OPINION

of Prof. Kaloyan Kirilov Petrov, Head of the Laboratory "Biochemical Engineering",
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Subject: Evaluation of a candidate, participant in a competition for the academic position "Associate Professor" in the Field of Higher Education 4. Natural Sciences, Mathematics and Informatics, Professional Direction 4.3. Biological Sciences (Microbiology)

1. Information about the competition

The competition was announced in the State Gazette No. 30/08.04.2025 for the needs of the Institute of Microbiology "Stefan Angelov" - Bulgarian Academy of Sciences, Department of General Microbiology, Laboratory "Extremophilic Microorganisms". My participation in the Scientific Jury is by Order No. I-77/28.05.2025 of the Director of the Institute of Microbiology.

2. Information about the candidate

The only candidate in the competition is Assist. Prof. Dr. Ivanka Petrova Boyadzhieva. She has a Master's degree in Molecular Biology from the Faculty of Biology of Sofia University "St. Kliment Ohridski" with a specialization in Virology (1999). In 2008, she obtained her PhD degree from the Institute of Microbiology - BAS. Her professional path is entirely connected with the Institute of Microbiology, where she has successively held the positions of microbiologist and Assistant Professor.

3. Fulfillment of the requirements for holding the academic position

Assist. Prof. I. Boyadzhieva is a co-author of 31 scientific works, of which 27 scientific articles, three book chapters, and one patent. She participated in the competition with 20 scientific articles, three book chapters, and one patent. Twenty articles have been published in journals with IF; the total IF is 42.694, with Hirsch-index 10 (Scopus).

Scientific works form points according to the indicators of the PPZRASRB as follows: indicator A - acquired PhD degree - 50 points; indicator B - 5 scientific articles (5 in journals with IF and quartile Q2) 100 points; indicator G - 340 points (sum of G7 - 15 scientific articles - 14 in journals with IF; of them 3 with Q1, 6 with Q2, 5 with Q3) and two book chapters - 270 points, G8 - 3 book chapters - 45 points and G9 - 1 patent - 25 points). Indicator D - 326 points exceed 163 citations (SCOPUS). In total, Dr. Boyadzhieva scores 816 points, which covers and exceeds the required 430 points according to the PPZRASRB and the Regulations of the Bulgarian Academy of Sciences.

Additional requirements of the Institute of Microbiology and Microbiology were also exceeded. Assist. Prof. Boyadzhieva is a co-author of 23 publications after receiving

the PhD degree (20 are required), and in 6 articles, she is the lead author. The total number of citations is 218, more than twice the 100 citations required by the IMikB Regulations.

4. Scientific topics

Dr. Boyadzhieva's scientific activity is in the field of microbiology of extremophiles, including isolation and characterization of halophilic and thermophilic microorganisms, study of their enzymes and exopolymers, and their application in biotechnology. The focus of her research is on the following interrelated areas:

- Microbiology of extremophiles (halophiles and thermophiles): isolation, cultivation, and systematic characterization of microorganisms from extreme habitats (salt evaporation ponds, thermal springs, etc.).
- Biosynthesis of microbial exopolysaccharides: optimization of parameters to increase yield and improve their functional properties (emulsifying activity, stability).
- Isolation, purification, and characterization of industrially essential enzymes (pectinases, lipases, phytases, and others), especially those with high thermostability or halotolerance.
- Applied microbiology and biotechnology: potential applications of discovered bioproducts in the food industry, cosmetics, feed industry, and in bioremediation processes (e.g., degradation of plastics).

One of the central and most cited achievements of Dr. Boyadzhieva is the development of a method for the biosynthesis of exopolysaccharides from the halophilic bacterium *Chromohalobacter canadensis* 28. Optimization of the processes leads to a twofold increase in the yield compared to the initial conditions, and reaches a maximum concentration of ~3.08 mg/mL in the presence of surfactants. The emulsifying ability of the obtained EPS surpasses commercial hydrocolloids such as xanthan and guar gum and shows a synergistic effect with commercial cellulose in the formation of stable emulsions. The achievements in scaling up and improving the functional properties make the obtained EPS competitive for applications in cosmetics, as a food additive, and as an industrial emulsion.

Another significant achievement is the purification of a thermostable lipase from *Brevibacillus thermoruber* (strain 7), capable of degrading ε-polycaprolactone (PCL). The kinetic parameters of the enzyme were determined, and the influence of divalent ions on its activity was monitored. The pure enzyme and ultraconcentrate showed significant changes on the PCL surface in a short period (within a week). The thermophilic community achieved 100% degradation of PCL under controlled conditions (28 days), and the pure strain achieved 63.6% degradation in the same period.

Key results of Dr. Boyadzhieva are related to the purification and characterization of pectinases from *Anoxybacillus gonensis* strain 357 and *Virgibacillus salarius* strain 434. The optimal conditions and stability of these enzymes are under haloalkaline conditions (pH ~9 and high salinity — 70 g/L NaCl), which makes them suitable for industrial

processes in harsh conditions (preservation, fruit pulp processing, industrial extraction). In addition, in a recent publication, Dr. Boyadzhieva is among the first authors reporting the purification and characterization of alkalophilic phytase from Cobetia marina strain 439. The potential of the enzyme is related to reducing the need for inorganic phosphorus fertilizers and improving the nutritional value of grain feeds.

5. Project activity and scientific cooperation

The candidate's cooperation with other Bulgarian groups and foreign partners (Italy, Romania, Russia, Turkey) strengthens the methodological capacity and supports the transfer of knowledge and technology. She is a participant in 3 national and 5 international scientific projects and is the leader of an inter-academic cooperation agreement between Bulgaria and Romania.

6. Conclusion

Assist. Prof. Dr. Ivanka Petrova Boyadzhieva has proven scientific competence in the field of extremophile microorganisms and biotechnology. Her publication activity, citations, and participation in projects reflect a stable scientific career and potential for further development. Her research has specific applications and is related to national scientific and economic priorities. The scientometric indicators of Dr. I. Boyadzhieva fully meet and exceed the criteria for occupying the academic position "Associate Professor" of the ZRASRB and the Regulations for its implementation, as well as the additional requirements of the BAS and the Institute of Microbiology. Based on the submitted materials and analysis of the achievements, I give a completely POSITIVE assessment of the candidate and I strongly support the occupation of the academic position "Associate Professor" by Senior Asst. Dr. Ivanka Petrova Boyadzhieva.

08/11/2025

Signature:

(Prof. Kaloyan Petrov)