

METHODS FOR DETERMINING THE MATURITY OF COTTON FIBER

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ANNOTATION:

This article analyzes the methods of determining the degree of maturity of cotton fiber, the order of determination. As a result of the research, methods have been developed to calculate the degree of maturity of the fiber.

Keywords: Cotton fiber, maturity, air permeability, sample, polarized light, microscope.

INTRODUCTION:

The purpose of maturation is to determine the polarized light and the air permeability of the sample.

Sampling of cotton fiber to determine the maturity of the cotton fiber, preparation of the sample for testing is carried out in accordance with the standards Uz.DSt 604 and UzDSt 618-94.

The method of testing the acceptance and delivery of cotton fiber for its maturity is its air permeability.

The method of determination of ripeness by polarized light is mainly used in the certification and grading of standard samples, and, if necessary, in arbitration tests.

The requirements of this standard are mandatory.

Instruments for determining the maturity of cotton fiber

- Polarity detection method: any type of microscope with a magnification of 80-120 times;

- A set of glasses with a size of 25-76 or 13-75 mm; polarizing equipment for the microscope;
- VT-200 torsion scales or other similar scales;
- Clamp for fiber laying 11;
- Velvet-covered board required for laying fibers on the subject windows;
- Clamp for inserting a pair of glass windows.

Method for determination of air maturity of the sample: LPS-4 device; laboratory scales with an interval of not more than 10 mg, a maximum weight limit of up to 1 kg, accuracy class 4;

Cotton analyzers type AX or FM-30 or other similar type.

Standard (standard) samples of cotton fiber approved in a special order are used to check the methods of determining maturity.

Measurement methods. Maturity of cotton fiber is characterized by the accumulation of cellulose, which occurs as a result of changes in the thickness of the wall tissue, and changes in the internal structure of the fiber during the growth of cotton.

The method of determining maturity in polarized light is based on the fact that the interference in polarized light polarizers depends on the internal structure and thickness of the fiber.

The method of determining maturity by air permeability is based on the fact that the thickness of the fiber depends on its air permeability.

Before testing on the LPS-4, the samples are stored in climatic conditions for at least 2 hours according to Oz DSt 618-94.

If the moisture content of cotton fiber is from 6 to 10%, as well as in cases where the humidity is less than 6% and more than 10%, the LPS-4 device is subjected to an experiment without storage in climatic conditions allowed.

The determination of the maturity of the fiber in polarized light is carried out in the laboratory, regardless of climatic conditions.

Sampling of cotton fiber, preparation of the sample for testing is carried out in accordance with Uz DSt604 and Uz DSt618.

Determination of fiber maturity by polarized light. During the ripening of the cotton fiber, growth rings form as the cellulose layers accumulate on the inner walls of the canal, causing the canal to narrow. Unripe fiber has low spinning properties and does not absorb dye well. The properties of the ripened fiber, as well as the quality of the yarn and fabric made from it, are good.

The ratio of the width of the fiber to the width of its channel indicates that the fiber is ripe. Conditionally, to determine the degree of maturity of cotton fiber, it is accepted to divide it into 2 groups (Figure 1). As a result of excessive accumulation of cellulose in the overcooked fiber, its shape is similar to a cylinder, its ripening coefficient is assumed to be 5.0 due to the loss of torsion, and the walls are very thin due to the almost complete absence of cellulose in the fully ripened fiber. Since it is, its ripening coefficient is assumed to be 0.0.

To determine the ripeness of the fiber, 250 cotton fibers are examined under a microscope with a magnification of 300-400 times, their ripening coefficients are determined by comparing them with those shown in the reference figure, and then the average ripening coefficient of the case group is found.

The ripeness of the cotton fiber can be detected more quickly by looking at it under a

microscope with polarized light. This method is based on the fact that when light is transmitted through the textile fibers, it becomes polarized and interferes.

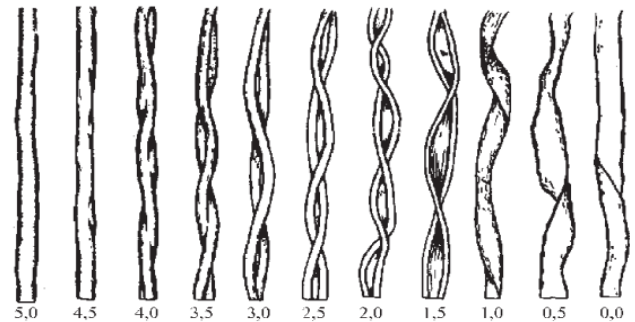


Figure 1. Fiber ripening coefficients

To do this, you can use any microscope with a special device called a polaroid. Separate 25-30 mg from the fiber obtained for the sample, make a staple by hand and make a preparation out of 4 glasses, magnifying each drug 80 ... 120 times under a microscope. should be. To determine the ripeness of a fiber, you need to look at a total of 300-400 fibers and calculate the percentage of fiber in different ripening groups. When viewed in polarized light through a polaroid, the fibers appear in different colors depending on the degree of maturity within the overall red. These colors are divided into the following four groups (Table 1).

Table 1. The color of the fiber depends on its degree of maturity when viewed through polarized light.

Maturity group	The degree of toughness of the fiber	The appearance color of the fiber	The shape of the fiber
1	Well cooked	Yellow-gold with orange and purple spots, greenish-yellow with green spots.	There is a channel
2	Immature	Blue is the color of the air, yellow is the color of the air, and green is the color of the air.	Tape-shaped, the channel is wide
3	Raw	Blue with purple and purple spots.	Tape-shaped, channel wide
4	Very raw	Purple with bright red spots, light red	Tape-shaped, channel wide

The method of determining the maturity of the sample by air permeability

At least 50 g of fiber is extracted from each of the combined cotton fiber samples and passed through an analyzer.

Four samples are separated from the cleaned and crushed cotton fiber. For each sample, the whole is taken from one place, not with separate sets from different places. Manual compaction of the fiber is not permitted during sample selection and measurement. The mass of each sample for measurement is determined according to the cotton selection navigation in accordance with the approved manual. The error in measuring the mass of the sample should not exceed 10 g. When measuring on an LPS device, the prepared fiber sequence is placed evenly inside the working chamber of the instrument. The chamber cover is tightly closed, the ventilator is activated and the throttle handle is supplied with the required amount of air through the right manometer (100mm water column). When the scale readings of the right manometer reach the desired values, the left manometer scale reading (mm in the water column) is recorded for the given fiber sample, which determines the amount of air thinning in the instrument. The scale sections are calculated from the lower meniscus of the water column in the right and left manometer tubes. The remaining samples are measured in this order.

Calculate measurement results. A method of determining ripeness in polarized light. Each section counts the number of cotton fibers belonging to maturity groups 1, 2, 3, and 4. The total is then calculated as 100 percent, and the percentage of maturity (A) of each group is calculated. The maturity coefficients of each group are determined by the percentage of maturity of group 1 of the fiber according to Table 2 K₁, K₂, K₃, and K₄.

Table 2

% Of maturity group.		Maturation coefficients of cotton fiber by maturity group				
		1	2	3	4	
Medium fiber cotton varieties	Long fiber cotton varieties	Medium fiber cotton varieties	Long fiber cotton varieties	Medium fiber cotton varieties		
77.5 and above	73.5 and above	2.40	2.45	1.30	1.00	0.50
69.1-77.4	65.1-73.4	2.35	2.40	1.30	1.00	0.50
43.5-69.0	40.5-65.0	2.30	2.30	1.30	1.00	0.50
35.5-43.4	35.5-40.4	2.00	2.00	1.30	1.00	0.50
Not less than 35.4	Not less than 35.4	2.00	2.00	1.30	1.00	0.50

The average fraction value (K) of the maturation coefficient is calculated by the following formula:

$$K = \frac{A_1K_1 + A_2K_2 + A_3K_3 + A_4K_4}{100}$$

where: A₁, A₂, A₃, A₄ - percentage of the four maturation groups;

K₁, K₂, K₃, K₄ is the maturity coefficient of 4 groups of fibers according to the percentage of maturity group 1.

The calculation is done with precision up to the first second decimal place and rounded to the first decimal place.

Measurement error rate. The permissible difference (similarity of the method) between parallel samples in terms of maturity should not exceed:

- At most between two samples in polarized light
- 0.1; - Between four samples, maximum and minimum values of air permeability, not more than 0.03 or 2.5% in Pa (mm water column) on the LPS-4 scale.

CONCLUSION:

The permissible difference between the test results of the maturation coefficient

between two different 80 laboratories or between two tests obtained in the same laboratory under different conditions (recovery of the method) shall not exceed 0.1.

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