Review

By assoc. prof. eng. Rayna Georgieva Bryaskova, PhD

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Member of a scientific jury in a competition for the academic position **"professor"** in a professional field 4.2. Chemical Sciences (Polymers)

This review is prepared in response to an Order issued by the Rector of Sofia University "St. Kliment Ohridski" № РД 38-162/06.04.2023 and the decision of the academic jury taken on 23.05.2023. The review is in compliance with the Act on the development of the academic staff in the Republic of Bulgaria (ADASRB), the Rules for applying ADASRB, and the Rules for the development of academic staff set at the Sofia University and the Faculty of Chemistry and Pharmacy.

1) Biographic information about the candidate

Documents for participation in the competition, announced in State Journal 24/17.03.2023, were submitted by a single candidate, assoc. prof. Dr. Elena Vasileva from Sofia University "St. Kliment Ohridski", Faculty of Chemistry and Pharmacy.

Assoc. prof. Dr. Elena Vasileva graduated from Sofia University "St. Kliment Ohridski", Faculty of Chemistry in 1995. In 2000, she defended her dissertation for the educational and scientific degree of doctor on the topic: "Research on some physical-mechanical properties and biodegradation of modified gelatin" with the supervisor Prof. Dr. Stoiko Fakirov. In 2004, she was appointed as an assistant at the Faculty of Chemistry of the Sofia University “St. Kl. Ohridski", in 2005 as the assistant professor, and from 2008 until now she is an associate professor at the same faculty of the Sofia University.

In 2000-2001, assoc. prof. Vasileva conducted a post-doctoral specialization at the Faculty of Process Engineering Chemistry, the University of Palermo, Palermo, Italy on the topic "Investigation of the influence of aging conditions on the pre-crystallization order in amorphous polyethylene terephthalate" in collaboration with Prof. S. Picarolo, and 2001-2002 she conducted a second post-doctoral specialization at the Institute of Composite Materials, University of Kaiserslautern, Kaiserslautern, Germany as a Marie Curie Fellow under the 5th Framework Program of the European Community on the topic “Development of new nanocomposite materials with high wear resistance based on epoxy resins and aluminum oxide nanoparticles”.

Assoc. prof. Vasileva has won several prestigious awards and has participated in a large number of national, international, and European projects as a participant or leader of the group. She is a member of the International Union of Pure and Applied Chemistry (IUPAC), a Member of the Association of Marie Curie Fellows, and a Member of the Union of Chemists in Bulgaria. She was an evaluator under the 7th Framework Program of the European Community, "Nanosciences and Nanotechnologies, Materials and New Production Technologies", and "Marie Curie" programs, at the Agency for Science, Innovation and Technology, Lithuania, at the National Scientific Fund, Ministry of Education, Science and Technology, Bulgaria, Belgian Research Fund, M-ERA.NET program of the European Community, H2020 Framework Program of the European Community, programs "FET-Open", "Marie Curie".

Assoc. Prof. Vasileva is the co-author of 48 articles and 2 published book chapters, of which 38 were published in journals with an impact factor, she was cited 716 times according to Scopus (without self-citations), and her h-index is 13 according to Scopus.

2). Assessment of the scientific and research accomplishments of the candidate

Assoc. prof. Vasileva participated in the competition with 15 publications and one chapter in a book. Of the publications presented, 14 were published in refereed journals with an impact factor, of which 7 were in quartile Q1 and the remaining 7 in quartile Q2. One of the publications is in a journal in quartile Q3 with no impact factor. The citations with which Assoc. prof. Vasileva participated in competition are 68, which are on the articles with which she participated in the competition (according to Scopus, without self-citations of all authors). The total impact factor of these articles is 51.96, the average impact factor per article is 3.46, and the average citation rate per article is 4.5.

The scientific works do not repeat those submitted for obtaining the educational and scientific degree "doctor" and for holding the academic position "associate professor".

According to the indicator of **group A**, the requirement for possession of the educational and scientific degree "Doctor" has been met.

According to the indicators from **group B**, assoc. prof. Vasileva has presented 5 publications, of which two are in the European Polymer Journal, which is in quartile Q1, and three publications in quartile Q2, which are in the following journals: Gels and Polymer International, summarized as a habilitation thesis on the topic "Polyzterions and materials based on them with application in medicine and pharmacy". According to this indicator, Associate Professor Vasileva collected 110 points with a minimum requirement of 100 points.

According to the indicators from **group D**, Associate Professor Vasileva collected 245 points, with a minimum requirement of 220 points. She presents 10 publications, which are distributed as follows: 5 of them are in quartile Q1 (25 points); 4 in quartile Q2 (20 points), and 1 in quartile Q 3 (15 points), as well as one book chapter that falls in quartile Q1 (25 points).

The total points for indicator D are 136, which are based on 68 citations with a minimum requirement of 120 points.

The sum of the points for indicator Z is 270 points out of the required 120 points. She collects these points from 11 defended diploma theses for the "Bachelor" and "Master". She is a lecturer on advanced biomedical applications of polymers, Organic-inorganic hybrid materials, and Film-forming polymers.

The scientific contributions presented by Prof. Vasileva in the competition for "professor" can be summarized as follows:

Scientific contributions related to Group B

The publications presented under indicator B are summarized as a habilitation thesis that describes the development of new "smart" polymer materials based on polyzwitterionic hydrogels and their possible application as dressing materials for chronic wounds and as materials for modified drug release.

Polyzwitterionic hydrogels as dressing materials for chronic wounds

Polyzwitterionic (poly(sulfobetaine methacrylate) (PSB) and poly(carboxybetaine methacrylate) (PCB) hydrogels have been successfully developed as dressing materials for chronic wounds. This was achieved by using poly(ethylene glycol) diacrylate (PEGDA) as a cross-linking agent. The polymers used for the preparation of polyzwitterionic hydrogels possess low non-specific protein adsorption, which leads to high antibiofilm activity, which has been studied against *S. aureus*, which is a major bacterial agent in chronic wounds. Their anti-biofilm activity, together with their non-adhesive properties to tissues, makes them non-adhesive to the wound, which defines for the first time their application as dressing materials for chronic wounds. As a result of the performed research, it was established their high ability to absorb exudate from wounds and to bind water; while having good control over the concentration of enzymes in chronic wounds through absorption without inhibiting their activity.

Polyzwitterionic hydrogels for modified drug release

Polyzwitterionic hydrogels for modified drug release were obtained by synthesizing a copolymer network based on sulfobetaine methacrylate (SB), vinyl pyrrolidone (VP), and poly(ethylene glycol) diacrylate (PEGDA) as a cross-linking agent, which was loaded with the drug substance timolol maleate (TM). The resulting hydrogels have been investigated as potential materials for the production of soft contact lenses, in which the drug substance timolol maleate is released into the eyes.

Scientific contributions related to Group D

Preparation of interpenetrating polymer networks (IPMs)

Interpenetrating polymer networks, different in their composition and properties, were obtained, which, depending on their application, are classified as:

- - IPMs for the drug delivery which are obtained based on poly(acrylic acid) (PAA) and polyacrylamide (PAAM) and of PAAM with poly(methacrylic acid) (PMAA). The two polymer networks were loaded with verapamil hydrochloride and the possibility of prolonged release of the drug depending on the density of the polymer networks was investigated. The IPMs based on poly(N,N'-dimethylamino ethyl methacrylate) (PDMAEMA) and PAAM, in which diclofenac sodium was included, were also synthesized and the possibility of prolonged release of diclofenac sodium was investigated.
- - IPMs to obtain polymer composites based on PAA and PAAM and used as matrices, in which polymer composites were obtained for the first time by *in situ* precipitation of calcium phosphates, in an attempt to follow the natural process of biomineralization.
- - IPMs as "smart" biomaterials synthesized from (poly(sulfobetaine methacrylate) (PSBMA) and poly(carboxybetaine methacrylate) (PCBMA) that respond to three "biological" external stimuli: temperature, pH, and salt concentration. The obtained IPMs showed pronounced antibiofilm activity against *P. Aeruginosa, A. Baumanii*, and *K. Pneumoniae*. They are non-cytotoxic and possess good in vivo biocompatibility, as a result of which they may find several applications in medicine, pharmacy, as smart sensor materials, etc.

Preparation of polymer particles

Polymer particles varying in size, shape, and structure have been successfully obtained using a variety of chemical and physical methods, which can be summarized as follows:

- Gelatin-based protein particles were successfully obtained by ultrasound and were used as carriers of two hydrophobic drugs: α-tocopherol and acetylsalicylic acid.
- Polyzwitterionic particles were obtained by chemical and physical crosslinking based on PSB, which demonstrates a high efficiency of loading with the medicinal substance timolol maleate.
- Polyelectrolyte particles with fibril-like morphology based on chitosan and alginate were also obtained, which were tested for prolonged release of diclofenac sodium (DFN). The resulting fibril-like morphology of the obtained polyelectrolyte complexes (PECs) was found to control the release profile of DFN.
- A "bottom-up" method was developed for the synthesis of polymer particles with different anisotropic shapes, in which polymer particles with hexagonal and triangular shapes, as well as threads from them with a size of 50 nm to 1 mm, were obtained, using

droplets of various hydrophobic monomers in the presence of selected surfactants that polymerize by UV radiation to permanently fix the anisotropic shape.

The conducted research and the published results of assoc. prof. Vasileva has a scientific and scientific-applied contribution. Assoc. prof. Vasileva's scientific activity is in a very topical area related to health care, as a result of which polymer materials of different compositions and structures have been obtained, which were successfully loaded with drugs with a view to their potential application in medicine and pharmacy.

3. Opinions, recommendations, and notes

The submitted materials for the competition have been prepared by the requirements of ADASRB and its regulations. The contributions of the scientific works are clearly presented, impressing the high quality of the conducted research, the results of which have been published in many authoritative journals with a high impact factor**.**

I have no critical remarks towards assoc. prof. Vasileva, but I have the following question: How would you apply IPMs based on poly(acrylic acid) (PAA) and polyacrylamide (PAAM) and of PAAM with poly(methacrylic acid) (PMAA) loaded with verapamil hydrochloride, which is a drug used in the treatment of cardiovascular disease?

Conclusion

The analysis of the presented documents gives me a reason to believe that Associate Professor Elena Vasileva is a well-established scientist and teacher with significant scientific and teaching activities. The candidate meets, and in some respects exceeds, the requirements for holding the academic position of "professor" according to the Act on development of the academic staff in the Republic of Bulgaria (ADASRB), the Rules for applying ADASRB, and the specific conditions for acquiring an academic position at Sofia University.

Based on this, I give a positive assessment of the candidate and propose to the esteemed Scientific Jury and the members of the Faculty Council at the Faculty of Chemistry and Pharmacy at Sofia University to vote for awarding the academic position "professor" in professional field 4.2. Chemical Sciences (Polymers) to Prof. Elena Vasileva.

03.07.2023 Reviewer……

Sofia Assoc. prof. Rayna Bryaskova