【別紙２】

論文名：Nondestructive Evaluation of Postharvest Quality of Cabbage Using Visible and Near Infrared Spectroscopy（要約）

新潟大学大学院自然科学研究科
氏名　Somsak KRAMCHOTE

（以下要約を記入する）

In recent years, most researchers have focused on developing non-destructive techniques for measuring fruit quality. In this field, visible and near infrared (Vis/NIR) spectroscopy using radiation in the 350-2500 nm wavelength region of the electromagnetic spectrum has proved accurate in detecting the bruising of fruits and vegetables. Most of the techniques developed to detect bruises on fruits using Vis/NIR spectroscopy are only suitable for qualitative analysis. However, few prediction models have been developed to quantify the degree of bruise damage related to the absorbed impact energy in cabbage. The aim of this study is to develop models capable of predicting the damage to cabbage head by absorbed impact energy and quantify the degree of bruise damage as bruise volume using Vis/NIR information.

This study shows that spectral information is a useful to predict the degree of bruise damage of cabbage head according to the absorbed impact energy levels. Cabbage is very susceptible to the formation of bruises. Visible and near infrared spectroscopy techniques were used to determine bruise damage on cabbage head with different absorbed impact energy levels (40 cm (5.04±0.07 J), 80 cm (10.70±0.24 J), 120 cm (15.32±0.29 J), and 160 cm (21.13±0.42 J). The wavelength ranges of 500-1100 nm were used in this experiment. Multiplicative scatter correction (MSC) plus second derivative ($D_2\log(1/R)$) were applied to improve the calibration model based on partial least squares (PLS) regression model. The greater differences in interactance in the near-infrared region of 700-950 nm enabled a good quantitative analysis by distinguishing between the different impacts energy levels. Partial least square models were developed to determine the bruise volume (BV) in damaged head and the absorbed energy during impact. Good fits (R^2 = 0.82-0.85) were obtained between the values predicted by visible and near infrared spectroscopy and the values measured in laboratory by the interactance methods for bruise volume and absorbed impact energy. Vis/NIR spectroscopy technique can be used to determine the degree of bruise damage of cabbage. The results also confirm the possible applicability of Vis/NIR technology in cabbage for qualitative determination of the degree of bruising, responsible for cabbage quality after harvesting.

Besides, cabbage quality attributes evaluation during storage and transport is

also the most importance for the cabbage supply chain, an NIR technology would be suitable. The objectives of this study were a) to investigate the potential of visible and near infrared (Vis-NIR) spectroscopy to develop a rapid nondestructive method and b) to compare the prediction potential of interactance and reflectance measurements in evaluating the quality of cabbage including moisture content, SSC and ascorbic acid content.

NIR spectroscopy can be used to develop relatively accurate prediction models of cabbage quality attributes (moisture content, SSC and ascorbic acid). The wavelength ranges of 500-1100 nm were used in this experiment. Two types of data preprocessing were applied to enhance the calibration model based on partial least squares (PLS) regression with respect to the logarithms of reciprocal absorbance (log (1/R)), its first and second derivatives. The PLS regression models for moisture content yielded correlation coefficients (R^2) of 0.48-0.67 and root mean square error of prediction (RMSEP) of 2.34-2.83 g/kg for interactance, with R^2 of 0.58-0.74 and RMSEP of 2.50-3.25 g/kg for reflectance. The PLS statistics for SSC were R^2 of 0.59-0.66 and RMSEP of 0.20-0.22 °Brix for interactance and R^2 of 0.53-0.64 and RMSEP of 0.20-0.27 °Brix for reflectance, respectively. Statistics for ascorbic acid content were R^2 of 0.24-0.61 and RMSEP of 0.11-0.15 g/kg FW for interactance and R^2 of 0.35-0.38 and RMSEP of 0.13 g/kg FW for reflectance. Finally, it is possible to use the Vis/NIR spectroscopy as a rapid tool for evaluating the cabbage quality.