FTIR INVESTIGATION OF SECONDARY CELL WALL DEVELOPMENT IN COTTON FIBERS

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Abstract

The effect of maturity on dye uptake of cotton fiber is well-known. It is also known that from fine and mature fibers one can produce finer yarns and high quality textiles. But maturity and fineness of cotton fibers are also essential qualitative characteristics if one wants to better understand the facility of the fibers to break when subjected to mechanical stress. It is intuitively obvious to hypothesize that immature fibers (having a thin, poorly developed secondary wall) will be fragile, and therefore, are likely to break during multiple mechanical stresses involved in transforming fibers into yarns. Immature fibers generate short fibers and neps (entanglement of fibers) that result in yarn defects and decreased productivity. Fiber maturity is a major yield component and an important fiber quality trait that is directly linked to the structure and composition of the Secondary Cell Wall (SCW), i.e. how much cellulose is deposited during SCW biogenesis, and to the organization and orientation of crystalline microfibrils.

Cotton fiber development consists of five major overlapping stages: differentiation, fiber initiation, fiber elongation, secondary cell wall development, and maturation. The transition period between 16 and 21 dpa (days post anthesis) is regarded to represent a major developmental stage between the primary cell wall and the SCW.

In this work, we report on the use of Fourier Transform Infrared spectroscopy to investigate the structural changes that occur during different developmental stages of cotton fibers. The results obtained showed that the FTIR could be used to document the changes in structure and composition during cotton fiber development starting at 10 dpa. Complete analysis of this work will be published.

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