REPORT

from assoc. prof. Petya Georgieva Popova-Krumova

regarding to a competition for holding the academic position "**Associate Professor**" in professional field **4.2. Chemical Sciences "Processes and Apparatus in Chemical and Biochemical Technology"**, for the needs of the laboratory "Innovative Processes and System Engineering" of the Institute of Chemical Engineering at Bulgarian Academy of Sciences, announced in the state newspaper no. 77 (10.09.2024)

Candidate: **Assist. Prof. Dr. Eng. Rayka Kirilova Vladova**

1. Brief biographical data and description of the candidate's scientific interests

The candidate, assist. prof. Dr. Eng. Rayka Kirilova Vladova, was born on 6.06.1982 in Pernik. She graduated from the University of Chemical Technology and Metallurgy - Sofia in 2010 as a Bachelor of Engineering - Biotechnologist in the specialty "Biotechnology". In 2013, she received a Master's degree in Environmental Engineering at the University of Chemical Technology and Metallurgy, Sofia, in the scientific specialty "Ecology and environmental protection". During the period 2014-2017 she was a full-time PhD student in the Laboratory of Process Systems Engineering of the Institute of Chemical Engineering at the Bulgarian Academy of Sciences. In 2017 Rayka Vladova received the PhD degree in scientific specialty 4.2. Chemical Sciences "Processes and Apparatus in Chemical and Biochemical Technology" with a dissertation entitled "Increasing the sustainability and energy efficiency of production systems with batch processes on the example of autothermal thermophilic aerobic treatment (ATAD) system of wastewater".

Assist. prof. Dr. Eng. Rayka Kirilova Vladova has international specializations in Turkey and Serbia, is a member of scientific organizations and research networks MPNS COST ACTION MP1305 "Flowing matter", Horizon 2020, European Commission; ICT COST ACTION TD1207 "Mathematical Optimization in the Decision Support Systems for Efficient and Robust Energy Networks", Horizon 2020, European Commission and CA COST Action CA15118 "Mathematical and Computer Science Methods for Food Science and Industry", Horizon 2020, European Commission.

The scientific interests of Dr. Eng. Rayka Vladova are in the field of chemical engineering and process systems engineering, and are focused on problems related to the mathematical modeling, multi-objective optimization, stochastic optimization and sustainable management of resource supply chains and improving the sustainability of chemical and biochemical processes and production systems.

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

The candidate in the competition for the academic position of Associate Professor, Dr. Eng. Raika Kirilova Vladova has mainly scientific and applied activity.

Assist. Prof. Vladova was a participant in five projects financed by the National Science Fund, Ministry of Education and Science of the Republic of Bulgaria (BNSF) under competitions for the funding of fundamental scientific research and the bilateral cooperation between Bulgaria and Russia.

Assist. Prof. Vladova was a leader of two projects:

- Project "Mathematical Approach for Design and Reconstruction of Wastewater Treatment Plants to Increase Sustainability and Energy Efficiency", National Program "Young Scientists and Postdocs" Postdoctoral Module;
- Project for co-funding of an international scientific forum "1-st International Scientific Conference on Cleaner Energy and Chemical Engineering for Sustainable Circular Economy: CLES-CE 2022", No. KP-06-MNF/11, financed by the National Science Fund under the "Program for International Scientific Forums".

The candidate has been chairman of the organizing and scientific committees of 2 scientific forums organized and held in the period 2022 - 2024. Chemical Engineering Transactions, Energy, Cleaner Energy Systems, Bulgarian Chemical Communications.

3. Evaluation of the presented materials

Assist. prof. Dr. Eng. Rayka Vladova is the only Author of 1 book chapter and co-author of 35 scientific publications and 1 book chapter, 31 of which are not included in her dissertation. She participated in the competition as a co-author in 20 scientific publications and 2 book chapters. Six of the publications are included in the extended habilitation abstract (indicator B) and 14 publications and two book chapters under indicator G, respectively.

All research submitted under indicator B has been published in journals referenced and indexed in Web of Science and Scopus databases. The distribution of articles according to journal rank expressed in quartiles (Q-factor) is as follows: Q1-1 publication, Q2-1 publication, Q3-3 publication and 1 publication in Q4.

The distribution of the other scientific and applied research, excluding the habilitation thesis, by indicator G, according to the rank of the scientific journals is as follows: two book chapters, 2 publications in a journal with Q1, 8 in a journal with Q3, 2 in a journal with Q4 and 2 with SJR.

The materials submitted by Dr. Rayka Vladova show that the minimum national requirements for the academic position "Associate Professor" according to the Regulations on the Conditions and Procedures for the Occupation of Academic Positions in the Bulgarian Academy of Sciences and the Regulations for the Implementation of the Academic Staff Development Act in the Republic of Bulgaria (RASDA) have been achieved.

4. Basic scientific and scientific-applied contributions

The scientific and scientific applied works presented by Dr. Raika Vladova are in the field of chemical engineering and process systems engineering, and are focused on problems related to mathematical modeling, multi-objective optimization, stochastic optimization and sustainable management of resource supply chains and improving the sustainability of chemical and biochemical processes and production systems.

Methods for increasing the sustainability and eco-efficiency of municipal wastewater treatment plants using the autothermal thermophilic aerobic sludge digestion process are proposed. Methods have been developed to recover the heat in the system outlet streams used to preheat the incoming wastewater streams. A mixed-integer nonlinear programming model is proposed for the optimal design of a sustainable resource-supply chain (RSC) for the production of various dairy products, and the approach incorporates dairy production models along with the economic, environmental, and social impacts on the RSC under consideration. A stochastic optimization approach is developed to deal with uncertainty in product requirements in a ROV for the production of different dairy products under different technologies, different number of suppliers and different number of markets while satisfying environmental, economic and social criteria.

The obtained scientific applied results are related to the development of a new optimization approach for dealing with uncertainties in product requirements in RDF for the production of different dairy products by different technologies, with simultaneous consideration of economic, environmental and social criteria. A model of an industrial bioreactor predicting the depth of thermal shock, the expected temperature at the end of the process, the degree of reduction of volatile solids at given values of the input flow parameters was developed.

The results obtained by Dr. Vladova are both fundamental and scientifically applied.

5. Reflection of scientific publications in the literature

The candidate has submitted 33 citations in scientific publications referenced and indexed in world databases with scientific information (Web of Science and Scopus).

6. Critical notes and recommendations

I have no critical remarks to make about the candidate. The competition documents are formatted according to the requirements and contain comprehensive information on the results and scientific contributions of the candidate.

7. Personal impressions of the reviewer about the candidate

I have known Dr. Vladova since 2014, when she was a full-time PhD student at the Process Systems Engineering Laboratory at the Institute of Chemical Engineering at BAS. Over the years, she has established herself as a conscientious and competent professional in the field of her research interests. Dr. Vladova shows very high organizational skills and ability to work in a team on joint scientific projects and tasks.

CONCLUSION

On the basis of the above, I consider that the candidate in the present competition for "Associate Professor"- Assist. prof. Dr. Eng. Rayka Vladova, fully satisfies the minimum requirements for the position of "Associate Professor" in the professional field 4.2. Chemical Sciences, according to the Regulations on the conditions and procedure for the acquisition of scientific degrees and academic positions at BAS, as well as the additional requirements of the Institute of chemical engineering-BAS for the position of "Associate Professor".

On the basis of the enclosed documents, I propose the Honorable Scientific Jury and the Scientific Council of the Institute of Chemical Engineering-BAS to award the scientific title of "Associate Professor" to Assist. prof. Dr. Eng. Rayka Vladova in the professional field 4.2. Chemical sciences, scientific specialty "Processes and apparatus in chemical and biochemical technology".

Date:18. 12. 2024

Prepared the report:

/ Assoc. Prof. Dr. Petya Popova-Krumova /