Abstract

The economic value of cotton fiber is far more superior to any other natural fiber. And when it comes to the trade of cotton fiber and its value added products, the grading of cotton fiber is very important which depends upon different properties. Color is one of those important properties which play a vital role in cotton selection. Currently used system in the cotton world for the color classification is not that much reliable if keeping in view the importance of fiber. Mostly before the buying of cotton fiber a professionally trained visual cotton inspector gives grade to the cotton which is later on confirmed in the mills by HVI which measures Rd and +b values to grade the cotton fiber. The grade given by visual inspection not only varies from the HVI grading but, also has contradiction with the cotton classers which are professionally trained. In this study we will try to find out the relationship between the visual classification and the instrumental classification of cotton fiber by keeping in view the universal standards for cotton grading. So, different instrumental methods for color measurements will be used and their relationships will be the main objective of the study.

Keywords: Cotton, Visual Inspection, HVI, Rd.

1. Introduction

Globally the classification of cotton is done by the AMS of the United States department of Agriculture (USDA) by using the HVI. There are different parameters measured by HVI unit like fiber length, length uniformity, micronaire, trash content and color. The properties of color which are measured by the HVI are Rd and +b. For the color analysis of cotton fiber the HVI unit uses a camera based system, with two broad band filters (two wavelengths) to determine Rd and +b. The AMS supplies two sets of cotton standards for the HVI color measurement – a set of five ceramic tiles and a set of 12 uniform cotton batts. There is no doubt that HVI does a very good job but it is also true that the parameters of cotton measured by the HVI are specific to cotton only. And the origin of these values is back in 1930s [1,2,3]. And these parameters of cotton do not relate to the other well known and globally recognized color systems like CIELAB, where L* is the lightness, a* is the redness/greenness and
b* is the blueness/yellowness of the sample [4,5]. As a two wavelengths based system the HVI does not include information about other regions of the color space which might play a vital role in the cotton color measurement. And the values of the specific wavelengths used are proprietary to Uster and it was not possible for the others to have access to these values. If these improvements can be added into the HVI then this system will become a much improved color analysis system for the color evaluation of the cotton fiber. Modern spectrophotometers and colorimeters include diffuse reflectance measurements of the sample over the full visible spectral region of the electromagnetic spectrum (at a minimum, 400-700 nm), use globally recognized color systems and units, and use an NIST traceable white standard.

(Fig. 1) AMS standards Ceramic tiles

2. Materials and methods

Cotton samples and also ceramic tiles used for the evaluation. AMS standard ceramic tiles (2 boxes, n=10) one box is provided with the xenon flash light standards and the other one is provided with the Incandescent light source standards and the HV standards are provided by the AMS. These standard ceramic tiles are well prepared and possess a smooth surface for the evaluation. White, brown, yellow, grey and central, these five colors for each set of boxes were provided with the standards readings. The Fig (1) shows the standards used for the measurement. The ceramic tiles were measured with the HunterLab MiniScan portable color spectrophotometer. As discussed earlier, AMS provided also the HVI Rd and +b values as reference values. The data obtained from the HunterLab MiniScan were compared with the provided data. For all the measurements five replications were
made and an average per sample was taken, then average HunterLab values were compared with the HVI values. All the measurements were performed at the laboratory conditions (70 ± 2 °F and 54 ± 2% RH).

For the visual grading of cotton samples in a light cabinet AT Color was used and common observers were invited for the color measurement of cotton samples instead of a professionally trained cotton classer. These observers have been asked to grade the cotton samples by taking the ceramic tiles as reference measurement. Five replications again were taken from each observer for five different days. Each observer was fully aware of the international cotton grading system but, they never performed the cotton grading so they were just common people. This phenomenon was performed for the set of standards (xenon, incandescent).

3. Results and Discussion

For the AMS standard ceramic tiles, the reference Rd values were obtained from the master HVI-1000 colorimeter in Memphis, TN. The HVI colorimeter uses two filters to measure the samples diffuse reflectance at the two visible spectrum regions and the value of Rd and +b obtained from the Uster algorithms. In the Laboratory of Color and Appearance measurement in the Technical University of Liberec, two sets of tiles were measured again with the Non-contact method. One set with incandescent and the second with the xenon light source. Then the values of Rd and +b were compared with the HVI-1000 and with the Non-contact method.

\[ y = 0.9071x + 6.3783 \]
\[ R^2 = 0.9974 \]

(Fig. 1) AMS standard ceramic tiles (xenon). HVI Rd Vs Non-Contact method Rd.
4. Conclusion

- The color standards provided by the AMS for the cotton color measurement confirmed through non-contact method and it was confirmed that the results show a strong relationship between the two methods.
- The measurement of Rd values of cotton samples with the two methods mentioned above also shows a strong relationship between two methods but a contradiction with the visual inspection.
- Disagreement between the visual inspection and the instrumental grading continues as presented before this research article.

The new method (telescopic measurement) for the cotton color measurement can be implemented with some more focus on this method.

References
