OPINION

by Assoc. Prof. Rumyana Yankova, PhD, Department of Physiology, Pathophysiology, Chemistry and Biochemistry, Medical Faculty, University "Prof. Dr. Assen Zlatarov" - Burgas

For awarding the educational and scientific degree "Doctor" in the area of higher education 4. Natural Sciences, Mathematics and Informatics, Professional sub-area 4.2 Chemical Sciences, the doctoral program: Ecology and environmental protection. The title of PhD dissertation is „Thermodynamic study of temperature versus concentrations of some ambient air pollutants and the global ecosystem", author Mihai Petrov, Faculty of Natural Sciences, University "Prof. Dr. Assen Zlatarov" - Burgas.

By order No UD-271/23.07.2024 from the Rector of University "Prof. Dr. Assen Zlatarov" - Burgas I'm appointed as a member of the scientific jury. At its first meeting I was chosen to write an opinion. I have received all materials for the competition in electronic form.

1. Brief biographical data

Mihai Petrov was born in 1972. In 1995 he graduated from the State University of Moldova, Master's degree in Physics, and in 2009 graduated from the Nicolae Testemitanu state university of medicine and pharmacy of the Republic of Moldova, Master's degree in Pharmacy. In Moldova he worked as a laboratory assistant, computer service engineer, lecturer-assistant, lecturer in informatics. Since 2021 till now he has been an assistant at the Department of Mathematics, Informatics and Physics, Faculty of Natural Sciences and at the Department of Physics, Biophysics, Radiology and Radiology, Faculty of Medicine, University "Prof. Dr. Assen Zlatarov".

2. Presented materials

I have received a complete set of documents required by the Law for the development of the academic staff in the Republic of Bulgaria (LDASRB) and RALDASRB (Rules on the application of LDASRB), and according to the rules of University "Prof. Dr. Assen Zlatarov":

- ✓ the thesis;
- ✓ thesis abstract (53 pages);
- ✓ curriculum vitae of the applicant;

- ✓ list of applicant's scientific publications;
- ✓ a reference for the original scientific contributions of the thesis.

3. General description of the presented materials

According to the data in the submitted materials and the reference with data from world databases (Web of Science (WOS), Scopus), the PhD student's points (86) exceed the required number of points according to the minimum national requirements for PhD studies in the field of higher education 4.2 Chemical sciences: total number of points - 80, including 50 points from the dissertation for the degree of Doctor of Science (group A) and 30 points from the scientific publications (group G).

According to the received documents, the list of publications (WOS, Scopus) with which Mihai Petrov participated for the PhD degree is 3 in quartile Q4, i.e. the number of points in indicator group G is 36. In one of these publications the PhD student is an independent author, in the other two he is the first author.

The presented abstract objectively reflects the structure and content of the thesis.

4. Dissertation thesis

The main goal of this dissertation is to study of atmospheric temperature in relation to concentrations of certain air pollutants.

The dissertation has a total length of 164 pages and contains 28 tables and 97 figures. The bibliography consists of 333 references. The dissertation includes the following main paragraphs:

- ***Introduction***, stating the relevance and importance of the scientific problem (pp. 4,5).

- ***An overview of the state of research on the problem:*** the greenhouse effect and pollutants, the role of the anthropogenic factor, changing the Earth's albedo (pp. 6-47).

- ***Aim and tasks of the dissertation***: the aim of the research and the tasks to be solved for its achievement are clearly formulated

- ***Scientific research methodology*** (pp. 49-61): a) Empirical adiabatic method for determining the variation of atmospheric temperature with pollutant concentrations; b) Empirical calorimetric method for determining the variation of atmospheric temperature with carbon dioxide and oxygen concentrations; c) A method for determining the correlation between albedo values, density, specific heat

capacity, and temperature of biosphere and atmosphere components; d) A method for determining the ignition temperature of forest fuel material components as a function of greenhouse gas concentrations.

- ***Results obtained and discussion*** (pp. 62-144):

Investigating changes in atmospheric temperature as a function of greenhouse gas concentrations (pp. 62-130)

The adiabatic constant of air has been determined and a quantitative expression for the temperature change as a function of greenhouse gas concentrations has been developed. A thermodynamic study of temperature as a function of concentrations of some air pollutants and of the global ecosystem was performed. The relationship between albedo values, density, specific heat capacity and temperature of biosphere and atmosphere components is investigated. The time and temperature of ignition of forest fuels as a function of greenhouse gas concentrations is investigated.

Analysis of the complex unified system Biosphere-Technosphere-Humanity (pp. 131-144):

The entropy description of the complex system Biosphere-Technosphere-Humanity (Noosphere) is investigated. Changes in the Biosphere lead to corresponding changes in the Noosphere and Technosphere. Using an entropic conceptual approach of this unified system, the energy metabolic costs of humans per day are also calculated.

- ***Main scientific and applied contributions*** (pp. 145, 146)

In the scientific work of Mihai Petrov, the following fundamental contributions have been delineated:

1) An adiabatic method has been devised that enables the comparison of actual measured values regarding temperature changes, which are of the same order as those calculated using this technique

2) A calorimetric method has been developed that facilitates the explanation of natural phenomena, such as the intensification of natural cataclysms due to abrupt fluctuations in atmospheric temperature, which result from alterations in the specific heat capacities of the atmosphere, influenced by pollutants.

3) The examination of the Albedo values within the unified Earth-Atmosphere system elucidates the alterations in the physicochemical properties of the biosphere components, which play a crucial role in shaping the microclimate of the respective ecosystem. For instance, the increase in Albedo values in soils leads to their densification. Concurrently, a reduction in their specific heat capacity is observed.

4) The increased frequency of spontaneous natural fires is exacerbated by the presence of flammable pollutants – gases and particles in the atmosphere. The

developed empirical expression for flame temperature, based on the laws of thermodynamics, emphasizes the following aspect: when there are no flammable gases, the flame temperature reaches the minimum possible values, allowing for fire containment.

5 Critical remarks and recommendations:

- The critical remark concerns the formatting of the dissertation: presentation of figures and tables, spelling and grammatical errors.

- Since Mihai Petrov's research has high scientific value, I recommend publishing his future results in journals of international scientific publishers with a high impact factor.

CONCLUSION

I consider that the dissertation and the abstract submitted to me for review meet the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria and its implementing regulations, and I recommend the scientific jury to award Mihai Petrov the degree of "Doctor" in the field of higher education 4. Natural Sciences, Mathematics and Informatics, professional direction 4.2. Chemical Sciences, PhD program "Ecology and environmental protection".

30.08.2024

Reviewer: Подпис заличен чл.2 от ЗЗЛД

Assoc. Prof. Rumyana Yankova, PhD