MEASURING DARK & MEDULLATED FIBRES

In 2001, research was undertaken by AWTA Ltd and the South Australian Research & Development Institute (SARDI) on contamination of Merino wool caused by contact with exotic sheep breeds. A key outcome of this research was that contamination from this source is detectable in the core-samples routinely used for Yield & Micron testing – thus allowing a test to be developed for woolgrowers. This test used the Dark Fibre Detector originally developed by CSIRO for detecting contamination in wool tops.

In the new system four specimens of scoured and carded wool (each of 5 grams) are prepared from the core sample, which has been submitted to AWTA Ltd for Yield & Micron testing. The carding process is specifically designed to present the sample as a thin, carded sliver with a relatively uniform thickness.

These samples are placed in specially designed rectangular transparent plastic bags. An experimentally determined volume of Benzyl Alcohol is added, and the top of the bag is heat sealed. The sample is immersed in the solvent by placing the bag on an inclined surface and squeezing the bag between two rollers as the bag moves down this surface.

PREVIOUS SYSTEM

In the early 1980's a team from CSIRO led by Dr Roger Foulds developed an instrument for detecting pigmented fibres, dark fibres and medullated fibres in wool tops (*Preparation and Dark Fibre Contamination, Clip Preparation Research, CSIRO Division of Textile Physics, September 1983* - a copy of this paper is available on AWTA Ltd's website at

www.awta.com.au

This instrument is very simple (see illustration, top left). Approximately 0.25–0.50 grams of washed and carded core sample is spread thinly between glass plates and illuminated by dual sources of light – from above and below.

When examining for dark fibres the intensity of the illumination is balanced such that white fibres tend to merge into the background, while the objectionable fibres tend to stand out. The entire illuminated specimen is examined using 2x magnification. When a dark fibre is detected its colour can be categorised by reference to a scale, also developed by CSIRO.

When examining for medullated fibres a black background is inserted below the glass slides and the sample illuminated from above. The medullated fibre reflect this light differently and therefore can be identified and counted.

The limitation of this technology is that it relies on a painstaking examination of the illuminated sample by an observer. Due to the small amount of specimen (0.25-0.50 grams) that can be examined at one time, several (20-40) such specimens must be examined to achieve the level of sensitivity required. This is very labour intensive and therefore very expensive.

NEW SYSTEM

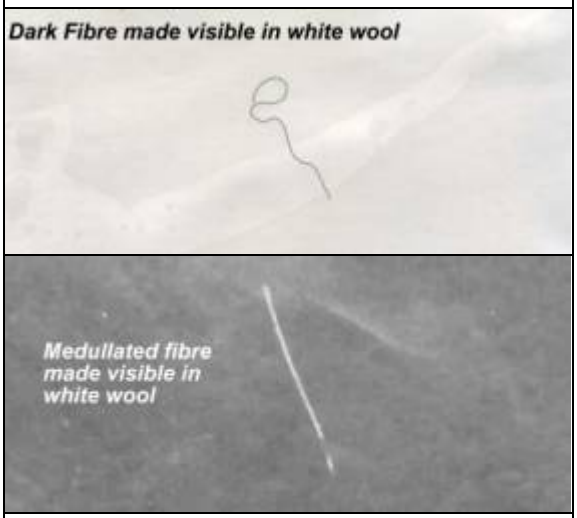
Wool fibres are semi-translucent. That is they both reflect and transmit incident light. In the absence of any pigmentation (colour) they absorb little of the incident white light and therefore appear white in colour.

Reflection of light occurs because the refractive index of wool fibres (1.553) is different from air (1.00). Due to phenomenon of refraction light incident on the fibres is reflected from the exterior and interior air/fibre interface.

However, if normal white wool fibres are immersed in a solvent with the same or very similar refractive index they become transparent and very little reflection occurs. If the fibres are pigmented (eg dark fibres) then some of the incident light will be absorbed and the pigmented fibres can be seen against a white background. Likewise, medullated fibres, due to their internal medulla continue to reflect incident light so that against a black background they appear white.

The lower section of the bag contains the wool fibres totally immersed in the solvent in a thin and relatively uniform layer. The wool sliver becomes transparent (right hand image).

The lower section of the bag is placed on a modified Dark Fibre Detector.



Using special lighting conditions dark and/or medullated fibres can be made more visible and can then be counted and reported.

Benzyl Alcohol, a common industrial solvent with a large number of uses, has a refractive index of 1.540. Therefore white wool fibres become virtually transparent when immersed in this solvent.

The practical benefit of using this property in a test for Dark and Medullated Fibres is that it facilitates the examination of much larger samples in one sitting than does the previous technology. CSIRO developed a process for immersing 5 grams of scoured and carded core samples of greasy wool in Benzyl Alcohol that is efficient, safe and presents the sample so that it can examined using a modified version of the existing Dark Fibre Detector. This process, enhanced by AWTA Ltd's Research & Development Division, is the basis of the new test. The process is as follows:

1. Four specimens of scoured and carded wool (each of 5 grams) are prepared from the core sample, which has been submitted to AWTA Ltd for Yield & Micron testing. The carding process is specifically designed to present the sample as a thin, carded sliver with a relatively uniform thickness.
2. These samples are placed in specially designed rectangular transparent plastic bags.
3. An experimentally determined volume of Benzyl Alcohol is added, and the top of the bag is heat sealed.
4. The sample is immersed in the solvent by placing the bag on an inclined surface and squeezing the bag between two rollers as the bag moves down this surface. All the air and any excess solvent expelled to the top of the bag. Another heat seal is applied separating the bag into two sections:
   a) The upper section (approximately 25%) contains the expelled air and excess solvent.
   b) The lower section contains the wool fibres totally immersed in the solvent in a thin and relatively uniform layer.
5. The lower section of the bag is placed on a modified Dark Fibre Detector. These modifications include an x,y stage (the area of sample to be examined is larger than the area of the glass slides used in the previous system) and a simple device for placing a black background under the sample.
6. The same procedure as used previously is then followed to examine the specimen for dark and medullated fibre contamination.

NEXT STEPS

There is considerable scope to further automate this system. Research to achieve this is continuing.

FURTHER INFORMATION

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