

REVIEW

by Prof. Dr. Silvia Zhivova Todorova, Institute of Catalysis, Bulgarian Academy of Sciences

on the materials submitted for participation in a competition for the academic position of “Associate Professor” at the Institute of Organic Chemistry with Centre of Phytochemistry (IOCCP), BAS, in the field of higher education:

4. Natural Sciences, Mathematics and Informatics

Professional field: 4.2 Chemical Sciences

Scientific specialty: “Organic Chemistry”

for the needs of the Laboratory “Organic Reactions on Microporous Materials”

In the competition for the academic position of “Associate Professor,” announced in State Gazette, issue 13 of 03.02.2026 and on the website of IOCCP-BAS, the candidate is Chief Assistant Professor Dr. Ivalina Ognyanova Trendafilova of IOCCP-BAS.

1. General presentation of the submitted materials

For participation in the announced competition, one candidate was admitted: Assistant Professor Dr. Ivalina Ognyanova Trendafilova of IOCCP-BAS.

The set of materials submitted by Dr. Trendafilova in hard copy complies with the Regulations for the Development of the Academic Staff of IOCCP and meets the criteria of IOCCP-BAS for the academic position of “Associate Professor,” namely: scientific autobiography; report on fulfillment of the minimum requirements according to the regulations governing academic degrees and positions at IOCCP-BAS; diplomas certifying the educational and scientific degree “Doctor”; abstract of the doctoral dissertation; extended habilitation report on scientific contributions in Bulgarian and English; complete list of scientific publications; list and copies of publications included under Indicator B; habilitation work under Indicator Group B; list and copies of publications included under Indicator Group G; list of conference participations with supporting documents; list of citations; list of participation in research projects; and supporting documents for certificates and awards received.

The candidate has submitted a total of 16 scientific papers for participation in the competition. All are within the subject area of the competition and have not been used in other competitions or procedures in which the candidate has participated. Therefore, all materials are accepted for review and considered in the final evaluation.

Additional documents have been submitted certifying international specializations and postdoctoral training at the National Institute of Chemistry in Ljubljana, Slovenia; the University of Namur, Belgium; and the University of Cincinnati, USA. Certificates and diplomas for prestigious national scientific awards have also been submitted, including the “Acad. Rumen Tsanev” award, the “Prof. Marin Drinov” award, the National Endowment Fund “13 Centuries of Bulgaria” award, and the Union of Chemists in Bulgaria award “Prof. Hristo Balarev.” Dr. Trendafilova has also received numerous distinctions for best poster and scientific presentation at national scientific forums in the fields of nanoscience, nanotechnology, and polymers.

2. Brief biographical data

The candidate has a consistent and successfully developing scientific career in the field of organic and medicinal chemistry. Her professional experience includes academic and research positions in prestigious scientific institutions in Belgium, Slovenia, France, and the United States.

After obtaining a Master's degree in Medicinal Chemistry and defending her doctoral degree at the Institute of Organic Chemistry with Centre of Phytochemistry, BAS, Dr. Trendafilova completed successful postdoctoral specializations at the National Institute of Chemistry in Ljubljana and at the University of Namur. She has been a visiting scientist at the French National Centre for Scientific Research, Institute de Chimie, Montpellier, France, and at the Department of Chemical and Environmental Engineering, University of Cincinnati, Ohio, USA.

Her research activity in numerous scientific organizations outside Bulgaria and her participation in programs such as Marie Skłodowska-Curie Actions and the National Scientific Program "Petar Beron and Us" demonstrate a high scientific level, professional development, and international recognition.

3. General characteristics of the candidate's activity

Under **Indicator Group A** of the regulations implementing the Academic Staff Development Act, Dr. Trendafilova has submitted the abstract of her doctoral dissertation entitled "Development of New Modified Mesoporous Silicate Nanocomposites for Controlled Drug Delivery," in professional field 4.2 Chemical Sciences, specialty Organic Chemistry, for which she receives 50 points.

Under Indicator B, five publications are presented on which the habilitation report is based. They are distributed as follows: three publications in Q1 journals and two publications in Q2 journals. These publications have not been used in other competitions for academic positions or scientific degrees. In four of the publications the candidate is first author and in one she is second author; in three publications she is also the corresponding author, which unequivocally demonstrates her substantial role in the research. These publications provide 115 points, exceeding the required minimum of 100 points. The research is focused on the synthesis and modification of mesoporous silicate materials and the study of their application as carriers of biologically active substances. The results reveal relationships between structure, properties, and functionality and demonstrate significant potential applications in pharmacy and biomedicine.

Under Indicator Г, eleven publications are presented: six in Q1 journals, one in Q2, one in Q3, and two in Q4 journals, yielding a total of 234 points and exceeding the required 220 points.

Under Indicators Д and Ж, the candidate reports a total of 368 citations for her scientific work, of which 198 refer to publications included in the competition. The citations are recorded in peer-reviewed publications indexed in Scopus and Web of Science. Under this indicator she receives 369 points, more than five times the minimum required 70 points for the position of Associate Professor at IOCCP.

At the time of preparation of this review, Dr. Trendafilova's overall Scopus H-index, excluding self-citations, is 14. She therefore not only fulfills but significantly exceeds the specific requirement of IOCCP-BAS, which stipulates a minimum H-index of 5.

The candidate actively disseminates her research results through participation in numerous national and international scientific forums, where she has presented lectures, posters, and invited talks. She has participated in more than 35 scientific forums during the period 2014–2025, including prestigious international conferences. She has presented mainly oral reports: 15 oral presentations, one plenary lecture, and two invited lectures; the remaining presentations were posters.

As can be seen from the information presented, Dr. Trendafilova's scientific output not only meets but substantially exceeds the minimum scientometric requirements established by national legislation and the regulations of IOCCP-BAS for the position of Associate Professor.

The research of Dr. Trendafilova is focused on one of the most current, important, and rapidly developing topics today: the development of new drug delivery systems that can address problems related to the short half-life of drugs, undesirable side effects, and poor solubility. The habilitation work addresses issues related to the synthesis, modification, and functionalization of mesoporous silicate materials. The research is directed toward obtaining new materials and evaluating their applicability as carriers of biologically active substances. The results expand existing knowledge regarding the influence of synthesis conditions on structure and properties and provide data on their use in systems for delivery of active compounds.

The habilitation work is based on 16 scientific publications devoted to the development of innovative drug delivery systems for biologically active substances of natural origin using mesoporous silicate materials and their composites. Five publications are included as the habilitation work (Indicator B), while the remaining eleven belong to Indicator G. The studies fall within materials science, medicine, and pharmacy, and the contributions are both fundamental and applied. The principal contributions may be summarized as follows:

1. A new approach was developed for dermal delivery of quercetin using SBA-15 mesoporous silicate carriers modified with zinc. Quercetin is a natural flavonoid with proven antioxidant, antitumor, and antiviral properties, but its application is limited by poor solubility, chemical instability, and low bioavailability.

Optimal conditions were established for synthesis, zinc modification, and quercetin loading. Formation of a Zn–quercetin complex and delayed release of the active substance from the modified carriers were demonstrated. Biological studies showed enhanced antineoplastic activity of quercetin incorporated into Zn-modified SBA-15, making the developed materials promising systems for dermal application. For the first time, FT-IR spectroscopy demonstrated formation of the Zn–quercetin complex on the silicate surface. In vitro studies showed delayed release at pH 5.5, characteristic of dermal systems. Cytotoxicity tests demonstrated that quercetin loaded into silicate carriers containing 2 wt.% Zn exhibited higher antineoplastic activity against HUT-29 cells than pure quercetin.

2. The second part of the research was devoted to development of an innovative system for simultaneous dermal delivery of curcumin and capsaicin using mesoporous silicate carriers modified with silver. Spherical mesoporous silicate particles with high specific surface area were synthesized and successfully modified with silver and silver oxide nanoparticles. Both biologically active substances were efficiently loaded, showing significantly improved solubility and controlled release under dermal conditions.

Biological activity studies demonstrated that antioxidant activity was preserved in unmodified silicates, whereas a reduction was observed in Ag-modified carriers, likely due to interactions between silver, curcumin, and capsaicin. The resulting systems displayed high antineoplastic, antioxidant, and antibacterial activity, making them promising carriers for dermal treatment of skin diseases.

3. Studies of interactions between flavonoids and metal-functionalized mesoporous silicates showed that the developed materials are suitable carriers for natural biologically active substances such as quercetin, curcumin, capsaicin, morin, hesperetin, and kaempferol. Incorporation into mesoporous carriers improved solubility in physiological media relevant to dermal and oral dosage forms and could enhance bioavailability. The developed systems demonstrated improved cytotoxic profiles while preserving antioxidant properties.

4. A nanosystem for oral delivery of quercetin was developed based on amino-modified KIT-6 mesoporous silicate particles coated with polyelectrolyte layers. The impregnation method achieved higher loading and amorphization of quercetin, resulting in improved solubility and faster release. Quantum-chemical modeling clarified interaction mechanisms between quercetin and the functionalized surface. Polymer coating enabled effective control of release, extending it from 4 to more than 24 hours. Biological tests demonstrated good biocompatibility and preservation of antineoplastic potential.

5. Another research direction involved oral delivery systems for the flavonoids morin and hesperetin using SBA-16 mesoporous silicates modified with silver and magnesium. Modification improved loading and enabled controlled release under simulated gastrointestinal conditions. The formulations showed preserved or enhanced antioxidant activity, reduced toxicity toward non-malignant cells, and good selectivity toward tumor cell lines.

6. A comparative study examined three approaches for magnesium modification of MCM-41 mesoporous silicate: direct synthesis, wet impregnation, and template ion exchange, aiming to obtain efficient carriers for oral delivery of kaempferol. Magnesium modification increased loading capacity and significantly improved solubility. Materials obtained through post-synthesis modification, particularly template ion exchange, demonstrated the best release characteristics and antioxidant activity.

4. Assessment of the candidate's personal contribution

The publications submitted for the competition have been published in high-impact journals leading in the fields of mesoporous materials and pharmacy. In four of the habilitation publications Dr. Trendafilova is first author and in one she is second author; in three publications she is also the corresponding author, clearly demonstrating her essential role.

5. Critical remarks and recommendations

I have no critical remarks or recommendations.

6. Personal impressions

My personal impressions of Dr. Trendafilova stem from her work as a doctoral student, my evaluation of her dissertation, and her participation in scientific events. I consider her a highly educated young scientist who is exceptionally dedicated to her work.

CONCLUSION

The documents and materials submitted by Assistant Professor Dr. Ivalina Ognyanova Trendafilova comply with all requirements of the Academic Staff Development Act of the Republic of Bulgaria, its implementing regulations, the BAS regulations, and the IOCCP-BAS regulations.

The candidate has presented a significant number of scientific works published after the materials used in obtaining the PhD degree. These works contain original scientific and applied contributions that have received international recognition, and all have been published in journals issued by international academic publishers. Dr. Trendafilova's scientific qualifications are beyond doubt. The achievements in her scientific research activity fully correspond to the specific requirements of the IOCCP-BAS regulations. After reviewing the materials and scientific works submitted in the competition, analyzing their significance and the scientific, scientific-applied, and applied contributions contained therein, I find it justified to provide my positive evaluation and recommend that the Scientific Jury prepare a proposal to the Scientific Council of

IOCCP-BAS for the election of Assistant Professor Dr. Ivalina Ognyanova Trendafilova to the academic position of Associate Professor in professional field 4.2 Chemical Sciences, scientific specialty "Organic Chemistry.

10. 06. 2026

Reviewer:
Prof. Dr. Silvia Todorova

Sofia