Effect of refrigerator positions on quality of fresh-cut pepper

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KEYWORD: fresh cut; pepper; refrigerator; texture

ABSTRACT: The effect of refrigerator position in the same layer on the quality of fresh-cut pepper was evaluated. The temperatures of the front and rear in the same layer were different. The front temperature was about 0.5 oC higher than the rear temperature. The soluble solid content of the front pepper was higher than that of the rear pepper, while the Vc content of the front pepper was lower than that of the rear pepper. The texture of the front pepper was similar to that of the fresh pepper. Hence, the front position was a good option for the storage of fresh-cut pepper.

Introduction

Peppers (*Capsicum annuum* L.) are welcomed for their appealing and characteristic shape, size, color and flavor (Conesa, et al., 2007a, Conesa, et al., 2007b, Gonzalez-Aguilar, et al., 2004). Pepper is also rich in vitamins as well as in minerals such as potassium and magnesium (Ayranci & Tunc, 2004, Daood, et al., 1996).

The processing of fresh-cut pepper includes the washing, sterilizing, cutting, packaging and storage. The commercial storage of the fresh-cut pepper was stored at an open refrigerator with an air curtain at 4 ^{o}C. The temperature and air flow of the different refrigerator layer was a little difference (Antonia Murcia, et al., 2009, Laguerre, et al., 2005, Laguerre, et al., 2007). The difference would result in a change of the quality and shelf life of the fresh-cut pepper (Laguerre, et al., 2005, Laguerre, et al., 2007). However, the further survey showed that the different position in the same layer was also different, which has not been reported to our knowledge. Consequently, the quality of the fresh-cut pepper in the different position in the same layer was compared based on our previous finding. Specifically, a typical refrigerator was used to simulate the commercial storage the fresh-cut pepper in the sales section. The quality of the stored fresh-cut pepper was monitored and compared in 7 d.

Material and Methods

Storage of fresh-cut pepper.

Fresh-cut pepper was prepared by Beijing Yunong Food Processing Co Ltd. (Beijing, China). The fresh-cut pepper was transported to the refrigerator in 12 h after being processed. The refrigerator (Fudao, Beijing 2nd Commercial Machine Plant, Beijing, China) was set at 4 ^{o}C for the whole shelf life evaluation. The refrigerator had 5 layers with an air curtain, which was widely used in the supermarket. The layer was named as 1st, 2nd, 3rd, 4th and 5th layer from the top to the bottom. A few temperature sensors were placed with the pepper to monitor the temperature of each layer. The quality of the products was evaluated on the 1st, 3rd, 5th and 7th d. The fresh-cut pepper of the 1st d was designated as the control.

Determination of soluble solid content

The sample was smashed in a HR1861food mixer (Philips, Dongguan, China). An aliquot of 1 ml sample juice was dropped on a pocket digital refractometer (Pal-α, ATAGO Co., Ltd., Japan) to measure the soluble solid content.

Determination of Vc content

The Vc content of the fruits was determined by an HPLC method (Oms-Oliu, et al., 2009). An aliquot of 25 mL of the juice was mixed with 25 mL of a solution containing 45 g/L of metaphosphoric acid and 7.2 g/L of dithiothreitol. The mixture was centrifuged at 20,000 × g for 15 min at 4 °C and the supernatant was vacuum-filtered through the Whatman No. 1 paper. The sample was then passed through a millipore 0.45 μm membrane into an opaque vial and kept at -80 °C until being used. An aliquot of 20 μL was injected into Agilent 1200 series HPLC (Agilent Technologies, Palo Alto, California) fitted with a reverse-phase C18 Spherisorb® ODS2 (5 μm) stainless-steel column (4.6 mm × 250 mm). The mobile phase was a 0.01% sulphuric acid solution adjusted to a pH of 2.6. The flow rate was fixed at 1 mL/min and monitored at 245 nm at 25 °C. Vitamin C was quantified using a calibration curve based on ascorbic acid pure standards and results were expressed as relative Vc concentration.

Texture analysis.

The texture of the sample was measured by a TA.XT2i plus texture analyzer (Stable Micro Systems Ltd., Godalming, Surrey, UK). The pepper was place on the test platform with the skin on top. The trigger (P/2, 2 mm cylinder) was compressed to 50 % of the total height with a pre-test speed of 2 mm/s, test speed of 1 mm/s, and post-test speed of 2 mm/s. The maximal force was designated as the hardness of the sample, and number of the peak represent the fragility.

Statistical Analysis.

Analysis of variance (ANOVA) was used to compare mean differences of the results. If the differences in mean existed, multiple comparisons were performed using Duncan's Multiple Range Test. All analysis was conducted using SPSS for Window Version 19. All experiments were done in triplicates or more.

Results and Discussion

Effect of refrigerator position on soluble solid content of fresh-cut pepper

Temperature is the key factor related to the shelf life and quality of fresh-cut vegetables (Mohammed & Yahia, 2011). A proper temperature will extend the shelf life and hold the original quality of the vegetables (Paull, 1999). Figure 1 presents the temperature fluctuation of the refrigerator in the first day of the storage. Four main fluctuations were presented to defrost. And each defrosting lasted for about 2 h. The temperature fluctuation was repeated as the first day for the whole storage. The temperature of the front was about 0.5 °C higher than the rear in the refrigerator. This phenomenon resulted from the air flow of the refrigerator.

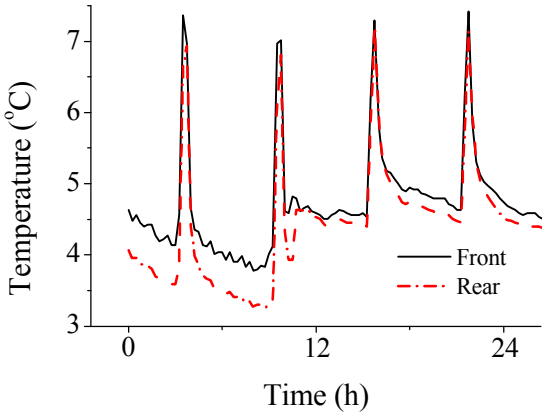

Figure 1 Temperature fluctuation of the refrigerator

The soluble solid content of the pepper is shown in Figure 2. The soluble solid content of the fresh-cut pepper decreased during the 7 d storage. Especially, the soluble solid content decreased quickly in the 3 d, and kept in about 3.3 in the following days. The soluble solid content reflects the accumulation of the nutrition of the vegetable (Khandpur & Gogate, 2015). Consequently, the physiological metabolism of the pepper was speculated to be slowed dawn after 3 days' storage. On the other hand, the soluble solid content of the front pepper was lower than that of the rear pepper. The difference was mainly related the different temperature.

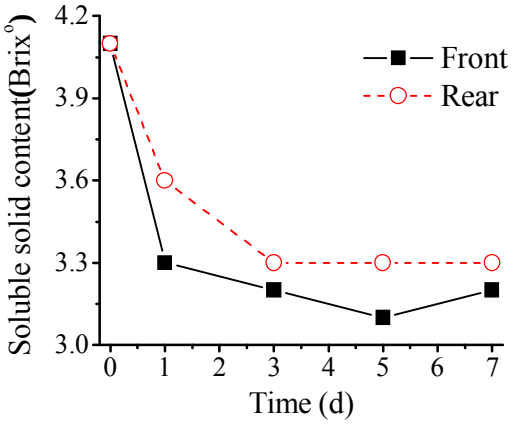

Figure 2 Effect of storage on soluble solid content of fresh-cut pepper

Effect of storage on Vc content of fresh-cut pepper

Pepper is rich of Vc among all the vegetables(Ayranci & Tunc, 2004). Vitamin C plays a huge role in maintaining a healthy lifestyle, and preventing disease by its high antioxidant activity (Spínola, et al., 2014). The effect of storage on Vc content of the fresh-cut pepper is shown in Figure 3. The Vc content decreased quickly in the 3 days' storage, and hold at a constant level. On the other hand, the Vc content of the front pepper was higher than that of the rear pepper. The Vc is believed to been a stress factor. Both the exterior and inherent stress will enhance the Vc responds (Reuter, et al., 1981). The front pepper was subject to more light, oxygen exposure, and air fluctuation. Hence, the Vc content of the front pepper was higher.

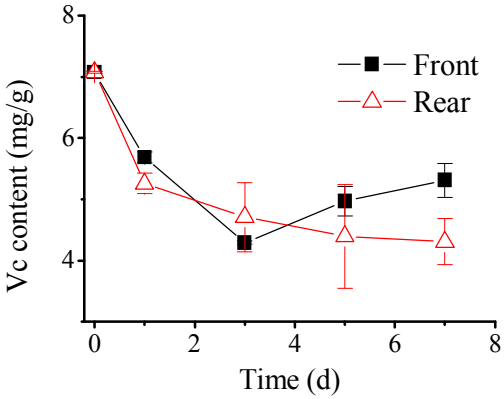

Figure 3 Effect of storage on Vc content of fresh-cut pepper

Effect of storage on texture of fresh-cut pepper

The effect of storage on hardness and fragility of the fresh-cut pepper is shown in Figure 4. The hardness of the fresh-cut pepper was reduced after 7 d storage. Moreover, the hardness of the front pepper was higher than that of the rear pepper. Meanwhile, the fragility of the front pepper was similar to that of the rear pepper. Consequently, the texture of the front pepper was similar to that of the fresh pepper.

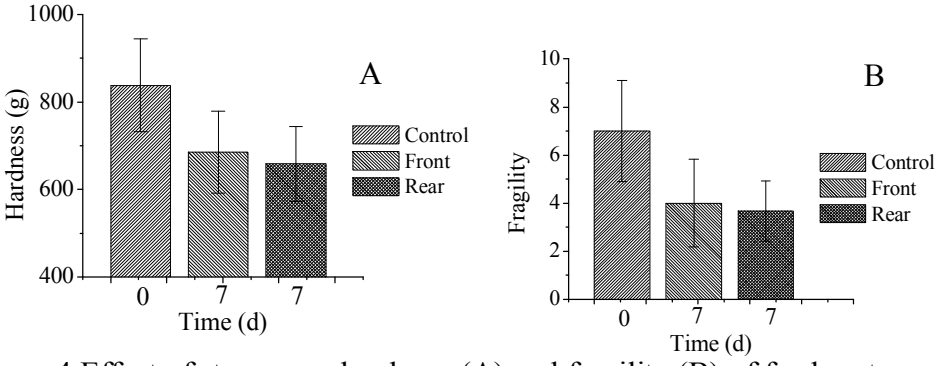

Figure 4 Effect of storage on hardness (A) and fragility (B) of fresh-cut pepper

Conclusions

The temperatures of the front and rear in the same layer were different. The front temperature was about 0.5 ^{o}C higher than the rear temperature. The soluble solid content of the front pepper was higher than that of the rear pepper, while the Vc content of the front pepper was lower than that of the rear pepper. The texture of the front pepper was similar to that of the fresh pepper. Hence, the front position was a good option for the storage of fresh-cut pepper.

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