R E V I E W

by Prof. Dr. Kaloyan Petrov, Head of the Biochemical Engineering Laboratory, Institute of Engineering Chemistry - BAS

of the documents submitted for participation in a competition for the academic position of "professor" at the "Stefan Angelov" Institute of Microbiology - BAS. Professional code: 4.3. Biological Sciences, specialty "Microbiology", for the needs of the "Biotechnology" Department, "Bioremediation and Biofuels" laboratory

In the competition for the academic position "professor", announced in the State Gazette, no. 43 of 10. 06. 2022, as the only candidate, Associate Professor Dr. Lyudmila Vladimirova Kabaivanova, head of the Biotechnology Department at IMikB.

1. General presentation of the received materials

The set of materials presented by Prof. Kabaivanova is in accordance with the Regulations for the Development of the Academic Staff of the Institute of Microbiology and includes the following required documents:

1. Autobiography according to the European model;
2. Copies of diplomas;
2.1. For an acquired master's degree;
2.2. For an acquired doctoral degree;
2.3. For an acquired position of Assoc. prof.;
3. Abstract of the Ph.D. thesis for the acquisition of a Ph.D. degree;
4. Certificate from the current employer;
5. List and copies of the publications falling under criteria B and Г
6. List of participation in scientific conferences
7. List of projects
8. List of citations
9. Reference to the research areas in which the candidate works
10. Reference to original scientific contributions
11. Reference for the meeting of the criteria of PPZRASRB, BAS, and IMikB.

2. Brief biographical data

Assoc. Prof. Kabaivanova graduated with a Master's degree in "Biochemistry and Microbiology" from the Sofia University "St. Kliment Ohridski" in 1992. She took her first steps as a scientist at the Institute of Microbiology of the BAS, where in 2006 she defended her doctoral dissertation on the topic: "Degradation of nitrile compounds with cells immobilized in different supports".

From 1993 until now, Dr. Kabaivanova has worked at the Institute of Microbiology of the Bulgarian Academy of Sciences, successively as a specialist, Assistant, and the academic position of associate professor took place in 2011.

Associate Professor Kabaivanova has many years of management experience, having been the scientific secretary of the Institute for 4 years, and is currently the deputy director. She manages to perfectly combine administrative and scientific commitments, as in addition to the management of IMikB, she is the head of the

Department of Biotechnology and the Bioremediation and Biofuels Laboratory, she was the Vice-President of the General Assembly of scientists at IMikB, she is a member of the National Assembly of the Institute of Microbiology and was a representative of IMikB in the General Assembly of BAS.

3. Characteristics of the applicant's activity

The total number of publications of the candidate Prof. Kabaivanova is 115. She participated in the competition for "Professor" with a total of 21 scientific publications in refereed journals (SCOPUS, WOS). She presented a list of 19 research projects of which she was the leader (3) or participant. The distribution of scientific works (except for the PhD-degree and those reviewed in the competition for "associate professor") by relevant rubrics, in the country and abroad, is as follows:

- 21 publications in refereed foreign publications, of which:
- 16 in journals with an Impact factor (IF) and
- 5 - in a journal with an Impact rank (SJR)

Of them: 1 - in journals from the first quartile - Q1; 3 - Q2; 13 - Q3 and 4 - Q4.

Eight full-text publications in national and international Proceeding books are also presented, after acquiring an "associate professor".

In 19 publications, Assoc. Prof. Kabaivanova is the lead (first or corresponding) author, an indicator accounting for the contribution to specific scientific works. The candidate has a Hirsch factor of 12 and a total IF of 55.6.

After her habilitation in 2011, Prof. Kabaivanova worked in several main directions, which I would define as challenges for modern microbiology and biotechnology:

• Aerobic biodegradation processes, including the detoxification capabilities of microorganisms and the study of optimal conditions for biodegradation and biosorption to solve a number of environmental problems,

• Anaerobic biodegradation processes concerning the absorption of various wastes in order to obtain renewable energy carriers with the participation of specific microbial communities as an alternative to fossil fuels,

• Incorporating waste products and plant residues from agricultural practice and using the activities of bacteria and fungi in biodegradation processes to obtain nutrient-rich composts in order to improve soil fertility for sustainable agriculture and clean foods,

• Microalgae - food and therapeutic applications, obtaining new biologically active substances from algae in order to test their potential as antitumor agents for use in biomedicine,

• Obtaining new biologically active substances from bacteria, characterizing their properties, and testing their action on certain types of cancer cells, potentially applicable as an alternative to conventional drugs.

In the first direction, Prof. Kabaivanova's team focuses on systematic studies on the detoxification abilities of microorganisms and the study of the optimal conditions

for the biodegradation processes for the purpose of bioremediation. The candidate's main contributions in this regard are the following:

- A new immobilized system was obtained based on a hybrid sol-gel matrix with the participation of chitosan and Aspergillus awamori cells, which was shown to effectively degrade the xenobiotic phenol and could be used as a tool for detoxification of industrial contaminated sites containing toxic aromatic compounds (Article B3).
- For the first time, immobilization of Pseudomonas aeruginosa in cryogel was carried out for the extraction of rhamnolipid biosurfactants (Article B2). The ability of a Rhodococcus wratislawiensis strain to simultaneously mineralize both aromatic and aliphatic xenobiotics to the complete depletion of n-hexadecane in 40 active cycles was demonstrated. The immobilized strain could be used to treat polluted industrial wastewater (Article D3).
- In order to biodegrade n-hexadecane by Pseudomonas aeruginosa, the cells were immobilized in a SiO2-chitosan/PEG system and the efficiency of the biodegradation of hydrocarbon pollutants was evaluated (Г4).
- A newly isolated strain of Bacillus cereus with impressive activity has been used for the biodegradation of hydrocarbons from crude oil (free and immobilized in cryogel cells), (article Г6).
- Nitrilase enzyme producers are immobilized in sol-gel Sepharose matrices for purification from nitrile compounds (Article B6).

The second direction in the works described is the anaerobic biodegradation of agricultural waste to obtain energy (biogas) and biofuels (hydrogen and methane).

- The processes of hydrolysis, acidogenesis, acetogenesis, and methanogenesis from plant substrates and the microbial communities involved in them were studied.
- Experiments dedicated to the valorization of waste products after the process of anaerobic digestion for the cultivation of microalgae have a beneficial character (articles Г1 and Г12).
- With the approaches of modern metagenomics, the microbial communities in the bioreactors have been studied, which provides insight into the symbiotic relationships during the process (publication B1).
- The processes of obtaining hydrogen and methanogenesis in the course of two-stage biodegradation have been studied (article Г15). Mathematical models describing the processes were made.
- Pioneering research has been done on the application of microbial biodegradation for the utilization of cellulose-containing waste during long-term manned space missions. (Article Г12).
- Related to the above direction is the biodegradation of plant residues to obtain compost (publications Г10 and Г14).

In the direction dedicated to the applications of microalgae in various biotechnological processes to obtain valuable products, the following significant successes have been achieved:

- A new extracellular polysaccharide was isolated from the red microalga *Porphyridium sordidum* with anticancer activity. The production of polysaccharides from *Rhodella reticulata* was optimized and antitumor activity was demonstrated for both polysaccharides (articles В4, В5, Г1).
- The influence of stress factors on the development of microalgae has been studied (articles Г7 and Г8), and a novelty is the proof of the influence of temperature on the synthesis of eicosapentaenoic acid by *Rhodella reticulata*.

In the direction dedicated to obtaining new biologically active substances from bacteria, these promising new compounds have been characterized and their potential action on certain types of cancer cells has been tested.

- A trehalosolipid biosurfactant from Nocardia farcinica has been shown to reduce the viability of cancer cells (Article Г9).
- A trehalose lipid and disaccharide isolated from a strain of Rhodococcus wratislaviensis affected cell viability and migration of two human breast cancer cell lines, making these substances promising for biomedical application (publication Г2).

4. Project activity

The candidate's remarkable scientific output is based on good research funding for a total of 17 scientific projects and two administrative ones. Assoc. Prof. Kabaivanova is a participant in 13 and head of 3 projects financed by the National Institute of Scientific Research. A contract on the topic "Isolation and characterization of bacteria, producers of thermostable nitrile-metabolizing enzymes" received the First Prize from the Scientific Research Fund for significant results achieved during its implementation. Prof. Kabaivanova is a participant in several international projects and has a contract with the Bulgarian company “Agria”. The funds raised by Prof. Kabaivanova for the various projects in which she participated or led amounted to over BGN 2 million BGN.

5. Educational activity

Prof. Kabaivanova is a lecturer at HTMU, where she leads lectures and exercises for students in the master's program of the "Silicate Technology" department. He actively participates in the "Student Practice" program of the Ministry of Education and Science, teaching dozens of specialists.

In the Training Center at the BAS, she prepares Ph.D. students as leads a lecture course "Technological foundations of the immobilization of microbial cells and application to increase the efficiency of anabolic and catabolite processes".

He is the supervisor of three doctoral students with topics close to the theme of the competition. Under her supervision, six diploma theses were developed for the acquisition of the Master's degree.

6. Meeting the criteria for the position of "Professor"

The report on compliance of the points of associate professor Dr. Lyudmila Kabaivanova with the minimum scientometric requirements under ЗРАСРБ and the increased minimum requirements of the BAS shows that her scientometric indicators meet all requirements. In the case of requirement for indicator "B" - 100 points, the candidate submits publications forming 102 points, in the case of requirement according to the indicator "Г" - 220 points, those of Prof. Kabaivanova are 226. Requirements according to the criterion "D" - citations and criterion " E" - attracted funds the applicant significantly exceeds (200 items under "D" with a requirement of 120 items) and 236.6 items under "E", with a requirement of 150 items.

The candidate also meets and exceeds the increased requirements of the Regulations for the application of ЗРАС in IMikB. With a requirement of 400 citations for the position of "professor", Associate Professor Kabaivanova submits 450, with a requirement of a Hirsch factor of 10, hers is 12, and she is the head of 3 projects and of three doctoral students.

7. Prospects

In the documents submitted for the competition, the candidate Prof. Kabaivanova outlines her future plans for scientific research. They are no less ambitious than her current work. Along with bioremediation and obtaining alternatives to fossil fuels, the team will devote itself to the research of biologically active compounds with applications in medicine. The investigation of the properties of new bioactive compounds will continue in the direction of their detailed characterization and elucidation of their mechanisms of action to reveal the potential possibility of using their antitumor properties for the treatment of certain cancers.

8. Personal impressions

I have known Associate Professor Kabaivanova since 2004. Over the years, we have not had any professional activity in common, but following the scientific successes of the Institute of Microbiology, I see that Associate Professor Kabaivanova is a recognizable scientist among the scientific community, and proof of this is her active participation in committees at Ministries, or in scientific juries related to various procedures under the Law on the Development of the Academic Staff in the Republic of Bulgaria, quite often in our institute as well.

9. CONCLUSION

The documents and materials presented by Assoc. Dr. Kabaivanova 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 and the

relevant Regulations of the Institute of Molecular Biology at the BAS for occupying the academic position "Professor".

The candidate's works contain original scientific and applied contributions that have received international recognition, a representative part of which has been published in renowned scientific journals and scientific collections issued by international academic publishing houses. The results achieved by Assoc. Dr. Kabaivanova in her scientific activity, teaching work, and project management exceed the specific high requirements for the position of "professor" laid down in the PPZRASRB of the Institute of Microbiology at the BAS. After familiarizing myself with the materials and scientific works presented in the competition, analyzing their significance, and the scientific, scientific-applied, and applied contributions contained in them, I give my positive assessment and recommend that the Scientific Council of IMikB elect Assoc. Dr. Lyudmila Vladimirova Kabaivanova for "Professor" in professional direction 4.3. Biological sciences, scientific specialty Microbiology, at the Institute of Microbiology "Stefan Angelov" - BAS.

10/17/2022

Reviewer:
(Prof. DSc. Kaloyan Kirilov Petrov)