INTERNATIONAL WOOL TEXTILE ORGANISATION Nice Meeting

Commercial Regulations and Contracts Committee December 1997

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The Commercial Implications of the Coefficient of Variation of Fibre Diameter on Measuring Mean Fibre Diameter

by

J.W. Marler and P.J. Sommerville

AWTA Ltd. Cnr Byron and Military Roads, Guildford, New South Wales, Australia

At the Boston meeting in May, 1997, technical papers were presented to the Technical Committee, demonstrating that Coefficient of Variation of Fibre Diameter (CVD) has an effect on the Mean Fibre Diameter (MFD) results measured by Airflow. This means that the MFD measured by Airflow will be different from the MFD measured by either Laserscan, OFDA or Projection Microscope, when the CVD deviates from the 'normal' value for a given diameter. The practical results have confirmed the theory first published by Anderson and Warburton[1] in 1949, and commented upon by Roberts in 1959 [2].

Generally, the magnitude of the effect of CVD on Airflow estimates of MFD is small, smaller than the confidence limits of the method. However, the effect increases as the CVD for a given MFD becomes substantially greater than or substantially less than the CVD of the tops used to calibrate the Airflow instrument at the particular MFD. For abnormally high values of CVD, the Airflow estimates of MFD will tend to be higher than the estimates obtained by Laserscan, OFDA and Projection Microscope. For abnormally low values of CVD the Airflow estimates will tend to be lower.

The commercial implications of this are simply stated. The CVD of a sliver produced from a wool blend is determined by two factors:

- the CVD of each of the sub-lots in the consignment used to produce the sliver; and
- the range in MFD between sub-lots in this consignment.

The first factor becomes the more important in special circumstances. Consignments assembled from lots that have a lower than normal CVD, and where the range in MFD between lots is very small, are more likely to have an abnormally low CVD. This situation is most likely to occur in fine wool consignments, particularly where the lots have been classed using objective MFD data for each fleece, or it may occur where the consignment consists of lots assembled from an individual farm. It will result in the MFD of the sliver, measured by Airflow, being finer than measurements made by Laserscan, Projection Microscope or OFDA.

For consignments assembled from visually classed farm lots or dealer lots, the second of these factors is likely to be the more important. The larger the range in MFD between the sub-lots the larger the CVD of the consignment. This is accentuated by the fact that CVD of farm lots tends to increase as MFD increases. The MFD of the sliver produced from these consignments when measured by Airflow, is likely to be higher than the measurements made by Laserscan, OFDA and Projection Microscope. Conversely the narrower the range in MFD between the sub-lots the smaller the CVD of the consignment, and the Airflow MFD is likely to be closer to the MFD obtained by Laserscan, OFDA and Projection Microscope.

It must also be noted that situations may arise where these factors can act together to either increase the differences or to reduce the differences between the methods.

[1] Anderson, S.L. & Warburton F.L., J. Text. Inst (Trans), 40, T749-T758, 1949
[2] Roberts, N. F. , IWTO Tech.Ctte ., Report No. 9, June, 1959

The relationship between the calculated diameter, derived from measurements on core samples from the consignment sublots, and the diameter measured on the resulting wool top is well understood in most mills. These comparisons (core/comb) have been derived using Airflow technology. Uncertainty in the relationship will increase if the core sample is measured by one type of instrument and the top by another.

The following table shows the size of the differences in MFD that could be expected for differing Standard Deviation (SD) values. The corresponding CVD is shown in brackets.

Table 1: Expected Airflow MFD (Calculated from MFD and SD by PM)

		Sample MFD by PM				
		19.0	20.0	21.0	22.0	
Sample SD by PM	2.5	18.5 (13)				
	3.0	18.7 (16)	19.6 (15)	20.5 (14)		Airflow
	3.5	18.9 (18)	19.7 (18)	20.6 (17)	21.5 (17)	is
	4.0	19.0 (21)	19.9 (20)	20.8 (19)	21.7 (18)	finer
	4.5	19.3 (24)	20.1 (23)	21.0 (21)	21.9 (21)	
	5.0	19.5 (26)	20.4 (25)	21.2 (24)	22.1 (23)	Airflow
	5.5		20.6 (28)	21.5 (26)	22.3 (25)	is
	6.0				22.6 (27)	coarser

In the case of the 20.0µm wool the differences between Airflow and other measurement systems will be near zero at an SD of 4.2µm (i.e. CVD 21%) whereas one could expect to be 0.4µm finer by Airflow when the SD was 3.0µm (i.e. CVD 15%) and 0.4µm coarser when the SD was 5.0µm (i.e. CVD 25%). It must be emphasised that these differences only relate to effects from differing SD or CVD. Other factors, such as variations in density of the wool, may reduce or increase the differences shown in Table 1. Research is continuing to quantify these factors.

The magnitudes of the potential differences are small, but can be commercially significant. The commercial risk, in most instances can be minimised by ensuring the same method is used for estimating the MFD of the sliver and the greasy wool.