**Title** Nondestructive evaluation of internal maturity of tomatoes using spatially offset Raman spectroscopy

**Author** Jianwei Qin, Kuanglin Chao and Moon S. Kim

**Citation** Postharvest Biology and Technology. Volume 71, September 2012, Pages 21–31

**Keywords** Raman spectroscopy; Subsurface detection; Tomato; Internal maturity; Carotenoid; Lycopene

## Abstract

This research explored the use of spatially offset Raman spectroscopy (SORS) for nondestructive evaluation of internal maturity of tomatoes. A Raman system using a 785-nm laser was developed to collect spatially offset spectra in the wavenumber range of 200–2500 $cm^{-1}$. The SORS measurements were conducted using a source-detector distance ranging from 0 to 5 mm with a step size of 0.2 mm. One hundred and sixty tomatoes at seven ripeness stages (i.e., immature green, mature green, breaker, turning, pink, light red, and red) were tested. The feasibility of the SORS for subsurface detection was examined by using a Teflon slab placed under outer pericarp slices of 5-mm and 10-mm thicknesses cut from green and red tomatoes. Raman signals from the outer pericarp layer and the Teflon layer were effectively separated by self-modeling mixture analysis of the offset spectra after fluorescence correction. Three Raman peaks due to carotenoids inside the tomatoes started showing at the mature green stage. Two peaks appeared consistently at 1001 and 1151 $cm^{-1}$, and the third peak was gradually shifted from 1525 $cm^{-1}$ (lutein at mature green stage) to 1513 $cm^{-1}$ (lycopene at red stage) owing to the loss of lutein and β-carotene and the accumulation of lycopene during tomato ripening. The Raman peak changes were evaluated by spectral information divergence (SID) with pure lycopene as the reference. The SID values decreased as the tomatoes ripened, and thus these values can be used to evaluate the internal ripeness of tomatoes.