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TEXTILE INDUSTRY STANDARD

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FZ/T 30003-2024

Replacing FZ/T 30003-2009

**Textiles - Quantitative analysis of bast fibers and cotton
blended - Light microscopy method**

纺织品 麻棉混纺产品定量分析方法 光学显微镜法

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Foreword

This document was drafted in accordance with the provisions of GB/T 1.1-2020 "Directives for standardization - Part 1: Rules for the structure and drafting of standardizing documents".

This document replaces FZ/T 30003-2009 "Method for quantitative analysis of ramie (flax hemp)cotton blended textile - Micro projection"; compared with FZ/T 30003-2009, in addition to structural adjustments and editorial changes, the main changes are as follows:

- CHANGE the standard name into "Textiles - Quantitative analysis of bast fibers and cotton blended - Light microscopy method";
- CHANGE the "Digital image analyzer" into "Digital fiber analyzer"; ADD the hemp fiber to the scope of application (see Chapter 1);
- DELETE GB/T 6529 "Textiles - Standard atmospheres for conditioning and testing" (see Chapter 2 of the 2009 edition);
- ADD the "Terms and definitions" (see Chapter 3);
- DELETE the "RM fiber colorant"; ADD the "transparent colorless nail polish", "sodium hypochlorite", "N,N-dimethylformamide" (see Chapter 5);
- CHANGE the sampling method for "loose fibers", changing the fabrics into two parts: "Woven fabrics" and "Knitted fabrics" (see 7.1.2);
- MOVE the "Specimen coloring" into Appendix A, changing the dye into zinc chloride-iodine dye; adding the test steps of "De-sizing" and "Fading" (see 7.2);
- ADD the "Number of slides to be made" (see 7.3.1);
- DIVIDE the "Measurement" in "Test steps" into two measurement methods: "Method A: Measurement with a micro projector" (see 7.4.1) and "Method B: Measurement with a digital fiber analyzer" (see 7.4.2), adding the conditions that shall be excluded when measuring the diameter (see 7.4.1.2);
- ADD the "Calibration magnification" (see 7.4.1.1) and "Calibration system scale" (see 7.4.2.1);
- ADD the calculation formula for apocynum fiber (see Chapter 8);
- CHANGE the numerical rounding of test results (see Chapter 9);
- ADD the content to be included in the test report (see Chapter 10);

Textiles - Quantitative analysis of bast fibers and cotton blended - Light microscopy method

1 Scope

This document describes the test method for quantitative analysis of hemp-cotton blended products using an light microscope (including micro projector and digital fiber analyzer).

This document is applicable to ramie-cotton, flax-cotton, hemp-cotton, hemp-cotton blended products.

2 Normative references

The contents of the following documents constitute the essential provisions of this document through normative references in the text. Among them, for dated references, only the version corresponding to that date applies to this document. For undated references, the latest version (including all amendments) applies to this document.

GB/T 8170 Rules of rounding off for numerical values and expression and judgement of limiting values

FZ/T 01057.3 Test method for identification of textile fibres - Part 3: Microscopy

3 Terms and definitions

There are no terms and definitions that need to be defined in this document.

4 Principle

Both hemp and cotton fibers have unique appearance characteristics. This method uses an optical microscope (including micro projector and digital fiber analyzer) to identify and count a certain number of fibers; measures the fiber diameter or cross-sectional area to calculate the mass percentage of various fibers.

5 Reagents

5.1 Distilled water or deionized water.

5.2 Collodion or colorless transparent nail polish.

5.3 Anhydrous glycerin or liquid paraffin.

5.4 Sodium hypochlorite: 1 mol/L.

5.5 N,N-dimethylformamide: Analytical pure.

6 Instruments and equipment

6.1 Optical microscope including micro projector and digital fiber analyzer.

6.1.1 Micro projector: Magnification of at least 400 times.

6.1.2 Digital fiber analyzer: It shall include microscope, camera, computer, acquisition card, special analysis software, display. The microscope shall be able to provide at least 500 times magnification. It shall be accompanied by a micrometer scale for calibrating the instrument magnification.

6.2 Oven: Capable of maintaining a temperature of $105\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$.

6.3 Fiber slicer.

6.4 Slide (thickness is the same as the thickness of the objective micrometer glass), cover glass, watch glass, scissors, tweezers, blade, etc.

6.5 Wedge ruler: It is printed with a scale of 500 times magnification. A movable linear regular scale with millimeter scale can also be used.

7 Test steps

7.1 Qualitative analysis of specimen and sampling

7.1.1 Qualitative analysis

Perform according to FZ/T 01057.3.

7.1.2 Sampling

7.1.2.1 Loose fibers

Uniformly and randomly extract about 10 g of fiber from the laboratory sample; lay the test sample flat on the test bench; use tweezers to randomly extract about 0.5 g of fiber from different parts of the front and back sides (no less than 10 points on each side); mix them thoroughly and divide them into three parts as evenly as possible. Slightly arrange the fiber bundles so that the fibers are basically parallel.

7.3.2 Preparation of longitudinal section slide specimens

Use a fiber slicer to cut fiber segments of about 0.2 mm ~ 0.4 mm in length from the middle of the fiber bundle. Each fiber bundle shall be cut only once and shall not be cut repeatedly. Place all the fiber segments on a watch glass; drop an appropriate amount of liquid paraffin or glycerin; stir with tweezers to evenly distribute them in the medium. Then take an appropriate amount of specimen and place it on the slide; spread it evenly; cover it with a cover glass to fix the sample; be careful not to let the fibers flow out of the slide to avoid fiber loss. For ease of detection, the specimen can be made using one slide and two cover glasses. At least 500 fibers shall be detected under one cover glass. Other specimen preparation methods that can meet the requirement of not less than 1000 fibers can also be used.

7.3.3 Preparation of cross-sectional slide specimens

Put the specimen into a fiber slicer; flatten the cross section of the specimen; fine-tune and push out the specimen; apply collodion or nail polish; wait for it to solidify; evenly cut a 20 μm ~ 30 μm thick fiber cross-sectional slice; move the slice onto a slide with liquid paraffin or glycerol; cover it with a cover glass for measuring the fiber cross section.

7.4 Measurement

7.4.1 Method A: Determination with a micro projector

7.4.1.1 Calibrate the magnification

Select an objective lens with an appropriate magnification; place a micrometer scale with a graduation of 0.01 mm on the stage; the 20 graduations (0.20 mm) of the micrometer scale projected on the screen shall be accurately magnified to 100 mm, at which time the magnification is 500 times.

7.4.1.2 Determination of fiber diameter

After calibrating the micro projector, place the glass slide specimen prepared in 7.3.2 on the stage so that the measured fibers are all within the projection circle. Adjust the micro projector fine-tuning, so that the edge of the fiber image is projected onto the wedge ruler like a thin line; measure the projection width in the middle of the fiber length as the diameter. After the measurement, calculate the average diameter of each fiber in μm . If the measurement accuracy requirement is not too high, the reference diameter in Appendix D can be used. More than 200 fibers of each type shall be measured; the following situations shall be excluded during measurement:

- 1) Fibers with more than half of their length outside the field of view;
- 2) Fibers whose ends are outside the width range of the transparent scale;

- 3) Fibers that intersect with another fiber at the measurement point;
- 4) Severely damaged or deformed fibers.

7.4.1.3 Counting of fiber numbers

Observe the various types of fibers that enter the field of view; identify their types based on the morphological and structural characteristics of the fibers (see Appendix B). Start counting from the top or bottom corner close to the field of view. When the slide moves slowly across the field of view in the horizontal direction, identify and count all the fibers that pass through the field of view. After each stroke across the field of view, move the slide vertically by 1 mm ~ 2 mm and then slowly move it horizontally across the field of view to identify and count the fibers. Repeat this operation procedure, until all slides are viewed. The total number of counts shall be more than 1000. If the number of fibers on the slide exceeds 1000, it cannot be interrupted and the counting must be completed within the entire range of the slide; if there are less than 1000 fibers within the entire range of the slide, another counting slide must be made to calculate the converted number of fibers for each fiber in the two groups (see Appendix C). The difference in the converted number of fibers for each fiber in the two tests shall not exceed 10.

7.4.1.4 Determination of fiber cross section

Place the glass slide specimen prepared in 7.3.3 on the stage of the micro projector; calibrate the micro projector according to 7.4.1; use tracing paper to measure the cross-sectional area of each fiber. If there are less than 100 fibers of each type on a glass slide, prepare another glass slide until there are more than 100 fibers of each type. Calculate the cross-sectional area of each fiber in mm^2 .

7.4.2 Method B: Determination by digital fiber analyzer

7.4.2.1 Calibrate the system scale

Select an objective lens of appropriate magnification; place a micrometer scale with a graduation of 0.01 mm on the stage; calibrate the system scale according to the digital fiber analyzer operation manual; form a scale file.

Note: The scale file shall match the objective lens when used.

7.4.2.2 Determination of fiber diameter

Place the glass slide specimen prepared in 7.3.2 on the stage; turn on the fiber analysis software; observe various types of fibers in the screen view; measure and record the fiber diameter when the focused fiber shows a clear edge. The test results are automatically calculated by the fiber analysis software and form a test report.

7.4.2.3 Counting the number of fibers

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