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Evaluation of sapodilla fruit quality using near-infrared spectroscopy

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Abstract

Fruit quality detection using near-infrared spectroscopy is a fast, accurate, and non-destructive method. Hence the fruits can still be marketed after the measurement. The purpose of this study was to analyze the quality of sapodilla fruit using near-infrared spectroscopy. The study was conducted in March to August 2017 at the Plant Production Technology Laboratory of Horticulture Division, Agriculture Faculty of Padjadjaran University, Jatinangor. The method used in this study was multivariate data analysis of chemometrics. The spectra data were obtained using portable near-infrared spectrometer (NirVana AG410, Integrated Spectronics Pty, Ltd, Australia) with wavelength range of 312-1050 nm. Calibration and prediction models were acquired using partial least square (PLS). The results revealed that non-destructive method using near-infrared spectrometer was able to measure sapodilla fruit quality such as, firmness, total dissolved solids, and color values including L^*, a^*, b^*, h^o, and C^*.

Key words: Calibration, prediction, root mean square errors of calibration, sapodilla.

Introduction

Sapodilla (*Achras zapota* L.) is a long-lived tree native to tropical America. It was introduced to the country of Philippines by Spanish. Nowadays, it spreads through some Asian countries especially Southeast Asia and India, moreover now it is found growing throughout warm areas over the world.

Postharvest researchers and producers describe the quality of fruits by certain characteristics such as sugar content, firmness and color [24]. In general, quality assessment of fruit can be performed by visual assessment, tasting the fruit itself or destructive analysis at the laboratory. Visual assessment will not be able to assess the internal quality, while tasting fruit itself and destructive analysis will damage the fruit. Destructive analysis also requires some hazardous chemicals. Hence, this method is calculated to be cost and time-consuming, also requiring materials and laboratory analysis[10, 21].

Near-infrared spectroscopy has been used to predict fruit quality since 1990s [12]. This is an alternative technique that saves time and labor. Near-infrared spectroscopy method can be used to measure the quality of fresh commodities quickly, accurately and environmental friendly [3]. Near-infrared spectrometer record spectra data consists of physical and chemical information from irradiated samples such as total dissolved solids (TDS), firmness, and internal defects [19, 26]. There has been a lot of researches done to predict fruit quality using near-infrared spectroscopy as performed in prune fruit [25], mango [23], fuji apple [17], apricot[7], apple [4, 18] and jujube[27, 28]. This method was also used to detect some fruit-vegetable commodities such as tomato [13, 14] and bitter gourd [15]. Therefore, this work aimed to analyze total dissolved solids (TDS), firmness, and fruit color of sapodilla fruit using near-infrared spectroscopy.

Materials and Methods

Sample collection: Samples of 300 sapodillas cv. Sukatali were all harvested from the orchard, located in Situraja, Sumedang with the same criteria 90 days after flowering. Then, the fruits were brought to the laboratory for further analysis.

Spectra data acquirement: Six separate measurements using the NirVana AG410 spectrometer with wavelength range of 312-1050 nm were taken out of each sapodilla at six point's scaterred along the axial region, with three points located on each side of the fruit (Fig.1). Hence, the total spectral data was 1800 which then be picked for calibration and prediction set. The spectral data were obtained by positioning the near-infrared spectrometer directly on the fruit skin.

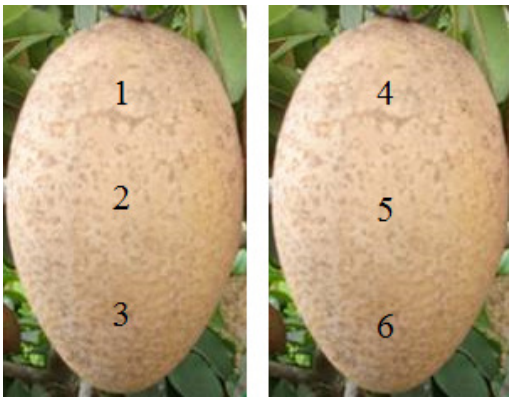

Figure 1. Irradiated points on each side by near-infrared spectrometer.