Abstract

The internal browning (IB) disorder of Pink Lady apples is a consequence of some undefined physiological conditions of the fruit at harvest, which predisposes them to damage during controlled atmosphere (CA) storage. The underlying biochemical factors remain poorly understood. In fall 2004, Pink Lady apples were harvested in Stockton, California at commercial maturity, then placed into storage in air or CA with 1.5% O_2 + 3% CO_2 or 1.5% O_2 + 5% CO_2 at 0.5°C for 2, 4 or 6 months. Following storage, fruit were assessed and separated into groups of damaged (IB) or undamaged apples. The injury pattern showed a higher severity in the upper portion of the fruit; consequently we collected samples of healthy and brown tissues form the upper and lower halves of damaged apples to check for any biochemical differences. Tissue from both types and locations was collected to analyze for ascorbic acid (AA) and dehydroascorbic acid (DHA) content (addition of both: total AA), electrolyte leakage (EL), polyphenol oxidase activity (PPO), total phenolic concentration, mineral content, stress related hydrogen peroxide (H_2O_2) accumulation, and cell viability. Two months of storage resulted in significant differences in the content of AA and DHA between undamaged CA-stored apples and those affected by IB. The brown tissue only contained DHA. Upper tissue contained less total AA compared to lower tissue in both damaged and undamaged CA-stored apples; however there was no difference in air-stored apples. Cell viability studies revealed that brown tissue was dead while surrounding tissue was viable. Additionally, the EL was significantly higher in the healthy tissue of apples with IB, upper tissue showing more leakage than lower tissue, and brown tissue having 5-fold higher EL due to the death of the tissue. There was significantly higher EL in apples stored under either CA atmosphere as compared to air stored fruit. Previous studies of apples in CA storage have demonstrated a negative correlation between the concentrations of calcium, magnesium and boron with IB susceptibility. Mineral content analysis will demonstrate if differences in mineral distribution among tissue locations within individual apples and among fruits are related with IB susceptibility. Additionally, the accumulation of hydrogen peroxide, the relationship of PPO activity and its solubilization and the content of phenolic compounds during CA storage with IB susceptibility will be discussed.