

## OPINION

by Dr. Penka Angelova Moncheva, Professor at Sofia University "St. Kliment Ohridski", Faculty of Biology

on a Dissertation for the award of the Educational and scientific degree "doctor"

in: Field of higher education 4. Natural Sciences, Mathematics and Informatics, Professional field 4.3. Biological Sciences, doctoral program Biochemistry

Author: Teodora Mincheva Panayotova

Topic: "Study of the properties of biologically active peptides obtained by enzymatic hydrolysis with proteolytic enzymes from lactic acid bacteria"

Scientific supervisor: Prof. Dr. Iliya Nikolov Iliev

### 1. General presentation of the procedure and the doctoral student

By order № PD-22-742 of 07.04. 2026 by the Rector of Plovdiv University (PU) "Paisii Hilendarski" I have been appointed as a member of the scientific jury for ensuring a procedure for the defense of a dissertation on the topic "Investigation of the properties of biologically active peptides obtained by enzymatic hydrolysis with proteolytic enzymes from lactic acid bacteria" for the acquisition of the Educational and scientific degree (ESD) "doctor" in: Field of higher education 4. Natural sciences, mathematics and informatics, Professional field 4.3. Biological sciences, doctoral program Biochemistry. The author of the dissertation is Teodora Mincheva Panayotova - a doctoral student in part-time study at the Department of "Biochemistry and Microbiology", with scientific supervisor Prof. Dr. Iliya Nikolov Iliev from PU "Paisii Hilendarski".

The set of materials on paper and electronic media presented by Teodora Panayotova is in accordance with Art. 36. (1) of the Regulations for the Development of the Academic Staff of the University of Plovdiv and includes the following documents:

- Application to the rector of the PU for the opening of a procedure for the defense of a dissertation;
- Curriculum vitae in European format;
- Minutes of the department council, related to reporting the readiness to open a procedure and to a preliminary discussion of the dissertation;
- Dissertation, including a list of publications and participation in scientific forums related to the dissertation;
- Abstract (in Bulgarian and English);
- Copies of scientific publications on the topic of the dissertation;
- Declaration of originality and authenticity of the attached documents;
- Certificate of fulfillment of the minimum national requirements for acquiring the ESD "doctor" in the field of higher education 4. 4. Natural sciences, mathematics and informatics, professional field 4.3. Biological sciences.

The general review of the documents, the abstract and the dissertation, as well as the three attached scientific publications in scientific journals, referenced and indexed in world-renowned databases with scientific information, shows that the doctoral candidate fulfills the minimum national requirements for acquiring the ESD "doctor". The submitted documents are prepared and formatted very well and with the necessary completeness, which allows for an objective assessment of the dissertation work.

Teodora Panayotova completed her higher education at the University of Food Technology - Plovdiv, successively acquiring a bachelor's degree in "Meat and Milk Technology" and a master's degree in "Control and Safety of Foods of Animal Origin", which are directly related to the field of her activity as a researcher at "LB Bulgaricum" and the doctoral studies.

### 2. Relevance of the topic

In the modern world, characterized by a high degree of stress of various nature, increasing importance is attached to the understanding and aspiration, especially among younger people, that food should be a source of dietary and biologically active substances, including bioactive peptides. This is largely due to the growing awareness and culture of consumers regarding the importance of nutrition on their health. Bioactive peptides obtained from protein-rich foods have the potential to produce functional foods and food supplements that have positive health effects on humans, being considered a new generation of biologically active regulators of homeostasis. In recent years, there has been increased interest in the development of foods and beverages based on plant proteins as an alternative to those of animal origin, which is of great importance for meeting the needs of groups of society with various health problems, as well as those with a preference for foods of

plant origin. That is why I believe that the topic of Teodora Panayotova's dissertation is part of a contemporary and topical problem, which is confirmed by the set goal, namely the conduct of research related to the production of biologically active peptides with ACE-inhibitory activity when cultivating lactic acid bacteria in nutrient media with plant proteins.

### **3. Knowledge of the problem**

In the chapter "Literature review" the doctoral student has reviewed what is known in the scientific literature on the following issues: a brief characterization of lactic acid bacteria; the proteolytic systems of the lactic acid bacteria, including their proteinases, peptide transporters, peptidases, bioactive peptides and their sources (of plant origin, from milk and dairy products), the methods for obtaining bioactive peptides and physiological properties of bioactive peptides. The literature review is targeted and shows a very good theoretical preparation of the doctoral student and knowledge of the scientific problem developed in the dissertation, which is confirmed by the significant number of cited literary sources.

### **4. Research methodology**

I believe that the applied methods were appropriately selected and allowed the implementation of the experimental tasks set, so that the goal of the dissertation was achieved. Microbiological, cultivation and analytical-biochemical methods were used (determination of: degree of proteolysis, proteolytic activity, protein, aminopeptidase activity, ACE inhibitory activity, SDS-PAGE, ultra-high performance liquid chromatography with mass spectrometry).

### **5. Characteristics and assessment of the dissertation work and contributions**

The dissertation work is structured according to the generally accepted model for this type of work and contains all the necessary sections, namely - Introduction, Literature review, Aim and objectives, Materials and methods, Results and discussion, Conclusions, Contributions, List of cited literature. Additionally to the dissertation work have been added - Publications and participation of the doctoral student in scientific forums related to the dissertation work, annexes to the "Literature review" section, Declaration of originality of the results and contributions of the dissertation work. I believe that the volumes of the individual sections are in an optimal ratio to each other. The content of each section is presented clearly and in detail enough, without unnecessary deviations and allows the reader to get a clear information about the essence of the experimental work, the results obtained and their discussion, on the basis of which the conclusions and contributions are defined. The literature review is based on a study and discussion of a significant number of literary sources (324), the majority of which were published after 2000, and about 66% - in the last 10 years, which shows a thorough knowledge of the current state of the problem. The goal of the dissertation is clearly defined, as well as the tasks for its implementation. The materials and methods used in the experimental work are described in sufficient detail. The section "Results and Discussion" is very well illustrated, the presented results of the experimental work performed, as well as their discussion show that the tasks set have been fulfilled. The results of the experimental work are statistically processed, which proves their significance and reliability and allows for the drawing of categorical conclusions and contributions. The seven conclusions defined by the dissertation candidate logically follow from the results obtained. Four contributions of the dissertation work are outlined, among which I would like to note:

- The demonstration of bioactive peptides with ACE inhibitory activity from several strains of lactobacilli when cultivating nutrient media containing pea and soy protein, which reveals the potential of these strains for application;
- The formulation of new plant nutrient media suitable for cultivating selected strains of lactobacilli, as well as the formulation of combined nutrient media containing milk and plant proteins suitable for cultivating selected strains of lactobacilli for obtaining biologically active peptides. The contribution has an original, methodological and applied nature, as it is of fundamental importance for the successful cultivation of the selected strains with a view to future applied developments.

### **6. Assessment of the publications and personal contribution of the doctoral student**

The doctoral student has presented three scientific articles, thematically directly related to her dissertation work, as they present part of the results obtained by her and three participations in scientific forums. Two of the articles were published in *Acta Microbiologica Bulgarica* (Q4) and one in *Bulgarian Chemical Communications* (Q4), of which Teodora Panayotova is the lead author, which confirms her main role in the experimental work, as well as the fact that the presented dissertation work is her personal work.

## 7. Abstract

The abstract is well-structured, prepared according to the requirements and faithfully reflects the main results of the experimental work of the dissertation work.

## 8. Recommendations for future use of the dissertation contributions and results

I recommend that Teodora Panayotova continue her research with a view to realizing the application of the best strains of the studied lactic acid bacteria, as well as greater confidence in the significance of the obtained results for publication in higher-ranking journals.

## 9. Questions

I have the following question:

1. Are continued studies planned with the strains that have shown the ability to synthesize bioactive peptides with ACE inhibitory activity, and in what direction will they be?

## CONCLUSION

The dissertation presents results with an **original contribution** - scientific, scientifically applied and methodological, in the relevant areas of science. The dissertation **fully meets the requirements** of the Act on the Development of Academic Staff in the Republic of Bulgaria, the Regulations for its implementation and the Regulations of Plovdiv University "Paisiy Hilendarski" for the relevance of the topic, the volume and quality of the scientific research conducted. The dissertation shows that during the doctoral studies Teodora Panayotova has acquired in-depth theoretical knowledge and methodological skills in the scientific specialty of Biochemistry, as well as Microbiology, which she has successfully applied to carry out a significant amount of experimental work. She has acquired the ability to independently conduct scientific experiments, analyze and summarize the results obtained, discuss them in the context of what is known so far in the scientific literature on the specific scientific problem and outline the main conclusions from a scientific work. I believe that during the doctoral studies she has acquired new knowledge that fully corresponds to the ESD "doctor" and increases her qualification as a scientist-researcher.

In view of the above, I confidently give my **positive** assessment of the conducted research, presented through the dissertation, abstract, achieved results, conclusions and contributions, as well as through scientific publications and I propose to the esteemed scientific jury **to award** the Educational and scientific degree "doctor" to Teodora Mincheva Panayotova in the field of higher education 4. Natural Sciences, Mathematics and Informatics, Professional field: 4.3. Biological Sciences, doctoral program Biochemistry.

14.05. 2026

Prepared the opinion:

(Prof. Dr. Penka Moncheva)