

Ph.D. Examiner's report on the Ph.D. thesis

KOMBUCHA LEATHER: PREPARATION AND CHARACTERISATION

Submitted by:

Hau Trung Nguyen, M.Sc.

to the Tomas Bata University in Zlín for the defence in partial fulfilment of the requirements for the Ph.D. graduation in Doctoral study program P3924 Material Sciences and Engineering, Doctoral study branch 3911V040 Biomaterials and Biocomposites.

Ph.D. thesis examiner **doc. Ing. et Ing. Ivo Kuřitka, Ph.D. et Ph.D.**

The Thesis submitted by **Hau Trung Nguyen** is composed of 227 pages, where the first five pages are not numbered, including the title page etc., followed by 116 numbered pages, including the text of the Thesis itself. Then, four papers published in relevant, high-quality journals in English, one conference full-text proceedings contribution, and one utility model in the Czech language are attached as well as the CV of the author. It is hard to classify this work as a monograph containing extensive published results annexes. Rather than that, it is a thematically arranged collection of the five publications and the utility model. The commentary of this collection is longer than one would expect. The structure of the Thesis, namely the order of chapters and distribution of the content among them, does not fully follow the traditional thesis text organisation established at the TBU. Nevertheless, all compulsory and usual parts and contents are present. The text requires certain immersion of the reader into its content to get a complete picture of the work reported. On the other hand, it must be noted that the candidate also submitted a Doctoral thesis summary, which is well organised according to the rules and is intended to be published via a standard doctoral thesis summary publication process, thus obtaining an ISBN code.

Once accommodating with the structure, the text is scientifically sound and rich in content. The first introductory chapter delivers a literature review on genuine leather production, bacterial cellulose (BC) and kombucha-derived bacterial cellulose (KBC), their production, modification and combination with polymers. The review is based on 194 carefully selected, mostly recent references, thus providing a comprehensive, up-to-date overview of the state-of-the-art. The literature is listed at the end of the text and includes references to the literature used in the second chapter entitled "Experimentation", so the total number of references is 210. The second chapter comprehensively describes used materials, preparation procedures, and analytical methods used throughout the works. Note the numbers of subchapters 4.4.9. and 4.4.10. pages 72 and 73, respectively, need to be corrected to 2.4.9. and 2.4.10.

The third chapter postulates the motivation for the presented study in four brief points. First, an old idea of artificial leather is revived, aiming in this case at a Kombucha-cellulose-based product with enhanced biodegradability, possessing the unique properties of genuine leather obtained via a simple, clean, and economically efficient process in pursuit of addressing the urgent requirements of the leather industry. The main issues that need to be solved in the compounding of hydrophilic cellulose and hydrophobic polymer components, as well as undisputable prospective advantages of the proposed solution based on Kombucha production of bacterial cellulose utilising bio-waste resources and its enhanced post-consumer biodegradability, are defined. Lastly, the proposed research novelty is assessed based on lacking reports on these topics in the literature.

The fourth chapter reformulates the motivation into one clear goal that can be achieved in four consecutive objectives. The discussion and overview of the published results are added to this chapter instead of being included as an independent core chapter of the Thesis. The discussion is comprehensive yet somewhat repetitive in many details that are not illustrated by any figures. Nevertheless, all that content, including images, graphs etc., can be found in the attached papers. Moreover, links between individual publication outputs are discussed, and the internal cohesion of the results and ideas within a general aim framework is demonstrated in a convincing manner.

The fifth chapter, Concluding remarks, gives us a two-page conclusion, a summary of contribution to society, and a short overview of ongoing plans.

There is no need to review the publication outputs in detail, as they passed the standard review procedures before publication or the reviewing is in progress, and it will be the candidate's role to deliver a convincing speech during the defence facing to all committee members. However, there is one point of critical importance that must be stressed. Since the dissertation has been submitted as a commented collection of papers, an unambiguous statement of the author's contribution to each of the works must be provided, as all presented publications have more than one author. Indeed, the four journal publications attached to the Thesis contain explicit Author contribution statements that follow Contributor Roles Taxonomy. The author's contribution to the conference paper and the utility model may be clarified at the occasion of the defence. Nevertheless, the small booklet of the Doctoral thesis summary lacks this indispensable part. I suggest indicating the author's contribution by adding his mental share as % in brackets after his name to the chapter "LIST OF PUBLICATIONS RELATED TO DOCTORAL THESIS" before the publication of the Doctoral thesis summary with the ISBN.

In no way did the above-summarised critical comments lower the relevant quality of the Thesis. Finally, I would like to put some questions to promote the discussion after Thesis's presentation:

(i) Breathability is mentioned among the advantages of your product. How was it estimated and quantified?

- (ii) Is there any local alternative for sisal fibre in the Czech Republic?
- (iii) What happens with the synthetic polymer part of the KBC-based leather during biodegradation? Isn't there any danger of the eventual formation of microplastics?

Verdict of the examiner:

In my opinion, the submitted Thesis fulfils all requirements imposed on a PhD thesis by the Law and The Study and Examination Rules of Tomas Bata University in Zlín. Therefore, I recommend the Thesis for defence, and upon successful defence Hau Trung Nguyen, M.Sc., to be awarded a doctoral degree, i.e. the title “Doctor of Philosophy – Ph.D.”.

In Zlín, 15th August 2022

Ivo Kuřitka

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