

## REVIEW

of the materials submitted for participation in a competition  
for the academic position of "Associate Professor"  
at the Plovdiv University "Paisii Hilendarski"  
in professional direction 4. Natural Sciences, Mathematics and Informatics,  
professional field 4.2. Chemical Sciences (Analytical Chemistry)

by Prof. DSc. Elisaveta Hristova Ivanova,  
retired from the Institute of General and Inorganic Chemistry at the Bulgarian Academy of Sciences

By order No. PD 22-82 of 17 01. 2025 of the Rector of the Plovdiv University "Paisii Hilendarski" (PU) I was appointed as a member of the Scientific Jury of the competition for the academic position of 'Associate Professor', announced in the State Gazette, No 98 of 19. 11. 2024 and on the website of Plovdiv University "Paisii Hilendarski" for the needs of the Department of Analytical Chemistry and Computational Chemistry, Faculty of Chemistry, in professional direction 4. Natural Sciences, Mathematics and Informatics, professional field 4.2. Chemical Sciences (Analytical Chemistry).

The only candidate in the competition is Chief Assistant Dr. Deyana Lyubomirova Georgieva from the Department of Analytical Chemistry and Computational Chemistry, Faculty of Chemistry of Plovdiv University "Paisii Hilendarski".

### **1. General description of the submitted materials**

The materials submitted by Chief Assistant Dr. Deyana Lyubomirova Georgieva for the competition are in accordance with the Regulations for the Development of the Academic Staff of the Plovdiv University:

• *Articles submitted for the competition - 15, of which:*

- Article in a foreign monograph – 1;
- Articles in foreign scientific journals - 12;
- Articles in national scientific journals - 3;
- Articles in journals with impact or SJR factor – 14, of which 9 in quartile Q1, 1 in Q2, 1 in Q3 and 3 in Q4.
- In English - 15;
- Sole author - 1; with two co-authors - 2; with three or more co-authors - 12;
- Habilitation work on 5 of the scientific publications.

The submitted materials were not used in the procedure for acquiring the PhD degree. The quantitative indicators exceed the minimum national requirements for occupying the academic position "Associate Professor".

- *Participation in scientific and educational projects:*

- One international scientific project and 10 national scientific and educational projects.

- *Reflection of the scientific publications in the specialized literature:*

- List of 140 noted citations (without self-citations) of the publications of Chief Asst. Dr. Deyana Georgieva for the period 2015-2024 – 135 by foreign authors, 5 by Bulgarian authors. H-index – 7.

- *Organizational experience*

- Chief Asst. Dr. Deyana Georgieva has good organizational skills, acquired through participation in the organizing committees of 2 conferences (10th and 11th Chemistry Conference of PU) and 8 seminars (organized jointly with the company ASM2 in the period 2014–2024).

## **2. Brief biographical data**

Deyana Georgieva graduated from secondary school in 1988, after which she completed a two-year training at the Technical School of Biotechnology and Chemical Industry "D. Mendeleev" - Stara Zagora. She completed her higher education in 1995 at the Department of Analytical Chemistry and Computer Chemistry of the Faculty of Chemistry of the University "P. Hilendarski" with a master's degree. In 2004 she was elected Assistant in the same department, in 2008 Senior Assistant, in 2010 Chief Assistant. In 2015 she obtained a PhD grade with the dissertation "Solid-phase extraction with magnetic nanoparticles in the analysis of trace elements by plasma spectrometry".

## **3. Characteristics of the submitted materials**

- *Teaching and pedagogical activity*

According to the attached report, in the period from 2019 to 2024, Senior Asst. Prof. Dr. Deyana Georgieva had lectures and exercises for bachelor's and master's degrees of over 3000 hours, exceeding three times the additional requirements of the Faculty of Chemistry of PU for holding the academic position of "Associate Professor" (not less than 1080 hours); she was the supervisor of three graduate students and the co-supervisor of one successfully defended PhD student.

- *Scientific and scientific-applied activity*

The scientific and scientific-applied studies of Chief Asst. Dr. Deyana Georgieva in the materials submitted for the competition are in two main directions:

(1) *Optimization and application of inductively coupled plasma mass spectrometry for characterization of nanoscale materials (habilitation work based on scientific publications **B1-B5**).*

The habilitation work reviews the application of inductively coupled plasma mass spectrometry for characterization of nanoscale materials. The main factors influencing the capabilities of the method for characterization of nanoparticles (**B3**) are examined. The factors influencing the efficiency of inductively coupled plasma mass spectrometry operating in single particle registration mode (spICP-MS) for characterization of silver nanoparticles (AgNPs) are monitored. The capabilities of electron spectroscopy in the visible and ultraviolet regions of the spectrum for obtaining information about the size of AgNPs are investigated. The influence of the dispersion medium on the stability of nanocolloidal suspensions is assessed. The possibility of removing the "memory effect" in the analysis is studied. The method is applied to the analysis of nanocolloidal suspensions (**B1, B2**) and to calculate the uncertainty of the size of AgCl, AgI, Ag<sub>2</sub>O and Ag<sub>2</sub>S nanoparticles, the determination

of which is of environmental interest, but for which no reference materials are available. AgNPs loaded with medications are synthesized and the release of the medication component from their surface is studied (**B4, B5**).

(2) *Development of approaches for sample preparation in combination with spectrochemical methods of analysis for the determination of essential and potentially toxic elements in environmental objects (scientific publications (G1-G10)).*

The possibilities of ultrasound-assisted and microwave-assisted extraction (**G2, G3**) are compared and the influence of the composition of the reaction mixture (**G3**) on the acid mineralization of samples is studied. The possibility of applying dispersive solid-phase extraction using modified magnetic nanoparticles as a sorbent for simultaneous extraction of elements from water samples (**G5**) is investigated. For the determination of essential (**G1, G3**) and potentially toxic elements (**G4, G6 - G10**) in soil (**G3, G7, G8**) and plant (**G1, G4, G6, G8, G9, G10**) samples, spectrochemical methods using flame atomic absorption spectrometry (**G1**), electron spectrometry in the ultraviolet and visible spectral region (**G3**), optical emission spectrometry with inductively coupled plasma (**G6 - G9**) and mass spectrometry with inductively coupled plasma (**G1, G3, G4, G6 - G10**) are applied.

#### **4. Contributions (scientific, applied-scientific) and citations**

I agree with the author's assessment of the contributions (scientific and applied-scientific) in the scientific papers submitted for the competition. The contributions are from the category "Enrichment of existing knowledge and theories". The main contributions are as follows:

- The factors influencing the efficiency of mass spectrometry with inductively coupled plasma in the registration of single particles (spICP-MS) are monitored. A theoretical model is developed, allowing a statistically justified choice of an appropriate dilution factor for nanoparticles of different composition and size (**B1, B2**).

- For the first time it is experimentally proven that, based on the standard deviation of the signals, the contribution of ionization and mass transport processes to the total uncertainty in the characterization of nanoparticles can be estimated (**B2**).

- A systematic review of the influence of the sample introduction system on the analytical characteristics of the spICP-MS method is made (**B3**).

- The developed and optimized spICP-MS method is applied to the determination of Ag nanoparticles with a view to their use in nanomedicine as drug carriers (**B4**) and therapeutic anticoagulants (**B5**). For the first time, the density functional theory (DFT) is applied to establish the nature of the interaction between the drug component and the nanostructures (**B5**).

- For the first time, an automated, rapid and reliable method for the determination of Ca, Fe and Mn in mosses by flame atomic absorption spectrometry (**G1**) is proposed. The integrated ASDI-FAAS system used allows the introduction of solutions with high salt content into the flame.

The 140 citations of the scientific papers (excluding self-citations) noted so far are mainly by foreign authors in renowned international journals. Article **G2**, dedicated to the ultrasound-assisted extraction of heavy metals in combination with ICP-OES analysis, has been cited 60 times.

#### **5. Assessment of the candidate's personal contribution**

Chief Asst. Dr. Deyana Georgieva has obtained her PhD with a dissertation in the field of analytical chemistry, she has worked in the Department of Analytical Chemistry and Computational

Chemistry of the Faculty of Chemistry of PU "P. Hilendarski" for more than 20 years and has gained significant experience in the field of analysis. Therefore, I consider the candidate's personal contribution to the collective publications as significant, consisting in participation in performing of the experimental work and discussion of the results obtained.

#### **6. Critical remarks and recommendations**

I have a formal remark – although not used in the PhD dissertation, articles G1-G3 are from the period before its defense.

#### **7. Personal acquaintance with the candidate**

I am not personally acquainted with Chief Asst. Dr. Deyana Georgieva.

#### **8. CONCLUSION**

The significance of the scientific research of Chief Asst. Dr. Deyana Georgieva is determined by the fact that the process of analysis - sample preparation, separation and pre-concentration (when necessary), method of determination - is considered in its entirety and is optimized depending on the type of analyzed object and the determined components. All this contributes to the development of efficient, sensitive and accurate analytical methods that meet modern requirements and are applied to the analysis of various objects – soils, waters, plants, drug-loaded metal nanoparticles.

The topic on which Chief Asst. Dr. Deyana Georgieva is working - development and optimization of modern sensitive and accurate methods of analysis - is important on both national and global levels.

The documents and materials, presented by Chief Asst. Dr. Deyana Georgieva, meet all requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations of the Plovdiv University "Paisii Hilendarski". The candidate has presented a sufficient number of scientific works not included in the PhD procedure. The candidate's works contain original scientific and applied-scientific contributions that have received international recognition. The results achieved by Chief Asst. Dr. Deyana Georgieva in the educational and scientific research activities fully comply with the minimum national requirements and the additional requirements of the Faculty of Chemistry of the Plovdiv University according to the Regulations for the implementation of the Law on the Development of the Academic Staff in the Republic of Bulgaria.

After getting acquainted with the materials and scientific papers presented for the competition, analyzing their significance and the scientific and applied scientific contributions contained in them, I find it reasonable to give my positive assessment and to recommend to the Scientific Jury to prepare a report-proposal to the Faculty Council of the Faculty of Chemistry for the election of Chief Assistant Dr. Deyana Lyubomirova Georgieva to the academic position of "Associate Professor" at the Plovdiv University "Paisii Hilendarski" in professional direction 4. Natural Sciences, Mathematics and Informatics, professional field 4.2. Chemical Sciences (Analytical Chemistry).

Date: February 26, 2025

Sofia

Signature:

/Prof. DSc Elisaveta Ivanova/