

Response
official opponent

Doctor of Technical Sciences, Professor, Professor of the Department of
Chemistry, Biochemistry, Microbiology and Food Hygiene

State Biotechnological University

Holovko Mykola Pavlovych

for a dissertation (**Gao Dan**)

"Technology of protein isolate pumpkin seed meal and food products using it",

applied for the degree of Doctor of Philosophy

from the field of knowledge (18)

by specialty (181)

1. Relevance of the topic of the dissertation.

In recent years, meal proteins from oilseeds have appeared and become popular. Protein is one of the main nutrients in the vital activity of the human cell, and serious protein deficiency is the main cause of child mortality in many countries of Africa, Asia, and Ukraine. Complete proteins, containing all nine essential amino acids needed for human health, are usually found in animal products such as meat and dairy products. However, people are becoming more aware of the benefits of alternative proteins, such as plant-based proteins, particularly meals, given the scarcity of meat due to population growth, the environmental hazards of livestock farming, and the associated risk of chronic diseases caused by meat products. In developed regions, such as the United States of America and Europe, the effect of substitution of animal proteins for plant proteins is gradually increasing. According to the UN forecast, the world population will reach approximately 9.8 billion in 2050 and the level of urbanization will increase from 55% in 2018 to 68%. Urbanization and population growth will increase the overall demand for meat, and meat substitutes such as oilseed meal proteins will become more necessary and in demand.

Pumpkin seed meal after oil extraction is a valuable raw material. It is rich in protein, dietary fiber, etc., which have a very important effect on the nutritional value, biological value, and physicochemical properties of food products.

The solution proposed by the author regarding the use of meal after processing pumpkin seeds for further obtaining high-protein isolates and their use in the technologies of meat sausages and cookies is relevant for today, as it will allow rational use of production waste, reducing the burden on the environment.

2. Connection of work with scientific programs, topics, plans.

The dissertation work was planned and executed according to the plans of research work of the Sumy National Agrarian University, on research topics of the Department of Food Technology and Safety 0119U101237 "Innovative technological solutions in the production of food products" and 0122U201388 "Development of technical documentation for dual purpose protein raw materials". Scientific research of the dissertation work was carried out on the basis of the School of Food Sciences of the Henan Institute of Science and Technology (China).

3. Scientific novelty of the obtained results.

On the basis of analytical, scientific and experimental research and trends in the dissertation for the first time:

— the functional properties of protein isolate from pumpkin seed meal, necessary for use in the technology of meat sausages and biscuits, were analyzed, and the technology of products using protein isolate was described;

— it is scientifically proven that it was possible to improve the yield of protein extraction from pumpkin seed meal using the combined alkaline extraction method with pH -adjusting treatment;

— the effect of pH -adjusting treatment on thermal, structural and emulsifying properties was investigated, and as a result, a significant increase in emulsifying properties at high pH values was confirmed ;

— it was experimentally established that the functional properties of the protein isolate from pumpkin seed meal improved with the use of the pH -adjusting processing method,

— the microbiological and functional characteristics of the protein isolate from pumpkin seed meal were investigated, namely its foaming , emulsifying , fat-absorbing , moisture-retaining ability;

— optimization of the recipe of meat sausages and cookies using protein isolate from pumpkin seed meal was carried out;

— a complex of new data characterizing the chemical composition, organoleptic, microbiological and toxicological indicators, nutritional value was obtained, and the storage conditions and terms of meat sausages and biscuits using protein isolate from pumpkin seed meal were scientifically substantiated;

acquired further development and generalization:

ways of using protein isolate from pumpkin seed meal in food products of different groups.

4. Scientific and practical significance.

On the basis of fundamental and applied research, a protein isolate from pumpkin seed meal with high functional and technological properties was developed for its further use in the technology of meat sausages and biscuits, as a semi-finished product, which increases the nutritional and biological value, and also has a positive effect on the physical -chemical, structural-mechanical and organoleptic characteristics of these products.

The results of the dissertation work can be used in the educational process when studying the disciplines "Fundamentals of physiology and food hygiene", " Nutritionology ", "Quality and safety of food products", "General technologies of food production". At the same time, research results can be used in conducting fundamental and applied research in the direction of food technologies.

5. Completeness of presentation of the dissertation material in scientific publications.

The results of the dissertation are reflected in 13 printed works, including: 2 articles in scientific publications by specialty, included on the date of publication in the list of scientific specialized publications of Ukraine, 5 articles in periodical scientific publications, which are indexed in the Scopus / Web database of Science Core Collection, 1 of which is in the 1st quartile log (**Q1**), 1 of which is in the log of the 2nd quartile (**Q2**), 1 of which is in the log of the 3rd quartile (**Q3**), 6 abstracts of reports at scientific, scientific-practical and international conferences.

6. The degree of validity of scientific statements.

The main scientific propositions and conclusions given in the dissertation work are logically justified and developed on the basis of multilateral research.

The research tasks were developed on the basis of a thorough analysis of more than 131 literary sources and own research. In order to achieve the goal of the dissertation, the author presented a step-by-step plan for conducting dissertation research developed at a high scientific level

Sensory, organoleptic, structural-mechanical, microbiological methods, as well as methods of mathematical modeling and mathematical-statistical processing of results were used during experimental research.

Comprehensive solution of the tasks, modern and comprehensive experiment and analysis of the obtained results, industrial approbation of the proposed technological solutions and extensive discussion of research results at scientific conferences and in publications allow us to conclude about a high degree of validity of scientific statements and reliability of research results.

7. The structure and content of the dissertation, its completeness and compliance with the established requirements for design.

The dissertation consists of an abstract, an introduction, five chapters, conclusions, a list of used literary sources and appendices. The thesis is presented on 146 pages of the main text, including 29 tables, 46 figures and appendices.

In the dissertation work, the rules of planning and conducting scientific research are followed, and modern methods of research and processing of experimental results are used. The scientific novelty of the results of the work is based on comprehensive research, which was used at the appropriate level with the use of generally recognized research methods.

The dissertation is written in English and Ukrainian. The style and presentation of the work is logical, consistent and meets the requirements for printed works. The content of the work presents the results of scientific research and their approbation in practice. When presenting the text, modern scientific and lexical terminology is mainly used.

8. Discussion clauses and remarks to the dissertation.

Along with the positive assessment of the dissertation work, it can be noted that some statements are debatable or need to be revised:

1. Did the author take as a basis the study of functional and technological characteristics of protein isolate from pumpkin seed meal during the research? From the presented results, it is not completely clear, according to which principle the descriptors for analysis were chosen.

2. It is known that SEM analysis of protein molecules is quite expensive. From the presented results of SEM analysis of protein isolates from pumpkin seed meal, the conclusion regarding their further use for food technology is not clearly formulated.

3. In the offered sausage products, protein isolate from pumpkin seed meal is used in a small amount. It would be more appropriate to completely replace meat raw materials in the recipe of meat products with protein isolate from pumpkin seed meal to obtain a vegan food product.

4. The author suggests using pumpkin seed meal to obtain protein isolate. However, it is not clear why the author chose only one variety of pumpkin as the object of research for obtaining protein isolate? Moreover, in the work, there is no data on comparison within the pumpkin family.

5. The articles and the dissertation itself describe the method of obtaining pumpkin seed meal in laboratory conditions. It is not clear why the author does not buy it for research, as a waste of production.

6. The recipe for cookies is presented in the dissertation. However, it is not specified on the basis of which standard or collection of recipes the control was chosen. That is, it is advisable to prescribe whether this recipe is original or standard.

9. General conclusion.

Dissertation work (Gao Dan) " Technology of protein isolate pumpkin seed meal and food products using it ", which was submitted for defense to the specialized academic council for obtaining the degree of Doctor of Philosophy in the field of knowledge (18) in the specialty (181) according to its relevance, scientific and theoretical level, main results of validity, main provisions and results published in professional publications, novelty statement and practical meaning meets the requirements of the Order of the Ministry of Education and Culture of Ukraine No. 40 of January 12, 2017 "On approval of requirements for the preparation of a dissertation" and Resolution of the Cabinet of Ministers of Ukraine of January 12, 2022 No. 44 "On approval of the Procedure for awarding the degree of Doctor of Philosophy and cancellation of the decision of a one-time specialized of the academic council of the institution of higher education, scientific institution on awarding the degree of doctor of philosophy" with changes introduced in accordance with Resolution of the CM No. 341 dated 03/21/2022.

Official opponent:

doctor of technical sciences, professor,
professor of the Department of Chemistry, Biochemistry,
Microbiology and Food Hygiene
State Biotechnological University



Mykola HOLOVKO

Підпис *Микола Головка*
ЗАСВІДЧУЮ
Керівник відділу діловодства ДБТУ
Еф. Олена Мегія