Abstract:

A model has been generated and applied to estimate gas profile of modified atmosphere packaging (MAP) of prickly pear cactus stems. The model describes the transient gas exchange taking in consideration the effect of temperature (T) and relative humidity (RH) on the permeability of the films (P^P_X), rate of respiration (R_x) and tissue permeability (βT_X). The closed system for respiration measurement was used, generating conditions of 65 to 90% RH (at intervals of 5%) at 5, 14, 20 and 25ºC. In order to determine the film permeability (P^P_X) to O_2 and CO_2 in the different conditions of T and RH, a diffusion cell was constructed with 4 "swagelok" valves. In the case of the βT_X, the profile of gas concentration inside the tissue and the permeability coefficient were obtained at the different conditions, using a diffusion cell sealed at the surface of the cactus stem. The P_{H2O} was determined gravimetrically. The thickness of the films was determined using a micrometer. The data collected with the model were similar to the experimental data, indicating that the generated model suitably describes the in-package gas changes, and that the integration of the T, RH and P^T_X to the model allowed a more precise description of the in-package gas concentrations. The temperature effect on P^P_X, βT_X and R_X is described by the Arrhenius equation. R_X and βT_X decreased as RH increased. The effect T and RH can be described by the following equation:

$$Y = (P_0(RH)^{p1} + P_2)\, e^{(1/T)}$$

There was an increase in the P^P_X, and the bT_X at low T and high RH, which can be related to a greater solubility of gases at low temperatures.