

REVIEW

By Prof, DSc Elisaveta Ivanova,

member of the Scientific Jury for the contest for the academic position “Professor”, announced in the State Gazette no. 96/2021, professional field 4.2. Chemical Sciences (Inorganic Chemistry), for the needs of the Faculty of Chemistry and Pharmacy at Sofia University "St. Kl. Ohridski "

The only candidate in the current contest for the academic position "Professor" in the professional field 4.2. Chemical Sciences (Inorganic Chemistry) is **Assoc. Prof. Dr. Penka Vasileva Tsanova** (Author ID (SCOPUS): 16317777700 Researcher ID (Web of Science): AAL-8218-2021). The documents submitted by the candidate are in compliance with the requirements of the Law for development of the academic staff in the Republic of Bulgaria and the Regulations for its implementation, the Regulations for the terms and conditions for acquiring scientific degrees and holding academic positions at Sofia University "St. Kl. Ohridski", as well as with the Recommended Criteria of the Faculty of Chemistry and Pharmacy (FCP) at Sofia University, for acquiring scientific degrees and holding academic positions for the professional field 4.2 Chemical Sciences. The author's reference for the fulfillment of the minimum national requirements under art. 2b (2) of the Law for development of the academic staff in Republic of Bulgaria, as well as with the Recommended Criteria of FCP, Sofia University, in professional field 4.2. Chemical Sciences, for the academic position "Professor", shows that Assoc. Prof. Dr. P. Vasileva meets the required minima in all indicators and exceeds most of them.

Assoc. Prof. Dr. Vasileva graduated from the Faculty of Chemistry at Sofia University in 1981 with average grade of the study "very good" and professional qualification “Master “. In 2003 she obtained the educational and scientific degree "Doctor" in Inorganic Chemistry. In the period 1992-2012 she was "Assistant", "Senior assistant" and "Chief assistant" at the Faculty of Chemistry and Pharmacy of Sofia University, and in 2012 she was elected "Associate Professor".

Scientific publications

Assoc. Prof. Dr. Penka Vasileva is co-author of a total of 86 scientific papers, 66 of which in scientific journals and collections of scientific forums, incl. 3 chapters in books, 14 textbooks, teaching and methodical aids and 6 documented technologies. The citations in Scopus of these publications with excluded autocitations are 401, h index - 9. The list of research projects with participation of the candidate contains a total of 36 project topics, including two international projects funded by the EU, 11 projects funded by the Scientific Research Fund of the Ministry of Science and Education, 21 projects for research and technological development funded by various organizations and companies in Bulgaria.

Teaching activity

The teaching activity of Assoc. Prof. Dr. Penka Vasileva includes lecture courses on the topic of the contest and exercises to them: "General and Inorganic Chemistry", "Methods for preparation and purification of inorganic substances", "Distillation and rectification methods for purification", "Basic separation processes in low-volume production", "High-purity substances". Assoc. Prof. Dr. Penka Vasileva is the head of the practice of 4th-year students in Chemistry, specialization "Especially Pure Substances", co-supervisor of a defended PhD thesis, supervisor of 15 defended diploma theses.

Expert activity

The expert activity of Assoc. Prof. Dr. Penka Vasileva includes membership in the FCP's Training Council (1 term), in the FCP's Attestation Commission (2 terms), in the FCP's Committee of Quality (2 terms), in the Association of Olympic Team Leaders. She actively participated in the organization of the National Olympiad in Chemistry and Environmental Protection for high school students, is the head of the Bulgarian team for participation in the International Chemistry Olympiad, is a member of the International Jury for the International Chemistry Olympiad.

For participation in the contest for professor Assoc. Prof. Dr. Penka Vasileva has presented 36 papers that were not used in the "Doctor" thesis (2002) and in the contest for associate professor at the FCP of Sofia University (2012) including:

- ✓ 25 publications, of which:
 - 16 publications in scientific journals with quartile (13, of which: 6-Q1, 2-Q2, 4-Q3, 1-Q4), with SJR (1), in Bulgarian journals or collections, cited by independent foreign authors in Scopus (2);
 - 3 chapters of books dealing with smart materials and nanotechnologies;
 - 2 publications in a peer-reviewed scientific journal referred to in Chemical Abstracts and 1 in a collection of scientific forums;
 - 3 publications related to the International Olympiad in Chemistry in a peer-reviewed scientific journal referred to in Scopus (2-Q3, 1-Q4);
 - ✓ 11 textbooks, manuals and methodological aids, of which:
 - 3 textbooks (for 8th, 9th and 10th grade of high school), approved by the Ministry of Education and Science;
 - 4 manuals and methodological aids (for 8th and 10th grade of high school), approved by the Ministry of Education and Science;
 - 4 collections of tasks and their solutions from Regional and National rounds of the Olympiad in Chemistry and Environmental Protection in Bulgaria;
 - ✓ 153 citations in Scopus of the publications submitted for participation in the contest for "professor", with excluded autocitations;
 - ✓ A Habilitation thesis entitled: "Design and characterization of new nanomaterials for speciation analysis of mercury, chromium and iron". It is based on studies on "green" chemical methods for the synthesis of metal nanoparticles, metal-oxide nanocomposite particles of the "core-

shell" type, hybrid organic-inorganic nanocomposite films, their physicochemical characterization and analytical applications. The Habilitation thesis covers five scientific publications in which Dr. Vasileva is the first or corresponding author;

- ✓ Reports at 37 scientific forums (31 international, 6 national) after the habilitation.

Scientific contributions

The studies of Dr. Vasileva in the works submitted for participation in the contest for professor are mainly in the scientific field "Science and Technology of Nanomaterials" and additionally - in the field of "Chemical Education" - training in chemistry and environmental protection in high school.

The author's reference correctly reflects the purpose of the research, the most important results and conclusions, as well as her own contributions.

1. Science and technology of nanomaterials

The scientific contributions of Assoc. Prof. Dr. Vasileva in this field consist mainly in the combination of interdisciplinary basic and applied research aimed at obtaining the so-called smart nanomaterials, with tailored properties in terms of their practical application, for example, simple, possibly waste-free synthesis, stability during operation and storage, easy operation, high capacity, low cost and / or renewability. New nanomaterials have been synthesized using new optimized "green" procedures, their physicochemical and functional properties such as extraction efficiency / sensory activity, selectivity and sensitivity to certain chemical forms of the elements, biological activity and (photo) catalytic efficiency have been characterized. Dependences between the synthetic conditions, the physicochemical characteristics of the nanomaterials and their functional properties have been established. The obtained results make it possible to determine specific chemical forms of elements - toxic or essential, and the developed new synthetic procedures and analytical methods are characterized by high efficiency, sensitivity and selectivity. Some examples are given below.

- A new method for synthesis of ZnO nanocrystals and Au / ZnO composite nanocrystals in a starch matrix has been developed and optimized. The process is characterized by simplicity, environmental compatibility and good performance. Nanocomposite samples with different gold content have been synthesized. Their structure, size and shape of nanocrystals, thermal behavior, surface characteristics and optical properties, as well as their photocatalytic activity have been studied.

- An original procedure for the synthesis of nanocomposite materials SiO₂-NH₂ @ AgNPs and SiO₂-NH₂ @ AuNPs of the "core-shell" type has been developed. It has been shown that "colloidal mixing" yields discrete metal oxide nanocomposite particles consisting of pre-synthesized and surface-functionalized monodisperse submicron SiO₂-NH₂ spheres ("cores") and decoration of discrete and homogeneously located on the surface of the "cores" pre-synthesized nanoparticles Ag/Starch NPs and Au/Starch NPs ("shells"). The extraction

efficiency and the selectivity of the sorbents to the chemical forms of Hg have been studied and an analytical procedure has been developed to determine the forms of Hg in surface waters.

- Micrometer-sized spheres of silica coated with a layer of Cr (VI) printed methylimidazole ionic liquid have been synthesized. The silica cores have been obtained by an original nuclei-growth procedure. The formation of the ionic liquid layer on their surface is combined with simultaneous CrO_4^{2-} printing. Sorbent characterization has been performed by SEM / EDS, elemental microanalysis and thermogravimetric analysis. The developed analytical procedure for the determination of Cr (VI) in textile extracts fully complies with the requirements of international textile regulations.

- An eco-friendly method has been developed for the production of chitosan film loaded with silver particles (CS-AgNPs), which has been used as an effective sorbent for the separation and enrichment of Al (III), Cd (II), Cu (II), Co (II), Fe (III), Ni (II), Pb (II) and Zn (II). A stable colloidal solution of CS-AgNPs has been prepared by dispersing AgNPs in chitosan solution at the appropriate ratio and further used to produce a cast film with very good stability on storage and good mechanical strength for easy handling in aqueous media. The incorporation of AgNPs into the structure of the CS film and the interaction between the polymer matrix and the nanoparticles is confirmed by UV-vis and FTIR spectroscopy. In SEM micrographs, AgNPs homogeneously embedded in the film are clearly observed.

- Toxic forms of some priority (Hg) and country-specific (Cr) pollutants, as well as bioavailable forms of some essential elements (Fe) in aquatic samples from the environment have been identified using nanosensors and nanosorbents. The analytical characteristics of the proposed optical nanosensors and nanosorbents for solid-phase extraction have been studied in detail, and their analytical applicability for speciation analysis of chemical forms of Hg, Cr and Fe in various aqueous samples from the environment has been characterized.

- For the first time, a "green" chemical strategy has been used to synthesize raffinose-coated silver and gold nanoparticles with tailored physicochemical properties. The biological activity of raffinose-coated silver nanoparticles on cellular and subcellular components was studied. A dissociating effect on intact liver mitochondria has been demonstrated by both starch-coated silver nanoparticles and silver nanoparticles coated with raffinose. High catalytic activity of the gold nanoparticles coated with raffinose synthesized by an original procedure as a pseudohomogeneous catalyst for the reduction of the model dye methylene blue with sodium tetrahydroborate under UV irradiation has been established. The recorded high catalytic activity is attributed to the gold nanocluster fraction present in the freshly synthesized dispersion of gold nanoparticles coated with raffinose.

- An easy-to-perform analytical procedure for speciation analysis of Hg in tap water has been developed. The main advantage and novelty of the procedure is the sequential selective sorption of the chemical species Hg (II) and CH_3Hg^+ by the nanosorbents $\text{SiO}_2\text{-NH}_2 @ \text{AgNPs}$ and $\text{SiO}_2\text{-NH}_2 @ \text{AuNPs}$.

- An analytical method for the determination of Cr (VI) in surface waters using a hybrid nanocomposite film CS-AgNPs/Raff as an effective and selective sorbent of Cr (VI) in the presence of Cr (III) has been developed. The analytical characteristics of the method meet the technical requirements for analytical procedures used in the programs for monitoring the quality of surface water, which makes the method applicable in routine analytical practice.

2. Chemical education

The designed textbooks and manuals undoubtedly contribute to increasing the interest and knowledge of high-school students in chemistry through the proposed tests and tasks for preparation and assessment, which is the main contribution of these works related to the teaching of chemistry in high school.

Conclusion

In the contest for the academic position "Professor", Assoc. Prof. Dr. Penka Vasileva has presented a sufficient number of scientific papers published after the "Doctor" thesis and after the academic position "Associate Professor". They have been published in specialized journals with impact factor and quartile, and are well cited, which is proof of their high quality and international recognition. As a result of intensive research work, Dr. Penka Vasileva has gained extensive experience and specific qualifications in the field of the methods of inorganic chemistry for synthesis and characterization of nanomaterials and their various analytical applications. Her research is an example of the successful results achieved with the help of interdisciplinary studies. Her teaching activities are versatile. **Based on all her scientific and teaching achievements, I support the application of Assoc. Prof. Dr. Penka Vasileva for the academic position "Professor" in professional field 4.2. Chemical Sciences (Inorganic Chemistry) at the Faculty of Chemistry and Pharmacy of Sofia University "St. Kliment Ohridski".**

Reviewer:

Sofia, March 6, 2022.

Prof. DSc Elisaveta Ivanova