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As of October 2019

APPLE

Bergh, J. C., Joseph, S. V., Short, B. D., Nita, M., & Leskey, T. C. (2019). Effect of pre-harvest exposures to adult Halyomorpha halys (Hemiptera: Pentatomidae) on feeding injury to apple cultivars at harvest and during post-harvest cold storage. Crop Protection, 124, 104872. doi: 10.1016/j.cropro.2019.104872

Abstract

The effect of exposing apples to brown marmorated stink bug, *Halyomorpha halys*, for discrete intervals before harvest and of post-harvest cold storage on feeding injury expression was evaluated in 2011 and 2012. Individual apples from four cultivars in experimental orchards in Virginia and West Virginia, USA were caged soon after fruit set to protect them from insect injury. During each of the four weeks preceding harvest of each cultivar, five adult *H. halys* were placed in a subset of cages for 7-days, then removed. Control fruit were not exposed. The proportion of injured fruit and the number of external injuries was evaluated at harvest, after which the fruit were held in cold storage for about 5 weeks, followed by assessments of the proportion of fruit injured and the number of external and internal injuries. Most exposure timings resulted in external injury at harvest, but fruit exposed closer to harvest tended to show less injury than those exposed earlier. Fruit from all cultivars showed external injury at harvest, with variation in the proportion of injured fruit among them. The proportion of injured fruit and the number of external injuries tended to increase during post-harvest cold storage in some, but not all cultivars. The number of external injuries at harvest and after cold storage underrepresented the number of internal injuries. Results are discussed in the relation to the length of pre-harvest protection required to mitigate fruit injury from *H. halys*.

Keywords: /Brown Marmorated Stink Bug/ /*Malus domestica*/ /Management/

Martínez-Hernández, G. B., Castillejo, N., & Artés-Hernández, F. (2019). Effect of fresh–cut apples fortification with lycopene microspheres, revalorized from tomato by-products, during shelf life. Postharvest Biology and Technology, 156, 110925. doi: 10.1016/j.postharvbio.2019.05.026

Abstract

Fresh–cut apple browning has been conventionally tried to control with the help of ascorbic acid dips, although such antioxidant effect is limited. Lycopene, absent in apple flesh, is the carotenoid in nature with the highest antioxidant capacity, in special for its cis − isomers. Tomato skin is a low cost by-product with very high lycopene content (7.23 g kg−1) and high potential to be incorporated as an antioxidant agent in antibrowning dipping treatments. High lycopene extraction from tomato skin was achieved with a thermal treatment (75 °C, 1 h) favouring trans − to − cis lycopene isomerization with TiO2 nanoparticles. Lycopene extracts were highly encapsulated (encapsulation efficiency: 92.2%) with the complex coacervation method and the obtained microspheres were then incorporated in dipping treatments (0.5 (L0.5), 1 (L1) or 2 g L–1 (L2)) during fresh–cut apples processing, compared with an ascorbic acid dipping (AA; 10 g L–1). Quality changes (colour, microbial, physicochemical and bioactive compounds) were studied up to 9 d at 5 °C. The L2 dipping controlled better the browning during storage, showing the lowest browning index among treatments (BI = 43.8) after 9 d. Furthermore, L2 dipping did not affect the physicochemical quality of samples, while maintaining a good microbial quality. Incorporation of lycopene microspheres also improved the bioactive quality of samples, still showing total cis − lycopene isomer content of ≈ 20 mg kg−1 after 9 d. Furthermore, chlorogenic acid, the predominant phenolic acid, content was enhanced by 56% in L2 samples after 6–9 d. In conclusion, a dipping treatment of fresh–cut apples

including 2 g L–1 lycopene microspheres reduced browning, while quality was maintained and some bioactive compounds even enhanced after 9 d at 5 °C.

Keywords: /Lycopene Isomerization/ /Nanoencapsulation/ /Browning/ /TiO2 Nanoparticles/ /Antioxidant/ /Phenolic Compounds/

APRICOT

Hou, Y., Wu, F., Zhao, Y., Shi, L., & Zhu, X. (2019). Cloning and expression analysis of polygalacturonase and pectin methylesterase genes during softening in apricot (*Prunus armeniaca L.*) fruit. Scientia Horticulturae, 256, 108607. doi: 10.1016/j.scienta.2019.108607

Abstract

Apricot softening is an important physiological process that influences fruit quality and postharvest life. Polygalacturonase (PG; EC 3.2.1.6.9) and pectin methylesterase (PME; EC 3.1.11) are two important cell wall hydrolases that have been widely studied during fruit softening. However, the roles of PG and PME genes in apricot softening remain unclear. In the present study, *PaPG1* and *PaPME1* from the apricot fruit were cloned and characterized. Moreover, the effects of 1-methylcyclopropene (1-MCP) treatment on firmness, ethylene production, *PaPG1*and *PaPME1* expression levels as well as PG and PME activities in apricots during storage at 4 ℃ were investigated, and the quality traits of apricot fruit during shelf life at 25 ℃ after cold storage were analyzed. Results showed that the application of 1-MCP significantly inhibited the decrease in fruit firmness as well as the increase in ethylene production, and markedly suppressed the expression levels of *PaPG1*and *PaPME1* and the increases in PG and PME activities of the apricots during cold storage. In addition, the 1-MCP treated apricots exhibited higher firmness, titratable acid (TA) content as well as lower ethylene production, respiration rate and weight loss compared to the control during shelf life at 25 ℃. These results suggested that 1-MCP treatment delayed the softening and ripening of the apricots during cold storage, and maintained better quality and consumer acceptability of the apricots during shelf life. PG and PME genes might play crucial roles in the development of apricot softening during cold storage.

Keywords: /Apricot (*Prunus armeniaca* L.)/ /1-Methylcyclopropene/ /Cloning/ /Gene Expression/ /Softening/

BAMBOO

Li, C., Suo, J., Xuan, L., Ding, M., Zhang, H., Song, L., & Ying, Y. (2019). Bamboo shoot-lignification delay by melatonin during low temperature storage. Postharvest Biology and Technology, 156, 110933. doi: 10.1016/j.postharvbio.2019.110933

Abstract

Bamboo shoots may become lignified after harvest and even deteriorate rapidly under low-temperature storage. Melatonin reportedly delays plant senescence. This study was designed to investigate the effect of melatonin on texture quality index, lignin formation, scavenging-enzyme activity, and transcription-factor expression in Moso bamboo (*Phyllostachys edulis*) shoots stored at 4 °C for 12 d. Application of melatonin effectively retarded shoot lignification, as indicated by a reduction in the rate of hardening and yellowing, as well as reduced lignin and cellulose contents. Furthermore, melatonin treatment inhibited phenylalanine ammonia-lyase and peroxidase activities significantly, while enhancing superoxide dismutase, catalase, and ascorbate peroxidase activities at different storage stages. Additionally, transcription factors of *SND2*, *KNAT7*, *MYB20* and *MYB85* from the NAC and MYB families were upregulated during postharvest storage of bamboo shoots, and melatonin treatment significantly

inhibited their expression. These results suggest that the delaying effect of postharvest bamboo shoot lignification by melatonin treatment was mainly attributed to decreased activity of lignin biosynthesis-related enzymes and induced activation of antioxidant enzyme activity. Moreover, exogenous melatonin may be involved in the transcriptional regulation of the lignification process of bamboo shoots.

Keywords: /Melatonin/ /Lignification/ /Bamboo Shoots/ /Low Temperature/ /Storage/

BELL PEPPER

Ge, W., Kong, X., Zhao, Y., Wei, B., Zhou, Q., & Ji, S. (2019). Insights into the metabolism of membrane lipid fatty acids associated with chilling injury in post-harvest bell peppers. Food Chemistry, 295, 26–35. doi: 10.1016/j.foodchem.2019.05.117

Abstract

Bell peppers are susceptible to chilling injury (CI). To uncover the metabolism of membrane lipid fatty acids (FAs) accompanying CI, a gas chromatography-mass spectrometry (GC-MS)-based approach was used to quantitatively profile major membrane lipid FAs in bell peppers. RT-qPCR was performed to investigate the expression of the key genes that regulate the synthesis of unsaturated FAs. Additionally, we used microstructural, organoleptic, and physicochemical investigations to monitor the primary physiological metabolism of bell peppers. The study revealed that CI symptoms mostly resulted from the destabilization of the cytomembrane, which was induced by decreasing FA desaturation. Moreover, three times lower level of the double bond index in chilled fruits, than the control, further proved that membrane FA unsaturation can be considered a key factor during CI. In conclusion, this study revealed that the metabolism of membrane lipid FAs is involved in responses to CI.

Keywords: /Bell Peppers/ /Chilling Injury/ /Fatty Acid Metabolism/ /Fatty Acid Desaturase/

BLUEBERRY

Ge, Y., Li, X., Li, C., Tang, Q., Duan, B., Cheng, Y., Hou, J., Li, J. (2019). Effect of sodium nitroprusside on antioxidative enzymes and the phenylpropanoid pathway in blueberry fruit. Food Chemistry, 295, 607–612. doi: 10.1016/j.foodchem.2019.05.160

Abstract

The purpose of this study is to investigate the effects of sodium nitroprusside (SNP) treatment after harvest on the activity of antioxidative enzymes and the phenylpropanoid pathway of blueberries. Blueberry fruits were dipped in 1.0 mmol/L SNP solution for 10 min and stored at 4 °C. Fruits treated with distilled water were used as the control. The results indicated that SNP significantly inhibited the increase of weight loss and enhanced the ascorbic acid content of blueberry fruit. Moreover, SNP increased the activity of phenylalanine ammonia-lyase, 4-coumarate-CoA ligase, polyphenol oxidase, superoxide dismutase, glutathione reductase, ascorbate peroxidase, peroxidase, and hydrogen peroxide in blueberry fruit. The accumulation of lignin and anthocyanin in the fruit was also stimulated by the SNP treatment. These results demonstrate that SNP treatment could maintain the antioxidant ability of blueberries by regulating the phenylpropanoid pathway and antioxidant enzymes.

Keywords: /Northern Highbush Blueberry/ /Reactive Oxygen Species/ /Phenylpropanoid Pathway/ /Sodium Nitroprusside/

BROCCOLI

Han, A., Cao, S., Li, Y., Wang, H., Wei, Y., Shao, X., & Xu, F. (2019). Sucrose treatment suppresses programmed cell death in broccoli florets by improving mitochondrial physiological properties. Postharvest Biology and Technology, 156, 110932. doi: 10.1016/j.postharvbio.2019.110932

Abstract

The effect of sucrose treatment on mitochondrial membrane potential (ΔΨm), contents of reactive oxygen species (ROS), cytochrome c oxidase (COX) activity, alternative oxidase (AOX) activity, mitochondrial Ca2+ content and cytochrome c release from mitochondria in broccoli florets during storage at 20 °C was investigated. The results showed that sucrose treatment effectively retarded the onset of programmed cell death (PCD) in broccoli florets by a mitochondria-dependent pathway. Sucrose treatment inhibited the increase of ROS and a decrease in ΔΨm, which was associated with the open state of permeability transition pore (PTP) and the ratio of cytochrome c/a. The decrease of COX activity and Ca2+content in broccoli florets was suppressed under sucrose treatment. Sucrose treatment maintained higher AOX activity, and retarded the cytochrome c release from mitochondria. These results indicated that sucrose treatment delayed the appearance of PCD in broccoli florets through improving mitochondrial physiological properties.

Keywords: /Broccoli/ /Sucrose Treatment/ /Programmed Cell Death (PCD)/ /Mitochondrial/

FERN

Teerarak, M., & Laosinwattana, C. (2019). Essential oil from ginger as a novel agent in delaying senescence of cut fronds of the fern (*Davallia solida (G. Forst.) Sw.*). Postharvest Biology and Technology, 156, 110927. doi: 10.1016/j.postharvbio.2019.06.001

Abstract

Rabbit's foot fern (*Davallia solida* (G. Forst.) Sw.) is traded as cut floral greens and commonly used in orchid flower arrangements and bouquets; however, its use is limited by its relatively rapid postharvest yellowing and desiccation. This study was designed to investigate the chemical profile of the essential oil from ginger rhizome (*Zingiber officinale* Roscoe) and to determine the oil's effectiveness in extending the postharvest quality of rabbit's foot fern. Essential oil was extracted from ginger rhizomes by hydrodistillation. The percentage composition of major identified compounds was citral (29.91%), zingiberene (13.3%), *α*-farnesene (11.68%), 1,8-cineole (10.60%), and *β*-sesquiphellandrene (6.14%). The ginger essential oil was applied in emulsion form to rabbit's foot fern fronds as a pulse (25, 50, or 100 mg L−1) or a holding solution (5, 10 and 20 mg L−1). Pulse treatments were applied for 6 h before the fronds were transferred into a holding solution containing either distilled water or essential oil of ginger. Control fronds received distilled water as both pulsing and holding solutions. Rabbit's foot fern pulsed with 25 mg L−1 essential oil and transferred into a holding solution with 5 mg L−1essential oil increased frond longevity by 4.9 days and helped maintain both water uptake and visual quality. Under this treatment, fronds exhibited higher chlorophyll *a* and *b* contents, lower malondialdehyde content, and delayed loss of radical scavenging ability compared to control. Together, these results indicate that when dosed appropriately in pulsing and holding solutions, essential oil of ginger prolongs the vase life of fronds; it also enhances postharvest quality by simultaneously retarding the degradation of chlorophyll *a* and *b*, preserving DPPH scavenging activity, and lowering malondialdehyde accumulation.

Keywords: /Preservative Solution/ /Chlorophyll Content/ /Lipid Peroxidation/ /Cut Leaf/ /Antioxidant Activity/

GARLIC

Singh, S., Gaikwad, K. K., & Lee, Y. S. (2019). Development and application of a pyrogallic acid-based oxygen scavenging packaging system for shelf life extension of peeled garlic. Scientia Horticulturae, 256, 108548. doi: 10.1016/j.scienta.2019.108548

Abstract

In this study, an LDPE film was modified by blending with sodium carbonate and coating with 10%and 20% pyrogallic acid. The developed oxygen scavenging film was used to store peeled garlic at room temperature (25 °C) and 5 °C for 30 days over which the quality attributes and package atmosphere were monitored. Oxygen and CO2 concentration were stabilized much faster in the oxygen scavenger package at low temperature compared to that stored at 25 °C. However, in the control sample, O2 and CO2 were not stabilized due to respiration, and O2 concentration reached0 at day15 of storage. The oxygen scavenger packaging reduced fungal decay, weight loss, and aerobic count compared to the control package at both temperatures. Garlic stored in the oxygen scavenger package remained firmer than that in control during storage. The control sample developed yellow coloration during storage; the example in the oxygen scavenger package stored at 5 °C showed a negligible colour change, whereas the package stored at 25 °C show slight yellowish colour after 20 days. Garlic packed with the LDPE/PG 10% and 20% films and stored at 5 °C retained excellent quality until day 30 of storage, whereas garlic stored at 25 °C started deteriorating after day 20.

Keywords: /Garlic/ /Pyrogallic Acid/ /Active Packaging/ /Oxygen Scavenger/ /Shelf Life/

GRAPEFRUIT

Lado, J., Gurrea, A., Zacarías, L., & Rodrigo, M. J. (2019). Influence of the storage temperature on volatile emission, carotenoid content and chilling injury development in Star Ruby red grapefruit. Food Chemistry, 295, 72–81. doi: 10.1016/j.foodchem.2019.05.108

Abstract

Grapefruits are sensitive to develop chilling injury (CI) on the peel upon postharvest storage at low temperature. We investigated the influence of the storage at 2 and 12 °C on CI, carotenoids, and emission of volatiles by intact fruit. CI symptoms at 12 °C were restricted to green fruit peel sectors but at 2 °C the CI severity was higher and distributed through the whole fruit surface. Fruit peel coloration and carotenes content increased at 12 °C whereas experienced minor changes at 2 °C. At 2 °C the emission of total volatiles and specific monoterpenes, mainly limonene, but also linalool and α-terpineol was enhanced, while storage at 12 °C resulted in higher emission and diversity of cyclic sesquiterpenes and aliphatic esters. Results indicate a selective emission of volatiles by intact red grapefruit that appears to be a specific response to the storage temperature or to the cold-induced damage.

Keywords: /Carotenoids/ /Citrus/ /Chilling Injury/ /Cold Storage/ /Grapefruit/ /Limonene/ /Volatile/

GREEN PEPPER

Wei, F., Fu, M., Li, J., Yang, X., Chen, Q., & Tian, S. (2019). Chlorine dioxide delays the reddening of postharvest green peppers by affecting the chlorophyll degradation and carotenoid synthesis pathways. Postharvest Biology and Technology, 156, 110939. doi: 10.1016/j.postharvbio.2019.110939

Abstract

The change in colour from green to red, known as reddening, is a major problem in green pepper cultivation, implying ripening and senescence. Chlorine dioxide (ClO2) is used to preserve the quality of vegetables and fruits because of its safety. In this work, the effects of ClO2 on reddening in green peppers, their chlorophyll and carotenoid content, and the molecular mechanisms involved are studied. The results show that 30 μL L−1 of ClO2 treatment reduced the reddening rate markedly compared to the control. ClO2 delayed the degradation of chlorophyll and significantly reduced the synthesis of capsanthin and β-carotene. Additionally, the transcript levels of pheophytin pheophorbide hydrolase (*PPH*), pheophorbide a oxygenase (*PAO*), and red chlorophyll catabolite reductase (*RCCR*) genes, associated with chlorophyll breakdown, were inhibited by ClO2 treatment, and the relative expression of phytoene synthase (*Psy*), lycopene β-cyclase enzyme (*Lcyb*), capsanthin/capsorubin synthase (*Ccs*), and β-carotene hydroxygenase enzyme (*Crtz*) genes, associated with carotenoid synthesis, were suppressed. These findings indicate that ClO2 delayed reddening by suppressing the expression of certain genes associated with chlorophyll breakdown and carotenoid synthesis in harvested green peppers.

Keywords: /Chlorine Dioxide/ /Green Pepper/ /Reddening/ /Chlorophyll Degradation/ /Carotenoid Synthesis/

GUAVA

Martínez-Ortiz, M. A., Palma-Rodríguez, H. M., Montalvo-González, E., Sáyago-Ayerdi, S. G., Utrilla-Coello, R., & Vargas-Torres, A. (2019). Effect of using microencapsulated ascorbic acid in coatings based on resistant starch chayotextle on the quality of guava fruit. Scientia Horticulturae, 256, 108604. doi: 10.1016/j.scienta.2019.108604

Abstract

Filmogenic solutions based on chayotextle (*Shechium edule Sw.*) starch mixed with microcapsules of resistant starch (RS) containing ascorbic acid (AA) were used as coatings for guavas. The viscosity properties of the coatings were affected by the concentration of microcapsules in the filmogenic solution. Fruits were coated by dipping them in filmogenic solutions without microcapsules (control) or in solutions with a concentration of microcapsules of 6.25% or 12.5%. Fruits were stored under controlled conditions (4 °C, 65% relative humidity), and the loss of weight, changes in the respiration rate (RR) and physicochemical parameters were assessed. In general, fruits coated with the control solution and solutions containing 6.25% and 12.5% microcapsules showed significant changes in the content of total soluble solids (TSS), pH, and titratable acidity (TA). Significant decreases in RR, firmness and weight were observed in fruits covered with the 12.5%, 6.25% and control solutions, respectively. Fruits covered with edible coatings showed a decrease in ripening, with lower values for their physicochemical properties and reduced changes in surface color compared with uncoated fruits.

Keywords: /Edible Coatings/ /Starch/ /Fruits/ /Resistant Starch/ /Microcapsules/ /Shelf Life/

JUJUBE FRUIT

Gong, L., Zhao, Z., Yin, C., Gupta, V. K., Zhang, X., & Jiang, Y. (2019). Synergistic interaction of natamycin with carboxymethyl chitosan for controlling *Alternata alternara*, a cause of black spot rot in postharvest jujube fruit. Postharvest Biology and Technology, 156, 110919. doi: 10.1016/j.postharvbio.2019.05.020

Abstract

Black spot rot of jujube, caused by *Alternata alternara*, is an important disease affecting jujube tree and fruit production. In this study, the mixtures of natamycin (NATA) and carboxymethyl chitosan (CMCS) were investigated for their combined and/or individual bioactivity against *A. alternara* and the quality maintenance of postharvest jujube fruit. The combined effectiveness between NATA and CMCS was calculated by Wadley's method, and the results indicated synergistic interactions (SR ≥ 1.5) between NATA and CMCS up to the ratios of 1: 100 and 1: 500. Then, an emulsion was developed by mixing NATA and CMCS and was characterized by determining the particle size and the zeta potential. The results suggested that the emulsion has great physical stability after storage for 60 d at 25 °C. Furthermore, the emulsion was applied to the postharvest treatment of fresh jujube fruit. The results indicated that the treatment significantly decreased the fruit respiration rate and ethylene production, reduced postharvest natural decay, promoted fruit firmness, and delayed loss of titratable acidity and vitamin C during the storage 40 d at 10 °C, maintaining a better quality of the jujube fruit. Finally, high-throughput sequencing was used to determine the sequences of the ITS2 gene in ITS5-1737F variable regions between the treated and control jujube fruit. The results showed that the emulsion reduced the entire fungal counts and altered the absolute abundance of plant pathogens, including *Alternaria* species, in the jujube fruit. Taken together, these results suggested that the formulation incorporating NATA and CMCS represents an alternative to control postharvest diseases and to improve the shelf life quality of jujube fruit.

Keywords: /Jujube Fruit/ /Natamycin/ /Carboxymethyl Chitosan/ /*Alternata alternara*/ /ITS Sequencing/

Zhao, Y., Zhu, X., Hou, Y., Wang, X., & Li, X. (2019). Effects of nitric oxide fumigation treatment on retarding cell wall degradation and delaying softening of winter jujube (*Ziziphus jujuba* Mill. cv. Dongzao) fruit during storage. Postharvest Biology and Technology, 156, 110954. doi: 10.1016/j.postharvbio.2019.110954

Abstract

Winter jujube (*Ziziphus jujuba* Mill. cv. Dongzao) fruit were fumigated with 20 μL L−1of nitric oxide (NO) for 3 h and then stored at 0 ± 1 ºC with 90–95 % relative humidity for 75 d. The effects of NO fumigation on changes in fruit firmness, activities of cell wall degrading enzymes, the compositions of the cell walls, as well as the cell wall ultrastructure in the winter jujube fruit were investigated during storage. The results showed that the decline in fruit firmness, contents of CDTA-soluble pectin (CSP), Na2CO3-soluble pectin (SSP), hemicellulose, and cellulose, as well as the increase in water-soluble pectin (WSP) of the winter jujube fruit could be delayed by NO treatment relative to the control. NO treatment also suppressed the activities of pectin methylesterase (PME; EC 3.1.1.11), polygalacturonase (PG; EC 3.2.1.15), β-galactosidase (β-Gal; EC 3.2.1.23) and cellulase (EC 3.2.1.4) during storage. Furthermore, ultrastructural observations revealed that NO treatment delayed the disruption of cell wall structure of the winter jujube fruit. These results indicated that retarding the disassembly of cell walls polysaccharides via inhibition of an array of cell wall degrading enzymes activities, which in turn would help maintain the intactness of the cell walls, might be one possible mechanism by which NO treatment can help prevent softening of the winter jujube fruit.

Keywords: /Winter jujube (*Ziziphus jujuba* Mill. cv. Dongzao)/ /Nitric Oxide Fumigation/ /Softening/ /Cell Wall Degradation/ /Cell Wall Degrading Enzyme/

KALE

Shah, U., Ranieri, P., Zhou, Y., Schauer, C.L., Miller, V., Fridman, G., Sekhon, J.K. (2019). Effects of cold plasma treatments on spot-inoculated Escherichia coli O157:H7 and quality of baby kale (*Brassica oleracea*) leaves. Innovative Food Science & Emerging Technologies, 57, 102104 https://doi.org/10.1016/j.ifset.2018.12.010

Abstract

The efficacy of non-equilibrium atmospheric pressure-pulsed dielectric barrier discharge (cold plasma)-treated mist in disinfecting baby kale leaves, and its effect on color values and cuticle composition were evaluated. UV-treated baby kale leaves were spot-inoculated (0.04-mL of 106 CFU/mL) with rifampicin-resistant strain *E. coli* O157:H7 ATCC 700728 incubated (0–4 °C) overnight and treated with plasma mist at 60, 120, 180, 240 or 300 s. Treated and untreated leaves were analyzed for change in color values (L*, a*, b*, chroma, hue, and browning index (BI)) using a Chroma meter. Functional groups (alcohols, esters, aldehydes, and ketones) were determined in the cuticle using FTIR. Color stability of treated leaves was also evaluated after refrigerated storage (4 °C) for 12 days. Levels of *E. coli* O157:H7 on the kale leaves were reduced below the detection limit of 5.5 × 103 CFU/mL after plasma treatment for 300 s with no significant change in color values. Visible change in color (browning or leaf damage) was observed after 600 s of plasma treatment. Color stability of plasma-treated leaves was enhanced during refrigerated storage (4 °C), indicated by a lower BI value of 34.4 ± 5.4 at 120-s plasma treatment compared to untreated leaves after 12 days of storage. Fourier transform infrared (FTIR) spectroscopy analysis concluded that plasma treatment of kale did not negatively affect functional groups in the cuticle. This study demonstrated that cold plasma mist has the potential to reduce *E. coli* on the surface of baby kale leaves with no significant change in the color values.

Keywords: /Food Safety/ /Cold Plasma/ /Color/ /Cuticle/ /Storage/

KIWI

Huang, H., Guo, L., Wang, L., Wang, H., Ma, S., Jiang, Y., & Qu, H. (2019). 1-Methylcyclopropene (1-MCP) slows ripening of kiwifruit and affects energy status, membrane fatty acid contents and cell membrane integrity. Postharvest Biology and Technology, 156, 110941. doi: 10.1016/j.postharvbio.2019.110941

Abstract

Changes of energy status and membrane fatty acids during ripening of kiwifruit without as with 1-methylcyclopropene (1-MCP) treatment have been investigated. Fruit were treated without (as control) or with 1 μL L−1 1-MCP for 24 h and then kept at 22 ± 2 °C for 16 d. In comparison to control, 1-MCP treatment inhibited the increase of membrane permeability, lipid peroxidation, and palmitic acid, the major saturated fatty acid; and slowed the decrease of flesh firmness, energy charge, ATP, ATP/ADP, and ATP/AMP. The decrease of unsaturated fatty acids was slowed by 1-MCP treatment. Negative correlation was found between unsaturated to saturated fatty acids ratio and both lipid peroxidation and membrane permeability. Moreover, ATP concentrations were positively associated with the unsaturated to saturated fatty acids ratio. These results suggested that small changes in the energy status and membrane fatty acid contents were associated with the maintenance of the cell membrane integrity of kiwifruit after harvest.

Keywords: /Kiwifruit/ /Energy Status/ /Membrane Fatty Acids/ /Lipid Peroxidation/ /Membrane/ /Permeability/

LETTUCE

Fan, K., Zhang, M., Bhandari, B., & Jiang, F. (2019). A combination treatment of ultrasound and ε-polylysine to improve microorganisms and storage quality of fresh-cut lettuce. Lwt, 113, 108315. doi: 10.1016/j.lwt.2019.108315

Abstract

A combination treatment of ultrasound and ε-polylysine to improve microorganisms and storage quality of fresh-cut lettuce were investigated. Fresh-cut lettuce was treated with ultrasound (20 kHz, 17–29 W/L), ε-polylysine (0.1–0.6 g/L) and their combination at 20 °C for 10 min and then packaged as well as stored at 4 °C for 12 d. The results showed that 23 W/L ultrasound combined with 0.4 g/L ε-polylysine treatment was superior to 23 W/L ultrasound or 0.4 g/L ε-polylysine treatment alone in inhibiting the growth of microorganisms such as total number of colonies, mold and yeast, and total coliform counts of fresh-cut lettuce during storage. Ultrasound combined with ε-polylysine treatment reduced weight loss and total color difference (ΔE), declined POD and PPO activities, maintained the higher level of total phenolics content, vitamin C and chlorophyll, as well as decreased water mobility and respiration rate in fresh-cut lettuce during storage compared to control. Therefore, these results demonstrated that ultrasound combined with ε-polylysine treatment was helpful for inhibiting microorganisms and improving storage quality, and can be an effective preservation method to extend shelf-life of fresh-cut lettuce.

Keywords: /ε-Polylysine/ /Ultrasound/ /Microorganisms/ /Storage Quality/ /Fresh-cut Lettuce/

Teng, Z., Luo, Y., Bornhorst, E. R., Zhou, B., Simko, I., & Trouth, F. (2019). Identification of romaine lettuce (Lactuca sativa var. longifolia) Cultivars with reduced browning discoloration for fresh-cut processing. Postharvest Biology and Technology, 156, 110931. doi: 10.1016/j.postharvbio.2019.110931

Abstract

Discoloration (browning) represents a major challenge that limits the quality and shelf life of fresh-cut lettuce. In this study, we aimed to find romaine lettuce (*Lactuca sativa* var. *longifolia*) accessions with low browning potential. Midribs of 14 accessions (11 cultivars, two breeding lines, and a single plant introduction) were shredded and packaged in perforated bags for five days. Images of processed samples were captured daily and analyzed with computer vision technology to quantify browning intensity via L*a*b* color values and browning index (BI). Enzymatic activity[phenylalanine lyase (PAL), peroxidase (POD), and polyphenol oxidase (PPO)] and total phenolic content (TPC) were measured daily. After five days in storage, the accessions in the Tall Guzmaine and Parris Island Cos pedigree groups exhibited the greatest and least browning, respectively. In addition, while the PAL, POD, and TPC increased substantially over time, the PPO of twelve accessions fluctuated with only minor increases. For all accessions, the temporal increase of PAL, POD, and TPC showed significant, positive correlation to browning progression. Comparing between accessions, those that had greater amounts of accumulated PAL and smaller amounts of POD tended to have a greater amount of browning after five days of storage, despite relatively low correlation coefficients. However, the accumulation of TPC and PPO was not correlated to browning severity after five days of storage. This systematic study provides lettuce growers and breeders with guidance for selecting accessions with limited browning, and it supplies researchers in plant physiology and genetics with more information on the roles of enzymes in the lettuce browning process.

Keywords: /Romaine Lettuce/ /Fresh-Cut Produce/ /Browning/ /Computer Vision/ /Image Analysis/ /Phenylalanine Ammonia Lyase/ /Peroxidase/ /Polyphenol Oxidase/ /Total Phenolic Content/

Lilium Casa Blanca CUTFLOWER

Zheng, M., & Guo, Y. (2019). Effects of neodymium on the vase life and physiological characteristics of Lilium Casa Blanca petals. Scientia Horticulturae, 256, 108553. doi: 10.1016/j.scienta.2019.108553

Abstract

In this paper, we investigated the effects of neodymium trichloride (NdCl3) on the vase life and physiological characteristics of the petals of *Lilium Casa* Blanca cut flower. The results showed that NdCl3 markedly enhanced the activities of antioxidant enzymes ascorbate peroxidase (APX), superoxide dismutase (SOD), catalase (CAT), peroxidase (POD), glutathione reductase (GR) and glutathione peroxidase (GPX), the contents of reduced ascorbate (AsA), reduced glutathione (GSH) and osmotic adjustment substances soluble sugar, proline and soluble protein, the ratios of AsA/DHA and GSH/GSSG, as well as the relative water content (RWC) in the petals, compared with control. However, NdCl3 markedly reduced malondialdehyde (MDA) content and electrolyte leakage (EL) in the petals, compared with control. Meanwhile, NdCl3 markedly increased the vase life, compared with control. Above results indicated that NdCl3 prolonged the vase life of *Lilium Casa* Blanca cut flower by enhancing the antioxidant capacity and water-holding ability of the petals.

Keywords: /Neodymium trichloride/ /Vase Life/ /Antioxidant Capacity/ /Water-Holding Ability/ /*Lilium Casa* Blanca/

LIME

Soriano-Melgar, L. D. A. A., Raddatz-Mota, D., León-Sánchez, F. D. D., Rodríguez-Verástegui, L. L., & Rivera-Cabrera, F. (2019). Effects of under-water cutting treatments on oleocellosis development, quality and shelf-life of minimally processed Persian lime fruit. Postharvest Biology and Technology, 156, 110953. doi: 10.1016/j.postharvbio.2019.110953

Abstract

The main problem for minimally processed acid limes commercialization is oleocellosis, a physiopathy generated on the surface of the fruit by the release of essential oils from flavedo's oil glands due to processing, which causes sinking of the tissue, necrosis and loss of product quality. In order to reduce this problem, we evaluate the effect of underwater cutting (UWC), either alone or in combination with other chemicals treatments on the development of oleocellosis and quality of minimally processed Persian lime. Persian lime fruit was cut into 8 wedges inside a refrigerated chamber at 10 °C under water (UWC) at 4 °C (control) or UWC with calcium lactate (5%) and 4-hexylresorcinol (4HR, 1 mM), either alone or in combination. The obtained minimally processed Persian lime fruit were washed, disinfected and stored in crystal clear polystyrene clam shells at 7.5 °C for 10 d. Visual quality and physicochemical parameters were determined. UWC + calcium presented the lowest levels of dehydration, weight loss, lipid peroxidation and the minimum damage at the cutting surface, showing to be the best treatment for minimally processed Persian lime reaching 10 d of shelf life and retaining marketable quality.

Keywords: /Calcium Lactate/ /4-Hexylresorcinol/ /Oil Spotting/ /*Citrus latifolia*/ /Fresh-cut/ /Lipid Peroxidation/

LONGAN

Joradol, A., Uthaibutra, J., Lithanatudom, P., & Saengnil, K. (2019). Induced expression of NOX and SOD by gaseous sulfur dioxide and chlorine dioxide enhances antioxidant capacity and maintains fruit quality of 'Daw' longan fruit during storage through H_2O_2 signaling. Postharvest Biology and Technology, 156, 110938. doi: 10.1016/j.postharvbio.2019.110938

Abstract

Hydrogen peroxide (H_2O_2) is known to be a signaling molecule involved in the activation of plant defense against both biotic and abiotic stresses. The current study aimed to demonstrate that fumigation induces H_2O_2 production, which is believed to act as the upstream signaling molecule in the antioxidant defense responses. Longan (*Dimocarpus longan* Lour. cv. Daw) fruit were fumigated with either 1000 mg L−1 sulfur dioxide (SO_2) or 10 mg L−1 chlorine dioxide (ClO_2), or in combination, and stored for 8 d. Both types of fumigation reduced pericarp browning and maintained fruit quality for up to 3, 5 or 7 d, respectively, comparing with a 2 d shelf life for the non-fumigated control fruit. 2,2'-Azino-bis-3-ethylbenzthiazoline-6-sulphonic acid (ABTS) and 1,1-diphenyl-2-picrylhydrazy (DPPH) assays indicated that antioxidant capacity was enhanced in treated fruit. H_2O_2 concentrations increased immediately after the fumigation in treated fruit, reaching a maximum within 6–12 h. Treatments increased expression of the plasma membrane nicotinamide adenine dinucleotide phosphate oxidase (*RbohD*) and superoxide dismutase (*SOD*). Subsequent nicotinamide adenine dinucleotide phosphate oxidase (NOX) and superoxide dismutase activity surges coincided with the rise of H_2O_2. Compared with the fumigated samples, H_2O_2 concentrations did not increase in the control until day 1, reaching concentrations that were about three times higher than those of the fumigated samples at the end of the experiment, while that of the fumigated fruit remained lower. These results suggested that SO_2 and/or ClO_2 fumigation triggers the NOX-dependent H_2O_2 generation, which could activate the antioxidant response in longan aimed to overcome the subsequent H_2O_2 production, thereby reducing the pericarp browning and maintaining fruit quality.

Keywords: /ClO_2/ /SO_2/ /H_2O_2/ /NADPH Oxidase/ /Antioxidant/ /*Dimocarpus longan* Lour./

LOTUS

Ali, S., Khan, A. S., Anjum, M. A., Nawaz, A., Naz, S., Ejaz, S., & Hussain, S. (2019). Aloe vera gel coating delays post-cut surface browning and maintains quality of cold stored lotus (*Nelumbo nucifera Gaertn.*) root slices. Scientia Horticulturae, 256, 108612. doi: 10.1016/j.scienta.2019.108612

Abstract

Post-cut surface browning is the leading constraint in shelf life extension and marketing of fresh-cut slices of lotus roots. In the current work, efficacy of *Aloe vera*gel (AVG) coating on quality and post-cut surface discoloration of lotus root slices was investigated. The slices were coated with 0, 25 and 50% AVG concentrations and kept at 5 ± 1 °C for 8 days. The slices coated with 50% AVG concentration showed substantially higher overall visual quality with markedly lower weight loss, browning degree, total aerobic bacteria and activities of polyphenol oxidase and peroxidase enzymes. Relative electrolyte leakage, hydrogen peroxide, superoxide anion and malondialdehyde content were also significantly lower in 50% AVG gel coated slices. Similarly, 50% AVG treatment had substantially higher total phenolic content and superoxide dismutase, ascorbate peroxidase and catalase enzymes activities. So, 50% AVG concentration is suitable to reduce enzymatic browning and to conserve overall quality of lotus root slices.

Keywords: /Edible Coating/ /Enzymatic Browning/ /Fresh-cut/ /*Nelumbo nucifera/* /Visual Quality/

MANDARIN

Lo'Ay, A., & Dawood, H. (2019). Tolerance of 'Baladi' mandarin fruits to cold storage by postharvest pectin/PVA blend with ascorbic acid treatment. Scientia Horticulturae, 256, 108637. doi: 10.1016/j.scienta.2019.108637

Abstract

Postharvest chilling injury (CI) of 'Baladi' mandarin is related to the activity of antioxidant enzyme activities (AEAs) during cold storage. The performance of pectin/polyvinyl-alcohol (PC/PVA) blending in ascorbic acid (AA) to increase storability tolerance of mandarin fruit under cold otherwise the impacts of PC/PVP-AA on antioxidant enzymes were assessed. The mandarins were harvested manually from trees aged-8-years on April 15th when the fruits reached commercial maturity stage. Fruit were coated with PC/PVA biopolymer with AA at the different concentration (0, 3, 6 and 9 mM). The experiment was conducted during two growth seasons (2017–2018). Fruits coated by PC/PVA-AA for 20 min and stored at low temperature (4 ± 1 °C and 95 ± 1% RH) for 60 days. The studies were distinguished within a pair of groups: physical and chemical assessments. The physical measurements chilling injury index (CI-index), weight loss%, and mandarin peel color profile (lightness, Chroma, Hue) were monitored. However, the chemical analysis for instance soluble solid content (SSC%), titratable acidity (TA%), SSC/TA-ratio, for evaluating mandarin fruit maturity were estimated. The AEAs were evaluated: ascorbate peroxidase (APX), catalase (CAT), granulation reductase (GR), and superoxide dismutase (SOD). Plus, malondialdehyde (MDA), and cell membrane ion leakage (IL%) were considered. Further, the O2 and H2O2 production rate were measured beside the scavenging activity and inhibition (DPPH and ABTs). Results indicate that the coated mandarin by PC/PVA-AA 9 mM exhibited less CI. Also, it forced AEAs in activities much more compared to other treatments. Moreover, it reduced the formation of $O_2^{\bullet}$ radical and H2O2 and more scavenging activities (DPPH and ABTs) during cold storage. Therefore, the coating treatment PC/PVA-AA 9 mM for mandarin fruits provided more tolerant to cold storage stress.

Keywords: /Mandarin/ /Cold Storage/ /Coating Mixture/ /Chilling Injury/

MANGO

Diskin, S., Sharir, T., Feygenberg, O., Maurer, D., Alkan, N. (2019). Fludioxonil – A potential alternative for postharvest disease control in mango fruit. Crop Protection, 124, 104855 https://doi.org/10.1016/j.cropro.2019.104855

Abstract

Stem-end rot (SER) is one of the most prevalent postharvest diseases of mango fruit grown in the Mediterranean climate, whereas anthracnose disease caused by *Colletotrichum gloeosporioides* almost never occurs due to the dry environment during fruit development and harvest. SER is caused by a variety of fungal pathogens. The main cause of SER in Israel is *Lasiodiplodia theobromae*, which is not well controlled by the current fungicide. In the search for potential alternatives to control postharvest SER in mango, we assessed the efficacy of various fungicides and focused on two commercial fungicides — fludioxonil and prochloraz — at controlling postharvest decay of mango fruit. In *vitro* testing, Fludioxonil was found to be significantly more effective at inhibiting *L. theobromae* mycelial growth and conidial germination. Subsequent treatments with fludioxonil were also significantly more effective than prochloraz in controlling SER of mango fruit inoculated with *L. theobromae*. Both fungicides controlled side decay, mainly *Alternaria alternata*, of mango fruit with similar efficiency. However, fludioxonil treatments significantly changed the stem end microbiome community and reduced SER incidence and severity in mango fruit relative to similar treatments with prochloraz. We suggest fludioxonil as a postharvest treatment to control mango fruit decay in areas that harvest during a dry season.

Keywords: /Mango Fruit/ /*Lasiodiplodia theobromae/* /Stem-End Rot/ /Fungicide/ /Fludioxonil/

Aguirre-Güitrón, L., Calderón-Santoyo, M., Bautista-Rosales, P. U., & Ragazzo-Sánchez, J. A. (2019). Application of powder formulation of Meyerozyma caribbica for postharvest control of Colletotrichum gloeosporioides in mango (*Mangifera indica L.*). Lwt, 113, 108271. doi: 10.1016/j.lwt.2019.108271

Abstract

Meyerozyma caribbica has been demonstrated to be effective against *Colletotrichum gloeosporioides.* However, it is important to evaluate the biocontrol effectiveness of yeast powder formulation in fruit. This formulation was obtained by spray drying and stored for 6 months at 4 °C. The powder was evaluated to control *Colletotrichum gloeosporioides* on mango cv Ataulfo. The product was effective in postharvest control of fungal pathogen in fruit stored at 25 °C, However, it was less effective for fruit stored at 13 °C. The formulation was able to reduce the incidence and severity of the disease up to 53.4% and 23.9% respectively in mangoes stored at 25 °C. On the other hand, the yeast application (fresh and powder formulation) did not affect quality parameters of mangoes during storage.

Keywords: /Powder Formulation/ /*Meyerozyma caribbica/* /Postharvest/ /Mango Fruit/

MUSHROOM

Li, T., Zhang, J., Gao, X., Chen, J., Zheng, Y., Gao, Y., & Qiu, L. (2019). The molecular mechanism for the ethylene regulation of postharvest button mushrooms maturation and senescence. Postharvest Biology and Technology, 156, 110930. doi: 10.1016/j.postharvbio.2019.110930

Abstract

The button mushroom (*Agaricus bisporus*) produces ethylene and respiration climacteric bursts coupling with rapidly maturation and senescence during postharvest storage. However, the molecular mechanism for the ethylene regulation of button mushroom maturation and senescence is still unclear. In this study, postharvest button mushrooms were treated with ethephon and the plant ethylene receptor inhibitor 1-methylcyclopropene (1-MCP), and the results showed that ethylene accelerated postharvest mushroom maturation and senescence and upregulated maturation- and senescence-related genes, which was in contrast to the effect of 1-MCP. Plant ethylene response elements were predicted in the promoter regions of all 19 maturation- and senescence-related genes in the button mushroom, and the 1-aminocyclopropane-1-carboxylic acid (ACC) oxidase (ACO) gene promoter region contained three ethylene response elements, which all expressed the GUS gene in transgenic onion epidermal cells by exogenous ethylene induction. The *ACO* gene was also highly expressed in postharvest mushrooms by ethylene induction. The results suggest that the ethylene response elements harbored in the promoter regions of the maturation- and senescence-related genes are probably responsible for the ethylene and respiration bursts as well as maturation and senescence of the postharvest button mushroom. The molecular mechanism for the ethylene regulation of postharvest button mushroom maturation and senescence may be similar to that of climacteric fruits.

Keyword: /*Agaricus bisporus/* /Preservation/ /Climacteric/ /Ethylene/ /Maturation- and Senescence-Related Genes/ /Ethylene Response Element/

Ojeda, G. A., Sgroppo, S. C., Martín-Belloso, O., & Soliva-Fortuny, R. (2019). Chitosan/tripolyphosphate nanoaggregates enhance the antibrowning effect of ascorbic acid on mushroom slices. Postharvest Biology and Technology, 156, 110934. doi: 10.1016/j.postharvbio.2019.110934

Abstract

Enzymatic browning is the main deleterious phenomenon affecting the quality of minimally processed mushrooms. Nano-encapsulation of antibrowning agents provides a new strategy to prevent discoloration in minimally processed commodities. In this study, coatings containing AA-loaded chitosan/tripolyphosphate nanoaggregates were applied to evaluate the postharvest preservation of minimally processed mushrooms during 16 d of storage at 5 °C. Package headspace composition, browning index, firmness, phenolic and ascorbic content, antioxidant capacity and polyphenol oxidase activity were evaluated as quality indicators. The results indicate that nanostructured coatings can effectively alleviate browning development (browning index was significantly reduced) and maintain firmness. Higher levels of phenolic compounds, ascorbic acid, as well as improvement in antioxidant capacity were achieved with the application of nano-encapsulated ascorbic acid. Polyphenol oxidase activity was partially inhibited as a consequence of the high AA concentration maintained during storage. The results allow concluding that AA-loaded chitosan/tripolyphosphate nanoaggregates are an interesting alternative to prevent browning of fresh-cut mushrooms and maintain high ascorbic acid concentrations through refrigerated storage.

Keywords: /Fresh-Cut Produce/ /Mushrooms/ /Nanoaggregates/ /Browning/ /Edible Coatings/

NANCE (*Byrsonima crassifolia* L.)

Rivas-Castro, S. F., Martínez-Moreno, E., Alia-Tejacal, I., & Pérez-López, A. (2019). Physical and physiological changes in phenotypes of nance [*Byrsonima crassifolia* (L.) H.B.K.] with different harvest maturity. Scientia Horticulturae, 256, 108620. doi: 10.1016/j.scienta.2019.108620

Abstract

Nance [*Byrsonima crassifolia* (L.) H.B.K.] belongs to a subgenus of *Byrsonima* Rich. ex Kunth that comprises approximately 200 species distributed in tropical and subtropical climates of Mexico, Central America and South America. Some of these species are endangered. Nance fruit contain functional nutrients but have not been commercially used. Local residents usually collect natural abscission fruit from ground and the shelf life is very short, only one or two days. Five nance phenotypes produced in Tabasco, Mexico, were studied at different stages of maturity to determine physical and physiological changes to establish harvest criteria. The results showed that the phenotypes yellow, yellow chintul and red chintul grew in direction of the equatorial diameter, while the green phenotype and green chintul grew in direction of the polar diameter. All the phenotypes studied showed significant changes in peel color, a decrease in peel firmness and increase in the content of total soluble solids of the pulp. The evidence found in these physical changes, as well as in the change in kinetics and production of carbon dioxide and ethylene, lead us to conclude that the phenotypes studied have a ripening climacteric pattern dependent on ethylene. Consequently, it is possible to harvest nance fruit directly from the tree to ensure a fruit visual, physical and eating quality to establish an industry.

Keywords: /Nance Fruit/ /Respiration/ /Ethylene/ /Ripening/ /Harvest Maturity/

OKRA

Phornvillay, S., Pongprasert, N., Wongs-Aree, C., Uthairatanakij, A., & Srilaong, V. (2019). Exogenous putrescine treatment delays chilling injury in okra pod (*Abelmoschus esculentus*) stored at low storage temperature. Scientia Horticulturae, 256, 108550. doi: 10.1016/j.scienta.2019.108550

Abstract

Okra as tropical crop is susceptible to chilling injury (CI), which limit the usage of low storage temperature. Polyamine, particularly putrescine (Put) has been proposed to play important role in plant to cope with cold stress. Thus, the aim of this study was to determine the effect of polyamines treatment specifically Put on alleviating the CI in okra when exposed to low storage temperature. Okra pods were dipped into Put at 0, 0.5 mM, 1 mM and 2 mM and stored at 4 °C. The results showed that 2 mM Put effectively reduced CI symptoms of okra. Interestingly, seed browning increased with severity of CI. Meanwhile, Put treatment significantly reduced seed browning by retarding the activity polyphenol oxidase (PPO) and peroxidase (POD) enzymes. Additionally, Put treatment elevated total phenolics, total antioxidant activity (DPPH radical scavenging activity and FRAP), antioxidant enzymes (CAT and SOD) activity and contributed to low hydrogen peroxide and malondialdehyde

Keywords: /Okra/ /Putrescine/ /Chilling Stress/ /Seed Browning/ /Antioxidants/

ORANGE

Gao, Y., Liu, Y., Kan, C., Chen, M., & Chen, J. (2019). Changes of peel color and fruit quality in navel orange fruits under different storage methods. Scientia Horticulturae, 256, 108522. doi: 10.1016/j.scienta.2019.05.049

Abstract

Fruit color is one important traits that largely determine the quality of navel orange fruits. The goal of this work was to evaluate the influence of ventilating warehouse (VW), mechanical refrigeration warehouse (MRW) and mountain evaporative cooling ventilating warehouse (MECW) storage on the quality and peel color in navel orange. The weight loss rate, decay rate, total soluble solids (TSS), titratable acidity (TA) and vitamin C (Vc) content of fruit were measured. The color index of the skin was determined by a chromameter, and the carotenoids from the skin were determined by high performance liquid chromatography. During storage, the weight loss rate and rot rate of navel orange fruit gradually increased, and TSS, TA and Vc gradually degraded. The weight loss rate and decay rate of fruits stored in MRW and MECW were lower than those of fruits stored in VW, and the contents of TSS, TA and VC were higher than those of fruits stored in VW. However, the color change of VW and MECW fruits was better than that of MRW fruits. The chlorophyll content of VW and MECW fruits was significantly lower than that of MRW fruits, and the carotenoid content of VW and MECW fruits was significantly higher than that of MRW fruits in the late storage period. Our study suggests that MECW had the best storage effect among the three storage methods, which provided a theoretical basis for the practical application of MECW in citrus fruit storage.

Keywords: /Peel Color/ /Fruit Quality/ /Navel Orange/ /Storage Methods/ /Mountain Evaporative Cooling Ventilating Warehouse/

PAK CHOY

Gu, S., Fu, L., Ren, H., Wang, X., & Huang, J. (2019). Effects of exogenous cholesterol treatment on quality characteristics of pak choy (*Brassica chinensis L.*) during storage. Postharvest Biology and Technology, 156, 110926. doi: 10.1016/j.postharvbio.2019.05.027

Abstract

Freshly harvested pak choys were immersed with 0.15 g L−1 cholesterol solution for 2 h and then stored at 2 ± 0.5 ℃ for 35 d to investigate the effect of cholesterol on quality, antioxidant activity, as well as fatty acids characteristics of thylakoid membrane (20 ± 0.5 ℃ for 3 d). The results showed that cholesterol led to the lower level of nitrites (reduced by 70.43%), higher levels of ascorbic acid (increased by 33.61%) and chlorophyll (increased by 22.76%) during storage. Cholesterol effectively inhibited the loss of weight, soluble protein and malondialdehyde (MDA), and contributed to the preservation of soluble solids content (SSC) and antioxidant enzyme activities. In addition, the antioxidant enzyme activities of catalase (CAT), superoxide dismutase (SOD), ascorbate peroxidase (APX) and glutathione reductase (GR) were positively correlated with chlorophyll (r = 0.46 to 0.88) and ascorbic acid (r = 0.73 to 0.99), whereas negatively correlated with nitrite (r= -0.53 to -0.76) throughout the storage period. Fatty acids analysis showed that exogenous cholesterol retarded phytol degradation, and total fatty acids of thylakoid membranes decreased 72.40% in controls, while that in cholesterol treatment only increased 5.39% after 3-day storage at 20 ℃. Cholesterol effectively maintained higher total fatty acid contents and retarded degradation of unsaturated fatty acid in the thylakoid membrane. Hence, postharvest application of cholesterol could enhance antioxidant capacity and sustain the stability of thylakoid membrane, which may have potential commercial benefit for extension in market life of green leafy vegetables.

Keywords: /Cholesterol/ /Pak Choy/ /Antioxidant/ /Fatty Acid/ /Storage/

PEACH

Abdipour, M., Hosseinifarahi, M., & Naseri, N. (2019). Combination method of UV-B and UV-C prevents post-harvest decay and improves organoleptic quality of peach fruit. Scientia Horticulturae, 256, 108564. doi: 10.1016/j.scienta.2019.108564

Abstract

Rapid ripening and post-harvest decay are the most limiting factors that affect the storage life of peach fruit. Postharvest UV exposure is a relatively new method that can induce positive biological effects, such as reducing decay rate and prolonging the storage period in fruit. The single and combined effects of ultraviolent radiations (UV-B and UV-C) treatments with different intensities (0.36 and 0.72 kJ m−2) and duration (10 and 20 min) were studied on the weight loss, vitamin C, decay, total soluble solids (TSS), texture firmness, total phenolic compounds (TPC), titratable acidity, and sensory properties of peach fruits during 25 days at 4 °C. Compared with control group, UV treatments (UV-B, UV-C, UV-B + UV-C) showed significant positive effects on peach fruits after long-term storage ($P < 0.001$). UV-C treatment compared to UV-B treatment improved physicochemical and sensory properties throughout storage ($P < 0.001$). Overall, UV-C + UV-B treatment (28.8 kJ m−2) showed the best results compared to control, and peach weight loss, decay, and TSS decreased by 22.1, 290 and 10%, respectively, and vitamin C, firmness, TPC, titratable acidity, pH, increased by 34.78, 22.82, 4.7, 92.85, 17.77%, respectively. Furthermore, we obtained the desired values of sensory properties with the above treatment. It seems UV-C + UV-B treatment because of keeping the quality and shelf life can be considered as a high-performance pre-treatment method for long-term keeping of peach fruit.

Keywords: /Decay/ /Peach Fruit/ /Post-harvest Quality/ /UV Irradiation/ /Weight Loss/

Zhu, L., Du, H., Wang, W., Zhang, W., Shen, Y., Wan, C., & Chen, J. (2019). Synergistic effect of nitric oxide with hydrogen sulfide on inhibition of ripening and softening of peach fruits during storage. Scientia Horticulturae, 256, 108591. doi: 10.1016/j.scienta.2019.108591

Abstract

The effects of fumigation with NO, H_2S and combination of both on the quality, ethylene biosynthesis and softening of postharvest 'Dahong' peach fruit were investigated in current study. Results showed that NO or H_2S significantly inhibited the increase of rot index, soluble solid contents, decrease of firmness along with titratable acid contents ($P < 0.05$). Combinatorial treatment (NO+H_2S) further inhibited ripening of peach fruits, moreover it also showed significant decline in ACC content, ACC synthase and oxidase activities compared to individual treatments, was mainly linked with reduced ethylene production. The combined treatment significantly inhibited the increase of water-soluble and CDTA-soluble cell wall fractions, the decrease of Na_2CO_3-soluble fractions in peach fruit with significantly reduced softening related enzymes activities. These observations suggested the existence of synergistic functions between NO and H_2S in inhibiting ethylene biosynthesis and cell wall metabolism in order to maintain superior quality of peach fruits.

Keywords: /NO/ /H_2S/ /Peach/ /Ethylene Biosynthesis/ /Cell Wall Metabolism/

PEAR

Seo, H.-J., Wang, Y.-S., Lwin, H. P., Choi, J.-H., Chun, J.-P., Roan, S.-F., … Lee, J. (2019). Early season 'Wonhwang' pear fruit quality following international transport and storage is negatively impacted by fruitlet stage gibberellic acid4 7 (GA4 7) application but improved by postharvest 1-methylcyclopropene (1-MCP). Scientia Horticulturae, 256, 108549. doi: 10.1016/j.scienta.2019.108549

Abstract

The popularity and demand of early season 'Wonhwang' pear fruit are getting increased due to premium fruit quality. However, numerous physiological disorders can be developed after harvest and during short-term storage. The objective of the study was aimed to evaluate the effectiveness of gibberellic acid4+7 (GA4+7) at fruitlet stage, 1-methylcylcopropene (1-MCP), pre-conditioning, or 1-MCP + pre-conditioning on fruit quality attributes and incidence of physiological disorders in 'Wonhwang' pears stored at commercial storage facility and then shipped to Taiwan from South Korea. GA4+7 treatment reduced fresh weight loss but was lowered flesh firmness compared with the other treatments. 1-MCP treatment maintained superior fruit firmness during shelf life relative to other treatments. Soluble solids concentration (SSC) did not differ among treatments. Titratable acidity (TA) was lowest in GA4+7 treatment but relatively retained in 1-MCP treatment, compared with the other treatments. Lightness (L^*) was not affected by treatments among tissues during shelf life but was higher in 1-MCP treatment than in pre-conditioning or GA4+7 treatments. Peel staining was only detected in GA4+7 treated fruit. 1-MCP treatment reduced the severity of flesh browning, core browning, water soaking and cavity, compared with the other treatments. Overall, the results suggested that 1-MCP treatment to early season 'Wonhwang' Asian pears enables the retention of fruit firmness and reduces the severity of physiological disorders for international trading, compared with GA4+7 or pre-conditioning treatments.

Keywords: /International Trade System/ /Fruit Color Variables/ /Peel Staining/ /Internal Browning/ /Water Soaking/ /Cavity/

Kaur, A., Gill, P., Jawandha, S., & Singh, M. (2019). Pre-storage exogenous application of boric acid extends storability and maintains quality of pear fruits. Scientia Horticulturae, 256, 108616. doi: 10.1016/j.scienta.2019.108616

Abstract

Present studies were carried out to investigate the potential of boric acid to extend storage the life of pear (*Pyrus pyrifolia* L.) cv. 'Patharnakh' fruits. Pear fruits were dipped in aqueous solutions of different concentrations (0- water dip, 1–3%) of boric acid for 5 min and thereafter stored at 0–1 °C, 90–95% RH for 70 days. Compared with control, boric acid 3% treatment retarded the degradation of fruit colour, titratable acidity (TA) and soluble solids content (SSC) and maintained higher fruit firmness by suppressing the activity of cell wall degrading enzymes like pectin methyl estarase (PME) and cellulase. Alongwith this boric acid 3% treated fruits also retained the higher total phenolic content (TPC) by retardation of polyphenol oxidase (PPO) activity than control. At the end of storage, all boric acid treatment exhibited significantly higher sensory quality than control. Furthermore, analysis of correlations and regressions showed that many quality attributes were interdependent. It can be summarized that postharvest dip treatment of boric acid (3%) was most effective to extend the storage life of 'Patharnakh' pear fruit.

Keywords: /Boric acid/ /Pear Storage/ /Fruit Quality/ /Pectin methyl estarase/ /Polyphenol oxidase/

Singh, V., Jawandha, S., Gill, P., & Gill, M. (2019). Suppression of fruit softening and extension of shelf life of pear by putrescine application. Scientia Horticulturae, 256, 108623. doi: 10.1016/j.scienta.2019.108623

Abstract

Softening during storage limits the shelf life of pear fruit (*Pyrus* spp.) which lead to remarkable losses. To develop an effective technique to reduce softening and maintain quality of pear fruit, the effect of postharvest dip treatment of putrescine (PUT) @ 1 mM, 2 mM and 3 mM was investigated on pear fruit cv. Punjab Beauty. The 2 mM and 3 mM PUT treatment effectively reduced the weight loss (WL), retained higher firmness, suppressed the degradation of starch and titratable acidity (TA) and maintained the higher quality of fruit. Moreover, these treatments suppress the activity of cell wall degrading enzymes pectin methyl esterase (PME) and cellulase concomitant with reduction in fruit softening than in control. The 2 mM and 3 mM PUT exhibited the lower spoilage of fruit. These results suggest that, 2 mM and 3 mM PUT suppressed the activity of cell wall degrading enzymes and maintained higher sensory quality (SQ) with prolongation of shelf life of 12 days under ambient conditions.

Keywords: /Cellulase/ /Fruit Quality/ /Pear/ /PME/ /Putrescine/ /Softening/

POTATO

Ellis, G. D., Knowles, L. O., & Knowles, N. R. (2019). Respiratory and low-temperature sweetening responses of fresh-cut potato (*Solanum tuberosum L.)* tubers to low oxygen. Postharvest Biology and Technology, 156, 110937. doi: 10.1016/j.postharvbio.2019.110937

Abstract

Enzymatic browning (EB) has impeded the commercialization of fresh-cut (FC) potato. However, recently introduced Innate®-engineered cultivars with silenced polyphenol oxidase (PPO) have overcome this obstacle. As a supplement to refrigeration, low O2 atmosphere may extend the shelf-life of FC potato by reducing wound-induced respiration, associated dry matter loss, EB, and low-temperature sweetening

(LTS). Determining the O2 concentration that minimizes these deteriorative physiological processes without invoking anaerobic metabolism is prerequisite to designing effective modified atmosphere packaging (MAP). Accordingly, FC tubers of cultivars Russet Burbank (RB), Ranger Russet (RR), and their Innate® counterparts, CultivATE®, GenerATE®, and GlaciATE®, were stored (4 °C) in ten O2 atmospheres ranging from 0 to 21 kPa to determine the lower oxygen limit (LOL) for aerobic respiration and effects on LTS and EB. FC tissue stored at 21 kPa O2 displayed a prominent cold-induced respiratory acclimation response (RAR), characterized by an initial decline in respiration rate followed by a steady increase through 48 h. The RAR decreased with O2 and was extinguished at ≤1.5 kPa. Lowering O2 from 21-7 kPa had little effect on tissue respiration; however, rates fell from 4.23 to 3.41 μg kg−1 s−1 as O2 decreased from 7 to 3.5 kPa, followed by a further 79% reduction to 0.70 μg kg−1 s−1 at 0 kPa O2. Tissue lactate profiles revealed the onset of anaerobic metabolism at ca 1.5 kPa O2 for all cultivars. Importantly, lactate and ethanol accumulation were negligible through 16 d at ≥2 kPa O2 (= LOL) but increased considerably at ≤1 kPa. Low O2 attenuated the cold-induced synthesis of sucrose and reducing sugars in FC tissue from RB, and sucrose from GlaciATE®tubers in which acid invertase is silenced. Enzymatic browning of FC RB and RR tubers was inhibited by anoxia, but extensive at ≥0.5 kPa O2. FC Innate® tubers exhibited only minor EB at all O2 concentrations. Collectively, these data inform the further development of MAP for FC potato.

Keywords: /*Solanum tuberosum* L./ /Respiration/ /Lower Oxygen Limit/ /Anaerobic Metabolism/ /Enzymatic Browning/ /Cold-Induced Sweetening/

Hajian-Maleki, H., Baghaee-Ravari, S., & Moghaddam, M. (2019). Efficiency of essential oils against Pectobacterium carotovorum subsp. carotovorum causing potato soft rot and their possible application as coatings in storage. Postharvest Biology and Technology, 156, 110928. doi: 10.1016/j.postharvbio.2019.06.002

Abstract

This research was conducted to exploit an innovative approach for potato soft rot disease management by application of natural compounds as coatings. The activity of three novel essential oils (EOs) extracted from indigenous plants including *Hyssopus officinalis, Satureja khuzistanica* and *Zataria multiflora* was investigated against *Pectobacterium carotovorum* subsp. *carotovorum* (*Pcc*) under *in vitro* and *in vivo* conditions. The effect of sub-MIC concentrations of the oils was analyzed on different pathogenicity determinants of *Pcc* including motility, biofilm forming activity and enzyme secretion. The potential of the EOs to reduce soft rot was also evaluated in tuber maceration trial and under semi-practical storage conditions. The effect of the EOs application on decay progression and prevalence in potato tubers was determined by *in vivo* preventing and curing assays. The highest suppressive effects were displayed by *S. khuzistanica* and *Z. multiflora* EOs with MIC at 0.19 and 0.38 g L−1. Studied compounds were considerably able to inhibit virulence determinants of *Pcc* with higher efficiency than streptomycin. Biofilm-forming ability was sharply repressed in tested strains within the range of 24.8–47.6%. A significant induced motility was observed in oil-treated cells which is adversary with surface adhesion and biofilm development. Secretion of plant cell wall degrading enzymes (PCWDEs) was decreased in the range of 37.6–100% and among them, pectate lyase (Pel) and polygalacturonase (Peh) were considerably inhibited (53.4–100% and 65.4–100%). Sub-MIC values of *S. khuzistanica* and *Z. multiflora* EOs led to reduce maceration ability of *Pcc* strains in the range of 1.4 to 2.9 times compared with control. The results of *in vivo* trial indicated that tuber rot development was more efficiently controlled in preventive than curative conditions. Disease incidence was reduced by 38.4–70.6% as compared with non-coated samples in preventing assessment. In conclusion, the EOs were capable to control soft rot disease under *in vitro* and *in vivo* conditions. GC-MS analysis revealed that *cis*-pinocamphone, carvacrol and thymol were the main active constituents in *H. officinalis*, *S. khuzistanica* and *Z. multiflora* volatile oils, respectively. Studied test phytochemicals could be promising antibacterial agents for preserving potato tubers against soft rot and preventing storage loss. This is the first report on the activity of herbal antimicrobial compounds against a postharvest bacterial disease of potato as a practical solution which

can be suggested as preserver coatings for the tubers and incorporated with other disease management strategies.

Keywords: /Essential Oil/ /Pathogenicity Determinants/ /*Pectobacterium carotovorum* subsp. *carotovorum*/ /Potato/ /Postharvest/ /Soft Rot/

RASPBERRY

Shi, K., Liu, Z., Wang, J., Zhu, S., & Huang, D. (2019). Nitric oxide modulates sugar metabolism and maintains the quality of red raspberry during storage. Scientia Horticulturae, 256, 108611. doi: 10.1016/j.scienta.2019.108611

Abstract

The purpose of the study was to optimize the proper concentration of exogenous nitric oxide (NO), and it's regulation on the fruit quality of red raspberry during cold storage. Red raspberry fruits were immersed in 5, 15, 30 μmol L−1 NO and 200 μmol L−1 cPTIO solution, respectively, for 2 min. The soluble solids contents (SSC), weight loss, respiratory rate, ethylene production, and the contents of anthocyanin, rutin, total phenolic, total flavonoid, O2．−, •OH of red raspberry were measured. And the changes in sugar contents and the activities of enzymes associated with sugar metabolisms were investigated. The results showed that, compared with other concentrations, NO at 15 μmol L−1 maintained high contents of anthocyanin, rutin, total phenol, and total flavonoids, and reduced the release of superoxide anion and hydroxyl radical; increased the enzymes activities of soluble sugars metabolism and regulated the composition of soluble sugars in red raspberries during storage. It could be concluded that exogenous NO at 15 μmol L−1was more suitable than other concentrations for maintaining the good quality of red raspberries during storage. NO at 15 μmol L−1 could improve the antioxidant capacity and enhance the soluble sugar metabolism, and then maintain the storage quality of red raspberries.

Keywords: /Nitric Oxide/ /Raspberry/ /Storage/ /Quality/ /Soluble Sugar/

STONE FRUIT

Bernat, M., Casals, C., Torres, R., Teixidó, N., & Usall, J. (2019). Infection risk of Monilinia fructicola on stone fruit during cold storage and immersion in the dump tank. Scientia Horticulturae, 256, 108589. doi: 10.1016/j.scienta.2019.108589

Abstract

Monilinia spp. is the main pathogen responsible for postharvest losses of stone fruit. Several studies have examined the conditions for *Monilinia* spp. infection in the field, but very limited information is available about postharvest. Storing fruit for 1 day in the cold room or dumping fruit in a water tank are the most common handling operations during the postharvest of fruit. Then, the aim of this study was to investigate the risk of *Monilinia fructicola* infection for two peach and one nectarine cultivars during cold storage and water dump operations. A new methodology was performed using a dry inoculum of *M. fructicola.* A set of fruit was used as control to demonstrated that at 20 °C 60% relative humidity (RH) was not able to infect fruit, however, the disease was developed when was already infected. In addition, *M. fructicola* was able to infect and develop disease in fruit at 20 °C 100 RH. The storage of fruit with the presence of *M. fructicola* conidia on their surface for up to 30 days at 0 °C 100% RH or 4 °C 100% RH did not suppose an important risk of infection since only 3.3 and 3.8%, respectively of fruit were already infected. Overall, all treatments tested with the water dump operation gave optimal conditions to *M. fructicola* to infect fruit when it was superficially dry inoculated or it was immersed with water contaminated with conidia, increasing the need for water disinfection. In addition, when fruit was immersed in water free from *M.*

fructicola conidia, the postharvest operation gave optimal conditions to develop infections already produced.

Keywords: /Brown Rot/ /*Monilinia* spp./ /Postharvest/ /Cold Storing/ /Water Dumping/ /Peach/ /Nectarine/

STRAWBERRY

Nicolau-Lapeña, I., Abadias, M.,Bobo, G., Aguiló-Aguayo, I., Lafarga, T., Viñas, I. (2019). Strawberry sanitization by peracetic acid washing and its effect on fruit quality. Food Microbiology, 83, 159-166 https://doi.org/10.1016/j.fm.2019.05.004

Abstract

The risk posed by outbreaks associated with strawberries together with the safety issues of by-products from chlorine disinfection in the fruit industry has led to a search for alternative sanitizers. The disinfection capacity of peracetic acid (PA) at three concentrations (20, 40 and 80 ppm) and washing times (1 and 2 min) was compared to sodium hypochlorite (200 ppm) (NaClO) treatments and a water control, and its influence on the physico-chemical, biochemical and nutritional quality of strawberries was also studied. Counts on total aerobic mesophilic microorganisms were comparable between NaClO and PA. For yeasts and molds, only NaClO and 80 ppm PA reduced contamination in washing water, but no differences were observed in strawberries. Artificially inoculated *L. innocua* was reduced by at least 4 log cfu/g in strawberry by all the PA treatments, except at 20 ppm PA for 1 min. Total soluble solids, pH, titratable acidity, antioxidant activity and total phenolic content values were maintained after all treatments. Only anthocyanin content was affected. Treatments of 20 and 40 ppm PA did not significantly affect fruit color, and there were no losses on strawberry firmness. PA, as a GRAS substance that has shown potential to reduce microorganisms present in strawberries without any major physicochemical or sensorial alteration, could be a suitable alternative to chlorine disinfection.

Keywords: /*Listeria innocua/* /Native Microbiota/ /Nutritional/ /Biochemical/ /Disinfection/

Li, M., Li, X., Han, C., Ji, N., Jin, P., & Zheng, Y. (2019). UV-C treatment maintains quality and enhances antioxidant capacity of fresh-cut strawberries. Postharvest Biology and Technology, 156, 110945. doi: 10.1016/j.postharvbio.2019.110945

Abstract

The effects of ultraviolet C (UV-C) irradiation on quality and antioxidant capacity of fresh-cut strawberries were investigated by means of electronic nose, electronic tongue and chemical analysis. Strawberries were cut into four wedges and treated with UV-C, then stored at 4 °C for 7 d. The results indicated that the UV-C treatment suppressed microbial growth, inhibited the increase of sourness, bitterness, astringency and the decrease of firmness as well as vitamin C content, while the aroma was not affected. It also promoted the production of reactive oxygen species (ROS) and the increase of total phenolics, total anthocyanin and individual phenolic compounds. Moreover, the UV-C treatment enhanced the antioxidant enzyme activity and antioxidant capacity and increased the gene expression and activity of key enzymes involved in phenylpropanoid pathway. Therefore, UV-C treatment could maintain the quality, induce phenolic accumulation and thus improve antioxidant capacity by inducing ROS generation and activating the phenylpropanoid pathway in fresh-cut strawberries.

Keywords: /UV-C Treatment/ /Fresh-Cut Strawberries/ /Phenolic Compounds/ /Reactive Oxygen Species/

Lan, W., Zhang, R., Ahmed, S., Qin, W., & Liu, Y. (2019). Effects of various antimicrobial polyvinyl alcohol/tea polyphenol composite films on the shelf life of packaged strawberries. Lwt, 113, 108297. doi: 10.1016/j.lwt.2019.108297

Abstract

In this study, we developed and tested various antimicrobial polyvinyl alcohol (PVA)/tea polyphenol (TP) composite films intended to extend the shelf life of packaged strawberries. Each PVA/TP film with volumetric ratios of 10/0, 9/1, 8/2, 7/3, 6/4 and 5/5 was prepared using tap-casting methods and characterized with respect to its infrared spectrum, tensile strength, oxygen permeability, water solubility, biodegradation, and antimicrobial properties. The effects of the various composite films were subsequently evaluated based on the fruit's weight loss, decay rate, firmness, pH, titratable acidity, and soluble solids. The results indicated that the PVA/TP-8/2 composite film effectively retarded the fruit's weight and firmness loss. In addition, the PVA/TP-8/2 composite film significantly retarded the fruit's titratable acid and soluble solid loss and limited microbial proliferation. Among the various antimicrobial composite films tested, the PVA/TP-8/2 composite film exhibited significant potential as a packaging material that would extend the shelf life of strawberries.

Keywords: /PVATP/ /Packaged Strawberries/

Khodaei, D., & Hamidi-Esfahani, Z. (2019). Influence of bioactive edible coatings loaded with Lactobacillus plantarum on physicochemical properties of fresh strawberries. Postharvest Biology and Technology, 156, 110944. doi: 10.1016/j.postharvbio.2019.110944

Abstract

Carboxymethyl cellulose (CMC) edible coating used as a carrier to deliver an adequate amount of *Lactobacillus plantarum* on fresh strawberries and the shelf life of strawberries during the storage period was investigated. For this aim, different amounts of *L. plantarum* incorporated into CMC edible coatings and the physicochemical and microbiological characteristics of strawberries through storage at 4 °C were evaluated. The results showed that the number of viable probiotics in all treatments was higher than 6 log CFU g−1 and it increased by inoculation of a higher amount of probiotics into the coating solution. The population of *L. plantarum* in all coating treatments remained constant over the storage period and it helped to reduce the growth of yeast and molds on the surface of strawberries compared to control samples which it is mainly due to competitive and antimicrobial properties of probiotics. The presence of *L. plantarum* improved some physicochemical properties of coated strawberries compared to control samples by reducing the amount of weight loss, decay, and slowing the deteriorations rate of ascorbic acid and phenolic compounds during the storage time. No significant difference between color, hardness, TSS, TA and total anthocyanin of different treatments was observed and strawberries loaded with *L. plantarum* showed similar sensorial properties to CMC coated and control samples. It can be concluded that using the edible coating with probiotics is a novel method to design new functional foods and helps to improve the shelf life of strawberries.

Keywords: /Probiotics/ /Functional Foods/ /Shelf Life/ /Non-Dairy/ /Bio-protection/

SWEET CHERRY

Swamy, P., Probst, C., & Grove, G. G. (2019). Incidence of Podosphaera clandestina on sweet cherries (*Prunus avium*) and the influence of postharvest handling practices on the survival of conidia on harvested fruit. Postharvest Biology and Technology, 156, 110929. doi: 10.1016/j.postharvbio.2019.06.003

Abstract

Powdery mildew of sweet cherry in the Pacific Northwest (PNW) is caused by *Podosphaera clandestina,* which infects fruit and leaves. Disease symptoms are commonly observed near harvest and such infections are a major concern for offshore cherry markets due to the possibility of diseased cherries providing inoculum to establish the pathogen in a region where *P. clandestina* has not been reported. The present study was designed to identify periods at which fruit infections are most severe and to determine the efficacy of PNW's industry postharvest handling practices on the survival of *P. clandestina* conidia on diseased fruit surfaces. Morphological characteristics and next-generation sequencing (NGS) platform was used to identify the causal agent of foliar and fruit powdery mildew found in the PNW. We combined qPCR and, the use of a viability dye, propidium monoazide (PMA), to differentiate between viable and dead (membrane-compromised) conidia. These tools helped to determine the viability of conidia in real-time. Conidia on the fruit surface naturally lost their viability within a few days of harvest. Postharvest treatments in the PNW include hydrocooling with chlorinated water and methyl bromide fumigation prior to export. These practices were extremely effective in deactivating all conidia on the fruit surface. The residual conidia recovered from the fruit surface after the postharvest treatments failed to establish consistent powdery mildew colonies on the susceptible host leaves; this confirms that diseased, treated cherries are unlikely to serve as a source of inoculum needed to establish the pathogen areas where it has not been documented. After postharvest treatments, regular sampling of conidia up to three weeks after harvest indicated that the conidia were non-viable. Results of this study indicated that the sweet cherry postharvest handling procedures in the PNW are effective for the elimination of the potential sources of *P. clandestina* inoculum associated with cherry fruit.

Keywords: /Powdery Mildew/ /Sweet Cherry Export/ /Quarantine/ /*Podosphaera clandestina*/ /Next-Generation Sequencing (NGS)/ /Viability qPCR/ /Conidia/

WALNUT

Ortiz, C. M., Vicente, A. R., Fields, R. P., Grillo, F., Labavitch, J. M., Donis-Gonzalez, I., & Crisosto, C. H. (2019). Walnut (*Juglans regia L.*) kernel postharvest deterioration as affected by pellicle integrity, cultivar and oxygen concentration. Postharvest Biology and Technology, 156, 110948. doi: 10.1016/j.postharvbio.2019.110948

Abstract

Increased demand for convenient, healthy foods has promoted the commercialization of shelled, more perishable walnut kernels. In this work for two of the major commercial walnut cultivars ('Chandler' and 'Howard') we determined the influence that disruption of the integrity of the seed coat pellicle during shelling operations trigger postharvest deterioration. Commercially mature 'Chandler' and 'Howard' nuts were subjected to Gentle (*GS*, <4% pellicle area damaged per kernel) or Harsh Shelling (*HS*, 20–22% of pellicle area damaged) and stored in air at 25 or 35 °C (accelerated aging) for three or six weeks. During this period, which simulated current marketing and retail display, we evaluated kernel color changes (Dried Fruit Association of California 'DFA' scale, *L** and *Hue*), ethanol-soluble phenolic antioxidants, oil-free fatty acids (FFA), and peroxide value (PV). The kernel color changed from 'light' to 'amber' during storage, as demonstrated by the decrease in extra light and light kernels and by the reduced lightness (*L**) and *Hue* values. Pellicle browning (amber) incidence was common on *HS* kernels, which also lost

more phenolic antioxidants during storage. Minimizing pellicle damage by *GS* operations reduced triglyceride hydrolysis and peroxidation. Kernel quality loss was largely dependent on cultivar; browning oxidation, and lipid hydrolysis and oxidation were faster in 'Howard' than in 'Chandler'. Searching for a practical and direct postharvest technology, in absence of proper temperature control, to reduce the rate of kernel deterioration, we tested controlled atmospheres (CA) at different O2 concentrations (0.0, 3.0, 6.0 or 21.0 kPa) on both cultivars. Overall, commercially shelled 'Howard' and 'Chandler' (kernels) will benefit from retail packaging with oxygen concentrations equal to or lower than 3.0 kPa during warm retail display. This information will be useful for processors, distributors and produce handlers to protect snack-friendly, ready-to-eat walnuts.

Keywords: /Seed Coats/ /Shelling/ /Packing Tissue Brown/ /Hull Split/ /Kernel Browning/ /Rancidity/ /Controlled Atmosphere/ /Genotypes/ /Total Phenolics/ /Free Fatty Acids/ /Peroxide Values/

WILD ROCKET

Bonasia, A., Conversa, G., Lazzizera, C., & Elia, A. (2019). Post-harvest performance of ready-to-eat wild rocket salad as affected by growing period, soilless cultivation system and genotype. Postharvest Biology and Technology, 156, 110909. doi: 10.1016/j.postharvbio.2019.05.010

Abstract

The present study focuses on the effect of growing period (autumn-winter and winter-spring), soilless cultivation system (floating system and ebb and flow system) and genotype ('Naturelle' and 'Nature') on the post-harvest performance of wild rocket salad. Changes in bio-physical characteristics (weight losses, main colour indices, the concentration of dry matter and chlorophylls), physiological characteristics (relative water content, osmotic potential, electrolytic leakage), antioxidant compounds (vitamin C, phenolic compounds, carotenoids), glucosinulates, and activity of antioxidant enzymes (CAT-catalase; APX-ascorbate peroxidase; SOD-superoxide dismutase; GR-glutathione reductase) were evaluated in wild rocket salad after 7 days of cold storage. Wild rocket salad grown under winter spring conditions and in a floating system was more prone to post-harvest quality decay as highlighted by higher electrolyte leakage and osmotic potential, and lower relative water content, greater weight losses due to respiration activity, and a rapid breakdown of colour to yellowness. A higher shelf-life of the product grown under less photo-thermal stressing condition (autumn-winter cycle) was attributable to less physiologically stressed raw material and to a rise in non-enzymatic antioxidant compounds, namely carotenoids, phenols, and vitamin C (ascorbic acid), all effective at contrasting oxidative stress during storage. The higher shelf-life of the product grown in an ebb and flow system (lower losses of mass and lower visual decay) and of 'Nature' (a higher retention of the green colour) under autumn-winter conditions, seems to be imputable both to a higher efficiency of antioxidant enzyme activity (APX and CAT) and to a greater content of antioxidant compounds, mainly carotenoids. The role of individual glucosinolates in delaying senescence was only observed as a genotype-specific response of 'Nature' to the root oxygen limitation occurring with the floating system.

Keywords: /Visual Appearance/ /Antioxidant Compounds/ /Glucosinulates/ /Antioxidant Enzyme Activity/

Ziziphus jujuba

Deng, B., Guo, M., Liu, H., Tian, S., & Zhao, X. (2019). Inhibition of autophagy by hydroxychloroquine enhances antioxidant nutrients and delays postharvest fruit senescence of *Ziziphus jujuba*. Food Chemistry, 296, 56–62. doi: 10.1016/j.foodchem.2019.05.189

Abstract

Autophagy, a mechanism of recycling intracellular constituents, favors plant growth, especially under nutrient starvation. However, autophagy's role in regulating postharvest fruit senescence is unclear. Here, effects of the autophagy inhibitor hydroxychloroquine (HCQ) and activator LiCl on postharvest jujube fruit senescence were investigated. HCQ significantly reduced weight loss and decay incidence, and enhanced firmness compared with those of the control. LiCl had the opposite effects. Protein oxidation and H2O2 increased significantly in LiCl-treated compared with HCQ-treated fruit. The contents of vitamin C, total thiol, and phenolics, and total antioxidant capacity and DPPH-radical scavenging capacity, followed the order: HCQ > control > LiCl. The HCQ-mediated reduction in fruit respiration was significantly enhanced by ATP and partly reversed by 2,4-dinitrophenol, a mitochondrial uncoupler. Thus, jujube fruit senescence may be regulated by autophagy and the antioxidant capacity. A mechanism of autophagy-mediated postharvest fruit senescence involving mitochondrial biogenesis and respiration was proposed.

Keywords: /Antioxidant/ /Hydroxychloroquine/ /Jujube Fruit/ /Mitochondria/ /Senescence/