

Title Analysis of absorption and scattering spectra for assessing the internal quality of apple fruit

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Abstract

Optical absorption and scattering properties are useful for quantifying light interaction with plant tissue, as well as for quality assessment of horticultural products. The aim of this research was to measure the absorption (μ_a) and reduced scattering (μ_s') coefficient spectra (500-1,000 nm) of apple (*Malus domestica*) cultivars 'Golden Delicious' (GD) and 'Delicious' (RD) for assessing their internal quality. A newly developed hyperspectral imaging-based spatially-resolved instrument was used to acquire reflectance images for 1039 GD apples and 1040 RD apples immediately after harvest or after they had been kept in refrigerated air for various periods for up to 12 weeks. Absorption and reduced scattering coefficient spectra of the apples were determined from the spatially-resolved reflectance profiles using a diffusion model coupled with an inverse algorithm. The spectra of μ_a and μ_s' , and their combinations ($\mu_a \& \mu_s'$, $\mu_a \times \mu_s'$, and $\mu_{\text{eff}} = [3\mu_a(\mu_a + \mu_s')]^{1/2}$) were used for predicting fruit firmness and soluble solids content (SSC) by partial least squares regression method. The combinations of μ_a and μ_s' improved prediction results, compared with individual μ_a and μ_s' spectra. The best correlations (r) for firmness prediction for GD and RD apples were 0.892 and 0.863 with the standard errors of prediction (SEP) of 7.89 N and 8.94 N, and were 0.778 and 0.825 for SSC with the SEP of 0.82 and 0.85°Brix, respectively, when all samples were pooled. This research showed that optical absorption and scattering properties are useful for assessing internal quality of apples.