IMAGE ANALYSIS AS A RELIABLE METHOD FOR ASSESSING COTTON FIBER MATURITY

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Abstract

Accurate measurement of cotton fiber maturity is essential for use by the textile industry. Indirect measurement of fiber maturity by several methods such as AFIS(Advanced Fiber Information System), FMT (Fitness and Maturity Tester), NIR (Near Infrared Specroscopy), VIS/NIR (Visual/Near Infrared Spectroscopy) are currently being used or being developed in different segments of the textile industry. Availability of an accurate reference standard based on direct measurement of fiber parameters such as perimeter, degree of secondary wall thickening and maturity ratio will be beneficial. Image analysis of thin fiber cross sections is being used in our laboratory to assess the fiber maturity. The refined method involves a simple and rapid embedding procedure under controlled conditions and image analysis of thin fiber cross sections using a CCD camera attached to a Leica microscope. The statistical software computes perimeter, area of the secondary wall and computes circularity (the ratio of the wall area, A, excluding lumen to the area of a perfect circle having perimeter, P). We have optimized various steps involving sampling, embedding and cross sectioning of fiber bundles to minimize errors and to improve speed, accuracy and reproducibility. Our image analysis results for nine fiber samples from 1984 ITMF Round Test cottons representing different maturity ratios and the excellent correlation (R^2=0.88) to previously published maturity ratios as determined by FMT will be presented. Extensive statistical analyses indicated that a minimum of 529 to 1436 fibers is needed to estimate the true population means for each parameter with 99% confidence. With 95% probability level analysis, the sample size of less than 300 fibers is needed for determining the fiber parameters with 95% accuracy. The importance of drawing representative samples from cotton bales is emphasized in this research. Image analysis requires extensive microscopic skills. However, image analysis can serve as a reference standard for other indirect methods that are currently employed for determining fiber quality.