
Development of effective permeance relationships for ethylene losses from packaging systems.

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Physiological changes in fruit can be influenced by the within packaging ethylene microenvironment created by the fruit and the losses through the film. Predicting ethylene concentrations profiles within packaging systems may help in packaging perforation design to minimize ethylene accumulation. Predicting the concentration profile for a packaging system needs to consider the transfer through different features that a package may have, such as holes, folds or micro-perforations. Prediction of gas within packaging microenvironments has been well established for micro-perforations but there are less robust models for larger features, with the assumption usually being that there is no meaningful profile. The objective of this study was to establish the dimensional bounds of packaging and when an effective permeance model is appropriate (assuming uniform internal package concentration). Simulations were conducted using COMSOL for ethylene gas loss from a range of different packaging scenarios with large holes and folds and with ethylene sources at different locations within the package. Based on the simulations, simplified effective permeabilities to account for gas losses through holes and folds were developed and related to their geometry. The Finite Element Model and effective permeance models were compared with experimental data.

The effective permeance relationships created in this study could be used for a range of gas systems with uniform internal package concentrations.

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