Pulsed electric fields affect endogenous enzyme activities, respiration and biosynthesis of phenolic compounds in carrots

Gloria López-Gámez, Pedro Elez-Martínez, Olga Martín-Belloso and Robert Soliva-Fortuny

Postharvest Biology and Technology, Volume 168, October 2020, 111284

Abstract

Pulsed electric fields (PEF) can be applied to induce accumulation of bioactive compounds in plant tissues to obtain commodities with health-promoting properties. However, causes of this accumulation are not fully understood as it may result from either an improvement in extraction or an activation of stress-related biosynthetic pathways. The objective of this study was to investigate the effects of PEF on the physiological response and elucidating the causes underpinning changes in carrot phenolic contents. Respiration rate, oxidative and pectinolytic enzyme activities, synthesis, and content of phenolic compounds were evaluated in PEF-treated (580 J kg^{-1}) carrots after treatment and through storage (12, 24 and 36 h) at 4 °C. The highest production of CO_2 and volatile organic compounds was observed 12 h after PEF treatment whereas the largest increases in total phenolic content (80.2 %), *p*-OH-benzoic (94.7 %), chlorogenic acid (74.9 %) and ferulic acid (52.2 %) occurred 24 h after treatment. Enhanced in phenylalanine ammonia lyase activity indicated that the increase in phenolic compounds may be mainly due to the triggering of biosynthesis pathways instead of structural modifications of the food matrix. Electropermeabilization also induced considerable changes in pectinolytic enzyme activities (increases in pectinmethylesterase and decreases in polygalacturonase) whereas no clear trends were observed for oxidative enzyme activities (peroxidase and polyphenol oxidase) during storage. These results suggest that volatile compounds generation, changes in respiration rate and the biosynthesis of phenolic compounds are induced by PEF application, as a plant defence response to stress.