NEW INSIGHT INTO THE MEASUREMENT OF SHORT FIBER CONTENT

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Abstract

Short fiber content (SFC) is defined as the percent of fibers shorter than ½ inch in length. Short fibers are detrimental to textile processing since they increase waste, reduce yarn strength and cause ends-down in spinning, weaving and knitting. Short fiber content has been identified as one of the top priority research areas in several national meetings. The accuracy and precision of short fiber content measurement are very important to several important research topics related to short fiber content, such as establishing a reference method to measure short fiber content, creating reference cottons for short fiber content, studying the feasibility of incorporating short fiber content into the cotton grading system, and assessing the economical impact of short fiber content to the textile industry.

There are several instruments and methods to measure the short fiber content, including Suter-Webb Fiber Sorter, AFIS (Advanced Fiber Information System), HVI (High Volume Instrument) and Peyer Almeter. The Suter-Webb Array Method is generally considered the reference method for cotton fiber length measurement. We selected 45 samples and tested them on various instruments for short fiber content along with other fiber properties. The samples included 36 different commercial and experimental varieties of US Upland cotton grown at Stoneville, MS, by Dr. William Meredith, 3 International Calibration Cottons (ICC) and 6 HVI calibration cottons (3 long-strong cottons and 3 short-weak cottons). Four laboratories participated in the Suter-Webb Array tests, namely, Southern Regional Research Center (SRRC), USDA Cotton Quality Research Station at Clemson, International Textile Center (ITC) of Texas Tech University and Starlab at Knoxville, TN.

The test results showed that the variation of short fiber content was very high and there were level (average value) differences among different methods as well as among the Suter-Webb Array test results from different laboratories. The correlation coefficients of the measured short fiber content values from different methods and from different labs were lower in all cases than other fiber length parameters (such as fiber mean length). This indicates that the short fiber content is more difficult to measure accurately than other fiber length parameters (such as mean length). A close examination of the Suter-Webb Array test procedure revealed that the alignment of fibers in shorter fiber arrays were much worse than those in longer fiber arrays and thus resulted in error in the measured short fiber content. Although the Suter-Webb Array Method is considered the reference method for fiber length measurement, its accuracy and precision are very limited for short fiber content.

We believe that the difficulty of handling shorter fibers, the high variation in fiber length, and the inconsistencies in instrument calibration are among the major contributors to the problem. In addition, the differences in sampling method, specimen preparation, testing principle, and calibration algorithms among these instruments also contribute to the problem. The high variation in short fiber content measurement needs to be considered in interpretation and application of SFC results, such as evaluation of cotton quality and textile processing.

The test results from the Suter-Webb Array and the AFIS methods showed the highest correlation coefficient among the different instruments, although the short fiber content measured by the two methods were quite different. This indicates that the AFIS is promising for use as an alternative reference method for short fiber content once the two instruments are calibrated to the same level.

In order to estimate the variation of short fiber content, we performed 100 tests each on two calibration cottons (one long-strong and the other short-weak) on the HVI and the AFIS. The results showed that the variation of short fiber content was much higher for the short fiber sample and therefore the confidence interval was much wider for this sample. We were able to obtain better than a ±1% confidence interval by less than three replications of the longer fiber sample, but could not do so by more than 10 replications for the short fiber sample. The requirement for many replications should be considered in incorporating short fiber content in the cotton grading systems.

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