

Review of the Doctoral Thesis

“Utilisation of whey fermentation products for antimicrobial modification of biodegradable polymers”

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This Thesis written by Ing. P. Holčapková covers the work on development of biodegradable polymers with antimicrobial modification through the utilization of bacteriocin nisin. The developed systems result in formation of polymer films or core-shell porous microparticles composed of polylactic acid supplemented by polyethylene glycol or polyvinyl alcohol as a substrate for the natural nisin variant isolated from *Lactococcus lactis*. These systems have been tested for their mechanical and chemical properties, antibacterial activity, nisin releasing in time and thermal stability. This Thesis sets out to provide biodegradable polymers with antimicrobial properties which can be produced using mass production processing technology.

I am pleased to conclude already at this part of the review that this ambition seems to have been achieved.

The Thesis is written in a form of a monograph and consists of about 110 pages, quoting 213 references mainly from the last ten years, and it is based on the results of 2 publications printed in impacted journals and one submitted for publication; in all of these publications the applicant is the first author. The Theoretical Background has an expected structure and provides comprehensive information on the topic of biodegradable polymers, the application potential of the whey, relevant information about bacteriocin nisin followed by antimicrobial modification of polymers. After the necessary Experimental part the Results and Discussion part addresses the topic of the Thesis thoroughly, namely it describes the following topics:

- Effect of polyethylene glycol plasticizers on long-term antibacterial activity and release profile of bacteriocin nisin from polylactide blends.
- Thermal stability of bacteriocin nisin in polylactide-based films.
- Core-shell PLA-PVA porous microparticles as carriers for bacteriocin nisin.

The text is fluent, written in a logical and clear way, a number of misprints or incorrectness is minimized. Nevertheless, a lot of rather long passages from the applicant's attached papers, which is also atypical of a monograph type of thesis, repeats throughout the Thesis.

As Ing. Holčapková concludes, the Thesis deals with novel approaches to modification of biopolymers in order to achieve a biodegradable material with antibacterial properties, which is a highly coveted topic nowadays.

The following questions may be discussed during the Thesis defense:

1. Which methods could be used for the evaluation of the degree of crystallinity for polymer materials besides the DSC, which was used in this Thesis?
2. Could the applicant comment on the number of independent tests in the most important (release study, antibacterial activity) experiments?
3. What was the antibacterial efficiency of PLA/PEG1000/Nisin sample in comparison with other substances presented in the Table 14?
4. Is it possible to apply the time–temperature superposition principle in Chapter 3.2?
5. The presence of PEG within the investigated samples seems to have a positive influence in the Chapter 3.1 but a negative one in the Chapter 3.2. Could the applicant decide which one is more relevant from the practical point of view?

In summary, the submitted Thesis of Ing. Holčapková meets the academic standards of a PhD thesis. I am glad to recommend it, without reservation, for public defense in a disputation and, after that, to present Ing. Holčapková with the degree Doctor philosophiae.

Zlín, 20th November 2018



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