

Potential of non-destructive evaluation of internal disorder, browning of outer scale in onions using near infrared (NIR) spectroscopy

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Abstract

It is difficult to diagnose internal disorder, browning of outer scale ('Hadagusare' in Japanese), in onions. Consumers do not want to buy such onions. The objective of this study was to assess the potential of near infrared (NIR) technology for non-destructive evaluation of the internal disorders in onions. NIR technology is low cost and high performance with non-contact interactance mode of spectral measurement. To measure the NIR absorption spectrum of an intact onion, each onion was hand placed 3 mm apart from the end of a fiber optic probe so that the upper side was centered. 2 spectra per one onion were measured. Following optical measurement, onion was cut vertically and the browning symptom inside irradiated area with NIR beam was visually scored 0, 0.5 or 1.0 (1.0 is the severest) and taken a photograph using a scanner. Multiple linear regression (MLR) analysis on spectra (750-1000 nm, n=120) gave a calibration equation using absorbance at 3 wavelengths (750, 810 and 942 nm) with a multiple correlation coefficient (MR) of 0.86. We validated the MLR calibration using other lots of onions (n=660). Nevertheless, 83.2% of the onions in which the symptom occurred could be detected by our NIR method. Therefore, we concluded that NIR technology offers the potential of non-destructive internal disorder, browning of outer scale evaluation in onions.