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**Ripening, aging and degradation rates of vegetables and fruits by *in situ* colorimetry and visible – near infrared spectroscopy****Satoru Nakashima**

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Ripening, aging and degradation processes of foods are essential for evaluating conditions and safety of foods. The timing of harvesting vegetables/fruits is often empirical depending on farmers' experiences. After the harvest, some show further ripening before aging and degradation. Despite some data on high temperature (>50 °C) behavior of foods during drying and cooking conditions, changes with time of foods at environmental temperatures around 25 °C have not been studied quantitatively. In this study, a handy visible – near infrared spectrometer (PRISMO MIRAGE) have been developed and applied to monitor color and spectral changes with time of some vegetables and fruits either under natural outdoor conditions (ripening: 5-35 °C) or in containers (aging/degradation: 15-35 °C). Changes with time in  $a^*$  color values (reddishness) and in peak heights at 675 nm in visible spectra are analyzed for determining the first order decrease rates of  $a^*$  and chlorophylls, respectively. These rate constants are plotted together with some literature data on food drying processes. Decrease rates of  $a^*$  color value during the final degradation of tomato at around 20 °C appears to be on the linear trend from those for drying of green peas at 70-100 °C. The decrease rates of lycopene/carotenoid for tomato puree during drying are also on the similar trend. Increase rates of  $a^*$  value during ripening (green to red) of bell pepper at 30 °C are also close to these trends. Decrease rates of chlorophylls by 675 nm peak heights for the same ripening processes of bell pepper is slower than the  $a^*$  increase rates but close to the extrapolation of chlorophyll decrease rates during bell pepper drying at 40-70 °C. The chlorophyll decrease rates are considered to control some of the ripening and degradation processes of vegetables and fruits.

**Biography**

Satoru Nakashima is Professor of Physical Geochemistry at Osaka University and has been developing non-destructive evaluation methods of earth, planetary and environmental materials and quantifying their changes with time. In particular, he pioneered spectro-colorimetry of rocks and soils and has been applying it to degradation of rocks. He has recently developed handy spectro-colorimeters in the visible to near infrared wavelength range and now is using them for measuring ripening, aging and degradation processes of plants (vegetables and fruits) and meats. He is aiming at founding a non-profit organization on Earth's Environmental Health including safety of plants and foods, after his retirement from Osaka University in 2 years. He wishes to collaborate with experts from all over the world to maintain the health of our natural environment.

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