

Evaluation report on dissertation thesis  
**Composite materials based on polysaccharides**  
by Ing. Simona Káčerová

BRNO, August 15, 2023

The doctoral thesis deals with preparation and functional analysis of composite materials based on hyaluronic acids, chitosan and polypyrrol substances. The introductory part provides basic facts on tissue engineering, properties of hydrogel biomaterials, finally it overviews both synthetic and natural polymers. The text is well written and supported by appropriate number of references.

*Here are some formal comments to this part:*

1. For non-experts in this field (as me) it would be beneficial to include short summary on methods employed for measurements of mechanical or functional properties of biomaterials, just simple principles.
2. In Fig. 7 the scales of SEM images the scale is missing.
3. Fig. 13 shows according to caption collagen type II, but I think it is just primary structure of single strand. It needs clarification.
4. The structure of HA building unit in Fig. 17 seems to be in-correct: please show right connection and stereochemistry. Also numbering of pyranose ring should be included. Also formula of chitosan in Fig 15 is represented in nonstandard way.

The aims of this work are clearly formulated and discussed in a form of short summary, details are presented in two manuscripts prepared for submission, where the Ph.D. candidate is the first author.

*Here are some questions related to discussion of results:*

1. For characterization of particle size of PPy colloids DLS and TEM methods were used. Is it possible to correlate the results at least semi-quantitatively? Which of method is more relevant for functional studies?
2. Fig 21 shows the dependence of storage modulus ( $G'$ ) of HA hydrogel crosslinked via cysteamine. What is the physical meaning  $G'$  expressed in Pa.s units? How to interpret practically constant value for span of stress frequency 1-10 Hz? Addition of  $H_2O_2$  decreases storage module significantly, what might be the reason?
3. The surface positive charge of newly synthesized materials determines the antimicrobial activity. What is the exact mechanism – just immobilization of bacterial cell due to electrostatic attraction, is analogous to usage of silver nanoparticles? What is the role of cell wall composition in case of different bacterial species? Could the author show whether it is possible to tune positive charge in case of PPy/PVP colloid system, what is the exact chemical mechanism?
4. When a potential immunomodulatory activity is discussed in context of PPy, the importance of antioxidant effect is evaluated. Could be the efficacy compared with another compounds (e.g. ascorbic acid, reduced glutathione, carotenoids, flavonoids)?
5. The results of project 2 and 3 seems to be finalized, what is perspective of their publication or are any additional analysis going on still?

**CONCLUSION: The doctoral thesis by Ing. Simona Káčerová fulfills the formal requirements for obtaining PhD degree. The student has demonstrated her creative abilities in the relevant research area I recommend the work for the defense.**

Mgr. Jan Novotný, Ph.D. Masaryk University, Brno