# OPINION

regarding a PhD thesis for the acquisition of the educational and scientific degree "doctor"" in 4. Natural sciences, mathematics and informatics, 4.3. Biological Sciences (PhD program "Microbiology")

**Author of the dissertation:** Assistant Professor Nikolina Atanasova Atanasova
**Title of the PhD thesis:** "Degradation of plastics by thermophilic and halophilic bacteria isolated from Bulgarian extreme niches"
**Reviewer:** Acad. Prof. Atanas Ivanov Pavlov, DSci

The materials presented to me for review are a complete set of the necessary documents, according to the Regulations of the IMikB-BAS and the Law on the Development of the Academic Staff in the Republic of Bulgaria.

**1. Relevance of research in the PhD thesis problem**

Plastics are at the heart of the accumulation of environmentally polluting waste. This, in turn, is one of the main reasons for the deterioration of the environment and climate change, the depletion of natural resources, the reduction of biodiversity, as well as the increase of carcinogenic diseases in humans. A number of studies on their recycling have focused on microorganisms. It seems that extremophiles will play a major role in the future in the bioremediation of contaminated extreme habitats, as well as in the development of composting processes and thus be part of the solutions to the problem of plastic pollution. It is in this context that the research presented in this PhD thesis is presented, and therefore it is relevant and timely.

The PhD thesis is structured according to the classical model adopted in Bulgaria, on 180 pages and including 38 figures, 23 tables and 187 cited literary sources. The structure of the dissertation is balanced, with the individual sections providing an opportunity for an in-depth presentation of what has been achieved in the world so far and for interpreting the results obtained in fulfillment of the formulated goal.

**2. Degree of knowledge of the state of the problem and of the literary material**

The level of absorbed experiences of the PhD student is evident even after reading the Introduction. It categorically convinces the reader of the timeliness and relevance of the subsequently presented research.

The literature review is logically structured and has a sufficient volume. Assistant Professort Atanasova discussed the issue at a good scientific level. The presented text shows the competence of Assistant Professor Atanasova in the specific field of science. The rich information presented in the literature review is summarized graphically and analytically in a sufficient number of figures, tables and diagrams, which is a clear indicator of the depth of knowledge of the problem. In my humble opinion, the literature review is a value analysis of the published materials on the topic at the moment. The analyzed literature is correctly cited, with a large part of it published in the last 5 to 8 years. This is definitely indicative of the thorough work of the PhD student in this regard.

**3. Correspondence of the chosen research methodology with the set goal and tasks of the dissertation work**

Assistant Professor Atanasova's methodical experience level is good. She has absorb a variety of classical and modern microbiological and analytical methods, which allows her to perform the assigned tasks at a high scientific level. The experimental approaches, analytical and statistical methods used are described with the necessary details, which is indicative of the level of their knowledge.

**4. Characterization and evaluation of the credibility of the material**

The presented protocols of the plagiarism check clearly indicate the originality of the experimental work and the description of the results obtained as a result of its implementation.

**5. Results, discussion and contributions of the PhD thesis**

In the results and discussion section, the PhD student describes and discusses her research on the degradation of plastics by thermophilic and halophilic microorganisms, as well as the characterization of a lipase isolated from *Brevibacillus thermoruber* strain 7, which is the first reported thermostable enzyme capable of degrading polycaprolactone. Based on the analysis of the state of the extreme niches and more specifically the degree of degradation of their pollutants, it was decided to focus the research on the degradation of polypropylene, polystyrene, polycaprolactone and polyvinyl alcohol. The experimental matrix is structured logically so as to allow a holistic analysis of the problem. Logically, the work begins with an analysis of the potential of the strains available in the laboratory collection and flows into studies of natural microbial communities as potential sources of extremophilic microorganisms with the requested properties. The presented text, visualized with a sufficient

number of tables and figures, represents a complete scientific monograph. This part of the dissertation is one of the valuable texts I have read in the last year.

The formulated conclusions are no less categorical. They are clear, precise and well written.

The contributions of the dissertation work can be considered novel to science and applied.

**6. Evaluation of publications on the PhD thesis**

Assistant Professor Atanasova declared 4 published materials in good scientific journals - 1 from the first quartile, 2 from the second and 1 from the fourth quartile. The first citations of the publications are also presented (31 items, of which 30 are from one of the publications!).

**7. Fulfillment of formal requirements**

1. Minimum national requirements:

- Group of indicators "A" 50 points out of the required 50 points;

- Group of indicators "D" 77 points out of the required 30 points.

2. Additional requirements of IMikB-BAS:

- 4 publications in refereed journals with 2 required.

**8. Conclusion**

The reviewed PhD thesis meets the quality and volume requirements for a PhD thesis for the educational and scientific degree "Doctor". The minimal national as well as the requirements of IMikB-BAS for ONS "Doctor" are covered. The main results have been published in good international journals. A large number of citations to publications related to the dissertation were also found.

Based on the analysis made above, with conviction I give a positive assessment of the developed PhD thesis and consider it reasonable to suggest that Assistant Professor Atanasova acquire the educational and scientific degree "Doctor" in scientific field 4. Natural sciences, mathematics and informatics, professional direction 4.3. Biological Sciences in the PhD program "Microbiology".

Date: May 2023 Reviewer:

/Acad. Atanas Pavlov/