

**SELECTIVE DISSEMINATION OF INFORMATION (SDI)PDF REPRINTS
AS OF JULY 2016**

GENERAL

BIOLOGICAL CONTROL

Di Francesco, A. C. Martini, M. Mari 2016. **Biological control** of postharvest diseases by microbial antagonist how many mechanisms, of action. Eur. J. Plant Pathol. 145: 711 – 717.

Abstract

The postharvest phase has been considered an environment for successful application of biological control agents (BCAs). However, the interactions between fungal pathogen, host (fruit), and antagonist are influenced by several parameters such as temperature, oxidative stresses, oxygen composition and water activity that could determine the success of biocontrol. Knowledge of the modes of action of BCAs is essential in order to enhance their viability and increase their potential in disease control. The antagonists display a wide range of modes of action: antibiosis, competition for nutrients and space, parasitism and induction of resistance are considered the main ones. Their efficacy, however, is related to the host and the pathogen; sometimes, these mechanisms could act simultaneously, and it is therefore difficult to establish which is related to a specific antifungal action. The current review presents a brief summary of the research that has led to a better understanding of the mode of action of BCAs with particular emphasis on the most recent literature.

Keywords: /Biological Control/ /Fungal Diseases/ / Postharvest Decay/

FOOD SAFETY

Schaarschmidt, Sara, et.al. 2016. Public and private standards for dried culinary herbs and spices part II. Production and product standards for ensuring microbiological safety. Food Control. 70: 360 - 370.

Abstract

Dried culinary herbs and spices (DCHS) are minor food components with widespread use. Despite their low water activity, some microorganisms including pathogenic and toxigenic ones can survive in DCHS. The addition of microbial contaminated DCHS to ready-to-eat food in combination with improper food storage can pose a serious health risk for the consumer. In the past, several food-borne disease outbreaks were related to microbial contaminated spices. The aim of this study was to provide an overview on (i) spice/herb production standards important for promoting food safety by preventing microbial contaminations, (ii) public and private standards providing microbiological criteria to assess the microbiological safety of DCHS, and (iii) product testing performed by DCHS producing/processing businesses to comply with these standards. For that, a literature search and a survey among herb/spice businesses were conducted. Several good practices and production guidelines specific for the primary production and/or processing of culinary herbs and spices were found. Microbiological criteria specific for DCHS are usually rare, but some national standards (mostly of non-EU member states) as well as

recommendations by private bodies could be identified. By EU law, no mandatory microbiological criteria specific for DCHS are laid down. The survey indicated a frequent application of business-to-business agreements. The microbiological quality of DCHS was tested by the survey participants mainly in a routine manner by checking every lot or based on buyer seller agreements. Risk-based testing was less common, which differed to chemical safety testing. Upon import into the EU, testing appeared to be performed predominantly in a routine manner for the pathogenic bacteria *Salmonella* spp., sulphite-reducing clostridia (including *Clostridium perfringens*), *Bacillus cereus*, and *Staphylococcus aureus*.

Keywords: /Food Safety/ /Herbs/ /Spices/

FRESH CUT

Santo, David, et.al. . 2016. Survival and growth of *Cronobactersakazakii* on **fresh cut** fruit and the effect of UV C illumination and electrolyzed water in the reduction of its population. Intl. J. Food Microbiol. 231: 10 - 15.

Abstract

Cronobactersakazakii, found in foods such as powdered infant formula and plant origin ready-to-eat food, is an opportunistic pathogen to infants, neonates and vulnerable adults. The objective of this study was to monitor the growth of *C. sakazakii* in fresh-cut 'Royal gala' apple, 'Rocha' pear, and 'Piel de sapo' melon, and the effect of UV-C illumination, acidic electrolyzed water (AEW) and neutral electrolyzed water (NEW) in the reduction of its population. Fresh-cut fruits were inoculated and incubated at different temperatures during 10 days while monitoring *C. sakazakii*. The inhibitory activity of different doses of UV-C (0–10 kJ.m²), electrolyzed water and sodium hypochlorite (SH) (100 ppm chlorine) was evaluated on the fruits inoculated with *C. sakazakii*. The bacterium showed a significant growth in the fruits at 12 and 20 °C, but did not grow at 4 °C, despite having survived for 10 days. At 8 °C, adaptation phases of 0.6–3.9 days were estimated in the fruits before exponential growth. The UV-C 7.5 and 10 kJ/m² produced greater *C. sakazakii* population decreases (2–2.4 log cfu/g) than AEW(1.3–1.8 log cfu/g), NEW (1–1.2 log cfu/g) and SH (0.8–1.4 log cfu/g). The UV-C decontamination system and refrigeration at 4 °C, may contribute to the product's safety and quality. The results help better understand the behavior of *C. sakazaki* on fresh-cut fruit alerting producers of the necessity to respect the high hygienic practices, adequate refrigerating temperature maintenance and caution with the tendency to prolong the validity of this kind of ready-to-eat food.

Keywords: /Fresh Cut/

PACKAGING

Nousiainen, L. S., et.al. 2016. Bacterial quality and safety of packaged fresh leafy vegetables at the retail level in Finland. Intl. J. Food Microbiol. 232: 73 - 79.

Abstract

Consumption of packaged fresh leafy vegetables, which are convenient ready-to-eat products, has increased during the last decade. The number of foodborne outbreaks associated with these products has concurrently increased. In our study, (1) label information, (2) O₂/CO₂ composition, (3) bacterial quality and (4) safety of 100 fresh leafy vegetables at the retail level were studied in Finland during 2013. Bacterial quality was studied using aerobic bacteria (AB) and coliform bacteria (CB) counts,

and searching for the presence of *Escherichia coli*, *Listeria* and *Yersinia*. The safety was studied by the presence of *Salmonella*, ail-positive *Yersinia*, stx-positive *E. coli* (STEC) and *Listeria monocytogenes* using PCR and culturing. Important label information was unavailable on several packages originating from different companies. The packaging date was missing on all packages and the date of durability on 83% of the packages. Storage temperature was declared on 62% of the packages and 73% of the packages contained information about prewashing. The batch/lot number was missing on 29% of the packages. Very low oxygen (O₂) (b1%) and elevated carbon dioxide (CO₂) (2–22%) concentrations were measured in all packages labelled to contain a protective atmosphere. O₂ and CO₂ concentrations varied widely in the rest of the packages. AB and CB counts were high in the leafy vegetable samples varying between 6.2 and 10.6 and 4.2–8.3 log cfu/g, respectively. In most of the samples, the AB and CB counts exceeded 10⁸ and 10⁶ cfu/g, respectively. A positive correlation was observed between the AB and CB counts. *E. coli* was isolated from 15% of the samples and *Yersinia* from 33%. *L. monocytogenes* was isolated from two samples and ail-positive *Y. enterocolitica* in one. Using PCR, STEC was detected in seven samples, and *Salmonella* and ail-positive *Y. enterocolitica* in two samples each. The AB and CB mean values of products originating from different companies varied widely. High AB and CB counts and pathogenic bacteria were detected in ready-to-eat products not needing washing before use. Our study shows that the bacterial quality and safety of packaged fresh leafy vegetables is poor and label information on the packages is inadequate. More studies are needed concerning the impact of a protective atmosphere on bacterial growth, and the impact of washing for removing bacteria.

Keywords: /Packaging/ /Leafy Vegetables/ /Quality / /Safety/

PACKAGING FILMS

Das, Madhusweta, Tanima Chowdhury. 2016. Heat sealing property of starch based self-supporting edible films. *Food Packag. & Shelf Life*. 9: 64 – 68.

Abstract

Heat sealing property of self-supporting edible films based on corn starch and a functional polysaccharide, such as amylose (AM), methylcellulose (MC) or hydroxypropylmethylcellulose (HPMC) was evaluated. Films were prepared in the laboratory by casting and heat sealed at 85–166 °C by an impulse heat sealer. Irrespective of film composition, sealing temperature influenced the seal strength. Films sealed at temperature <143 °C showed peeling mode failure attributing to weak seal strength, while that at 144 °C showed tearing mode failure indicating good seal strength. The highest seal strength was obtained at 166 °C, and the value was 0.396, 0.211 and 0.385 N/mm for AM, MC, and HPMC containing film, respectively.

Keywords: /Packaging Films/ /Edible films/

FRUITS

AVOCADO

Blakey, Robert J. 2016. Evaluation of avocado fruit maturity with a portable near infrared spectrometer. *Postharvest Biol. Technol.* 121: 101 - 105.

There is considerable financial incentive for avocado (*Persea americana* Mill.) growers in South Africa to begin harvest as soon as the minimum fruit maturity has been reached. The need to quickly

process a large amount of samples for maturity determination pre- and postharvest using a user-friendly instrument provided motivation this study. 'Fuerte', 'Hass' and 'Carmen1-Hass' fruit were included in the calibration of the portable near-infrared spectrometer. The calibration included fruit from three seasons and the external validation included fruit from two further seasons. With this portable NIR spectrometer, it was not possible to develop a calibration model to accurately measure the maturity of avocado fruit non-destructively ('Fuerte': $R^2 = 0.654$, RMSECV = 2.62, RPDCV = 1.23, 'Hass' and 'Carmen1-Hass': $R^2 = 0.400$, RMSECV = 2.94, RPDCV = 0.79). A model incorporating all three cultivars, with the fruit peel removed, provided comparable results to the commercial method when using at least four fruit per sample ($R^2 = 0.732$, RMSEP = 1.83, RPD = 1.14). The measurement of a single fruit took 30s, and could be conducted pre- or postharvest

Keywords: /Avocado/ /Maturity/

Nayrko, Esmond, et.al. 2016. Survival and growth of *Listeria monocytogenes* on whole cantaloupes is dependent on site of contamination and storage temperature. *Int'l. J. Food Microbiol.* 234: 65 – 70.

Abstract

Whole cantaloupes (*Cucumis melo* L.), marketed as 'Rocky Ford', were implicated in a large multi-state outbreak of listeriosis in the United States in 2011; however, survival and growth of *Listeria monocytogenes* on whole cantaloupes remains relatively unexplored. The research presented here evaluated three different storage temperatures, two sites of contamination of cantaloupes, and two cantaloupe varieties to determine their effect on the survival of *L. monocytogenes*. 'Athena' and 'Rocky Ford' cantaloupe cultivars were grown in soil and harvested, and individual melons subsequently received a multi-strain inoculum of *L. monocytogenes* (6 log CFU/melon), which were then stored at 4 °C, 10 °C, and 25 °C. Changes in *L. monocytogenes* populations on the rinds and stem scars of cantaloupes stored at each temperature were determined at selected times for up to 15 days. An analysis of variance revealed that inoculation site and storage temperature significantly affected survival of *L. monocytogenes* on cantaloupes during storage ($p < 0.05$), but cultivar did not influence *L. monocytogenes* ($p > 0.05$). Populations of *L. monocytogenes* on stem scars of cantaloupes stored at 25 °C increased by 1–2 log CFU/melon on day 1, and were significantly greater than those on cantaloupes stored at 4 °C or 10 °C ($p < 0.05$), which remained constant or increased by approximately 0.3 log CFU/melon, respectively, over the same time period. A decrease of 2–5 log CFU/melon of *L. monocytogenes* occurred on the rinds of cantaloupes during storage by day 7, and were not significantly different at the three different storage temperatures ($p > 0.05$). In trials performed in rind juice extracts, populations of *L. monocytogenes* decreased by 3 log CFU/mL when stored at 25 °C by day 3, but grew by 3–4 log CFU/mL when stored at 4 °C over 7 days. Overall, site of contamination and storage temperature influenced the survival of *L. monocytogenes* on cantaloupes more than cantaloupe cultivar type.

Keywords: /Cantaloupe/ /Storage/

Ukuku, Dike O, et. al. 2016. Microbial safety and overall quality of cantaloupe fresh cut pieces prepared from whole fruit wet steam treatment. *Intl. J. Food Microbiol.* 231: 86 - 92.

Abstract

Fresh-cut cantaloupes have been associated with outbreaks of Salmonellosis. Minimally processed fresh-cut fruits have a limited shelf life because of deterioration caused by spoilage microflora

and physiological processes. The objectives of this study were to use a wet steam process to 1) reduce indigenous spoilage microflora and inoculated populations of Salmonella, Escherichia coli O157:H7 and Listeria monocytogenes on the surface of cantaloupes, and 2) reduce the populations counts in cantaloupe fresh-cut pieces after rind removal and cutting. The average inocula of Salmonella, E. coli O157:H7 and Listeria monocytogenes was 10⁷ CFU/ml and the populations recovered on the cantaloupe rind surfaces after inoculation averaged 4.5, 4.8 and 4.1 log CFU/cm², respectively. Whole cantaloupes were treated with a wet steam processing unit for 180 s, and the treated melons were stored at 5 °C for 29 days. Bacterial populations in fresh-cut pieces prepared from treated and control samples stored at 5 and 10 °C for up to 12 days were determined and changes in color (CIE L*, a*, and b*) due to treatments were measured during storage. Presence and growth of aerobic mesophilic bacteria and Salmonella, E. coli O157:H7 and L. monocytogenes were determined in fresh-cut cantaloupe samples. There were no visual signs of physical damage on all treated cantaloupe surfaces immediately after treatments and during storage. All fresh-cut pieces from treated cantaloupes rind surfaces were negative for bacterial pathogens even after an enrichment process. Steam treatment significantly (p < 0.05) changed the color of the fresh-cut pieces. Minimal wet steam treatment of cantaloupes rind surfaces designated for fresh-cut preparation will enhance the microbial safety of fresh-cut pieces, by reducing total bacterial populations. This process holds the potential to significantly reduce the incidence of foodborne illness associated with fresh-cut fruits.

Keywords: /Cantaloupe/ /Hot water/ /Fresh-Cut/

CITRUS

Lombardo, Pamela, et.al. 2016. Effectiveness of essential oils for postharvest control of *Phyllosticta Citricarpa* (citrus black spot on citrus) fruit. *Postharvest.Biol.Technol.* 121: 1 – 8.

Abstract

The in vitro and in vivo control of *Phyllosticta citricarpa* (citrus black spot, CBS) on citrus fruits was evaluated using 14 essential oils (EOs) extracted from Uruguayan native plants. In vitro, volatile components of *Chenopodium ambrosioides* completely inhibited fungal growth. The dilution agar test showed that fungus reproduction was completely inhibited by *Conyza bonariensis* essential oil (EO). The other 12 EOs tested showed high inhibition after 10–15 d, presenting fungistatic effects. In vivo, assays were performed on fruit of lemon [*Citrus limon* (L.) Burm] and Valencia orange [*Citrus sinensis* (L.) Osbeck] in order to evaluate the effects of liquid and volatile EO phases on reproduction. Typical lesions of CBS without reproductive structures were exposed to *Ch. Ambrosioides* and *C. Bonaerensis* EOs for 20 d at 27 °C and cycles of 16 h light and 8 h dark. The volatile components of *Ch. Ambrosioides* were able to control 100% of *P. Citricarpa* production in orange and lemon fruit. The growth of other fungi such, as *Colletotrichum gloeosporioides* and *Fusarium* sp., was also inhibited. Nevertheless, the liquid phase was not effective to control the pathogen. In another test, carton boxes with 20 fruits, each presenting typical CBS symptoms, but without the presence of reproductive structures, were exposed to 0.01 and 0.05% of *Ch. ambrosioides* EO (w/v). The fruits were stored at 5 °C for 20 d and then kept for 7 d at room temperature. A 40% reduction of reproduction was observed in citrus fruit exposed to 0.05% of EO. GC–MS analysis of EOs showed that *Ch. Ambrosioides* EO was composed of 76% monoterpene compounds (49 and 27% of oxygenated and hydrocarbons, respectively), while *C. bonaerensis* EO presented 17% monoterpenes and 10% sesquiterpenes.

Keywords: /Citrus/ /Quarantine Disease/ /Black Spot/ /Orange/ /Lemon/

FIG

Rosianskey, Yogev, et.al. 2016. Chlorophyll metabolism in pollinated vs. parthenocarpic **fig** fruits throughout development and ripening. *Planta*. 44: 491 - 504.

Abstract

Main conclusion Expression of 13 genes encoding chlorophyll biosynthesis and degradation was evaluated. Chlorophyll degradation was differentially regulated in pollinated and parthenocarpic fig fruits, leading to earlier chlorophyll degradation in parthenocarpic fruits. Varieties of the common fig typically yield a commercial summer crop that requires no pollination, although it can be pollinated. Fig fruit pollination results in larger fruit size, greener skin and darker interior inflorescence color, and slows the ripening process compared to non-pollinated fruits. We evaluated the effect of pollination on chlorophyll content and levels of transcripts encoding enzymes of the chlorophyll metabolism in fruits of the common fig 'Brown Turkey'. We cloned and evaluated the expression of 13 different genes. All 13 genes showed high expression in the fruit skin, inflorescences and leaves, but extremely low expression in roots. Pollination delayed chlorophyll breakdown in the ripening fruit skin and inflorescences. This was correlated with the expression of genes encoding enzymes in the chlorophyll biosynthesis and degradation pathways. Expression of pheophorbide a oxygenase (PAO) was strongly negatively correlated with chlorophyll levels during ripening in pollinated fruits; along with its high expression levels in yellow leaves, this supports a pivotal role for PAO in chlorophyll degradation in figs. Normalizing expression levels of all chlorophyll metabolism genes in the pollinated and parthenocarpic fruit skin and inflorescences showed three synthesis (FcGluTR1, FcGluTR2 and FcCLS1) and three degradation (FcCLH1, FcCLH2 and FcRCCR1) genes with different temporal expression in the pollinated vs. parthenocarpic fruit skin and inflorescences. FcCAO also showed different expressions in the parthenocarpic fruit skin. Thus, chlorophyll degradation is differentially regulated in the pollinated and parthenocarpic fruit skin and inflorescences, leading to earlier and more sustained chlorophyll degradation in the parthenocarpic fruit.

Keywords: /Fig/ /Fruit Ripening/

KIWIFRUIT

Ampa, Kongsuwan, et.al. 2016. Effects of pre harvest application of ethephon on abscisic acid on Kohi **kiwifruit** (*Actinidia chinensis*) ripening on the vine. *Scientia Hort*. 209: 155 - 260.

Abstract

The effects of ethephon, abscisic acid (ABA), and nordihydroguaiaretic acid (NDGA) application on the ripening of pre-harvest 'Kohi' kiwifruit (*Actinidia chinensis*) were studied. The fruits were treated on-vine at 155 days after full bloom (DAFB) (mature stage) with 250 µL/L ethephon, 100 µmol ABA, or 100 µmol NDGA. The fruits were sampled at 0, 3, 6, 9, and 12 days after treatment (DAT), and the following were analyzed at each time point: ethylene production, 1-aminocyclopropane-1-carboxylate (ACC) and ABA concentrations, ACC synthase (ACS) and ACC oxidase (ACO) activities, volatile compounds (n-hexanal and (E)-2-hexenal), and the expressions of AcACS1, AcACO1, and 9-cis-epoxycarotenoid dioxygenase 1 (AcNCED1) genes. ABA concentrations and AcNCED1 gene expression increased in ABA-

treated fruit. Malic acid concentrations and fruit firmness decreased in ethephon-treated fruit, but soluble solids concentrations (SSC), ethylene biosynthesis, and both AcACS1 and AcACO1 gene expressions increased. The accumulated fruit drop rate in ethephon-treated fruit was 4% at the edible stage at 9 DAT. Moreover, the production of n-hexanal and (E)-2-hexenal decreased in ethephon-treated fruit. These results suggest that 'Kohi' kiwifruit may be ripened by on-vine ethephon application at 9 DAT, thus obviating ripening treatment after harvest.

Keywords: /Kiwifruit/ /Ethephon/

LITCHI

Ali, Sajidi, Ahmad Sattar Khan, Aman Ullah Malik. 2016. Postharvest L-cysteine application delayed pericarp browning, suppressed lipid peroxidation and maintained antioxidative activities of litchi fruit. *Postharvest Biol & Technol.* 121: 135 – 142.

Abstract

Efficacy of L-cysteine as an anti-browning agent was investigated on 'Gola' litchi fruit. Fruit were treated with its different concentrations (0.0, 0.25, 0.50, 0.75 and 1.0%) and stored at 5 °C with 90 – 95% relative humidity (RH) for 28 d. Among the used concentrations, 0.25% treatment was most effective. L-cysteine (0.25%) treated-fruit showed significantly reduced weight loss, disease incidence, disease severity, browning index, membrane leakage and malondialdehyde (MDA) contents. Application of L-cysteine (0.25%) to litchi fruit maintained acidic pericarp pH, exhibited higher total anthocyanins, 2,2-Diphenyl-1-picryl-hydrazyl (DPPH) radical-scavenging-activity and total phenolic contents (TPC) along with reduced activities of peroxidase (POD) and polyphenol oxidase (PPO) enzymes. L-cysteine (0.25%) treatment also maintained substantially higher soluble solid contents (SSC), titratable acidity (TA), ascorbic acid contents and activities of catalase (CAT) and superoxide dismutase (SOD) enzymes. In conclusion, pre-storage L-cysteine (0.25%) application to litchi fruit exhibited reduced pericarp browning index and maintained antioxidative system for 28 d.

Keywords: /Litchi/ /Browning/

MANDARIN

Jeong, Rae-Dong, et.al. 2016. Inhibitory effect of gamma irradiation and its application for control of postharvest green mold decay of Satsuma mandarins. *Intl.J.Food.Microbiol.*234: 1 – 8.

Abstract

Gamma irradiation has been shown to be effective for the control of postharvest fungi in vitro, but little is known regarding antifungal action, responses to gamma irradiation, and its application to fresh produce. Gamma irradiation was evaluated for its in vitro and in vivo antifungal activity against *Penicillium digitatum* on Satsuma mandarin fruits. Green mold was inhibited in a dose-dependent manner. Gamma irradiation showed a complete inhibition of spore germination, germ tube elongation, and mycelial growth of *P. digitatum*, particularly at 1.0 kGy. To further investigate the mechanisms by which gamma irradiation inhibits fungal growth, the membrane integrity and cellular leakage of conidia were tested, indicating that gamma irradiation results in the loss of plasma membrane integrity, causing the release of intracellular contents such as soluble proteins. In vivo assays demonstrated that established doses can completely inhibit the growth of fungal pathogens, but such high doses cause

severe fruit damage. Thus, to eliminate the negative impact on fruit quality, gamma irradiation at lower doses was evaluated for inhibition of *P. digitatum*, in combination with a chlorine donor, sodium dichloro-striazinetrione (NaDCC). Interestingly, only a combined treatment with 0.4 kGy of gamma irradiation and 10 ppm of NaDCC exhibited significant synergistic antifungal activity against green mold decay. The mechanisms by which the combined treatment decreased the green mold decay of mandarin fruits can be directly associated with the disruption of cell membrane of the fungal pathogen, which resulted in a loss of cytoplasmic material from the hyphae. These findings suggest that a synergistic effect of combining treatment with gamma irradiation with NaDCC has potential as an antifungal approach to reduce the severity of green mold in mandarin fruits.

Keywords: /Mandarin/ /Gamma Irradiation/

MELON

Botondi, Rinaldo, et.al. 2016. A comparative study on the effectiveness of ozonated water and peracetic acid in the storability of packages fresh cut melon. J. Food Sci. Technol. 53: 2352 – 2360.

Abstract

Ozonated water and peracetic acid were tested as sanitizers to enhance the storability of fresh-cut melon cubes. Sanitizers were also combined with suitable packaging materials (polypropylene and polylactic acid based plastic films). Fresh-cut melon cubes were stored at 4 °C for up to 7 days. Ozonated water and peracetic acid treatments were given by dipping cubes into 0.8 ppm O₃ and 100 ppm Tsunami 100™ solutions, respectively, for 3 min. Both sanitizers exhibited efficiency in reducing the total microbial counts on melon cubes (< 2 log CFU g⁻¹). Respiratory activity and ethylene production were both affected by the interaction between the sanitizer and the packaging used. Carbon dioxide and oxygen reached 9.89 kPa and 12.20 kPa partial pressures, respectively, using peracetic acid treatment in combination with polypropylene film packaging, consequently developing off-odors starting from day 3. Strong color changes were noted in cubes stored in polylactic acid packaging after 7 days of storage, affecting the sensory quality of the melon cubes. Sensory evaluation (overall visual quality) indicated loss in flavor in the polypropylene packaging. The overall visual quality started to decline on 3rd day because of the development of translucency. Overall, the use of ozone in combination with polypropylene packaging provided the best solution to maintain the quality of melon cubes for up to 5 days of storage at 4 °C.

Keywords: /Melon/ /Fresh Cut/ /Quality/

PEACH

Contador, L., 2016. A proposal for determining the flesh softening of peach and nectarine in postharvest through simplified targeted modeling. Scientia Hort. 209: 47 - 52.

Peach flesh softening is a continuous process that occurs mainly during postharvest. It allows fruit to reach the proper firmness for consumption. In this trial, it was evaluated different texture attributes of three nectarine cultivars and three peach cultivars over a 5-day period (day of harvest, and the first, second, third, and fourth days after harvest) at 20°C using penetration and uniaxial compression tests. Through linear modelling with it was obtained the fixed and random effects and linear functions, where the slopes represent the flesh softening. Cultivars were segregated using contrast tests. It was found that the penetration test was more effective than the uniaxial compression

test, as it allowed for the segregation of the genotypes into three clusters. One cluster, grouped the melting fleshed (MF) nectarines ('Andes Nec-1', 'Andes Nec-3', and 'Venus'), showed the fastest softening rate. The MF 'Sweet September' and the non-melting (NMF) 'Hesse' were grouped together, as they exhibited the lowest softening rate. Lastly, the NMF 'Andross' was alone, showing an average score. These results suggest that the different softening patterns cannot be fully explained by the MF/NMF classification. In order to facilitate the implementation of the protocol for determining softening, it was used a targeted model that focused on the most informative phase of the curve—namely, the first and third days of the evaluations. This simplified targeted model allowed to segregate the genotypes into the same original clusters, and it confirms that the analysis of only two points of evaluation is sufficient to characterize the softening rates of different peach cultivars.

Keywords: /Peach/ /Ripening/ /Firmness/

Pazolini, Kelly, et.al. 2016. 2016. The use of brassica extracts and thermotherapy for the postharvest control of brown rot in peach. *Scientia Hort.* 209: 41 - 46.

Abstract

Brown rot (*Monilinia fructicola*), one of the most important diseases of stone fruits, can lead to significant fruit losses in the field and postharvest. Canola and Indian mustard extracts acquired through different extraction methods, alone and in combination with thermotherapy, were tested against postharvest brown rot in peaches. Initially, canola and Indian mustard extracts collected through the methods of simple extraction (Sp), infusion (In) and maceration (Mc) were assessed for their capacity to control *M. fructicola* in vitro and in vivo. The Sp extracts of each species were selected to be tested under different treatment sequences, alone and in combination with thermotherapy (50°C for 30 s) on peaches inoculated with *M. fructicola*. The most effective canola and Indian mustard treatment sequences were selected and compared with the chemical treatment (azoxystrobin®, 2 g L⁻¹) and a control (sterile distilled water). The Sp extractions of canola and Indian mustard were effective at postharvest control of brown rot in peaches. When these extracts were combined with thermotherapy in the sequence Sp extract + thermotherapy + Sp extract, the efficacy of postharvest brown rot control in peaches was improved. The canola Sp extract was more effective than the Sp of Indian mustard when combined with thermotherapy and it achieved *M. Fructicolas* population reduction level equal to that given by the fungicide solution when applied to "Eldorado" peaches.

Keywords: /Peach/ /Brown Rot/ /Postharvest/

PEAR

He, Xueming, et.al. 2016. Assessing firmness and SSC of pears based on absorption and scattering properties using an automatic integrating sphere system from 400 to 1150 nm. *Postharvest.Biol.Technol.* 121: 62 - 70.

Abstract

It is important to understand the fundamental optical properties of fruit tissues when applying optical techniques for quality inspection of fruits. An automatic integrating sphere (AIS) system was used to measure the total reflectance and total transmittance of pear tissue in the wavelength range of 400–1150 nm. These two measurements were used to estimate the bulk optical properties (absorption coefficient μ_a and reduced scattering coefficient μ'_s) of tissue samples using inverse adding-doubling

(IAD) method. The accuracy of AIS system was verified by using both an INO solid phantom and a set of liquid phantoms. Relationships between soluble solids content (SSC), firmness and the optical properties were investigated, with coefficients of determination of 0.40 and 0.48 for validation, respectively. In addition, the m_a decreased with the increase of shelf-life time, while the m'_s did just the opposite. This study demonstrated the feasibility of detecting multiple qualities of pears by investigating the tissue optical properties. For further research, the measured optical properties of pear tissues can be used for modeling and simulation of light-fruit interaction.

Keywords: /Pear/ /Shelf Life/ /Firmness

Hui, Wei, et.al. . 2016. Evidence supporting the involvement of MHO in the formation of superficial scald in Dangshansuli pears. Postharvest Biol. Technol. 121: 43 - 50.

Abstract

The development of superficial scald in 'Dangshansuli' pears (*Pyrus bretschneideri* Rehd) was investigated in relation to 6-methyl-5-hepten-2-one (MHO). Over the course of a 180-day cold storage at $2 \pm 0.5^\circ\text{C}$ and a 9-day post storage at 20°C , the effect of endogenous MHO was investigated in chemically untreated pears, and pears treated with diphenylamine (DPA) and 1-methylcyclopropene (1-MCP) after harvest. In the untreated pears, MHO began to accumulate in peel tissue after 60 d of cold storage and continued to do so until the end of cold storage, by which time superficial scald had developed. In DPA- and 1-MCP- treated pears, on the other hand, there was very little MHO accumulation during cold storage and, at the end of this period, no scald had developed. Results from the cold storage period, therefore, indicate a positive relation between scald incidence and endogenous MHO concentration. Results from 9-day post-storage reveal also a strong positive correlation between scald and endogenous MHO concentration, with a correlation coefficient of 0.97936 ($P < 0.05$). The effect of exogenous MHO was investigated before and after cold storage in DPA- and 1-MCP-treated pears, as well as untreated pears. The application of 0.5, 1.0, and 2.0 mL L⁻¹ MHO both before and after cold storage caused scald develops in a concentration-dependent manner: The higher the MHO concentration, the higher the scald incidence. The application of DPA and 1-MCP prior to application of MHO did not affect scald development before cold storage. However, after cold storage, DPA-treated pears were found to have a lower scald incidence and MHO concentration than untreated pears. Moreover, the results indicate that MHO directly induces superficial scald in 'Dangshansuli' pears.

Keywords: /Pear/ /Superficial Scald/

PLUM

Majeed, Ruqiya, S.K. Jawandha. 2016. Enzymatic changes in plum *Prunus silicifera* Lindl. subjected to some chemical treatments and cold storage. J. Food Sci. Technol. 53(5): 2372 - 2379.

Abstract

The objective of the present work is to see the effect of different chemical treatments on pectin methylesterase (PME) activity and softening of the fruits. Purple plums (cv. Satluj) fruits were harvested at colour break stage and treated for 5- minutes in aqueous solutions of salicylic acid at 138, 276 and 414 ppm, Ascorbic acid at 10,000, 20,000 and 30,000 ppm, and Gibberelic acid at 20, 40 and 60 ppm. For control the fruits were dipped in distilled water. Treated fruits were stored at low temperature conditions for 40 days. Physico-chemical characteristics and PME activity were determined at 10 day

interval. The colour of the fruits improved with respect to a^* and b^* values progressively throughout the storage, whereas, fruit firmness decreased. Total sugars and PME activity increased before showing a declining trend. Pre-storage application of salicylic acid (414 ppm) significantly delayed colour development. Fruits treated with salicylic acid (414 ppm) retained highest firmness, total sugars and PME activity at the end of storage.

Keywords: /Plum/ /Firmness/ /Fruit Softening/ /Salicylic Acid/

Wang, Jiao. 2016. Patterns of flesh reddening, translucency, ethylene production and storability of Friar **plum** fruit harvested at three maturity stages as affected by the storage temperature. *Postharvest Biol. Technol.* 121: 9 – 18.

Abstract

Flesh reddening and translucency are two predominant physiological disorders of 'Friar' plum (*Prunus salicina* Lindl.) during cold storage. In order to investigate the occurrence of these disorders, the fruit were harvested at early-, mid- and late-maturity stages and stored at 0, 2, 5, 15 or 25 °C, 85–95% relative humidity. Three concomitant patterns for flesh reddening, translucency and abnormal softening (melting) of 'Friar' plums were evident: rapid increases in these disorders at 5 and 15 °C, a delayed/suppressed of these disorders at 0 and 2 °C, and normal ripening at 25 °C, irrespective of fruit maturity stage. Three similar temperature-mediated patterns of anthocyanin accumulation related to flesh reddening, pectin solubilization related to translucency, and decline in firmness related to abnormal softening were observed. Three patterns of ethylene production were also identified: early and dramatically high ethylene production at 5 and 15 °C, suppressed ethylene production at 0 and 2 °C, and almost no ethylene production at 25 °C. These results suggest that ethylene may be involved in the onset and development of flesh disorders of 'Friar' plums during cold storage. Respiration greatly increased, water-soluble pectin content increased early during storage and remained high, and insoluble pectin (i.e., protopectin) decreased, in plums held at 5 and 15 °C. Overall, the biochemical and physiological behavior of plums were greatly affected by storage at 5 and 15 °C compared with 0, 2 and 25 °C, and late-maturity plums were more susceptible to storage disorders.

Keywords: /Plum/ /Anthocyanins/ /Ethylene

STRAWBERRY

Sangsuwan, Jurmkwan, et.al. 2016. Effects of chitosan incorporated with lavender or red thyme essential oils in inhibiting *Botrytis cinerea* and their application in **strawberry** packaging system. *LWT - Food Science and Technol.* 74:14 – 20.

Abstract

Chitosan beads (C), those containing lavender (L) or red thyme (RT) essential oils at 2 levels: low or high (0.125 or 0.25 g/plate or sachet) were used to inhibit *Botrytis cinerea* on potato dextrose agar (PDA) and in strawberry clamshell. The system without beads served as control. L-high, RT-low and RT-high can effectively inhibit *B. cinerea* on PDA. The efficiency of beads was also tested with strawberry packed in clamshell by attaching a bag containing beads under clamshell lid and stored at 7 °C for 10 days. On Day 10, decay of control strawberry, strawberry with C-low, C-high, L-low, L-high, RT-low and RT-high were 40%, 30%, 30%, 5%, 5%, 10% and 0%, respectively. The quality of strawberry during storage was evaluated. On Day 10, weight loss of strawberry packed with C-high, L-high, RT-low and RT-

high were significantly lower than control. Also these treatments had higher CO₂ and lower O₂ concentration in the clamshell. From sensory evaluation using 9-point hedonic scale, essential oils did not affect appearance, colour and firmness of strawberry but lowered odour, flavour and overall acceptability scores. However, on Day 10, the control strawberry, strawberry with C-high, L-high and RT-high were acceptable with the score of 7.0, 7.2, 5.8 and 5.1, respectively.

Keywords: /Strawberry/ /Botrytis Cinerea/ /Active Packaging/

HERBS & SPICES

BASIL

Cozzolino, Rosaria, et.al. 2016. Assessment of volatile profile as potential marker of chilling injury of basil leaves during postharvest storage. Food Chem. 213 - 368.

Abstract

The volatile profile of three sweet basil cultivars, “Italico a foglialonga”, “Cammeo” and “Italianoclassico”, packaged in air at 4 or 12 °C until 9 days, was monitored by solid phase micro extraction with GC–MS. Chilling injury (CI) score and electrolyte leakage were also assessed. In total, 71 volatile organic compounds (VOCs) were identified in the headspace of basil samples. A preliminary principal component analysis highlighted the dominant effect of the cultivar on VOCs profiles. Data analysis by post transformation of projection to latent structures regression (ptPLS2) clarified the role played by time and temperature of storage. Temperature influenced the emission of volatiles during storage, with much lower total volatile emissions at 4 °C compared to 12 °C. Finally, a ptPLS2 regression model performed on VOCs and the two CI parameters allowed selection of 10 metabolites inversely correlated to both CI parameters, which can be considered potential markers of CI in basil leaves

Keywords: /Basil/ /Chilling Injury/ /Storage/

WILD ROCKET

Wieczynska, Justyna, et.al. 2016. The use of antimicrobial sachets in the packaging of organic wild rocket: impact on microorganisms and sensory quality. Postharvest Biol. & Technol. 121: 126–134.

Abstract

Natural plant extracts from herbs and spices are regarded as safe products for the control of microorganisms. The aim of this work was to study the effects of natural antimicrobial compounds on the quality of packaged fresh organic wild rocket (*Diplotaxis tenuifolia* L.). The effects of eugenol, carvacrol, trans-anethole, trans-cinnamaldehyde, and α-pinene were tested in vitro against rot and human pathogens. All of the compounds exhibited antimicrobial activity, except for α-pinene. The efficacy of the antimicrobial compounds to control microorganisms, leaf color, spoilage volatiles, such as dimethyl disulfide, and sensory quality was tested in two in vivo experiments with sachets: a lab-scale jar experiment and a commercial-scale packaging experiment. In the jar experiment, eugenol showed higher antimicrobial activity than carvacrol against aerobic bacteria. All of the jars contained dimethyl disulfide in the headspace, but the sulfurous rotten odor was only detected in the control and eugenol samples, demonstrating that carvacrol, trans-anethole, and trans-cinnamaldehyde could mask the

unpleasant odor of rotten wild rocket. In the packaging experiment, there was no clear effect of eugenol, carvacrol or trans-anethole on the microbial load, but eugenol and trans-anethole masked the off-odor ratings of wild rocket. Evaluation of antimicrobial compounds for packaged fresh produce must include in vitro and in vivo testing because the benefits in real food systems may differ from those obtained in the laboratory.

Keywords: /Wild Rocket/ /Packaging/ /Quality/

VEGETABLES

ASPARAGUS

Donnis-Gonzales, Irwin T., Daniel E. Guyer, Anthony Pease. 2016. Postharvest noninvasive classification of tough fibrous asparagus using computed tomography images. Postharvest Biol. Technol. 121: 27 - 35.

Abstract

This research was devised to evaluate Computed Tomography (CT) for asparagus fibrousness detection and more specifically develop and test an automatic image analysis method (algorithm) to classify CT images obtained from 859 asparagus (*Asparagus officinalis*L.) segment (samples), collected during two harvesting seasons (2014 and 2015). Classification accuracy was calculated by comparing the classes obtained using a combination of imaging, image processing, feature extraction, and classification schemes per asparagus segment against an industry-simulated invasive quality assessment. Grayscale intensity and textural features, 3762 total, were extracted from minimum and maximum resultant images from three CT planer views. A 4-fold cross-validation linear discriminant classifier with a performance accuracy of 91.2% was developed using 75 relevant features, which were selected using a sequential forward selection algorithm with the Fisher discriminant objective function. This objective method is accurate in determining the presence of tough-fibrous tissue in asparagus, which demonstrates a potential for such technology to objectively forecast asparagus quality and thus supports the asparagus industry through optimizing consumer acceptability and product utilization.

Keywords: /Asparagus/ /Quality/

BROCCOLI

Caleb, Oluwafemi, et.al. 2016. Integrated modified and humidity package for minimally processed broccoli Brassica oleracea L. var. Italica .Postharvest Biol. Technol. 121: 87 - 100.

Abstract

Broccoli is often over wrapped in polymeric films (with low water vapour transmission rates) or packaged in macro-perforated films, which results in a water vapour saturated headspace (with _100%) or sub-optimal relative humidity. This study investigated the effects of appropriate design of modified atmosphere and humidity packaging systems (based on package type, presence of micro-perforation and the use of ethylene scavenger) on the postharvest quality of minimally processed broccoli branchlets stored at 10 °C for 11 d. Package design optimization (with a cellulose-based film window on polymeric film and/or micro-perforations) was performed using respiration and transpiration rate data at temperatures of (4, 10 and 16 °C) and 100% RH, respectively, in order to establish desired gas and

water vapour transmission rate of packaging materials. Equilibrium modified atmosphere and humidity of 97% and 95% was established in the headspace of bi-axially oriented polypropylene (BOPP) packages with 20% of cellulose film window area. Further use micro-perforations reduced humidity to 92% and prevented the accumulation of volatile sulphur compounds. Packages incorporated with cellulose-based film window effectively prevented water vapour condensation on the film surface when compared to bi-axially oriented polypropylene and cling-wrapped commercial control. Non-perforated packaging system with cellulose-based film window better retained surface colour and maintain quality attributes at 10 °C for 11 d, but at the expense of a significantly ($p < 0.05$) higher difference in product mass loss compared to the control package.

Keywords: /Broccoli/ /Storage/ /Quality/

CARROT

Alegria, Carla, et.al. 2016. Peel removal improves quality without antioxidant loss, through wound induced phenolic biosynthesis in shredded carrot. Postharvest Biol.Technol. 120: 232 - 239.

Abstract

In this study we evaluated the effect of abiotic stresses, peeling and shredding, in different carrot tissues as a phenolic synthesis elicitor to improve bioactive quality of shredded carrot as a fresh-cut. The phenolic content (TPC) present in carrot peels (2954 mg kg^{-1}) is up to ~6 times higher than that of inner tissues (762 and 510 mg kg^{-1} for cortical parenchyma and vascular tissues, respectively). However, the effect of peel removal is mitigated by the respective tissue proportion in the root (~11% for peel and ~89% for inner tissues). Phenolic biosynthesis was verified in all carrot tissues and even when peel was removed, inner tissues were able to significantly accumulate phenolics during low temperature storage (5 °C, 10 d), with increases of 155% (compared to day 0). As key enzyme of the phenylpropanoid pathway, phenolic biosynthesis, in inner tissues, was confirmed by the phenylalanine-ammonia lyase (PAL) activity increase ($p < 0.05$) after wounding (peeling and shredding). It was also shown that color changes in carrot peel tissues (browning), with high polyphenoloxidase activity levels (up to 2 times regarding inner tissues), were more pronounced than in inner tissues under a high intensity wounding (shredding), showing that carrot fresh-cut production can benefit from peel removal. The use of controlled wound stresses, by increasing pre-existing raw material antioxidants, creates an opportunity to guarantee the bioactive fresh-like quality, a major challenge for fresh-cuts.

Keywords: /Carrot/ /Low Temperature Storage/ /Peeling / /Shredding/

CUCUMBER

Guo, Yanbiai, et.al. 2016. Salmonella entericaserovar Choleraesuis on fresh cut cucumber slices after reduction treatments. Food Control. 70: 20 - 25.

Abstract

Cucumber is a popular fruit around the world and has been implicated in Salmonella food poisonings. S. Choleraesuis is a serovar that can cause pig and human infections but was rarely examined in food safety context. To investigate S. Choleraesuis behavior on cucumber slices, it was inoculated, at 104 colony forming units (CFU)/mL, onto fresh-cut cucumber slices and subjected to

reduction with either high hydrostatic pressurization (HHP), hydrogen peroxide (H₂O₂), or Peredibactersp. BD2GS treatment, its reduction and survival during 48 h storage at 4 °C and 25 °C were compared. Reduction tests revealed that 5% H₂O₂ was most effective in killing *S. Choleraesuis*, with 97.5% reduction after 15 min action, compared to 90.7%, 87.7%, 29.2% and 60.2% reduction rates with HHP, 2.5% H₂O₂, high- and low-dose BD2GS treatments, respectively. At the end of storage, contrast to no changes at 4 °C, *S. Choleraesuis* counts rose significantly ($p < 0.05$) at 25 °C. Compared to control that reached 7.1 ± 0.1 log CFU/g, HHP, 5% and 2.5% H₂O₂ attained 6.3 ± 0.1 , 6.7 ± 0.1 and 6.4 ± 0.2 log CFU/g correspondingly, whereas high- and low-dose BD2GS attained 4.9 ± 0.1 and 5.9 ± 0.1 log CFU/g respectively. A shared growth peak of between 9 h and 12 h was noted in all treatments except high-dose BD2GS where it occurred in the first 3 h. Results of this study revealed the effectiveness of 5% H₂O₂ in the reduction of *S. Choleraesuis*, and demonstrated that if not stored properly, contaminated cucumber slices, though treated, can still have potentials to cause *S. Choleraesuis* outbreaks.

Keywords: /Cucumber/ /Fresh-Cut/

LETTUCE

Li, Zhiguo, Yuqing Wang. 2016. A multiscale finite element model for mechanical response of tomato fruits. *Postharvest Biol. Technol.* 121: 19 - 26.

Abstract

A multiscale finite element model, which included three parts: cuticle, pericarp frame and septal tissues, and a nearly incompressible surface-based fluid-filled locule, was developed to simulate the compressive mechanical response of a tomato fruit. In the model, the cuticle was bonded to the outer surface of a frame of pericarp tissue; the tissue frame was meshed into hexahedral tissue (cell aggregate) elements so that the macroscopic fruit could be linked to microscopic cell aggregates. The contact between the fruit and compression probe was defined as a hard contact pressure-overclosure relationship and followed a Coulomb friction model. Assuming elastic-plastic constitutive behavior for the cuticle and the cell aggregate elements and water-like fluid in the locule, the simulated compression force mainly depended on the elastic modulus of the cell aggregates. Increasing the modulus of the cell and cuticle resulted in coupling effects between the fruit tissue structure and the fluid inside the locule that gradually intensified with increasing percentage deformation. Using previously determined material parameters of pericarp cells and cuticle, the model was found to be remarkably capable of reproducing the macroscopic force-deformation behavior of a tomato fruit in compression up to 10% deformation. The model can be used to predict the mechanics of the cuticle if the mechanics of the pericarp are known, or vice versa. In this way, the elastic modulus, yield strength and Poisson's ratio of *Delyca* tomato cuticle at 5 mm/s loading speed was eventually predicted to be 800 MPa, 50 MPa and 0.49 respectively. The multiscale modeling method might also be used for other fruits.

Keywords: /Tomato/

MUSHROOM

Ding, Yang. 2016. Effects of postharvest estrassinolide treatment on the metabolism of white button mushroom *Agaricus bisporus* in relation to development during storage. *Food Bioprocess Technol.* 9: 1327 – 1334.

Abstract

Postharvest browning is the primary cause of a decrease in the shelf life of the white button mushroom (*Agaricus bisporus*). This study investigated the effect of postharvest brassinolide (BL) treatment on metabolism in relation to browning of the white button mushroom. Each harvested mushroom was dipped into one of three solutions containing 0, 1, or 3 μM BL for 5 min and stored in darkness at 4 °C for 16 days. Our results indicated that treatment with BL restrains browning development and reduces the total phenolic content and polyphenol oxidase activity. In addition, BL treatment maintains lower weight loss, electrolyte leakage, and malondialdehyde content and inhibits any increase in lipoxygenase activity compared with those of the control mushrooms. Furthermore, BL treatment significantly decreases the accumulation of reactive oxygen species (ROS) and induces the antioxidant enzyme system. Compared with 1 μM BL, treatment with 3 μM BL is more effective in reducing cap browning. The reduction of membrane oxidative damage and ROS levels induced by BL inhibits enzymatic browning reaction in the white button mushroom. These findings suggest that treatment with BL could have the potential of inhibiting browning and thus maintaining the mushroom's commercial value.

Keywords: /Mushroom/ /Storage/

SPINACH

Oliveria, Ana L.S. 2016. Impact of different calcium dips and solution pH on quality of ready to eat baby leaf spinach. *Postharvest Biol. Technol.* 121: 36 - 42.

Abstract

The effect of calcium application and solution pH on ready-to-eat (RTE) baby-leaf spinach (*SpinaciaoleraceaL.*) texture and structure preservation was studied. Spinach leaves were treated with calcium chloride, calcium lactate and calcium propionate, at two different pH conditions (5 and 7), packaged and stored for 7 days at 5 °C. After 24 h, the leaves crispness increased 49 and 29% for leaves treated with calcium chloride and lactate at pH 5 and the elasticity increased 100% after calcium propionate treatment at pH 7. During spinach shelf-life, the tissue flexibility decreased (20–60%) for all calcium treatments at pH 5 and 7 while tissue crispness increased (7–40%) only for calcium treatments under pH 7. The electrolyte leakage increased throughout storage and was higher for all calcium treated samples when compared with controls. The chlorophyll content slightly decreased (12%) by the end of product shelf-life and did not differ according the calcium treatments. Total vitamin C content was lower in leaves treated with calcium chloride at pH 5 (31%) and pH 7 (19%) while the remaining treatments did not affect vitamin C content. The different calcium additives tested for potential texture quality maintenance did not provide the expected benefits on baby spinach leaves but increasing solution pH from 5 to 7 lead to an increased firmness by the end of shelf-life.

Keywords: /Spinach/ /Firmness/ /Quality/

Agüeroa, Victoria M., et.al. 2016. Surface decontamination of spinach by intense pulsed light treatments: impact on quality attributes. *Postharvest Biol. & Technol.* 121: 118 – 125.

Abstract

Intense pulsed light (IPL) treatments constitute an emerging non-thermal technology proposed to decontaminate food surfaces. In this study, the bactericidal effect of IPL against *Listeria innocua* and

Escherichia coli inoculated on spinach leaves was evaluated and mathematically modeled. Also, the impact of IPL treatments (20 and 40 kJ m⁻²) on headspace gas composition, microbial quality, antioxidant properties and color of spinach was assessed immediately after treatment and during refrigerated storage. IPL treatments were effective for reducing the naturally-occurring microbial load on the raw material by 0.4–2.2 Log CFU g⁻¹, depending on the applied fluence. IPL treatments also reduced the growth rates of microbial populations through storage. Changes in the package headspace composition were significantly affected by IPL treatments. In-package production of CO₂ increased at a higher rate than for untreated spinach leaves, while O₂ concentrations decreased. Total polyphenolic content and antioxidant capacity of spinach exhibited significant increases in the range of 5–10% and 32–34% for the samples treated with 20 or 40 kJ m⁻², respectively. Despite these initial increases, treated spinach leaves presented an accelerated decrease in these quality indicators during refrigerated storage. At the end of storage, IPL-treated samples presented a slightly lower phytochemical quality but significant better microbial quality than control samples.

Keywords: /Spinach/ /Quality/

TUBERS & ROOTCROPS

POTATO

Herman, Derek J. Lisa O. Knowles, N. Richard Knowles. 2016. Low oxygen storage modulates invertase activity to attenuate cold induced sweetening and loss process quality in potato Solanum tuberosum L. Postharvest Biol. Technol. 121: 106 - 117.

Abstract

Russet Burbank and Innovator are mid- to late-season frozen-processing cultivars with inherently different dormancy periods and susceptibilities to low temperature-induced sweetening (LTS). In contrast to Russet Burbank, which is highly prone to accumulation of reducing sugars (Glc + Fru) when stored below 8–9 °C, Innovator tubers exhibit moderate resistance to LTS and retain process quality longer at lower temperatures (4–6 °C). However, Innovator's LTS resistance is not robust and often varies across production regions. Here we show that low O₂ storage modulates LTS to reveal metabolic differences intrinsic to these cultivars. Changes in tuber respiration, process quality, reducing sugars, sucrose, starch phosphorylase and invertase activities were compared at 4 and 8 °C in 2.5 and 21 kPa O₂ over a 212-d storage period. Tuber respiration declined rapidly as O₂ level decreased from 21 to 2.5 kPa during acclimation at 8 °C. Respiration rates then fell further as the temperature was lowered from 8 to 4 °C, but this response was greatly muted for tubers at 2.5 versus 21 kPa O₂. Tubers at 21 kPa O₂ completed their cold-induced respiratory acclimation response (RAR) within 7 d compared with 13 d at 2.5 kPa O₂, and the RAR was much greater for tubers at 2.5 kPa O₂. While reducing sugars increased most rapidly in tubers over the first 30 d at 4 °C, Innovator tubers had lower invertase activity and sweetened less than Russet Burbank tubers, characterizing its LTS-resistant phenotype. Low O₂ greatly attenuated these initial LTS responses for both cultivars; however, the effect was only temporary in Innovator. LTS resumed in Innovator tubers from 93 to 212 d with reducing sugar levels increasing to equal that of Russet Burbank tubers stored at 4 °C and 21 kPa O₂. Activities of α-1,4-glucan phosphorylase (SP) were higher in Russet Burbank than Innovator and increased progressively over the storage period regardless of temperature and oxygen concentration. Innovator tubers stored at 2.5 kPa O₂ had higher SP activities from 30 to 153 d at 4 and 8 °C compared with tubers stored at 21 kPa O₂, which correlated well with increased sucrose build-up and earlier sprouting. The low O₂-mediated inhibition of LTS was largely a consequence of reduced invertase activities.

Keywords: /Potato/ /Controlled Atmosphere Storage /

ORNAMENTALS

ANTHURIUM

Aghdam, Morteza S., et al. 2016. Impact of exogenous GABA treatments on endogenous GABA metabolism in anthurium cut flowers in response to postharvest chilling temperature. *Plant Physiol. Biochem.* 106: 11 – 15.

Abstract

Anthurium flowers are susceptible to chilling injury, and the optimum storage temperature is 12.5±0.2 °C. The g-aminobutyric acid (GABA) shunt pathway may alleviate chilling stress in horticultural commodities by providing energy (ATP), reducing molecules (NADH), and minimizing accumulation of reactive oxygen species (ROS). In this experiment, the impact of a preharvest spray treatment with 1 mM GABA and postharvest treatment of 5 mM GABA stem-end dipping on GABA shunt pathway activity of anthurium cut flowers (cv. Sirion) in response to cold storage (4 °C for 21 days) was investigated. GABA treatments resulted in lower glutamate decarboxylase (GAD) and higher GABA transaminase (GABA-T) activities in flowers during cold storage, which was associated with lower GABA content and coincided with higher ATP content. GABA treatments also enhanced accumulation of endogenous glycine betaine (GB) in flowers during cold storage, as well as higher spathe relative water content (RWC). These findings suggest that GABA treatments may alleviate chilling injury of anthurium cut flowers by enhancing GABA shunt pathway activity leading to provide sufficient ATP and promoting endogenous GB accumulation.

Keywords: /Anthurium/ /Chilling Injury/ /Postharvest/

CARNATION

In, Bying-Chun, et al. 2016. Recovery of ethylene sensitivity and responses in carnation petals post treatment with 1-methylcyclopropene. *Postharvest Biol. Technol.* 121: 78 - 86.

Abstract

In ethylene-sensitive plants, such as carnation, ethylene perception is considered an indispensable requirement to initiate and perpetuate the ethylene-mediated senescence program. Ethylene binding antagonists, such as 1-methylcyclopropene (1-MCP) compete for ethylene binding and block the hormone signaling. Despite its antagonistic propensity, plants treated with 1-MCP often recover sensitivity to ethylene post-treatment. Here we demonstrate that increases in the transcript level of the ethylene receptor DcETR1 results in the recovery of ethylene sensitivity in carnation petals treated with 1-MCP. This study reveals that the ethylene-induced reduction in mRNA levels of DcETR1 and DcCTR1 is completely suppressed by 1-MCP, and that the transcripts fluctuate periodically in association with petal senescence and ethylene biosynthesis. The results suggest that the periodic increase in receptor transcript may represent the appearance of new active receptors leading to renewed sensitivity to ethylene after treatment with 1-MCP. While ethylene sensitivity is temporarily blocked by 1-MCP, ethylene binding to new receptors is completely prevented by successive treatment of 1-MCP prior to recovery of ethylene-sensitivity, resulting in repression of petal senescence.

Keywords: /Carnation/ /Ethylene Biosynthesis/ /Flower Senescence/ /1-MCP / /Postharvest/