

**Title** Influence of hot water and molybdenum dips on the production of total antioxidants during cold storage of lemon and the ability of such compounds 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 cold sterilization is necessary for phytosanitary purposes. 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 (LP) and DNA mutation, leading to metabolic and structural dysfunction and cell death. Previous work has indicated that hot water (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 $\mu$ mol for 30min and HWD at 47°C and 53°C for 2min. 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, Lipid peroxidation by spectrophotometric method and ROS quantified spectrofluorometrically. 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.