

Title Antioxidant treatment alters metabolism associated with internal browning in ‘Braeburn’ apples during controlled atmosphere storage

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Abstract

‘Braeburn’ apple [*Malus sylvestris* var. *domestica* (Borkh.) Mansf] fruit can develop internal browning (Braeburn browning disorder; BBD) during hypoxic cold storage in elevated levels of CO₂. Pre-storage treatment with the antioxidant diphenylamine (DPA) can prevent this disorder. To evaluate disorder-related metabolism, untargeted metabolic profiling using GC–MS and LC–MS was performed to characterize metabolism in cortex tissue of ‘Braeburn’ apple fruit treated with 2 g L⁻¹ DPA or left untreated and stored under high CO₂, controlled atmosphere (CA) storage of 1.5 kPa O₂/3 kPa CO₂ at 0.5 °C for up to 12 weeks. Partial least squares (PLS) regression analysis was employed to define metabolomic differences developing between untreated and DPA-treated fruit during storage and to identify metabolites linked with treatments, storage duration, and BBD. Metabolomes of control and DPA-treated fruit began to diverge at 1 week after storage and then oppositely diverge at 4 weeks after storage, which accompanied increased flesh browning in untreated fruit only. Flesh browning was associated with increased acetaldehyde, ethanol, and ethyl esters. DPA treatment reduced the levels of these and other volatile compounds. DPA treatment also reduced flesh content of many amino acids. These results indicate that metabolism is altered by DPA treatment and that these metabolic changes may be related to tissue integrity.