

REVIEW

by Prof. Petar Dimitrov Petrov, Institute of Polymers of the Bulgarian Academy of Sciences member of the Academic Jury set to render a decision on the competition for occupying the academic position "Professor" in Professional Field 4.2. Chemical Sciences (Polymers)

The review was prepared in response to the Order No. RD-38-162 from 06 April 2023 of the Rector of Sofia University "St. Kliment Ohridski" and the decision of the Academic Jury from the meeting held on 23 May 2023.

The only candidate in the competition for the academic position "Professor" in Professional Field 4.2 Chemical Sciences (Polymers) is Assoc. Prof. Dr. Elena Dimitrova Vassileva from the Department of Pharmaceutical and Applied Organic Chemistry at the Faculty of Chemistry and Pharmacy, Sofia University "St. Kliment Ohridski". She has submitted a complete set of documents in accordance with the Act on Development of the Academic Staff in the Republic of Bulgaria (ADASRB) and the Rules for applying ADASRB, and in accordance with the Art. 117 of the Regulations on the terms and conditions for acquiring scientific degrees and holding academic positions at Sofia University "St. Kliment Ohridski".

Biography

Elena Vassileva was born on July 10th, 1972, in Kazanlak. In the period 1990-1995, she was a student at the Faculty of Chemistry of the Sofia University "St. Kliment Ohridski". In 1995, she completed her studies with high score, and obtained master's degree with a specialty in Organic and Analytical Chemistry. In 1996, she was enrolled as PhD student in the Laboratory Structure and Properties of Polymers at the Faculty of Chemistry of Sofia University "St. Kliment Ohridski", where she developed a dissertation titled "Study on some physico-mechanical properties and biodegradation of modified gelatine", with supervisor Prof. Stoiko Fakirov. In 2001, after the successful defence of her dissertation, she obtained the educational and scientific degree "doctor". In the period 2000 - 2002, she was a post-doc at the Faculty of Engineering, University of Palermo, Palermo, Italy, and at the Institute of Composite Materials, University of Kaiserslautern, Kaiserslautern, Germany (Marie Curie Fellow). From the middle of 2003, she was appointed at the Faculty of Chemistry of Sofia University "St. Kliment Ohridski", where she successively held the academic positions Assistant (until 2004), Assistant Professor (until 2008) and Associate Professor (until now).

Assessment of the research accomplishments

Prof. Dr. Elena Vassileva is the co-author of 50 scientific publications and 1 patent. Most of them are referred and indexed in the world-known databases with scientific information Scopus and Web of Science. According to Scopus, more than 650 citations from foreign authors have been noticed on her works (H-index 13) (accessed at the beginning of June 2023). Assoc. Prof. Vassileva submitted in the competition for the academic position "Professor" 16 original scientific works, of which 15 publications in international journals with an impact factor and one book chapter. 68 citations were noticed on them. The candidate is the corresponding author

in 12 of the publications. The articles submitted for the competition are different from those included in the dissertation for obtaining the degree "doctor" and in the competition for the academic position "Associate Professor".

The quantitative indicators (points) formed by the research and teaching activity of Prof. Vassileva satisfy the minimum requirements for acquiring the academic position "Professor" of ADASRB and the recommended criteria of Sofia University "St. Kliment Ohridski" in Professional Field 4.2 Chemical Sciences. The distribution of points by individual groups of indicators is shown in the table below.

Groups of indicators	A	B	C	D	E	F	G
Minimum required points for Professional Field 4.2 Chemical Sciences by ADASRB	50	-	100	200	100	150	-
Recommended minimum points by Sofia University for Professional Field 4.2 Chemical Sciences	50	-	100	220	120	150	120
<i>Points of the candidate</i>	<i>50</i>	<i>-</i>	<i>110</i>	<i>245</i>	<i>136</i>	<i>380</i>	<i>270</i>

Obviously, in terms of collected points, the scientometric data of Prof. Vassileva exceed the required minimum points for each of the indicators (without indicator A) and, therefore, her participation in the competition is legal. According to the indicator from group A, the requirement for possessing the degree "doctor" has been met. According to the indicators from group C (Habilitation thesis), Prof. Vassileva has presented 5 articles in the journals *European Polymer Journal* (Q1, 25 items) - 2 items, *Gels* (Q2, 20 items) - 2 items. and *Polymer International* (Q2). The points in Group D are obtained from 11 publications, of which 5 articles in journals of category Q1, 4 articles in journals of category Q2, 1 article in journals of category Q3 (15 pts) and 1 book chapter (25 pts). 68 citations of the scientific works presented in the competition bring 136 points to indicator E. The points from the indicators: supervision of successfully defended PhD students (2, 50 pts), participation in national scientific projects (3, 30 pts), participation in international scientific projects (3, 60 pts), management of national scientific projects (2, 40 pts), coordinator of the Bulgarian team in international scientific projects (3, 150 pts) and attracted funds on projects led by the candidate (BGN 250,000, 50 pts), in group F in total are 380. The additional group of indicators G, adopted by decision of the Scientific Council of the Faculty of Chemistry and Pharmacy at the Sofia University "St. Kliment Ohridski" as part of the recommended criteria, includes the indicators H-index of the candidate, introduced new lecture courses, defended graduates, articles other than those in group E and scientific projects other than those in group F. The sum of points for this group of indicators is 270 (130 pts from H-index and 140 pt. from 3 courses and 11 graduates), which formally exceeded the required minimum points more than twice.

Scientific contributions

The research activity of Dr. Vassileva are in a modern sub-area of polymer science focused on the design and study of new biomaterials. The core objects of her scientific developments are

polymeric micro- and nanoparticles, and networks and hydrogels based on them, with potential application in medicine and pharmacy. The scientific papers are of high quality, contain original results and contribute to the enrichment of knowledge in the relevant thematic area. At the same time, the research carried out has a specific practical orientation and aims to solve existing problems. I can summarize the contributions of the scientific works presented by Assoc. Prof. Vassileva in the competition for the academic position "Professor" as follows:

Habilitation thesis (Papers relevant to the indicators from group C)

Assoc. Prof. Vassileva presented a habilitation thesis titled "Polyzwitterions and materials on their basis with application in medicine and pharmacy", which summarizes published results from 5 scientific articles. The author discusses the development of original polymer materials from polyzwitterionic polymers and their unique properties arising from the presence of covalently linked positively and negatively charged functional groups in each of their monomer units. The systems were evaluated for potential applications as chronic wound dressings, soft contact lenses, and drug carriers.

New hydrogel biomaterials have been synthesized based on an interpenetrating polymer network (IPN) of the polyzwitterionic polymers polycarboxybetaine methacrylate (PCBM) and polysulfobetaine methacrylate (PSBM), capable of responding to changes in three environmental parameters - temperature, pH and salt concentration. The hydrogels exhibit anti-biofilm activity against bacteria such as *P. Aeruginosa*, *A. Baumannii* and *K. Pneumoniae*, while being non-cytotoxic and possessing very good *in vivo* biocompatibility.

Hydrogels from PSBM and PCBM polymer networks with high water binding capacity were developed. It has been proven that, thanks to their specific properties, hydrogels can absorb and retain wound exudate, thereby adsorbing and regulating the concentration of the main enzymes that cause wound chronification. This fact, combined with the pronounced anti-biofilm activity, low cytotoxicity, and the good biocompatibility of polyzwitterion hydrogels makes these materials suitable for chronic wounds healing.

Two types of PSBM systems (nanoparticles and hydrogels) were obtained for controlled delivery of timolol maleate (TM) to the eyes. A relationship between the structure and composition of the carriers and the release profile of the active substance was established. PSBM hydrogels loaded with TM, in addition to high optical transmittance, effectively absorb the harmful UV-B radiation, which makes them attractive for developing innovative soft contact lenses.

Contributions relevant to the indicators from group D

Interpenetrating polymer networks

Different hydrogel carriers have been synthesized for extended release of the active substances verapamil hydrochloride (VP) and diclofenac sodium (DF) by forming a IPN from:

- i) poly(acrylic acid) / polyacrylamide - VP
- ii) poly(methacrylic acid) / polyacrylamide - VP

iii) poly(N,N'-dimethylaminoethyl methacrylate) / polyacrylamide -DF

The functionality of the components and the density of IPN have been shown to influence the loading efficiency and the release profile of the substance.

Polymeric composite materials were obtained by *in situ* precipitation of calcium phosphates in a hydrogel matrix based on a poly(acrylic acid)/polyacrylamide IPN. Thus, the potential of IPN to deposit calcium phosphates (mimicking the natural biomineralization process) has been demonstrated with concern to use these materials for bone regeneration.

Polymer particles

A new "bottom-up" method was introduced for the synthesis of polymer micro- and nanoparticles with different anisotropic shapes (hexagonal, triangular, fibre-like), by photochemical cross-linking of drops of hydrophobic monomers, pre-shaped by using an appropriate surfactant and playing with the cooling rate. Polymer composite particles have also been synthesized by incorporating magnetic nanoparticles into the monomer droplets.

Particles of a polyelectrolyte complex of chitosan and alginate with fibre-like morphology, designed for modified release of diclofenac sodium were obtained. The carrier composition was found to affect the loading efficiency, DF crystallinity and its release profile.

Using the ultrasonic method, gelatine capsules (GC) with an average size between 200 and 400 nm were prepared. The influence of the main parameters that affect the size of the GC has been studied. The potential of GC as carriers of hydrophobic drugs (α -tocopherol and acetylsalicylic acid) has been demonstrated.

Teaching activity

Prof. Vassileva has performed extensive teaching activities at the Sofia University "St. Kliment Ohridski" (since 2004), with a significant academic workload. According to the attached documents, she gives lectures on "Polymers" to students from the specialties "Computer Chemistry", "Engineering Chemistry and Modern Materials", "Chemistry and Informatics", "Ecochemistry", "Nuclear Chemistry" and the optional lectures courses "Modern Biomedical Applications of Polymers" and "Film-Forming Polymers" at the Faculty of Chemistry and Pharmacy at Sofia University "St. Kliment Ohridski". She has developed the lecture courses for the abovementioned disciplines. She is the head of the master's program "Polymers" at the same university.

Associate Professor Vassileva has also been involved in a number of other academic activities. In the period 2006 - 2023, she was the supervisor of 3 successfully defended PhD students and 11 successfully defended graduates (6 for the "Bachelor" and 5 for the "Master" degrees). She is a member of the Faculty Council and the Pharmacy Council of the Faculty of Chemistry and Pharmacy, Sofia University "St. Kliment Ohridski".

Opinions, recommendations, and notes

I have known Associate Professor Vassileva since 2003 and have personal impressions of her activities in the field of science and higher education. Since she has been appointed as an

assistant at the Sofia University "St. Kliment Ohridski", Vassileva established herself as a leading researcher and teacher in the Faculty of Chemistry and Pharmacy in the field of polymer science. I am convinced that Elena Vassileva has made a significant personal contribution to the scientific works submitted for review. I would like also to mention my excellent impressions of her work as an evaluator for various funds and institutions and her effectiveness in getting funding for research projects implementation. Associate Professor Vassileva takes part in the work of the Scientific Council of the Institute of Polymers at the Bulgarian Academy of Sciences. She joins always with enthusiasm the committees organizing the National Symposium "Polymers" and a lot of other initiatives of the scientific community in Bulgaria.

I have no remarks to the documents and scientific work presented in the competition. The materials are designed carefully and in accordance with the requirements of the Act and the corresponding regulations. The research results have been published in peer-reviewed international journals, which means that they have been evaluated and accepted by reviewers with specific expertise in the field. I highly appreciate the teaching and research activities of Associate Professor Vassileva, and I would like to emphasize the good balance between the fundamental and applied aspects of the studies.

Conclusion

The scientometric indicators of Prof. Dr. Elena Vassileva, based on her scientific papers, research, and teaching activities, presented in the competition for the academic position "Professor", exceed the minimum required points determined in the Act and the Rules for its implementation, and the recommended criteria for acquiring scientific degrees and holding academic positions at Sofia University "St. Kliment Ohridski" in Professional Field 4.2 Chemical Sciences. The fulfilment of this formal requirement together with my positive opinion about the high quality of the scientific outcomes and the active participation of the candidate in various projects and training activities, gives me the reason to recommend to the esteemed members of the Faculty Council of the Faculty of Chemistry and Pharmacy at the Sofia University "St. Kliment Ohridski" to award Assoc. Prof. Dr. Elena Vassileva the academic position "Professor" in Professional Field 4.2 Chemical Sciences (Polymers).

27 June 2023

Sofia

Reviewer:

/ Petar Petrov/