ABSTRACT

Freshly harvested mature guava (Cv. Baruipur and Desi) and banana (Cv. Grand naini, Singapuri and Chapa) were sorted on the basis of uniformity at external peel color, weight and dimensions. The respiration rates of fruits were measured at 13 °C for guava and 15 °C for banana after the fruits attain equilibrium with the storage environment with different concentrations of O_2 (0-21 %) and CO_2 (0-17 %) varied as per central composite rotatable design (CCRD). Response surface model and artificial neural network (ANN) model were fitted to the experimental respiration data which could predict the O_2 consumption rate and CO_2 evolution rate of the banana and guava, respectively under any combination of O_2 and CO_2 of the storage environment. The transpiration rates (TR) of fruits were determined using factorial design at 10-30 °C and 70-90 % RH. The ANN and the energy balance model were fitted to predict the TR of guava and banana, respectively at unknown storage conditions. The O_2 transmission rate (OTR) and CO_2 transmission rate (CTR) of two thicknesses of commonly used polymeric films namely LDPE, PP and PVC were evaluated using data from the literature. The WVTR was experimentally determined using the desiccant method of the ASTME96 -16. The required WVTR for packaging banana (Cv. Grand naini) and guava (Cv. Baruipur) were higher than that available with the studied films. But, the required OTR and CTR of the film for designing MAP of guava and banana were close to that available in PVC 40 and PVC 50 films, respectively. Hence, they were used to design active MAP for guava and banana in 5-10 °C temperature range with estimated mass of moisture scavenger (MS) to prevent in-package water condensation. In the MAP of guava and banana the MS sachet containing 30-50 g & 40-60 g, respectively of coarse silica gel as MS and ethylene scavenger (ES) sachet containing 0-4 g of $KMnO_4$ were added as per CCRD. Following 30 and 21 days of storage of guava and banana, respectively at 4, 8 and 12 °C, the fruit samples were transferred at 30 °C and left for three days to ripen. The physico-chemical qualities of the fruits were analyzed using standard methods. The treatment at 4 °C with 3 g ES & 46 g MS in MAP maintained best quality of guava post-ripening and was considered as the optimized treatment for guava. The Michaelis-Menten equation predicted 2 g ES & 60 g MS added in MAP at 8 °C as the optimized AP treatment for banana. The maximum shelf life at the optimized condition was 30 days at 8 °C + 3 days at 30 °C for banana and 30 days at 4 °C + 2 days at 30 °C for guava. The edible coating formulations based on arabic gum (AG) (0-15 %), sodium caseinate (SC) (0-2 %) and tulsi extract (TE) (0-5 %) were developed using CCRD and its OTR, CTR and WVTR was studied on guava (Cv. Desi) at 28 ± 2 °C. The optimized coating formulation (5 % AG, 1 % SC and 2.5 % TE) exhibited best OTR, CTR and WVTR properties to extend the shelf life of guava to 7 days at 28 ± 2 °C compared to 4 days of control. The effect of addition of different concentration of lemon grass oil (LG) and cinnamon oil (CE) in the optimized base coating formulation of AG-SC on the shelf life and quality of guava and banana was studied. The shelf life of guava samples treated with coating formulations 5 % AG +1 % SC + 2 % CE and 5 % AG +1 % SC + 2 % LG was 35 days at 4-7 °C + 5 days at 25 ± 2 °C compared to 7 days of control and that of banana treated with coating formulation 5 % AG + 1 % SC + 1 % CE was 8 weeks at 25 ± 2 °C compared to 1 week of control stored under similar condition.

Keywords: Guava, banana, respiration, modified atmosphere packaging, edible coating