Abstract of thesis

Fluorescence Evaluation of Kiwifruit Maturity and Ripeness in Pre- and Post-harvest Stages

By

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To evaluate the quality of kiwifruit, a nondestructive method is needed in both the preharvest and postharvest stages; Fluorescence and imaging techniques have a great potential to meet these demands. The aim of this study is to investigate the potential of fluorescence spectroscopy and imaging techniques for characterization of maturity index and ripeness of kiwifruit. To achieve this, both 'Hayward' and 'ZESY002' kiwifruit varieties were selected to represent the two commercialized cultivars of green- and yellow-fleshed kiwifruit. During maturation, surface fluorescence properties of these two cultivars were investigated using a spectrofluorometer. Two fluorescence areas were identified in both cultivars; area A (Ex.: 300 – 400 nm, Em.: 400 – 600 nm), where fluorescence intensity increased during maturation; and for Area B (Ex.: 370 – 700 nm, Em.: 660 – 750 nm), which also showed an increasing tendency during maturation. To select the appropriate wavelength for determination of a kiwifruit harvest index, a least squares regression method was adopted. Consequently, a double lighting imaging system was developed with the selected wavelength. The potential to use this system for maturity determination, represented as soluble solid content, was investigated. For 'Hayward' kiwifruit, the prediction ability and accuracy of the system was given by a root mean square error of validation of 0.39 and a correlation coefficient of 0.94. For 'ZESY002' kiwifruit, maturity was defined as soluble solid content and flesh color. For soluble solid content prediction, this system had a root mean square error of validation of 0.76 and a correlation coefficient of 0.97. and in flesh hue prediction, the results showed a root mean square error of validation of 0.009 and a correlation coefficient of 0.94. The potential to use fluorescence spectroscopy to monitor ripeness during storage was also investigated. During storage (24 ℃), the fluorescence intensities in area A decreased during storage, but below 4 ℃ storage emission intensities fluctuated. However, the fluorescence intensity of area B decreased in both the 4 ℃ and 24 ℃ treatments. Consequently, the fluorescence excitations and emissions in area B, which are associated with chlorophyll, were investigated using partial least squares regression to establish a general soluble solid content model using both the 4 ℃ and 24 ℃ treatment data. The results showed a root mean square error of validation of 1.39 and a correlation coefficient of 0.87, and the prediction ability of the general model at both 4 ℃ and 24 ℃ treatment were evaluated. The results showed that the general model has a root mean square error of validation of 0.93 and a correlation coefficient of 0.82 at 4 ℃, and a root mean square error of validation of 1.09 and a correlation coefficient of 0.86. This study demonstrates that fluorescence techniques have the potential to be used to develop a nondestructive tool for kiwifruit maturity and ripeness estimation during pre- and post-harvest stages in the future.