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A Sonic Digitizer Technique for Measuring Medullation in Mohair

December 8, 1987

Dear Sir:

We have evaluated a special configuration of established techniques for accurately measuring, characterizing, and reporting medullation in mohair. Measuring and data handling are facilitated by a computer-supported sonic digitizer in conjunction with a projection microscope. This short communication is motivated by a desire to further familiarize user groups with the merits of digitizing technology.

Medullated fibers, which have a hollow or partially hollow core (medulla), cause problems in mohair products because they tend to differ in appearance from normal fibers both before and after dyeing [5]. The ASTM distinguishes two types of medullated fibers [1]: med fibers are those in which the diameter of the medulla is less than 60% of the diameter of the fiber, and kemps are medullated fibers in which the diameter of the medulla is 60%, or more, of the diameter of the fiber when viewed in longitudinal section. This distinction was established by the ASTM's Committee D-13, which recognized that kemp fibers are the source of more visible problems than med fibers. Recently reported observations [5] on dyed mohair fibers tend to support this differentiation, although a mean medulla diameter to fiber diameter ratio of 0.5 was the critical value for undyed fibers.

At least two standard methods are currently used to quantify medullation in mohair. The ASTM and British Standard [2] methods both require measurement of images produced by a projection microscope. A third method [6] uses a photo-electric device (Medullameter), which provides a measure of the amount of light scattered at the fiber/medulla interface of all medullated fibers. A measure of total medullation is provided by this instrument from which med and kemp contents can be estimated. Hutchings and Ryder [3] recently described the use of a Summagraphics Bit-pad One in conjunction with a computer for measuring fiber diameter and medullation. They noted that the digitizing method was faster and potentially more accurate than current standard methods.

A GP-7 Grafbar two-dimensional sonic digitizer [4] is being used in conjunction with an IBM personal computer AT and a wool fiber digitizing program (Geographix, Denver, Colorado) to measure the diameter of fiber images produced by a projection microscope in accordance with ASTM Test Method 2130 [7]. This system permits accurate (± 0.5 μm), relatively rapid measurement of the diameters of individual, projected (500 $\times$) fiber images.

In using the sonic digitizer in conjunction with the digitizing program, a cursor is touched to both edges of a correctly focused image. Upon contact with the screen, the cursor emits sound waves that are picked up by two receptors on the module. From the times it takes the sound waves to travel from the two points to the receptors, the actual distance between the points is calculated almost instantaneously by the computer. This method has been modified to measure medullation. Mohair samples are prepared and projected in accordance with ASTM D 2968. One thousand fibers on each slide are examined. When a medullated fiber is observed, fiber diameter and medulla diameter are measured with the sonic digitizer. After the required number of fibers is examined, a computer file is created containing fiber diameter and medulla diameter of each medullated fiber in the sample. A separate file is created for each sample. The files are then analyzed using the Lotus 1-2-3 (Lotus Development Corporation, Cambridge, Massachusetts) program, and a medullation ratio is calculated for each fiber by dividing the medulla diameter by the fiber diameter.

The ASTM Standard Test Method 2968 using the wedge card or ruler and the described sonic digitizer technique result in *identical* values for med and kemp when the same medullated fibers are examined. However, the digitizer method is capable of producing not only the standard information, but also a more complete characterization of medullated fibers present in the sample. With this system, raw data can be analyzed conveniently and presented in any number of informative ways (for example, Figures 1–4) after the manner of Smuts *et al.* [6]. The standard method and the digitizer technique take the same amount of time for sample preparation. Actual measurement with the digitizer is at least twice as fast than with a ruler or wedge scale, but preparation of the more detailed digitizer report takes somewhat longer.

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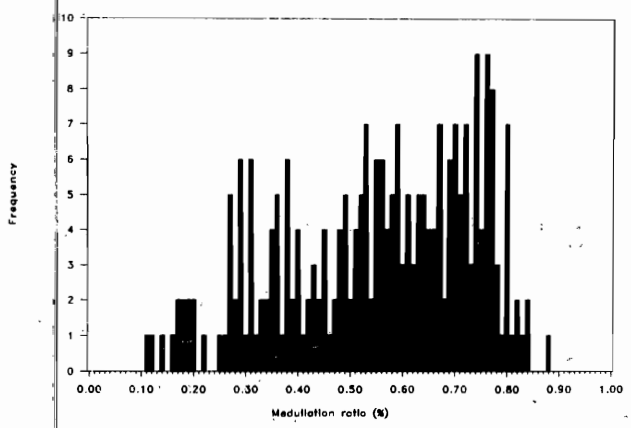

FIGURE 1. Frequency and degree of medullation for 248 medullated fibers from 65 angora goat fleeces.

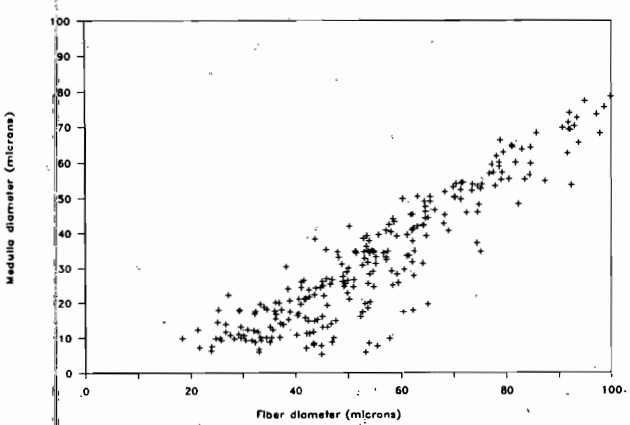

FIGURE 2. Medulla diameter versus fiber diameter for 248 medullated fibers from 65 angora goat fleeces.

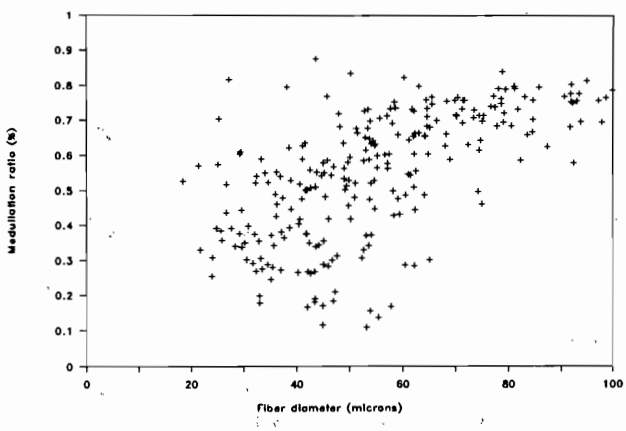

FIGURE 3. Medullation ratio versus fiber diameter for 248 medullated fibers from 65 angora goat fleeces.

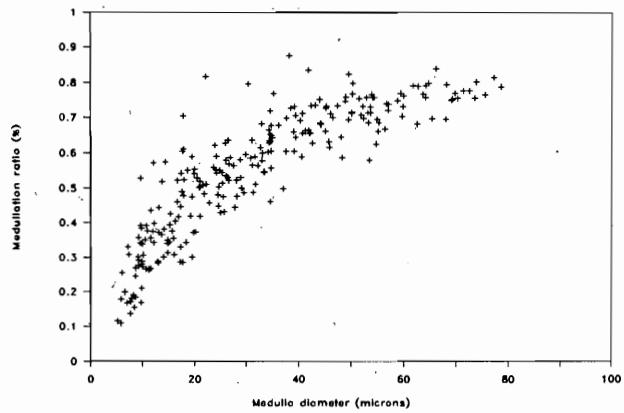

FIGURE 4. Medullation ratio versus medulla diameter for 248 medullated fibers from 65 angora goat fleeces.

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