

FROM: Miroslav Raab, Professor of Macromolecular Technology
SUBJECT: Report on Doctoral Thesis
**“Antibacterial Modifications of Polymers by Using Metallic Compounds”
or in Czech:**

“Antibakteriální úpravy polymerů pomocí sloučenin kovů”

submitted by

Tsermaa Galya

to the

Tomas Bata University in Zlín

DATE: January 12, 2009

OPINION: Recommended

The thesis is basically composed of a series of four original scientific papers totaling 75 pages. Two of them have already been published in renowned scientific journals, one submitted and one prepared for submission. Obviously, these papers contain also material produced by someone other than the candidate, however Tsermaa Galya appears as the first author at all four articles. This indicates her substantial contribution to the experimental results of this work and their interpretation.

The set of articles is introduced by abstracts in English and Czech and a comprehensive general introduction on antibacterial polymeric systems. (The author uses an abbreviation APS.) The well written introduction provides on 36 pages the reader with a lot of useful information concerning the antibacterial activity of several metals, including zinc, titanium and platinum and their compounds. Incidentally, this part would deserve a publication of itself (in cooperation with the supervisor), perhaps as a review article.

The four original papers representing the basic part of the thesis are devoted to the issue of the antibacterial modification of materials based on poly(vinyl alcohol). Several metallic modifiers were used: silver nanoparticles (paper I), silver nitrate (paper II), zinc nitrate (paper III) and zinc sulphate (paper III). Of course the level of the papers varies slightly but overall, the standard is good and papers I and III (already published) are excellent according to my opinion. Obviously, the thesis constitutes a part of a general research project at the Tomas Bata University in Zlín aiming at the development of better polymeric materials for medical application, The valuable support from the supervisor and consultant is here obvious.

In sum, the thesis represents an important original contribution to the development of an interesting class of polymeric materials. In particular, it is interesting that relatively low concentration of the modifier (e.g. silver particles) can have a significant antibacterial effect. In such a case mechanical behavior is affected but slightly. Two of the papers within the thesis have already passed peer review and have been published. This shows originality and scientific level of these papers. The obtained original results and developed laboratory techniques will surely be useful for the future research at the Faculty of Technology of the Tomas Bata University in Zlín.

I have some questions to the author that can initiate discussion during and after the defense.

- (1) A hydrophilic polymer, poly(vinyl alcohol), has been used as the experimental material throughout the study. What is known about antibacterial modifications of *hydrophobic* polymers?
- (2) Can biocompatibility of the polymer be affected by the presence of metallic compounds?
- (3) Can you estimate an average distance, to which the antibacterial effect of an individual antibacterial particle or domain is expressed?
- (4) Figs 10 and 11 (pp. IV-33, 34) show different trends of the antibacterial activity of zinc sulphate on two different bacterial strains. Can you explain the difference?

These questions do not deny the good standard of the presented thesis. The candidate, Tsermaa Galya, has proven an expertise both in polymer materials science and microbiology, originality and independence in her scientific work. Besides, the amount of work is quite substantial. I recommend the thesis for the award of PhD. degree by Tomas Bata University in Zlín.

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