



REVIEW

on the application materials for the competition for the academic position of Professor, a field of higher education 4. Natural Sciences, Mathematics and Informatics, Professional direction 4.4. Earth Sciences, Scientific speciality "Ecology and Ecosystem Management", in the discipline "Solid Waste Processing Technologies", announced by the University of Forestry in Official Gazette 100//16.12.2022, procedure code ELAAsP-1222-98

Candidates for the competition are:

1. Assoc. Prof. PhD engineer chemist Ekaterina Ivanova Todorova

Reviewer: PhD engineer chemist Violina Angelova Rizova, Professor, Professional direction 4.4. Earth Sciences

1. Brief biographical details of the applicant

Ekaterina Todorova, Associate Professor, was born on 28.12.1961. She completed her higher education in 1985 at the University of Chemical Technology and Metallurgy (UCTM) – Sofia (Higher Institute of Chemical Technology). She obtained the qualification of "Eng. Chemist" with the speciality "Technology of Inorganic Substances" (Master). In 1987 she received the qualification "Patent Specialist" at the Higher Economic Institute in Sofia. In 1987 she graduated from the Faculty of Economics in Sofia. In 1995 she defended a doctoral thesis on "Distribution of impurities and ecological problems in the preparation of extraction phosphoric acid" at UCTM -Sofia.

Assoc. Prof. Ekaterina Todorova started working as a patent specialist in 1983 at UCTM -Sofia. From 1991 to 1993, she participated in research project teams at the Research sector (NIS) of UCTM -Sofia. From 1993 to 1999, she held the position of Project Manager at the NIS of the Mining and Geological University, "St. Y. Rilski." She conducted "Inorganic Chemistry" and "Electrochemistry" exercises with students.

In 1999, eng. Ekaterina Todorova, as a senior assistant professor, joined the Department of Ecology, Environmental Protection and Restoration at the Faculty of Ecology and Landscape Architecture at the University of Forestry. In 2006 she was awarded the scientific title of Associate Professor in the scientific speciality of Ecology and Ecosystem Protection (Solid Waste Treatment Technologies). During the period from 17.02.2016 to 25.02.2020, Assoc. Prof. PhD Eng. Ekaterina Ivanova Todorova is the Vice Dean of the Faculty of Ecology and Landscape Architecture, and from 26.02.2020, she is the Dean of the Faculty of Ecology and Landscape Architecture.

The professional development of the candidate is related to increasing the level of teaching work through participation in courses and training in "Methodology of Academic Teaching" (2014), and operation and maintenance of the e-learning platform Blackboard Learn TM (2013); upgrading the qualification for transport and management of chemical substances and mixtures in 2002 and 2004, and acquiring a certificate for internal auditor - Internal QMS Auditor Training Course in 2013.

Not without importance for the development of Assoc. Prof. PhD Ekaterina Todorova as a scientist and professional is, the experience gained as Coordinator of "Transport and Logistics of Hazardous Substances and Mixtures" at the Bulgarian Chamber of Chemical

Industry and at Ecotech Consult - Ltd. Assoc. Prof. Ekaterina Todorova is also a professional and experienced consultant in the field of Environmental and Technical Services, Sofia, where he works at present. The main activities related to the work in the company Ecotech Consult - Ltd. are related consulting, expert and engineering activities in the field of waste treatment, water treatment, climate change, hydrometallurgy of precious metals, work on regulatory documents in the area of chemical substances and preparations, Works as coordinator "Transport and logistics" of hazardous substances to the Bulgarian Chamber of Chemical Industry.

Leader of 12 waste projects and six climate change projects. She participated in 15 projects in the field of waste and two projects in preparing strategies, programmes and plans.

Assoc. Prof. Ekaterina Todorova has one implementation of "Technological scheme for composting of green waste in Dobrich Municipality" in 2013.

Assoc. Prof. Ekaterina Todorova is fluent in English and Russian.

2. Compliance of the submitted documents and materials of the candidate with the required ones according to the Regulations for the RAC at the LTU;

For participation in the current competition for the academic position "Professor" Assoc. Prof. PhD Eng. Ekaterina Todorova has submitted a list including 35 published works (beyond those included in the doctoral dissertation (13), and for the academic position of "Associate Professor" (30), for which information is provided in the List of publications by stages of growth), of which:

- 1 peer-reviewed monograph (B3);
- 9 articles published in scientific journals, refereed and indexed in world-known databases (G7);
- 25 articles and papers published in non-peer-reviewed journals or published in edited collective volumes (G8).

The self-assessment report on the fulfilment of the minimum national requirements according to Article 2a and Article 60, paragraph 4, item 8 of the PRAS at LTU contains information on the candidate's scientific and applied scientific activity exceeding the requirements for the mandatory academic position by groups of indicators (600), as follows:

- Indicator A (3 and 4) - 50 pts. with minimum requirements - of 50 points;
- Indicator group B - 100 points with minimum requirements - 100 points;
- Indicator group G (5 to 9) - 308,1 points with a minimum requirement of 200 points;
- Indicator group D (10 to 12) - 850 points with a minimum requirement of 100 points;
- Indicator group E (13 to 26) - 764 points with a minimum requirement of 150 points.

Assoc. Prof. PhD Eng. Ekaterina Todorova participated in the competition with 2072.1 points.

The candidate Assoc. Prof. PhD Eng. Ekaterina Todorova fully satisfies the minimum requirements for the academic position of Professor as laid down in the requirements of the Academic Staff Development Act in the Republic of Bulgaria (ASDA), the Regulations for its implementation (RASDA) and the Regulations for the Development of Academic Staff at the University of Forestry and Mechanical Engineering.

3. Evaluation of the teaching and learning activities of the candidate

Assoc. Prof. PhD Eng. Ekaterina Todorova has been a Senior Assistant Professor at the Department of Ecology, Environmental Protection and Restoration, Faculty of Ecology and Landscape Architecture, University of Forestry since 1999, with over 23 years of experience. She

teaches students with Bachelor's and Master's degrees, speciality "Ecology and Environmental Protection". Assoc. Prof. PhD Eng. Ekaterina Todorova is the holder of 5 disciplines in the Bachelor's degree - 4 compulsory disciplines ("Solid Waste Treatment Technologies", "Fluid Treatment Technologies", "Environmental Prevention", "Municipal Waste Management") and 1 elective discipline ("Environmental Management Systems").

Assoc. Prof. PhD Eng. Ekaterina Todorova holds the elective course in the MSc "Chemicals and Environmental Risk" of the MSc "Settlement Ecology". For students in the MSc in Environmental Restoration and Ecological Monitoring, he teaches the module "Waste" of the compulsory course "Abiotic Monitoring".

Assoc. Prof. PhD Eng. Ekaterina Todorova also teaches the elective "Application of Remote Sensing Methods for Monitoring of Mining Facilities" from a joint Master's programme with MGU "St. Ivan Rilski" "Remote Methods for Monitoring and Modelling in the Environment" and "Circular and Sustainable Waste Management" from a joint Master's programme with TU-Gabrovo from the specialty "Environmental Engineering".

Assoc. Prof. PhD Eng. Ekaterina Todorova also teaches at the Continuing Education Centre at the Latvian Technical University. She teaches courses on Environmental Management Systems, Chemicals and Environmental Risk and Environmental Protection in Parks and Gardens, Floriculture and Bio-waste Treatment.

Assoc. Prof. PhD Eng. Ekaterina Todorova is the supervisor of 2 successfully defended PhD students in the scientific speciality "Ecology and Ecosystem Protection" in the professional field "Earth Sciences". Both PhD students Alexandrina Georgieva Kostadinova-Slaveva and Savina Rumenova Brankova have worked in the Department of Ecology, Environmental Protection and Restoration at the Faculty of Ecology Landscape Architecture at the University of Forestry and Technology.

She has co-authored three books ("The most frequently asked questions related to the conversion of municipal waste into raw material and energy resources" (G8.10), "Methods for the treatment and recovery of municipal solid waste" (G8.2), "Technologies for the disposal of persistent organic pollutants" (G8.3). Assoc. Prof. PhD Eng. Ekaterina Todorova has also submitted two materials (information and training material and guide) that are not included in the List of scientific publications for self-evaluation for "Professor": Information and training material "Recovery of biodegradable waste through composting" and "A guide to quick and easy composting at home". The books, and training material can be used in teaching students studying "Ecology and Environmental Protection", and the guide can be used to promote composting among non-specialists.

In addition to her direct teaching work, Assoc. Prof. PhD Eng. Ekaterina Todorova is also engaged in administrative activities as Deputy Dean (2016-2020) and Dean (2020-present) of the Faculty of Ecology and Landscape Architecture.

The materials presented by Assoc. Prof. PhD Eng. Ekaterina Todorova for the teaching and pedagogical activities give grounds to conclude that they are following the accepted scientific-metric requirements for the academic position of "Professor" at the LTU.

4. Evaluation of the scientific, applied and publication activity of the candidate

4.1. Participation in scientific, applied and educational projects

Assoc. Prof. Ekaterina Todorova participated in the competition with 36 scientific research and applied projects. Among them:

- 3 international scientific and applied projects (participant)
- 33 national scientific and applied projects, of which 15 she is the leader;

Assoc. Prof. Ekaterina Todorova is also the leader of 2 scientific projects funded by

international programmes with national co-financing. The first project is an infrastructural and scientific project for constructing the Centre of Competence "Clean Technologies for Sustainable Environment - Water, Waste, Energy for Circular Economy" with the amount of funding of 723068.42 BGN. The second CirCe project is on "Orienting European Regions towards the Circular Economy".

Assoc. Prof. Ekaterina Todorova has one implementation, "Technological scheme for composting of green waste in Dobrich Municipality", in 2013.

4.2 Characteristics of published scientific results

Assoc. Prof. PhD Eng. Ekaterina Todorova participated in the competition for Professor with 35 scientific papers presented by;

- Monograph (indicator B3) - 1 pc;
- Articles and reports published in scientific journals, refereed and indexed in the world databases WEB of Science and/or Scopus) (Indicator G7) - 9 pcs,
- Articles and papers published in non-refereed peer-reviewed journals or published in edited collective volumes (Indicator G8) - 25 pcs.

Scientific papers can be classified as follows:

- 4 publications with impact factor;
- 16 publications in peer-reviewed and refereed scientific journals;
- 14 publications in conference proceedings;

According to the number of co-authors in the publications: the lead author in 8 of the scientific publications is (G7.4; G7.5; G7.6; G8.5; G8.7; G8.8; G8.12; G8.20), second author - in 15 publications (G7.2; G7.3; G7.7; G8.4; G8.6; G8.9; G8.10; G8.13; G8.15; G8.16; G8.17; G8.18; G8.19; G8.21; G8.23), third and subsequent author in 11 publications (G7.1; G7.8; G7.9; G8.1; G8.2; G8.3; G8.11; G8.14; G8.22, G8.24; G8.25).

By the language of publication: 21 were published in English and 13 in Bulgarian.

PhD Ekaterina Todorova has participated in 14 scientific forums in Bulgaria, Greece, Turkey, Chile and Serbia.

The presented monograph "Industrial Symbiosis of Biodegradable Wastes - a Key Element for their Prevention" (B3) includes studies related to finding opportunities for realization of industrial symbiosis in Bulgaria for biodegradable wastes - sludge from municipal sewage treatment plants, green biowaste and food biowaste, concerning the obligations of our country for the introduction of the circular economy.

4.3. Reflection of the candidate's scientific activity in the literature (citation rate)

The citations in the competition documents assess the candidate's recognition in the scientific community. According to the reference submitted by the candidate, citations have been noted for 24 publications, of which:

- in scientific journals refereed and indexed in world-known databases of scientific information or monographs and collective volumes (E10) - 156;
- in monographs and collective volumes with scientific peer review (E11) - 6;
- in non-refereed peer-reviewed journals (E12) – 26

It is noteworthy that the publication "New hybrid electrocoagulation membrane process for removing selenium from industrial wastewater, Desalination", authored by Mavrov, V., S. Stamenov, E. Todorova, H. Chmiel and T. Erwe, published in "The International Journal on the Science and Technology of Desalting and Water Purification", Volume 201, Issues 1-3, (2006),

290-296, ISSN: 0011-9164, Elsevier, Q1, with IF =0,636 has been cited 144 times.

All this testifies to the scientific community's interest in the papers and their results. These data lead me to conclude that the applicant is a recognizable author in the scientific community, having published in influential scientific journals in the field of the competition.

Following the minimum national requirements for the position of Professor at LTU, the citations provided are quite sufficient and prove the excellent level of reflection of the scientific production of Assoc. Prof. PhD Eng. Ekaterina Todorova in the research work of Bulgarian and foreign authors.

4.4. Contributions to the work of the candidate (scientific, scientifically applied, applied)

I accept the author's summary of scientific and applied contributions proposed by the candidate.

The main scientific and applied contributions in the works involving Assoc. Prof. PhD Eng. Ekaterina Todorova is in 3 main areas as follows:

- 1. Minimization and utilization of waste as a raw material and energy resource, including through industrial symbiosis**
- 2. Environmentally sound management of mining waste**
- 3. Environmental efficiency of waste treatment technologies**

The scientific and applied contributions in the first area based on the monograph (B3) and 18 publications (G7.1, G7.2, G7.9, G8.2, G8.3, G8.5, G8.6, G8.7, G8.8, G8.10, G8.12, G8.14, G8.17, G8.19, G8.20, G8.23 and G8. 25) related to the minimization and utilization of waste as a raw material and energy resource, and opportunities for the realization of industrial symbiosis for biodegradable waste in Bulgaria are as follows: (1) A link is made between the possibilities of minimization and utilization of waste as a raw material and energy resource in settlement systems, depending on the size, number of population and industrial sectors involved; (2) A scheme is developed for minimization and utilization of non-hazardous sludge from sewage treatment plants for municipal and fecal water and the production of compost and lubricompost; (3) Anaerobic biotechnological treatment of sludge is a prerequisite for its energy and material recovery; (4) A scheme of industrial symbiosis of hazardous sludge from municipal sewage treatment plants based on thermal methods (gasification-plasma plant, thermotribochemical catalytic plant, etc.) has been developed. (5) A scheme of industrial symbiosis is proposed between biodegradable waste-generating companies and companies from the chemical industry, electricity and poto-energy companies, agricultural products and fertilizers companies for the production of biogas, synthesis gas, synthetic oil and other substances and products by thermal treatment; (6) A scheme for the treatment and energy and material recovery of generated municipal solid waste in Sofia is proposed; (7) It is recommended to construct in each regional centre a plant for thermal disposal of waste from humanitarian and veterinary medicine; (8) The quantities of composite packaging waste by the municipality are increasing, while the quantities of hazardous waste and the content of hazardous substances in them are decreasing; (9) It has been found that when industrial wastewater is treated by electrocoagulation and microfiltration, the resulting fresh iron hydroxide sludge sorbs and leads to a reduction of Se content by 98. 7%, As by 99.9%, Cu and Pb over 98.0%, Zn and Cd over 99.9%; (10) The parameters ensuring the optimal composting regime in implementing a technological composting scheme in the Municipality of Dobrich have been determined.

The leading scientific and applied scientific contributions **in the second area** (publications G7.3, G7.4, G7.6, G7.7, G8.1, G8.4, G8.9, G8.11, G8.13, G8.15, G8.16, G8.21, G8.22)) are the following: (1) A methodological approach for the classification of mining waste and its behaviour

in the environment has been developed by applying static and kinetic leaching tests. (2) Mining wastes from the processing of copper and polymetallic ores containing gold and silver meet the regulatory requirements and do not contain toxic elements hazardous to the environment and human health (As, Cd, Co, Cr, Cu, Hg, Mo, Ni, Pb, V and Zn), and the content of weak acid decomposable cyanide at the discharge points does not exceed 10 mg/kg in mining wastes derived from cyanide recovery of gold; (3) Utilization of mine waste for backfilling of mine workings does not result in further leaching of the impurities contained therein; (4) Pretreatment of mine waste by separating the clay from it, is a prerequisite for minimizing the amount of waste and utilization of the clay as an alternative to naturally mined clay; and (5) The incorporation of mine waste in the construction of forest roads is adequate for their strengthening and results in the utilization of significant amounts of mine waste.

The main scientific and applied contributions of **the third area** (establishing the environmental effectiveness of waste treatment technologies (publications G7.5, G7.8, G8.18 and G8. 20) are as follows: (1) The methods with the highest environmental efficiency are those that utilize the energy and raw material potential of the waste; (2) The highest efficiency is the plant for the production of electricity, followed by the plants for the production of ammonia and diesel; (3) The appropriate methods for the treatment of hazardous waste have been identified, which is a prerequisite for reducing its impact on the environment and converting it into an energy and raw material resource; (4) Collecting and recycling one ton of recyclable materials is much more economical than landfilling one ton of waste; (5) A system for detailed, specific and reliable assessment of environmental performance is proposed through thirteen groups of indicators, each of which includes a different number of specific indicators for environmental protection, human health protection and sustainable development.

5. Evaluation of the personal contribution of the candidate

The assessment of the personal contribution is made based on the published monograph and the scientific publications with which Assoc. Prof. Ekaterina Todorova participated in the competition for Professor. In all 34 publications, the candidate is the lead or equal author; in 8 publications, he is the first author; in 15, he is the second author; and in 11, he is the third and following author.

To the personal contribution can be added the participation of Assoc. Eng. PhD Ekaterina Todorova in 36 scientific and applied projects related to the subject of the announced competition, of which she is the leader of 15 projects.

The candidate's contributions are personal work, entirely sufficient and relevant to the subject of the competition. They show consistency and perseverance on the part of the candidate to solve problems related to waste treatment and recovery technologies. The scientific results achieved are of high scientific and applied value.

I consider that the qualitative and quantitative indicators and criteria for holding the academic position of "professor" have been met by the national minimum requirements for the relevant field of higher education and the needs of the LTU.

6. Critical comments and recommendations

I have no critical remarks about the candidate's work.

7. Personal impressions

I have no personal impressions of the candidate's work, and my evaluation is based entirely on the materials presented.

8. Conclusion

Based on the scientific, applied and pedagogical activity analysis, I SUGGEST the candidate Ph. D. EKATERINA IVANOVA TODOROVA take the academic position of "Professor" in the discipline "Solid Waste Processing Technologies" of Professional Direction 4.4. Earth Sciences.

Reviewer's signature:

The review was submitted on: 6.4.2023.