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NEW METHOD FOR COMPLETING SORTING FROM COTTON FIBER

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Abstract: This article discusses a new methodology for compiling sortings for the production of cotton yarn of various assortments and purposes. The disadvantages and inappropriateness of using existing standard sortings in spinning production in cotton-textile clusters are analyzed. The proposed new technique provides the necessary planning for mixing cotton fiber with a limited number of mixture components. The recommended technique also ensures the necessary increased requirements, especially the color shades of the produced yarn, making maximum use of the fiber indicators determined by the HVI system.

Keywords: Cotton, Fiber, Method

Annotation

The growing demand for the quality of textile products in the world takes into account important factors influencing the processes of technological transitions in the production of finished products, and therefore scientific research is being carried out. Therefore, more and more attention is paid to the correct selection of raw materials in the manufacture of finished textile products, the selection of raw materials while maintaining the properties of the fibers, as well as the introduction of complex, high-tech and innovative technologies for the production of high-quality and competitive products [1].

The quality of products is formed during the production process. Rational use of raw materials is one of the most important areas for increasing the efficiency of textile enterprises. The cost of raw materials has a significant impact on the cost of yarn; therefore, it is important to determine the share of each component in the mixture, ensuring minimal costs for raw materials and the required properties of the yarn [2]. Spinning enterprises produce yarn according to market demand, and therefore the question of selecting raw materials that meet consumer requirements often arises.

The mixture of fibers from which yarn of a given quality is produced is called sorting. The required quality of yarn is determined by its purpose, as well as the conditions for its further processing. The main factors that determine the quality of yarn are the properties of the raw materials from which it is produced, as well as spinning systems and plans, air temperature and humidity in the workshops of the spinning factory, the technical condition of the equipment, and the qualifications of workers [3].

The task of designing a grading composition is to select such a grading and such a technological process in the mill that, with minimal costs for raw materials and processing, yarn can be produced that meets the standard. It must be borne in mind that the cost of raw materials in the cost of yarn is about 70-75% and the optimal choice of raw materials for the production of yarn of the required quality is very important.

Until recently, textile enterprises in the CIS countries used standard sorting to produce yarn of a certain range and purpose. Based on the standard one, a working sorting was compiled, which ensured the profitability, grade and breaking characteristics of the produced yarn. Based on this, factories sort at least 6-8 grades of cotton fiber. Working sortings provide for complete processing of production waste (sliver and roving torn, sliver).

Currently, at spinning mills it is practically impossible and impractical to use previously developed standard sortings for the following reasons:

1. in cotton-textile clusters it is possible to form 3-4 grades of cotton fiber as much as possible, because a separate breeding variety of cotton has been zoned;
2. in a market economy, the production program is not constant and depends on the ordered range of yarn;
3. standard sorting ensures profitability, grade and breaking characteristics of the produced yarn, but does not provide increased requirements for its shade.

Based on this, we can conclude that in order to meet the increased requirements, especially for the color shade, of the produced yarn, it is necessary to make maximum use of the quality indicators of the fiber determined according to the HVI system.

At spinning mills around the world, sorting is done in two stages: selecting the components of the LOT mixture and forming a rate from it. LOTS are alternated after complete processing of the subsequent LOTS of fiber. The yarn of each LOT is processed according to separately drawn up regulations. Such an event leads to a reduction in finishing defects in yarn, fabric and knitwear.

Cotton bales, after entering the sorting department, are subjected to testing, i.e. Fiber parameters are determined using the HVI system. The selection of mixture components is carried out with the minimum possible deviations. The components of the LOT mixture by brand, grade and class are stacked in the warehouse in accordance with enterprise standards.

In accordance with the mixing plan with the minimum possible deviations, several bales are formed from the total number of components of the LOT mixture and used as necessary. Minimum possible deviations in the properties of cotton fiber:

1. Length - 2-2.5 mm
2. Micronaire – 0.6-0.8 inches.
3. Fibre strength – cN/tex.
4. Maturity coefficient
5. Uniformity index,%.
6. Short fiber index SFI, %.
7. Trash content %.
8. Humidity ,%.
9. Reflection coefficient Rd - 5-6.
10. Degree of yellowness b - 2-2.5%
11. Color grade Rd + b.

The HVI system also determines the SCI value. The Spinability Index (SCI) is a calculated value based on a regression equation. This equation takes into account all HVI properties and calculates one value that will be used for each sample tested. SCI is an index derived from data from a large number of cotton samples having a wide range of properties and is linked to test data on the yarns obtained from each sample. Using multiple regression analysis, the contribution of each fiber property to the yarn properties was identified. Therefore, the unit SCI value is influenced by the internal ratios of cotton microner, length, uniformity index, strength, Rd and +b.

Below are the SCI equations for the most important HVI measurements, including color:

For HVI calibration mode:

SCI = - 414.67 + (2.9 x Strength) - (9.32 x Mic) + (49.17 x Length in inch) + (4.74 x Uniformity Index) + (0.65 x Rd) + (0.36 x +b)

If the color module is not installed, the SCI equation looks like this:

SCI = - 322.98 + (2.89 x Strength) - (9.02 x Mic) + (43.53 x Length) + (4.29 x Uniformity Index)

For ICC calibration mode:

SCI = - 414.67 + (2.9 x Strength) - (9.32 x Mic) + (49.17 x Length) + (8.61 x Uniformity Ratio) + (0.65 x Rd) + (0.36 x +b)

If the color module is not installed, the SCI equation is defined as follows:

$$SCI = -322.98 + (2.89 \times Strength) - (9.02 \times Mic) + (43.53 \times Length) + (7.79 \times Uniformity\ Index)$$

Instead of monitoring multiple parameters for a blending plan, it may be easier to monitor the "SCI" value of cotton properties obtained from the HVI test report. The following guidelines can be adapted to use the SCI value when planning cotton grading and blending.

1. The average SCI value for daily mixing should be maintained constant and there should not be more than +/- 2 variations on a daily basis.

2. It should be ensured that the maximum and minimum range of SCI values does not exceed 30, for an ideal mixing plan it should be kept below 20.

3. The overall range of the maximum and minimum SCI value should also be monitored on a daily basis and there should not be too much fluctuation on a daily basis.

Conclusion

The basic properties of cotton fiber and their influence on spinning processes and yarn quality are explained in detail with examples, data and graphics. Much attention has been paid to SCI and fiber maturity. Cotton fiber maturity is an important parameter and also affects other parameters such as length, strength, elongation etc. SCI spinnability index obtained from regression equation, length, uniformity, strength, Rd and + b which can help spinners control the bet with only one parameter.

Mixing planning is a very important function for spinning, and investing time and skill in a systematic mixing plan yields good results such as consistency in productivity and quality. A systematic blending plan maintaining the minimum possible variation in cotton quality parameters ensures smooth production of yarn with consistent quality. Differences in the color gamut of cotton are the main factor responsible for shade variations and banding problems in the fabric and hence, controlling the color gamut of cotton is one of the most important functions of a blending plan that cannot be ignored. Matching sub-standard quality bales is a complex job and should be used under strict control so as not to affect the performance of the spinning process and the quality of the yarn.

References

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