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GENERAL

ACTIVE FOOD PACKAGING

Tas, C.E., et.al. 2017. Halloysite nanotubes/polyethylene nanocomposites for active food packaging materials with ethylene scavenging and gas barrier properties. Food Bioprocess Technol. 10:789–798.

Abstract

Novel polymeric active food packaging films comprising halloysite nanotubes (HNTs) as active agents were developed. HNTs which are hollow tubular clay nanoparticles were utilized as nanofillers absorbing the naturally produced ethylene gas that causes softening and aging of fruits and vegetables; at the same time, limiting the migration of spoilage-inducing gas molecules within the polymer matrix. HNT/polyethylene (HNT/PE) nanocomposite films demonstrated larger ethylene scavenging capacity and lower oxygen and water vapor transmission rates than neat PE films. Nanocomposite films were shown to slow down the ripening process of bananas and retain the firmness of tomatoes due to their ethylene scavenging properties. Furthermore, nanocomposite films also slowed down the weight loss of strawberries and aerobic bacterial growth on chicken surfaces due to their water vapor and oxygen barrier properties. HNT/PE nanocomposite films demonstrated here can greatly contribute to food safety as active food packaging materials that can improve the quality and shelf life of fresh food products.

Keywords: /Active Food Packaging/ /Ethylene/

EDIBLE FILMS

Kumari, Madhu, et.al. 2017. Development and structural characterization of edible films for improving fruit quality. Food Packag. & Shelf Life 12: 42–50.

Abstract

The antimicrobial films and coatings can play an important role in reducing postharvest losses and boosting packaging industry. Gluten based films were prepared by incorporating pomegranate peel and curry leaf extracts. Proximate analysis of edible films revealed no unfavorable changes in its characteristics after incorporation of antimicrobial agents. Minimum inhibitory concentration (MIC) values of curry leaves powder extract against *Staphylococcus aureus* and *Micrococcus luteus* were 7.81 mg/ mL and 15.62 mg/mL, respectively. High performance liquid chromatography (HPLC) analysis showed higher gallic acid in pomegranate peel extract (0.31 \pm 0.01 mg/mg) than murraya leaves extract (0.29 \pm 0.03 mg/mg). Scanning electron microscope studies did not show significant differences in cross linking. The films of curry leaves and pomegranate extract are good in its structural stability and best for food products. The main significance of these bioactive extracts can be used to make edible films to increase shelf life of fruits and vegetables.

Keywords: /Edible Films/ /Fruit Quality/

Murmu, S.B. and H.N. Mishra. 2017. Optimization of the arabic gum based **edible coating** formulations with sodium caseinate and tulsi extract for guava. LWT - Food Sci. & Technol. 80: 271 - 279.

Abstract

Edible coating formulations based on Arabic gum (AG) (0e15 g/100 mL), sodium caseinate (SC) (0e2 g/ 100 mL) and tulsi extract (TE) (0e5 mL/100 mL) were developed using central composite rotatable design and its effect on quality of guava was studied at 28 ± 2 # C for seven days. The guava peel and pulp color, respiration rate, and weight loss were analyzed after 3rd and 7th days of storage. After seven days pulp firmness, mold growth, and overall acceptability were additionally evaluated. The OTR, CTR, and WVTR of the coated guava with AG concentration in the range of 7.5e12 g/100 mL in the coating formulation was lower than those of the control samples (coated with water). The SC showed significant ($p < 0.001$) positive effect on CTR, and WVTR; TE showed a significant effect on the carbon dioxide evolution rate; its interaction with AG showed significant effects on the oxygen consumption rates of coated guava. The optimized coating formulation (5 g/100 mL AG, 1 g/100 mL SC and 2.5 mL/100 mL TE) maintained suitable internal gas composition to delay ripening, showed higher overall acceptability and shelf-life of 7 days at 28 ± 2 # C compared to 4 days of control.

Keywords: /Edible Coating/ /Firmness/ /Shelf-life/

FRESH-CUT

Baselice, A., et.al. 2017. Trends in EU consumers' attitude towards **fresh-cut** fruit and vegetables. Food Quality & Prefer. 59: 87 - 96.

Abstract

Although there is a long-term decrease in the consumption of fruits and vegetables (hereafter F&V), fresh-cut products, because of their convenience, represent a valid alternative to counteract this negative trend. In fact, the fresh-cut sector is showing positive figures, and innovation in product quality and safety attributes, which are generally valued by consumers. Nonetheless, which product innovations will effectively take place in the coming years? Will they be accepted by consumers? Will they increase the probability of switching from fresh to fresh-cut F&V? Our study, with the help of on-field research, aims at analysing the trending attributes in the fresh-cut F&V industry, and evaluating their impact on segments of F&V consumers' preferences in terms of attitude and willingness to pay. Therefore, we applied a latent class discrete choice model with an original dataset consisting of face-to-face interviews conducted across EU. Results of the study highlight the similarities in preferences of consumers across the EU countries and the relevance of shelf-life and food safety attributes in orienting choices.

Keywords: /Fresh-Cut/ /Fruit/ /Vegetables/ /Consumer's Preferences/

FRESH PRODUCE

Jin, S., H. Li and Y. Li. 2016. Preferences of Chinese consumers for the attributes of **fresh produce** portfolio in an e-commerce environment. British Food J. 119 (4): 817 - 829.

Abstract

Purpose – In recent years, fresh produce (fresh vegetables and fruit) has been circulated widely via e-commerce in Chinese large cities in the form of fresh produce portfolios (FPPs). The purpose of this paper is to analyze the preferences of Chinese consumers for specific FPP attributes. **Design/methodology/approach** – A choice experiment approach was used to explore consumer preferences. The authors conducted a means-end-chains evaluation to select the attributes for the choice experiment. The authors used a fractional factorial design and finally obtained 18 choice scenarios. The authors collected 166 effective consumer questionnaires in Beijing. **Findings** – The authors found that among the four attributes considered, certification and the diversity of the FPP had significant effects on the willingness to pay (WTP) among consumers. Residents had heterogeneous preferences for FPP diversity and certification, but certification was the major concern when considering fresh produce in the FPP. With regard to the WTP for attributes in the portfolio, the WTP values for “green” and “organic” attributes were high, but the WTP for the diversity of FPPs was low. **Originality/value** – This study is the first attempt to explore the preferences of Chinese consumers regarding the attributes of FPP in an e-commerce environment.

Keywords: /Fresh produce/

PACKAGING

Rux, G., et.al. 2016. Application of humidity-regulating trays for **packaging** of fresh strawberry and tomato. *Acta Hortic.* 1141: 263 - 268.

Abstract

Most polymeric materials used in fresh-produce packaging have lower water vapour transmission rates relative to the transpiration rate of fresh produce. The consequences are high humidity levels and condensation of water vapour inside the package. Humidity-regulating trays were developed and tested in this study. They were made from a thermoformed multilayer structure consisting of polyethylene (outside), a foamed hygroscopic ionomer (active layer) with 0 or 12% (w/w) NaCl, and a hygroscopic ionomer (sealing layer, inside). These trays were used to study moisture absorption kinetics at 100% relative humidity (RH) for 16 days. Additional trays containing 7 g water were sealed with the high barrier lidding film, and headspace RH was monitored continuously over time. Finally, strawberries and tomatoes were used to test the performance of the humidity-regulating trays. The amount of moisture absorbed by the tray was directly proportional to the amount of salt embedded into the tray matrix, e.g. 0 and 12 % (w/w) salt trays absorbed 7.6 and 13.2 g moisture, respectively. The headspace RH in the trays sealed with lidding film was found to be 89.8, 99.6 and 100% in trays with 12 and 0 % (w/w) salt and control polypropylene trays, respectively. The trays containing fresh produce were able to regulate RH below 97%, but at the expense of higher product weight loss (2-3% for strawberry, 1% for tomatoes) compared with control polypropylene trays (0.6%).

Keywords: /Fresh Produce/ /Humidity/ /Packaging/

Shapii, R.A., et.al. 2017. Effect of ball milling and ultrasonication time on particle size of chitosan for potential nanofiller in food **packaging** film. *Acta Hortic.* 1152: 125 - 130.

Abstract

Incorporation of chitosan nanoparticle (CNP) into food packaging film is very promising due to the many advantages such as improving mechanical and barrier properties of the film. Recently, ionic gelation of chitosan with addition of sodium tripolyphosphate (TPP) has been a popular method to synthesize chitosan nanoparticle (CNP). This study aims to investigate the effect of ball milling and ultrasonication on CNP particle size produced using ionic gelation method. Ball milling time (0, 12, 18 h) and ultrasonication time (15, 30 min) were varied. Combination of ball milling and ultrasonication were found to produce smaller and more uniform size of CNP compared to ball milling or ultrasonication alone. It was found that particle sizes of CNP that underwent ultrasonication decreased with the increase in ball milling time. This may be due to the shear stress during ball milling which led to fragmentation of CNP into smaller and uniform particle size. Meanwhile, particle sizes of CNP underwent ultrasonication without ball milling decreased with the increase in ultrasonication time due to the longer exposure time to cavitation effect produced by ultrasonic probe. The optimum ball milling and ultrasonication time were found to be 18h and 15 min, respectively.

Keywords: /Packaging/ /Chitosan/

FRUITS

AVOCADO

Boonruang, K., et.al. 2017. Antifungal effect of poly (lactic acid) films containing thymol and *R*-(-)-carvone against anthracnose pathogens isolated from avocado and citrus. Food Control. 78: 85-93.

Abstract

Biodegradable antifungal films were developed to be used for controlling postharvest anthracnose pathogens. Two antifungal compounds, thymol and *R*-(-)-carvone, were incorporated into poly(lactic acid) (PLA)-based polymer at 10, 15 and 20% (w/w). Antifungal activity of the pure compounds and the antifungal films against *Colletotrichum gloeosporioides* isolated from avocado and citrus was evaluated at 12 and 25 ° C using vapor diffusion assays. The results indicated that the colony diameter was affected by the vapor concentration of the antifungal compounds in the headspace. At 12 ° C, 20% thymol showed complete growth reduction of avocado isolate, while at 25 ° C, 15 and 20% thymol showed complete growth reduction of both avocado and citrus isolates. The PLA films incorporated with 15% *R*-(-)-carvone and 20% thymol were the most effective at 12 ° C in suppressing the mycelial growth of the avocado and citrus *C. gloeosporioides* isolates, respectively, whereas the film incorporated with 20% thymol had the highest antifungal activity against both anthracnose isolates at 25 ° C. The inhibitory effect of the antifungal films against anthracnose isolates was correlated to the vapor concentration of the antifungal compounds remaining in the headspace of the Petri dish. Antifungal packaging films can potentially be used to control postharvest pathogens of fresh produce.

Keywords: /Avocado/ /Citrus/Anthracnose/

Sarkhosh, Ali, et.al. 2017. Postharvest management of anthracnose in avocado (*Persea americana Mill.*) fruit with plant-extracted oils. Food Packag. & Shelf Life 12: 16 – 22.

Abstract

We tested the inhibitory properties of five different plant extracts to extend avocado fruit shelf life against anthracnose (*Colletotrichum gloeosporioides* Penz.). Essential oils were extracted from mint, savory, thyme, cinnamon and lavender and then analysed by gas chromatography-mass spectrometry. Carvacrol (71.2%) and thymol (73.3%) were the main components in savory and thyme. The main chemical compounds in mint oil were menthone (33.8%) and menthol (36.1%). *cis*-cinnamaldehyde (59.1%) was the main constituent of cinnamon oil, whereas linalyl acetate (43.1%) and linalool (26.3%) were the key compounds in lavender oil. The polymerase chain reaction (PCR) method using the internal transcribed spacer (ITS) primer confirmed the identity of the *C. gloeosporioides* isolate. In-situ antifungal activity was assayed by artificially inoculating avocado fruit with *C. gloeosporioides* then applying essential oils to the fruit at concentrations of 0, 0.05, 0.1 or 0.2 percent. After four weeks of storage, savory and thyme oils applied at 2000 ppm exhibited the strongest antifungal activity, reducing expansion of necrotic lesions around the inoculation sites on the fruit by 58–64%. Savory and thyme oils also considerably decreased (54–67%) lesion expansion. The results of a fruit firmness assay showed that savory and thyme oils applied at 500–2000 ml L⁻¹ resulted in fruit that were 2.5-3.3 times firmer than the non-treated controls, whereas other oils applied at 500 ml L⁻¹ did not help maintain fruit firmness. Disease severity and fruit firmness variables were quadratically related to savory oil concentration. This study confirms the potential for using savory and thyme essential oils as biological fungicides for increasing the storage time of avocado fruit.

Keywords: /Avocado/ /Anthracnose/

BANANA

Awad, M.A., et.al. 2017. Postharvest chitosan, gallic acid and chitosan galate treatments effects on shelf life quality, antioxidant compounds, free radical scavenging capacity and enzymes activities of 'Sukkari' bananas. J. Food Sci. Technol. 54(2):447 – 457.

Abstract

The effect of postharvest chitosan, gallic acid (GA) and chitosan gallate (CG) dipping treatments at different concentrations on quality parameters, antioxidant compounds, free radical scavenging capacity (FRSC) and enzymes activities of 'Sukkari' bananas were studied during storage (ripening) at 20 ± 2 °C and 60–70% RH for 13 days. Weight loss and peel color index (the change from green to yellow) increased while, membrane stability index of peel tissues, pulp firmness and acidity decreased during storage. CG and GA treatments slowed down the changes in these parameters compared to control. Total soluble solids (TSS) concentration increased during storage and was lower at CG than other treatments. TSS/acid ratio increased during storage and showed higher value after storage than initial. This ratio was lower at 1% chitosan, 0.075% GA and CG treatments than control. Both vitamin C and total flavonoids concentrations decreased during storage and were not affected by the applied treatments. Total phenols concentration decreased during storage and was higher at acetic acid and the high rate of chitosan, GA and CG treatments than control. FRSC (DPPH IC₅₀ values) of fruit peel ranged from 2.54 to 4.19 lg phenolics concentration among the treatments. FRSC was not affected by the applied treatments but increased (lower IC₅₀ value) during shelf life. The possible relations of these biochemical changes with the activities of the enzymes α-amylase, xylanase, polygalacturonase, peroxidase and polyphenoloxidase were discussed. It is concluded that postharvest CG and GA treatments delayed ripening and maintained better quality parameters of 'Sukkari' bananas during 13 days of shelf life than control.

Keywords: /Banana/ /Edible Coatings/ /Chitosan/

CANTALOUPE

Pei Chen Koh, et.al. 2017. Application of edible coatings and repetitive pulsed light for shelf life extension of fresh-cut **cantaloupe** (*Cucumis melo* L. *reticulates* cv. Glamour). *Postharvest Biol. & Technol.* 129: 64 - 78.

Abstract

The objective of this study was to investigate the effects of edible coatings combined with repetitive pulsed light (RPL) treatment on microbiological stability, quality and physicochemical changes of fresh-cut cantaloupes during storage at 4 ± 1 °C. Fresh-cut cantaloupes were coated with various coating materials. The coated fresh-cut cantaloupes were packed in polypropylene bag and exposed to RPL treatment with a fluence of 0.9 J cm^{-2} every 48 h up to 28 d of storage at 4 ± 1 °C. The microbiological quality, headspace gas composition, physical quality (firmness, fluid loss and colour), chemical quality (pH, titratable acidity, total soluble solids, total phenolic content and ascorbic acid content) and coating homogeneity and adherence of these fresh-cut cantaloupes were determined. The combination of pectin, alginate and gellan coatings with RPL treatment was effective to reduce fluid loss and retain firmness of fresh-cut cantaloupes compared to control samples while maintaining the desired headspace gas composition for fresh-cut cantaloupe throughout storage. Chitosan-based coating enhanced the microbiological quality of fresh-cut cantaloupes but increased its fluid loss and reduction of ascorbic acid content. Colour, pH, titratable acidity, total soluble solids and total phenolic content were maintained throughout the storage for coated fresh-cut cantaloupes treated with RPL. In conclusion, a combination of alginate and RPL treatment was the most effective treatment condition to extend the shelf life of fresh-cut cantaloupes by maintaining microbiological quality up to 28 d with significantly reduced fluid loss and enhanced firmness compared to samples treated with RPL alone. Alginate coating adhered well to the surfaces of fresh-cut cantaloupes and retained its physicochemical and nutritional quality when combined with RPL.

Keywords: /Cantaloupe/ / Edible Coating/ /Shelf life/

GOJI BERRIES

Jatoi, M.A., et.al. 2017. The effects of postharvest application of lecithin to improve storage potential and quality of fresh **goji** (*Lycium barbarum* L.) **berries**. *Food Chem.* 230: 241 – 249.

Abstract

To enhance storage life and post-storage quality of fresh goji berries, three treatments with lecithin (1, 5, 10 g.L⁻¹) and two storage times (8, 16 days) were evaluated. The significant effects on the physiological and biochemical parameters were varied. 1 g.L⁻¹ lecithin showed its main effects after 8 days of storage by reduction in total weight loss and decay, SSC/TA ratio (also at 16 days), and chlorophyll content and with highest scores of sensory attributes (also at 16 days). 5 g.L⁻¹ lecithin showed its main effects after 16 days of storage: highest SSC, highest TA (also at 8 days), highest TPC, only significant reduction in DPPH antioxidant activity, and highest total flavonoid content. 10 g.L⁻¹ lecithin showed its main effects after 8 days of storage with highest SSC, chlorophyll content, total

flavonoid, DPPH, and ABTS antioxidant activity (also at 16 days), but with least scores of sensory attributes.

Keywords: /Goji Berries/ /Fruit Quality/ /Postharvest Decay/

GUAVA

Silva, R.S., et.al. 2016. Influence of biodegradable coatings on the volatiles profile of fresh-cut 'Paluma' guava. Acta Hortic. 1141: 319 - 326.

Abstract

Fresh-cut 'Paluma' guava is highly appreciated for its characteristic aroma and taste. However, due to the fresh-cut operations the volatiles profile may change. Edible coatings may affect the biosynthesis of specific compounds or modify the profile of volatiles. The objective of this study was to evaluate changes in the volatiles profile of slices of fresh-cut 'Paluma' guava coated with chitosan at 2% (CH), calcium chloride at 1% (CC), calcium chloride at 1% + sodium alginate at 1% (CC+SA), calcium chloride at 1% + chitosan at 2% (CC+CH) and without coating (W). The evaluation of the volatile profile was performed by SPME-GC-MS after 4 days of storage at $3\pm 1^{\circ}\text{C}$ and $75\pm 4\%$ RH. Odor, taste, and texture were positively correlated with hexanal, hexenal (2E), hexenol (3Z), and 1-hexanol, which may account for the higher overall acceptance of slices coated with CC and CH. Coating 'Paluma' guava slices with CH and with CC resulted in maintenance of a volatile profile similar to that of the control on the fourth day.

Keywords: /Guava/ /Modified Atmosphere/ /Chitosan/ /Quality/

MANGO

Jincy, M., et.al. 2017. Inhibition of phospholipase D enzyme activity through hexanal leads to delayed mango (*Mangifera indica L.*) fruit ripening through changes in oxidants and antioxidant enzymes activity. Scientia Hortic. 218: 316 – 325.

Abstract

Fruit ripening is a senescence process and phospholipase D (PLD) is a key enzyme causing degradation of membrane phospholipids during that process. Our earlier studies showed that hexanal, is known to inhibit the PLD activity. The objectives were (i) to quantify the effects of postharvest hexanal treatment in mango fruit on physiochemical traits, (ii) to assess the changes in oxidants, antioxidants, and antioxidant enzymes activity in mango fruit after hexanal treatment. Fully matured mango fruit, var. Neelum were harvested from the tree, dipped in 0.02% hexanal solution, and stored under ambient conditions to study the physio and biochemical changes during storage period. The results indicated that hexanal treatment significantly reduced ethylene evolution rate, oxidants content and PLD enzyme activity in the fruit compared with control, key factors to delay ripening and senescence in fruit. However, the activities of antioxidant enzymes like superoxide dismutase, catalase, ascorbate peroxidase, glutathione peroxidase and the contents of ascorbic acid were increased in response to hexanal treatment. The decreased ethylene evolution rate, PLD enzyme activity and oxidant production caused by hexanal treatment might have led to increased shelf life. Overall, the results suggest that

post-harvest dip of mango fruits in 0.02% hexanal solution extended the shelf life of mango fruit under ambient storage conditions, without the loss of quality of fruits.

Keywords: /Mango/ /Fruit Ripening/ /Mango/

Zhang, Yu, et.al. 2017. Effects of state/phase transitions on the quality attributes of mango (*Mangifera indica* L.) during frozen storage. Food Sci. & Technol. 52: 239 - 246.

Abstract

Effects of different state/phase transitions (temperature fluctuations) on quality attributes of mango cubes during frozen storage were investigated. Temperature of frozen mango was modulated from $-65\text{ }^{\circ}\text{C}$ to different states, namely, rubbery state ($T > T'_m$), partially freeze-concentrated state ($T''_g < T < T'_m$) and glassy states ($T < T'_g$ and $T'_g < T < T''_g$). Results revealed that frozen samples after 4 weeks of storage in a glassy state showed higher quality in hardness, drip loss, colour and ascorbic acid. Quality of mango still continued to change during frozen storage even in the glassy state without temperature fluctuations. Furthermore, there was a significant decrease in quality attributes of frozen mango subjected to temperature fluctuations above T'_m and T''_g . Current work indicates glassy state storage can improve retention of quality attributes in frozen mango and glassy state without temperature fluctuation was proposed as the most favourable frozen storage condition.

Keywords: /Mango/ /Quality Attributes/ / Temperature/

PEACH

Duvenage, Stacey and Lise Korsten. 2017. Assessment of foodborne pathogen presence in the peach supply chain and its potential risk to the end consumer. Food Control 78: 374 - 382.

Abstract

Peaches are popular, nutritious and widely consumed. Being a tree crop, it is considered a low risk fruit, with no direct water contact, and no previous foodborne disease outbreaks associated with its consumption. However, in 2014 the pioneer association between stone fruit and a foodborne illness was reported, linking *Listeria monocytogenes* to stone fruit. This highlights the need for better understanding of risk associated with contaminated fresh stone fruit, in order to implement adequate preventative measures. No information is available on the presence of foodborne pathogens on peaches in the supply chain. A case study approach was therefore followed to assess foodborne pathogen presence on the farm, focusing on the impact of irrigation water, facility sanitation and hygiene by collecting various fruit and environmental samples (n 1/4 428). This study demonstrates the effectiveness of integrating basic microbial testing with safety management and risk assessment tools that can be collectively used to improve the food safety management system. No *Salmonella* Typhimurium was detected from samples, however, *Escherichia coli* O157:H7, *Listeria* spp. and *Staphylococcus aureus* were detected on fruit and environmental samples. Despite the Global G.A.P. certification status of the farm, livestock frequented water sources which lead to *E. coli* O157:H7 contamination. This conclusion was based on positive detection of foodborne pathogens from the water sources and subsequent removal of livestock which resulted in a definite decrease in pathogen detection. A number of *E. coli* O157:H7 and *S. aureus* were detected during the second year of monitoring from environmental samples and it was observed that the personal hygiene and facility

sanitation was not adequately enforced. Based on feedback given to the farmer, enforcement was improved and a definite decrease in foodborne pathogens was observed in the following sampling cycle. Areas of risk that were still identified following the fourth year of monitoring included the water source used for irrigation and poor sanitation in the production and processing facilities. Limited foodborne pathogen prevalence on peaches over the full study period as well as the extended export supply chain at controlled temperatures resulted in low-to-medium calculated consumer risk. The correct and meticulous implementation of integrated and holistic pre- and post-harvest food safety management systems is therefore essential to prevent produce contamination, reduce the consumer risk and therefore ensure overall product safety.

Keywords: /Peach/ /Supply Chain/

PEAR

Graca, A., D. Santo, C. Quintas and C. Nunes. 2017. Growth of *Escherichia coli*, *Salmonella enterica* and *Listeria* spp., and their inactivation using ultraviolet energy and electrolyzed water, on 'Rocha' fresh-cut pears. Food Control . 77: 41 - 49.

Abstract

The present study aimed at evaluating the growth of *Escherichia coli*, *Salmonella enterica*, and *Listeria* spp. and studying the efficacy of Ultraviolet-C (UV-C) irradiation, acidic electrolyzed (AEW) and neutral electrolyzed (NEW) waters in the reduction of these bacteria on 'Rocha' pear. Fresh-cut pieces were inoculated and incubated at 4e20 # C for 8 days. Inoculated pears were treated with UV-C (2.5e10 kJ/m²), AEW, NEW and sodium hypochlorite (SH) and microbiological and quality parameters were evaluated. The three bacteria, inoculated at 6.1e6.2 log cfu/g, grew on the pear at high growth rates at 12 and 20 # C reaching populations of 8.1e8.6 log cfu/g, in 24 h. At 8 # C the microorganisms increased their populations by at least 1 log cfu/g in three days. At 4 # C adaptation phases of less than 24 h for *Listeria* spp. were measured before exponential growth occurred and the enterobacteria did not grow despite having survived for 8 days. AEW and NEW caused microbial reductions similar to SH, of approximately 1 log cfu/g, while the best UV-C dose (7.5 kJ/m²) of at least 2.4 log cfu/g. Fresh-cut pears were a good substrate for foodborne bacteria emphasizing the importance of preventing contaminations and cross contaminations. The UV-C was more effective than the chemical decontaminations, as it provided superior microbial reductions without greatly affecting the quality of pears.

Keywords: /Pear/ / Fresh Cut/

Kowalczyk, Dariusz, et.al. 2017. Effect of carboxymethylcellulose/candelilla wax coating containing potassium sorbate on microbiological and physicochemical attributes of pears. Scientia Hort. 218: 326 – 333.

Abstract

The main objective of this study was to assess the efficacy of a coating composed of carboxymethylcellulose (CMC), candelilla wax and potassium sorbate (KS) as a post-cold-storage treatment to prevent fungal infections in pears stored under simulated retail display conditions. Moreover, the effect of coating on the physiology and biochemistry of pears was investigated. The

coating was very effective against *Botrytis cinerea* and *Monilinia fructigena*, while *Rhizopus nigricans* was the most resistant to KS. The KS-free coating also delayed the fungal growth rate, probably due to modification of the gaseous atmosphere within the fruit tissues. Coated pears showed slower ripening than the uncoated samples, as indicated by unaffected green skin color and inhibited loss of firmness. Unfortunately, coating induced anaerobic respiration and the symptoms of superficial scald in pears. Overall, the results showed that KS can be added into a coating formulation to control fungal growth; however, CMC-based emulsion is not a suitable carrier for KS, when coating is intended to be applied to pears exposed to postharvest cold storage.

Keywords: /Pears/ /Coating/

Li, Z., Y.Zhang and H. Ge. 2017. The membrane may be an important factor in browning of fresh-cut pear. Food Chem. 230: 265 – 270.

Abstract

Surface browning is an important cause of deterioration of fresh-cut fruit during postharvest handling. In this paper, four pear cultivars with different extents of natural browning were selected to analyse the factors involved in browning. The main results are as follows: the lipoxygenase (LOX) activity of ‘Mantianhong’ and ‘Yali’ pears was higher accompanied by a stronger degree of browning, while the LOX activity in ‘Xueqing’ and ‘Xinli 7’ pears was lower, with less browning. A higher unsaturated fatty acid ratio of pear resulted in reduced browning. The cell membranes disappeared 30 min after being cut in ‘Mantianhong’ pear, which browns easily; however, the cell membranes were still intact 30 min after being cut in ‘Xueqing’ pear, which does not brown easily. Therefore, it can be assumed that the stability of the cell membrane plays an important role in inhibiting browning of fresh-cut pears.

Keywords: /Pear/ /Fresh-Cut/ /Browning/

Nham, N.T., et.al. 2017. A model to predict ripening capacity of ‘Bartlett’ pears (*Pyrus communis* L.) based on relative expression of genes associated with the ethylene. Postharvest Biol. & Technol. 128: 138 – 143.

Abstract

Resistance to ripening in European pears depends on various preharvest and postharvest factors. Exposure to cold temperatures has been demonstrated to condition pears to produce endogenous ethylene and ripen. Mature green ‘Bartlett’ pears were exposed to 0, 5, or 10 # C for 2–14 d to induce different rates of ripening. At higher temperatures, expression of ethylene biosynthesis genes (*ACS1a* and *ACO*) and ethylene receptor genes (*ETR2*, *ERS1a*, and *ETR1a*) increased, while *CTR1* expression decreased. Multiple linear regressions between relative expression of these genes after 0 d and fruit firmness after 6 d during ripening at 20 # C were conducted. Using K-fold cross validation and conventional validation, it appears that expression of *ACO* could be utilized as an early predictor of pear ripening capacity.

Keywords: /Pears/ /Firmness/ /Ripening/

Xanthopoulos, G.T., et.al. 2017. The contribution of transpiration and respiration in water loss of perishable agricultural products: the case of pears. Biosystems. Eng. 158: 76 - 85.

Abstract

Transpiration and to a lesser degree respiration are two well-known processes of water loss from fresh agricultural products, associated with visual and texture degradation. Neglecting respiration as a water loss mechanism leads to erroneous results at saturation where, although the water vapour pressure deficit is zero and therefore water loss should be zero, on the contrary a finite water loss exists. In this context an experiment was set up to analyse the water loss associated with transpiration and respiration in pears (*Pyrus communis* L., *Kontoula*) at 0, 10 and 20 ° C and 70%, 80% and 95% RH, as well as the air humidity of the cold storage. The choice of pears was based on the fact that they rank third among the most important tree fruits. The estimated transpiration rates ranged between 0.03 and 0.28 mg cm⁻² h⁻¹ for water vapour pressure deficit range of 0.0-0.52 kPa. The mean respiration rates were calculated at 0, 10 and 20 ° C as 0.48 ± 0.1, 1.27 ± 0.2 and 3.48 ± 1.1 mL[CO₂] 100 g⁻¹ h⁻¹. Quantification of the two sources of water loss showed that, close to saturation (20 ° C and 95% RH), the water loss due to respiration accounts for 39% of the water loss due to water vapour pressure deficit while, on average, the water loss due to respiration accounts for 8%, 14% and 23% of the water loss due to water vapour deficit at 0, 10 and 20 ° C. These findings justify why water loss due to respiration should not be neglected under certain environmental conditions.

Keywords: /Pears/ /Cold Storage/

PINEAPPLE

Lima, R.P., et.al. 2016. Using digital image processing for evaluation of translucency in fresh-cut 'Pérola' pineapple coated with biofilms. Acta Hort. 1141: 311 - 318.

Abstract

The physiological disorder of translucency compromises the quality of fresh-cut pineapple. Edible coatings have been applied to fresh-cut pineapple to reduce the translucency. In general, a sensory panel using subjective scales performs the evaluation of translucency. However, digital image processing, using free software such as ImageJ®, can enable more precise information to be obtained on translucency, considering for instance, the tone of image coloration, the areas in which it occurs, and the pixels in the RGB or HSB channels. Therefore, this study proposed a method for evaluation of translucency in fresh-cut 'Pérola' pineapple using digital image processing (DIP). 'Pérola' pineapple was fresh-cut into slices 10 mm thick that were coated with cassava starch at 3%, cassava starch 3% + fennel oil (0.025%), cassava starch 3% + 1% glycerol + 0.5% ascorbic acid, and cassava starch 3% + 1% glycerol + 0.5% ascorbic acid. Coated slices were placed into cylindrical PET trays of 500 mL, which were covered with PVC film and stored for 6 days at 5°C and 90% RH. The translucency did not differ among slices treated with different coatings. DIP allowed the segmentation and quantification of the translucent areas in fresh-cut 'Pérola' pineapple slices. By the segmentation of the images, the HSB color system was more efficient in differentiating the translucent pulp than was the RGB system. The translucency values obtained by DIP had a highly significant correlation ($r=0.91^{**}$) with the values obtained by sensorial evaluations, as well as with the estimated values as a function of L* and Blue ($r=0.93^{**}$).

Keywords: /Pineapple/ /*Ananas comosus*/ /Browning/

Treviño-Garza, M.Z., et.al. 2017. Layer-by-layer edible coatings based on mucilages, pullulan and chitosan and its effect on quality and preservation of fresh-cut pineapple (*Ananas comosus*). Postharvest Biol. & Technol. 128: 63 – 75.

Abstract

Edible coatings (ECs) based on chitosan (CH), pullulan (PU), linseed (LM), nopal cactus (NM) and aloe mucilage (AM) were applied by layer-by-layer technique to preserve the quality and prolong the shelf-life of fresh-cut pineapple. Pineapples were washed, disinfected, dried and cut into 2 cm side cubes. Fresh-cut fruit was coated by dipping using four treatments (CH + PU, CH + LM, CH + NM and CH + AM), packed into polyethylene terephthalate containers and stored for 18 d at 4 °C. Uncoated fruit was used as control. Application of layer-by-layer ECs decreased ($P < 0.05$) the weight loss, pineapple softening, and, retarded the fall on total soluble solids content and color (L^* and a^*). CH + AM EC was effective in delaying ($P < 0.05$) ascorbic acid degradation. In contrast, ECs did not affect titratable acidity ($P > 0.05$). Microbiological analyses demonstrated the effectiveness ($P < 0.05$) of the layer-by-layer ECs against spoilage microorganisms, *L. monocytogenes* and *S. typhi*. CH + PU EC was the most effective in controlling microbial levels. Sensory analysis demonstrated that layer-by-layer ECs helped to preserve ($P < 0.05$) the quality properties (color, odor, flavor, texture and overall acceptance). In conclusion, layer-by-layer ECs based on CH + PU, CH + LM, CH + NM and CH + AM improved the quality and prolonged the shelf-life of fresh-cut pineapple by six days compared with control.

Keywords: /Pineapple/ /Fresh-Cut /Shelf-life/

STRAWBERRY

Dhital, R., et.al. 2017. Integrity of edible nano-coatings and its effects on quality of strawberries subjected to simulated in-transit vibrations. LWT - Food Sci. & Technol. 80: 257 - 264.

Abstract

Strawberries are a popular fruit with a pleasing color and flavor. However, its delicate tissue and high sugar content makes it highly perishable with visible mold. In this study, we have attempted to test feasibility of a new edible coating for extending shelf life of 'Chandler' strawberries subjected to simulated vibrations of local transportation. Six types of coatings were compared based on the quality of treated berries. Curcumin and limonene were used as natural antimicrobials and coatings were prepared from their liposomes and were over-coated with methyl cellulose. One set of each coating type were subjected to the simulated vibration of local transportation. The vibrated samples had lower shelf life than non-vibrated samples, indicating a robust coating which remains intact during road vibrations is required. Based on the number of berries with visible mold, limonene liposomes showed significantly lower fungal growth compared to the control on the 14th day of storage. Titratable acidity and total phenolic contents were also found to be higher in limonene coated strawberries compared to other coatings. Further study is suggested to test liposome coatings of limonene with different particle size to improve integrity of the coatings when strawberries are subjected to local transportation.

Keywords: /Strawberry/ /Shelf Life/ /Edible Coating/

WATERMELON

Gomez, P.A., et.al. 2017. UV-C light preserves quality of minimally processed watermelon cylinders. Acta Hort. 1151: 279 - 286.

Abstract

Watermelon (*Citrullus lanatus*) is usually minimally processed as cubes, edge-cut damage being a remarkable defect. To avoid such disorder, processing as cylinders and using UV-C as sanitizing tool can be an interesting alternative to preserve quality during shelf life. The effect of UV-C radiation on overall quality, microbial growth, phenolics content and lycopene concentration of watermelon cylinders (2.7 cm ϕ) of several lengths (1, 2, 4 and 8 cm) were analyzed. After harvesting, fruits were washed (150 μ L L⁻¹ NaClO), precooled and processed at 8°C. Once removed the skin, fruits were manually cut as cylinders, exposed to 4.79 kJ UV-C m⁻² and packaged in polypropylene packages under passive modified atmosphere. UV-C untreated cylinders were used as control. After 7 days at 5°C, O₂ partial pressure was higher for the longest cylinders (17.9 kPa for 8 cm vs. 14.2 kPa for 1 cm) with the lowest CO₂ partial pressure (3 kPa for 8 cm vs. 7.4 kPa for 1 cm), indicating a higher respiration rate for the smaller sizes. A better sensory quality in 8 cm cylinders for both, control and UV-C treated, was observed. However, microbial growth was better controlled and phenolics content better maintained (60-80 mg CAE kg⁻¹ fw) in UV-C treated samples. Lycopene content did not significantly decrease in any treatment. As conclusion, watermelon minimally processed as cylinders pretreated with 4.79 kJ UV-C m⁻² can be stored for up to 7 days at 5°C without noticeable quality changes.

Keywords: /Watermelon/ /Fresh-Cut/ /Postharvest/

VEGETABLES

ASPARAGUS

Techavuthiporn, Chairat, Panida Boonyarittongchai. 2006. Effect of prestorage short term Anoxia treatment and modified atmosphere packaging on the physical and chemical changes of green asparagus. Postharvest Biol. Technol. 117. 64 – 70.

Abstract

The effects of prestorage short-term Anoxia treatment combined with modified atmosphere packaging (MAP) on quality changes during the storage of green asparagus (*Asparagus officinalis* L.) spears were investigated. Two sets of asparagus were used in this study. The first set underwent short-term Anoxia treatment via the administration of gaseous N₂ for 8 h at room temperature, while the second set was kept in ambient air at the same temperature. Consequently, treated and untreated spears were stored either freely or packaged in plastic bags with low density polyethylene, in which a passive modification of the atmosphere was allowed to develop. All samples were stored at 4 °C for 8 days, followed by 8 days at 10 °C. Samples treated with neither Anoxia nor MAP were used as a control. Our results show that treating the asparagus samples with Anoxia and MAP (Anoxia + PE) caused lower respiration, slowing the decrease in headspace O₂. In the Anoxia + PE treated samples, spears lost <12% fresh weight after 8 days at 10 °C. All treatments showed less increase in shear force while exposed at 4 °C for 8 days, as compared with the significant increase found when transferred to 10 °C. This increase

in shear force was accompanied by the accumulation of fiber and lignin content. There was a positive relationship between toughening and fiber ($R^2 = 0.958$) and toughening and lignin ($R^2 = 0.915$). Moreover, the degradation of chlorophyll, sugar and ascorbic acid content under the Anoxia and MAP treatments were significantly reduced. The results of the present work indicate that Anoxia treatment, a non-chemical and simple postharvest technology, feasible for use in developing countries where food storage technologies are lacking.

Keywords: /Asparagus/ /Modified Atmosphere Packaging/ /Quality/

ARTICHOKE

Maicaurkaew, S., S., et.al. 2017. Fructan: fructan 1-fructosyltransferase and inulin hydrolase activities relating to inulin and soluble sugars in Jerusalem **artichoke** (*Helianthus tuberosus* Linn.) tubers during storage. J. Food Sci. Technol. 54(3): 698 – 706.

Abstract

Influences of harvest time and storage conditions on activities of fructan: fructan1-fructosyltransferase (1-FFT) and inulin hydrolase (InH) in relation to inulin and soluble sugars of Jerusalem artichoke (*Helianthus tuberosus* L.) tubers were investigated. Maturity affected 1-FFT-activity, inulin contents, and inulin profiles of the tubers harvested between 30 and 70 days after flowering (DAF). Decreases in 1-FFT activity, high molecular weight inulin, and inulin content were observed in late-harvested tubers. The tubers harvested at 50 DAF had the highest inulin content (734.9 ± 20.5 g kg⁻¹ DW) with a high degree of polymerization (28% of DP [30]). During storage of the tubers, increases in InH activity (reached its peak at 15 days of storage) and gradual decreases in 1-FFT activity took place. These changes were associated with inulin depolymerization, causing decreases in inulin content and increases in soluble sugars. As well, decreasing storage temperatures would retain high inulin content and keep low soluble sugars; and freezing at -18 °C would best retard 1-FFT, InH, and inulin changes.

Keywords: /Artichoke/ /Storage/

Martinez-Espla, A., et.al. 2017. Preharvest application of oxalic acid improves quality and phytochemical content of **artichoke** (*Cynara scolymus* L.) at harvest and during storage. Food Chem. 230: 343–349.

Abstract

In this study the effect of oxalic acid (OA) treatment of artichoke plants (*Cynara scolymus* L.) on head artichoke development and on artichokes quality parameters (weight loss, firmness, and color), respiration rate, antioxidant activity and phenolics (measured by Folin Ciocalteu and HPLC-DAD-ESI/MSn) at harvest and during storage for 21 days at 2 °C was evaluated. OA treatment increased the percentage of the first class artichokes although no significant effect was found in artichoke developmental process. OA-treatment reduced the respiration rate of artichokes and led to higher total hydro soluble antioxidant activity and total phenolics and hydroxycinnamics and luteolins concentration both at harvest and during cold storage. In addition, luteolin 7-O-glucuronide 3-O-glucoside was identified for the first time in artichoke. Thus, it can be concluded that OA preharvest treatment could be a natural and useful tool to delay the artichoke postharvest senescence and improve the reported health-beneficial properties of artichokes consumption.

Keywords: /Artichoke/ /Respiration/ /Storage/

BOTTLE GOURD

Akma, O. L. and Hanani, Z.A.N. 2017. Effect of modified atmosphere packaging (MAP) on physicochemical of fresh-cut **bottle gourd**. Acta Hort. 1152: 143 - 148.

Abstract

The effect of modified atmosphere packaging (MAP) with different initial gas compositions on fresh-cut bottle gourd was determined. Vegetables were packaged under each of the following conditions: (1) 3% O₂/9% CO₂ initially, (2) 5% O₂/5% CO₂ initially and (3) 9% O₂/3% CO₂ initially. Passive modified atmosphere packaging with air inside initially (20.9% O₂/0.03% CO₂) was used as the control treatment. Changes in headspace, weight loss, firmness, colour, pH, soluble solid content, titratable acidity and sensory characteristics were evaluated. O₂ concentration continuously decreased below its initial concentration for all packaging conditions. Meanwhile, CO₂ concentration inside all packages continuously decreased up to 17% from the initial conditions. The results indicated a minimum reduction in flesh firmness and delayed the change of colour values in packaged 2 and 3. There were no significant differences observed for titratable acidity, pH and soluble solid content among packaging conditions. In conclusion, the higher oxygen content was effective to maintain the postharvest quality of fresh-cut bottle gourd.

Keywords: /Bottle Gourd/ /Fresh-Cut/ /Modified Atmosphere Packaging/

BROCCOLI

Darre, M., et.al. 2017. Role of UV-B irradiation dose and intensity on color retention and antioxidant elicitation in **broccoli** florets (*Brassica oleracea* var. *Italica*). Postharvest Biol. & Technol. 128: 76 – 82.

Abstract

Postharvest UV exposure has been useful to i) delay senescence and ii) induce the accumulation of bioactive compounds in some vegetable species. However, no studies have been conducted to determine the treatment conditions (radiation dose and intensity) required to maximize these two diverse responses. In this work, we evaluated the effect of UV-B irradiation intensity (*Control*: 0, *Low*: 3.2, *Medium*: 4.0 and *High*: 5.0 W/m²) and dose (0, 2, 4, 8, 12 kJ/m²) on quality retention and antioxidant capacity of fresh broccoli florets during storage (4 ° C for 17 days). Exposure to *Low* UV-B radiation and dose (2, 4 kJ/m²) reduced broccoli weight loss, delayed yellowing and improved chlorophyll and chlorophyllide retention. After long term storage, no marked improvement on the antioxidant capacity was found regardless of the irradiation condition. Evaluations at short time after UV-B exposure (0, 2, 6, 18 h) indicated that the treatments elicited antioxidant accumulation. Greatest antioxidant capacity was found in broccoli subjected to *High* intensity UV-B. Increased levels of aliphatic glucosinolates were found 18 h after the UV-B irradiation, whereas phenolic antioxidants peaked 6 h after the treatment. Results showed that *Low* UV-B doses and intensities delayed chlorophyll degradation and may be useful to complement refrigeration in fresh broccoli. Instead, *High* intensity UV-

B exposure may be better suited as a pre-treatment to increase the antioxidant capacity prior to further processing such as freezing.

Keywords: /Broccoli /Irradiation/

CABBAGE

Prietto, L., et.al. 2017. pH-sensitive films containing anthocyanins extracted from black bean seed coat and red cabbage. LWT - Food Sci. & Technol. 80: 492 - 500

Abstract

The aim of this study was to develop pH-sensitive films based on corn starch and anthocyanins extracted from black bean seed coat and red cabbage. The pH-sensitive films were developed from solvent casting of polymer solutions containing corn starch, glycerol, and anthocyanin extract (from red cabbage or black bean) prepared at pH 5. The color of films changed from pink to purple and blue, as a function of the pH. The pH-sensitive films were evaluated by their morphological, chemical, physical, mechanical and thermal properties. In addition, the stability was evaluated during 28 days of storage (presence and absence of light; with and without cooling). The pH-sensitive films with red cabbage anthocyanins showed a higher stability than that with black bean anthocyanins when stored at room temperature and exposed to light. Both pH-sensitive films exhibited greater color stability when stored under refrigeration as compared to storage at room temperature.

Keywords: /Cabbage/ /Temperature/

Valencia-Chamorro, S., C. Et.al. 2016. Effects of chemical compounds and hot water on quality of fresh-cut white cabbage (*Brassica oleracea* var. *capitata*). Acta Hortic. 1141: 335 - 342.

Abstract

The effects of the addition of chemical compounds classified as 'generally recognized as safe' (GRAS), and hot water, on fresh-cut cabbage were studied. Strips were prepared from cabbages and treated with solutions of acetic acid (AT) (0.15%, w/w), ascorbic acid (AA) (0.2%, w/w) and citric acid (0.5%, w/w) in combination, potassium sorbate (SP) (0.2%, w/w), and water as a control (C). Treated samples were packed in polypropylene (PP) bags and stored at 4°C for 12 days. Physical, chemical, microbiological, and sensory analyses were performed. Samples treated with the ascorbic-citric acid combination exhibited lower browning index (BI), lower microbial contamination and better sensory attributes than the other samples. In another experiment, this chemical treatment was compared with samples immersed in hot water. Cabbage strips were treated with the ascorbic-citric acid combination, dipped in hot water (60°C, 2 min), and dipped in water at ambient temperature as a control; these were packed in PP and low-density polyethylene (LDPE) bags, and stored at 4°C for 12 days. Samples with the hot-water treatment showed a weight loss of less than 0.2%, and lower carbon dioxide accumulation inside the bags than other samples. In this treatment, total polyphenol content was reduced by around 15.5% compared with the initial sample (363 mg 100 g⁻¹ as % gallic acid equivalents); however, ΔE was the highest. The ascorbic-citric acid combination treatment showed a weight loss of less than 0.5%. This treatment maintained the microbiological and sensory quality of samples during the storage time. Total polyphenol content was increased by 8.2%. Thus, the ascorbic-citric acid combination treatment may be an alternative for fresh-cut white cabbage.

Keywords: /Cabbage/ /Fresh-Cut/ /Quality/

LEAFY GREENS

Brown, W., et.al. 2016. Temperatures experienced by fresh-cut leafy greens during retail storage and display. *Acta Hort.* 1141: 103 - 108.

Abstract

There has been limited published work in the United States on temperature profiling of fresh-cut, bagged leafy greens during their transport, retail storage, and retail display. This study utilized temperature monitors placed in backrooms and display cases at nine supermarkets located in southern California: the Central Coast (Santa Barbara to Los Osos), Greater Los Angeles (Burbank area), and Greater Palm Desert. Sensors were installed midway along each 8-foot display case section containing fresh-cut leafy greens. Monitors were placed at the front and back of shelves and in the lower bin. In storage rooms, sensors were placed 4 feet from the floor in each corner. High and low temperature abuse occurred in retail display cases, with slightly more than 40% of the sensors indicating temperatures $>7.22^{\circ}\text{C}$, and 17% of the sensors indicating temperatures $<-0.17^{\circ}\text{C}$, for at least 5% of the time. Temperatures in storage rooms were rarely too low, but were often too high: slightly more than 58% of the sensors indicated temperatures $>7.22^{\circ}\text{C}$ more than 5% of the time, and five sensors measured continuous temperatures $>7.22^{\circ}\text{C}$ for nearly a year. Overall, most temperature abuse of pre-cut leafy greens at the retail level occurred during backroom storage. This study should be expanded to include major grocery chains in cities across the United States in order to verify these results.

Keywords: /Leafy Greens/ /Storage/ /Fresh-Cut/

Gogo, E.O. et.al. 2017. Postharvest UV-C treatment for extending shelf life and improving nutritional quality of African indigenous leafy vegetables. *Postharvest Biol. & Technol.* 129: 107 – 117.

Abstract

Currently, consumer eating habits have shifted to an increasing demand for high quality, safe and healthy food products worldwide. In many African countries, specifically African indigenous leafy vegetables (AIVs) gained importance in this respect contributing to human diet by providing minerals, proteins, vitamins and health-promoting antioxidant compounds. Moreover, these vegetables have an immense potential in creating job opportunities in rural as well as peri-urban areas. However, AIVs tend to suffer severe quantitative and qualitative postharvest losses because of their high perishability. UV-C has been mainly applied in sanitation and food safety for its germicidal effect but also has an impact on preventing nutritional losses. To address this, studies were conducted to evaluate the effect of postharvest application of hormic UV-C dosages on bioactive plant compounds of two AIVs, i.e. African nightshade (*Solanum scabrum* Mill.) cv. Olevolosi and vegetable amaranth (*Amaranthus cruentus* L.) cv. Madiira. Eight weeks after planting, the leaves were harvested and treated with UV-C (254 nm) at either 1.7 kJ m^{-2} or 3.4 kJ m^{-2} while untreated leaves served as control. The leaves were kept for 4 and 14 d at 20°C (65% RH) and 5°C (85% RH), respectively. The quality parameters studied were fresh weight loss, mineral elements (N, P, K, Ca, Mg, Fe, and Zn), protein, and structural carbohydrates determining dietary fibre content and microbial counts. In addition, antioxidative, health promoting plant compounds, i.e. carotenoid, and chlorophyll contents were evaluated. The results showed that fresh weight loss of both

AIVs was significantly reduced with application of lower UV-C dosage (1.7 kJ m^{-2}). Mineral elements and proteins were variedly affected with a general decline in the initial stages followed by an increase compared to the untreated leaves. Hemicellulose and cellulose was significantly increased in vegetable amaranth and lignin content was significantly increased in African nightshade following UV-C treatment. Chlorophyll and carotenoid contents declined within 2–4 d during storage, depending on storage conditions; but thereafter increased again significantly compared to the control. Aerobic mesophyllic and yeast counts were significantly reduced by UV-C treatment, while mould counts were not affected. The findings demonstrate the potential of using hormic UV-C for maintaining the nutritional quality of AIVs during their supply chain as an easy to apply and effective tool, hence contributing to improved food accessibility and food safety in Sub-Saharan areas such as Kenya.

Keywords: /Leafy Vegetables/ /Postharvest Quality/ /Food Safety/

LEAFY VEGETABLES

Klintham, P., S. Et.al. 2016. Combination of microbubbles with oxidizing sanitizers to eliminate *Escherichia coli* and *Salmonella Typhimurium* on Thai leafy vegetables. Food Control. 77: 260-269.

Abstract

Microbubbles (MB) technology was applied in a washing process a few studies have been done with food materials, particularly to reduce the microbial contamination on leafy vegetables. This study determined the effectiveness of MB ($\emptyset \sim 50\text{-}70 \text{ mm}$) combined with three sanitizers acidic electrolyte water (AEO, 20 and 40 mg/L, ORP 910-1010 mV, pH 2.7-3.1), chlorine dioxide (ClO_2 , 3 and 5 mg/L, ORP 550-680 mV, pH 7.1-7.5), and sodium hypochlorite (NaOCl, 40 and 80 mg/L, ORP 900-990 mV, pH 6.5-6.7) in order to inactivate *Escherichia coli* and *Salmonella Typhimurium* on artificially contaminated sweet basil (*Ocimum basilicum* Linh) and Thai mint (*Mentha cordifolia* Opiz.). Although air MB alone did not possess antimicrobial activity, washing with MB combined with the two oxidizing sanitizers (NaOCl and AEO) for 5 min resulted in an effective reduction in *S. Typhimurium* and *E. coli* on sweet basil and Thai mint with 2-3 log reductions (99.2-99.8%). Washing vegetables with MB and NaOCl at a concentration of free chlorine of 40 mg/L NaOCl or 20 mg/L AEO yielded the best results in killing *S. Typhimurium* with 1.21-1.90 and 0.67-2.25 log reductions, respectively. In addition, the reduction of *E. coli* and *S. Typhimurium* on sweet basil appeared to be higher than on Thai mint. Differences in surface roughness may assist the bubbles and sanitizers to detach bacterial cells and therefore increase the washing efficacy. Furthermore, applying sanitizers in washing solution was a powerful means of killing planktonic *E. coli* and *S. Typhimurium* in the wash water and preventing cross-contamination in the washing process.

Keywords: /Leafy Vegetables/ /Washing/

LETTUCE

Goni, M.G., et.al. 2017. Lactic acid as potential substitute of acetic acid for dissolution of chitosan: preharvest application to butter head lettuce. J Food Sci. Technol. 54(3):620 – 626.

Abstract

Chitosan must be dissolved in acid solution to activate its antimicrobial properties. The objectives of present study were to determine whether acetic and lactic acids used to dissolve chitosan would influence its effectiveness to control the native microflora of Butterhead lettuce at harvest and during postharvest storage (7–8 °C, 5 days). Chitosan was applied as a SINGLE DOSE (14, 10, 7, 3 or 0 days previous to harvest) or in SUCCESSIVE DOSES (at 14 + 10 + 7+3 + 0 days prior to harvest). Although chitosan in acetic acid showed antimicrobial activity, treated plants showed dried brown stains which significantly reduced sensorial quality. Chitosan in lactic acid applied in a SINGLE DOSE at harvest or in SUCCESSIVE DOSES reduced microbial counts of all populations at harvest without affecting sensorial quality. After postharvest storage, lettuce treated with SUCCESSIVE APPLICATIONS of chitosan in lactic acid presented significant reductions in the microbial populations compared with untreated sample (- 2.02 log in yeast and molds, -1.83 log in total coliforms, -1.4 log CFU g⁻¹ in mesophilic bacteria and -1.1 log in psychrophilic bacteria). In conclusion, replacement of acetic by lactic acid did not affect the antimicrobial activity of chitosan, reducing microbial counts at harvest and after postharvest storage without affecting sensorial quality.

Keywords: /Lettuce/ /Chitosan/ /Biopreservative/

Paillard, M.J.M., et.al. 2016. Organic acids produced by lactic acid bacteria (*Leuconostoc* sp.) contribute to sensorial quality loss in modified-atmosphere-packed fresh-cut iceberg **lettuce**. Acta Hortic. 1141: 289-296.

Abstract

The shelf-life of fresh-cut lettuce packed in a modified atmosphere (MA) is determined by its “overall visual quality” (OVQ), being a measure of its general appearance based on colour and shape criteria. In addition to the OVQ, the development of off-flavour and acid off-smell reduces consumer acceptance of such products. Concomitant with these changes in organoleptic properties, there is a rapidly developing microbial population inside the MA package (MAP), dominated by lactic acid bacteria. We studied the bacterial population dynamics of active MAP fresh-cut lettuce as well as the effect of metabolites produced by the bacteria (lactic acid and acetic acid) on lettuce quality aspects. Within 3 days of packaging, the oxygen concentration in the package was reduced to near zero, and this resulted in the selective advantage of lactic acid bacteria, in particular *Leuconostoc* and *Lactococcus* species. *Leuconostoc*, when cultivated on lettuce-enriched artificial medium, was found to produce both acetic and lactic acids. Low concentrations of acetic and lactic acids were found in MAP lettuce after 5 days of storage at 7°C. Freshly prepared fresh-cut product treated with comparably small amounts of acetic and lactic acids showed severe quality loss. This was reflected by rapid browning, yellowing and loss of texture. The experiments demonstrate that, under anaerobic conditions, organic acids are produced by lactic acid bacteria, affecting both off-flavour production and sensorial quality in fresh-cut lettuce.

Keywords: /Lettuce/ /Fresh-Cut/

SPINACH

Diaz-Mula, Huertas, et.al. 2017. Off-odor compounds responsible for quality loss of minimally processed baby **spinach** stored under MA of low O₂ and high CO₂ using GC-MS and olfactometry techniques Postharvest Biol. & Technol. 129: 129 – 135.

Abstract

Strong off-odor development is still one of the major problems associated with quality loss of baby spinach stored in MA with low O₂ and high CO₂. Freshness has been generally evaluated by sensory techniques that allow the description of aromatic profiles but it does not identify the responsible compound(s). An approach including sensory analysis and Gas Chromatography-Mass Spectrometry (GC-MS)/Gas Chromatography-Olfactometric (GC-O) techniques were applied to elucidate the complex combination of volatile organic compounds (VOCs) responsible for the off-odor perception of intact baby spinach without generation of new volatiles due to tissue manipulation. After 14 days, levels of low O₂ and high CO₂ (0.3 and 9.3 kPa, respectively) were achieved and off-odors development was detected. After GC-MS/GC-O analysis, there were 39 main compounds with olfactory activity, identified as alcohols associated with lipid peroxidation or LOX pathway; sulfur compounds from amino acid degradation; and alkanes from lipid autoxidation processes or carotenoid degradation. Odor-active compounds were grouped into the six odor categories as described by the sensory panel, with rotten and fishy being the strongest odors perceived after storage. The isolated VOCs grouped in the rotten descriptor were the alcohols 1-pentanol, (Z)-3-hexen-1-ol and 1-octen-3-ol, and the sulfur compounds methanethiol and dimethyl disulfide. A compound responsible for fishy notes was dimethyl sulfide but some evidence indicated that amine compounds with low odor thresholds could be also implicated. Since sulfur compounds were perceived by all sniffers and easily detected by mass spectrometry, they may be good candidates as biomarkers of off-odors in baby spinach.

Keywords: /Spinach/ /Minimally Processed/ /Modified Atmosphere/ /Sensory Quality/

TOMATO

Develeeschauwer, B., et.al. 2017. High relative humidity pre-harvest reduces post-harvest proliferation of *Salmonella* in tomatoes. Food Microbiol. 66: 55 - 63.

Abstract

Outbreaks of human illness caused by enteric pathogens such as *Salmonella* are increasingly linked to the consumption of fruits and vegetables. Knowledge on the factors affecting *Salmonella* proliferation on fresh produce therefore becomes increasingly important to safeguard public health. Previous experiments showed a limited impact of pre-harvest production practices on *Salmonella* proliferation on tomatoes, but suggested a significant effect of harvest time. We explored the data from two previously published and one unpublished experiment using regression trees, which allowed overcoming the interpretational difficulties of classical statistical models with higher order interactions. We assessed the effect of harvest time by explicitly modeling the climatic conditions at harvest time and by performing confirmatory laboratory experiments. Across all datasets, regression trees confirmed the dominant effect of harvest time on *Salmonella* proliferation, with humidity-related factors emerging as the most important underlying climatic factors. High relative humidity the week prior to harvest was consistently associated with lower *Salmonella* proliferation. A controlled lab experiment confirmed that tomatoes containing their native epimicrobiota supported significantly lower *Salmonella* proliferation when incubated at higher humidity prior to inoculation. The complex interactions between environmental conditions and the native microbiota of the tomato crop remain to be fully understood.

Keywords: /Tomatoes/ /Postharvest/

Esua, O.J., N.L. Chin, Y.A. Yusof and R. Sukor. 2017. Postharvest deterioration of **tomato** (*Solanum lycopersicum*) and associated effects on antioxidant bioactive contents. Acta Hortic. 1152: 327-334.

Abstract

Postharvest storage effects of tomato on antioxidant bioactive compounds and its spoilage was investigated from its lipophilic and hydrophilic extracts and studied using standard microbiological methods. Fungal species of *Penicillium* sp., *Aspergillus niger* and yeast sp. (*Candida* sp.) with total load from 3.90×10^3 to 9.02×10^7 CFU g⁻¹ FW and bacterial species of *Enterobacter sakazakii*, *Acinetobacter iwoffii*, *Stenotrophomonas maltophilia*, *Klebsiella pneumonia*, *Klebsiella planticola*, *Pantoea agglomerans*, *Pseudomonas aeruginosa* and *Chromobacterium* sp. with total load of 1.70×10^4 to 1.01×10^8 CFU g⁻¹ FW were isolated and identified responsible for tomato spoilage. Microbial spoilage resulted in increase in colony forming units and 52.37% loss in vitamin C content. Lycopene biosynthesis was enhanced up to a maximum of 38.45 mg kg⁻¹ during storage. Pronounced increase was observed in total phenols reaching 2.29 times at the end of storage whereas antioxidant activity's increase was 40%.

Keywords: /Tomato/ /Postharvest/

Giuffrida, F., et.al. 2016. Shelf-life of fresh-cut **tomato** in relation to cut and fruit types. Acta Hortic. 1141: 199 - 206.

Abstract

Three typologies of tomato (round 'Ventero', ribbed 'Marmalindo', elongated 'Sir Elyan') were minimally processed in slices or wedges and packaged in polypropylene trays (500 g each). Slices (7 mm thick) were obtained by cutting fruits perpendicularly to the main axis. For wedges, fruits were divided into 4 or 8 parts (depend on fruit diameter). Initially (day 0), and after 3, 6 and 9 days of storage at 5°C, quality attributes (microbial load, colour, pericarp firmness, soluble solids, titratable acidity, dry matter, antioxidant activity, content of vitamin C, lycopene and β-carotene) were evaluated. Concentrations of CO₂ and O₂ in the trays were also measured. Oxygen concentration decreased dramatically in the ribbed tomato trays after 3 days of storage. The reduction of O₂ during storage was higher for wedges compared to slices and started before on elongated tomato type compared to round tomatoes. For maintaining a good microbiological quality during cold storage, cutting in slices or wedges should be opportunely suited to tomato type. Firmness was lower (12.8%) in the slices of elongated tomato compared to the wedges, whereas no differences were found in ribbed and round tomatoes. Lycopene content decreased in round tomato slices compared to wedges (about 16%), no differences were observed in ribbed and elongated tomatoes. A vitamin C reduction (26%) was observed in the elongated tomato cut in slices compared to wedges.

Keywords: /Tomato/ /Minimally Processed/ /Storage/

Patane, C., et.al. 2016. Minimally processed long-storage Mediterranean **tomato**: a novel product from traditional crops in the agrifood industry. Acta Hortic. 1141: 297 - 304.

Abstract

The Mediterranean small-sized “long-storage” tomato, which allows an extended shelf life due to its textural properties, provides a delightful product that combines good taste with excellent nutritional properties. Due to the high drought tolerance of the plant, long-storage tomato is traditionally cultivated with no water supply once established, indicating an interesting genetic source in breeding programmes for water stress tolerance in both fresh and processing tomatoes. Recently, the feasibility of obtaining a new minimally processed product from local landraces of long-storage tomato has been considered. A study was conducted to assess the quality of fresh-cut long-storage tomato during storage at 4°C compared to a commercial cultivar of grape-shaped tomato, and also the efficacy of some dipping treatments on shelf-life extension. All fruits were disinfected for 10 min in a sodium hypochlorite solution before cutting in half. Dipping consisted of a 1 h dip in 1% citric acid or 2.4% calcium chloride solutions (w/v) after cutting. Long-storage tomato exhibited higher quality than commercial tomato throughout 13 days of storage, e.g. in terms of total solids (>8 g 100 g⁻¹), total polyphenols (>0.12 mg g⁻¹ fresh weight), soluble solids (>5 °Brix), and antioxidant activity [>80% 2,2-diphenyl-1-picrylhydrazyl (DPPH) inhibition]. The calcium chloride dip resulted in greater cut fruit quality compared to the citric acid dip. Both treatments were beneficial for microbial quality (mesophiles, *Enterobacteriaceae*, lactic acid bacteria, yeasts and moulds) when compared to the control (distilled water dip), but not when compared to the untreated control (no dip), in which microbial load was the lowest.

Keywords: /Tomato/ /Fresh-Cut/ /Shelf-life/

Van Roy, J., et.al. 2017. Measuring colour of vine tomatoes using hyperspectral imaging. *Postharvest Biol. & Technol.* 129: 79 - 89.

Abstract

As consumers buy with their eyes, colour is considered one of the most important quality parameters of food products. Traditionally, this is defined by human inspection, or measured using a colorimeter or a spectrophotometer. As the first is subjective and prone to factors like fatigue, this is not ideal for industrial use. The second only measures a small area of the food product, making it difficult to get a clear overview of the colour of the whole sample. To overcome these limitations, hyperspectral imaging has been used in this research to measure the postharvest colour of vine tomatoes. Two methods to calculate the colour based on hyperspectral images are compared. The first is the use of a direct method to calculate the colour from the spectra in terms of CIELab-values, while the second method is a soft modelling approach involving multivariate statistics. The soft modelling method was found to achieve the best results ($R^2_{L^*} = 0.86$; $R^2_{a^*} = 0.93$; $R^2_{b^*} = 0.42$, $R^2_{Hue} = 0.95$, $R^2_{Chroma} = 0.51$), but its applicability is limited to the range of products on which the models have been trained. The direct method is more generally applicable, but was found to lack robustness against intensity variations due to the curvature and glossiness of the tomatoes.

Keywords: /Tomato/ /Ripeness/ /Quality/

HERBS AND SPICES

SWEET BASIL

Fратиanni, F., et.al. 2017. Changes in visual quality, physiological and biochemical parameters assessed during the postharvest storage at chilling or non-chilling temperatures of three sweet basil (*Ocimum basilicum* L.) cultivars. *Food Chem* 229: 752–760.

Abstract

Leaves of three different sweet basil (*Ocimum basilicum* L.) cultivars (*Italico a foglia larga*, *Cammeo*, and *Italiano classico*) packed in macro-perforated polyethylene bags were stored at chilling (4 °C) or non-chilling temperature (12 °C) for 9 days. During storage, visual quality, physiological (respiration rate, ethylene production, ammonium content) and chemical (antioxidant activity, total polyphenols and polyphenol profile) parameters were measured. Detached leaves stored at chilling temperature showed visual symptoms related to chilling injury, while ethylene production and ammonium content resulted associated to cultivar sensibility to damage at low temperature. Storage at 4 °C caused a depletion in polyphenols content and antioxidant capability, which was preserved at 12 °C. Regarding the polyphenols profile, stressful storage conditions did not enhance the phenolic metabolism. However, leaves stored at 12 °C did not loss a significant amount of metabolites respect to fresh leaves, suggesting the possibility to extend the storability after the expiration date, for a possible recovery of bioactive compounds.

Keywords: /Sweet Basil/ /Chilling Injury/ /Quality/

TUBERS AND ROOTCROPS

Heltoft, Pia, Anne-Berit Wold, Eldrid Lein Molteberg. 2017. Maturity indicators for prediction of potato (*Solanum tuberosum* L.) quality. *Postharvest Biol. & Technol.* 129: 97 – 106.

Abstract

Important factors for development of quality defects are the physical, physiological and chemical state of the tubers, which is also described as the maturity status of the crop. The use of maturity indicators as predictors of quality in potato tubers during and after storage was explored in cvs. Asterix and Saturna with three different maturity levels during three years (2010, 2012 and 2013). The maturity indicators measured 1–3 weeks before harvest and at harvest included haulm senescence (haulm maturity), skin set (physical maturity), dry matter content (physiological maturity) and contents of sucrose, glucose and fructose (chemical maturity). Potato quality parameters were measured three times during storage (December, February and April) and included dry matter content, sucrose, glucose and fructose contents, weight loss and fry colour. Cultivar and maturity level were included as categorical predictors in a linear regression model and contributed significantly ($P < 0.001$) to the models predicting reducing sugars during storage. Dry matter, sucrose, glucose and fructose were included as continuous predictors in the linear regression models and contributed significantly ($P < 0.01$) to the sucrose, glucose and fructose models and these models explained a high proportion of the

variation ($R^2 \geq 0.88$). Skin set contributed significantly to the weight loss models ($P < 0.01$) but the models showed low R^2 -values ($R^2 < 0.48$). Sucrose contents contributed significantly ($P = 0.05$) to the fry colour model for Asterix and the fry colour models for both Asterix and Saturna had R^2 -values of 0.50 and 0.51 respectively. This study provides new information about the influence of maturity on potato quality during storage and the potential of using field measurements of maturity as predictors of storage potential for processing potato cultivars Asterix and Saturna in Norway.

Keywords: /Potato/ /Quality/ /Storage/ /Maturity/