บทความวิจัย

EFFECT OF SHORT-TERM ANOXIA TREATMENTS ON QUALITY CHANGES IN FRESH CUT PINEAPPLE CV. SRI-RACHA

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Received: 2019-11-26

Revised: 2020-01-31

Accepted: 2020-01-31

ABSTRACT

The objective of this study was to investigate the effect of short-term anoxia treatment on quality changes of fresh-cut Smooth cayenne pineapple fruit cv. Sri-Racha. The periods of anoxia treatment were set at 0 (control), 10, 20 or 30 h using humidified nitrogen gaseous with a flow rate at 100 ml min^{-1}. Color (L^*, b^* and Hue angle values) and sensory quality attributes (using preference test; 5-points hedonic scales and disorder evaluations) were periodically analyzed 2 days interval during storage at 4±2 °C for 8 days. It was found that anoxia treatments had no effect on the Hue angle of fresh-cut pineapple from day 0 of storage. However, anoxia treatment for 20 and 30 h had significant higher L^* value than that of other treatments, and, treated sample with 20 and 30 h of anoxia had significant lower level of b^* value (yellowness). In addition, treated Sri-Racha sample with 30 h anoxia had higher scores of color and overall appearance, whereas, higher score of browning was found in control sample. Furthermore, anoxia treatment had no significantly effect on texture of fresh-cut pineapple, whilst difference of firmness score among treatment was significantly found throughout storage.

Keywords: Anoxia, Pineapple fruit, Fresh cut, Appearances, Sri-Racha

Introduction

The demand of fresh cut products has been rapidly increased and become more popular due to their fresh like characteristics and rich of phytonutrients. In addition, the other advantages such as ease in serving portions, reduce risk of physiological disorders, deduct cost of packaging, extend shelf-life and maintain quality of products will be benefit. In term of minimal processing, the postharvest managements is concerned both pre- (for intact) and post-treatment (for fresh cut). Using pre-treatment either physical or chemical treatments has been found to be advantageous to minimize the stress from metabolism inducing, maintaining qualities such firmness and color and improving overall organoleptic quality of various produces (Benitez et al., 2013; Prathibha et al., 2019).

Owing to the harmful of chemical utilization, physical treatment for fresh produce after harvest is concerned. The using of controlled or modified the atmosphere (physical treatment) may be an alternative method instead of chemical treatment. It would lessen postharvest changes such as texture, color, flavor, taste and other chemical compositions. The system of modified atmosphere is changing normal gas composition by removing O_2 and increasing CO_2 concentrations. Fortunately, pre-treatment with low O_2 concentration or short-term anoxia treatment prior to storage showed an effective to maintain quality by delaying physiological and chemical changes in fresh produce (Techavuthiporn et al., 2017), even though below a limiting point of O_2, living plant cells undergo anaerobic respiration and produce metabolites such as lactic acid, acetaldehyde and ethanol.

However, there is no report yet on the application of short anoxia treatment to fresh produce prior to minimal processing for minimizing the stress from metabolism induction and controlling quality changes after processing. The aim of this present research was undertaken to investigate the effect of short-term anoxia treatment on color, sensory tests and texture changes of minimally processed Smooth cayenne pineapple cv. Sri-Racha during storage at 4± ^{o}C for 8 day.

Materials and Methods

Sample preparation

Smooth cayenne pineapple cv. Sri-Racha fruit at the commercial maturity was obtained from the wholesale market in Prathumthani Province, Thailand. The fruits with an identical color (less than 2/4 yellow of the fruit peel) and an average weight of 900 ± 50 g

per fruit were selected. Each fruit was individually washed by rinsing with tapped water and then dried with ambient air at room temperature (25 ^{o}C) for 8 days.

Anoxia treatment and fresh-cut process

The fruit were divided into 4 groups (12 fruit per group). Each group was directly placed in hermetic plastic chamber (10 L; 4 fruits per chamber). All chambers were then continually circulated with humidified pure nitrogen to create 90-95% RH with flow rate at 100 ml min^{-1} for 0 (as control), 10, 20 or 30 h at room temperature (25 ± 2 ^{o}C). Then, they were peeled and cut equally 8 pieces in the longitudinal direction and core portion of each piece was discarded with a sharp stainless-steel knife. Three pieces of cut pineapple were randomly placed in a polypropylene plastic tray (10 x 15 x 4 cm^{3}) and wrapped with polyvinyl chloride plastic film (film thickness = 11μm) to simulate as retail package. All samples were kept at 4± 2 ^{o}C (85-95% RH) for 8 days. Each treatment was applied to four replicates in randomly (1 tray per replicate).

Color assessment

The assessment of flesh color was randomly done at 3 different locations on each piece of cut pineapple with a colorimeter (Konica Minolta chromameter, model CR-400, Japan), . The expression based on the *L**, *a** and *b** value of the CIE scale and hue angle (^{o}H) value was calculated.

Sensory evaluation

The sensory evaluations of fresh-cut pineapple were carried out. Using preference test (overall appearance and color). A hedonic scale from 1 to 5, where 1 = dislike, 3 = moderate and 5 = like were used to determined. Whilst, preference test was used to evaluate browning color of pineapple pulp tissue accepting core portion using a hedonic scale from 1 to 5 where 1 = not present and 5 = very pronounced.

Texture determination

Flesh hardness was determined by taking twelve pieces for each treatment which were cut into small cubes (30 x 40 x 30mm^{3}). Firmness of each sample was measured at the middle point of each cube by performing a compression test (Magness-Taylor Probe; TA-MTP) using a texture analyzer (CT3, Brookfield), with a crosshead speed of 10 mm min^{-1}. Hardness of the samples was defined as a maximum rupture load of the force/deformation curve and expressed as Newton (N).

Statistical analysis

The experimental data were the average of 12 pieces cut pineapple from four independent trays and performed using completely randomized design. Statistical significance was assessed using an ANOVA at the 99% confidence level.

Results and Discussion

Figure 1 shows the color changes of fresh cut pineapple during storage at 4 ^{o}C for 8 days. It was found that L^* value of anoxia treated fruit at 20 and 30 h had significant higher than that of other treatments, whereas, the b^* value (yellowness) of the both treatments was significant lower than control and 10 h anoxia treatment respectively. The both parameters indicated color changes from bright to dark yellow (brown) (Techavuthiporn et al., 2017). However, anoxia treatments had no effect on ^{o}H angle of fresh-cut pineapple throughout storage

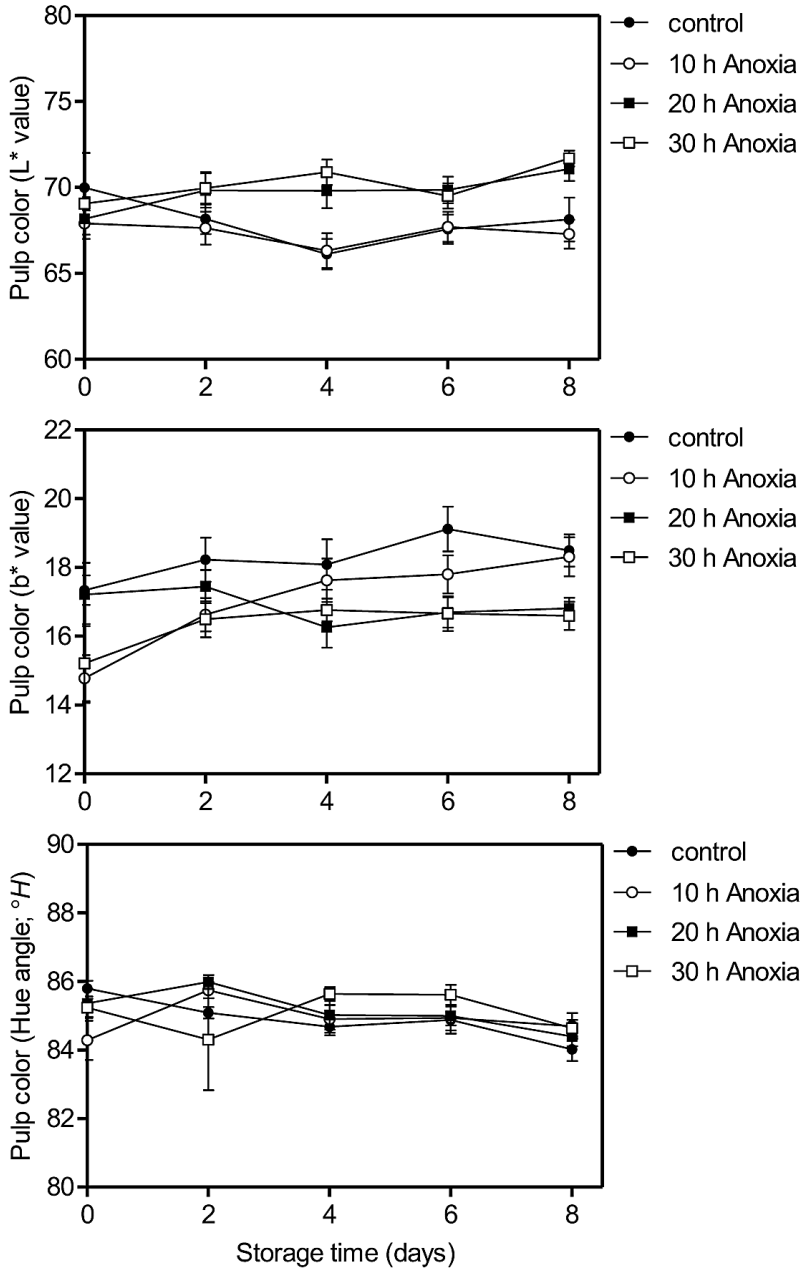

Figure 1 Changes in color (*L**, *b** and °H angle values) of Sri-Racha pineapple fruit with treated with short-term anoxia before minimal processing and storage at 4±2 °C for 8 days. Data are the average of twelve replicates ± standard deviation.

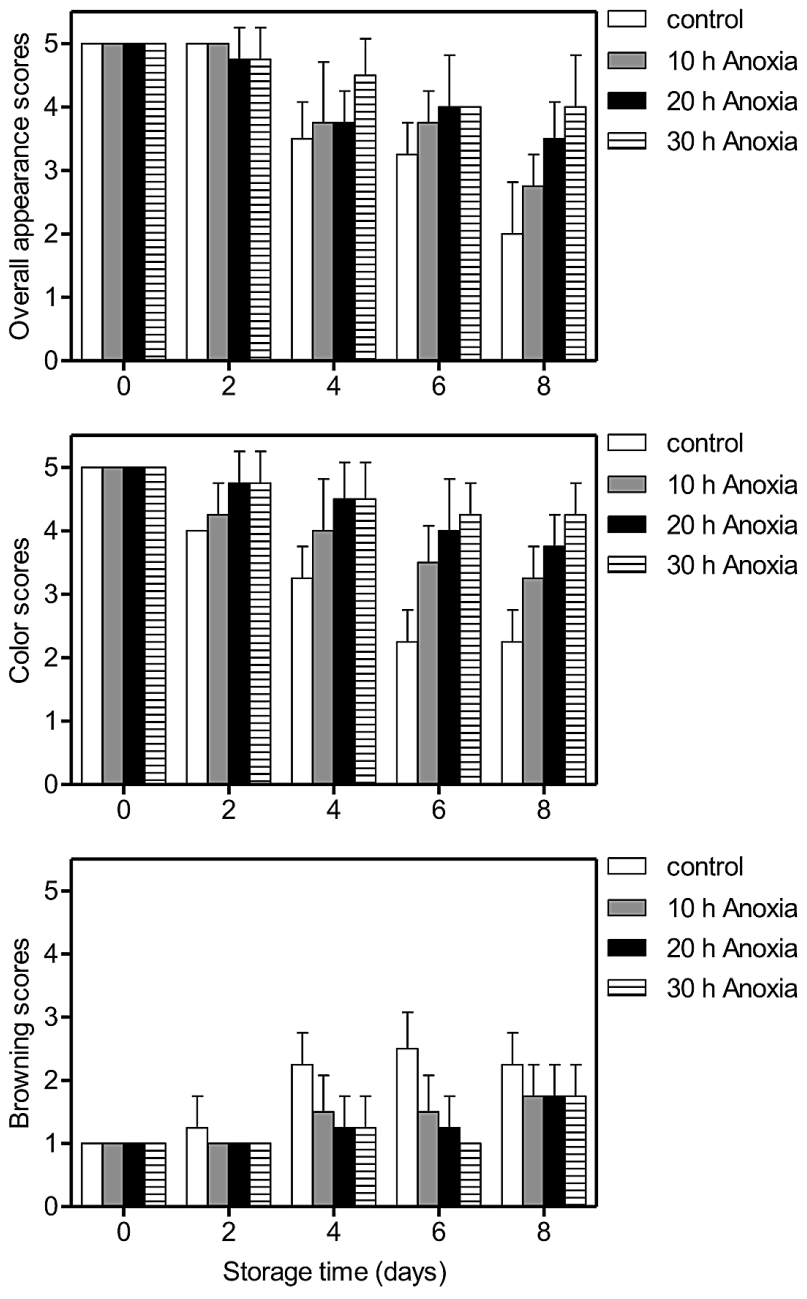

Figure 2 Sensory score of overall appearance, color and browning of fresh-cut Sri-Racha pineapple treated with anoxia at 0, 10, 20 and 30 hr storage at 4±2 °C for 8 days. The evaluation was done at day 8 of storage at 4±2 °C.

The sensory evaluations of both preference and disorder tests were performed to establish any differences between the different anoxia conditions during 8 days of storage (Figure 2). For preference test, significant differences of overall appearance and color among treatment were observed. The 30 h anoxia treated fruit had overall appearance and color scores higher than other treatments. We found that anoxia treatment obviously maintained quality in the term of pulp appearance greater than control sample. Score of color observation was well in accordance with the findings from the color values as shown in Figure 1. In addition, the dominant disorder of cut pineapple was browning symptom. Short-term anoxia treatment could delay pulp-browning occurrence. The result study indicated that fresh cut pineapple would sensitive to exposure time of anoxia condition (Nielsen and Leufven, 2008).

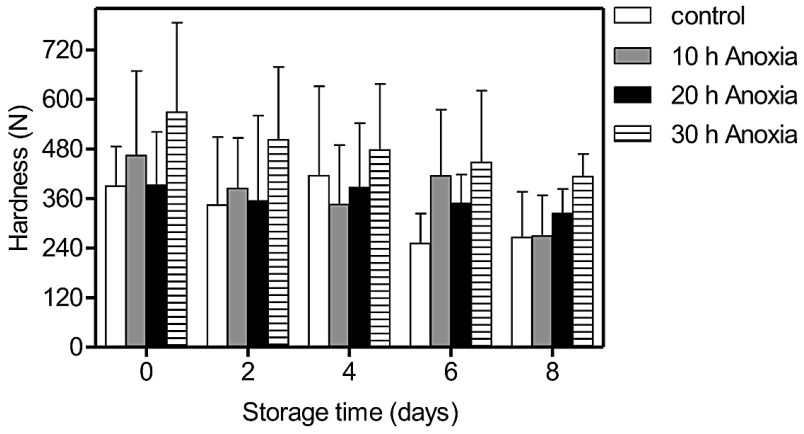

Figure 3 Changes in texture of treated pineapple fruit cv. Sri-Racha with different exposure time of short-term anoxia condition before minimal processing and storage at 4±2 °C for 8 days. Data are the average of twelve replicates ± standard deviation.

Texture of fresh-cut Sri-Racha pineapple was shown in Figure 3. In particular, initial hardness showed the lower value about 390 N in control, while showed the higher value about 569 N in treated fruit with 30 h Anoxia. Firmness tended to decrease in all treatment throughout the experimental period. The firmness was more significant lower in control and treated fruit with 10-20 h Anoxia. This decrease was not as great in fresh-cut samples cv. Sri-Racha treated with anoxia for 30 h prior to processing. However, no significant difference in the loss of hardness was found in all treatments. Absence of significant changes in hardness of fresh-cut pineapple among treatment throughout storage indicates that fruit structure properly resist storage time (Montero-Calderóna et al., 2008).

A previous studies had reported that anoxia treatment could delay postharvest changes such as physiological changes and also remain the sensorial quality characteristics of postharvest fruits (Fallik et al., 2005; Pesis & Marinansky, 1993). Although, Anoxia treatment had been found to have a significant influence on respiration rate of the pineapple fruit (cv. PhuLae) causing a higher value of respiratory quotient (RQ > 1) (Techavuthiporn et al., 2017). They also indicated that after transfer to an aerobic condition, the activities of fermentative enzymes could turn to the same level as in the non-treated fruit.

Conclusion

Color and texture parameters were affected by anoxia treatments in which browning symptom and a loss of flesh hardness was observed. It would be said that anoxia treatment could be alternative method if there is a desire to maintain quality and prolong shelf life of intact and fresh cut pineapple.

Acknowledgement

This research work was financially supported by National Research Council of Thailand and Phranakhon Rajabhat University.

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