



COLOR QUALITY CONTROL IN THE PRODUCTION OF COTTON FIBER

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Abstract. The article provides recommendations for the use of indicators such as Rd (light reflectance coefficient) and + b (yellowing rate) obtained in the HVI equipment of cotton fiber in order to control the color quality of the spun yarn. Sorting has been developed to ensure the continuous production of spun yarns with constant quality indicators due to the minimum deviation of cotton fiber quality indicators, and recommendations have been made for the use of "SCI" (spinning index) value in cotton sorting and blending planning.

Keywords: cotton fiber, yarn, spinning index, spinning process, light reflectance coefficient.

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INTRODUCTION

The main raw material base of the textile industry of the republic is cotton fiber. At present, cotton fiber is used to produce a variety of beautiful and high-quality fabrics and knitwear. In order to obtain quality fabrics and knitwear, the performance of the yarn must be at the required level.

Designing and predicting the properties of yarn is of great importance in ensuring the quality and reducing the cost of spinning yarn.

At present, spinning mills use lots for these processes. This is also a form of blending, with businesses trying to make the most of the available fibers as efficiently as possible [2].

Currently, the data obtained in the HVI system are used in the selection of cotton fiber. In the HVI system, 22 quality indicators of cotton fiber have been identified and put into practice. With the use of the HVI system, great convenience has been achieved in the selection of cotton fiber, ie in the creation of "lots" [3]. For spinning a certain range of yarn, a mixture of different brands of cotton fibers is formed. The properties of the blended fibers are determined using the HVI system. The HVI system identified 22 properties of cotton fiber, the main of which affect the quality of yarn: fiber length (UHML), micronaire (Mic), tensile strength (Str), maturity (Mat), uniformity index (UI), light reflection coefficient (Rd), yellowing rate (+ b).

According to the USDA classification, the type of fiber in terms of color and impurity is determined by comparing the standard parameters obtained in computer memory on the appearance of the sample cotton fiber [4].

MATERIALS AND METHODS

Currently, the quality indicators of cotton fiber defined in the HVI system are widely used not only in the sale and purchase

of fiber, but also in the management of the process in the spinning mill, the calculation of the expected quality of yarn and selection of yarns for sorting [4,5].

Color quality control is an important task when controlling discoloration of spun yarn and fabric or problems with problematic road surfaces in the fabric. To better control the quality of cotton by color, the following recommendations should be followed:

1. Reflection coefficient (Rd): Rd value in Uzbek cotton usually ranges from 68 to 82. For good control, it is recommended that the daily mixing plan ensure that Rd values are in the range below 5.

2. + b yellowing index: + b yellowing index varies depending on the region and grade. In Uzbek cotton, the + b value ranges from 7.0 to 11.0. When mixing cotton of the same variety, it is preferable to keep the + b interval at a value of less than 2.5.

Evaluation of cotton fiber color: The color of cotton fiber is evaluated by determining the location of the color chart quadrant. Here, the Rd coefficient and the color of the cotton fiber are determined by the intersection of the + b indicator in the diagram. For example, a sample with a light reflection coefficient Rd 72 and a yellowing index of + b 9.0 will have a color code of 41-3 (Figure 1).

RESULT AND DISCUSSIONS

The color class is represented by the number XX-U in three digits. The first number represents the color brightness. The larger the number, the higher the brightness of the cotton. The second number represents the degree of yellowing of the cotton; as the number of the second digit increases, the yellowness also increases. There are 25 color varieties and five color categories. Uzbek cotton usually falls into the white and light-spotted color categories, which have an average and good average coloring level. It is recommended to choose only four side-by-side cotton varieties in the blending plan, e.g., 11, 12, 21, 22 can work together, but using 11 with 31 or 11 with 13 to avoid discoloration or streak problems that can form on the will not happen fabric.

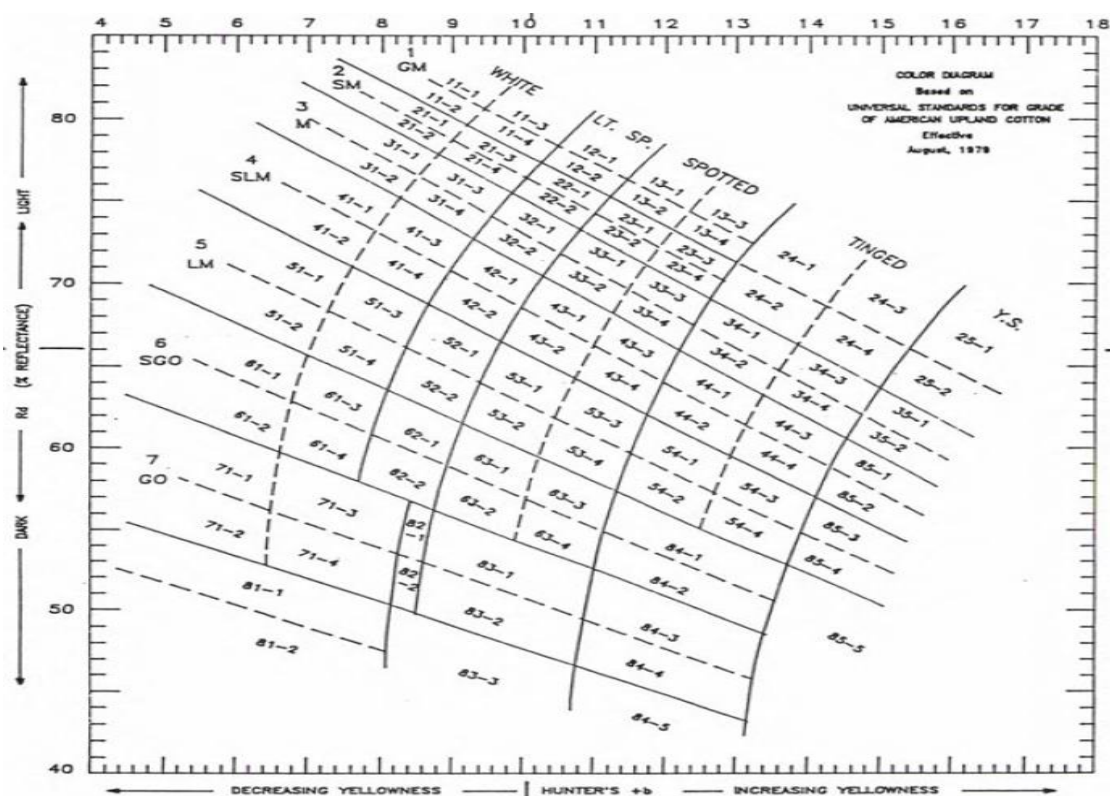


Figure 1. Color diagram of cotton fiber

In order to ensure the color uniformity of the yarn and the fabric, the stained, numbered, high-yellowness fibers of different colors are not strictly applicable.

Another key property indicator measured in the HVI system is the Spinning Consistency Index (SCI) - calculated based on the regression equation. This equation calculates a single value used for each test sample, taking into account all the parameters. SCI is an index obtained on the performance of a large number of cotton samples with a wide range of properties, which is related to the test results of the spun yarn taken from each sample. Based on numerous regression analyzes, it was found that each fiber property affects the yarn property. Consequently, the SCI value is affected by the fiber micronaire, length, uniformity index, breaking strength, light reflection coefficient (Rd), and yellowing rate (+ b) [6,7].

The following are SCI equations for important HVI-system measurements, including color rendering:

For HVI calibration mode:

$$\text{SCI} = -414.67 + (2.9 \times \text{Strength}) - (9.32 \times \text{Micronaire}) + (49.17 \times \text{Length in inches}) + (4.74 \times \text{Uniformity index}) + (0.65 \times \text{Rd}) + (0.36 \times + b)$$

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For the blending plan, it is more convenient to observe the properties of cotton fiber using the "SCI" value obtained in the HVI-system report instead of observing several indicators [8].

Table 1. The grade level of the SCI spin index determined by the HVI system

Classes	Spinning index values
A++	Above 150
A+	140÷149
A	130÷140
B	120÷129
C	120 and past

The following recommendations can be made for using the SCI value when planning the sorting and blending of cotton:

1. Cotton fiber (SCI) can be divided into five classes by the values of the Spinning Consistency Index and stored in a warehouse according to the market price, ie as shown below:
2. In accordance with the warehouse regulations, a mixing plan should be prepared in the warehouse and a range of minimum, average, maximum values should be calculated for the SCI value.
3. The average SCI value of daily mixing should be kept constant and the daily deviations should not exceed the +/- 2 limit.
4. Maximum and minimum SCI values should not exceed 30, ensuring that the ideal mixing plan has a value of less than 20.
5. SCI maximum and minimum values should be monitored daily and the interval of days to be monitored should not be too large.

Table 2: HVI indicators of the lot consisting of brands and the fibers in it

Brands	Bales	SCI	Mic	Mat	UHML	Str	Elg	Rd	+b	CG	Tr.Cnt
104-171	220	133	4,47	0,86	29,18	30,7	7,8	78,4	9,3	21-4	35
104-173	220	133	4,52	0,86	28,62	30,3	7,9	78,4	9,3	21-4	33
104-174	220	131	4,57	0,86	28,72	30,6	7,9	78,3	8,8	31-1	38
100-162	220	128	4,48	0,85	28,26	29,6	8,8	79,2	9,9	11-3	31

170-215 (good)	150	126	4,24	0,85	28,41	28,5	8,4	80,5	8,4	21-2	54
170-215 (middle)	70	124	4,32	0,85	28,72	28,4	8,4	79,7	8,3	21-2	66
total	1100	130	4,46	0,86	28,66	29,9	8,17	78,9	9,13		39,04

Table 2 shows the lot consisting of 6 maracas and its HVI indicators. The Rd index of the fibers in this mixture was 78.9 and the b + index was 9.13. The Rd index of blended fibers corresponds to the 25% quality category (78.5) given in USTER STATISTICS 2018, while the b + corresponds to the 50% quality category in terms of yellowing level. The maximum value of the SCI twist index of the fibers in the mixture is 133 and the minimum is 124, the difference between them is 9. The SCI values of the fibers in the mixture correspond to the above recommendations in terms of differences. The total value of SCI corresponds to class A (3), and the average value of SCI and fiber length correspond to the 50% quality category (128) given in USTER STATISTICS 2018 [9].

Conclusion: Cotton fiber is a necessary raw material resource for spinning mills. Since cotton is a natural fiber, it is natural that its properties vary. Scientific and systematic control of cotton quality is necessary to eliminate this discrepancy in the composition of the mixture. The quality of spun yarn is affected by the following important indicators: maturity of cotton fiber, fiber length, tensile strength, elongation, micronaire and others.

Cotton fiber is represented by a set of important indicators (SCI) - Spinning Consistency Index, which affects the quality of yarn of cotton fiber, and gives a single total value calculated on the basis of regression equations. The Spinning Consistency Index (SCI) is an indicator that includes the specific integral properties of cotton, such as the micronaire, length, uniformity, tensile strength, light reflection coefficient (Rd), and yellowing rate (+ b) of the cotton fiber. This, in turn, allows to ensure the stability of the spinning process through a single value. The systematic mixing plan ensures the continuous production of spun yarns with constant quality indicators due to the minimal deviation of the cotton fiber quality indicators.

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