

## REVIEW

by Prof. Dr. Eng. Pavlinka Alexandrova Dolashka,  
Professor in the Institute of Organic Chemistry with the Centre of Phytochemistry (IOCCP) –  
Bulgarian Academy of Sciences (BAS), and chairman of the Scientific Jury, according to  
Order No. RD-09-93/11.07.2022

**REGARDING:** materials submitted for participation in a competition for the academic position of "Professor" at the Institute of Organic Chemistry with the Centre of Phytochemistry, Bulgarian Academy of Sciences

In the higher education field "4. Natural Sciences, Mathematics and Informatics", professional direction "4.2. Chemical Sciences", scientific specialty "Organic Chemistry", for the requirements of the laboratory "Chemistry of Solid Fuels", Institute of Organic Chemistry with the Centre of Phytochemistry, Bulgarian Academy of Sciences.

In the competition announced in Bulgarian State Gazette No. 40/31.05.2022 and announced on the website of Institute of Organic Chemistry with the Centre of Phytochemistry, Bulgarian Academy of Sciences, one candidate submitted documents for the academic position of "Professor" - Dr. Boyko Gueorguiev Tsyntsarski, who is Associate Professor in the Institute of Organic Chemistry with the Centre of Phytochemistry, Bulgarian Academy of Sciences.

### **1. General presentation of the procedure and the candidate**

The paper and electronic materials, presented by Associate Professor Dr. B. Tsyntsarski, are in accordance with the Law on the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB), the Regulations for the Implementation of the ZRASRB of BAS, and the Regulations for the Development of the Academic Staff of the Institute of Organic Chemistry with the Centre of Phytochemistry, Bulgarian Academy of Sciences, whereas the presented paper and electronic materials comply with the criteria for occupying the academic position "Professor".

The candidate has presented a set of materials, which contains: CV according to the European model; Copy of a diploma from High Attestation Commission for the educational and scientific degree "doctor" from 20.04.2006 and a certificate from the BAS for holding an academic position "Associate Professor" from 2013; Abstract (Autoreferate) of the dissertation work; Extended habilitation reference for scientific contributions in Bulgarian and English; A total list of 107 scientific publications, including 50 papers since 2013; List of publications from groups B and Γ according to the requirements of IOCCP-BAS; List of 12 participations in scientific conferences; List of 1096 citations, whereas 817 of them are after habilitation; List of 8 scientific and scientific-applied projects.

### *Brief biographical data of the candidate*

Assoc. Prof. Tsyntsarski graduated from National Natural-Matematical High-School «Acad. L. Chakalov», class "Chemistry", and further he continued his education at the Faculty of Chemistry of the Sofia University "St. Kl. Okhridski". In 1998, he started working in the Institute of General and Inorganic Chemistry (IGIC) - BAS, as a chemist, and in 2000 he was enrolled as a full-time doctoral student in the lab. "Synthesis and reactivity of oxide systems" at IGIC under the scientific supervision of Academician Konstantin Hadjiivanov. Since January 2003, he has an employment contract at IOCCP in the lab. ORMM. In 2006, he was nominated for assistant in the lab. "Chemistry of Solid Fuels", and in 2008 he became chief assistant. In 2013, he won a competition for the academic position of "Associate Professor" in the "Chemistry of Solid Fuels" laboratory, and from 2018 he is the head of the laboratory.

## **2. General characteristics of the applicant's activity**

### *The scientific research activity of the candidate*

The publication production of Assoc. Prof. Dr. Boyko Tsyntsarski includes over 100 scientific works, cited in more than 1000 scientific works, which is an indicator of very high publication activity. Eight of these research papers are included in his dissertation work, 38 in the competition for Associate Professor (2013). 89 scientific papers were published in journals with an impact factor, mostly in the category Q1 – 34; Q2 – 24 Q3 – 7 and Q4 – 24; 13 in journals with SJR without IF, and only 3 in journals without IF or SJR.

After attaining the academic position "Associate Professor", Dr. Tsyntsarski is co-author of 67 published works. In the competition for the academic position "Professor", he participated with an extended habilitation reference for his scientific contributions, presented in 5 articles from group B, (2 x Q1, 2 x Q2 and 1 x Q4) and another 12 from group Γ (6 x Q1 and 6 x Q2), and also 7 more publications from group X. The number of citations after the 2013 competition for "Associate Professor" is 817 in journals indexed in the world databases Scopus and Web of Science. The total H-index is 17 according to the Scopus database (after excluding the self-citations of all co-authors).

All published works are in accordance with the professional direction of the competition - 4.2 Chemical Sciences (Organic Chemistry), namely - Technology of Natural and Synthetic fuels.

The analysis of the scientific works presented by Assoc. Prof. Tsyntsarski, their reflection in the specialized scientific literature, presented with a total of 85 oral or poster reports at national and international forums (after 2018 in 12 scientific forums), his participation in a large number of projects - 8 projects, as well as his professional development till now, demonstrate that Assoc. Prof. Tsyntsarski meets the requirements for occupying the academic position "Professor" of ZRASRB of BAS, the Regulations for the

Implementation of the ZRASRB of BAS, as well as the criteria from the Regulations of the IOCCP-BAS.

#### *Teaching activity*

Assoc. Prof. Tsyntarski was a scientific consultant in 3 projects under the National Program "Young scientists and postdoctoral students" of the Ministry of Education (2018-2022).

### **3. Analysis of the main scientific contributions**

In the submitted extended reference, Assoc. Prof. Tsyntarski has summarized the main scientific contributions, grouped mainly in 3 directions:

1. Development of methods for obtaining new carbon materials based on various organic raw materials and characterization of precursors and final carbon products.
2. Study the influence of various factors on the processes of synthesis of carbon materials.
3. Application of nanoporous carbon materials as catalysts, adsorbents for water and air purification, composites for hydrogen synthesis and hydrogen storage, etc.

#### *Contributions of the works presented in group of indicators "B"*

The main scientific contributions of Assoc. Prof. Tsyntarski in the works presented in group "B" can be summarized as follows:

- Development of methods for obtaining new carbon materials based on various organic raw materials.
- Detailed characterization of precursors and final carbon products.
- Investigating the influence of various factors on carbon material synthesis processes and finding the optimal processing conditions allowing the production of high quality products.
- Finding opportunities to adjust the properties of the final product according to their application.
- Determining the applicability of synthesized carbon materials in various fields.

Special attention deserves the development of method for conversion of algae biodiesel processing waste into products suitable for use as energy sources, and to porous carbon with carbon adsorbent properties. This is a contribution to the development of a zero-waste technology for the processing of algae. (B1)

- Turkish asphaltites from two Turkish deposits were subjected to various studies and treatments, and the most suitable one was selected for obtaining a carbon adsorbent with good characteristics. This opens up new possibilities for the development of technology for obtaining porous carbon from this relatively little-studied raw material. (B2)

Assoc. Prof. Tsyntarski actively participated in the development of an intelligent integrated scheme for the full utilization of biomass for the production of clean energy. The

approach used involving the production of catalysts based on activated carbon derived from a biomass precursor for their application in the decomposition of methanol as a source of hydrogen, where both activated carbon and methanol can be produced from biomass. The influence of the different characteristics of the activated carbon on the formation of the catalytically active phase was established, as for the purpose, carbons with different texture and surface functionality were purposefully obtained by changes in the activation conditions or post-synthetic treatment with nitric acid. The research with the active participation of Assoc. Prof. Tsyntsarski in this area is particularly relevant and is a contribution to the search for alternative sources of energy, with special attention being paid to hydrogen, as an opportunity for future decarbonization of the energy system and transition to a "hydrogen" economy. (B3)

A series of scientific reports are devoted to the synthesis of carbon adsorbents intended for the purification of waste and drinking water organic pollutants and heavy metals. An indisputable achievement is the synthesis of a carbon adsorbent based on a mixture of coal and biomass processing products/coal pitch and furfural. The obtained carbon adsorbents were found to have a high adsorption capacity for toxic pollutants. The influence of the porous texture and the size of the surface of the adsorbents on their adsorption capacity was established. (B4, B5)

*Contributions of the works presented in indicator group "Г" (publications outside the Habilitation reference)*

- In the habilitation report, Prof. Cintsarski did not note his significant contribution to the synthesis of graphitized carbon foam, which was tested for the extraction of phenol from wastewater. The carbon foam was synthesized by an original, significantly simplified method, created with his active participation. No scientific report has been submitted on this, but Assoc. Prof. Tsyntsarski presents the conducted research in an oral report at a major international conference in Albena. These studies are part of a project funded by the EU. Lecture 11.

- Continuation of research on the applicability of obtained samples of porous carbon as a carrier of an active phase and its influence on the activity of the obtained catalysts are scientific reports (Г2, Г3 and Г7).

- A new method was developed and carbon structural materials with improved thermomechanical and tribological properties, and relatively low density were obtained on the base of carbon composites with a suitable composition (Г6).

- Materials with the participation of composites have been obtained and characterized, and the possibility of their use as electrodes with good electrocapacitive properties has been established (Г5).

- An important contribution is the preparation of a new type of hybrid composite that combines the advantages of different materials used to purify water from toxic pollutants. It

is suitable for the removal of metal cations (nickel) from waste water by combining two purification methods - mechanical by using a polymer membrane and adsorption by using synthetic activated carbon. It was found that the developed hybrid organic-inorganic membranes showed a high adsorption capacity (51%) towards Ni<sup>2+</sup> cations in aqueous solutions. (Γ12). These studies are a contribution to the development of water purification technology.

- Joint research with Italian colleagues on the adsorption of CO<sub>2</sub> on activated carbons obtained in the HTG laboratory from lignin-cellulosic materials is presented. These studies contribute to efforts to make filters to reduce carbon emissions from various industries. (Γ4, Γ10).

The extended habilitation reference clearly reflects the applicant's scientific contributions. The perspectives for future scientific research show that the candidate has accumulated a significant amount of experience and knowledge.

Assoc. Prof. Tsyntsarski leads and participates in the preparation and implementation of national and international scientific projects. He participated in a Space Research Institute project to determine the effect of the outer space environment on the quality of the glassy carbon coating on a carbon material used to measure cosmic radiation, as well as a project with the Institute of Inorganic Chemistry to create materials that can serve as a hydrogen depot. The results are reflected in (Γ1, Γ8, Γ9).

Within the framework of Inter-Academic Projects, he is the head of long-term fruitful cooperation with Poland and Romania, he is a coordinator of a project with Bulgarian National Science Fund. For the period 2018-2022, he has presented the results of his research at 12 national and international scientific events, whereas he has 10 lectures, and two of them are plenary lectures. In ten of the presented reports, he is the first author.

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

In the scientific works presented by Assoc. Prof. Dr. Tsyntsarski, there are several co-authors, due to the interdisciplinary nature of the research. He is first or corresponding author in 6 of the published papers, which reflects his notable personal contribution to the research conducted.

#### **5. Personal impressions of the candidate**

I have personal impressions of Assoc. Prof. Dr. Tsyntsarski from our joint work on the NNP "BioActivMed" and the Competence Center "Clean technologies for a sustainable environment - water, waste, energy for a circular economy". He is a motivated, hardworking, humble and responsive colleague who works well in a team.

Assoc. Prof. Tsyntsarski successfully leads the lab. HTG since 2018. He is coordinator of several projects. During the annual attestations held at IOCCP from 2017 until now, Assoc. Prof. Tsyntsarski has been ranked among the first 3-4 in the group of Associate Professors.

## 6. Critical remarks and recommendations

Some small inaccuracies were made in the presented materials, which were further corrected. There are spelling mistakes and some technical errors, that do not detract from the applicant's presented scientific achievements. Also, in the indicator group A, he did not indicate that he had a dissertation for the award of the scientific and educational degree "Doctor".

## CONCLUSION

From the listed educational institutions, BAS institutes and scientific groups, it is clear that Assoc. Prof. Dr. Tsyntsarski was educated and worked in the most prominent centers of chemistry in Bulgaria under the leadership, and later in collaboration, with world-renowned scientists in the field of chemistry. This is confirmed by the candidate's active publication activity and high citation rate. The response in the world literature of the candidate's scientific research is impressive. Obviously, he is visible, recognizable, which is undeniable proof that he works in an up-to-date scientific field.

The documents and materials presented by Assoc. Prof. Dr. Boyko Tsyntsarski meet all the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB), the Regulations for the Implementation of the ZRASRB, the Regulations for the Implementation of the ZRASRB of the BAS and the Regulations of the IOCCP-BAS.

The candidate in the competition has submitted a significant number of scientific works published after the materials used in the defense of doctoral thesis. In the works of the candidate, there are original scientific and applied contributions, connected with the synthesis and characterization of carbon materials, which are reflected in publications in journals and scientific collections issued by international academic publishing houses. There is no doubt that the candidate has the necessary scientific qualifications. The results achieved by Assoc. Prof. Dr. Boyko Tsyntsarski in the research activity fully correspond to the specific requirements of the Regulations of the IOCCP for the application of ZRASRB.

After getting acquainted with the materials and scientific works presented in the competition, analyzing their significance and the scientific, scientific-applied and applied contributions contained in them, I find it reasonable to give my positive assessment and recommend the Scientific Jury to prepare a report-proposal to the Scientific council of IOCCP-BAS for the election of Assoc. Prof. Dr. Boyko Georgiev Tsyntsarski to the academic position of "Professor" in IOCCP-BAS in the professional direction 4.2. Chemical sciences, scientific specialty "Organic Chemistry".

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