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DISSERTATION THESIS REPORT

Name of the PhD candidate: **M.Sc. Zahra Yadollahi**

Supervisor: **Prof. Ing. Petr Sáha, CSc., Dr.h.c.**

Consultant: **Prof. Natalia Kazansteva, M.Sc., Ph.D**

Title of the thesis: **Biopolymer-Based Nanocomposites as Drug Delivery System**

The dissertation thesis of Zahra Yadollahi is focused on the **fabrication of innovative stabilized Polyelectrolyte nanoparticles using whey protein isolate and chitosan as a drug delivery system**. The main aim of the dissertation thesis was to coat the whey protein isolate core with chitosan shell and stabilize it with tripolyphosphate as crosslinker, leading to high encapsulation efficiency and sustained release of the chemotherapeutic drug doxorubicin. The topic of the dissertation is **very actual**, due to the targeted delivery of drugs is currently of great importance of the research.

The thesis is divided into 5 chapters. The first 43 pages contain the introduction to the topic, description of the Polyelectrolyte nanoparticles as a nanodelivery system and the literature review on chitosan-whey protein isolate structure. The Introduction contains the motivation of the submitted dissertation and information about developed material. The theoretical part of this dissertation establishes a robust foundation for the empirical analysis. By systematically reviewing existing literature, evaluating relevant models, and contextualizing the research problem, it ensures the study is both theoretically grounded. The literature cited in the thesis is comprehensive and relevant to the research topic. Thesis is terminated with a list of references, mainly international journals and books – 190 citations.

In general, the text is written in a very good English with only few minor errors which does not reduce the quality of the text.

Publication activities of the author are average. M.Sc. Zahra Yadollahi is the first author of 1 current content article according to Scopus. Also, she is the co-author of 1 other article. The author attended one international conference in Switzerland where the results of her research were presented. She also attended internal competition mobility scholarship of Tomas Bata University in Zlín for international collaborations in University in Waterloo in Canada.

The objectives of the thesis are clear. Experimental procedures, methods, and results are summarized in chapter 5 spanning only **17 pages**. While this section provides the core findings of the study, its length can be considered **relatively small** considering that it is a dissertation thesis. In the future, I would recommend dividing the Methodology and results sections into separate chapters. In the case of the Materials section, I would recommend standardizing the presentation of the countries and locations of individual suppliers.

I have the following questions and comments regarding the dissertation thesis:

1. Please explain the statement from Chapter 5.2, where you mentioned that various ratios of CS and WPI were mixed (1/1, 1/2, 1/4, 1/6, 1/8, and 1/10), followed by the addition of different amounts of TPP (0.05, 0.075, 0.1, 0.125, 0.2, 0.4, and 0.6). However, the thesis does not further elaborate on how you determined which ratio of CS and WPI was the most suitable for further use. Can you please explain it? Did you add different amounts of TPP to all samples with various ratios of CS and WPI? Does this mean there were a total of 42 samples?
2. In Chapter 5.3.1 „Effect of pH and concentration on hydrodynamic size “you mention: Finally, the PENs were synthesized in the presence of TPP at a concentration of 0.075 and pH 8. What was the basis for selecting this concentration of TPP? Can you please provide results based on which you choose exactly the preparation conditions?
3. It is not completely clear to me why did you chose WPI at pH 7 for further analysis since at mentioned pH the size of WPI was not smaller one. Can you please explain it?
4. In Chapter 5.3.5 “Colloidal stability analysis” you provided studies for 29 days. It would not be appropriate to follow it for a longer period?
5. In Chapter 5.3.6 “Drug loading and *in vitro* release assay of PENs” you realized the experiment to calculate encapsulation efficiency (EE) and loading capacity (LC). Based on the given procedure 3 mL of the medium with DOX-loaded PENs was taken in regular intervals and the UV-VIS spectrophotometry was utilized to measure the concentration of doxorubicin. Can you please specify the term “regular intervals” and how many measurements did you do? You also meant that various influences like temperature of the medium, pHs etc. for drug releases. Did you study some of these influences towards doxorubicin release?

Despite the smaller scale of the given dissertation thesis, unclear statements, and some missing experiments, which I would recommend doing in near future, the thesis meets the requirements set for a dissertation. After successful defence of this dissertation thesis the author shall be awarded with the title PhD. and I also recommend classification grade for the exam “passed”.

In Košice, 22.11.2024

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