REVIEW

In accordance of competition for the academic position of **"Associate Professor"** in the field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.4 Earth Sciences, scientific specialty 22.02.04. ***Technology for utilization and treatment of waste*** (*Utilization and treatment of waste from the production of biodiesel*) announced in State Journal, issue No. 1/01.03.2020

candidate: **Nikola Stoyanov Todorov**, PhD, Chief Assistant Professor at the Department of Ecology and Environmental Protection at University "Prof. dr. Assen Zlatarov" - Burgas

reviewer: **Svetlana Dimitrova Zheleva**, PhD, Associate Professor in Professional Field 4.2 Chemical Sciences at University "Prof. dr. Assen Zlatarov"-Burgas

1. Brief biographical data

Nikola Stoyanov Todorov is the only candidate in the announced competition for associate professor of 4.4 Earth Sciences (Technology for utilization and treatment of waste) at the University "Prof. dr. Assen Zlatarov"-Burgas, for the needs of the Department of Ecology and Environmental Protection. He was born on 25 October, 1983. He completed his secondary education at the English language high school "Geo Milev"-Burgas and in 2007 he got his Bachelor's degree in Tourism. Consecutively, in the period 2009-2011, Nikola Todorov studied two master's degrees - "International Business" and "Ecology and Environmental Protection", the latter proving to be decisive for his academic career. He has became a "Doctor" in "Chemistry of polymers" in 2015 with a dissertation on "Utilization of poly(ethylene terephthalate) waste."

Nikola Todorov started working at University "Prof. dr. Assen Zlatarov"-Burgas in 2010 as a chemist-technician in the section "X-ray structural analysis" at the Central Research Laboratory.

He was elected as an assistant on 01.06.2015 and chief assistant on 13.07.2016 in professional field 4.2 "Chemical Sciences" in department of Ecology and Environmental Protection at the Faculty of Natural Sciences in University "Prof. dr. Assen Zlatarov"-Burgas. His experience as a lecturer, until the submission of the documents is 4 years and 9 months.

Chief Assistant Nikola Todorov, PhD is fluent in English and very good in German and Russian language. He has excellent computer skills and has knowledge of specialized graphic softwares.

2. General review of the submitted materials

Total number of scientific papers of Chief Assistant Professor Nikola Todorov, PhD, published from 2010 to 2020, is 1 scientific monograph and 26 publications. Scientific publications are distributed as follows:

– 3 in referenced editions, indexed in Scopus or Web of Science;

Journal of Chemical Technology and Metallurgy (IF = 0.48; SJR = 0.189; Q3) – [1]

Bulgarian Chemical Communications (IF = 0.29; SJR = 0.137, Q4) – [2]

Food and Agricultural Immunology (IF = 2,568, SJR = 0,55, Q2) – [3]

– 5 in foreign peer-reviewed journals;

International Journal of Scientific Research – [4,8]

Indian Journal of Applied Research – [5]

International Journal of Applied Research – [6,7]

- 18 in Bulgarian peer-reviewed journals;

Annual of Asen Zlatarov University – [15-19]

Conference proceedings – [9-14, 20-26]

The presented monograph is on the topic "Utilization of the glycerol phase obtained in the production of biodiesel from rapeseed oil", published by Libra Scorp, Burgas in 2020 (ISBN 978-954-471-608-0). It is the first independent monographic work of Chief Assistant Professor Nikola Todorov, PhD, has a volume of 168 pages and meets the requirements for a monograph.

The documentation submitted for participation in the competition for the academic position of "Associate Professor" by the only candidate Chief Assistant Professor Nikola Todorov, PhD is complete and meets the regulatory requirements and criteria of conditions and procedure for holding the academic position of "Associate Professor" at the University "Prof. Dr. Asen Zlatarov "- Burgas.

The implementation of the minimum national requirements and the minimum requirements under the regulation at the University "Prof. Dr. Asen Zlatarov "- Burgas for the academic position "Associate Professor" by groups of indicators for field 4. Natural sciences, mathematics and informatics, professional field 4.4 Earth sciences are as follows:

Indicator group	Minimum national requirements	Minimum requirements under the regulation at the University "Prof. Dr. Asen Zlatarov "-Burgas	**Points of the candidate**
A	50	50	**50**
B	–	–	**–**
C	100	100	**100**
D	200	300	**337,9**
E	50	100	**100**
F	–	100	**100**
Total	400	650	**687,9**

Group of indicators A – defended dissertation on "Utilization of waste poly(ethylene terephthalate)", University "Prof. Dr. Asen Zlatarov "-Burgas, 2015, professional field 4.2 Chemical Sciences, scientific specialty "Chemistry and Physics of Macromolecular Compounds", code 01.05.06, under the supervision of Assoc. Prof. Dr. Martin Radenkov and Assoc. Dr. Donka Todorova. (*50 points*)

Group of indicators C – C3 Habilitation work - monograph on "Utilization of the glycerol phase obtained in the production of biodiesel from rapeseed oil", published by Libra Scorp, Burgas in 2020 (ISBN 978-954-471- 608-0). (*100 points*)

Group of indicators D – D7 Scientific publications in journals that are referenced and indexed in Scopus and Web of Science. Three articles are presented, one with a protocol for 90% contribution of the candidate in the competition. (*86 points*)

D8 Scientific publications in non-peer-reviewed journals with scientific review or in edited collective volumes. In Annex 18.2, in the list of indicators G8 are indicated 24 publications. №20 is not included in the list of scientific publications with which the candidate participates in the competition. I accept for review 23 publications, 5 with a protocol for 90% and 1 for 95% contribution of the candidate in the competition. (*251.9 points*)

Group of indicators E – E10 Citation or review in scientific journals, referenced and indexed in Scopus and Web of Science. In the presented reference are indicated 7 citations of the candidate's publications. (*35 points*)

According to indicator E11 Cited in monographs and collective volumes with scientific review, the candidate has noticed 3 citations of his publications (*9 points*), and according to indicator E12 Citation or reviews in unreferred journals with scientific review – 28 citations. (*56 points*)

Group of indicators F (required by PURPNSZAD at the University "Prof. Dr. Assen Zlatarov" -Burgas) - F15 Participation in a national scientific or educational project, Chief Assistant Professor Nikola Todorov, PhD presented proof for participation in two national research projects: 1) to the Research Fund on "Preparation and processing of ceramic fractal compositions and their application as filtering and separating systems" and 2) to the MES National Research Program "Young scientists and postdoctoral students ". (20 points)

F16 Participation in an international scientific or educational project - Digital training platform in the field of circular economy to stimulate innovative green entrepreneurs. (20 points)

From the Appendix 13 presented in the documents it can be seen that the applicant has participated in six intra-university projects, to two of which he was the leader. Also, there is a contract with a business organization (company "Decor Design" Ltd., Burgas) on "Preparation of models, production, processing and analysis of polymers and polymer compositions and waste recycling".

F20 Published university textbook or textbook used in the school network. There are 2 textbooks - "Protected Areas" and "Environmental Monitoring - Practical Guidelines", one of which is co-authored. (*60 points*)

The materials submitted to me for review by the candidate Chief Assistant Professor Nikola Todorov, PhD in the competition for the academic position of "Associate Professor" in the professional field 4.4 Earth sciences are prepared in accordance with regulatory requirements. The requirement for minimum number of points for each group of indicators according to the national requirements and requirements under the regulation at the University "Prof. Dr. Asen Zlatarov "- Burgas has been fulfilled.

3. Evaluation of teaching employment

The total teaching experience of Chief Assistant Professor Nikola Todorov, PhD at the time of submission of documents for the competition is 4 years and 9 months. For the last three years his total study employment is 1311 hours, of which 457 hours are lectures. His main teaching activity is realized in the Bachelor's degree for students majoring in "Ecology and Environmental Protection", "Ecology and Environmental Management" and "Chemistry" and in the Master's degree of environmental specialties. The candidate conducts lectures in disciplines "Environmental Monitoring", "Environmental Legislation", "Air Pollution" and "Protected Areas".

It is evident from Appendix 10 that Chief Assistant Professor Nikola Todorov, PhD has participated in the training of foreign students - he has led exercises in "Environmental Monitoring" to four students in the Master's degree and in Geoecology to one student in the Bachelor's degree from Kazakhstan. In the period December 2016 - October 2017, he participated as an expert in the project "Engage" under the Erasmus + program.

4. Research activity

The overall research activity of Chief Assistant Professor Nikola Todorov, PhD is summarized in three scientific areas:

I. Utilization and treatment of waste from biodiesel production.

II. Environmental monitoring.

III. Investigation of the structure of some organic compounds or polymers by instrumental methods of analysis.

The majority of the scientific production of the candidate submitted for review is into the first scientific field, which is the topic of the competition (Technology for utilization and treatment of waste). Outside the review, I leave a publication [14], of which I am a co-author and publication [17], which is related to the candidate's academic work.

Scientific and scientific-applied contributions in direction I. Utilization and treatment of waste from the production of biodiesel.

- Monograph

The main contributions of the monograph are:

• It has been found that the glycerol phase obtained as a by-product of the production of rapeseed oil biodiesel can be used as a feedstock for the production of alkyd resins, but these resins can dry at temperatures ≥ 130°C and can only be used as primers in which there are no special requirements for the color and the complex of physico-chemical properties.

• An opportunity has been found to improve the properties of alkyd resins by modification with maleic anhydride. The modification improves the drying properties of the alkyd resins and thus expands the scope of application of the glycerol phase for the production of air-drying paints and varnishes.

• for the first time alkyds were obtained by simultaneous utilization of two waste products – poly(ethylene terephthalate) (PET) from bottles for soft drinks and glycerol phase, obtained as a by-product in the production of biodiesel from rapeseed oil. PET-modified alkyd resins show improved drying properties, increased hardness and improved chemical resistance.

• It has been found that alkyd resins can be successfully obtained under microwave irradiation conditions, thus reducing time and energy costs.

- Scientific publications [1,2,4-13,15,16]

The main contributions to the presented scientific results on the use of crude glycerol as a depolymerizing reagent for PET can be summarized as follows:

• It has been found that PET can be chemically recycled by depolymerization with crude glycerol, which is obtained as a by-product in the production of biodiesel without the presence of a catalyst [11];

• precursor monomers, dimers and oligomers have been obtained, which have been proven by the method of material balance, the method of UV spectroscopy [12] and non-isothermal decomposition [14];

• the conditions for depolymerization have been optimized [12], and a technology for achieving a high degree of depolymerization has been proposed [9];

In part of his scientific production, Chief Assistant Professor Nikola Todorov, PhD investigates the possibility of applying the depolymerization product of PET in the production of unsaturated polyester resins, alkyd resins and polymer concrete. The main contributions that can be summarized in the recovery of PET depolymerization products are:

• by modification with propylene glycol is achieved improvement of compatibility with styrene of unsaturated polyester resins and physical and mechanical properties of hardened products;

• by replacing part of the styrene with methyl methacrylate, an unsaturated polyester resin with low styrene emission is obtained. The residual styrene content is reduced by more than 20 times and the appearance of the hardened products is improved.

• it has been shown that unsaturated polyester resin based on waste PET and crude glycerol can be used as a binder in the production of polymer concrete, which, however, has a lower compressive strength;

• films obtained from alkyd resins based on products of depolymerization of PET, phthalic anhydride and sunflower oil or a mixture of sunflower oil and linseed oil have increased hardness compared to the films of reference alkyd resins, while drying, adhesion and chemical resistance do not change.

The utilization of all organic compounds in the glycerol phase is a complex task, as its composition is complex (multicomponent) and unspecified (amounts vary widely). It depends on the raw feedstock for biodiesel production (sunflower oil, rapeseed oil, soybean oil) and also on the production process. The main contributions that can be summarized in the recovery of all organic compounds in the glycerol phase are:

• all organic substances of the glycerol phase are used for preparation of monoglycerides, depolymerization of PET and preparation of surface coatings;

• the products of depolymerization of PET with monoglycerides were studied and obtaining of precursor dimers was proved;

• by esterification of phthalic anhydride and with the product from the solvolysis of PET with monoglycerides, alkyd resins are obtained, films on their basis exceed reference ones in terms of degree of drying and hardness.

5. Critical remarks and recommendations

I recommend to the Chief Assistant Professor Nikola Todorov, PhD in the future to focus his efforts on publishing the results of his research work in publications that are referenced and indexed in databases as Scopus and Web of Science. From the presented data and the reference made by me in Scopus and Web of Science it can be seen that the scientific publications of the candidate have a weak response in the scientific community - 7 citation of three publications and h-index 2. Considering the recommendation, undoubtedly Chief Assistant Professor Nikola Todorov, PhD will be recognizable as a scientist after a period.

6. Conclusion

I know Chief Assistant Professor Nikola Todorov, PhD very well and I am sympathetic to his growth as a colleague. During his work as a chemist in the Central Research Laboratory, his doctoral studies and then as a lecturer and researcher in the Department of Ecology and Environmental Protection, he acquired and developed the qualities of an ambitious and consistent young scientist. Setting scientific problems and finding solutions to various research challenges in the field of utilization and treatment of waste from biodiesel production gave him the opportunity to shape his scientific profile as a researcher with specific contributions of emphasized scientific, scientific-applied, environmental and economic nature.

The outlined profile of the candidate for "Associate Professor" meets the regulatory requirements and criteria of the regulation at the University "Prof. Dr. Asen Zlatarov "-Burgas. In this regard, and on the basis of all the above, I would like to conclude that I will support the candidacy of Chief Assistant Professor Nikola Todorov, PhD and I recommend to the respected members of the Scientific Jury to vote positively for his election to the academic position of "Associate Professor" in the professional field 4.4 Earth Sciences, scientific specialty "Technology for waste recovery and treatment.

May 7, 2020

Burgas

Reviewer:

Assoc. Prof. Svetlana Zheleva, PhD