

**Review of the PhD dissertation**  
**Nayab Khan, M.Sc.**  
**“A Novel Method for Color Measurement of Cotton Fiber”**

The main aim of the PhD dissertation is to develop a novel approach and a system for measurement of cotton color measurement and color grading that eliminates the disadvantages of visual grading system and HVI system.

Cotton fiber, which is one of the most important natural fibers used in textile industry, is produced in different regions of the world and its quality characteristics may possess a high variation. Accurate grading of cotton without confusion is important not only for textile processes which use cotton as raw material but also world cotton marketing. The grading process is mainly based on different fiber properties such as length, strength, Micronaire, thrash content and color of the cotton fiber and traditionally human classifiers are used for inspection and classification. Instrumental measurement is realized using HVI (High volume instrument) system for measurement of cotton quality characteristics in order to obtain quantitative data in addition to visual inspection.

Cotton color grades, one of the most important cotton properties, can be determined by human classifiers using visual inspection and/or HVI system using  $R_d$  and  $+b$  parameters measured by the system. Unfortunately, high disagreement between visual grading and HVI measurements is present. Although an objective instrumental grading system is needed for many reasons, it was not possible to eliminate the human inspection from the cotton color grading process until today due to the shortcomings of the instrumental measurement approach. The topic of this dissertation is up to date and the main aim of the research conducted is to overcome this worldwide problem. In order to solve the big problem, Khan partitioned it into parts each of which can be regarded as separate thesis. The chapters are dealing with each part extensively.

Khan researched the illuminants for color measurement of cotton in the first chapter and experimented LED illuminants having full range of spectrum (400-700 nm) to be used for color measurement instead of incandescent lamps which are generally used. In this part author experimented two different instruments for measurements; one is the standard portable spectrophotometer and the other is telescopic system as is used for non-contact method. Enough experimental work has been done in order to derive conclusions. In the second chapter, Khan researched a novel approach for color measurement which is capable of eliminating drawbacks of HVI system. Noncontact method using telescopic system is used to measure the color variation in the cotton sample which is not possible by HVI system. In this chapter also digital color camera is used for measurement of color variation. After trials and experimental studies the results obtained from noncontact method are compared with the data obtained from HVI and Hunter Lab Miniscan XE. In this chapter it is concluded that non-contact method can be used for developing an instrumental approach for color measurement of cotton which is also capable of acquiring color variation as well. The third chapter is an extensive experimental work for examining visual grading approach. Author developed a novel improved HVI diagram for color grading which consists of three parameters instead of two used in classical HVI diagram. 24 cotton samples were used for the visual classification which consist of USDA standard cotton samples and Pakistani cotton samples. The visual

comparison is performed not only to grade the cotton but also it was performed to rank the cotton according to its whiteness. It is shown that the instrumental measurement of color and visual grading of cotton have some differences due to the presence of the trash particles. This finding leads to another very important chapter where a system is developed for cotton color measurement using digital color camera and using image analysis methods which eliminates thrash particle regions while measuring color.

A complete theoretical and experimental research work has been done in the dissertation in order to examine the parameters which can affect the proposed grading system. This indicates the student's expert and theoretical knowledge is sufficient for developing novel scientific research on the subject of cotton color measurement and developing a novel grading system.

The dissertation consists of 181 pages including table of contents, acknowledge, list of figures and tables, list of abbreviation, abstracts in English, Czech and Turkish, and body of the thesis consists of 6 sections in addition to back-matter including appendix, references and Curriculum Vitae of the author. Tables and figures are given clearly within the dissertation and contribute to represent the results of the experimental work. At the end of each chapter novel contributions are derived, results are discussed in addition to the overall conclusions given in section 6 "New Findings of the Research". Khan has made several publications in indexed journals in addition to oral and poster presentations in conferences.

I believe that Khan achieved main goals in his dissertation and his findings contribute the field with completely novel and original knowledge. The topic in this dissertation is very important not only for the scientific community but also for the whole cotton related industries in the world. The problem solving approach in this work and its presentation were scientifically sound.

Depending on my evaluation, I consider the PhD thesis "A Novel Method for Color Measurement of Cotton Fiber" is a valuable scientific contribution and I RECOMMEND the PhD THESIS FOR THE DEFENSE

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