REVIEW

for a competition for the academic position of "Associate Professor" at the Institute of Organic Chemistry with Centre of Phytochemistry of the Bulgarian Academy of Sciences in the professional field 4.2 Chemical Sciences, scientific specialty "Organic Chemistry", published in the State Gazette, issue No. 13 of 03.02.2026.

Candidate (sole applicant): Dr. Ivalina Ognianova Trendafilova
Reviewer: Assoc. Prof. Dr. Gloria Said Issa-Ivanova, Institute of Organic Chemistry with Centre of Phytochemistry – Bulgarian Academy of Sciences (IOCCP, BAS); member of the scientific jury appointed by Order No. RD-09-53/12.03.2026 of the Director of IOCCP-BAS.

Dr. Ivalina Trendafilova has submitted all required documents in accordance with the Law for the Development of the Academic Staff in the Republic of Bulgaria (LDASRB), the Regulations for its Implementation, the Regulations on the Terms and Conditions for Acquiring Academic Degrees and Holding Academic Positions at the Bulgarian Academy of Sciences, and the Regulations on the Terms and Conditions for Acquiring Academic Degrees and Holding Academic Positions at the Institute of Organic Chemistry with Centre of Phytochemistry at the Bulgarian Academy of Sciences, related to her participation in the competition for the academic position of "Associate Professor".

I. Personal and professional data of the candidate

In 2014, Ivalina Trendafilova was appointed as an assistant at the Institute of Organic Chemistry with Centre of Phytochemistry at the Bulgarian Academy of Sciences. After successfully completing her PhD studies, she continued her academic career as a research associate at the National Institute of Chemistry in Ljubljana, Slovenia (2018–2020), and in the period 2020–2021 she held the position of assistant professor at IOCCP, BAS.

The candidate has significant international research experience gained through specializations and research appointments at prestigious foreign scientific institutions. In 2019, she was a visiting researcher at the Department of Chemical and Environmental Engineering at the University of Cincinnati, USA (University of Cincinnati), and in the period 2021–2024 she was appointed as a postdoctoral researcher at the University of Namur, Belgium (University of Namur), under the BEWARE program, co-financed under the Marie Skłodowska-Curie actions. At the beginning of 2024, she completed a research stay as a visiting scientist at the French National Centre for Scientific Research (CNRS), Institute of Chemistry – Montpellier, France.

Since April 2024, she has held a position as a “researcher” at IOCCP, BAS under the National Scientific Program “Petar Beron and NIE”.

II. General characteristics of the scientific and applied scientific activity

According to the Scopus database, Dr. Trendafilova has 32 publications for the period 2015–2026. For participation in the competition, Dr. Trendafilova has submitted a list of 16 publications that are not included in her dissertation. These publications are distributed across journal quartiles according to Scopus/WoS classification as follows: 10 publications in Q1 journals, 3 in Q2 journals, 1 in Q3 journals, and 2 in Q4 journals. Dr. Trendafilova’s results have been published in prestigious journals with high impact factors.

For Indicator B, Dr. Trendafilova has submitted 5 articles in journals ranked Q1 (3 articles) and Q2 (2 articles). For Indicator G, Dr. Trendafilova has submitted 11 articles, distributed as follows: 7 articles in Q1 journals, 1 article in a Q2 journal, 1 article in a Q3 journal, and 2 articles in Q4 journals. The personal contribution of Dr. Trendafilova in the scientific publications submitted for the competition is indisputable. She is the first author and corresponding author in 4 articles under Indicator B and in 3 of the articles under Indicator G. The total score of Dr. Trendafilova under Indicator B is 115 points, and under Indicator G is 234 points. The presented list of recorded citations of Dr. Trendafilova’s publications shows that they have received a strong response within the scientific community. The citations indexed in Scopus for all scientific publications amount to 368. A list of 198 citations has been submitted in the competition, corresponding to 396 points under Indicator D. The Hirsch index (h-index) of the candidate is 13 (Scopus), which exceeds the required minimum h-index of 5, in accordance with the Regulations on the terms and conditions for acquiring academic degrees and holding academic positions at the Institute of Organic Chemistry with Centre of Phytochemistry. The scientific results of Dr. Trendafilova have been presented in 36 contributions at national and international scientific forums, including 17 oral presentations. Dr. Trendafilova has participated in the implementation of 15 research projects. The scientific achievements of Dr. Ivalina Trendafilova have received high national and international recognition, evidenced by a number of prestigious awards and distinctions, including the “Prof. Marin Drinov” Award of the Bulgarian Academy of Sciences (2019), the “Acad. Rumen Tsanev” Award and the National “Prof. Hristo Balarov” Award of the Union of Chemists in Bulgaria (2022), the award of the Namur Institute of Structured Matter for postdoctoral career development plans (2023), as well as three consecutive nominations for the National “Pythagoras” Award in the “Young Scientist” category (2021–2023).

The data show that the candidate's contributions fully meet the national requirements and the requirements of the Law for the Development of the Academic Staff in the Republic of Bulgaria (LDASRB), the Regulations for its Implementation, as well as the Regulations on the terms and conditions for acquiring academic degrees and holding academic positions at the Bulgarian Academy of Sciences and at the Institute of Organic Chemistry with Centre of Phytochemistry at the Bulgarian Academy of Sciences (IOCCP, BAS) for holding the academic position of Associate Professor.

III. Main scientific contributions

The research activity of Dr. Ivalina Trendafilova is focused on the development of new approaches for the synthesis and functionalization of mesoporous silicate materials with controlled structural and textural characteristics. A major emphasis in her research is the preparation of nanoscale composite systems based on modified silicate supports and the evaluation of their potential application as systems for the controlled delivery of natural biologically active compounds. The obtained scientific results expand the understanding of the influence of synthesis conditions and surface modification on the structure and functional properties of the materials, and create prerequisites for the development of a new generation of high-performance materials with promising applications in biomedicine, pharmaceutics, and related interdisciplinary fields.

The conducted research is of both fundamental and applied scientific character and can be summarized in the following main directions:

* development of innovative and highly efficient systems enabling targeted delivery and controlled release of biologically active substances, based on composite silicate carriers. The research in this direction is focused on the development of procedures for obtaining hybrid carriers based on mesoporous silicates, their effective loading with biologically active compounds, and their potential application in diagnostics, pharmaceutics, and medicine.

* establishing the relationship between synthesis conditions and the physicochemical properties of the obtained materials, achieved through comprehensive characterization of their structural, textural, and surface properties using appropriate modern physicochemical techniques;

* investigating the interactions between biologically active molecules and polymer coatings and the surface of modified and unmodified silicate carriers;

* studying the pharmacokinetics, biological activity against selected cell lines, and antioxidant activity of the developed delivery systems.

The following significant results have been obtained:

* A mesoporous silicate support of the SBA-15 type (ordered 2D hexagonal mesostructure) with suitable structural characteristics has been developed and successfully modified with different amounts of zinc. It has been demonstrated that this modification leads to the formation of Zn-containing active sites, which facilitate the formation of a complex between Zn and quercetin and have a significant influence on the loading and controlled release processes of the biologically active compound. It has also been established that the incorporation of quercetin into the Zn-modified carriers enhances its antineoplastic activity against HUT-29 cells compared with the unloaded (pure) biologically active substance **[Publication 1].**

* Spherical mesoporous silicate particles with high specific surface area and pore volume have been developed using CTAB and Pluronic 123 as structure-directing agents. An efficient method for silver modification via template ion exchange has been established, leading to the preparation of materials with improved pore characteristics and the presence of metallic and silver oxide nanoparticles, designed for the delivery of curcumin and capsaicin. It has been demonstrated that the developed systems provide a high loading capacity and enhanced release of the bioactive compounds, while simultaneously improving their solubility and antibacterial activity. A synergistic effect has also been observed during the simultaneous delivery of curcumin and capsaicin, manifested by increased cytotoxicity against tumor cells. These findings identify the developed materials as promising candidates for application in dermal therapeutic systems **[Publication 2].**

* Amino-functionalized mesoporous silicate support of the KIT-6 type have been developed for the efficient loading and controlled release of quercetin. It has been demonstrated that both the method of incorporation of the bioactive compound and the surface modification of the carrier have a significant effect on the loading efficiency, release rate, and formation of stable complexes. Coating the carriers with polymeric polyelectrolyte layers enables the sustained release of quercetin without compromising its antineoplastic activity, making the developed systems promising carriers for applications in anticancer therapy **[Publication 3].**

* Ag- and Mg-modified mesoporous silicate supports of the SBA-16 type have been developed for the incorporation of the natural flavonoids morin and hesperetin. It has been established that surface modification enhances the loading capacity and enables the controlled release of the bioactive compounds. The obtained systems exhibit reduced toxicity toward non-malignant cells while maintaining good activity against tumor cell lines, highlighting their potential as promising carriers for the selective delivery of anticancer agents **[Publication 4].**

* Mg-modified mesoporous silicate supports of the MCM-41 type have been developed, and a detailed comparison has been made of different methods for magnesium incorporation and their influence on the structure and properties of the resulting materials. It has been established that Mg modification enhances the loading capacity for kaempferol and affects the interactions between the carrier and the bioactive compound. The study has shown that different approaches to silicate modification can produce materials with distinct physicochemical properties, which directly influence their behavior and effectiveness in the design of delivery systems for biologically active substances (BAS). It has been demonstrated that post-synthetic surface modification procedures for silicates provide superior results in the preparation of suitable carriers for oral flavonoid delivery systems **[Publication 5].**

Various inorganic–inorganic and organic–inorganic hybrid materials based on porous silicates have been developed for application as efficient delivery systems for natural and synthetic bioactive compounds. Based on nanosized Beta zeolite, a two-component system for the simultaneous release of silver and sulfadiazine has been designed, and the release kinetics and antibacterial activity of the resulting system have been investigated **[Publication 6].** In addition, zeolite–mesoporous silicate composite materials (ZSM-5/KIT-6 and ZSM-5/SBA-15), functionalized with sulfonic and carboxylic groups, loaded with verapamil, and subsequently coated with polyelectrolyte layers, have been synthesized. These systems have been evaluated as potential carriers for overcoming multidrug resistance in cancer cells **[Publication 7].** Core–shell composites consisting of magnetic particles encapsulated within a mesoporous silicate matrix have also been successfully synthesized, and their potential as carriers for prednisolone has been assessed through in vivo evaluation of the anti-inflammatory activity of the developed systems **[Publication 8].** Furthermore, magnetic mesoporous systems based on MCM-41, functionalized with amino or carboxyl groups and PEG chains, have been developed. It has been demonstrated that the loading efficiency and release profile of tamoxifen depend significantly on the modification method employed **[Publication 9].** In curcumin delivery systems based on amino-functionalized mesoporous silica nanoparticles coated with a polymeric complex (κ-carrageenan/chitosan), the influence of the pore structure (KIT-6 and KIL-2) on the properties of the resulting carriers has been investigated **[Publication 10].**

Dr. Ivalina Trendafilova's research activity is focused on the development of mesoporous silicate materials and hybrid composites with controllable structures and successfully functionalized surfaces for the loading of natural biologically active compounds (BACs). It has been demonstrated that the incorporation of biologically active compounds into modified mesoporous silicates enhances their solubility, while polyelectrolyte polymer coatings provide

targeted and sustained release, thereby reducing the frequency of administration while maintaining therapeutic efficacy. For the first time, the complex formation of flavonoids with metal-functionalized mesoporous silicates has been investigated, demonstrating that these materials effectively increase the solubility of natural compounds and, consequently, their potential therapeutic efficacy. The developed drug delivery systems exhibit an improved cytotoxicity profile compared with the pure compounds, while preserving their antioxidant properties. These findings provide strong evidence for the potential of the developed carriers in the design of highly efficient delivery systems for naturally derived biologically active substances.

The candidate's plans for future scientific development are also presented:

* Development of new "green" and economically efficient procedures for the synthesis of silicate materials through the use of non-toxic and renewable templates based on sugars, lipids, and biodegradable polymers as alternatives to conventional toxic structure-directing agents. The planned research includes the optimization of template removal and regeneration methods (extraction and low-temperature calcination) with the aim of improving the sustainability as well as the environmental and economic efficiency of the synthesis processes.

* Development of techniques for the surface modification of silicate materials through various in situ and post-synthetic approaches using organic amino groups (primary, secondary, and cyclic), together with the optimization of process conditions, with the aim of obtaining highly efficient CO_2 adsorbents.

* Synthesis of highly efficient adsorbents for the purification and isolation of biologically active substances of natural origin through the functionalization of porous silicates with metal particles or organic groups. Their efficiency will be evaluated in the separation of flavonoids, proteins, and enzymes from complex matrices.

* Development of sustainable composite materials of mesoporous silicate–biodegradable polymer and silicate–lipid types, obtained from environmentally friendly or waste-derived starting materials. The processes will be optimized for low energy consumption, minimal waste generation, and the use of non-toxic solvents under mild conditions.

IV. Critical remarks, opinion and recommendations

I have no remarks regarding the submitted materials and documents, nor regarding the application of Dr. Trendafilova. It should be noted that the documents submitted for the competition are well organized and structured, which facilitates their analysis and evaluation. The habilitation report is substantive and clearly presents the scientific contributions of Dr.

Trendafilova. The scientific works included in the habilitation material represent in-depth and methodically well-conducted research with a clearly expressed contribution to the field of mesoporous silicate carriers and systems for controlled delivery of biologically active substances. The approaches used are modern, and the experimental results are thoroughly characterized. The scientific developments are of a high scientific level and represent a significant contribution to the development of modern drug delivery systems with potential for practical application.

Based on my personal impressions of the scientific work of Dr. Trendafilova, I would like to note that she stands out as a highly qualified and in-depth researcher with clearly demonstrated independent scientific skills. During joint professional observations, her ability to organize and lead scientific activities is evident, as well as her capacity to take a leading role in the implementation of research projects. She demonstrates a high degree of commitment, methodological precision, and consistency in her scientific work, which establishes her as a reliable and authoritative specialist in the field.

V. Conclusion

The documents and materials submitted by Dr. Ivalina Trendafilova for participation in the present competition demonstrate that she is an established and experienced researcher with her own approach to the formulation and execution of scientific tasks. After analysis of the achieved scientific results, the relevance and перспективе of the investigated topics, the intentions for future research, and the personal qualities of the candidate, I consider that they fully meet all the requirements of the Law for the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its Implementation, the Regulations on the terms and conditions for acquiring academic degrees and holding academic positions at the Bulgarian Academy of Sciences, and the Regulations on the terms and conditions for acquiring academic degrees and holding academic positions at the Institute of Organic Chemistry with Centre of Phytochemistry at the Bulgarian Academy of Sciences for holding the academic position of “Associate Professor”. On the basis of the above, I strongly recommend to the Scientific Council of the Institute of Organic Chemistry with Centre of Phytochemistry at the Bulgarian Academy of Sciences to award Dr. Ivalina Trendafilova the academic position of “Associate Professor” in professional field 4.2 Chemical Sciences, scientific specialty “Organic Chemistry”.

Sofia,
10.06.2026

Prepared by the reviewer:
/Assoc. Prof. Dr. Gloria Issa/