REVIEW

on the competition for "Professor" at the IChE-BAS, specialty "Processes and Apparatus in Chemical and Biochemical Technology", professional field 4.2. Chemical Sciences, announced in the State Gazette No. 77 of 10.09.2024, with candidate Associate Professor Dr. Elena Nikolaeva Razkazova-Velkova

Prepared by the review: Prof. Dr. Kaloyan Kirilov Petrov, DSc

Candidate Assoc. Prof. Razkazova-Velkova was born in 1972. In 1995, she graduated Master's degree at the HTMU-Sofia, specialty Engineering Chemistry. She has been working at the Institute of Chemical Engineering - BAS (IChE-BAS) since 1995, where she has been carrying out her entire academic career. She obtained the PhD Degree in 1999 and successively held the scientific titles (corresponding to the current academic positions) Associate Professor III degree (Assistant-Prof.) – 1999 – 2003; Researcher 2nd Class (Assistant Prof.) – 2003 – 2006; Researcher 1st Class (Senior Assistant-Prof.) – 2006 – 2012. He received her habilitation in 2012, after which he has been working as an associate professor at the IChE-BAS. The candidate's scientific interests are related to several of the main areas in chemical engineering – research of processes in packed columns, development of technologies for cleaning flue gases from sulfur dioxide; research of various catalysts for capturing pollutants (for oxidation of sulfides, hydrogen sulfide, sulfites, reduction of nitrates, etc.); construction of fuel cells with the same environmental application. The highly applied nature of this research is reflected in the co-authorship of the candidate in two national patents – "Method for oxidation of hydrogen sulfide and sulfide ions" (2014) and "Electrochemical method for separation of hydrogen sulfide and sulfur dioxide from fluids" (2019). Associate Professor Elena Razkazova-Velkova is involved in numerous national and international contracts, among which it is worth noting: the contract funded by the Ministry of Education and Science under the National Scientific Program "Low-carbon Energy for Transport and Households – E+" (since 2017), a contract under the National Roadmap for Scientific Infrastructures (2017-2023) - NI "Energy Storage and Hydrogen Energy", the contracts under the ADB – "Belcell" - Bioelectrochemical Systems for Cleaning Organic Pollutants and "HYSULFCEL" - Hydrogen Production From Black Sea

Water By Sulfide-Driven Fuel Cell. She is the leader of two contracts funded by the National Science Fund – "Integrated absorption-adsorption process for waste-free purification of sulfur dioxide gases" (2019-2024) and "New fuel cells based on chemical and microbial processes" (2014-2018), as well as the leader of the ADB contract "Belcell" on behalf of the IIH-BAS. The candidate Assoc. Prof. Razkazova-Velkova was the scientific supervisor of the successfully defended doctoral student Nadezhda Shukova (2022).

She participated in the competition with 22 of her scientific publications after the degree of associate professor (the total number of scientific publications of the candidate after the degree of associate professor is 47), a book chapter and two patents. Of the 22 publications submitted, 20 are in journals with a quartile in the Scopus or WoS databases (3 in journals with Q1 for the respective year, 3 in journals with Q2, 2 – in Q3 and 12 – in Q4). With the submitted materials, Assoc. Prof. Razkazova-Velkova fully covers or exceeds the minimum national requirements for the position of "professor" from the regulations for the implementation of the ZRASRB of the Bulgarian Academy of Sciences in professional field 4.2. Chemical Sciences in the following way: under indicator A, a dissertation for the ONS "Doctor" was submitted – 50 points out of a requirement of 50 points; under group of indicators B, one publication in a journal with Q2, two – in Q3 and five in Q4, giving a total of 110 points out of a requirement of 100 points; under indicator group Г, 3 publications in journals with Q1, two in Q2, seven in Q4, two in journals referenced in Scopus but without quartile, a book chapter and two patents are presented, giving a total of 284 points with a requirement of 220 points; under indicator group D, 62 citations in journals referenced in Scopus or WoS are presented, giving 124 points with a requirement of 120 points; under indicator group E, the candidate was the supervisor of a successfully defended doctoral student (25 points), led two national projects (40 points), participated in two national (20 points) and one international project (20 points), and attracted 337,057 leva from projects led by him. (67 points) – total 172 points with a requirement of 150 points.

Regarding the fulfillment of the additional requirements of the IChE-BAS for holding the position of "professor", the candidate has submitted 22 scientific publications after associate professor (with a requirement of 20), of which 22 are referenced in journals in Scopus or WoS (with a requirement of 7); total number of publications 71 (with a requirement of 40), of which referenced in Scopus or WoS - 28 (with a requirement of 12) and a total of 162 noted citations with a requirement of 50 citations.

The reference made shows that the candidate Assoc. Prof. Elena Razkazova-Velkova fully meets the scientometric requirements for the position of "professor" of the ZRASRB, the Regulations for the implementation of the ZRASRB of the BAS, as well as the additional requirements of the Institute of Chemical Engineering.

The research in the materials presented by the candidate relates to the following thematic areas: research on hydrodynamics and mass transfer in packed columns, research related to the purification of flue gases from sulfur dioxide, research on catalysts for oxidation of pollutants, construction and research of fuel elements with an ecological focus.

As a significant scientific and applied contribution, I would note the development of an absorption-adsorption method for capturing sulfur dioxide from flue gases, including selection of resin adsorbent, modeling of the process and determination of the optimal kinetic parameters for its implementation. Other scientific and applied contributions are the developed catalysts for the oxidation of pollutants - based on titanium dioxide incorporated on activated carbon - for the oxidation of azo dye, based on zirconium dioxide - for the oxidation of sulfides, based on manganese for the oxidation of sulfites and reduction of nitrates. I would also add to the significant contributions the development of the patented electrochemical method for the simultaneous purification of fluids from sulfur dioxide and hydrogen sulfide through their mutual reduction/oxidation under certain conditions.

Also of significant contribution are the studies related to the construction of various fuel cells for the purpose of removing pollutants. For example, for the purification of seawater from sulfides, a fuel cell using hydrogen sulfide was constructed, where sulfides are oxidized to sulfite and sulfate ions. To optimize the process, various anode catalysts were tested - graphite, cobalt phthalocyanine and perovskite. A fuel cell for simultaneous chemical and biological denitrification was also constructed. The possibilities for fully microbial fuel cells were also studied separately, in which both processes of sulfide oxidation and nitrate reduction are carried out using the metabolism of microorganisms - Pseudomonas putida 1046 and Pseudomonas denitrificans, respectively.

Candidate Assoc. Prof. Elena Razkazova-Velkova is a corresponding author in a large part of the publications that include the above-mentioned contributions. Therefore, I believe that she has a significant personal contribution to their creation. The materials presented show that the candidate has a clear vision for the future development of the competition topic – especially in the part on cleaning pollutants through their microbial oxidation in fuel cells. For

this purpose, new thermophilic strains and communities isolated from thermal springs in the country will be tested, as well as strains oxidizing iron from its ferrous to ferric form. The candidate's future plans also include research with fuel cells for cleaning from organic solvents, using 3D printing methods to construct new fuel cells, etc.

Regarding my personal impressions of the candidate, I have known Assoc. Prof. Razkazova-Velkova for over 20 years and I believe that her competencies, qualities as a scientist, head of thematic areas and organizer, fully correspond to the job description for a professor and suggest its successful implementation.

CONCLUSION

In conclusion, the documents and materials presented by Assoc. Prof. Dr. Elena Razkazova-Velkova 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 of the Bulgarian Academy of Sciences and the relevant Regulations of the Institute of Chemical Engineering for occupying the academic position of "Professor". After consideration of the materials and scientific papers presented in the competition, analyzing their significance and the scientific, scientifically applied and applied contributions contained in them, I give my positive assessment and recommend that the Scientific Council of the Institute of Chemical Engineering elect Assoc. Prof. Dr. Elena Nikolaeva Razkazova-Velkova for "Professor" in the professional field 4.2. Chemical Sciences, scientific specialty "Processes and Apparatus in Chemical and Biochemical Technology", for the needs of the laboratory "Transfer Processes in Multiphase Media" at the Institute of Chemical Engineering - Bulgarian Academy of Sciences.

Reviewer: [redacted]

18.12.2024

(Prof. Kaloyan Petrov, DSc)