（学位第３号様式）

学　位　論　文　要　旨	
氏　名	JANNOK　Piyamart
題　目	Development of nondestructive quality evaluation techniques for agricultural products by near infrared (NIR) spectroscopy (近赤外分光法による農産物の非破壊品質評価技術の開発)

The objective of my study was to find out the solutions to develop the practical calibration model for predicting the chemical components of fruit samples by near infrared (NIR) spectroscopy. This study consists of (1) development of a common calibration model for determining the Brix value of intact apple, pear and persimmon fruits by NIR spectroscopy and (2) development of a calibration model with temperature compensation (CMTC) using common temperature-difference spectra for determining the Brix value of intact fruits.

(1) Calibrations developed using NIR spectroscopy to determine the qualities of fruits or vegetables are usually applicable to a single species. The ability to determine the quality of several species using a common calibration would have advantages in some situations. Therefore, a method to develop a common NIR calibration model that could be applied to many fruit species was examined. NIR spectra of apples, pears and persimmons were measured in the short wavelength region using an interactance method. Partial least squares (PLS) regressions based on second derivative (2D) spectra were performed for Brix value determination using calibration samples comprising each fruit species independently and the three species combined. Each single species calibration model predicted the Brix value in validation samples of the same species with a low standard error of performance (SEP) (0.34 ~ 0.40°Brix and with low bias (0.01 ~ 0.08 °Brix) but with much higher SEP and bias errors when used to predict the Brix value in other species. The common calibration model developed from the combined sample set predicted Brix values in the apples, pears and persimmons with an SEP = 0.43 °Brix and a bias of –0.03 °Brix.

(2) In order to make a CMTC, the calibration method using the PLS regression based on the combined spectra measured at some different temperatures is promising. However, the method is time-consuming since it requires spectra acquisition at different temperatures. In addition, the sample quality may change during the period for the different temperature adjustment of samples. Spectra of the target fruit species of peaches, pears and persimmons were measured at 25°C using the interactance method. Spectra for 20°C and 30°C were made artificially using temperature-difference 2D spectra from the 25°C-2D spectra. Then, the possibility of temperature-difference 2D spectra of fruit (s) to make correct 20°C and 30°C artificial 2D spectra was evaluated. The temperature-difference 2D spectra made from each target fruit species could be useful for each target fruit species while the common temperature-difference 2D spectra made from the three target fruit species were useful for not only each target fruit species but also the other fruit species of apples. The CMTC for apples developed using the common temperature-difference 2D spectra showed low SEP and bias of 0.45°Brix and 0.09°Brix, respectively. The model could be applied well to the prediction sets of apples at 20°C, 25°C and 30°C with non-significant biases.

(3) Moreover, the method to make a CMTC using common temperature-difference 2D spectra was applied to the common calibration developed before.