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As of FEBRUARY 2020

APPLE

Shoffe, Y. A., Nock, J. F., Baugher, T. A., Marini, R. P., & Watkins, C. B. (2020). Bitter pit and soft scald development during storage of unconditioned and conditioned 'Honeycrisp' apples in relation to mineral contents and harvest indices. *Postharvest Biology and Technology*, *160*, 111044. doi: 10.1016/j.postharvbio.2019.111044

Abstract

'Honeycrisp' apple fruit are highly susceptible to development of soft scald and bitter pit during storage. However, the commercial postharvest treatment of conditioning fruit at 10 °C for 7 d before storage at 3 °C to reduce soft scald development can increase bitter pit incidence. Prediction of these physiological disorders would enable storage operators to modify management techniques to reduce fruit losses due to both disorders. To develop prediction tools, harvest indices and mineral concentrations of fruit were analyzed from orchard blocks in Pennsylvania (PA) for three years, the Hudson Valley region (HV) for four years, the Champlain region for two years, and Western New York (WNY) for five years. Fruit were stored at 3 °C, without or with conditioning, and stored for 2 - 5 months in 2013- 2017. Fruit were also stored at 0.5 °C without or with conditioning in 2013, 2015, 2016. Multivariate analysis described significant relationships that were different for unconditioned and conditioned fruit. In unconditioned fruit, bitter pit incidence was negatively correlated with increasing internal ethylene concentration (IEC) and starch pattern indices (lower starch content), positively with higher chlorophyll content as indicated by the index of absorbance difference and with all minerals except N, as well as mineral ratios. In conditioned fruit, bitter pit incidence was correlated negatively with IEC, Ca, and positively with firmness, and all mineral ratios. Soft scald incidence in fruit stored at 0.5 °C was positively correlated with IEC and firmness, and all fruit mineral ratios except N/Ca and P/Ca, and negatively with Ca and Mg. For conditioned and unconditioned fruit stored at 3 °C, harvest indices predicted 27-28 % and 21-26 % bitter pit, respectively, while minerals and mineral ratios predicted 22-55 % and 18-54 % bitter pit, respectively. Harvest indices predicted 29-57 % soft scald, while minerals and mineral ratios predicted 29-49 for % soft scald for fruit stored at 0.5 °C. Correlations of bitter pit against P, K, and Mg were higher, and Ca and all mineral ratios lower, in conditioned fruit stored at 3 °C as opposed to those stored unconditioned at 3 °C. Nonlinear iterative partial least square algorithms based on variable importance plots *vs* coefficients showed that the regression of determination was affected by postharvest treatment in relation to harvest indices, minerals and their ratios. A negative correlation of bitter pit incidence against soft scald incidence was found for a region with high bitter pit and soft scald development.

Keywords: /*Malus* × *domestica*/ /Bitter pit/ /Soft scald/ /Minerals/ /Maturity/ /Prediction models/

Amarante, C. V. D., Silveira, J. P. G., Steffens, C. A., Freitas, S. T. D., Mitcham, E. J., & Miqueloto, A. (2020). Post-bloom and preharvest treatment of 'Braeburn' apple trees with prohexadione-calcium and GA4 7 affects vegetative growth and postharvest incidence of calcium-related physiological disorders and decay in the fruit. *Scientia Horticulturae*, *261*, 108919. doi: 10.1016/j.scienta.2019.108919

Abstract

Calcium (Ca) deficiency disorders in apple fruit have been associated with high gibberellins (GAs) activity in the tree. This study was carried out to assess the effects of treatments of 'Braeburn' apple trees with prohexadione-calcium (ProCa, an inhibitor of GAs biosynthesis) or gibberellins (GA_{4+7}) on vegetative

growth of the trees and postharvest incidence of Ca-related physiological disorders and decay in the fruit. ProCa (300 mg L^{-1}) or GA_{4+7} (300 mg L^{-1}) treatments were applied post-bloom (PB) and preharvest (PH). PB treatments started 15 days after full bloom (DAFB), with one application every week and six applications in total. PH treatments started five weeks before anticipated harvest (125 DAFB), with one application every week and four applications in total. Control trees were left untreated. When applied PB, ProCa reduced and GA_{4+7} promoted vegetative growth of the trees. ProCa PB delayed the impairment of xylem functionality (at the proximal region of the fruit) during fruit growth on the tree. Treatments had no effect on fruit weight, *pectinmethylesterase* (PME) activity or the expression of *CAX3*, *CAX6* and *V-ATPase* (transporters of Ca into the vacuole) genes assessed in the external cortical tissue at the distal end of the fruit at harvest. When sprayed PB, ProCa increased the total Ca content and reduced K/Ca, Mg/Ca, N/Ca, (Mg + K)/Ca and (K + Mg + N)/Ca ratios in the flesh at the distal portion of the fruit, compared to the treatment with GA_{4+7}, but without differing from the control. In general, ProCa application PB or PH reduced the expression of Ca-*ATPase1*, *Ca-ATPase2*, *H^+-PPase* and *CAX2* (Ca transporters into the vacuole) genes, increased total water-soluble Ca and reduced electrolyte leakage in the fruit at harvest. After two months of cold storage followed by five days of shelf-life, the incidence and severity of bitter pit (BP) was lower on fruit from trees treated with ProCa PH, and higher on fruit from trees treated with GA_{4+7} PB. GA_{4+7} PB also increased the incidence of skin cracking and decay in the fruit. The results showed that ProCa application represents a feasible tool to reduce the incidence of BP. However, ProCa is more effective to reduce BP if applied weekly for five week before harvest.

Keywords: /*Malus domestica* Borkh/ /Anti-gibberellin/ /Fruit mineral content/ /Gene expression of Ca transporters/ /Water-soluble Ca content/ /Electrolyte leakage/ /Bitter pit/ /Skin cracking/

Saba, M. K., & Watkins, C. B. (2020). Flesh browning development of 'Empire' apple during a shelf life period after 1-methylcyclopropene (1-MCP) treatment and controlled atmosphere storage. *Scientia Horticulturae*, *261*, 108938. doi: 10.1016/j.scienta.2019.108938

Abstract

Little information is known about metabolism of flesh browning disorders in apples after removal of fruit from cold storage. 'Empire' apples develop a firm flesh browning, a physiological disorder that is assumed to be a chilling injury because it occurs usually at 0.5 °C; however, incidence is increased in fruit at warmer storage temperatures (2–3 °C) if fruit have been treated with 1-methylcyclopropene (1-MCP). In this study, fruit were untreated or treated with 1-MCP and stored in controlled atmospheres at 0.5 or 3 °C for 40 weeks, followed by a 10 d shelf life period at 20 °C. The greatest increase of internal ethylene concentration (IEC) and softening occurred in the fruit that had been stored at 3 °C without 1-MCP, and the lowest in fruit from 0.5 °C plus 1-MCP. Flesh browning was present in 1-MCP treated fruit and in fruit stored at 0.5 °C at the time of removal, and low in fruit stored at 3 °C. Incidence and severity of the disorder in 1-MCP treated fruit stored at 3 °C increased greatly during the shelf life period. Electrolyte leakage was higher in 1-MCP treated fruit stored at 0.5 °C than in the other treatments. Polyphenol oxidase (PPO) activity was higher in 1-MCP treated fruit regardless of storage temperature but peroxidase (POX) activity was higher in fruit that had been stored at 0.5 °C regardless of 1-MCP treatment. The highest POX activity was measured in the fruit that had been stored at 0.5 °C without 1-MCP treatment. Overall, browning development during the shelf life is associated with higher PPO activity in 1-MCP treated fruit and higher POX activity at the lower storage temperature.

Keywords: /Cold storage/ /Polyphenol oxidase/ /Physiological disorder/ /Shelf life/

Schmidt, S. F. P., Schultz, E. E., Ludwig, V., Berghetti, M. R. P., Thewes, F. R., Anese, R. D. O., … Brackmann, A. (2020). Volatile compounds and overall quality of 'Braeburn' apples after long-term storage: Interaction of innovative storage technologies and 1-MCP treatment. *Scientia Horticulturae*, *262*, 109039. doi: 10.1016/j.scienta.2019.109039

Abstract

In this study, we evaluated storage methods which sustains 'Braeburn' apples volatile compounds and overall quality characteristics after 9 months of storage at 2.5 °C, and their relation with 1-methylcyclopropene (1-MCP) treatment. We also proposed to evaluate if there was a relation of the methyl and ethyl esters with flesh breakdown incidence. The storage design was composed by five atmosphere conditions: controlled atmosphere (CA) (1.2 kPa O2), dynamic controlled atmosphere based on the chlorophyll fluorescence (DCA-CF), and three levels of respiratory quotient: 1.3; 1.5 and 1.7 (DCA-RQ 1.3; DCA-RQ 1.5 and DCA-RQ 1.7). In all conditions, the CO2 was kept at 0.7 kPa and relative humidity was 94 ± 1 %, whether without or with 1-MCP treatment (0.625 μL L−1). 1-MCP maintains higher flesh firmness, suppresses the ethylene production and internal ethylene concentration (IEC), due to lower ACC oxidase enzyme activity. Ethyl acetate was not reduced by 1-MCP treatment in DCA-RQ 1.3, 1.5 and 1.7 storage conditions. Without 1-MCP, DCA-RQ 1.3 storage resulted in better flesh firmness and titratable acidity maintenance. There was no correlation of methyl and ethyl esters with flesh breakdown.

Keywords: /*Malus domestica*/ /Aroma/ /DCA/ /Respiratory quotient/ /Methyl acetate/ /Ethyl acetate/

APRICOT

Álvarez-Hernández, M. H., Martínez-Hernández, G. B., Avalos-Belmontes, F., Miranda-Molina, F. D., & Artés-Hernández, F. (2020). Postharvest quality retention of apricots by using a novel sepiolite–loaded potassium permanganate ethylene scavenger. *Postharvest Biology and Technology*, *160*, 111061. doi: 10.1016/j.postharvbio.2019.111061

Abstract

A new potassium permanganate–based ethylene (C2H4) scavenger was developed using sepiolite as support material. The effects of the scavenger on the main quality attributes of 'Mirlo naranja' apricots were evaluated in combination with modified atmosphere packaging (MAP) at 2 °C and under air packaging conditions at 15 °C. In–package gas composition, physicochemical traits (weight loss, fruit firmness, skin colour, pH, titratable acidity (TA), soluble solid content (SSC) and SSC/TA ratio, fungal incidence and sensory analysis), were monitored throughout storage. Results were compared with those obtained by using a commercial scavenger. As control, no scavengers were used. The results showed that both scavengers could achieve undetectable C2H4 concentrations within MAP packages at 2 °C. Overall, C2H4 removal resulted in a significant decrease in fruit weight loss, delayed TA decrease and led to lower SSC/TA ratio increase, while no effect was observed on fruit softening. In addition, the 15 °C–stored apricots also exhibited a lower pH increase, a decrease in C* colour parameter and less fungal incidence as a consequence of a C2H4–free environment. Furthermore, the developed scavenger reduced SSC changes of 15 °C–stored fruit, delayed fungal incidence at 2 °C, and maintained higher sensory quality during storage, maintaining good quality up to 36 d at 2 °C or 14 d at 15 °C. Accordingly, the developed C2H4 scavenger could be a good mean to delay ripening process of fresh apricots, and probably other C2H4 sensitive fruit, prolonging their postharvest storability and improving consumer acceptability.

Keywords: /*Prunus armeniaca* L./ /Ethylene adsorber/ /Phyllosilicate/ /Stone fruit/ /Sensory quality/ /Fungal incidence/

Nourozi, F., & Sayyari, M. (2020). Enrichment of Aloe vera gel with basil seed mucilage preserves bioactive compounds and postharvest quality of apricot fruits. *Scientia Horticulturae*, *262*, 109041. doi: 10.1016/j.scienta.2019.109041

Abstract

The effect of *Aloe vera* gel (AVG) and basil seed mucilage (BSM) as coating on qualitative attributes of apricot fruits were studied during storage at 2 °C for 28 days. Fruits coating with AVG and BSM alone or in combination with/together significantly reduced weight loss, soluble solid content, respiration rate, ethylene production and ripening index in comparison to the uncoated fruits. Also, in coated fruits the firmness and titratable acidity were higher than control fruits. Application of AVG and BSM efficiently increased antioxidant activity, total phenolic content and ascorbic acid of apricot fruits during cold storage. In evaluating sensory attributes, the panelists did not detect any negative effect of AVG and BSM on flavor and external visual aspect of coated fruits. The results demonstrated that addition of BSM to AVG or their individual application as an edible coating could be a promising approach to maintain postharvest quality and control physiological process of apricot fruits during cold storage.

Keywords: /Carotenoids content/ /Edible coatings/ /Ethylene production/ /Respiration rate/ /Phenolic compounds/

ARTICHOKE

Capotorto, I., Innamorato, V., Cefola, M., Cervellieri, S., Lippolis, V., Longobardi, F., … Pace, B. (2020). High CO_2 short-term treatment to preserve quality and volatiles profile of fresh-cut artichokes during cold storage. *Postharvest Biology and Technology*, *160*, 111056. doi: 10.1016/j.postharvbio.2019.111056

Abstract

In this research paper fresh-cut artichokes were treated for 48 h at 0 °C with different CO2 concentration (CO_2-10%, CO_2-20%, CO_2-30%, CO_2-40%, AIR) and then stored for 7 d at 5 °C in air. High CO_2 short-term treatment until 30% reduced respiration rate, browning index, preserving the total phenols content and antioxidant activity at the level of untreated samples. However, the application of CO_2 concentration around 40% might cause a fermentative metabolism, according to maturity stage. VOCs analysis showed that CO_2-10% was the best treatment to preserve the volatile profile of the fresh samples, characterized by specific compounds, including terpenes, alcohols, esters, aldehydes, hydrocarbons and heterocyclic compounds. On the other hand, CO_2-40% resulted, associated with fermentative compounds, mainly esters. Finally aqueous metabolite profile, evaluated by NMR, was not affected by CO2 short-term treatments.

Keywords: /*Cynara cardunculus* L./ /High-CO_2 modified atmosphere/ /VOCs/ /Respiration rate/ /Metabolic profile/

BANANA

Dwivany, F. M., Syam, F., Nugrahapraja, H., Radjasa, O. K., Moeis, M. R., & Uchiyama, S. (2020). Dataset of microbial community structure in alcohol sprayed banana associated with ripening process. *Data in Brief*, 105216. doi: 10.1016/j.dib.2020.105216

Abstract

Banana ripening is a complex molecular process that produces visible changes in the texture, aroma,

taste and nutritional content. Ripening is controlled by genetic code, metabolic pathway and associated microbiome. We reported the microbial community structure during banana ripening with alcohol treatment to discover endophytic and epiphytic microbes. We observed the pulp and peel from the first and seventh days of Cavendish (*Musa acuminata* cv. Cavendish) from mature green fruit and treated with 70% alcohol or distilled water sum up to eight samples and applied the 16S rRNA Illumina sequencing from V3–V4 gene region. After quality check 144,368 sequences were obtained in the dataset comprising a total read length of 1,237,805 base pairs. A sum of 199 genera were successfully isolated, with genera *Alcaligenes* was the most dominant genera at 56.65% and followed by more than 1% were genera *Acinetobacter*, *Enhydrobacter*, *Pseudomonas*, *Stenotrophomas*, *Thermus*, and *Aerococcus* using mothur pipelines. The highest diversity sample with 101 unique genera belongs to distilled water treated raw banana peel (NN1K) and the lowest diversity at 38 belongs to distilled water treated ripe banana pulp (NN7D). The metagenome data are available at NCBI Sequence Read Archive (SRA) database and Biosample under accession number PRJNA590572. The data contribute to discovering different bacterial communities during post-harvest treatment.

Keywords: /Amplicon sequencing/ /*Musa acuminata* AAA group/ /Endophytic/ /Epiphytic/ /*Alcaligenes/*

Lo'Ay, A., Hamed, S. E., El-Khateeb, A. Y., & Mohamed, A. H. (2020). Implementation exogenous ATP on the starch degradation enzyme activities of 'Grand Nain' banana fruit during shelf life. *Scientia Horticulturae*, *262*, 109021. doi: 10.1016/j.scienta.2019.109021

Abstract

The activities of starch degradation enzymes (SDEA), α-amylase (AMY, EC: 3.2.1.1), Invertase (INV, EC: 3.2.1.26), and phosphorylase (PHO, EC: 2.4.1.14), were quantified in the pulp of 'Grand Nain' banana fruit. Practically, the bananas were set in many doses of ATP (0, 0.5, 1.0, and 1.5 mM) for 10 min, hence processed at store condition (25 ± 1 °C and 63 ± 2 % RH) for 12 days of storage. The activities of starch degradation enzymes (SDEA) such as a-amylase (AMY, EC: 3.2.1.1), Invertase (INV, EC: 3.2.1.26), and phosphorylase (PHO, EC: 2.4.1.14), were quantified in the banana pulp of 'Grand Nain' fruit. Later fruits were immersed in different concentration of ATP (0, 0.5, 1.0, and 1.5 mM) for 10 min, then stored at ambient condition (25 ± 1 °C and 63 ± 2 % RH) for the period of up to 12-days. Generally, low initial SDEA at harvest time was noticed then increased up to the end of storage time. The increases in SDEA were independently due to ATP concentrations. Throughout the storage duration, ATP 1.5 mM treatment displayed higher activity of SDEA than other ATP and control treatments, then, the sugar profile was increased. However, the fruit quality, ATP 1.5 mM minimized of fruit softening, alleviated fruit browning and enhanced carotenoid synthesis. Moreover, it was controlled by ethylene and respiration rate plus it reduced the accumulation of MDA and ion leakage percentage during the storage period. In view of these processes, ATP treatment at 1.5 mM will result which affects the SB and fruit quality.

Keywords: /ATP/ /Banana/ /Shelf life/ /Starch/

BELL PEPPER

Saravanakumar, K., Hu, X., Chelliah, R., Oh, D.-H., Kathiresan, K., & Wang, M.-H. (2020). Biogenic silver nanoparticles-polyvinylpyrrolidone based glycerosomes coating to expand the shelf life of fresh-cut bell pepper (Capsicum annuum L. var. grossum (L.) Sendt). *Postharvest Biology and Technology*, *160*, 111039. doi: 10.1016/j.postharvbio.2019.111039

Abstract

The present work reported the comparative analysis on the preparation and characterization of chemically and green synthesized silver nanoparticles polyvinylpyrrolidone (PVP) based glycerosomes

(C/G-PVP-AgNPs) and their function as antimicrobial nano coating agent to augment the shelf life of the fresh cut pepper (FCP). The UV Spectrophotometer results revealed peaks at 400–420 nm indicating the formation of G-AgNPs and C-PVP-AgNPs. The Fourier-transform infrared spectroscopy (FTIR) results indicated the involvement of phytomolecules from the pedicel extracts on the synthesis of G-AgNPs and this analysis displayed the peaks corresponding to copolymers PVP and glycerol in G/C-PVP-AgNPs. The X-ray diffractometer (XRD) results confirmed G-AgNPs followed the occurrence of the Ag in G/C-PVP-AgNPs. The particle size analyzer (PSA) and field emission transmission electron microscopy-Energy Dispersive X-ray Spectroscopy (FETEM-EDS) revealed the mean size of 37.01 nm for G-AgNPs, 123 nm for G-PVP-AgNPs and 45.26 nm for C-PVP-AgNPs. The G-PVP-AgNPs showed more antibacterial activities than the C-PVP-AgNPs as evident by low minimal inhibitory concentration (MIC) and minimal bactericidal concentration (MBC). The application of the nano coating of G-PVP-AgNPs extended the shelf life of the red or yellow FCP (Fresh Cut bell Pepper) for 12 d at 4 °C without causing any harm to cellular or physicochemical properties of FCP. The G/C-PVP-AgNPs coated FCP juices did not cause any toxicity to the survival of roundworms while the uncoated FCP juice caused the cellular damage in the roundworm. These results suggested the potential application of G-PVP-AgNPs as a preservative agent to augment the shelf life of FCP in the food industry for the future.

Keywords: /Polyvinylpyrrolidone/ /Nanocoating/ /Antibacterial agent/ /Silver nanoparticles/

BLACKBERRY

Vilaplana, R., Guerrero, K., Guevara, J., & Valencia-Chamorro, S. (2020). Chitosan coatings to control soft mold on fresh blackberries (Rubus glaucus Benth.) during the postharvest period. *Scientia Horticulturae*, *262*, 109049. doi: 10.1016/j.scienta.2019.109049

Abstract

Blackberry (*Rubus glaucus* Benth.) is a perishable fruit with high susceptibility to soft mold which reduces its marketability. The antifungal chitosan action has been studied to maintain blackberry quality during postharvest. However, this biopolymer needs to be dissolved in organic acid to be able to perform correctly as a coating. In this work, the effectiveness of different chitosan concentrations prepared with either lactic or acetic acid was evaluated, for controlling *Mucor racemosus* in blackberries stored at 4 °C for 14 d. Fruit decay treated with chitosan was compared with the one obtained in blackberries treated with the chemical fungicide imazalil (0.4 g L−1) and with that one obtained in untreated fruit. The treatment with chitosan 17.5 mg mL−1 - lactic acid (LA-17.5) was the most effective ($p < 0.05$) in the control of soft mold. Blackberry physicochemical properties and its sensory quality were not negatively affected by the treatment with chitosan 17.5 mg mL−1- lactic acid (LA-17.5). The results suggested that the coating with chitosan could be used for the control of soft rot in blackberries during the postharvest period.

Keywords: /*Mucor racemosus*/ /Alternative methods/ /Fruit/ /Natural products/ /Organic acid/

BLUEBERRY

Saito, S., Obenland, D., & Xiao, C.-L. (2020). Influence of sulfur dioxide-emitting polyethylene packaging on blueberry decay and quality during extended storage. *Postharvest Biology and Technology*, *160*, 111045. doi: 10.1016/j.postharvbio.2019.111045

Abstract

Blueberries are highly susceptible to decay after harvest and application of sulfur dioxide (SO2) has been shown to effectively control decay during extended storage. Box liners are commonly used with other

commodities to reduce water loss. In 2017 three varieties, ‘Emerald’, Jewel’ and ‘Misty’, were obtained from commercial packing houses. They were contained in plastic clamshells with 12 clamshells per box. We examined: 1) two liners that continuously emitted SO2 from sodium metabisulfite incorporated into the liner film. These ventilated with holes that comprised 0.3 % or 0.9 % of the liner surface area; 2) two solid, non-ventilated liners designed to develop a modified atmosphere (MA) during storage, either alone or with SO2 emitting sheets inside the packages within the liners; 3) control packages without liners. After packaging the fruit were placed into storage for either 3 or 6 weeks and then evaluated for decay and fruit quality. The effect on decay was determined both by assessing natural decay and by determining the spread of decay from berries inoculated with *Botrytis cinerea.* In 2018 two varieties, ‘Draper’ and ‘Duke’ were tested in a similar manner, except a 0.1 % vented liner replaced the 0.9 % liner, which performed poorly in 2017, and the SO2-emitting sheets were not included as a treatment. In 2018 we measured concentrations of SO2 and atmospheric gases were monitored within the packages. Results from both years indicated that the SO2-emitting liners were effective in reducing natural decay and the spread of aerial mycelial growth of *B. cinerea* from inoculated berries compared to treatments without SO2. Treatments that combined SO2 and MA (SO2/MA) were the most effective. MA alone did not consistently control decay. The high level of effectiveness of the SO2/MA treatment in controlling decay may be due to higher humidity levels within the packages that would enhance SO2 activity, because SO2 concentrations did not differ among the liner types and concentrations of CO2 in the MA packaging were too low to have had much effect. Weight loss was significantly less in packaging with liners with less vent area, with the least being in the MA packaging, regardless of the presence of SO2. Less weight loss was associated with reduced shrivel, although firmness was not always greater. SO2 concentrations measured in 2018 did not exceed 10 µL L-1 and bleaching of the berries did not occur in either year. SO2-emitting liners are an effective means of preserving blueberry quality during extended storage, particularly when combined with MA. The simplicity of assembling a package with a single liner versus using a conventional liner followed by a SO2-emitting sheet could be of benefit to blueberry packers.

Keywords: /*Botrytis cinerea*/ /Water loss/ /Bleaching/ /Shrivel/ /Carbon dioxide/ /Oxygen/

BROCCOLI

Li, Y., Cao, S., Han, A., Wang, H., Wei, Y., Shao, X., … Xu, F. (2020). Sucrose alleviated programmed cell death in broccoli after harvest. *Postharvest Biology and Technology*, *160*, 111032. doi: 10.1016/j.postharvbio.2019.111032

Abstract

The effect of sucrose treatment on morphological and biochemical features of programmed cell death (PCD) in broccoli florets was explored. The apoptosis of untreated and treated cells was evaluated by flow cytometry (FCM) and by laser scanning confocal microscopy (LSCM). DNA ladders, resulting from the cleavage of nuclear DNA into oligonucleosome fragments in PCD, were evaluated by gel electrophoresis. DNA frag-mentation and nuclear DNA condensation were further confirmed by using the terminal deoxynucleotidyl transferase (TdT)-mediated dUTP nick end in situ labeling (TUNEL). The results revealed that sucrose treatment inhibited DNA degradation, and delayed the early apoptosis of broccoli cells as demonstrated with FCM and LSCM. DNA laddering was observed in control broccoli florets, which could not be detected in sucrose-treated samples. In addition, the caspase-like activities in broccoli cells were suppressed under sucrose treatment. Taken together, our results suggested that PCD was delayed in sucrose-treated broccoli florets, which provided a new model to investigate the mechanism of sugar in regulating PCD during postharvest storage.

Keywords: /Programmed cell death/ /sucrose/ /DNA fragmentation/ /caspase-like activities/

Yan, Z., Shi, J., Gao, L., Wang, Q., & Zuo, J. (2020). The combined treatment of broccoli florets with kojic acid and calcium chloride maintains post-harvest quality and inhibits off-odor production. *Scientia Horticulturae*, *262*, 109019. doi: 10.1016/j.scienta.2019.109019

Abstract

The effect of a combination of 25 mg L−1 kojic acid and 10 g L−1 calcium chloride (KA + CaCl2) on the postharvest senescence of broccoli was investigated, along with potential modes of action. Results indicated that the KA + CaCl2 treatment of broccoli florets maintained their sensory evaluation scores, inhibited yellowing of florets, and generally prolonged shelf-life. The KA + CaCl2 treatment decreased the rate of respiration, ethylene production, and inhibited the degradation of chlorophyll. Furthermore, the relative gene expression and enzyme activity of ascorbate peroxidase, peroxidase, and catalase were elevated, and the expression of genes (*BoCHL1*, *BoCHL2*, *BoCHL3*, *BoPAO*, and *BoPPH*) involved in chlorophyll degradation were down-regulated. KA + CaCl2 also maintained the production of the characteristic volatiles produced by broccoli florets as measured with the use of an electronic nose. Results of the present study provide new insights into the ability of KA + CaCl2 to inhibit the postharvest senescence of broccoli florets and extend their shelf-life.

Keywords: /Broccoli/ /Antioxidant enzymes/ /Chlorophyll-degradation/ /Gene expression/

CHERRY TOMATO

Zeng, C., Tan, P., & Liu, Z. (2020). Effect of exogenous ARA treatment for improving postharvest quality in cherry tomato (Solanum lycopersicum L.) fruits. *Scientia Horticulturae*, *261*, 108959. doi: 10.1016/j.scienta.2019.108959

Abstract

The study aimed to characterize the effects of exogenous arachidonic acid (ARA) treatment on improving postharvest physiological quality in cherry tomato fruits stored at 20 ℃ (room temperature) for 14 days. Freshly harvested cherry tomato fruits were treated with ARA at the concentrations of 2.5 and 5.0 mg L^{-1}. As compared with the control, ARA reduced the decay and weight loss of cherry tomato fruits, decreased malondialdehyde (MDA) accumulation, and maintained higher activities of polyphenol oxidase (PPO), peroxidase (POD), and catalase (CAT). In addition, the application of ARA in cherry tomato fruits delayed the increase of membrane permeability, kept the integrity of the cell membrane and reduced total soluble solids (TSS) and titratable acidity (TA) loss during the later stage of storage. Therefore, the concentration of 2.5 mg L^{-1} ARA was found to be an optimum ARA treatment for maintaining the storage quality of cherry tomato fruits. These findings may suggest that ARA treatment effectively improves the metabolism and storage quality of cherry tomato fruits stored at 20℃. The exogenous ARA is a kind of green, safe and non-polluting preservative in the postharvest fruits and vegetables, which has good application value and economic benefit.

Keywords: /Cherry tomato (*Solanum lycopersicum* L.)/ /Postharvest quality/ /Arachidonic acid (ARA)/ /Antioxidant enzyme/

CHINESE CABBAGE (PAK CHOI)

Zhou, F., Zuo, J., Xu, D., Gao, L., Wang, Q., & Jiang, A. (2020). Low intensity white light-emitting diodes (LED) application to delay senescence and maintain quality of postharvest pakchoi (Brassica campestris L. ssp. chinensis (L.) Makino var. communis Tsen et Lee). *Scientia Horticulturae*, *262*, 109060. doi: 10.1016/j.scienta.2019.109060

Abstract

In this study, the effect of white LED irradiation on quality, antioxidant, chlorophyll-related enzyme activity and gene expression were evaluated in pakchoi. Results indicated that white LED irradiation (10 μmol m−2 s−1) significantly suppressed the changes in sensory evaluation, respiration rate, and malondialdehyde content, and also maintained higher chlorophyll and vitamin C content in harvested pakchoi stored at 20 °C. Furthermore, LED treatment maintained the levels of gene expression and enzyme activity of peroxidase, catalase, and ascorbate peroxidase, inhibited the activity and expression of several enzymes (chlorophyllase, chlorophyll-degrading peroxidase, Mg-dechelatase, pheophytinase) and chlorophyll-degrading genes (*BrChlase1*, *BrChlase2*, and *BrPPH*), and increased the expression of the chlorophyll synthetase gene, *BrHEMA1*. Collectively, the results demonstrate that LED treatment represents an effective method for delaying senescence and maintaining the quality of pakchoi by enhancing the activity and relative gene expression level of antioxidant enzymes and regulating chlorophyll metabolism.

Keywords: /White LED light/ /Antioxidant enzyme/ /Chlorophyll metabolism/ /Gene expression/

COFFEE

Gil, M., Ruiz, P., Quijano, J., Londono-Londono, J., Jaramillo, Y., Gallego, V., … Notario, R. (2020). Effect of temperature on the formation of acrylamide in cocoa beans during drying treatment: An experimental and computational study. *Heliyon*, *6*(2). doi: 10.1016/j.heliyon.2020.e03312

Abstract

The aim of this work was to determine the effect of temperature on the formation of acrylamide in cocoa beans during drying treatment by an experimental and computational study, in order to assess the presence of this neoformed compound from the postharvest stage. The computational study was conducted on the reaction between fructose, glyoxal from glucose, and on asparagine at the M06-2X/6-31+G(d,p) level, under cocoa bean drying conditions at 323.15 to 343.15 K. The proposed reaction for acrylamide formation consisted of seven steps, which required to progress a via cyclic transition state of the four members. In addition, step III (decarboxylation) was considered to be the rate-determining step. Glucose followed an E1-like elimination and fructose exhibited an E1cb-like elimination. Computational models showed that the reaction of acrylamide formation was favored by fructose rather than glucose. The content of reducing sugars, asparagine and acrylamide in fermented and dried cocoa from two subregions of Antioquia-Colombia, as well as roasted cocoa, were evaluated by UHPLC-C-CAD and UHPLC-QqQ. The concentrations of monosaccharides measured at the end of the fermentation and drying process of cocoa nibs showed greater decreases in the levels of fructose as compared to glucose, supporting the main model hypothesis. Acrylamide formation only occurred in Bajo Cauca due to the presence of both precursors and fast drying time (72 h). Finally, it was possible to find the conditions to which acrylamide can be formed from the drying process and not only from roasting, information that can be used for future control strategies.

Keywords: /Theoretical computer science/ /Computational chemistry/ /Food analysis/ /Chemical food analysis/ /Food composition/ /Elimination reaction/ /Asparagine/ /Acrylamide/ /Drying/ /Cocoa bean/ /Reducing sugars/

COMMON BEAN

Xie, G., Yang, C., Fei, Y., & Ma, L. (2020). Physiological and proteomic analyses of 1-MCP treatment on lignification in fresh common beans (Phaseolus vulgaris L) during storage. *Postharvest Biology and Technology*, *160*, 111041. doi: 10.1016/j.postharvbio.2019.111041

Abstract

1-methylcyclopropene (1-MCP) is widely used in postharvest technology to maintain the quality and prolong the storage life of fruit and vegetables. The present work aimed to investigate the regulation of 1-MCP on lignification of common beans during storage by physiology and proteomics. As expected, 1-MCP treatment inhibited lignification and decline in relative thickness of pods after fifteen days of storage by suppressing respiration rate and lignin synthesis-related enzymes, including phenylalanine ammonialyase (PAL), 4-coumarate: coenzyme A ligase (4CL), cinnamyl-alcohol dehydrogenase (CAD), peroxidase (POD), and slowing the increase of lignin content. These biochemical and physicochemical data showed the fifteen day is critical days during storage of common beans treated by 1-MCP. Therefore, we performed proteomics for CK0, CK15, and T15 groups, respectively. A total 609 differentially expressed proteins (Fold change ≥1.2, $P < 0.05$) were successfully identified, and classified into eight main categories based on their biological function, involved in the 'catalytic activity', 'cell', 'cell part', 'binding', 'metabolic process', 'cellular process', and 'membrane', in CK15 *vs*. T15. The top three KEGG pathways in CK15 *vs*. T15 were the phenylpropanoid biosynthesis, plant - pathogen interaction and starch and sucrose metabolism during the storage. Down-regulation of proteins involved in oxidative phosphorylation, phenylpropanoid biosynthesis and protein processing in endoplasmic reticulum, and up-regulation of galactose metabolism, glycan degradation, and glycolysis/gluconeogenesis provided molecular evidence that oxidative phosphorylation and phenylpropanoid metabolism play a crucial role in lignification regulation. Expression of four genes related to lignin synthesis was inhibited at the transcriptional level during storage and were decreased by 1-MCP treatment. These results might improve our understanding of the mechanisms of 1- MCP inhibition of common bean postharvest lignification.

Keywords: /*Phaseolus vulgaris L.*/ /1-MCP/ /Proteomics/ /Lignification/ /Storage/

FRESH PRODUCE

Ramos, B., Brandão, T. R., Teixeira, P., & Silva, C. L. (2020). Biopreservation approaches to reduce Listeria monocytogenes in fresh vegetables. *Food Microbiology*, *85*, 103282. doi: 10.1016/j.fm.2019.103282

Abstract

Two biopreservation approaches for fresh lettuce, rocket salad, parsley and spinach were studied. The potential of *Pediococcus pentosaceus* DT016, as a protective culture, to suppress *Listeria monocytogenes* in vegetables during storage was evaluated. The pathogen numbers in the vegetables inoculated with *P. pentosaceus* DT016 were significantly ($p < 0.01$) lower throughout the storage period and, at the last storage day, a minimum difference of 1.4 log CFU/g was reported when compared with the vegetables without the protective culture. Moreover, by using two levels of *L. monocytogenes* (about 6 and 4 log CFU/g), it was observed that the antagonist effect of *P. pentosaceus* was higher for the lower pathogen numbers. The second approach evaluated a pediocin DT016 solution to inactivate and control *L. monocytogenes* proliferation. The pathogen load was studied after washing with: water, chlorine and the pediocin solution and along storage at 4 °C. Comparing the various washing solutions, the vegetables washed with pediocin presented significantly ($p < 0.01$) lower pathogen numbers throughout storage, by a minimum of 3.2 and 2.7 log CFU/g, than in vegetables washed with water and chlorine, respectively. The proposed methodologies are promising alternatives to maintain the safety of fresh

vegetables during extended storage at refrigeration temperature.

Keywords: /Biopreservation/ /*Listeria monocytogenes*/ /Fresh vegetables/ /Protective culture/ /Pediocin/ /*Pediococcus pentosaceus* DT016/

Mathabe, P. M., Belay, Z. A., Ndlovu, T., & Caleb, O. J. (2020). Progress in proteomic profiling of horticultural commodities during postharvest handling and storage: A review. *Scientia Horticulturae*, *261*, 108996. doi: 10.1016/j.scienta.2019.108996

Abstract

Abiotic and biotic stresses in horticultural commodities during postharvest handling and storage can result in changes in protein regulation and accumulation, and under suboptimal conditions the changes could accelerate fruit physiological disorders and fruit quality degradation. Thus, it is essential to constantly optimize postharvest handling and storage conditions that could maintain fresh produce. Hence, understanding the role of various protein level responses and mechanisms linked to the responses for accurate characterization of physiological observations is crucial. In light of the limitations of molecular or metabolomics-based tools such as their inability to reveal post-translational modifications, an overview on the status of proteomic tools available and progress made in application for postharvest research is presented. The intent of this review was to demonstrate that proteomics research can provide guidance for all the role players along the postharvest value chain through – (a) ensuring identification and validation of biomarkers associated with specific quality and abiotic stress response, (b) the use of protein markers in the development of appropriate postharvest handling and storage tools to circumvent any emerging hurdles along the postharvest value chain, (c) the profiling of markers, which will allow targeted cultivar development, and (d) the identification of early postharvest physiological disorder and development of pathogen recognition tools.

Keywords: /Abiotic stress/ /Fresh fruit/ /Storage/ /Postharvest treatments/ /Quantitative proteomics/

Maringgal, B., Hashim, N., Tawakkal, I. S. M. A., & Mohamed, M. T. M. (2020). Recent advance in edible coating and its effect on fresh/fresh-cut fruits quality. *Trends in Food Science & Technology*, *96*, 253–267. doi: 10.1016/j.tifs.2019.12.024

Abstract

Numerous studies have been conducted to investigate the capability of edible coatings for preserving the quality and prolonging the shelf life of fresh/fresh-cut fruits. Evidence has shown that an edible coating could function as a barrier on the fruit surface, modify the internal gas atmosphere, decrease water losses and delay fruit ripening. Efforts have been exerted to introduce new natural coating materials to sustain the safety and quality of fresh/fresh-cut fruits. This review attempts to provide a summary of the recent studies on the application of edible coatings on different fresh/fresh-cut fruit categories, namely pome fruits (apple and pear), citrus, stone fruits, tropical and exotic fruits, berries, melon, and tomatoes. A fundamental theory behind the edible coating treatment and the effect on the physiological, physicochemical, sensory, and antimicrobial properties of fresh/fresh-cut fruits is discussed. The future perspective of this preservation method is also highlighted.Edible coating can be used as an alternative strategy to prolong the shelf life of fresh/fresh-cut fruits. The materials selection for edible coating play a key role in determining its effectiveness and consumers acceptability. The ability of the selected materials in extending the shelf life of fresh/fresh-cut fruits without reducing the sensory and nutritional characteristics are the main challenges in the edible coating techniques, which demands attention for further research.
Keywords: /Edible coating/ /Physicochemical/ /Antimicrobial/ /Fruit quality/ /Fresh-cut fruit/ /Shelf-life/

Gardenia jasminoides

Çelikel, F. G., Reid, M. S., & Jiang, C.-Z. (2020). Postharvest physiology of cut Gardenia jasminoides flowers. *Scientia Horticulturae*, *261*, 108983. doi: 10.1016/j.scienta.2019.108983

Abstract

We investigated the postharvest physiology of *Gardenia jasminoides,* and a range of postharvest treatments that might permit its use as a cut flower. The effects of different vase solution treatments, containing a range of biocides, acidulants, carbohydrate sources and/or growth regulators on the postharvest performance of cut gardenia flowers were studied by measuring water uptake (WU), water loss (WL) and relative fresh weight (RFW) of the flowers during vase life. In deionized (DI) water, gardenia flowers wilted after 2–3 days. Pulse treatment with silver thiosulfate (STS) to inhibit ethylene responses had no effect on vase life. However, abscisic acid (ABA) treatment increased vase life to 5 days by reducing WL and maintaining RFW. Including a cytokinin, benzyl adenine (BA), in the vase solution was the most effective plant growth regulator treatment, doubling vase life to 5.5 days. Vase solutions containing a commercial flower preservative, or combining citric acid, sucrose and aluminum sulfate also doubled the vase life of gardenia flowers. NaOCl in the vase solution provided little benefit, but acidification with aluminum sulfate (AS) or citric acid (CA) increased initial WU and extended vase life. The results suggest that improving water uptake is important for extending the vase life of cut gardenia flowers, and that acidification of the vase solution is an effective tool.

Keywords: /Gardenia/ /Bud development/ /Senescence stages/ /Vase life/ /Vase solutions/ /Water uptake/ /PGR/ /Sucrose/ /Bactericide/

GRAPES

Lo'Ay, A., & Taha, N. (2020). Evaluation rachis browning phenomena of 'Superior Seedless' vines grafted on different rootstocks during shelf life. *Scientia Horticulturae*, *261*, 109040. doi: 10.1016/j.scienta.2019.109040

Abstract

Rachis browning phenomena during shelf life is an important issue faced by grapes trading. The experiment was carried out during two growth seasons (2017–2018) to evaluate the effect of 'Superior Seedless' rootstocks such as 'Freedom', 'SO_4', '1103 Paulsen', and 'own-roots on rachis fruit clusters browning phenomena were tested during shelf life. Fruit cluster samples were harvested from commercial vineyards when total soluble solids reached 16° Brix. Thereafter, bunches were stored at ambient temperature (26 ± 1 °C and 45 ± 1 RH% air relative humidity) for four days as a shelf life experiment. Samples selected everyday interval as for physical properties and chemical determinations. The results pointed out that the '1103 Paulsen' rootstock decreased the water loss percentage, rachis browning symptoms, and improved berries color hue angle. Moreover, a significant decline in enzyme activities of cellular walls such as polygalacturonase (PG; EC:3.2.1.15), and lipoxygenase (LOX; EC:1.13.11) monitored. Consequently, '1103 Paulsen' minimized the malondialdehyde (AMD) accumulation and cell membrane cellular ionic permeability during four days of shelf life. Lately, both browning enzymes PPO and PAL diminished. Thus, preserving the phenolic compounds accompanied by less browning incidence on fruit rachis during the shelf-life period. Overall, '1103 Paulsen' minimizes the browning symptoms of 'Superior seedless' grapes were grafted on four rootstocks during shelf life stress/marketing.

Keywords: /Superior seedless/ /Rachis browning/ /Rootstocks/ /Shelf life/

JUJUBE FRUIT

Ban, Z., Zhang, J., Li, L., Luo, Z., Wang, Y., Yuan, Q., … Liu, H. (2020). Ginger essential oil-based microencapsulation as an efficient delivery system for the improvement of Jujube (Ziziphus jujuba Mill.) fruit quality. *Food Chemistry*, *306*, 125628. doi: 10.1016/j.foodchem.2019.125628

Abstract

Microencapsulation of *Zingiber officinale* essential oil (EO) in polysaccharide, chitosan (CH) and sodium carboxymethyl cellulose (CMC) based on the electrostatic interaction between charged polysaccharides at pH 3.0 in dual delivery system. Ratio variations of CH and CMC in microencapsulation were studied at 1:2, 2:1 and 1:1. This study aimed to evaluate the influence of the encapsulating materials combination on freeze-dried EO powders and to present the mechanisms for loading and releasing EO involved in the preparation of CH/CMC microcapsules. The spectroscopy analysis, physical properties, microstructural, encapsulation efficiency and EO release behavior in obtained EO microparticles were evaluated by using the analysis of fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), scanning electron microscopy (SEM) and gas chromatography mass spectrometry (GC-MS), respectively. Afterwards, the above prepared microcapsules were applied on winter jujube fruit (*Ziziphus jujuba* Mill.) preservation. Results demonstrated that both the microstructure and stability of microencapsulation were improved in delivery system loading with CH and CMC (1:1) with the encapsulation efficiency of 88.50%, compared to other ratios of CH and CMC (1:2 and 2:1). Furthermore, the microencapsulation had a capacity to control and reduce the EO release, therefore the morphological and sensory quality of jujube fruits in EO delivery system during storage was enhanced significantly ($P < 0.05$), in comparison to control. Results revealed that the microparticles produced with CH and CMC (1:1) were considered to present better characteristics of microstructure, encapsulation efficiency, as well as to maintain higher nutritional quality for jujube fruit. Thus, EO microencapsulation loaded in CH/CMC-based dual delivery systems has potential application and developmental value prospects in food industries.

Keywords: /Microencapsulation/ /Essential oil/ /Microstructure/ /FTIR/ /Encapsulation efficiency/ /Jujube/

Ge, Y., Zhang, J., Li, C., Xue, W., Zhang, S., & Lv, J. (2020). Trisodium phosphate delays softening of jujube fruit by inhibiting cell wall-degrading enzyme activities during ambient storage. *Scientia Horticulturae*, *262*, 109059. doi: 10.1016/j.scienta.2019.109059

Abstract

The purpose of this study was to evaluate the effects of trisodium phosphate (TSP) (0.5 g L−1) treatment on softening of harvested jujube fruit during storage at 20 ± 2 °C with a relative humidity of 50–55 %. The results showed that jujube fruit treated with TSP showed a higher firmness. The activity of pectin methylesterase, polygalacturonase, cellulase and β-glucosidase was also suppressed by TSP treatment. The results demonstrated that the content of water soluble pectin in jujube fruit treated with TSP was lower than in the control (dipped in distilled water) during storage. TSP treated fruits had higher pectin content than control fruits. The results of atomic force microscopy showed that water soluble pectin structure treated by TSP was denser compared with the control. Taken together, these results demonstrated that TSP could delay softening of jujube fruit by regulating cell wall-degrading enzyme activities and controlling the pectin substances.

Keywords: /Jujube fruit/ /Softening/ /Cell wall-degrading enzymes/ /Trisodium phosphate/

KIWI

Pan, L., Zhao, X., Chen, M., Fu, Y., Xiang, M., & Chen, J. (2020). Effect of exogenous methyl jasmonate treatment on disease resistance of postharvest kiwifruit. *Food Chemistry*, *305*, 125483. doi: 10.1016/j.foodchem.2019.125483

Abstract

Kiwifruit (*Actinidia deliciosa* cv. Jinkui) were treated with 0.1 mmol/L methyl jasmonate (MeJA) to investigate the effects on disease resistance to soft rot caused by *Botryosphaeria dothidea.* The results showed that MeJA treatment significantly reduced the diameter of lesions after inoculation with *B. dothidea*. This treatment significantly enhanced the activities of related antioxidant protective enzymes, defence-related enzymes including catalase (CAT), peroxidase (POD), superoxide dismutase (SOD), polyphenol oxidase (PPO), chitinase (CHI), β-1,3 glucanase (GLU) and increased the accumulation of total phenolic content, while the degree of membrane lipid peroxidation was reduced. MeJA treatment effectively enhanced gene expression of *AcPOD, AcSOD, AcCHI* and *AcGLU*. The results from this research suggest that MeJA treatment is a promising and safe strategy for controlling postharvest rot soft kiwifruit.

Keywords: /Kiwifruit/ /Methyl Jasmonate/ /Soft rot/ /Induced resistance/ /Defence enzyme/ /Gene expression/

Gan, Z., Shan, N., Fei, L., Wan, C., & Chen, J. (2020). Isolation of the 9-cis-epoxycarotenoid dioxygenase (NCED) gene from kiwifruit and its effects on postharvest softening and ripening. *Scientia Horticulturae*, *261*, 109020. doi: 10.1016/j.scienta.2019.109020

Abstract

According to the general consensus, post-ripening effects of ABA on climacteric fruits accelerate the softening process, especially in kiwifruit. In order to further understand the mechanism of ABA action during postharvest ripening of kiwifruit, five ABA synthase genes related to 9-*cis*-epoxycarotenoid dioxygenase (NCED) were isolated from kiwifruit genome, namely, *AcNCED1*, *AcNCED1.1*, *AcNCED2*, *AcNCED3*, and *AcNCED3.1*. Gene expression analysis showed that the expression of *AcNCED1* peaked early during postharvest ripening, a finding that was consistent with the trend observed for the changes in ABA content. *AcNCED1* expression was induced by ABA and repressed by ABA synthesis inhibitor nordihydroguaiaretic acid. We found *cis*-elements related to fruit development and ripening in the *AcNCED1* promoter sequence. Analysis of *AcNCED1* promoter activity showed that ABA and ethylene significantly enhanced the expression of *AcNCED1*. Furthermore, *AcNCED1* silencing inhibited ABA synthesis and delayed kiwifruit softening, whereas transient overexpression of *AcNCED1* in tomato accelerated fruit color development relative to controls. These results indicated that *AcNCED1* encodes a key enzyme involved in ABA synthesis in kiwifruit, and that it may play an important role in the softening process of fruits early in postharvest.

Keywords: /Kiwifruit/ /*AcNCED1*/ /ABA/ /Gene expression/ /Postharvest softening/

LEMON

Daquino, S., Continella, A., Gentile, A., Dai, S., Deng, Z., & Palma, A. (2020). Decay control and quality of individually film-wrapped lemons treated with sodium carbonate. *Food Control*, *108*, 106878. doi: 10.1016/j.foodcont.2019.106878

Abstract

The efficacy of 3-min-dip treatments with 3% sodium carbonate solutions at 20 or 50 °C was tested on lemons individually, not hermetically, sealed within low density polyethylene (LDPE) bags. Before sealing, treated lemons were rinsed (SCR) or not rinsed (SC) with fresh water. SC treatment almost completely inhibited green mold (*Penicillium digitatum*) development in wound-artificially inoculated lemons both wrapped and not wrapped after 15 d at 5 °C followed by 7 d at 20 °C or in those stored for 10 d at 20 °C. In SCR lemons, decay control was inferior, especially in wrapped lemons treated at 20 °C. Similar results were achieved with sound fruit inoculated 24 h before the treatments and stored for 30 d at 20 °C. SC and, at a less extent, SCR treatments increased dramatically mass loss of unwrapped fruit compared to control fruit, whereas in wrapped fruit overall mass loss was almost completely inhibited. Wrapping the fruit in LDPE bags allowed it to maintain fruit freshness and firmness and chemical quality along the whole storage time, regardless of the treatments.

Keyword: /Decay/ /Sodium carbonate/ /Lemons/ /Film-wrapping/ /Storage/

LONGAN

Lin, Y., Li, N., Lin, H., Lin, M., Chen, Y., Wang, H., … Lin, Y. (2020). Effects of chitosan treatment on the storability and quality properties of longan fruit during storage. Food Chemistry, 306, 125627. doi: 10.1016/j.foodchem.2019.125627

Abstract

Effects of various concentrations of Kadozan (chitosan) treatment on storability and quality properties of harvested ‘Fuyan’ longans were investigated. Compared to the control samples, Kadozan treated-longans displayed lower fruit respiration rate, lower pericarp cell membrane permeability, pericarp browning index, pulp breakdown index, fruit disease index, and weight loss, but higher rate of commercially acceptable fruit, higher levels of pericarp chlorophyll, carotenoid, anthocyanin, flavonoid and total phenolics, higher amounts of pulp total soluble sugar, sucrose, total soluble solids, and vitamin C. These results revealed Kadozan treatment could increase storability and retain better quality of harvested longan fruit. Among different concentrations of Kadozan, the dilution of 1:500 (VKadozan: VKadozan + Water) showed the best results in storability and maintained the best quality of longans during storage. These findings demonstrated that Kadozan could be a facile and eco-friendly postharvest handling approach for increasing storability and lengthening shelf-life of harvested ‘Fuyan’ longan fruit.

Keywords: /Longan fruit/ /Storability/ /Quality attributes/ /Nutritive properties/ /Chitosan/ /Kadozan/

Chen, Y., Sun, J., Lin, H., Lin, M., Lin, Y., Wang, H., & Hung, Y.-C. (2020). Salicylic acid reduces the incidence of Phomopsis longanae Chi infection in harvested longan fruit by affecting the energy status and respiratory metabolism. *Postharvest Biology and Technology*, *160*, 111035. doi: 10.1016/j.postharvbio.2019.111035

Abstract

This study investigated the effects of salicylic acid (SA) on the disease development, respiration rate, energy status, and respiratory metabolism in *Phomopsis* longanae Chi-inoculated longans. SA treatment reduced the fruit disease index and respiration rate of *P. longanae*-inoculated longans as compared to the fruit with mere inoculation. SA treatment suppressed the decline of energy charge, decreased the activities of PGI, SDH and CCO, but boosted the G-6-PDH+6-PGDH and NADK activities. Meanwhile, the NAD and NADH contents were decreased, but NADP and NADPH contents were increased. These findings demonstrated that SA could be used to inhibit disease development in harvested longans because SA treatment helped maintain a high energy charge level, decreased respiration rate and respiratory pathways like EMP-TCA cycle and CCP, but increased PPP respiratory pathway. This study

indicated that the SA treatment was a facile and effective way to retard the disease development of postharvest longans.

Keywords: /Longan (*Dimocarpus longan* Lour.) fruit/ /*Phomopsis longanae* Chi/ /Respiration rate/ /Energy status/ /Respiration metabolism/ /Salicylic acid/

LOQUATS

Wang, X., Yuan, Z., Shi, Y., Cai, F., Zhao, J., Wang, J., & Wang, Y. (2020). Bacillus amyloliquefaciens HG01 induces resistance in loquats against anthracnose rot caused by Colletotrichum acutatum. *Postharvest Biology and Technology*, *160*, 111034. doi: 10.1016/j.postharvbio.2019.111034

Abstract

We aimed to investigate the efficacy of *Bacillus amyloliquefaciens* HG01 in controlling anthracnose rot caused by *Colletotrichum acutatum* in postharvest loquats and to explore the probable underlying mechanisms. We observed that relative to the control, HG01 treatment led to lower incidence of disease and smaller diameter of lesions. In HG01-treated loquats, it was observed that there were significant increases in total phenolic and amino acid contents; moreover, HG01-treated fruit appeared to maintain significantly higher sugar and organic acid contents in comparison with the control. Further, the treatment significantly enhanced the activities of two defense-related enzymes, namely chitinase and β-1,3-glucanase. Additionally, after HG01 treatment, the relative expression levels of the following genes were significantly increased: nonexpresser of pathogenesis-related gene, phenylalanine ammonia lyase 2, peroxidase, ethylene-insensitive 3, and mandelonitrile lyase 1. We also noted HG01 significantly inhibited the growth of *C. acutatum* in vitro, with an inhibition rate of 58.9%. These results suggest that *B. amyloliquefaciens* HG01 can effectively inhibit anthracnose rot caused by *C. acutatum* in postharvest loquat fruit, possibly by directly inhibiting growth of the pathogen, and indirectly inducing disease resistance in loquats.

Keywords: /Loquats/ /*Bacillus amyloliquefaciens* HG01/ /Anthracnose rot/ /*Colletotrichum acutatum*/ /Biocontrol agents/ /Resistance/

LOTUS

Li, J., Bai, J., Li, S., Zhu, Z., Yi, Y., Wang, H., & Lamikanra, O. (2020). Effect of lactic acid bacteria on the postharvest properties of fresh lotus root. *Postharvest Biology and Technology*, *160*, 110983. doi: 10.1016/j.postharvbio.2019.110983

Abstract

The oxidation of phenolic compounds caused by polyphenol oxidase (PPO) often contributes to the browning and decaying of the lotus root. However, methods are limited to solve this problem and to effectively extend the shelf life of fresh lotus. Thus, lactic acid bacteria (LAB) were used in this study as an alternative solution. Michaelies-Menten equations analysis indicated that gallic acid, chlorogenic acid and catechin of lotus were the most optimal substrates of PPO. So *Lactobacillus plantarum* (LH-B02), *Lactobacillus acidophilus* (LA-05) and *Lactobacillus casei* (LC-01) were cultivated at the presence of gradient concentrations of these phenols, presenting different dose-effect relationship. The decomposition of polyphenols by effective strains was detected by HPLC analysis, indicating that after interacting for 30 h, 84.17% of catechin was transformed by LH-B02. When LH-B02 suspension (1.44 × 1011 CFU L−1) were sprayed on the surface of the lotus root for 1, 3, 5, and 8 times, the color loss of treated lotus root was significantly reduced ($p < 0.01$), compared with the control during the storage of 15 d. Texture

properties involving hardness, chewiness, springiness and cohesiveness of the lotus was significantly ($p < 0.05$) enhanced, especially for the samples sprayed five and eight times, suggesting that LAB could improve the postharvest properties of lotus root.

Keywords: /Lotus root/ /Polyphenol/ /Lactic acid bacteria/ /Browning/ /Texture property/

MASHUA (*Tropaeolum tuberosum*)

Aguilar-Galvez, A., Pedreschi, R., Carpentier, S., Chirinos, R., García-Ríos, D., & Campos, D. (2020). Proteomic analysis of mashua (Tropaeolum tuberosum) tubers subjected to postharvest treatments. *Food Chemistry*, *305*, 125485. doi: 10.1016/j.foodchem.2019.125485

Abstract

Mashua (*Tropaeolum tuberosum*) is an important food in certain areas of the Andean region, where it is popularly believed to possess medicinal properties. Several studies have previously shown the potential of this tuber as a source of bioactive compounds. Traditionally, the tuber is exposed to the sun before consumption, in order to reduce its bitterness. The present work aims to study, at the proteome level, the differential abundance of proteins in tubers subjected to different postharvest treatments: sun-exposure (SUN), shade (SHA), refrigeration (COLD) and shade combined with sun-exposure (SHA-SUN) compared to recently harvested tubers (INIT). Results showed that sun exposure for prolonged times (9 days) resulted in increased abundance of proteins classified as heat shock proteins, intracellular traffic, disease/defense and protein degradation. Our results reflect that the sun treatment activates defense systems and osmoprotection adjustment against water loss and reactive oxygen species.

Keywords: /Postharvest/ /Abiotic stress/ /Cold/ /Shade/ /Sun-exposure/ /Proteomics/ /*Tropaeolum tuberosum/*

ORANGE

Habibi, F., Ramezanian, A., Guillén, F., Serrano, M., & Valero, D. (2020). Blood oranges maintain bioactive compounds and nutritional quality by postharvest treatments with γ-aminobutyric acid, methyl jasmonate or methyl salicylate during cold storage. *Food Chemistry*, *306*, 125634. doi: 10.1016/j.foodchem.2019.125634

Abstract

The effects of postharvest treatments with γ-aminobutyric acid (GABA), methyl jasmonate (MeJA) or methyl salicylate (MeSA) on antioxidant systems and sensory quality of blood oranges during cold storage were evaluated (150 days at 3 °C plus 2 days at 20 °C, shelf life). Fruit firmness, titratable acidity (TA), total antioxidant activity (TAA) and ascorbic acid (AA) decreased during cold storage, all these changes being delayed in treated fruit, with the greatest differences observed with the 50 μmol L−1 MeJA and 100 μmol L−1 MeSA treatments. Total phenolic content (TPC), total anthocyanin content (TAC) and the major individual anthocyanins, cyanidin 3-glucoside and cyanidin 3-(6″-malonylglucoside), were found at higher concentration in treated fruit than in control during the whole cold storage period. Overall, 100 μmol L−1 MeSA was the most effective for maintaining fruit quality and maintained higher anthocyanin concentration due to higher phenylalanine ammonia-lyase (PAL) and lower polyphenol oxidase (PPO) activities.

Keywords: /Anthocyanin/ /Antioxidant activity/ Blood oranges/ /Enzymes of antioxidant metabolism/ /Phenylalanine ammonia-lyase/ /Polyphenol oxidase/

PAPAYA

Vilaplana, R., Chicaiza, G., Vaca, C., & Valencia-Chamorro, S. (2020). Combination of hot water treatment and chitosan coating to control anthracnose in papaya (Carica papaya L.) during the postharvest period. *Crop Protection*, *128*, 105007. doi: 10.1016/j.cropro.2019.105007

Abstract

Papaya (*Carica papaya* L.) suffers deterioration, mainly due to anthracnose caused by *Colletotrichum fructicola*, during postharvest preservation and export periods. The conventional use of synthetic fungicides, to reduce this disease, has been substituted in recent years by alternative methods that are friendlier to human health and the environment. Studies have demonstrated that a combination of these alternative systems is more effective in controlling pathogen development than the same ones used individually. For this reason, hot water dipping followed by coating with different chitosan concentrations has been studied to decrease or substitute the utilization of fungicides during the papaya postharvest period. Results showed that papayas treated with hot water dipping (49 °C for 20 min) and chitosan coating at 20 g L−1 combination presented a higher reduction in anthracnose than papayas treated only with hot water dipping and fruit treated with prochloraz. In addition, this combined treatment reduced maturity symptoms throughout storage, increased the shelf-life period, and did not have a negative effect on sensory characteristics in contrast to chemical treatments and hot water dips applied individually. These results prompted the combination of hot water dipping and chitosan coating as a valid strategy to reduce papaya anthracnose during the postharvest period.

Keywords: /Fruit/ /*Colletotrichum fructicola*/ /Alternative methods/ /Coating/ /Physical treatment/

PEAR

Sun, H., Luo, M., Zhou, X., Zhou, Q., Sun, Y., Ge, W., … Ji, S. (2020). Exogenous glycine betaine treatment alleviates low temperature-induced pericarp browning of 'Nanguo' pears by regulating antioxidant enzymes and proline metabolism. *Food Chemistry*, *306*, 125626. doi: 10.1016/j.foodchem.2019.125626

Abstract

The effect of glycine betaine (GB) on chilling injury (CI)-induced pericarp browning in 'Nanguo' pears was investigated during shelf life at 20 °C after storage at 0 °C for 120 d. GB treatment alleviated the severity of browning in 'Nanguo' pears as represented by lower browning index (BI) and browning incidence. Membrane lipid peroxidation in GB-treated fruit was lower than that in the control, and membrane integrity was maintained in good condition. The activities and expression of ascorbate peroxidase (APX), catalase (CAT), and superoxide dismutase (SOD) were higher in GB-treated fruit than in control fruit. Furthermore, significantly higher proline content, proline synthesis key enzyme activities, and gene expression were observed in the treated fruit, including ornithine d-aminotransferase (OAT) and Δ1-pyrroline-5-carbox-ylate synthetase (P5CS), which were consistent with the browning tendency. In a nutshell, GB treatment can effectively alleviate pericarp browning of cold-stored 'Nanguo' pears by regulating antioxidant enzymes and proline metabolism.

Keywords: /'Nanguo' pears/ /Chilling injury/ /Pericarp browning/ /Glycine betaine/ /Membrane lipid peroxidation/

Lindo-García, V., Muñoz, P., Larrigaudière, C., Munné-Bosch, S., & Giné-Bordonaba, J. (2020). Interplay between hormones and assimilates during pear development and ripening and its relationship with the fruit postharvest behaviour. *Plant Science*, *291*, 110339. doi: 10.1016/j.plantsci.2019.110339

Abstract

The ability of European pears (*Pyrus communis L.*) to ripen immediately after harvest is cultivar-dependent and relies on a range of physiological and biochemical events occurring during fruit growth and development that remain largely unknown. To gain further knowledge on these events, changes in the content of sugars, acids, major hormones and ethylene precursors or related enzymes were studied in two pear varieties ('Blanquilla' and 'Conference') with known differences in their postharvest ripening behaviour. In both cultivars, low contents of abscisic acid (ABA) seemed to be a prerequisite to initiate on-tree fruit ripening including sugar accumulation and softening. In 'Blanquilla' pears, the enhanced potential to produce ethylene and thereby to ripen upon harvest was associated to a late increase in ABA content paralleled by an accumulation of indole 3-acetic acid (IAA). In turn, the inability of 'Conference' fruit to produce ethylene upon harvest appeared to be related to a coordinated action of gibberellins (more specifically GA1), salicylic acid (SA) and jasmonic acid (JA), which remained at high concentrations during the latest phases of fruit growth. Collectively, our results highlight that a complex hormonal cross-talk during the development and on-tree ripening of pear fruit may finally determine the ability of the fruit to ripen upon harvest.

Keywords: /ACC/ /Chilling requirements/ /Fruit growth/ /Hormonal cross-talk/ /Sugar accumulation/

Zhao, L., Wang, Y., Wang, Y., Li, B., Gu, X., Zhang, X., … Zhang, H. (2020). Effect of β-glucan on the biocontrol efficacy of Cryptococcus podzolicus against postharvest decay of pears and the possible mechanisms involved. *Postharvest Biology and Technology*, *160*, 111057. doi: 10.1016/j.postharvbio.2019.111057

Abstract

In this study, the effect of β-glucan on the biocontrol efficacy of *Cryptococcus podzolicus* against blue mold decay of pears as well as the physiological mechanism and related molecular mechanism through transcriptome technology was investigated. Our results revealed that β-glucan could enhance the biocontrol ability of *C. podzolicus* on blue mold decay of pears. Meanwhile, β-1,3-glucanase and catalase (CAT) activities of 0.5% β-glucan-induced *C. podzolicus* were significantly increased, though the malondialdehyde (MDA) content of 0.5% β-glucan-induced *C. podzolicus* was decreased. During the whole storage time, the polyphenol oxidase (PPO), peroxidase (POD) and CAT activities of pears treated with 0.5% β-glucan-induced *C. podzolicus* were significantly increased. In addition, the transcriptome analysis indicated that *C. podzolicus* induced by β-glucan was able to increase the rate of polysaccharide utilization, accelerate the synthesis of cell walls and energy, improve its antioxidant capacity, and enhance its ability to adapt to oxidative stress. The aging process of *C. podzolicus* cells was delayed, and could be related to the improvement of the biocontrol ability of *C. podzolicus*. Therefore, β-glucan treatment can be used as an effective method to improve the biocontrol ability of antagonistic yeasts on postharvest diseases of pear fruits.

Keywords: /*Cryptococcus podzolicus*/ /Pears/ /Transcriptome/ /Biocontrol mechanisms/

Wang, J., Lv, M., He, H., Jiang, Y., Yang, J., & Ji, S. (2020). Glycine betaine alleviated peel browning in cold-stored 'Nanguo' pears during shelf life by regulating phenylpropanoid and soluble sugar metabolisms. *Scientia Horticulturae*, *262*, 109100. doi: 10.1016/j.scienta.2019.109100

Abstract

Long-term cold storage can postpone the senescence and preserve the quality of postharvest 'Nanguo' pear fruit. However, peel browning (PB), which is deemed to be a symptom of chilling injury (CI), usually develops after the fruit is transferred to shelf life at room temperature. In this study, the effect of glycine betaine (GB) treatment (10 mmol L−1 for 10 min) on PB, as well as on phenylpropanoid and soluble sugar metabolisms of pear fruit was investigated. The results showed that GB treatment effectively delayed the occurrence of PB by 6 d after cold storage for 120 d, and significantly inhibited the browning index in fruit by more than 35% during the 15 d of shelf life. Enzymes activities and gene expression levels related to phenylpropanoid metabolism were increased after GB treatment, which resulted in the increase of total phenols and flavonoids content. Moreover, higher sucrose content, and lower fructose and glucose content were observed in GB-treated fruit, which was concomitant with increased activities and genes expression levels of sucrose synthase (SS) and sucrose phosphate synthase (SPS), as well as decreased activities and genes expression levels of invertase. The results showed that the development of PB in cold-stored 'Nanguo' pears was closely related to phenylpropanoid and soluble sugar metabolisms. GB treatment could alleviate PB by ways of regulating phenylpropanoid and soluble sugar metabolisms, as well as by sustaining higher levels of phenolic and sucrose content. Therefore, exogenous GB treatment could be an effective method to alleviate PB of 'Nanguo' pear fruit during cold storage.

Keywords: /Peel browning/ /'Nanguo' pear/ /Enzyme activity/ /Gene expression/ /pHenylpropanoid and soluble sugar metabolisms/

PERSIMMONS

Denoya, G. I., Pataro, G., & Ferrari, G. (2020). Effects of postharvest pulsed light treatments on the quality and antioxidant properties of persimmons during storage. *Postharvest Biology and Technology*, *160*, 111055. doi: 10.1016/j.postharvbio.2019.111055

Abstract

Pulsed light (PL) treatment for food consists in the application of a polychromatic light (wavelength: 200–1100 nm) in the form of intense but short pulses, frequently investigated as a decontamination method. In this work, the effects of PL treatments on the physicochemical properties, total phenolic content, vitamin C, and antioxidant capacity of persimmons (*Diospyros kaki* L. cv. Vanilla*)* at two different maturity stages (unripe yellow-green and ripe orange-red) during postharvest storage were investigated. The fruit were exposed to PL treatments at a dose of 20 kJ m−2 and 60 kJ m−2. Untreated and treated samples were allowed to ripe in dark conditions at 15 ± 1 °C for up to 6 d. The effects of PL treatments on the color, total soluble solids (TSS) as well as on total phenolic content, vitamin C and antioxidant capacity by three different methods were evaluated during storage and compared with those of untreated samples. Results showed that the physicochemical properties (color and TSS) and vitamin C content of the fruit were not affected by the PL treatments over the storage period. On the other hand, the total phenols content and the antioxidant capacity were significantly ($p < 0.05$) affected by the treatments. Considering that these parameters were related to the soluble tannins in persimmons and these compounds are related to the astringency of these fruit, this work encourages the research of the potential application of PL as a de-astringency method for persimmons.

Keywords: /Persimmons/ /Pulsed light/ /Color/ /Total phenols/ /Vitamin C/ /Antioxidant capacity/

PISTACHIO

Sheikhi, A., Mirdehghan, S. H., Arab, M. M., Eftekhari, M., Ahmadi, H., Jamshidi, S., & Gheysarbigi, S. (2020). Novel organic-based postharvest sanitizer formulation using Box Behnken design and mathematical modeling approach: A case study of fresh pistachio storage under modified atmosphere packaging. *Postharvest Biology and Technology*, *160*, 111047. doi: 10.1016/j.postharvbio.2019.111047

Abstract

In the present study Box Behnken Design (BBD) and Artificial Neural Network-Genetic Algorithm (ANN-GA) hybrid system were used for predicting and optimizing a new organic-based postharvest sanitizer for fresh pistachio nuts under modified atmosphere packaging, combining different concentrations of five generally recognized as safe (GRAS) ingredients including H2O2 (1, 3 and 5%), Na2CO3 (1, 3 and 5%), K2CO3 (1, 3 and 5%), citric acid (CA) and acetic acid (AA, 1000, 5500 and 10,000 mg L−1). The nuts were submerged in sanitizer solutions for two minutes then dried for five minutes in ambient condition and packaged in polyethylene bags injected with ambient atmospheric gas (21% O2, 0.03% CO2, and 87% N2). BBD as a computer-based design of experiment (DOE) tool reduced the cost, labor and time needed to perform the experiment by reducing the number of treatments from 243 to 40 while ensuring the well-sampled experiment design. NaOCl (100 mg L−1) and distilled water (DW) were used as controls for the validation experiment. The ANN-GA described relations between five input (H2O2, Na2CO3, K2CO3, CA, and AA) and four output (total viable count, enzymatic browning, overall acceptability, and taste) variables. Sensitivity analysis was used to find the most important ingredient as input variable affecting output variables. ANN-based models could effectively fit the supplied data on the total viable count and quality parameters of pistachios to various concentrations of the ingredients in the sanitizers. Based on the ANN-GA results, the input variables concentrations of 3.6% H2O2, 3.9% Na2CO3, 3.2% K2CO3, 8118.5 (mg L−1) CA, and 8202.8 mg L−1 AA could result in the lowest total viable count (0.07 log colony forming units (CFU g-1)). The lowest amount of enzymatic browning (1.48%) can be obtained by applying a mixture of 4.26% H2O2, 3.7% Na2CO3, 3.7% K2CO3, 7785.4 mg L−1 CA, and 7363.5 mg L−1 AA. The highest overall acceptability (1.38) can be achieved using a mixture of 3.0% H2O2, 3.0% Na2CO3, 3.4% K2CO3, 8190.1 mg L−1 CA, and 8316.7 mg L−1 AA. The best taste (1.21) was predicted to be attained using a combination of 3.3% H2O2, 4.1% Na2CO3, 3.9% K2CO3, 8114.5 mg L−1 CA, and 7574.0 mg L−1 AA. According to the sensitivity analysis, AA was the most important factor in reducing total viable count and enzymatic browning and enhancing overall acceptability. The validation test showed that the optimized sanitizer for total viable count was superior to the 100 mg L−1 NaOCl which is the most used commercial sanitizer for fresh crops.

Keywords: /Genetic algorithm/ /Artificial neural network/ /Organic sanitizer/ /Fresh pistachio/ /Modified atmosphere packaging/ /Box Behnken design/

PITAYA

Wu, Q., Zhou, Y., Zhang, Z., Li, T., Jiang, Y., Gao, H., & Yun, Z. (2020). Effect of blue light on primary metabolite and volatile compound profiling in the peel of red pitaya. *Postharvest Biology and Technology*, *160*, 111059. doi: 10.1016/j.postharvbio.2019.111059

Abstract

Blue light treatment can effectively delay the decay of many fruits during postharvest storage. However, little is known about the blue light-induced metabolites. In this study, pitaya fruit was treated with 300 lx blue light for 2 h. Results showed that the decay of pitaya fruit was significantly delayed after blue light treatment, and the change tendency of many physiological characters of pitaya fruit was also significantly weakened. Blue light treatment significantly reduced the increasing tendencies of respiratory rate,

titratable acid (TA), H2O2 content, as well as the decreasing tendencies of total soluble solids (TSS), TSS-TA ratio, DPPH radical-scavenging activity, reducing power. To excavate the details of the change in pitaya peel, the primary metabolites and volatile compounds were determined by using gas chromatography coupled to mass spectrometry (GC–MS). A total of 84 metabolites changed significantly after blue light treatment, including 45 primary metabolites and 39 volatile compounds. Most primary metabolites increased their levels at 1 d after blue light treatment, mainly including soluble sugars, amino acids, fatty acids, organic acids and alcohols. The increase of those metabolites might play a vital role in blue light-delayed the decay of pitaya fruit. After blue light treatment, the contents of most of volatile compounds and some primary metabolites significantly decreased at later stage of storage, mainly including cell wall monosaccharides, aldehydes, esters, ketones, alkanes and volatile alcohols, which might be related to the delay of fruit senescence by blue light treatment.

Keywords: /Blue light treatment/ /Fruit decay/ /Pitaya peel/ /Primary metabolites/ /Reactive oxide species/ /Volatile compounds/

POMEGRANATE

Mincuzzi, A., Ippolito, A., Montemurro, C., & Sanzani, S. M. (2020). Characterization of Penicillium s.s. and Aspergillus sect. nigri causing postharvest rots of pomegranate fruit in Southern Italy. *International Journal of Food Microbiology*, *314*, 108389. doi: 10.1016/j.ijfoodmicro.2019.108389

Abstract

Most diseases of pomegranate fruit are caused by fungal pathogens, which provoke post harvest yield and economical losses. *Aspergillus* and *Penicillium sensu lato* (*s.l.*) are the main wound pathogens of pomegranate fruit. In the present investigation, the populations of *Aspergillus* and *Penicillium s.l.* isolated from pomegranate fruit in Southern Italy were characterized. Since the morphological identification of species belonging to these genera is laborious, molecular approaches, such as PCR and High-Resolution Melting (HRM), were used. Particularly, a specific primer pair was designed to discriminate, within the *Penicillium s.l.* population, *Penicillium sensu stricto* (*s.s.*) from *Talaromyces* strains. Then, a new HRM assay for species identification within *Penicillium s.s.* according to SNPs present in a portion of the beta-tubulin gene was set up. Similarly, *Aspergillus* sect. *nigri* population was characterized arranging a HRM assay, whose primer pair was designed on a portion of the calmodulin gene. According to these assays, 10% of the *Penicillium s.l.* population proved to be made up of *Talaromyces biverticillius* strains. Furthermore, six species of *Penicillium s.s.* (*P. adametzioides*, *P. brevicompactum*, *P. citrinum*, *P. glabrum*, *P. pagulum*, and *P. johnkrugii*) and four of black aspergilli (*A. tubingensis*, *A. welwitschiae*, *A. japonicus*, and *A. uvarum*) were identified; all species belonging to both genera disclosed different incidences in postharvest rotted pomegranate fruit. Moreover, since *Aspergillus* and *Penicillium* are potentially producers of mycotoxins, like ochratoxin A and fumonisins, the presence/absence of genes involved in mycotoxin biosynthetic pathways was tested. Some *Aspergillus* strains belonging to species *A. welwitschiae* proved to possess fumonisin genes. The setup of molecular tools to characterize *Penicillium s.l.* and *Aspergillus* sect. *nigri* species infecting pomegranate fruit after harvest is of paramount importance for their effective control, even more considering the ability of these fungal genera to produce mycotoxins, which are hazardous for human health and potentially present also in by-products.

Keywords: /High Resolution Melting/ /Genotyping/ /*Punica granatum/ /*Blue mould/ /*Aspergillus* rot/

ROSE

Gil, C. S., Lim, S. T., Lim, Y. J., Jung, K.-H., Na, J.-K., & Eom, S. H. (2020). Volatile content variation in the petals of cut roses during vase life. *Scientia Horticulturae*, *261*, 108960. doi: 10.1016/j.scienta.2019.108960

Abstract

Volatile content during postharvest is a critical factor affecting the quality of rose products. However, changes in the volatile content of cut rose flowers during vase life have not yet been identified although the maturity of flower petals may result in the significant changes of volatile profiles. The present study investigated volatile changes in the petals of two rose varieties, 'Fuego' exhibited to longer vase life and 'Red eagle', during vase life. 'Fuego' petals contained 31 volatiles, of which 12 increased and 11 decreased in content during vase life. 'Red Eagle' petals contained 37 volatiles, of which 9 increased and 19 decreased. The major components that increased during vase life included 2-ethylhexan-1-ol and phenylmethanol in 'Fuego' and hexan-1-ol and 2-phenylacetaldehyde in both cultivars, whereas the major components that decreased during vase life included methyl butanoate in 'Fuego', 3,5-dimethoxytoluene in 'Red Eagle', and 2-methylhexane in both cultivars. The total volatile content was maintained in 'Fuego' petals during the 6-day vase life, despite the changes in the content of individual volatile compounds. By contrast, the total volatile content of 'Red Eagle' petals significantly decreased during vase life. Additionally, the volatile compounds that increased in content were relatively small molecules (≤ C_8**),** whereas those that decreased in content during vase life were relatively large molecules (≥ C_9). These results suggest that the analysis of volatile changes during vase life contributes to the harvest time selection of rose flowers and the determination of petal stages used for essential oil in many rose varieties.

Keywords: /Aroma/ /Essential oil/ /GC–MS/ /Postharvest/ /Volatile emission/

SWEET CHERRY

Gu, S., Xu, D., Zhou, F., Gao, H., Hu, W., Gao, X., & Jiang, A. (2020). Cold shock treatment maintains quality and induces relative expression of cold shock domain protein (CSDPs) in postharvest sweet cherry. *Scientia Horticulturae*, *262*, 109058. doi: 10.1016/j.scienta.2019.109058

Abstract

The aim of the study was to explore the effect of cold shock treatment on quality and relative expression of cold shock domain proteins (*CSDP*s) in sweet cherry fruits. The sweet cherry fruits were immersed in 0 °C ice water (ice : water = 1:1 w/v) for 10 min, then were stored at 0 ± 1 °C and 90 % relative humidity (RH) in the dark. The results showed that cold shock treatment not only reduced the weight loss and inhibited the accumulation of malondialdehyde (MDA) of the sweet cherry fruits, but also maintained some other indicators like firmness, *H** values, chroma values, and total anthocyanin content. The quality of sweet cherries treated with cold shock was better than that of the control. Moreover, the cold shock treatment reduced the expression of *CSDP2*, but induced the expression of *CSDP3*. Interestingly, the cold shock treatment did not have much impact on the expression of *CSDP1* and *CSDP4*. The study showed that cold shock treatment could maintain the quality and induce the relative expression of *CSDPs* in sweet cherry fruits, which may be a potential approach for reducing the loss of postharvest sweet cherry.

Keywords: /Cold shock/ /Sweet cherry/ /Electronic tongue/ /*Cold shock domain protein/*

STONE FRUIT

Riva, S. C., Opara, U. O., & Fawole, O. A. (2020). Recent developments on postharvest application of edible coatings on stone fruit: A review. *Scientia Horticulturae*, *262*, 109074. doi: 10.1016/j.scienta.2019.109074

Abstract

Stone fruit, including peaches, nectarines, plums, apricots and cherries, are popular worldwide as a result of their high nutritional value and desirable taste. However, stone fruits are susceptible to various postharvest quality problems including high weight loss, decay, over ripeness and susceptibility to physiological disorders such as internal breakdown and chilling injury symptoms. In the quest to improve fruit storability and shelf life of stone fruit, a lot of research has focused on the postharvest application of edible coatings. However, these coatings have varied effects on the external and internal quality attributes of fruit and the effects are dependent on types of stone fruit. This review, therefore, discusses the different edible coatings applied to enhance storage of stone fruit, with a focus on coating formulation, properties and mode of action specific to stone fruit. Furthermore, gaps in the literature and future prospects of edible coating application on stone fruit are identified.

Keywords: /Respiration rate/ /Cuticle/ /Weight loss/ /Postharvest quality/ /Plums/

STRAWBERRY

Li, D., Zhang, X., Qu, H., Li, L., Mao, B., Xu, Y., … Luo, Z. (2020). Delaying the biosynthesis of aromatic secondary metabolites in postharvest strawberry fruit exposed to elevated CO_2 atmosphere. *Food Chemistry*, *306*, 125611. doi: 10.1016/j.foodchem.2019.125611

Abstract

Aromatic secondary metabolites are closely related to quality attributes of postharvest fruit. In the present study, 20% CO_2 was applied to strawberry fruit to investigate the regulation of elevated CO_2 on aromatic secondary metabolites. The results showed that elevated CO_2 delayed accumulations of anthocyanins, eugenol and lignin. Phenylalanine and tyrosine, the precursors of the above secondary metabolites, were 18.90% and 35.61%, respectively, lower in CO_2-treated fruit compared with the control on day 6. Furthermore, enzyme activities and transcriptional profiles analysis showed pentose phosphate pathway and glycolysis were activated by elevated CO_2 whereas the aromatic amino acids (AAAs) pathway was inhibited. These results indicated that elevated CO_2 restricted carbon flux into aromatic secondary metabolism by inhibiting the AAAs pathway, leading to the decrease of phenylalanine and tyrosine, and thus, delayed the accumulation of aromatic secondary metabolites. In addition, the effect of elevated CO_2 was eliminated after transferred CO_2-treated fruit to the air.

Keywords: /Strawberry fruit/ /Elevated CO_2/ /Aromatic secondary metabolites/ /The aromatic amino acids pathway/

TABLE GRAPE

Vazquez-Hernandez, M., Blanch, M., Sanchez-Ballesta, M. T., Merodio, C., & Escribano, M. I. (2020). High CO_2 alleviates cell ultrastructure damage in Autumn Royal table grapes by modulating fatty acid composition and membrane and cell oxidative status during long-term cold storage. *Postharvest Biology and Technology*, *160*, 111037. doi: 10.1016/j.postharvbio.2019.111037

Abstract

Cell membranes provide a link between postharvest disorders and their integrity is essential for reducing table grape deterioration due to dehydration and susceptibility to fungal infection. We examined the relationship between ultrastructural membrane integrity at the subcellular level (transmission electron microscopy), cell (H_2O_2 generation) and membrane (malondialdehyde accumulation) oxidative status, membrane fatty acid composition (polar lipid fraction) and berry quality in order to determine the critical membrane events associated with long-term storage disorders at 0 °C in table grapes (*Vitis vinifera* L.) cv. Autumn Royal, and evaluate their response to the application of a single or dual short-term 20 kPa CO_2 treatment. The results revealed a progressive disorganization of the cytoplasm and the breakdown of the cell organelle ultrastructure, associated with elevated hydrogen peroxide generation and lipid peroxidation rates and an imbalance in the saturated/unsaturated ratio of polar lipids, mainly due to the decrease in the degree of unsaturation of 18-carbon fatty acids. Conversely, high CO_2 levels maintained the integrity of the microstructure of cell and energy-related organelles that are essential for metabolic damage repair and cell membrane restoration, reduced oxidative damage in cells and membranes, and increased the unsaturation of 18-carbon fatty acids, lipid unsaturation ratio and index of unsaturated fatty acids (IUFA) in the membrane polar lipids. The results also revealed that the more short-term high CO_2 treatment is applied to Autumn Royal grapes, the more cytological evidence there is of enhanced tolerance to long-term cold and prevention of storage disorders in terms of cluster weight loss, rachis browning, berry water loss and decay incidence.

Keywords: /Cold storage/ /Malondialdehyde/ /Oxidative damages/ /Polar lipids/ /Short-term high CO_2/ /*Vitis vinifera*/

TOMATO

Konagaya, K., Riza, D. F. A., Nie, S., Yoneda, M., Hirata, T., Takahashi, N., … Kondo, N. (2020). Monitoring mature tomato (red stage) quality during storage using ultraviolet-induced visible fluorescence image. *Postharvest Biology and Technology*, *160*, 111031. doi: 10.1016/j.postharvbio.2019.111031

Abstract

The potential of UV-induced fluorescence imaging was investigated as a non-destructive tool to monitor postharvest quality degradation of tomatoes harvested at the red stage and stored at 25 °C. The fluorescence images (excitation at 365 nm) were found to be a better indicator of tomato quality degradation than color images after color saturation. Tomatoes were stored at 25 °C for 9 d. The changes in color and fluorescence of tomato were evaluated by two types of images: Color and fluorescence images. A conventional colorimeter was also used as a reference. Changes in the RGB ratio for these two types of images were opposite. In the color images, the G ratio decreased rapidly for the initial 3 or 5 d and then stabilized afterwards. On the other hand, in the fluorescence images, the G ratio increased continuously up to 9 d. Given that temperature conditions during transportation and storage of tomatoes is not always ideal, the results from this research provide the foundation for developing a postharvest monitoring system of mature tomato quality degradation.

Keywords: /*Solanum lycopersicum*/ /Storage/ /Fluorescence image/ /Color image/ /RGB ratio/