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COTTON MEDIUM FIBRE COLOUR ASSESSMENT

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ABSTRACT

The Uster HVI system evaluates the colour of medium staple cotton fibre based on the international universal standard and replaces the subjective visual colour assessment of Uzbek cotton fibre determined by the classifier with an objective instrumental measurement.

KEYWORDS

Cotton fibre colour, quality, international universal standard, HVI system, yellowing, whiteness level, reflectance, USDA, integration, organoleptic, classifiers, standards - a set of appearance samples.

INTRODUCTION

Cotton is the main textile raw material processed all over the world. Despite strong competition for the cultivation of man-made fibres, the share of cotton in total fibre consumption remains high. The quality classification of cotton fibre plays a very important role in the global cotton trade. Traditionally, cotton fibre is

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evaluated by cotton classifiers in an organoleptic-visual way. However, pricing for a person is subjective and may not meet the needs of consumers. Today it is planned to replace the subjective visual assessment, determined by the class, with an objective instrumental measurement [1-3]. To date, there are many methods, techniques and devices for measuring the quality of cotton fibre. Some of them are designed to measure certain parameters of cotton fibre. For example Microner, Pressly, Stelometer, Fibrograph, Thermal detector and others. There are also measuring systems that allow a comprehensive assessment of the quality of cotton fibre, such as Uster HVI (High Volume Instrument), Premier ART, AFIS (Advanced Fibre Information System), IsoTester, FibroLab and UAK. These devices and systems provide producers, traders and spinners of cotton fibre with valuable information that can be used not only to classify cotton fibre but also to predict fibre characteristics [4-9].

MATERIALS AND METHODS

Cotton fibre colour measurement. The colour of cotton fibre is one of the most important properties that determine the quality classification. The colour of cotton fibre can be influenced by many factors associated with its cultivation: rainfall, changing climatic conditions, insects, fungi, soil, grass and cotton leaves, humidity and temperature during cotton licking and storage [10-14].

Thus, the deterioration of the colour affects the processing efficiency of cotton and at the same time its price value. Colour deterioration also affects the ability of the fibres to absorb and retain dyes. The assessment of the colour of cotton fibre is usually carried out by classifiers by the organoleptic method. Specially trained classmates classify the cotton fibre sample by visual comparison with a set of standard appearance samples in a room equipped with a black desk, the walls of which are illuminated with 1200 lux light, painted in matt grey [15-19].

In the 1930s, the USDA began developing an instrumental colour chart. Two parameters were then included in the classification of cotton fibre grades: luminosity reflectance (Rd) and yellowing (+b). Brightness level (Rd) indicates how bright or dull the sample is, and yellowness (+b) indicates the degree of colour pigmentation. The colour of cotton fibre was determined instrumentally using a two-filter colourimeter. This objective method was developed by Nickerson and Hunter in the early 1940s to test USDA cotton quality standards. In the 1970s, colourimeter technology was integrated into the HVI [20-24].

In the colour measurement process, cotton fibre is placed on a glass sample and compressed to a predetermined pressure:

a) The light from the lamps is returned, filtered and returned by the photodiodes.
b) The values are measured.

The reflectance describes how bright, white or dull. The cotton fibre colour type is determined by the location of the intersection points on the Nickerson and Hunter diagrams of the Rd and +b values measured in the HVI in Figure 1. The light is measured by two separate detectors. The signals from these detectors are used to calculate the sample with an accuracy of tenths of a colour unit (Rd) and (+b). Yellowing on HVI (+b) is determined using a yellow filter indicating the degree of pigmentation of the cotton. The yellowing in HVI (+b) corresponds to the value (+b) shown in the Nickerson Hunter colour chart. The yellowing (+b) is used in conjunction with the reflectance value (Rd) to determine the colour level of the cotton measured on the instrument [25-28].

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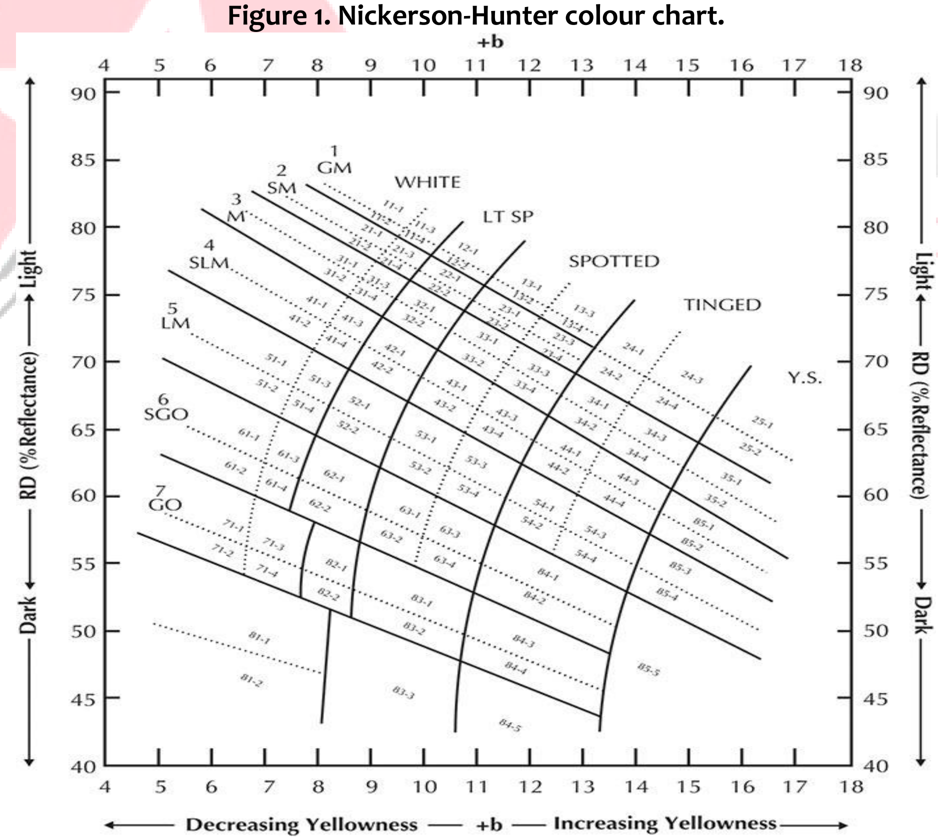
Currently, HVI is considered worldwide as a universal method for measuring the colour of cotton fibres. In the HVI system, the fibre colour type is identified by the three-digit Nickerson-Hunter code "Upland" in accordance with the International American Universal Standard for the colour table in Figure 1. The first two digits of the colour code, according to the International American Universal Standard, describe the colour gamut. For a more accurate measurement, each variable value is divided into squares that indicate the difference in colour within the variety. The third number of the colour code identifies the square code (shown in Figure 1). According to the international American universal standard, Upland medium staple cotton fibre must be white. Cotton fibre is divided into groups depending on the colour, depending on the different saturation of yellowing: White-white, Light spotted-slightly spotted, Spotted-spotted, Shade yellow, and Yellow-spotted-yellow groups. Varieties in each colour group differ in the degree of darkening due to increased weediness and adverse weather conditions, which is expressed in a decrease in the reflection coefficient and are divided into classifiers as follows: Good Middling (GM) - good average; Strict Middling (SM) - hard medium; Middling (Middling) - medium; Strict Low Middling (SLM) - strictly low average; Low Middling (LM) - from low to medium; Strict Good Ordinary (SGO); Good Ordinary (GO) - good simple; Below Grade (BG) – Standard [24-29].

Figure 1. Nickerson-Hunter colour chart.



Uzbek cotton fibre UzDST 604:2016 Cotton fibre. According to the specification, the quality of cotton fibre is determined by three different classification methods. These are STIC method (HVI); cool method;

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special methods. The SITC (HVI) method is used to certify and determine the quality of cotton fibre in Uzbekistan. The quality indicators of cotton fibre, determined in the Uster HVI system, are accepted as mandatory indicators and reference indicators in accordance with the state standards UzDST 604:2016 and UzDST 3295:2018. However, the Uzbek cotton fibre is not covered by Colour Grade (colour according to the American universal standard), which is determined by the colour and modulus of impurities of the HVI system [27-31]. This is because only the Rd and +b values of USDA mountain cotton are integrated into the HVI based on the Nickerson and Hunter charts of the Colour Grade cotton fibre, which is determined in the HVI colour and impurities module system. Due to adverse weather conditions in the United States, the colours of the cotton fibre are very different from the climatic conditions of Uzbekistan. When testing Uzbek cotton fibre in the GVI system, the results are disproportionate to the requirements for the colour and appearance of technical grades of cotton fibre, given in chapter 5.2.1 of the UzDST 604:2016 standard. This is due to the fact that the values of luminosity-reflection coefficient (Rd,%) and the degree of yellowing (+b) of Uzbek fibres are higher than the Rd and +b values of USDA mountain cotton.

CONCLUSION

Today, worldwide, HVI is considered the universal method for measuring the colour of cotton fibres, and the subjective visual assessment, determined by the class, is planned to be replaced by objective instrumental measurement. Therefore, to further improve the quality of Uzbek fibre in the world market, it is necessary to use world experience and new modern technologies. To eliminate the above shortcomings, it is possible to master the nomenclature of colour codes in the Nickerson-Hunter colour table, defined in the colour and impurities module of the HVI system, and change some state standards and appearance samples (reference samples) of Uzbek cotton.

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