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PHYSICO – CHEMICAL PROPERTIES OF MATURE GREEN TOMATOES (*LYCOPERSICON ESCULENTUM*) COATED WITH PECTIN DURING STORAGE AND RIPENING

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ABSTRACT

A study was undertaken to investigate the effect of pectin as an edible coating on the postharvest quality of mature green tomatoes at 30°C. The tomatoes were dipped in the concentrations of 1, 3 and 5% (w/v) pectin solutions for 5 min and stored at 30 ± 0.2°C. Fruits coated with 3% of pectin showed greater retention of ascorbic acid, titratable acidity and total sugars of 9.96 mg%, 0.41% and 11.2% respectively during storage. The shelf life of the tomatoes coated with 3% pectin solution increased up to 4 weeks without showing signs of decay and quality losses.

***Key words**:* Pectin, Physio-chemical quality, Self life, Skin coating, Tomatoes

INTRODUCTION

Tomato, *Lycopersicon esculentum,* (Solanaceae) is a popular vegetable in the tropics. It is grown widely in many parts of the wet, intermediate as well as some parts of the dry zone in Sri Lanka where the environmental conditions are favourable for the cultivation [A postharvest loss] of tomato in Sri Lanka is estimated at 40 - 60%, which eventually contributes to high market prices. Reduction in postharvest losses could reduce unit cost of production. Several techniques include refrigeration, modified atmosphere storage, chemical preservatives (Zhang and Quantick 1997) and packaging are being used to minimize deleterious effects. Disadvantages due to environmental concerns of these techniques used to preserve fresh-cuts and fresh fruits have created a necessity for the invention of alternative packaging techniques such as edible coatings, which is a simple environmentally friendly technique. Edible coatings are mainly composed of polysaccharides, proteins, lipids or a blend of these compounds. Coatings have the potential to reduce moisture and firmness loss, provide oxygen barrier properties, retard respiration rates, hinder solute movement, reduce metabolism, seal in flavour volatiles and improve the appearance (Arvanitoyannis and Gorris 1999). Therefore, the objectives of this study were to select the suitable concentration of pectin solution to maintain the physico – chemical properties and to extend the shelf life of the tomatoes by controlled ripening.

MATERIALS AND METHODS

Freshly harvested, uniform sized, undamaged mature green tomatoes "var. KC-1" was collected from a commercial tomato grower in Sri Lanka. After the purchase, each fruit was individually washed with cold water and with 0.5% sodium hypochlorite solution for disinfection purpose and allowed to dry at 30 ± 0.2°C. Commercially available pectin (Food Ingredient Suppliers Colombo) was used in this study. The solutions were prepared by dispersing pectin in 100ml mild warm water (40°C) whilst stirring with a magnetic stirrer (IKAMAG – RHS7) at the concentrations of 1, 3 and 5% (w/v) and allowed to homogenize, with moderate stirring until the solute were completely dissolved. After homogenization, the whole mature green tomato fruits were dipped separately for 5min into pectin solutions. Excess gel was allowed to drain off and the fruit were allowed to dry and stored in 30°C along with uncoated fruit samples in Complete Randomized Design (CRD) consisted of 15 fruits per sample with three replicates.

The treatments of the present study include;

T_1-Tomatoes without coating stored at 30°C (Control)
T_2-Tomatoes coated with 1% pectin and stored at 30°C
T_3-Tomatoes coated with 3% pectin and stored at 30°C
T_4-Tomatoes coated with 5% pectin and stored at 30°C

The physico-chemical properties of physiological weight loss, ascorbic acid, titratable acidity and total sugars of tomato were analyzed by using the recommended AOAC (2002) methods. The nutritional parameters were analyzed at different ripening stages such as Breaker, Turning, Pink, Light red and Red by using USDA colour chart (Suslow and Cantwell 2008). The samples were tested for shelf life evaluation. Observations were made daily to evaluate the spoilage, off-flavour development and decay. Data were subjected to analysis of variance and the mean differences of physico-chemical characteristics were determined by the Duncan's multiple range test at 5% significant level.

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RESULTS AND DISCUSSION

Weight loss of coated tomato fruits was relatively lower than the uncoated tomato fruits. There were significant differences ($p<0.05$) in physiological weight loss among treatments. The highest weight loss of 17.8% was observed in the tomatoes without coating whereas the lowest of 0.87% is observed in the tomatoes which were coated with 5% pectin solution. The differences of physiological weight loss between coated and uncoated tomatoes is supported by Lin and Zhao (2007) who observed that edible coatings provide an effective barrier to oxygen, carbon dioxide and water vapour transmission thus helping to alleviate the problem of moisture loss.

The ascorbic acid content increased at each stage during ripening of tomatoes. The retention of ascorbic acid is high in coated fruits at Red maturity stage than the uncoated fruits (Fig. 1). Tomatoes coated with 3% pectin solution showed the highest retention of ascorbic acid among other treatments at Red stage (9.96 %) whereas the uncoated fruits had the value of 7.72 %. This is supported by the observations of Sumnu and Bayindirli (1994) where coating reduces respiration of the fruits and retains the ascorbic acid in the fruits. They also showed that the ascorbic acid increased significantly ($p<0.05$) between the treatments at Red maturity stage except in the treatment T_4, where the tomatoes were coated with 5% pectin solution. This is due to the hydrophilic nature of polysaccharide films which provide a viscous nature and increase the respiration rate and oxidation of ascorbic acid.

In this study, titratable acidity showed a significant change ($p<0.05$) during storage which is shown in Table 1. Titratable acidity declined over the ripening stages due to the climacteric rise in respiration over the degree of ripeness and with maturity evolution where the tomatoes coated in 3% pectin stored had the lowest mean value of 0.43%. This is supported by Castro *et al.* (2005) who observed that the rate of reduction in acidity in coated fruits compared to uncoated fruits is low due to restriction of oxygen availability that leads to reduced respiration rate.

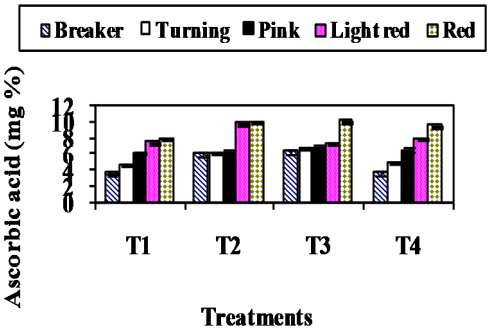

Figure 1: Changes in Ascorbic Acid Content of Pectin Coated Tomatoes at Different Ripening Stages at 30°C.

The percentage of total sugars in tomato fruits increased initially and then decreased in all coated and uncoated tomato fruits, due to the ripening and respiration of the fruits simultaneously. At the Red stage, coated fruits showed a high total sugar content than the uncoated fruits. These changes are due to the modified atmosphere created by polysaccharide coatings inside the fruit that delays ripening. But at the same time the total sugar percentage decreased between treatments 3% protein and 5% protein due to limited hydrophilic nature of polysaccharide coatings (Robertson 2006).

The number of days taken to attain Red stage showed much difference between coated and uncoated tomatoes. Studies showed that coating create a modified atmosphere inside the fruits and vegetables that delays ripening and senescence (Lin and Zhao 2007). Therefore, the coated tomatoes took 15 days to ripe at the 30°C whereas the uncoated fruits took 5 days to ripe. The shelf life of tomatoes was determined in terms of days until the peel of fruits turned to pulp and began to decay. The Uncoated fruits perished by the end of 8th day of storage. Tomatoes coated with 1 and 3% pectin coating extended the shelf life of tomato fruits to 22 and 28 days where the tomatoes coated with 5% pectin solution showed lower shelf life of 20 days and higher decay percentage than those with other treatments. Studies showed that coatings provide sufficient gas barrier for controlling gas exchange between the fresh produce and its surrounding atmosphere, which would slow down respiration and delay deterioration; but when the coatings exceeds the critical thickness they can cause detrimental effects by reducing internal oxygen concentration and increasing anaerobic fermentation (Lin and Zhao 2007).

The findings of the study showed that the tomatoes coated with the 3% pectin solution showed best results in retaining physico-chemical parameters compared to other combinations and also extended the shelf life by 4 weeks. Therefore, skin coating with 3% pectin solution and stored at 30°C was selected as the most effective and desirable

Table1: Effects of Treatments on Titratable Acidity and Total Sugars of Tomatoes at Red Stage (n=3)

Treatments	Titratable Acidity (%) *	Total Sugars (w/w %) *
Untreated control	0.88±0.02a	7.80±0.003c
1% pectin coated	0.56±0.02b	8.32±0.006b
2% pectin coated	0.43±0.02cd	11.20±0.003a
5% pectin coated	0.41±0.01d	5.97±0.006d

T* - mean ± standard error

edible coating for the commercial application of mature green tomatoes to maintain the quality attributes during storage and ripening. This technique also can be adopted as an economically feasible method compared to modified atmosphere storage which can also be used by the small holding farmers in the developing countries.

REFERENCES

AOAC 2002 Official Methods of Analysis. (17th Edn). Association of Official Analytical Chemists. Washington, USA. 8-14

Arvanitoyannis I and Gorris LGM 1999 Edible and biodegradable polymeric materials for food packaging or coating in processing foods. *In: Quality Optimization and Process Assessment.* Fernanda ARO (Ed.). CRC Press, Florida, USA. 357-371

Castro LR, Vigneault C, Charles MT and Cortez LAB 2005 Effect of cooling delay and cold-chain breakage on 'Santa Clara' tomato. *Journal of Food Agricultural Environment.* 3: 49-54

Lin D and Zhao Y 2007 Innovations in the Development and Application of Edible Coatings for Fresh and Minimally Processed Fruits and Vegetables. *Comprehensive reviews in Food Science and Food Safety.* 6: 62-63

Robertson GL 2006 Food packaging and principles (2nd Edn). Boca Raton, CRC Press, Florida, USA. 44- 45

Sumnu G and Bayindirli L 1994 Effects of Semperfresh and Johnfresh fruit coatings in post storage quality of Ankara pears. *Journal of Food Processing and Preservation.* 18: 189-199

Suslow TV and Cantwell M 2006 Tomato Recommendations for Maintaining Postharvest Quality. Department of Plant Sciences, University of California, USA. http://Produce/ProduceFacts/Veg/tomtato.shtml (accessed on 02/02/2009).

Zhang D and Quantick PC 1997 Effects of chitosan coating on enzymatic browning and decay during postharvest storage of litchi (*Litchi chinensis* Sonn.*)* fruit. *Postharvest Biology and Technology.* 12: 195-202