

Title Involvement of ethylene in browning development of controlled atmosphere-stored 'Empire' apple fruit

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Abstract

'Empire' apples [*Malus sylvestris* (L.) Mill var. *domestica* (Borkh.) Mansf.] are susceptible to development of chilling injury, expressed as firm flesh browning, during controlled atmosphere (CA) storage. Because of this susceptibility, fruit are typically stored at 2–4 °C, but the incidence of flesh browning can be increased by 1-methylcyclopropene (1-MCP) treatment at these temperatures. In this study, flesh browning development has been investigated in relationship to ethylene production, internal ethylene concentration (IEC), flesh firmness, total phenolic concentrations, and the activities of polyphenol oxidase (PPO) and peroxidase (POX) in the flesh tissues. Fruit were harvested from two orchards, either untreated or 1-MCP treated, and then stored under CA conditions at either 0.5 or 4 °C. Fruit were removed from storage at 1.5-month intervals for 10.5 months. 1-MCP treated apples were firmer than those of untreated apples, and had lower IECs, at all removals. Flesh browning incidence and severity developed earlier in 1-MCP-treated apples than untreated apples stored at either temperature. Total phenolic concentrations differed by orchard, but no major differences in concentrations were detected between untreated and 1-MCP treated apples. However, PPO activities were higher in the flesh of 1-MCP treated apples than untreated apples from both orchards and at both storage temperatures. POX activity was not consistently affected by 1-MCP treatment or storage temperature. Overall, our results suggest that inhibited ethylene production, either as a result of storage at 0.5 °C, or by treatment with 1-MCP at either temperature, may cause stress and damage to cells and result in higher PPO activity that leads to progressive flesh browning development during CA storage.