Modelling quality and maturity of ‘Namdokmai Sithong’ mango and their variation during storage

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Abstract

‘Namdokmai Sithong’ mangoes, grown in carbon paper bags, are harvested at commercial maturity. As chlorophyll is virtually absent, they have a yellow skin colour changing only slightly during fruit ripening. This special characteristic, i.e., the absence of chlorophyll, conceals the variation within the batch in maturity stage and as well as in quality. Quality variables were assessed during storage by destructive (traditional penetration test F_{pff}, flesh colour L*a*b*, total soluble solids TSS and titratable acidity TA) or non-destructive techniques (limited distance compression F_{comp}, skin colour L*a*b*). Three batches of mango in export quality grown at different cultivation locations were stored at four constant temperatures (kinetic experiment) and at 13 °C for 14 d then at 25–28 °C (dynamic experiment). Huge variation was observed in all quality variables in both systems mainly due to differences in maturity of individual fruit. Kinetic models are presented to describe behaviour of quality variables including the biological variation expressed as biological shift factor. A logistic model (logis) was used for all variables, except flesh colour b* value and TSS in the dynamic experiment, where a first order production model (FOP) was applied to analyse the data. Destructively measured data were first grouped based on rank at every measuring time (probelation). Rank number and fruit number were used as an index in non-linear regression. High explained parts (R^2_{adj} above 90%) were obtained for firmness and skin colour (a* and b*) for all temperatures of the kinetic experiment separately as well as combined. The (lower) asymptote values for limited compression firmness (F_{comp}) were somewhat different at different temperatures, which is again an indication of large difference in maturity. In absence of chlorophyll, a strong relation was found between the biological shift factors of F_{comp} and all colour values. During first storage period at 13 °C of the dynamic experiment, most obtained

explained part (R^2_{adj}) but not all were well over 90%. When both temperature schemes (13 °C and ambient temperature) were analysed together, the rate constant after the temperature switch for firmness and colour was higher indicating a faster fruit ripening. The two cultivation locations generated a substantial difference in colouration, but not so much in terms of firmness. A strong correlation between F_{comp}, TSS and TA was revealed. All these results indicate that observed variation in any of the quality variables are all linked directly to variation in maturity. In fruit industry, the biological variation is ignored completely which results in a heterogeneity in the final product at the consumers. Modelling techniques have studied can take care of this variation and could help to improve quality management in the production line in order to assure a constant level of the fruit quality.