Title Permselective MA packaging of litchi (cv. Shahi) for preserving quality and extension of shelf-life

Author S. Mangaraj, T.K. Goswami, S.K. Giri and M.K. Tripathi

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Abstract

Modified atmosphere (MA) packaging with selective permeability was developed to achieve the optimum atmosphere inside the package within minimum possible time for extending storage life of litchi (cv. Shahi) fruit. On the basis of preliminary investigations, the sub-optimal package air composition of 5% O_2 and 5% CO_2 in N_2 was appropriate for designing the optimal MA packages. The MA packages were made from laminates of bi-axially oriented polypropylene (BOPP) and polyvinyl chloride (PVC) in order to meet the gas transmission requirements of the fruit. A package size of 28 cm × 22 cm was finalized for 1 kg ± 100 g fill-weight of fruit. A mathematical model for MA packaging of fruit applying a respiration equation based on enzyme kinetics coupled with the Arrhenius model was developed. The model was solved numerically using MATLAB and the models efficiently predicted the time to reach equilibrium and levels of O_2 and CO_2 at equilibrium with E values in the range of 5.92–8.60% and 7.14–9.35%, respectively. Different quality attributes such as physiological weight loss, volume reduction, firmness, total soluble solids, titratable acidity, color parameters, polyphenoloxidase and peroxidase values and anthocyanin contents were determined at regular intervals. Sensory attributes such as color, texture, taste and mouth feel of fruit samples were evaluated using fuzzy logic. The MAP system increased the shelf-life of litchi fruit by 100–150% that of unpacked fruit at various storage temperatures with a quality comparable with freshly harvested fruit. Fruit stored in MAP retained quality up to 17, 13 and 9 d of storage at 10, 15 and 20 °C, respectively. MAP of EDTA-treated fruit resulted in a reduction of weight loss, prevention of browning, and retention of good color and sweet taste during extended storage. The direct effect as well as a two and three factor interaction of the effects of temperature, packaging system and storage periods were found to have significant effects on quality parameters of fruit at the 1% level of significance.