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Rapid and visual detection of the main chemical compositions in maize seeds based on Raman hyperspectral imaging

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Abstract

Rapid and visual detection of the chemical compositions of plant seeds is important but difficult for a traditional seed quality analysis system. In this study, a custom-designed line-scan Raman hyperspectral imaging system was applied for detecting and displaying the main chemical compositions in a heterogeneous maize seed. Raman hyperspectral images collected from the endosperm and embryo of maize seed were acquired and preprocessed by Savitzky-Golay (SG) filter and adaptive iteratively reweighted Penalized Least Squares (airPLS). Three varieties of maize seeds were analyzed, and the characteristics of the spectral and spatial information were extracted from each hyperspectral image. The Raman characteristic peaks, identified at 477, 1443, 1522, 1596 and 1654 cm^{-1} from 380-1800 cm^{-1} Raman spectra, were related to corn starch, mixture of oil and starch, zeaxanthin, lignin and oil in maize seeds, respectively. Each single-band image corresponding to the characteristic band characterized the spatial distribution of the chemical composition in a seed successfully. The embryo was distinguished from the endosperm by band operation of the single-band images at 477, 1443, and 1596 cm^{-1} for each variety.