INTERNATIONAL MULTI DISCIPLINARY JOURNAL FOR RESEARCH & DEVELOPMENT
eISSN 2394-6334 Impact factor: 7,854 Volume 12, issue 12 (2025)

IMPORTANCE OF METROLOGICAL SUPPORT IN ASSESSING THE QUALITY OF COTTON FIBER

Kasimova Dilafruz

Assistant of the Department of "Metrology and Light Industry"

at Andijan State Technical Institute

Annotation: This article highlights the role and importance of metrological support in determining the quality indicators of cotton fiber. It analyzes the main measurement methods used in assessing cotton fiber quality, testing equipment and their calibration, as well as the accuracy and reliability of measurement results. The metrological support system plays a crucial role in ensuring stable production in the cotton industry that meets international standards.

Keywords: Cotton fiber, quality, indicators, metrological support, calibration, accuracy, measuring instruments, testing methods.

Introduction

The cotton industry is one of the strategic sectors of Uzbekistan's economy, with product quality determining competitiveness in domestic and foreign markets. The quality of cotton fiber is crucial at all stages from processing to finished product. If indicators such as fiber length, fineness, and strength are not measured accurately and reliably, it can lead to errors throughout the entire production chain. Therefore, the metrological support system is an integral part of this process.

In the cotton industry, fiber quality directly affects the efficiency of further processing, the quality of manufactured products, and their market value. Therefore, cotton fiber is evaluated based on a number of important physical and normative indicators. These parameters are determined in accordance with criteria established by international standards (such as ISO, ASTM, USDA) and national technical regulations.

Fiber length is the physical dimension of cotton fiber in its average elongated state. This indicator directly affects the quality of yarn produced in the textile industry. Long fibers allow for strong, smooth, and uniform yarn, resulting in durable and visually appealing finished fabric. Typically, fibers are categorized into short (≤25 mm), medium (26-27 mm), and long (≥28 mm) groups based on their length.

The fiber fineness or "micronaire" indicator is considered a complex combination of fiber diameter and density. This parameter determines not only the technological processing capability of cotton but also the softness and thermal conductivity of the woven fabric. The micronaire value is required to be within the optimal range (approximately 3.8-4.9). Fibers that are either too fine or too thick can cause problems in production.

Strength is the force a fiber can withstand before breaking. This indicator is measured in g/tex units and shows the stability of the fiber when spun into yarn. Strong fibers are necessary for high-speed weaving machines and also extend the service life of the finished product. In high-quality fibers, this value exceeds 28 g/tex.
Cotton fiber has the property of moisture absorption. Moisture content plays an important role in the processes of production, storage, and transportation. Normal moisture content (6-8%) is

optimal for technological fiber processing. Excess moisture can lead to rot and weight increase, which causes economic damage.

The quality of cotton fiber is also affected by its appearance, particularly the uniformity of color, the presence of spots, and foreign matter between the fibers (leaves, husks, dust, etc.). Spotted or rotted fibers are classified as low-grade. Additionally, the percentage of waste is one of the evaluation criteria, indicating what percentage of clean fiber can be separated. HVI equipment allows for precise measurement of waste content in percentages. In the process of determining cotton fiber quality indicators, various laboratory instruments are used, combining modern technologies with traditional methods. These tools are used to determine fiber length, fineness, strength, moisture content, waste content, and other physical and normative properties. Below are the most common devices and their functions:

One of the primary tools for modern cotton analysis, this device automatically analyzes large volumes of samples in a short time. The HVI system (Table 1) determines key quality parameters such as fiber length, micronaire (fineness), strength, color indicators, waste content, and degree of uniformity. The equipment minimizes human factor influence in laboratory work, ensuring reproducibility and accuracy of results.

The AFIS system provides in-depth and comprehensive information about cotton fiber and the fibers in its composition. It enables the determination of individual fiber length, the number and volume of fibers, as well as fine fibers and microcracks in the cotton. This equipment is especially used in scientific research and in-depth laboratory analyses. Classical equipment has also retained its importance in studying the microstructure of cotton fiber diameter and surface. With the help of microscopes, the surface coating of the fibers, the degree of staining, and the uniformity of structure are examined. Using micrometers, the exact thickness of the fiber is measured. These instruments are more commonly used in small laboratories and for control measurements.

When assessing the mechanical strength of a fiber, dynamo machines or electronic tensometers are used to determine stress resistance. These instruments measure the fiber's maximum strength until it breaks. Usually, this indicator is measured in g/tex units and is considered very important in the yarn and fabric industry. Reliable determination of cotton fiber quality indicators depends not only on laboratory accuracy but also on the technological level of the instruments used. Automated systems such as HVI and AFIS are of great importance for the industry, increasing the accuracy, speed, and repeatability of cotton analysis. At the same time, additional and visual assessment work is also carried out using classical methods.

Table 1.
Comparison of cotton fiber grade-class by HVI indicators

Indicator	**High quality (1st grade, 1st class)**	**Medium quality (2nd-3rd grade, 2nd class)**	**Low quality (4th grade, 3rd class and below)**
Length (mm)	≥ 28 mm	26-27 mm	≤ 25 mm
Fineness (Micronaire)	3.8-4.2	4.3-4.9	≥ 5.0 or ≤ 3.5
Strength (g/tex)	≥ 29	24-28	≤ 23

Color (Reflectance)	≥ 78 (white)	70-77 (cream)	≤ 69 (yellowish or brown)
Trash Content	≤ 2%	2-4%	> 5%
Uniformity (Uniformity Index)	≥ 85%	80-84%	≤ 79%
Luster (Luster)	High	Medium	Low

Length is a crucial parameter in the yarn production process. The longer the fibers, the more smooth, even, and durable the yarn becomes. Micronaire (fineness) represents the average diameter and density of the fiber. This indicator is related to the difficulties in fiber processing and the quality of the finished product. Very thin or very thick fibers are rated lower in terms of quality. Strength (g/tex) indicates the breaking strength of the fiber. High-strength fibers reduce yarn breakage in weaving processes and increase production efficiency.

Color (Reflectance) is the visual quality of fiber. White color is especially preferred for export-oriented cotton.

Trash Content - the amount of foreign matter in the fiber, such as leaves, bark, dust, and lint, directly affects quality.

Uniformity Index indicates the degree of uniformity in fiber length. The higher this index,

the closer the fibers are in length to each other, allowing for more consistent yarn production.

Conclusion.

To improve metrological support for determining the quality of cotton fiber,

the following is important:

- Implementing modern equipment, such as HVI and AFIS, in more laboratories.
- Strengthening the system of mandatory annual calibration of testing instruments.
- Training laboratory staff in metrological culture.
- Creating a system for storing and analyzing measurement results on digital platforms.

When assessing the quality indicators of cotton fiber, metrological support is an important guarantee of high accuracy, reliability, and the supply of competitive products in international markets.

References:

1. ISO 13274:2003 - "Cotton fibers - Test methods for cotton fiber properties"
2. Law of the Republic of Uzbekistan "On Metrology"
3. Documents and technical regulations of the TJTS Agency
4. Cotton Incorporated. HVI and AFIS System Guides.
5. Reports of the Cotton Industry Research Center, 2023