COTTON FIBER SURFACES: AFM IMAGING BEFORE AND AFTER CHEMICAL AND ENZYMATIC DEGRADATION

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Abstract

Cotton (*Gossypium hirsutum var. MD51)* fiber cell walls were analyzed with an atomic force microscope (AFM) to determine the effect of chemical treatments on cell wall organization and topography. The results indicate that the AFM is an excellent tool to use to evaluate the morphology of the fiber surface and to quantitatively analyze the effect of each treatment. Treatment of fibers with 1% H_2O_2 had little effect on surface morphology. Alkali removed much of the cuticle, some primary wall components, and revealed mostly thin diameter microfibrils. Acidic Updegraff reagent fragmented the fibers, removed much of the cuticle, and revealed mostly thick microfibrils. The surface roughness of fibers treated sequentially with alkali and acid was quantitatively distinguishable from all other fiber types based on the standard deviation of the "Z" data (RMS), amplification of surface area (SAD), and integration of the scan line data (TP). Analysis of the fractal dimension enabled untreated and peroxide treated fibers to be clearly distinguished from the other fiber types. Segmentation of the fractal data revealed specific portions of the fractal dimension which were especially useful for defining the size of structures that differentiated fiber types. Areas containing microfibrils could be quantitatively differentiated from non-microfibrillar areas.

PEG treatment of fibers that had been pre-treated with alkali fibers resulted in the microfibrils being either wholly or partially covered, depending on the amount of PEG used. Incubation of native fibers with cutinase removed all of the cuticle when a high concentration of enzyme was used. Heptane removed some of the surface and altered the phase behavior of structural features. In water, some alkali treated fibers had microfibrils that were relatively small in diameter while others appeared to consist of crystalline arrays of smaller fibrils having a diameter of 5-7 nm.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1468-1468 (1997)
National Cotton Council, Memphis TN