

REVIEW

by Prof. Iskra Vitanova Ivanova, DSc

regarding the scientific works and materials of Assoc. Prof. Dr. Anatoliy Tsankov Angelov submitted for participation in the competition for the academic position of **Professor** in Professional Field 4.4. “Earth Sciences”, Scientific Specialty “Systems and Devices for Environmental Protection”, announced by the University of Mining and Geology “St. Ivan Rilski” in State Gazette, issue 1 of 06.01.2026

The announced competition for the academic position of “Professor” has a single candidate – Assoc. Prof. Dr. Anatoliy Angelov. The submitted documents and materials fully comply with the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations for the Conditions and Procedure for Acquiring Scientific Degrees and Holding Academic Positions at the University of Mining and Geology “St. Ivan Rilski”.

Brief Biographical Reference and Evaluation of Publication Activity

Assoc. Prof. Dr. Anatoliy Angelov has 31 years of professional experience. In 1993, he graduated from the Technical University of Sofia with a degree in “Biotechnics” (Master Engineer), and in 1995 he obtained a second Master’s degree in “Engineering Ecology.” During the period 1995–1998, he worked as an environmental specialist at PDNG-AD “Oil and Gas,” Dolni Dabnik.

In 1998, after successfully passing a competition, he was appointed Assistant Professor in the Department of “Engineering Geoecology” at the University of Mining and Geology “St. Ivan Rilski.” In 2002, he became Senior Assistant Professor, and since 2006 he has held the position of Chief Assistant Professor.

In 2009, he defended his dissertation entitled “Treatment of Mine Waters from Manganese by Rock Filters.” In 2011, he was habilitated as Associate Professor in Professional Field 4.4. “Earth Sciences,” Scientific Specialty “Systems and Devices for Environmental Protection.” Since 2012, he has been elected Head of the Department of “Engineering Geoecology” at the University of Mining and Geology “St. Ivan Rilski.”

General Description of the Submitted Materials for the Competition

The materials submitted by the sole candidate, Assoc. Prof. Dr. Angelov, fully meet the requirements of the competition and present the specific evidentiary part regarding the required criteria, as well as the candidate's overall scientific output through publication and citation lists, the text of the scientific contributions, autobiography, etc.

The submitted documentation is exceptionally well organized and highly detailed, including digital copies of the publications related to participation in this competition, as well as their abstracts in Bulgarian and English.

For participation in the competition for the academic position of "Professor," scientific publications have been submitted that were not used for obtaining the educational and scientific degree "Doctor" and the academic positions of "Chief Assistant Professor" and "Associate Professor."

The scientific works are distributed as follows:

- 12 publications in journals with impact factor or impact rank, indexed in Web of Science and Scopus;
- 53 publications in peer-reviewed journals without impact factor or impact rank, but included as scientific contributions.

The scientific works of Assoc. Prof. Dr. Anatoliy Angelov can be distributed according to the criteria of the minimum national requirements under the Law and its Regulations as follows:

Criterion A

Abstract of dissertation for awarding the educational and scientific degree "Doctor" – **50 points**

Criterion B

Habilitation work – scientific publications in journals indexed in internationally recognized databases – **120 points**

Criterion C

Includes publications indexed in Web of Science and Scopus in Q2–Q4 categories – **86 points**

Fifty-three scientific publications in peer-reviewed journals and edited collective volumes – **318 points**

Published chapter in a collective monograph – **15 points**

Total for Group C – **419 points**

Criterion D

71 citations in scientific publications, monographs, collective volumes, and patents indexed in Web of Science and Scopus – **395 points**

Criterion E

Supervision of 5 successfully defended PhD students – **175 points**

Leadership and participation in national and international projects – **380 points**

Funds attracted from projects (BGN 419,250) – **83.8 points**

Published university textbook used in the educational network – **6.7 points**

Total for Criterion E – **635.5 points**

Assoc. Prof. Angelov significantly exceeds the minimum requirements: with a required minimum of 600 points, he demonstrates a total of **1619 points**.

Evidence is also provided for participation in 12 Bulgarian and international scientific forums.

Overview of the Scientific and Applied Scientific Contributions of the Candidate

The contributions of the submitted materials can be grouped into several directions:

Use of Microbial Fuel Cells Based on Dissimilatory Microbial Sulfate Reduction

These studies concern energy production and the removal of sulfates, heavy metals, and organic pollutants from wastewater. Microbial sulfate reduction can be integrated into bioelectrochemical systems such as microbial fuel cells and microbial electrolysis cells for effective treatment and simultaneous energy generation.

Kinetic and Parametric Analysis of Factors Determining MFC Efficiency

A systematic analysis of technological parameters affecting microbial fuel cell performance was carried out by varying nitrate concentration, anolyte conductivity, temperature, separator type, and external resistance.

Integration of Microbial Fuel Cells into Constructed Wetlands and Sediment Ecosystems

This represents a qualitatively new stage in the development of bioelectrochemical technologies. The generated electrical signal correlates with organic load dynamics, enabling the use of sediment microbial fuel cells as self-powered biosensors for monitoring water quality.

Application to Real Mining Wastewater (Acid Mine Drainage)

Research expands existing approaches by proposing functional separation of processes: electrochemical reduction of metal ions in the cathodic zone and biological sulfate reduction in the anodic zone using electroactive sulfate-reducing consortia.

Optimization of Biomethanization and Biogas Production

Microbial electrolysis cells are integrated into anaerobic digestion systems. The application of a modulated pulsed electric field represents a novel optimization approach compared to conventional constant-voltage systems.

Active and Passive Systems for Treatment of Mining Wastewater

The research focuses on:

1. Passive biogeochemical systems based on microbial sulfate reduction;
2. Optimization of active chemical methods for sulfate removal via ettringite precipitation;
3. Engineering and environmental assessment regarding sludge formation and regulatory compliance;
4. Selective precipitation of metals from wastewater streams.

Photo-Bioelectrochemical Systems

Original hybrid constructions combining microbial fuel cells with photobioreactors in the cathodic zone have been developed and proven effective for simultaneous water treatment and electricity generation.

Development of Carbon Nanomaterials as Cathodic Electrocatalysts

Nitrogen-doped carbon nanodots were synthesized and characterized. For the first time, a synergistic effect between Ru^{2+} -C-dots modified cathodes and sulfate-reducing bacterial biofilms was demonstrated.

Treatment of Municipal Solid Waste Landfill Leachates

The main factors influencing leachate genesis and quality were identified, and an original laboratory treatment system was developed and experimentally validated.

Environmental Monitoring and Bioremediation of Mining-Disturbed Areas

Integrated assessment of mining impacts was performed, including aerosol soil contamination and rehabilitation strategies for historically disturbed mining terrains.

Environmental Risks and Regulatory Challenges in Unconventional Energy Technologies

The EU regulatory framework for CO₂ storage (CCS) and the environmental challenges of shale gas extraction technologies were analyzed.

Original Scientific Contributions

1. For the first time, an original microbial fuel cell configuration was developed and experimentally validated in which the electroactive biofilm is formed by a natural consortium of sulfate-reducing bacteria immobilized on modified zeolite.
2. For the first time, the influence of the type of electron donor on the structure and functional activity of the anodic microbial consortium was demonstrated.
3. The mechanism of formation and control of elemental sulfur in the anodic zone was clarified and shown to be associated with improved long-term process stability.
4. The developed and experimentally tested integrated hybrid system “anaerobic fixed bed – microbial fuel cell” demonstrated functional strategic significance for hybrid bioelectrochemical technologies.
5. A significant contribution is the systematization of three major directions: passive biogeochemical systems based on microbial sulfate reduction; optimization of active chemical sulfate removal methods; engineering and environmental assessment of technologies and selective precipitation of metals.

I accept the presented applied scientific contributions.

Teaching Activity

Dr. Anatoliy Angelov is a lecturer in the Department of “Engineering Geoecology.” He delivers lecture courses and practical classes in bachelor’s and master’s programs for full-time and part-time students.

He is responsible for seven main courses in biotechnology and geoecology, including:

- Processes and Equipment in Geoecology
- Processes and Equipment in Biotechnology
- Water Protection and Purification
- Techniques and Technologies for Biogas Production and Application
- Industrial Wastewater Treatment
- Regulation Systems for Purification Processes
- Environmental and Technological Safety and Environmental Impact

He also supervises practical training in “Processes and Equipment in Biotechnology.”

The candidate has submitted an official certificate from the Dean’s Office of the Faculty of Geology and Prospecting confirming that during the last four academic years he has had a teaching workload meeting and exceeding the requirements for the academic position of Professor.

Critical Remarks and Recommendations

I have no critical remarks regarding the materials submitted by Assoc. Prof. Dr. Anatoliy Angelov.

Personal Impressions

I have known Assoc. Prof. Angelov personally for many years. He is a scientist with strong teaching skills and a disseminator of knowledge in the field of biotechnology.

As a public figure and contributor to science and education, Assoc. Prof. Angelov contributes to the high standard of knowledge transfer not only to students but also to the prosperity of the University of Mining and Geology “St. Ivan Rilski.”

Conclusion

The documents and materials submitted by Assoc. Prof. Dr. Angelov meet all the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its implementation, and Art. 19 (1) of the Rules for Holding Academic Positions at the University of Mining and Geology “St. Ivan Rilski.”

The achieved scientific and applied scientific contributions are of a high professional level, confirmed by the list of publications in journals indexed in Scopus and Web of Science, as well as by the citation impact of the results.

The teaching activity is demonstrated through supervised PhD students, long-term teaching work, and participation in projects.

The candidate is an established scientist in the field of biotechnology, possessing the ability to focus on current scientific problems, penetrate their essence, and present innovative ideas.

Based on everything stated above, I strongly support the candidacy of Assoc. Prof. Dr. Anatoliy Angelov and confidently recommend that the esteemed scientific jury, appointed by Rector’s Order No. RD-13-7/10.02.2026, propose to the Faculty Scientific Council of the Faculty of Geology and Prospecting at the University of Mining and Geology “St. Ivan Rilski” that he be elected to the academic position of Professor in Professional Field 4.4. “Earth Sciences,” Scientific Specialty “Systems and Devices for Environmental Protection” in the Department of Engineering Geoecology.

Sofia, 22.04.2026

Reviewer:.....

/Prof. Iskra Ivanova/