STATEMENT

from Assoc. Prof. Kiril Simitchiev, PhD
Faculty of Chemistry, University of Plovdiv "Paisii Hilendarski"

REGARDING: competition for the academic position "Associate Professor",
Field of higher education 4. Natural sciences, mathematics and informatics,
Professional direction 4.2. Chemical Sciences (Analytical Chemistry)

Deyana Lyubomirova Georgieva from University of Plovdiv "Paisii Hilendarski" participated as a single candidate in the competition for "Associate Professor", announced in the State Gazette, issue 98 from 19.11.2024 and on the website of University of Plovdiv "Paisii Hilendarski" for occupation in the Department of Analytical Chemistry and Computer Chemistry at the Faculty of Chemistry.

1. General overview of the procedure and the candidate

Procedure materials: By order No. RD-22-82 from 17.01.2025 of the Rector of the University of Plovdiv "Paisii Hilendarski", I have been assigned as a member of the scientific jury of a competition for the academic position "Associate Professor" at the University of Plovdiv in the Field of higher education 4. Natural sciences, mathematics and informatics, Professional direction 4.2. Chemical Sciences (Analytical Chemistry), announced for the needs of the Department of Analytical Chemistry and Computer Chemistry at the Faculty of Chemistry.

Only one candidate has submitted documents for participation in the announced competition: Chief Assist. Prof. Deyana Lyubomirova Georgieva, PhD from the University of Plovdiv "Paisii Hilendarski".

The candidate has submitted all the necessary documents and their review shows that they are in accordance with the requirements of the Law on the Development of the Academic Staff of the Republic of Bulgaria, the Rules for its Implementation (RILDASRB) and the Regulations for the Development of the Academic Staff at the University of Plovdiv "Paisii Hilendarski".

The candidate is co-author of a total of 26 scientific papers and one book chapter. In the competition for the academic position "Associate Professor" Deyana Georgieva participate with 14 publications and one book chapter. The scientific results are reported on 42 national and 11 international conferences as nine oral and 44 poster presentations. Chief Assist. Prof. Deyana Georgieva is a member of the working group of 22 research projects (4 international, 11 national and 7 projects funded by the Research Fund of the University of Plovdiv).

A brief biography data of the candidate: Deyana Georgieva graduated at the Faculty of Chemistry at University of Plovdiv in 1995 with a Master's degree in Teacher of Chemistry and Physics. She initiated her professional career as a chemist at the Faculty of Chemistry at the University of Plovdiv, from 1994 to 2004. She subsequently held the position of assistant professor (2004-2008), senior assistant professor (2008-2010), and since 2010, she has been recognized as a chief assistant professor. Deyana Georgieva obtained her PhD degree in 2015.

Personal impressions: As a member of the Department of Analytical Chemistry and Computational Chemistry at the University of Plovdiv, I have had the opportunity to know Deyana Georgieva for over two decades. In the course of my collaborative work with her, I have come to recognize her as a highly erudite and ethical individual. She is a qualified lecturer in the field of analytical chemistry and an established researcher with experience in atomic spectrometry.

2. General description of the applicant's activities

Assessment of the teacher activity: The main part of the teacher activities of Deyana Georgieva includes conducting classes with bachelor students in mandatory subjects, including "Analytical Chemistry (Part I and II)", "Analytical Chemistry with Instrumental Methods of Analysis", "Sampling and sample preparation", and "Methods for Separation and Concentration in Chemical Analysis". Notably, Dr. Georgieva has developed the lecture course and the practical classes for the latter, underscoring her commitment to comprehensive curriculum design. In addition, the applicant has actively participated in practice classes with students from the Master's Programs of the Faculty of Chemistry and Biology at the University of Plovdiv. It is also important to point out that Dr. Deyana Georgieva was actively involved in the development of a joint Master's program "Intelligent Analytics" between the Faculty of Chemistry and Pharmacy at Sofia University “Saint Kliment Ohridski" and the Faculty of Chemistry at the University of Plovdiv. Under Dr. Georgieva's supervision, a total of six diploma theses were successfully defended. Dr. Georgieva was a co-supervisor of a PhD student in the "Analytical Chemistry" program.

Over the course of the past five academic years, Chief Assist. Prof. Deyana Georgieva has delivered lectures and practice classes to students for a total of 2,571 hours (Bachelors) and 490 hours (Masters), thereby satisfying the additional requirement of the Faculty of Chemistry at the University of Plovdiv for candidates applying for the academic position of "Associate Professor" in Professional direction 4.2. Chemical Sciences, namely to have minimum 1080 hours of classes with students.

Assessment of the scientific activities: In the context of the academic position competition for "Associate Professor," the candidate presents a total of 14 scientific publications and one book chapter. These publications and chapter are not utilized in prior competitions, which were designed to encourage scientific advancement. The scientific works are distributed in the following way according to the indicators in the RILDASRB: five are in indicator group C (achieved a total of 102 points), and the remaining 10 scientific papers are in indicator group D (achieved a total of 209 points). The majority of the publications (9) were in first quartile (Q1) journals, which is indicative that the results were published in recognizable and established journals and is a testament to the quality of the research. Notable publications in prestigious journals in the field of analytical chemistry and instrumental methods of analysis include *Journal of Analytical Atomic Spectrometry*, *Talanta*, *Analytica Chimica Acta*, and *Spectrochimica Acta Part B*. According to the documents submitted by the applicant, 140 citations (excluding self-citations by all authors) have been recorded for the total scientific output of Dr. Georgieva. A check in Scopus on 01.03.2025 shows that the number of citations has increased to 166, which exceeds the requirements for the position of an associate professor many times over. According to Scopus (01.03.2025), excluding self-citations of all authors, Deyana Georgieva's Hirsch index is 7. The listed scientific metrics indicate the candidate's good scientific recognition. A significant aspect of the scientific research is the active involvement of the candidate in various scientific research projects. Dr. Georgieva has demonstrated a high level of engagement in research projects, as evidenced by her participation in 22 projects. The results of the research conducted with the participation of the candidate have been presented at scientific forums in a total of 53 oral reports and poster presentations.

A scientific and applied contributions: On the basis of the presented author's statement of contributions, the thematic systematization of the results obtained by the candidate in the form of a habilitation thesis, as well as the publications under the competition, I define the scientific research of Dr. Georgieva as interdisciplinary with scientific and applied character. The interdisciplinary nature of the research determines the active cooperation with a number of research groups from the country and abroad. The focal point of Dr. Georgieva's research endeavors lies in the domain of enhancing the capabilities of inductively coupled plasma mass spectrometry (ICP-MS) for single particle detection (spICP-MS) and the development and application of methodologies for spectrochemical elemental analysis. I accept the scientific contributions in the author's abstract as original and correctly formulated, namely:

1. Development and application of Inductively Coupled Plasma Mass Spectrometry for Characterization of Nanoscale Materials. The scientific and applied contributions of the research in this area can be summarized as follows:

−A statistical model has been developed for the selection of an appropriate dilution factor allowing adequate analysis (single nanoparticle registration) of nanoparticles of different composition and size;

−A systematic study was conducted to investigate the impact of dispersion medium on the stability of nanocolloid suspensions. Additionally, the efficacy of various washing solvents in eradicating the "memory effect" induced by nanoparticle deposition on ICP-MS sampling system surfaces was assessed;

−For analysis of the metallic nanoparticles has been proposed a methodology for the experimental evaluation of the mass fraction of the two forms (ionic and particular) of the analyte's presence in the sample;

−The transport efficiency in the spICP-MS analysis was evaluated by considering the influence of the processes occurring in the sample introduction system and those related to ionization in the plasma and the subsequent transfer of the analyte to the detector;

−A calibration strategy, which involves the use of an ionic solution of the element present in the composition of the nanoparticles is proposed. This strategy is an alternative to the approach of utilizing a set of costly and rarely available reference materials of nanoparticle with certified diameter. To facilitate the implementation of the proposed calibration approach, a spreadsheet-based theoretical model has been developed. This model enables the calculation of the concentrations of homogeneous standards that would deliver a specific mass of analyte (corresponding to a particle of a given diameter) for a given integration time. Additionally, the inverse calculation, which determines the diameter of the nanoparticle whose mass corresponds to the mass of analyte introduced by an ionic standard of a given concentration is also available;

−A methodology has been developed for the estimation of the combined uncertainty in the determination of the diameters of nanoparticles of varying composition and size. The uncertainty intervals of diameters enable the derivation of a statistically reasonable resolution of spICP-MS. This approach facilitates the determination of an appropriate cluster width in the size distribution histogram of the analyzed nanoparticles. An important conclusion that is drawn is that when introducing homogeneous ionic solutions of the analyte, the noise of the recorded signal depends only on the delivered mass of the analyte but not on the integration time. The standard deviation of the recorded signals, therefore, represents a robust and reliable estimate of the contribution of ionization and mass transport processes to the combined uncertainty in nanoparticle size determination;

−The spICP-MS method has been utilized in the characterization of nasal suspensions containing silver nanoparticles, as well as in the study of drug-loaded silver nanoparticles.

2. Development and evaluation of sample preparation approaches and spectrochemical methods for elemental analysis. The scientific and applied contributions of the research in this area can be summarized as follows:

−A comparative analysis was conducted to assess the extraction efficiencies of Cd, Co, Cr, Cu, Mn, Ni, Pb, and Zn from sewage sludge samples using ultrasonic extraction or microwave-assisted extraction. It is concluded that ultrasonic extraction can be applied as an alternative to the more expensive and operating at higher pressure microwave-assisted acid mineralization;

−A comparative study of different soil sample preparation approaches to determine the total and extractable (plant-available) forms of phosphorus was implemented. The results obtained by UV VIS spectroscopy were compared with those detected by ICP-MS;

−A methodology for syntheses of ligand-impregnated (ammonium pyrrolidine dithiocarbamate) silica-modified manganese ferrite nanoparticles ($MnFe_2O_4$@SiO_2-APDC) with magnetic properties is proposed. These nanoparticles are suitable as sorbents for solid-phase extraction of Co, Cu, Zn, Mo, Cd, Tl, Pb, and Bi. The optimal conditions for the retention and elution of the aforementioned elements have been determined, and the procedure has been combined with ICP-MS for the analysis of the analytes in aqueous samples;

−An automated and rapid method was developed for the analysis of Ca, Fe and Mn in mosses by combining flame atomic absorption spectrometry with a discrete liquid sample introduction system operating in solvent-air-sample-air-solvent (ASDI-FAAS) mode. The proposed method leads to results compatible with those obtained by the much more expensive instrumental technique, ICP-MS;

−The content of a set of elements (V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Mo, Pb) in wild berries (bilberry, cranberry, dogwood and hawthorn) collected from the territory of Bulgaria was determined. A similar study was also conducted to establish the elemental profile (Al, As, Ba, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni Pb, Se, Sr, V and Zn) of Linden flowers collected from different locations in Plovdiv. In both cases, chemometric methods were applied to create clusters of samples, which was used to draw conclusions about the content of essential and toxic elements in the plant samples. The concentration of elements extracted in a hot water during the preparation of infusions was also estimated for the Linden blossom samples;

−A series of studies were conducted to ascertain the ecological status of surface freshwater. The accumulation of 12 elements (Al, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, and Zn) by mosses and mussels placed into natural water bodies was monitored. The results for elemental composition were used to calculate pollution factors/indexes, which were subsequently applied to assess the ecological status of the water bodies under study. The elemental analysis was carried out using ICP-OES and ICP-MS, and for both instrumental methods were taken precautions to identify and correct spectral interferences;

−Plasma-based spectrochemical methods (ICP-OES and ICP-MS) were employed to examine the composition of macro (N, P, and K) and trace elements (Co, Cu, Mn, and Zn) in the upper soil horizon of samples collected in the town of Plovdiv. The study revealed significant variations in trace element content, with loading levels being higher in roadside soils compared to park soils from the same area. The potential for remediation of soils from urban areas through the cultivation of diverse crops was examined. For a set of elements (As, Cd, Co, Cu, Mn, Mo, Ni, Pb, U, and Zn), bioaccumulation and translocation factors for the plant species under study were assessed.

Evaluation of the personal contribution of the candidate: The review of the materials provided by Deyana Georgieva and my direct observations of her research activities give me a reason to confirm that she has a substantial participation and significant personal contribution in the implementation of the research and the development of each of the scientific works submitted for the competition for the academic position of Associate Professor.

3. Critical comments and recommendations

I have no critical comments/recommendations for the applicant.

CONCLUSIONS

The documents and materials, presented by Chief Assist. Prof. Deyana Lyubomirova Georgieva comply with all the requirements of the Law on the Development of the Academic Staff of the Republic of Bulgaria, the Rules for its Implementation (RILDASRB) and the Regulations for the Development of the Academic Staff at the University of Plovdiv “Paisii Hilendarski” and the additional requirements of the Faculty of Chemistry at University of Plovdiv.

The candidate has submitted a sufficient number of scientific publications other than those used in the defense of her PhD degree. After reading the materials and the scientific works submitted in the competition, analyzing their significance and the scientific and applied contributions contained in them, I find it justified to give my positive assessment and to recommend the Scientific Jury to prepare a report-proposal to the Faculty Council of the Faculty of Chemistry for the election of Deyana Lyubomirova Georgieva to the academic position of "Associate Professor" at the University of Plovdiv “Paisii Hilendarski” in: Field of higher education 4. Natural sciences, mathematics and informatics, Professional direction 4.2. Chemical Sciences (Analytical Chemistry).

01.03.2025 г. **Prepared by**: .....

/*Assoc. Prof. Kiril Simitchiev, PhD*/