

OPINION

from Prof. Dr. Pavletta Stoyanova Shestakova
Institute of Organic Chemistry with Centre of Phytochemistry, BAS

on the materials presented for the competition for the academic position of "Professor"
at the Institute of Organic Chemistry with Centre of Phytochemistry (IOCCP), BAS

in the higher education field **4. Natural Sciences, Mathematics and informatics**,
professional field **4.2. Chemical Sciences**, scientific specialty "**Bioorganic chemistry, chemistry of natural
and physiologically active substances**"

Assoc. Prof. Dr. Milena Popova from the Institute of Organic Chemistry with Centre of Phytochemistry, BAS, is the only candidate in the competition for the academic position of "Professor" announced in the State Gazette, issue. 43 of May 31, 2019, and on the website of the IOCCP-BAS, for the needs of the Laboratory of Chemistry of Natural Substances at IOCCP-BAS.

1. General presentation of the materials and of the applicant

The set of materials presented by Assoc. Prof. Dr. Milena Popova is in accordance with the Rules of the Development of the Academic staff of IOCCP-BAS, and meets the criteria of IOCCP-BAS for the academic position of "Professor".

Assoc. Prof. Milena Popova has presented 35 scientific papers for participation in the competition, which are not included in her PhD Thesis and in the competition for the academic position "Associate Professor". All 35 submitted publications are accepted for evaluation, 8 of which are under indicator B, 27 are under indicator D and one is a registered utility model. The distribution of the journals in which the scientific papers for participation in the competition on the respective quartiles (Q factors) are published is as follows: Q1 – 11, Q2 – 15, Q3 – 3, Q4 – 4. Of the 35 scientific papers presented, 32 were published in Impact Factor journals (Scopus and Web of Science), one - in an internationally specialized journal and two - as book chapters.

Assoc. Prof. Dr. Milena Popova received her PhD in 2004 at IOCCP-BAS, defending a dissertation on "Chemical composition and biological activity of propolis from different geographical regions and bee species", after which she was appointed as a senior assistant researcher (2004-2014) and in 2014 she received the academic position of Associate Professor. Assoc. Prof. Popova's scientific career is entirely in IOCCP-BAS, with 3 short-term specializations in research institutions in Italy, Macedonia and France, as well as one long-term post-doc in the Laboratory of Pharmacognosy and Chemistry of Natural Substances at the Faculty of Pharmacy, University of Athens, Greece (8 months). In September 2018, Assoc. Prof. Milena Popova was appointed Head of Laboratory "Chemistry of Natural Products" at IOCCP-BAS.

The main scientific interests of the applicant are in the field of chemistry of natural and physiologically active substances, which is in line with the subject of the announced competition. Assoc. Prof. Popova's entire scientific activity is summarized in 79 publications with her participation, 64 of which are in scientific journals, which are referenced in international databases (Scopus and Web of Science) and 4 book chapters. The large number of citations - over 2000, is an acknowledgment of the importance of the research conducted by Assoc. Prof. Popova (refer to Scopus, H-index 18 (Popova) and 20 (Velikova)).

2. General characteristics of the applicant's activities

Evaluation of scientific and applied research activities

Assoc. Prof. Popova's research interests and scientific contributions are in the field of bio-organic chemistry and chemistry of natural and biologically active substances with a focus on propolis research. An extensive habilitation report on the applicant's scientific contributions is presented (both in Bulgarian

and in English), based on which the applicant's scientific contributions can be summarized in two main areas: (i) Propolis studies from different geographical areas and bee species; (ii) Studies on the chemical composition and biological activity of medicinal plants.

The research related to the first area represents the most significant part of the scientific work of Assoc. Prof. Popova and is summarized in 29 of the publications submitted for participation in the competition. The publications reflect studies on the chemical composition and biological activity of propolis from different geographical areas and bee species, identification of its plant origin (22 publications), as well as a summary and analysis of data on propolis (7 publications). Propolis from three geographical and climatic areas was investigated: (i) temperate climate regions (Europe, North America, Argentina, South Africa, Asia and New Zealand), including propolis from Bulgaria; (ii) subtropical climate regions (Greece, Cyprus, Croatia, Algeria, Morocco); (iii) tropical climate regions (Oman, Thailand, Vietnam, Fiji and Pitcairn islands, Cameroon, Colombia, Brazil, Taiwan). Modern methods of extraction, chemical profiling, fractionation of extracts and isolation of the active components have been used in the studies, complements by a wide variety of chromatographic, mass spectral and NMR methods for analyzing the composition of the extracts obtained and of the individual components. The contribution of the studies carried out is related to the creation of a database of mass spectra of the isolated compounds for their use in the dereplication studies of known types of propolis by GC/MS. Compounds that can be used as markers in identifying the plant origin of some of the studied propolis species are isolated and characterized. Methods for quality control and standardization for poplar-type propolis are proposed and approved by the International Honey Commission. The methods are used in the grading of propolis in the framework of contracts with national and international companies. The results of studies on propolis from Bulgaria can serve as a basis for its standardization in order to introduce ISO standards.

An important contribution to the work of Assoc. Prof. Popova is the summary of propolis data presented in several review articles, published in books and scientific journals. Aggregated literature data and own studies on the chemical composition of propolis volatiles, phytochemical approaches to propolis research, biological activity against bee pathogens, and problems with propolis' standardization are presented. For the first time, data on the use of propolis in new and promising areas and innovative products have been summarized. Aggregated knowledge of poplar and Taiwanese green propolis, as well as the criteria for quality control and standardization of poplar-type propolis, can serve as valuable guide for propolis research.

The results related to the second main scientific field of Dr. Popova are published in 6 articles from the submitted for the participation in the competition. They include results on the investigation of the chemical composition and biological activity of four plant species: *Apium graveolens*, *Apium nodiflorum*, *Verbascum eriophorum*, *Verbascum nobile* and *Geum urbanum*. The scientific contributions of these works are related to the elucidation of the chemical composition and biological activity of extracts and isolated individual components of the investigated plants, in order to evaluate their pharmacological potential.

The last part of Assoc. Popova's habilitation report is devoted to plans for future research. These plans envisage continuing and deepening research on propolis and bee honey. This is a subject in which the laboratory Chemistry of natural substances at IOCCP-BAS has world-renowned scientific achievements, which is why it is extremely important that Assoc. Prof. Popova will continue to develop the traditions established in this direction. Assoc. Popova also envisages continuing research on medicinal and aromatic plants for investigation of their composition and revealing their pharmacological potential. This area has an important place in the prospects for development of IOCCP-BAS, as one of the main topics within the Center for Competence "Sustainable utilization of bio-resources and wastes from medicinal and aromatic plants for innovative bioactive products", coordinated by IOCCP-BAS.

Participation in projects and scientific forums

Information was presented on the participation of Assoc. Prof. Popova in 17 research projects, of which 8 international, three of which were funded under programs of the European Commission (FP7 and H2020) and 9 national projects, funded by the NSF, in two of which Assoc. Popova was a coordinator..

The active scientific and applied activity of Assoc. Prof. Popova realized within the framework of contracts with foreign and national companies, state institutions, and universities in Bulgaria and abroad, makes an excellent impression.

The research results of Assoc. Prof. Popova have been presented at a significant number of international and national scientific forums, through scientific reports and poster communications. She has presented two plenary reports at international forums which is recognition of the high quality of her research.

Assessment of educational and pedagogical activity

Assoc. Prof. Popova actively participates in the education of undergraduate and doctoral students. She was a supervisor of two master's theses and consultant in 4 diploma theses of students from the Faculty of Chemistry and the Faculty of Chemistry and Pharmacy, Sofia University.

Assoc. Prof. Popova was a scientific consultant of a doctoral thesis entitled: "Chemical composition and biological activity of propolis from different geographical regions".

Applied research activities

The studies on poplar-type propolis from Bulgaria, have been further developed in an efficient method for enhancing the water solubility of propolis by its inclusion in biocompatible polymeric micelles. It was demonstrated that the new micellar form exerts a strong cytotoxic effect on leukemic cells. The research was performed in collaboration with colleagues from the Institute of Polymers-BAS. A utility model has been registered and its license has been granted to Organic BG EOOD for the period up to 30.09.2025.

With the participation of Assoc. Prof. Popova, another approach was developed to increase the water solubility of propolis and its activity against *S. aureus*, *E. coli* and *C. albicans* by incorporating it into silver-modified mesoporous silicate materials that have the potential of drug delivery systems.

Scientific-organizational and expert activity

Dr. Popova is a member of the editorial board of the Austin Journal of Bioorganic and Organic Chemistry and was a guest editor for Natural Product Communication.

Assoc. Prof. Popova is also involved in reviewing publications for a significant number of international journals and was a jury member for PhD defense at the Institute of Plant Physiology and genetics, BAS.

Assoc. Prof. Popova was co-chair of one and a member of the organizing committee of 4 international conferences.

Assessment of the applicant's personal contribution

Assoc. Prof. Popova is the first author in 8 publications and a corresponding author in 2 of the publications presented for participation in the competition. Her personal contribution is mainly related to the development and implementation of appropriate methods for extraction, fractionation and investigation of the composition of propolis and medicinal and aromatic plants, with potential pharmaceutical relevance, as well as the development of methods for standardization and quality control of propolis. The research conducted by Assoc. Popova requires an integrated scientific approach and involvement of experts from different fields, which explains the participation of larger scientific teams in some of the publications. Nevertheless, I strongly believe that the contribution of Assoc. Prof. Popova in the publications and research presented for participation in the competition is clearly outlined and indisputable.

Personal impressions

I have known Assoc. Prof. Dr. Milena Popova since her appointment at the IOCCP-BAS. It is my personal impression that she is a talented and highly competent researcher who can successfully continue and expand with new aspects the traditionally strong research activities of the Laboratory of natural products at IOCCP-BAS, through her research creativity and her ability to establish useful research collaborations within national and international projects. I would like to emphasize that Assoc. Prof. Popova is part of the younger generation researchers at IOCCP-BAS, who the Institute definitely relies on to address the challenges associated with the implementation of Centre of competence "Sustainable utilization of bio-resources and wastes from medicinal and aromatic plants for innovative bioactive products," as well as for the successful execution of the commitments of the Institute in the National Science Program "Healthy Foods for a Strong Bio-Economy and Quality of Life".

3. Critical comments and recommendations

I have no critical comments on the work of Assoc. Prof. Popova and the materials presented for participation in the competition. The documents are very carefully prepared and the contributions are clearly and interestingly presented. I wish Prof. Popova success in her future work and I hope that she will pass on her knowledge, skills and expertise to current and future young colleagues in the laboratory.

CONCLUSION

The scientific activity and research metric indicators of Assoc. Prof. Milena Popova, reflected in the materials submitted for participation in the competition, cover and exceed the requirements for the academic position of "Professor", in accordance with the Law for the Development of Academic Staff in the Republic of Bulgaria, The Regulations of BAS for the Implementation of this Law and the Regulations of IOCCP-BAS.

The scientific achievements of Assoc. Prof. Dr. Milena Popova convincingly present her as a talented and promising scientist, distinguished by her own scientific profile and a thorough approach in topical and important scientific area.

After the analysis of the research output of Assoc. Prof. Dr. Milena Popova, its importance and the scientific contributions reflected therein, **I give my positive assessment** and recommend to the Scientific Jury to prepare a report-proposal to the Scientific Board of IOCCP-BAS **for the selection of Assoc. Prof. Dr. Milena Petkova Popova, at the academic position of "Professor" at IOCCP-BAS** in the professional field 4.2. Chemical Sciences, scientific specialty "Bioorganic chemistry, chemistry of natural and physiologically active substances".

09. 09. 2019.

Reviewer:

Prof. Dr. Pavletta Shestakova