Novel polylactic acid (PLA)-based active packaging with incorporation of nanoparticles and its performance throughout shelf-life of fresh-cut fruit

\[03/05\]

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This study aimed at developing innovative and environmentally friendly packages for fresh-cut fruits and at a better understanding their effect on physicochemical, mechanical and microbiological characteristics during shelf-life. Packages were developed under the scope of EU project SusFoFlex (7th framework programme) – thought to incorporate materials in final packaging formulations complying environmental and sustainability concerns and valorisation of agri-food by-products. Polylactic acid (PLA)-based active packaging formulations differed in nanoclays used and presence/absence of a surfactant. PLA-nanocomposite packaging performance was evaluated and compared with pristine-PLA and conventional polyethylene terephthalate (PET). Polyone was used as plasticizer in PLA packages. PET formulation did not include any nanoclay. Fresh-cut melon was selected as food model to assess PLA packaging formulations performance on quality changes taking place throughout 7-d storage under controlled conditions. Physicochemical and textural analysis over time encompassed weight loss, colour, visual appearance, pH, soluble solids and firmness, whereas microbial enumeration covered vegetative mesophiles and psychrotrophics, Gram- rods, nonsporing Gram- rods and cocci, yeasts and moulds. Environmental impact of PLA-based packaging was evaluated via life cycle assessment (LCA) and compared with PET. Under limit storage conditions, all microbial groups exhibited maximum viable counts after 5-d. Pseudomonas aeruginosa and Escherichia coli were absent, and refrigeration proved to effectively reduce microbial activity. Overall inspection of dataset throughout storage, unfolded that nanoclays and surfactants in PLA formulations improved their performance, thus contributing to bring together the characteristics of both biopolymers (PLA and PET). Finally, LCA impact assessment indicated that PLA packaging with nanoclays had the highest environmental performance.

Keywords: Packaging, polylactic acid (PLA), ready-to-eat fresh-cut fruit, physicochemical/microbial properties, life cycle assessment (LCA)

Analysis of fatty acids and photosynthetic pigments profiles highlight differences between Vitis species differing in their tolerance to fungal pathogens

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Fatty acids and fatty acid-derived metabolites are not only major structural and metabolic constituents of the cell but they also function as modulators of a multitude of signal transduction pathways evoked by abiotic and biotic stresses. Emerging evidence identifies lipids as second messengers, regulators of signal transducing molecules or transcription factors, and regulators of cell survival and plant cell death. Also it has been recently proposed that specific fatty acids may be involved in plant resistance against pathogens. Grapevine (Vitis spp.), is prone to several diseases and fungal-associated diseases are one of the major treats of modern viticulture. After pathogen inoculation, the content of several fatty acids (eg. C18:1, C18:3) suffers alterations at early time-points. Thus, as a strategy for high-throughput plant phenotyping, in order to discriminate grapevine genotypes, we have accessed the constitutive differences in photosynthetic pigments and membrane fatty acids of two grapevine species, Vitis riparia and Vitis vinifera cv Pinot noir. Wood cuttings of Vitis riparia plants were obtained from Estação Vitivinicola Nacional, at Dois Portos, Torres Vedras, central Portugal and plants were grown under controlled conditions in a climate chamber at 23 °C / 18 °C (day / night), relative humidity 60% and a photosynthetic photon flux density of 300 µmol m-2 s-1. Fatty acids were analysed by gas chromatography and pigments by spectrophotometry. Total fatty acid content is significantly higher in the susceptible cultivar Pinot noir and the total amounts of pigments display a similar trend. A higher linolenic (C18:3) to linoleic (C18:2) acids ratio was found in the tolerant Vitis riparia, which also tends to have a lower chlorophyll a to chlorophyll b ratio. This study suggests that fatty acid and pigment profiling could represent valuable tools in high-throughput Vitis phenotyping regarding disease tolerance traits.

Keywords: Vitis vinifera, Vitis riparia, lipids, pigments
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