

REPORT

by Prof. Milena Georgieva Ignatova, PhD,

Member of the Academic Jury set to render a decision on the competition for filling the academic position of an Associate 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 and Polymer Materials"), announced in the State Gazette, issue 65 of August 12, 2022

candidate in the competition - Assist. Prof. Radostina Genova Kalinova, PhD

This Report is prepared in response to Order № RD-09-148/11.10.2022 issued by the Director of the Institute of Polymers, Bulgarian Academy of Sciences, following the decision made by the Academic Jury that was held on October 26, 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-BAS, for applying the Acts aforementioned.

Assessment of the scientific and research accomplishments of the candidate

The competition for Associate professor in the professional field 4.2. Chemical Sciences (Scientific Specialty Polymers and Polymeric Materials) is declared in SG, issue 65 of August 12, 2022 for the needs of the Scientific direction "Macromolecular engineering" of IP-BAS. Assist. Prof. Radostina Genova Kalinova, PhD, is the only candidate in the competition. The documents presented by Dr. Kalinova meet all the regulatory requirements related to DASRB. Assist. Prof. Radostina Kalinova, PhD, acquired PhD degree in 2012 in the Laboratory of Polymeric and Composite Materials, University of Mons, Belgium, after successfully defending a dissertation on "Imparting (bio)adhesive properties to silicone coatings: effect of functionalized diblock copolymers", with scientific supervisor: Prof. Philippe Dubois, DSc. In 1998 she worked as a chemist at the Institute of Polymers - BAS, Laboratory "Conjugated Polymers". Since 2013 Dr. Radostina Kalinova is a member of the Laboratory "Polymerization Processes" at the Institute of Polymers – BAS, from 2014 to present, she was an assistant professor at the same laboratory.

Dr. Radostina Kalinova has participated in the competition with 18 scientific papers, 7 of which have been published in the last 5 years. These scientific papers do not repeat those presented for acquiring the educational and scientific "PhD" degree. 17 of the scientific papers have been published in specialized journals, that are referenced and indexed in world-renowned databases of scientific information (Web of Science and Scopus), falling into the quartiles from Q1 to Q4 according to the grouping of scientific journals. One of the papers has been published in a journal that was referenced in Web of Science, but it was without an IF. All the publications are co-authored. Dr. Radostina Kalinova being the first co-author in 9 of the papers, the second co-author in 5 of the papers and corresponding (co)author in 1 of the papers, which proves the significant contribution of the candidate in the presented studies. The candidate holds the educational and scientific degree "PhD" since 2012, which fulfills the requirement for indicator A. Indicator C.4: Habilitation work includes 5 scientific publications (four of them fall in Q1 and one in Q2). The total points for this indicator are 120, which exceed the minimum number of points (100) of the minimum national competition requirements. The evaluation of group D indicators is based on 13 scientific publications. The publications are distributed over the quartiles, as follows: five of them fall in Q1, two in Q2, two in Q3 and three in Q4. One of the papers is published in a journal for which no quartile was available in the year of publication and it is without an IF. The sum of the points for the indicators of group D is 241, which exceeds the

required minimum number of points (220). A significant part of the scientific papers of Assist. Prof. Dr. Radostina Kalinova has been published in renowned international journals in the highest quartile Q1, such as *Molecules*, *Nanomaterials*, *Reactive and Functional Polymers*, *J. Phys. Chem. B*, *Int. J. Mol. Sci.*, *ACS Biomater. Sci. Eng.*, *RCS Advances*, *Polymer*.

The total number of times Dr. Kalinova's papers have been cited by other authors is 140, carrying 280 points in indicator E.11, which exceed many times the required minimum number of points (60) for the competition. It is noteworthy that publications are cited in reviews, patents, book chapters, and in publications that are referred and indexed in the world-renowned databases of scientific information Web of Science and Scopus. This is a certificate for the relevance of the thematic area and good research level.

Dr. Kalinova has participated in 13 research projects with national and European funding. The sum of the points for all indicators is 691, with which the candidate not only meets the minimum requirements (400 points for the national minimum requirements and respectively 430 points according to the Rules set at the Institute of Polymers-BAS), but also significantly exceeds them.

The publications presented at the competition outline up-to-date and promising scientific topics. The main contributions of fundamental and applied scientific importance in the studies of Dr. Kalinova included in the publications presented in the indicators C.4. can be summarized as follows:

- Original synthetic procedures have been developed for the preparation of new block copolymers with diverse architecture and defined composition. Controlled atom transfer radical polymerization, anionic or cationic ring-opening polymerization, highly efficient "click" chemical reactions, etc., have been skillfully applied. The self-association behavior of the copolymers was studied, proving the preparation of nanosized micelles for solubilization and optimization of the pharmacokinetic profile of hydrophobic biologically active substances (phenethyl ester of caffeic acid, curcumin).
- Novel hybrid block copolymers from poly(ethylene glycol)methacrylate and poly(L-lysine) have been prepared and characterized. The obtained copolymers form nanosized particles from polyplex with DNA. The transfection efficiency of the systems with plasmid DNA has been demonstrated *in vitro*.
- Linear diblock copolymers comprising polyoxyethylene and poly(L-lysine) blocks have been developed. The ability of these block copolymers to form complex with insulin has been studied. A promising result is the demonstrated low level of their interaction with serum albumin, that is most probably due to the formed shell of polyoxyethylene. These new systems are promising as nanocarriers for proteins and peptides for *in vivo* applications.

The main contributions of the research of Dr. Kalinova included in the publications presented in indicator D.7., can be grouped as follows:

- Diblock copolymers comprising alkyne-end functionalized poly(D,L-lactide) and poly(N,N-dimethylaminoethyl methacrylate) blocks have been prepared and characterized. The polycationic blocks were additionally functionalized with mitochondria targeting triphenylphosphonium cations. The self-association of these copolymers in aqueous media with the formation of nanosized micelles that were able to incorporate the biologically active substance (curcumin) has been shown. A multifunctional carrier of the biologically active substance curcumin with cellular- and subcellular- targeting ligands was also prepared by the attachment of polyoxyethylene block modified with end cellular- targeting group to the obtained diblock copolymer.
- Functional block copolymers with pendant amino groups have been prepared by radical addition of 2-aminoethanethiol hydrochloride to the allylic double bonds of block copolymers of polyglycidol and poly(allyl glycidyl ether). These copolymers have been shown to form aggregates with a highly positive surface charge in aqueous media and were able to condense DNA into stable and compact polyplexes.

- A series of amphiphilic poly(dimethylsiloxane)-*block*-poly(acrylic acid) diblock copolymers has been prepared and their self-association behavior in different solvents has been studied. The influence of the concentration of the copolymers, the length of the poly(acrylic acid) block, the solvent composition and thermal annealing on the size and the shape of the obtained aggregates was evaluated. It has been shown that the morphology of the aggregates does not depend on the concentration and composition of the copolymers, but depends on the solvent and thermal annealing.
- A multistep synthetic procedure has been developed to obtain new pyrrolidinium based poly(ionic liquids) with potential application in the design of capacitors.
- Polydiphenylacetylenes with Schiff base end groups have been synthesized. The polymers have been shown to exhibit photoluminescence not only in solution but also in film, making them suitable candidates for application in electronics as LEDs.
- New polymer–organic solar cells have been constructed on polyethylene terephthalate substrates with an active layer of conjugated polymer poly(3-hexylthiophene) and fullerene derivative [6,6]-phenyl-C61-butyric acid methyl ester. These polymer-organic solar cells have been shown to exhibit current–voltage characteristics and structural properties comparable to those of traditionally constructed photovoltaic cells on glass substrates.

The up-to-date scientific topic developed by the Dr. Kalinova shows her significant contributions of fundamental and scientific- applied nature in the field of synthesis of new (co)polymers with potential application in the biomedicine, in the design of capacitors, polymer-photovoltaic cells and LEDs.

Opinions, notes and recommendations

I have no critical comments on the publications submitted for participation in the competition. I am well aware of the work of Dr. Radostina Kalinova and I am convinced of her qualities as a serious researcher, possessing skills and experience, capable of conducting research in accordance with the modern trends of polymer science. I am convinced of her significant contribution to the presented scientific papers and the development of the subject on which she works.

Conclusion

Based on the examination of the competition documentation and taking into account the significance of the scientific and scientific-applied contributions of the presented publications it can be seen that the scientific indicators of the candidate exceed the requirements for occupying an academic position "Associate Professor" defined in the 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 the Rules set at the Institute of Polymers-BAS, for applying the Acts aforementioned. The results achieved strongly demonstrate the applicant's competence and research experience. This gives me a reason to give a positive assessment to the candidate and to recommend to the Scientific Council of the Institute of Polymers-BAS to support the election of Assist. Prof. Radostina Genova Kalinova, PhD in the Academic Position "Associate Professor" in the professional field 4.2. Chemical Sciences (Polymers and Polymeric Materials).

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