**Title** Transient state in-pack respiration rates of mushroom under modified atmosphere packaging based on enzyme kinetics

**Author** Deepak Raj Rai and Shashi Paul

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**Abstract**

The evaluation of transient-state in-pack respiration rates for oxygen ($O_2$) consumption and carbon dioxide ($CO_2$) evolution at any instant of time for a commodity packaged in polymeric film packages and kept under modified atmosphere (MA) for long-term storage requires regular analysis of the in-pack partial pressures of $O_2$ and $CO_2$. Enzyme kinetic theory has been observed to make near-accurate predictions of the respiration rates of many commodities under MA. This approach was followed to evaluate the respiration rates of the 'button' mushroom, packaged in low-density polyethylene (LDPE), polypropylene (PP) and oriented polypropylene (OPP) film packages at any instant of time, utilising the produce, package and the environmental parameters. The respiration model parameters under the specified environmental conditions of 15 °C and 75% relative humidity (RH) were evaluated using multiple regression analysis and were utilised to know the predicted rates of respiration for $O_2$ consumption and $CO_2$ evolution. The experimental in-pack partial pressures of $O_2$ and $CO_2$ under all the packaging treatments agreed fairly well with the predicted values for a storage period of 96 h. The predicted rates of respiration dropped drastically in LDPE and PP film packages, but arrived to near-constant levels (115 and 110 ml $kg^{-1}$ $h^{-1}$ for the $O_2$ consumption and $CO_2$ evolution, respectively) in the OPP film packages after 36 h, indicating the condition of gaseous equilibrium in these packages. Results of the study confirm that the enzyme kinetics approach can be used to predict the respiration rates of any commodity under MA in polymeric films.