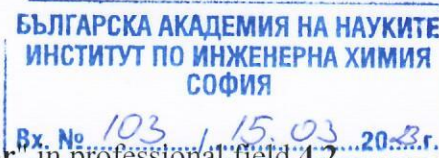


## Report



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 no. 96 (02.12.2022)

Candidate: **Assoc. Prof. Dr. Eng. Daniela Boyanova Dzhonova-Atanasova**

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

### **1. Brief biographical data and description of the applicant's scientific interests**

Assoc. Prof. Daniela Dzhonova-Atanasova is the only candidate in the competition for holding the academic position "Professor", announced for the needs of the laboratory "Transfer Processes in Multiphase Media" of the Institute of Chemical Engineering at Bulgarian Academy of Sciences (ICHE-BAS) by professional field 4.2. Chemical Sciences "Processes and Apparatus in Chemical and Biochemical Technology". Assoc. Prof. Dzhonova-Atanasova was born on March 5, 1963 in Vidin, Bulgaria. She graduated from the Technical University-Sofia, receiving MSc degree "Mechanical Engineer" in Heating, Ventilation and Air Conditioning in 1988. After her graduation, she obtained a postgraduate qualification in applied mathematics and informatics at the Technical University-Sofia. During the period 1988-1992 she was a full-time PhD student and at the same time a part-time lecturer in the Department of Hydroaerodynamics of the Technical University-Sofia, leading laboratory exercises in "fluid mechanics" at the same department. In 1992 Daniela Dzhonova-Atanasova defended her PhD thesis on "Heat exchange processes in two-dimensional free turbulent jets", receiving the title "candidate of technical sciences" in the same scientific organization, which is equivalent to the PhD degree. Since 1994 until now, Daniela Dzhonova-Atanasova has working in the laboratory "Transfer processes in multiphase media" of the Institute of Chemical Engineering at the Bulgarian Academy of Sciences, initially in the position of "technologist" (1994-2006), and then in the position assistant professor. In 2011 Dr. Dzhonova-Atanasova hold the academic position "associate professor". In parallel with this, in 2014 she became the head of the "Transfer Processes in Multiphase Media" laboratory at IChE-BAS, a position she has holding until now. During the period of 2018 - 2022 Assoc. Prof. Dzhonova-Atanasova was the "Scientific Secretary", and from 2022 is the deputy director of IChE-BAS. In the period 2012-2013, Assoc. Prof. Dzhonova-Atanasova was also a part-time lecturer at the European Polytechnic University, Pernik, giving lectures and exercises in English on the topic "Energy from the Ocean".

Assoc. Prof. Dzhonova-Atanasova's scientific interests are in the field of: heat and mass exchange processes in column apparatus; mathematical modeling; purification of liquids and gases; absorption; desorption; energy efficiency of technological processes; computational fluid dynamics; integrated technologies using filtration processes; heat accumulators for the recovery of waste heat and the use of renewable energy sources.

Assoc. Prof. Dzhonova-Atanasova speaks English, Russian and French.

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

For the period from 1994 up to this point, the candidate has presented information about his participation, as well as the management of scientific projects funded by national and international

sources such as the Bulgarian National Science Fund - Ministry of Education and Science, the National Science Fund of Kazakhstan, the European Commission, projects with foreign companies such as Rashig, etc.

Assoc. Prof. Dzhonova-Atanasova was the supervisor of two graduate students. She led student internships for students from UCTM-Sofia under the "Student internship" program of the Ministry of Education and Science of Republic of Bulgaria. She has one PhD student who has successfully defended his thesis, and she is currently the co-supervisor of two PhD students, one of whom is from Kazakhstan.

The candidate has been a joint guest editor of 6 special issues of the scientific journal "Bulgarian Chemical Communications". She has also been co-chair and chairman of the organizing committees of several national and international scientific forums. He is a member of the Union of Chemists in Bulgaria and the Working party on Mixing-European Federation of Chemical Engineering.

### **3. Evaluation of the presented materials**

According to the reference for meeting the minimum requirements of the Regulations for the terms and conditions for holding the academic positions in the Bulgarian Academy of Sciences and the Regulations for the application of the Law on the Development of the Academic Staff in the Republic of Bulgaria by groups of indicators, the candidate participates in the competition with:

**Indicator A:** Received PhD degree **(50p. from a minimum of 50p.)**;

**Indicator C:** 8 publications with ISI Impact factor and/or SJR, that are distributed by quartiles: 4 in Q1, 1 in Q2 and 3 in Q4; **(140p. from a minimum of 100p.)**;

**Indicator D:** 20 publications, outside the habilitation, which are distributed by quartiles: 3 in Q1, 2 in Q2, 2 in Q3 and 11 in Q4, and 2 publications, that have no quartile but are with SJR (265p. from a minimum of 220p.); 4 book chapters in prestigious national and international publishing houses (60p.); 1 utility model for which the candidate has been issued a document (25p.). Total number of points according to indicator D – **350p. from a minimum of 220p.**

**Indicator E:** Citations in scientific publications, referenced and indexed in world databases of scientific information (Web of Science and Scopus) - 82 on 21 publications **(164p. from a minimum of 120p.)**

**Indicator G:** The guidance of a successfully defended PhD student (25p.); participation in 3 projects funded by the Bulgarian National Science Fund and 1 project funded under the national program of the Ministry of Education and Science of Republic of Bulgaria "Low-carbon energy for transport and household (EPLUS)" (40p.); 4 internationally funded projects - 1 funded by the National Science Fund of Kazakhstan and 3 scientific research networks funded under the "COST" program of the European Commission (80p.); management of two projects funded by the Bulgarian National Science Fund - Ministry of Education and Science under the bilateral cooperation with India and Russia (100p.); funds earned on projects managed by the candidate (13.6p.). Total number of points according to indicator G - **258.6p. from a minimum of 150p.**

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

**Total number of publications - 65 (min. 40);**

**Total number of publications in journals with ISI Impact Factor and/or SJR - 35 (min. 12);**

**Number of publications, outside the habilitation - 33 (min. 20);**

**Number of publications with ISI Impact Factor and/or SJR, outside the habilitation - 29 (min. 7);**

**Number of citations in scientific publications, referenced and indexed in world databases of scientific information (Web of Science and Scopus) - 172 (min. 50);**

**Recommended Hirsch index - 7 (min. 8).**

From the quantitative indicators presented above, it can be seen that the candidate fully satisfies the requirements of the Regulations for the terms and conditions for holding the academic positions in the Bulgarian Academy of Sciences, the Regulations for the application of the Law on the Development of the 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 position of "Professor"

#### **4. Basic scientific and scientific-applied contributions**

Based on the materials provided to me for review, I would summarize the scientific, applied science and applied contributions as follows:

1. Conducting theoretical and experimental studies of membrane separation processes by nanofiltration in bioreactors for concentrating biologically active compounds in medicinal plant extracts. The aim is to determine the influence of hydrodynamics and mass transfer near the membrane surface. As a result of the conducted research, the shear rates and stresses of the membrane surface as well as the mass transfer coefficient in the considered bioreactors were determined. Theoretical studies are related to the creation of computer fluids dynamics (CFD) models of external membrane modules with tangential mode (in cross flow to the membrane surface), normal mode (in dead-end flow), as well as with a membrane module immersed in the bioreactor volume with the aim determination of flow characteristics (velocity and velocity gradient) when performing the nanofiltration process.
2. Development of highly efficient packing for industrial column apparatuses, as well as conducting theoretical and experimental studies of the effectiveness of mass transfer and heat exchange processes in the considered column apparatuses.
  - 2.1. Development of high-performance ceramic honeycomb block packings for column apparatus for absorption of hydrogen sulfide from flue gases produced in the manufacture of staple cellulose fibers, as well as for heat recovery from natural gas fired boilers. Developed packing of this type are characterized by low relative weight and low pressure drop.
  - 2.2. Conducting theoretical and experimental studies of the efficiency of heat and mass transfer processes in absorption and distillation column apparatuses with random packings with an open structure. This type of packing provides a uniform distribution of phases along the cross-section of the column, a large interphase surface and turbulization of the flows, which results in low pressure drop. Equations are derived that summarize own experimental data on pressure drop and retention capacity for this type of packing.
  - 2.3. Development of a dispersion analytical model for estimation of the radial maldistribution of phases in random open-structure packings.

An experimental installation was designed and built for the identification of the parameters of the created dispersion model. A special liquid distributor was designed to ensure the validity and applicability of the uniform initial irrigation model. Original data on liquid distribution in this type of packing are obtained. Special statistical methods are proposed to estimate the parameters of the dispersion model, achieving a better prediction of the experimental data. A two-step optimization procedure is applied to identify the model parameters and the maldistribution factor of the radial phase distribution.

A utility model is reported which reduces to a practical minimum the radial maldistribution of the axial velocity component of the phase in the column by swirling the gas (liquid) flow in the apparatus.
  - 2.4. Conducting experimental studies on the efficiency of mixture separation and mass and heat transfer in counter-current distillation columns with structured packing.



3. Development of efficient thermal accumulators for the storage of latent heat energy using phase change materials.
- 3.1. Development of efficient heat accumulators for hybrid heating, cooling and hot water systems in residential buildings. Creation of a CFD model to predict the heat transfer process of the fluid flow in this type of accumulators. Development and testing of a method for modeling the thermal behavior of a paraffin container and evaluating the factors that influence the heat exchange process before a physical experiment.
- 3.2. Development of efficient thermal accumulators for solar drying installations. Two modes of energy storage were evaluated through sensible and latent heat storage along with a control experiment without heat storage in a small mixed-mode solar thermal dryer. A CFD model was created to predict the airflow and temperature distribution patterns of the modules using Reynolds-averaged Navier-Stokes equations for natural convection in turbulent flow.

## 5. Reflection of scientific publications in the literature

The candidate has submitted a total number of citations of 172, of which 82 are in scientific publications, referenced and indexed in world scientific information databases (Web of Science and Scopus), which exceed the requirements of the above-cited regulations for holding the academic position of "Professor".

## 6. Personal impressions of the reviewer about the candidate

I have known Assoc. Prof. Dzhonova-Atanasova since the moment I started to work entered IChE-BAS. My impressions of her are as a very serious and responsible researcher, distinguished by high professionalism and very good organizational and leadership qualities. Holding the academic position of "Professor" will give her the opportunity to direct her professional interests in new areas of science, as well as to pass on the accumulated knowledge and experience to young scientists, students and PhD students.

## CONCLUSION

The materials presented to me for review are in accordance with the the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its implementation as well as the Regulations for the terms and conditions for holding academic positions at the Institute of Chemical Engineering at Bulgarian Academy of Sciences. Bearing in mind their importance, as well as that of the contributions contained in them, I consider it reasonable to propose **Assoc. Prof. Dr. Eng. Daniela Boyanova Dzhonova-Atanasova**, to hold the academic position of "Professor" in professional field **4.2. Chemical Sciences "Processes and Apparatus in Chemical and Biochemical Technology"**.

Data 13.03.2023

Reviewer:



/Assoc. Prof. E. Kirilova/