Abstract

The shelf life of apples (*Malus x domestica* Borkh.) can be greatly improved by controlled atmosphere (CA) storage in conjunction with low temperature. However, both conditions result in a marked reduction of total aroma volatile production during the long-term storage of apple fruits. The objective of the present study was to understand the mechanism of aroma volatile biosynthesis from 'Gala' apples stored in CA. Fruits were harvested at optimum maturity for long-term storage, precooled overnight at 0ºC, and then placed either at 0 or 3ºC either in standard CA (2.5% O_2 +2.5%CO_2) for 120 and 240 days, or in ambient air for 75 and 150 day. Post-storage fruit volatile biosynthesis was monitored by headspace analysis at 22°C for 14 days and quantified by solid-phase micro-extraction (SPME) FID-GC and GC-MS. Gene expression and enzymatic activity analysis of three major enzymes in aroma biosynthesis, namely alcohol o-acyltransferase (AAT), alcohol dehydrogenase (ADH) and lipoxygenase (LOX), were performed. Fruit volatile production was greatest at harvest and decreased thereafter for fruit held in air and CA; however, total aroma volatiles were significantly higher in fruits removed from air than from CA. CA storage increased the activity of ADH whereas AAT and LOX activity was reduced when compared to fruit stored in air. The activities of all three enzymes studied were higher in fruits removed from 3ºC than from 0ºC. The higher enzyme activities and total volatile production from 'Gala' fruit held at 3ºC suggests that aroma volatile biosynthesis in 'Gala' is chilling sensitive.