

# REVIEW

**by Prof. Dr. Aleksey Dimitrov Benderev**

*Subject: competition for the academic position of "Professor" in Professional field 4.4. Earth Sciences, scientific specialty "Systems and devices for environmental protection", at the Department of "Engineering Geoecology" at the University of Mining and Geology "St. Ivan Rilski" with candidate Assoc. Prof. Dr. Anatoly Tsankov Angelov*

This review was prepared based on a Decision taken at the 1st meeting of the Scientific Jury appointed by Order No. RD10-7 of 10.02.2026 by the Rector of the University of Mining and Geology "St. Ivan Rilski", held on March 19, 2026. It is in accordance with the requirements of the Act on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations for its implementation at the University of Mining and Geology "St. Iv. Rilski". The competition for the academic position of "Professor" in Professional Direction 4.4. "Earth Sciences", scientific specialty "Systems and Devices for Environmental Protection" at the Department of "Engineering Geoecology" was announced in the State Gazette No. 1 of 06.01.2026, and within the regular deadline, documents were received from only one candidate - Assoc. Prof. Dr. Anatoly Tsankov Angelov.

## **General description and analysis of the submitted materials**

The candidate has submitted all required documents and materials for participation in the competition, in accordance with the adopted requirements in the Regulations for the implementation of the Law for development of academic staff in the Republic of Bulgaria at the University of Mining and Geology "St. Ivan Rilski":

***Indicator A - Dissertation for the award of the educational and scientific degree "Doctor" (PhD)***

The candidate has successfully defended a dissertation for the degree of "Doctor" at the University of Mining and Geology "St. Ivan Rilski" on the topic "Purification of mine waters from manganese by rock filters" (Diploma No. 33725 of 01.06.2010). Three publications related to it have been submitted, which are not included in the general scientometric assessment.

***Required points - 50***

***Proven points by the candidate – 50***

***Indicator C - Habilitation work or scientific publications in refereed and indexed in world-renowned databases***

This indicator is supported by 6 articles published in journals, refereed and indexed in world-renowned databases (SCOPUS, WEB of SCIENCES) with an impact factor or impact rank (2 in Q1, 2 in Q2 and 2 in Q3). All articles are focused on modern methods of water purification. They are in English and are collective, with A. Angelov as the first author in 3 of them.

***Required points - 100***

***Proven points by the candidate – 120***

#### **Indicator D - Publication activity**

A total of 61 publications are presented under this indicator. Of these, 6 (85 points) are in journals, referenced and indexed in world-renowned databases (SCOPUS, WEB of SCIENCES) with an impact factor or impact rank, 1 (15 points) is a chapter of a monograph, and the remaining 53 (318 points) - in non-refereed publications, with 18 being in proceedings of prestigious scientific forums, and the remaining 35 being published in national and international journals. Considering the multidisciplinary nature of the research in which Associate Professor Angelov participates, all publications are collective, with the candidate being the first author in 11 of them. No incorrect use of other scientists research is established in the presented articles.

***Required points - 200***

***Proven points by the candidate – 419***

#### **Indicator E - Citations**

The candidate has provided evidence of 78 citations found by him, referenced and indexed in world-renowned databases of scientific information or in monographs and collective volumes of 7 of his publications. With the most citations - 29 times, is the article Angelov A., Bratkova S., Loukanov A., 2013. Microbial fuel cell based on electroactive sulfate-reducing biofilm.

***Required points – 100***

***Proven points by the candidate – 395***

#### **Indicator F – Pedagogical and project activity**

With regard to the assessed indicators of pedagogical activity, Associate Professor Angelov has presented evidence of supervision of 5 successfully defended doctoral students (175 points) and 1 university textbook – “Guide to Exercises on Industrial Wastewater Treatment” (6.7 points). The candidate has been the supervisor of 10 scientific educational projects and a participant in another 15 (380 points). His financial contribution to these projects amounts to 419,250 leva (83.8 points).

***Required points - 150***

***Proven points by the candidate – 635***

SUMMARY TABLE  
ON THE VOLUME AND TYPE OF SCIENTIFIC PRODUCTION of Assoc. Prof. Anatoly  
Angelov

Indicator group Number	Number of points of the candidate	Number of points required
A	50	50
B	—	—
C	120	100
D	419	200
E	395	100
F	635	100
<b><i>TOTAL</i></b>	<b><i>1619</i></b>	<b><i>600</i></b>

The analysis of the submitted materials and their evaluation show that, according to the accepted criteria, Associate Professor Anatoly Angelov meets the regulated requirements. According to criterion A, he has the required number of points, and according to the remaining indicators (C, D, E, F) the proven points are more than the required minimum. The total amount of points collected by the candidate is 1619, which exceeds the minimum of 600 points specified in the Regulations for the implementation of the Law for development of academic staff in the Republic of Bulgaria at the University of Mining and Geology.

### **General characteristics of scientific activity**

The candidate associate professor Anatoly Angelov received a master's degree in the specialty "Biotechnics" at the Technical University, Sofia in 1996. At the same time, he also completed a second specialty - "Engineering Ecology". In 2009, he defended the scientific and educational degree of doctor (PhD) in the specialty 02.22.05 Systems and devices for environmental protection (mining industry) at the University of Mining and Geology "St. Ivan Rilski". In 2011, Anatoly Angelov won a competition for associate professor at the Department of Engineering Geoecology at the same University, and since 2012 he has been elected its head.

As such, he actively participates in the organization and implementation of the educational process in the field of engineering geoecology. He actively participates in the development of new curricula, lecture courses and exercises for bachelors and masters. He has been the supervisor of a large number of successfully defended diplomas and 5 doctoral students. At the same time, he actively participates in the research activities of the department, having gained significant experience in scientific, applied and practical activities in the field of environmental protection in mining activities. His main scientific interests are related to water protection and purification, environmental monitoring and Application of biotechnology in ecology. Anatoly Angelov has been a licensed expert in carrying out ecological assessment and environmental impact assessment since 2008. In the period 2019-2024 he is a Member of the Standing Committee on Natural Sciences, Mathematics and Computer Sciences at the National Agency for Assessment and Accreditation. Associate Professor Angelov has proven himself not only as a successful teacher and researcher, but with his leadership positions in organizing the educational process and scientific research activities.

### **Contributions**

Associate Professor Anatoliy Angelov has submitted a precise and well-documented statement of his scientific contributions, clearly identifying the publications in which they are substantiated and organizing them into several thematic groups.

Of considerable scientific and applied significance are the candidate's studies focused on the advancement of microbial fuel cells based on dissimilatory microbial sulfate reduction. The obtained results expand current knowledge and enhance the applicability of classical cell models by increasing their electrochemical activity. In this way, a foundation is established for a new class of bioelectrochemical systems with environmental protection applications. An analysis of the factors determining the efficiency of microbial fuel cells has been conducted. The systematic evaluation of technological parameters enables a quantitative description of the processes and provides a basis for mathematical modeling and control. The results are of practical relevance for the treatment of waters containing mixed contaminants. Particularly innovative are the studies on the application of microbial fuel cells in wetlands and sedimentary ecosystems, representing a qualitatively new stage in the development of bioelectrochemical technologies.

Of direct scientific and practical relevance is the application of the developed bioelectrochemical systems to real wastewater streams from the mining industry. These studies build upon existing approaches in microbial fuel and electrolysis cells by introducing a functional separation of processes. The possibility of simultaneous removal of sulfates and heavy metals has been demonstrated. The sequence of heavy metal reduction has been elucidated, highlighting the system's potential not only for wastewater treatment but also for the selective recovery of 3

valuable metals. The stability of the treatment processes under different electrochemical regimes has been analyzed, enabling the identification of optimal operating conditions.

A number of publications are devoted to the development, optimization, and technological assessment of methods for the treatment of acid mine drainage and sulfate-containing industrial wastewaters. Various approaches have been investigated with the aim of achieving maximum efficiency, contributing to the advancement and experimental validation of passive biogeochemical systems based on microbial sulfate reduction, as well as to the optimization of active chemical methods for deep sulfate removal. These studies also address the engineering and environmental evaluation of the technologies, with particular emphasis on sludge formation, regulatory compliance, and the potential for the utilization of secondary products.

The contributions related to the optimization of the biomethanation process and the further development of biogas production technology through the integration of microbial electrolysis cells into anaerobic digestion are also of considerable interest.

Associate Professor Angelov has made significant contributions to research on treatment methods based on the interaction between photosynthesis and electrogenesis. These studies focus on the development and characterization of hybrid photo-bioelectrochemical systems, the investigation of the effect of light wavelength on the performance of microbial fuel cells, the combined application of microbial sulfate reduction and oxygenic photosynthesis in such systems, and the demonstration of a synergistic effect between photosynthesis and electrogenesis.

Scientific and applied contributions are also evident in the candidate's work on the development of carbon nanomaterials as cathodic electrocatalysts for bioelectrochemical systems. These efforts are directed toward technologies employing ultra-small nitrogen-doped carbon nanodots with high photoluminescence, as well as toward enhancing their efficiency. Optimal kinetic relationships and parameters for nitrogen removal from municipal landfill leachates have also been established.

Of notable environmental relevance are the monitoring studies and bioremediation efforts conducted at specific sites along the Topolnitsa River basin that have been impacted by mining activities. Approaches have been proposed for the separation of "clean" and "contaminated" water streams. The role of aerosol-induced soil contamination has been analyzed, and a multidisciplinary approach for the rehabilitation of historically disturbed mining areas has been developed. A synergistic effect resulting from the combined application of selected bacterial strains and humic acids has been demonstrated.

Of particular contemporary significance are the candidate's studies addressing environmental risks and regulatory challenges associated with unconventional energy technologies. The regulatory framework of Bulgaria and the European Union has been analyzed, and a classification of environmental risks related to underground CO<sub>2</sub> storage and shale gas extraction has been proposed.

The contributions identified by Associate Professor Angelov are predominantly of a scientific-applied and methodological nature. They also possess substantial environmental and social significance, as they are aimed at effectively reducing the negative impacts of mining activities, which in turn play an important role in improving the country's economic performance and the well-being of the population. Although the majority of the publications are co-authored, the leading role of Anatoliy Angelov in the conducted research, its interpretation, and the formulation of the resulting conclusions is clearly evident.

### **Critical remarks and recommendations**

There are no significant critical remarks to the work presented by Associate Professor Anatoly Angelov. The main recommendation to the candidate is to prepare a monograph on methods for treating wastewater from the mining industry.

Към представените от доцент Анатолий Ангелов няма съществени критични бележки. Като основна препоръка към кандидата е да подготви монография относно методите за пречистване на отпадъчни води от минно-добивната промишленост

### **Personal impression**

I know Anatoly Angelov mainly from professional meetings related to environmental protection, participation in EIAs and conferences. I have always been impressed by his modesty, breadth of knowledge, and his thoroughness in solving theoretical and practical problems related to environmental protection and improvement. His many years of experience as a section head has allowed him to accumulate useful and rich administrative and organizational skills. His role in the education of students and the preparation of doctoral candidates is impressive.

### **Conclusion**

From the verification of the submitted materials for the competition for Professor, announced in the State Gazette No. 1 of 06.01.2026, no violations in the procedure have been found. According to the submitted materials, the scientific and applied scientific activities of Associate Professor Anatoly Angelov exceed the recommended criteria specified in the Regulations for the implementation of the " Law for development of academic staff in the Republic of Bulgaria " at the University of Mining and Geology "St. Iv. Rilski" for occupying the academic position of "Professor". With a required minimum of 600 points, evidence for 1619 points has been submitted.

The indicated contributions have, in addition to scientific, applied scientific and methodological, also important social significance due to their environmental focus. The candidate successfully combines his scientific work with the organization of scientific research, training of personnel and popularization of the results obtained. The significant number of doctoral students who defended their dissertations under his supervision gives reason for my conviction that he has managed to create his own school in the field of Engineering Geoecology.

***In this regard, I propose that Associate Professor Dr. Anatoly Tsankov Angelov be elected as a "Professor" in Professional Field 4.4 "Earth Sciences", scientific specialty "Systems and Devices for Environmental Protection", at the Department of "Engineering Geoecology" at the University of Mining and Geology "St. Ivan Rilski".***

22 April 2026,  
Sofia

Presented:  
(Prof. Dr. Aleksey Benderev)