

## **Doctoral thesis review**

Thesis title: Composite Materials for Medical Applications

Author: Ing. Michal Machovský

Reviewer: doc. Ing. Vladimír Sedlářík, Ph.D.

The reviewed doctoral thesis entitled “Composite Materials for Medical Applications” authored by Michal Machovský is written in form of a compilation of four manuscripts supplemented with the abstract, introductory text that puts the thesis into the context of the issue of medical applications of polymers and author’s CV including list of his publications. The thesis presents an accomplishment of the doctoral study carried out at Tomas Bata University in Zlin, Faculty of Technology within the study programme Chemistry and Materials Technology, study course Technology of Macromolecular Substances.

The introductory text is divided into 9 chapters. Chapters 1-6 bring a general overview of the field of polymers, medical devices, biofilms, control of infections related to indwelling medical devices, antimicrobial polymer systems, inorganic systems, and, finally, aims of the work are shown. Chapters 7-9 include the description of the materials studied and the techniques used, summary of the results and conclusion remarks. The literature sources can be considered relevant from both qualitative and quantitative point of view.

The attached manuscripts are intended for publication in international scientific journals. One of them (Paper II) has already been accepted for publication and three presented manuscripts are currently under review process.

There are several general comments relating to the thesis structure and its content:

Generally, the rendition of the thesis does not entirely follow Rector’s directive (SR 4/2012). In addition, quality of some of the figures is disputable (Paper IV). Figure 3 (page 34) is not shown at all.

The experimental part of the thesis (Papers I-IV) is mostly dedicated to the synthesis of ZnO based particles which have potential applicability as antimicrobial additives/fillers for polymer composites (Papers I-II). Only Papers III and IV describe explicit use of the developed fillers in polymer composite preparation. The research results presented in this thesis seem to be on the edge of the field of technology of macromolecular substances. Thus the author should put the introductory texts in context with what is further being presented, and also with the studied doctoral course and the introductory text should respond to that. In short, a deeper introduction into the area of polymer composites, antibacterial composites, inorganic antimicrobial systems and principles of their function could have been presented rather than providing too general information on polymers and medical devices.

The topic of antimicrobial modifications of polymers has been studied at the Polymer Centre already for several years. It is surprising that the author took account of this fact neither in the introductory text nor in the reference list.

Since the complete manuscripts create a part of the thesis, chapter No. 7 (Methodology) seems to be redundant.

Despite the above mentioned imperfections, it is evident that Ing. Michal Machovský has proved sufficient knowledge in the field of technology of macromolecular substances and their characterization. The outcomes of the conducted research are of significant scientific relevance and they can have potential applicability in practice. Thus, it is a pleasure for me to recommend Ing. Michal Machovský for the award of Ph.D. degree.

In Zlin, 13 August 2013

doc. Ing. Vladimír Sedlářík, Ph.D.

**Questions for discussion:**

- 1) In some cases, Zn compounds are known to initiate depolymerisation process during thermoplastic processing. Has this been studied in case of PVC within this work? In this context, are there any limitations for certain polymer matrices and/or processing techniques?
- 2) The ZnO based particles were incorporated into PVC matrix (Papers III and IV). What was the effect of the filler presence on surface properties of the resulting composites? Can the release of Zn or Ag (probably in form of ions) be expected from the composite surface?
- 3) In Papers I and II, significant attention is paid to syntheses of ZnO particles and their optimisations. Is there any relevant connection with preparation process of ZnO/Ag particles presented (Paper IV)?
- 4) Can you estimate a price of ZnO and ZnO/Ag fillers and compare it with commercially available additives?
- 5) Nowadays, there is a concern of nano-silver use. Please add your own comment on that.