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Full Length Research Paper

Quality characteristics of fresh-cut 'Hami' melon treated with 1-methylcyclopropene

Qin Guo[1], Linlin Cheng[1], Jide Wang[1], Fenbin Che[2], Pin Zhang [2] and Bin Wu[1,2]*

[1]Key Laboratory of Oil and Gas Fine Chemicals of the Ministry of Education, College of Chemistry and Chemical Engineering, Xinjiang University, Urumqi 830046, China.
[2]Farm Product Storage and Freshening Institute, Xinjiang Academy of Agricultural Sciences, Urumqi 830091, China.

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To further understand the response of 'Hami' melon to 1- methylcyclopropene (1-MCP) and search for additional more reliable parameters to determine edible quality, fresh-cut 'Hami' melons were treated with 0, 1.0 µL/L 1-MCP, 1.0 µL/L 1-MCP + 10 µL/L ethylene and 10 µL/L ethylene, then stored at 4°C and relative humidity 90 to 95% for 10 days. Ethylene production and respiratory rate were evaluated. Effects of 1-MCP on firmness, electrolyte leakage rate, appearance, the soluble solids content, decay rate and vitamin C were measured in order to help elucidate their potential roles during melon storage. In addition, the role of microbial counts during storage in response to 1-MCP was analysed. It was observed that in fresh-cut 'Hami' melon treated with 1-MCP, ethylene production was reduced, but no change in respiration rate was recorded. 1-MCP treatment significantly influenced the decrease of appearance and increase of decay, maintained high content of vitamin C and the soluble solids content. It also had high effect on reducing ethylene-induced on firmness, electrolyte leakage rate and translucency. Microbial counts of 1-MCP treated fresh-cut 'Hami' melon were still in low level after storage at 4°C.

Key words: 1-MCP, fresh-cut, melon, quality.

INTRODUCTION

The 'Hami' melon (*Cucumis melo* L. var. inodorus Jacq.) is climacteric fruit and the main factors affecting their eating quality are texture, sweetness and microbial population. 'Hami' melon is famous for its delicious flavor and crispy flesh texture, which is becoming one of the most important fruits in Xinjiang (Cong et al., 2007). However, losses are high due to high respiration rate and a rapid ripening process during storage. Thus, fresh-cut processing may be a strategy to reduce losses in quantity and quality during storage of perishable whole fruits. On the other hand, fresh-cut 'Hami' melon has great potential in Chinese fresh-cut market, direct supply to supermarkets and the provision of pre-cut and 'green' melons represent growing markets for potential exploitation. Currently, an array of chemical treatments (Luna Guzman et al., 1999) is used to preserve fresh produce. However, there is risk of generating potentially harmful by products and residues. 1-Methylcyclopropene (1-MCP) is an inhibitor of ethylene action (Sisler et al., 2009; Seglie et al., 2008; Saftner et al., 2007; Mathooko et al., 2001).Ethylene has an undesirable effect on the quality of fresh-cut fruit, while 1-MCP as an ethylene antagonist has a great value on inhibiting ethylene, especially on climacteric fruits (Blankenship and Dole, 2003). Ripening and senescence of intact have been delayed by 1-MCP (Ergun et al., 2005, 2007; Nilsson, 2005; Golding et al., 1998; Aguayo et al., 2006; Pelayo et al., 2003). So it has potential commercial value to slow the changes associated with loss of quality and to extend the shelf-life of fresh-cut fruits. Exposure of fresh-cut apples to 1-MCP could decrease ethylene production, respiration, softening and color change (Rocculi et al., 2009). It had been reported that 1-MCP also exhibited great potential on inhibiting the action of

*Corresponding author. E-mail: xjuwubin0320@sina.com. Tel: +0860991-8582807. Fax: +860991-8582807.

ethylene-induced from exogenously ethylene, although the concentrations of exogenous ethylene reached as low as 1 µL/L (Ergun et al., 2007). In watermelon, 1-MCP has recently been shown to maintain the firmness of whole fruit stored in the presence or absence of added ethylene (Mao et al., 2004; Saftner et al., 2007), The response of watermelons to ethylene is not associated with fruit maturation or normal ripening, but rather to a postharvest disorder in which phospholipid degradation and membrane deterioration are involved (Karakurt and Huber, 2004; Mao et al., 2004).

Processing of fresh-cut fruits involves wounding stress as a result of mechanical injury when cutting, leading to an increase in the respiration rates of fresh-cut commodities in comparison to those of the corresponding whole fruits. Minimal processing damages the tissue integrity, leading to several biochemical deteriorations such as browning, off-flavors and texture breakdown. The objective of this study was to use 1-MCP to prolong the shelf-life and improve the quality of fresh-cut 'Hami' melon during storage. Consequently, we investigated the influence of 1-MCP, ethylene and 1-MCP + ethylene, applied to fresh-cut 'Hami' melon upon respiration and quality attributes, to evaluate the effects of 1-MCP and exogenous ethylene on ripening and senescence. Moreover, food safety has become of growing concern for the public, hence in this study, microbial counts for fresh-cut 'Hami' melon were also determined.

MATERIALS AND METHODS

Plant materials and treatment

'Hami' melons were purchased at physiologically mature stage from a local commercial orchard in Shanshan, Xinjiang Province, China. Then melons were quickly transported to laboratory on the day of harvest and sorted. The melons were selected for uniform size, maturity and appearance and freedom from defects. To prepare fresh-cut pieces, the surfaces of 'Hami' melons were sanitized by 50 mg/L chlorine dioxide, then each melon was removed with a sterile knife, and the melon longitudinally cut into 2.5 cm thick slices. The two outermost slices were peeled and cut using a commercial bread slicer into cubes with approximate dimensions of 2.5 cm and weighing 15 to 16 g. Eight cubes were derived from each fruit. The cubes were placed in single layers in 3.6 L vented plastic containers (50 pieces per container) with molded grids on the lower surface to facilitate uniform air circulation. Relative humidity in the containers was in the range of 90 to 95%.

1-MCP and ethylene treatment

The experiments were carried out at 4°C and RH 90 to 95%. The fresh-cut 'Hami' melon samples were kept in two sealed plastic containers (3.6 L). 1-MCP was injected into the containers by controlling the released velocity with injector to attain concentrations of 1-MCP at 1.0 µL/L. After 24 h exposure to 1-MCP, one of samples was immediately fumigated with 10 µL/L ethylene gas for 10 min (1-MCP + ethylene). While ethylene treatment melons were fumigated with 10 µL/L ethylene gas for 10 min. Untreated melons were used as control. All treatments were replicated three times with eight cubes as an experimental unit for each parameter evaluation. Parameter was measured immediately after treatment and at 2 days intervals thereafter.

Ethylene production and respiration rate

Ethylene production was measured every 2 days with a gas chromatograph (GB14-B, JAPAN) equipped with an activated alumina SS column (80/100, 1.83 m long, 3.2 mm wide) and flame ionization detector. The flow velocity of carrier gas (nitrogen) was 0.5 ml/s. Detector, oven (column) and injector were operated at 150, 70 and 120°C, respectively. Eight pieces of tissue were placed in 1.5 L sealed plastic chambers filled with gas sampling ports. 1 ml gas sample was extracted from the headspace for ethylene determination. The respiration rate, measured as evolved CO_2, was analyzed by an infrared CO_2 analyzer (model ZGSB1SCY-2A, Beijing P.R. China) and the results were expressed as ng Kg^{-1} s^{-1}.

Firmness

The firmness was measured using the single column materials testing system (Instron5542, Instron Corporation, Hampshire, USA) interfaced to a personal computer with Nexygen® software. Magness-Taylor probe, with a 500 N load cell on, punctured the fruit at a speed of 300 mm/min to 23 mm depth. For each treatment, each cube used to determine the firmness was measured on three different spots, every sample was measured in triplicate. Data were reported as the maximum force (N).

Electrolyte leakage and translucency

Cylinders of 'Hami' melon were excised with a 10 mm diameter stainless steel cork borer. Two pieces of 4 mm thickness were cut from each cylinder. Ten pieces of tissue were put into 50 ml of distilled water and shaken at 100 cycles per min for 30 min. Electrolyte leakage was measured using a Conductance Bridge (Orion 145A, Thermo Electron Instrument Factory) and calculated as relative conductivity. Total electrolyte content was measured after boiling the sample for 10 min, and was taken as 100% leakage (Mao et al., 2007). Translucency of fresh-cut melon was subjectively evaluated on the percentage of affected area (0%: opaque, not translucent; to 100%: fully translucent) (Paull and Reyes, 1996).

Quality parameters

All quality evaluation procedures were performed at about 4°C. The soluble solids content (TSS) was determined by a portable refractometer (WYT-J, Sichuan, China), General appearance was evaluated visually with regard to the freshness of fresh-cut piece, on a scale of 1 to 5: 1, poor; 2, poor-fair; 3, good; 4, good-excellent; and 5, excellent. Fruit with a rating of less than 2.5 was considered not suitable for marketing. Vitamin C was determined by 2, 6-dichlorophenolindophenol (Zhu et al., 2009) and expressed in mg/100 g fresh weight. The percent of decay incidence was determined by the method of Cao et al. (2010).

Microbial counts

On days 0, 5 and 10, three tissue samples (each approximately 5 g) were removed with a steel, flame-sterilized cork borer (21.5 mm

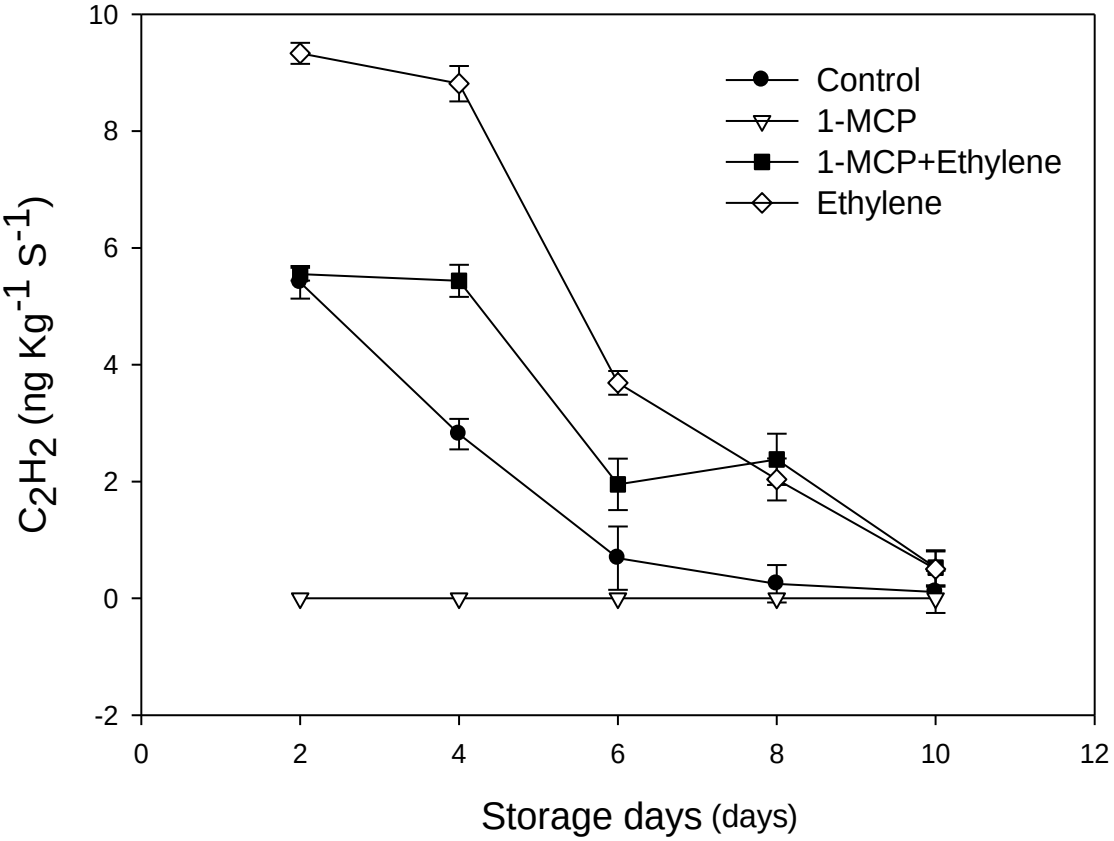

Figure 1. Effects of treatment on ethylene production of fresh-cut 'Hami' melon during storage at 4°C. Vertical bars represent S.E. of means. Some error bars are not visible due to lower value of S.E against the axis scale.

diameter) and a flame-sterilized knife on sterilized aluminum foil in a microbial transfer hood. Tissue was obtained by inserting the cork borer through the original 2.5 cm^3 mesocarp cubes. The 5.0 g samples were then incubated in 45 ml sterile phosphate buffered saline (PBS), pH 7.0.

The PBS and fruit tissue were vortexed at high speed for 1 min using a homogenizer (DS-1, Shanghai, China) for 2 min, followed by 10-fold dilutions using sterile PBS as needed. Enterobacteriaceae and Salmonella were made using 1 ml of the PBS extract. The plates and incubation conditions for each count were: Enterobacteriaceae, 3 M Petrifilm Enterobacteriaceae count plate; Salmonella, 3 M Petrifilm yeast and molds count plate, incubated for 5 days at 4°C in a 1.5 L airtight plastic container with a Gas Pak anaerobic system envelope. The plates were prepared in a laminar-flow hood at day 0 (immediately after slicing) and after 5 and 10 days storage at 4°C. Microbial counts were reported as log/g fresh weight.

Statistical analysis

The experimental results are shown in graphs and tables as the mean ± standard error (SE) of determinations made for each sample. The experimental results shown in graphs were analyzed by Sigmaplot (10.0), while the statistical package SPSS (version 16.0) was used to evaluate the significance of the means showed in tables.

RESULTS AND DISCUSSION

Ethylene production and respiration rate analyses

1-MCP treated fresh-cut 'Hami' melon significantly ($P \leq 0.01$) reduced ethylene production during storage at 4°C (Figure 1). Melons treated with ethylene (9.33 ± 0.18 ng Kg^{-1} s^{-1}) were about 2-fold higher than the control (5.41 ± 0.28 ng Kg^{-1} s^{-1}) on the second day. While 1-MCP + ethylene treatment (5.55 ± 0.11 ng Kg^{-1} s^{-1}) had similar level with the control (5.41 ± 0.28 ng Kg^{-1} s^{-1}). We did not measure ethylene production rates of fresh-cut cubes treated by 1-MCP during storage throughout the experiment. It appeared that 1-MCP not only suppressed the endogenous ethylene, but also inhibited exogenous ethylene production. The lower ethylene production was observed in 1-MCP treated in contrast to ethylene-treated melons, which could result from inhibition of the initiation of autocatalytic ethylene production; similar result has also been reported (Sisler and Serek, 1997). Exogenous ethylene accelerated the increase in ethylene and 1-aminocyclopropane-1-carboxylate (ACC) oxidase, whereas 1-MCP reduced both (Wang et al., 2009). This observation indicated that accumulation of ethylene was

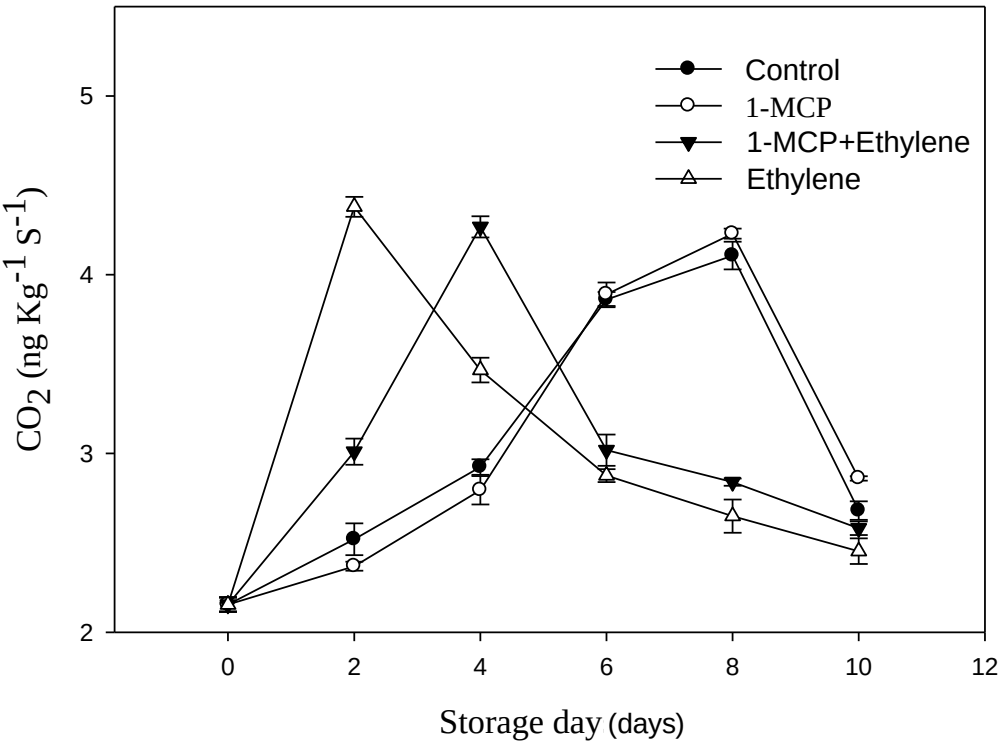

Figure 2. Effects of treatment on respiration rate of fresh-cut 'Hami' melon during storage at 4°C. Vertical bars represent S.E. of means. Some error bars are not visible due to lower value of S.E against the axis scale.

possibly due to higher rates of oxidation of ACC to ethylene. 1-MCP or exogenous ethylene treatment also could enhance the ACO activity, which was associated with higher ethylene production of 1-MCP and ethylene treated fruits (Wang et al., 2009).

In this study, we observed a strong inhibition of ethylene production in 1-MCP treated melon leading to delay ripening and senescence (Figure 1). Ethylene production of fruits are usually inhibited by 1-MCP (Ergun et al., 2005), but not always. Some results showed that 1-MCP treatment can increase ethylene production in fruits such as banana, grape fruit and strawberry (Golding et al., 1998; Mullins et al., 2000; Tian et al., 2000). Therefore, we speculated that either one of these proposed via ethylene inhibition may exist in different plants. This further elucidated why 1-MCP treated melon can also ripen and show physiological changes such as softening and rot. It was suggested that other access to reduce the ethylene production might exist, hence exploring the possible mode of action of 1-MCP in ethylene inhibition in plant is worthy of further studying.

Respiration rate measured as CO_2 production in fresh-cut 'Hami' melon cubes increased quickly during the first 2 days after treated with ethylene (4.38 ± 0.056 ng Kg^{-1} s^{-1}) or 1-MCP + ethylene (3.01 ± 0.073 ng Kg^{-1} s^{-1}) (Figure 2) and was probably due to ethylene-induced. 1-MCP treatment maintained similar trend of respiration rates compared to the control, which is consistent with those of fresh-cut watermelon slices stored at 5°C for 12 days and Persimmon stored at 8°C (Saftner et al., 2007; Salvador et al., 2004). However, other reports showed that 1-MCP decreased rates of softening and respiration in pears (Villaobos et al., 2011), tomato (Guillen et al., 2007). Our results indicate that 1-MCP and control had similar physiological function on respiration rate. Although, there was no significant effect on respiration rate, the inhibition of ethylene in 1-MCP treated fruit emphasized this inhibitor ability to compete even in the case of stress ethylene production. This event is very important because it allowed the control of melon ripening following mechanical injury, thus confirming the observation regarding the effect of 1-MCP on delaying fruit ripening (Botondi et al., 2003).

Firmness analyses

The firmness of all treatments declined during subsequent storage. 1-MCP treatment suppressed fresh-cut melon softening during storage at 4°C (Figure 3). Among treatments, 'Hami' melon cubes treated with ethylene alone were softer than those from all other treatments (Figure

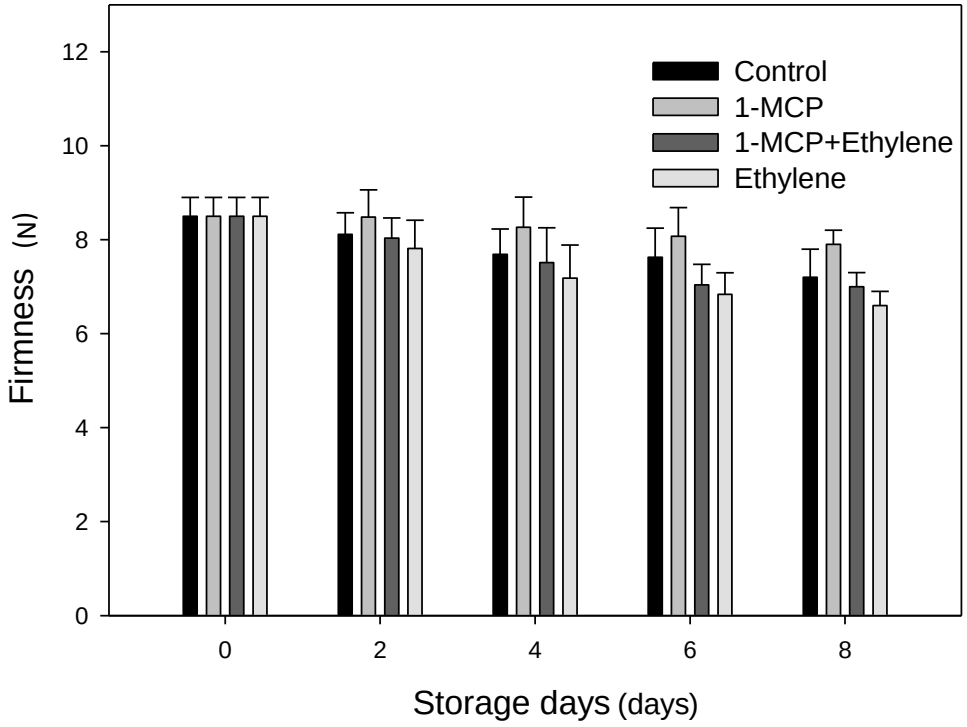

Figure 3. Effects of treatment on firmness of fresh-cut 'Hami' melon during storage at 4°C. Vertical bars represent S.E. of means.

3). The firmness in response to 1-MCP indicated that 1-MCP could essentially prevent ethylene-mediated softening and the processes contributing to softening depending on continued ethylene action. The softening of 1-MCP treated fresh-cut melon was delayed compared with the non-treated fruit (Figure 3),which is consistent with the effects of 1-MCP on the softening of other fruits at advanced stages of ripening including 'Galia' melon (Ergun et al., 2007) and seedless cucumbers (Nilsson, 2005). Moreover, the firmness of fresh-cut melon had a positive correlation with ethylene (r = 0.943**).

1-MCP treatment could prevent ethylene-induced softening in all tissues. 1-MCP treated melons declined from an initial value of 8.5 ± 0.4 N to about 7.9 ± 0.3 N during 10 days of storage compared with a decline to 7.2 ± 0.6 N from non-treated tissue. Tissue derived from 1-MCP + ethylene treated fruit also declined from 8.5 ± 0.4 N to about 7.0 ± 0.3 N during 10 days of storage compared with a decline to 6.6 ± 0.3 N from ethylene treated tissue. So the effect of 1-MCP on delaying softening suggested an important role of ethylene in softening. It is already known that fruit softening is due to a great extent, the degradation of the activities of fruit softening enzymes (pectin esterase, endoglucanase, exo- and endo-polygalacturonase) (Maruvada and McFeeters, 2009; Luo et al., 2009; Khan and Singh, 2007; Jeong et al., 2002). In future research, it would be more interesting to use 1-MCP to understand the role of ethylene in the synthesis or activity of enzymes.

Translucency and electrolyte leakage analyses

Next to firmness, the high rate of translucency compared to intact fruit is also an important quality issue for fresh-cut melon. Tissue water soaking or translucency and juice leakage are major factors limiting the longevity and quality of fresh-cut fruits. For translucency, fresh-cut melon treated with 1-MCP showed significantly ($P \leq 0.01$) lower levels than other treatments during the storage; there was a slight increase in cases observed until day 8, and finally a sharp rise was detected on the 10th day (Figure 4). Electrolyte leakage in fresh-cut melon without 1-MCP treatment increased rapidly during storage, but 1-MCP treatment increased slightly until the 4th day (Figure 5). Other treatments had the higher electrolyte leakage than 1-MCP during most of the storage period, especially ethylene treatment. However, 1-MCP + ethylene had lower electrolyte leakage than ethylene treatment.

Treatment with 1-MCP significantly ($P \leq 0.01$) suppressed the increase of electrolyte leakage rate and translucency, and also maintained the integrity of membrane. During storage, the tendency of higher translucency was consistent with the increase of electrolyte

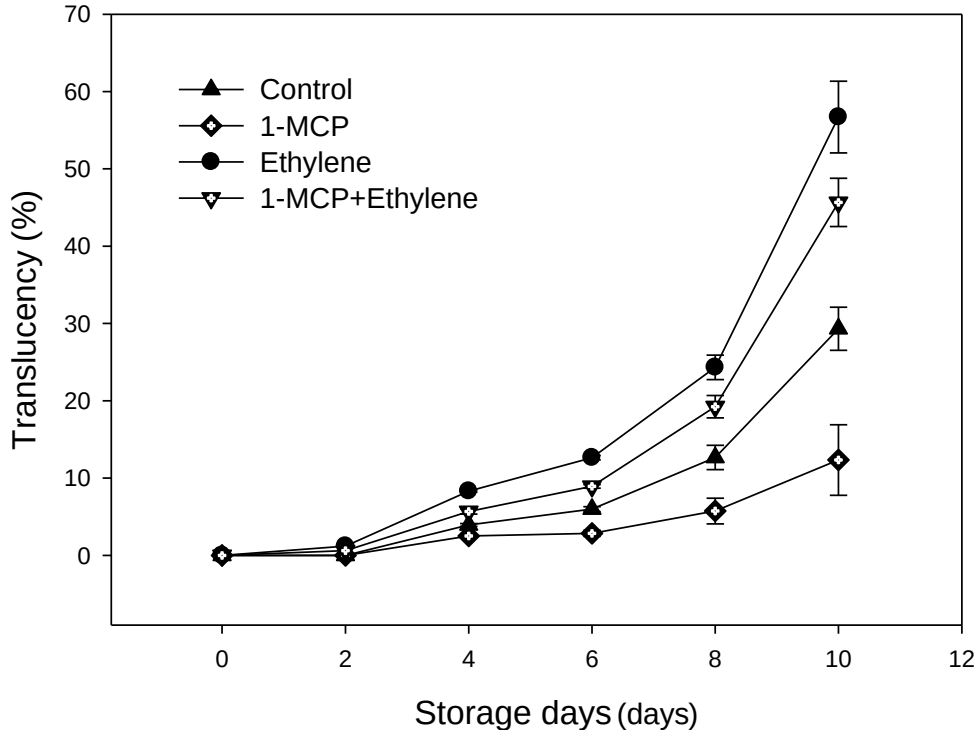

Figure 4. Effects of treatment on translucency percentage of fresh-cut 'Hami' melon during storage at 4°C. Vertical bars represent S.E. of means. Some error bars are not visible due to lower value of S.E against the axis scale.

leakage rate (r = 0.994**). It was possible that translucency symptoms were also caused by other factors such as sugar content. An increase in sugar concentration in the pineapple fruit tissue would favor translucency occurrence (Chen and Paull, 2001). In fact, cut fruit had much lower electrolyte leakage rate when 1-MCP was pre-applied.

These results showed that electrolyte leakage rate in ethylene treated fruit is thought to occur as a result of increased lipid metabolism, and high fruit electrolyte leakage at the storage of melon development favored translucency occurrence, possibly through an effect on membrane permeability.

Quality analyses

Quality parameters such as taste and flavor are much more difficult to evaluate objectively. However, the appearance is also significant for consumers to have a final judgment of the acceptability of that fruit. From Table 1, it was suggested that the declining appearance of the fresh-cut tissue paralleled the increased incidence of tissue translucency (r = -0.935**), yet 1-MCP treated tissue inhibited the decrease of appearance. Appearance was significantly associated with ethylene and firmness; the correlation coefficients are 0.877 and 0.966, respectively.

Vitamin C is known as the most important vitamin in fruits and vegetables for human nutrition. However, vitamin C is easily oxidized. Results show a gradual decrease in vitamin C content, which can be prevented by 1-MCP treatment (Table 1), paralleled the increased incidence of tissue translucency (r = -0.956**). This was thought to occur as a result of increased lipid metabolism and high rate of active oxygen which can oxidize vitamin C. In addition, treatment with 1-MCP was very effective in reducing the decay incidence during the later storage at 4°C. The decay incidence in 1-MCP treated fruit and control were 0 and 8% on the 4th day, respectively which further increased to 80 and 95% on the 10th day. Ethylene treatment could significantly ($P \leq 0.01$) accelerate decay incidence during storage (Table 1). Decay incidence had a highly positive correlation with translucency (r = 0.959**) and had a negative correlation with firmness (r = -0.833*). 1-MCP treatment also caused significant prevention in the soluble solids content (TSS) compared with control. The TSS in fresh cut melon tissue was 13.85 to 10.95% in those treated with 1-MCP, compared to the control from 13.85 to 8.95% during 10 days storage at 4°C (Table 1). Results suggest that a gradual decrease in TSS, paralleled the increased incidence of translucency (r =-0-

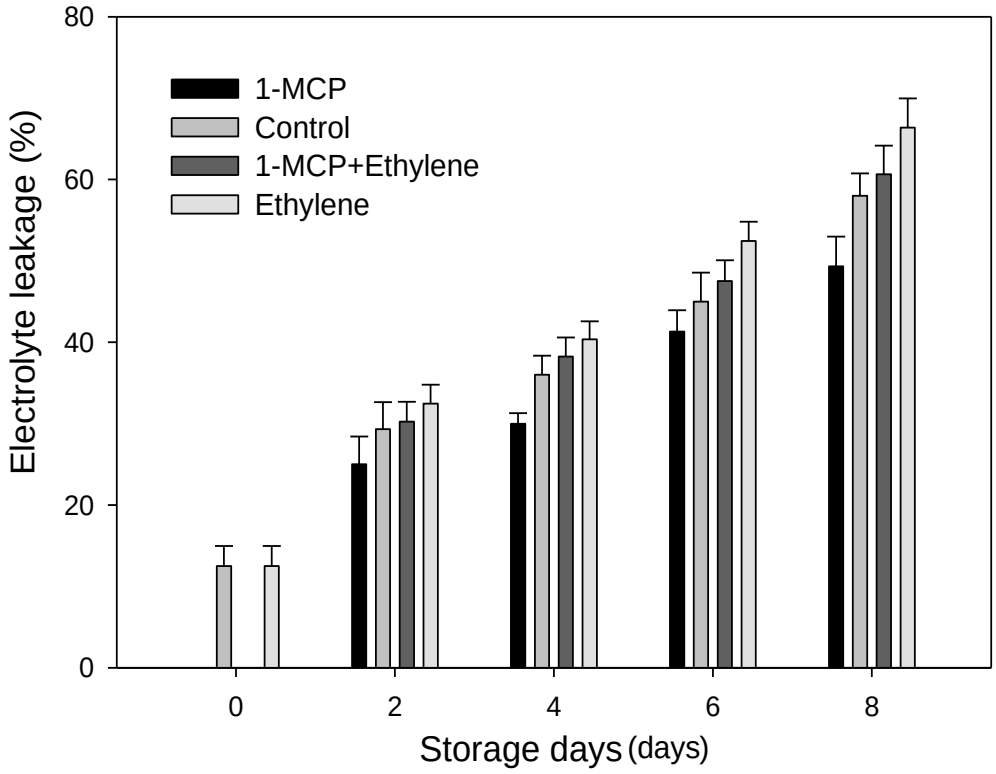

Figure 5. Effects of treatment on electrolyte leakage of fresh-cut 'Hami' melon during storage at 4°C. Vertical bars represent S.E. of means.

.955**).The changes in these quality parameters such as appearance, vitamin C, decay and TSS were restricted in 1-MCP treated melons during storage. Appearance ratings for 1-MCP treated melon tissue were significantly ($P \leq 0.01$) different from other treatments during storage at 4°C, and similar results were obtained in fresh-cut melons stored at 5°C and fresh-cut pieces at 10°C (Ukuku, 2004). Our result of TSS treated with 1-MCP was higher than other treatments during the storage. The decrease in vitamin C, also called the ascorbic acid, was significantly ($P \leq 0.01$) inhibited in 1-MCP treated tissue during early storage, thus preserving their initial nutritional value. The maintenance of vitamin C concentration in fresh-cut melon treated with 1-MCP may be explained through the low presence of oxygen inside the trays in agreement with previous reports (Serrano et al., 2008). Hence, the higher level of oxygen in the bags headspace, the greater decrease in vitamin C content. It appeared that the effects of 1-MCP were not only limited to TSS and vitamin C, but also to postharvest decay of fruit. In our study, the decay incidence was lower in 1-MCP treated melon as compared to untreated melon during ripening at 4°C (Table 1), which may be due to 1-MCP application initially triggering endogenous H_2O_2 levels and delaying its accumulation at later stages. According to the correlation among the quality parameters, it was suggested that 1-MCP, via the translucency inhibition, could directly or indirectly maintain the good appearance and high vitamin C, prevent melon from decay and reduce the loss of sugar during the fresh-cut melon storage.

Microbial counts analyses

The key problem to ensure the quality and safety of fresh-cut fruit is microorganisms' control, which directly affects health of the consumers. The positive action of 1-MCP in reducing the microbial counts on fresh-cut 'Hami' melon on days 0, 5 and 10 are summarized in Table 2. 1-MCP treatment caused significant ($P \leq 0.01$) reduction in the counts of both Enterobacteriaceae and Salmonella. Significant increases in microbe populations of fresh-cut 'Hami' melon occurred after 5 days, but there was difference between control and ethylene treatments. Processing of cutting stress damaged the tissue integrity, leading to several biochemical deteriorations such as increase of ethylene production and humidity, which was associated with the growth of microorganism. Therefore, it is important to sterilize using chlorine dioxide before cutting. Our results suggested that 1-MCP could prevent ethylene-induced microorganism population in fresh-cut melon through inhibiting ethylene production which could

Table 1. Quality assessment parameters of fresh-cut 'Hami' melon during storage at 4°C.

Day	Treatment	Appearance	TSS (%)	Vitamin C	Decay (%)
0		5.0	13.85	7.43	0
2	Control	5.0^{a}	13.78^{b}	7.26^{b}	0^{a}
	Ethylene	5.0^{a}	12.83^{d}	7.13^{c}	0^{a}
	1-MCP + Ethylene	5.0^{a}	12.93^{c}	7.25^{b}	0^{a}
	1-MCP	5.0^{a}	13.85^{a}	7.38^{a}	0^{a}
4	Control	4.5^{b}	13.15^{b}	6.94^{b}	8.0^{c}
	Ethylene	3.5^{d}	12.26^{d}	6.68^{d}	13.0^{a}
	1-MCP + Ethylene	4.0^{c}	12.55^{c}	6.87^{c}	10.0^{b}
	1-MCP	5.0^{a}	13.55^{a}	7.03^{a}	0^{d}
6	Control	3.5^{b}	12.66^{a}	6.58^{b}	12.5^{c}
	Ethylene	3.0^{d}	11.12^{d}	6.02^{c}	42.0^{a}
	1-MCP + Ethylene	3.3^{c}	11.12^{d}	6.02^{c}	42.0^{a}
	1-MCP	4.0^{a}	11.98^{b}	6.89^{a}	9.0^{d}
8	Control	2.5^{b}	10.50^{b}	5.75^{b}	60.0^{d}
	Ethylene	2.0^{c}	9.35^{d}	5.32^{c}	80.0^{a}
	1-MCP + Ethylene	2.5^{b}	9.85^{c}	5.27^{d}	75.0^{b}
	1-MCP	3.5^{a}	11.03^{a}	6.45^{a}	66.0^{c}
10	Control	1.5^{b}	8.95^{b}	5.25^{b}	95.0^{b}
	Ethylene	1.0^{c}	8.15^{d}	4.93^{d}	98.0^{a}
	1-MCP + Ethylene	1.0^{c}	8.35^{c}	5.18^{c}	95.0^{b}
	1-MCP	3.0^{a}	10.95^{a}	6.38^{a}	80.0^{c}

*Means in the same column followed by the same letter were not significantly different at the 1% level by the Duncan's test.

Table 2. Microbial counts of fresh-cut 'Hami' melon during storage at 4°C.

Treatment	Enterobacteriaceae (log CFU g^{-1})			Salmonella (log CFU g^{-1})		
	0	5	10	0	5	10
Control	ND	2.69^{c}	3.56^{c}	ND	2.15^{b}	3.89^{c}
1-MCP	ND	2.32^{d}	3.27^{d}	ND	ND	2.83^{d}
Ethylene + 1-MCP	ND	2.72^{b}	3.68^{b}	ND	2.43^{a}	4.02^{b}
Ethylene	ND	3.45^{a}	5.18^{a}	ND	2.13^{b}	4.68^{a}

*Means in the same column followed by the same letter were not significantly different at the 1% level by the Duncan's test. ND represents undetected value.

accelerate the translucency and electrolyte leakage. It also maintained cell membranes integrity, prevented juice from flowing and further inhibited the growth or action of microorganisms. Other reports showed that 1-MCP treatment can lead to increased decay or microbial growth in fresh-cut fruits and vegetables (Budu and Joyce, 2003). The increase of the lag phase caused by 1-MCP in the growth of mesophilic bacteria could be due to decreased oxygen and increased carbon dioxide content in the package headspace (Antoniolli et al., 2007; Liu et al., 2007). In other cases, however, there are no significant effects on microbial growth (Rupasinghe et al., 2005). Therefore, the mechanism of the 1-MCP on micro-organisms deserves further attention.

Conclusion

The response of ‘Hami’ melon to cutting stress is directly related to its quality during storage. Results showed that 1-MCP and exogenous ethylene performed analogous regulation action to ethylene synthesis. This similar behavior suggested that 1.0 µL/L 1-MCP not only inhibited ethylene-induced effects in fruits, but protected quality compared to cubes from non-treated or ethylene-treated. Consequently, we suggested that 1-MCP may be useful to some extent, in improving the storage quality and edible quality of fresh-cut melon at 4°C. At the same time, it also maintained the nutritional value, thus becoming a potential for ‘Hami’ melon commercial use in the future.

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