

REPORT

Regarding to a competition for holding the academic position “**Professor**” in professional field **4.2. Chemical Sciences “Processes and Apparatus in Chemical and Biochemical Technology**”, for the needs of the laboratory “Transfer Processes in Multiphase Media” of the Institute of Chemical Engineering at Bulgarian Academy of Sciences, announced in the state newspaper № 77 (10.09.2024)

Candidate: **Assoc. Prof. Dr. Eng. Elena Nikolaeva Razkazova-Velkova**

Reviewer: **Assoc. Prof. Dr. Eng. Elisaveta Georgieva Kirilova**

1. Brief biographical data and description of the applicant’s scientific interests

Assoc. Prof. Elena Nikolaeva Razkazova-Velkova was born in 1972 in Sofia, Bulgaria. She graduated from the University of Chemical Technology and Metallurgy in Sofia in 1995, earning the educational and professional degree of "Master in Chemical Engineering" in the specialty "Chemical Engineering." In the period from 1995 to 1999, Assoc. Prof. Razkazova-Velkova was enrolled as a full-time PhD student at the Institute of Chemical Engineering at the Bulgarian Academy of Sciences (ICHE-BAS). In 2006, she defended her doctoral dissertation on the topic: "Development of Packings for Column Apparatuses Operating at Extremely Low Densities," earning the PhD degree from the same scientific organization. In 2000, she was awarded the Bulgarian Academy of Sciences Prize for the youngest scientists under the age of 30. Since 1999, Assoc. Prof. Razkazova-Velkova has been working in the "Transport Processes in Multiphase Media" laboratory at the ICHE-BAS. She has held the following positions in succession: Research Fellow III degree (1999–2003), Research Fellow II degree (2003–2006), and Research Fellow I degree (2006–2012). In 2012, Dr. Razkazova-Velkova assumed the academic position of "Associate Professor" in the same laboratory at ICE-BAS.

The scientific interests of Assoc. Prof. Razkazova-Velkova are related to the study of packed columns, absorption, adsorption, kinetics, as well as the development and investigation of environmentally fuel cells.

Assoc. Prof. Razkazova-Velkova is proficient in English, Russian, French, and German.

2. General characteristics of the candidate’s scientific research and applied scientific activity

Since 1996, Assoc. Prof. Elena Razkazova-Velkova has provided information about her participation in and leadership of scientific projects funded by Bulgarian and international sources, including the Bulgarian National Science Fund of the Ministry of Education and Science (BNSF-MES), a project under the 7th Framework Programme of the European Union, projects financed through contracts with ministries and agencies in Bulgaria, as well as projects with Bulgarian and foreign companies. She has served as a scientific supervisor to one successfully defended PhD-student. Assoc. Prof. Razkazova-Velkova is also a member of the Union of Chemists in Bulgaria.

3. Evaluation of the presented materials

According to the report on meeting the minimum requirements of the Regulations for the Conditions and Procedures for Holding Academic Positions at the Bulgarian Academy of Sciences and the Regulations for the Implementation of the Law on the Development of the Academic Staff in the Republic of Bulgaria by group of indicators, the candidate is participating in the competition with:

Indicator A: The diploma for the PhD degree - 50 points (minimum required: 50).

Indicator C: 8 publications in journals with an ISI Impact Factor and/or SJR, distributed across quartiles as follows: 1 in Q2, 2 in Q3, and 5 in Q4. **Total points for Indicator B - 110 points (minimum required: 100).**

Indicator D: 15 publications in journals with an ISI Impact Factor and/or SJR, distributed across quartiles as follows: 3 in Q1, 2 in Q2, 2 in Q3, 7 in Q4, and 1 publication without a quartile but with an SJR (**239 points**); **1 book chapter** in an international academic publisher (**15 points**); **2 patents** for which the candidate has presented issued protective documents (**50 points**). **Total points for Indicator D – 304 points (minimum required: 220).**

Indicator E: Citations in scientific publications, referenced and indexed in world databases of scientific information (Web of Science and Scopus) – 62 citations across 21 publications. **Total points for Indicator D – 124 points (minimum required: 120).**

Indicator G: Scientific consultant for one successfully defended PhD student (25 points); management of 2 projects (40 points) and participation in 1 project (10 points) funded by the Bulgarian National Science Fund (BNSF-MES); participation in 1 project funded under the national program of the Ministry of Education and Science (MES) "Low-Carbon Energy for Transport and Households (EPLUS)" (10 points); and 1 project funded under the 7th Framework Program of the European Union (20 points). Funds earned on projects managed by the candidate – 67.41 points. **Total points for Indicator G – 172.41 points (minimum required: 150).**

The candidate also meets the additional criteria of the Institute of Chemical Engineering at the Bulgarian Academy of Sciences for the position of "Professor" by presenting the following information:

Total number of publications – **71 (minimum required: 40);**

Number of publications in journals with ISI Impact Factor and/or SJR – **28 (minimum required: 12);**

Number of publications outside those presented during the habilitation – **47 (minimum required: 20);**

Number of publications in journals with ISI Impact Factor and/or SJR, outside those presented during the habilitation – **25 (minimum required: 7).**

Total number of citations for all publications referenced and indexed in world databases of scientific information (Web of Science and Scopus) – **62 (minimum required: 50).**

Recommended Hirsch index – **6 (minimum required: 8).**

From the above indicators, it is evident that the candidate fully meets the requirements of the Rules for the conditions and procedures for holding academic positions at the Bulgarian Academy of Sciences, the Rules for the implementation of the Law on the Development of Academic Staff in the Republic of Bulgaria, and the additional criteria of the Institute of Chemical Engineering at the Bulgarian Academy of Sciences for holding the academic position of "Professor."

4. Main scientific and scientific-applied contributions

From the materials provided to me for review, it is evident that the candidate has conducted experimental and theoretical research in several areas related to the development and application of waste-free technologies for the removal of hydrogen sulfide and sulfur dioxide from seawater or industrial waste, with the aim of obtaining clean products and energy. The scientific and scientific-applied contributions contained in these works can be summarized as follows:

1. Development of methods for the oxidation of sulfides and reduction of nitrates in fuel cells. Creation of original fuel cell designs.

- 1.1. Development of an electrochemical method for oxidizing Black Sea waters containing H₂S, used as fuel in a laboratory fuel cell powered by sulfide, converting it into sulfate and releasing energy.
 - 1.2. Synthesis of suitable catalysts based on metal oxides such as manganese, cobalt, zirconium, and others for conducting the electrochemical oxidation processes of sulfide ions. Research on the electrical power of fuel cells at different initial concentrations and temperatures of sulfide ions, varying operational modes of the fuel cells (with the application of different types of aeration: direct aeration and aeration with an ejector using a Venturi tube), as well as in the presence of light.
 - 1.3. Development of a method for microbiological oxidation of sulfides and chemical denitrification of nitrates in waste streams using different strains of microorganisms for the anodic and cathodic spaces in the examined fuel cells.
 - 1.4. Construction of chemical and microbiological fuel cells for the simultaneous oxidation of sulfides and reduction of nitrates using electrodes in the anodic compartment made from various materials. Conducting studies on the electrochemical power of the fuel cells at different concentrations of sulfides and nitrates, with the aim of achieving their complete neutralization, using various oxidizers such as aerated seawater, hydrogen peroxide, and ammonium chloride, as well as different electrocatalysts based on manganese, deposited on fullerenes and carbon nanotubes.
- 2. Development and application of methods for the removal of hydrogen sulfide and sulfur dioxide from seawater or industrial waste in column reactors.**
- 2.1. Development of a method for the simultaneous electrochemical purification of hydrogen sulfide and sulfur dioxide from seawater or industrial waste. The oxidation of H₂S and reduction of SO₂ occur with a suitable catalyst in a flow reactor, through an electrochemical process without external power supply.
 - 2.2. Development of an energy-efficient method for the purification of flue gases from SO₂ in combustion systems using the Wellman-Lord method. The process is conducted in a packed column, divided into several sections with recirculation.
 - 2.3. Conducting experimental and theoretical studies to determine the dynamic holding capacity of different metal packing materials in column reactors for the purification of flue gases from sulfur dioxide.
 - 2.4. Development of an absorption-adsorption method for the purification of flue gases from sulfur dioxide using various ion-exchange resins. The process is carried out in a tray column with bells, where the absorption-adsorption process occurs in an aqueous suspension of synthetic anion-exchange resin. Convective-diffusion and mean-concentration models have been developed to describe the process.

CONCLUSIONS

The materials presented to me for review comply with the Law on the Development of Academic Staff in the Republic of Bulgaria, the Rules for its implementation, as well as the Rules for the conditions and procedures for holding academic positions at the Institute of Chemical Engineering at the Bulgarian Academy of Sciences. Given their significance, as well as the contributions contained in them, I find it reasonable to propose **Assoc. Prof. Eng. Elena Nikolaeva Razkazova-Velkova** for the academic position of "**Professor**" in the professional field 4.2. Chemical Sciences, "**Processes and Apparatuses in Chemical and Biochemical Technology.**"

Data: 03.01.2025

Reviewer:.....
/Assoc. Prof. E. Kirilova/