REVIEW

by Prof. Dr. Milen Georgiev Bogdanov,
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on the materials submitted for the competition to occupy the academic position of **"Professor" at the Institute of Organic Chemistry with Centre of Phytochemistry, Bulgarian Academy of Sciences (IOCCP-BAS)**
in the field of higher education 4. Natural sciences, mathematics and informatics, professional field 4.2. Chemical Sciences, specialty "Bioorganic Chemistry, Chemistry of Natural and Physiologically Active Substances"

In the competition for the academic position "Professor", announced in the State Journal, issue. 43/31.05.202019 and on the website of IOCCP-BAS, the only candidate Assoc. Prof. Dr. Milena Petkova Popova from the Institute of Organic Chemistry with Centre of Phytochemistry has submitted the respective documents.

1. General presentation of the received materials

The documents submitted by the applicant are in accordance with the requirements of the Law for the development of the academic staff in Republic of Bulgaria, the Rules for its implementation, the Rules for the Development of the Academic Staff of IOCCP-BAS, and meets the criteria of IOCCP-BAS for occupation of an academic position "Professor".

The candidate, Assoc. Prof. Popova, presented a total of 77 scientific papers, 35 of which counted for this competition: 2 book chapters and 33 original articles. They are all in accordance with the competition's field and are therefore subject to review. Additionally, a certificate of a registered utility model is provided, as well as a list of citations of the scientific papers, participation in scientific conferences, participation in and management of research projects, guidance of PhD and undergraduate students, which are also taken into account for the formation of the final opinion of the reviewer.

2. Brief CV of the applicant

Milena Popova completed her secondary education as a specialist in field of "Fine Organic Synthesis" at the School of Industrial Chemistry "Prof. Dimitar Balarev ", Ruse. She graduated in 1995 with a Master's degree in Chemistry and Physics from the Faculty of Chemistry at Sofia University St. Kliment Ohridski, and in 2004 defended her doctoral thesis, title: "Chemical composition and biological activity of propolis from different geographical regions and species of bees", under the supervision of Prof. Dr. Vasya Bankova. Dr. Popova's scientific career is mainly developed at IOCCP-BAS where she held the following positions: Chemist (1999-2001); Research Associate III (2001-2004); Chief Assistant Professor (2004-2014) and Associate Professor (2014 – till now). From 2018 she is Head of the Laboratory for Chemistry of Natural Products. Assoc. Prof. Popova is a member of the editorial board of the *Austin Journal of Bioorganic and Organic Chemistry* and a guest editor of a special issue of *Natural Product Communication*. She is a member of the International Propolis Research Group at the International Honey Commission, Association for Medicinal and Aromatic Plants of Southeastern

Europe (CAMAPSEEC) and is the chairman of the Bulgarian Phytochemical Society. She has reviewed scientific publications in a number of renowned international scientific journals, including *Journal of Natural Products*, *Phytochemistry*, *Phytomedicine*, etc. Assoc. Prof. Popova has completed four specializations abroad: Institute of Biomolecular Chemistry (Naples, Italy); Laboratory of Pharmacognosy and Chemistry of Natural Substances (University of Athens, Greece); University St. Cyril and Methodius (Skopje, Macedonia); Phycosource Company (Paris, France). For her work on the development of a water-soluble form of propolis, she has been awarded the "SIB IT'2015 Trophy.

2. Assessment of the applicant's contributions and scientific and practical activity

Assoc. Prof. Popova has submitted for the competition a list and copies of 35 publications, of which 2 book chapters and 33 articles, as well as an extended habilitation reference for her scientific contributions. All articles have been published in well known international journals indexed by Web of Science and/or SCOPUS and holding an impact factor or impact rank, respectively. The articles can be grouped as follows: 11 articles in specialized journals in the first quartile (Q1), 15 in the second (Q2), 3 in the third (Q3) and 4 in the fourth (Q4).

The scientific works of Assoc. Prof. Popova have found wide reverberation in the international literature. So far, 1529 citations have been noted, of which 1172 are in refereed and indexed in ISI Web of Knowledge and/or SCOPUS journals and in monographs abroad. The citations to the publications discussed in this competition are 338, *i.e.* received in the last five years. At the time of this review, a report in SCOPUS indicates that Assoc. Prof. Popova has a Hirsch Index of 20 for the entire period of creative work; with 4 of the articles contributing to this index being reviewed for this competition. Of these, one can highlight paper 44, which has been cited 122 times so far. It is noteworthy Article 60 of the annexed list, which was published in the current 2019 year but has already been cited 22 times. Another article, 43 from the list, was published in a journal with Impact Factor 2.094 (*Chemistry Central Journal*), but was cited 40 times so far.

Part of Popova's research is disseminated among the scientific community with 57 presentations in international and national scientific conferences, with 37 (65%) participations after the habilitation.

Assoc. Prof. Popova also demonstrates a wealth of experience in conducting research and leadership in research projects funded by international, national and corporate organizations.

From the material presented, it is clear that Assoc. Prof. Popova is a productive scientist, able to find the means to conduct research, work within and lead research teams, as well as to generate scientific production in accordance with the generally accepted high international standards.

During her professional career, Assoc. Prof. Popova was the head of two successfully defended Master theses and an advisor to four more. Data for supervision of doctoral theses were not provided, but her participation as a consultant to successfully defended, including international ones, as well as the active project activity of Assoc. Prof. Popova makes me convinced that she possesses the necessary competences to successfully pursue scientific guidance.

The applicant's research activity is consistent with the direction of the announced competition. Prof. Popova's main scientific contributions are in the field of chemistry of natural and physiologically active substances – an area both traditional and intensively developing globally due to the ever-increasing requirements of the food, cosmetic and pharmaceutical industries for finding active substances of natural origin. The main subjects of research of Assoc. Prof. Popova are medicinal plants, mushrooms and propolis, the latter being a bee product of plant origin.

Scientific contributions can be grouped thematically into two main areas:

- **Propolis studies** – investigation of the chemical composition and biological activity of propolis from different geographical regions and species of bees, and determination of its plant sources; summary and analysis of data for propolis;
- **Research on medicinal plants** – examination of the chemical composition and biological activity of medicinal plants.

Assoc. Prof. Popova makes a self-assessment of her scientific contributions in the form of extended habilitation work, which thoroughly and accurately reflects the main conclusions in the enclosed publications. A large part of her work is covered by research on propolis, a traditional subject in the Laboratory of Chemistry of Natural Products at IOCCP-BAS. The chemical composition of propolis from regions with temperate (Europe, North America, Argentina, southern Africa, Asia and New Zealand), subtropical (Europe and North America) and tropical (Asia and Africa) climates has been studied in detail. It has been shown that the samples from the individual regions are characterized by a similar chemical composition, with the main biologically active components being proven. For some types of propolis, a method and criteria for quality control and standardization have been proposed, which have been adopted and approved for application by the International Honey Commission and are currently applied in the practice of qualitative analysis of propolis. A large number of samples from different regions of Bulgaria have been analyzed and specific quantitative characteristics have been identified to guarantee good product quality. The average values have been found to be higher than the generally accepted minimum, which indicates that Bulgarian propolis is a high quality product.

In order to establish the composition-biological activity relationship, detailed studies were conducted with the aim to identify the active components of propolis. The chemical composition of propolis from different regions was investigated and the relationship between the chemical composition and the health status of bee families was deduced.

Another significant contribution of the applicant is the development of an efficient method for the preparation of aqueous colloidal solutions of detailed poplar-type propolis by incorporation into biocompatible polymeric micelles. This formulation has been shown to have a high potential for parenteral administration and cancer therapies. Silver mesoporous silicate materials loaded with propolis have been also prepared, and have been shown to posses enhanced water solubility and potential as drug-delivery systems with effective action against bacterial and fungal strains such as *S. aureus, E. coli, C. albicans*, etc.

An important point in propolis research is the production of empirical data to create a database of mass spectra of isolated compounds in the form of trimethylsilyl ethers (derivatized products) with a view to subsequent depletion of already known propolis types by GC / MS.

Another significant contribution of the applicant is the summary of literature data for propolis, which provides systematic information regarding its: chemical composition; plant sources; biological activity; innovative methods for qualitative and quantitative analysis;

problems with standardization; its application in promising fields and innovative products such as animal growth enhancer, food preservative, food storage packaging, textile materials for medical use, etc.

Studies in the applicant's second scientific area include the determination of the chemical composition and biological activity of isolated components of medicinal plants. Extracts of celery (*Apium graveolens*) , mullein (*Verbascum eriophorum*) and St. Benedict's herb (*Geum urbanum*) were studied in detail. Activity against bacterial and fungal strains, potential to regulate increased T cell activation and to suppress the development of experimental osteoporosis in rats have been identified for individual components.

In addition to the contributions listed above, it is important to note that the guidance at the end of the habilitation work for future research leaves an excellent impression to me as a reviewer and shows, on the one hand, Assoc. Prof. Popova as a researcher with a clear vision for the development of the scientific field, and on the other hand, as a worthy successor of topics developed during the years by world-famous Bulgarian scientists in the Chemistry of natural products field. It is planned to continue and deepen the studies on: chemical composition, plant sources and biological activity of propolis from different geographical regions; the chemical composition of the bee product – honey, in order to detect secondary metabolites; propolis and medicinal plants regarding the application of "green" approaches for the extraction of biologically active compounds; medicinal and aromatic plants, mushrooms, propolis, incl. research on wastes from the processing of natural products with a view to discovering their composition and pharmacological potential.

4. Assessment of the applicant's personal contribution

I have no doubts about the personal contribution of Assoc. Popova to the results obtained and the corresponding publications. In most of them, she is a leading author. For her qualities as a leading researcher in the field of this competition can also be judged by her election as Chairman of the Bulgarian Phytochemical Society, as well as a Head of the Laboratory for Chemistry of Natural Products at IOCCP-BAS.

CONCLUSIONS

The documents submitted by the applicant are in accordance with the requirements of the Law for the development of the academic staff in Republic of Bulgaria, the Rules for its implementation, the Rules for the Development of the Academic Staff of IOCCP-BAS, and meets the criteria of IOCCP-BAS for occupation of an academic position "Professor".

Overall, the candidate submitted a considerable number of scientific papers published after the appointment as Associate Professor. Dr. Popova's scientific qualification is undoubted. Her works have original scientific and applied contributions and have been published in renowned international journals. They have received wide international recognition. Therefore **I do recommend** to the Scientific Jury to prepare a report proposal to the Scientific Council of IOCCP-BAS for the selection of Assoc. Prof. Milena Petkova Popova for the academic position "Professor" at IOCCP-BAS in the professional field 4.2. Chemical Sciences, specialty "Bioorganic Chemistry, Chemistry of Natural and Physiologically Active Substances".

11 September 2019 Reviewer: .....

/Prof. Dr.Milen Georgiev Bogdanov/