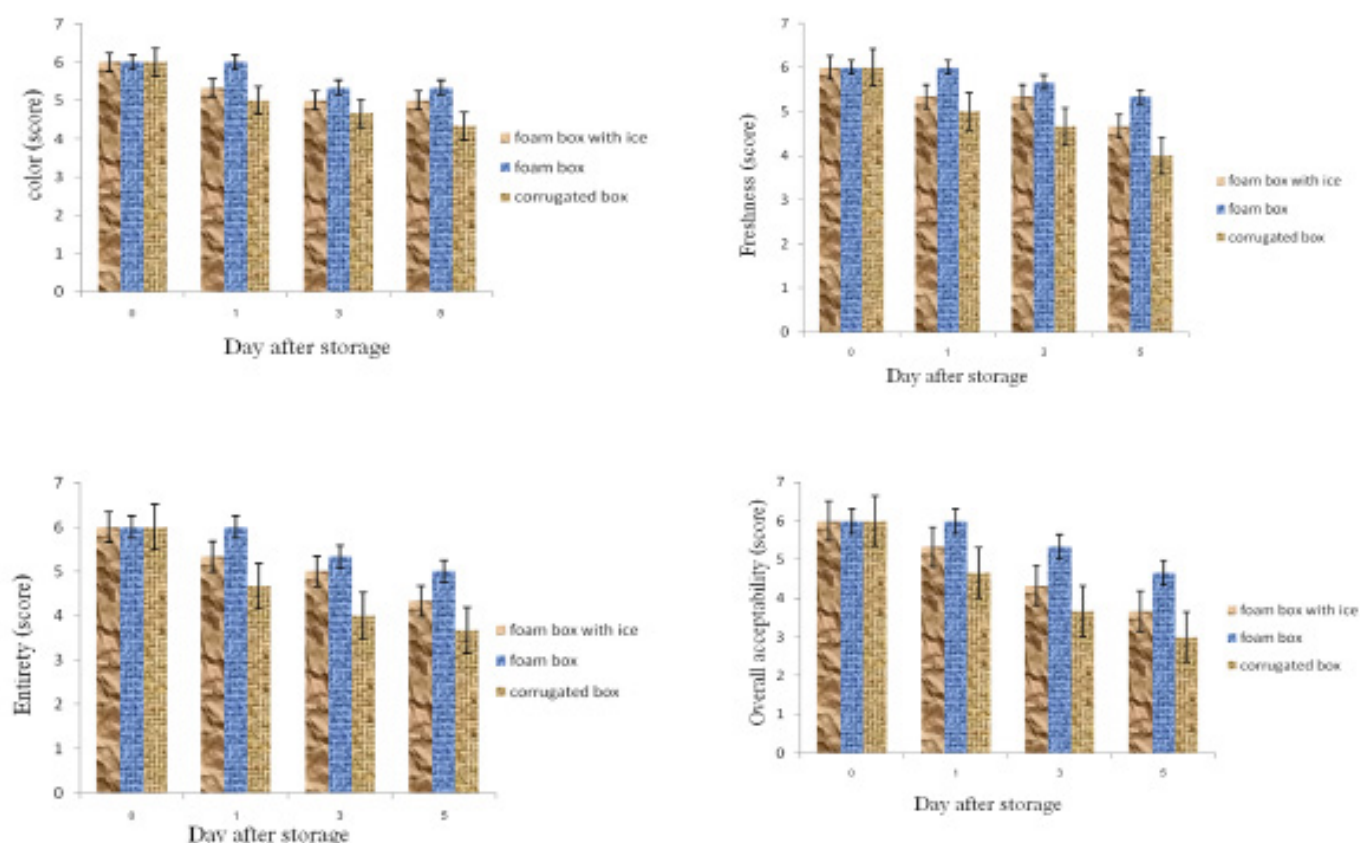
Figure 7 Sensory evaluations on color, freshness, entirety and overall acceptability of fresh Angelica packed in various transport packages and stored at 5%C with 90-95% relative humidity

DISCUSSION

This result was consistent to retard weight loss, having the least to maintain the fresh produce quality in the package films for long shelf-life compared to without package film (Jingtae, 2003). The experimental results sensory characteristics of Angelica in transport packages showed that the longest shelf-life of storage of Angelica packed in foam box at 5°C was at 10-day storage which was evaluated acceptability scores less than 5 points and 7.47% weight loss. While it was found that there was the vapor and moisture from ice in foam box after 7-day storage, the germination root of Angelica and mold were occurred. In addition, the Angelica packed in corrugated box which could protect water and gas permeability less than foam box, were withered after 5-day storage at the same conditions. However, the experimental results on sensory evaluation showed that the Angelica contained in the foam box received the best acceptable scores followed by the foam box with ice and the corrugated box with hole respectively and without statistically significant difference at 0.05 confidence level.

CONCLUSION

The foam box was suitable for transportation of fresh Angelica by delay of weight loss and maintains fresh quality up to 10 days storage. The experiment results of this study could be used as the guidance for the cultivators and manufacturers for the selection of suitable container for product distribution.

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