SELECTIVE DISSEMINATION OF INFORMATION
As of August 2021

APPLE

Chen, J., Wu, A., Yang, M., Ge, Y., Pristijono, P., Li, J., Xu, B., & Mi, H. (2021). Characterization of sodium alginate-based films incorporated with thymol for fresh-cut apple packaging. *Food Control*, *126*, 108063. https://doi.org/10.1016/j.foodcont.2021.108063

Abstract

The non-antibacterial and relatively poor mechanical properties of sodium alginate film limit its application for fresh-cut fruit packaging. The phenolic compound thymol has prominent antioxidant and antibacterial activities. The physical and functional properties of thymol/sodium alginate composite films and their ability to preserve fresh-cut apples were investigated. Thymol/sodium alginate composite films were observed to have high tensile strength, elongation at break and UV–vis light blocking capability, but low water vapor permeability, water solubility, and swelling ratio compared with standard sodium alginate film without thymol. The composite films also showed notable scavenging activity against 1,1-diphenyl-2-picrylhydrazyl radicals. In addition, the composite films exhibited remarkable inhibition of the growth of Staphylococcus aureus and Escherichia coli. Furthermore, thymol/sodium alginate films could effectively reduce weight loss, retain nutrition and surface color of fresh-cut apple slices. Therefore, sodium alginate films with thymol have strong potential as a cling wrap material used in the packaging of fresh-cut fruits. • A moderate amount of thymol can improve the properties of sodium alginate film. • Thymol can endow antioxidant and antibacterial activities to sodium alginate film. • The composite film has good effects on extending the shelf-life of fresh-cut apple.

Keywords: /Edible film/ /Fresh-cut fruit/ /Sodium alginate/ /Thymol/

Lu, L., Zuo, W., Wang, C., Li, C., Feng, T., Li, X., Wang, C., Yao, Y., Zhang, Z., & Chen, X. (2021). Analysis of the postharvest storage characteristics of the new red-fleshed apple cultivar "meihong." *Food Chemistry*, *354*, 129470. https://doi.org/10.1016/j.foodchem.2021.129470

Abstract

This study examined the effects of postharvest storage conditions on the fruit quality of a new red-fleshed apple cultivar ('Meihong'). Mature 'Meihong' and 'Golden delicious' apples were exposed to room temperature, low temperature, and low temperature and 1-MCP, after which several fruit characteristics were evaluated (i.e., firmness, ethylene release rate, relative content of aroma components, phenolic compounds and antioxidant capacity, fruit softening-related enzyme activities, and related gene expression). Both 'Meihong' and 'Golden delicious' were *ACS1-1/-2* heterozygotes, but the ethylene release rate in 'Meihong' fruits was lower than that in 'Golden delicious' fruits during storage. Therefore, 'Meihong' fruits are more conducive to storage. The low temperature storage with and without 1-MCP delayed fruit softening, decreased the ethylene release rate and ester aroma component content, and maintained total flavonoid and anthocyanin contents. Therefore, storage at low temperatures with 1-MCP or other preservatives may be useful for maintaining the 'Meihong' fruit quality.

Keywords: /Apple/ /Fruit softening/ /Storage quality/ /Aroma/ /Phenolic compounds/ /Anthocyanin/ /Gene expression/

BELL PEPPER

Frans, M., Aerts, R., Ceusters, N., Luca, S., & Ceusters, J. (2021). Possibilities of modified atmosphere packaging to prevent the occurrence of internal fruit rot in bell pepper fruit (Capsicum annuum) caused by Fusarium spp. *Postharvest Biology & Technology*, *178*, 111545. https://doi.org/10.1016/j.postharvbio.2021.111545

Abstract

Bell pepper (*Capsicum annuum* L.), with its wide array of colors and flavors, plays an important role in many different cuisines around the world. Yet once harvested, it is a highly perishable fruit and needs appropriate post-harvest handling. Recently, post-harvest internal rotting (IFR) by *Fusarium lactis* species complex isolates (FLASC), became an additional challenge to maintain shelf-life and quality of bell pepper fruit. Therefore, modified atmosphere packaging (MAP) was explored as a possible technique to postpone symptom development of infected bell peppers. Four artificially infected bell pepper cultivars with different susceptibility towards IFR were stored under MAP conditions for a maximum of 14 d at challenging conditions of 20 °C resembling unrefrigerated shelf life conditions. Each week, 5 fruits of each object were analyzed for IFR symptom development and additional physicochemical and quality parameters. For all cultivars, MAP packaged fruit showed less severe fungal proliferation compared to controls after 14 d. As total titratable acid (TA), total soluble solids (TSS) and vitamin C concentrations in fruit remained rather stable throughout the experiment, fungal development was likely to be postponed directly due to reduced oxygen levels in the pouches rather than a decreased host susceptibility by influencing fruit metabolism. Since no significant differences of disease development were observed between sensitive and less sensitive cultivars for both colors, sensitivity for IFR seems not likely to be caused by different post-harvest disease development patterns but rather by differences in the initial susceptibility for flower infection under normal growth conditions. Based on our results, MAP can indeed be considered a useful tool to ameliorate IFR development during post-harvest storage of bell pepper under conventional temperatures of 7−16 °C.

Keywords: /Internal fruit rot/ /Fusarium lactis/ /FLASC/ /Bell pepper/ /Capsicum annuum/

Yao, M., Ge, W., Zhou, Q., Zhou, X., Luo, M., Zhao, Y., Wei, B., & Ji, S. (2021). Exogenous glutathione alleviates chilling injury in postharvest bell pepper by modulating the ascorbate-glutathione (AsA-GSH) cycle. *Food Chemistry*, *352*, 129458. https://doi.org/10.1016/j.foodchem.2021.129458

Abstract

We investigated the effect of exogenous glutathione (GSH) on chilling injury (CI) in postharvest bell pepper fruits stored at low temperature and explored the mechanism of this treatment from the perspective of the ascorbate-glutathione (AsA-GSH) cycle. Compared with the control, fruits treated with exogenous GSH before refrigeration displayed only slight CI symptoms and mitigated CI-induced cell damage after 10 d. Moreover, the treated peppers had lower lipid peroxidation product, H_2O_2, and O_2^- content than those that did the control. Glutathione treatment enhanced the ascorbate-glutathione cycle by upregulating *CaAPX1, CaGR2, CaMDHAR1*, and *CaDHAR1* and the antioxidant enzymes APX, GR, and MDHAR associated with the ascorbate-glutathione cycle. Glutathione treatment also increased ascorbate and glutathione concentrations. Taken together, our results showed that exogenous GSH treatment could alleviate CI in pepper fruits during cold storage by triggering the AsA-GSH cycle and improving antioxidant capacity.

Keywords:/Ascorbate-glutathione cycle/ /*Capsicum annuum* L./ /Glutathione/ /Low-temperature damage/ /Oxidative stress/

CHINESE CHERRY

Wang, C., Wang, Y., Wang, L., Fan, W., Zhang, X., Chen, X., Wang, M., & Wang, J. (2021). Biocontrol potential of volatile organic compounds from *Pseudomonas chlororaphis ZL3* against postharvest gray mold caused by *Botrytis cinerea* on Chinese cherry. *Biological Control, 159*, 104613

Abstract

Postharvest gray mold is the most devastating fungal disease, and could lead to enormous losses on Chinese cherries. To formulate an effective and environment friendly management strategy for postharvest gray mold, an endophytic bacterial strain ZL3 with excellent antifungal activity was screened by using a dual culture method. Strain ZL3 was identified as Pseudomonas chlororaphis based on 16S rRNA and gyrB gene sequence analysis. The maximum percent of mycelial growth inhibition (PGI) of VOCs to B. cinerea was up to 97.23% under the antifungal conditions (temperature of 31.96 °C, pH of 6.74 and glucose of 25.96 g/L) optimized by using Box-Behnken Design (BBD) of response surface method (RSM). The biological efficiency of VOCs was performed on cherry fruit at 0 °C for 21 d and 25 °C for 7 d. At 25 °C and 0 °C, the disease incidence reduced to 31.67% and 21.67%, whereas the lesion diameter decreased to 0.60 cm and 0.32 cm, respectively. Additionally, twenty-three VOCs, including 6 alkanes, 4 aldehydes and ketones, 4 alcohols, 4 alkenes, 3 acids & esters, 1 aromatic compound, and 1 sulfur compound, were detected by gas chromatography-mass spectrometry (GC–MS). It is noticed that most VOCs, except for 1, 10-undecadiene and 1-dodecene, demonstrated significant differences among different collection times. The results of this work suggested that strain ZL3 could be used as a promising biocontrol agent to control postharvest gray mold on Chinese cherry.

Keywords: /Pseudomonas chlororaphis/ /Botrytis cinerea/ /Biocontrol/ /Postharvest gray mold/ /Chinese cherry/

CITRUS

Behkaum F., Paloschi, A., Marin, T.G.S., Santos, T., Ferreira, H., & doHascimento, L. (2021). Chlorine dioxide, peroxyacetic acid, and calcium oxychloride for post-harvest decontamination of citrus fruit against *Xanthomonas citri* subsp. *citri*, causal agent of citrus canker. *Crop Protection, 146*, 105679. https://doi.org/10.1016/j.cropro.2021.105679 (NPS)

Abstract

After a new regulation on the control of citrus canker (*Xanthomonas citri* subsp. *citri*) came into force in Brazil in 2017, the post-harvest sanitization of citrus fruit became mandatory to prevent dissemination of the causal pathogen and enable the commercial trade of citrus to other states and countries. Although several sanitizers are available worldwide for decontamination of fresh produce, only sodium hypochlorite is legally required by the country for decontamination of citrus fruit traded with other states and countries against *X. citri* in the packing house. Thus, the objectives of this study were to assess the efficiency of chlorine dioxide, peracetic acid, and calcium oxychloride as alternative sanitizers and exposure times of 1 and 2 min for the post-harvest decontamination of citrus fruit against *X. citri*. Sodium hypochlorite, the legally required standard, was used as control. The sanitizers were evaluated regarding the capacity to eliminate live *X. citri* in solution immediately or 1 h after exposure to the products and the efficiency in disinfecting artificially and naturally contaminated lime fruit. An additional assessment was carried out to determine the infective potential of *X. citri* suspensions at different concentrations in order to evaluate the risk of disease dissemination by the remaining bacterial population on the fruit following treatment. All the assessed sanitizers were able to completely eliminate *X. citri* in suspension immediately after treatment. In artificially and naturally contaminated fruit, the sanitizers promoted a significant reduction of 2.4–2.8 and 1.1 to 1.5 $\log_{10}$ cfu/mL, respectively, in the population of live bacteria when compared to the untreated control. In these experiments, the amount of *X. citri* that remained on the fruit ranged from 0.5 to 1.0 and 0.1 to 0.3 $\log_{10}$ cfu/mL, respectively, regardless of the exposure time. The labeled concentrations and treatment periods assessed effectively decontaminated fruit with *X. citri* and demonstrated little or no risk

of pathogen spread from treated fruit.

Keywords: /Sanitization/ /Sodium hypochlorite/ /Packing house/ /Lime/ /Orange/ /Lemon/

Soto-Muñoz, L., Martínez-Blay, V., Pérez-Gago, M. B., Fernández-Catalán, A., Argente-Sanchis, M., & Palou, L. (2021). Starch-glyceryl monostearate edible coatings formulated with sodium benzoate control postharvest citrus diseases caused by Penicillium digitatum and Penicillium italicum. *Phytopathologia Mediterranea*, *60*(2), 265–279. https://doi.org/10.36253/phyto-12528

Abstract

The curative antifungal activity of edible composite coatings (ECs) based on pregelatinized potato starch-glyceryl monostearate (PPS-GMS) formulated with or without sodium benzoate (SB) to control green mould (caused by Penicillium digitatum) and blue mould (P. italicum) was assessed on 'Orri' mandarins, 'Valencia' oranges and 'Fino' lemons. These fruit were artificially inoculated with P. digitatum or P. italicum, treated by immersion in coating emulsions and compared to uncoated control fruit immersed in water and fruit immersed in 2% SB (w/v) aqueous solution. Treated fruit were then stored at either 20°C or commercial low temperature (5°C for mandarins and oranges, 12°C for lemons). Coatings without SB did not exhibit antifungal activity, whereas coatings containing 2% SB reduced incidence and severity of green and blue moulds, in comparison to the controls, on all citrus species and in all storage conditions, without differing from the aplication of 2% SB alone. For example, incidence reduction on 'Fino' lemons was from 99 to 0% after 7 d at 20°C, and from 99 to 30% after 2 weeks at 12°C. None of the treatments was phytotoxic. These results indicate that applications of SB as antifungal ingredient of PPS-GMS based ECs is a promising non-polluting alternative to control Penicillium postharvest decay of citrus, and these ECs are effective substitutes for conventional waxes amended with synthetic fungicides.

Keywords: /Alternative disease control/ /Antifungal fruit coatings?/ /Blue mould/ /GRAS salts/ /Green mould

CUT FLOWERS

Song, J., Li, Y., Hu, J., Lee, J., & Jeong, B. R. (2021). Pre- and/or Postharvest Silicon Application Prolongs the Vase Life and Enhances the Quality of Cut Peony (Paeonia lactiflora Pall.) Flowers. *Plants (Basel, Switzerland)*, *10*(8). https://doi.org/10.3390/plants10081742

Abstract

Peony is an important ornamental plant and has become increasingly popular for cut flower cultivation. However, a short vase life and frequent poor vase quality severely restrict its market value. The study described herein was conducted to investigate the effects of silicon application on the vase life and quality of two cut peony (*Paeonia lactiflora* Pall.) cultivars, 'Taebaek' and 'Euiseong'. For pre- and/or postharvest silicon application, four experimental groups based on treatments were designed. With silicon treatment, the relevant growth attributes, including the shoot and leaf lengths, stem and bud diameters as well as the leaf width were all remarkably increased. In the postharvest storage, the addition of silicon to the holding solution in the vase was able to significantly extend vase life, delay fresh weight decrease, and improve vase quality, as characterized by the antioxidant enzyme activities and mechanical stem strength. Taken together, silicon application, regardless of the approach, was able to effectively prolong the vase life and enhance the quality of cut peony flowers.

Keywords: /Antioxidant enzymes/ /Flower stage/ /Holding solution/ /Preservatives/ /Stem strength/

FRUITS AND VEGETABLES

Bisht, B., Bhatnagar, P., Gururani, P., Kumar, V., Tomar, M. S., Sinhmar, R., Rathi, N., & Kumar, S. (2021). Food irradiation: Effect of ionizing and non-ionizing radiations on preservation of fruits and vegetables– a review. *Trends in Food Science & Technology*, *114*, 372–385. https://doi.org/10.1016/j.tifs.2021.06.002

Abstract

Food irradiation is a non-thermal, energy-efficient, non-chemical and physical method of food preservation in which the food is exposed to various ionizing and non-ionizing radiations. It is used to extend the shelf-life of a product by not adversely affecting its nutritive parameters.The present review deals with the current understanding of the effect of ionizing and non-ionizing radiations on different properties of fruits and vegetables. Studies have revealed the positive effects of irradiation on physical and nutritional properties of different fruits and vegetables followed by significant reduction in microbial load during storage. Food irradiation can be seen as a promising, safe and well-established technology but still underutilized at large scale. The buying behaviour of consumers poses a significant challenge with innovating food processing technologies like food irradiation. Thus, on the basis of the current review, scientific proof of irradiated food safety is still needed and work needs to be accomplished to increase technological appeal for food safety. Data collected from existing studies revealed that UV-C has the potential to be proved better than other preservation techniques at an acceptable dose that can be helpful in maintaining the desirable quality, enhancing the nutritive value of product during storage and has the efficacy of eliminating COVID-19.

Keywords: /Food irradiation/ /Shelf-life/ /Non-thermal/ /Food preservation/ /COVID-19/

Wang, S.-Y., Shi, X.-C., Liu, F.-Q., & Laborda, P. (2021). Effects of exogenous methyl jasmonate on quality and preservation of postharvest fruits: A review. *Food Chemistry*, *353*, 129482. https://doi.org/10.1016/j.foodchem.2021.129482

Abstract

Methyl jasmonate (MeJA) is a volatile hormone involved in a number of plant processes, acting as a signal in response to external stresses and modulating the biosynthesis of other phytohormones. Here, we are reviewing for the first time all reports related to the effects of exogenous MeJA on postharvest fruits. Application of MeJA during preharvest and postharvest stages has been demonstrated to enhance fruit antioxidant capacity and phenolics content, which in turn extended fruit shelf-life, enhanced fruit quality and reduced chilling injury. The postharvest application of MeJA has been reported to alter volatiles pattern and to enhance the innate disease resistance of postharvest fruits against pathogenic fungi. The results obtained using different treatment conditions, such as temperature, storage time and concentration, have been highlighted and compared along the manuscript in order to provide new insights on the applicability of MeJA for enhancing postharvest fruit quality and preservation.

Keywords: /Methyl jasmonate/ /Fruit postharvest preservation/ /Fruit quality/ /Chilling stress/ /Fungal diseases/

Zhang, W., Cao, J., & Jiang, W. (2021). Application of electrolyzed water in postharvest fruits and vegetables storage: A review. *Trends in Food Science & Technology*, *114*, 599–607. https://doi.org/10.1016/j.tifs.2021.06.005

Abstract

Due to rapid senescence and disease, a large amount of economic losses of fresh fruits and vegetables (F&V) occurs during the postharvest stage. As a non-residue physical sterilization and preservation

method, many scientists have recently applied electrolyzed water (EW) to postharvest F&V storage. This article reviews recent applications of EW in postharvest storage of F&V, including effects on sterilization and removal of pesticide residues. Moreover, this work summarizes the effect of EW treatment on improving postharvest F&V quality during storage including suppressing browning, delaying senescence, maintaining nutraceutical/bioactive compounds and alleviating chilling injury. This work reviews the application of EW as a disinfectant to postharvest F&V in recent years, and concludes that EW controls the postharvest diseases caused by fungal infections not only through the direct inhibition to pathogen, but also seems to be related to the increased resistance of host induced by EW. In addition, this article also summarizes the application of EW as a pesticide remover in postharvest F&V and reveals the types as well as molecular structures of target pesticides that acidic electrolyzed water (AEW) and alkaline electrolyzed water (ALEW) may act on. Particular finding is that in addition to the efficacy of disinfection and removing pesticide residues, EW also gets involved in regulating the physiological metabolism of postharvest F&V, which plays an important role in improving the quality and extending the shelf life of fresh products. The main applications of EW in improving the quality of postharvest F&V include (Ⅰ) suppress browning, (Ⅱ) delay senescence, (Ⅲ) maintain bioactive compounds, and (Ⅳ) alleviate chilling injury. In addition, the potential biochemical mechanisms of EW on improving the quality of postharvest F&V are also discussed.

Keywords: /Fruits and vegetables/ /Postharvest/ /Electrolyzed water/

GOJI BERRY

Zhang, H., Liu, F., Wang, J., Yang, Q., Wang, P., Zhao, H., Wang, J., Wang, C., & Xu, X. (2021). Salicylic acid inhibits the postharvest decay of goji berry (Lycium barbarum L.) by modulating the antioxidant system and phenylpropanoid metabolites. *Postharvest Biology & Technology*, *178*, 111558. https://doi.org/10.1016/j.postharvbio.2021.111558

Abstract

Goji berry is a perishable fruit after harvest. To explore the biochemical and molecular mechanisms by which salicylic acid (SA) suppresses rot in goji berry, the fruit was treated with SA and stored for 30 d. Compared with the control, the SA-treated fruit showed smaller lesion areas during storage at 20 °C. During storage at 0 °C, the $O_2^{\bullet-}$ production and H_2O_2 levels were lower in SA-treated fruit, although the H_2O_2 content was higher at the beginning of storage. SA induced the activities and gene expressions of the key proteins (SOD, CAT, APX and POD) associated with redox homeostasis. Simultaneously, the activities and gene expressions of PAL, C4H, 4CL, CHS, CHI and CAD in phenylpropanoid metabolism were activated. Moreover, the production of chlorogenic acid, ferulic acid, *p*-coumaric acid, sinapic acid, protocatechuic acid, naringenin, and rutin were stimulated to maintain the higher levels by the most effective SA treatment (2 mmol L^{-1}). The results indicate that SA inhibits rot of goji fruit during storage by mediating the antioxidant system and phenylpropanoid metabolism.

Keywords: /*Lycium barbarum* L.Salicylic acid/ /Phenylpropanoid pathway/ /ROS metabolism/ /Secondary metabolites/

GRAPE

Li, C., Kaituo, W., Lei, C., Cao, S., Huang, Y., Ji, N., Xu, F., & Zheng, Y. (2021). Alterations in sucrose and phenylpropanoid metabolism affected by BABA-primed defense in postharvest grapes and the associated transcriptional mechanism. *Molecular Plant-Microbe Interactions : MPMI*. https://doi.org/10.1094/MPMI-06-21-0142-R

Abstract

Defense elicitors can induce fruit disease resistance to control postharvest decay but may incur quality impairment. Our present work aimed to investigate the resistance against Botrytis cinerea induced by the elicitor β-aminobutyric acid (BABA) and to elucidate the specific transcriptional mechanism implicated in defense-related metabolic regulations. The functional dissection results demonstrated that after inoculation with the fungal necrotroph B. cinerea, a suite of critical genes encoding enzymes related to sucrose metabolism and phenylpropanoid pathway in priming defense in grapes were transcriptionally induced by 10 mM BABA treatment. In contrast, more UDP-glucose, a shared precursor of phenylpropanoid and sucrose metabolism, may be redirected to the phenylpropanoid pathway for the synthesis of phytoalexins, including trans-resveratrol and ε-viniferin, in 100 mM BABA-treated grapes, resulting in direct resistance but compromised soluble sugar contents. An R2R3-type MYB protein from Vitis vinifera, VvMYB44, was isolated and characterized. VvMYB44 expression was significantly induced upon the grapes expressed defensive reaction. Subcellular localization, Y2H and Co-IP assays revealed that the nuclear-localized VvMYB44 physically interacted with the SA-responsive transcription co-activator NPR1 in vivo for defence expression. In addition, VvMYB44 directly bound to the promoter regions of sucrose and phenylpropanoid metabolism-related genes and transactivate their expression, thus tipping the balance of antifungal compound accumulation and soluble sugar maintenance. Hence, these results suggest that 2R-type VvMYB44 might be a potential positive participant in BABA-induced priming defense in grape berries, contributing to avoiding the excessive consumption of soluble sugars during the postharvest storage.

Keywords: /Grapes/ /Postharvest decay/

Xu, M., Zhang, X., Li, D., Gu, X., Godana, E. A., Dhanasekaran, S., Zhao, L., & Zhang, H. (2021). Transcriptome analysis of postharvest grapes in response to Talaromyces rugulosus O1 infection. *Postharvest Biology & Technology*, *178*, 111542. https://doi.org/10.1016/j.postharvbio.2021.111542

Abstract

Grapes are high nutritional and economic fruit but extremely vulnerable to fungus infections during postharvest storage. Our previous study found that the fungi, *Talaromyces* rugulosus O1 secretes ochratoxin A (OTA), which inflicts consumer health and economic value. This study found that *T. rugulosus* O1 has strong pathogenicity and spore germination to produce germ tubes to help it infect grapes. To better understand the molecular interaction between *T. rugulosus* O1 and grape, RNA sequencing (RNA-seq) was performed, and 5037 genes were identified as differentially expressed genes (DEGs) in grapes after *T. rugulosus* O1 infection. RNA-seq analysis revealed that *T. rugulosus* O1 infection, induced complex defense reactions in grapes, including an influx of Ca^{2+}, oxidative burst, changes in GSH, plant hormone signal transduction, transcription factor regulation, overexpression of protein kinases, and biosynthesis of plant secondary metabolites. Our study found that the activity of the resistance enzymes in grapes increased after *T. rugulosus* O1 infection, which is consistent with the RNA-seq results. Moreover, the accumulation of some antifungal compounds, including flavonoids, phenols, and lignin in grapes, increased grapes' antifungal ability.

Keywords: *ITalaromyces rugulosus* O1/ /Grape/ /Defense mechanism/ /RNA sequencing/ /Antifungal compound/

GUAVA

Silva, N. C. da, Barros-Alexandrino, T. T. de, Assis, O. B. G., & Martelli-Tosi, M. (2021). Extraction of phenolic compounds from acerola by-products using chitosan solution, encapsulation and application in extending the shelf-life of guava. *Food Chemistry*, *354*, 129553. https://doi.org/10.1016/j.foodchem.2021.129553

Abstract

Aiming the simplification of the production of chitosan nanoparticles as an encapsulating material, the primary approach of this study was to investigate the extraction of active compounds from acerola-pulp by-products directly in chitosan solution by using tip sonication. The results have shown that chitosan solution can be used as a good solvent, mainly for total phenolic compounds (TPC) extraction (1792.7 mg/100 g of dry by-product). The extract was submitted to the ionic gelation process using, as a counter-ion, the sodium tripolyphosphate to form loaded nanoparticles with TPC. The suspension was applied as protective coatings on the guavas. The nanoengineered coatings provided an effective barrier that delayed the maturation and maintained the green pigmentation for longer periods along with good firmness. To the best of our knowledge, this was the first study that uses chitosan solution as extraction solvent of TPC from food byproducts in order to facilitate the encapsulation process.

Keywords: /Fruit wastes/ /Chitosan nanoparticles/ /Phenolic compounds/ /Coatings/ /Ionic gelation/

KIWI FRUIT

Dai, Y., Wang, Z., Leng, J., Wang, Q., & Liu, J. (2021). Heat stress alters the transcriptome of Debaryomyces hansenii and reduces its biocontrol activity against postharvest gray mold on kiwifruit. *Postharvest Biology & Technology*, *178*, 111541. https://doi.org/10.1016/j.postharvbio.2021.111541

Abstract

Heat stress plays an important role in a postharvest biocontrol system. A basic understanding of heat stress response is crucial to the use of antagonistic yeasts as postharvest biocontrol agents. In the present study, heat stress (42 °C, 20 min) decreased the biocontrol efficacy of the yeast antagonist, *Debaryomyces hansenii*, against gray mold, caused by *Botrytis cinerea,* on kiwifruit. RNA-seq was used to conduct a comparative transcriptomic analysis of heat-treated vs. non-heat-treated cultures of *D. hansenii.* A total of 9775 transcripts comprising 7805 unigenes were obtained from the two treatment groups by *de novo* assembly. A set of 706 differentially expressed genes (DEGs) were identified between the two treatment groups, comprising 376 up-regulated DEGs and 330 down-regulated DEGs. The identified DEGs were mainly associated with response to stimulus, biological regulation, and developmental process. RT-qPCR analysis was conducted on a subset of eight genes to corroborate the results of the RNA-seq data. The present study provides new information on the molecular response of biocontrol yeasts to heat stress.

Keywords: /*Debaryomyces hansenii*/ /Heat stress/ /Kiwifruit/ /Molecular response/ /Postharvest gray mold/

Gan, Z., Yuan, X., Shan, N., Wan, C., Chen, C., Xu, Y., Xu, Q., & Chen, J. (2021). AcWRKY40 mediates ethylene biosynthesis during postharvest ripening in kiwifruit. *Plant Science : An International Journal of Experimental Plant Biology*, *309*, 110948. https://doi.org/10.1016/j.plantsci.2021.110948

Abstract

WRKY transcription factors belong to a superfamily that is involved in many important biological processes, including plant development and senescence. However, little is known about the transcriptional regulation mechanisms of WRKY genes involved in kiwifruit postharvest ripening. Here, we isolated a WRKY gene from the kiwifruit genome and named it AcWRKY40. AcWRKY40 is a nucleus-localized protein that possesses transcriptional activation activity. The expression of AcWRKY40 was detected, and the gene responded to ethylene treatment during kiwifruit postharvest ripening, indicating its involvement in this process at the transcriptional level. We found multiple cis-acting elements related to maturation and senescence in the AcWRKY40 promoter. GUS activity analysis showed that its

promoter activity was induced by exogenous ethylene. Yeast one-hybrid and dual-luciferase assays demonstrated that AcWRKY40 binds to the promoters of AcSAM2, AcACS1, and AcACS2 to activate them. In addition, transient transformations showed that AcWRKY40 enhances the expression of AcSAM2, AcACS1, and AcACS2. Taken together, these results suggest that AcWRKY40 is involved in kiwifruit postharvest ripening, possibly by regulating the expression of genes related to ethylene biosynthesis, thus deepening our understanding of the regulatory mechanisms of WRKY transcription factors in fruit ripening.

Keywords: /AcWRKY40/ /Ethylene biosynthesis/ /Gene expression/ /Kiwifruit/ /Postharvest ripening/

Huang, W., Billing, D., Cooney, J., Wang, R., & Burdon, J. (2021). The role of ethylene and abscisic acid in kiwifruit ripening during postharvest dehydration. *Postharvest Biology & Technology*, *178*, 111559. https://doi.org/10.1016/j.postharvbio.2021.111559

Abstract

Kiwifruit may be stored for prolonged periods at low temperatures during which time the fruit continues to ripen slowly and dehydration occurs. Abscisic acid (ABA) plays important roles in both fruit ripening and environmental stress response, including dehydration. To investigate the inter-relationships among postharvest dehydration, ethylene production, ABA and fruit ripening, two independent experiments were undertaken with 'Hayward' kiwifruit. Water loss was manipulated by holding fruit in three environments of different humidities at 20 °C for up to 6 d, and at 0 °C for up to 16 weeks. The impacts of the treatments over time after harvest were investigated on fruit softening, ABA content and ethylene production, and on the expression of genes of the ABA biosynthetic pathway and ethylene metabolism. Water loss induced earlier ethylene production and accelerated softening late in storage. However, these changes were not directly related to increased ABA content. The strongest association seen was between tissue ABA content and fruit firmness, irrespective of the degree of water loss. In conclusion, it is suggested that the accelerated softening of 'Hayward' kiwifruit caused by dehydration may be mediated via ethylene, but that the precise role for ABA, either directly or indirectly, is as yet difficult to ascribe.

Keywords: /*Actinidia*/Abscisic acid/ /Ethylene/ /Firmness/ /Water loss/ /Humidity/

Liu, J., Guo, X., Zhang, H., Cao, Y., & Sun, Q. (2021). First Report of Postharvest Fruit Rot Disease of Hardy Kiwifruit Caused by Diaporthe eres in China. *Plant Disease*,*108 (8)*. https://doi.org/10.1094/PDIS-08-20-1705-PDN

Abstract

Hardy kiwifruit (Actinidia arguta), as an economically important fruit crop growing in Northeast China with thin, hairless and smooth skin, is susceptible to postharvest decay. In September 2018, infected cultivar Kiwi fruits were obtained from a commercial farm in Liaoning province, northeastern China. The occurring incidence of the rot disease varied from 20% to 90% according to the fruit number in each box during a 7-day-long storage at room temperature, and the initial symptom included a small, soft, chlorosis to light brown lesion and later watery brown lesions. Pure cultures of the same characteristics were obtained from the isolated strains in four rotten fruits on PDA medium. The isolates grew into transparent radial mycelium on PDA in the first two days followed by abundant white, fluffy aerial mycelium. After 14 days, colonies formed white to light brown aerial mycelial mats with gray concentric rings, and they produced gray and embedded pycnidia. Alpha conidia of 4.4 to 8.8 µm × 1.4 to 3.3 µm (n = 50) were abundant in culture, hyaline, aseptate, ellipsoidal to fusiform, while Beta conidia at 20.5 to 28.6 µm × 1.0 to 1.4 µm (n = 50) were hyaline, long, slender, curved to hamate. These morphological characteristics were similar to Diaporthe species (anamorph: Phomopsis spp.) (Udayanga et al. 2014). For identification, DNA was extracted from three single isolates respectively , and the internal transcribed spacer (ITS) region, β-tubulin (BT), and histone (HIS) H3 gene were amplified by using primers ITS1/ITS4 (White et al. 1990),

T1/T22 (O'Donnell et al. 1997) and HIS1F/HISR (Gao et al. 2017), respectively. The three isolates produced identical sequences across all three gene regions, which were submitted to NCBI (Genbank accession numbers MT561361, MT561360 and MT855966). Nucleotide BLAST analysis revealed that the ITS sequence shared 99% homology with those of ex-type Diaporthe eres in NCBI GenBank (MG281047.1 and KJ210529.1), so did the BT sequence that had 98% identity to D. eres (MG281256.1 and KJ420799.1) and the HIS 99% identity to D. eres (MG28431.1 and MG281395.1) (Hosseini et al. 2020, Udayanga et al. 2014). Pathogenicity was tested by wound inoculation on the cv. Kwilv fruits. Five mature and healthy fruits were surface-sterilized with 1% NaClO solution, rinsed in sterile distilled water and dried. Every fruit was wounded by penetrate the peel 1-2 mm with a sterile needle, and inoculated with mycelium plugs (5 mm in diameter) of the isolate on PDA, with five inoculated with sterile PDA plugs as controls. Treated fruits were kept in sterilized transparent plastic cans separately under high humidity (RH 90 to 100%) at 28°C. After five days, the same rot symptoms were observed on all fruits inoculated with mycelium while the control remained symptomless. The fungi was re-isolated from the lesions of inoculated fruits and identified as D. eres by sequencing, thus fulfilling Koch's postulates. The pathogenicity experiment was re-performed using D. eres conidial suspension (107 conidia/ml) in sterile distilled water in October 2019 and the same results were obtained. D. eres was recently reported to cause European pear rot in Italy (Bertetti et al. 2018). To our knowledge, this is the first report of D. eres causing a postharvest rot in hardy kiwifruit in China, leading to severe disease and thus huge economic losses in Northeast China. Accordingly, effective measures should be taken to prevent its spreading to other production regions in China.

Keywords: /China/ /Diaporthe eres/ /Hardy kiwifruit/ /Postharvest Fruit Rot/

LITCHI

Liu, J., Sun, J., Pan, Y., Yun, Z., Zhang, Z., Jiang, G., & Jiang, Y. (2021). Endogenous melatonin generation plays a positive role in chilling tolerance in relation to redox homeostasis in litchi fruit during refrigeration. *Postharvest Biology & Technology*, *178*, 111554. https://doi.org/10.1016/j.postharvbio.2021.111554

Abstract

The potent role of endogenous melatonin (MEL) in affecting chilling injury (CI) and related chilling tolerance regulatory mechanisms in harvested litchi fruit during refrigeration at 4 °C were investigated in this study. In the first experiment, exogenous MEL exposure exerted an inhibitory impact on the development of CI severity in refrigerated litchi fruit, as indicated by the lower CI index and delayed red color loss of pericarp, whereas treatment with *p*-chlorophenylalanine (*p*-CPA), an inhibitor of MEL biosynthesis, aggravated the degree of CI. The suppression of CI afforded by exogenous MEL was abated under the combined application of exogenous MEL and *p*-CPA. In the second experiment, the effects of *p*-CPA alone treatment on changes in biochemical parameters during refrigeration were analyzed. The results showed that *p*-CPA down-regulated the expressions of MEL biosynthesis genes, including *LcTDC*, *LcT5H* and *LcSNAT*, contributing to reduced generation of endogenous serotonin and MEL. *p*-CPA treatment accelerated oxidative stress-triggered membrane deterioration, as reflected by increases in relative leakage rate (RLR), reactive oxygen species (ROS) production, lipoxygenase (LOX) activity and malondialdehyde (MDA) accumulation. The membrane damage caused by *p*-CPA further resulted in loss of subcellular compartmentalization and enzymatic oxidation, as demonstrated by increased activities of polyphenol oxidase (PPO) and peroxidase (POD) in parallel with reduced contents of total phenolics and anthocyanin. Compared with control fruit, lower activities of antioxidant enzymes, including superoxide dismutase (SOD), catalase (CAT), ascorbate peroxidase (APX), monodehydroascorbate reductase (MDHAR), dehydroascorbate reductase (DHAR) and glutathione reductase (GR), were observed in fruit receiving *p*-CPA. Additionally, *p*-CPA suppressed the expression levels of genes encoding oxidized protein repair-related enzymes, including *LcMsrA1*, *LcMsrA2*, *LcMsrB1* and *LcMsB2*. These results suggest that endogenous MEL might confer a protective role against chilling stress by modulating cellular redox status in harvested litchi fruit during refrigeration.

Keywords: /Litchi/ /Chilling injury/ /Melatonin/ /Enzymatic browning/ /Antioxidant system/ /Oxidation repair/

MANDARIN

Fadda, A., Sarais, G., Lai, C., Sale, L., & Mulas, M. (2021). Control of postharvest diseases caused by Penicillium spp. with myrtle leaf phenolic extracts: in vitro and in vivo study on mandarin fruit during storage. *Journal of the Science of Food & Agriculture*, *101*(10), 4229–4240. https://doi.org/10.1002/jsfa.11062 (NPS)

Abstract

In the postharvest handling of horticultural commodities, plant extracts with fungicidal activity are a valid alternative to synthetic fungicides. The fungicidal activity of myrtle leaf extracts from eight cultivars was studied in vitro against Penicillium digitatum, Penicillium italicum, and Penicillium expansum and on artificially inoculated mandarins with green and blue molds during storage for 12 days at 20 °C and 90% RH. Hydroxybenzoic acids, hydrolysable tannins, and flavonols were identified by high-performance liquid chromatography (HPLC). Despite sharing the same phenolic profile, extracts of eight myrtle cultivars significantly differed in the concentration of phenolics. Hydrolysable tannins are the principal subclass representing nearly 44.9% of the total polyphenols, whereas myricitrin was the most abundant flavonol in all cultivars. Myrtle extracts strongly inhibited conidial germination of the pathogens tested, although the greatest efficacy was observed against P. digitatum. At a concentration of 20 g L−1, all the extracts completely inhibited fungi growth; only 'Angela', 'Tonina' and 'Grazia' extracts were effective at lower concentrations (15 g L−1). On inoculated fruit, myrtle extracts significantly controlled rot development. As a preventive treatment, 'Ilaria' and 'Maria Rita' extracts significantly reduced the rate of fruit with green mold decay lesions. When applied as a curative treatment, all the exacts decreased the incidence of decay. Against P. italicum, all the extracts applied as preventive treatments controlled decay effectively, while as curative treatment some of the extracts were not effective. All the extracts reduced the size of the infected areas. The results propose myrtle extracts as a possible natural alternative to synthetic fungicides.

Keywords: /Fungicidal activity/ /Myrtle/ /Penicillium/ /Phenols/ /Plant extracts/ /Storage/

MANGO

Ma, J., Zhou, Z., Li, K., Li, K., Liu, L., Zhang, W., Xu, J., Tu, X., Du, L., & Zhang, H. (2021). Novel edible coating based on shellac and tannic acid for prolonging postharvest shelf life and improving overall quality of mango. *Food Chemistry*, *354*, 129510. https://doi.org/10.1016/j.foodchem.2021.129510

Abstract

This study aimed to investigate the combined effects of a coating based on shellac and the active agent tannic acid (TA) on the storability and physiological variations of mangoes stored at room temperature. Results showed that TA-shellac prolonged shelf life and improved overall quality of mangoes to a higher extent compared with controls, which was reflected in the extension of shelf life for approximately 10 days, maintaining of tissue firmness and weight loss, slowing down of respiration rate, improvement of physical properties and chemical qualities, suppression of browning, reduction of lipid peroxidation, preservation of aromatic volatiles, and regulation of the related enzymes activities. Addition of TA to shellac coating also improved the antifungal effect of the formulation. The results suggest that a synergistic effect took place between TA and shellac, which demonstrates the high potential for shelf life extension and quality improvement of mangoes of this formulation.

Keywords: /Shellac/ /Tannic acid/ /Edible coating/ /Biochemical change/ /Mango fruit/ /Postharvest quality/

Nguyen, T. T., Kato, M., Ma, G., Zhang, L., Uthairatanakij, A., Srilaong, V., Laohakunjit, N., & Jitareerat, P. (2021). Electron beam radiation delayed the disassembly of cell wall polysaccharides in harvested mangoes. *Postharvest Biology & Technology*, *178*, 111544. https://doi.org/10.1016/j.postharvbio.2021.111544

Abstract

Fruit softening, accompanied by cell wall polysaccharides degradation, is a common phenomenon in harvested mango (*Mangifera indica* L.) fruit. To reduce fruit's firmness loss and maintain cell wall polysaccharides of mangoes, the effect of electron beam (E-beam) radiation on firmness, cell wall degrading enzyme activities, contents of cell wall polysaccharides, reactive oxygen species (ROS), and the expression of genes involved with fruit softening were studied in harvested mangoes stored at 13 ℃. As compared with untreated fruit, E-beam treated fruit at a dose of 0.5 kGy exhibited higher firmness, higher contents of cell wall polysaccharides, such as sodium carbonate-soluble pectin, hemicellulose and cellulose, as well as a lower content of water-soluble pectin, a lower activity of cell wall degrading enzymes, such as pectin esterase (PE), β-galactosidase (BG), pectate lyase (PEL) and cellulase (CEL), except polygalacturonase (PG), and lower contents of hydrogen peroxide (H_2O_2) and superoxide radical ($O_2-\cdot$) during the storage period. In addition, E-beam radiation also suppressed the expression of *MiPE*, *MiPEL,* and *MiBG* genes. These results suggest that E-beam radiation retards the softening process by reducing the production of H_2O_2 and $O_2-\cdot$, and that they are caused to alternate plant cell wall polysaccharides and retard the transcript level of genes involved in fruit softening in harvested mangoes.

Keywords: /Ionizing radiation/ /Cell wall polysaccharides/ /Reactive oxygen species/ /Cell wall degrading enzymes activity/ /Genes expression/

Perumal, A. B., Nambiar, R. B., Sellamuthu, P. S., & Emmanuel, R. S. (2021). Use of modified atmosphere packaging combined with essential oils for prolonging post-harvest shelf life of mango (cv. Banganapalli and cv. Totapuri). *LWT - Food Science & Technology*, *148*, 111662. https://doi.org/10.1016/j.lwt.2021.111662

Abstract

This study aimed to evaluate the combined application of modified atmosphere packaging (MAP) with essential oil (EO) vapours (Thyme, Clove, and Cinnamon) on the shelf life extension of cv. Banganapalli and cv. Totapuri mango fruit. The fruit quality was evaluated in terms of postharvest disease incidence and severity, physicochemical and sensory parameters. Also, the antioxidant enzyme activities, total phenolic, and flavonoid contents, DPPH radical scavenging activity, weight loss, and CO_2 evolution were studied. Our results demonstrated that MAP + thyme oil vapour (TO) treatment significantly ($p < 0.05$) reduced the incidence and severity of anthracnose, and loss of fruit firmness. The MAP + TO treatment enhanced the shelf life of cv. Banganapalli up to 26 ± 2 days and cv. Totapuri up to 23 ± 2 days. MAP + Cinnamon EO treated fruits exhibited a shelf life of 22 ± 2 and 19 ± 1 days for cv. Banganapalli and cv. Totapuri, respectively whereas MAP + Clove EO prolonged the shelf life of mango up to 21 ± 2 days for cv. Banganapalli and 20 ± 1 days for cv. Totapuri fruits. The results of this study showed that a MAP + EO treatment could effectively control postharvest decay and preserve the physicochemical quality of mango fruits, extending their shelf life.

Keywords: /Thyme oil/ /Antioxidant activity/ /Total phenolic/ /Flavonoid/ /Shelf life extension/

MUSHROOM

Liu, Q., Cui, X., Song, Z., Kong, W., Kang, Y., Kong, W., & Ng, T. B. (2021). Coating shiitake mushrooms (Lentinus edodes) with a polysaccharide from Oudemansiella radicata improves product quality and flavor during postharvest storage. *Food Chemistry*, *352*, 129357. https://doi.org/10.1016/j.foodchem.2021.129357

Abstract

In this work, we investigated whether coating fresh shiitake mushrooms with a polysaccharide isolated from *Oudemansiella radicata* (ORWP) would impact key quality characteristics after 18 d of storage at 4 °C. We found that ORWP-coated mushrooms had significant improvements in many qualities during storage, including reduced weight loss, improved firmness, reduced browning, decreased malondialdehyde content, and an improved physical microstructure. Further, ORWP-coated mushrooms had higher contents of nutritional and cell wall compounds compared to control samples. ORWP-coated mushrooms had reduced activities of the following enzymes: protease, polyphenol oxidase, peroxidase, phenylalanine ammonia lyase, cellulase, and chitinase, relative to control samples. However, mushrooms coated with ORWP had higher concentrations of superoxide dismutase and catalase, as well as higher contents of certain key monosodium glutamate-resembling amino acids, umami 5′-nucleotides and 1-octen-3-ol. These findings suggest that ORWP coatings have potential value as a method to improve the postharvest quality of shiitake mushrooms.

Keywords: /Shiitake mushroom/ /Edible coating/ /Postharvest quality/ /Flavor/

ORANGE

Ma, Q., Lin, X., Wei, Q., Yang, X., Zhang, Y., & Chen, J. (2021). Melatonin treatment delays postharvest senescence and maintains the organoleptic quality of "Newhall" navel orange (Citrus sinensis (L.) Osbeck) by inhibiting respiration and enhancing antioxidant capacity. *Scientia Horticulturae*, *286*, 110236. https://doi.org/10.1016/j.scienta.2021.110236

Abstract

Melatonin can improve postharvest quality and strengthen resistance to oxidative stress-induced senescence of many horticultural products, however, the effects of melatonin on storage quality and physiological senescence of citrus fruit are still unclear. The objective of this study was to determine the effect of 200 μmol•L^{-1} melatonin on the organoleptic quality and antioxidant system of 'Newhall' navel orange stored under ambient conditions for 84 days post-harvest. Melatonin caused a significant decrease in respiration rate and weight loss rate, and increased in fruit firmness, total soluble solids, soluble sugar content, titratable acidity and Citrus Color Index (CCI) indicating inhibition of fruit quality deterioration. Melatonin treatment impeded the accumulation of hydrogen peroxide and malondialdehyde, suggesting an inhibition of reactive oxygen species (ROS) burst and oxidative damage. In addition, the application of melatonin enhanced ROS scavenging capacity by increasing the activity and expressions of catalase, superoxide dismutase, ascorbate peroxidase, glutathione reductase and by promoting the accumulation of ascorbate, reduced glutathione and total phenol. Moreover, the PCA (principal component analysis) demonstrated melatonin delayed postharvest senescence of orange fruit is associated with inhibition of postharvest respiration and stimulation of oxidant-defense systems.

Keywords: /Melatonin/ /Antioxidant/ /'Newhall' navel orange (*citrus sinensis* (L.) osbeck)/ /Postharvest quality/ /senescence/

PAPAYA

Singh, A., & Yemmireddy, V. (2021). Fate of Salmonella spp. in fresh-cut papaya (Carica papaya L.) at different storage temperature and relative humidity. *LWT - Food Science & Technology*, *148*, 111810. https://doi.org/10.1016/j.lwt.2021.111810

Abstract

Salmonella has been a recurring issue in the papaya industry. The purpose of this study was to determine

the effect of post-harvest storage conditions on the growth kinetics of *Salmonella* in fresh-cut papaya. Papaya samples were spot inoculated with nalidixic acid adopted *Salmonella* spp (4-strain) at 4–5 log CFU/g and then stored in an environmental chamber at six different temperature (4, 12 and 21 °C) and relative humidity (55 and 90%) combinations for up to 14 days. The levels of *Salmonella* and the changes in pH, TSS, color, and water activity of papaya were determined. Increasing the storage temperature from 4 to 21 °C and RH from 55 to 90% increased the log survival. However, no significant effect ($P > 0.05$) of RH was observed when the samples were stored either at 12 or 4 °C for 14 days. Both Baryani-Roberts ($R^2$0.794–0.975) and Biphasic models (0.793–0.975) best fitted the experimental data at the tested storage conditions. *Salmonella* showed a maximum growth rate ranging from −0.0207 to 0.0632 (1/h) and the highest growth rate was observed at 21 °C and 90% RH. These findings demonstrate that better control over storage temperature and RH is critical to mitigate the risk of *Salmonella* in papaya.

Keywords: /*Salmonella* spp/ /Papaya/ /Temperature/ /Relative humidity/ /Modeling/

PEACH

Zhao, Y., Song, C., Qi, S., Lin, Q., & Duan, Y. (2021). Jasmonic acid and salicylic acid induce the accumulation of sucrose and increase resistance to chilling injury in peach fruit. *Journal of the Science of Food and Agriculture*, *101*(10), 4250–4255. https://doi.org/10.1002/jsfa.11064 (NPS)

Abstract

Salicylic acid (SA) and jasmonic acid (JA) can both enhance resistance of chilling injury (CI) in cold-storage peach fruit, but the regulatory mechanisms involved and whether there is a coordinated regulation between them is unclear. In this study, postharvest peach fruit were treated with an aqueous SA solution for 15 min or an aqueous JA solution for 30 s before storage at 4 °C for 35 days. SA and JA treatments both delayed and reduced development of internal browning (a symptom of CI) and induced the accumulation of hydrogen peroxide and sucrose. The SA and JA also reduced catalase and peroxidase activities, which are involved in hydrogen peroxide generation. The SA and JA treatments significantly regulated the transcript abundance of genes related to sucrose biosynthesis and degradation consistent with the observed increase in sucrose content. These results intimate that JA and SA may be involved in coordinating the alleviation of CI via increased accumulation of sucrose.

Keywords: /Prunus persica/ /Antioxidase enzymes/ Internal browning/ /Mealiness/ /Sugar metabolism/

PEAR

Li, J., Luo, M., Zhou, X., Zhou, Q., Wei, B., Cheng, S., & Ji, S. (2021). Polyamine treatment ameliorates pericarp browning in cold-stored "Nanguo" pears by protecting mitochondrial structure and function. *Postharvest Biology & Technology*, *178*, 111553. https://doi.org/10.1016/j.postharvbio.2021.111553

Abstract

Refrigeration is the most common way to store 'Nanguo' pears. However, their pericarps are prone to browning during the shelf life after refrigeration. In this study, we examined the effects of polyamines (PAs) on pericarp browning and analyzed their impact on mitochondrial morphology and function. Exogenous PAs substantially alleviated the onset and development of pericarp browning in pear fruit treated with them. PA content and the expression and activity of anabolic enzymes related to PAs increased, whereas the reactive oxygen species levels decreased. Moreover, the PA treatment preserved pericarp mitochondrial structure. Exogenous PA diminished the rate of increase and amplitude of mitochondrial membrane permeability transition pore opening and mitochondrial membrane permeability. To a certain extent, the PA treatment maintained mitochondrial energy levels. These results imply that exogenous PA treatment may be a strategy for ameliorating the browning of cold stored 'Nanguo' pears.

Keywords: /Mitochondrial function/ /‘Nanguo’ pear/ /PA/ /Peel browning/

Zhang, Y., Zhang, J., Zhang, Y., Hu, H., Luo, S., Zhang, L., Zhou, H., & Li, P. (2021). Effects of in-package atmospheric cold plasma treatment on the qualitative, metabolic and microbial stability of fresh-cut pears. *Journal of the Science of Food and Agriculture*, *101*(11), 4473–4480. https://doi.org/10.1002/jsfa.11085 (NPS)

Abstract

The greatest hurdle to commercial marketing of fresh-cut fruits and vegetables is limited shelf life due to microbial hazards and quality deterioration. Atmospheric cold plasma (ACP) is an emerging non-thermal technology with significant potential to improve the safety and storability of fresh products. The objective of this study was to evaluate the effects of ACP, generated in sealed packaging, on the qualitative, metabolic and microbial stability of fresh-cut pears during simulated cold storage. ACP treatments were effective in inhibiting the growth of mesophilic aerobic bacteria, yeast and mold, particularly CP3 (65 kV, 1 min), which could prolong shelf life to the greatest extent. While decontamination was not always associated with an increase in plasma intensity. Moreover, at 65 kV for 1 min, ACP treatment had the potential to retard respiration, and maintain organoleptic properties and other quality attributes. Additionally, peroxidase and pectin methylesterase (PME) activities were reduced immediately after treatments. These effects were dependent on treatment voltage and time, while a subsequent recovery in activity was only observed for PME. The results obtained from this study will contribute to an understanding of the effects of in-package ACP treatments on the storability and microbial safety of fresh-cut pears. This knowledge could be beneficial in reducing quality losses for fresh-cut pears and the preservation of other products. © 2021 Society of Chemical Industry.

Keywords: /Enzymatic activity/ /Fresh-cut pears/ /In-package atmospheric cold plasma/ /Microbial inactivation/ /Quality evaluation/

PITAHAYA

de Oliveira, M. M. T., Albano-Machado, F. G., Penha, D. M., Pinho, M. M., Natale, W., de Miranda, M. R. A., Moura, C. F. H., Alves, R. E., & de Medeiros Corrêa, M. C. (2021). Shade improves growth, photosynthetic performance, production and postharvest quality in red pitahaya (Hylocereus costaricensis). *Scientia Horticulturae*, *286*, 110217. https://doi.org/10.1016/j.scienta.2021.110217

Abstract

High solar radiation impairs the successful cultivation of *Hylocereus* (Cactaceae) species. This investigation aimed to evaluate shading as a strategy for coping with high solar radiation in red pitahaya (*Hylocereus costaricensis*), through a long-term field experiment. To this end, we studied growth, physiological performance, productivity and postharvest quality of red pitahaya grown under four shade levels, namely, 35, 50, 65 and 80%, compared to plants under full sunlight (control). Red pitahaya showed superior performance under shading compared to the control, especially plants under about 35% shade. Shading improved initial plant growth followed by high physiological performance, i.e., increased maximum quantum efficiency of photosystem II (F_v/F_m) along with the accumulation of total chlorophyll content, with no photoinhibition and sunburn. Shaded plants showed improved yields along with production precocity, as seen through comparison with the local cultivation under full sunlight. In the second year, a maximum estimated yield of 18.7 t ha^{-1} was observed under about 35% shade, which is a production increase of 70% vs plants under full sunlight (10.9 t ha^{-1}). Shading improved fruit quality through increased fresh weight, pulp yield, pulp firmness and reddish pulp coloring, indicating the accumulation of betalain pigments. Our findings support shading as a valuable strategy for coping with stress induced by extremely high solar radiation in field plantations, thus providing increased productivity by preventing bleaching and death of *Hylocereus*, especially in drylands.

Keywords: /Cactaceae/ /Morphology/ /F_v/F_m/ /Photoinhibition/ /Chlorophyll/ /Productivity/ /Fruit quality/

POMEGRANATE

Lufu, R., Ambaw, A., & Opara, U. L. (2021). Functional characterisation of lenticels, micro-cracks, wax patterns, peel tissue fractions and water loss of pomegranate fruit (cv. Wonderful) during storage. *Postharvest Biology & Technology*, *178*, 111539. https://doi.org/10.1016/j.postharvbio.2021.111539

Abstract

Pomegranate fruit is prone to moisture loss irrespective of its thick rind and tough leathery outer skin, resulting in compromised visual appearance and financial loss. The aim of this study was to identify and characterise structural changes in lenticels, micro-cracks, wax patterns and peel tissue fractions to aid the understanding of water loss trends in pomegranate fruit during storage. Fruit was stored at 7 °C and 90 % RH for 42 d and thereafter transferred to shelf conditions (23 °C and 58 % RH) for 8 d. Peel samples were obtained from the calyx-end, equatorial-region and stem-end of randomly selected fruit. Lenticels, micro-cracks, thickness of waxy cuticle and wax layer patterns were examined under scanning microscopes. The trends of water loss with respect to peel tissues and location on fruit were examined by monitoring changes in tissue thickness. Increased fragmentation of waxy cuticles and widening of micro-cracks were observed during fruit storage. Higher count of lenticels, larger lenticel size and generally low peel thickness were observed at the calyx-end and equatorial-region as compared to the stem-end of the fruit. A noticeable water loss trend was detectable with respect to region on the fruit, the calyx-end being more susceptible compared to the equatorial-region and stem-end.

Keywords: /Transpiration/ /Scanning electron microscopy/ /Confocal laser scanning microscopy/ /Waxy cuticle/ /Punica granatum/ /Postharvest storage/

POSTHARVEST DISEASE

de Oliveira Filho, J. G., Silva, G. da C., Cipriano, L., Gomes, M., & Egea, M. B. (2021). Control of postharvest fungal diseases in fruits using external application of RNAi. *Journal of Food Science (John Wiley & Sons, Inc.)*, *86*(8), 3341–3348. https://doi.org/10.1111/1750-3841.15816

Abstract

Contamination with a variety of filamentous fungi can cause deterioration of food and agricultural products. Fungal contaminations reduce the quality and the shelf life of fresh fruits and are one of the main causes of economic loss in the global fresh fruit industry. Although chemical fungicides are effective and traditionally used to control postharvest fungal diseases, they are harmful to human health. In this context, use of RNA interference (RNAi)-based fungicides is a promising alternative strategy. Spray-induced gene silencing (SIGS) is an innovative RNAi-based approach for silencing target genes in phytopathogens. This review aims to discuss the recent findings on the use of RNAi-based fungicides to control the postharvest spoilage of fresh fruits. Practical Application: Control of postharvest fungal diseases is one of the most important strategies to make food available to consumers longer. In this sense, the external application of RNAi seems to be technologically advantageous and efficient as it helps to maintain the characteristics of plant products. In this sense, this review discussed what is possible to find in the literature regarding this new technology.

Keywords: /Fresh vegetables/ /Gene silencing/ /Phytopathogens/ /Postharvest spoilage/ /RNAi/

Wang, Y., Qiao, Y., Zhang, M., Ma, Z., Xue, Y., Mi, Q., Wang, A., & Feng, J. (2021). Potential value of small-molecule organic acids for the control of postharvest gray mold caused by Botrytis cinerea. *Pesticide Biochemistry and Physiology*, *177*, 104884. https://doi.org/10.1016/j.pestbp.2021.104884

Abstract

In the present study, a total of 21 natural or synthetic small-molecule organic acids were selected and determined for their activity against postharvest gray mold caused by B. cinerea. Overall, cuminic acid, which was extracted from the seed of Cuminum cyminum L, showed the most promising antifungal activity against B. cinerea both in vitro and in vivo. The study on action mechanism showed that cuminic acid could inhibit the development of sclerotia and the secretion of oxalic acid, destroy the cell membrane integrity, and down regulate the expression of several key genes involved in sclerotia development and pathogenicity of B. cinerea. Furthermore, cuminic acid could potentially reduce the degradation of TSS and TA content, while it had no significant effect on the weight loss, firmness, and VC content of apple and tomato. Importantly, cuminic acid could enhance the antioxidant enzyme activities of the fruits. All these results demonstrate the antifungal activity and highlight the great potential of cuminic acid as an alternative environmental-friendly agent for the control of postharvest gray mold both on fruits and vegetables.

Keywords: /Antifungal activity/ /Cuminic acid/ /Fruit quality/ /Postharvest gray mold/ /Small-molecule organic acids/

POTATO

Ma, Y., Wang, H., Yan, H., Malik, A. U., Dong, T., & Wang, Q. (2021). Pre-cut NaCl solution treatment effectively inhibited the browning of fresh-cut potato by influencing polyphenol oxidase activity and several free amino acids contents. *Postharvest Biology & Technology*, *178*, 111543. https://doi.org/10.1016/j.postharvbio.2021.111543

Abstract

Enzymatic browning is an important issue affecting the quality and shelf life of fresh-cut potatoes. Previous research showed post-cut sodium chloride (NaCl) dipping treatment doesn't have an anti-browning effect on fresh-cut potatoes. In this research, the influence of pre-cut NaCl solution treatment on browning, polyphenol oxidase (PPO) activity and amino acids contents in fresh-cut potato was investigated. The results showed that pre-cut NaCl solution treatment at 5 % for 3 h improved the overall visual quality, reduced browning and surface dehydration and extended shelf-life by 3−4 d at 5 °C. The PPO activity in pre-cut NaCl treated potato tubers and slices was lower than that in control and water treated ones. Compared with control, the contents of glutamic acid and proline in NaCl treated potato were increased, whereas tyrosine and arginine decreased. Exogenous differential compensation of glutamic acid reduced the browning of control potato mash, while the compensation of tyrosine and arginine as well as their mixture aggravated the browning of pre-cut NaCl treated potato mash. The compensation of proline showed no influence on the browning of control potato mash, whereas pre-cut proline solution treatment inhibited the browning of fresh-cut potato. This research showed that pre-cut NaCl solution treatment can effectively inhibit the browning of fresh-cut potato by influencing polyphenol oxidase activity and several free amino acids contents, which provides a new way to prevent the browning of fresh-cut potato and elucidates the anti-browning mechanism of pre-cut NaCl treatment.

Keywords: /Pre-cutNaCl treatment/ /Fresh-cut/ /Potato/ /Browning/ /Amino acid/

Visse-Mansiaux, M., Tallant, M., Brostaux, Y., Delaplace, P., Vanderschuren, H., & Dupuis, B. (2021). Assessment of pre- and post-harvest anti-sprouting treatments to replace CIPC for potato storage. *Postharvest Biology & Technology*, *178*, 111540. https://doi.org/10.1016/j.postharvbio.2021.111540

Abstract

To avoid losses from sprouting during potato storage, the anti-sprouting agent chlorpropham [CIPC] has been widely used over the past few decades. However, the European Union recently decided not to authorize the renewal of CIPC, prompting the value chain to find alternative treatments. We assessed for three years the potential of pre- and post-harvest anti-sprouting treatments to replace CIPC using four potato-processing varieties. Pre-harvest application of maleic hydrazide [MH] and post-harvest applications of 3-decen-2-one, 1, 4-dimethylnapthalene [1,4-DMN] and CIPC were performed following supplier's recommendations. In addition, we evaluated the potential of 3-decen-2-one and 1,4-DMN to prolong the efficacy of pre-harvest MH treatment anti-sprouting activity during storage. All molecules significantly reduced sprouting after seven months of storage compared with the untreated control group. MH, 3-decen-2-one, 1,4-DMN and CIPC displayed respectively 86.9 %; 77.9 %, 73.6 % and 99.8 % of efficacy to control sprout weight and 79.4 %; 73.4 %, 68.4 % and 96.9 % of efficacy to control sprout length. Our results suggest that using 3-decen-2-one and 1,4-DMN in combination with MH do not bring additional benefit to control sprouting. Because differences in dormancies could be observed between varieties, we also showed that the efficacy of post-harvest treatments is genotype-dependent, while MH pre-harvest treatment is effective equally for all varieties. Applications of CIPC and MH led to detectable residues in tubers, while no residue of 1,4-DMN has been detected in tubers treated with this molecule (< LOQ). We concluded that treatments with MH, 1,4-DMN and 3-decen-2-one are valuable alternatives to CIPC to control sprouting of processing potatoes.

Keywords: /Potato/ /Sprouting/ /Maleic hydrazide/ /Post-harvest treatments/ /Genotypes/

STRAWBERRY

Huang, D., Wang, Y., Zhang, D., Dong, Y., Meng, Q., Zhu, S., & Zhang, L. (2021). Strigolactone maintains strawberry quality by regulating phenylpropanoid, NO, and H2S metabolism during storage. *Postharvest Biology & Technology*, *178*, 111546. https://doi.org/10.1016/j.postharvbio.2021.111546

Abstract

Strawberries (*Fragaria* × *ananassa* Duch. cv. Akihime) were treated with different concentrations of exogenous strigolactone (SL) (0, 0.5, 1, 2, and 4 μmol L^{-1}). Changes in the antioxidant system, nitric oxide (NO) synthesis, hydrogen sulfide (H_2S) synthesis, and phenylpropanoid metabolism of postharvest strawberries were studied. Among the treatments, 1 μmol L^{-1} SL significantly inhibited peroxidase and polyphenol oxidase activities, and enhanced the ability to scavenge ·DPPH, ·OH, and $\cdot O_2^-$Treatment with 1 μmol L^{-1} SL effectively reduced weightlessness rate and respiratory intensity, maintained the water content, inhibited the increase in POD activity and the decrease in the activities of CAT and SOD, maintained the reduced ascorbic acid, and reduced glutathione contents. Exogenous SL effectively increased the activities of 4-coumaric acid coenzyme A ligase and phenylalanine ammonia-lyase, thus promoting the accumulation of flavonoids, lignin, and total phenols. These findings suggested that SL alleviated the oxidative damage of strawberries by improving the defense capability of the antioxidant system. SL improved nitric oxide synthase (NOS)-like activity and the contents of L-arginine and endogenous NO, but had no significant effects on nitrate reductase activity and nitrite content, suggesting that SL regulates the synthesis of NO mainly through the NOS-like pathway. Exogenous SL promoted the cleavage of L-cysteine by activating L-cysteine desulfhydrase, D-cysteine desulfhydrase, *O*-acetylserine thiolyase, and serine acetyltransferase, thus increasing endogenous H_2S content in strawberries. SL maintained fruit quality by improving the antioxidative system and the metabolism of phenylpropanoid, NO, and H_2S in strawberries during storage.

Keywords: /Strawberry/ /Strigolactone/ /Nitric oxide/ /Hydrogen sulfide/ /Phenylpropanoid metabolism/

Liu, C., Jin, T., Liu, W., Hao, W., Yan, L., & Zheng, L. (2021). Effects of hydroxyethyl cellulose and sodium alginate edible coating containing asparagus waste extract on postharvest quality of strawberry fruit. *LWT - Food Science & Technology*, *148*, 111770. https://doi.org/10.1016/j.lwt.2021.111770

Abstract

Edible coatings have been used as a medium for the incorporation of functional compounds to maintain postharvest quality parameters of fruits. In this study, we explored the influence of 1.5 g/100 mL hydroxyethyl cellulose coatings (HEC1.5), 1.5 g/100 mL sodium alginate coatings (SA1.5), and the composite coatings of 1.0 g/100 mL HEC and 0.5 g/100 mL SA (HEC1.0/SA0.5) containing asparagus waste extraction on quality of strawberry fruit. The fluorescence microscope and scanning electron microscope images showed that the HEC1.0/SA0.5 coatings displayed a continuous, smooth and porous structure. The HEC1.0/SA0.5 coatings also exhibited favorable anti-fungal activity against *Penicillium italicum*. Furthermore, the HEC1.0/SA0.5 coatings significantly delayed color change (*ΔE*), reduced weight loss, and maintained total phenolic and flavonoid contents. These results indicated that the application of HEC and SA based edible coatings containing asparagus waste extract could be an effective, safe and environmentally friendly approach to maintain the quality and extend the shelf life of strawberry fruit.

Keywords: /Edible coatings/ /Hydroxyethyl cellulose/ /Sodium alginate/ /Strawberry fruit/ /Quality/

Yu, Y.-Y., Dou, G.-X., Sun, X.-X., Chen, L., Zheng, Y., Xiao, H.-M., Wang, Y.-P., Li, H.-Y., Guo, J.-H., & Jiang, C.-H. (2021). Transcriptome and Biochemical Analysis Jointly Reveal the Effects of Bacillus cereus AR156 on Postharvest Strawberry Gray Mold and Fruit Quality. *Frontiers in Plant Science*, *12*, 700446. https://doi.org/10.3389/fpls.2021.700446

Abstract

Postharvest strawberry is susceptible to gray mold disease caused by *Botrytis cinerea* , which seriously damages the storage capacity of fruits. Biological control has been implicated as an effective and safe method to suppress plant disease. The aim of this study is to evaluate the postharvest disease control ability of *Bacillus cereus* AR156 and explore the response of strawberry fruit to this biocontrol microorganism. *Bacillus cereus* AR156 treatment significantly suppressed gray mold disease and postponed the strawberry senescence during storage. The bacterium pretreatment remarkably enhanced the reactive oxygen-scavenging and defense-related activities of enzymes. The promotion on the expression of the encoding-genes was confirmed by quantitative real-time PCR (qRT-PCR) that significantly increased the expression of the marker genes of salicylic acid (SA) signaling pathway, such as *PR1* , *PR2* , and *PR5* , instead of that of the jasmonic acid (JA)/ethylene (ET) pathway, which was also shown. Moreover, through transcriptome profiling, about 6,781 differentially expressed genes (DEGS) in strawberry upon AR156 treatment were identified. The gene ontology (GO) classification and Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway enrichment indicated that AR156 altered the transcription of numerous transcription factors and genes involved in the SA-related plant disease resistance, metabolism, and biosynthesis of benzoxazinoids and flavonoids. This study offered a non-antagonistic *Bacillus* as a method for postharvest strawberry storage and disease control, and further revealed that the biocontrol effects were arisen from the induction of host responses on the transcription level and subsequent resistance-related substance accumulation.

Keywords: /Bacillus cereus AR156/ /biological control/ /gray mold/ /Induced systemic resistance (ISR)/ Strawberry/ /Transcriptome profiling/

TOMATO

Hussain, A., Khan, S. W., Ali, S., Faiz, F., Hussain, M., Ali, A., Ur Rahman, S., & Qasim, S. (2021). Geostatistical Analysis of Tomato Fruit Rot and Diversity of Associated Fungal Species. *JAPS: Journal of Animal & Plant Sciences*, *31*(4), 1007–1014. https://doi.org/10.36899/JAPS.2021.4.0297

Abstract

Tomato fruit rot caused by fungi is the most common postharvest problem. The fungi are responsible for spoilage of produce between harvest and consumption. This study analyzed the distribution of tomato fruit rot using descriptive as well as geostatistical techniques and diversity of associated fungal species. Descriptive statistics indicated that the rot incidence and severity ranged from 10.22-44.17% and 0.7 - 7.10 mm. Geostatistical techniques were used to predict the spatial dependency class. Results revealed that rot incidence data had a nugget/sill ratio of 0.487 inferring moderate spatial dependence, whereas severity inferring weak spatial dependence with nugget/sill ratio of 0.221. Furthermore, geostatistical analysis was also applied to examine spatial variability within-field using semivariogram and kriged maps. The maps of current study showed spatial distribution of rot incidence and severity in the study area. These digital maps will be helpful to develop pre-and post-harvest management strategies against tomato fruit rot. A total of nine fungal species were isolated from infected tomato fruit namely; Geotrichum candidum, Alternaria alternata, Aspergillus flavus, Aspergillus niger, Bipolaris, Fusarium oxysporum, Rhizopus stolonifer, Culvularia lunata and Penicillum digitatum. Aspergillus flavus was dominating species (17.02%) followed by Fusarium oxysporum (14.89%) and Alternaria alternata (12.76%), while Culvularia lunata has the least occurrence (6.38%). This study provides information about post-harvest rotting fungi of tomato to the growers, extension workers and researchers in the district Gilgit.

Keywords: /Associated fungi/ /Distribution/ /Geostatistics/ /Gilgit-Baltistan/ /GIS/ /Tomato rot/

Ünal, S., Küçükbasmaci, Ö. A., & Küçükbasmaci Sabir, F. (2021). Salicylic Acid Treatments for Extending Postharvest Quality of Tomatoes Maintained at Different Storage Temperatures. *Selcuk Journal of Agriculture & Food Sciences / Selcuk Tarim ve Gida Bilimleri Dergisi*, *35*(2), 141–146. https://doi.org/10.15316/SJAFS.2021.241

Abstract

Salicylic acid (SA) is known to be an effective tool on extending the postharvest quality of horticultural commodities by preventing synthesis and movement of ethylene. Thus, the present study was established to study the effect of different dozes of SA treatments (0.5 mM, 1.0 mM and 2.0 mM) on extending postharvest quality of pink maturity tomatoes maintained at two different storage conditions (5 °C with 90% relative humidity and 20 °C with 65% relative humidity). SA treatment at all doses significantly retarded weight loss at both storage conditions. SA treated tomatoes were firmer, higher in titratable acidity, and exhibited less biochemical changes than the control fruit at the end of storage. Among the applied dozes, SA at 2 mM can be recommended as it was pioneering for most of the parameters analyzed during cold storage at both 5 °C for 20 d and at 20 °C for 10 d. SA treatment may be recommended as an environmentally friendly, healthy and sustainable method for extending postharvest quality of tomatoes cold storage and shelf life, without significant adverse effect on produces.

Keywords: /Postharvest/ /Quality/ /Salicylic acid/ /Tomato/