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Modeling the effect of oxygen availability and storage temperature on fresh-cut strawberry respiration rate

***Amaro, Ana Luísa*[1]; *Pereira, Maria João*[1]; *Carvalho, Susana*[2]; *Vasconcelos, Marta*[1]; *Pintado, Maria Manuela*[1]**

[1]CBQF/Escola Superior de Biotecnologia, Universidade Católica Portuguesa, 4200-072 Porto, Portugal;
[2]Faculdade de Ciências, Universidade do Porto, Departamento de Geociências Ambiente e Ordenamento do Território, Rua do Campo Alegre 697, 4169-007 Porto, Portugal

E-mail: aamaro@porto.ucp.pt

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Abstract

Fresh-cut commodities shelf-life is limited by minimal processing operations and storage conditions. Wound damage is sensed by sensors/receptors that recognize increased concentrations of endogenous molecules or their fragments, and tissue response involves an increase in respiration rate. Respiration behavior of fresh-cut strawberries is affected by wounding, storage temperature and oxygen availability. Modified atmosphere packaging and refrigerated storage are frequently used to reduce the respiration rate without negatively affecting the physiology of the fruit and to increase shelf life. Mathematical models have been proposed to correlate the respiration rate with different storage parameters such as gas composition and temperature, but the two factors have rarely been considered simultaneously and the systematic approach to modified atmospheres packaging design involves the knowledge of respiration rate kinetics at different temperatures. The objectives of this study were to determine respiration rate of fresh-cut strawberries as a function of oxygen and temperature conditions during storage and to develop and validate mathematical models for predicting respiration rate. Freshly harvested strawberries were processed into wedges and placed in 750 mL glass jars. The glass jars containing fresh-cut strawberries were then flushed with different oxygen concentrations (2.5; 5; 10 and 20% O_2) and stored in three different temperatures (0, 5 and 10 °C), for 5 days. The experiments were performed in three replicates. Oxygen and carbon dioxide concentrations inside the glass jars were analyzed throughout refrigerated storage with a gas analyzer, measuring at two hours intervals in the first 48 hours and then in 12 hours intervals until the end of the 5 days. Initial oxygen partial pressure and temperature had significant effects on fresh-cut strawberry respiration rate with significant decreases with lower initial oxygen levels and lower temperature. The models developed are useful for supporting decision on fresh-cut strawberry optimal storage conditions based on physiological response.

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