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As of February 2022

BANANA

Tian, J., Xie, S., Zhang, P., Wang, Q., Li, J., & Xu, X. (2022). Attenuation of postharvest peel browning and chilling injury of banana fruit by Astragalus polysaccharides. *Postharvest Biology & Technology*, *184*, 111783. https://doi.org/10.1016/j.postharvbio.2021.111783

Abstract

The effect of Astragalus polysaccharides (APS) on peel browning and chilling injury (CI) of banana fruit was investigated. The results showed that APS induced the activities of 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical and reactive oxygen species (ROS) scavenging, reduced the H_2O_2 accumulation and the membrane lipid peroxidation and electrolyte leakage, by which delayed fruit CI, alleviated peel browning and the loss of nutrients in the flesh. It also improved the antioxidant capacity of fruit, enhanced the expression of *MaSOD*, *MaCAT*, *MaAPX* and led to the increase of superoxide dismutase (SOD), catalase (CAT), ascorbate peroxidase (APX) activities. Moreover, APS up-regulated the expression of *MaPOD*, *MaPAL*, *MaCHS* and down-regulated the expression of *MaPPO*, resulting in the composition changes of the phenolics and flavonoids in banana fruit. Higher levels of hesperidin, ferulic acid, acacetin and myricetin were detected in APS treated fruit and were involved in alleviating fruit CI and peel browning. The present results for the first time demonstrated that APS treatment alleviated the CI of banana fruit, and provided a promising strategy for enhancing postharvest chilling tolerance.

Keywords: /Banana fruit/ /Chilling injury/ /Peel browning/ /Astragalus polysaccharides/ /

BASIL

Larsen, D. H., Li, H., van de Peppel, A. C., Nicole, C. C. S., Marcelis, L. F. M., & Woltering, E. J. (2022). High light intensity at End-Of-Production improves the nutritional value of basil but does not affect postharvest chilling tolerance. *Food Chemistry*, *369*, 130913. https://doi.org/10.1016/j.foodchem.2021.130913

Abstract

Basil suffers from chilling injury (CI) when stored at temperatures below 10-12 °C which seems related to the imbalance between reactive oxygen species (ROS) and antioxidants. We hypothesized that increased light intensity applied shortly before harvest (EOP, End-Of-Production) increases nutritional value i.e. carbohydrates and antioxidants and could improve the chilling tolerance. Two basil cultivars were grown in a vertical farming set-up at a light intensity of 150 μmol m^{-2} s^{-1} . During the last 5 days of growth, EOP light treatments ranging from 50 to 600 μmol m^{-2} s^{-1} were applied. After harvest the leaves were stored at 4 or 12 °C in darkness. Higher EOP light intensity increased the antioxidant (total ascorbic acid, rosmarinic acid) and carbohydrate contents at harvest. During storage antioxidants decreased more rapidly at 4 than at 12 °C. However, increased EOP light intensity did not alleviate chilling symptoms suggesting a minor role of antioxidants studied against chilling stress.

Keywords: /Antioxidants/ /Basil (Ocimum basilicum L.)/ /Chilling injury/ /LED light/ /Postharvest/ /Vertical farming/

BELL PEPPER

Castillejo, N., Martínez-Zamora, L., & Artés-Hernández, F. (2022). Postharvest UV radiation enhanced biosynthesis of flavonoids and carotenes in bell peppers. *Postharvest Biology & Technology*, *184*, 111774. https://doi.org/10.1016/j.postharvbio.2021.111774

Abstract

A UV-C treatment of 6 kJ m−2 greatly enhanced the flavonoid accumulation in red bell peppers. UV-C+UV-B increased by ~94 % the carotenoid content in red bell peppers. UV-C and UVB + C are good abiotic elicitors of the flavonoid biosynthesis. Rutin accumulation is highly enhanced (~70 %) after UV treatments. UV abiotic stresses have beneficial effects in plants inducing the synthesis of secondary metabolites when low doses were applied. The aim of this study was to evaluate the effect of 6 kJ m−2 UV (B or C) and 6 + 6 kJ m−2 UV (B + C) on the main bioactive compounds of red bell peppers during a refrigerated shelf-life period. Changes in carotenoids, phenolics, and flavonoids were studied after 8 and 14 d at 7 °C, and after an additional retail sale period of 4 d at 18 °C. Physicochemical quality attributes were not affected by any UV treatment. Generally, UV treatments induced carotenoid accumulation, highlighting that after 14 d at 7 °C, UVB and UVC increased by 59 % the total carotenoid content, and UVB + C did it by 94 % compared to non-UV-treated peppers as control (CTRL). UVC, UVB, and UVB + C are good elicitors of the flavonoid biosynthesis with 42, 66, and 43 % increases just after treatment, respectively, compared to CTRL. This behaviour was enhanced in UVC and UVB + C treated peppers after 8 d at 7 °C (15 and 44 %, respectively) and after 14 d at 7 °C (146 and 137 %) regarding CTRL peppers, which was also shown after the retail period assayed of 4 d at 18 °C. In conclusion, a postharvest 6 kJ m-2 UV-C treatment could be a great tool for increasing the accumulation of carotenoids and flavonoids in red bell peppers.

Keywords: /Antioxidants/ /Capsicum annuum/ /Radiation/ /Rutin/ /Shelf life/ /Ultraviolet B and C/

BROCCOLI

Xie, C., Tang, J., Xiao, J., Geng, X., & Guo, L. (2022). Purple light-emitting diode (LED) lights controls chlorophyll degradation and enhances nutraceutical quality of postharvest broccoli florets. *Scientia Horticulturae*, *294*, 110768. https://doi.org/10.1016/j.scienta.2021.110768

Abstract

Purple LED light was the most effective treatment to reduce yellowing of broccoli. Purple light retained chlorophyll by regulating the expression of related genes. Purple light enhanced glucoraphanin metabolism via upregulation related genes. The aim of this study was to evaluate the effect of white, red, green, yellow, blue and purple LED lights on visual and nutraceutical quality of broccoli florets during storage at 20 °C for 5 days. The results showed that purple LED light exhibited the best effect on reducing yellowing and retaining chlorophyll via down-regulating expression of genes related to chlorophyll degradation, including BoSGR, BoPAO, BoNYC1 and BoRCCR. On the other hand, yellow, blue and purple LED light increased the contents of total phenolic and carotenoids compared to darkness. The highest glucoraphanin content was recorded in purple LED light treated broccoli florets, which was supported by the enhanced expression levels of genes related to glucoraphanin biosynthesis. Meanwhile, purple LED light promoted myrosinase activity and its expression, and reduced ESP expression; thus enhanced sulforaphane formation. In conclusion, among all LED lights, purple LED light showed a significant positive effect considering all estimated indicators and would be useful to maintain and improve the quality of broccoli during storage at 20 °C.

Keywords: /Bioactive compounds/ /Broccoli/ /Chlorophyll/ /Gene expression/ /Glucoraphanin/ /Purple led light/

Zhang, Y., Ma, Y., Guo, Y., Chen, Y., Yang, M., Fu, R., & Sun, Y. (2022). Physiological and iTRAQ-based proteomic analyses for yellowing of postharvest broccoli heads under elevated O2 controlled atmosphere. *Scientia Horticulturae*, *294*, 110769. https://doi.org/10.1016/j.scienta.2021.110769

Abstract

Proteomic analysis was used to reveal the yellowing mechanism under elevated O 2. 189 proteins related to broccoli yellowing were identified and classified. Elevated O 2 might damage the thylakoid structure and thus to promote yellowing. Elevated O 2 destroyed the photosystem and led to chlorophyll photobleaching. The oxidative damage of chloroplast was aggravated by high O 2 stress. Controlled atmosphere storage has been proved to be an effective measure to regulate chlorophyll degradation. The obvious inhibitory effect of CO 2 on chlorophyll degradation was widely studied, but information available on the promotion of chlorophyll degradation by elevated O 2 was limited. The present work aimed to investigate the regulation of different O 2 concentrations on yellowing of broccoli heads during storage by physiology and proteomics. As expected, 40% O 2 + 5% CO 2 treatment promoted the chlorophyll degradation and carotenoid synthesis, and thus accelerated the yellowing of broccoli heads. In addition, elevated O 2 decreased the ascorbic acid, glucosinolate, and flavonoid contents and increased the MDA content. A total of 189 proteins related to the yellowing of broccoli heads were identified as differentially expressed proteins (fold change ≥1.20 or ≤0.83). These proteins were mainly associated with pigment metabolism, thylakoid structure, photosynthetic system, chloroplast ribosome, antioxidant substance metabolism, and antioxidant enzyme metabolism. The proteomics results showed 40% O 2 + 5% CO 2 treatment disrupted antioxidant metabolism and aggravated oxidative stress compared with 5% O 2 + 5% CO 2 and 20% O 2 + 5% CO 2 treatments, thus leading to the destruction of photosystems I and II, thylakoid membrane, and chloroplast ribosome in broccoli heads. In addition, 40% O 2 + 5% CO 2 treatment accelerated the yellowing of postharvest broccoli heads by down-regulating chlorophyll biosynthetic pathway and the expression of apolipoproteins (light-harvesting complex I, II, and oxygen-evolving enhancer protein) and ribulose-1,5-bisphosphate carboxylase (Rubisco), and up-regulating chlorophyll degradation and carotenoid biosynthetic pathways. This study might improve our understanding of yellowing acceleration mechanisms of broccoli heads by elevated O 2 , thereby promoting the development of new broccoli heads preservation technology.

Keywords: /Broccoli/ /Chlorophyll degradation/ /Chloroplast/ /Postharvest/ /Proteomic/ /Yellowing/

CITRUS

Wang, S., Zhang, H., Qi, T., Deng, L., Yi, L., & Zeng, K. (2022). Influence of arginine on the biocontrol efficiency of Metschnikowia citriensis against Geotrichum citri-aurantii causing sour rot of postharvest citrus fruit. *Food Microbiology*, *101*, 103888. https://doi.org/10.1016/j.fm.2021.103888

Abstract

This study investigated the effect of arginine (Arg) on the antagonistic activity of Metschnikowia citriensis against sour rot caused by Geotrichum citri-aurantii in postharvest citrus, and evaluated the possible mechanism therein. Arg treatment up-regulated the PUL genes expression, and significantly induced the pulcherriminic acid (PA) production of M. citriensis, which related to the capability of iron depletion of M. citriensis. By comparing the biocontrol effects of Arg-treated and untreated yeast cells, it was found that Arg treatment significantly enhanced the biocontrol efficacy of M. citriensis, and 5 mmol L^{-1} Arg exerted the best effect. Additionally, the biofilm formation ability of M. citriensis was greatly enhanced by Arg, and the higher population density of yeast cells in citrus wounds was also observed in Arg treatment groups stored both at 25 °C and 4 °C. Moreover, Arg was shown to function as a cell protectant to elevate antioxidant enzyme activity [including catalase (CAT), superoxide dismutase (SOD) and glutathione peroxidase (GPX)] and intracellular trehalose content to resist oxidative stress damage, that directly helped to enhance colonization ability of yeasts in fruit wounds. These results suggest the application of Arg is a useful approach to improve the biocontrol performance of M. citriensis.

Keywords: /Arginine/ /Biocontrol efficiency/ /Biofilm formation/ /Metschnikowia citriensis/ /Oxidative stress/ /Pulcherrimin pigment/ /Sour rot/

Wang, Z., Zhong, T., Chen, X., Xiang, X., Du, M., Zalán, Z., & Kan, J. (2022). Multiple pre-harvest applications of antagonist Pseudomonas fluorescens ZX induce resistance against blue and green molds in postharvest citrus fruit. *LWT - Food Science & Technology*, *155*, 112922. https://doi.org/10.1016/j.lwt.2021.112922

Abstract

The pre-harvest applications of antagonists are promising strategies to minimize various postharvest diseases. Given this, we sought to evaluate the capability of Pseudomonas fluorescens ZX in inducing resistance of postharvest citrus fruit against blue and green molds, caused by Penicillium italicum and Penicillium digitatum , respectively. Results showed that pre-treatment with P. fluorescens ZX significantly inhibited blue and green molds, generally providing stronger protection with an increasing number of sprays. More specifically, three applications of the antagonist reduced disease incidence by about 47% and 41%, reduced lesion diameter by around 40% and 28%, and reduced disease index by approximately 69% and 57%, when exposed to blue and green molds, respectively. Mechanistically, these protective effects might be linked to the increased activities of superoxide dismutase, ascorbate peroxidase, peroxidase, and polyphenoloxidase, along with substantial response of phenolic acids (syringic, p -coumaric, ferulic, and sinapinic acids) and flavonoids (rutin, neohesperidin, hesperetin, sinensetin and tangeretin). P. fluorescens ZX survived well on the fruit surface, and more importantly, pre-treatments exhibited no negative effects on fruit quality; on the contrary, it partly improved fruit quality during postharvest storage. Collectively, these results indicated that multiple pre-harvest applications of P. fluorescens ZX are useful for control of postharvest diseases. [Display omitted] Pre-treatment with P. fluorescens ZX markedly reduced postharvest citrus diseases. Generally, increasing spray numbers evoked higher levels of defensive responses. Pre-treatments did not impair and partly improved the fruit quality during storage. Pre-treatment effectively stimulated the accumulation of several special phenols.

Keywords: /Biocontrol/ /Induced resistance/ /Postharvest diseases/ /Pre-harvest application/ /Pseudomonas fluorescens ZX/

CUT FLOWER

Lezoul, N. E. H., Serrano, M., Ruiz-Aracil, M. C., Belkadi, M., Castillo, S., Valero, D., & Guillén, F. (2022). Melatonin as a new postharvest treatment for increasing cut carnation (Dianthus caryophyllus L.) vase life. *Postharvest Biology & Technology*, *184*, 111759. https://doi.org/10.1016/j.postharvbio.2021.111759

Abstract

Melatonin at low concentration controls effectively carnation senescence. Calyx had higher chlorophyll content in melatonin treated cut-flowers. Melatonin maintained fresh weight and petal membrane stability. Melatonin was effective in increasing antioxidant activity and total phenolic content. The marketability of cut flowers is directly affected by their vase life, which determines acceptability for commercial purposes. In carnations and other species of cut flowers, corolla is one of the most affected parts during flower senescence due to the petal withering which is accelerated by metabolic processes occurring after separation from the mother plant. Melatonin (MT) is a compound with antioxidant properties, naturally present in plant tissues that plays important roles in the regulation of different metabolic processes. In this research work the effect of different MT concentrations (0.01, 0.1 and 1 mM) on the vase life of cut carnations flowers cv. Baltico was evaluated. The greatest delay in senescence was observed with 0.1 mM MT concentration, increasing vase life up to 10 days more as compared to control carnations. Although all MT concentrations assayed significantly ($P < 0.05$) maintained initial levels of fresh weight, membrane stability index, bioactive compounds and antioxidant activity for a longer time, the lowest concentrations were those that had the most relevant impact on vase life. The highest dose evaluated (1 mM) maintained all the parameters evaluated but showed the wilting symptoms earlier. For this reason, 0.1 MT concentration could be a tool capable of improving carnation vase life for a longer time, increasing the commercial potential of this cut flower.

Keywords: /Antioxidant activity/ /Chlorophyll/ /Cut carnation/ /Melatonin/ /Petal/ /Total phenolic content/

GRAPES

Hamie, N., Zoffoli, J. P., Tarricone, L., Verrastro, V., Pérez-Donoso, A. G., & Gambacorta, G. (2022). Rachis browning and water loss description during postharvest storage of "Krissy" and "Thompson Seedless" table grapes. *Postharvest Biology & Technology*, *184*, 111758. https://doi.org/10.1016/j.postharvbio.2021.111758

Abstract

Rachis browning was evaluated under different storage conditions. Rachis browning after harvest was determined by image analysis and NIRS. Storage with saturated humidity conditions reduced rachis browning and water loss. Water loss was not the only reason for rachis browning. Models to predict rachis browning and water loss were developed. Rachis browning is a serious symptom of water loss affecting the quality of table grapes (Vitis vinifera L.) during storage. It has been evaluated subjectively based on a color scale or by image analysis, while water loss, which is considered as the main factor behind this problem, is mostly measured on the basis of whole-cluster weight loss, with only few studies focusing on the rachis exclusively. Our main objective was to compare the sensitivity to water loss and rachis browning of 'Krissy' and 'Thompson Seedless' cultivars under different storage conditions and using different methods of evaluation (NIR spectrometry, image analysis, colorimeter, weight loss from initial weight and relative water content). The rachises were evaluated during 3 d subjected to a combination of temperatures (0 °C or 20 °C), relative humidity (Saturated or reduced RH), and previous storage at 0 °C for 0 (HT, Harvest Time) and 30 days (ST, Storage Time). NIR spectra (896−2500 nm) were collected, and Partial Least Squares regression (PLS) models were calculated to test the correlation between the spectra and the measurements from other evaluation techniques. Results showed that 'Krissy' is more sensitive to dehydration symptoms than 'Thompson Seedless'. Saturated RH combined with low temperature (0 °C) are the most suitable to reduce rachis browning and water loss during the 3 d of storage at both HT and ST. The decrease in RWC (Relative Water Content) coincided with an increase in rachis browning throughout storage. Additionally, results provided six NIRS-based prediction models for browning severity (R2 = 0.82 and 0.84), hue color (R2 = 0.68 and 0.72) and water loss (R2 = 0.63 and 0.90) in rachises of 'Krissy' and 'Thompson Seedless', respectively. These results demonstrate that the NIRS can be a suitable non-destructive method to quantify a range of rachis browning severity produced under different storage conditions.

Keywords: /NIRS/ /Non-destructive analysis/ /Prediction models/ /Rachis browning/ /Table grape/ /Water loss/

Wang, L., Yang, M., Dong, Y., Reiter, R. J., Xu, Y., Lin, X., Luo, Z., & Li, L. (2022). Melatonin confers enhanced polyamine metabolism and cell tolerance in Vitis vinifera against oxidative damage: Quantitative proteomic evidence. *Postharvest Biology & Technology*, *184*, 111756. https://doi.org/10.1016/j.postharvbio.2021.111756

Abstract

The 200 μmol L−1 melatonin exhibited a great effect on grape preservation. Melatonin contributed to the tolerance against oxidative damage in berries. The abundance of 158 proteins were differentially regulated by melatonin. • The 200 μmol L−1 melatonin promoted polyamine metabolism. Contents of arginine, proline, GABA, and polyamines were increased by melatonin. Melatonin (MLT) exhibited pleiotropic effects in multiple plant physiological processes; however, its role in the polyamine metabolism and quality performance of postharvest Vitis vinifera berry remain unknown. In the present study, MLT was applied to postharvest Vitis vinifera cv. Kyoho berry, which delayed berry abscission, made the berry rotten, and promoted cell tolerance to oxidative stress. Notably, the malondialdehyde content of berries

was reduced to 40.8 % on the application of 200 μmol L−1 MLT. Furthermore, tandem mass tags (TMT)-based quantitative proteomic analysis identified 5,156 proteins from berry skin, among which 158 proteins showed quantitative differences in response to MLT application. These differentially expressed proteins were mainly upregulated in the arginine and proline metabolism pathways, lysine degradation, and ascorbate and aldarate metabolism pathways. The abundance of proteins involved in polyamine metabolisms, including N -carbamoylputrescine amidase, spermidine synthase, and aldehyde dehydrogenases were also upregulated. Moreover, MLT application enhanced contents of arginine, proline, 4-aminobutanoic acid, and polyamines, which played an essential role in oxidative stress response. Further, the transcript level of key enzymes involved in polyamine metabolism, including VvADC , VvODC , VvNAC , VvSPDS and VvCuAO were up-regulated on MLT application. Overall, the role of MLT in regulating the polyamine metabolism and subsequently in cell tolerance against oxidative damage was scientifically established for the first time for Vitis vinifera. The empirical findings of this study may propose new insights on MLT application in postharvest berry physiology and provide theoretical regulation for the preservation of berries, perhaps other fruits.

Keywords: /Cell tolerance/ /Melatonin/ /Oxidative stress/ /Polyamine/ /Quantitative proteomics/ /Vitis vinifera/

Zhang, Z., Wei, J., Wang, M., Zhang, J., & Wu, B. (2022). Induced sulfur metabolism by sulfur dioxide maintains postharvest quality of "Thompson Seedless" grape through increasing sulfite content. *Journal of the Science of Food and Agriculture*, *102*(3), 1174–1184. https://doi.org/10.1002/jsfa.11454

Abstract

The commercial preservation of table grapes largely depends on the application of sulfur dioxide (SO_2). However, little is known about whether SO_2 participates in sulfur metabolism to improve the postharvest quality of table grapes. In this study, the contents of sulfur-containing compounds, activities of enzymes, and expression of genes involved in sulfur metabolism in table grapes (Vitis vinifera cv. Thompson Seedless) were evaluated. The results indicated that SO_2 treatment maintained the postharvest quality of table grapes. The sulfite content in rachises and berries, but not the sulfate content, increased in response to SO_2 treatment. SO_2 caused high activities of sulfite reductase, O-acetylserine (thiol)-lyase, and γ-glutamylcysteine synthetase, thereby increasing the contents of cysteine, hydrogen sulfide, and glutathione in the rachises and berries. The expression of VvSURTL, VvATPS1, VvATPS2, and VvAPR3 decreased in response to SO_2 treatment; however, the transcript levels of VvSiR1 and VvOASTL exhibited the opposite tendency.These findings indicated that the sulfite converted from SO_2 participated in sulfur metabolism and maintained the postharvest quality of table grapes by modulating the contents of metabolites, activities of enzymes, and expression of genes related to sulfur metabolism.

Keywords: /Enzyme activity/ /Gene expression/ /Sulfur dioxide/ /Sulfur metabolism/ /Table grapes/

KIWIFRUIT

Cheng, J., Zheng, A., Li, H., Huan, C., Jiang, T., Shen, S., & Zheng, X. (2022). Effects of melatonin treatment on ethanol fermentation and ERF expression in kiwifruit cv. Bruno during postharvest. *Scientia Horticulturae*, *293*, 110696. https://doi.org/10.1016/j.scienta.2021.110696

Abstract

Melatonin treatment maintained postharvest storage quality of kiwifruit. • Melatonin treatment reduced the acetaldehyde and ethanol content in kiwifruit during the later storage. • Melatonin inhibited ethanol metabolism by regulating ADH,PDC and ERFs. Kiwifruit (Actinidia deliciosa) cv. Bruno is easy to accumulate ethanol during postharvest, which seriously affects fruit quality. In this study, the effects of melatonin (MT) treatment on ethanol accumulation and AdERF genes relative expression in kiwifruit were

investigated. The main results were as follows: MT treatment slowed down the fruit softening by inhibiting the rates of respiration and ethylene release, and significantly reduced the acetaldehyde and ethanol contents in kiwifruit during the later storage. Correspondingly, MT treatment significantly down-regulated the relative expressions of AdADH1, AdPDC1 and AdPDC2 , and inhibited the activities of pyruvate carboxylase (PDC) and alcohol dehydrogenase (ADH) in kiwifruit during the later storage period. Also, MT treatment down-regulated the expressions of AdERF4, AdERF74, AdERF75 and Achn226291 during the later storage, while the relative expressions of AdERF5, AdERF6, AdERF15, Achn164421 and Achn330401 were not significantly changed. These results indicated that MT treatment could affect the ethanol metabolism in kiwifruit by regulating the expressions of ADH1, PDC1 and PDC2 as well as the activities of ADH and PDC, thereby contributing to the quality maintenance and the shelf-life extension of kiwifruit. AdERF4, AdERF74, AdERF75 and Achn226291 might be implicated in the process. This study provided a theoretical basis for the MT application in maintaining fruit quality associated with control of alcoholic off-flavor via regulation of ethanol fermentation in kiwifruit during postharvest.

Keywords: /AdERF transcription factor/ /Ethanol fermentation/ /Kiwifruit/ /Melatonin (MT)/ /Postharvest/

MUSHROOM

Fu, Y., Yu, Y., Tan, H., Wang, B., Peng, W., & Sun, Q. (2022). Metabolomics reveals dopa melanin involved in the enzymatic browning of the yellow cultivars of East Asian golden needle mushroom (Flammulina filiformis). *Food Chemistry*, *370*, 131295. https://doi.org/10.1016/j.foodchem.2021.131295

Abstract

Browning seriously causes postharvest deterioration of the yellow cultivars of Flammulina filiformis, yet the browning process and its mechanism have not been described. Changes of L*, a*, b* values, the browning and whiteness index during air contacted storage were evaluated, uncovering the great loss of brightness and meanwhile the accumulation of yellowness and redness. Browning tissue showed an increase of malondialdehyde, total phenolics, and browning-related enzyme activities of polyphenol oxidase and peroxidase, in contrast to the decrease of bioprotective catalase, superoxide, and dismutase. Non-targeted metabolomics revealed an upregulation of melanin synthesis under oxidation stress, and targeted LC-MS/MS verified the upregulation of l-dopa (3,4-dihydroxy-l-phenylalanine) during browning. Pyrrole-2,3,5-tricarboxylic acid was identified in the degradation products of browning pigments after alkaline hydrogen peroxide by LC-MS/MS, suggesting the existence of 5,6-dihydroxyindole-2-carboxylic acid derived units of eumelanin. Therefore, the biosynthesis of eumelanin via the l-dopa pathway could participate in the enzymatic browning of postharvest F. filiformis.

Keywords: /Enzymatic browning/ /Flammulina filiformis/ /LC-MS/MS/ /Melanin biosynthesis/ /l-dopa/

ONION

Tiwari, S., Goswami, U., Kate, A., Modhera, B., Tripathi, M. K., & Mohapatra, D. (2022). Biological relevance of VOCs emanating from red onions infected with Erwinia (Pectobacterium) carotovora under different storage conditions. *Postharvest Biology & Technology*, *184*, 111761. https://doi.org/10.1016/j.postharvbio.2021.111761

Abstract

Number of VOCs increased over storage time for both healthy and infected samples. Storage condition, time, and infection influence VOCs emission pattern in onion. 3-bromo furan is a unique compound of inoculated onion with Erwinia carotovora. Performance of PLS-DA cluster analysis was better than PCA. Volatile organic compounds (VOCs) are generated in different commodities through various biosynthetic pathways. They act as biomarkers for different infections and metabolisms and can be instrumental in the

development of biosensors for monitoring the health of stored horticultural commodities. Healthy onions and samples infected with Pectobacter Erwinia carotovora were stored at different conditions (4 °C, 60 %; 8 °C, 65 %; 15 °C, 75 %; 25 °C, 60–80 %) for 4 weeks and the VOCs were mapped using SPME-GC–MS. The data were analyzed using multivariate data analysis techniques like Principal Component Analysis (PCA), and Partial Least-Squares Discriminant Analysis (PLS-DA), and visualized using a cluster heat map. The number of VOCs was higher in the infected samples, which increased over the storage duration. The predominant class of VOCs at 25 °C are mostly ester and sulfur; and at 15 °C, alkane and ketone groups of VOCs contributed more, during the initial phase of infection. At a lower temperature of 8 °C bacterial metabolic VOCs belonging to alcohol or aldehyde groups could be observed. On the other hand at 4 °C, since the microbial activity is retarded, no such compounds were found. With storage and extent of spoilage, the predominant VOCs belonged to acids and multi-functional group variants for lower temperatures. VOC profile was found to be correlated with storage conditions as well as periods that ultimately had an impact on Erwinia carotovora secondary metabolism. Except for the 4 °C storage temperature, PCA could distinguish and separate the VOCs into clusters for the classification of infected and non-infected samples; however, PLS-DA performed better separation and distinction of VOCs among the groups for all the storage conditions. The dominance of the VOCs with respect to sample type, storage condition, and storage duration was represented through the clustered heat maps.

Keywords: /Erwinia carotovora/ /Onion/ /PLS-DA/ /SPME-GC–MS/ /Storage conditions/
Volatile organic compounds

PEACH

Li, Y., Liu, S., Chen, S., Rashid, A., Wang, L., & Wang, K. (2022). Physicochemical changes in fresh-cut peaches with the combined treatment of UV-B irradiation and 1-MCP. *Postharvest Biology & Technology*, *184*, 111755. https://doi.org/10.1016/j.postharvbio.2021.111755

Abstract

The combination of UV-B and 1-MCP facilitated preservation of fresh-cut peaches. The combined treatment inhibited the activities of polyphenol oxidase and peroxidase.The combined treatment reduced membrane peroxidation and retained membrane stability.The combined treatment retarded energy deficit and moderated respiratory metabolism. Fresh-cut peaches are prone to quality deterioration, including browning, which is detrimental to their shelf life and marketability. Physiochemical changes in the fruit treated with the combination of a hormetic dose of UV-B irradiation (1.46 kJ m−2) and 1 μl L−1 1-MCP fumigation were assessed. The combined treatment effectively maintained the fruit quality as indicated by the inhibited weight loss and browning, which was associated with the enhancement of total phenolic content by UV-B, and restraint activities of polyphenol oxidase and peroxidase by 1-MCP. Meanwhile, a stable membrane was suggested based on the facts of the reduced membrane peroxidation and improved unsaturated fatty acid proportion. Moreover, the retarded energy deficit was coupled with moderated respiratory metabolism. In summary, the combination of UV-B and 1-MCP treatments compromised phenolic metabolism, enhanced membrane stability, and moderated respiratory metabolism, and hence can be used to extend the shelf life of fresh-cut peaches.

Keywords: /1-MCP/ /Browning/ /Fresh-Cut/ /Peach/ /UV-B/

PEARS

Huang, R., Cheng, Y., Li, C., Guo, M., Zhu, J., Ge, Y., & Sun, T. (2022). Postharvest application of acibenzolar- S-methyl delays the senescence of pears by mediating the ascorbate-glutathione cycle. *Scientia Horticulturae*, *293*, 110741. https://doi.org/10.1016/j.scienta.2021.110741

Abstract

ASM dipping decreased ethylene release in pear fruit. ASM modulated the AsA-GSH cycle to delay senescence of pears. The exocarp of pears responded more rapidly than the mesocarp to ASM treatment. This study was conducted to explore the changes of quality indicators and ascorbate-glutathione (AsA-GSH) cycle in 'Docteur Jules Guyot' pears after acibenzolar-S-methyl (ASM) dipping. Results demonstrated that ASM delayed the yellowing and flesh firmness decline, decreased the ethylene release and titratable acidity, and increased soluble solid content in pears. Additionally, ASM enhanced the hydrogen peroxide, ascorbic acid, and reduced glutathione contents, improved the activities of ascorbate peroxidase, glutathione reductase, monodehydroascorbate reductase, and dehydroascorbate reductase in the exocarp and mesocarp of pears. However, enzyme activities and hydrogen peroxide content in the exocarp were higher than that in the mesocarp after dipping with ASM. These results suggest that postharvest application of ASM could modulate the AsA-GSH cycle to delay senescence of pears, and the exocarp responded more rapidly than the mesocarp.

Keywords: /Acibenzolar-S-methyl/ /Ascorbate-glutathione cycle/ /Pyrus communis fruit/ /Quality/

Sun, T., Ouyang, H., Sun, P., Zhang, W., Wang, Y., Cheng, S., & Chen, G. (2022). Postharvest UV-C irradiation inhibits blackhead disease by inducing disease resistance and reducing mycotoxin production in “Korla” fragrant pear (Pyrus sinkiangensis). ***International Journal of Food Microbiology*****,** ***362*****, 109485. https://doi.org/10.1016/j.ijfoodmicro.2021.109485**

Abstract

Blackhead disease is a major fungal disease causing the quality deterioration of postharvest 'Korla' fragrant pear. In this study, the relationships of resistance to blackhead disease with the enzyme activity, phenolic compounds, and mycotoxin metabolism of 'Korla' fragrant pear were investigated, through UV-C irradiation of 0.12, 0.24, 0.36, 0.48, 0.72 and 1.08 kJ/m ^{2} on 'Korla' fragrant pear inoculated with Alternaria alternata (Fries) Keissler (A. alternata). The results showed that the low-dose UV-C irradiation (0.36 kJ/m ^{2}) effectively controlled blackhead disease. The activities of chitinase (CHI), β-1,3-glucanase (GLU), peroxidase (POD), superoxide dismutase (SOD), catalase (CAT), ascorbate peroxidase (APX), phenylalanine ammonia-lyase (PAL), and the content of phenolic compounds in fruit were enhanced, whereas the activities of lipoxygenase (LOX), polyphenol oxidase (PPO), and the contents of hydrogen peroxide (H_2O_2) and mycotoxins (including AOH, AME, and TeA) were decreased. Therefore, the low-dose UV-C irradiation could improve the resistance to blackhead disease and reduce the production of mycotoxins in 'Korla' fragrant pear. This study proves that UV-C irradiation may be a potentially effective strategy for the control of blackhead disease and the improvement of quality of postharvest 'Korla' fragrant pear.

Keywords: /Alternaria alternata/ /Antioxidant activity/ /Decay/ /Defense-related enzymes/ /Infection/

Torres, C. A., & Mogollon, R. (2022). Characterization of sun-injury and prediction of sunscald on “Packham’s Triumph” pears using Vis-NIR spectroscopy. ***Postharvest Biology & Technology*****,** ***184*****, 111776. https://doi.org/10.1016/j.postharvbio.2021.111776**

Abstract

Sunscald is a new physiological disorder on pears grown in hot and dry environments. Sunburn is directly correlated to sunscald appearance during cold storage. Both sunburn and sunscald changed the colorimetric and spectral profile of fruit skin. Sunburn increased spectral reflectance at 575−675 nm and the a* coordinate. Sunscald prediction was achieved using colorimetric data or 550−600 nm reflectance. Sun injury (sunburn) and sunscald (delayed sunburn) postharvest have been well characterized on apples but not on pears. In fact, a sunscald-type disorder has only been noticed, commercially, in the last five years on pears grown under increasingly warmer conditions. 'Packham's Triumph' pears with different

sunburn severity (healthy, mild, moderate, and severe) were harvested from three commercial orchards in Chile and stored in air (0 °C, >80 % RH) for six months. Sunscald incidence, skin color (colorimeter L, a*, b*) and peel diffuse reflectance (400−1100 nm) were recorded monthly. Sunscald symptoms (i.e., skin browning) started to appear 2–3 months into cold storage and only on fruit with sunburn. Among the color coordinates, L decreased as storage time progressed while a* increased and was the most effective parameter to separate sunburn categories. Interval partial least squares regression (iPLS) found the spectral reflectance from the wavelength regions 500−600 nm, 650−700 nm, and 800−850 nm separated the sunburn categories during storage. Conversely, fruit that developed postharvest sunscald had significantly lower L and b* values ($P \leq 0.05$), and lower overall reflectance intensities at harvest, regardless of sunburn severity. The best sunscald model was achieved using the 550–600 nm band, with a sensitivity of 77 % and specificity of 75 %.

Keywords: /Fruit quality/ /Physiological disorder/ /Pome fruit/ /Storage disorder/

PERSIMMON

Bagheri, M., & Esna-Ashari, M. (2022). Effects of postharvest methyl jasmonate treatment on persimmon quality during cold storage. *Scientia Horticulturae*, *294*, 110756. https://doi.org/10.1016/j.scienta.2021.110756

Abstract
MeJA postharvest treatment preserves persimmon quality during cold storage. • MeJA preserves phenolic compounds and antioxidant properties. • MeJA retards chilling injury manifestation during cold storage. • MeJA treatment reduces membrane peroxidation and enhances membrane integrity. This study investigates the effects of methyl jasmonate (MeJA) on chilling injuries of persimmon cv. Karaj during 120-day cold storage (at 0—1 °C). The results show that postharvest treatment of MeJA with variant concentrations (equaling to 8, 16, and 24 μL L −1) significantly decreases chilling injuries of the persimmon. Moreover, the MeJA application preserves persimmon's physico-chemical characteristics and contributes to maintaining its marketable features while reducing malondialdehyde (MDA) content as well as the electrolyte leakage level. Further, it maintains total phenolic compounds and increases antioxidant capacity. The above-mentioned achievements can be associated with the protection of fruit´s membrane integrity and alteration in antioxidant enzymes' activities. In conclusion, MeJA application specifically using 16 and 24 μL L −1 concentration can protect the quality of the persimmon fruit during long-term storage.

Keywords: /Antioxidant capacity/ /Chilling injury/ /Fruit quality/ /Persimmon/

PLUM

Ma, Y., Zhang, W., Cheng, S., Liu, Y., Yang, W., Wang, Y., Guo, M., & Chen, G. (2022). Postharvest storage at near-freezing temperature maintained the quality and antioxidant properties of Prunus domestica L. cv. Ximei fruit. *Scientia Horticulturae*, *293*, 110720. https://doi.org/10.1016/j.scienta.2021.110720

Abstract

NFTS had the best effect on storage quality compared to low and room temperatures. Near-freezing temperature storage (NFTS) delayed senescence in P. domestica fruit. NFTS reduced ROS accumulation and enhanced antioxidant enzyme activity. NFTS is effective for maintaining P. domestica fruit quality during storage. P. domestica fruit are highly perishable due to its intense metabolic activity. To increase the storage time while preserving the quality, the effects of postharvest storage at near-freezing temperature (NFTS) (−1 to −1.5 °C) on the physiological indexes and antioxidant enzyme activities of P. domestica fruit were investigated. The results showed that the weight loss rate (4.04 %), soluble solid content (1.08 %), color difference (18.27 %), respiration rate (23.90 %), anthocyanin content (41.13 %),

malondialdehyde content (5.39 %), hydrogen peroxide content (13.32 %), and superoxide anion activity (13.97 %) of P. domestica fruit in the NFTS group were reduced, but the firmness (4.95 %), ascorbic acid content (31.71 %), total phenol content (2.54 %), and the activities of superoxide dismutase (SOD, 4.67 %), catalase (CAT, 168.92 %), ascorbate peroxidase (APX, 127.17 %), and peroxidase (POD, 34.54 %) were increased, compared with the room temperature (25 °C) group. Therefore, NFTS could effectively preserve the quality of harvested P. domestica fruit, improve the antioxidant properties, and delay the senescence. This study proposed that NFTS could be used as a promising storage technique to reduce postharvest oxidative stress.

Keywords: /Enzyme activity/ /Ice-temperature/ /Storage quality/

POMEGRANATE

Aminzade, R., Ramezanian, A., Eshghi, S., & Hosseini, S. M. H. (2022). Maintenance of pomegranate arils quality by zinc enrichment, a comparison between zinc sulfate and nano zinc oxide. *Postharvest Biology & Technology*, *184*, 111757. https://doi.org/10.1016/j.postharvbio.2021.111757

Abstract

Zinc treatment is effective for pomegranate arils fortification. Increasing arils zinc content extends the storability and reduces microbial counts. Qualitative characteristics of arils maintained by zinc treatment. Zinc sulphate followed by nano zinc oxide were the most efficient treatments. Pomegranate arils are very perishable which restricts the distribution and supply chains of arils. Zinc treatment not only may fortify arils, but also has the capability of preventing the growth of pathogens. This study was performed to compare two different forms of zinc including nano zinc oxide (nZnO) and zinc sulfate (ZnSO 4), each one in four concentrations of 0 %, 0.4 %, 0.6 % and 0.8 %. Zinc enrichment was evaluated by atomic absorption. Zinc enriched arils were stored in polypropylene-packed containers weighing approximately 50 g at 5 °C and 90–95 % relative humidity. Sampling was done at 5 d intervals during 30 d of storage. Zinc content in arils treated with 0.8 % ZnSO 4 was 37.5 times more than the control, which can be a very effective way to meet body nutritional needs. Zinc treatment had an effect on all measured indices. The highest amount of total soluble solids (TSS), titratable acidity (TA), total phenolic content (TPC), antioxidant activity and anthocyanin content, and the lowest weight loss (WL) were found in the arils treated with 0.8 % ZnSO 4. Overall, 0.8 % ZnSO 4 followed by 0.8 % nZnO treatments were the most beneficial treatments to increase the shelf life and to maintain arils quality characteristics.

Keywords: /Anthocyanin/ /Antioxidant activity/ /Shelf life/ /Total phenol/ /Zinc fortification/

POSTHARVEST DISEASE

Jiao, W., Liu, X., Li, Y., Li, B., Du, Y., Zhang, Z., Chen, Q., & Fu, M. (2022). Organic acid, a virulence factor for pathogenic fungi, causing postharvest decay in fruits. *Molecular Plant Pathology*, *23*(2), 304–312. https://doi.org/10.1111/mpp.13159

Abstract

Decay due to fungal infection is a major cause of postharvest losses in fruits. Acidic fungi may enhance their virulence by locally reducing the pH of the host. Several devastating postharvest fungi, such as Penicillium spp., Botrytis cinerea, and Sclerotinia sclerotiorum, can secrete gluconic acid, oxalic acid, or citric acid. Emerging evidence suggests that organic acids secreted by acidic fungi are important virulence factors. In this review, we summarized the research progress on the biosynthesis of organic acids, the role of the pH signalling transcription factor PacC in regulating organic acid, and the action mechanism of the main organic acid secreted via postharvest pathogenic fungi during infection of host tissues. This paper systematically demonstrates the relationships between tissue acidification and

postharvest fungal pathogenicity, which will motivate the study of host–pathogen interactions and provide a better understanding of virulence mechanisms of the pathogens so as to design new technical strategies to prevent postharvest diseases.

Keywords: /Acidic fungi/ /Ambient pH/ /Organic acids/ /Regulatory mechanism/ /Virulence factor/

Paes, S. A., Rosado, A. W. C., Reis, A., & Pereira, O. L. (2022). Molecular phylogeny and morphological characterization of the aetiological agent of sour rot on fruits and vegetables in Brazil. *Plant Pathology*, *71*(2), 386–399. https://doi.org/10.1111/ppa.13473

Abstract

In Brazil, sour rot is an important postharvest disease on fruits and vegetables. Geotrichum candidum (synonym Galactomyces candidus) has been reported as the main species causing this disease. However, the identity of the causal agent is still uncertain. This research aimed to determine the identity of 165 fungal isolates associated with sour rot obtained from fruits and vegetables in Brazil, and to evaluate the effect of different temperatures on the incidence of sour rot on artificially inoculated tomato fruits. Based on the phylogenetic analyses of DNA sequences from the D1/D2 domain of the large subunit (LSU) rRNA gene and morphological analyses, 129 samples belonged to Galactomyces candidus, 15 to G. candidum var. citri‐aurantii, 6 to G. phurueaense, 2 to Gal. pseudocandidus, 1 to Hyphopichia burtonii, 1 to H. khmerensis, 3 to Saccharomycopsis crataegensis, 1 to S. vini, 1 to Magnusiomyces tetrasperma, 1 to Trichosporon coremiiforme, and 1 to Zygoascus meyerae. Two new species were found, namely, Geotrichum solani (on potato) and Geotrichum spondiadis (on red mombin). All isolates were pathogenic when inoculated on healthy tomato fruits, including the new species of Geotrichum, which were also inoculated into their respective hosts, that is, potatoes and red mombins. To the best of our knowledge, this study is the first to report the presence of five other genera besides Geotrichum associated with sour rot on fruits and vegetables in Brazil, which demonstrates the diversity of fungi and yeasts associated with this disease.

Keywords: /Dipodascaceae/ /Geotrichum/ /Postharvest disease/ /Rot disease/

Raorane, C. J., Raj, V., Lee, J.-H., & Lee, J. (2022). Antifungal activities of fluoroindoles against the postharvest pathogen Botrytis cinerea: In vitro and in silico approaches. *International Journal of Food Microbiology*, *362*, 109492. https://doi.org/10.1016/j.ijfoodmicro.2021.109492

Abstract

Botrytis cinerea is a common necrotrophic fungal pathogen, leading cause of gray mold diseases in plants and fruit. Several benzimidazoles are used for controlling B. cinerea-associated infection in fruit and vegetables, but benzimidazoles resistance restricts its further uses. Therefore, there is a need for alternative drugs that control B. cinerea. Indoles are multi-faceted compounds and their structural similarities with antifungal benzimidazoles make them a choice for further investigation. Thus, the main objective of the study was to investigate the antifungal potencies of indoles against B. cinerea and to decipher the molecular mechanism involved. We conducted in vitro antifungal assays, fruit assays, and computational studies of interactions between indoles and fungal microtubule polymerase. Of the 16 halogenated indoles examined, 4-fluoroindole, 5-fluoroindole, and 7-fluoroindole (MIC range 2-5 mg/L) were found to be more potent than the fungicides fluconazole and natamycin. Fluoroindoles inhibited or eradicated B. cinerea infections in tangerines and strawberries. Molecular dynamic simulation and density functional theory showed that these fluoroindoles stably interacted with microtubule polymerase. Quantitative structure-activity relationship analyses of halogenated indoles revealed that the presence of a fluoro group in the indole moiety is essential for anti-Botrytis activity. The plausibility of the underlying antifungal mechanism was confirmed by in vitro tubulin polymerization. Collective outcomes of this study indicates that fluoroindoles could be used as alternative fungicidal agents against B. cinerea.

Keywords: /Fungal inhibition/ /Indoles/ /MD simulation/ /Microtubule polymerase/ /Tubulin/

POTATO

Liu, J., Sun, Z., Zou, Y., Li, W., He, F., Huang, X., Lin, C., Cai, Q., Wisniewski, M., & Wu, X. (2022). Pre- and postharvest measures used to control decay and mycotoxigenic fungi in potato (Solanum tuberosum L.) during storage. *Critical Reviews in Food Science & Nutrition*, *62*(2), 415–428. https://doi.org/10.1080/10408398.2020.1818688

Abstract

Potato (Solanum tuberosum L.), a worldwide, staple food crop, is susceptible to postharvest rots caused by a variety of fungal pathogens, including Fusarium spp., Alternaria spp., Phytophthora infestans, Helminthosporium solani, Rhizoctonia solani, and Colletotrichum coccodes. Rots resulting from infections by these pathogens cause a significant reduction in potato quality and marketable yield. Importantly, some of these decay fungi also produce mycotoxins that represent a potential risk to human health. In the present review, an overview and discussion are provided on the epidemiology and pathogenesis of decay fungi, especially Fusarium spp., that include recent data derived from genomic and phylogenetic analyses. The biosynthesis and functional role of fungitoxic metabolites such as trichothecene mycotoxins and fusaric acid, produced in rotted potatoes are also reviewed. Advances in pre- and postharvest measures for rot management, especially eco-friendly methods including physical control, biological control, the use of natural compounds, and other agricultural management practices are also reviewed. Lastly, novel approaches to control potato dry rot such as the use of mycoviruses and CRISPR technology are highlighted.

Keywords: /Decay control/ /Food safety/ /Postharvest rot/ /Potato/

Datir, S. S., & Regan, S. (2022). Role of alkaline/neutral invertases in postharvest storage of potato. *Postharvest Biology & Technology*, *184*, 111779. https://doi.org/10.1016/j.postharvbio.2021.111779

Abstract

Potatoes stored at cold temperatures undergo undesirable sweetening due to the cleavage of sucrose into reducing sugars by invertases. Although significant research has focused on vacuolar invertase (*StVAC*) during cold storage of potatoes, little is known about the role of alkaline/neutral invertases (*StNI*). We identified eight members in the *NI* family from the potato genome, and phylogenetic analysis suggested their probable subcellular location as plastid/mitochondria (group α) or cytosol (group β). Using three commercially important potato cultivars with known differences in cold storage responses (‘Russet Burbank’, ‘Bintje’, and ‘Shepody’), we compared the expression of the eight *StNI* genes to *StVAC* and vacuolar invertase inhibitor (*StINH2*) genes during harvest, and after one and five months of storage at 4 °C or 22 °C. The activity of neutral invertase (NI), soluble acid invertase activity (SAI), and the levels of reducing sugars were also determined. Tubers of ‘Russet Burbank’ displayed high transcript abundance of *StNI5*, high reducing sugar content and more NI activity than SAI activity. This was associated with a high level of *StINH2* transcripts and low *StVAC* transcript levels suggesting the susceptibility of these tubers to cold-induced sweetening could be due to cytoplasmic cleavage of sucrose by NI. In ‘Bintje’, the induction of *StNI5* and *StVAC* transcripts and NI and SAI activities indicate that sucrose degradation is carried out by both NI and SAI. In ‘Shepody’, a higher abundance of the *StNI4* and *StNI6* transcripts indicates different isoforms of NI are required for sucrose degradation. This study reveals significant contribution of NI in the regulation of reducing sugars and the process of cold-induced sweetening. Additional studies are needed to determine the *in vivo* function of NI in cold-stored potato tubers.

Keywords: /Acid invertase/ /Alkaline/neutral invertase/ /Cold-induced sweetening/ /Reducing sugars/ /*Solanum tuberosum*/ /Sucrose/

Liu, P., Xu, N., Liu, R., Liu, J., Peng, Y., & Wang, Q. (2022). Exogenous proline treatment inhibiting enzymatic browning of fresh-cut potatoes during cold storage. *Postharvest Biology & Technology*, *184*, 111754. https://doi.org/10.1016/j.postharvbio.2021.111754

Abstract

Pre-treatment with proline reduced the browning of fresh-cut potatoes. Pre-treatment with proline suppressed the PPO activity and total phenol content. Pre-treatment with proline caused content changes of ten amino acids. Endogenous proline and antioxidant capacity were increased. Fresh-cut potato slices are prone to browning, resulting in a severely reduced commodity value. Hence, a safe and effective method to inhibit the browning of fresh-cut potatoes is urgently needed. In this study, we investigated the effect of pre-treatment with a proline solution on browning, polyphenol oxidase (PPO) activity, total phenol content, antioxidant activity, and free amino acid content of fresh-cut potatoes. The results showed that pre-treatment with 90 mmol L−1 proline for 1 h at 30 °C reduced browning and surface dehydration, improved the overall visual aspect, and extended the shelf-life of potato slices to 4 d at 2−4 °C. The PPO activity and total phenol content in pre-treated potato tubers and slices were lower than control and water treatment. The superoxide dismutase (SOD), catalase (CAT) activities, the percentage inhibition of 1,1-Diphenyl-2-picrylhydrazyl (DPPH) and 2,20-zo-bis-3-ethylben zothiazoline-6-sulfonic acid (ABTS), and the Fe2+ reduction capacity had increased compared with control and water treatment. Compared with control and water treatment, the tyrosine, aspartic acid, glutamic acid, serine, glycine, histidine, and valine content were reduced, whereas proline, histidine, and valine had increased. Mechanistically, pre-treatment with proline inhibited the browning of fresh-cut potatoes by reducing PPO activity, total phenolic content, and the content of several amino acids, while inducing the accumulation of intrinsic proline content and increasing the antioxidant capacity of fresh-cut potatoes.

Keywords: /Browning inhibition/ /Free amino acids/ /Fresh-cut potatoes/ /Pre-treatment/ /Proline/

Meng, Z., Wang, T., Malik, A. U., & Wang, Q. (2022). Exogenous isoleucine can confer browning resistance on fresh-cut potato by suppressing polyphenol oxidase activity and improving the antioxidant capacity. *Postharvest Biology & Technology*, *184*, 111772. https://doi.org/10.1016/j.postharvbio.2021.111772

Abstract

Isoleucine (Ile) could significantly delay the browning of fresh-cut potatoes. Ile treatment inhibited PPO activity partially by chelating Cu2+. Ile treatment suppressed PPO activity by interacting with amino acid residues of PPO. Ile treatment improved the antioxidant capacity of fresh potato. Fresh-cut potatoes are susceptible to enzymatic browning. In this study, the effect of isoleucine (Ile) on the browning of fresh-cut potatoes was evaluated, and the mechanism by which Ile influenced the browning was revealed. Results showed that exogenous Ile application could reduce the browning of fresh-cut potato chips. At 2–4 °C, control chips had lost saleability on day 1, while 1.0 % Ile treated chips were still acceptable on day 4. Ile alleviated the decrease of tyrosine, prevented the production of brown pigments, and inhibited the browning of potato mashes. The addition of Ile to potato mash decreased polyphenol oxidase (PPO) activity, which was partially recovered after adding copper acetate. Molecular docking showed that Ile could bind with the amino acid residues of PPO. Moreover, Ile treatment increased the activity of catalase (CAT) and peroxidase (POD), improved 1,1-diphenyl-2-picrylhydrazyl (DPPH) and 3-ethylbenzothiazoline-6-sulfonic acid (ABTS) inhibition rate, and decreased the malondialdehyde (MDA) content. This is the first research to demonstrate that Ile has potential to be used as a natural anti-browning agent and its mechanisms include decreasing PPO activity by chelating Cu2+ and interacting with the PPO amino acid residues, and improving the antioxidant capacity.

Keywords: /Fresh-cut potato/ /Browning/ /Isoleucine/ /Polyphenol oxidase/ /Antioxidant capacity/

Sangjan, W., Marzougui, A., Mattinson, D. S., Schroeder, B. K., Bates, A. A., Khot, L. R., & Sankaran, S. (2022). Identification of volatile biomarkers for high-throughput sensing of soft rot and Pythium leak diseases in stored potatoes. *Food Chemistry*, *370*, 130910. https://doi.org/10.1016/j.foodchem.2021.130910

Abstract

Volatile profiles of two potato varieties resulting from two rot pathogens were evaluated. Soft rot and Pythium leak-based volatile compounds were assessed using GC techniques. Biomarkers identified included n,n–dimethylmethylamine, 1–undecene, acetone, and styrene. Soft rot and Pythium leak are postharvest storage diseases of potato tubers that can cause substantial crop losses in the US. This study focused on detecting volatile organic compounds (VOCs) associated with rot inoculated tubers during storage (up to 21 days) using headspace solid-phase microextraction (SPME) coupled to gas chromatography (GC) with mass spectrometry (MS) and flame ionization detector (FID) analysis. Russet Burbank and Ranger Russet tubers were inoculated with the rot pathogens. Static sampling with 50 min trapping time followed by GC–MS and GC–FID analysis identified 23 and 30 common VOCs from the pathogen inoculated tubers. Overall, n,n–dimethylmethylamine, acetone, 1–undecene, and styrene, occurred frequently and repeatability in inoculated samples based on GC–MS analysis, with the latter two found using GC–FID analysis as well. Identification of such biomarkers can be useful in developing high-throughput VOC sensing systems for early disease detection in potato storage facilities.

Keywords: /Disease detection/ /Gas chromatography/ /Headspace sampling/ /Potato rot/ /Solid-phase microextraction/ /Volatile organic compounds/

SPINACH

Zhang, F., Xie, Y., Shi, J., & Jiang, L. (2022). Effects of 1-methylcyclopropene treatment on phenolic metabolism in postharvest Gynura bicolor DC. *Scientia Horticulturae*, *293*, 110668. https://doi.org/10.1016/j.scienta.2021.110668

Abstract

1-MCP fumigation enhanced antioxidant capacity in G.bicolor. 1-MCP fumigation increased rutin content, 75% up to 7 days. 1-MCP fumigation upregulated the expression of GbPAL, GbCHS, GbDFR, GbANS, GbUFGT to stimulate the phenolic accumulation in G.bicolor. 1-MCP fumigation downregulated the expression of GbC4H, GbCOMT, GbF5H and GbCCoAOMT to inhibit the lignin biosynthesis in G.bicolor. We examined the effects of 10 μ L−1 1-methylcyclopropene (1-MCP) treatment on phenolic metabolism in postharvest Gynura bicolor DC stored at 20 ± 2 °C. The results indicated that 1-MCP treatment stimulated the biosynthesis of flavonoids and anthocyanins but inhibited that of lignin by regulating gene expression and enzyme activity. Specifically, 1-MCP treatment increased the contents of cinnamic acid, kaempferol, rutin, and chlorogenic acid by upregulating the expression of GbPAL, GbCHS, GbDFR, GbANS and GbUFGT , and decreased the ferulic acid content by downregulating the expression of GbC4H, GbCOMT, GbF5H and GbCCoAOMT. A correlation heatmap suggested close relations between individual phenolics and gene expression. The resulting accumulation of phenolics enhanced 2,2-diphenyl-1-picrylhydrazyl hydrate radical (DPPH·) and 2,2-azinobis-(3-ethylbenzothiazoline-6-sulfonic acid) radical cation (ABTS·+) scavenging ability and ferric ion-reducing antioxidant power (FRAP). Furthermore, 1-MCP treatment decreased electrolyte leakage and inhibited the activity of peroxidase and polyphenol oxidase, alleviating the risks of phenolics degradation and the increase in superoxide anion (O 2 ·−) and H 2 O 2 levels. In summary, 1-MCP treatment increased the contents of total phenolics, flavonoids, and anthocyanins by stimulating gene expression, and retarded the risk of phenolic degradation, thus delaying senescence of G. bicolor leaves.

Keywords: /1-methylcyclopropene/ /Antioxidant capacity/ /Gene expression/ /Gynura bicolor DC/ /Phenolics/

TOMATO

Rai, A., Kumari, K., & Vashistha, P. (2022). Umbrella review on chilling injuries: Post-harvest issue, cause, and treatment in tomato. *Scientia Horticulturae*, *293*, 110710. https://doi.org/10.1016/j.scienta.2021.110710

Abstract

Mature tomatoes (Solanum lycopersicum) have a very short shelf life which deteriorates quickly at ambient temperatures. Low temperature storage is the most successful and commonly used treatment to slow down the ripening process and decay development in mature or green tomatoes. However, low temperature may induce a disorder "chilling injury (CI)" which could limit the storage time of tomatoes. This review will summarize the currently published biochemical and genetic knowledge about the potential development of chilling injury (CI) in tomato fruit. It encompasses all studies reported on pre and postharvest issues and treatments that may affect the occurrence and severity of CI. This review paper will provide a better insight to understand the detailed mechanism and genes involved in the process of CI in tomato and help investigate the areas which need to be further explored. Comprehensive analysis of physical and chemical treatments inducing tolerance to chilling injury (CI) are discussed. HAT/HWT is one of the most effective techniques to reduce the damage caused by chilling injury in tomatoes. Advanced techniques like circular RNAs technology discovered several novel genes directly involved in chilling injury. Future research perspectives should be focused on the analysis of the molecular basis of CI induced early events.

Keywords: /Chilling injury/ /Non-destructive methods/ /Postharvest losses/ /Transcriptomics/ /Treatment/

Tao, X., Wu, Q., Li, J., Huang, S., Cai, L., Mao, L., Luo, Z., Li, L., & Ying, T. (2022). Exogenous methyl jasmonate regulates phenolic compounds biosynthesis during postharvest tomato ripening. *Postharvest Biology & Technology*, *184*, 111760. https://doi.org/10.1016/j.postharvbio.2021.111760

Abstract

MeJA accelerated the accumulations of total phenolics and flavonoids contents. MeJA increased the contents of most phenolic compounds during tomato ripening. MeJA enhances the enzymatic activities associated with the phenylpropanoid pathway. MeJA up-regulated the expressions of genes involved in phenylpropanoid pathway. Methyl jasmonate (MeJA) acts as an elicitor to stimulate phenolic compounds in fruit and vegetables. To explore the regulation of MeJA on phenolic compound biosynthesis during postharvest tomato ripening, mature green tomato fruits were treated by 0.5 mM MeJA or deionized water under vacuum, and then kept in darkness for 16 d. Total phenolics and total flavonoids contents, phenolic compounds contents, enzymatic activities, as well as expression levels of genes in response to phenylpropanoid pathway were determined in the present study. Results showed exogenous MeJA enhanced total phenolics and flavonoids contents, augmented the contents of most phenolic compounds, as well as promoted enzymatic activities associated with phenylpropanoid pathway (PAL, C4H, 4CL, CHS, and CHI) during tomato ripening. Furthermore, MeJA up-regulated the expressions of the corresponding genes (1.16- to 19.32-fold) involved in phenylpropanoid pathway during the first 7 d. Results suggested MeJA enhanced phenolic compounds biosynthesis during postharvest tomato ripening via influencing the enzymatic activities and gene expressions. These results may provide valuable information for exploring technical means for the regulation of phenylpropanoid pathway during tomato ripening.

Keywords: /Enzymatic activity/ /Gene expression/ /Methyl jasmonate/ /Phenolic compounds/ /Phenylpropanoid pathway/ /Tomato/