CHEMICAL AND STRUCTURAL PROPERTIES OF COTTON FIBER BASE AND ASSOCIATED SEED COATS

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Abstract

Trash content is one of the cotton fiber quality traits. Seed coat fragments (SCFs) are among the most difficult-to-remove trash particles due to their strong attachment force with cotton fibers. The presence of SCFs is a major problem in the textile industry. Several studies reported that SCF count is mostly cultivar dependent. Cotton seed coats are composed of cellulose, hemicellulose, lignin, pectin, and wax substances. We hypothesized that understanding the amount and distribution of these macromolecules in the fiber base, and the associated seed coat will provide a new insight into their contributions to generate SCFs. We identified two cotton cultivars from a large number of F3 cotton lines with differences in the SCFs count. Then, we developed an integrated approach with Fourier transformed infrared (FTIR) spectroscopy and microspectroscopy imaging, microscopy techniques, and thermogravimetric analysis to characterize cotton fiber base and the associated seed coat. FTIR images of 8 µm thick seed coat sections were analyzed using functional group distribution images and multivariate data analysis methods. K-mean clustering produced representative spectra for each layer of cotton seed coats, which were further compared to identify biochemical differences between cultivars. We observed that these two cultivars show major differences in the distribution of wax, pectic acids, hemicellulose (vibrations 2893, 1734 and 1624 cm^{-1}) and lignin (vibration ~1504 cm^{-1}). This study demonstrates that FTIR imaging could be used as a powerful non-destructive technique to investigate biochemical composition and distribution of biomolecules in seed coat sections.