

**SELECTIVE DESSIMINATION OF INFORMATION (SDI)
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GENERAL

BIOFILM

Liu, N.T., et. al. 2014. Dual-species **biofilm** formation by *Escherichia coli* O157:H7 and environmental bacteria isolated from fresh-cut processing facilities. *Int'l J. Food Microbiol.* 171: 15 – 20.

Abstract

Biofilm formation is a mechanism adapted by many microorganisms that enhances the survival in stressful environments. In food processing facilities, foodborne bacterial pathogens, which many are poor biofilm formers, could potentially take advantage of this protective mechanism by interacting with other strong biofilm producers. The objective of this study was to determine the influence of bacteria native to fresh produce processing environments on the incorporation of *Escherichia coli* O157:H7 in biofilms. Bacteria strains representing 13 Gram negative species isolated from two fresh produce processing facilities in a previous study were tested for forming dual-species biofilms with *E. coli* O157:H7. Strong biofilm producing strains of *Burkholderia caryophylli* and *Ralstonia insidiosa* exhibited 180% and 63% increase in biofilm biomass, and significant thickening of the biofilms (*B. caryophylli* not tested), when co-cultured with *E. coli* O157:H7. *E. coli* O157:H7 populations increased by approximately 1 log in dual-species biofilms formed with *B. caryophylli* or *R. insidiosa*. While only a subset of environmental isolates with strong biofilm formation abilities increased the presence of *E. coli* O157:H7 in biofilms, all tested *E. coli* O157:H7 exhibited higher incorporation in dual-species biofilms with *R. insidiosa*. These observations support the notion that *E. coli* O157:H7 and specific strong biofilm producing bacteria interact synergistically in biofilm formation, and suggest a route for increased survival potential of *E. coli* O157:H7 in fresh produce processing environments.

Keywords: /Biofilm/ /Fresh cut/

ORGANIC AGRICULTURE

Mihailova, A., N. Pedentchouk and S.D. Kelly. 2014. Stable isotope analysis of plant-derived nitrate – Novel method for discrimination between **organically** and conventionally grown vegetables. *Food Chem.* 154: 238 – 245.

Abstract

The lack of reliable markers for the discrimination between organic and conventional products makes the organic food market susceptible to attempted fraud. Robust analytical methodologies for organic food authentication are urgently needed. In this study a new approach, compound-specific nitrogen and oxygen isotope analysis of plant-derived nitrate, has been applied alongside bulk nitrogen isotope analysis for discrimination between organically and conventionally greenhouse-grown lettuce and retail potatoes and tomatoes. The method revealed significant differences between conventional and organic fertilisation. An intra-plant isotopic variation as well as significant impact of the fertiliser application rate on the nitrogen and oxygen isotope values of plant-derived nitrate has been observed. Nitrogen and oxygen isotope analysis of nitrate has a potential for differentiation between organic and conventional

crops. Further analysis is needed to improve our understanding of the scope of application and robustness of this compound-specific approach.

Keywords: /Organic Agriculture/ /Vegetables/

FRUITS

BANANA

Wills, R.B.H., et. al. 2014. Reduction of energy usage during storage and transport of **bananas** by management of exogenous ethylene levels. *Postharvest Biol. Technol.* 89: 7 – 10.

Abstract

Unripe Australian-grown Cavendish and Lady Finger bananas were stored at 15, 20 and 25°C in an atmosphere containing 0.001, 0.01, 0.1 and 1.0 µL/L ethylene in air and the green life was determined as the time to reach the respiratory climacteric. As expected, green life increased as the temperature and ethylene concentration decreased. The equation describing the relationship between temperature, ethylene concentration and green life of Cavendish bananas was applied to a five-day 3000 km road transport route from the major tropical production area to the major urban markets. It predicted that bananas transported in the prevailing mean summer temperature of 25°C would not require refrigeration if the ethylene level did not exceed 0.58 µL/L while transport at the mean winter temperature of 14°C fruit could withstand a level of about 0.90 µL/L without ripening en route. The equation was also applied to a shipment protocol of 19 days for bananas exported from Central America to southern Europe. This predicted that fruit could be transported without refrigeration if ethylene levels were maintained at 0.04 µL/L during the winter temperature of 17°C and at 0.002 µL/L at the summer transport temperature of 24°C. Since a range of technologies are available to maintain such low ethylene levels or reduce the action of ethylene, these findings suggest that the current refrigerated transport of bananas could be minimised or eliminated. The use of higher temperatures in the supply chain would reduce energy consumption with resultant environmental and economic benefits.

Keywords: /Banana/ /Ethylene/ /Storage/

BLUEBERRY

Yang, G., et.al. 2014. Blueberry leaf extracts incorporated chitosan coatings for preserving postharvest quality of fresh **blueberries**. *Postharvest Biol. Technol.* 92: 46 – 53.

Abstract

The phenolic compounds in blueberry (*Vaccinium* spp.) fruit and leaf extracts (BLE) were determined based on HPLC analysis. Antimicrobial assays against *Staphylococcus aureus*, *Listeria monocytogenes*, *Salmonella typhimurium* and *Escherichia coli*, as well as fungi isolated from the rotting blueberry fruit were conducted. The effects of chitosan coating incorporating different concentrations of BLE on the quality of fresh fruit during postharvest storage at 2 ± 1°C and 95 ± 2% relative humidity (RH) for 35 d and then at room conditions for 3 d were also investigated. Five different coating treatments were applied including 2% (w/v) chitosan coating (T1), 2% (w/v) chitosan coating containing 4% (w/v, T2), 8% (w/v, T3), or 12% (w/v, T4) BLE, and 2% (w/v) chitosan coating containing 12% BLE plus modified atmosphere packaging (MAP at 3 kPa O₂+ 12 kPa CO₂) (T5). A sample of blueberries dipped into distilled water was used as control (T0). BLE had a greater variety of phenolic compounds than fruit extracts with

syringic acid the highest concentration ($0.259 \pm 0.003 \text{ g kg}^{-1}$), but the total phenolic content in BLE was lower ($P < 0.05$) than in fruit extracts. BLE showed good antimicrobial activity against all tested microorganisms, with a minimum inhibition concentration from 25 to 50 g L⁻¹. The 2% chitosan coating that incorporated 8% or 12% BLE showed some degree of decreasing decay rate of fruit compared with the control, and the coating with BLE plus MAP had more effective control of fruit decay. All treated samples maintained higher total phenolic content and radical scavenging activity than the control. This study suggested that chitosan coating incorporating BLE can be employed to extend shelf-life and maintain high nutritional value of fresh blueberries during postharvest storage.

Keywords: /Blueberry/ /Chitosan/ /Coatings/

CANTALOUPE

Martinon, M.E., et. al. 2014. Development of a multilayered antimicrobial edible coating for shelf life extension of fresh-cut **cantaloupe** (*Cucumis melo* L.) stored at 4°C. LWT – Food Sci. Technol. 56: 341 – 350.

Abstract

The objective of this study was to develop a multilayered edible coating with antimicrobial agent to extend the shelf life of fresh-cut cantaloupe stored at 4°C. Three different sets of experiments were designed to test the effect of different concentrations of chitosan (0.5, 1, 2 g/100 g), pectin (0.5, 1, 2 g/100 g), and encapsulated trans-cinnamaldehyde (1, 2, 3 g/100 g), on the quality of fresh-cut cantaloupe. The first set (chitosan concentrations) provided the optimum concentration of chitosan based on preferences by the panelists. The second set (pectin concentrations) produced an acceptable coating that maintained shelf life. The third set (antimicrobial concentrations) helped establish the optimum concentration of trans-cinnamaldehyde in the coating. Changes in fruits texture, color, moisture, acidity, and pH were monitored. Sensory testing was carried out to support the objective quality data and microbiological analysis helped verify the antimicrobial effectiveness of trans-cinnamaldehyde. Uncoated fresh-cut cantaloupes stored at 4°C served as controls. To test for the antimicrobial activity of chitosan alone, a second set of controls consisted of samples coated only with chitosan. Application of a multilayered edible coating composed of 2 g/100 g trans-cinnamaldehyde, 2 g/100 g chitosan and 1 g/100 g pectin helps extend the shelf life of fresh-cut cantaloupe (up to 9 days).

Keywords: /Cantaloupe/ /Edible Coating/ /Shelf Life/ /Quality/

CITRUS

Arnon, H., et. al. 2014. Effects of carboxymethyl cellulose and **chitosan** bilayer edible coating on postharvest quality of citrus fruit. Postharvest Biol. Technol. 87: 21 – 26.

Abstract

There is increasing public interest in development of edible natural biodegradable coatings to replace the currently used commercial synthetic waxes for maintaining postharvest quality of citrus fruit. We tested the efficacy of a newly developed polysaccharide-based edible bilayer coating comprising carboxymethyl cellulose (CMC) and chitosan in preserving postharvest quality of various citrus fruit, including 'Or' and 'Mor' mandarins, 'Navel' oranges, and 'Star Ruby' grapefruit after simulated storage and marketing. In all citrus species, it was found that the CMC/chitosan bilayer

coating was equally effective as the commercial polyethylene wax in enhancing fruit gloss. Furthermore, the CMC/chitosan bilayer coating slightly increased fruit firmness, especially of oranges and grapefruit, but was mostly not effective in preventing post-storage weight loss. Both the CMC/chitosan bilayer coating and the commercial wax had no significant effects on juice total soluble solids and acidity levels, and had similar effects on gas permeability, as indicated by only slight increases in internal CO₂ levels and in juice ethanol accumulation after storage. Sensory analyses revealed that neither the CMC/chitosan bilayer coating nor the commercial wax coating had any deleterious effects on flavor preference of 'Navel' orange and 'Star Ruby' grapefruit. However, application of the commercial wax, and moreover the CMC/chitosan bilayer coating, resulted in a gradual decrease in flavor acceptability of 'Or' and 'Mor' mandarins because of increased perception of off-flavors. Overall, we showed that the CMC/chitosan bilayer edible coating sufficiently enhanced fruit gloss, but was not effective in preventing postharvest weight loss. Furthermore, flavor quality was slightly impaired in mandarins but not in oranges and grapefruit.

Keywords: /Citrus/ /Chitosan/ /Edible Coating/

Fan, F., et. al. 2014. Use of citral incorporated in postharvest wax of **citrus** fruit as a botanical fungicide against *Penicillium digitatum*. Postharvest Biol. Technol. 90: 52 – 55.

Abstract

The antifungal activity of citral against *Penicillium digitatum*, the causal agent of citrus green mold, was tested by in vitro and in vivo experiments. In vitro assays showed that the minimum inhibitory concentration and the minimum fungicidal concentration (MFC) were both 4000 µL L⁻¹. Results of in vivo tests demonstrated that wax + citral (1× MFC) treatment did not effectively inhibit the growth of *P. digitatum* in Ponkan mandarin fruit, whereas wax + citral (10× MFC) treatment significantly decreased the incidence of green mold after 6 days of storage at 25 ± 2 °C. Wax + citral (10× MFC) treatment remarkably increased the content of vitamin C and antioxidant enzyme activities such as catalase, superoxidase dismutase, and peroxidase but decreased the activities of phenylalanine ammonia lyase, polyphenol oxidase, and malonaldehyde. The treatment had minor effects on the pH, coloration index, and total soluble solids. This study provided theoretical data for the practical application of citral on citrus fruit quality during postharvest storage.

Keywords: /Citrus/ /Postharvest Wax/

Smilanick, J.L., M. Mansour and D. Sorenson. 2014. Performance of fogged disinfectants to inactivate conidia of *Penicillium digitatum* within **citrus** degreening rooms. Postharvest Biol. Technol. 91: 134 - 140.

Abstract

Fogging with formaldehyde of citrus packinghouses when the fruit are absent is a practice to control conidia of *Penicillium digitatum* (Pers.) Sacc., the cause of citrus green mold. Replacements for formaldehyde in these facilities are needed because of worker and environmental health issues. To evaluate the effectiveness of candidate sanitizers, craft wood sticks with conidia of *P. digitatum* were attached throughout commercial citrus ethylene degreening rooms and either water alone or the sanitizers were applied. The rooms were 20 ± 2°C and humidified to 85–90% relative humidity. Aldehydes, peroxygen compounds, sodium hypochlorite, chlorine dioxide, quaternary ammonium, alcohols, one phenolic compound, and one organic acid were applied with a compressed air assisted atomizer or fan atomizer in a volume of approximately 6 L per 100 m³ of room volume dispensed over a

3 h period. Rates applied were expressed as active ingredient per m³ of room volume. All were compared to formaldehyde applied at 1.98 g m⁻³ of room volume. After 24 h, the craft wood sticks were retrieved, and germination of the conidia assessed. Five sanitizers reduced germination of conidia by more than 95% and equaled formaldehyde in effectiveness. They were (effective rates): (1) glutaraldehyde (0.1 g m⁻³); (2) hydrogen peroxide (4.4 g m⁻³); (3) Citrisol (1.0 g m⁻³), a proprietary mineral oxychloride oxidizer; (4) acetic acid (5.3 g m⁻³); and (5) peracetic acid (2.4 g m⁻³). The toxicity of effective sanitizers was determined by exposure of *P. digitatum* conidia for 10 min to concentrations of each and the proportion of survivors used to estimate EC₅₀ and EC₉₉ concentrations. The toxicity of the sanitizers in this assay did not predict their effectiveness when applied by fogging, probably because other factors, such as distribution, persistence, droplet size, or vapour pressure also influenced their effectiveness.

Keywords: /Citrus/ /Disinfectants/ /Degreening/

JUJUBE

Wang, L., et. al. 2014. Chitosan disrupts *Penicillium expansum* and controls postharvest blue mold of jujube fruit. Food Control. 41: 1 – 7.

Abstract

Chitosan has been shown to be effective for control of postharvest diseases on various fruit. However, little is known about the effect of chitosan on blue mold caused by *Penicillium expansum* on jujube fruit. Here we show that application of chitosan reduced disease development of blue mold caused by *P. expansum* in wounded and inoculated jujube fruit at 25°C. Chitosan also provided an inhibitory effect on natural decay of jujube fruit during storage at 0 °C. Application of a chitosan coating to fruit had hardly any significant effect on the changes of weight loss, soluble solid contents, titratable acidity, and vitamin C, as storage time increased. To investigate the mechanisms underlying the effectiveness of chitosan against blue mold on jujube fruit, we analyzed the growth of *P. expansum* after chitosan treatment. Results indicated that spore germination, germ tube length and mycelial growth of *P. expansum* were significantly inhibited by chitosan in a concentration-dependent mode. Using the fluorescent probe propidium iodide, we found that the plasma membrane of *P. expansum* collapsed significantly after chitosan treatment. Further observation by electron microscopy revealed that plasma membrane of *P. expansum* was gradually disrupted after chitosan application. Our data suggest that chitosan may be potentially used for controlling postharvest diseases in jujube fruit without negative effect on fruit quality.

KIWIFRUIT

Cantre, D., et. al. 2014. Microstructural characterisation of commercial kiwifruit cultivars using X-ray micro computed tomography. Postharvest Biol. Technol. 92: 79 – 86.

Abstract

The skin is the physical barrier between the fruit and the environment in which it develops. Environmental conditions during fruit development have a large influence on fruit quality, both at the time of harvest and during subsequent storage. It is hypothesised that some features of the skin and sub-epidermal tissues could provide information about the past growing conditions to which the fruit was exposed and therefore be of predictive value for storage quality. In this study, five commercial

kiwifruit cultivars ('Hayward', 'Hort16A', 'G3', 'G9' and 'G14') were studied, and 'Hayward' fruit were manipulated during growth with different cultural practices. After harvest at horticultural maturity, X-ray micro computed tomography (uCT) was used to investigate features of the skin and the immediate parenchyma tissue. Despite orchard management practices (crop load and girdling) being observed to effect macro fruit quality parameters (mass, firmness, SSC, and DM), differences in microstructure (e.g. porosity) caused by these practices were not observed. However, porosity and pore size were found to be highly variable between cultivars. The thickness of dense sub-epidermal tissue could be readily measured and the 3-D distribution of raphide bundles was visible as high density particles distributed within the parenchyma. Overall, uCT was found to be a powerful technique to explore fruit epidermal and sub-epidermal structures in three dimensions at a micro level. However, the length of time required for data capture and analysis and the large number of samples required to overcome natural variation within horticultural products need to be considered. Future work may define the impact of differences in porosity or sub-epidermal anatomy on kiwifruit physiology (e.g. firmness change or sensitivity to low oxygen storage atmospheres). With this information, uCT could be used as a screening tool during plant breeding, or to determine the response to agronomic treatments, without conducting lengthy storage trials.

Keywords: /Kiwifruit/ /X-ray/

Latocha, P., et. al. 2014. Changes in postharvest physicochemical and sensory characteristics of hardy **kiwifruit** (*Actinidia arguta* and its hybrid) after cold storage under normal versus controlled atmosphere. *Postharvest Biol. Technol.* 88: 21 – 33.

Abstract

Changes in sensory and physicochemical characteristics of fruit of *Actinidia arguta* and its hybrid after cold storage (1 °C and 85%RH) in air (AS) versus controlled atmosphere (CA) with low oxygen concentration (1.5% O₂ + 1.5% CO₂) were examined over a period of four and eight weeks. The investigation was carried out on two cultivars, 'Ananasnaya' (*A. arguta*) and 'Bingo' (*Actinidia purpurea* × *A. arguta*) harvested at two stages of maturity (6.5–8% and 8–9.5% soluble solids, respectively). During long-term storage the strongest changes in fruit characteristics were in fruit firmness and acidity. Air storage was an adequate method of refrigerated storage of fruit over a short period of 4 weeks. Application of CA can be very useful for storing hardy kiwifruit over a longer, 8 week period. The sensory characteristics of fruit stored in CA and then ripened during simulated shelf-life were similar to those of vine ripe fruit. The most significant change in the sensory characteristics of fruit after long-term cold storage was the increase in the intensity of their bitter taste.

Keywords: /Kiwifruit/ /Cold Storage/ /Controlled Atmosphere/

Orikasa, T., et.al. 2014. Impacts of hot air and vacuum drying on the quality attributes of **kiwifruit** slices. *J. Food Eng.* 125: 51 – 58.

Abstract

Hot air and vacuum drying were performed to investigate changes in the moisture content, hardness, L-ascorbic acid content, antioxidant activity, and surface color of kiwifruit samples over the course of the drying process at temperatures of 50, 60, and 70 °C and a vacuum drying pressure of 3.00 kPa. The residual ratio of AsA and the antioxidant activity in the dried kiwifruit samples was 0.75–0.99

and 4.3–5.5, respectively. The L-ascorbic acid changes in the kiwifruit samples during the hot air drying process followed first order reaction kinetics. Changes in the sample hardness and antioxidant activity were represented by zero-order reaction kinetics. The sample surface color changes after drying were also measured, and the total color change (ΔE) of the samples at all temperatures and for each drying process was greater than 12. The sample color changes (Δa^*) after vacuum drying at each temperature level were significantly ($P < 0.01$) lower than those associated with hot air drying.

Keywords: /Kiwifruit/ /Vacuum/ /Quality/

MANGO

Feygenberg, O., et. al. 2014. Improved management of **mango** fruit through orchard and packinghouse treatments to reduce lenticel discoloration and prevent decay. *Postharvest Biol. Technol.* 91: 128 – 133.

Abstract

Mango fruit are exposed to complex postharvest handling management, intended to improve postharvest quality retention during export shipment. Susceptibility to lenticel discoloration and to *Alternaria* side rots and Phomopsis stem-end rot under current handling conditions led us to re-evaluate and modify the chain of postharvest treatments, from the orchard to the packinghouse. The previously developed hot water brushing (HWB) treatment was found effective in reducing incidence of *Alternaria* and stem-end rots, but it significantly induced development of red lenticels. Two factors were key to improving fruit quality, by simultaneously reducing lenticel discoloration and decay development: (a) postharvest water and/or NaOH washes in the orchard, and (b) hot-water spray (HWS) applied over rollers without brushes in the packinghouse. The present results indicate that optimal management involves combinations of water washes in the orchard with packinghouse HWS treatment; this significantly reduced the severity of lenticel discoloration by 50–60%, and the incidence and extent of postharvest side rots caused by *Alternaria* by 60% or more. These results indicate that appropriate handling of fruit can appreciably improve their quality during prolonged storage and shipment.

Keywords: /Mango/ /Postharvest/ /Discoloration/

PAPAYA

Ali, A., M.K. Ong and C.F. Forney. 2014. Effect of ozone pre-conditioning on quality and antioxidant capacity of **papaya** fruit during ambient storage. *Food Chem.* 142: 19 – 26.

Abstract

The objective of this study was to compare the physico-chemical characteristics and antioxidant activity of ozone-treated papaya fruit and untreated fruit. Freshly harvested papaya fruit were exposed continuously to ozone fumigation (0, 1.5, 2.5, 3.5 and 5 ppm) for 96 h prior to ambient storage at 25 ± 3 °C and $70 \pm 5\%$ relative humidity (RH) for up to 14 days. The fruit exposed to 2.5 ppm ozone had higher levels of total soluble solids (25.0%), ascorbic acid content (12.4%), b-carotene content (19.6%), lycopene content (52.1%), and antioxidant activity (30.9%), and also reduced weight loss (11.5%) at day 10 compared to the control. The sensory attributes of papaya treated with 2.5 ppm ozone was superior

in sweetness and overall acceptability. These results support the application of ozone as a non-thermal and safe food preservation technique for papaya which can benefit both the producers and consumers.

Keywords: /Papaya/ /Storage/ /Quality/

PEAR

Sugar, D. and S.R. Basile. 2014. Induction of ripening capacity in 'Packham's Triumph' and 'Gebhard Red D'Anjou' Pears by temperature and ethylene conditioning. *Postharvest Biol. Technol.* 91: 84 – 89.

Abstract

Methods were tested for rapid induction of ripening capacity in 'Packham's Triumph' and 'Gebhard Red D'Anjou' pears in order to facilitate early marketing. Fruit of each cultivar were harvested at the onset of maturity and conditioned to develop ripening capacity by exposure to 100 $\mu\text{L L}^{-1}$ ethylene at 20°C for 0, 24, 48, or 72 h, followed by varying durations of temperature conditioning at -0.5 or 10°C. Ripening capacity was tested by measuring fruit firmness after 7 d at 20°C after completion of conditioning treatments. Fruit firmness was also measured after conditioning but before ripening, and was designated "shipping firmness," indicative of the potential for the fruit to withstand transport conditions without physical injury. With temperature conditioning at -0.5°C only, 'Packham's Triumph' pears needed 45 d to develop ripening capacity, while 'Gebhard Red D'Anjou' pears were not capable of fully ripening after 60 d, the longest duration tested. Using ethylene only, 72 h exposure was necessary to develop full ripening capacity in both cultivars, and adequate shipping firmness was maintained. Using temperature conditioning at 10°C, ripening capacity in 'Packham's Triumph' and 'Gebhard Red D'Anjou' developed within 10 and 20 d, respectively, but shipping firmness in 'Gebhard Red D'Anjou' was compromised at 20 d. In both cultivars, 24 or 48 h in ethylene followed by 5 d at 10°C induced ripening capacity while maintaining adequate shipping firmness.

Keywords: /Pears/ /Ethylene/ /Ripening/

Syamaladevi, R.M., et. al. 2014. UV-C light inactivation kinetics of *Penicillium expansum* on pear surfaces: Influence on physicochemical and sensory quality during storage. *Postharvest Biol. Technol.* 87: 27 – 32.

Abstract

UV-C inactivation kinetic data of *Penicillium expansum* on intact and wounded pear disks were determined. *P. expansum* conidia (0.5 mL, 1.6×10^7 CFU/mL) were spot inoculated onto intact and wounded pear tissue with skin (excised disks), treated with UV-C doses ranging 0.101–3.06 kJ/m^2 at 23°C and surviving conidia were enumerated. Changes in selected physicochemical parameters and sensory quality following UV-C treatment of whole pears were determined immediately after treatment, and 4 and 8 weeks of storage at 4°C. A greater UV-C intensity was required for similar inactivation levels of *P. expansum* populations on wounded pear disks (3.1 kJ/m^2 for 2.7 log reduction) compared to intact pear disks (1.7 kJ/m^2 for 2.8 log reduction). No significant difference in % weight loss, or soluble solids content and texture was observed between UV-C treated and untreated pears. However, browning was observed on UV-C treated pear surfaces after 4 and 8 weeks along with changes in flavor and texture. An increase in consumer preference was noticed for the untreated control pears after 4 weeks storage.

Keywords: /Pear/ /Storage/ /Quality/

PERSIMMON

Lv, J. et.al. 2014. Cloning and expression of lipoxygenase genes and enzyme activity in ripening persimmon fruit in response to GA and ABA treatments. *Postharvest Biol. Technol.* 92: 54 – 61.

Abstract

Two genes of the lipoxygenase (LOX) family, *DkLox1* and *DkLox3* (GenBank accession No. JF436951 and JF436950), were cloned from persimmon fruit (*Diospyros kaki* L. 'Fuping Jianshi'). Sequence analysis indicated that they belong to the 9-LOX sub-group. Transcriptional profiles of both LOX genes during fruit ripening and in response to gibberellin (GA3) and abscisic acid (ABA) treatments during postharvest storage were studied using quantitative reverse transcription PCR (qRT-PCR). The expression of *DkLox1* and *DkLox3* peaked at 15 d after the fruit were harvested under room temperature, corresponding to the patterns of LOX activity and ethylene production. ABA treatment accelerated the persimmon fruit softening and increased LOX enzyme activity, ethylene production and MDA content; and the expression of *DkLox1* and *DkLox3* peaked three days earlier than the non-treated control. By contrast, the GA3 treatment decelerated the ripening process and down-regulated the expression of *DkLox1* and *DkLox3* genes. The roles of LOX gene expression during persimmon fruit ripening are discussed.

Keywords: /Persimmon/ /Cloning/

Novillo, P., et. al. 2014. Deastringency treatment with CO₂ induces oxidative stress in persimmon fruit. *Postharvest Biol. Technol.* 92: 16 – 22.

Abstract

Because of astringency at harvest, 'Rojo Brillante' persimmons are regularly submitted to deastringency treatment based on exposing fruit to a high CO₂ concentration. The treatment conditions that ensure total astringency removal throughout the various maturity stages have been determined to be 95% CO₂, 20°C, 24 h. The aim of this study was to investigate changes in the redox state of persimmon fruit associated with this deastringency treatment. The levels of reactive oxygen species (ROS) (O₂⁻ and H₂O₂), and the activities of the main ROS scavenging enzymes (CAT, POD, APX, and SOD), were determined at harvest and after deastringency in fruit at three different maturity stages. Our results showed that during 'Rojo Brillante' persimmon maturation, the level of O₂⁻ gradually increased, while APX activity was lowered. The deastringency treatment with CO₂ induced oxidative stress in the fruit, observed as an over-accumulation of O₂⁻ and H₂O₂. As a response to ROS accumulation, the activities of the CAT, APX and SOD scavenging enzymes were up-regulated after deastringency treatment. The response of POD enzyme was dependent on maturity stage, showing enhanced activity after CO₂ treatment only for the fruit at the most mature stage.

Keywords: /Persimmon/ /Deastringency/ /Oxidative Stress/

PINEAPPLE

Azarakhsh, N., et. al. 2014. Lemongrass essential oil incorporated into alginate-based edible coating for shelf-life extension and quality retention of fresh-cut pineapple. *Postharvest Biol. Technol.* 88: 1 – 7.

Abstract

The effects of different concentrations (0.1%, 0.3% and 0.5%, w/v) of lemongrass essential oil incorporated into an alginate-based [sodium alginate 1.29% (w/v), glycerol 1.16% (w/v) and sunflower oil 0.025% (w/v)] edible coating on the respiration rate, physico-chemical properties, and microbiological and sensory quality of fresh-cut pineapple during 16 days of storage (10 ± 1 °C, $65 \pm 10\%$ RH) were evaluated. Coated fresh-cut pineapple without lemongrass and uncoated fresh-cut pineapple were stored under the same conditions and served as the controls. The results show that yeast and mould counts and total plate counts of coated samples containing 0.3 and 0.5% (w/v) lemongrass were significantly ($p < 0.05$) lower than other samples. However, the incorporation of 0.5% (w/v) lemongrass in coating formulation significantly ($p < 0.05$) decreased the firmness and sensory scores (taste, texture and overall acceptability) of fresh-cut pineapples. Therefore, the results indicate that an alginate-based edible coating formulation incorporated with 0.3% (w/v) lemongrass has potential to extend the shelf-life and maintain quality of fresh-cut pineapple.

Keywords: /Pineapple/ /Lemongrass/ /Essential Oil/ /Edible Coating/ /Shelf Life/

POMEGRANATE

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/

RASPBERRY

Tezotto-Uliana, J.V., et. al. 2014. Chitosan applications pre- or postharvest prolong raspberry shelf life quality. *Postharvest Biol. Technol.* 91: 72 – 77.

Abstract

Raspberries are fruit with high metabolism that makes them very perishable, impairing their storage and shelf-life. Chitosan coatings have the potential to improve their postharvest life by reducing water loss, respiration rate and decay incidence. The purpose of this work was to study the effect of different concentrations of chitosan, applied pre- or postharvest, on the retention of quality attributes of fresh raspberries. The chitosan concentrations tested were 0 (control), 0.5, 1.0 or 2.0%. The postharvest treatment was applied immediately after harvest, dipping the fruit in the solutions for 5 min. The pre-harvest treatment was done with one hand-spray application per week for three weeks, starting when the fruit were just turning pink. In both experiments the fruit were stored at 0°C and 90% RH. Pre- or postharvest use of chitosan at 1 or 2% was effective in maintaining titratable acidity and retarding respiration and ethylene production, weight loss and decay incidence. Application by both means resulted in the highest chitosan concentrations accelerating a reduction of ascorbic acid contents. Firmness was maintained only when the fruit were treated pre-harvest at 2%. Thus, application of chitosan at 1 or 2% postharvest and 2% pre-harvest was able to retain key raspberry quality attributes for 15 and 12 days, respectively.

Keywords: /Raspberry/ /Chitosan/ /Shelf Life/

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 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: /Stonefruit/ /Aloe vera/ /Rosehip Oil/ /Postharvest/

STRAWBERRY

Ugolini, L., et. al. 2014. Control of postharvest grey mould (*Botrytis cinerea* Per.: Fr.) on **strawberries** by glucosinolate-derived allyl-isothiocyanate treatments. *Postharvest Biol. Technol.* 90: 34 – 39.

Abstract

The vapours of allyl-isothiocyanate (AITC) were evaluated in in vitro and in vivo trials against *Botrytis cinerea*, a severe pathogen of strawberries. In in vitro trials AITC activity was assayed on conidial germination and mycelial growth of the fungus. The mycelium appeared less sensitive to AITC than conidia (EC50 values of 1.35 mg L⁻¹ and 0.62 mg L⁻¹, respectively). In addition, AITC had a fungistatic effect against the pathogen, since the values of EC50, for both parameters, increased by around 30% after AITC removal. In in vivo trials, 'Tecla' and 'Monterey' strawberries (spring-bearing and day-neutral cultivars, respectively) obtained from organic production and naturally infected by *B. Cinerea*, were exposed for 4 h in an atmosphere enriched by pure AITC or derived from defatted seed meals of *Brassica carinata* (0.1 mg L⁻¹, in a 0.1 m³ treatment cabinet). After 2 days at 0°C and another 3–4 days at 20°C, the fruit were evaluated for grey mould infections. The AITC treatment reduced the decay caused by the pathogen by over 47.4% up to 91.5%, significantly different from the untreated fruit. No significant differences were found between synthetic and glucosinolate-derived AITC. Residue analysis performed on fruit at the end of storage (7 d after treatment) showed values lower than 1 mg kg⁻¹. Total phenolic content and antioxidant capacity estimated in treated and untreated strawberries showed no significant difference between control and AITC treated fruit. Our results show it is possible to reduce the incidence of postharvest grey mould on strawberries with a treatment of AITC (0.1 mg L⁻¹) for 4 h, opening a potential application of biofumigation in the postharvest control of *B. cinerea* in strawberry.

Keywords: /Strawberry/ /Mold/ /Postharvest/

Vicente, E., et. al. 2013. Evaluation of the sensory characteristics of **strawberry** cultivars throughout the harvest season using projective mapping. *J. Sci. Food Agric.* 94: 591 – 599.

Abstract

BACKGROUND: Strawberry breeding programs should be able to rely on valid and simple methodologies for evaluating sensory quality of new cultivars. In this context, the aim of the present work was to evaluate the applicability of a simple sensory methodology, named projective mapping, to evaluate the sensory characteristics of strawberry cultivars and advanced selections throughout the harvest season. Three strawberry cultivars and two advanced selections were evaluated by an untrained assessor panel using projective mapping in three different moments of the harvest season: June (early season), August (mid-season) and September (peak harvest). Instrumental measurements were also performed. **RESULTS:** Projective mapping enabled the identification of the main sensory characteristics of the strawberry cultivars and advanced selections, as well as the similarities and differences among them. Sensory characteristics of the five evaluated strawberry cultivars and advanced selections largely varied throughout the harvest season. Simple instrumental measurements were not able to predict the sensory characteristics of the strawberry cultivars, suggesting the importance of sensory methodologies for the evaluation of new cultivars in breeding programs. **CONCLUSIONS:** Projective mapping consisted of a

quick alternative for the evaluation of new cultivars relative to standard commercial cultivars. Its main advantage is that a large number of cultivars can be screened with minimal investment of time and resources.

Keywords: /Strawberry/ /Sensory Characteristics/

SWEET CHERRY

Hampson, C.R., et. al. 2014. Determining the optimum firmness for sweet cherries using just-about-right sensory methodology. *Postharvest Biol. Technol.* 91: 104 – 111.

Abstract

This study evaluated Just-About-Right (JAR) ratings of untrained panellists for whole sweet cherry (*Prunus avium L.*) crispness and flesh firmness. Cherries from 17 different cultivars and breeding selections representing a wide range of fruit firmness were harvested over the course of the cherry maturity season in 2011 and 2012. The firmness of each cherry (n = 183–500 per sample) was measured with the FirmTech2 Fruit Firmness Tester, and the fruits were sorted into 19 firmness categories, of 0.20 N increments, ranging from 1.58 to 5.69 N. Untrained panellists (n = 48) assessed whole cherry crispness and flesh firmness using a 7-point JAR scale from 'much too soft', through 'just about right', to 'much too firm/crisp'. Four to eight firmness categories were evaluated per session in a series of 10 sensory sessions. Linear regression was used to model the relationship between JAR ratings and analytical firmness values, for whole cherry crispness ($r_{2011-12} = 0.75$) and flesh firmness ($r_{2011-12} = 0.75$). Crispness and firmness were highly correlated in both years ($R_{2011} = 0.99$, $R_{2012} = 0.99$). Frequency distributions of JAR ratings identified the proportion of responses at each rating (1–7), within each firmness category. The "acceptable" firmness range was calculated to be 2.52–4.75 N from JAR flesh firmness scores of between 3 ('slightly too soft') and 5 ('slightly too firm'), respectively. Cherries with measured firmness values between 2.56 and 4.71 N were "acceptable" to 72.9–91.7% of panellists. The work established the relationship between sensory and analytical evaluations in order to develop guidelines for acceptable sweet cherry fruit firmness to use in research on cultural practices and the selection of new cultivars.

Keywords: /sweet Cherries/ /Firmness/

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 O_2 and CO_2 concentrations on the respiratory physiology and the efficacy of modified atmosphere packaging (MAP) on extending shelf life. Oxygen depletion and CO_2 formation by 'Bing' and 'Sweetheart' cherry fruit were measured. While respiration rate was inhibited linearly by reduced O_2 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% O_2 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/ /Cold Storage/ /Quality/

TABLE GRAPES

De Oliveira, C.E.V., et. al. 2014. Effects of chitosan from *Cunninghamella elegans* on virulence of post-harvest pathogenic fungi in **table grapes** (*Vitis labrusca* L.). Int'l J. Food Microbiol. 171: 54 – 61.

Abstract

This study aimed to obtain chitosan (CHI) from *Cunninghamella elegans* cultivated in corn steep liquid (CSL)-based medium under optimized conditions and to assess the efficacy of the obtained CHI in inhibiting *Botrytis cinerea* and *Penicillium expansum* in laboratory media and when applied as a coating on table grapes (*Vitis labrusca* L.). Moreover, the influence of CHI-based coatings on several physical, physicochemical and sensory characteristics of the fruits during storage was assessed. According to the surface response methodology, the best conditions for isolating CHI from *C. elegans* cultivated in CSL-medium yielded 8.8 g/100 mL at pHs between 5.0 and 5.5 and at 180 rpm. CHI from *C. elegans* inhibited mycelial growth and spore germination and caused morphological changes in the spores of the tested fungal strains. The CHI coatings delayed the growth of the assayed fungal strains in artificially infected grapes. Applying a CHI coating preserved the quality of grapes, as measured by some physical, physicochemical and sensory attributes, throughout the assessed storage time. These results demonstrate the potential of CHI from *C. elegans* to control post-harvest pathogenic fungi in fruits, in particular, *B. cinerea* and *P. expansum* in table grapes.

Keywords: /Table Grapes/ /Chitosan/

Kim, G.C., et. al. 2014. Low-dose irradiation can be used as a phytosanitary treatment for fresh **table grapes**. J. Food Sci. 79: S81 – S91.

Abstract

Grapes (*Vitis vinifera* var. Sagraone and *Vitis labrusca* var. Crimson Seedless) were treated with 400, 600, and 800 Gy and the effects on physicochemical factors were measured alongside sensory testing during 3 wk of storage. Significant changes in texture and color with irradiation and age were measured but little visual difference was seen between control and irradiated grapes. However, age had

a greater effect on firmness than irradiation for Sugaone grapes. Irradiation did not significantly ($P \leq 0.05$) affect the SSC/TA ratio, which increased during storage. The trained panel detected significant changes in the berry texture and rachis color but rated sweetness and flavor significantly higher ($P \leq 0.05$) for irradiated Sugaone as compared to the control. Consumers liked both the untreated and 800 Gy treated Sugaone grapes, but liked the untreated grapes more for texture ($P \leq 0.05$). However, there was no difference in liking between irradiated (600 Gy or 800 Gy) and control samples of Crimson Seedless for any attribute. The results show that there are varietal differences in response to irradiation but the overall maintenance in quality of irradiated grapes during 3 wk of storage indicates that irradiation can serve as a viable phytosanitary treatment.

Keywords: /Table Grapes/ /Gamma Radiation/ /Quality/

HERBS AND SPICES

CULINARY HERBS

Vallverdu-Queralt, A., et. al. 2014. A comprehensive study on the phenolic profile of widely used culinary **herbs** and spices: rosemary, thyme, oregano, cinnamon, cumin and bay. Food Chem. 154: 299 – 307.

Abstract

Herbs and spices have long been used to improve the flavour of food without being considered as nutritionally significant ingredients. However, the bioactive phenolic content of these plant-based products is currently attracting interest. In the present work, liquid chromatography coupled to high-resolution/accurate mass measurement LTQ-Orbitrap mass spectrometry was applied for the comprehensive identification of phenolic constituents of six of the most widely used culinary herbs (rosemary, thyme, oregano and bay) and spices (cinnamon and cumin). In this way, up to 52 compounds were identified in these culinary ingredients, some of them, as far as we know, for the first time. In order to establish the phenolic profiles of the different herbs and spices, accurate quantification of the major phenolics was performed by multiple reactions monitoring in a triple quadrupole mass spectrometer. Multivariate statistical treatment of the results allowed the assessment of distinctive features among the studied herbs and spices.

Keywords: /Culinary Herbs/ /Rosemary/ /Thyme/ /Oregano/ /Cinnamon/

MINT

Curutchet, A., et. al. 2014. Nutritional and sensory quality during refrigerated storage of fresh-cut **mint**s (*Mentha x piperita* and *M. spicata*). Food Chem. 143: 231 – 238.

Abstract

The effect of storage time on quality attributes of refrigerated fresh-cut mints (*Mentha x piperita* and *M. spicata*) was studied. Atmosphere composition, respiratory activity, weight loss, surface colour, total chlorophyll, carotenoids, browning potential, total phenols, flavonoids, radical-scavenging activity, ascorbic acid and essential oil yield and composition were analysed. Respiratory activity of peppermint and spearmint samples diminished moderately (42% and 28%, respectively) after 21 days at

0°C. A slight modification of the internal atmosphere was achieved. Surface colour, chlorophyll, carotenoid and antioxidant compounds remained almost constant. The yield of essential oil did not change or it showed an apparent increase after 21 days at 0°C, depending on plant growth stage. The characteristic flavour components of peppermint (menthone and menthol) increased, while the contents of the main constituents of spearmint essential oil showed minor variations after storage. The conditions assayed for packaging and storing fresh-cut mints were adequate to achieve a relatively long shelf life and they retained their antioxidant properties.

Keywords: /Mint/ /Storage/

ONION

Eshel, D., et. al. 2014. Fast curing: A method to improve postharvest quality of onions in hot climate harvest. *Postharvest Biol. Technol.* 88: 34 – 39.

Abstract

Most of the onions (*Allium cepa* cv. Orlando) grown in southern Israel are treated with maleic hydrazide before storage, and are cold-stored for up to 8 months with minimal losses to rots or sprouting. Nevertheless, in most cases the complete dry outer skin (tunic) cracks and loosens, and tends to fall off during storage. To improve onion postharvest quality, bulbs were harvested at 80–100% green leaf drop (topdown), leaving about 10 cm of neck above the bulb. The early harvest reduced skin cracks in 93% of the bulbs, resulting in a sturdy tunic beneath the muddy outer skin. We applied fast curing (FC) at 30 °C and 98% RH for up to 9 days postharvest: the onion neck became 52% narrower after 6 days, similar to the effect of 5 months of cold storage. FC also changed the color of the treated onion bulbs' outer skin to a darker reddish brown. FC of onions harvested with a long neck and stored for 290 days reduced weight loss and rot by 30% and 80%, respectively, as compared to non-FC onions. The better onion quality induced by FC was accompanied by an increased number of onion skin layers (from an average of 1.8 to 4) and a higher force needed to tear the tunic (average 4.8 N as compared to 3.5 N in the control). FC compressed the effects of 5 months of cold storage into a few days, since most of the bulb neck and tunic changes measured during FC occurred only after long cold storage without FC. Although emission of the lachrymatory factor was not affected by FC, it markedly increased after 5 months of storage. Histological observation showed that FC keeps the onion tunic and inner fleshy scales intact and ensures postharvest quality, even after 8 months of cold storage. The high temperature used for FC can be reached in hot-climate storage areas with minimal energy investment.

Keywords: /Onion/ /Postharvest Quality/

Kahsay, Y., F. Abay and D. Belew. 2013. Intra row spacing effect on shelf life of onion varieties (*Allium cepa* L.) at Aksum, Northern Ethiopia. *World J. Agric. Res. Food Safety.* 1(2): 34 – 42.

Abstract

A field experiment was conducted to investigate the influence of intra-row spacing and, variety on yield and shelf life of onion. The study was conducted between August 2010 and April 2011 at Aksum area (Laelay Maichew District). Three different intra-row spacings (5, 7.5 and 10 cm) were evaluated using 4 varieties of onion ('Adama' Red, 'Bombay' Red, 'Melkam' and 'Nasik' Red) using randomized complete block design replicated 4 times. Data on yield and shelf life parameters were recorded and

subjected to analysis of variance using SAS 9.2 software. The result showed the postharvest deterioration as measured by percentage of marketable loss, total soluble sugars in °Brix and dry matter content (DMC) was less on 'Nasik' Red variety. The largest bulb size, produced by the larger intra-row spacing, showed highest rotting percentage compared to the smaller ones. Average bulb weight loss during storage also was higher at the intra-row spacing of 5 cm than 7.5 cm. Moreover, the result revealed that 'Melkam' and 'Bombay' Red varieties were superior in yield and an intra-row spacing of 7.5 cm can give good yield bulbs while 'Nasik' Red had best storage quality and 'Melkam' and 'Adama' Red are moderate.

Keywords: /Onion/ /Shelf Life/

PEPPER

Krasniewska, K., et. al. 2014. The use of pullulan coating enriched with plant extracts from *Satureja hortensis* L. to maintain **pepper** and apple quality and safety. Postharvest Biol. Technol. 92: 63 – 72.

Abstract

This study determined the minimum inhibitory concentration (MIC) and minimum bactericidal/fungicidal concentration (MBC/MFC) of water and ethanol *Satureja hortensis* (SH) extract, as well as the antimicrobial activity of pullulan films with an addition of the extracts against test strains. The pullulan coating with an addition of water SH extract was also applied pepper and apple fruit. The concentration of bioactive compounds in the extracts was assessed using HPLC. The analysis included the effect of pullulan coating with water SH extract on weight loss and color change in peppers during storage at 16°C/14 days, and 16°C/28 days, and apples at 16°C/14 days, and 2°C/28 days. A microscopic image of the coating on materials was evaluated and sensory analysis performed. Polyphenolic compounds from phenolic acid and flavone families were identified in the extracts, and higher levels of phenolic compounds ($p < 0.05$) were found in the water extract. The activity of pullulan films with SH extracts increased significantly ($p < 0.05$) with the increase in SH extract concentration (5%, 10% and 20%). Pullulan films with water SH extract inhibited the growth of Gram-positive and Gram-negative bacteria and *Penicillium expansum* more strongly than was the case with those films with an ethanol SH extract. Moreover, coating application resulted in a decrease in weight loss and an extension of storage time, and also protected the material against excessive wilting and wrinkling on the surface, maintaining freshness and consumer appeal.

Keywords: /Pepper/ /Apple/ /Pullulan Coating/

SPICES

Kirkin, C., et. al. 2014. Combined effects of gamma-irradiation and modified atmosphere packaging on quality of some **spices**. Food Chem.154: 255 – 266.

Abstract

Thyme (*Thymus vidgaris* L.), rosemary (*Rosmarinus officinalis* L.), black pepper (*Piper nigrum* L.) and cumin (*Cuminum cyminum* L.) in ground form were packaged in either air or 100% N₂ and c-irradiated at 3 different irradiation levels (7 kGy, 12 kGy, 17 kGy). Total viable bacterial count, yeast and

mould count, colour, essential oil yield and essential oil composition were determined. Microbial load was not detectable after 12 kGy irradiation of all samples. Irradiation resulted in significant changes in colour values of rosemary and black pepper. The discolouration of the irradiated black pepper was lower in modified atmosphere packaging (MAP) compared to air packaging. Essential oil yield of irradiated black pepper and cumin was lower in air packaging compared to MAP. Gamma-irradiation generally decreased monoterpenes and increased oxygenated compounds, but the effect was lower in MAP. Overall, spices should be irradiated under an O₂-free atmosphere to minimise quality deterioration.

Keywords: /Spices/ /Gamma-irradiation/ /Modified Atmosphere Packaging/

ORNAMENTALS

CARNATION

Ebrahimzadeh, A., et. al. 2013. Postharvest petal senescence of two cultivars of **carnation** flowers with different vase lives. *Australian J. Crop Sci.* 7(2): 1829 – 1835.

Abstract

This work studies the influence of variations in free polyamines, 1-aminocyclopropane-1-carboxylic acid and ethylene, and their possible relationship, during the different development stages of two carnation cultivars (*Dianthus caryophyllus* L. cultivars Domingo and Famosa) with noticeable differences in vase life. A pre-treatment with ethylene or silver thiosulphate helped to verify the possible link between polyamines, ethylene biosynthesis and carnation vase life. The senescence periods in carnation petals, both untreated and treated with ethylene (1 ppm for 8 h) and silver thiosulphate (1 mM for 2 h), were studied at 21°C and 60-70% relative humidity during eight different stages of senescence. 'Famosa' (long-life cultivar) was associated with lower ethylene production and 1-aminocyclopropane-1-carboxylic acid concentration in petals compared with 'Domingo' (short vase-life cultivar). The effects of pre-treatments with exogenous ethylene or silver thiosulphate were only evident in the short-life cultivar Domingo, in which ethylene production were increased or reduced, respectively. Silver thiosulphate reduced total ACC content during senescence in Domingo. The total polyamine content in Famosa (128-235 nmol g⁻¹ FW) was lower than in Domingo (220-372 nmol g⁻¹ FW). High free Putrescine and Spermidine concentrations were detected in earlier stages of flower senescence in the short vase-life cultivar. The high percentage of spermine in the petal tissue of 'Famosa' may inhibit ACC accumulation and ethylene production, resulting in increased flower longevity.

Keywords: /Carnation/ /Vase Life/

GERBERA

De Witte, Y., H. Harkema and W.G. van Doorn. 2014. 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⁻¹HQC 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⁻¹in 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 Life/

VEGETABLES

ASPARAGUS

Qiu, M., et. al. 2014. Effect of chitosan and its derivatives as antifungal and preservative agents on postharvest green asparagus. Food Chem. 155: 105 – 111.

Abstract

The antifungal activity and effect of high-molecular weight chitosan (H-chitosan), low-molecular weight chitosan (L-chitosan) and carboxymethyl chitosan (C-chitosan) coatings on postharvest green asparagus were evaluated. L-chitosan and H-chitosan efficiently inhibited the radial growth of *Fusarium concentricum* separated from postharvest green asparagus at 4 mg/ml, which appeared to be more effective in inhibiting spore germination and germ tube elongation than that of C-chitosan. Notably, spore germination was totally inhibited by L-chitosan and H-chitosan at 0.05 mg/ml. Coated asparagus did not show any apparent sign of phytotoxicity and maintained good quality over 28 days of cold storage, according to the weight loss and general quality aspects. Present results inferred that chitosan could act as an attractive preservative agent for postharvest green asparagus owing to its antifungal activity and its ability to stimulate some defense responses during storage.

Keywords: /Asparagus/ /Chitosan/ /Preservative Agents/

BROCCOLI

Esturk, O., Z. Ayhan and T. Gokkurt. 2014. Production and application of active packaging film with ethylene adsorber to increase the shelf life of broccoli (*Brassica oleracea* L. var. Italica). Packag. Technol. Sci. 27: 179 – 191.

Abstract

Broccoli (*Brassica oleracea* L. var. *Italica*) florets were packaged in low-density polyethylene (LDPE) bags with or without ethylene adsorber under passive modified atmosphere and then stored at 4°C for 20 days. LDPE films with (8% Tazetut W masterbatch, M2) or without ethylene adsorber (M1) were tested. The effects of modified atmosphere packaging treatments on gas concentrations (O₂, CO₂ and ethylene) in the headspace, the mass loss, colour, texture, pH, total soluble solids, chlorophyll content, total phenolic content and sensory quality of packaged broccoli were determined by comparing with unpackaged (control) florets. Results revealed that deterioration occurred quickly in control broccoli, manifested mainly by mass loss, chlorophyll degradation and stem hardening. Also, it was found unacceptable by sensory panel after 5 days. Conversely, in those florets packaged under modified atmosphere packaging, especially for LDPE with ethylene adsorber (M2), all changes related with loss of quality were significantly reduced and delayed with time. Additionally, total soluble solids and total phenolic content remained almost unchanged during the whole period. Ethylene concentration was determined as 61.8 ppm in M1 and 0.33 ppm in M2, respectively, at the end of the storage. Thus, broccoli packaged with M2 films had prolonged storability up to 20 days with high quality attributes, this period being only 5 days in unpackaged control broccoli. Oxygen concentration decreased below 1% after 5 days of storage in M1, and the shelf life of broccoli in these bags was limited to 5 days because of risk for anaerobic fermentation.

Keywords: / Broccoli/ /Shelf Life/

Li, S.P., et. al. 2014. Hydrogen sulfide alleviates postharvest senescence of **broccoli** by modulating antioxidant defense and senescence-related gene expression. J. Agric. Food Chem. 62(5): 1119 – 1129.

Abstract

Accumulating evidence has shown that hydrogen sulfide (H₂S) acts as a signaling regulator in plants. Here we show that H₂S delays the postharvest senescence of broccoli in a dose-dependent manner. H₂S maintains higher levels of metabolites, such as carotenoids, anthocyanin, and ascorbate, and reduces the accumulation of malondialdehyde, H₂O₂, and the superoxide anion. Further investigations showed that H₂S sustained higher activities of guaiacol peroxidase, ascorbate peroxidase, catalase, and glutathione reductase and lower activities of lipoxygenase, polyphenol oxidase, phenylalanine ammonia lyase, and protease than those of water control. Moreover, the expression of the chlorophyll degradation related genes BoSGR, BoCLH2, BoPaO, BoRCCR, as well as cysteine protease BoCP1 and lipoxygenase gene BoLOX1, was down-regulated in postharvest broccoli treated with H₂S. The functions of H₂S on the senescence of other vegetables and fruits suggest its universal role acting as a senescence regulator.

Keywords: /Broccoli/ /Postharvest Senescence/

CARROTS

Zhu, L., et. al. 2014. Apple, **carrot**, and hibiscus edible films containing the plant antimicrobials carvacrol and cinnamaldehyde inactivate *Salmonella* newport on organic leafy greens in sealed plastic bags. J. Food Sci. 79: M61 – M66.

Abstract

The objective of this study was to investigate the antimicrobial effects of carvacrol and cinnamaldehyde incorporated into apple, carrot, and hibiscus-based edible films against *Salmonella* Newport in bagged organic leafy greens. The leafy greens tested included organic Romaine and Iceberg lettuce, and mature and baby spinach. Each leafy green sample was washed, dip inoculated with *S. Newport* (107 CFU/mL), and dried. Each sample was put into a Ziploc bag. Edible films pieces were put into the Ziploc bag and mixed well. The bags were sealed and stored at 4 °C. Samples were taken at days 0, 3, and 7 for enumeration of survivors. On all leafy greens, 3% carvacrol films showed the best bactericidal effects against *Salmonella*. All 3 types of 3% carvacrol films reduced the *Salmonella* population by 5 log₁₀ CFU/g at day 0 and 1.5% carvacrol films reduced *Salmonella* by 1 to 4 log₁₀ CFU/g at day 7. The films with 3% cinnamaldehyde showed 0.5 to 3 log reductions on different leafy greens at day 7. The films with 0.5% and 1.5% cinnamaldehyde and 0.5% carvacrol also showed varied reductions on different types of leafy greens. Edible films were the most effective against *Salmonella* on Iceberg lettuce. This study demonstrates the potential of edible films incorporated with carvacrol and cinnamaldehyde to inactivate *S. Newport* on organic leafy greens.

Keywords: /Carrot/ /Apple/ /Hibiscus/ /Edible Films/

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/ /Stability/

LETTUCE

Beghi, R., et. al. 2014. Setting-up of a simplified handheld optical device for decay detection in fresh-cut *Valerianella locusta* L.J. Food Eng. 127: 10 – 15.

Abstract

The aim of this work was to study the feasibility of a simplified handheld and low-cost optical device. This study was focused on identifying the most significant vis/NIR wavelengths able to discriminate freshness levels during shelf-life of fresh-cut *Valerianella locusta* L. The shelf-life of *Valerianella* leaves was monitored using a portable commercial vis/NIR spectrophotometer and by traditional analyses (pH, moisture and total phenols content). The *Valerianella* samples were stored at three temperature: 4°C, 10°C, and 20°C. Through PLS-RCA technique, standardized regression coefficients of PLS models were used to select the relevant variables, representing the most useful information of full spectral region. The four selected wavelengths were 520 nm, 680 nm, 710 nm and 720 nm. Multiple linear regression was applied in order to verify the effectiveness of selected wavelengths. Results demonstrate the feasibility of a simplified device for quickly monitoring the shelf-life of fresh-cut *Valerianella* leaves

Keywords: /Valerianella/ /Lettuce/ /Fresh-cut/

Braidot, E., et. al. 2014. Low-intensity light cycles improve the quality of lamb's **lettuce** (*Valerianella olitoria* [L.] Pollich) during storage at low temperature. Postharvest Biol. Technol. 90: 15 – 23.

Abstract

The influence of light on fresh-cut vegetables during storage is controversial, since both positive and negative effects on shelf-life and quality of such products have been observed. In this work, the effect of low-intensity light treatments on lamb's lettuce, a fresh-cut leafy and ready-to-eat vegetable, was investigated during storage at low temperature (6°C), in comparison with conventional storage (in the dark at 4°C). Although continuous light treatment (1 cycle of 8 h per day) was deleterious, cycles of light treatments (8 cycles of 1 h per day; 16 cycles of 0.5 h per day) showed positive effects, assessed by evaluating the content of chlorophylls, carotenoids, ATP, glucose and ascorbate. These analyses were performed at the beginning and after 6 days of storage, in comparison with samples stored in the dark at 4°C. Under low-intensity light treatments, even if performed at a higher temperature (6°C), the content of such bioactive compounds increased or was at least similar to that found in samples stored in the dark at the same temperature. We suggest that continuous low-intensity light treatments during cold storage of lamb's lettuce are able to promote photosynthesis but, at the same time, induce photo-damage. On the contrary, under intermittent low-intensity light cycles, photosynthesis is only partially activated, while the metabolism of the green tissues is still able to provide carbon moieties for the synthesis of bioactive molecules involved in delaying senescence. Therefore, low-intensity light cycles at 6°C could contribute to maintain quality of lamb's lettuce, with respect to samples stored in the dark at both 6 and 4°C. Finally, setting the temperature at 6°C allows reduction of refrigerator energy consumption during storage.

Keywords: /Lettuce/ /Storage/

McKellar, R.C., et. al. 2014. Comparative simulation of *Escherichia coli* O157:H7 behaviour in packaged fresh-cut **lettuce** distributed in a typical Canadian supply chain in the summer and winter. Food Control. 35: 192 – 199.

Abstract

The ability to predict the risk associated with *Escherichia coli* O157:H7 in packaged fresh-cut lettuce hinges on the availability of realistic times and temperatures encountered in commercial supply chains. We report here on temperature profiles measured in winter and summer months in a retail supply chain and their predicted impact on the fate of the pathogen in fresh-cut lettuce. Time and temperature data were recorded in individual packages within cases of lettuce in the bottom, middle and top layers of pallets distributed from a processing facility to retail storage. Measurements indicated there were occasional increases in temperature during either season and that temperatures were $\geq 5^{\circ}\text{C}$ for longer periods of time during the summer. A stochastic simulation model based on time and temperature distributions was constructed in @RISKTM to predict the fate of *E. coli* O157:H7. The output from the model demonstrated a range of possible outcomes for the time-temperature profiles measured in the commercial supply chain, ranging from slight growth to die-off. The outputs of the stochastic simulations were similar to analytical simulations based on actual times and temperatures experienced by product in the supply chain. The distributions presented in the current model could be incorporated in quantitative assessments to improve predictions about the prevalence and fate of *E. coli* O157:H7 in fresh-cut lettuce supply chains.

Keywords: /Lettuce/ /Fresh-cut/ /Escherichia coli/

MUSHROOM

Yurttas, Z., R.G. Moirera and E. Castell-Perez. 2014. Combined vacuum impregnation and electron-beam irradiation treatment to extend the storage life of sliced white button **mushrooms** (*Agaricus bisporus*). J. Food Sci. 79: E39 – E46.

Abstract

This study assessed the application of an antibrowning solution using vacuum impregnation (VI) and then electron-beam irradiation as a means to extend the shelf life of sliced white button mushrooms (*Agaricus bisporus*). A preliminary study helped to determine the best antibrowning solution and VI process parameters. Mushroom slices were impregnated with 2 g/100 g ascorbic acid + 1 g/100 g calcium lactate; 2 g/100 g citric acid + 1 g/100 g calcium lactate; 1 g/100 g chitosan + 1 g/100 g calcium lactate; and 1 g/100 g calcium lactate at different vacuum pressures and times and atmospheric restoration times. Selection of the antibrowning solution and VI parameters was based on texture and color of the mushroom slices. Next, the slices were irradiated at 1 kGy using a 1.35-MeV e-beam accelerator. Physicochemical, sensory, and microbial quality of mushrooms was monitored for 15 d at 4 °C. The best impregnation process in this study was 2 g/100 g ascorbic acid and 1 g/100 g calcium lactate at 50 mm Hg for 5 min and an atmospheric restoration time of 5 min. The control (untreated) samples suffered structural losses throughout storage. Only the vacuum impregnated irradiated samples had acceptable color by the end of storage. Sensory panelists consistently preferred the samples produced

with VI and irradiation because exposure to ionizing radiation inhibited growth of spoilage microorganisms.

Keywords: /Mushroom/ /Storage/ /Irradiation/

RADISH

Xiao, Z., et. al. 2014. Postharvest quality and shelf life of radish microgreens as impacted by storage temperature, packaging film, and chlorine wash treatment. *LWT – Food Sci. Technol.* 55: 551 – 558.

Abstract

Microgreens are new and emerging products, which are young seedlings of vegetables and herbs. A recent study showed that microgreens contain higher nutrients compared to their mature counterparts. However, they typically have a short shelf life (1-2 days) at ambient temperature. The objective of this study was to optimize postharvest handling conditions to reduce the quality loss and extend the shelf life of daikon radish (*Raphanus sativus* L. var. *longipinnatus*) microgreens. Storage temperature, packaging film, and wash treatment were investigated. Changes in headspace composition, quality index, chlorophyll concentration, tissue electrolyte leakage, and aerobic mesophilic bacteria (AMB) and yeast & mold (Y&M) counts were monitored periodically during storage. Results indicated that (1) storage temperature significantly ($P < 0.05$) affected package atmosphere, product quality and shelf life. One degree Celsius was the optimal temperature for storage of radish microgreens with no chilling injury observed; (2) film oxygen transmission rate (OTR) significantly ($P < 0.05$) affected O_2 and CO_2 composition, but OTR did not significantly affect quality attributes during 28 days of storage at 1°C; (3) Chlorine wash treatment (100 mg/L) significantly reduced initial microbial populations by 0.5 log cfu g⁻¹, including AMB and Y& M. However, microbial populations rebounded after day 7.

Keywords: /Radish/ /Quality/ /Shelf Life/

SPINACH

Cocetta, G., et. al. 2014. Effect of cutting on ascorbic acid oxidation and recycling in fresh-cut baby **spinach** (*Spinacia oleracea* L.) leaves. *Postharvest Biol. Technol.* 88: 8 – 16.

Abstract

Fresh-cut spinach during processing undergoes several mechanical procedures such as cutting, which may induce stress responses. These stresses may trigger the accumulation of harmful reactive oxygen species (ROS). Plants respond through a wide range of mechanisms and ascorbic acid (AsA) has an important role. The combined effect of cutting, temperature and storage time on AsA recycling route in spinach fresh-cut leaves was studied. AsA, gene expression and activities of the enzymes involved in the AsA oxidation and recycling were considered. Spinach leaves were cut in six pieces and stored at 4°C or 20°C. AsA content and enzymes activities were measured over six days of storage, while gene expression analyses were performed in a time-point experiment within 24 h after cutting. Results showed that AsA decreased after cutting (from 19.41 mg/100 g FW to 15 mg/100 g FW) and generally was higher in samples stored at 4 °C. After six days, AsA was 10 mg/100 g in control and 5 mg/100 g FW in cut leaves. The expression of genes and activities of the enzymes involved in the AsA oxidation and

recycling route were, for some enzymes, in accordance with AsA levels. The APX (EC 1.11.1.11) activity after cutting increased up to 290 nmol AsA mg⁻¹ prot min⁻¹ compared to the control with 190 nmol AsA mg⁻¹ prot min⁻¹. AsA reduction is firstly affected by temperature and aggravated by cutting procedures. AsA represents a valuable postharvest quality indicator of freshness in spinach leaves.

Keywords: /Spinach/ /Fresh Cut/ /Ascorbic Acid/

Kou, L., et. al. 2014. Temperature abuse timing affects the rate of quality deterioration of commercially packaged ready-to-eat baby **spinach**. Part I: Sensory analysis and selected quality attributes. *Postharvest Biol. Technol.* 91: 96 – 103.

Abstract

Temperature abuse of fresh-cut products occurs routinely during transport and retail store display. However, the stage of product shelf life during temperature abuse and its impact on sensory attributes have not been studied. This study evaluated the effect of temperature abuse occurring immediately after processing and late in shelf life through measurements of sensory attributes, and membrane integrity of commercially packaged ready-to-eat baby spinach. The packaged products were received within 2 days of processing. Samples subject to early temperature abuse were immediately placed at 1, 4, 8, 12, 16 and 20°C storage upon arrival, and those subject to late temperature abuse were stored at 1°C for six days, and then transferred to 4, 8, 12, 16 and 20°C storage. Package headspace gas composition, in-package visual appeal, purchase intent, product color, off odor, decay, texture, overall quality, and tissue electrolyte leakage were evaluated every 1–2 day up to 16 day total. Results indicate that when the product temperature is maintained at 1–4°C, the quality of commercially packaged baby spinach can be retained for up to 18 days post-processing. However, storage temperature of 8°C or above, significantly ($P < 0.001$) shortened product shelf life as exhibited by accelerated tissue electrolyte leakage, product yellowing, decay and off odor development. Most importantly, the product's shelf life stage significantly affected its response to temperature. Quality deterioration proceeded more rapidly when temperature abuse occurred in late as opposed to early shelf life stage.

Keywords: /Spinach/ /Quality/ /Ready-to-eat/

TOMATO

Dhakal, R. and K.H. Baek. 2014. Short period irradiation of single blue wavelength light extends the storage period of mature green **tomatoes**. *Postharvest Biol. Technol.* 90: 73 – 77.

Abstract

Major postharvest quality factors of mature green tomatoes were investigated to improve their long-term storage. Mature green tomatoes pretreated with blue light (440–450 nm) emitted from blue light emitting diodes (LEDs) for 7 days developed a yellowish color and high levels of firmness, while those pretreated with darkness or red light (650–660 nm) from red LEDs for the same period ripened and developed red color. The pretreated tomatoes were incubated in darkness at room temperature, * and b* values, firmness and lycopene contents were measured after 7, 14, and 21 days of storage. The tomatoes pretreated with blue light had delayed softening; however, these tomatoes ripened fully, recovering red color development and accumulation of lycopene during 21 days of storage in darkness. These findings indicate that simple single blue wavelength illumination can be an effective application to

extend the shelf-life of tomatoes by delaying fruit softening and ripening. Further studies should be conducted to characterize the roles and regulatory mechanisms of the components involved in the delay of tomato ripening by blue light.

Keywords: /Tomato/ /Storage/

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/ /Beeswax/ /Edible Coatings/ /Quality/

Zhang, Y., et. al. 2014. Anthocyanins double the shelf life of **tomatoes** by delaying over ripening and reducing susceptibility to gray mold. *Current Biol.* 23: 1094 – 1100.

Abstract

Shelf life is an important quality trait for many fruit, including tomatoes. We report that enrichment of anthocyanin, a natural pigment, in tomatoes can significantly extend shelf life. Processes late in ripening are suppressed by anthocyanin accumulation, and susceptibility to *Botrytis cinerea*, one of the most important postharvest pathogens, is reduced in purple tomato fruit. We show that reduced susceptibility to *B. cinerea* is dependent specifically on the accumulation of anthocyanins, which alter the spreading of the ROS burst during infection. The increased antioxidant capacity of purple fruit likely slows the processes of overripening. Enhancing the levels of natural antioxidants in tomato provides a novel strategy for extending shelf life by genetic engineering or conventional breeding.

Keywords: /Tomato/ /Anthocyanins/ /Shelf Life/Ripening/

TUBERS AND ROOTCROPS

POTATO

Mahto, R. and M. Das. 2014. Effect of gamma irradiation on the physico-mechanical and chemical properties of **potato** (*Solanum tuberosum* L.), cv. 'Kufri Sindhuri', in non-refrigerated storage conditions. *Postharvest Biol. Technol.* 92: 37 – 45.

Abstract

The effects of γ -irradiation doses, 0.04, 0.08, 0.12 and 1 kGy, applied at two different postharvest times (5 and 30 days after harvest), were studied on the textural behaviour (puncture force, shear force, work done to puncture and shear, cohesiveness and gumminess), microstructure, reducing sugar, total sugar and tuber losses of potato (*Solanum tuberosum* L.), cv. 'Kufri Sindhuri', during storage at 22°C (RH: 85–90%). The lowest dose (0.04 kGy) was sufficient to inhibit sprouting in potatoes exposed on day 5 but not in the tubers exposed on day 30. The irradiated, non-sprouted potatoes maintained their appearance during storage. Potatoes irradiated early appeared more sensitive to radiation-induced damage, resulting in excessive loss of tubers at 1 kGy but low doses (up to 0.12 kGy) did not increase the susceptibility of the tubers to rotting. No significant differences between reducing sugar and total sugar contents of the control and low dose irradiated tubers were observed after 120 d. High dose (1 kGy) induced blackening of the bud tissue, increased rotting percentage and poor textural quality. Increasing low doses (up to 0.12 kGy) progressively reduced the textural deterioration in the tubers during storage. The scanning electron micrographs of potatoes irradiated with 0.08–0.12 kGy showed intact cells with rigid cell walls, accounting for the higher textural values registered by the samples. Among the two treatment timings, 'K. Sindhuri' irradiated early after harvest (i.e., on day 5) with 0.08–0.12 kGy doses retained higher textural parameters compared to those irradiated after a delay (day 30). The study showed the potential effect of γ -irradiation for enhancing the storage life of potatoes in non-refrigerated storage.

Keywords: /Potato/ /Gamma Irradiation/