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Effects of NaOCl and LDPE packaging on postharvest quality of tomatoes

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Abstract: Postharvest storage study of tomatoes was carried out using low density polyethylene bag (LDPE) and chlorine cleaning (NaOCl) to compare the effects of NaOCl and LDPE. The postharvest quality of tomatoes was evaluated by monitoring and analyzing the parameters including weight loss, color change, titrable acidity (TA), total soluble solid (TSS), and firmness measurement in every two-day. It was found that tomatoes washed with clean water followed by packed in LDPE bag and stored at 15^{o}C exhibited the best result by prolonging the self-life of 10 days. On the other hand, tomatoes washed in NaOCl followed by packed in LDPE and stored at 15^{o}C was able to prolong the shelf life of 8 days. However, tomatoes were stored at ambient temperature under similar experimental condition; the shelf life was prolonged only 6 days. Furthermore, LDPE packaging storage was found good in retaining the firmness and lightness, however, NaOCl washing was led to soften and shrive the tomatoes rapidly.

Keywords: Tomato, NaOCl, LDPE, Postharvest quality, and Shelf life

1. Introduction

Tomato (*Lycopersicon esculentum*) is one of the most widely consumed fresh vegetable in the industrialized world for long time.

Botanically, tomatoes are fruits (berry), but they are commonly referred to as vegetable. Fresh-market tomatoes are a popular and versatile fruit vegetable, making significant contributions to human nutrition throughout the world as tomato content important nutrition properties including vitamins, minerals, lycopene and other carotenoids [1]. The tomato is now grown worldwide and proper harvesting determines the nutrient contents as well as storage durability of any fruit.

Moneruzzaman et al. [2] reported that tomato is normally harvested at different maturity stages such as green mature stage, half ripen stage and red ripen stage. Since tomato is highly perishable food, it encounters several problems in its transportation, storage and marketing. Owing to lack of information on appropriate postharvest treatments, packaging, temperature, etc, tomatoes not only lose their quality but also encounter postharvest loss. On the other hand, fruits and vegetables can act as a vector for transporting pathogenic bacteria from the farm. Although washing produce with tap water may remove some soil and other debris, it cannot be relied upon to remove microorganisms and may result in cross-contamination of food preparation surfaces, utensils, and other food items. Therefore, effective sanitation of the raw produce is required. Washing raw produce with water containing sodium hypochlorite (NaOCl) is the most commonly used method for removing pathogens from the surfaces of vegetables. Chlorination of wash water up to 200 ppm is routinely applied to reduce microbial contamination in produce processing lines [3]. This research work was design to minimize postharvest loss, quality improvement and shelf life extension of tomato by using NaOCl followed by packaging in LDEP bags.

2. Materials and Methods

2.1. Experimental Design

Fresh and half ripened tomatoes were collected from a field located in Royal University of Agriculture, Phnom Penh, Cambodia, and delivered to the postharvest laboratory of faculty of Agro-Industry, Royal University of Agriculture. Then, they were washed with fresh water and divided into four treatments, T_0- kept in the ambient temperature, T_1- stored in 15^{o}C, T_2- packed in the plastic bag (LDPE) and stored in 15^{o}C, T_3- cleaned with 100ppm NaOCl for 5 minutes and stored in 15^{o}C. Each treatment was replicated three times.

2.2. Analysis

The postharvest quality of tomatoes was evaluated by monitoring and analyzing including weight loss, color change, titrable acidity (TA), total soluble solid (TSS), and firmness measurement in every two-day.

2.3. Shelf Life

The shelf life was calculated by counting the days required to attain the last stage of ripening, or upto the stage when fruit remained still acceptable for marketing.

2.4. Firmness

Firmness was determined by the visual observation. Development of spots on the fruit's skin, softening and rotting of fruits was also recorded. The tomato fruits were rated in 5-point hedonic scale: excellent (8-10), very good (7-8), good (6-7), fair (5-6) and poor (below 5).

2.5. Weight Loss (%)

The weight loss was calculated by differences between initial weight and final weight divided by initial weight using the following formula: (Fig. 1).

$$\% \text{ Weight loss} = \frac{(\text{Initial weight} - \text{final weight})}{\text{Initial weight}} \text{ x } 100$$

Fig. 1. *Calculation of weight loss in percentage*

2.6. Colour

Colour of tomato was measured using a Color Reader CR-10. The tomato was measured for L* (lightness), a* [green (-) to red (+)], b* [blue (-) to yellow (+)].

2.7. Titrable Acidity (TA)

The titrable acidity was determined using the following steps. First, sample was blended, filtered and transferred to volumetric flax (volume up to 100 ml mark). Five (5) ml of tomato juice was titrated with 0.1N NaOH using phenolphthalein as the indicator. Percentage of TA was calculated as citric acid (Fig 2).

$$\%\text{TA} = \frac{\text{Titrevalue x Normality x m.eq.wt.of acid}}{\text{Volume of sample}} \text{ x } 100$$

Fig. 2. *Calculation of titrable acidity in percentage*

2.8. Total Soluble Solid

Total soluble solid was measured using hand refractometer. Fruits were blended; the juice was filtered, and a few drops of juice were used for direct visual measurement on the hand refractometer.

3. Results

3.1. Firmness

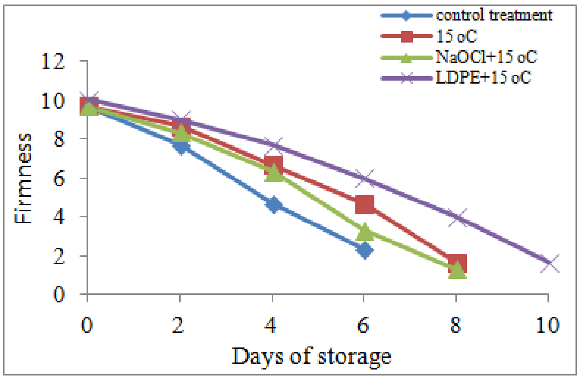

Fig. 3. *Firmness during storage*

As observed from the Fig. 3, samples stored at 15^{0}C in LDPE bag were ripen and soften very slowly in comparison to the control samples, which was ripen and soften rapidly depending on the days of storage.

3.2. Weight Loss

The total weight loss of control sample was the highest (5.81%), while the total weight loss in the treatment of packaging in LDPE bag stored in 15^{o}C was the lowest (1.82%) at the sixth day of storage. Tomatoes packed in LDPE bag and stored at 15^{o}C was showed the longest shelf life (10 days), followed by the treatment and stored in 15^{o}C (8 days). On the other hand, tomatoes washed in NaOCl followed by packed in LDPE and stored at 15^{o}C was able to prolong the shelf life of 8 days. However, control tomatoes were stored at ambient temperature under similar experimental condition; the shelf life was prolonged only 6 days. as shown in Fig. 4.

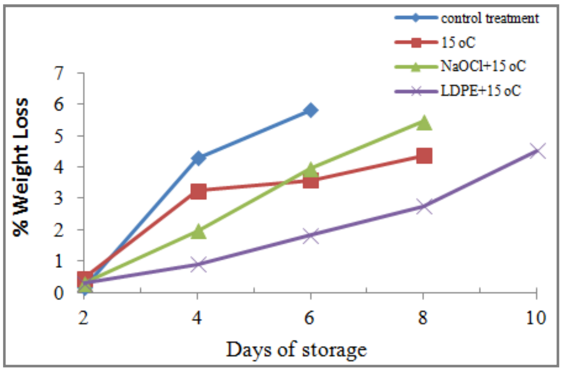

Fig. 4. *Weight loss during storage*

3.3. Color Change

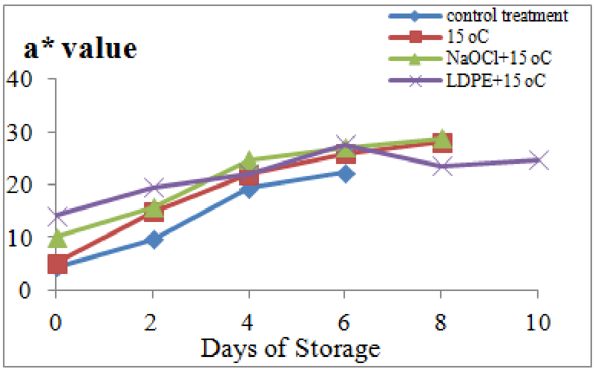

Fig. 5. *Color a**

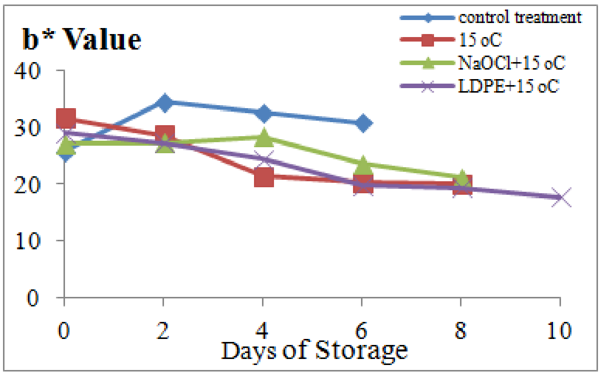

Fig. 6. *Color b**

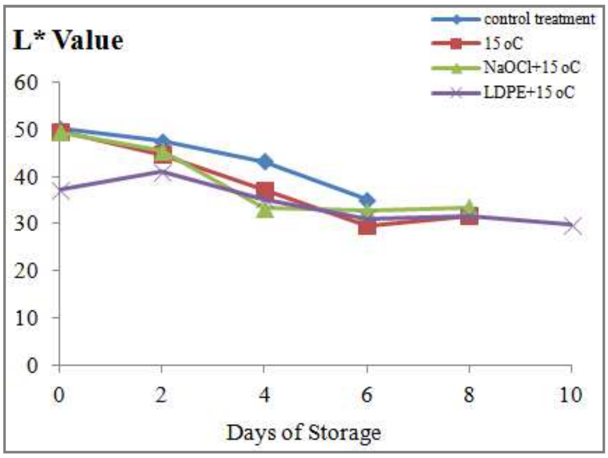

Fig. 7. *L* value*

From Fig. 5, 6 and 7, despite treatment condition, non significant color changes were occurred in the tomato samples. The a* value for all treatments were increased indicating that the tomatoes undergoes to red depending on the days of storage (Fig 5). The b* value for all treatments were declined indicating that the tomatoes undergoes to yellow depending on the days of storage (fig 6). The L* value for all treatments were declined indicating that the brightness of tomatoes decline depending on the days of storage. However the loss of brightness in LDEP packed samples, which was stored at 15°C was found lowest (Fig 7).

At the first day of storage, L* value was 37.13, and then it was declined to 31.03 at sixth day of storage. When tomatoes were washed with NaOCl and stored at 15°C, the L* value was 49.43 at the first day of storage, and then gradually declined to 32.66 at the sixth day of storage. On the other hand, when tomatoes were stored at 15°C, L* value was 49.66 at the first day of storage, and then gradually declined to 29.6 at sixth day of storage. In control tomatoes, the L* value was 50.23 at the first day of storage, and then gradually declined to 35.05 at sixth day of storage (Fig 7).

3.4. Titratable Acidity

As shown in figure 8, non-significant differences among titratable acidity values of tomatoes were observed in this study. The titratable acidity of all samples increased gradually depending on the increased storage period. The LDPE packed tomatoes followed by storage at 15°C showed the highest titratable acidity value. At the first day of storage, the titratable acidity value was 2.23g/L, and then gradually rose to the value of 3.07g/L at sixth day of storage.

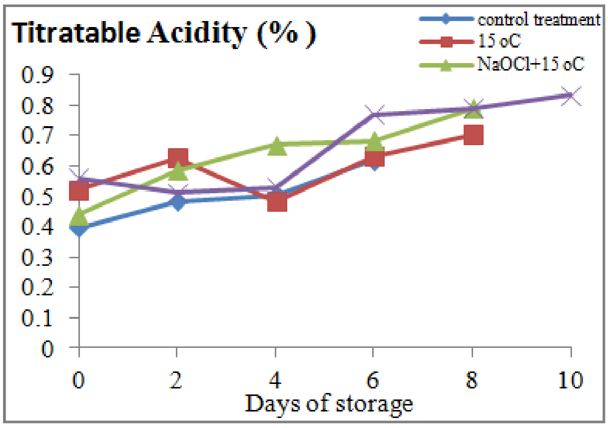

Fig. 8. *TA (%) value during storage*

On the other hand, NaOCl washed tomatoes and stored at 15°C, the titratable acidity value was recorded as 1.75g/L at the first day of storage, and then gradually rose to 2.73g/L at sixth day of storage. When the samples were washed with clean water and stored at 15°C, the titrable acidity was recorded as 2.09g/L at the first day of storage, then gradually rose to 2.52g/L at sixth day of storage. In control tomatoes, the titratable acidity value was 1.58g/L at the first day of storage, and then gradually rose to 2.47g/L at sixth day of storage (Fig. 8).

3.5. Total Soluble Solid (TSS)

Non significant differences in the total soluble solid content was found in all treatments condition and storage time, washing with water followed by packed in LDPE bag and stored at 15°C showed 3.33 °Brix value, washing with NaOCl and stored at 15°C showed 3.33 °Brix value, washing with water and stored at 15°C also showed 3.33 °Brix value at the eighth day of storage, However, the control tomatoes showed3.33 °Brix value at the sixth days of storage. (Fig. 9).

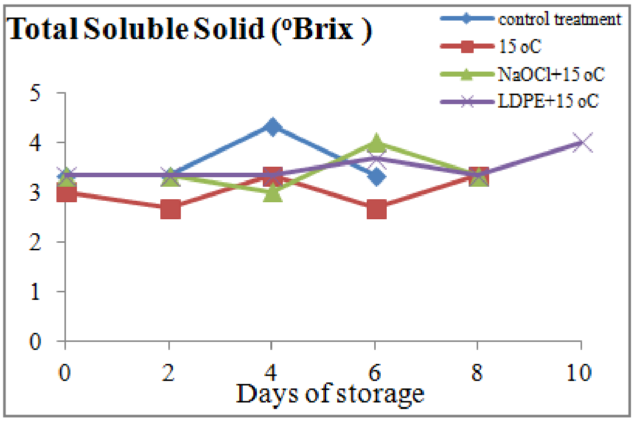

***Fig. 9.** TSS (⁰Brix) value during storage*

4. Discussions

The highest weight loss was found in unpacked tomatoes throughout the storage period. Alsadon et al. [4] reported that LDPE treatments gave lowest weight loss. Irrespective of storage period, non significant influence of the storage temperature or packing was observed throughout the study. Tomato stored in LDPE bag and placed in plastic sieve container showed controlled weight loss and delayed senescence significantly.

The results of the chemical analysis showed increase in titrable acidity. LDPE packaged tomato showed extended shelf life with lowest weight loss until the ninth day at room temperature and more than 9 days under refrigerating condition. Therefore, this study result concluded that LDPE bag was better than other storage materials in tomato storage, and refrigeration is better than room temperature storage [5].

5. Conclusion

This study result demonstrated that tomatoes storage using low density polyethylene bag (LDPE) was best for prolonging the self-life by maintaining the lightness, soften, smooth, and decay of tomato. However, tomatoes washed with chlorine water (NaOCl) were not found suitable in extending the self-life and maintain quality of tomatoes. Moreover, NaOCl washed tomatoes undergoes to shrive rapidly. Therefore, tomato should be stored in LDPE bag for maximizing the self-life and decreasing the physical damage.

References

[1] Gharezi M, Joshi N, Sadeghian E. (2012). Effect of Postharvest Treatment on Stored Cherry Tomatoes. J Nutr Food Sci. 2:157.

[2] K.M. Moneruzzaman, A.B.M.S. Hossain, W. Sani, M. Saifuddin and Alenazi. (2009). Effect of Harvesting and Storage Conditions of Postharvest Quality of Tomatoes. Australian Journal of Crop Science 3(2): 113-121.

[3] T.A.A. Nasrin, M.M. Molla, M. Alamgir Hossaen, M.S. Alam and L. Yasmin. (2008). Bangladesh Journal. 33(2): 579-585.

[4] Abdullah A. Alsadon, Abdullah M. Alhamdan, Mahmoud A. Obied.(2004). Effect of Plastic Packaging on Tomato Fruits Stored at Different Temperatures and High Relative Humidity. Res. Bult., No. (132), Food Sci. & Agric. Res. Center, King Saud Univ., pp. (5-28).

[5] Babarinde G.O., Fabunmi O.A. (2009). Effects Of Packaging Materials And Storage Temperature On Quality Of Fresh Okra (*Abelmoschus Esculentus*) Fruit. Agricultura Tropica Et Subtropica Vol. 42 (4).