

Abstract:

The objective of the study was to determine the set of physical and chemical actions leading to the disappearance of ethylene from artificial storage atmosphere exposed to ultraviolet irradiation. The goal was achieved by developing a static chemical model based on the physical properties of a commercially available ultraviolet low pressure mercury lamp, the photochemistry of gases, and the kinetics of chemical reactions. The model was used to perform computer simulations predicting time dependent concentrations of chemical species included in the model. Development of the model was accompanied by the design of a reaction chamber used for experiments.

Predictions from the model were compared to experimental data. The model accurately predicted the exponential shape of the ethylene concentration curve over time but under predicted the rate of conversion. It is concluded that the conservative assumption of a radial pattern of ultraviolet radiation is primarily responsible for the observed discrepancy. The model predicted analogous differences in ethylene conversion at different oxygen levels as were observed in the experiments. It is also concluded that atomic oxygen, not ozone, is the primary reactant in UV initiated ethylene decomposition.