Title Influence of hot water and molybdenum dips on the production of total antioxidants in lemon rind during cold storage and their ability to scavenge reactive oxygen species

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Abstract

Lemon fruits are sensitive to chilling injury. Long distance shipping requires low temperature storage, and cold injury is particularly of concern if could sterilization is necessary for phytosanitory proposes. Cold storage makes fruits susceptible to oxidative stress, which results in physical chilling injury. Oxidative stress is a result of imbalances between the production of reactive oxygen species (ROS) and scavenging thereof by anti-oxidants. High ROS concentrations accelerate deterioration of membranes, lipid peroxidation and DNA mulation, leading to metabolic and structural dysfunction and cell death. Previous work has indicated that hot water dip (HWD) and molybdenum (Mo) dips have potential in reducing chilling injury of citrus fruits, particularly in lemons (cv. Eureka). Therefore, the aim of this work was to investigate the physiological effects created by hot water and molybdenum dips with a focus on total antioxidant production and scavenging of ROS. Fruits from two growing areas were dipped postharvest into Mo solution at 1, 5 or 10 μmol for 30 min and HWD at 47°C and 53°C for 2 min. The fruits were stored at -0.5°C and sampled at 0, 7, 14, 21, and 28 days for evaluating chilling injury immediately after storage and 5 days after withdrawal from cold storage. After evaluation fruits were peeled and the peel freeze-dried, milled under liquid nitrogen and stored at -21°C for further use. Lemon rind total antioxidant capacity (TAC) was determined by FRAP assay, and ROS quantified spectroflourometrically. The Ukulinga fruits had higher TAC compared to Sun Valley fruits. Mo dips influenced TAC especially for Ukulinga fruits. Generally there was a relationship between TAC and the removal of ROS, such that when TAC was at maximum ROS was at minimum. The relationship was established within 7 days of cold storage. HWD at 53°C stimulated production of TAC more than HWD at 47°C. Hot water and Mo dips appear to be useful in stimulating TAC and decrease the potential for chilling injury, but fruit origin plays a critical role in the response.