SELECTIVE DISSEMINATION OF INFORMATION
AS OF December 2018

APPLE

Gao, H., Wu, S., Zeng, Q., Li, P., and Guan W. (2018). Effects of exogenous γ-aminobutyric acid treatment on browning and food-borne pathogens in fresh-cut apples. Postharvest Biology and Technology, 146: 1-8.
DOI: 10.1016/j.postharvbio.2018.08.007

Abstract

Browning and growth of food-borne pathogens during postharvest storage are major factors that reduce the quality and economic value of fresh-cut apples. Previous studies suggest that exogenous γ-aminobutyric acid (GABA) has a significant role in multiple physiological processes in plants. This study investigated the effects of exogenous GABA treatment on the browning process and growth of food-borne pathogens in fresh-cut apples. The optimal conditions for fresh-cut apples were evaluated by measuring the browning index (BI) and L* value. Immersion in 20 g L−1 GABA for 10 min was found to significantly inhibit the browning process. Additionally, the activities of catalase (CAT) and superoxide dismutase (SOD) were significantly enhanced, while the activity of polyphenol oxidase (PPO) was inhibited and the reactive oxygen species (ROS) was eliminated. Meanwhile, bacterial growth, as determined by total bacterial count, on fresh-cut apples was significantly reduced. Growth of food-borne pathogens, including inoculated Staphylococcus aureus, Salmonella typhimurium, Escherichia coli O157:H7, and Listeria monocytogenes, was inhibited. Moreover, the activities of phenylalanine ammonia lyase (PAL), chitinase (CHI), and β-1,3-glucanase (GLU) in fresh-cut apples inoculated with food-borne pathogens were increased. Therefore, GABA treatment may be a promising approach to inhibit the browning process and increase resistance to food-borne pathogens in fresh-cut apples.

Keywords: /γ-Aminobutyric acid/ /Fresh-cut apples/ /Browning/ /Food-borne pathogens/

Kim, S. M., Lee, S. M., Seo, J., and Kim, Y. (2018). Changes in volatile compounds emitted by fungal pathogen spoilage of apples during decay. Postharvest Biology and Technology, 146: 51-59.
DOI: 10.1016/j.postharvbio.2018.08.003

Abstract

Postharvest diseases in apples are mainly caused by pathogenic fungi. Fungal contamination and decay can change some of the emitted volatile organic compounds(VOCs). In this study, three major pathogens isolated from Fuji apples; Penicillium expansum, Botryosphaeria dothidea, and Alternaria alternata, were inoculated onto disease-free Fuji apples. The VOCs released were analyzed using gas chromatography-mass spectrometry combined with solid-phase microextraction to compare the changes in VOCs according to the decay index and pathogen species. After apples were inoculated with pathogens, ethanol, 3-methylbutan-1-ol, benzaldehyde, styrene, limonene and some ethyl esters constituted the main VOCs emitted

during decay. The main volatile compounds according to pathogen species were (E)-hex-2-enal, 1-methoxy-3-methylbenzene, methyl heptanoate, diethyl carbonate, ethyl 2-phenylacetate, propyl octanoate, and ethyl decanoateproduced in P. expansum, (E)-hex-3-enyl acetate, 1-methyl-4-propan-2-ylbenzene, 2-phenylethanol, α-terpinene, and α-terpinolene in B. dothidea, and phenylmethanol, 2-ethylhexan-1-ol, and acetophenone in A. alternata. The increase of fungal VOCs can be affected by tissue degradation and/or fungal metabolism of apples during decay.

Keywords: /Apple/ /Postharvest disease/ /Fungal pathogen/ /Volatile organic compounds/
Determining the resistance to mechanical damage of apples under impact loads
Citation data:

Stopa, R., Szyjewicz, D., Komarnicki, P., and Kuta, Ł. (2018). Determining the resistance to mechanical damage of apples under impact loads. Postharvest Biology and Technology, 146: 79-89.
DOI: 10.1016/j.postharvbio.2018.08.016

Abstract

The most destructive impacts on biological materials are impact loads, which cause tissue damage under surface peel. For apples, tissue damage increases due to the contact stresses resulting from the round shape of the fruit. Measurements of surface and volume of bruised apples expressed as a function of drop height have been measured, and a method has been developed to determine the resistance and the threshold to bruising for 'Idared', 'Golden Delicious' and 'Jonagold' apples. This method determines the resistance to bruises based on average surface pressures used as a load parameter in relation to the volume of damaged tissue. The relationship between the bruise surface and the volume was determined and confirmed as a power curve with a R2 determination factor of 0.97. A Bruise Resistance Index (BRI), defined as ratio of the average pressures to the bruised surface, was calculated as the ratio of surface pressure to measured bruise volume depending on the drop height. Comparison of both indicators showed that proposed BRIb power models precisely represent real BRI power curves. The bruise threshold as well as the bruise resistance for apples is an effective and rapid tool for assessment of damage degree.

Keywords: /Bruise resistance/ /Surface pressure/ /Bruise surface/ /Bruise volume/ /Apple/

Jaeger, S. R., Antúnez, L., Ares, G., Swaney-Stueve, M., Jin, D., and Harker, F. R. (2018). Quality perceptions regarding external appearance of apples: Insights from experts and consumers in four countries. Postharvest Biology and Technology, 146: 99-107.
DOI: 10.1016/j.postharvbio.2018.08.014

Abstract

Apples, one of the most popular fruit worldwide, are globally traded and consumers benefit from hyper-competition in the industry. To remain profitable, producers must offer very high quality fruit at competitive prices. This research sought to better understand consumers' quality

perceptions. We focused on external appearance, a readily available quality cue. Insights were gained from a categorization task where participants sorted images of apples based on perceived quality. A comparison between experts' (n = 37) and consumers' (n = 297) quality perceptions based on external appearance revealed high similarity. Both groups considered fruit with minor defects as inferior to fruit with no external defects. The consumers, who represented four different countries (72–76 per country; loosely regarded as a proxy for the global population of apple consumers), perceived the quality of the apples very similarly. Three quality groupings were established, representing apples with high quality, minor defects and major defects, respectively. The last-mentioned grouping consisted of any apple that showed signs of rot or mold, or where there the skin had been cut. Blemishes and odd shapes were generally regarded as minor defects. Both types of defects were associated with negative hedonic expectations, which increased with the severity of the external defect. The implications for consumers' purchase-related cognitions were clear and associated with rejecting consumption. This has associated implications for efforts to reduce food waste.

Keywords: /Fruit quality/ /Defects/ /Bruising/ /Sorting/ /Consumer research/ /Postharvest/ /Appearance/

Sheng, L., Hanrahan, I., Sun, X., Taylor, M. H., Mendoza, M., and Zhu, M. J. (2018). Survival of Listeria innocua on Fuji apples under commercial cold storage with or without low dose continuous ozone gaseous. Food Microbiology, 76: 21–28.
DOI: 10.1016/j.fm.2018.04.006

Abstract

This study evaluated the fate of *Listeria innocua*, a non-pathogenic species closely related to *Listeria* monocytogenes, on Fuji apple fruit surfaces during commercial cold storage with and without continuous low doses of gaseous ozone. Unwaxed Fuji apples of commercially acceptable maturity were inoculated with 6.0–7.0 Log10 CFU *L. innocua*/apple, and subjected to refrigerated air (RA, 33 °F), controlled atmosphere (CA, 33 °F, 2% O2, 1% CO2), or CA with low doses of ozone gas (50.0 –87.0 ppb) storage in a commercial facility for 30 weeks. A set of uninoculated apples was simultaneously subjected to the above storage conditions for total plate count and yeasts and molds enumeration. *L. innocua* survival under RA and CA storage was similar, which led to 2.5–3.0 Log10 CFU/apple reduction during storage. Continuous gaseous ozone application decreased *L. innocua* population on Fuji apples to ~1.0 Log10 CFU/apple after 30-week storage, and suppressed apple native flora. CA storage delayed apple fruit ripening through reduction of apple firmness and titratable acidity loss, and low dose gaseous ozone application had no negative influence on apple visual quality, including both external and internal disorders. In summary, *L. innocua* decreased on Fuji apple surfaces during commercial long-term RA and CA storage. Ozone gas has the potential to be used as a supplemental intervention method to control *Listeria* spp. and to ensure fresh apple safety.

Keywords: /Apple/ /Listeria innocua/ /Commercial storage/ /Gaseous ozone/ /Quality/

Prawiranto, K., Defraeye, T., Derome, D., Verboven, P., Nicolai, B., & Carmeliet, J. (2018). New insights into the apple fruit dehydration process at the cellular scale by 3D continuum modeling. Journal of Food Engineering, 239, 52–63.
DOI: 10.1016/j.jfoodeng.2018.06.023

Abstract

An accurate understanding of the dehydration kinetics of biological materials is essential to optimize their dehydration processes and to produce high-quality dried products. For a soft, cellular material like fruit, the underlying mass transport and deformation mechanisms at the cellular scale play a key role here. To improve our insight into the cellular scale dehydration kinetics, a 3D model is developed to quantify the impact of the changes in the cellular structure of apple (parenchyma) cells during dehydration on the tissue sorption isotherm and water permeability. As a step beyond the current state-of-the-art models, the model incorporates the changes in the cellular structure over entire dehydration process, starting from a turgid cell down to the occurrence of (free) shrinkage, plasmolysis (detachment of the cell membrane from the cell wall) or lysis (rupture of the cell membrane). Regarding the tissue sorption isotherm, plasmolysis induced a reduction in the equilibrium water content(up to 60%) compared to the free-shrinkage or lysis cases at the same water activity level. On the other hand, the tissue water permeability was found to increase up to five times when lysis occurs, compared to free shrinkage or plasmolysis. A parametric study also quantified the dependency of tissue permeability on the cell wall thickness, the cell membrane permeability, the cell size and the elongation aspect ratio of the cell. We identified that the dehydrated, shrunken cellular tissue reduces the outgoing water flux compared to fresh tissue for the same water potential gradient. As such, dehydrated tissue forms a barrier against further moisture removal from the fresh tissue below.

Keywords: /Fruit/ /Dehydration/ /Microscale model/ /Water transport/ /Water permeability/ /Sorption isotherm/

AVOCADO

Bowen, J., Billing, D., Connolly, P., Smith, W., Cooney, J., and Burdon J. (2018). Maturity, storage and ripening effects on anti-fungal compounds in the skin of 'Hass' avocado fruit. Postharvest Biology and Technology, 146: 43-50.
DOI: 10.1016/j.postharvbio.2018.08.005

Abstract

Fruit rots are a major risk to the quality of avocado fruit in international trade. For New Zealand-grown 'Hass' fruit, rots become increasingly problematic later in the harvest season. The presence of antifungal compounds, and associated compounds, in avocado fruit skin has been long documented, with much of the research done on fruit of the cultivar 'Fuerte'. In this paper, results are presented from an investigation of the effect of fruit maturity, storage and ripening on the concentration of the antifungal compound persin and compounds associated with its metabolism in the fruit skin of New Zealand grown 'Hass' avocado fruit. The persin concentration decreased markedly during maturation, with a ~ 30% decrease in total persin (the

combined persin and persenone-A), from ~ 600 mg kg−1 at the early harvest to ~ 400 mg kg−1 at the late harvest, approximately 4 months later. The concentration also decreased during storage and ripening, although the degree of change was dependent on the concentration present at harvest. Irrespective of harvest maturity or storage, the concentration of persin in the skin of ripe fruit did not decline below ~ 200 mg kg−1. The epicatechin concentration declined by ~ 17% and catechin by ~ 50% between the early and late harvests. The total (epi)-catechin (the combined epicatechin and catechin monomers, epicatechin dimer B2, and (epi)-catechin oligomers) concentration declined by ~ 20% between the early and late harvests, from ~15.4 g kg−1 to 12.5 g kg−1. The changes with storage and / or ripening were of a smaller magnitude than the change with maturation. Also, the total (epi)-catechins concentration tended to increase slightly during storage. The findings are discussed in the context of the risk of rots in late season New Zealand-grown 'Hass' fruit based on previously described associations between changes in skin composition with fruit rot development.

Keywords: /Antifungal diene/ /Persin/ /Epicatechin/ /Rot/ /Decay/

BANANA

Zhu X., Luo J., Li Q., Li J., Liu T., Wang R., Chen W., and Li X. (2018). Low temperature storage reduces aroma-related volatiles production during shelf-life of banana fruit mainly by regulating key genes involved in volatile biosynthetic pathways. Postharvest Biology and Technology, 68-78.
DOI: 10.1016/j.postharvbio.2018.08.015

Abstract:

Banana fruit is sensitive to chilling injury, which not only causes physical damage but also dramatically reduces fruit flavor. In this work, we evaluated the influence of non-chilling low temperature (NCT, 13 °C) and chilling temperature (CT, 5 °C) storage on volatiles production in banana in comparison to control conditions (20 °C) and evaluated the possible mechanisms. We found that CT storage caused chilling injury, which negatively affected the physical appearance of the fruit and dramatically reduced volatiles production, especially fruity note volatiles, such as esters. In contrast, NCT storage only reduced the production of a few specific volatiles. Both NCT and CT affected volatile-related amino acid and biosynthetic precursors of fatty acid compositions. The expression levels of the volatiles biosynthesis-related genes, MaHPL, MaLOX, and MaAAT, were repressed by low temperature (NCT and CT), particularly chilling temperature, while MaADH and MaPDCwere up-regulated. These results suggest that CT significantly reduces volatiles production by regulating different key enzymes and genes involved in volatiles biosynthetic pathways and is mainly mediated via the repression of the lipoxygenase and amino acid metabolic pathways.

Keywords: Banana/ /Volatiles/ /Low temperature/ /Chilling injury/ /Gene expression/ /Fatty acid/ /LOX pathway

BEANS

Chigwedere, C. M., Humerez Flores, J. N., Panozzo, A., Van Loey, A. M., and Hendrickx, M. E. (2018). Instability of common beans during storage causes hardening: The role of glass transition phenomena. Food Research International.
DOI: 10.1016/j.foodres.2018.12.006

Abstract

Long-term storage of common beans leads to loss of cooking quality and an ill-defined solution, appropriate storage, is recommended. Therefore, the polymer science theory of glasses that hypothesizes stability of a system below its glass transition temperature (Tg) was applied to determine bean stability during storage in relation to cooking behavior. Since composition influences Tg, powders of cotyledons and seed coats in addition to whole beans were equilibrated above different saturated salt solutions in order to generate materials with different moisture contents. A thermal mechanical compression test which measures compressibility changes in a system upon reaching its glass-rubber transition temperature region was conducted to obtain the Tg. A Tg-moisture relation was established, whose relevance was confirmed by storage and cooking experiments which showed development of hard-to-cook in beans stored above Tg but not below it. Therefore, this relation constitutes a stability map for storage of common beans.

Keywords: /Common beans/ /Cotyledons/ /Seed coats/ /Stability/ /Glass transition temperature/ /Moisture content

BLUEBERRY

Lobos, G. A., Bravo, C., Valdés, M., Graell, J., Ayala, I. L., Beaudry, R. M., and Moggia, C. (2018). Within-plant variability in blueberry (Vaccinium corymbosum L.): maturity at harvest and position within the canopy influence fruit firmness at harvest and postharvest. Postharvest Biology and Technology, 146: 26-35.
DOI: 10.1016/j.postharvbio.2018.08.004

Abstract

For blueberry, harvest readiness is based on skin color, with fruit being considered ready to pick when the berry skin reaches 100% blue coverage. The extended bloom period for the blueberry inflorescence and uneven developmental rates can yield fully blue fruit that are widely different in physiological maturity, at any given harvest date. The objective of this study was to determine the inherent variability in the firmness of a synchronized cohort of blueberry fruit and the effects of harvest delay and position within the canopy on fruit characteristics at harvest and after refrigerated storage. During two consecutive seasons, the harvest canopy of ‘Duke’ and ‘Brigitta’ was divided into two regions as east (E) and west (W) sides. Fruit of a specific developmental stage from each side were either harvested when reaching 100% blue coverage (ripe fruit: B100) or allowed to stay on the plant for six additional days (over-ripe fruit: B100+6). Despite the narrow period of time elapsed between harvests of ripe and over-ripe fruit, variation in firmness was extensive, with decreases up to 24%, depending on year and cultivar. The six days of additional development were enough to increase the amount of soft and very soft fruit at harvest and after storage, demonstrating the importance of frequent harvests to improve

firmness at final destinations. Both the percentage of blue fruit at each harvest date and total fruit produced were higher on the E side of the plant. Year-to-year variation in firmness exceeded that caused by the imposed treatment, which highlights the need to understand the environmental factors contributing to fruit softening. This is the first report on in-plant fruit variability for blueberry and its effect on postharvest performance.

Keywords: /Within plant/ /Within canopy/ /Variability/ /Heterogeneity/ /Softening/ /TSS/ /TA/ /Ethylene/ /Respiration/ /Cold storage/

Ortiz, C. M., Franceschinis, F., Grozeff, G. E. G., Chan, H., Labavitch, J. M., Crisosto, C., and Vicente, A. R. (2018). Pre-treatment with 1-methylcyclopropene alleviates methyl bromide-induced internal breakdown, softening and wall degradation in blueberry. Postharvest Biology and Technology, 146: 90-98.
DOI: 10.1016/j.postharvbio.2018.08.018

Abstract

Methyl bromide (MeBr) fumigation is the most common quarantine treatment used to control fruit flies in blueberry. Recent studies suggest that the treatments may increase decay and softening during transport, distribution and retail. We evaluated whether the ethylene action inhibitor 1-methylcyclopropene (1-MCP) could counteract the detrimental effects caused by MeBr. 'Jewel' and 'Emerald' blueberries with 100% surface blue color were harvested and treated with 1-MCP (1 μL L−1 12 h, 4 °C), MeBr (32 g m−3, 3 h, 21 °C), or 1-MCP followed by MeBr. Untreated berries were used as a control. Fruit was stored for 0, 7 or 14 d at 2 °C and internal breakdown, firmness, respiration, weight loss, color, soluble solids, acidity and the total ascorbic acid (AsA), anthocyanin and glutathione (GSH) concentrations were determined. We also assessed pectin solubility by sequential cell wall extraction and neutral sugar composition. MeBr exposure exacerbated internal breakdown and respiration after long-term storage. These effects were significantly reduced by pre-treatment with 1-MCP, indicating that MeBr-induced damage requires ethylene action. 1-MCP application prior to MeBr fumigation also prevented berry softening by delaying solubilization of cell wall uronic acids and galactose. The combination of 1-MCP followed by MeBr caused no detrimental effects on fruit surface color, anthocyanin, weight loss, soluble solids or acidity. MeBr fumigation reduced total GSH concentrations regardless of 1-MCP, indicating that the improved quality retention could not be attributed to the detoxification of the xenobiotic by this compound and was more likely due to inhibition of ethylene-dependent over-ripening and senescence symptoms. Pre-treatment with 1-MCP may be useful to alleviate MeBr-induced deterioration in blueberry.

Keywords: /Quarantine/ /Berries/ /Firmness/ /Cell wall/ /Uronic acid/ /Ascorbic acid/ /Glutathione/

BRASSICACEAE

Šamec, D., Pavlović, I., Radojčić Redovniković, I., and Salopek-Sondi, B. (2018). Comparative analysis of phytochemicals and activity of endogenous enzymes associated

with their stability, bioavailability and food quality in five Brassicaceae sprouts. Food Chemistry, 269: 96–102.
DOI: 10.1016/j.foodchem.2018.06.133

Abstract

Five Brassicaceae sprouts (white cabbage, kale, broccoli, Chinese cabbage, arugula) were comparatively analyzed based on phytochemicals (polyphenols, glucosinolates, carotenoids, chlorophylls, ascorbic acid) content and accompanying enzymes associated with phytochemical stability and bioavailability (peroxidases, myrosinase, and polyphenol-oxidase) that consequently impact food quality. Significantly high content of polyphenols and glucosinolates, as well as a high antioxidant activity were found in white cabbage, followed by kale sprouts. In addition, white cabbage contained higher amount of fibers and lower polyphenol-oxidase activity which potentially indicates prevention of browning and consequently better sprout quality. Arugula and broccoli showed higher activity of myrosinase that may result in higher bioavailability of active glucosinolates forms. According to our data, sprouts are cheap, easy- and fast-growing source of phytochemicals but also they are characterized by different endogenous enzymes activity. Consequently, this parameter should also be taken into consideration in the studies related to the health benefits of the plant-based food.

Keywords: /Brassicaceae sprouts/ /Phytochemicals/ /Antioxidant activity/ /Myrosinase activity/ /Polyphenol-oxidase/

CHILI PEPPER

Jiang, J., Cen, H., Zhang, C., Lyu, X., Weng, H., Xu, H., & He, Y. (2018). Nondestructive quality assessment of chili peppers using near-infrared hyperspectral imaging combined with multivariate analysis. Postharvest Biology and Technology, 146, 147–154.
DOI: 10.1016/j.postharvbio.2018.09.003

Abstract

There is an increasing demand of chili peppers due to their special taste and numerous applications through a number of markets, and high quality is crucial for both producers and customers. This research was aimed to investigate the potential of near-infrared hyperspectral imaging (HSI) for nondestructive quality assessment of chili peppers. Near-infrared HSI in the spectral range of 975–1646 nm was employed to acquire hyperspectral reflectance images of chili peppers. High-performance liquid chromatography and freeze-drying methods were conducted to obtain the reference values of capsaicinoid concentrations and water contents, respectively. Three different variable selection methodswith successive projections algorithm (SPA), competitive adaptive reweighted sampling (CARS) and genetic algorithm-partial least squares (GA-PLS) were performed to remove the redundant information and select the optimal wavelengths. Quantitative models including partial least squares (PLS), extreme learning machine (ELM) and least-squares support vector machine (LS-SVM) were then developed to predict the capsaicinoid concentrations and the water content. The results show that the ELM models combined with the SPA method yielded the best prediction performances for the capsaicin and dihydrocapsaicin concentrations, and the water content, with the highest

correlation coefficients of prediction (RP) of 0.83, 0.80 and 0.93, respectively. Distribution maps of capsaicin and dihydrocapsaicin concentrations for intact and cut chili peppers were obtained. Finally, classification models for discriminating pungent and non-pungent chili peppers with a classification accuracy of 98.0% were developed. The results demonstrate that near-infrared HSI technique is promising for pepper quality assessment.

Keywords: /Chili peppers/ /Near-infrared hyperspectral imaging/ /Capsaicin/ /Dihydrocapsaicin/ /Classification/

CITRUS

Deng, B., Wang, W., Deng, L., Yao, S., Ming, J., and Zeng, K. (2018). Comparative RNA-seq analysis of citrus fruit in response to infection with three major postharvest fungi. Postharvest Biology and Technology, 146, 134–146.
DOI: 10.1016/j.postharvbio.2018.08.012

Abstract

Green mold, blue mold and sour rot caused by Penicillium digitatum, Penicillium italicum and Geotrichum citri-aurantii infections, respectively, are major fungal diseases of citrus fruit. The above-mentioned diseases present a great threat to fruit quality, it is very important to clarify the pathogenicity mechanisms of the pathogens and the resistance mechanism of the host, but the mechanisms remain largely unknown. In this study, RNA sequencing was employed to analyze the gene expression of citrus fruit to P. digitatum, P. italicum and G. citri-aurantiion a genome-wide scale. The results suggest that a total of 4,520, 4785 and 4683 genes of citrus fruit were differentially expressed (P-value < 0.05, ｜Log2 fold change｜≥1) in response to P. digitatum, P. italicum and G. citri-aurantii, respectively. These differentially expressed genes are involved in a variety of stress responses, such as host innate immunity, synthesis of secondary metabolites and hormone-related pathways, etc. Remarkably, the host reactions under different pathogen infections are similar, and the establishment of citrus fruit systemic resistance in response to P. digitatum, P. italicum and G. citri-aurantii is salicylic acid-reliant. Overall, our study presents a genome-wide analysis of the similarities and differences in citrus fruit responses to common fungal pathogens, which is not only beneficial for a better understanding of host-pathogen interactions but also for the development of novel measures for the prevention of common fungal diseases.

Keywords: /Citrus fruit/ /Green mold/ /Blue mold/ /Sour rot/ /Disease resistance/ /RNA sequencing/

DRAGON FRUIT

Vilaplana, R., Alba, P., & Valencia-Chamorro, S. (2018). Sodium bicarbonate salts for the control of postharvest black rot disease in yellow pitahaya (Selenicereus megalanthus). Crop Protection, 114, 90–96.
DOI: 10.1016/j.cropro.2018.08.021

Abstract

Black rot caused by Alternaria alternata in yellow pitahaya (Selenicereus megalanthus) is a significant postharvest disease that is difficult to control. Sodium bicarbonate (SBC) treatments were tested in order to incorporate them into an integrated disease managementprogram and to reduce postharvest use of synthetic fungicide. The control of black rot on fruit treated with 298 mM (2.5%) sodium bicarbonate (SBC) was superior to that resulting from other SBC treatments on fruit examined after 21 d at 12 °C plus 5 d of shelf-life at 20 °C. Treatment with 298 mM reduced weight loss, retained color and firmness, slowed changes in total soluble solids, titratable acid content, and pH of yellow pitahaya during storage and shelf-life. After storage, the general appearance of fruit treated with 298 mM SBC was significantly better than that of those treated with imazalil or non-treated fruit. Treatment with 298 mM SBC is potentially useful in controlling postharvest black rot in yellow pitahaya without harming its sensory quality.

Keywords: /Alternaria alternata/ /GRAS compounds/ /Disease control/ /Sensory quality/ /Shelf-life/

FEIJOA

Henao, A., Quintanilla-Carvajal, M. X., and Moreno, F. L. (2018). Combination of freeze concentration and spray drying for the production of feijoa (Acca sellowiana b.) pulp powder. Powder Technology.
DOI: 10.1016/j.powtec.2018.12.015

Abstract

Feijoa (Acca sellowiana B.) is a fruit harvested in South America that is characterized by its nutritional value, high pectin content and high trading potential. In this study, freeze concentration was combined with spray drying to produce feijoa powder. Freeze concentration technology is proposed as a step prior to spray drying to increase the solid concentration and to avoid the feijoa gelation process. The drying parameters were optimized by studying the inlet air temperature (180, 195 and 210 °C), maltodextrin concentration (7, 16 and 25%) and atomizer system (two-fluid nozzle or rotary disk) on a pilot scale spray dryer. The process yield, moisture content, water activity, hygroscopicity, solubility, particle size, bulk and tapped density and colour preservation were determined. The freeze concentration technique allowed the solid content to increase without causing gelation and with low differences in colour. Statistical analysis showed that the maltodextrin concentration significantly affected all the response variables after spray drying. In addition, the temperature affected the solute yield and particle size. The optimum spray drying conditions to obtain feijoa pulp powder were 22.64% maltodextrin concentration, 180 °C inlet air temperature and nozzle as the atomizer system. At these optimum conditions, feijoa pulp powder with a 26.6% process yield, 6.5% (wb) moisture content, 20.7% hygroscopicity, 0.16 water activity, 92.8% solubility and ΔE of 27.71 were obtained. The combination of freeze concentration and spray drying allowed the production of fruit pulp powders from sensitive or gelled fruit pulps.

Keywords: /Spray drying/ /Fruit powder/ /Optimization/ /Freeze concentration/ /Gelation/

FREEZE DAMAGE

Jha, P. K., Xanthakis, E., Chevallier, S., Jury, V., and Le-Bail, A. (2018). Assessment of freeze damage in fruits and vegetables. Food Research International.
DOI: 10.1016/j.foodres.2018.12.002

Abstract

Freezing is an efficient and widely used method of food preservation. However, it can also cause irreversible damages at cellular level which in turn degrade the overall quality of the frozen food products. Therefore, qualitative and quantitative methods and technologies that will be able to evaluate with accuracy the freeze damage are of great importance. This review paper provides a comprehensive study of the methods that have been used to evaluate the freeze damage in fruits and vegetables. Further than the principles and the applications of those methods, the advantages and the limitations are also being discussed
Keywords: /Freezing/ /Freeze damage assessment methods/ /Fruits/ /Vegetables/

FRESH CUT-PRODUCE

Bornhorst, E. R., Luo, Y., Park, E., Vinyard, B. T., Nou, X., Zhou, B., Turner, E., and Millner, P. D. (2018). Immersion-free, single-pass, commercial fresh-cut produce washing system: An alternative to flume processing. Postharvest Biology and Technology, 146: 124–133.
DOI: 10.1016/j.postharvbio.2018.08.008

Abstract

Fresh-cut vegetable processing in the USA typically involves submerging produce in chlorinated water that is often reused and re-circulated. However, this washing practice is water and chemical intensive and subject to rapid decreases in free chlorine concentration, which may increase the probability of water mediated microbial cross-contamination. An immersion-free, single-pass produce washing system was recently developed to address these challenges by over-head spraying clean (retreated) water, rather than spent wash water. The objective of this study was to compare single-pass and flume systems during commercial processing of fresh-cut vegetables in terms of wash water physicochemical and microbiological quality and cut produce microbiological and sensorial quality. Two products, shredded iceberg lettuce and diced cabbage, were selected; processes were evaluated for each product on three separate days. Wash water and produce were sampled every 30 min during production for 2.7 h. Water that was used to wash the produce was collected from representative locations in the single-pass (input water, pre-wash, cutter, incline wash, vibra-wash) and flume (flume A, flume A catch tank, flume B, flume B catch tank) systems. Physicochemical (free chlorine, total chlorine, pH, total dissolved solids (TDS), chemical oxygen demand (COD), turbidity) and microbial analyses (aerobic plate count (APC)) were conducted on the wash water samples. Produce samples collected after cutting and after washing were analyzed onsite for APC immediately after collection. Final packaged products were analyzed weekly for sensorial quality (visual, olfactory, overall acceptability) during three weeks of storage at 1 °C by a trained panel using a 9-point hedonic scale. Results show that the organic load indicators in wash water samples from the

single-pass system were consistent over time for most sampling locations, with no statistically significant increases in turbidity, TDS, or COD during production. In contrast, the organic load indicators in wash water samples from the flume system increased significantly during production by 13–45 NTU h−1 for turbidity, 382–1094 mg L−1 h−1 for TDS, and 597–2772 mg L−1 h−1 for COD. For the single-pass system, the wash water from the cutter had the largest APC of 3.8–4.2 log CFU/100 mL and the highest values of organic load indicators (152–186 NTU for turbidity, 623–904 mg L−1 for TDS, and 4420–4673 mg L−1 for COD) compared to the wash water from all the other processing stages (input water, pre-wash, incline, vibra-wash), which ranged from <0.6–2.4 log CFU/100 mL for APC, 0.3–97 NTU for turbidity, 245–471 mg L−1 for TDS, and 62–1942 mg L−1 for COD. There were no significant differences ($p > 0.05$) in APC between the single-pass and flume washed product samples; APC on the final product samples ranged from 3.2 to 3.4 log CFU g−1 for lettuce and 3.9–4.1 log CFU g−1 for cabbage. Panelists rated the quality of the products washed using the single-pass system as comparable to those washed using the flume system within the first two weeks and slightly better after three weeks of storage. Results from this study could be used by the produce industry to further optimize the single-pass system and develop additional processing innovations to improve the safety, efficacy, economics, and environmental impacts of produce washing systems.

Keywords: /Post-harvest washing/ /Wash water/ /Sensory quality/ /Lettuce/ /Cabbage/ /Chlorine/

GRAPES

Admane, N., Genovese, F., Altieri, G., Tauriello, A., Trani, A., Gambacorta, G., Verrastro, V., and Di Renzo, G. C. (2018). Effect of ozone or carbon dioxide pre-treatment during long-term storage of organic table grapes with modified atmosphere packaging. LWT, 98, 170–178.
DOI: 10.1016/j.lwt.2018.08.041

Abstract

The aim of this study was to maintain the quality of organic table grapes extending its shelf-life during long-term storage by using organic approved methods. The effectiveness of pre-treatments with different concentrations of O3 (5, 10, 20 μL L−1) or CO2 (50%, 70%) followed by storage under modified atmosphere packaging (2%O2 __ 5%CO2) were evaluated on late-season organic Scarlotta table grapes as alternatives to the usual commercial SO2application. The main quality attributes as mass loss, decay incidence, rachis chlorophyll content, antioxidant activity, phenolic compounds and acetaldehyde content, were measured at harvest and after 15, 30, 45 days of cold storage (0 °C) under simulated shipping conditions and one week of shelf-life (15 °C). The O3 at 20 μL L−1 controlled the concentration of acetaldehyde, preserved rachis chlorophyll content and skin colour; in addition, the cumulative decay incidence was reduced compared to untreated samples, however, CO2 caused organoleptic quality loss with strong stem browning and perceived off-flavours; moreover, it was effective to preserve the initial sensory quality and to control the decay. The results encourage the use of this alternative approach treatment in other cultivars and under commercial conditions.

Keywords: /Quality loss/ /Organic table grapes/ /Decay control/ /SO2 alternative/ /Shelf-life/

KIWIFRUIT

Ashouri Vajari, M., Fatahi Moghadam, J., and Eshghi, S. (2018). Influence of late season foliar application of urea, boric acid and zinc sulfate on nitrogenous compounds concentration in the bud and flower of Hayward kiwifruit. Scientia Horticulturae, 242: 137–145.
DOI: 10.1016/j.scienta.2018.07.029

Abstract

Proper management of late season mineral nutrition and improving nitrogenous reserves in kiwifruit vines can result in efficient growth and yield in the following season. This experiment investigated the influence of late season foliar application type and time on the content of total nitrogen, total protein, total free amino acid, and individual amino acids of bud and flower and consequently vegetative and reproductive growth of Hayward kiwifruit in next spring. The orchard was located in Vajargah, Guilan province, Iran, with an average annual rainfall and temperature 1147 mm and 15.7 °C, respectively. Foliar application of mineral nutrients included urea (0.25%, 0.5% and 1%), zinc sulfate (1000, 1500 and 2000 mg l−1) and boric acid (500, 1000 and 1500 mg l−1) alone and in combined treatments as urea (0.25%) + H3BO3 (500 mg l−1) + ZnSO4 (1000 mg l−1); urea (0. 5%) + H3BO3 (1000 mg l−1) + ZnSO4 (1500 mg l−1); urea (1%) + H3BO3 (1500 mg l−1) + ZnSO4 (2000 mg l−1). The experimental treatments were conducted in 8 years old kiwifruit vines in late growing season. To determine appropriate time for late season foliar application, fertilization was performed in middle September, early and late October, 96, 75 and 54 days before the beginning of the winter dormancy, respectively. Samples were taken from buds at two stages: before leaf abscission and again during dormancy. Flower sampling was taken at the full bloom stage. Results indicated that 33.65 and 35.75 percentages of increases in dormant bud and flower nitrogen concentrations were achieved by combined foliar application of urea (1%), zinc sulfate (2000 mg l-1) and boric acid (1500 mg l-1) compared to control vines. Moreover, urea (1%) + H3BO3 (1500 mg l−1) + ZnSO4 (2000 mg l−1) treatment increased total protein, free amino acid and most individual amino acid concentration in analyzed tissue, however this significantly consistent elevation in almost all measured parameters was not found in other fertilization treatments. Interestingly, this treatment improved 14.51% leaf area and 22.21% fruit seed number in next growing season compared to control vines. Considering all measured parameters, late October was the best late season foliar application time. Based on our findings, late season mineral foliar application, especially urea (1%) + H3BO3 (1500 mg l−1) + ZnSO4 (2000 mg l−1), in late October can improve all nitrogenous compounds concentration in bud and flower tissues, as well as increase seed number and consequently fruit weight and grower income in the next growing season.

Keywords: /Amino acid/ /Boric acid/ /Fertilization/ /Protein/ /Urea/ /Zinc sulfate/

LETTUCE

Garcia, C. J., Gil, M. I., and Tomas-Barberan, F. A. (2018). LC–MS untargeted metabolomics reveals early biomarkers to predict browning of fresh-cut lettuce. Postharvest Biology and Technology, 146: 9-17.
DOI: 10.1016/j.postharvbio.2018.07.011

Abstract

A complete untargeted metabolomics study was developed to identify biomarkers related to the browning of fresh-cut lettuce which is the main cause of quality loss. For this purpose, UPLC-MS-QTOF analysis was optimized to explore the metabolome of 30 selected cultivars of romaine lettuce with different browning susceptibility harvested at three different harvest dates. Different multivariate analyses and statistics software, such as Agilent Mass Profiler Professional (MPP), SIMCA and The Unscrambler, were used for the selection of entities correlated with browning induced after cutting and storage. A group of metabolites that were identified through the analysis of different databases and comparison with authentic standards when available, highly correlated with browning measured by image analysismeasuring Hue angle difference between day 0 and day 5 of storage at 7 °C. A Multiple Linear Regression (MLR) model combined entities matrix and browning. At day 0 the metabolites that correlated positively ($P \leq 0.01$) with browning development at day 5 were caffeoylquinic acid and 3-hydroxy-tetradecadienoic acid while ferulic acid methyl ester and 2-O-p-hydroxyphenyl-6-O-galloyl glucose correlated negatively ($P \leq 0.01$). This study also confirmed the involvement of different types of metabolites (phenolic compounds, lipids and, terpenes) in the development of browning. A ratio ferulic acid methyl ester/caffeoylquinic acid at time 0 was able to predict browning after 5 days of storage in 70% of the cases.

Keywords: /UPLC-ESI-QTOF-MS/ /Multivariate data analysis/ /Phenolic metabolism/ /Quality/

Fu, T. J., Li, Y., Awad, D., Zhou, T. Y., & Liu, L. (2018). Factors affecting the performance and monitoring of a chlorine wash in preventing Escherichia coli O157:H7 cross-contamination during postharvest washing of cut lettuce. Food Control, 94, 212–221.
DOI: 10.1016/j.foodcont.2018.06.035

Abstract

This study examined factors that may affect the performance of a produce wash in preventing E. coli O157:H7 cross-contamination. Fresh-cut romaine lettuce (8 or 20 g) inoculated with ca. 7 log CFU/g of E. coli O157:H7 expressing green fluorescence protein was washed with uninoculated cut lettuce (800 or 2000 g) in 40 L of water for 2 min. Washing trials were performed in both sterile tap water and spent wash water collected from a commercial leafy greens processing facility under different prewash free chlorine levels (0, 5, 20 and 30 ppm), water temperatures (3 and 20 °C), leaf-to-water ratios (1:20 and 1:50), and flow rates (fast, medium, and slow). Performance of the chlorine wash was greatly affected by free chlorine level and wash water quality. Temperature, lettuce-to-water ratio, or water flow rate did not appear to have a significant impact. A prewash free chlorine concentration of 10 or 20 ppm was effective

in preventing E. coli O157:H7 cross-contamination when lettuce was washed in tap water in the two washing systems assembled; 30 ppm of chlorine was needed to prevent cross-contamination during washing in industry water. Small-scale (100 ml) inactivation studies were performed to examine the impact of organic and solid contents (with the addition of lettuce juice and play sand) on the antimicrobial efficacy of chlorinated water. Increases in organic matter resulted in greater depletion of chlorine and the presence of solids enabled the pathogen to better survive chlorination; both led to a lower antimicrobial efficacy observed. ORP did not correlate linearly with free chlorine. E. coli O157:H7 cross-contamination was observed when ORP exceeded 650 mV, indicating that a threshold level of 650 mV may not ensure the safety of produce wash water. Since effective chlorine level is highly influenced by wash water quality, monitoring of produce washing systems may best be performed by measuring wash water quality in conjunction with rapid measurement of free chlorine.

Keywords: /E. coli O157:H7/ /Fresh-cut lettuce/ /Postharvest washing/ /Chlorine/ /Wash water management/ /Oxidation reduction potential/

LONGAN

Lin Y., Chen M., Lin H., Lin M., Hung Y.-C., Lin Y., Chen Y., Wang, H., and Ritenour M.A. (2018). Phomopsis longanae-induced pericarp browning and disease development of longan fruit can be alleviated or aggravated by regulation of ATP-mediated membrane lipid metabolism. Food Chemistry, 269: 644-651.
DOI: 10.1016/j.foodchem.2018.07.060

Abstract

Compared to P. longanae-inoculated longan fruit, DNP-treated P. longanae-inoculated longans displayed higher fruit disease index, pericarp browning index and cell membrane permeability. Moreover, they exhibited higher activities of phospholipase D, lipase and lipoxygenase, lower amounts of phosphatidylcholine, phosphatidylinositol and USFA (unsaturated fatty acids) as well as higher amounts of phosphatidic acid and SFA (saturated fatty acids). Additionally, lower ratio of USFA to SFA and USFA index were shown in DNP-treated P. longanae-inoculated longans. However, ATP-treated P. longanae-inoculated longans exhibited the opposite results. These findings indicated that DNP stimulated longan pericarp browning and disease development caused by P. longanae resulted from the increases in activities of membrane lipids-degrading enzymes, promoting degradation of membrane phospholipids and USFA, and disruption of membrane structural integrity. Whereas, the opposite results observed in ATP-treated P. longanae-inoculated longans were due to the reduction in activities of membrane lipids-degrading enzymes and the maintenance of membrane structural integrity.

Keywords: /Longan/ /Phomopsis longanae Chi/ /Disease development/ /Pericarp browning/ /Membrane lipids metabolism/ /Cellular membrane permeability/ /Adenosine triphosphate (ATP)/ /2,4-Dinitrophenol (DNP)/

MANGO

Meindrawan, B., Suyatma, N. E., Wardana, A. A., and Pamela, V. Y. (2018). Nanocomposite coating based on carrageenan and ZnO nanoparticles to maintain the storage quality of mango. Food Packaging and Shelf Life, 18: 140–146.
DOI: 10.1016/j.fpsl.2018.10.006

Abstract

Mango is a tropical fruit which is one of major export commodities of Indonesia. During the distribution and storage, mango is potentially susceptible to both physical and biological deterioration. In this study, a coating method is applied to reduce quality loss of mango. Mango was coated by conventional carrageenan coating in combination with ZnO nanoparticles (0, 0.5, and 1% by weight of carrageenan) as filler. The results revealed that the elongation parameter of the carrageenan/ZnO nanoparticles (CZ) nanocomposite film are not significantly increase compared to that of carrageenan film, while the tensile strength increased and water vapor transmission rate decreased significantly. The incorporation of ZnO nanoparticles transformed the ordinary carrageenan coating to have antimicrobial properties against Escherichia coli as well. Finally, these qualities exhibited by the CZ 1 coatings could maintain the shelf life of fresh whole fruit of mango.

Keywords: /Carrageenan/ /Coating/ /Mango/ /Nanocomposite/ /ZnO nanoparticles/

NUTS

Gama, T., Wallace, H. M., Trueman, S. J., and Hosseini-Bai, S. (2018). Quality and shelf life of tree nuts: A review. Scientia Horticulturae. 242: 116-126.
DOI: 10.1016/j.scienta.2018.07.036

Abstract

The global market for tree nuts is growing rapidly with trade in excess of $US32 billion annually. Tree nuts have a high oil content and fatty acid composition that can render them susceptible to oxidative rancidity and rapid deterioration. In spite of their global importance, there is limited information on optimal storage conditions and shelf lives of many species of tree nut. This review explores current knowledge of the major factors that influence the shelf life of tree nuts. Storage conditions greatly influence the quality and shelf life of tree nuts. Tree nut species differ in their storage requirements because of their varying oil and fatty acid compositions. In general, nuts with high levels of monounsaturated fatty acids are more stable and less susceptible to oxidative rancidity than nuts containing high levels of polyunsaturated fatty acids. Temperatures ranging from 4 to 15 °C, kernel moisture content around 2.5%, relative humidity of about 40–60%, oxygen concentration less than 2.5%, and dark conditions are ideal storage conditions for most tree nuts. Harvesting time, cultivar and storage of nuts either as nut-in shell or as kernel also affect the quality and shelf life of nuts. There is a need for tree-nut industries to derive universal rancidity indicators for quality control. Optimised storage conditions will provide the best nutritional quality and health benefits of tree nuts for consumers.

Keywords: Almond/ /Cashew/ /Kernel/ /Lipid oxidation/ /Nut oil/ /Nut storage/ /Nut quality/ /Oxidative stability/ /Rancidity/ /Walnut

OKRA

Gundewadi, G., Rudra, S. G., Sarkar, D. J., and Singh, D. (2018). Nanoemulsion based alginate organic coating for shelf life extension of okra. Food Packaging and Shelf Life, 18: 1–12.
DOI: 10.1016/j.fpsl.2018.08.002

Abstract

Okra holds major share of domestic and export vegetable market, but has a short shelf life owing to desiccation and fungal spoilage. Alginate coating containing nanoemulsified basil (Ocimum basilicum. L) oil was attempted for maintaining its postharvest quality and preventing spoilage. O/W nanoemulsion was prepared by using basil oil with synthetic surfactant and a naturally sourced surfactant: Tween 20 and aqueous extract of Sapindus mukorossi using ultrasonication respectively. Alginate coatings with basil oil nano-emulsified with Tween 20 (ATNE) and Sapindus extract (ASNE) were compared for their effect on PLW (Physiological loss in weight), colour, texture and acceptability of okra pods stored at 5 ± 1 °C and 24 ± 2 °C. Coatings were able to retard loss of moisture, colour and firmness during storage. Compared to 10.05% weight loss in uncoated pods (control), PLW in ASNE and ATNE was recorded as 7.38% and 8.32% respectively after 4 days of cold storage. Increase in L* value during storage was 26.39% for control pods compared to 14.98% in coated pods. a* value and browning index revealed better effectiveness of ASNE coating for colour retention during storage. Developed formulations were found effective against spoilage fungi Penicillium chrysogenum and Aspergillus flavus. Effective concentration for 50% inhibition of pathogens was determined using probit analysis. EC50 values were lower for sapindusemulsified basil oil over Tween 20 based nano-emulsion. In vivo trials on okra inoculated with Penicillium chrysogenum and Aspergillus flavus yielded promising results. Thus alginate coating with basil oil nano-emulsified with Sapindus extract can emerge as a promising non-chemical approach towards extending postharvest quality and shelf life of okra.

Keywords: /Sapindus/ /Basil/ /Nanoemulsion/ /Antimicrobial/ /Shelf life/ /Okra/

PEAR

Sardella, D., Gatt, R., and Valdramidis, V. P. (2018). Modelling the growth of pear postharvest fungal isolates at different temperatures. Food Microbiology, 76: 450-456.
DOI: 10.1016/j.fm.2018.07.010

Abstract

The effect of temperature on the mycelium growth kinetics of four postharvest fungal isolates (i.e., Penicillium expansum, Alternaria alternata, Botrytis cinerea and Rhizopus stolonifer) was assessed. A cardinal model with inflection (CMI) was used to describe the effect of the temperature on the growth rate (μ) and the lag time (λ) of each isolate. Cardinal temperature values such as Tmin, Tmax and Topt were estimated and isolates were sorted according to their

growth rate and lag time duration. Additionally, model validation was performed on a medium prepared from mashed pear pulp and on artificially wound-inoculated pear fruits. P. expansum was shown to be the most psychotrophic fungus with the lowest estimated Tmin = −8.78. Model validation on pear pulp agar showed growth rate over-prediction in the case of R. stolonifer and B. cinerea but a good correlation in the case of P. expansum and A. alternata. In vivo experiments on pear fruits showed discrepancies from the synthetic and the simulated counterparts for all the fungi with the only exception of P. expansum.

Keywords: /Postharvest/ /CMI/ /Pears/ /Nutrients/ /Predictive mycology/

Hendges, M. V., Neuwald, D. A., Steffens, C. A., Vidrih, R., Zlatic, E., and Talamini do Amarante, C. V. (2018). 1-MCP and storage conditions on the ripening and production of aromatic compounds in Conference and Alexander Lucas pears harvested at different maturity stages. Postharvest Biology and Technology, 146: 18-25.
DOI: 10.1016/j.postharvbio.2018.08.006

Abstract

The objective of this investigation was to evaluate the quality parameters and aroma profiles of Conference and Alexander Lucas pears after 7 months of storage. Fruits of both cultivarswere harvested at two different maturity stages and stored under cold (CS) (20.9 kPa O2 + <0.04 kPa CO2), controlled atmosphere (CA) (2 kPa O2 + <0.7 kPa CO2) and ultra-low oxygen condition (ULO) (0.7 kPa O2 + <0.7 kPa CO2). CS and CA storage also included treatment with 1-methylcyclopropene (1-MCP) at 300 nL L−1. After seven months of storage at 0 ± 0.1 °C and 94 ± 2% RH plus seven days at 20 ± 2 °C and 60 ± 5% RH, fruits were evaluated for flesh firmness, peel color ('hue' angle = h°), soluble solids content (SSC), titratable acidity (TA), respiratory rate, ethylene production rate, and production of aromatic compounds. Fruits of both cultivars from the first maturity stage treated with 1-MCP did not develop a buttery texture or yellow color and produced significantly less alcohols and esters. A combination treatment (1-MCP + CA) most severely suppressed aroma development, particularly in the Conference cultivar. ULO storage also reduced yellowing, ethylene production and the development of aromatic compounds in both cultivars from the first maturity stage, but this reduction was less pronounced than that observed for 1-MCP treatments. The production of aromatic compounds was lower in fruits from ULO, regardless of their maturity stage. Fruits from the second harvest treated with 1-MCP had significantly more aromatic compounds than did those from the first harvest. In general, the CA condition has no effect on the ripening and production of aromatic compounds in both cultivars compared to CS.

Keywords: /Pyrus communis/ /Cultivar/ /Ethylene/ /Controlled atmosphere/ /Volatile/

PLUMS

Kritzinger, I., Theron, K. I., Lötze, G. F. A., and Lötze, E. (2018). Peel water vapour permeance of Japanese plums as indicator of susceptibility to postharvest shriveling. Scientia Horticulturae, 242: 188–194.
DOI: 10.1016/j.scienta.2018.07.033

Abstract

Moisture loss and postharvest shrivelling of some Japanese plum cultivars result in significant financial losses in the South African stone fruit industry. Even though fruit are stored at optimal temperatures and packaging solutions are implemented to reduce shrivel, the incidence of shrivel is still unacceptably high in susceptible cultivars. Fruit peel water vapour permeance (PH2O) can be calculated to determine the proneness of a cultivar to moisture loss. Knowledge of the status of the PH2O prior to harvest and the variation between cultivars, orchards and seasons could indicate whether newly developed cultivars are prone to postharvest shrivel. This could assist in determining the optimum handling protocols for susceptible cultivars to reduce potential moisture loss. The PH2O of various cultivars were determined during 2015/16 and 2016/17. In addition, to establish whether a relationship exists between postharvest fruit moisture loss and shrivel, weight loss and shrivel incidence was recorded on individual fruit of the cultivars Sapphire, Laetitia and African Delight™ during 2016/17. PH2O varied between seasons, cultivars and orchards. In 'African Rose', 'Ruby Sun' 'Ruby Star' and 'Sapphire', high PH2O corresponded with known shrivel susceptibility. 'Songold', 'Fortune' and 'Angeleno' are not prone to shrivel and these cultivars had a low PH2O. However, 'Laetitia' and 'African Delight™' had low PH2O, even though both cultivars are prone to shrivel. Pre-harvest moisture loss and PH2O could therefore not be used to predict shrivel susceptibility successfully for evaluated cultivars.

Keywords: /Maturity/ /Moisture loss/ /Prunus salicina Lindl./ /Weight loss/

POMEGRANATE

Belay, Z. A., Caleb, O. J., Mahajan, P. V., Fröhling, A., and Opara, U. L. (2018). A simplex lattice design to optimise active modified atmosphere for storing pomegranate (cv. Wonderful) arils: Part 1, determining optimum gas for physiological responses. Biosystems Engineering.
DOI: 10.1016/j.biosystemseng.2018.11.008

Abstract

Feijoa (Acca sellowiana B.) is a fruit harvested in South America that is characterized by its nutritional value, high pectin content and high trading potential. In this study, freeze concentration was combined with spray drying to produce feijoa powder. Freeze concentration technology is proposed as a step prior to spray drying to increase the solid concentration and to avoid the feijoa gelation process. The drying parameters were optimized by studying the inlet air temperature (180, 195 and 210 °C), maltodextrin concentration (7, 16 and 25%) and atomizer system (two-fluid nozzle or rotary disk) on a pilot scale spray dryer. The process yield, moisture content, water activity, hygroscopicity, solubility, particle size, bulk and tapped density and colour preservation were determined. The freeze concentration technique allowed the solid content to increase without causing gelation and with low differences in colour. Statistical analysis showed that the maltodextrin concentration significantly affected all the response variables after spray drying. In addition, the temperature affected the solute yield and particle size. The optimum spray drying conditions to obtain feijoa pulp powder were 22.64%

maltodextrin concentration, 180 °C inlet air temperature and nozzle as the atomizer system. At these optimum conditions, feijoa pulp powder with a 26.6% process yield, 6.5% (wb) moisture content, 20.7% hygroscopicity, 0.16 water activity, 92.8% solubility and ΔE of 27.71 were obtained. The combination of freeze concentration and spray drying allowed the production of fruit pulp powders from sensitive or gelled fruit pulps.

Keywords: /Spray drying/ /Fruit powder/ /Optimization/ /Freeze concentration/ /Gelation/

Belay, Z. A., Caleb, O. J., Mahajan, P. V., Fröhling, A., and Opara, U. L. (2018). A simplex lattice design to optimise active modified atmosphere for storing pomegranate (cv. Wonderful) arils: Part II, determining optimum gas for maintaining quality attributes. Biosystems Engineering.
DOI: 10.1016/j.biosystemseng.2018.11.009

Abstract

A simplex lattice mixture design approach was introduced to select and identify optimum gas composition for individual quality attributes of pomegranate arils stored at 10 °C for 9 days. The partial pressure of O2, CO2 and N2 were chosen as factors and visual quality, physicochemical attributes, antioxidant properties and volatile organic compounds (VOCs) were taken as response variables. Special cubical models were generated for the response variables and seven interactive terms were selected. Based on coefficients of model parameter estimates (β1,β2,β3,β12,β13,β23 and β123) and ternary contour plots, the component interaction of O2, CO2 and N2 were characterised. Single gas components had a synergetic effect on all response variables, however, binary and ternary interaction effects of gases varied across the responses. CO2 was the most important factor affecting visual colour, instrumental texture and VOCs (Aldehydes, Ketones Monoterpenes). Oxygen played a significant role towards colour attributes, organic acid, promoted surface decay and stimulated alcohol VOCs. Variability of optimum gas mixtures for individual quality parameters was observed, where maximizing the concentrations of the individual sugars, organic acids, TSS, and colour were achieved by using a gas mixture of (6–7 kPa O2 + 7–8 kPa CO2 + 82–90 kPa N2). Maximum release of volatiles responsible for characteristic flavour of the arils was achieved using (2 kPa O2 + 18 kPa CO2 + 80 kPa N2). The results showed that the predicted global optima for maximizing the quality parameters of pomegranate arils under modified atmosphere (MA) condition was close to the experimental values.

Keywords: /Active modified atmosphere/ /Individual sugars/ /Antioxidants/ /Volatile organic compounds/ /Mixture design/

POTATO

Liu, X., Lu, Y., Yang, Q., Yang, H., Li, Y., Zhou, B., Li, T., Gao, Y., and Qiao, L. (2018). Cod peptides inhibit browning in fresh-cut potato slices: A potential anti-browning agent of random peptides for regulating food properties. Postharvest Biology and Technology, 146: 36-42.
DOI: 10.1016/j.postharvbio.2018.08.001

Abstract

Enzymatic browning is a major industrial problem of fresh-cut vegetables and fruits. Bioactive peptides are safe, nutritive and low-cost sources of antioxidant and antimicrobial agents. However, there has been little research on the effect of random peptides on anti-browning of fresh-cut food. For developing more natural and nutritive anti-browning agents, the effect of the enzymatic hydrolysis of random peptides from cod fish skin on polyphenoloxidase (PPO), peroxidase (POD), phenylalanine ammonia-lyase (PAL), total phenolic content, membrane permeability, malondialdehyde (MDA) content and color changes were investigated during fresh-cut potato storage. The results showed that 0.1% (w/w) cod peptides efficiently blocked enzymatic browning by inhibiting PPO, POD and PAL activities, reducing the total phenol accumulation during the entire 8 d storage at 4 °C. Furthermore, the membrane permeability and MDA content increases were delayed in 0.1% cod peptides treatment compared with the control. Oddly, the browning of fresh-cut potato was aggravated in 1.0% cod peptides treatment, which expressed higher POD and PAL activities. Meanwhile, the functional composition of cod peptides was a random component, which total 1765 peptides were identified by LC–MS/MS and the amino acids length of peptides were 4~57 in the cod peptides. All the results showed that random peptides might be promising candidates as anti-browning agents for fresh-cut potato slices.

Keywords: /Cod peptides/ /Fresh-cut/ /Potato slices/ /Anti-browning/

SOYBEAN

Syukri, D., Thammawong, M., Naznin, H. A., Kuroki, S., Tsuta, M., Yoshida, M., and Nakano, K. (2018). Identification of a freshness marker metabolite in stored soybean sprouts by comprehensive mass-spectrometric analysis of carbonyl compounds. Food Chemistry, 269: 588–594.
DOI: 10.1016/j.foodchem.2018.07.036

Abstract

The objective of this study was to identify metabolites that quantitatively indicate degrees of freshness of soybean sprouts. Self-cultivated soybean sprouts were stored at 5 °C, 10 °C or 20 °C, and respiratory CO2 production rates were monitored using gas chromatography during storage. Carbonyl compounds (CCs) were analyzed comprehensively using mass-spectroscopic metabolomics analyses. CCs were derivatized using dansyl hydrazine (DH) and were then analyzed using high performance liquid chromatography-electrospray ionization tandem mass spectrometry (HPLC-MS/MS) with multiplexed multiple reaction monitoring (MRM). In the MRM chromatogram, 171 to 358 peaks were observed from stored soybean sprouts. Principle component analysis and discriminant analysis (PCA-DA) selected the CC-DH derivative ion with a m/z 512 at a retention time of 9.34 min as the most significant metabolite. Searching online metabolomics databases and matching fragment patterns of product ion mass spectra of an authentic standard revealed abscisic acid is a freshness marker of soybean sprouts.

Keywords: /Abscisic acid/ /Carbonyl compound/ /Freshness assessment/ /Metabolomics/ /Soybean sprouts/

SWEET POTATO

Xing, K., Li, T. J., Liu, Y. F., Zhang, J., Zhang, Y., Shen, X. Q., Li, X. Y., Miao, X. M., Feng, Z. Z., Peng, X., Li, Z. Y., and Qin, S. (2018). Antifungal and eliciting properties of chitosan against Ceratocystis fimbriata in sweet potato. Food Chemistry, 268: 188–195.
DOI: 10.1016/j.foodchem.2018.06.088

Abstract

The inhibitive effects of chitosan on black rot disease caused by Ceratocystis fimbriata in sweet potato tuber root (TR) were evaluated. The results demonstrated that chitosan effectively inhibited the mycelial growth and spore germination of C. fimbriata and directly led to the cell necrosis. Chitosan altered the chitin deposition and influenced the fatty acid composition of C. fimbriata. The application of chitosan effectively controlled the C. fimbriatadevelopment in sweet potato TRs 17 days of storage 25 °C. Phenylalanine ammonia lyase (PAL) and superoxide dismutase (SOD) activity were clearly enhanced by the chitosan treatment, while the malondialdehyde (MDA) production was not increased. These findings suggest that chitosan effectively controlled the infection of C. fimbriata in sweet potato TRs owing to its antifungal and eliciting properties, which induced some defense responses during storage.

Keywords: /Ceratocystis fimbriata/ /Sweet potato/ /Chitosan/ /Antimicrobial/ /Postharvest/

TOMATO

Macías-Rubalcava, M. L., Sánchez-Fernández, R. E., Roque-Flores, G., Lappe-Oliveras, P., and Medina-Romero, Y. M. (2018). Volatile organic compounds from Hypoxylon anthochroum endophytic strains as postharvest mycofumigation alternative for cherry tomatoes. Food Mirobiology, 76: 363-373.
DOI: 10.1016/j.fm.2018.06.014

Abstract

The antifungal activity and chemical composition of the volatile organic compounds (VOCs) produced by four Hypoxylon anthochroum endophytic strains were analyzed. The bioactivityof the VOCs synthesized at different periods of incubation on rice medium was assessed, both in vivo and in vitro, against the phytopathogen Fusarium oxysporum. The in vivo effect was evaluated on cherry tomatoes, while the mechanism of action was determined in vitroanalyzing the phytopathogen's growth, respiration and cell membrane permeability. In general, the VOCs from all strains and incubation periods significantly inhibited the growth of F. oxysporum on cherry tomatoes with percentages over 50%. They significantly inhibited the pathogen growth and respiration, and altered the cell membrane permeability and hyphal morphology. The chemical composition was analyzed after solid phase microextraction. In total, 36 VOCs were identified in the four strains, mainly sesquiterpenes and monoterpenes. Among the

monoterpenes, eucalyptol had the highest fiber affinity (>60% area) in three of the four strains studied; thus, it could be considered as a chemical marker for H. antochroum. Chemical markers are important for the identification and differentiation of species. The H. anthochroum strains are potential mycofumigation agents against postharvest diseases caused by F. oxysporum.

Keywords: /Fungal endophytes/ /Nodulisporium sp./ /Fusarium oxysporum/ /Tomato fruit rots/ /Eucalyptol/ /Biocontrol/

Wu, Q., Tao, X., Ai, X., Luo, Z., Mao, L., Ying, T., and Li, L. (2018). Effect of exogenous auxin on aroma volatiles of cherry tomato (Solanum lycopersicum L.) fruit during postharvest ripening. Postharvest Biology and Technology, 146: 108-116.
DOI: 10.1016/j.postharvbio.2018.08.010

Abstract

The phytohormone auxin has been proved to be involved in the regulation of quality traits in climacteric fruit ripening, but there was little information about the correlation between auxin and aroma volatiles in fruit. In the present study, the effect of auxin on aroma volatiles in tomato fruit during postharvest ripening was studied by treating detached tomato fruit at mature green stage with 2, 4-dichlorophenoxyacetic acid. The results showed that exogenous auxin delayed the ripening process of tomato fruit via inhibiting the ethyleneproduction and the carotenoids accumulation, as well as the degradation of chlorophyll. In addition, exogenous auxin enhanced the accumulation of phenolic volatiles such as phenylacetaldehyde (1.57-fold), 2-phenylethanol (1.56-fold) and methyl benzoate (1.75-fold), and inhibited the production of 1-hexanol (56.59 %), 1-nitro-2-phenylethane (23.74 %), benzyl cyanide (45.69 %) and 2-isobutylthiazole (35.18 %). Exogenous auxin altered the expression of a number of key genes involved in the biosynthetic pathway of aroma volatiles, including induction of SlSAMT1, LePAR1and LePAR2, and inhibition of TomloxC, HPL, ADH2, LeCCD1s, LePAR1, LePAR2, LeAADCs, SlBCAT1. The log2 fold change of these genes ranged between -4.53 and 3.02 compared to that in the control group. Moreover, correlation analysis revealed that changes of apocarotenoids and amino acid-derived volatiles were positively correlated with the expressions of related genes in response to auxin. The present study provided valuable information for further elucidating the regulation of tomato fruit aroma as well as quality traits during ripening.

Keywords: /tomato/ /auxin/ /fatty acid/ /apocarotenoids/ /amino acid-derived volatiles/

González-Casado, S., Martín-Belloso, O., Elez-Martínez, P., and Soliva-Fortuny, R. (2018). Induced accumulation of individual carotenoids and quality changes in tomato fruits treated with pulsed electric fields and stored at different post-treatments temperatures. Postharvest Biology and Technology, 146: 117-123.
DOI: 10.1016/j.postharvbio.2018.08.013

Abstract

Pulsed electric fields (PEF) have been proposed to elicit an increase in the content of health-related compounds in plant-based products. It has been previously demonstrated that PEF treatments may be applied to significantly increase the content and bioaccessibility of carotenoids in tomatoes. Nevertheless, the metabolic response of tomato is known to be greatly affected by postharvest storage conditions, which have a determinant impact on the quality characteristics of the product. The effects of PEF processing and post-treatment storage temperature on both carotenoid profile and the main physicochemical properties of tomato fruits were evaluated. Different specific energy inputs (0.02 kJ kg−1 and 0.38 kJ kg−1) and storage temperatures (4, 12 and 20 °C) were studied. The application of PEF treatments significantly improved the accumulation of carotenoids in tomato fruits. Nevertheless, the concentration of total and individual carotenoids during storage was differently influenced by the storage temperature depending on the applied PEF treatment. The increased concentration of carotenoids was noticeably higher in tomatoes stored at 12 °C than in those fruits stored at 4 or 20 °C. The mildest PEF treatment (0.02 kJ kg−1) promoted the greatest accumulations of total carotenoids (58%) and lycopene (150%) in tomatoes stored during 5 d at 12 °C without compromising the fresh-like quality of tomato fruits. However, the most intense PEF treatment (0.38 kJ kg−1) triggered a fast accumulation of carotenoids, leading to the greatest increase of β-carotene (77%), γ-carotene (200%) and lutein (238%) concentration in tomatoes stored at 12 °C for 1 d. Nonetheless, irreversible damage was caused to tomato tissues, thus leading to deleterious quality effects. The results obtained provide valuable information for the future application of PEF in the development of tomato derivative products with increased health-related properties.

Keywords: /Individual carotenoids/ /Pulsed electric fields/ /Physicochemical properties/ /Storage temperature/ /Tomato

Reissig, G. N., Posso, D. A., Borella, J., da Silveira, R. V. D., Rombaldi, C. V., and Bacarin, M. A. (2018). High MT-sHSP23.6 expression increases antioxidant system in 'Micro-Tom' tomato fruits during post-harvest hypoxia. Scientia Horticulturae, 242: 127–136. DOI: 10.1016/j.scienta.2018.07.035

Abstract

The effect of hypoxia on the antioxidant system during the storage of tomato fruits was investigated using plants with different expression levels of the encoding gene for the MT-sHSP23.6 protein. Fruits from two 'Micro-Tom' tomato plant genotypes (wild type and high expression of MT-sHSP23.6) were harvested at the breaker stage and subjected to normoxia (23 °C, dark) and hypoxia (daily nitrogen flow of 0.098 Mpa/10 min, 23 °C, darkness) treatments for 5 and 8 days, respectively. We evaluated the color tone (Hueº) of the fruits, as well as the components of the enzymatic antioxidant system, reactive oxygen species, non-enzymatic antioxidant system components and radical scavenging activity. Fruits from plants with high MT-sHSP23.6 expression had the highest activity for all the antioxidant enzymes under hypoxia conditions (25, 20, 76, and 48% higher than wild type for SOD, CAT, APX, and GPOD, respectively). They also had the lowest concentrations of superoxide anion under both normoxia and hypoxia storage. At the end of the normoxia storage period, the genotype with high MT-sHSP23.6 expression had the highest accumulation of lycopene (13%), whereas at the end of hypoxia storage, the wild type genotype had the highest lycopene

accumulation (39%). Higher accumulation of phenolic compounds was observed in the post-hypoxia period for plants subjected to the hypoxia treatment in high MT-sHSP23.6 expression genotype (12% on the fourth day and 9% on the eighth day). In addition, ascorbic acid concentration was considerably higher on the third and fourth storage days (47% and 8%, respectively). During the hypoxia period, the genotype with high MT-sHSP23.6 expression exhibited the highest radical scavenging activity. High MT-sHSP23.6 expression stimulated the enzymatic antioxidant system during the hypoxia period and led to higher accumulation of phenolic compounds and ascorbic acid, evidence that this protein may be related to tolerance mechanisms in plants subjected to post-harvest abiotic stresses.

Keywords: /Post-harvest physiology/ /Low oxygen storage/ /sHSP/ /Antioxidant secondary metabolites/ /Antioxidant enzymes/ /Reactive oxygen species/