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## **QUANTIFICATION OF MASS TRANSFER PROPERTIES FOR ENGINEERING MAP DESIGN OF FRESH PRODUCE**

**Maria J. Sousa Gallagher, Pramod V. Mahajan**

*Department of Process and Chemical Engineering, University College Cork, Ireland*

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### **Abstract**

Fresh produce mushrooms and strawberries are high value crops, with high consumer demand and with high export potential. However, being highly perishable products there are many packaging challenges in order to control fungal decay, gas and moisture for ultimately extending their shelf life. Modified Atmosphere Packaging (MAP) of fresh produce is a dynamic system which relies on the modification of the atmosphere inside the package, achieved by the natural interplay between two processes, the respiration of the product and the transfer of gases through the packaging film, which leads to an atmosphere richer in CO<sub>2</sub> and poorer in O<sub>2</sub>. It is well established that MAP can help to increase the post harvest life of mushrooms and strawberries, but it was found little evidence of application of MAP in the market for these two products. The aim of this work was to define specifications for packaging and quantify the mass transfer properties for engineering MAP design for strawberries and mushrooms. Mushrooms and strawberries have both high respiration and transpiration rate, but commercial packaging materials are not permeable enough to compensate the high physiological requirements of these products. Packaging design which does not take into account product respiration and transpiration rate and temperature fluctuation of the supply chain can lead to condensation inside the package, product degradation and potentially anoxia and increase for microbial growth. Integrative MAP modelling allows physical reality to be replaced by its equivalent computer model, therefore, allowing testing “what-if” scenarios and insights of the systems. The mass balance of gases involved in going in-and-out of the MAP system, can be used to quantify the mass transfer barrier properties requirement by integrating the relevant models. Therefore, to estimate target oxygen, carbon dioxide and water transmission rate, OTR, CTR and WVTR, respectively, knowledge would be required on optimum storage/packaging conditions, effect of temperature on product respiration rate and transpiration rate, effect of temperature on packaging permeability, along with other parameters such as package size and product weight. Mushrooms and strawberries require packaging films with high gas and water vapour permeability. The required tailor range would be: OTR 47501-71251 (32779-49169) mL/m<sup>2</sup>.day.atm, CTR 73872-110808 (22275-33413) mL/m<sup>2</sup>.day.atm and WVTR 425-638 (93-140) g/m<sup>2</sup>.day.atm for packaging mushrooms (strawberries), respectively, at 5°C and 90% RH considering a product variability of 20%.

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