Abstract

Elevated CO2 (15-20%) is routinely used during strawberry (*Fragaria* × *ananassa* Duch.) fruit postharvest shipping and storage to maintain fruit freshness and reduce decay. However, off-flavors may develop, depending on cultivar, CO2 concentration, duration and temperature. The physiological and biochemical basis of CO2 action on strawberries is not well understood. The objectives of this study were to investigate the effects of CO 2 on the two key enzymes of the ethanol fermentation pathway, pyruvate decarboxylase (PDC) and alcohol dehydrogenase (ADH), their activity in relation to their gene expression, the fermentation products accumulation and fruit quality, and to identify novel genes that are differentially expressed under the CO2 -treatment.

'Jewel' strawberry fruits were treated with 20% CO_2 at 2°C and 20°C for up to 9 days. Results showed that the CO_2 -treatment enhanced strawberry fruit firmness at 2°C but not 20°C, while the red color was maintained by the CO_2 -treatment at 20°C but not at 2°C. Temperature also affected the accumulation of acetaldehyde, ethanol and ethyl acetate in CO_2 -treated fruit. All three compounds accumulated in fruits at 2°C. At 20°C, only ethyl acetate accumulate. PDC enzyme activity was higher in CO_2 -treated fruit than air-treated control at 2°C but not 20°C. PDC mRNA accumulation was higher in CO_2 -treated than air-treated fruit at 20°C but not 2°C. ADH activity and ADH mRNA accumulation in the CO_2 -treated fruit was higher than in air at 20°C but not 2°C. The results, overall, indicated that relationships among gene expression, enzyme activities and fermentation product accumulation were inconsistent.

Other genes that found to be differentially expressed under the CO_2 -treatment included polygalacturonase (PG), late embryogenesis gene (LEA), scarecrow-like or RGA-like protein, indole-3-acetate beta-glucosyltransferase protein, metal lothionein-like protein and cytochrome P450. Northern hybridization showed that the PG gene expression was suppressed by the elevated CO_2 treatment under cold storage temperature. The rest of the cDNAs were mainly stress-induced, suggesting that the elevated CO_2 might serve as a stress factor during the storage.