Title Modelling the gas exchange dynamics during the storage of shredded carrots in perforation-mediated modified atmosphere packaging

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Abstract

Minimally processed fruit and vegetables are products with very high respiration rate that need to be stored in packages with high transmission rate of O_2 and CO_2, in order to avoid anaerobiosis. Perforation-Mediated Modified Atmosphere Packaging (PM-MAP) is an alternative system to convectional MAP with polymeric films that controls the gas exchange rates during the storage of fresh products. It has high gas permeability, making it suitable for products with high metabolic activity. The objective of this work was to verify the applicability of PM-MAP for the storage of shredded carrots at different temperatures (4 and 10°C). The amount of carrots required to achieve the optimal gas composition was calculated using PM-MAP permeability and respiration rate model of carrots. Glass jars were used to store the shredded carrots (*Daucus carota* L.). The tubes of different dimensions (D/L in mm:7/23.5, 7/31.5, 9/15.5 and 9/31.5) were inserted in the lid of the jar to control the gas exchange of O_2 and CO_2 between the package and surrounding atmosphere. PM packages were stored in a walk-controlled temperature room at different temperatures and gas was analyzed at regular time intervals. The results showed a good agreement between the predicted and experimental gas compositions of O_2 and CO_2 during the storage of shredded carrots, independent of the storage temperature studied. Steady state gas compositions were in the range of the optimal recommended for the storage of shredded carrots (O_2: 1-5% v/v and CO_2: 15-20% v/v), with the exception of PM packages (D/L: 9/15.5) because of the high gas permeability values. It was therefore concluded that PM-MAP showed a very good potential for the storage of products with high respiration rate, like fresh-cut fruits and vegetables, and also for products that can tolerate low O_2 and high CO_2 levels.