

## **Opponent's Review Report**

**Thesis Title:** Biopolymer for Reduction of Cotton Flammability

**Thesis Author:** Muhammad Sajid Faheem, M.Sc.

**Study Specialization:** Textile Technics and Material Engineering

**Thesis Supervisor:** prof. Ing. Jakub Wiener, Ph.D.

**Opponent Reviewer:** doc. Ing. Stanislav Petrík, CSc.

The presented Ph.D. dissertation thesis comprises abstract, comprehensive 6 chapters (introduction – significance, scope and objectives, literature review, experimental part, results and discussion, conclusions and future perspectives), references, and a list of publications elucidating the different essential parts. This dissertation thesis deals with the study of applications of biopolymer material for flame retardancy, char formation, and intumescence effect for cotton fabrics, furthermore, as its impact on basic essential and desired properties of cotton fabrics. The research work is conducted by exploiting casein application on cotton fabrics just as it alone and in combination with other environmentally friendly materials for synergistic and/or hybrid effects. In particular, its application on cotton fabrics through non-hazardous solvents and/or solutions by utilizing simple, time-saving, and industrially applicable techniques/methods is also explored.

The selected theme is scientifically advanced signifying innovative trends towards the utilization of bio-based natural and renewable materials/products that have become of growing interest and gained significant importance because of their environmental friendliness. The dissertation thesis is written very well in good English and entirely understandable with minimum formatting mistakes and typing errors. The scientific content of the dissertation thesis is quite logical. The abstract summarizes the whole research work rationally. The introduction and the state-of-the-art are broadly discussed including a large literature survey representing the author's sufficient scientific background. The planned aims and objectives are understandable and well-defined. The experimental part designates the used materials and methodology in a systematic way explaining sufficient details. The solutions preparation processes, the samples development methods, and the characterization/testing techniques are appropriately selected and described with sufficient details. The attained results are discussed and concluded precisely to study and investigate the causes with specific reasons for observance of different functional properties. Overall, it can

be observed that the defined goals of the dissertation thesis are achieved together with the necessary focus on many other parameters. However, I would appreciate more structured and briefer conclusion part, with most significant achievements highlighted and prioritized.

The individual research work steps undertaken in this study are based on the current knowledge in the field and proved to be appropriate for this kind of studies. This research work confers very useful results that present a good contribution to the field of textile flame retardancy.

The author has published multiple articles related to thesis, there are 7 SI published articles and 5 book chapters which are published in well-recognized journals, author also represented his research in multiple conferences nationally and internationally.

During the defense student can answer the following questions:

- Can you please discuss consistency of bio-based flame retardant materials, especially in the context of reproducibility of parameters for potential industrial production of the processed textiles (the influence of variability of individual batches of raw materials).
- What is future of this work and how the results are comparable to products which are available in the market?

All things considered; it is concluded that this research work complies with the requirements for Ph.D. quality standards. Based on the above review, I do recommend this dissertation thesis submitted by Mr. Muhammad Sajid Faheem for final defense.

Ing.  
Stanislav  
Petrík,  
CSc.

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podepsal Ing.  
Stanislav Petrík,  
CSc.  
Datum:  
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Place and Date: In Liberec on May 30, 2023

doc. Ing. Stanislav Petrík, CSc.

## Opponent's review

This opponent's review was elaborated based on doc. Ing. Vladimír Bajzík, Ph.D. (dean of Faculty of Textile, Technical University in Liberec) assignment for review Ph.D. dissertation thesis (ref. no. TUL23/4814/014204, dated 4.4.2023) of **Muhammad Sajid Faheem, M.Sc.** entitled "**Biopolymer for Reduction of Cotton Flammability**". Tutor of the PhD. student was Prof. Ing. Jakub Wiener, Ph.D.

Theses presented represents complex experimental study focused on reduction of the cotton fabric flammability by application of natural biopolymers. Thesis presented from the formal point of view are composed of 143 pages (A4 format) text divided into 6 chapters. Thesis are written in English language in the form of the monograph. Thesis total references cited was 417. There were cited fundamental research articles as well as the latest publications.

Main objectives of the theses were the preparation of casein aqueous solutions of different concentrations for impregnation of tested fabrics for flame retardant treatment of the cotton and for characterization of the char formation properties for cotton fabrics. Furthermore there were studied flame retardant properties of different casein based coatings such as alkaline and acidic casein, combination of casein with ammonium polyphosphate and polyvinyl alcohol. Finally, the washing durability of casein treated cotton fabrics was studied as well. Wide range of physicochemical, structural analysis, thermal and mechanical properties characterization techniques were employed during the study.

Results of the thesis of the applicant Faheem were published in 13 scientific papers in scientific journals (8 of them were in impacted journals registered in WoS), 9 conference proceedings contributions and 5 book chapters. Due to the fact, that the thesis results were published in recognized scientific journals and underwent vigorous peer review process, I will not be evaluating again the scientific merit of the applicants research output. The quality of the results and their interpretation was approved already by the acceptance and publishing the results in the respected scientific international journals.

**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 Muhammad Sajid Faheem, M.Sc. for defense.**

In Zlín, May 2, 2023

  
Assoc Prof. Mgr. Barbora Lapčíková, Ph.D.

Associated professor for materials science and  
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