REPORT

by

Prof. Jordan Atanassov Doumanov, 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 SG, issue 65/12.08.2022

This Report is prepared in response to Order No RD-09-148/11.10.2022 issued by the Director of the Institute of Polymers, Bulgarian Academy of Sciences. 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.

Assist. Prof. Dr. Radostina Genova Kalinova is the only candidate in the competition for the academic position of an Associate Professor in the Professional field 4.2. Chemical Sciences (Polymers and Polymer Materials) announced in SG, issue 65/12.08.2022 for the needs of a „Macromolecular engineering" laboratory.

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

Dr. Radostina Kalinova participated in the competition with 18 scientific publications, which are referenced and indexed in the databases with scientific information Web of Science and Scopus. According to group of indicators V4 (B4) (Habilitation work), five scientific publications are presented, four of which are with quartile Q1 and one with quartile Q2. Thus, the points for this indicator are 120 out of the minimum required 100. In four of the publications the candidate is the first author and in one she is the second author. Three of the papers were published in the last 5 years. According to indicator group G7 (Г7) (Scientific publications), thirteen scientific papers are presented, and the sum of points is 241 out of the required 220 points. The publications are distributed by quartiles, according to the reference submitted by the candidate, as follows: Q1 – 5, Q2 – 2, Q3 – 2. and Q4 – 3 issues. One of the publications (No17) has no quartile and Impact Factor, but is referenced and indexed in Web of Science. In five of the publications, Dr. Kalinova is the first author, and in another four she is the second author. Four of these papers were published in the last 5 years. A list of 140 citations (not including self-citations) is presented for indicator D11 (Д11) (with 35 citations required) carrying a total of 280 points. The total number of points for indicators A, V, G and D is 691, thus the candidate not only fulfills the minimum national requirements (400 points) and the specific requirements of the Institute of Polymers (430 points) for the position of "Associate Professor", but also significantly exceeds them. The total Impact Factor of scientific publications is over 45 (above the required impact factor of 25). The presented scientific production does not repeat the presented publications for the acquisition of the educational and scientific degree " Philosophy Doctor, PhD". In addition to the mandatory criteria, Dr. Kalinova also presented a list of 13 funded scientific and applied projects in which she participated.

The presented scientific articles show high-quality scientific production meeting the high criteria of the Institute of Polymers. The contribution of Dr. Kalinova is undoubted and can be divided into the following four main areas:

I. Preparation of functional (co)polymeric materials as carriers of drugs and biological macromolecules

The five scientific publications from indicator group B4 and three publications from D7 are included here. They describe for the first time the development of new synthetic strategies and procedures for the preparation of multifunctional amphiphilic copolymers based on poly(ethylene glycol)-poly(lactide-co-carbonate), a triblock copolymer with a biodegradable poly(D,L-lactide) hydrophobic block. a positively charged block of poly((2-dimethylamino)ethyl methacrylate and a neutral hydrophilic block of poly(oligo(ethylene glycol) methyl ether methacrylate), as well as polyionic complex (PIC) micelles (from the positively charged hybrid block copolymer poly(2-hydroxyethyl methacrylate)-block-poly(L-lysine) and the negatively charged block copolymer poly(ethylene glycol)-block-poly(L-aspartic acid**)**. The inclusion of caffeic acid phenethyl ester (CAPE) and curcumin in these nanoparticles makes it possible to determine the potential of micelles for future application in nanomedicine as an effective carrier for the delivery of drugs into the human body. An important scientific contribution here is the successfully formed nanoscale polyplexes (based on densely spaced short PEO side chains and a block of poly(L-lysine) containing DNA, which possess low cytotoxicity and high transfection efficiency (about 30%), as well as the block copolymers based on ethylene oxide and L-lysine that form a complex with insulin. This defines these polyplexes/copolymers as good candidates for efficient and safe delivery of nucleic acids and peptides to target cells. Dr. Kalinova also participated in the preparation and characterization of other new (nano)polymers with specific properties intended for the transfer of drugs and DNAs. I would like to summarize that the emphasis of these contributions is the development of a series of new nanocarriers and their physicochemical, biochemical and cell-biological characterization, which is a major challenge in nanobiotechnology.

II. Preparation of new linear (co)polymers and investigation of their behavior in different solvents

Three scientific publications from the G7 indicator group are included here. New copolymers of poly(dimethylsiloxane)-block-poly(acrylic acid) were synthesized, and the morphology of the resulting micelles does not depend on the concentration and composition of the copolymers, but depends on the type of solvent. Three different polymers based on 1,3,4-oxadiazole were also synthesized, as well as Sulfobetaine copolymers (containing N-vinyl-2-pyrrolidone units or styrene in the main chain), the sizes of the first aggregates increasing with increasing solvent polarity, while in the second aggregates the presence/concentration of salt determines the aggregation and micelle formation of the copolymers. In this direction, the emphasis is on the behavior of newly synthesized nanoparticles in aqueous or salt solution and the role of the solution in obtaining stable aggregates.

III. Polymers and polymer films with potential applications in capacitors, polymer photovoltaic cells and light-emitting diodes

Three new scientific publications from indicator group G7 are included in this field of research. Polyionic liquids (PILs) based on pyrrolidine derivatives (using a multi-step synthetic procedure) were obtained and were used to impregnate composite electrodes. The newly developed PIL-based symmetric supercapacitor has shown high stability and high efficiency of the charge-discharge process. Polydiphenylacetylenes with Schiff bases with

photoluminesce properties have also been successfully synthesized, both in solution and as a film, making them suitable for use in the construction of light-emitting diodes (LEDs). Last but not least, polymer-organic photoelements (POPs) were obtained on plastic substrates of polyethylene terephthalate (PET) with an active layer of conjugated polymer (P3HT) and a fullerene derivative (PC60BM). The resulting photovoltaics are similar in volt-ampere (V-A) characteristics to those placed on classical glass substrates, and ZnO deposition even improves their V-A characteristics.

IV. Other topics

These topics include four new scientific publications from a group of G7 indicators. One of the topics is historically related to the scientific achievements at the Institute of Polymers (in the eighties of the last century) based on the Carbonyl-Olefin Exchange Reaction (COER). Through the design of a transition metal complex, a carbonyl-olefin metathesis has been catalyzed when the two functional groups are in two separate molecules (rather than one) and are not conjugated ie. COER is an alternative to other carbon-carbon bond forming reactions. The last contribution indicated by the candidate is the development of a new method for surface modification of the hydrophobic poly(dimethylsiloxane) (PDMS) by incorporating amphiphilic block copolymers into its composition during the cross-linking process.

2) Opinions, recommendations and comments

It is evident from the presented materials that Dr. Radostina Kalinova is a serious researcher with interdisciplinary and integral skills and experience, actively participates in various scientific projects, which is a stable basis for her further development at the Institute of Polymers. The results obtained in her previous work in various relevant and attractive fields are significant from both, fundamental and applied aspects and are directly related to the development of nanotechnology, nanomedicine and electrochemistry.

3) Conclusion

The scientific indicators of Dr. Radostina Genova Kalinova exceed the requirements for occupying the academic position of an Associate Professor as defined in the Development of Academic Staff in the Republic of Bulgaria Act and the Regulations for its implementation, as well as those specified in the Regulations for Acquisition of Academic Degrees and Occupation of Academic Positions at BAS and IP-BAS. On the basis of the application materials presented and the said-above, the overall assessment is positive and I would like to recommend to the Scientific Council of IP-BAS to support the election of **Assist. Prof. Dr. Radostina Genova Kalinova** at the academic position of an Associate Professor in the Professional Field 4.2. Chemical Sciences (Polymers and Polymer Materials).

Date: 05.12.2022 Report prepared by:

Prof. Dr. Jordan Doumanov