Opponent's review

This opponent's review was elaborated based on prof. RNDr. Aleš Linka, CSc. (dean of Faculty of Textile, Technical University in Liberec) assignment for review Ph.D. dissertation thesis (ref. no. DFT/5003/2010, dated 26. 10. 2010) of **Rattanaphol Mongkholrattanasit, MSc.** entitled **"Dye Extraction from Eucalyptus Leaves and Application for Silk"**. Tutor of the PhD. student was prof. Ing. J. Kryštůfek, CSc., specialist supervisor doc. Ing. J. Wiener, PhD.

Above mentioned Ph.D. dissertation thesis forms broad scientific study on the latter topic of silk dying with natural extracts of the total 130 A4 pages split into 6 chapters. Thesis presented fulfills all requirements stated in "Study and execution order" of Technical University in Liberec published on 23. 9. 2009, paragraph 22 with respect to the composition and structure of the dissertation thesis requirements.

Dissertation thesis of Mr. Rattanaphol Mongkholrattanasit represent novel and wide set of data not available till present time in literature on basic coloristic and physico-chemical characteristics of natural Eucalyptus leaves extract based dyes. Due to the increased pressure both from customer as well as environmental legislation requirements globally, the study of natural product based dying systems and processes is at the forefront of the present research interests not only in textile industry but also in food stuff, cosmetics and medical research. That is why, the thesis presented brings vital information for eco-design approach needs for construction and application of environmental harmless (or environmental friendly) dying systems. As found by the author, leave extracts with combination with metal mordents (e.g. $FeSO_4$) have certain economical potential for industrial application in fabric dying of silk. There was found also UV protection factor increase for silk fabrics when Eucalyptus leaves extract based dyes where applied on fabric treatment. During the progress of the theses preparation the need of in detail analysis of color components of Eucalyptus leaves extract and of dyed silk and wool fabrics was essential scientific methodology used, based on optical color strength (K/S) and CIELAB spectrophotometric bases. As an addition the proper analytical characterization of individual dye chemical constituents was performed by means of HPLC and TLC analysis in combination with Mass Spectrometry and UV VIS spectrophotometry. Sets of calibration curves for spectrophotometric quantification of dying process were obtained and evaluated. Introduction and review parts were written brilliantly and vigorously deep with respect to the scientific and critical point of view for the qualified reader (totally 49 pages text, 165 references) covering detail description of chemical reactions describing dying process, individual chemical components description and in detail chemical and physico-chemical properties explanation for selected pH, ionic strength and temperature regimes. There were discussed the author´s views on ecological and economical aspects of dying with natural dyes – namely the padding technologies, in a separated chapter. Experimental part contains in detail information of all chemicals used, detail procedures and methods description. In the results and discussion part the comparison of data for silk and wool dying quality for different extraction conditions, such as stirring at room temperature, soaking for 24 hours, and extraction by reflux technique was offered. Finally the sorption characteristics were quantified both for silk and wool fabrics by means of determination of

adsorption isotherms. Mechanical, optical and durability properties of wide range of applied coating system combinations (such as pat-batch, pad-dry, mordant type etc.) where determined (e.g. color fastness to rubbing, color fastness to washing, color fastness to light etc.).

All scientific methods used and the overall scientific approach applied for this type of study is adequate to the up to date scientific knowledge. From the formal point of view, theses were written in excellent English language style and excellent graphical quality. I found only two errors: the first one on page 18, where the author states for cystine, that it contains two atoms of sulphur in its molecule, what is not correct (see also Table 2.6); the second one on page 57, row 7 from the top, where should be used not capital B in the term Between.

Based on the thesis, I would like to hear answers from the applicant on the following questions:

1. How would you explain the difference in measured K/S values obtained for wool fabric dyed with Eucalyptus leaf extract in comparison with silk (data shown in page 67)?

2. On page 93, the lower percentage of exploitation of Eucalyptus leaf extract dye on silk compared with wool was ascribed also to the greater crystallinity of silk in comparison with wool. Would you please explain in more detail the mechanism or the chemistry of this effect?

3. For better understanding and proper evaluation adsorption isotherm shown in Chapter 5.4 Fig. 5.8 would be preferable to plot adsorption isotherm in the form of $C_S = f(C_L)$, where CL is the equilibrium concentration of the dye after sorption expressed in mg/g units (meaning mg of dye per gram of the fiber). Can you redraw the latter graph with respect to this requirement and comment the result?

The author has published part of the data presented in the PhD. dissertation thesis in international scientific journals (6 publications totally, 4 published or accepted, 2 in press) such as J. Natural Fibers, Fibers and Polymers, RMUTP Research J., Fibres and Textiles in Eastern Europe, J. Textile Institute, in one book chapter and in the form of oral or poster presentations at scientific conferences (5 items).

Based on the latter mentioned facts and by the course of law (Higher Education Law No. 111/1998. Sb.) §47 I recommend to accept the PhD. dissertation thesis of Rattanaphol Mongkholrattanasit, MSc. for defense.

10.11.2010

In Zlín, November 10, 2010

prof. Ing. Lubomír Lapčík, Ph.D.

Professor for materials science and engineering
Tomas Bata University in Zlín

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Associate Professor Jakub Wiener
Technical University Liberec
Czech Republic
November 30, 2010

Dear Professor Jakub Wiener

I would like to inform you the evaluation of Ph.D. dissertation of **Rattanaphol Mongkholrattanasit, M.Sc.** as follows:

1. Evaluation of importance

The subject of the PhD dissertation is very informative in natural dyes and will be most beneficial for applied research and development of ecofriendly and sustainable textiles.

2. Opinion about the used methods of solving the problem

The research methods were well documented from various scientific literature. The appropriate methods for preparation and analysis of natural dyes based on the leaves of eucalyptus were well selected. The application for silk and wool fabrics dyeing by the use of two padding techniques, namely the pad-batch and pad-dry techniques were used for development of ecotextile products. The test methods and standards were internationally recognized.

3. Achievement of aims

Mr. Rattanaphol Mongkholrattanasit demonstrated an excellent level of knowledge and achievement for his project and aims. The outcome of this research can be applied to silk and wool textiles, especially modification of natural dyes for UV protection property of silk fabrics.

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4. **Discussion of results**

Mr. Rattanaphol Mongkholrattanasit was able to present their research results in a clear and concise fashion in good order. He demonstrated an outstanding ability to analyze and interpret their experimental results.

5. Evaluation of formal

This dissertation has been well written up and organized in academic writing way.

6. If you recommend (or not recommend) for defend

I highy recommend this dissertation be accepted for the defence process.

With best regards.

Khemchai Hemachandra

Associate Professor Khemchai Hemachandra, Ph.D.