

Ph.D. Examiner's report on the Ph.D. thesis
NANOCOMPOSITES FOR MEDICAL APPLICATION

Submitted by:

Katerina O. Filatova, 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 programme: Chemistry and Materials Technology (P2808) Course: Technology of Macromolecular Compounds (2808V006).

Ph.D. Thesis examiner: **prof. Ing. et Ing. Ivo Kuřitka, Ph.D. et Ph.D.**

The thesis submitted by Katerina O. Filatova is composed of 147 numbered pages. The text advances from general facts about nanoparticles to specific issues of drug delivery systems and silica-based nanocomposites, followed by results and discussions. Some of the figures are of good quality, while others are poor, especially when containing embedded texts with too small fonts. Moreover, tables and schemes suffer from poor formatting, which makes them confusing (e.g. improper alignment in text boxes or cells, size of the fonts, gaps, figures split into two pages, figures and captions split, tables divided, etc.), and text formatting is not uniform. The reader has to adapt to the structure of the text. The level of written English is sufficient; however, typos are frequently present. Formally, it is highly advised to use predefined styles in the Word editor (template) and generate automatic content and other lists so that they may be updated in the thesis writing process whenever necessary. The lists of Figures, Schemes and Tables should have also pages included where the items can be found.

The literature survey, an important underlying part of any research, is presented in four main chapters. I recommend updating Chapter 2 with references published in the last 5 years to cover the recent advances in the field. Nevertheless, the chapter presents general knowledge. Chapter 3, Nanoparticles for Drug Delivery Systems (DDS), involves the description of organic, inorganic and organic-inorganic systems, and Chapter 4, Silica/PLA nanoparticles, is the most extensive, which is logical as it unequivocally presents the core of the Ph.D. thesis. Advantages of silica nanoparticles are described, as well as their classification according to structure, synthesis methods and NP formation influencing factors. These Chapters need text polishing and improvement in formatting rather than significant improvements in the content. Also, the list of citations should be upgraded, and more recent sources should be included in the literature survey.

Based on the summary of the above-described literature review, the author defined the gaps for further research in Chapter 5, which is a key opening the work to the reader. It is more understandable than the first three paragraphs in Chapter 6, where the aims of the dissertation are described. Nevertheless, the particular goals leading to the main aim are briefly overviewed in the last five points of Chapter 6, and the intended goals are articulated in an understandable manner. Here, just a small comment, it would be better to use another acronym than Si for silica, as Si normally means the element silicon.

Chapter 7 combines the experimental part with results and discussions, although these parts are usually presented separately. The amount of reported work is large. In the first part, the preparation of silica nanoparticles coated with chitosan and polylactic acid is reported for controlled delivery of doxorubicin, chosen as a model molecule. It was demonstrated how different types of controlled delivery systems with a wide range of release parameters could be

developed for both extended and short-term drug release. The second part of the study is devoted to the design and fabrication of mesoporous silica nanoparticles doped with aluminium for improved bioavailability of Methotrexate. The positive effect of the chosen approach was confirmed. Finally, electrospun PLA-based silica-modified composite nanofibers with antibacterial properties were prepared for perspective wound treatment. Amikacin was chosen as the model drug for the study. It was shown, that the incorporation of amikacin into silica nanoparticles with further embedding into nanofibers by electrospinning can be used to produce drug-loaded electrospun fibres with different release profiles of this hydrophilic drug. This approach has the potential for applying lower doses of antibiotics with the same or better effect in comparison with the application without the silica-based carrier. The conclusions in Chapter 8 briefly summarize the key results. Besides emphasizing the findings of the work, I have a general comment pertaining again to the presentation of the results. While the main part of the work is very rich in content, the presentation suffers from many drawbacks. Figure 31 on page 88 and the following explanatory paragraph can be cited as examples.

Concerning used literature, the author reported 123 mostly relevant references, yet some updates of the resources will be highly advised.

The text also includes the author's CV, including a list of publications with two main and three co-authorships and five conference contributions.

A list of symbols and acronyms is not attached. For instance, it would be nice to know without further searching that Ami stands for amikacin.

Verdict of the examiner:

In spite of all my critical comments, the submitted Thesis fulfils the requirements imposed on a Ph.D. 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, Kateryna Filatova will be awarded a doctoral degree, i.e., the title “Doctor of Philosophy—Ph.D.”

In Zlín,

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