

Reviewer's Dissertation Thesis Report

University	Tomas Bata University in Zlín
Faculty	University Institute
Study program	Materials Science and Engineering
Ph.D. student	Ilkay Karakurt, MSc.
Doctoral thesis	Preparation and characterisation of saccharide-based antibacterial coatings
Supervisor	doc. Ing. Marián Lehocký, Ph.D.
Consultant	Kadir Özaltın, M.Sc. Ph.D.
Reviewer	doc. Mgr. Pavel Šťáhel, Ph.D.

Ilkay Karakurt's doctoral thesis aims to develop a technique for creating saccharide-based bioactive coatings, especially for biomedical applications. Polylactic acid (PLA) was used as a substrate on which various bioactive layers were deposited. In the first study, plasma-activated PLA substrates were coated with the poly (acrylic acid) brush and then glucosamine (GlcN) and/or chondroitin sulfate (ChS) film. In the second study, PLA was directly or with a carbodiimid agent coated with chitosan (CS) and chondroitin sulfate. These bioactive systems were studied using different laboratory techniques to determine their morphology, chemical composition, and surface properties. Prepared samples were also tested for their antibacterial properties on *E. Coli* and *Staphylococcus aureus* model microorganisms. Inhibition and cytotoxicity tests were also done.

The doctoral thesis consists of three parts:

The *Introduction* briefly describes general information about biomaterials and antibacterial materials.

The *Theoretical part* is focused on the more detailed description of biomaterials, surface activation methods, antibacterial coatings, biofilm formation and used saccharides.

The first part of the *Experimental* part is dedicated to the sample preparation. Basic principles of the characterisation techniques and assays used in this work are also described in this part. The second part of the *Experimental* part shows the surface characteristics of obtained bioactive systems. The contact angle measurements, SEM imaging, XPS spectra and chemical composition results are presented. The biocompatibility and antibacterial tests of PLA coated with GlcN and/or ChS are also assessed here. The third part of the *Experimental* part shows the results obtained with the chitosan and chondroitin sulfate, including the sample characteristics. All results are well discussed at the end of each part.

The dissertation thesis concludes with a summary of work done, a list of references, a list of author's publications, and a list of figures, tables and abbreviations.

The dissertation thesis contains only a small number of spelling, stylistic and other errors, e.g., p.p. 65: contact angles are given in %, missing reference at figures 19, 21 and others. References of used literature are not in a uniform format. The author achieved interesting results in depositing layers with different bioactive properties where the properties of samples are close to actual application requirements. There are targeted experiments to improve the properties of PLA samples utilising bioactive layer applications. However, the effort is missing to optimise the layer properties and the plasma pre-treatment process (perhaps just a note that this was done).

Conclusion:

Despite some reservations about the reviewed dissertation thesis, I assume that the work of Ilkay Karakurt entitled "*Preparation and characterisation of saccharide-based antibacterial coatings*" fulfils the requirements for a PhD thesis in the field of Chemistry and Materials Technology at TBU. I am recommending the dissertation thesis for defence and acceptance as a basis for awarding the author the PhD degree.

Questions of the reviewer:

1. You have obtained excellent properties of bioactive films. Please discuss the possibility of optimisation of each deposition process (thickness, concentration of precursor solutions, time and temperature during the deposition process) and how you have chosen plasma conditions and plasma treatment times.

2. Discuss the importance of adhesion layers to the substrate for a given application. Have you carried out adhesion tests?

In Brno 31.7. 2022

doc., Mgr.
Pavel
Sťahel,
Ph.D.

Digitálně
podepsal doc.,
Mgr. Pavel Sťahel,
Ph.D.
Datum: 2022.08.03
12:25:46 +02'00'