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Abstract
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Postharvest Physiology and Biochemistry of Fruits and Vegetables
2019, Pages 425-441

Chapter 20 - Physiological and Biochemical Effects of Controlled and Modified Atmospheres

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Abstract

Controlled and modified atmosphere techniques are applied on specific horticultural crops to delay ripening and senescence, maintain quality, reduce postharvest losses, and prolong commercial life. These protocols are based on a decrease in the oxygen concentration and an increase in carbon dioxide levels. Stored produce reacts to the imposed stress conditions by activating molecular and physiological responses, resulting in changes to primary and secondary metabolism and composition. A main effect induced by low oxygen is the inhibition of ethylene production, and the possible shift from aerobic to anaerobic respiration (at very low levels of oxygen and/or very high levels of carbon dioxide), resulting in the production of ethanol and other fermentative metabolites that, above a specific threshold, may negatively affect quality parameters and general metabolism of the commodity. Other responses involve changes in terms of amino acids, organic acids, sugars, and cell-wall metabolisms, as well as a rearrangement of volatile compound profiles. Protocols based on low O_2/high CO_2 atmospheres must be properly applied and managed to avoid the onset of physiological disorders, resulting in poor quality and produce losses.

References (0)

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Review of fruits flavor deterioration in postharvest storage: Odorants, formation mechanism and quality control

2024, Food Research International

Citation Excerpt :

…As an emerging physical preservation technology, it has been applied to the storage and preservation of dates, pears, and strawberries, achieving the effects of delaying fruit softening and aging, inhibiting color changes, and reducing weight loss (Huan et al., 2021; Maryam et al., 2022; Xu & Li, 2023). It has been reported that alcohol off-flavor in kiwifruit is related to the development of anaerobic respiration (Cukrov et al., 2019), which leads to the hypothesis that hypobaric treatment may control off-flavor of fruit by regulating aerobic and anaerobic metabolism. On one hand, hypobaric treatment primarily suppresses anaerobic metabolism in fruits by lowering the concentrations of acetaldehyde and ethanol in fermentation metabolism, as well as the activities of PDC and ADH.…

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Influence of modified atmosphere packaging on post-harvest physiology, overall quality, and bioactive compounds during cold storage and shelf-life of 'Tondo Nero' figs (Ficus carica L.)

2023, Food Packaging and Shelf Life

Citation Excerpt :

…Several studies report that modified atmospheres influence sugars' metabolism even if it has not been fully clarified what is the fate of individual sugars such as fructose, sucrose, and glucose. The different responses reported in the literature may be a function of different oxygen and carbon dioxide concentrations (Cukrov et al., 2019; Brizzolara et al., 2020). The best performances of MICRO and MACRO films can be attributed to the atmosphere generated inside the packages with CO2 and O2 which remained at optimal levels, while in BOLPH and OPP films, the higher concentration of CO2 detected inside the packages after 14 days of cold storage (9.6 and 14.8 kPa respectively), but most of all at the end of the two SMC periods (15.8 and 16.8 kPa for BOLPH and 22.3 and 30.5 kPa for OPP), might have negatively influenced the carbohydrate content (Bahar & Lichter, 2018; Colelli & Amodio, 2020).…

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Chitosan and graphene oxide-based biodegradable bags: An eco-friendly and effective packaging alternative to maintain postharvest quality of 'Palmer' mango

2022, Lwt

Citation Excerpt :

…However, depending on the shipping distance, the use of low temperatures alone is not enough to guarantee high mango quality in the market, requiring other technologies associated with low temperatures to further reduce metabolic activity and increase fruit postharvest life (Ntsoane, Zude-Sasse, Mahajan, & Sivakumar, 2019). Modified atmosphere packaging (MAP) can potentially increase fruit postharvest life by reducing oxygen and increasing carbon dioxide concentrations around the fruit as a result of its metabolic activity (respiration) (Cukrov, Brizzolara, & Tonutti, 2019). The MAP delays the fruit ripening and its related physiological, biochemical and organoleptic transformations, such as increased respiration and ethylene production, color changes, softening, increased sugar content and reduced acidity (Singh, Singh, Sane, & Nath, 2013).…

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Effect of hypobaric treatment on off-flavour development and energy metabolism in 'Bruno' kiwifruit

2021, Lwt

Citation Excerpt :

…Energy metabolism is the support for life in postharvest fruit, which exhibits correlation with biological properties, such as ripening, senescence and physiological disorders (Zhao et al., 2019). It has been reported that alcoholic off-flavour in kiwifruit is associated with the development of anaerobic respiration, which is accompanied by changes in energy metabolism during storage (Cukrov et al., 2019, pp. 425–441). Accordingly, learning about the mechanism of energy metabolism and its relationship with postharvest off-flavour development can provide a guideline to explore available techniques for extending the shelf life of postharvest kiwifruit.…

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1-MCP Regulates Ethanol Fermentation and GABA Shunt Pathway Involved in Kiwifruit Quality During Postharvest Storage

2021, Horticultural Plant Journal

Citation Excerpt :

…However, as one typically climacteric fruit, kiwifruit is prone to rapid softening, and frequently occurs off-flavor during postharvest storage (Ali et al., 2019; Gao et al., 2020). Such changes are associated with fruit low internal O2/high external CO2 atmosphere that further alter the physiological and biochemical metabolism of the fruit, among which anaerobic respiration is a major outcome (Cukrov et al., 2019). Under anaerobic respiration, pyruvate redirected to ethanol fermentation to generate ATP via glycolytic pathway for temporary cell survival (Geigenberger, 2003; Porat and Fallik, 2008), and in turn, ethanol accumulation might lead to alcohol off-flavor development in fruit (Shi et al., 2007).…

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Food Processing Technology: Principles and Practice

2022, Food Processing Technology Principles and Practice

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