R E P O R T

by Prof. Dr. Darinka Christova,
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: Selin Erdinch Kyuchyuk-Hyusein, Institute of Polymers - BAS
Topic: "New eco-friendly electrofibrous polymer materials with fungicidal activity"
Scientific supervisors: Assoc. Prof. Dilyana Paneva, D.Sc.
Prof. Iliya Rashkov, D.Sc., corr.-member of BAS

This Report is prepared in response to Order № РД-09-125 of 01.10.2025 issued by the Director of the Institute of Polymers, Bulgarian Academy of Sciences (IP-BAS), following the decision made by the Academic Jury that was held on 26.07.2022. The Report is in compliance with *Development of Academic Staff in the Republic of Bulgaria Act* (DASRB), the *Rules for the Application of the Development of Academic Staff in the Republic of Bulgaria Act*, the Rules of BAS and with the Rules set at the Institute of Polymers, Bulgarian Academy of Sciences, for applying the Act aforementioned.

The documents presented by Selin Erdinch Kyuchyuk-Hyusein in the procedure fully comply with regulatory requirements. His academic achievements fulfil and significantly exceed the minimum national requirements for acquiring the educational and scientific degree "doctor" (PhD) under Art. 2b, para. 2 of DASRB.

The dissertation work of Selin Kyuchyuk-Hyusein is written on 148 pages, contains all the normatively required sections and includes 9 tables, 68 figures and 3 schemes. Cited literature covers 132 sources, the majority of which were published in the last 15 years. The overview of the state of the problem briefly discusses the theoretical foundations of the process of electrospinning of polymer solutions and the devices used for this purpose. Main attention is paid to the approaches to obtaining fibers with complex architecture - electrospinning using a coaxial or multi-nozzle system, as well as electrospinning of mixed solutions using a single-nozzle spinneret. The properties of selected biocompatible and biodegradable polymers are examined in detail with a view to obtaining innovative composite materials by electrospinning. The properties of beeswax and the possibilities for developing fibrous materials containing beeswax are discussed. Here I would like to note that the unclear numbering in the cited literature, as well as the inconsistent numbering of the subsections (e.g. after section 3.2.4.2 follows 3.4, and then - 1.4) make the review difficult to read. However, a good impression is made by the formulation of conclusions summarizing the review of the current state of research on obtaining core-sheath fibers by electrospinning without the use of an auxiliary device for coaxial electrospinning. Thus, the purpose of the

research in the dissertation is justified and the appropriate polymers for the construction of electrospun materials with controlled fiber architecture are identified.

The aim of dissertation is clearly defined: to find suitable conditions for obtaining composite fibers with core-sheath architecture by electrospinning of PEO/beeswax or PEO/polyester/beeswax homogeneous solutions without the use of an auxiliary device for coaxial electrospinning. The identified tasks are logical in order to achieve the main goal, and also include the study of the possibilities for potential application of the obtained fibrous materials as carriers of biologically active substances with antibacterial, antifungal and anticancer activity.

The experimental results of the conducted research are systematized in 4 chapters, dedicated respectively to: 1) fibers with a "core-sheath" architecture of PEO and beeswax, obtained by electrospinning of homogeneous solutions; 2) fibers with a "core-double sheath" architecture of PEO, PLA and beeswax, obtained by electrospinning of homogeneous solutions; 3) fibers with a "core-double sheath" architecture of PEO, a PLA substitute (PCL, PLAGA, PBS or PHB) and beeswax and study on the influence of polymer molar mass characteristics on the fiber morphology; and 4) study on the antibacterial, antifungal and anticancer activity of the obtained fibrous materials loaded with biologically active substances (5-chloro-7-iodo-8-hydroxyquinoline, 5-nitro-8-hydroxyquinoline).

The main contributions of the dissertation can be defined as scientific and scientific-applied and refer to the development of innovative composite fibrous materials made of fibers with a "core-sheath" or "core-double sheath" architecture by electrospinning of homogeneous solutions without the use of an auxiliary device for coaxial electrospinning. For the first time, fibers with "core-sheath" architecture are obtained by electrospinning of homogeneous solutions of PEO and beeswax. Also, fibers with "core-double sheath" architecture are obtained for the first time by electrospinning of homogeneous solutions of PEO, polyester (PLA, PCL, PLAGA, PBS or PHB) and beeswax. The influence of molar mass characteristics of PEO and polyester on the fibers morphology is investigated. The possibilities for potential application of the developed new fibrous materials loaded with biologically active substances in the field of medicine or "green" agriculture are demonstrated. The conclusions of the dissertation, comprehensively formulated, are correct as they fully derive from the experimental results and well supported by scientific outcomes.. The final section outlines the contributions of the dissertation in the context of further development in the scientific field.

The results of the research carried out in the frame of present dissertation are summarized in 5 papers published in renowned international academic journals: one in *Macromolecular Bioscience* (IF 5.859, Q1), one in *Polymers* (IF 4.967, Q1), one in *Journal of Applied Polymer Science* (IF 2.8, Q2), as well as two articles in *Materials* (IF 3.748, Q2). Selin Kyuchyuk-Hyusein is the first author in all publications. An excellent certificate for the relevance of the topic of the dissertation and the level of the conducted scientific research are the reported 20 citations of the papers on the dissertation (according to Scopus data as of 10.11.2025), with each of the publications receiving reviews in the scientific literature. Parts of the dissertation are presented by Selin Kyuchyuk-Hyusein as 3 oral and 2 poster communications at national and international scientific forums.

I have personal impression of the work of Selin Kyuchyuk-Hyusein and am convinced of her particular contribution to the research. The dissertation is developed in the traditions and based on the long-term experience of the Laboratory Bioactive Polymers at the Institute of polymers, BAS, in the development of innovative fibrous materials. I do believe that the knowledge and skills acquired during the doctoral studies are a good basis for a successful scientific career of Selin Kyuchyuk-Hyusein.

Conclusion

The dissertation work of Selin Kyuchyuk-Hyusein contains original scientific and scientific-applied contributions in the field of innovative polymer fibrous materials with potential application in medicine and agriculture. I am confident that the scope and contributions of the presented scientific research fully satisfy the requirements of the ZRASRB and its implementing regulations, as well as the criteria for obtaining scientific degrees within BAS and IP-BAS. **Based on all of the above, I give a positive evaluation of the dissertation and support awarding the educational and scientific degree of "Doctor of Philosophy" (PhD)** in Professional Field 4.2. Chemical Sciences (Scientific specialty Polymers and Polymer Materials) **to Selin Kyuchyuk-Hyusein.**

Sofia, 14.11.2025

Prof. Dr. Darinka Christova,
Member of the Academic Jury