

STANDPOINT

on competition for a professorship
in 4.2. Chemical Sciences (Physical Chemistry)
announced in SG No. 21/15/03/2022
with Candidate Associate Professor Dr. Veselin Kostadinov Petrov

by Prof. Dr. Tony Georgiev Spasov
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One candidate participated in the competition for professor of Physical Chemistry at the Faculty of Chemistry and Pharmacy of the University of Sofia - Associate Professor Dr. Veselin Kostadinov Petrov. Veselin Petrov graduated from the Faculty of Chemistry of the University of St. Kliment Ohridski", majoring in "Inorganic and Analytical Chemistry" in 1996. In 2004, he defended his doctoral thesis for the acquisition of the scientific and educational degree "Doctor" (Doctor of Ecology (analytical chemistry and ecometrics)) on the topic "Modern methods of analysis of tautomeric and dimerization processes".

Veselin Kostadinov Petrov worked in the representative office of "Bayer" in Bulgaria, S.P.Y. Ltd., Special Electronics Agency Ltd. During the period 1998 - 2000, he worked in the Vibrational Spectroscopy Laboratory at the Institute of Organic Chemistry with Center for Phytochemistry of the BAS. From 2006 to 2014, he was a senior researcher at the New University of Lisbon, Portugal. In the period 2013 - 2015, he was a guest researcher at the University of St. Kl. Ohridski" in the Faculty of Chemistry and Pharmacy under the "Beyond Everest" project. From 2015 to 2017, he was the chief assistant in the Department of Physical Chemistry of the FHF, and in 2017, Dr. Veselin Petrov was elected as an associate professor at the same department.

The scientific activity of Prof. Dr. Veselin Petrov covers 45 articles in scientific journals. In the current competition for a professor, he participated with 27 works (outside of the publications in the dissertation and the associate professor competition at the FHF of SU). All articles in the list are referenced and indexed in SCOPUS and have an impact factor: 16 publications in journals with quartile Q1, eight - Q2, two publications in Q3 and one with quartile Q4. He is first author in 6 publications, corresponding author in 5. On the publications included in the current competition, 427 citations in Scopus have been noticed, of which 250 are after 2017. Results of the candidate's research activity have been presented with oral reports and posters in several international and national conferences.

A habilitation thesis was presented on the topic: "Molecular Metamorphoses".

Veselin Petrov participated in teams on projects with the industry and a project with the National Research Institute. He is the head of the Bulgarian project ITN, MARIE CURIE ACTIONS - Rheology of nanoemulsions.

Prof. Petrov is a lecturer in the following courses at FHF: Information Technologies, ICS, POD and NIT I and II part, Chemical Informatics, Nonequilibrium Thermodynamics, Near Infrared Spectroscopy (NIR), Physical Chemistry and Colloidal Chemistry (I and II), as well as Physicochemistry I and II part - seminar classes and exercises.

Dr. Veselin Petrov is the co-supervisor of a dissertation work.

In his author's reference for scientific contributions, Associate Professor Petrov has divided his publications and, accordingly, results and contributions into three thematic areas. In each of them, Petrov's participation and his impact to scientific developments can be distinguished. For me, the first direction, concerning the preparation and investigation of the properties of new synthetic flavylum salts, is the main one in the candidate's research work. However, what has been achieved on the themes "Inclusion complexes in cyclodextrins and cucurbiturils" and "Preparation and characterization of metal complexes" is also essential.

I will briefly describe those results in each of the indicated scientific directions, which, in my opinion, are the most significant. Undoubtedly, the objects of research - flavylum salts and related anthocyanins are compounds with wide application as colorants and food additives and with great potential for new uses. In a large group of works, the equilibria of flavylum salts have been studied. The equilibria of natural and synthetic analogues of anthocyanins are reviewed as well. Thermodynamic and kinetic constants of a network of chemical reactions involving anthocyanins have been established. The products of these reactions are used in the wine industry and as antioxidants. With the participation of the candidate, a general approach was developed, enabling the complete thermodynamic and kinetic characterization of this class of substances. Prof. Petrov has made an important contribution to a study related to the application of flavylum compounds as optical recording media, neural networks, ionic liquids, in the field of phytochemistry and photochromism. Phenomena related to dimerization or aggregation leading to new forms in the reaction chain of the flavylum cation were also investigated. Equations are derived that cover all possible reactions and forms of the flavylum and antocyanate compounds. In his studies of flavylum salts and their various forms, the candidate also comes to outline their potential applications, especially as dyes used in photovoltaic panels.

Another thematic area in which Prof. Petrov works covers the study of complexes of inclusion of organic molecules in beta cyclodextrins and cucurbiturils. Using spectroscopic methods, the interaction of several different molecules (flavylum compounds, ibuprofen, naproxen) with beta cyclodextrins was investigated. The stability of the complexes was determined to depend on various factors, such as size, shape, type of substituents. The orientation of the "guest" molecule (flavylum cation) in the "host" cavity also depends on the type of substituents. A group of articles is devoted to the incorporation of drug molecules into cyclodextrins in order to improve their solubility in water and to increase their bioavailability. Here, too, the interaction between the two molecules (the conditions for the formation of the complexes, including their optimization) and the stability of the composites was mainly investigated. Various experimental synthesis methods have been applied and their efficiency in terms of completeness of the complexation process has been compared. The complexes were characterized using both structural and spectroscopic methods, and the methods of computational chemistry (quantum chemical calculations) were also used to calculate the thermodynamic parameters of the complex formation reaction. Combining these approaches and methods has allowed the determination of the most likely position of the guest molecule in the cyclodextrin cavity.

Associate Professor Petrov has taken a full part in an investigation involving the preparation and characterization of the structure and properties of spinels and metal complexes of phenanthroline with rare earth elements. Hydrophobic silica gels have been shown to be a

suitable matrix for obtaining hybrid composites with interesting optical properties. Effective luminescence of europium ion-functionalized silica aero-gel was found. Petrov's main contribution to these studies is the in-depth spectroscopic analyzes of the optical properties of the complexes and the theoretical justification of the observed effects (e.g. of temperature).

The research that Petrov is conducting is co-authored with colleagues from the Faculty of Chemistry and Pharmacy of SU "St. Kl. Ohridski", IOCCP-BAS, New University of Lisbon, Portugal. However, from the Author's reference, his contributions are clearly visible, and it is beyond doubt that they are essential and in many of the publications they can be characterized as basic, including participation in the construction of the research idea, in the creation of methodology, in experimental work, analysis of the results and in the writing of the article. Of the 27 publications included in the competition for professorship, in 10 Prof. Petrov is a corresponding author or first author, which shows his significant personal contribution.

The candidate's habilitation work "Molecular Metamorphoses" is dedicated to flavilia, synthetic substances with wide application in the food industry, in the pharmaceutical and cosmetic industries, optical memory medium, in logic circuits and molecular timers. The author considers flavilia compounds as good examples of systems exhibiting chemical metamorphosis. The diverse reaction networks generated by the flavylum salts are presented in detail and at a good scientific level. Numerous reactions of flavylum cations were examined, equilibrium constants and rates of transformation of one form into another were determined. Flavylum cations functionalized with specific substituents and their possibility to generate other flavylum isomers with different chemical and physical properties, which further increase the number of species in the reaction network, were also examined. In his habilitation work, Assoc. Prof. Petrov devotes space to the possibilities for the development of the scientific field, mainly through the inclusion of flavylum compounds in polymers, nanoparticles, surfaces, interfaces or as molecular building blocks of micelles or for the construction of molecular machines and complex supramolecular systems.

In conclusion, I am convinced that Associate Professor Veselin Petrov meets all the requirements of the Law for holding the academic position of Professor of Physicochemistry, having also fulfilled the additional recommended criteria accepted by the Faculty Council of the FCP. Based on the above arguments, I propose Associate Professor Veselin Petrov to be elected as a professor of Physical Chemistry at the Faculty of Chemistry and Pharmacy, SU "St. Kliment Ohridski".

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Prof. Dr. Tony Spassov
BAS Corr. Member