Title A mathematical model for packaging with microperforated films of fresh-cut fruits and vegetables

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Abstract

For the design of modified atmosphere packaging with microperforated films it is necessary to know the respiratory kinetics of the product and the gas interchange through the packaging. The aim of this work was to describe an empirical equation that relates the microperforation area with the transmission rate in order to present a mathematical model, valid for packages of constant volume. The model should take into account the dependency of the respiration rate with the gas composition and the existence of a hydrodynamic flow through the microperforations. The evolution of the gas composition inside the package predicted by the model has been compared with the results of experiments conducted at 4 °C with minimally processed peach ('Andross' and 'Calante' cultivars), fresh-cut cauliflower and whole black truffle, by using seven packages of different number (0–14) and size (from 90 × 50 µm to 300 × 100 µm) of microperforations. The respiratory kinetics of these products was previously determined in a closed system. It has been established that the rate of O_2 consumption is a potential function of the O_2 concentration, while the production of CO_2 is linear, except in the case of the truffle which showed a linear dependency for O_2 and CO_2. The experimental data and those predicted by the model showed a satisfactory agreement for the O_2, while the CO_2 is underestimated for products with RQ < 1 but in agreement when RQ > 1. The reason for this behaviour could be the CO_2 concentration gradient within the package owing to the air flow that moves to compensate pressure differences.