Title	Model-driven development of microperforated active modified-atmosphere packaging for fresh-cut produce
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Citation	ISHS Acta Horticulturae 746:83-88. 2007.
Keywords	strawberry; plastic film; gas mixtures; laser perforation; mathematical modeling; spoilage

Abstract

Modified-atmosphere (MA) packaging is one of the major approaches to preserve the fresh-cut produce. In traditional equilibrium (“passive”) MA systems the establishment of the modified atmosphere is based on produce respiration resulting in oxygen decline and carbon dioxide accumulation. The steady-state level of the two gases is determined by the equilibrium between the produce respiration rate and the permeability characteristics of the packaging material. This traditional MA approach has two major problems: (a) the MA buildup typically takes a number of days when the produce is exposed to non-optimal atmosphere and therefore continues to deteriorate, and (b) the oxygen permeability of available packaging materials is insufficient for highly-respiring commodities, which leads to eventual oxygen depletion and off-flavor development. The method of active MA is based on initial filling of the packages with optimal gas mixtures instead of air, so that the produce spoilage during the transient period is reduced. In this work we present a seemingly paradoxical approach when active MA (“gas-flushing”) is combined with the use of microperforated plastic films in order to simultaneously solve both above-listed problems. Optimization of perforation level and of the gas mixture composition is critical for design of efficient microperforated active MA packages. Although this optimization may be conducted empirically, using mathematical modeling can facilitate the packaging design. The efficacy of this new approach is illustrated by experimental results obtained with fresh-cut strawberries.