



QUALITY ASSESSMENT OF MANGOSTEEN IN DIFFERENT MATURITY STAGES BY HAND-HELD NEAR-INFRARED SPECTROSCOPY

(Penilaian Kualiti Manggis dalam Tahap Kematangan yang Berbeza dengan Genggam Spektroskopi Inframerah Dekat)

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Abstract

Quality loss of mangosteen, a tropical fruit, is caused by improper post-harvest handling. A method that can evaluate mangosteen color along with its physical and chemical properties quickly and conveniently should be developed. In this study, 90 mangosteen samples were collected and scanned by the hand-held micro near-infrared (NIR) spectrometer in the wavelength from 900–1700 nm. The mangosteen samples were tested with destructive methods such as color, total soluble solids, reducing sugar content, titratable acidity, and pH to obtain the reference data for the predictive model. Spectral data collected has undergone several pre-processing techniques. The enhanced spectral data are regressed using the regression model. Partial least square (PLS) regression and Principal Component Regression (PCR) are used as the regression method for predicting mangosteen attributes with the help of Orange data mining software. The results showed that color of the sample was not ideal and stage 5 maturity had the lowest L* (27.99), a* (9.03) and b* (7.22). Maturity of stage 6 mangosteen have the highest amount of reducing sugar (10.70×10^{-6} g/100g) and total soluble solids (7.18%). Pearson's correlation was used to determine the relationship between the chemical and physical properties of the mangosteen samples. The PLS and PCR predictive models for reducing sugars were obtained with accuracy as $R^2 = 0.56$ and $R^2 = 0.50$ for the training and testing data, respectively. This achieved accuracy may not be good, but it can be improved in the future by using nonlinear machine learning and ensemble methods such as PLS and PCR. Overall, this study indicated that the NIR spectroscopy technique combined with several pre-processing methods and the predictive model by PLS and PCR could be a rapid and non-destructive method for evaluating the quality and maturity of the mangosteen fruit.

Keywords: hand-held near-infrared spectroscopy, mangosteen, color analysis, total soluble solids, non-destructive quality assessment