

CONCLUSION

**of the official opponent of Sukmanov Valerii Alexandrovich,
Doctor of technical sciences, professor, professor of the Department of
"Food Technologies" Poltava State Agrarian University
regarding Deng Chunli's dissertation on the topic "Technology of
physically modification of potato starch and their applications in food products"
submitted to obtain the scientific degree of Doctor of Philosophy
in the specialty 181 "Food Technologies",
field of knowledge 18 - Production and Technology**

1. General information.

Deng Chunli's dissertation work on the topic "Technology of physically modification of potato starch and their applications in food products" was carried out within the framework of the implementation of the joint program of training graduate students and conducting scientific research between the Henan Institute of Science and Technology of China and the Sumy National Agrarian University of Ukraine since October 2019 to October 2023 at the Sumy National Agrarian University.

The topic of the dissertation work was approved by the Academic Council of the University (protocol No. 5) on 25.11.2019.

The work was carried out during postgraduate studies at the Sumy National Agrarian University.

Thus, the Educational and Scientific Program was completed by graduate student Deng Chunli's in its entirety.

The individual research plan of the winner Deng Chunli's was approved by the decision of the Academic Council of the university on 25.11.2019 (protocol No. 5).

The supervisor of the dissertation student is Oksana Yurievna Melnyk, Ph.D., associate professor, Head of Technology of Nutrition Department Sumy National Agrarian University.

The dissertation is presented for obtaining the scientific degree of Doctor of Philosophy in the specialty 181 Food Technologies

The structure of the dissertation. The dissertation consists of an introduction, 5 sections, conclusions, a list of references of 236 names, appendices. Main content dissertation is laid out 186 pages of printed text, contains 48 tables and 48 figures.

2. The relevance of the dissertation, the purpose and tasks of the dissertation.

Relevance of the research topic

In 2020, the potato production in Asia accounted for 49.7% of the global potato production, while the potato production in Europe accounted for 30%, which indicated that Asia and Europe were the main potato producing areas in 2020. Starch is the main component of potato tubers and the starch content varies with cultivar and it is extensively utilized as food ingredients, thickeners, excipients or pharmaceutical fillers in variety food systems for its unique properties of large granule size, neutral flavor, high pasting viscosity and swelling power, high clarity of starch paste and ability to form thick viscoelastic gels upon heating and subsequent cooling.

Heat-moisture treatment (HMT) is one of the most important physical modification methods of starch, which refers to the utilization of high moisture content and temperature for a period of treatment time. Microwave treatment (MW) is another appealing physical modification method of starch for its effectively heating, high yield and potentially good quality of products

The author successfully proposed the technology of physical modification of potato starch, which combines the two given methods of starch modification.

It should be emphasized, that significant interest in physical modification methods is caused by the absence of chemical pollution, food safety, environmental friendliness and low production cost.

The purpose and tasks of the research.

The aim of the research is to develop technology of physically modified starches with heat-moisture treatment (HMT), microwave treatment (MW) and investigate the effects of their application in the production of food products.

To achieve the main goal, the dissertation student solved a number of interrelated tasks:

- to investigate the effects of heat-moisture treatment conditions on potato starch physicochemical properties, mainly include swelling power, solubility, freeze-thaw stability, retrogradation, transparency and textural properties.

- to investigate the effects of heat-moisture treatment reaction conditions on the structural and digestion characteristics of potato starch, mainly include paste viscosity properties, particle size, morphological properties, crystal structure and in vitro digestibility.

- to optimize the modification process of potato starch by heat moisture treatment using Box-Behnken response surface methodology.

- to investigate the effects of heat-moisture treatment combined with microwave pre- and post-treatment on potato starch physicochemical properties, mainly include color characteristics, particle size, water distribution, swelling power, solubility, freeze-thaw stability, retrogradation, transparency and textural properties.

- to investigate modification in physicochemical, structural and digestive properties of potato starch during heat-moisture treatment combined with microwave pre- and post-treatment, mainly include paste viscosity properties, morphological properties, crystal structure and in vitro digestibility.

- to investigate the effects of partial substitution of wheat flour with modified potato starch on the quality of cookies, Chinese steamed bread, noodles, mainly include the texture properties of dough, the textural properties, color characteristics and the sensory acceptance of products.

3. The connection of work with scientific programs, plans, topic

Scientific research was carried out within the framework of the thematic plan of research works according to topic 0119U103484 "Scientific grounding and development of technologies of food and culinary products using innovative types of raw materials", Department of Food Technology, Sumy National Agrarian University, Ukraine, and the College of Food and Biological Engineering, Hezhou University, China.

4. Scientific provisions developed personally by the acquirer and their novelty.

The scientific novelty of the main provisions of the dissertation consists in the experimental substantiation of a new technology for the production of pork sausages using soy protein isolate with a low content of common salt under high pressure processing.

This makes it possible to theoretically substantiate a new method of production of low-salt emulsion sausage products using high-pressure processing.

As a result of the research, for the first time:

- the viscosity properties, gel textural properties and in vitro cleavage characteristics of HMT modified starch and HMT and MW bidirectionally modified starch were systematically analyzed to provide reliable evidence for their application in the food industry.

– the regularities of the effects of wheat flour substitution with modified potato starch on properties of mixed dough and quality of cookies, steamed bread and noodles are substantiated.

– experiments on cookies, steamed bread and noodles products confirmed that adding a suitable dose of modified potato starch can improve the quality of the products, making the products have good texture properties and sensory acceptability, which is of positive significance for promoting the process of potato staple food.

5. The degree of validity and reliability of the provisions, conclusions and recommendations formulated in the dissertation.

The degree of scientific statements' validity, conclusions and recommendations formulated in the dissertation, and their reliability.

The results of experimental research confirm the required degree of validity of scientific propositions put forward by the author. The conclusions and recommendations formulated in the dissertation are sufficiently substantiated both from the point of view of modern scientific and theoretical statements of food science and from the point of view of the possibility to be practically implemented in production.

The degree of scientific statements' validity is beyond doubt and is confirmed by the use of traditional standard and modern physical, physicochemical, organoleptic and other contemporary methods of research, application of methods of experiment planning, mathematical-and-statistical processing of the obtained data. The nuclear magnetic resonance method, spectroscopic and rheological research used by the author deserve special attention, which made it possible to convincingly prove the results obtained.

The obtained results correlate with the known data of profile studies.

New scientific results are confirmed by testing conclusions and recommendations at scientific and practical conferences and in industrial conditions. The main provisions of the dissertation were published in specialized scientific publications of Ukraine and periodical scientific publications indexed in the Web of Science Core Collection and Scopus databases.

6. Approbation of dissertation results.

Approbation of the scientific and practical results presented in the dissertation was carried out by the applicant personally with the methodical and scientific support of the scientific supervisor.

The main results of the work were reported at the II International Scientific and Practical Conference " The world of science and innovation ", London, United Kingdom, September 16-18, 2020; II International Scientific and Practical Conference " Topical issues of modern science, society and education " , Kharkiv, Ukraine, September 5-7, 2021; III International Scientific and Practical Conference "Modern scientific research: achievements, innovations and development prospects ", Berlin, Germany , August 29-31,2021; II International Scientific and Practical Internet Conference "Informational and innovative technologies in hotel and restaurant business, tourism and design ", Dnipro – Opole, December 1-2, 2021; VI International Scientific and Practical Conference "MODERN RESEARCH IN WORLD SCIENCE ", Lviv, Ukraine, 4-6 September 2022.

7. The completeness of the publication of the results of the dissertation, the number of scientific publications and the specific personal contribution of the recipient.

Personal contribution of the acquirer.

The personal contribution of the acquirer consists in the analysis of the scientific problem and the formulation of the goal and tasks of the research, the development of the research program and methodology, in the planning, organization and conduct of experimental work, in the analysis, processing and generalization of the obtained data, the formulation of conclusions and the preparation of materials for publication, the approval of scientific research at scientific and practical conferences and tasting meetings. In the implementation of research results in production at enterprises of the Republic of China and in the educational process.

Publications. According to the results of the research, the applicant published 14 scientific papers, including 9 journal articles, 2 of which are published in a category B scientific professional publication approved in Ukraine and 2 in a scientific professional publication approved in Ukraine indexed by Scopus, 1 publication in a Polish scientific journal indexed by Web of Science, 1 publication in Slovakia scientific journals indexed by Scopus, 2 in Hungarian scientific journals, 1 publication in a Brazil scientific journal indexed by Scopus; 5 abstracts of scientific conference reports.

The results presented in the dissertation are covered in full in these scientific publications.

8. Unity of the content of the work, evaluation of the language and style of the dissertation

The text of the dissertation is written in competent technical English in a logical and consistent manner. Dissertation structure, language and presentation style meet the requirements for PhD dissertations.

The scientific terminology used in the work is generally recognized.

The style of presenting the results of theoretical and practical research, new scientific provisions, conclusions and recommendations ensures the accessibility of their perception and use.

The dissertation is a completed scientific work corresponding to specialty 181 - Food technologies.

9. Characteristics of the academic integrity of the acquirer

Deng Chunli's dissertation was checked for academic plagiarism using a licensing program.

The analysis of the results of checking Deng Chunli's dissertation for academic plagiarism, taking into account the explanations provided regarding the coincidence of some part of the dissertation with Deng Chunli's articles, shows the absence of academic plagiarism, self-plagiarism, fabrication, falsification, etc.

10. Recommendations and comments on the dissertation work

Noting positively the level of scientific and practical value of the dissertation, it is necessary to note a number of remarks:

1. When using images borrowed from other scientific publications, it is advisable to indicate the source that was used after the name of the image (example: Fig. 1.1, 1.2, 1.4.).

2. Page 37 (item 1.2) – the first use of the term «retrogradation of starch»; the method of determining retrogradation of starch paste is given in item 2.4.3. And the definition of this term is given in item 3.2.3: «Retrogradation of starch is the process of transition of gelatinized starch molecules from a disordered state to an ordered rearrangement, finally coagulation and sedimentation...» and in item 3.4.7 - there is a repetition of 7 lines of the text from the definition term «Retrogradation of starch».

3. Sensory evaluation of cookies, fresh noodles and steamed bread was performed by the participants – «graduate students and employees of the Technologies of Nutrition Department». There is no information in the work on how the selected participants were prepared, whether their sensory abilities were assessed, and whether

there is consistency between the assessments she gave during the assessment.

4. When analyzing the physical methods of starch modification (Chapter 1), the author rightly draws attention to the ultra-high pressure treatment method (Table 1.1). But further, in the study of «stability of potato starch gels during freezing and thawing» a conventional freeze-thaw cycle was used (freezing for 24 hours at -18 °C and thawing for 2 hours at 30 °C). But it is known that freezing at high pressure fundamentally changes the size and physical structure of the frozen moisture in the product, which significantly affects its properties (starch gel matrix, syneresis and other properties) after thawing. Therefore, it would be advisable to investigate the freeze-thaw stability of potato starch when using high-pressure freezing.

5. Regarding the determination of the particle size of modified starch, it is not clear what is meant by the expression «optical Mie mode»?

6. It would be appropriate to describe the experimental dependences shown on the graphs (example: Fig. 3.14 -3.16) with appropriate equations, which would allow them to be used when comparing and evaluating the dynamics of changes in the analyzed indicators.

7. In the process of hydrothermal processing, native starch undergoes a drying operation, it is advisable to explain the double drying of starch.

8. It is not clear how the processing parameters in the microwave oven were set: weight of the sample, power (400 W) and duration of processing.

9. The author suggests using modified starch in the amount of 30.0, respectively, in the production of bread, noodles and cookies; 30.0 and 15.0%, which is due to the difference in the dosage of the studied raw materials in the recipes of food products.

10. The volume of the dissertation (186 pages) is somewhat too large. The spaces between the names of some figures and tables are missing.

The comments and suggestions expressed are not fundamentally significant, some are of a debatable nature, do not affect the value of the dissertation and do not reduce the overall positive assessment of the content of the dissertation, which solves an important scientific and practical problem and will increase the efficiency of technological processes, expand the range and improve the provision of high-quality food products for the population.

11. Compliance of the dissertation with the requirements of Clause 10 of the Procedure for conducting an experiment on awarding the degree of Doctor of Philosophy, approved by the Resolution of the CMU dated 03.06.2019 No. 167 and

Requirements for the design of the dissertation, approved by the Order of the Ministry of Education and Culture of Ukraine of 01.12.2017 No. 40.

GENERAL CONCLUSION

The dissertation of the applicant Deng Chunli on the topic "Technology of physically modification of potato starch and their applications in food products" in the specialty 181 Food Technologies fully meets the requirements for thesis preparation, approved by the order of the Ministry of Education and Science of Ukraine dated 12.01.2017 No. 40 as amended by the order of the Ministry of Education and Science of Ukraine dated 31.05.2019 No. 759 and the requirements of the Procedure for awarding the degree of Doctor of Philosophy and canceling the decision of a one-time specialized academic council of a higher education institution, scientific institution to award the degree of Doctor of Philosophy, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 12.01.2022 No. 44. The author of dissertation, Deng Chunli, deserves to be awarded the scientific degree of Doctor of Philosophy in the specialty 181 Food Technology.

OFFICIAL OPPONENT,

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