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SUBJECT: Report on Doctoral Thesis

**“THE INFLUENCE OF SURFACE PROPERTIES OF MATERIALS ON BIOFILM
FORMATION”**

submitted by
Eng. Nikola Mikušová

OPINION: Recommended

The thesis entitled “The influence of surface properties of materials on biofilm formation” written by Nikola Mikušová summarizes her research on biomaterials, including conducting polymers and oxide nanostructures as well as modification of their surface. Special attention was paid to the interactions with biological objects - biofilm-forming bacteria and fungi.

The thesis is divided into the 7 chapters. The structure is logical and the chapters are linked to each other. The thesis is written in 135 pages including 40 figures and 275 references. Overall structure of the thesis is in agreement with the rules for the doctoral thesis.

In the first part of the thesis, “Introduction”, conducting polymers, their biological and surface properties are introduced. This part provides insight to two main fields, material chemistry and microbiology. Within this part, a sufficient number of recent references were used and the chapter itself provides a comprehensive overview of the studied topic. Within some paragraphs, the information are provided repeatedly and more general while some important information could be described in more detailed. More details could be provided on oxide based nanostructures and pigments used in the research. Generally, the introduction provides sufficient overview into the studied topics.

The next paragraphs are “Methodology” and “Results and discussion”. The methodology part is written comprehensibly. Besides conducting polymers with different modifications and coatings, titanium nanotubes were prepared and further tested. This part indicates that the student co-operated closely with other groups, both within Czech Republic and abroad. Regarding biological testing two methods were described as novel and introduced by the student in practice of the laboratory where the research have been performed. In this context more details on standardization and adaptation of the methods to tested materials could be described. More information should be provided on references, controls and testing non-specific interactions. Along with novel, standard methods were also used for characterizing materials and evaluate their biological activities.

Within “Results and discussion” part there are four segment of research: synthesis and chemical modification of polymers, plasma-assisted physical modification of polymers, incorporation of pigments into polymers and titanium oxide nanostructures formation and surface modification. All four parts are followed by description of the investigations with biological objects. Some paragraphs are written a bit incomprehensibly with too long introduction and without specific discussion. Nevertheless, the results are original and extensive. The applicant has focused mainly to the biofilm formation study. To obtain these result, time-consuming methodologies which require lot of tedious work were employed. It is worth noting that these results extend the knowledge of biofilm formation on conducting

polymers. Evidence of this fact is that these results were published in international journals. Specifically, the applicant is main author of two articles and co-author of another two articles.

Concluding remarks summarized in last three chapters outline performed work and put it in a context of contribution to the science and future perspectives. Although more details are needed on how investigated four topics conjugate into universal conclusions, provided information clearly show the extent of broadening the knowledge in area of surface modification and specific biological outcome reached by the research performed within this dissertation. Applicant fulfils the aims of the work and contributes decisively to the research of interaction between the conducting polymers and biofilm forming microorganisms.

The candidate has proven an expertise, originality and independence in her scientific work. Besides of that, the amount of work is quite substantial. **The submitted doctoral thesis fulfils all requirements** given by Tradition, Law and by The Study and Examination Rules of Tomas Bata University in Zlín as Ph.D. qualifying paper **and therefore I recommend approval of the paper for further needful assessment.**

In Ljubljana, Slovenia

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Marija Vukomanovic