

REVIEW

In a competition for the academic position of "**Associate Professor**"
In the field of higher education: 4. Natural sciences, mathematics and informatics,
Professional field: 4.2. Chemical sciences,
Scientific specialty: Ecology and environmental protection (Ion exchange and
bioelectrochemical methods for water purification),
published in the State Gazette, issue 87 / 19.10.2021

Reviewer: Prof. Dr. Eng. Krassimir Georgiev Vassilev, University, "Prof. Dr. Asen Zlatarov"
- Burgas, member of the Scientific Jury, appointed by Order № RD - 322 of 22.11.2021 year of
the Rector of the University.

The only candidate in the competition is Ch. Assistant Professor Dr. Blagovesta Nikolaeva Midyurova. The presented materials are in accordance with the ZRASRB, the Regulations for its implementation and the Regulations for the terms and conditions for obtaining scientific degrees and holding academic positions at the University "Prof. Dr. Asen Zlatarov" - Burgas.

1. Brief biographical data of the candidate.

Chief Assistant Dr. Blagovesta Nikolaeva Midyurova graduated in 2001 with a master's degree chemical engineer in the specialty "Technology of materials and materials science" at the University "Prof. Dr. Asen Zlatarov", Burgas. In the period 2012-2016 she is a doctoral student in the professional field 5.10 Chemical Technologies, and defended her doctorate with the qualification "Water Purification Technology". The scientific career of Ch. Assistant Dr. Blagovesta Midyurova started as a chemist at the Department of Ecology and Environmental Protection for the period 2007-2016, after which she defended her doctorate and acquired the position of assistant. In 2017 she was elected Chief Assistant at the Department of Ecology and Environmental Protection at the Faculty of Natural Sciences at the University "Prof. Dr. Asen Zlatarov", Burgas.

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

The candidate Ch. Assistant Professor Dr. Blagovesta Nikolaeva Midyurova presented all the documents required for participation in the competition. The peer-reviewed documents on the topic of the competition include: independent scientific monograph; publications referenced and indexed in Scopus and Web of Science databases - a total of 17, of which 5 independent and 12 co-authored; 2 independent publications, which are referenced and indexed in world-famous databases with scientific information (Conference Proceedings); participation in 8 research projects (national scientific or educational project - 5; international scientific or educational project - 3).

All presented materials are related to the topic of the competition.

According to *indicator A* of the national minimum requirements, Blagovesta Nikolaeva Midyurova has 50 points. She is registered with NACID for holding a diploma № 0041/

30.05.2016 for acquiring "**Doctor**" in the professional field 5.10. Chemical technologies, after successful defense of the topic "Application of proton exchange membranes in fuel cells", 02.22.02 "Technology for water purification" with supervisor Prof. Dr. Valentin Nenov.

According to *indicator B*, the candidate presents an independent scientific monograph presented for Habilitation Thesis. The monograph is approved by NACID, which carries 100 points.

According to *indicator Г*, Ch. Assistant Dr. Blagovesta Nikolaeva Midyurova presents 261 of the required according to the national minimum requirements and the minimum requirements according to PURPNSZAD in the University "Prof. Dr. A. Zlatarov", 200 points. A list of 19 publications in the period from 2017 to 2021 is presented, as 13 are indexed in quartile Q3 (total 195 points), 3 are indexed in Q4 (total 36 points) and 3 are referenced (total 30 points).

Evidence of 54 citations in 11 of the applicant's publications is presented under *indicator Д* "Citation in scientific journals, monographs, collective volumes and patents, referenced and indexed in world-famous databases of scientific information (Web of Science and Scopus)". The received 108 points exceed the national minimum requirements of 50 points and cover the minimum requirements of 100 tons, according to PURPNSZAD in the University "Prof. Dr. A. Zlatarov".

According to *indicator E* "Participation in a national scientific or educational project" the candidate declares a total of 110 points out of the minimum 100, which are according to the requirements of the University "Prof. Dr. Asen Zlatarov".

Summary of the group of indicators *A, B, Г, Д* and *E* presented in the Report on minimum national and requirements according to PURPNSZAD in University "Prof. Dr. A. Zlatarov", including the total number of points of the author to participate in a competition for Associate Professor are shown in the table.

Group of indicators	Minimum national requirements	Minimum requirements according to PURPNSZAD in the University "Prof. Dr. A. Zlatarov"	Total points of the author for participation in the competition for Associate Professor
A Indicator 1	50	50	50
Б Indicator 2	-	-	-
B Indicator 3	100	100	100
B Indicator 4	-	-	-
Г Sum of indicators 5 to 9	200	200	261
Д Sum of indicators from 10 to 12	50	100	108
E Sum of the indicators from 13 to 23	-	100	110
Amount	400	550	629

3. Audit activities and scientific forums.

For participation in the competition are attached documents proving the teaching, teaching and research activities: teaching experience at the moment - 5 years (assistant and chief assistant); references for the number of lectures and exercises in the Bachelor's and Master's degrees; developed curricula - 12 pieces: for bachelor's degree - 6 and master's degree - 6; list of successfully defended graduates.

For the last three years Ch. Assistant Professor Dr. Blagovesta Nikolaeva Midyurova gives 1567 classroom lectures and exercises on "Climatology and Hydrology", "Water pollution and impact on ecosystems", "Fluid purification" and "Water Purification Project". All disciplines are from the curriculum for the bachelor's degree in "Ecology and Environmental Protection" and "Ecology and Environmental Management" at the Faculty of Natural Sciences. She also conducted 930 classroom classes in the subjects of the curriculum for Master's degree broad and narrow profile of the same specialties - "Water Pollution and WPP", "Water Management", "Marine Ecology" and "Specific technologies for limitation of anthropogenic pressure on the hydrosphere". For the completed academic disciplines, the candidate has taken part in the development of the respective curricula. Ch. Assistant Professor Dr. Blagovesta Midyurova was the scientific supervisor of four successfully defended graduates: one in 2019, two in 2020 and one in 2021.

The candidate has participated in the organizing committees of two conferences - the international scientific conference "*Environmental Engineering and Environmental Protection*" and the national conference for students "*Think ecologically for the future*" from 2017 to 2022.

4. Main scientific and applied scientific contributions of the candidate.

The scientific works of Ch. Assistant Professor Dr. Blagovesta Midyurova are in the field of ecology and environmental protection (Ion exchange and bioelectrochemical methods for water purification), which corresponds to the announced competition for "Associate Professor". Part of the trends in modern research is aimed at solving one of the most pressing problems of our time - water pollution and their impact on ecosystems. The scientific publications presented by the candidate are multidisciplinary. They cover three of the priority areas of the "National Strategy for the Development of Research", 2030 and the "Strategy for the Development of Research Activities of the University "Prof. Dr. Asen Zlatarov" for the period 2017-2025, namely:

- environment (water, soil, air) and biodiversity;
- energy efficiency and alternative energy sources;
- Mathematical modeling and computer simulations.

I accept the scientific and scientific-applied contributions, classified and presented by Dr. Midyurova in the four thematic areas, namely:

I. Ion exchange methods in natural water treatment:

- The ion exchange processes have been established and described. The obtained experimental results under different operating conditions lead to a relatively accurate prediction

of the processes in the ion exchange systems. Several methods have been developed for the analysis and conditioning of polluted watercourses [1.1].

- A thorough analysis was performed and the exchange isotherms were constructed using strongly acidic cations and solutions of different concentrations. The relationship between the contact time of the ion exchanger and the solution was determined, and their influence on the ionic strength, kinetics and dynamics of ion exchange was evaluated [2.7].

- Attached are technological schemes for ion exchange softening. It is clear that other things being equal, the ions of hardness are affected by the stratification of the ionic layer as well as its regeneration. As a result, it is achieved economical technological process with weaker anthropogenic is n pressure on the Environment [2.3].

- Quantitative assessment of the influence of the concentration of electrolytes in aqueous solutions has been made. It was found that it is necessary to calculate the selectivity coefficients in order to operate with the values of thermodynamic equilibrium constants characterizing the processes occurring in water- dispersed systems [2.6].

II. Application of bioelectrochemical systems in wastewater treatment.

- The main characteristics of three types of bioelectrochemical systems have been studied. The multifunctionality of these reactors is demonstrated and the processes taking place in them are presented in detail. The effectiveness of bioelectrochemical methods for the removal of organic matter without reagent -raising pH, reduction of transition metal ions and desalination of water has been proven [2.13].

- The productivity of Microbiological Fuel Cells (MFCs) when working with electrodes of different composition was studied. It has been found that when using a VITO[®] 40:60 air cathode reactor, the removal of organic matter increases up to 80% [2.1].

- It was found that when modifying the cathode with electrically conductive polyaniline (PANI) material, an improvement was observed in the operating parameters of the electrode. It has been experimentally proven that when the cathode is modified, the voltage generated in the MFC increases [2.2]. An empirical relationship has been established between the different types of networks used (pre-treated) and the change in the output power of the cell.

- Different combinations of cathodes have been developed containing different amounts of Vulcan[®] and MnO₂ catalyst [2.8, 2.10]. Satisfactory results have been found at the Vulcan[®] powder cathode and at the cathode with a layer of ceramic powder and MnO₂. The application of these modified air cathodes there is important advantages for the functionality of bioelectrochemical systems. The larger working area range is due to the different material ratio and the improved oxygen transfer acting as an electron acceptor.

- A detailed analysis of the influence of the type of network from which the air cathode is constructed is made. The influence of the electrode geometry on the generated electromotive voltage in the MFC has been experimentally determined [2.9].

- The possibility of improving the operational stability of the processes in the MFC has been studied. It has been found that the efficiency of bioelectrochemical methods for water purification depends on the optimization of reactor design. Maximum efficiency is achieved only at close values of the internal resistance and the resistance of the externally connected resistor in the circuit [2.19].

- Different types of membranes from natural sources have been developed. They are applied in Bioelectrochemical Systems (BES) and a comparative analysis is made by analytical techniques, such as: laser diffraction, spectroscopic methods, etc., in order to select the more efficient membrane based on the obtained characteristics. New electrodes have been developed by assembling with different coatings - polymeric and inorganic in order to improve the processes of diffusion through the membrane [2.16, 2.18].

- The feasibility of treating livestock waste fluids with a high content of organic matter, suspended solids, phosphorus and nitrogen has been assessed, through microbiological fuel cells [2.15]. It was found that the voltage generated by the system remained relatively constant for nearly 300 hours.

III. Methods for assessment of surface water pollution.

- The self-purification capacity of river waters on the basis of physicochemical indicators was examined [2.5]. The hydrochemical type of water has been determined - hydrogen carbonate calcium, neutral to slightly alkaline. It was found that the self-purification capacity of river waters on the indicators: mechanical impurities and permanganate oxidizability is relatively low - 30% and 22%, respectively.

- A preliminary study on air pollution has been carried out, which has a negative impact on water quality and damages ecosystems [2.17]. For the purposes of the study, a database generated by an automatic mobile measuring station located near the Burgas Lake Vaya was used. This study is the initial stage of the survey of the water body and clearly demonstrates that air pollution is an integral and extremely important part of the overall maintenance of aquatic ecosystems.

- Vollenweider method for calculating the Trophic Index (TRIX) based on measured physicochemical and biological parameters in surface aquatic ecosystems is applied [2.4]. Four state variables were used: chlorophyll A, dissolved oxygen, dissolved inorganic nitrogen, and total phosphorus. Two combinations of the TRIX index and the efficiency factor related to the production of nutrients in an aqueous source have been calculated. An easy and fast approach to the assessment of a database from the monitoring of Burgas Lake has been demonstrated. The implementation of the TRIX index helps to take future actions and measures to prevent and protect water from pollution.

IV. Application of neural networks and fuzzy sets in bioelectrochemical systems. Mathematical modeling and computer simulations.

- The prediction of the behavior of a microbiological fuel cell based on artificial neural networks has been made [2.14]. This type of modeling makes it possible to identify complex nonlinear relationships between input and output data.

- Statistical analysis [2.11] of experimental and predicted data was performed by modeling carbon emissions at the inlet and outlet of the primary precipitator from the Wastewater Treatment Plant - Lukoil, Burgas. The obtained values were compared with similar values obtained using Water 9.3[®] software and the US EPA algorithm AP-42. It was found that the values of hydrocarbons calculated using Water 9.3[®] software are about twice as high, while those calculated using AP-42 and are four times lower than experimental. It has also been found

that the AP-42 algorithm predicts emission values twice lower than those of Water 9.3[®] software.

- For the purposes of modeling, the method of central orthogonal compositional planning is applied. The role of the reaction parameters for the fabrication of air cathodes, subsequently applied in BES, is defined. As a result of the conducted central orthogonal compositional planning, three significant coefficients b_0 , b_1 and b_2 were obtained and an adequate equation with coded value of the input factors was obtained $F < F_T$ ($18.64 < 19.33$). The equation adequately describes the process of obtaining air cathodes under the studied conditions. The conducted systematic research shows that there are significant parameters that can be used in process optimization and the model can be applied to another type of polymer and catalyst [2.12].

5. Reflection in the scientific literature and international reviews.

Evidence of current and promising topics are the quotes in international scientific journals such as: *Journal of Power Sources* with Impact Factor - 9.127, *International Journal of Hydrogen Energy* with Impact Factor - 5.816, *Bioelectrochemistry* with Impact Factor - 5.373, *RSC Advances* with Impact Factor - 3.390 and in others with high index-reference.

In the course of her research work, Ch. Assistant Dr. Blagovesta Midyurova has participated in several international research teams. Evidence of this is provided by recommendations from four international scientific organizations: *American University of Sharjah*, *Tekirdag Hint Kemal University*, *Cyprus Science University* and *University of Kragujevac*.

Everything presented gives me reason, based on her research, citations and recommendations, to conclude that the personal contribution of the candidate Ch. Assistant Professor Dr. Blagovesta Nikolaeva Midyurova is significant. From the presented publications, it can be seen that in 15 of them, he is an independent author or in the first place.

6. Critical remarks

I have no principled critical remarks on the research from the publications of Ch. Assistant Professor Dr. Blagovesta Midyurova.

CONCLUSION

The presented materials from Ch. Assistant Professor Dr. Blagovesta Nikolaeva Midyurova meet the requirements for holding the academic position of "Associate Professor" at the University "Prof. Dr. Asen Zlatarov" - Burgas in the professional field: 4.2. Chemical sciences. The scientometric indicators, on modern and promising topics on which the candidate works, give me reason to accept with dignity her scientific achievements.

This shows that Ch. Assistant Professor Dr. Blagovesta Nikolaeva Midyurova is a promising young researcher with her own scientific style and new ideas for future research.

I give my positive assessment of the scientific, research and teaching activities of Ch. Assistant Professor Dr. Blagovesta Nikolaeva Midyurova and I strongly recommend to the

Faculty Council of the Faculty of Natural Sciences at THE University "Prof. Dr. Asen Zlatarov"
- Burgas, to elect her to the academic position of "**Associate Professor**" in the field of higher
education: 4. Natural Sciences, Mathematics and Informatics, professional field: 4.2. Chemical
sciences, scientific specialty: Ecology and environmental protection (Ion exchange and
bioelectrochemical methods for water purification), published in the State Gazette, issue 87 /
19.10.2021.

Date: **21.02.2022**

Jury member:

Prof. Dr. Eng. Krassimir Vassilev