

Abstract:

Knowledge of gas diffusion is important for understanding and developing controlled atmosphere treatments and modified atmosphere packaging for extended product life. Measuring gas diffusion properties of fruit tissue has proven difficult due to the available gas measurement techniques and the inherent biological variability of biological material as well as the fast deterioration and respiration activity of cut tissue samples. A measurement set-up for tissue diffusivities using fluorescent optical probes was developed. The optical sensors produced good informative O₂ and CO₂ partial pressure versus time profiles. Diffusivities of O₂ and CO₂ were estimated based on a finite element model describing simultaneous O₂ and CO₂ gas transport as well as respiration in the tissue. The average O₂ and CO₂ diffusivity of pear inner cortex tissue were $(2.56 \pm 0.48) \times 10^{-10} \text{ m}^2/\text{s}$ and $(3.8 \pm 1.1) \times 10^{-9} \text{ m}^2/\text{s}$, respectively.