

STATEMENT

From Prof. Dr. **Albert Ivanov Krastanov**, UFT - Plovdiv

Regarding the dissertation work "FUNCTIONAL AND TECHNOLOGICAL CHARACTERISTICS OF NEWLY ISOLATED STRAINS OF LACTIC ACID BACTERIA FROM TRADITIONAL FOODS", presented by **RAMIZE HODZHA** for the award of the educational and scientific degree of "**DOCTOR**" in scientific field 5. Technical Sciences, professional direction 5.11. Biotechnologies, scientific specialty 02.11.11 "Technology of biologically active substances".

The presented dissertation focuses on a current and intriguing issue concerning one of the tasks of the food industry - the production of functional foods that have a pleasant taste and health benefits for consumers. The dissertation sheds light on a part of the problem through the development of a modern and rational method for obtaining products with functional properties, as well as defining their properties and biological activity.

The chosen dissertation topic represents interest from both a scientific and applied standpoint for obtaining and establishing the relationship between composition, structure, and biological activity in the studied objects, as well as for creating diverse healthy and functional foods. The title succinctly reflects the purpose and essence of the conducted research. The exposition clearly outlines the relevance and necessity of this study in light of the modern concept of healthy and functional food products.

The developed problem is current, but its execution is complex and requires comprehensive knowledge in several areas of analytical chemistry, microbiology, genetics, and food technologies. The doctoral student skillfully combines their knowledge in these areas in solving the problems related to the development of the dissertation work.

The dissertation is well-structured methodically, executed precisely at a high level using various methods, and with well-processed and accurately presented results. The execution is characterized by clear and terminologically accurate language.

Some of the key observations in the dissertation include:

1. Isolation of new microbial strains from various sources, including *Lactiplantibacillus plantarum*, *Lactobacillus delbrueckii* ssp. *bulgaricus*, *Loigolactobacillus coryniformis*, *Latilactobacillus sakei*, and *Pediococcus pentosaceus*.

2. Antimicrobial activity against various bacteria and yeasts, as well as antiviral activity against HHV.

3. Well-expressed activity of aminopeptidase enzymes, which may be of significant importance for various applications.

4. Presence of antibiotic multidrug resistance, but also absence of some of the main genetic markers for antibiotic resistance transfer.

5. Auto- and co-aggregation abilities, as well as adhesive properties, which are important for microbe-host interactions.

6. Probiotic potential and survivability under different conditions.

7. Bioprotective effect against certain pathogens, such as *E. coli*.

These observations are important for understanding the potential application of isolated microbial strains in the food industry or for creating new probiotic products. The study of newly isolated microbial strains from traditionally fermented foods has a significant scientific and applied contribution, as it reveals potential opportunities for developing new functional food products. These products can be enriched with antimicrobial and probiotic properties, which promote human

health and can have a positive effect on food safety. Such innovations have the potential to improve product quality and meet consumer needs for functional, healthy, and safe foods.

The contributions of dissertation work are crucial for the advancement of science and technology in the fields of food science and microbiology. Here are some of the significant aspects:

1. Expansion of knowledge: Research on new microbial strains and their properties expands our understanding of the microbial ecology of food products, which is essential for the development of the food industry and ensuring the provision of safe and quality food.

2. Potential for new products: Discovering the antimicrobial and probiotic properties of new microbial strains paves the way for the development of new functional food products that can offer health benefits to consumers.

3. Improvement of food safety: The antimicrobial activity of discovered strains can play a vital role in improving food safety by reducing the risk of contamination with pathogenic microorganisms.

4. Probiotic products: The probiotic properties of some isolated strains can be utilized to develop products that support the health of the digestive tract and the immune system.

In summary, the provided contributions have the potential to stimulate innovation in the food industry, improve food safety, and offer new products that meet consumers' needs for healthy and functional foods. They can also inspire new research and development in the fields of microbiology and food science.

The provided collection of 12 newly isolated strains of lactic acid bacteria from traditionally fermented foods represents a significant scientific and scientifically applied contribution to the fields of microbiology and food science. Here are some of the key contributions:

1. Species identification and characteristics: The strains have undergone detailed studies, including species identification and analysis of their fundamental physiological, functional, and technological characteristics.

2. Comprehensive approach to probiotic potential assessment: A comprehensive approach has been used to assess the probiotic potential and bio-protective characteristics of the strains, contributing to understanding their potential role in human health and food safety.

3. Established antiviral activity: Antiviral activity against human herpes virus has been established for the first time in a strain of *Lactobacillus delbrueckii* ssp. *bulgaricus*, which is an important discovery with potential applications in the production of functional foods.

4. Development of a model product: A model yogurt product with successfully applied strains has been developed, contributing to confirming their importance and role in shaping the specific metabolic profile and sensory characteristics of the product.

5. Applicability of NMR spectroscopy: The applicability of NMR spectroscopy as a high-tech method for clear differentiation of various types of sour milk based on their specific metabolic profile has been demonstrated, which is important for quality control of products.

6. Confirmed applicability of the strains: The applicability of the strains *Lactobacillus delbrueckii* ssp. *bulgaricus* KZM 2-11-3 and *Lactiplantibacillus plantarum* KC 5-12 with bio-protective and probiotic potential has been confirmed for inclusion in starter cultures for the production of new functional food products with health benefits for consumers and preserved quality throughout the storage period.

These contributions not only contribute to expanding our knowledge of the microbial flora of food products but also have the potential to inspire new innovations in the food industry and functional foods.

These studies are relevant and significant in the context of the modern scientific community. Here are some of the reasons:

1. Innovative approach: The research stands out for its innovative approach and contributes to expanding knowledge in the fields of microbiology and food science. The identification of antiviral activity against the human herpes virus in *Lactobacillus delbrueckii* ssp. *bulgaricus* is particularly impressive and has potential applications in the field of functional foods.

2. Applied approach: The research not only presents scientific discoveries but also has applications in industry and practice through the development of model foods and confirming the importance of specific microbial strains for the quality and safety of foods.

3. Technological innovations: The studies use high-tech methods such as NMR spectroscopy for analyzing the metabolic profile of sour milk, which represents an innovation in the field of analytical methods for food control.

4. Confirmed results: The results of the studies are confirmed and supported by objective data and analyses, which strengthens their relevance and significance.

According to these factors, the studies are relevant and significant in the scientific community and have the potential to contribute to the development of food science and industry and represent a significant contribution to the field of microbiology and food science. They include the formation of a collection of 12 newly isolated strains of lactic acid bacteria from traditionally prepared fermented foods. These strains have undergone detailed study, contributing to identifying their species affiliation and analyzing their fundamental physiological, functional, and technological characteristics. A model yogurt product has been developed with two successfully applied strains, confirming their importance and role in shaping a specific metabolic profile and sensory characteristics. This study is further strengthened by the application of high-tech methods such as NMR spectroscopy for clear differentiation of various types of sour milk.

The research confirms the applicability of the isolated strains for inclusion in starter cultures for the production of new functional foods with health benefits for consumers and preserved quality throughout the storage period. Thus, they are not only relevant but also significant in the context of the modern scientific community, with the potential to stimulate innovations in the food industry and functional foods.

The material included in the abstract fully reflects the conducted research within the dissertation.

Based on all the aforementioned points, I confidently propose to the esteemed scientific jury to award **Ramize Hodzha** the educational and scientific degree of "**DOCTOR**" in scientific field 5. Technical Sciences, professional direction 5.11. Biotechnologies, scientific specialty 02.11.11 "Technology of biologically active substances".

09.05.2024
Plovdiv

Signature:
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