

# INFLUENCE OF ANTI-BROWNING INHIBITORS AND BIODEGRADABLE PACKAGING ON THE QUALITY OF FRESH-CUT PEARS

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*Pears usually are used as ingredients in the production of fresh-cut fruit salads. Fruit browning in the food industry is one of the main problems, and therefore, different anti-browning inhibitors are used to maintain the quality of fresh-cut pears. The aim of this study was to evaluate the use of Japanese quince (*Chaenomeles japonica*) juice (QJ) as an anti-browning agent for the pear (*Pyrus communis*) cultivar 'Belorusskaya Pozdnaya' and to compare its effect to that of ascorbic acid (AA) solution, which is typically used as an anti-browning agent. In addition, the effect of biodegradable packaging material on quality of treated pears during storage was assessed, in comparison with packaging in conventional polymer pouches. Diluted 20% Japanese quince juice and 1.5% ascorbic acid solution were used as inhibitors of pear browning. Produce quality during storage of fresh-cut pears for ten days using biodegradable polylactid (PLA) containers with lids and VC999 BioPack PLA films coated with a barrier of pure silicon oxide (SiO<sub>2</sub>) was compared with that using conventional packaging with polyethylene (PE) film as a control. The quality of pears during storage was estimated by changes of colour brightness value  $L^*$ , whitening index (WI), firmness (N), pH value and total soluble solid content (Brix °). The results showed that colour of fresh-cut pears was maintained better using biodegradable packaging materials and using the control anti-browning agent ascorbic acid. After nine storage days, the brightness  $L^*$  value of fresh cut pears was significantly lower when conventional packaging material (PE film pouches) and treatment with Japanese quince juice was used.*

**Key words:** ascorbic acid, Japanese quince, anti-browning, pears, biodegradable packaging.

## INTRODUCTION

In recent years the market for fresh-cut or minimally processed and chilled ready-to-eat products has grown in response to evolving consumer demand and a trend toward healthier foods (Lamikanra, 2002). The major problem is that the shelf life of these commodities is very short, usually not exceeding one to three days. Fruit processing promotes their faster physiological deterioration and biochemical changes, also microbial spoilage of the final product, which may result in a degradation of its colour, texture and flavour, even when only slight processing operations are used (O'Beirne *et al.*, 2003). The visual appearance and colour are the main characteristics that attract consumer attention and affect their choice (Barrett *et al.*, 2010).

Fresh fruit browning is one of the fundamental problems faced in fruit processing steps and is also a quality indicator for the control of fresh fruit salad during shelf life. Nevertheless, the browning caused by enzyme oxidation leads not

only to the deterioration of appearance of the products, but also to the decline of their nutritional value (Toivonen and Brummell, 2008).

Several scientists have pointed out that a major problem during storage is a decrease of fresh cut fruit firmness, which is related to action of endogenous enzymes on cell walls degradation and growth of microorganisms. The changes of fruit cell walls depend on content of protopectin and activity of enzymes like polygalacturonase, methylcellulases, cellulase and pectinase (Cheng *et al.*, 2009). During fruit cutting enzymes are released, and in the presence of oxygen they accelerate endogenous processes and cause physical reactions in the cells leading to softer structure of fruit flesh (Prasanna *et al.*, 2007; Ferreira *et al.*, 2008).

Different surface coatings, like maltodextrin, methylcellulose, Semperfresh TM made on the basis of sucrose polyesters, soy protein, pectin, gelatine, alginate, shellac, whey protein concentrate, and bee wax, of fresh-cut fruit have

been explored in various studies (Lee *et al.*, 2003; Oms-Oliu *et al.*, 2008; Oms-Oliu *et al.*, 2010). Often, in order to reach a higher efficiency of the coatings, combinations of several treatments are used (Rojas-Graü *et al.*, 2009; Olivas *et al.*, 2007). Suttirak and Manurakchinakorn (2010) in their research used ascorbic, citric and oxalic acids, which are natural anti-browning agents and generally recognized as safe (GRAS). The scientists noted that browning of fresh-cut apples and mango could be effectively eliminated using oxalic acid in combination with ascorbic acid or citric acid (Suttirak and Manurakchinakorn, 2010). Successful results were obtained in studies by Xiao *et al.* (2010) with fresh cut pears, where rosemary extract and chitosan coating in various combinations were used against enzymatic browning. That treatment reduced permeability of cell membranes and caused slower respiration of pear pieces. As a result, the treated fruits had lower weight losses, higher content of vitamin C and colour was preserved better compared to the control. Ascorbic acid is a natural component in fresh fruits and vegetables and greatly accepted as an important nutrient for human health (Pernice *et al.*, 2009). The most frequent alternative to sulphite is ascorbic acid, which is generally recognized by the U.S. Food and Drug Administration (FDA) as a safe (GRAS) antioxidant for use on fruits and vegetable to prevent browning. Ascorbic acid (L-ascorbic acid) and its various neutral salts and other derivatives have been the leading GRAS antioxidants for use on fruit and vegetables and in fruit juices, for the prevention of browning and other oxidative reactions. Ascorbic acid also acts as an oxygen scavenger, removing molecular oxygen in polyphenol oxidase reactions. Polyphenol oxidase inhibition by ascorbic acid has been attributed to the reduction of enzymatically formed *o*-quinones to their precursor diphenols (Özoglu and Bayindirli, 2002; Rojas-Graü *et al.*, 2006; Rico *et al.*, 2007; Jeong *et al.*, 2008).

Mostly various salts (sodium chlorite, acidified sodium chlorite, ascorbate, isoascorbate, citrates, chelates, calcium chloride, sodium boron, and acetylcysteine), acids (ethylene diamine tetra acetic acid, salicylic acid, cinnamic acid, ascorbic acid, citric acid, and oxalic acid compositions) or specific enzyme inhibitors (4-hexylresorcinol, glutathione, etc.) are used as anti-browning inhibitors (Rojas-Graü *et al.*, 2009; Oms-Oliu *et al.*, 2010; Gomes *et al.*, 2010). They are chemically derived inhibitors, and nowadays consumers are paying attention not only to fresh-cut product appearance and shelf life, but also critically evaluate the additives used in fruit processing for colour and texture preservation (Corbo *et al.*, 2009). Therefore, in recent years research has been focused on the study of naturally occurring inhibitors. Several studies have demonstrated the prevention of fresh-cut fruit browning by the antioxidant Natureseal® AS5, which is produced from natural substances (Abbott *et al.*, 2004; Röbke *et al.*, 2009; Krasnova *et al.*, 2012). Jeon and Zhao (2005) explored different flower origin honeys against browning processes of fresh-cut apples. The results showed that honey could be used as an anti-browning inhibitor by preserving the high quality of fresh-cut fruit. There is insufficient information about application of natural juices in

browning prevention. Perera *et al.* (2010) reported pineapple juice usage for the treatment of apples 'Granny Smith' and 'Pink Lady'. After treatment with 50% pineapple juice, polyphenol oxidase was inhibited by 30% in 'Granny Smith' and for 40% in 'Pink Lady' apple slices. Other studies showed that treatment with 20% rhubarb juice solution declines apple browning for several hours (Son *et al.*, 2000).

Another factor that must be considered in processing of fresh-cut products is the packaging. Fresh salad storage time and quality is significantly dependent on the packaging material and its barrier properties — permeability of O<sub>2</sub> and CO<sub>2</sub> (Montanez *et al.*, 2010). Packaging is an integral and determinant part of the industrial and commercial food supply chain (Platt *et al.*, 2006). Packaging materials, including biodegradable polymers, can be used to extend the shelf life extension of fresh-cut products. At present, polylactid (PLA) is the most widely used biodegradable polymer for fresh-food applications. Nowadays, new biodegradable materials have been produced with improved barrier properties, for example VC999 BioPack lidding film PLA, coated with a barrier of pure silicon oxide (Perez-Gago *et al.*, 2006). Alternatively, polylactide (PLA) containers have properties that enable their use as a substitute for commercial clamshell containers. PLA is biodegradable, recyclable, compostable, made 100% from renewable resources, approved by the Food and Drug Administration (FDA) for contact with food, and has similar physical and mechanical properties to those of Polyethylene terephthalate (PET) and oriented polystyrene (PS) (Auras *et al.*, 2004). In this work the suitability of biodegradable films as packaging materials for fresh-cut pears was addressed. In previous work, the authors explored the influence of low environmental impact packaging materials on the respiration rate of fresh fruit salad.

The objective of this research was to evaluate the use of watery Japanese quince (*Chaenomeles japonica*) juice as an anti-browning treatment source of pears and to compare its effect with the usually used anti-browning method by ascorbic acid solution. Also, the use of biodegradable packaging material to preserve quality of treated pears during storage was assessed, in comparison with that of conventional PE pouches.

## MATERIALS AND METHODS

**Materials used for experiments.** The experiments were carried out in laboratories of the Latvia State Institute of Fruit Growing in 2010. The object of the research was pear (*Pyrus communis*) of cultivar 'Belorusskaya Pozdnaya' harvested in Dobeles (Latvia State Institute of Fruit Growing) in autumn 2009. After harvesting, the fruits were stored for four months in a warehouse at temperature +41 °C and relative humidity (RH) 90%. Before experiments, the fruits were removed from the storehouse and ripened for five days at indoor temperature 18–20 °C. Before processing, the fruits were washed in running water, peeled with a sharp

stainless steel knife, cored and cut into 1–1.5 cm cubical pieces (average mass of each  $7 \pm 1$  g), and immediately for ten minutes immersed in the prepared anti-browning agent, and then dried on a sieve. Watered Japanese quince juice (QJ) and ascorbic acid (AA) solutions were used as browning inhibitors. Ascorbic acid solution (1.5%) was prepared by dissolving 1.5 g of ascorbic acid (Fluka) in 85 ml of water. Diluted Japanese quince juice (concentration 20%) was made by mixing of 20 ml natural juice and 80 ml water, following by pasteurisation at temperature  $95\text{ }^{\circ}\text{C}$  and cooling till ambient temperature  $20 \pm 2\text{ }^{\circ}\text{C}$ .

**Packaging and storage of samples.** Fresh-cut pear produce quality during storage was compared using two types of biodegradable materials — biodegradable polilactid (PLA) containers with lids and pouches composed of VC999 Bio-Pack PLA films coated with a barrier of pure silicon oxide (SiOx), and conventional packaging – polyethylene (PE) film pouches ( $185\text{ mm} \times 205\text{ mm}$ , thickness of  $65\text{ }\mu\text{m}$ ) as a control.

The treated samples ( $200 \pm 10$  g) were placed in each PE and VC999 BioPack PLA film pouches ( $185\text{ mm} \times 205\text{ mm}$ , thickness of  $50\text{ }\mu\text{m}$ ) and hermetically sealed in air ambience by a vacuum sealing machine *Faverani* MOD.350B (*Faverani, Italia*) and in sample ( $160 \pm 10$  g) were also placed in PLA containers ( $100\text{ mm} \times 80\text{ mm} \times 45\text{ mm}$ , thickness  $300\text{ }\mu\text{m}$ ) and closed by non-hermetical lids.

**Experiment design.** Samples were stored in a Commercial Freezer/Cooler at temperature  $+4.0 \pm 0.5\text{ }^{\circ}\text{C}$ , controlled by a MINILog Gresinger. During storage for nine days two packages of each treatment were removed every three days for measurement of parameters with three replicates. Features of the materials used in experiments and structure of performed experiments is shown in Figure 1.

**Physical and chemical analyses.** Colour of pear samples was measured by a CIE  $L^*a^*b^*$  colour system using a Tristimulus Colorimeter, measuring Hunter colour parameters by Colour Tec PCM/PSM. Colour values were recorded as  $L^*$  (brightness) from  $L^* = 0$  (black) through grey to  $L^* = 100$  (white);  $a^*$  (-a, greenness, +a, redness) from -a\* (green)

through grey to +a\* (red) and  $b^*$  (-b, blueness, +b, yellowness) from -b\* (blue) through grey to +b\* (yellow). The colour measurements were performed on ten fruit pieces in three replication for each and expressed as whiteness index (WI), which was calculated according to equation (1) using colour indices  $L^*$ ,  $a^*$  and  $b^*$  as suggested by Albanese:

$$WI = 100 - \sqrt{(100 - L^*)^2 + a^{*2} + b^{*2}}, \quad (1)$$

where:

$L^*, a^*, b^*$  – colour measurements of the fruit samples.

Flesh firmness (N) was determined using a digital penetrometer *TMS-PRO* (Food Technology Corporation, USA). A nozzle diameter of 4 mm, penetration depth of 6 mm and speed measurement of  $600\text{ mm min}^{-1}$  was used.

pH was determined using a pH meter 3510 (Jenway, England) according to the standard LVS EN 1132:2001 “pH Determination of Fruit and Vegetable Juice”.

Soluble solids content (Brix, °) was determined according to LVS EN 12143:2001 using a refractometer (ATAGO, Japan).

**Statistical analysis.** The results were processed by mathematical and statistical methods. Statistics for the completely randomised design were determined using the General Linear Model (GLM) procedure with SPSS 15 software package. Two-way analyses of variance ( $P \leq 0.05$ ) was used to determine significance of differences between whitening index and firmness changes of pears during storage in biodegradable and conventional packaging materials after anti-browning treatment with Japanese quince and ascorbic acid as a control.

## RESULTS

The surface brightness  $L^*$  dynamics of fresh-cut pear's treated with anti-browning agents ascorbic acid (AA) and Japanese quince juice (QJ) is represented in the Figure 2. The  $L^*$  value was influenced by the anti-browning treatment agent and differed significantly ( $P < 0.05$ ) between treatments. Pears treated with ascorbic acid were lighter in colour than those treated with Japanese quince juice (QJ). The effect of conventional PE packaging film on decrease of brightness  $L^*$  value was higher than that of the biodegradables by more than 9.0%. The difference of  $L^*$  value among investigated pear samples in biodegradable packaging after nine storage days was insignificant ( $P = 0.015$ ), while samples packed in PE film pouches and treated with Japanese quince juice became darker. The results showed that colour of fresh-cut pears during storage was better preserved using biodegradable packaging materials and the control anti-browning agent ascorbic acid.

The results of colour changes expressed as whitening index WI showed similar results as those of colour brightness  $L^*$  value dynamics (Fig. 2). Significant differences in WI value

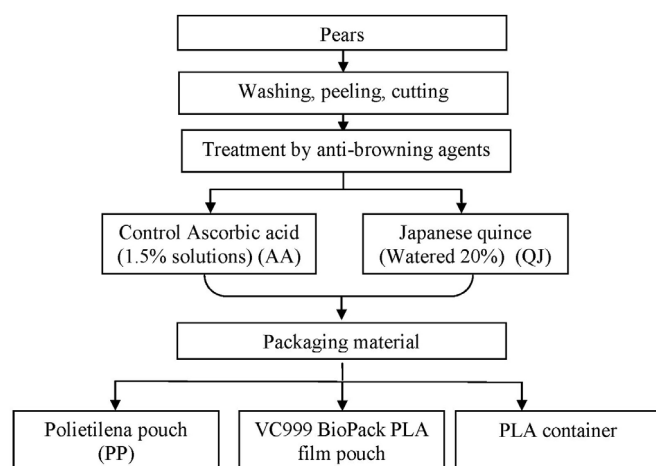


Fig. 1. The scheme of performed experiment.

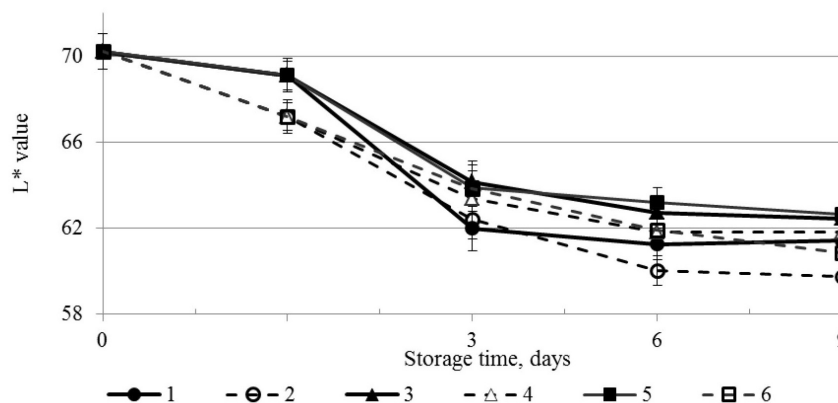


Fig. 2. Colour brightness value  $L^*$  of fresh-cut pears during storage in different packaging materials: 1, packaging in PE pouches (AA); 2, packaging in PE pouches (QJ); 3, packaging in PLA containers (AA); 4, packaging in PLA containers (QJ); 5, packaging in VC999 BioPack PLA film pouches (AA); 6, packaging in VC999 BioPack PLA film pouches (QJ).

did not differ between pear samples packed in VC999 Bio-Pack PLA film pouches (AA) and in PLA containers (AA). The WI value of fresh cut pears after nine storage days when packed in conventional packaging material (PE film pouches) treated by Japanese quince juice was significantly lower ( $P < 0.05$ ) (Fig. 3). Better results in browning inhibition during storage were obtained using ascorbic acid (AA) and packaging in biodegradable PLA containers and VC999 BioPack PLA film pouches. The WI value of pear samples treated with Japanese quince juice and stored for nine days in PE film pouches significantly differed from all other samples ( $P = 0.029$ ).

Firmness during storage significantly depended on storage time ( $P < 0.05$ ). The flesh firmness of the investigated pear samples gradually decreased during storage for nine days. Before treatment, the firmness of fresh-cut pear cubes was on average  $18.4 \pm 1.9$  N (Fig. 4). Firmness of pears during

storage differed between treatments. The least change in firmness of pears was observed for in both biodegradable material packaging treatments and was similar for both anti-browning solutions (average 7.3% for pears treated with Japanese quince juice and 7.9% for those treated with ascorbic acid). A larger decrease of firmness decrease was observed when pears were stored in PE film pouches: 19.0% when treated with Japanese quince juice and 19.3% when treated with ascorbic acid.

Acidity can act on respiration processes of fresh-cut fruits. Analysis of variance indicated that pH of pear samples somewhat increased during storage and at the end of storage slightly differed between packaging material treatment ( $P < 0.05$ ). Increase of pH of samples in PE film packaging was slightly higher (4.59 (AA) and 4.61 (QJ) to 4.94) than in samples stored in biodegradable packaging (4.82 to 4.85) (Table 1).

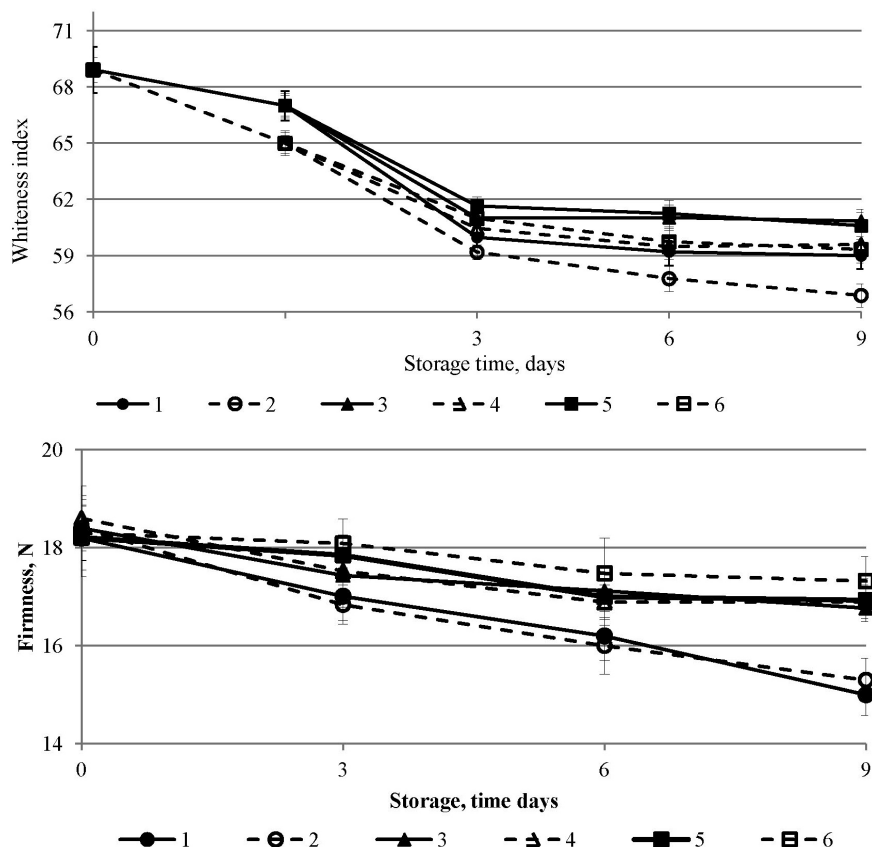


Fig. 3. Whiteness index of fresh-cut pears during storage in different packaging materials: 1, packaging in PE pouches (AA); 2, packaging in PE pouches (QJ); 3, packaging in PLA containers (AA); 4, packaging in PLA containers (QJ); 5, packaging in VC999 BioPack PLA film pouches (AA); 6, packaging in VC999 BioPack PLA film pouches (QJ).

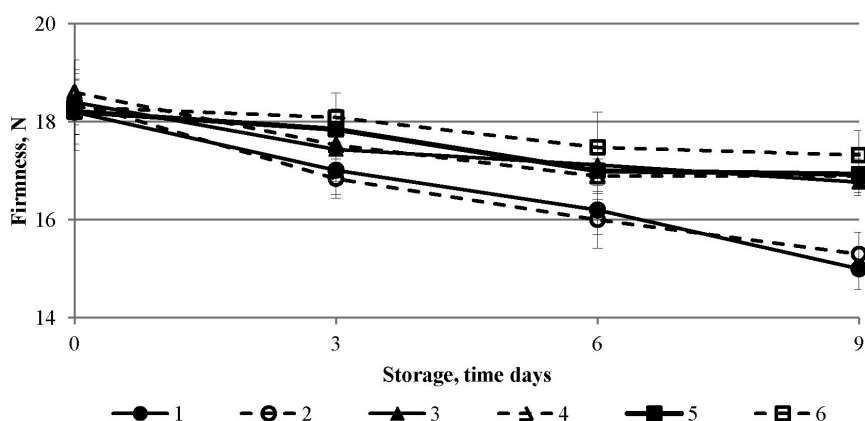


Fig. 4. Firmness of fresh-cut pears during storage in different packaging materials: 1, packaging in PE pouches (AA); 2, packaging in PE pouches (QJ); 3, packaging in PLA containers (AA); 4, packaging in PLA containers (QJ); 5, packaging in VC999 BioPack PLA film pouches (AA); 6, packaging in VC999 BioPack PLA film pouches (QJ).



Table 1

pH VALUE OF FRESH-CUT PEARS DURING STORAGE IN DIFFERENT PACKAGING MATERIALS

Samples	Storage time, days			
	0	3	6	9
1***	12.54* ± 0.36 <sup>b**</sup>	11.93 ± 0.18 <sup>c</sup>	11.84 ± 0.23 <sup>a</sup>	11.75 ± 0.17 <sup>b</sup>
2	12.44 ± 0.32 <sup>a</sup>	11.85 ± 0.21 <sup>b</sup>	11.75 ± 0.42 <sup>a</sup>	11.66 ± 0.20 <sup>a</sup>
3	12.54 ± 0.36 <sup>b</sup>	12.09 ± 0.22 <sup>d</sup>	12.05 ± 0.2 <sup>c</sup>	11.97 ± 0.22 <sup>d</sup>
4	12.44 ± 0.32 <sup>a</sup>	12.01 ± 0.28 <sup>d</sup>	11.93 ± 0.17 <sup>b</sup>	11.84 ± 0.18 <sup>c</sup>
5	12.54 ± 0.36 <sup>b</sup>	11.73 ± 0.11 <sup>a</sup>	11.83 ± 0.15 <sup>a</sup>	11.81 ± 0.31 <sup>c</sup>
6	12.44 ± 0.32 <sup>a</sup>	12.1 ± 0.26 <sup>d</sup>	12.05 ± 0.27 <sup>c</sup>	11.88 ± 0.20 <sup>c</sup>

\*Each value is the mean of 12 determinations, ±SD, (n = 12). \*\*Values, marked with the same letter in a column, are not significantly different at  $P < 0.05$ . \*\*\*1, packaging in PE pouches (AA); 2, packaging in PE pouches (QJ); 3, packaging in PLA containers (AA); 4, packaging in PLA containers (QJ); 5, packaging in VC999 BioPack PLA film pouches (AA); 6, packaging in VC999 BioPack PLA film pouches (QJ).

Table 2

TOTAL SOLUBLE SOLID CONTENT (Brix, °) OF FRESH-CUT PEARS DURING STORAGE IN DIFFERENT PACKAGING MATERIALS

Samples	Storage time, days			
	0	3	6	9
1	4.59 ± 0.02 <sup>a</sup>	4.78 ± 0.01 <sup>a</sup>	4.92 ± 0.01 <sup>a</sup>	4.94 ± 0.02 <sup>c</sup>
2	4.61 ± 0.01 <sup>b</sup>	4.79 ± 0.01 <sup>ab</sup>	4.92 ± 0.10 <sup>a</sup>	4.94 ± 0.02 <sup>c</sup>
3	4.59 ± 0.01 <sup>a</sup>	4.79 ± 0.03 <sup>ab</sup>	4.83 ± 0.01 <sup>b</sup>	4.85 ± 0.01 <sup>b</sup>
4	4.61 ± 0.02 <sup>b</sup>	4.78 ± 0.02 <sup>ab</sup>	4.84 ± 0.00 <sup>c</sup>	4.85 ± 0.02 <sup>b</sup>
5	4.59 ± 0.02 <sup>a</sup>	4.79 ± 0.01 <sup>ab</sup>	4.83 ± 0.00 <sup>b</sup>	4.79 ± 0.01 <sup>a</sup>
6	4.61 ± 0.01 <sup>b</sup>	4.8 ± 0.01 <sup>c</sup>	4.82 ± 0.00 <sup>b</sup>	4.84 ± 0.01 <sup>b</sup>

\*Each value is the mean of 12 determinations, ±SD, (n = 12). \*\*Values, marked with the same letter in a column, are not significantly different at  $P < 0.05$ . \*\*\*1, packaging in PE pouches (AA); 2, packaging in PE pouches (QJ); 3, packaging in PLA containers (AA); 4, packaging in PLA containers (QJ); 5, packaging in VC999 BioPack PLA film pouches (AA); 6, packaging in VC999 BioPack PLA film pouches (QJ).

The total soluble solid contents of fresh-cut pears packed in various packaging materials are presented in Table 2. Total soluble solid content slightly decreased in all studied samples on average by about 12.5 to 11.8 Brix°.

## DISCUSSION

The intensity of fresh-cut fruit browning usually is described by the value of colour parameter  $L^*$  and whiteness index (WI). It was noted that both colour brightness value  $L^*$  and Whiteness index (WI) equally describe the changes in fresh-cut apple colour. Substantial colour changes mostly occur during the first days of storage (Mao *et al.*, 2007; Lu *et al.*, 2007).

In the last few years, the use of PLA as a packaging material has increased in Europe, Japan, and the United States, mainly in the area of fresh produce (Arvanitoyannis and Kasaveti, 2007). Reduced respiration rate leads to lower en-

zymatic browning reactions (Rodriguez-Aguilera and Oliveira, 2009; Sandhya, 2011). Similar results were obtained by scientists of Latvia when testing fresh-cut apple pieces treated with 5% solution of Natureseal® AS5 (Krasnova *et al.*, 2012). Perera *et al.* investigated the combined effect of high pressure processing (HPP) treatment and pineapple juice prevention of enzymatic browning of fresh cut Granny Smith and Pink Lady apples (Perera *et al.*, 2010). For both apple varieties the samples treated with the highest concentration of pineapple juice 50% and the longest HPP treatment time 5 min had the lowest  $\Delta E$  and the least browning score after 5 h of air exposure. A non-volatile organic acid in pineapple juice was the major inhibitor of enzymatic browning in apple products (Perera *et al.*, 2010; Dong *et al.*, 2000). Pineapple juice, pineapple shell extract and rice bran extract have been used as banana anti-browning agents (Theerakulkaita and Sukhonthara, 2008). The  $L^*$  value of banana slice treated with rice bran extract was not significantly higher than that treated with Pineapple juice and both had ability to reduce browning values in the banana slices.

Decrease of flesh firmness was found (Xiao *et al.*, 2010) following anti-browning treatment of cut pears with rosemary extract, chitosan and their combinations. During 3-day storage the firmness of treated pears decreased from 5.5 to 7.3%. This decrease is related with ripening processes in storage, when the cell structure of flesh firmness is changed due to reactions of polysaccharide hydrolysis (Prasanna *et al.*, 2007; Ferreira *et al.*, 2008).

The increase of pH can be explained by increased breathing intensity after peeling and slicing of fruits (Rocha and Morais, 2003). The organic acids along with other compounds take part in respiration, and as a result the total content of acids decreases and pH value increases (Bico *et al.*, 2009).

The observed decrease of total soluble content in all studied samples was caused by physiological and biochemical processes that accelerated after fresh fruit peeling and cutting. Organic acids, pectin substances and other sugars participating in these reactions stimulate the decrease of soluble solids during storage (Rocha and Morais, 2003). However, the content of soluble solids in the fresh cut-pears during the experiment did not vary throughout storage and were not significantly influenced by time, packaging material and anti-browning treatment agent ( $P > 0.05$ ). These results are in accordance with those found by Soliva-Fortuny *et al.* (2002).

The results of this study showed that colour of fresh-cut pears was better maintained using biodegradable packaging materials and by the control anti-browning agent ascorbic acid. Following nine storage days, the brightness  $L^*$  value of fresh cut pears was significantly lower in the treatment with conventional packaging material (PE film pouches) and Japanese quince juice.

The treatment of fruits by diluted Japanese quince (*Chaenomeles japonica*) juice provided higher firmness after

treatment. The least change of firmness was observed for pears packed in both biodegradable materials with either anti-browning solution, while a considerably greater decrease of pear firmness was observed in the PE film pouch treatment.

pH of pear samples somewhat increased during storage and at the end of storage slightly differed among packaging material treatments, while total soluble solid content slightly decreased in all samples.

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## PRETBRŪNĒŠANAS INHIBITORU UN BIODEGRADĒJAMO IEPAKOJUMU IETEKME UZ SVAIGI GRIEZTU BUMBIERU KVALITĀTI

Grieztu augļu kvalitatīvo īpašību saglabāšanai realizācijas laikā tiek izmantoti pretbrūnēšanas apstrādes līdzekļi — inhibitori. Iepakojums ir neatņemama sastāvdaļa pārtikas produktu ražošanas un mārketinga procesos. Pētījums veikts Latvijas valsts augļkopības institūtā 2010. gadā. Pētījuma mērķis bija novērtēt pretbrūnēšanas inhibitoru apstrādes efektivitāti (20% krūmcidoniju sulas) salīdzinājumā ar 1.5% askorbīnskābes šķīduma (kontroles) un novērtēt biodegradējamo iepakojuma materiālu ietekmi uz apstrādāto grieztu bumbieru kvalitāti uzglabāšanas laikā, salīdzinot ar tradicionālo parasto iepakojumu — polietilēna (PE) maisiņiem. Biodegradējamie polilaktīda (PLA) konteineri ar vākiem un VC999 BioPack PLA plēves, ar silīcija oksīda barjeru (SiOx) izmantotas grieztu bumbieru iepakojšanai, bet kontroles paraugs iepakots PE plēves maisiņos. Pētījuma laikā kontrolēta bumbieru kvalitāte, krāsa, cietība, pH, šķīstošās sausas satur. Bumbieri (*Pyrus communis*) 'Belorusskaja Pozdnaja' nomizoti, sagriezti gabaliņos (1–1.5 cm) desmit minūtes mērcēti inhibitoru šķīdumos (1.5% askorbīnskābes šķīdumā, 20% krūmcidoniju sulas ūdens atšķaidījumā). Augļu gabaliņi notecināti, iepakoti PE plēves maisiņos, biodegradējamie iepakojumos: VC999 BioPack PLA maisiņos un PLA kārbīnās. Paraugi uzglabāti +4 ± 1 °C temperatūrā deviņas dienas. Pētījuma rezultāti rāda, ka krāsa labāk saglabājusies svaigi grieztajiem bumbieriem biodegradējamā materiāla iepakojumos, kā arī pēc apstrādes ar 1.5% askorbīnskābes šķīdumu. L\* vērtība svaigi grieztajiem bumbieriem pēc deviņu dienu uzglabāšanas bija būtiski zemāka parastajos PE plēves maisiņos pēc apstrādes ar 20% krūmcidoniju sulu.