SHORT FIBER CONTENT OF COTTON AND ITS MEASUREMENT

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Abstract

This presentation reports the progress of a joint project between Southern Regional Research Center (SRRC) and Cotton Incorporated on the study of short fiber content of cotton and its measurement. Short fiber content has a significant effect on mill productivity and product quality. The textile industry has demanded a more accurate measurement of short fiber content. There are several instruments and methods currently available for fiber length measurement. Most of them can provide short fiber content or its estimator. These instruments include HVI (High Volume Instrument), AFIS (Advanced Fiber Information System), Peyer Almeter, and Suter-Webb Fiber Sorter. Sampling method, specimen preparation, testing principle, and calibration procedure are different among these instruments.

Introduction

In this presentation, the short fiber contents of various cotton samples have been measured on different instruments, and the results are compared. Factors that affect the short fiber content measurement are also discussed.

Results and Discussion

We selected 36 U.S. Upland cotton varieties that have a relatively wide range of fiber properties, and tested them on HVI, AFIS, and Peyer for short fiber content along with other fiber length parameters. The results obtained from these instruments showed significant difference. The AFIS reported the lowest short fiber content by weight (6.88% on the average of the 36 cotton samples), Peyer produced the highest SFC_w (12.34%), and HVI results were in between (10.0%). The mean length by weight of the 36 samples was 0.97, 0.94 and 0.85 inch from AFIS, HVI and Peyer, respectively. It is obvious that the calibration levels of the instruments were different. The three instruments we used were calibrated according to their own procedure and passed the calibration, but thus far, they failed to produce comparable results.

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In addition, the correlation coefficients between the results from different instruments were very low, all below 0.255, although the mean lengths by different methods showed relatively good correlation (as high as 0.88 when comparing AFIS and HVI).

There are four categories of factors that affect the short fiber content measurement, namely, sampling, sample preparation, measurement and calculation. We have investigated several factors affecting short fiber content measurement, including sampling by the HVI clamp, the fiber loss in Peyer sample preparation, the influence of testing parameters on AFIS results, and the effect of association of fiber length and fineness on short fiber content calculated by AFIS.

In the Peyer method, a sample is first prepared manually to form a beard of parallel fibers on the edge of a velvet board, the beard then is fed to the needle field of the Peyer Fibroliner. The Fibroliner straightens and aligns the fibers to form a test specimen on the sample holder. The specimen then is transferred with the sample holder to the Fiber Length Measurement Unit AL-101. We noticed some fibers were lost during the process of the sample preparation. Some fibers were lost in the needle field of the Fibroliner, and most of these fibers seemed short and neppy. Some other fibers were lost in the sample holder, and most of those were longer fibers. These two groups of lost fibers were collected separately after each test, and then weighed. In addition, some fibers were dropped down into the instrument, and were not collected due to the difficulty reaching them. On the average of the 13 cotton samples we used in this investigation, the "shorter" fiber loss was 1.20% of the total sample, the "longer" fiber loss was 4.75%, and hence the total loss was 5.95%. A maximum of total fiber loss of 13.52%was observed. The "shorter" fiber loss showed a relatively high correlation coefficient of -0.7068 with mean length and +0.6845 with short fiber content of the samples. This indicates that if a sample has more short fibers, more short fibers might be lost and hence not measured.

In calculating fiber length statistics, such as mean length or short fiber content, an assumption has been widely used, explicitly or implicitly, that the fiber length and the fiber fineness are independent. This assumption is also used in AFIS commercial software. Since the AFIS measures both the fiber length and fiber fineness, we recalculated the short fiber content by weight without use the assumption of the independency. Statistical analysis showed that the correlation coefficients between fiber length and linear density ranged -0.013 to -0.157 with an average of -0.089 based on the 36 cotton samples, indicating no linear relationship between fiber length and fineness. The recalculated short fiber content by weight from our program was compared with those originally from AFIS. The difference ranged from -0.4 to 0.4% and the average difference was only -0.03%. The results showed that the

association between fiber fineness and length distributions has only minor influence on the calculated short fiber content by weight by AFIS.

The factors we have investigated contributed to the inconsistency in the results from the different methods, but cannot explain it conclusively. The short fiber content values also showed higher variation compared to mean length, and seemed to be more sensible to sampling and sample preparation. This is under investigation. We believe the calibration level is another major factor causing the inconsistency, and have begun to investigate it.