

**SELECTIVE DESSIMINATION OF INFORMATION (SDI)
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GENERAL

CONSUMER PREFERENCE

Sporleder, E.M., et. al. 2014. **Consumer preferences** for sustainability produced bananas a discrete choice experiment. Int'l Food Agribusiness Mgt. Review. 17(1): 59 – 82.

Abstract

Even though sustainability has become an omnipresent mega-trend, very little related research has been done in Europe. The objective of the present paper is to discover consumers' perceptions concerning sustainably produced bananas. To this end, 316 German consumers participated in a discrete choice experiment and filled in a questionnaire. The results confirm that trust in the standard setter plays a particularly important role for the success of a label. Generally there is need for further simplification and information.

Keywords: /Consumer Preference/ /Banana/

PHYTOPATHOGENIC FUNGI

Quintero-Cereon, J.P., et. al. 2014. In vitro fungistatic activity of ethanolic extract of propolis against postharvest **phytopathogenic fungi** Preliminary assessment. Acta Hort. 1016: 157 – 162.

Abstract

A study was conducted to evaluate the fungistatic activity of a sample of Colombian propolis. The crude matrix was extracted with ethanol (96% v/v); the thus obtained ethanolic extract of propolis (EEP) was centrifuged, concentrated at low pressure and used to determine its effect on the mycelial growth of economically important phytopathogenic fungi (*Aspergillus niger*, *Penicillium* sp., *Rhizopus oryzae* and *Botrytis cinerea*) with the poisoned food technique on potato dextrose agar. The results, expressed as the median effective concentration of emulsified propolis extract, indicated that *A. niger* was the most susceptible fungus (0.09% w/v), followed by *Penicillium* sp. (0.42% w/v), *R. oryzae* (0.53% w/v) and *B. cinerea* (1.09% w/v). From the obtained information, it may be concluded that EEP had a suppressing effect on pathogen growth of the above-mentioned fungi. Consequently, EEP may have the potential to be used alone or in combination with others procedures as an alternative source of antifungal agents for the protection of plants and highly perishable fruits and vegetables during the crop and postharvest stages.

Keywords: /Phytopathogenic Fungi/ /Ethanol/

POSTHARVEST BIOLOGY

Pech, J.C. and A. Latche. 2014. New trends in **postharvest** molecular **biology** and biotechnology. Acta Hort. 1016: 23 – 32.

Abstract

This paper aims at giving the new trends in the area of molecular biology and biotechnology of fruit ripening. Fruit ripening is viewed as a genetically programmed process corresponding to the expression of ripening-related genes. Among the ripening-related genes some are involved in the biochemical changes occurring during the ripening process, others in the biosynthesis of hormones and signalling and others in the regulation of transcription. Post-harvest biotechnology has consisted in up- or down-regulating the expression of endogenous genes so as to modify the ripening process and understand the function of the gene in vivo. It has also consisted in introducing foreign genes in order to bring new characters. In the recent years post-harvest biology has entered into the “omics” period with the development of high throughput technologies such as transcriptomics, proteomics and metabolomics that require the use of bio-informatics methods. The sequencing of a number of fruit genomes has also been performed that give new and powerful tools for the molecular biologist, geneticist and physiologists.

Keywords: /Postharvest Biology/ /Biotechnology/

FRUITS

ASAI

Diaz, R.O., et. al. 2014. Stages of **asia** (*Euterpe precatoria* Mart.) fruits harvested at different maturity stages. Acta Hort. 1016: 137 – 140.

Abstract

Asai is a tropical palm widely distributed in the Amazon and its fruits have a high antioxidant capacity and are also a source of dietary fiber and bioactive compounds. The generation of asai value chains demands the standardization of fresh fruit quality for processing and the establishment of a postharvest system that allows quality preservation and offers regulation. In order to evaluate fruit quality trait evolution during postharvest storage, asai fruits from the Guaviare Department (Colombia) were collected in three successive maturity stages: green, half-ripe and ripe; and stored at 20±2°C. Respiration rate, ethylene production, fresh weight loss and skin color were measured daily. Weight loss increased as time passed, reaching more than 10% on day 6 of storage with no significant difference between the maturity stages. Ethylene production was not detected, nevertheless, skin color changed from green to purple and the respiratory rate increased (lower production in green fruits), suggesting a climacteric pattern.

Keywords: /Asai/ /Maturity Stages/

AVOCADO

Pedreschi, R., et. al. 2014. Metabolomics analysis of postharvest ripening heterogeneity of 'Hass' avocados. *Postharvest Biol. Technol.* 92: 172 – 179

Abstract

The complex physiology of 'Hass' avocado renders its postharvest ripening heterogeneous and unpredictable. Several approaches have previously been undertaken to broaden our understanding of the causes of this postharvest ripening heterogeneity but without much success. In this study, a fruit biopsy methodology was undertaken to sample mesocarp tissue from a series of individual avocado fruit while following individual fruit postharvest ripening characteristics without significantly disturbing their metabolism. Using both targeted and untargeted metabolomics approaches, we analyzed the metabolite profiles of the biopsies in order to get more insight into the biochemical mechanisms underlying 'Hass' avocado ripening heterogeneity. While C7 sugars (mannoheptulose and perseitol), dry matter and total Ca²⁺ were not correlated with time to reach edible ripeness, untargeted metabolomics profiling of polar and semi-polar compounds (based on GC–MS and LC–MS platforms), revealed several metabolites, mainly amino acids, that were related to ripening heterogeneity. In addition, analysis of fatty acids revealed linoleic acid to be differentially accumulating. In general, slowest ripening avocados had lower amounts of precursors of metabolites involved in key metabolic pathways. Our study indicates that comprehensive metabolomics may provide new markers for avocado ripening stage at harvest, and may give more insight into the complex ripening physiology of this fruit.

Keywords: /Avocado/ /Postharvest/ /Ripening/

BANANA

Huang, H., et. al. 2014. The combined effects of phenylurea and gibberelins on quality maintenance and shelf life extension of banana fruit during storage. *Scientia Hort.* 167: 36 – 42.

Abstract

The combined effects of phenylurea (CPPU) and gibberellins (GA3) on quality maintenance and shelf life extension of harvested banana fruit were investigated. Banana fruit were treated with 10 mg L⁻¹ CPPU in combination with GA3 at 25, 50 or 100 mg L⁻¹ and then stored under ambient conditions (23 ± 2 °C and 75–90% relative humidity). The results exhibited that the combined treatments of CPPU and GA3 significantly suppressed fruit softening in association with the delayed peaks of respiration and ethylene production rates and retarded decreases of hue value and the maximal chlorophyll fluorescence (Fv/Fm) of banana fruit during storage. Furthermore, the accumulation of soluble reducing sugars and losses in contents of ascorbic acid and total phenols were delayed. The most beneficial effect of quality maintenance and shelf life extension of postharvest banana fruit was obtained by application of 10 mg L⁻¹ CPPU and 50 mg L⁻¹ GA3. These results clearly indicated that the combined treatment of CPPU and GA3 could contribute to ripening inhibition, shelf life extension and quality maintenance of banana fruit during storage.

Keywords: /Banana/ /Quality/ /Shelf Life/

Wu, B., et. al. 2014. Impact of postharvest nitric oxide treatment on antioxidant enzymes and related genes in **banana** fruit in response to chilling tolerance. *Postharvest Biol. Technol.* 92: 157 – 163.

Abstract

Banana fruits harvested at the mature green stage were treated with $60 \mu\text{L L}^{-1}$ nitric oxide (NO) for 3 h at 22°C , and then stored at $7 \pm 1^\circ\text{C}$ with 90% RH for 15 days. The results showed that the application of NO at $60 \mu\text{L L}^{-1}$ was most effective in reducing chilling injury in banana fruit. The treatment reduced increases in electrolyte leakage and malondialdehyde content, and delayed increases in both superoxide anion ($\text{O}_2\bullet^-$) production rate and H_2O_2 content. Fruit treated with NO exhibited higher activities of superoxide dismutase (SOD), catalase (CAT), peroxidase (POD), and ascorbate peroxidase (APX), and significantly higher expression of MaSOD, MaCAT, MaPOD and MaAPX genes than control fruit during storage. These results indicate that NO treatment might enhance chilling tolerance of banana fruit via improving the activities of antioxidant enzymes and inducing the expression of antioxidant-related genes.

Keywords: /Banana/ /Chilling/

CITRUS

Moscoso-Ramirez, P.A. and L. Palou. 2014. Effect of ethylene degreening on the development of postharvest penicillium molds and fruit quality of early season **citrus** fruit. *Postharvest Biol. Technol.* 91: 1-8.

Abstract

The effect of commercial degreening with ethylene gas on fruit susceptibility and quality and development of postharvest green (GM) and blue (BM) molds on early season citrus fruit was investigated. Each cultivar was harvested with different peel color indexes (CI). Fruit were exposed for 3 d to $2 \mu\text{L L}^{-1}$ ethylene at 21°C and 95–100% RH before or after artificial inoculation with *Penicillium digitatum* or *Penicillium italicum*. Control fruit were kept at the same environmental conditions without ethylene. Fruit were stored at either 20°C for 7 d or 5°C for 14 d and disease incidence (%) and severity (lesion diameter) were assessed. No significant effect of commercial degreening was observed on fruit susceptibility to both GM and BM on citrus cultivars inoculated after degreening. Likewise, no significant effect was observed on disease incidence on citrus cultivars inoculated before degreening and stored at either 20°C for 7 or 5°C for 14 d. In contrast, in cultivars like ‘Clemenules’ mandarins and ‘Navelina’ oranges, degreening significantly increased the severity on fruit with higher initial CI (–3.6 and 1.7, respectively). GM and BM severity on degreened and control ‘Clemenules’ mandarins incubated at 20°C for 7 d was 146 and 118 mm and 56 and 46 mm, respectively. In general, commercial degreening did not significantly affect external and internal quality attributes of citrus cultivars. Commercial degreening after inoculation of less green (more mature) fruit showed a trend to increase mold severity, presumably through an aging effect (acceleration of peel senescence).

Keywords: /Citrus/ /Ethylene/

GOOSEBERRY

Garzon-Acosta, C.P., et. al. 2014. Deficiencies of phosphorus, calcium and magnesium affect the postharvest quality of cape **gooseberry** (*Physalis peruviana* L.) fruits. Acta Hort: 1016: 83 – 88.

Abstract

The cape gooseberry is an exotic tropical fruit and, nowadays, is the second most exported fruit from Colombia. Therefore, the high demand for quality necessitates the search for a better understanding of fruit behavior. Furthermore, postharvest quality properties play an important role in meeting consumer demands. The cape gooseberry fruits were developed under plastic greenhouse conditions with plants maintained in 25 L plastic pots filled with quartz sand and irrigated with a nutrient solution lacking phosphorus (P), magnesium (Mg) and (Ca) as compared with the complete control solution. The fruits were stored at 1°C (cold storage, 91% relative humidity [RH]) or 19°C (room temperature, 68% RH) for a period of 30 days in order to test the chemical, physical and sensory changes, evaluating fruits every 3 days. One hundred grams of fruit with calyx were packed in fruit baskets and covered with a vinipel plastic film. At the beginning of storage, the control fruits reached the highest fresh weight; the fruit cracking was higher in the Mg-deficient fruits, with 11.30%, than in the Ca-deficient and P deficient fruits with only 0.79 and 0.10%, respectively. Supposedly, in the cape gooseberry, Mg²⁺ is very important for maintaining pectic acids as insoluble in the cell wall, even more so than calcium. During storage, the fruits deficient in P showed the greatest losses of fresh weight. The fruits stored at room temperature showed the highest values of total titratable acidity (TTA), while the total soluble solids (TSS) lower compared to the fruits kept in the cold storage (1°C). Because of this behavior, the maturity index (TSS/TTA) was higher in fruits stored at 1°C. In the sensory evaluation, the fruits of the control, maintained at 19°C, were better in appearance and color, while those kept at 1°C had better taste (aroma and flavor). The fruits stored at this low temperature and lacking in Mg showed good aroma and flavor, but those deficient in P and Ca were less acceptable. Although the Mg deficient fruits had a better taste than the P- and Ca-deficient ones, their appearance was not well accepted by the sensorial panelists. P-deficiency constrained the physical, chemical and sensory quality of the cape gooseberry fruits, as reflected in the lowest values for most of the studied variables.

Keywords: /Gooseberry/ /Postharvest Quality/

JUJUBE

Zhang, S. and N. Li. 2014. Effects of carbon monoxide on quality, nutrients and antioxidant activity of post-harvest **jujube**. J. Sci. Food Agric. 94(5): 1013 – 1019.

Abstract

BACKGROUND: To effectively extend the shelf life of fresh jujube, carbon monoxide (CO), as a small molecular gas, was applied to fumigate fresh jujube. The quality and antioxidant activity of jujubes fumigated with carbon monoxide at concentrations of 0 (control), 5, 10, 20 and 40 μmol L⁻¹ for 1 h under ambient temperature were investigated. **RESULTS:** The jujube fumigated with 10 μmol L⁻¹ CO showed the best preserving effect amongst all samples. At 30 days, the decay incidence of jujube fumigated with 10 μmol L⁻¹ CO is only two-thirds of that of control sample; its red index and weight loss rate were 22.8% and 19.4% lower, and its firmness, soluble solids content (SSC) and acidity were 18.7%, 5.4% and 12.2% higher than that of control samples, respectively. Its vitamin C and total flavonoid contents were also

the highest. However, no significant difference in total polyphenol content was found. The jujubes treated with $10\mu\text{mol L}^{-1}$ CO exhibited the highest antioxidant activity in terms of reducing power and 2,2-diphenyl-1-(2,4,6-trinitrophenyl) hydrazyl radical scavenging activity. However, the jujubes fumigated with $40\mu\text{mol L}^{-1}$ CO showed inferior characteristics compared with the control sample. CONCLUSION: Fumigating jujubes with proper concentration of CO probably is a potential novel method for post-harvest jujube preservation in the future.

Keywords: /Jujube/ /Carbon Monoxide/ /Antioxidant/

KIWIFRUIT

Burdon, J., et. al. 2014. Postharvest performance of yellow-fleshed 'Hort16A' **kiwifruit** in relation to fruit maturation. *Postharvest Biol. Technol.* 92: 98 – 106.

Abstract

Postharvest performance of fruit is dependent on the maturity or physiological state of the fruit at harvest in conjunction with the postharvest management applied. For yellow-fleshed kiwifruit, the flesh colour is a significant quality attribute, and for 'Hort16A', flesh colour has been used for timing harvest. Variability in the postharvest performance of 'Hort16A' kiwifruit suggests that flesh colour alone is not as strongly indicative of postharvest performance as soluble solids content (SSC) was found to be for 'Hayward' kiwifruit 30 years ago. The postharvest performance of 'Hort16A' kiwifruit, assessed as the fruit firmness and chilling injury expression during storage, has been associated with a range of fruit characteristics: flesh colour, SSC, firmness, seed colour, fresh weight, dry matter, starch and soluble carbohydrates measured at harvest throughout maturation. The changing responses of the fruit SSC to temperature, and softening to ethylene, have also been determined. The data illustrate the complex nature of 'Hort16A' fruit maturation, even when looking only at simple, easy-to-measure fruit attributes. While a yellow flesh colour is a commercial necessity for 'Hort16A' kiwifruit, flesh colour is not a robust indicator of postharvest performance and is not tightly linked to SSC or firmness. Changes in the capacity of fruit to respond to temperature or ethylene are not reflected in on-vine changes. Softening in storage is strongly linked to the softening rate occurring on the vine at the time of harvest. Any association between at-harvest characteristics and chilling susceptibility is less clear, and chilling tolerance appears more associated with the completion of growth and carbohydrate accumulation than with increased soluble solids accumulation rates as in 'Hayward'. Approaches to extend the understanding of the link between maturation, harvest indices and postharvest performance are discussed.

Keywords: /Kiwifruit/ /Maturation/

LIME

Jonglertjunya, W., et. al. 2014. Properties of lignin extracted from sugarcane bagasse and its efficacy in maintaining postharvest quality of **limes** during storage. *LWT - Food Sci. Technol.* 57: 116 – 125.

Abstract

Lignin extracts from sugarcane bagasse by alkaline extraction in the presence and absence of ethanol were investigated for their efficacy on maintaining fresh fruit shelf life. For lignin extraction, the highest yield was obtained from 40% (w/w) NaOH extraction in water. Addition of ethanol gave

relatively lower yield of lignin but less hemicellulose contamination. FT-IR intensity of lignin-to-carbohydrate transmittance ratios of extracted lignin from 40% (w/w) NaOH in distilled water were similar to the ratios of lignin standard from Kraft process. From gel permeation chromatography (GPC), lignin isolated from 40% (w/w) NaOH in distilled water yielded high amount of both large and small molecules of lignin. The weight loss ratio between lignin and hemicellulose was analyzed by thermogravimetric analysis (TGA). It was confirmed that isolated lignin from 40% (w/w) NaOH in distilled water contained highest amount of hemicellulose in lignin extract. The test of coating formulas on limes demonstrated that coating solutions of 0.8% (w/w) xanthan gum and 1.5% (w/w) extracted lignin from 40% (w/w) NaOH had potential to maintain weight loss and color change. This coating formula also exhibited higher antifungal activities. Limes coated with extracted lignin showed higher antifungal activity than limes coated with commercial lignin.

Keywords: /Limes/ /Sugarcane/ /Lignin/ /Quality/

LONGAN

Chen, Yihui, et.al. 2014. *Phomopsis longanae* Chi-induced pericarp browning and disease development of harvested **longan** fruit in association with energy status. *Postharvest Biol. & Technol.* 93. 24 – 28.

Abstract

The effects of *Phomopsis longanae* Chi infection on browning development and disease incidence in relation to energy status in pericarp of harvested longan fruit were investigated. Longan fruit were inoculated for 5 min with *P. longanae* at 10^4 spores mL⁻¹, while fruit dipped in sterile deionized water were used as control. These fruits were stored at $(28 \pm 1)^\circ\text{C}$ and 90% relative humidity for up to five days. The results showed that the browning index, disease incidence, cellular membrane permeability and AMP content increased but the contents of ATP and ADP, and energy charge decreased in pericarp of longan fruit infected by *P. longanae*. It was suggested that *P. longanae* infection caused energy deficiency in longan fruit, possibly resulting in accelerated senescence and decreased resistance to pathogen, and thus promoted browning development and disease occurrence.

Keywords: /Longan/ /Browning/ /Disease/

Saengnil, K., et. al. 2014. Use of chlorine dioxide fumigation to alleviate enzymatic browning harvested 'Daw' **longan** pericarp during storage under ambient conditions. *Postharvest Biol. Technol.* 91: 49 – 56.

Abstract

Pericarp browning reduces both the shelf-life and market value of harvested longan fruit stored at room temperature. Our study investigated the efficiency of chlorine dioxide (ClO₂) fumigation at reducing pericarp browning of longan (*Dimocarpus longan* Lour.) cv. Daw. Fresh longan fruit were fumigated with 0 (control), 2.5, 5, 10 and 25 mg/L ClO₂ for 10 min, before being packed in cardboard boxes, and stored at $25 \pm 1^\circ\text{C}$, RH $82 \pm 5\%$ for 7 days. Fruit treated with ClO₂ had a lower browning index, but higher hue angle (true color), L* (lightness) and b* (yellowness) values than non-treated fruit. The 10 and 25 mg/L ClO₂ treatments were the most effective at extending shelf-life from 1 to 5 days, compared with the control, by reducing pericarp browning, the activities of polyphenol oxidase (PPO) and peroxidase (POD), disease development and by maintaining the highest total phenolic content.

However, quality acceptance of fruit treated with 10 mg/L ClO₂ was higher than fruits treated with 25 mg/L, as determined by odor and flavor. Consequently, ClO₂ fumigation at a concentration of 10 mg/L was considered to be the most effective treatment to reduce pericarp browning of longan, whilst maintaining fruit quality.

Keywords: /Longan/ /Enzymatic Browning/ /Pericarp/

MELON

Lignou, S., et. al. 2014. Sensory and instrumental analysis of medium and long shelf-life Charentais cantaloupe melons (*Cucumis melo* L.) harvested at different maturities. Food Chem. 148: 218 – 229.

Abstract

The flavour profiles of two genotypes of Charentais cantaloupe melons (medium shelf-life and long shelf life), harvested at two distinct maturities (immature and mature fruit), were investigated. Dynamic headspace extraction (DHE), solid-phase extraction (SPE), gas chromatography–mass spectrometry (GC–MS) and gas chromatography–olfactometry/mass spectrometry (GC–O/MS) were used to determine volatile and semi-volatile compounds. Qualitative descriptive analysis (QDA) was used to assess the organoleptic impact of the different melons and the sensory data were correlated with the chemical analysis. There were significant, consistent and substantial differences between the mature and immature fruit for the medium shelf-life genotype, the less mature giving a green, cucumber character and lacking the sweet, fruity character of the mature fruit. However, maturity at harvest had a much smaller impact on the long shelf-life melons and fewer differences were detected. These long shelf-life melons tasted sweet, but lacked fruity flavours, instead exhibiting a musty, earthy character.

Keywords: /Melon/ /Cantaloupe/ /Shelf Life/

ORANGE

Moscoso-Ramirez, P.A. and L. Palou. 2014. Preventive and curative activity of postharvest potassium silicate treatments to control green and blue molds on orange fruit. Eur. J. Plant Pathol. 138: 721 – 732.

Abstract

Preventive and curative antifungal activities of postharvest treatments with potassium silicate (PSi) against green (GM) and blue (BM) molds were evaluated on oranges (cvs. 'Valencia' or 'Lanelate') artificially inoculated in rind wounds with *Penicillium digitatum* and *P. italicum*, respectively. The most effective Psi concentration, the effect of fungal inoculum concentration, and the influence of temporal and spatial factors on antifungal activity were assessed in in vivo primary screenings. After 6 days of incubation at 20°C, significant preventive (treatment before fungal inoculation) and curative (treatment after inoculation) activities against GM and BM were observed with PSi at 90 mM (GM and BM incidence reductions of 23 and 52 %, and 23 and 40 %, respectively). In preventive tests, the effectiveness of PSi was influenced by inoculum concentration (10³, 10⁴, 10⁵, or 10⁶ spores ml⁻¹), but not by the distance between treatment and inoculation sites (10, 20 or 30 mm). PSi applied about 2 h before inoculation showed higher preventive activity than applied before 24, 48 or 96 h. In order to determine the best dip

treatment conditions, PSI at 90 mM was tested at 20 or 50°C for 60 or 150 s in small-scale trials with 'Lanelate' oranges artificially inoculated before or after the treatment and incubated for 7 days at 20°C. Dips at 20 °C for 60 s were selected and subsequently applied on inoculated 'Valencia' oranges stored at 5°C and 90 % RH for up to 6 weeks. Curative postharvest dips effectively reduced the incidence and severity of both GM and BM during cold storage, while preventive dips significantly reduced the severity but not the incidence. Overall, postharvest PSI treatments showed potential as a new tool to be part of non-polluting strategies to control penicillium decay of citrus fruit.

Keywords: /Orange/ /Postharvest/ /Green Moulds/

Velasquez, M.A., et. al. 2014. Effect of edible, fungistatic coating on the quality of 'Valencia' **orange** during storage and marketing. Acta Hort. 1016: 163 – 170.

Abstract

Generally, citrus fruits are waxed in the postharvest stage to restore the natural wax removed in the washing procedure and to improve the appearance of the fruit, providing luster. Nowadays, in Colombia, the waxes employed in this step of citrus fruits are imported, which represents a high cost for producers and marketers. On the other hand, the citrus industry generates about 50,000 tons of waste annually just in the coffee region of Colombia, which is undervalued and put to limited use. In this regard, an edible coating, based on pectin and essential oils, would be a solution to the under-utilization of the waste and the import of waxes and would also provide a safe product for consumers and reduce the impact on the environment. In this study, the effect of an edible coating (EC) made of pectin and essential oils on the postharvest quality of 'Valencia' oranges was evaluated. The fungistatic activity of the coat was evaluated at 0.5, 1.0, and 1.5% of essential oils (EO) in fruits inoculated with *Penicillium* sp. in three conditions of storage: direct marketing, cold storage and USA quarantine simulation. The EC at 1% of EO was also applied in a commercial packing line of citrus and studied after different storage conditions. The EC with 1.5% of EO extended the shelf life of the fruits at 23°C with a controlled decay of 83%. Nevertheless, at low temperatures, there was no control of the fungus, as with the other commercial waxes studied. The EC did not affect the internal fruit quality in a detrimental way, although the control of weight loss must be improved. In general, the EC could be applied in a commercial packing line and the fruits could be stored for 1 week at 25°C with an acceptable weight loss and for 2 weeks at 7°C plus 7 days at 25°C with a weight loss control of 0.9%.

Keywords: /Orange/ /Edible Coating/ /Quality/

PAPAYA

Yeoh, W.K., A. Ali and C.F. Forney. Effects of ozone on major antioxidants and microbial populations of fresh-cut **papaya**. Postharvest Biol. Technol. 89: 56 – 58.

Abstract

The problems that are usually associated with fresh-cut commodities are the rapid depletion of nutritional value and the presence of high microbial populations. Ozone is a strong oxidant that can elicit physiological, chemical and microbial changes in fresh produce. Therefore, fresh-cut papaya was treated with ozone ($9.2 \pm 0.2 \mu\text{L/L}$) at 10, 20 and 30 min to investigate its effect on phytochemicals and microbial load. Following a 20 min ozone treatment, the total phenolic content of fresh-cut papaya increased by

10.3% while the ascorbic acid content decreased by 2.3% compared to that of untreated control fruit. Also, gaseous ozone reduced microbial counts being more effective on coliforms (0.39–1.12 log 10 CFU/g) than on mesophilic (0.22–0.33 log 10 CFU/g) bacteria. The results suggest that microbial populations on fresh-cut papaya can be reduced without depleting its major antioxidants except for ascorbic acid when subjected to $9.2 \pm 0.2 \mu\text{L/L}$ gaseous ozone for 20 min.

Keywords: /Papaya/ /Fresh-cut/ /Antioxidants/

PEAR

Helena Gomes, M. et. al. 2014. Polyphenoloxidase activity and browning in fresh-cut 'Rocha' **pear** as affected by pH, phenolic substrates, and antibrowning additives. *Postharvest Biol. Technol.* 91: 32 – 38.

Abstract

The effect of pH, phenolic substrates, and food additives on polyphenoloxidase (PPO) activity and on tissue browning was studied in fresh-cut 'Rocha' pear. Substrates 4-methylcatechol, caffeic acid, (+)-catechin hydrate, catechol, chlorogenic acid, dopamine hydrochloride, and pyrogallol, were prepared in citric acid-phosphate buffer at pHs ranging from 3.0 to 8.0. pH optima for PPO activity depended on the phenolic substrate. Activity was optimal at pH 5.0 for catechol and 4-methylcatechol; pH 6.0 for chlorogenic acid; pH 7.0 for dopamine, caffeic acid, and catechin; and pH 8.0 for pyrogallol. Discrepancies were observed between the pH dependency of PPO activity and browning, as assessed by objective color measurement. Significant correlations were obtained between enzyme activity and metric-hue difference (ΔH^*) over the pH range 3.0–8.0 for four of the eight phenolics. Chlorogenic acid, the main PPO substrate in 'Rocha' pear, induced high tissue browning but very low PPO activity at pH 3.0–4.0. Chemical inhibition of PPO was tested using catechol as substrate, and buffer solutions containing 250 mM Ca^{2+} in four salts (ascorbate, chloride, lactate and propionate), 57 mM ascorbic acid, 61 mM N-acetyl-L-cysteine and 3 mM 4-hexylresorcinol. PPO inhibition by additives was affected by the pH of the buffer, and was more effective with ascorbic acid, N-acetyl-L-cysteine and calcium ascorbate. It was concluded that inferences on tissue browning based on PPO activity can be misleading. Measurement of tissue color is proposed as a reliable means to assess the antibrowning effectiveness of additives and the pH of additives for cut pear should be corrected to reduce the browning potential.

Keywords: /Pear/ /Polyphenoloxidase Activity/ /Browning/

Ochoa-Velasco, C.E. and J.A. Guerrero-Beltran. Postharvest quality of peeled prickly **pear** fruit treated with acetic acid and chitosan. *Postharvest Biol. Technol.* 92: 139 – 145.

Abstract

White (*Opuntia albicarpa*) and red (*Opuntia ficus-indica*) prickly pears were peeled and submerged in chitosan solutions containing different concentrations of acetic acid (1.0 or 2.5%) to obtain ready-to-eat prickly pear products. Some physicochemical (pH, total soluble solids, color, weight loss, and firmness), antioxidant (phenolic compounds and antioxidant activity), microbiological (aerobic mesophile bacteria and yeasts plus molds), and sensory (color, firmness, aroma, flavor, and overall acceptance) characteristics were assessed during 16 d of storage at $4 \pm 1^\circ\text{C}$ and $85 \pm 5\%$ of relative humidity. Chitosan coating containing 1.0% of acetic acid delayed weight loss, maintained firmness and

color of white prickly pear during the storage time. Most of the sensory values for white prickly pear coated with chitosan containing 1.0 and 2.5% of acetic acid were higher than those obtained for uncoated fruit. Red prickly pear coated with chitosan with 2.5% acetic acid did not maintain its sensory quality throughout 16 d of storage. Chitosan coating with 1 and 2.5% acetic acid did not affect phenolics content and antioxidant activity in white prickly pears; however, an increase of these compounds was observed in red prickly pears. Microbe populations were unchanged in white prickly pears (<10 CFU g⁻¹) and slightly increased in red prickly pears (10–500 CFU g⁻¹) coated with chitosan during the entire storage time.

Keywords: /Pear/ /Chitosan/ /Quality/ /Postharvest/

Rizzolo, A., M. Grassi and M. Vanoli. 2014. 1-Methylcyclopropene application, storage temperature and atmosphere modulate sensory quality changes in shelf-life of 'Abbe' Fétel pears. *Postharvest Biol. Technol.* 92: 87 – 97.

Abstract

'Abbé Fétel' is the most important pear cultivar in Italy but is susceptible to superficial scald and soft scald during storage, the former is effectively prevented by 1-methylcyclopropene (1-MCP) treatment at harvest and by dynamic controlled atmosphere (DCA). However, 1-MCP at –0.5°C prevents pear ripening, and DCA can favor the appearance of soft scald, specially after long storage. The aim of this research was to study the sensory profiles of 1-MCP treated (SmartFresh™, 300 nL L⁻¹) and untreated 'Abbé Fétel' pears after 20 and 28 weeks of storage at –0.5°C and 1°C in normal air (NA), controlled atmosphere(CA) and DCA and up to 7 days of post-storage shelf-life at 20°C, and their relationships with mechanical characteristics of the pulp (firmness, stiffness and energy-to-rupture) and sugar (SSC) and acids (TA) content. During storage and shelf-life, untreated fruit softened, more at 1°C than at –0.5°C, and to a greater extent after 28 weeks of storage, while 1-MCP treated pears on average showed higher values of firmness, stiffness and energy-to-rupture than untreated fruit, independently of storage time and days of shelf-life. Mechanical properties of the pulp were positively correlated with sensory firmness and negatively with juiciness, sweetness and aroma, the three descriptors positively correlated with overall acceptability. Cluster analysis carried out on sensory scores separately for 20 and 28 weeks samples underlined that, within either untreated or 1-MCP treated samples, similar sensory profiles could be obtained in response to the diverse combinations of storage atmosphere, storage temperature and day of shelf-life. The most preferred sensory profile (juicy, not grainy, sweet, aromatic, quite sour and less astringent) was obtained for untreated pears after 20 weeks storage at –0.5°C in CA, independently of time of shelf-life and in NA and DCA after 4 and 7 days of shelf-life, as well as in DCA pears stored at 1°C after 4 and 7 days of shelf-life. In contrast, the worst sensory characteristics (grainy, not firm, not juicy, not sweet, not sour, very astringent and not aromatic) distinguished untreated pears after 28 weeks storage at 1°C in NA. After 20 weeks storage, the two sensory profiles of 1-MCP treated fruit were both characterized by firm texture associated with graininess but differing for the flavor description, and were less preferred by the assessors. After 28 weeks storage it was possible to distinguish the sensory profile of 1-MCP treated pears stored at –0.5°C after 4 and 7 days of shelf-life, from that of 1-MCP treated pears stored at 1°C after 3 days of shelf-life. Both profiles were characterized by a firm/quite grainy texture but differed for flavor, the former being less sweet, less sour, less astringent and less aromatic than the latter.

Keywords: /Pear/ /Shelf Life/ /Sensory Quality/

POMEGRANATE

Barman, K., et. al. 2014. Influence of putrescine and carnauba wax on functional and sensory quality of pomegranate (*Punica granatum* L.) fruits during storage. J. Food Sci. & Technol. 51(1): 111 – 117.

Abstract

Functional properties (anthocyanins, antioxidant, ascorbic acid and tannin) and sensory score were determined in pomegranate fruits at two storage temperatures (3 and 5 °C) after treatment with 2 mM putrescine and 1 : 10 carnauba wax (carnauba wax : water). The treatments (putrescine and carnauba wax) were given by immersion method followed by storage up to 60 days. Both treatments retained significantly higher anthocyanins, antioxidant, ascorbic acid, tannin and sensory qualities as compared with control fruits under both the storage conditions. Combined application of putrescine + carnauba wax showed better response in retaining functional properties than putrescine treated or nontreated fruits. The impacts of putrescine and carnauba wax treatments were found more pronounced after 30 days at 3-5 °C storage temperature in retaining functional and sensory qualities. After 60 days of storage, putrescine + carnauba wax retained about 25% higher antioxidant activity both at 3 and 5 °C storage temperatures.

Keywords: /Pomegranate/ /Sensory Quality/ /Storage/

Selcuk, N. and M. Erkan. 2014. Changes in antioxidant activity and postharvest quality of sweet pomegranates cv. Hicrannar under modified atmosphere packaging. Postharvest Biol. Technol. 92: 29 – 36.

Abstract

The effects of different modified atmosphere packaging (MAP) on antioxidant compounds and storage quality of 'Hicrannar' sweet pomegranates were investigated during long term storage. Pomegranates were harvested at the commercial harvest stage and packed in two different types of MAP (MAP1 and MAP2). After packaging, all fruit were stored at 6°C and 90–95% RH for 120 days, then removed from storage for different quality analyses. Some fruit were kept at 20°C for 3 days to simulate a period of shelf-life. Fruit weight loss, decay index, skin color, total titratable acidity, total soluble solids content, total phenolics, total anthocyanins and antioxidant activity were determined. Internal atmospheres created by the MAP were periodically assessed during cold storage, and CO₂ concentrations increased and O₂ concentrations decreased inside the MAP. MAP significantly reduced weight loss after both 120 days of cold storage and shelf-life. MAP2 was the most effective packaging in reducing weight loss. Storage of pomegranates in MAP also reduced decay and the decay index, and maintained visual appearance compared to control fruit. During storage, a decrease in L* and C* values and an increase in h° values were observed in all treatments. However, fruit stored in MAP2 had higher L*, C* and lower h° values than in other treatments. Titratable acidity and total soluble solids decreased after cold storage and shelf-life, and no significant differences among treatments were found. Total phenolics, total anthocyanin contents and antioxidant activity increased during the storage period in control fruit.

Keywords: /Pomegranate/ /Modified Atmosphere Packaging/ /Antioxidant/

STONEFRUIT

Paladines, D., et. al. 2014. The addition of rosehip oil improves the beneficial effect of Aloe vera gel on delaying ripening and maintaining postharvest quality of several stonefruit. Postharvest Biol. Technol. 92: 23 – 28.

Abstract

In this work Aloe vera gel (AV) alone or with the addition of 10 or 2% rosehip oil was used as fruit edible coatings in a wide range of *Prunus* species and cultivars: peaches ('Roma' and 'B-424-16' flat type), plums ('Red Beauty' and 'Songria'), nectarine ('Garofa') and sweet cherry ('Brooks'). Following treatments, fruit were stored at 20°C for 6 days and analysed for the effect of treatments on fruit ripening and quality parameters compared with uncoated fruit (control). The addition of the rosehip oil to AV gel reduced respiration rate in all fruit, and ethylene production in the climacteric ones (peaches, plums and nectarine). In addition, all the parameters related with fruit ripening and quality, such as weight loss, softening, colour change and ripening index, were also delayed in treated compared with control fruit, the effect being generally higher when rosehip oil was added to AV, and especially in those fruit that exhibited the highest ethylene production rates ('Roma' and flat type peaches). Although the highest effect was obtained with AV + rosehip oil at 10%, the sensory panel detected an excess of gloss and oiliness on the fruit surface, which was considered as a negative attribute. Thus, 2% rosehip oil added to AV could be used as an innovative postharvest tool to increase the beneficial effect of AV as an edible coating, especially in climacteric fruit showing high ethylene production rates.

Keywords: /Stone fruit/ /Aloe Vera/ /Delayed Ripening/ /Quality/

STRAWBERRY

Aday, M.S. and C. Caner. 2014 Individual and combined effects of ultrasound, ozone and chlorine dioxide on strawberry storage. LWT - Food Sci. Technol. 57: 344 – 351.

Abstract

The objectives of this study were to determine the effectiveness of ultrasound and the chemical sanitizers ozone and chlorine dioxide, alone and in combination, on strawberry storage life. Fruits were treated with 0.075 mg/L ozone, 6 mg/L chlorine dioxide and ultrasound at 30 Watt, combination of ultrasound plus ozone and combination of ultrasound plus chlorine dioxide for 5 min and stored for up to 4 weeks at 4°C. All treatments inhibited mold growth during storage. However, individual ozone treatment causes bleaching of the fruit. Ultrasound treatments with ozone and chlorine dioxide were more beneficial for quality factors such as pH, total soluble solids, electrical conductivity and texture compared with the individual treatment or untreated fruit. Also, nondestructive near infrared spectroscopy in transmission and reflectance modes gave promising results for evaluating the sugar and water content of the fruit. Overall our findings suggest that combinations of ultrasound plus ozone and chlorine dioxide could be used for prolonging shelf life of strawberries.

Keywords: /Strawberry/ /Storage/

Peretto, G., et. al. 2014. Increasing strawberry shelf-life with carvacrol and methyl cinnamate antimicrobial vapors released from edible films. Postharvest Biol. Technol. 89: 11 – 18.

Abstract

The effect of carvacrol and methyl cinnamate vapors incorporated into strawberry puree edible films on the postharvest quality of strawberry fruit (*Fragaria × ananassa*) was investigated. Fresh strawberries were packed in clamshells and kept at 10°C for 10 days with 90% RH. Strawberry puree edible films, applied in the clamshell, served as carriers for the controlled release of natural antimicrobial compounds without direct contact with the fruit. Changes in weight loss, visible decay, firmness, surface color, total soluble solids content, total soluble phenolics content and antioxidant capacity of strawberries during storage were evaluated. A significant delay and reduction in the severity of visible decay was observed in fruit exposed to antimicrobial vapors. Carvacrol and methyl cinnamate vapors released from the films helped to maintain firmness and brightness of strawberries as compare to the untreated strawberries. The natural antimicrobial vapors also increased the total soluble phenolics content and antioxidant activity of fruit at the end of the storage period.

Keywords: /Strawberry/ /Edible Film/ / Shelf Life/

SWEET CHERRY

Taghadomi-Saberi, S., et. al. 2014. Evaluating potential of artificial neural network and neuro-fuzzy techniques for estimating antioxidant activity and anthocyanin content of **sweet cherry** during ripening by using image processing. J. Sci. Food Agric. 94: 95 – 101.

Abstract

BACKGROUND: This paper presents a versatile way for estimating antioxidant activity and anthocyanin content at different ripening stages of sweet cherry by combining image processing and two artificial intelligence (AI) techniques. In comparison with common time-consuming laboratory methods for determining these important attributes, this new way is economical and much faster. The accuracy of artificial neural network (ANN) and adaptive neuro-fuzzy inference system (ANFIS) models was studied to estimate the outputs. Sensitivity analysis and principal component analysis were used with ANN and ANFIS respectively to specify the most effective attributes on outputs. **RESULTS:** Among the designed ANNs, two hidden layer networks with 11-14-9-1 and 11-6-20-1 architectures had the highest correlation coefficients and lowest error values for modeling antioxidant activity ($R=0.93$) and anthocyanin content ($R=0.98$) respectively. ANFIS models with triangular and two-term Gaussian membership functions gave the best results for antioxidant activity ($R = 0.87$) and anthocyanin content ($R = 0.90$) respectively. **CONCLUSION:** Comparison of the models showed that ANN outperformed ANFIS for this case. By considering the advantages of the applied system and the accuracy obtained in somewhat similar studies, it can be concluded that both techniques presented here have good potential to be used as estimators of proposed attributes.

Keywords: /Sweet Cherry/ /Antioxidant/ /Ripening/

Wang, Y. and L.E Long. 2014. Respiration and quality responses of **sweet cherry** to different atmospheres during cold storage and shipping. Postharvest Biol. Technol. 92: 62 – 69.

Abstract

Most sweet cherries produced in the US Pacific Northwest and shipped to distant markets are often in storage and transit for over 3 weeks. The objectives of this research were to study the effects of sweet cherry storage O₂ and CO₂ concentrations on the respiratory physiology and the efficacy of modified atmosphere packaging (MAP) on extending shelf life. Oxygen depletion and CO₂ formation by 'Bing' and 'Sweetheart' cherry fruit were measured. While respiration rate was inhibited linearly by reduced O₂ concentration from 21% to 3–4% at 20°C, it was affected very little from 21% to ~10% but declined logarithmically from ~10% to ~1% at 0°C. Estimated fermentation induction points determined by a specific increased respiratory quotient were less than 1% and 3–4% O₂ for both cultivars at 0 and 20°C, respectively. 'Bing' and 'Sweetheart' cherry fruits were packaged (~8 kg/box) in 5 different commercial MAP box liners and a standard macro-perforated polyethylene box liner (as control) and stored at 0°C for 6 weeks. MAP liners that equilibrated with atmospheres of 1.8–8.0% O₂+ 7.3–10.3% CO₂ reduced fruit respiration rate, maintained higher titratable acidity (TA) and flavor compared to control fruit after 4 and 6 weeks of cold storage. In contrast, MAP liners that equilibrated with atmospheres of 9.9–14.4% O₂+ 5.7–12.9% CO₂ had little effect on inhibiting respiration rate and TA loss and maintaining flavor during cold storage. All five MAP liners maintained higher fruit firmness (FF) compared to control fruit after 6 weeks of cold storage. In conclusion, storage atmospheres of 1.8–14.4% O₂+ 5.7–12.9% CO₂ generated by commercial MAP, maintained higher FF, but only the MAP with lower O₂ permeability (i.e., equilibrated at 1.8–8.0% O₂) maintained flavor of sweet cherries compared to the standard macro-perforated liners at 0°C. MAP with appropriate gas permeability (i.e., equilibrated at 5–8% O₂ at 0°C) may be suitable for commercial application to maintain flavor without damaging the fruit through fermentation, even if temperature fluctuations, common in commercial storage and shipping, do occur.

Keywords: /Sweet Cherry/ /Quality/ /Cold Storage/

TABLE GRAPES

Balic, Ivan, et.al. 2014. Biochemical and physiological study of the firmness of table grape berries. *Postharvest Biol. & Technol.* 93: 15 – 23.

Abstract

Firmness is an essential quality parameter of table grapes (*Vitis vinifera*) for consumers, with grape bunches that contains soft berries less preferred, resulting in a reduction in the market price. The softening of grape berries has been commonly associated with cell walls, especially the disassembly of pectic polysaccharides. However, the process of berry softening is not completely understood. To investigate the softening process of grape berries, we compared the Thompson Seedless variety, which suffers significant economic losses due to fruit softening, and NN107, a new variety with a significantly higher level of berry firmness. The composition of the cell wall during the berry development of these two grape varieties was compared. NN107 berries had a greater amount of calcium and uronic acids in the cell wall material than Thompson Seedless grapes, suggesting a special role for calcium formation in NN107. Additionally, polyacrylamide carbohydrate electrophoresis (PACE) analysis suggested differences between these varieties in pectin structure. Thompson Seedless grapes showed increased pectolyase hydrolysable site dynamics in the cell wall material and higher polygalacturonase activity than NN107. Immunohistochemistry focusing on the pectin structure confirmed the roles of both calcium bridge formation and cell wall integrity as they relate to a firmer grape berry phenotype.

Keywords: /Table Grape/ /Firmness/

Feliziani, E., et. al. 2014 Application of low concentrations of ozone during the cold storage of **table grapes**. Postharvest Biol. Technol. 93: 38 – 48.

Abstract

The control by ozone of postharvest decay of table grapes, caused by *Botrytis cinerea* and other pathogens, was evaluated in chambers and commercial storage facilities. Ozone at 0.100 $\mu\text{L/L}$ or higher inhibited the spread of gray mold among stored grapes. Ozone diffusion into many types of commercial packaging was measured. Boxes made of uncoated paper corrugate inhibited diffusion more than those composed of coated paper corrugate, plastic corrugate, hard plastic, or expanded polystyrene. Internal packaging of hard plastic clamshell containers inhibited diffusion less than low density polyethylene cluster bags. Atmospheres of 0.100 $\mu\text{L/L}$ ozone in the day and 0.300 $\mu\text{L/L}$ at night reduced the natural incidence of gray mold by approximately 65% after 5–8 weeks of storage. Its effectiveness to control postharvest decay was compared to sulfur dioxide fumigation. After 68 days at 1°C the incidence of gray mold among grapes stored in air, ozone, or with weekly sulfur dioxide fumigation was 38.8%, 2.1%, and 0.1%, respectively. However, decay by other fungi, such as *Alternaria* spp. and *Penicillium* spp., was controlled by sulphur dioxide, but not by ozone. In some tests, rachis appearance was moderately harmed by ozone. The combination of ozone use in storage following a single initial sulfur dioxide fumigation, or its use in between biweekly sulfur dioxide fumigations, controlled both gray mold and other pathogens and matched the commercial practice of initial and weekly sulfur dioxide fumigation. The use of both gases in this way reduced sulfur dioxide use greatly. Differences in flavor of grapes treated with ozone were not detectable compared to those stored in air, and grapes treated with ozone were preferred over those treated with sulfur dioxide.

Keywords: /Table Grapes/ /Cold Storage/

Harindra Champa, W.A., et. al. 2014. Postharvest treatment of polyamines maintains quality and extends shelf-life of **table grapes** (*Vitis vinifera* L.) cv. Flame Seedless. Postharvest Biol. Technol. 91: 57 – 63.

Abstract

Investigations were carried out to verify the potential of putrescine and spermidine as a postharvest dip treatment for maintaining quality and extending storage life of table grapes (*Vitis vinifera* L.) cv. Flame Seedless during the 2012 and 2013 seasons. Grape clusters were manually harvested at the commercial mature stage and were dipped in different concentrations (0.0, 0.5, 1.0 and 1.5 mM) of putrescine and spermidine, and then stored at 3–4°C, and 90–95% RH. Evaluation of physicochemical parameters and other fruit quality attributes were made at 0 day (before treatment) and at 30, 45, 60 and 75 days of storage. Putrescine and spermidine at the lowest dose (0.5 mM) effectively maintained berry firmness, peel colour (L^* , C^* , h°) and stabilized anthocyanins as well as suppressing the activity of pectin methyl esterase and reducing the rate of electrolyte leakage. The polyamines also retarded the degradation of TSS and TA while maintaining higher total phenol content and reduced decay incidence. Putrescine and spermidine at 1.0 mM exhibited almost similar effects with a 0.5 mM dose. The highest doses (1.5 mM) of both polyamines showed detrimental effects, especially on weight loss, decay incidence, rachis browning and organoleptic properties, as found in the control group, which was commercially acceptable only up to 45 days. Furthermore, analysis of linear

regressions and correlations showed that many quality parameters were interdependent. The postharvest dip treatment of spermidine or putrescine at a dose of 0.5 mM for 5 min could be an effective means for prolonging storage and increasing shelf-life of 'Flame Seedless' grapes.

Keywords: /Table Grapes/ /Polyamines/ /Shelf Life/

Teles, C.S., et. al. 2014. Prestorage application of high carbon dioxide combined with controlled atmosphere storage as a dual approach to control *Botrytis cinerea* in organic 'Flame Seedless' and 'Crimson Seedless' **table grapes**. Postharvest Biol. Technol. 89: 32 – 39.

Abstract

Pre-storage application of 40% CO₂ at 0°C for 24 or 48 h and controlled atmosphere (12% O₂+ 12% CO₂) storage at 0°C for up to eight weeks on decay control and quality of organic 'Flame Seedless' and 'Crimson Seedless' table grapes were studied as a postharvest disease control alternative. To simulate different potential field conditions, these organic treatments were applied to organic-grown grapes that were naturally infected (without inoculation), surface inoculated (berries inoculated by spraying with a conidia suspension), and nesting inoculated (clusters inoculated by placing in the middle an artificially infected berry) with the pathogen *Botrytis cinerea*, the cause of grape gray mold. Under these three conditions, a 40% CO₂ for 48 h pre-storage treatment followed by controlled atmosphere reduced the gray mold incidence from 22% to 0.6% and from 100% to 7.4% after four and seven weeks, respectively. High CO₂ pre-storage alone limited botrytis incidence in both naturally and artificially infected grapes, but was more effective when combined with CA. These treatments did not affect visual or sensory fruit quality. Exposure to high CO₂ for 24 or 48 h effectively inhibited mycelial growth of *B. cinerea* in PDA plates incubated at 22°C for up to 72 h. Conidia germination in PDA plates was reduced ~60% after 12 h incubation. In vitro studies demonstrated a fungistatic effect, but further studies on the mechanism of action could improve treatment performance. This novel high CO₂ initial fumigation followed by controlled atmosphere during storage or transportation could be a commercially feasible alternative for postharvest handling of organic and conventional table grapes. Our results encourage validating this combined physical treatment in other cultivars and under commercial conditions.

Keywords: /Table Grapes/ /Carbon Dioxide/ /Controlled Atmosphere/

TAMARIND

Mohammed, M. 2014. Quality Indices of ripe Spanish **tamarind** (*Vangueria edulis* [Vahl] Vahl) fruits. Acta Hort. 1016: 131 – 134.

Abstract

Studies were conducted from 2008-2010 to investigate the physical and chemical attributes of Spanish tamarind fruits that were ripened at 20 and 30°C. Ripe fruits had a yellowish brown skin colour accompanied with a soft spongy pulp which had a similar colour. The typical acidic flavour of the fruit pulp was associated with a relatively low total soluble solid (TSS) of 3.0-3.1%, total titratable acidity (TTA) of 2.24-2.48 g/100 g, TSS: TTA of 1:1.3, pH of 3.4 and vitamin C content of 1.84 mg/100g. Visible evidence of fruit senescence was noticeable as sporadic white masses of fungal growth on the fruit skin which seldom penetrated the skin to affect the pulp.

Keywords: /Tamarind/ /Quality/

HERBS AND SPICES

GREEN CHILLI

Chitravathi, K., O.P. Chauhan and P.S. Raju. 2014. Postharvest shelf-life extension of green **chillies** (*Capsicum annuum* L.) using shellac-based edible coatings. *Postharvest Biol. Technol.* 92: 146 – 148.

Abstract

Shellac-based coatings were developed in combination with starch, EDTA and sodium alginate and were evaluated for shelf-life extension of fresh green chillies during storage at ambient temperature (26 ± 2 °C, RH $68 \pm 4\%$) for 12 days. The developed composite coatings were found to be effective in extending the shelf-life of chillies. The control samples showed a higher weight loss (12.35%) compared to coated ones (5.60-6.90%). The coated samples showed significantly ($p < 0.05$) higher retention of ascorbic acid, firmness and chlorophyll content, whereas, total phenolic content was found to be significantly ($p < 0.05$) higher in uncoated samples after 12 days of storage. Shellac-sodium alginate based coating was found to be the most effective in maintaining the quality of fresh green chillies during ambient storage as compared to other coatings.

Keywords: /Green Chilli/ /Edible Coating/ /Shelf Life/

HOT PEPPER

Mohammed, M., L. Wilson and P. Gomes. 2014. Occurrence, manifestation and alleviation of chilling injury of **hot peppers** (*Capsicum chinense* L.). *Acta Hort.* 1016: 89 – 94.

Abstract

Hot pepper fruits were sealed-packaged in 0.035 mm thick micro-perforated and sealed high density polyethylene bags (HDPE) at 5, 10, 20 and 30°C in separate storage rooms and examined at 5, 10, 15, 20 and 25-day intervals for marketable quality, chilling injury, bioelectrical resistance (BER), electrolyte leakage (EL), in-package and in-fruit carbon dioxide and ethylene concentrations and percentage decay-free fruits. Fruits packaged in micro-perforated bags stored best at 10°C with the level of decay-free fruits at 96.1% after 25 days. Incipient chilling injury without visible symptoms after short storage periods at 5°C was detected both by reduced BER and increased EL but the former measurement was more sensitive in detecting chilling injury than the latter. Changes in both measurements reflected changes in membrane permeability.

Keywords: /Pepper/ /Chilling Injury/

RED BELL PEPPER

Alexandre, E.M.C., et. al. 2013. Impact of non-thermal technologies and sanitizer solutions on microbial load reduction and quality factor retention of frozen **red bell peppers**. *Innov. Food Sci. & Technol.* 17: 99 – 105.

Abstract

The effect of non-thermal technologies (ozone in aqueous solution, ultrasounds and ultraviolet C radiation) and washings with chemical solutions (sodium hypochlorite and hydrogen peroxide) on *Listeria innocua* survival was studied in red bell peppers. Quality attributes such as total colour difference, firmness, pH and ascorbic and dehydroascorbic acid content were also evaluated. The treatments were applied before product storage under frozen conditions (-7 and -30 °C). Pre-washings with hydrogen peroxide solutions allowed obtaining frozen shred red bell peppers with lower microbial loads, when compared to the results obtained with the remaining treatments. However, those washings had a negative impact on colour and firmness. Alternatively, ozonation provided microbial reductions significantly higher than water-washings and improved, or at least allowed to preserve, all quality parameters analysed under both storage conditions. Storage at -7 °C provided higher microbial reductions in red bell peppers. However, this temperature implied higher colour alterations and ascorbic acid losses. Industrial relevance: The native microbial flora of fresh fruits and vegetables may include pathogens which are dangerous threats to consumers. Thermal treatments are conventionally used to attain safety standards; however, overall quality may be negatively affected by heat. Chemical treatments (environmental friendly) or non-thermal processes such as ozone, UV-C radiation and ultrasonication are promising technologies. From an industrial point of view, these processes may have potential application if safe and high quality produce is to be attained.

Keywords: /Red Bell Pepper/ /Quality/

ROSEMARY

Scollard, J., et. al. 2014. Chemical basis of anti-listerial effects of rosemary herb during stomaching with fresh-cut vegetables. 57: 16 – 21.

Abstract

Fresh rosemary herb has demonstrated much stronger anti-listerial effects when stomached with contaminated fresh-cut vegetables than those obtained by application of rosemary essential oils. Various types of rosemary extracts (hydrodistillates, CO₂ extracts, hexane/acetone extracts) were analysed by GC eMS and tested for anti-listerial effects in vitro. Principal component analysis showed that verbenone levels were most correlated with anti-listerial effects, followed by levels of camphor. Stomaching rosemary herb greatly increased headspace levels of verbenone and camphor (by up to 20 times) compared to intact or chopped fresh rosemary. It is speculated that by crushing the herb under water, stomaching released enhanced levels of these components as lipophilic nanosomes which rapidly migrated to lipophilic surfaces, including the membranes of *Listeria* cells.

Keywords: /Rosemary/ /Anti-listerial Effect/

ORNAMENTALS

GERBERA

de Witte, Y., H. Harkema and W.G. van Doorn. Effect of antimicrobial compounds on cut **Gerbera** flowers: Poor relation between stem bending and numbers of bacteria in the vase water. *Postharvest Biol. Technol.* 91: 78 – 83.

Abstract

Gerbera flowers (*Gerbera jamesonii*) often show stem bending. In four cultivars (Tamara, Liesbeth, Cora, and Mickey), we tested the effects on bending of antimicrobial compounds (chlorine bleach, a slow release chlorine compound, 8-hydroxyquinoline citrate [HQC], silver nitrate, carvacrol and thymol), some combined with sugars. At concentrations used for other cut flowers, inclusion in the vase solution of several of the antimicrobial compounds delayed bending, had no effect, or hastened bending. Hastening of bending was found at higher concentrations. It was accompanied with visible damage on the stem ends. Results with HQC indicated high toxicity as it did not delay bending at any of the concentration tested (100–400 mg L⁻¹). At 200 mg L⁻¹ HQC induced growth of bacteria that were not found in the controls. The number of bacteria in the vase water showed a low correlation with bending. Visible toxicity on the stem surface was often associated with a high bacteria count. However, at relatively high concentrations of the antimicrobial compounds stem bending was associated with a low count. This indicated an effect other than bacteria. Water uptake was low in stems that bent early. It is hypothesized that material from dead stem cells resulted in a xylem blockage which led to early bending. Sucrose at 15 g L⁻¹ in combination with an antimicrobial compound (slow release chlorine, HQC) resulted in the absence of stem damage and produced much less bending than the same concentration of the antimicrobial compounds alone. Sucrose apparently counteracted the toxic effects of the antimicrobial chemicals.

Keywords: /Gerbera/ /Vase Water/ /Antimicrobial/

GLADIOLUS

Eshghi, S.N. and S.K. Jari. 2013. Application methods of thymus vulgaris essential oil and their effect on vase life and qualitative traits of **Gladiolus grandiflorus** L. cut flower. *J. Ornamental Plants.* 3(4) 253 – 250.

Abstract

In this study, combined effect of two essential oils, Thymol and Carvacrol, with different concentrations in two methods on *Gladiolous grandiflorous* L. was investigated based on a completely randomized design with 3 replicates and four flower in each replicate. Sansusi variety applied that was red. In short term method, different concentrations of Thymol and Carvacrolin including 25+25, 50+50 and 75+75 ppm with sucrose 6% and distilled water (as control) and then they were taken to distilled water to the end of evaluation period. In standard method, different concentrations including 12.5+12.5, 25+25 and 37.5+37.5 ppm and sucrose 2% and distilled water as control were used. Flowers were kept in solutions from beginning experiment until the end of vase life. Every 48 hour, once, solutions were made to replace. Preserver solutions can use with wholesalers or retailers to protect flowers in order to sold users and carvacrol as the most essential oil of Thymus vulgaris have strong antimicrobial and antioxidant effects. In short term method, combined treatment of thymol and carvacrol with 150 ppm had the most soluble sugar and petal contents and the least rate of blossoming. In addition, the most vase life in combined treatment of carvacrol and thymol was observed in 100 ppm

mean of 11.57 days. Concentration of Anthocyanin was the most in short term method in compared to standard in last days of experiment.

Keywords: /Gladiolus/ /Vase Life/ /Quality/

ROSE

Nergi, M.A.D. and N. Ahmadi. 2014. Effects of 1-MCP and ethylene on postharvest quality and expression of senescence-associated genes in cut rose cv. Sparkle. Scientia Hort. 166: 78 – 83.

Abstract

The aim of this study was to investigate the effects of 1-methylcyclopropene (1-MCP) and ethylene on postharvest quality of cut rose 'Sparkle' and expression of Laccase and Aquaporins genes. Cut flowers were pre-treated with 0, 0.5 or $1\mu\text{L L}^{-1}$ of 1-MCP concentrations for 12 h and subsequently exposed to $8\mu\text{L L}^{-1}$ of exogenous ethylene for 6 h. Control treatment was received neither 1-MCP nor ethylene. Molecular study was carried out on petals of flowers pre-treated with 0 or $1\mu\text{L L}^{-1}$ 1-MCP exposed to $8\mu\text{L L}^{-1}$ ethylene. The results showed that 1-MCP treatment did not have significant effects on flower diameter, relative fresh weight, solution uptake, and water loss, while it reduced ethylene production and chlorophyll degradation, and increased postharvest longevity. Control and ethylene treated cut stems revealed 2 days differences in postharvest longevity of 'Sparkle'. 1-MCP suppressed the expression of all investigated genes except RhPIP1. The expression of RhLAC and RhTIP1 was induced by ethylene. Physiological and molecular data showed that this cultivar is sensitive to exogenous ethylene, while 1-MCP treatment inhibited ethylene's detrimental effects. Therefore, applying 1-MCP or other ethylene blocking agents are recommended as a postharvest treatment for extending the postharvest quality of cut rose 'Sparkle'.

Keywords: /Rose/ /Quality/ /1-MCP/ /Ethylene/

TUBERS AND ROOTCROPS

POTATO

Zommick, D.H., et. al. 2014. In-season heat stress compromises postharvest quality and low-temperature sweetening resistance in potato (*Solanum tuberosum* L.). Planta. 1 – 21.

Abstract

The effects of soil temperature during tuber development on physiological processes affecting retention of postharvest quality in low-temperature sweetening (LTS) resistant and susceptible potato cultivars were investigated. 'Premier Russet' (LTS resistant), AO02183-2 (LTS resistant) and 'Ranger Russet' (LTS susceptible) tubers were grown at 16 (ambient), 23 and 29 °C during bulking (111–164 DAP) and maturation (151–180 DAP). Bulking at 29 °C virtually eliminated yield despite vigorous vine growth. Tuber specific gravity decreased as soil temperature increased during bulking, but was not affected by temperature during maturation. Bulking at 23 °C and maturation at 29 °C induced higher reducing sugar levels in the proximal (basal) ends of tubers, resulting in non-uniform fry color at harvest, and abolished the LTS-resistant phenotype of 'Premier Russet' tubers. AO02183-2 tubers were more tolerant of heat for retention of LTS resistance. Higher bulking and maturation temperatures also accelerated LTS and

loss of process quality of 'Ranger Russet' tubers, consistent with increased invertase and lower invertase inhibitor activities. During LTS, tuber respiration fell rapidly to a minimum as temperature decreased from 9 to 4 °C, followed by an increase to a maximum as tubers acclimated to 4 °C; respiration then declined over the remaining storage period. The magnitude of this cold-induced acclimation response correlated directly with the extent of build up in sugars over the 24-day LTS period and thus reflected the effects of in-season heat stress on propensity of tubers to sweeten and lose process quality at 4 °C. While morphologically indistinguishable from control tubers, tubers grown at elevated temperature had different basal metabolic (respiration) rates at harvest and during cold acclimation, reduced dormancy during storage, greater increases in sucrose and reducing sugars and associated loss of process quality during LTS, and reduced ability to improve process quality through reconditioning. Breeding for retention of postharvest quality and LTS resistance should consider strategies for incorporating more robust tolerance to in-season heat stress.

Keywords: /Potato/ /Heat Stress/ /Quality/ /Low Temperature/

SWEET POTATO

Ojeda, G.A., et. al. 2014. Application of edible coatings in minimally processed sweet potatoes (*Ipomea batatas* L.) to prevent enzymatic browning. Int'l J. Food Sci. Technol. 49: 876 – 883.

Abstract

To control browning phenomenon, an edible coating of cassava starch along with ascorbic acid (AA) (combined treatment) was applied to minimally processed sweet potatoes var cv. 'Blanca Correntina'. The samples were stored at 4 °C for 16 days, and the activities of polyphenol oxidase, peroxidase and phenylalanine ammonia lyase were studied; also, surface colour, antioxidant capacity, ascorbic acid, chlorogenic acid content were evaluated. The combined treatment showed a beneficial impact on the quality of the product, avoiding browning when compared with untreated samples and individual treatments (coating without AA or immersion in AA solution). The improvements were evidenced by the absence of changes in hue, minor changes in a* parameter and a major inhibitory effect of AA on the activity of the three enzymes. Ascorbic acid content and antioxidant capacity increased ($P < 0.05$). The combined treatment not only was effective in preventing enzymatic browning but also retained freshness and improved nutritional value.

Keywords: /Sweet Potato/ /Edible Coating/ /Minimally Processed/

VEGETABLES

ASPARAGUS

Chinsirikul, W, et. al. 2014. Porous ultrahigh gas-permeable polypropylene film and application in controlling in-pack atmosphere for asparagus. Packaging Technol. Sci. 27: 313 – 325.

Abstract

Porous polypropylene (PP) films with greater gas permeability and lower permeability ratios (b) than existing commercial films were developed for fresh produce packaging. PP containing high content of beta-form crystal was biaxially stretched under controlled conditions. Resulting porous films with

uniquely high oxygen transmission rate (OTR) of $2\ 659\ 000\ \text{cm}^3\ \text{m}^{-2}\ \text{d}^{-1}$, water vapor transmission rate of $67\ \text{g}\ \text{m}^{-2}\ \text{d}^{-1}$, and b value of 0.76 was used as a “breathable window” attached to the less permeable commercial BOP on packaging asparagus of 400 g, at 5°C. Results demonstrated that in-pack O₂ and CO₂ concentrations could be practically controlled and modified by changing areas of the breathable windows. Altered porous high OTR area directly affected total gas permeation of the package. Optimum gas composition of O₂ and CO₂ within the recommended controlled atmosphere for asparagus, stored at 5°C, was effectively created and maintained in the package containing 25 cm² breathable window (15% of total film lid’s area). The shelf life of asparagus under optimum modified atmosphere was extended to 29 days, as compared with <3 days in the normal, low OTR tray sealed with BOPP lidding film. Clearly, these developed porous ultrahigh permeable PP films can be useful materials in designing high OTR package with desirable in-pack O₂ and CO₂ concentrations.

Keywords: /Asparagus/ /Polypropylene Film/

Herpich, W.B., et. al. 2014. Impact of ethanol treatment on physiological and microbiological properties of fresh white **asparagus** (*Asparagus officinalis* L.) spears. LWT - Food Sci. Technol. 57: 156 – 164.

Abstract

Fresh and minimally processed white asparagus (*Asparagus officinalis* L.) spears are very susceptible to microbial spoilage, often accompanied by changes in physiological and textural quality. To prevent economic losses and to guarantee product quality and safety, postharvest handling and processing need to be improved. New environmentally friendly and safe sanitation techniques should be introduced. This study investigates the efficacy of short-term washing in 0.5 L L⁻¹ ethanol solution at 10 °C as disinfectant of asparagus spears. The prevention of microbial spoilage and treatment effects on physiological properties and value adding quality parameters such as respiration, TSS, vitamin C and water content, and texture were evaluated in fresh white asparagus spears in four harvest seasons. Short-term dipping immediately reduced total bacterial counts and mould loads, and retarded their growth during storage. Retardation apparently did not increase with treatment duration. Short-term (30 s) ethanol washing but not longer treatments result in lower tissue water content and less stiff spears; it also reduced respiration and consumption of sugars. It seems to stabilize the vitamin C contents. Hence, short-term washing with ethanol is a promising approach to improve quality maintenance and safety of fresh asparagus spears and can be easily used in processing lines.

Keywords: /Asparagus/ /Ethanol/

BROCCOLI

Guerrero-Arteaga, D., et. al. 2014. Effect of hot air treatment on the conservation of **broccoli** (*Brassica oleracea* L.), cultivar 'Legacy. Acta Hort. 1016: 151 – 156.

Abstract

Broccoli (*Brassica oleracea* L.) is a product of great importance in international markets. However, it deteriorates quickly after harvest, characterized by color loss and bad appearance. The enzyme peroxidase (POD) is responsible for the degradation of chlorophyll and the emergence of black and brown pigments in the florets. As an alternative solution to this problem, a quarantine treatment

using hot air was assessed to partially inactivate this enzyme and to increase the shelf life of the fresh product without altering its nutritional or physicochemical properties. A combination of temperatures between 55 and 48°C during times of between 1 and 3 was applied; POD activity was quantified and measured by spectrophotometry at a wavelength of 470 nm. The chlorophyll a and b concentrations were measured at wavelengths of 663 and 645 nm, respectively. Optimal conditions of enzymatic inactivation were 55°C and 3 hours, resulting in a residual POD activity of 11.04% and retaining 70.9% chlorophyll a and 16.6% chlorophyll b. This treatment increased the shelf life of the product to 6 days in storage under non-refrigerated conditions (17°C) and retained 75.19% of the remaining chlorophyll a and 70.21% of chlorophyll b, measured in respect to day zero of the treated product. The effect of the thermal treatment on the respiration index (RI) was also assayed, obtaining a reduction of 54.1% as compared to day-zero for the control without treatment and a 77.3% reduction in the treated broccoli. These results show that the treatment was efficient. The texture values of the treated broccoli decreased by 73.2 and 33.6% in the treated product and the control, respectively. This effect is attributed to post-treatment metabolic reactions, resulting in loss of strength of the cell wall. It was concluded that the hot air treatment improves the general appearance of broccoli, but has a detrimental effect on its texture.

Keywords: /Broccoli/ /Hot Air Treatment/

Severino, R., et. al. 2014. Antimicrobial effects of different combined non-thermal treatments against *Listeria monocytogenes* in **broccoli** florets. J. Food Eng. 124 1 - 10.

Abstract

The antilisterial effect of three non-thermal treatments in combination with a bioactive coating formulation on broccoli florets inoculated with *Listeria monocytogenes* was evaluated. The nano emulsions of carvacrol, bergamot, lemon and mandarin essential oils (EO) were incorporated in native and modified chitosan coating formulations and the antilisterial effect in inoculated samples was evaluated. The modified chitosan based coating containing mandarin EO was the best treatment which caused a load reduction of 1.46 log CFU/g after 6 days of storage. The antilisterial effects of this coating formulation in combination with ozonated water, UV-C and c-ray treatments on inoculated samples were evaluated during 13 days storage at 4 °C. The combined coating and ozonated water showed very high antilisterial effects at days 1 and 3; however, their antilisterial activity was reduced after day 5. The combined coating and UV-C did not show any additive effect against *L. monocytogenes* as compared to coating alone. The best antilisterial activity was obtained in the combined coating and c-rays. This combined treatment caused an increase in relative radiation sensitivity of *L. monocytogenes* by 1.33-fold. Further, this combined treatment ensured microbial safety during storage with a reduction of *L. monocytogenes* by 2.5 log CFU/g after 13 days.

Keywords: /Broccoli/ /Non-thermal Treatments/

CELERY

Gonzales-Buesa, J., et. al. 2014. Effect of non-conventional atmospheres and bio-based packaging on the quality and safety of *Listeria monocytogenes*-inoculated fresh-cut **celery** (*Apium graveolens* L.) during storage. Postharvest Biol. Technol. 93: 29 – 37.

Abstract

The increased consumption of fresh-cut celery has led to the need to explore packaging alternatives for fresh-cut celery that can meet consumer, market, and industry needs. In this study, the effect of bio-based packaging and non-conventional atmospheres on the quality and safety of chlorine-sanitized celery sticks stored at 7°C was investigated. Two materials differing in permeability [a bio-based polyester (polylactic acid (PLA)) and a petroleum-based polyolefin (polypropylene/low density polyethylene (PP/PE))] and four initial gas compositions [air (A-PLA or A-PP/PE), 95 kPa O₂ + 5 kPa N₂ (O₂-PLA), 99 kPa N₂ + 1 kPa O₂ (N₂-PLA), and 6 kPa O₂ + 12 kPa CO₂ + 82 kPa N₂(CO₂-PLA)] were evaluated. Changes in headspace composition, weight loss, surface and cut end color, texture, ethanol content, appearance, and growth of *Listeria monocytogenes* on inoculated celery sticks were assessed during 21 d of storage. Active MAP (CO₂-PLA) out-performed passive MAP (A-PLA) in maintaining celery stick quality but not safety. Conventional active MAP (CO₂-PLA) out-performed non-conventional active MAPs (O₂-PLA and N₂-PLA) in maintaining celery stick quality throughout storage, but O₂-PLA suppressed *L. monocytogenes* growth while CO₂-PLA promoted growth during the first 10 d of storage. PLA and PP/PE materials affected celery stick quality but not *Listeria* growth. This study shows that the initial gas composition and packaging material both impact the quality and safety of celery sticks. Overall, the combination PLA and 95 kPa O₂ proved most beneficial in maximizing both the safety and quality of celery sticks during one week of storage at 7°C.

Keywords: /Celery/ /Packaging/ /Quality/ /Safety/

EGGPLANT

Zaro, M.J., et. al. 2014. Distribution, stability and fate of phenolic compounds in white and purple eggplants (*Solanum melongena* L.). Postharvest Biol. Technol. 92: 70 – 78.

Abstract

Eggplants rank among the vegetables richest in antioxidants, but little is known about the allocation, stability, and turnover of these metabolites. The distribution, accumulation and degradation of phenolic antioxidants in the inner and outer pulp of two commercially important eggplant types (white and dark purple), at harvest and after 14 and 30 d of refrigerated storage under non-chilling conditions (10°C and 90% RH) were determined in this study. Chlorogenic acid (ChA) was histolocalized by fluorescence with 2-aminoethyl-diphenylborinate and the activity of phenolic compounds oxidizing enzymes (polyphenoloxidase, PPO and peroxidase, POD) as well as H₂O₂ concentration in both fruit regions was determined. During storage, dark purple fruit were more susceptible to dehydration and showed greater deterioration than white eggplants. Both genotypes accumulated higher sugar content in the inner pulp as opposed to acids, which were more concentrated in the outer region. At harvest, pulp antioxidant capacity was similar in both eggplant types. TEAC and DPPH• assays and in situ localization, showed greater total antioxidants and ChA content in the core than in the outer pulp in both white and dark purple fruit. The stability of ChA was markedly different between genotypes. In white fruit, antioxidants increased during the first two weeks of storage, remaining stable afterwards. In contrast, in dark purple eggplants, phenolic compounds declined after an initial stage at which they accumulated. PPO and POD in vitro activities, associated mainly with fruit seeds, fibers, and vascular bundles did not correlate with pulp browning or loss of phenolic antioxidants. Instead, the reduction of ChA in the core of dark purple fruit was associated with increased production of H₂O₂. Results indicate that antioxidants are predominantly located in the inner pulp of eggplants regardless of the genotype, but are more stable in white fruit. Rather than being the result of browning reactions, substantial losses

of phenolic antioxidants in whole eggplants under the recommended storage conditions likely result from seed coat development and vascular lignification in the immature fruit.

Keywords: /Eggplant/

LETTUCE

Witkowska, I.M. and E.J. Woltering. 2014. Storage of intact heads prior to processing limits the shelf-life of fresh-cut *Lactuca sativa* L. *Postharvest Biol. Technol.* 91: 25 – 31.

Abstract

Harvested lettuce heads are usually transported and stored for some period of time under a variety of conditions prior to processing. During storage, especially under suboptimal conditions, nutritional composition of the harvested produce continues to change. The possible impact of prior storage of the heads on the performance of the fresh-cut product has not been quantified, and was the aim of this study. The experiments were performed with three related genotypes of *Lactuca sativa* L. (butterhead lettuce): two green varieties and one red variety. The effect of prior storage on quality parameters in the stored whole heads and on subsequent fresh-cut quality performance was investigated. In addition, the effect of prior storage of heads with and without their root system and the application of light during storage were investigated. The changes in visual quality, the levels of energy reserves, and some selected senescence markers, i.e. chlorophyll content and electrolyte leakage were evaluated. Despite the relatively high storage temperature of 12°C, the intact heads still looked fresh even after 17 days of storage. However, a decline in the soluble sugars, a decrease in chlorophyll, and an increase in electrolyte leakage were observed with advancing storage duration. Prior storage of intact heads greatly decreased the shelf-life of the fresh-cut product prepared from these heads. Storage of rooted heads and the continuous application of light (above the light compensation point) did not alter the effect of prior storage of the heads on the quality of the fresh-cut product.

Keywords: /Lettuce/ /Shelf Life/

LOTUS

Jiang, J., et. al. 2014. Establishment of a statistical model for browning of fresh-cut lotus root during storage. *Postharvest Biol. Technol.* 92 164 – 171.

Abstract

A browning model was proposed to investigate the physiological and biochemical changes of fresh-cut lotus root cv. "3537". The effects of water (CK), 0.1% (w/v) NaHSO₃, 0.2% citric acid (CA), 0.01% ascorbic acid (AA), 0.1% l-cysteine (Cys) and composite preservative (CP: 0.1% CA, 0.005% AA and 0.05% Cys) on the quality and physiology of the lotus root during low-temperature storage were determined. CP treatment minimized browning degree L*, respiration rate and levels of malondialdehyde (MDA), superoxide anion (O₂•-) and hydrogen peroxide (H₂O₂), and maximized activities of superoxide dismutase, peroxidase (POD) and catalase. Linear regression analysis was performed by using browning degree L* as the dependent variable and the other nine indices as the independent variables. Browning degree was significantly negatively correlated with MDA and O₂•- contents, but was significantly

positively correlated with POD activity. The simplified regression model was $Y = 65.784 - 11.062x_3 - 0.101x_5 + 0.003x_6$ (x_3 : MDA, x_5 : O_2 , x_6 : POD).

Keywords: /Lotus/ /Browning/ /Storage/

MUSHROOM

Li, Y., et. al. 2014. Effect of active modified atmosphere packaging with different initial gas compositions on nutritional compounds of shiitake mushrooms (*Lentinus edodes*). Postharvest Biol. Technol. 92: 107 – 113.

Abstract

The effect of active modified atmosphere packaging with different initial gas compositions on fresh shiitake mushrooms was investigated. Shiitake mushrooms were packaged under each of the following conditions: (1) high oxygen packaging (HOP), 100% oxygen initially; (2) medium oxygen packaging (MOP), 50% O_2 and balanced with N_2 initially; (3) low oxygen packaging (LOP), 3% O_2 /5% CO_2 , balanced with N_2 initially. Passive modified atmosphere packaging with air inside initially (AIR) was used as the control treatment. All the packaged samples were stored at 10°C with 90% RH for 7 days. During storage, gas compositions, electrolyte leakage, crude water-soluble polysaccharides, total phenolic content and free amino acid content were determined. The results showed that ethanol release was high in LOP and AIR but retarded in MOP and HOP. No packaging could prevent the decrease in polysaccharide content decreasing. Both the active and passive modified atmosphere packaging maintained the color and integrity of the mushrooms. The active modified atmosphere packaging had a significant effect on the increase of total phenolic content and total amount of free amino acids. LOP had a harmful impact on mushrooms with high levels of electrolyte leakage. In conclusion, HOP and MOP had a better effect on maintaining the nutritional compounds of shiitake mushrooms.

Keywords: /Mushroom/ /MAP/

SPONGE GOURD

Han, C., et. al. 2014. Effects of chitosan coating on postharvest quality and shelf life of sponge gourd (*Luffa cylindrica*) during storage. Scientia Hort. 166: 1 – 8.

Abstract

Sponge gourd is perishable and has a relative short shelf life. In this research, young immature sponge gourds were treated with aqueous solutions of 0% (Control), 0.5% and 1.0% of chitosan, all samples were enclosed in plastic boxes with polyethylene film bags and then stored in darkness at $25 \pm 1^\circ C$ and 90–95% relative humidity (RH). The results showed that of 0.5% and 1.0% chitosan were effective in reducing respiration rate and weight loss, preserving firmness and visual appearance, retaining the content of ascorbic acid and total phenolics, and delaying the increase of polyphenol oxidase (PPO) activity. Moreover, 1.0% chitosan markedly suppressed peroxidase (POD) and phenylalanine ammonia lyase (PAL) activities and exhibited a low level of cellulose contents compared with 0.5% chitosan and control. The results indicated that the use of chitosan effectively retained postharvest quality and extended shelf life of sponge gourd.

Keywords: /Sponge Gourd/ /Postharvest Quality/ /Shelf Life/

TOMATO

Babiker, E. and Eltoun, Y.A.I. 2014. Effect of edible surface coatings followed by dehydration on some quality attributes and antioxidants content of raw and blanched **tomato** slices. Food Sci. Biotechnol. 23(1): 231 – 238.

Abstract

Changes in quality attributes and antioxidants of tomato slices coated with gum Arabic at different concentrations then sun- or air-dried were investigated. Drying increased the dry matter content and the rehydration ratio with increase in gum Arabic concentrations. The water activity was fluctuated. Slices coated with 10% gum Arabic and air-dried had a maximum dry matter content (84.87%), a minimum water activity value (0.27) and a rehydration ratio (4.69), compared to uncoated slices. Drying of slices before and after coating had no ($p \leq 0.05$) effect on the pH. Coating of the slices followed by drying had no effect on the total soluble solids content. Blanched slices coated with 10% gum Arabic and sun-dried had a lower browning index value (0.029). Dried uncoated slices were darker than coated slices. Surface coating alleviates the effect of heat on the ascorbic acid, total phenolics, and flavonoid contents.

Keywords: /Tomato/ /Edible Surface Coating/ /Antioxidant/ /Quality/

Bu, J., et. al. 2014. Postharvest ultraviolet-C irradiation suppressed Psy 1 and Lcy-B expression and altered color phenotype in **tomato** (*Solanum lycopersicum*) fruit. Postharvest Biol. Technol. 89: 1 – 6.

Abstract

Mature green cherry tomato fruit were harvested and treated with ultraviolet-C (UV-C) irradiation at a predetermined dose of 4.2 kJ m^{-2} , and stored at 18°C for 35 days. The effects of UV-C treatment on color change, pigment contents, and the expression of major genes involved in carotenoid metabolism, including Psy 1, Pds, Lcy- β , and Lcy- ϵ , encoding phytoene synthase, phytoene desaturase, lycopene β -cyclase and lycopene ϵ -cyclase, respectively, were examined. The UV-C treated fruit developed a pink red color in contrast to the normal orange red color of control fruit. Lycopene accumulation during ripening in UV-C treated fruit was significantly inhibited but its final content was not affected. However, both accumulation and final content of β -carotene were significantly suppressed in UV-C treated fruit. The lower content of β -carotene, leading to a higher lycopene to β -carotene ratio, is probably responsible for the altered color phenotype in UV-C treated fruit. Psy 1, a major gene involved in lycopene synthesis was inhibited by UV-C irradiation. Significantly suppressed expression of Lcy- β gene was also observed in UV-C treated fruit. Thus it is possible that the lower transformation from lycopene to carotenes contributed to the relatively stable content of lycopene.

Keywords: /Tomato/ /UV-C irradiation/

Fagundes, C., et. al. 2014. Effect of antifungal hydroxypropyl methylcellulose-beeswax edible coatings on gray mold development and quality attributes of cold-stored cherry **tomato** fruit. Postharvest Biol. Technol. 92: 1 – 8.

Abstract

Edible composite coatings based on hydroxypropyl methylcellulose (HPMC), beeswax (BW), and food preservatives with antifungal properties, were evaluated on cherry tomatoes during cold storage. Food preservatives selected from previous research work included sodium propionate (SP), potassium carbonate (PC), ammonium phosphate (APh) and ammonium carbonate (AC). Cherry tomatoes artificially inoculated with *Botrytis cinerea* were coated and stored up to 15 d at 5°C followed by 7 d of shelf-life at 20°C. All antifungal HPMC-BW coatings significantly reduced gray mold development on inoculated and cold-stored cherry tomatoes, the SP-based coating being the most effective. Analytical and sensory fruit quality was also evaluated after cold storage and shelf-life. The AC-based coating was the most effective to control weight loss and maintain the firmness of coated cherry tomatoes. Respiration rate, firmness, color, sensory flavor, off-flavor, and fruit appearance were not adversely affected by the application of the antifungal coatings. Overall, the application of HPMC-BW edible composite coatings containing AC could be a promising treatment to extend the postharvest life of cherry tomatoes. Further studies should focus on the modification of some physical characteristics of the coatings in order to enhance the general performance and provide higher peel gloss.

Keywords: /Tomato/ /Edible Coating/ /Beeswax/

Guo, Q., et. al. 2014. Effects of chlorine dioxide treatment on respiration rate and ethylene synthesis of postharvest **tomato** fruit. *Postharvest Biol. Technol.* 93: 9 – 14.

Abstract

Tomato fruit at the mature green stage were treated with ClO₂ gas in a sealed container for 12 h, and then stored at 23°C with 85% relative humidity (RH) for 23 d. Respiration rate, respiration-related enzymes including phosphohexose isomerase (PHI), succinate dehydrogenase (SDH), and glucose-6-phosphate dehydrogenase (G-6-PDH) and 6-phosphogluconate dehydrogenase (6-PGDH), ethylene production, and the expression of LeAOX1a, LeCOX1, LeACS2, LeACS4 and LeACO1 genes were measured. The results showed that application of ClO₂ gas was effective in reducing total respiration, cytochrome pathway respiration and the expression of LeCOX1, but no significant reduction in the activities of respiration-related enzymes was observed during storage. Fruit treated with ClO₂ resulted in lower ethylene production. Furthermore, the expression of ethylene biosynthesis related genes, including LeACS2, LeACS4 and LeACO1 was reduced by the ClO₂ treatment. These results indicate that ClO₂ treatment might delay the ripening of tomato fruit, possibly by a mechanism involving suppression of respiration rate and ethylene biosynthesis.

Keywords: /Tomato/ /Chlorine Dioxide/ /Ethylene/

Ortiz, C.M., A.N. Mauri and A.R. Vicente. 2013. Use of soy protein based 1-methylcyclopropene-releasing pads to extend the shelf life of **tomato** (*Solanum lycopersicum*). *Innov. Food Sci. & Emerging Technol.* 20: 281 – 287.

Abstract

In the last years great interest has been devoted to the development of preservation treatments for packed foods. In this work, we developed and tested soy protein biodegradable films releasing the inhibitor of ethylene action 1-methylcyclopropene (1-MCP). Soy protein pads were prepared by casting from formulations containing different glycerol concentrations (20, 40 or 60% on protein basis) and pHs (2.0, 7.0 or 10.0). Their tensile strength, water content and ability to delay tomato ripening were determined. The best performing films (pH 7.0; 20% glycerol) were selected to further characterize the influence of the 1-MCP-releasing pads on tomato texture, color, sugars, acids, antioxidants and decay

under different storage regimes. Results showed that soy protein 1-MCP-releasing pads delayed tomato softening and pectin solubilization, reduced decay and lycopene accumulation and could be useful for postharvest “in package” treatments. Industrial relevance: Controlling ethylene action is crucial to prevent over-ripening. In the last years the inhibitor of ethylene action 1-MCP was launched and since then its use in fruits and vegetables has rapidly expanded. We have developed and evaluated soybean protein pads intended to be used as 1-MCP releasers. When incorporated into tomato fruit packages, the pads delayed ripening without causing negative quality changes. Soy protein based releasers could be useful to perform postharvest treatment during transit or distribution.

Keywords: /Tomato/ /Soy Protein/ /Shelf Life/

Salamanca, F.A., H.E. Balaguera-Lopez and A.O Herrera. 2014. Effect of potassium permanganate on some postharvest characteristics of **tomato** 'Chonto' fruits (*Solanum lycopersicum* L.). Acta Hort. 1016: 171 – 176.

Abstract

The tomato is a highly perishable climacteric fruit whose ripening processes are fast. Ethylene absorbers composed of a mixture of clay and potassium permanganate (KMnO₄) are a good alternative to eliminate ambient ethylene during the storage of fruits and vegetables. For KMnO₄ to be effective, it must be adsorbed to a vehicle (or carrier) that forms a solid absorber, easily manageable and which increase the effective contact area. The objective was to evaluate the effect of KMnO₄ on the behavior of some postharvest physical characteristics of the 'Chonto' tomato. We used a completely randomized design to evaluate three doses of zeolite (0.5, 1.0 and 1.5% based on fresh weight) and three concentrations of KMnO₄ (0.5, 1 and 1.5% based on fresh weight), plus one control treatment. The fruits were selected in the field and harvested at maturity 1 (100% green) with an average firmness of 50.93 Newton (N), 4.47 of °Brix, and total titratable acidity (TTA) of 1.11%; and therefore a maturity index of 4.01. Then, the fruits were stored in the postharvest laboratory at the National University of Colombia at room temperature (18°C and 85% relative humidity) for 28 days in commercial TPT packaging (Thermoformed polyethylene terephthalate); physicochemical variables were evaluated. The treatment with zeolite clay 1% + KMnO₄ 1% showed the lowest fresh weight loss, meanwhile in the zeolite 1.5% + KMnO₄ 0.5% treatment, the fruits exhibited greater firmness values. The lowest value of total soluble solids was presented with zeolite 1% + KMnO₄ 1.5%, while the highest acidity was seen in the zeolite 1% + KMnO₄ 0.5% treatment. Ethylene absorbers composed of zeolite and KMnO₄ retard the ripening of 'Chonto' tomato fruits.

Keywords: /Tomato/ /Potassium Permanganate/ /Postharvest/

Tian, D., et. al. 2014. Roles of ethylene and jasmonic acid in systemic induced defense in **tomato** (*Solanum lycopersicum*) against *Helicoverpa zea*. Planta. 239 (3): 577 – 589.

Abstract

Inducible defenses that provide enhanced resistance to insect attack are nearly universal in plants. The defense-signaling cascade is mediated by the synthesis, movement, and perception of jasmonate (JA) and the interaction of this signaling molecule with other plant hormones and messengers. To explore how the interaction of JA and ethylene influences induced defenses, we employed the never-ripe (*Nr*) tomato mutant, which exhibits a partial block in ethylene perception, and the defenseless (*def1*) mutant, which is deficient in JA biosynthesis. The defense gene proteinase

inhibitor (*PIN2*) was used as marker to compare plant responses. The *Nr* mutant showed a normal wounding response with *PIN2* induction, but the *def1* mutant did not. As expected, methyl JA (MeJA) treatment restored the normal wound response in the *def1* mutant. Exogenous application of MeJA increased resistance to *Helicoverpa zea*, induced defense gene expression, and increased glandular trichome density on systemic leaves. Exogenous application of ethephon, which penetrates tissues and decomposes to ethylene, resulted in increased *H. zea* growth and interfered with the wounding response. Ethephon treatment also increased salicylic acid in systemic leaves. These results indicate that while JA plays the main role in systemic induced defense, ethylene acts antagonistically in this system to regulate systemic defense.

Keywords: /Tomato/ /Ethylene/

Yang, Chun-Chieh, et.al. 2014. Development of multispectral imaging algorithm for detection of frass on mature red tomatoes. *Postharvest Biol. & Technol.* 93: 1 – 8.

Abstract

In this research, a multispectral fluorescence-based imaging algorithm was developed to detect frass contamination on mature Campari tomatoes. Tomato images were acquired using a hyper spectral fluorescence line-scan imaging system with violet LED excitation, then analysed for wavelength selection. The fluorescence intensities at five wavelengths, 515 nm, 640 nm, 664 nm, 690 nm, and 724 nm, were used to compute three simple ratio functions to detect frass contamination. The contamination spots were created on the tomato surfaces using four low-concentration frass dilutions. The algorithms detected over 99% of the 0.2 kg/L and 0.1 kg/L frass contamination spots and successfully differentiated these spots from tomato skin surfaces, stem scars, and stems. However, differentiation of the 0.05 kg/L and 0.02 kg/L frass contamination spots was more difficult. Adjusting the Algorithm to successfully detect 95% of the 0.05 kg/L spots also resulted in false-positive pixel detections occurring on 28% of the tomatoes. This study demonstrates that a simple multispectral fluorescence imaging algorithm based on violet LED excitation could be useful for rapid postharvest detection of frass contamination on tomatoes in processing lines.

Keywords: /Tomato/ /Food Safety/ /Machine Vision/