

SELECTIVE DISSEMINATION OF INFORMATION
As of November 2020

APPLE

Aviat, F., Le, I., Federighi, M., & Montibus, M. (2020). Comparative study of microbiological transfer from four materials used in direct contact with apples. *International Journal of Food Microbiology*, 333, 108780. doi: 10.1016/j.ijfoodmicro.2020.108780

Abstract

Several materials such as plastic, wood, cardboard or stainless steel are used as working surfaces or packaging in direct contact with foodstuffs. In food industries, the hygienic surface status is one of the criteria to product conform packaging as described in the European regulation ECR 1935/2004. Today in European Union, there exists one harmonized regulation specific for Food Contact material made of plastic called EU N°10/2011 (Anonymous 2011a). This regulation specifies that materials intended for safe foodstuff contact must not modify food characteristics in terms of chemical, microbiological and sensorial properties. This study aims to compare the survival and transfer of *Penicillium expansum* conidia and *Escherichia coli* cells from several materials to apples. Poplar, cardboards, newly manufactured plastic and reusable plastic specimens were artificially inoculated with both microorganisms, subsequently put in contact with apples and stored under realistic storage conditions. After incubation for up to 1 week, apples and specimens were analysed to assess the survival of the microorganisms and their transfer from materials to apples. While *P. expansum* survived and did not grow on any of the materials, *E. coli* mortality was observed after 1 h on wood and cardboard and after 1 week on both plastics. The proportion of microorganisms transferred was different according to the considered material. This transfer was lower than 1% for wood.

Keywords: /Wood/ /Cardboard/ /Plastic/ /Microorganism/ /Foodstuffs/ /Contamination/

Malladi, A., Battapady, H., Hampton, R., & Jing, S. (2020). Determination of cortex and pith contributions to fruit morphology in apple (*Malus domestica* Borkh.) using image analysis. *Scientia Horticulturae*, 271, 109474. doi: 10.1016/j.scienta.2020.109474

Abstract

The apple (*Malus × domestica*) fruit consists of two main fleshy tissues, cortex and pith, that are of diverse origins and contribute differently to final fruit size. The contribution of these fruit spatial constituents to variation in fruit morphology has not been determined previously. We developed an image-analysis based method that uses two-dimensional images of the fruit sectioned in the proximo-distal plane to determine fruit, cortex, and pith volumes, and key shape descriptors. Fruit volume determined by image-analysis was compared to that determined using water displacement. These two methods were strongly correlated ($R^2 = 0.95$) and displayed good agreement. The cortex volume constituted the majority (> 86 %) of the fruit. Variation in cortex volume explained most of the variation in fruit volume ($R^2 = 0.99$), while that of the pith

explained a relatively minor portion ($R^2 = 0.32$). Further, variation in pith volume explained only a minor part of cortex volume variation ($R^2 = 0.24$), suggesting that growth in these tissues is regulated by a combination of shared and differential mechanisms. Proportion of the fruit constituted by cortex displayed limited variability across 28 apple cultivars. However, the proportion of cortex was substantially lower, and that of pith higher, in a crabapple (*Malus* sp.) cultivar, Callaway, suggesting that change in tissue proportions contributes to increase in fruit size from that observed in crabapples. Limited variation in the fruit aspect ratio, a key shape descriptor, was noted in the apple cultivars analyzed. A weak relationship was observed between the fruit aspect ratio and that of the core ($R^2 = 0.29$), indicating that differential mechanisms determine shapes of the fruit and its internal tissues. Together, data from this study suggest that growth of cortex and pith tissues is mediated in part by shared, and substantially by differential mechanisms.

Keywords: /Fruit growth/ /Fruit shape/ /Fruit size/ /Image analysis/ /Spatial growth/

ASPARAGUS

Lwin, W. W., Srilaong, V., Boonyarittongchai, P., Wongs-Aree, C., & Pongprasert, N. (2020). Electrostatic atomised water particles reduce postharvest lignification and maintain asparagus quality. *Scientia Horticulturae*, 271, 109487. doi: 10.1016/j.scienta.2020.109487

Abstract

Asparagus has a high respiration rate and short shelf-life. The loss in quality is observed through the wrinkling of stems, loss of green colour and toughening. The objective of this study was to reduce the spear lignification and maintain the quality of asparagus using electrostatic atomised water particle (EAWP) treatment. Asparagus were treated with EAWPs for 0 (control) and 90 min and kept at 4 °C for 24 days. The results showed that EAWP treatment for 90 min maintained the colour and total chlorophyll content of the spears. EAWP treatment retarded the respiration rate and ethylene production, reduced weight loss and induced stomatal closure in the stored asparagus. Additionally, the treatment significantly delayed the rise in the activities of phenylalanine ammonia-lyase (PAL), cinnamyl alcohol dehydrogenase (CAD) and peroxidase (POD), which were associated with the inhibition of lignin and cellulose accumulation. Similarly, treated asparagus showed lower hydrogen peroxide content than that of the control but had higher nitric oxide content during the initial days in storage, and decreased thereafter. Distinctly, the total phenolic in EAWP treated asparagus was higher than the control. These findings suggest that EAWPs worked as a stress treatment to inhibit the lignification process and maintained the quality of asparagus during storage at 4 °C.

Keywords: /Asparagus/ /EAWPs/ /Lignification/ /Nitric oxide/

BANANA

Liang, S. min, Chen, S. cen, Liu, Z. li, Shan, W., Chen, J. ye, Lu, W. jin, ... Kuang, J. fei. (2020). *MabZIP74 interacts with MaMAPK11-3 to regulate the transcription of MaACO1/4 during banana fruit ripening. Postharvest Biology and Technology, 169, 111293. doi: 10.1016/j.postharvbio.2020.111293*

Abstract

Fruit ripening is an economically important process of many edible fruits, which is controlled by a multi-level regulatory network coordinating the spatio-temporal expression of a large array of genes and/or proteins. In bananas, ethylene orchestrates the ripening process, but the regulatory mechanism(s) controlling the expression of genes encoding ethylene biosynthesis-related enzymes is not fully understood. Here, we report the identification and characterization of a basic leucine zipper (bZIP) transcription factor *MabZIP74* from banana fruit. It gradually decreased with the progression of banana fruit ripening, implying a negative role for *MabZIP74* in banana fruit ripening. *MabZIP74* is localized in the nucleus and displays transcriptional inhibitory activity. More specifically, *MabZIP74* was found to be a transcriptional repressor of ethylene biosynthetic genes *MaACO1* and *MaACO4*, the accumulation of which paralleled ethylene production during banana ripening. Importantly, a protein kinase *MaMAPK11-3* interacted with and phosphorylated *MabZIP74*, which attenuated *MabZIP74*-mediated transcriptional repression of *MaACO1* and *MaACO4* during ripening. Taken together, our findings reveal a novel *MabZIP74*-mediated regulatory network involved in ethylene biosynthesis and fruit ripening in bananas. These results advance our knowledge on fruit ripening and provide additional opportunities for genetic improvement of banana fruit ripening.

Keywords:/bZIP//Banana fruit//Ripening/Ethylene/Protein-protein interaction/

BETEL

Kempri, P., Protim Mahanta, B., Kumar Bora, P., Jyoti Das, D., Lakshmi Hati Boruah, J., Proteem Saikia, S., & Haldar, S. (2020). A ¹H NMR spectroscopic method for the quantification of propenylbenzenes in the essential oils: Evaluation of key odorants, antioxidants and post-harvest drying techniques for Piper betle L. *Food Chemistry, 331, 127278. doi: 10.1016/j.foodchem.2020.127278*

Abstract

¹H quantitative Nuclear Magnetic Resonance (qNMR) spectroscopy technique has certain advantages such as low-temperature operation, authentic structural prediction and short data acquisition time. In this study, a ¹H qNMR method was developed for the analysis of propenylbenzenes (eugenol and seven analogues) in the essential oils, a broadly distributed class of natural flavours. It was validated in terms of specificity (methoxy/acetate signal), linearity (range 0.05–5.00 mg per assay), sensitivity (limit of detection and quantification 4.4 and 14.9 µg/mL respectively), accuracy and precision. The qNMR technique was utilized during the sensory or activity-guided identification of chavibetol as the key odorant and antioxidant in the

betel (*Piper betle* L., Bangla cultivar) oil, a widely consumed chewing stimulant and valuable flavouring agent. The method was also applied for the evaluation of six different post-harvest drying techniques for betel leaves through the quantitative analysis of unambiguously identified propenylbenzene markers (chavibetol, chavibetol acetate and 4-allyl-1,2-phenylene diacetate).

Keywords: /Essential oil/ /qNMR/ /Betel //Sensory analysis/ /Post-harvest drying/ /Antioxidant/

BLUEBERRIES

Zheng, W., Bai, Y., Luo, H., Li, Y., Yang, X., & Zhang, B. (2020). Self-adaptive models for predicting soluble solid content of blueberries with biological variability by using near-infrared spectroscopy and chemometrics. *Postharvest Biology and Technology*, 169, 111286. doi: 10.1016/j.postharvbio.2020.111286

Abstract

Biological variability is the natural characteristic of agricultural products. Non-destructive determination of fruit/vegetable soluble solid content (SSC) using spectral detection methods is still a challenge due to the spectral variation caused by abundant biological variations, such as different cultivars, geographic origins and harvest seasons. In this paper, a self-adaptive model was established by combining five correcting methods for biological variability elimination, self-selection strategy and model search technology. Thus, the model can automatically adapt to the change of diverse biological variation compared to others. Furthermore, 100 cycles of selection accompanied with the random algorithm were set up to randomly select the calibration sets and prediction sets to ensure the reliability of the results. For the same batch of blueberry samples, five correcting models showed different prediction performances and all achieved satisfactory prediction accuracy compared to the individual-variation model and the hybrid-variation model. The consequence of the self-adaptive model showed consistency when considering multiple variation as well as variation with only cultivars or seasons. The best models in the three cases (multiple variation, only cultivars and only seasons) were all based on the preprocessing method, which was selected for 70, 57 and 47 times respectively. The results indicated that the biological variability had an impact on SSC prediction and that correcting models could improve the prediction accuracy. For the blueberry samples, the most suitable model selected according to the adaptive results was the preprocessing-based model. Within the study conditions, the self-adaptive model can select the most reliable model with the best prediction performance with respect to different variations.

Keywords: /FT-NIR spectroscopy/ /Blueberry/ /Soluble solid content/ /Biological /variability/ /Self-adaptive model/

CHINESES BAYBERRY

Yuan, L. ming, Mao, F., Huang, G., Chen, X., Wu, D., Li, S., ... He, R. (2020). Models fused with successive CARS-PLS for measurement of the soluble solids content of Chinese bayberry by vis-NIRS technology. *Postharvest Biology and Technology*, 169. doi: 10.1016/j.postharvbio.2020.111308

Abstract

Variables selection methods have been proven successfully in the field of visible-near infrared spectroscopy (vis-NIRS) to optimize the predictive performance of regression models. However, because only selected spectral variables have been used, discarding residual spectral variables result in loss of spectral information. In this work, soluble solids content (SSC) of Chinese bayberry was non-destructively measured by a portable vis-NIRS equipment in the interactance spectral acquiring mode, and combined with a consensus modeling approach. The first member model was developed with the full spectra by applying a competitive adaptive reweighting algorithm (CARS), and the remainder developed successively with the residual spectral variables until the performance of the CARS- partial least square (PLS) model was not improved over that of the residual-spectral-based PLS model. A series of consensus models were developed with different numbers of top member-models in a fusing strategy of distributing the weightings. Results showed the residual spectral wavelengths after variables selection still reserved some useful information. In total, five CARS-PLS member models were developed. All consensus models performed better than any univocal member model, and the second consensus model F_2 that fused the top two- member models performed best. Compared to the full-spectral-based PLS model, the F_2 model promoted its performance with RMSECV of 0.80 by 11.3 % in the calibration set, and an RMSEP of 0.85 by 9.1 % in prediction set. The fusing strategy combined with member models that were successively developed with the discarded spectral variables utilized more useful information and improved the predictive performance.

Keywords: /Visible-near infrared spectroscopy (vis-NIRS)/ /Competitive adaptive reweighting algorithm (CARS)/ /Consensus model/ /Bayberry/ /Soluble solids content (SSC)/

CITRUS

Romero, P., Alférez, F., & Lafuente, M. T. (2020). Involvement of phospholipases and sucrose in carbon starvation-induced non-chilling peel pitting in citrus fruit. *Postharvest Biology and Technology*, 169, 111295. doi: 10.1016/j.postharvbio.2020.111295

Abstract

The involvement of different isoforms of genes encoding phospholipases D (*CsPLD α* , *CsPLD β* , *CsPLD δ* , *CsPLD γ* and *CsPLD ζ*) and A_2 (*CsPLA $_2\alpha$* , *CsPLA $_2\beta$* and *CsPAT1*) on starvation-induced postharvest non-chilling peel pitting (NCP) has been compared in the inner (albedo) and outer (flavedo) parts of the peel of citrus fruit treated or not with sucrose (Suc). The study has been performed in Navelate (*Citrus sinensis* (L.) Osbeck) sweet orange, which is prone to NCP, stored under non-stressful environmental conditions (90–95 % relative humidity (RH) and 20 °C). Transcriptional changes, as well as respiration rate and ATP content evolution during fruit storage were compared in both peel tissues. Results indicated that the albedo is more susceptible than the flavedo to starvation; and that, at early stress stage, ATP and all *CsPLD* isoforms and *CsPLA $_2\beta$* are good indicators of carbon starvation in the albedo, and *CsPLD β* in the flavedo. These carbon starvation-induced signals were not activated when Suc was applied as an external energy source. In the second phase of starvation, expression of all *CsPLD*-encoding genes increased with NCP; and *CsPLD γ* and *CsPLD ζ* showed major

increases in both peel tissues. The correlation of the expression of *CsPLA* isoforms with damage development was lower. In this phase, Suc may protect the fruit by providing additional energy sources to sustain respiration; and by favouring phospholipid-derived signaling messengers mediated by *CsPLD β* and *CsPAT1* in the albedo, *CsPLD ζ* in the flavedo, and *CsPLA $_2\beta$* in both tissues. Results from the examination of changes in gene expression point out tissue specificities in the expression of *CsPL* genes but also different susceptibility to starvation between the flavedo and the albedo in citrus fruit.

Keywords: /Phospholipases D and A/ /Postharvest physiological / /disorders/ /Energy stress/ /Transcriptomic/

Zhu, M., Ji, J., Wang, M., Zhao, M., Yin, Y., Kong, J., ... Li, Y. (2020). Cuticular wax of mandarin fruit promotes conidial germination and germ tube elongation , and impairs colony expansion of the green mold pathogen , *Penicillium digitatum*. *Postharvest Biology and Technology*, 169, 111296. doi: 10.1016/j.postharvbio.2020.111296

Abstract

The cuticle of citrus is known to modulate fruit postharvest quality and is hypothesized to be involved in resistance against the fungal pathogen, *Penicillium digitatum*. However, only scarce information is available on the effect of cuticular wax on the conidial germination, germ tube elongation, and colony development of *P. digitatum*. Utilizing a versatile Formvar®-based *in vitro* system, we were able to assess the development of *P. digitatum* in the absence of secondary effects of its host. *In vivo* and *in vitro*, we found that the cuticular wax of mandarin (*Citrus reticulata*) fruit impaired *P. digitatum* colony expansion. Compared with the colony size of *P. digitatum* on intact fruit, the area of colonies on fruit supplemented with mandarin cuticular wax decreased significantly by 1.7 times, whereas it increased 1.6 times on dewaxed fruit 72 h post inoculation. Similar results were observed at 96 h post inoculation. Thus, the cuticular wax of mandarin fruit, acting as a physical barrier, impairs the colony expansion of *P. digitatum*, making it a viable alternative for citrus fruit coating that effectively controls green mold colony formation during postharvest storage. Interestingly, *in vitro* cuticular wax of mandarin fruit dramatically stimulated conidial germination and germ tube elongation of this pathogen. These results suggest that the cuticular wax might be the chemical cue for *P. digitatum* during host-recognition processes. Overall, our results suggest that the cuticular wax of mandarin fruit plays meaningful roles in the interaction between the citrus fruit and *P. digitatum*, and hence, can be considered for postharvest disease management.

Keywords: /Cuticular wax/ /*Penicillium digitatum*/ /Germination/ /Colony / /development/ /*Citrus reticulata*/

DAHLIA

Azuma, M., Onozaki, T., & Ichimura, K. (2020). Difference of ethylene production and response to ethylene in cut flowers of dahlia (*Dahlia variabilis*) cultivars. *Scientia Horticulturae*, 273, 109635. doi: 10.1016/j.scienta.2020.109635

Abstract

Cut dahlia flowers have a short vase life of 3–7 days, and some cultivars exhibit petal abscission, even inside of cardboard boxes during transport. This petal abscission is induced by ethylene in many cases. In the present study, we investigated the role of ethylene in dahlia flower senescence by comparing the responses to ethylene, ethylene inhibitors, and ethylene production among cultivars. Exogenous ethylene significantly accelerated petal abscission in seven cultivars and petal wilting in other five cultivars out of 12 cultivars. Whole florets and detached receptacles (with bracts) produced different amounts of ethylene; ethylene production was higher in ‘Carnelian’ and ‘Port Light Pair Beauty’ than ‘Heavenly Peace’ and ‘Purple Stone’. Onset of senescence was delayed in detached petals compared with attached petals, suggesting that petal abscission was induced by ethylene produced by ovary and receptacles. The ethylene action inhibitor 1-methylcyclopropene inhibited petal abscission and delayed petal wilting in eight cultivars. Moreover, the silver thiosulfate complex delayed petal wilting of ‘Carnelian’. Together, our findings suggested that ethylene plays a role in senescence of cut dahlia flowers and ethylene inhibitors can extend their vase life.

Keywords: /Cut flower/ /Dahlia/ /Ethylene/ /1-MCP/ /STS/ /Vase life/

EDIBLE FLOWER

Skrajda-Brdak, M., Dąbrowski, G., & Konopka, I. (2020). Edible flowers, a source of valuable phytonutrients and their pro-healthy effects – A review. *Trends in Food Science and Technology*, 103, 179–199. doi: 10.1016/j.tifs.2020.06.016

Abstract

Edible flowers have been used for their therapeutic properties for ancient times. Many sources indicate that edible flowers have many beneficial activities like anti-anxiety, anti-cancer, anti-diabetic, anti-inflammatory, antioxidant, diuretic, anthelmintic, immunomodulatory and anti-microbial. People use it also in culinary applications, because they improve the aesthetic value, taste, flavour and appearance of dishes. This study expands knowledge on the content and composition of low molecular phytochemicals of edible flowers and the pro-healthy activities of their extracts or preparations. It is focused on showing flowers which are the best sources of individual compounds and on recent findings with the use of flower extracts or preparations in various cell-lines, animal and human models. Performed comparison of composition includes simple phenolic acids, flavonols, flavanols, flavons, anthocyanidins, carotenoids and tocopherols. Species with the highest content of selected compounds are highlighted. Unique components of some flowers such as crocin, nimbolide, oleanic and ursolic acids, and acteoside are also mentioned. The potential activity of edible flowers for human health was analysed based on *in vitro* models with the use of various cell-lines and *in vivo* models with animal (mostly mice and rat) and human trials. The majority of the reviewed studies confirm the pro-healthy activity of edible flowers or their extracts.

Keywords: /Flower composition/ /Cell-lines/ /In-vivo studies/ /Human trials/ /Anti-inflammatory/ /Anti-cancer/

EDIBLE COATING

Xie, B., Zhang, X., Luo, X., Wang, Y., Li, Y., Li, B., & Liu, S. (2020). Edible coating based on beeswax-in-water Pickering emulsion stabilized by cellulose nanofibrils and carboxymethyl chitosan. *Food Chemistry*, 331, 127108. doi: 10.1016/j.foodchem.2020.127108

Abstract

In this work, novel edible coating films based on beeswax-in-water (O/W) Pickering emulsions had been investigated. The Pickering emulsions were stabilized with cellulose nanofibrils (CNFs)/carboxymethyl chitosan (CCS). The emulsions with a droplet diameter of around 10 μm had uniform particle size distribution, and the creaming stability was improved with the increasing the contents of CNFs in the complexes, rheological analysis demonstrated that the Pickering emulsions had an elastic gel-like network. Furthermore, free-standing films were obtained when the emulsions were dried at ambient condition, the tensile strength of the coating films could be 5.0 MPa at a strain of 2.2%, and the water vapor permeability (WVP) value was lower than $2 \times 10^{-7} \text{ g}\cdot\text{h}^{-1}\cdot\text{m}^{-1}\cdot\text{Pa}^{-1}$. Moreover, the coating films could inhibit the growth of typical spoilage organisms such as *S. aureus* or *E. coli*, it indicated that the coating films would have promising applications in antiseptic and fresh keeping for berry fruits.

Keywords: /Coating/ /Cellulose nanofibrils/ /Carboxymethyl chitosan/ /Beeswax/ /Pickering emulsion/

EGGPLANT

Yang, Y., Liu, J., Zhou, X., Liu, S., & Zhuang, Y. (2020). Transcriptomics analysis unravels the response to low temperature in sensitive and tolerant eggplants. *Scientia Horticulturae*, 271, 109468. doi: 10.1016/j.scienta.2020.109468

Abstract

Low temperature is one of the stresses which threaten eggplant during its whole growth period, resulting in the inhibition of growth and development and the loss of yield. It is essential to realize the key genes and pathways in response to low temperature for eggplant breeding. To compare the transcriptomics profiling of two eggplant varieties with differential low temperature tolerance, we conducted the present experiment. Gene ontology (GO) enrichment and Kyoto Encyclopedia of Genes and Genomes (KEGG) analysis were used for comparing the transcriptomics profile. Here, a total of 2854 and 2697 differentially expressed genes were identified in A153 which was selected from the local variety and locally named 'Chengdumiqie' and A80 (CGN22911) following the low temperature treatment. Through GO analysis, we found that sequence-specific DNA binding was the representative of GO term in the unique differentially expressed genes (DEGs) of both varieties. The KEGG analysis of unique DEGs showed that in both varieties plant hormone signal transduction was the most dominant group. Further analysis revealed that several significant differences existed in the plant hormone signal transduction between two varieties. Finally, the analysis of transcription factor families revealed the complex transcriptional regulation in both cultivars. These findings provided a new insight

into the molecular mechanisms responsible for response to low temperature and genetic improvement in eggplant.

Keywords: /Eggplant/ /RNA-seq/ /DEGs/ /Plant hormone signal transduction/

FOOD SAFETY

Mostafidi, M., Sanjabi, M. R., Shirkhan, F., & Zahedi, M. T. (2020). A review of recent trends in the development of the microbial safety of fruits and vegetables. *Trends in Food Science and Technology*, 103, 321–332. doi: 10.1016/j.tifs.2020.07.009

Abstract

Increasing living standards and improvement of purchase empowerment has led to consume packed and ready made fruits and vegetables. Also awareness of the health properties of fresh fruits and vegetables in preventing many cancers and cardiovascular dysfunction and their high nutritional value lead to an increase of these demands. From the other side the expansion of urbanization and modern life, and the lack of enough time to supply personally the necessary daily fruits and vegetables, could be extra reasons for these increasing demands over the past three decades. But at the same time, the prevalence of food-borne diseases associated with fresh vegetables and also abuse of fertilizers and pesticides should be noticed properly. In this review article, the main ways of contamination of fruits and vegetables with pathogens has been reviewed. Also the major methods of prevention of contamination in all parts of the food chain, and using various disinfectants such as chemical and radiation preservatives to reduce microbial load, edible coatings, bacteriocins, irradiation, Gamma-ray, UV-C, high hydrostatic pressure, Ultrasonic, acid electrolyzed water, Ozone, Modified Atmosphere Packaging (MAP) and Cold Plasma in the microbial safety of fruits and vegetables have been stated. Since fruits and vegetables are very important in the nutrition and health of individuals, pre- and post-harvest contaminants play a very important role in the safety of fruits and vegetables. The choice of various methods for having the highest levels of the microbiological safety of fruits and vegetables, according to initial microbial load, type of fruits and vegetables, size of products and type of infrastructures is completely different and should be applied cautiously.

Keywords: /Chemical and bacterial contamin

FRUIT STACK

Olatunji, J. R., Love, R. J., Shim, Y. M., & East, A. R. (2020). An automated random stacking tool for packaged horticultural produce. *Journal of Food Engineering*, 284(April), 110037. doi: 10.1016/j.jfoodeng.2020.110037

Abstract

One of the major obstacles to the modelling and optimisation of horticultural cooling processes is the construction of an accurate 3D bulk fruit geometry. When a collection of horticultural products is packed into a box, the shape of the individual fruits or vegetables combine to form a

stack with a complex and convoluted shape. The precise shape of the stack may have a significant impact on the airflow pathway and hence the rate of transfer processes in the system, such as cooling. Thus it is important for a realistic model for cooling of stacked, packaged fruit to have the capability to explore sensitivity to the randomness of possible stacking outcomes. Numerous realistic stacks of fruit may need to be generated to enable subsequent simulation to quantify effect in outcome. In this paper a new tool is developed that is capable of rapidly generating the geometry of a fruit stack. The tool (implemented in Blender) takes a size and weight distribution of fruit (in this case Hayward kiwifruit) and simulates the effect of gravity and friction forces to form a realistic stack. The tool-generated stacks were validated against CT scans of real fruit stacks and found to be similar, except that in the CT scans the presence of an internal polyliner appeared to hinder the occurrence of fruit in the bottom corners of the stack, which was not simulated in the stacking tool. Generating a stack required only 150 s on a desktop PC, which makes the tool viable for integration with other simulation systems to optimise packaging design. Automated methods to generate a realistic polyliner shape were also developed, and the tool was used to predict box volumetric efficiency to within 2%.

Keywords: /Fruit stack/ Horticultural products/

GUAVA

Anjum, M. A., Akram, H., Zaidi, M., & Ali, S. (2020). Effect of gum arabic and Aloe vera gel based edible coatings in combination with plant extracts on postharvest quality and storability of 'Gola' guava fruits. *Scientia Horticulturae*, 271, 109506. doi: 10.1016/j.scienta.2020.109506

Abstract

Guava is an important climacteric fruit that exhibits short shelf life in ambient conditions. Due to short shelf life, marketing and subsequent storage of guava is difficult. Therefore, some treatments that can extend shelf life and conserve quality of guava fruits are required. In the present work, the effect of ginger extract, garlic extract, gum arabic and *Aloe vera* gel coating (in combinations) was investigated on guava fruits at 25 ± 3 °C for 15 days. The combination of garlic extract + gum arabic markedly suppressed weight loss, skin browning and disease severity. In addition, fruits of garlic extract + gum arabic treatment had higher titratable acidity and this combination also suppressed excessive increase in total soluble solids till the end of storage period compared with control. Similarly, garlic extract + gum arabic combination significantly extended shelf life of guava fruits as compared with control. Garlic extract + gum arabic treatment showed significantly higher ascorbic acid content and lower total sugars. In contrast, reducing sugars were lower in gum arabic + *Aloe vera* gel treatment and non-reducing sugars were lowest in ginger extract + gum arabic coated guavas. Antioxidant activity and antioxidant capacity were not affected with any combined treatment but these were comparatively higher in gum arabic + *Aloe vera* gel treatment. In contrast, total carotenoids were higher in ginger extract + gum arabic combination while total flavonoid contents were higher in garlic extract + gum arabic coated guava fruits. In conclusion, combined application of garlic extract and gum arabic could be considered a suitable treatment for shelf life extension and quality conservation of guava fruits.

Keywords: /Aloe vera gel/ /Antioxidant activity/ /Gum Arabic/ /Ginger extract/ /Garlic extract/

GRAPE

Wang, L., Luo, Z., Yang, M., Li, D., Qi, M., Xu, Y., ... Li, L. (2020). Role of exogenous melatonin in table grapes: First evidence on contribution to the phenolics-oriented response. *Food Chemistry*, 329. doi: 10.1016/j.foodchem.2020.127155

Abstract

Melatonin (MLT) has gained increasing attention due to its pleiotropic effects. In the present study, 'Kyoho' grapes were immersed in 200 µM of MLT to investigate the role of exogenous melatonin in postharvest metabolism response. Results indicated that berry abscission and rotten index was reduced by 37.50% and 58.37%, respectively, by exogenous MLT treatment, while the amino acid accumulation was greatly enhanced. Furthermore, the endogenous MLT biosynthesis was activated, where the transcript expression of genes, encoding tryptophan decarboxylase, tryptophan decarboxylase, *N*-acetylserotonin methyltransferase and *N*-acetyltransferase were upregulated significantly ($p < 0.05$), in accordance with the increase of endogenous MLT. Phenolic biosynthesis related genes were upregulated significantly, accompanied with the significantly higher phenolics content ($p < 0.05$). On day 15, the expression level of *phenylalanine ammonia-lyase* in the MLT-treated group was twice that in control. Therefore, this study provides the first evidence pertinent to the contribution of exogenous melatonin to the phenolics metabolism in postharvest table grapes.

Keywords: /Amino acid/ /Melatonin/ /Metabolism/ /Phenolics/ /Response/ /*Vitis vinifera*/

JAMUN FRUIT

Khaliq, G., Saleh, A., Bugti, G. A., & Hakeem, K. R. (2020). Guggul gum incorporated with basil essential oil improves quality and modulates cell wall-degrading enzymes of jamun fruit during storage. *Scientia Horticulturae*, 273, 109608. doi: 10.1016/j.scienta.2020.109608

Abstract

The effect of guggul gum (GG) 5, 10 and 15 % (w/v) enriched with basil oil (BO) 0.1 % on physico-chemical and qualitative properties of jamun (*Syzygium cumini* L.) fruit were investigated during storage at 20 °C for 12 days. Jamun fruit treated with GG 10 % + BO 0.1 % or GG 15 % + BO 0.1 %, significantly reduced weight loss, decay incidence and total soluble solids compared to the control fruit. The same treatment delayed depolymerisation of pectin content, and inhibited the activity of polygalacturonase (PG) and cellulase (CEL) enzymes. BO added to GG 10 % or GG 15 % efficiently maintained higher firmness, titratable acidity, ascorbic acid, phenolics and total antioxidant activity of jamun fruit. Moreover, the experts have not observed any negative effects of GG and BO on the sensory quality of jamun fruit. The results disclose that GG and BO could be an innovative technology for retarding the physico-chemical changes and extending the shelf life of jamun fruit during storage.

Keywords: /Guggul gum/ /Basil oil/ /Quality/ /Texture/ /Pectin/ /Polygalacturonase/ /Cellulase/

MANGO

Vega-Alvarez, M., Salazar-Salas, N. Y., López-Angulo, G., Pineda-Hidalgo, K. V., López-López, M. E., Vega-García, M. O., ... López-Valenzuela, J. A. (2020). **Metabolomic Changes in Mango Fruit Peel Associated with Chilling Injury Tolerance Induced by Quarantine Hot Water Treatment.** *Postharvest Biology and Technology*, 169, 111299. doi: 10.1016/j.postharvbio.2020.111299

Abstract

The application of a quarantine hot water treatment (HWT) induces chilling injury (CI) tolerance in mango fruit, but little is known about the mechanisms involved in this tolerance. The aim of this study was to identify metabolomic changes associated with HWT-induced CI tolerance in 'Keitt' mango fruit. Mature green fruit treated with hot water (HWT; 46.1 °C, 75-90 min) and non-treated (control) were stored for 20 d at 5 °C and ripened for 7 d at 21 °C. The incidence of chilling injury symptoms was registered as CI index. Methanol extracts of fruit peels were used for comparative metabolomics analyses by UPLC-DAD-MS and GC-MS. Total phenolics (TP) were analyzed by the Folin-Ciocalteu assay and the antioxidant activity (AA) was measured by ABTS, DPPH, and FRAP methods. HWT provided CI tolerance to mango fruit as evidenced by a low incidence of symptoms. Fifty-two and 14 metabolites were identified by UPLC-DAD-MS and GC-MS, respectively. These metabolites were classified as galloylquinic acids, gallic acid esters, gallotannins, gallic acid derivatives, benzophenone derivatives, xanthenes, flavonoids, organic acids, sugars, fatty acids, and other metabolites (myo-inositol). The HWT before cold storage increased the abundance of galloylquinic acids, gallic acid esters, gallotannins, quercetin 3-O-rhamnoside, and myo-inositol; and it decreased the levels of mangiferin, ribose, malic acid, and palmitic acid. After cold storage and ripening, HWT fruit maintained higher levels of galloylquinic acids, gallic acid esters, gallotannins, quercetin 3-O-rhamnoside, mangiferin, myo-inositol, linolenic acid, and sugars than those in control fruit. HWT fruit also had higher values of TP and AA by the three methods. Control fruit had higher levels of citric acid, malic acid, palmitic acid, and ribose, as well as lower unsaturated/saturated fatty acid ratio. The HWT-induced CI tolerance in mango fruit appears to be associated with an increased content of antioxidants and osmoprotectant metabolites and a higher ratio of unsaturated/saturated fatty acids.

Keywords: /Mango/ /Chilling tolerance/ /Hot water treatment/ /Metabolomics/

MUSHROOM

Barbosa, J. R., Maurício, M. M., Oliveira, L. C., Luiza, L. H., Almada-Vilhena, A. O., Oliveira, R. M., ... Carvalho Junior, R. N. (2020). **Obtaining extracts rich in antioxidant polysaccharides from the edible mushroom *Pleurotus ostreatus* using binary system with hot water and supercritical CO₂.** *Food Chemistry*, 330, 127173. doi: 10.1016/j.foodchem.2020.127173

Abstract

Pleurotus ostreatus is an edible mushroom with pharmacological potential, due to its metabolites, mainly polysaccharides. Here, the development of a new methodology for the recovery of extract rich in antioxidant polysaccharide was reported. The extracts were characterized, evaluated for antioxidant activity *in vitro* and in cell models and cytotoxicity. The best defined extraction condition was 25 MPa, 433.15 K, and 20% H₂O, with 30.69% of the total yield and 0.921 mg of CHO₃. The anomeric bonds, identified in the FTIR and NMR spectrum, indicate that the extracts are a mixture of heteropolysaccharides, β-glucans, α-glucans, and oligosaccharides. The best extraction condition has 80.83% of antioxidant activity, without cytotoxic effect *in vitro*. In addition to antioxidant activity in the cell model, increasing protection against oxidative damage induced by H₂O₂. Finally, H₂O + CO₂-SFE technology can be used to obtain extracts rich in antioxidant polysaccharides with pharmacological and food potential.

Keywords: /Supercritical extraction//Antioxidant activity/ /Oyster mushroom/ /Polysaccharides/ /Cell protection/

Lei, S., Shi, P., Wu, W., Xia, B., Fu, X., Wan, Y., & Zhou, Y. (2020). Extensive screening of cyclopeptide toxins in mushrooms by ultra-high-performance liquid chromatography coupled with quadrupole-Orbitrap mass spectrometry. *Food Chemistry*, 329, 127146. doi: 10.1016/j.foodchem.2020.127146

Abstract

A non-target screening method of cyclopeptide toxins and their analogues in mushroom was developed, using ultra-high-performance liquid chromatography coupled with quadrupole Orbitrap mass spectrometry (UHPLC-Q-Orbitrap MS) followed by mass spectrometry databases retrieval and software tools analysis for the candidate analogues. Three cyclopeptide toxins in the toxic mushroom *Amanita rimosa* were first screened without standard, and two of them were unknown analogues which were tentatively identified by the accurate masses, isotopic patterns and characteristic fragments. A validated quantitative method was performed to rapidly quantify three major cyclopeptide toxins in the *Amanita rimosa* sample including α-manitin, β-amanitin and phalloidin, and their contents were detected to be 4.52 mg/kg, 2.37 mg/kg and 2.53 mg/kg, respectively. The developed method has good selectivity and sensitivity for rapid and comprehensive screening of the cyclopeptide toxins and their analogues in mushrooms at trace levels. Successful non-target screening of trace cyclopeptide toxin analogues will guarantee food safety in mushroom consumption.

Keywords: /Cyclopeptide toxins and their analogues/ /Non-target screening/ /Characteristic fragments filtering/

Wang, Y., Xiang, C., Li, D., Du, M., Mo, Y., Jiang, Z., & Wang, J. (2020). Identification of key genes involved in the two ligninifications in stored king oyster mushrooms (*Pleurotus eryngii*) and their expression features. *Postharvest Biology and Technology*, 169, 111289. doi: 10.1016/j.postharvbio.2020.111289

Abstract

The enzyme genes involved in two lignifications of stored *Pleurotus eryngii* remain unclear. Here, we investigated the lignification profiles and associated gene expression by RNA-seq, molecular clone and qRT-PCR analysis to identify the key structural genes and reveal their expression features under different conditions. A total of 2803 differentially expressed genes (DEGs) were identified in samples at 1 °C compared to those at 4 °C, and 56 DEGs were annotated to lignification-related gene families. Ten lignification-related structural genes were cloned and only the expression patterns of *PePAL1*, *Pe4CL1*, *Pe4CL3* and *PePOD* were proportionate to the change of lignification indexes of mushrooms during 4 °C storage. Their expression profiles at key time points during mushrooms growing, development, and two lignifications presented their consistency with that of lignin contents and implied relatively high expression in two lignifications. Expression profiles under cold and no-wounding treatments also showed correlation with two lignifications and presented their expression features. Namely, *PePAL1* and *PePOD* could be stimulated by cold stress during the first lignification and triggered by wounding stress during the whole storage, meanwhile *Pe4CL1* and *Pe4CL3* could be induced by wounding stress during the first lignification and irritated by cold stress at the time point of the second lignification. These results showed that *PePAL1*, *Pe4CL1*, *Pe4CL3* and *PePOD* were the key genes involved in two lignifications of stored *P. eryngii* and could be stimulated by wounding and cold stress at different time points of storage.

Keywords: *Pleurotus eryngii*/ Postharvest lignifications/ Key genes/ Expression features/

1-MCP

Zhang, W., Zhao, H., Jiang, H., Xu, Y., Cao, J., & Jiang, W. (2020). Multiple 1-MCP treatment more effectively alleviated postharvest nectarine chilling injury than conventional one-time 1-MCP treatment by regulating ROS and energy metabolism. *Food Chemistry*, 330, 127256. doi: 10.1016/j.foodchem.2020.127256

Abstract

The objective of the present study was to investigate the effectiveness of different 1-MCP treatment patterns on alleviating chilling injury (CI) of postharvest nectarine stored at 0 ± 1 °C. Nectarine fruits were subjected to the following treatments: Single-High dose 1-MCP treatment (S-H): $1 \mu\text{L L}^{-1}$ application before storage; Multi-low dose 1-MCP treatment: (M-L) Five $0.25 \mu\text{L L}^{-1}$ applications after 0, 5, 10, 15, and 20 d of storage; Multi-high dose 1-MCP treatment (M-H): Five $1 \mu\text{L L}^{-1}$ applications after 0, 5, 10, 15 and 20 d of storage. The results showed that although all 1-MCP treatments alleviated CI, M-H 1-MCP treatment is the most effective pattern in alleviating CI of nectarine fruit in S-H, M-L, and M-H 1-MCP treatments. Moreover, this study indicated that the reduction of CI in nectarine by 1-MCP application was related to its regulations of ROS and energy metabolism.

Keywords: Nectarine fruit/ 1-MCP/ Chilling injury/ Energy state/

ONION

Taglienti, A., Dell'Abate, M. T., Ciampa, A., Tomassoli, L., Albanese, G., Sironi, L., & Tiberini, A. (2020). Study on ultra-structural effects caused by Onion yellow dwarf virus infection in 'Rossa di Tropea' onion bulb by means of magnetic resonance imaging. *Scientia Horticulturae*, 271, 109486. doi: 10.1016/j.scienta.2020.109486

Abstract

'Rossa di Tropea' onion is a particular pink/red coloured onion cultivated in Calabria region (Southern Italy), representing one of the Italian most important vegetable crops granted with Protected Designation of Origin (PDO) and Protected Geographical Indication (PGI) trademarks. This local cultivar is characterised by a high nutraceutical compounds content showing anti-inflammatory, anti-cholesterol, anticancer and antioxidant properties. As all vegetable crops and *Allium* spp., 'Rossa di Tropea' onion is affected by several viruses. Among these, the species *Onion yellow dwarf virus* (OYDV, genus *Potyvirus*, family *Potyviridae*), represents the most limiting biotic stress, inducing severe symptoms. OYDV effect on tissues architecture in whole bulbs was investigated using magnetic resonance microimaging (MRI) technique, which allows the interior of samples to be imaged non-invasively and non-destructively and yields quantitative information on physico-chemical parameters describing water mobility (T1 and T2 relaxation times). The use of such tools allowed to determine how OYDV alters plant physiology by inducing water accumulation in bulb tissues as well as causing ultra-structural modifications of cell walls, highlighted by MRI. All these effects resulted in an increase of free water in plant tissues, and consequently relevant water losses during post-harvest storage, seriously affecting bulb quality, marketability and shelf life.

Keywords: /OYDV/ /Virus disease/ /*Allium cepa*/ /MRI/ /Proton relaxation/ /Post-harvest/

PEARS

Sun, Y., Sun, H., Luo, M., Zhou, X., Zhou, Q., Wei, B., ... Ji, S. (2020). Membrane lipid metabolism in relation to core browning during ambient storage of 'Nanguo' pears. *Postharvest Biology and Technology*, 169, 111288. doi: 10.1016/j.postharvbio.2020.111288

Abstract

'Nanguo' pears are prone to core browning at ambient temperatures. To reveal the role of membrane lipid metabolism in the process of core browning, fruit were treated with n-butanol, a phospholipase D (PLD) inhibitor. Changes in phospholipids and fatty acids, as well as the activities and gene expression of key enzymes were analyzed. Membrane phenotype and ultrastructure were also documented. Phospholipid and fatty acid levels, the activities of PLD and lipoxygenase (LOX), and gene expression changes during fruit ripening. PLD activity and gene expression in n-butanol-treated fruit were lower than those in control fruit, and the symptoms of core browning appeared later and were less severe. Furthermore, the membrane ultrastructure of fruit treated with n-butanol was intact compared with that in control fruit. These results suggested that membrane lipid metabolism plays an important role in the core browning

of harvested 'Nanguo' pears, and that n-butanol treatment can alleviate disorder development by regulating membrane lipid metabolism.

Keywords: /'Nanguo' pears/ /core browning/ /Membrane lipid/ metabolism/ /Phospholipase D/ /Lipoxygenase/

PERSIMMON

Qi, Y., Liu, J., Liu, Y., Yan, D., Wu, H., Li, R., ... Ren, X. (2020). Polyphenol oxidase plays a critical role in melanin formation in the fruit skin of persimmon (*Diospyros kaki* cv. 'Heishi'). *Food Chemistry*, 330, 127253. doi: 10.1016/j.foodchem.2020.127253

Abstract

In this study, the melanin in persimmon and its formation were investigated. Melanin was found to be deposited on the cell walls of the upper epidermis and subepidermal cells in persimmon skin and the isolated pigment appears to have lamellar structures. Diagnostic analysis of the isolated pigment showed results that were similar to those of melanin from other sources. Ultraviolet–visible spectroscopy revealed that the extracted skin pigment displayed a broadband, structureless absorption profile that increased progressively towards shorter wavelengths. The Fourier transform infrared spectroscopy assay revealed that melanin in persimmon skin exhibits many characteristic absorption peaks. The phenolic profile analysis suggested that the precursors of this pigment may include gallic acid, procyanidin B1, procyanidin B2, ferulic acid and epigallocatechin gallate. The PPO activity and *DkPPO* expression significantly increased during melanin formation, and transient overexpression of *DkPPO* promoted melanin synthesis. These results indicate that the isolated pigment was a type of melanin and that PPO plays a critical role in its formation.

Keywords: /Persimmon? /Melanin/ /UV–Vis spectroscopy/ /FT-IR spectroscopy/ /Polyphenol oxidase/ /*DkPPO*/

PITAYA

Jiang, Y. L., Chen, L. Y., Lee, T. C., & Chang, P. T. (2020). Improving postharvest storage of fresh red-fleshed pitaya (*Hylocereus polyrhizus* sp.) fruit by pre-harvest application of CPPU. *Scientia Horticulturae*, 273, 109646. doi: 10.1016/j.scienta.2020.109646

Abstract

The appearance, flavor, and taste are important criteria of fruit quality, which is affected by environmental conditions, orchard management, and postharvest storage. The current study was conducted to investigate the influence of the pre-harvest application of forchlorfenuron (CPPU) on the red-fleshed cv. 'Fu Kwai Hong' pitaya (*Hylocereus polyrhizus* sp.) fruit during storage at 5 °C. On the flowering day, 100 mg L⁻¹ CPPU was sprayed on the bracts and water was used as the control. The significantly higher bract thickness (1.49 mm and 1.67 mm), shorter fruit length (88.6 mm and 99.4 mm), lower fruit shape index (0.91 and 0.95), and less

cracking ratio (0% and 2.17%) were recorded on CPPU treated fruit in both winter and summer seasons, respectively. Moreover, CPPU resulted in more chlorophyll *a*, chlorophyll *b*, and total chlorophyll content in the bracts than in the control, which caused fresh-green color of the bracts when CPPU treated fruit was harvested compared to the control, and was significantly less degree of bract browning than the control fruit during storage. Additionally, CPPU treated fruit exhibited later incidence of chilling injury than the control fruit during 5 °C storage. On the other hand, CPPU treated fruit had more weight loss and a slight increase of respiration rate compared to the control during storage at 5 °C.

Keywords: /Plant growth regulator/ /Dragon fruit/ /Cytokinin/

PLUM

Salazar, J. A., Pacheco, I., Zapata, P., Shinya, P., Ruiz, D., Martínez-Gómez, P., & Infante, R. (2020). Identification of loci controlling phenology, fruit quality and post-harvest quantitative parameters in Japanese plum (*Prunus salicina* Lindl.). *Postharvest Biology and Technology*, 169, 111292. 10.1016/j.postharvbio.2020.111292

Abstract

Japanese plums are popular fruits since they are exceptionally nutritious with high fiber and antioxidant content. This work has aimed to analyze the most critical phenology, fruit quality and postharvest parameters from a genomic point of view to identify molecular markers closely linked to the most significant Quantitative trait loci (QTLs). A genetic linkage map of an F1 population of 151 individuals from the cross '98–99' × 'Angelino' was constructed using previously reported Single Nucleotide polymorphism (SNP) data and 25 additional Simple Sequence Repeat (SSR) markers. Twenty-three phenotypic traits evaluated during three harvest seasons were assayed to estimate best linear unbiased predictors by using two genomic association QTL analysis approaches: General Linear Model-based single marker-trait associations (GLM) and Multiple QTL Model analyses (MQM). In addition, loss of weight and chlorophyll degradation between days 1 and 7 as well as fruit softening for days 1, 4, and 7 were monitored during two consecutive seasons. The most significant identified QTLs were linked to fruit development period and fruit weight in Linkage Groups (LG) 4 and 2, respectively. Regarding postharvest parameters, the identified QTLs related to chlorophyll degradation and loss of weight showed lower significance than phenology or fruit quality traits. In contrast, minor QTLs for fruit firmness evolution using destructive and non-destructive methods were confirmed in LG 4 and 5.

Keywords: /Fruit breeding/ /Mapping/ /MAS/ /*Prunus salicina*/ /QTL/ /SSR/ /SNP/

Xu, Y., Li, S., Huan, C., Jiang, T., Zheng, X., & Brecht, J. K. (2020). Effects of 1methylcyclopropene treatment on quality and anthocyanin biosynthesis in plum (*Prunus salicina* cv. Taoxingli) fruit during storage at a non-chilling temperature. *Postharvest Biology and Technology*, 169. doi: 10.1016/j.postharvbio.2020.111291

Abstract

The effects of 1-methylcyclopropene (1-MCP) treatment on the quality attributes of 'Taoxingli' plum fruit, particularly on whole fruit anthocyanin content *via* anthocyanin biosynthesis during storage at the non-chilling temperature of 10 °C were investigated. The results showed that 1-MCP treatment effectively reduced weight loss and better maintained soluble solids content (SSC) and titratable acidity (TA), resulting in increased contents of fructose, glucose, sorbitol, and malic acid, and reduced decay during storage. Furthermore, major anthocyanins, including cyanidin 3-O-glucoside and cyanidin 3-O-rutinoside, were detected. 1-MCP treatment delayed increases in total anthocyanins along with the major individual anthocyanins during storage, which was attributed to its effect in suppressing the expression of synthesis-related structural genes and the transcription factor *PsMYB10* early in storage, enhancing their expression later in the storage period. Thus, 1-MCP treatment was beneficial for retaining the quality of 'Taoxingli' plums, particularly the chemical attributes, and extending the storage life with low economic loss during storage.

Keywords: /Anthocyanin biosynthesis/ /1-methylcyclopropene/ /Plum/ /Quality/

POSTHARVEST RIPENING

Garza-Aguilar, S. M., García-Salinas, C., Mejía-Ponce, P. M., Licona-Cassani, C., Ramos-Parra, P. A., & Díaz de la Garza, R. I. (2020). The complexity of folate polyglutamylation in plants: Postharvest ripening and ethylene modulate polyglutamylated profiles in climacteric fruits plus systematic analysis of the glutamyl tail-editing enzymes. *Scientia Horticulturae*, 273, 109588. Doi: 10.1016/j.scienta.2020.109588

Abstract

Folate derivatives exist in nature in a variety of polyglutamyl forms (G_n); the glutamyl tail is added to the folate molecule by polyglutamyl synthetase (FPGS), and removed by gamma-glutamyl hydrolase (GGH) isoforms in several compartments within the cell. Folate polyglutamylation affects the use of the folate cofactors and their transport in organisms, also impacting their bioavailability as vitamins in mammals; however, little is known about its regulation in plants. We explored the possible effect of genetic, developmental, and environmental factors on the G_n extent of the most prevalent folate in plants, 5-CH₃-THF. We chose ripening and ethylene treatment in climacteric fruits, to assess developmental and environmental factors. Postharvest ripening increased short G_n tails, and ethylene gassing affected negatively long G_n tails. To evaluate genetic factors, we retrieved and compared the deduced FPGS and GGH sequences from 27 plants with known G_n profile and attempted to correlate their phylogenetic relation, number of isoforms, predicted localization, and primary sequence with the G_n profiles generated and gathered by this study. GGH sequences were quite conserved among plants, while FPGS diverged more. We postulate that the very long G_n tail found only in papaya is the result of very particular changes in one of the FPGS's primary structure.

Keywords: /Ripening/ /Ethylene/ /Polyglutamylation/ /Gamma-glutamyl / /hydrolase (GGH)/ /Folatefolylpolyglutamate synthetase (FPGS)/

POTATO

Sampaio, S. L., Petropoulos, S. A., Alexopoulos, A., Heleno, S. A., Santos-Buelga, C., Barros, L., & Ferreira, I. C. F. R. (2020). Potato peels as sources of functional compounds for the food industry: A review. *Trends in Food Science and Technology*, 103, 118–129. doi: 10.1016/j.tifs.2020.07.015

Abstract

Potato (*Solanum tuberosum* L.) is the most important vegetable crop, with a global production of around 368 million tonnes and more than 5000 known varieties. Tubers are the edible part of the plant, which can be eaten in various forms e.g. boiled, cooked, fried, crisped, etc. Processing of raw tubers usually involves peeling that generates a great amount of bulky waste which is usually discarded or used as animal feed. The present review aims at deeply discussing the current knowledge on the nutritional value, chemical composition and potentially related bioactivities of potato peels. Moreover, an overview on the reutilization of this bio-residue by the food industry is presented, by discussing the reported applications/incorporations into different food matrices, along with the potential technological properties. Considering the nutritional value and chemical composition of potato peels, along with the bioactivity and technological properties of their extracts, the sustainable valorization of potato processing by-products presents great interest for the food and pharmaceutical industries that could increase the overall added value and minimize the environmental impact of this food crop.

Keywords: /Bioactive compounds/ /Functional ingredients/ /Glycoalkaloids/ /Phytochemicals/ /Phenolic compounds/ /Potato peels/ /*Solanum tuberosum* L/

PUMMELO

Nie, Z., Huang, Q., Chen, C., Wan, C., & Chen, J. (2020). Chitosan coating alleviates postharvest juice sac granulation by mitigating ROS accumulation in harvested pummelo (*Citrus grandis* L. Osbeck) during room temperature storage. *Postharvest Biology and Technology*, 169(April), 111309. doi: 10.1016/j.postharvbio.2020.111309

Abstract

Juice sac granulation is a serious problem in pummelo (*Citrus grandis* L. Osbeck) fruits during postharvest storage owing to various abiotic stress conditions, which greatly reduces their attractiveness and commercial value. Hence, measures to alleviate the postharvest juice sac granulation of pummelo are of great importance. The current study was designed to investigate the effects of 1.5 % chitosan treatment on the granulation index, fruit color, nutrient contents, hydrogen peroxide (H₂O₂) content, malondialdehyde (MDA) content, antioxidant enzymatic activities and related gene expressions in pummelo fruits stored at room temperature (20 ± 2

°C) for 150 d. The results showed that chitosan treatment significantly maintained the appearance of pummelo fruits by delaying postharvest granulation and color variation, retarded the degradation of total soluble solid (TSS), titratable acids (TA) and total sugars. The O_2^- production rate, H_2O_2 content and MDA content in the fruit pulp were significantly decreased whereas the contents of lycopene, ascorbic acid (AsA) and glutathione (GSH) were enhanced following chitosan treatment. The alleviation of postharvest granulation of pummelo was attributed to the higher levels of active antioxidant enzymes such as superoxide dismutase (SOD), catalase (CAT), ascorbate peroxidase (APX) and glutathione reductase (GR) both at the transcriptional and translational levels. The evidence from this study shows that postharvest chitosan treatment can efficiently reduce juice sac granulation and prolong the postharvest storage period of pummelo fruits by mitigating ROS accumulation, delayed fruit senescence under storage at room temperature.

Keywords: /Chitosan coating/ /Pummelo/ /Postharvest granulation/ /Antioxidant/ /ROS metabolism/

SPONGE GOURD

Zhang, Y., Zhu, G., Li, X., Zhao, Y., Lei, D., Ding, G., ... Liu, Y. (2020). Combined medium- and short-wave infrared and hot air impingement drying of sponge gourd (*Luffa cylindrical*) slices. *Journal of Food Engineering*, 284, 110043. doi: [oi.org/10.1016/j.jfoodeng.2020.110043](https://doi.org/10.1016/j.jfoodeng.2020.110043)

Abstract

Influences of drying air temperature, radiation distance, slice thickness and wavelength on drying time, energy consumption, and product quality (color, shrinkage, rehydration and total saponin) were investigated in combined infrared and hot air impingement drying (IR-HAD). Results illustrated that temperature and slice thickness were the most distinct factors affecting the drying time. Moisture effective diffusivity decreased with decrease in moisture content, and was influenced by drying conditions. Radiation distance significantly affected rehydration capability, while temperature and thickness affected almost all quality attributes. Drying caused an insignificant reduction in total saponin, and similar volume shrinkage results were found due to the constant amount of water removed. Thickness of 6 mm maintained better quality than thicker bodies, coincidence with the calculated infrared penetration depth (5.30–7.25 mm). IR-HAD at wavelength of 2–4 μm increased drying rate slightly than that at 0.25–2 μm , while insignificant difference in product quality. Particularly, IR-HAD samples showed smaller thickness shrinkage and larger area shrinkage, as opposed to hot air drying. IR-HAD offered many advantages in minimizing the drying time and better preserving the quality over hot air drying under the same conditions, but markedly enhanced the specific energy consumption. This study proves that IR-HAD is a suitable technique that retains quality characteristics of vegetables.

Keywords: /Infrared drying/ /Sponge gourd/ /Drying kinetics/ /Shrinkage/ /Rehydration/

STRAWBERRY

del Olmo, I., Blanch, M., Romero, I., Vazquez-Hernandez, M., Sanchez-Ballesta, M. T., Escribano, M. I., & Merodio, C. (2020). Involvement of oligosaccharides and sucrose-related genes on sucrose retention in strawberries from ripening to shelf-life. *Postharvest Biology and Technology*, 169, 111301. doi: 10.1016/j.postharvbio.2020.111301

Abstract

Sucrose is a key player in strawberry metabolism. However, the molecular mechanisms underlying sucrose status in strawberries during later ripening stages and postharvest storage remains quite limited. Therefore, we identified members of various gene families encoding key enzymes involved in sucrose metabolism, analyzed their expression profiles and determined the sugar content in strawberries at different ripening stages and postharvest treatments. Three different ripening stages around harvest time, almost red (AR), full red (FR) and dark red (DR) were analyzed, as well as after pre-treatment with high CO₂ levels (18 % CO₂, 2 d) during low temperature (LT) storage and further shelf-life at 20 °C. The accumulation of sucrose, hexoses, trehalose, *myo*-inositol, fructo-oligosaccharides (FOS) and raffinose family oligosaccharides (RFOs) was analyzed. Our results indicate that the transition from FR to DR stages was characterized by a prominent accumulation of hexoses, sucrose and a sharp decrease in the levels of FOS. We therefore suggest that FOS, in addition to their protective role in stressful conditions, are also important metabolic signals of the end of the ripening process. The highest levels of RFOs were detected in strawberries at LT in air, making them a possible marker of damage, an idea reinforced too by the low RFOs and high *myo*-inositol quantities found in high CO₂ protective treatment. Interestingly, the sucrose accumulation in fully ripe strawberries and in high CO₂-treated ones was linked to a significant decrease in the expression of *FvVIN2* (vacuolar invertase), an opposite trend to that observed in fruit stored in air. Furthermore, high levels of CO₂ prevented both the upregulation of *FvSS1* and the sharp increase in the expression of *FvCWINV1* observed at low temperature in air. The efficiency of high CO₂ pre-treatment on sucrose accumulation was particularly evident during the shelf-life period at 20 °C (SL) after LT storage. Our study provides new insights into how strawberries become sweet by retaining sucrose content. Additionally, our results clearly highlight the need to specify the sugar status at harvest to know the effectiveness of a treatment in maintaining quality attributes.

Keywords: /Ripening stages/ /High-CO₂/ /Low-temperature/ /Sucrose-related genes/ /Oligosaccharides/

Muley, A. B., & Singhal, R. S. (2020). Extension of postharvest shelf life of strawberries (*Fragaria ananassa*) using a coating of chitosan-whey protein isolate conjugate. *Food Chemistry*, 329, 127213. doi: 10.1016/j.foodchem.2020.127213

Abstract

Chitosan and whey protein isolate (WPI) conjugate films were prepared as a novel matrix for

encapsulating and extending the postharvest shelf life of strawberries. Film forming solutions of chitosan, WPI, and chitosan-WPI conjugate were mixed with glycerol, casted for films at 60 ± 2 °C and assessed for their colour, water vapour and oxygen transfer rate, textural, functional groups and secondary structure, thermal, crystallinity, and antioxidant properties. Chitosan-WPI conjugate films were applied as an edible coating on strawberries, and studied for storage stability at 5 °C and 20 °C by assessing physical and biochemical parameters. A considerable reduction in colour indices, weight loss, pH and titratable acidity, reducing sugars, ascorbic acid, total phenolics, DPPH and ABTS assay was noted in the coated strawberries over the control at both the studied temperatures. The control strawberries had a shelf life of 5 and 3 days, whereas coating enhanced the shelf life of strawberries to 8 and 5 days when stored at 5 °C and 20 °C, respectively.

Keywords: /Chitosan/ /Whey protein isolate/ /Films/ /Strawberries/ /Storage/ /Postharvest shelf life/

Shi, M., Wang, S., Zhang, Y., Wang, S., Zhao, J., Feng, H., ... Xie, X. (2020). Genome-wide characterization and expression analysis of ATP-binding cassette (ABC) transporters in strawberry reveal the role of FvABCC11 in cadmium tolerance. *Scientia Horticulturae*, 271, 109464. doi: 10.1016/j.scienta.2020.109464

Abstract

The ATP-binding cassette (ABC) transporter is the largest gene family and is associated with the transport of various molecules, such as heavy metal ions, secondary metabolites, and phytohormones. Strawberry is an important berry fruit and a model plant for studying fleshy fruits. However, the ABC gene family has not been identified in strawberry. In present study, 115 putative ABC genes were identified in the genome of woodland strawberry (*Fragaria vesca*). Based on the phylogenetic analysis results, the ABC genes were grouped into eight subfamilies (6 ABCAs, 29 ABCBs, 16 ABCCs, 1 ABCDs, 2 ABCEs, 5 ABCFs, 46 ABCGs, and 10 ABCIs). Additionally, gene structure analysis revealed that the intron-exon patterns of the ABC genes are not conserved in *F. vesca*. Some additional conserved motifs with group specificity were found. Quantitative reverse transcription-polymerase chain reaction (qRT-PCR) analysis indicated ABCC subfamily gene expression across different fruit and seed developmental stages and organ profiling revealed functional diversification. Most ABCC genes exhibited preferential expression in the stems and leaves. All ABCC genes showed significant increases during the seed development stages but only ABCC8 and ABCC11 showed significant increases during fruit development. The significant changes of the 16 ABCC genes exhibited during abiotic stress treatments suggested that they might be stress-responsive genes. Over-expression of FvABCC11 in *Arabidopsis* partially restored seedling development under cadmium (Cd) treatment, indicating that FvABCC11 increased Cd tolerance. The results of this study provide useful information for heavy metal resistance that can be utilized to improve agricultural production.

Keywords: /*Fragaria vesca*/ /ABC/ /Subfamilies/ /Heavy metal/ /Resistance/

Wang, K., Li, T., Chen, S., Li, Y., & Rashid, A. (2020). The biochemical and molecular

mechanisms of softening inhibition by chitosan coating in strawberry fruit (*Fragaria x ananassa*) during cold storage. *Scientia Horticulturae*, 271, 109483. doi: 10.1016/j.scienta.2020.109483

Abstract

Strawberry fruit is extremely perishable at least partially because of excessive softening, which can be inhibited by edible chitosan coating during ripening, but the biochemical and molecular mechanisms are not completely understood in the fruit under cold conditions. Here, changes in levels of quality attributes, cell wall constituents, activities and expression of cell wall modifying enzymes, were evaluated in strawberry fruit treated with 1.5% (w/v) chitosan coating and stored at 4 °C for 12 days. Chitosan coating had a significant inhibitory effect on fruit softening during cold storage, rather than other quality attributes. Chitosan coating treated fruit showed the reduction in the content of water-soluble pectin coincident with significant inhibition in activities of polygalacturonase (PG) and pectin methylesterase (PME), and expression of *FaPG1* and *FaPME1*, relative to the controls. Activities of these two enzymes and expression of *FaPG1* were significantly correlated with the contents of water-soluble pectin. Besides, the decreased link between cellulose and hemicellulose was indicated by the reduced transcript levels of *FaXTH1* and *FaEXP2*, with significantly positive correlation. In conclusion, the effect of chitosan coating on strawberry fruit mainly involves the softening inhibition by metabolic enzymes of pectin, especially PG and PME. The results will provide insights into developing measures to control strawberry fruit softening during cold storage and cold chain logistics.

Keywords: /Cell wall/ /Chitosan coating/ /Cold storage/ /Softening/ /Strawberry fruit/

TOMATO

Fatchurrahman, D., Amodio, M. L., de Chiara, M. L. V., Chaudhry, M. M. A., & Colelli, G. (2020). Early discrimination of mature-and immature-green tomatoes (*Solanum lycopersicum* L.) using fluorescence imaging method. *Postharvest Biology and Technology*, 169, 111287. doi: 10.1016/j.postharvbio.2020.111287

Abstract

Detecting mature-green and immature-green tomatoes using non-destructive approaches is a challenge for the fresh produce industry. Hyperspectral fluorescence imaging technique with excitation wavelength at 365 nm and UV-vis CCD camera was used for early non-destructive detection of mature-green and immature-green fruit from 200 randomly harvested green tomatoes. Conventional destructive analysis regarding locule gel development and seed texture were assessed to assign the maturity stage of the fruit. In addition soluble solid content (SSC), pH, total acidity (TA), and color were measured, on the training set and on the prediction set, in this case also after 10 d of storage. Fluorescence intensity at the surface of immature-green fruit was higher in the red region (690 nm) than that of mature-green fruit, suggesting that hyperspectral fluorescence imaging can be an effective classification tool. A univariate classification method was used to distinguish mature-green and immature-green tomatoes based on the grey scale values extracted from fluorescence imaging, with a non-error rate of 96 % in calibration and 100 % in external prediction. Hence, a non-destructive method for the early distinction of mature-green from immature-green tomatoes is available.

Keywords: /Maturity stage/ /Hyperspectral/ /Fluorescence/ /Univariate/ /Classification/

Yang, J., Jing, X., Wang, T., Di, J., Chen, L., & Wang, Y. (2020). Overactivation of glutamate consuming pathways in L-glutamate treated tomato fruits lead to resistance against *Alternaria Alternata*. *Postharvest Biology and Technology*, 169, 111311. doi: 10.1016/j.postharvbio.2020.111311

Abstract

Previous studies reported the ability of L-glutamate (glutamate) to induce host resistance against *Alternaria alternata*, but the underlying mechanism is still scarce. Here, temporal alteration in antioxidant enzymes and glutamate consuming pathways were transcriptionally and enzymatically monitored in tomato fruits. The results showed that exogenous glutamate application enhanced the activities of antioxidant enzymes, including peroxidase, superoxide dismutase and catalase, in tomatoes upon inoculation with *Alternaria alternata*, while lower concentrations of H₂O₂ and malondialdehyde were observed. Interestingly, glutamate led to a decline in carbon:nitrogen ratio and induction of deaminating activity of glutamate dehydrogenase, resulting in replenishment of the tricarboxylic acid cycle. Concurrently, proline dehydrogenase mediated the proline catabolism was downregulated by glutamate, accompanied by the enhanced biosynthesis of proline due to increased expression of pyrroline-5-carboxylate synthase. Together our findings favored a model whereby overactivation of antioxidant enzymes and glutamate consuming pathways, deamination of glutamate and proline biosynthesis from glutamate, played a vital role in the mechanism of glutamate-induced resistance.

Keywords: /L-glutamate/ /Postharvest/ /Induced resistance/ /Tomato fruits/

TUBER AESTIVUM TRUFFLES

Tejedor-Calvo, E., Morales, D., García-Barreda, S., Sánchez, S., Venturini, M. E., Blanco, D., ... Marco, P. (2020). Effects of gamma irradiation on the shelf-life and bioactive compounds of *Tuber aestivum* truffles packaged in passive modified atmosphere. *International Journal of Food Microbiology*, 332, 108774. doi: 10.1016/j.ijfoodmicro.2020.108774

Abstract

The effects of gamma irradiation (0.5, 1.0, 1.5 and 2.5 kGy doses) on *Tuber aestivum* packaged under modified atmosphere was evaluated. The respiration rate, microbial populations, sensory characteristics and content of bioactive compounds (total carbohydrates, chitins, β -glucans, proteins, total phenols and sterols) were monitored from immediately after treatment up to day 42 of storage at 4 °C. All the irradiation treatments tested reduced the microbial groups studied by more than 3 log cfu/g. Increasing irradiation doses slowed down the subsequent microbial development throughout the conservation period for all the groups studied. The irradiation treatments did not negatively affect truffle sensory characteristics. Only a slight visible superficial yeast growth was detected at the end of the shelf-life in all doses applied. Total

carbohydrate content, chitins, β -glucans and proteins levels were not affected after irradiation. However, sterols, particularly stigmasterol, slightly decreased after irradiation, while levels of phenolic compounds doubled during storage. Gamma irradiation (2.5 kGy) could be used to extend the shelf-life of summer truffles packaged under modified atmosphere, since no remarkable reduction of bioactive compounds were noticed after 42 days of storage, and their sensory and microbial parameters were of higher quality than those of non-irradiated controls.

Keywords: /Summer truffle/ /Microbial degradation/ /Sensory analysis/ /Bioactive compounds/
/Sterols/