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**Test Method for Maturity of Cotton Fibers – Microscopic  
Method**

棉纤维成熟度试验方法 显微镜法

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# Test Method for Maturity of Cotton Fibers – Microscopic Method

## 1 Scope

This Document describes a test method for the microscopic determination of the maturity of cotton fibers after swelling with sodium hydroxide solution.

This Document is applicable to cotton fibers extracted from raw cotton, cotton rolls, cotton slivers, and yarns that have not been chemically treated.

## 2 Normative References

The provisions in following documents become the essential provisions of this Document through reference in this Document. For the dated documents, only the versions with the dates indicated are applicable to this Document; for the undated documents, only the latest version (including all the amendments) is applicable to this Document.

GB/T 6097 Sampling method for testing of cotton fibers

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

## 3 Terms and Definitions

For the purposes of this Document, the following terms and definitions apply.

### 3.1 Mature ratio

The ratio of the cell wall increased thickness to the standard increased thickness (0.577).

### 3.2 Dead fiber

After cotton fibers expand under specified conditions, the cell wall thickness is less than or equal to one-fifth of the maximum width.

NOTE: Dead fibers have various forms, usually flat ribbons without twists or ribbons with more twists.

### 3.3 Normal fiber

After the cotton fiber expands under specified conditions, it presents a discontinuous central cavity or a rod-shaped fiber with almost no trace of the central cavity and no obvious bending.

## 7 Test Atmosphere

The test can be carried out in any atmosphere without humidity controlling. In order to make it easier to fix the fiber on the slide, it should carry out the test under the condition of relative humidity no less than 40% and without violent airflow.

## 8 Preparation of Sample

### 8.1 Method A - Hand-pulling arrangement method

**8.1.1** Sampling quantity: Take at least 32 fiber bundles of about 0.001 g from different parts of the laboratory sample to form a test sample, and take two portions of samples in total; or take two test samples according to the provisions of GB/T 6097, each about 0.001 g.

**8.1.2** Pull a test sample by hand or use a limiter flannel board to arrange it into a parallel cotton bundle with one end neat and straight, uniform thickness, and clear layers.

**8.1.3** In the order of sparse combing first and dense combing later, comb out the short fibers of 16 mm and below for fine-staple cotton and 20 mm and below for long-staple cotton from the neat end of the cotton bundle; and divide it into approximately 5 equal small cotton bundles along the longitudinal direction of the arranged cotton bundle.

**8.1.4** Apply a little glue along the edge of the slide; hold one end of the small cotton bundle with one hand, and use tweezers with the other hand to pick up small amounts of fibers from the neat end of the small cotton bundle and arrange them evenly on the slide. Repeat this process until 100 pieces or more fibers are arranged on the slide.

**8.1.5** Use a pick needle to move the fibers on the slide so that the fibers are arranged parallel, straight, and evenly distributed. The arrangement width is about 25 mm.

**8.1.6** Gently cover the cover glass; drop sodium hydroxide solution on one corner of the cover glass; and gently press the cover glass to allow the solution to penetrate; soak each fiber and prevent bubbles from forming.

**8.1.7** Use a paper towel to absorb the overflowed solution along the edge of the cover glass to prevent corrosion of the microscope lens.

**8.1.8** Make the other 4 small cotton bundles according to procedures of 8.1.4~8.1.7.

**8.1.9** Prepare another test specimen according to the above procedure.

### 8.2 Method B - Central cutting method

**8.2.1** Sampling quantity: Take at least 32 fiber bundles from different parts of the laboratory sample to form a test sample of no less than 0.3 g; and take two samples in total; or take two

test samples according to the provisions of GB/T 6097, each at least 0.3 g.

**8.2.2** Pull a test sample by hand or use a limiter flannel board to arrange it into a parallel cotton bundle with one end neat and straight, uniform thickness, and clear layers.

**8.2.3** In the order of sparse combing first and dense combing later, comb out the short fibers of 16 mm and below for the fine-staple cotton and 20 mm and below for the long-staple cotton from the neat end of the cotton bundle.

**8.2.4** Cut a fiber segment of 0.4 mm~0.6 mm in length from the middle of the fiber with a Hastelloy slicer and divide it into 5 roughly equal test samples.

**8.2.5** Place at least 100 fiber fragments on a slide, drop an appropriate amount of sodium hydroxide; and stir with tweezers to evenly distribute them in the medium. Cover the sample with a cover glass to fix it. Be careful not to let the fibers flow out of the cover glass to avoid fiber loss. Otherwise, a new slide needs to be prepared.

**8.2.6** Prepare test specimen by another test sample according to the above procedure.

## 9 Test Procedures

**9.1** Adjust the condenser of the microscope to enhance the contrast between the fiber cell wall and the middle cavity.

**9.2** Place the slide on the stage of the microscope so that the middle of the fiber is in the center of the field of view. Observe and classify the fibers one by one and record the number of fibers of each type for each specimen. Test the maturity ratio or percentage of mature fibers. The legend of fiber morphology is shown in Appendix A.

**9.3** For the maturity ratio test, all fibers of each specimen are divided into three categories:

- a) Normal fibers;
- b) Dead fibers;
- c) Thin-walled fibers.

**9.4** For the percentage of mature fibers test, all fibers of each specimen are divided into two categories:

- a) Mature fibers;
- b) Immature fibers.

**9.5** Test results of 5 test specimens are tested by two test personnel each.

## 10.4 Percentage of mature fiber

Calculate the percentage of mature fiber of a test sample according to Formula (4).

$$PM = \frac{M'}{T} \times 100 \quad \dots\dots\dots (4)$$

Where:

PM – percentage of mature fiber, in %;

$M'$  – number of mature fibers on each slide;

$T$  – number of test fibers on each slide.

Calculate the arithmetic mean of the percentage of mature fibers of 10 specimens. In addition to the specified number of tests, if the confidence level is determined to be 95%, when the half-width value of the confidence interval [ $C$  (%)] (percentage of the arithmetic mean) exceeds 5%, the number of tests shall be increased according to the provisions of Appendix B.

The percentage of mature fibers and the maturity ratio can be converted by formula. The specific conversion formula is shown in Appendix C.

## 10.5 Calculation of statistical values

The calculation of statistical values such as arithmetic mean, standard deviation, and coefficient of variation shall be in accordance with the provisions of Appendix B.

## 10.6 Rounding-off of values

According to the provisions of GB/T 8170, the average maturity ratio shall be rounded-off to two digits after the decimal point; and the average percent maturity shall be rounded-off to one digit after the decimal point.

# 11 Test Report

The test report shall include the following contents:

- a) This Document number;
- b) Name of the sample;
- c) Test temperature and relative humidity;
- d) Name and model of the used equipment;
- e) Test results, if the standard deviation and coefficient of variation are calculated, they shall

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