R E P O R T

by

Prof. Dr. Daniela Bogdanova Karashanova

member of the Academic Jury set to render a decision on a procedure for the acquisition of Academic Degree ("Doctor of Philosophy" (PhD)
in the Professional Field 4.2. Chemical Sciences according to the Classifier of the Areas of Higher Education and the Professional Fields (Scientific Specialty "Polymers and Polymer Materials")

Author of the dissertation: Ina Borislavova Anastasova

Topic: Electrospun hybrid materials of poly(L-lactide-with-D,L-lactide) and chitosan derivatives with directionally patterned design for potential applications in biomedicine and for photocatalytic water purification

Scientific supervisors: Prof. Dr. Olya Stoilova
Prof. Dr. Milena Ignatova

This Report is prepared in response to Order № RD-09-182 of 02.12.2025 issued by the Director of the Institute of Polymers, Bulgarian Academy of Sciences and is in accordance with the requirements of the Act on the Development of the Academic Staff in the Republic of Bulgaria (ADSRB) and the Regulations for its implementation, as well as in the relevant regulations for the implementation of the ADSRB at BAS and at the Institute of Polymers - BAS.

1. Analysis of the dissertation.

The presented dissertation is described on 123 standard pages and is structured in the following 7 separate parts: Introduction, Literature review, Aim and objectives, Results and discussion, Description of the experiment, Conclusions, Scientific contributions and future directions. It is accompanied by a list of references, covering 323 sources. It contains 35 figures, 2 schemes, a list of abbreviations used and a list of publications, citations and scientific communications reflecting the results of the dissertation.

In the introduction and review of scientific literature, which constitute half of the volume of the dissertation, the advantages of the main synthesis method used - electrospinning and biopolymers - as a modern, ecological alternative to the conventional polymers widely used in our everyday life are highlighted. The large number of literature sources reviewed on the topic speaks of the relevance of the problems posed. Based on the traditions, rich experience and accumulated knowledge in the field of electrospinning of biopolymers, a niche of new, unexplained problems has been found in the Laboratory of Bioactive Polymers of the Institute of Polymers of the Bulgarian Academy of Sciences, which are the subject of the dissertation, and the goal and tasks are clearly formulated and precisely implemented. In the literature review, an important place is given to two significant biocompatible and bioactive polymers: chitosan and polylactic acid, as well as their derivatives - quaternized chitosan and its Schiff bases, and the copolymer poly(L-lactide-with-D,L-lactide) (PLDLLA). Previous studies of complexes with metal ions, as well as nanoparticles of zinc and iron oxide, their properties and the applications they have found are also reviewed.

The results of the experiments are described in one third of the volume of the dissertation. They relate, on the one hand, to the synthesis of the studied materials, respectively: the Schiff base of chitosan with 8-hydroxyquinoline-2-carboxaldehyde, the quaternized derivative N,N,N-trimethyl chitosan iodide, the fibers, both from the starting biopolymers and their derivatives, and also to hybrid fibers containing complexes with copper and iron ions or containing nanoparticles of zinc oxide or iron oxide. A large part of the results relates to the characterization of the structure, composition and some properties of the studied systems, as well as to proving the

possibility of their application in systems with antibacterial and antitumor activity and for photocatalytic purification of water from organic pollutants.

The results of the dissertation have been published in 2 articles in the journal *Polymers* with IF=5.0 and 4.9 for 2022 and 2024, respectively and quartile Q1 and have received 14 citations to date, which undoubtedly proves the relevance of the topic and the significance of the results obtained. In one publication, the doctoral student is the first author, and in the other she is in second place, which reflects her role in the experiments and analyses conducted. In addition, Ina Anastasova has personally presented her work at scientific events with 9 oral and 6 poster presentations and has received 4 awards, including the "Prof. Ivan Shopov" award for an outstanding young scientist in the field of polymers.

The scientific contributions reflected in the dissertation are both fundamental and applied in nature. The first type includes the first synthesis of a Schiff base of chitosan with 8-hydroxyquinoline-2-carboxaldehyde, which opens up new possibilities for modifying biopolymers with targeted functionality. The applied contributions include the developed original approach for obtaining a set of hybrid fibrous materials from PLDLLA and chitosan derivatives by combining electrospinning with various techniques for structural and functional modeling - electrospinning and subsequent complexation with Cu^{2+} and Fe^{3+}, as well as its combination with electrospraying of ZnO and Fe_2O_3 for application in biomedicine and in the photocatalytic purification of water containing organic pollutants, respectively.

2. Critical notes and recommendations.

I have no critical remarks about the work of doctoral student Ina Anastasova. It is commendable that, based on the acquired experience and knowledge, she has a vision for the further development and continuation of research on hybrid materials with the studied and similar compositions and finding their applications in biomedicine and ecology.

3. Conclusion.

The dissertation submitted to me for review is a detailed study on the synthesis, morphology, structure, thermal, surface, antibacterial and photocatalytic properties of hybrid fibers obtained from two types of biopolymers and their derivatives by two strategies of electrospinning and electrospraying. The experimental synthesis methods, the type of polymers and complexes used and the electrospinning conditions, as well as the analytical methods are precisely selected in order to obtain composite materials with a certain composition and design, to prove their good antibacterial and photocatalytic properties. These properties, combined with the biocompatibility of the polymers used, determine the potential of the obtained composites for application in innovative systems in biomedical and environmental applications.

The achieved results have been published in a sufficient number of scientific publications, all with an impact factor, which provides the necessary number of points required by the Act on the Development of the Academic Staff in the Republic of Bulgaria (ADSRB) and the Regulations for its implementation under this criterion. **Therefore, I fully recommend to the esteemed members of the Academic Jury to render a positive decision for the acquisition of the Academic Degree PhD in the professional field 4.2 Chemical Sciences, specialty Polymers and Polymer Materials on Ina Borislavova Anastasova.**

09.02.2026 Report prepared by: .....

/Prof. Dr. Daniela Karashanova/