

OPINION

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Member of the Academic Jury set to render a decision
on the competition for filling the academic position of Professor
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")

This opinion was prepared in response to order № РД-38-161 of 06.04.2023 issued by the Rector of the Sofia University "St. Climent Ohridski" (SU) and the decision of the first meeting of the scientific jury held on 23.05.2023. The opinion is in accordance with the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria (LADRSA), the Regulations for its Implementation (RAPRSA), and the Regulations of SU, for applying the Act aforementioned.

Assoc. Prof. Dr. Elena Vassileva was the sole candidate in the contest for "Professor", announced in the State Gazette, No. 24, dated 17.03.2023, for the needs of the Faculty of Chemistry and Pharmacy of Sofia University, currently appointed as Associated Professor in the same Faculty.

1. Assessment of the scientific and research accomplishments of the candidate

The set of documents presented in the electronic format is in full compliance with the SU's Academic Development Policy Regulation, and conversely meets the institutional criteria for lending the academic position of a professor.

In the present competition for the professorship Elena Vassileva participated with a total of 16 publications, classified in accordance with the relevant regulations of publications on the habilitation thesis, publications outside it, and book chapters. Five of the submitted publications are included in the Habilitation work under the indicator "B.4" and are publications in scientific journals with a high impact factor (IF) according to Thomson Reuters/Clarivate Analytics, falling in Q1 and Q2 and carrying a total of 110 points. 11 publications were submitted under indicator "G.7" publications outside the habilitation thesis ", nine of them with IF. The distribution of these publications across quartiles is as follows: Q1(5), Q2(4), Q3(2). One book chapter is also presented. Collectively, the publications submitted under indicator "G" carry 245 points, and the cumulative impact factor of all the candidate's publications in the competition is 51,961. Very impressive fact is that all publications submitted by Assoc. prof. Vassileva are in the profile of the scientific specialty of the competition. The leading contribution of the candidate in the submitted publications is indisputable - in one of them the candidate is the first, and in 14 she is the last and corresponding author. The relevance of the scientific topic and the significance of the results of the research of Assoc. Prof. Elena Vassileva is also proven by the large number of citations of her works as shown in indicator "D" - 68, carrying 136 points.

Assoc. Prof. Elena Vassileva has submitted a report on participation in 11 scientific research projects, including 6 international and 5 national projects. In 2 of the presented national projects Assoc. Prof.

Vassileva is the project coordinator and in 3 of the international projects she is the team leader of the Bulgarian participants.

Assoc. Prof. Vassileva was the supervisor of two PhD student who successfully defended their thesis, and of eleven graduates.

The candidate's submitted set of documents includes other materials in accordance with the criteria formulated by the regulations.

The research program underlying the scientific papers submitted by the candidate under B and G Indicator Groups are to be summed up in an extremely rapidly developing scientific area, namely design and synthesis of new functional polymer materials for biomedical application. Polymer materials have long-standing applications and are favored in the development of innovative therapeutic devices, including implants and three-dimensional tissue engineering matrices. The use of new polymer materials for pharmaceutical application, such as carriers for the controlled delivery and release of drugs and therapeutic biomacromolecules, is also indisputable. In this regard, the major scientific contributions of Prof. Elena Vassileva in the indicated area can be summarized as follows:

❖ *Design and characterization of polyzwitterions for biomedical applications.*

In this field, which is the basis of the habilitation thesis and 4 full-text publications developed under the procedure, for the first time, specific physicochemical properties of two polyzwitterions - poly(sulfobetaine methacrylate) and poly(carboxybetaine methacrylate) were investigated in detail as promising new materials for the development of dressings for the treatment of chronic wounds. It has been proven that the used polyzwitterions can be referred to the so-called smart polymer materials, as they show a pronounced linear dependence of their degree of swelling as a function of the temperature of the environment (in the range of 20-70 °C) and as a function of the salt concentration. The in-depth studies carried out further show that the developed polyzwitterions are also characterized by a pH-dependent degree of swelling and low non-specific protein adsorption. Mechanistic studies proved that these effects are mediated by the developed materials' high capacity of binding water ~40%.

Next, for the first time, poly(sulfobetaine methacrylate) zwitterions were used to develop copolymer hydrogels with the inclusion of poly(vinylpyrrolidone) as materials for the preparation of soft contact lenses for the modified release of timolol maleate. The influence of the quantitative ratio of the two polymers in the copolymer hydrogels on important technological parameters of the systems was systematically investigated: loading efficiency and release profile of the model drug substance. Systematic analysis found that increasing the polyvinylpyrrolidone fraction resulted in a higher loading efficiency and a higher release rate of timolol maleate.

❖ *Synthesis and characterization of new functional polymer materials based on interpenetrating polymer networks.*

In this direction, 7 full-text publications show the candidate's achievements in the synthesis of functional polymer materials, by using the approach of interpenetrating polymer networks. Scientific studies are focused on the synthesis and detailed characterization of three types of interpenetrating networks based on: poly(acrylic acid) and polyacrylamide; polyacrylamide and poly(methacrylic acid) and polyacrylamide and poly(N,N'-dimethylamino ethyl methacrylate) as carriers of medicinal substances: verapamil hydrochloride and diclofenac sodium. It was found that the composition and the quantitative ratio of polymers had the greatest influence on the loading efficiency and the release profile of the drug substance. The high loading efficiency

found was shown to be due to physical interactions between the model drug substances and the polymer molecules, e.g. formation of ionic or H-bonds. The composition was also found to influence the cross-linking density of the interpenetrating matrix and was a key factor in controlling the release rate of the loaded drug. Therefore, varying the composition of the interpenetrating network has been shown to be a key mechanism for imparting drug-targeting properties to polymeric materials.

In another study, the conceptual design and characterization of composite materials based on PAA and PAAM interpenetrating networks through the *in situ* precipitation of calcium phosphates is presented. The two key components of the *in situ* deposition of calcium phosphates in polymer networks have been established: composition and crosslinking density.

An indisputable contribution of the candidate is the use of the approach of directed synthesis of interpenetrating networks to obtain stimulus-sensitive polymeric materials. On the basis of interpenetrating networks, a polymer material sensitive to three physiological stimuli: temperature, pH and salt concentration was obtained, which conditions various fields of application, including medicine and pharmacy.

❖ *Development and characterization of polymeric nanoparticles as potential drug delivery systems.*

Another direction of Assoc. Prof. Vassileva's research activity with original contributions is focused on the development of new methods for obtaining micro- and nanosized polymer drug carriers. In studies of 5 articles, the developed various methods are presented, such as: sonochemical, chemical and physical crosslinking of polyzwitterions; method of formation of polyelectrolyte complexes, as well as a method applicable to low molecular weight substances, originally modified and translated by the authors to obtain polymer particles.

Based on the in-depth analysis of the works of Prof. Elena Vassileva, I believe that the results obtained should be considered original contributions in the field of the synthesis of new polymer materials and their biomedical application.

2. Recommendations and comments

As can be seen from the presented publications, as well as from the projects in which the candidate is a participant or a leader, it is beyond any doubt for me that Assoc. Prof. Elena Dimitrova Vassileva is an established scientist with a leading impact to the presented scientific works. Elena Vassileva manages to combine the enormous capacity of polymer synthesis in collaboration with specialists from various applied fields. Scientific interests and their realization in the form of original full-text publications confirm Assoc. prof. E. Vasileva as a scientist capable of generating ideas, providing their project funding and their practical implementation, which undoubtedly makes her an infinitely suitable candidate for the position under the competition. The documents are exemplary.

CONCLUSION

Based on the documents submitted by the candidate Elena Vassileva for the competition, I am of the opinion that she meets all the criteria for holding the academic position of "Professor" as laid down in the relevant legal framework, namely, the RASDP Act, its Implementing Rules, and the Institutional regulations for the application of the aforementioned law of the University of Sofia.

On the basis of all the above, I confidently give my positive assessment and recommend the scientific jury to prepare a report-proposal to the Faculty Council of the Faculty of Chemistry and Pharmacy, SU "St. Kl. Ohridski" for the election of Assoc. Prof. Elena Vassileva to the academic position of Professor in the professional field 4.2. Chemical Sciences, specialty "Polymers".

Sofia, July 6th2023 r.

Reviewer:

/Prof. Denitsa Momekova, PhD/