

ผลของสารดูดซับเอทิลีนต่อคุณภาพและการประเมินอายุการวางจำหน่ายผักชี
Effect of Ethylene Absorber on the Quality and Shelf-Life Assessment in Coriander during Storage

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บทคัดย่อ

ผักชีมีอายุการวางจำหน่ายสั้น การเสื่อมสภาพของผักชีเกิดจากการทำงานของเอทิลีน ดังนั้นงานวิจัยนี้จึงศึกษาผลของสารดูดซับเอทิลีนต่อคุณภาพและการประเมินอายุการวางจำหน่ายผักชี โดยนำผักชีที่ติดรากที่มีความยาวจากปลายรากถึงปลายยอดประมาณ 30 เซนติเมตร มาล้างทำความสะอาด คัดเลือกส่วนที่มีตำหนิออก จากนั้นบรรจุผักชี 50 กรัม ในถุงพลาสติกพอลิเอทิลีน ขนาด 15×38 เซนติเมตร ซึ่งแต่ละถุงบรรจุสารดูดซับเอทิลีนที่มีปริมาณแตกต่างกัน 3 ระดับ ได้แก่ ร้อยละ 0 (ชุดควบคุม), 1.5 และ 3 ของน้ำหนักผักชี ปิดปากถุงด้วยสก็อตซ์เทป จากนั้นนำผักชีมาเก็บรักษาที่อุณหภูมิ 5 องศาเซลเซียส ความชื้นสัมพัทธ์ร้อยละ 85 สุ่มตรวจคุณภาพทุกๆ 2 วัน จนถึงสิ้นสุดอายุการวางจำหน่าย จากผลการทดลองพบว่า การใช้สารดูดซับเอทิลีนในปริมาณร้อยละ 0, 1.5 และ 3 ของน้ำหนักผักชี มีอายุการวางจำหน่ายนาน 10, 14 และ 16 วัน ตามลำดับ และพบว่า การใช้สารดูดซับเอทิลีนในปริมาณร้อยละ 3 ของน้ำหนักผักชี เป็นสภาวะการเก็บรักษาที่ดีที่สุด โดยมีความเข้มข้นของเอทิลีน การสูญเสียน้ำหนัก ปริมาณใบเหลือง และการสูญเสียคลอโรฟิลล์น้อยที่สุด เมื่อเปรียบเทียบกับชุดทดลองอื่น

คำสำคัญ: ผักชี, สารดูดซับเอทิลีน, การเก็บรักษา

Abstract

Coriander is a highly perishable leafy vegetable with a short shelf life. Ethylene has been shown to play an important role in senescence of coriander during storage. In this research, shelf-life assessment and quality changes of coriander during storage with different amounts of ethylene absorber were investigated. Fresh coriander with roots (approximately 30 cm in length) was washed with tap water. Soil was removed from the roots and unwanted parts were trimmed. It was then packed in a 15 cm × 38 cm polyethylene bag, approximately 50 g/bag. There were 3 treatments in this experiment according to the amount of ethylene absorber (EA) as 0% (control), 1.5% and 3% of the coriander weight, respectively. The bag were sealed and stored at 5°C, 85% RH. The qualities of coriander were investigated at 2-day intervals until the end of storage. It was found that the shelf life of coriander exposed to 0%, 1.5% and 3% EA were 10, 14 and 16 days, respectively. Storage with 3% EA is the best condition for shelf-life extension, as indicated by the lowest ethylene concentration in package, weight loss, yellowing and chlorophyll loss.

Keywords: coriander, ethylene absorber, storage

Introduction

Coriander (*Coriandrum sativum* L.) is widely featured in the cuisines of China, Mexico, South America, India and Southeast Asia (Loaiza and Cantwell, 1997). During 2011-2013, Thailand exported coriander worth 1.91 thousand million baht (Thai National AGRIS Center, 2013). The characteristics of fresh coriander need to have green leaves, good appearance and no yellow leaves. The defects of coriander during storage are mainly yellow leaves, decay leaves and weight loss (Jiang *et al.*, 2002; Kim *et al.*, 2007). Ethylene has been shown to play an important role in senescence of detached leaves. Rapid decline in coriander leaf quality due to postharvest senescence from ethylene often causes serious commercial losses.

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Ethylene is a plant hormone which is produced by fruits and vegetables during senescence and it is also found in an environment (Brody *et al.*, 2001). Its excessive exposure can radically reduce the shelf life of the produce, in some cases inducing undesirable reactions such as loss of chlorophyll. Chlorophyll degradation during storage is a major defect for most leafy green vegetables which indicates the loss of fresh quality as well as the consumer acceptability. Therefore, ethylene inhibition or its removal should be used to maintain postharvest quality (Aday and Caner, 2011). Some of the chemical agents that can be used to absorb ethylene such as KMnO_4 or block ethylene binding to its receptor have been reported (Sisler *et al.*, 1999).

The objectives of this study was to monitor the coriander quality and evaluate the shelf life using sensory score (Likert scale between 1-5) during storage under different concentrations of ethylene absorber at 5°C.

Materials and Methods

Fresh coriander with roots (approximately 30 cm in length) packed with ice in a foam box was obtained from Ratchaburi province, Thailand. It was transported at 7°C from the factory to the Agro-Industry Faculty within 12 hours. Coriander was washed with tap water. Soil was removed from the roots and unwanted parts were trimmed. It was then packed in a 15 × 38 cm polyethylene bag approximately 50 g/bag. There were 3 treatments in this experiment according to the amount of ethylene absorber (KMnO_4 , Bio Safer Co., Ltd.) as 0% (control), 1.5% and 3% of the coriander weight, respectively. Then, it was sealed and stored at 5°C, 85% RH. The sensory, physical and chemical qualities of coriander were evaluated at 2-day intervals until the end of storage. The end of shelf life of coriander was judged mainly by the sensory score (Likert scale 1-5) from 1=very poor quality to 5=very good quality. The end of storage was reached as the score fell below 3.

Statistical analysis

The experimental design was completely randomized design (CRD) with 3 replications. Data was subjected to analysis of variance (ANOVA). Comparison of means was carried out by Duncan's multiple range test (DMRT), with a level of significance of 0.05. Difference at $p < 0.05$ was considered significant. Analysis was performed using the Statistical Package for Social Science (SPSS for windows, SPSS Inc., Chicago, IL, USA).

Results and Discussion

In general, consumer acceptability is considered by appearance of coriander. The characteristics of fresh coriander need to have green leaves and no yellow leaves. Therefore, the shelf-life assessment of coriander was mainly monitored and judged by using sensory evaluation. As can be seen in Table 1, storage time and amount of ethylene absorber (EA) had a significant effect on sensory score ($p < 0.05$). Sensory score on color of fresh coriander was 5.00. It decreased with storage time ($p < 0.05$). Decrease of sensory score in coriander stored under 3% EA was lower than the coriander package that contained 1.5% and 0% EA, respectively ($p < 0.05$). The end of shelf life of coriander in the package that contained 3% EA was 16 days. Sensory score of coriander that was stored with 3% EA was less than 3 on day 18. This result correlates well with the percentage of yellow leaves (25% of yellow leaves) (Figure 1). The shelf life of coriander that was stored under 0% and 1.5% EA were 10 and 14 days, respectively.

Ethylene concentration in the coriander package during storage with different amounts of EA at 5°C was monitored (Figure 2A). Storage time and amount of EA had a significant effect on ethylene concentration inside the package and weight loss ($p < 0.05$). Ethylene concentrations in the coriander packages that contained 3% EA were lower than 1.5% and 0% EA, respectively ($p < 0.05$). This result correlates well with weight loss and chlorophyll loss. The rate of biological reaction depends on the ethylene concentration inside the package. High ethylene concentration can accelerate respiration and transpiration rates. Therefore high weight loss and chlorophyll loss were detected. The result of weight loss in coriander during storage with different amounts of

ethylene absorber at 5°C is shown in Figure 2B. The highest weight loss (9.96%) was found in the coriander package stored with 0% EA.

The chlorophyll a, chlorophyll b and total chlorophyll contents in coriander during storage with different amounts of EA at 5°C are shown in Figures 3A-C. It was found that storage time and amount of EA had a significant ($p < 0.05$) effect on chlorophyll content. Chlorophyll content of coriander in the package that contained 3% EA was significantly ($p < 0.05$) higher than that with 1.5% and 0%, respectively. Chlorophyll degradation during storage is a major problem of fresh quality loss as well as consumer acceptability for most leafy green vegetables. The data on chlorophyll content is correlated well with color evaluation. The L^* and b^* values of coriander during storage with different amounts of EA at 5°C are shown in Figures 4A and 4B. It was found that storage time and amount of EA had a significant ($p < 0.05$) effect on L^* and b^* values. The L^* and b^* values of coriander in the package that contained 3% EA was higher ($p < 0.05$) than that with 1.5% and 0% EA, respectively. High L^* and b^* values indicate lighter and more yellowish leaf color in coriander.

Table 1 Sensory evaluation score on color of coriander during storage with different amounts of ethylene absorber at 5°C

Storage (days)	Sensory evaluation score on color (Scale 1-5)		
	Ethylene absorber concentration		
	0%	1.5%	3%
0	5.00±0.00 ^{a, NS}	5.00±0.00 ^{a, NS}	5.00±0.00 ^{a, NS}
2	4.90±0.32 ^{a, B}	5.00±0.00 ^{a, A}	5.00±0.00 ^{a, A}
4	4.40±0.52 ^{b, B}	4.80±0.42 ^{a, A}	4.90±0.32 ^{a, A}
6	4.10±0.57 ^{b, C}	4.50±0.53 ^{ab, B}	4.70±0.48 ^{ab, A}
8	3.50±0.53 ^{c, C}	4.10±0.32 ^{b, B}	4.30±0.48 ^{b, A}
10	3.00±0.00 ^{c, C}	3.50±0.52 ^{c, B}	3.70±0.48 ^{c, A}
12	2.60±0.52 ^{d, C}	3.30±0.48 ^{d, B}	3.50±0.53 ^{d, A}
14		3.00±0.00 ^{e, B}	3.30±0.48 ^{e, A}
16		2.70±0.48 ^{f, B}	3.00±0.00 ^{f, A}
18			2.70±0.48 ^g

Note: - Means with different lower-case letters in the same column are significantly different ($p < 0.05$).

- Means with different capital letters in the same row are significantly different ($p < 0.05$).

- NS is non-significantly different ($p \geq 0.05$).

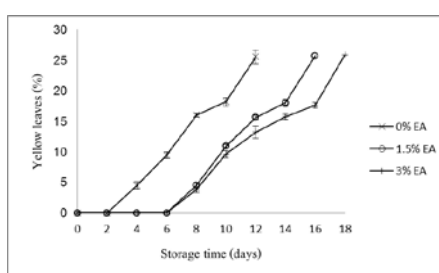


Figure 1 Percentage of yellow leaves of coriander during storage with different amounts of ethylene absorber (EA) at 5°C

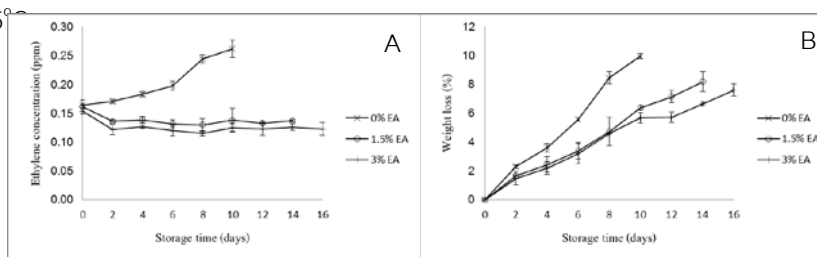


Figure 2 Ethylene concentration (A) and weight loss (B) in coriander during storage with different amounts of ethylene absorber (EA) at 5°C

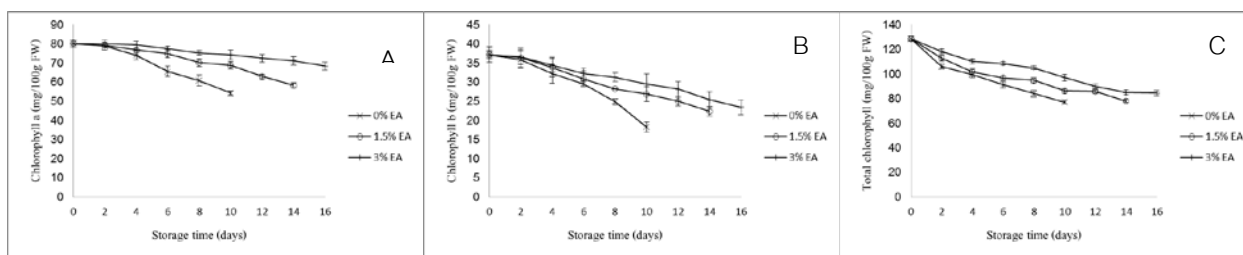


Figure 3 Chlorophyll a (A), chlorophyll b (B) and total chlorophyll (C) of coriander during storage with different amounts of ethylene absorber (EA) at 5°C

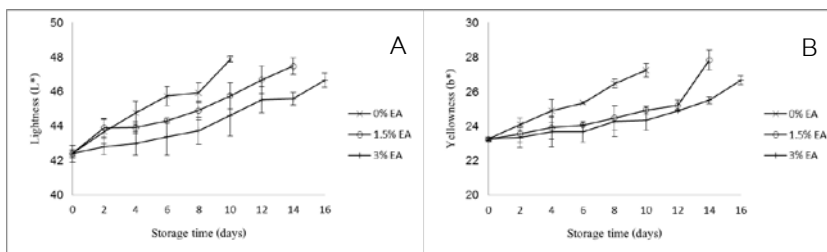


Figure 4 Lightness (A) and yellowness (B) of coriander during storage with different amounts of ethylene absorber (EA) at 5°C

Summary

Ethylene absorber can be used to extend the shelf life of coriander. The best conditions to extend the shelf life of coriander were packaging in a polyethylene bag with 3% ethylene absorber and storage at 5°C RH 85%. The shelf life was 16 days. Under these conditions, the lowest ethylene concentration, weight loss, yellowing and chlorophyll loss were detected.

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