Abstract

Calcium is known to be associated with the regulation of ripening processes in fruit and to influence the postharvest storage life. There are some specific disorders in apples which can be prevented if sufficient calcium is present in them. Atomic absorption spectrophotometry (AAS) is the standard method to measure calcium concentrations in plant tissues but this method has many limitations. The use of an ion selective electrode (ISE) with a standard addition procedure to estimate calcium in apple tissue after homogenization in water was examined. It was found that calcium could be reliably estimated in synthetic apple mixtures based on potassium malate. However, the calcium estimates using ISE were consistently lower than AAS data for apple homogenates. This lower estimate of calcium could be because of cell wall binding of calcium. When apple cell walls were titrated with increasing volumes of calcium it was observed that the proportion of bound calcium was dependent on the free calcium concentration. The reciprocal of the square of bound calcium correlated with the reciprocal of free calcium concentration. When this relationship was used to calculate calcium in apple homogenates it was found that ISE and AAS estimates were similar. A series of ripening apples were analyzed to test consistency in calcium estimation by the ISE method. It was observed that the ionic (free) calcium content increased as the apples ripened, suggesting the release of calcium ions. Potassium concentrations appeared to increase in the intercellular liquid, suggesting that potassium might be displacing calcium ions from the cell walls and thus causing softening of the apples. A decrease in malate concentration during ripening could also be related to the increase in ionic calcium. Total calcium appeared to decline during ripening, suggesting that there may still be problems in the ISE method.