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**MEAT PATE TECHNOLOGY DEVELOPMENT WITH ACOUSTIC BASED
TREATMENT OF MEAT AND BY-PRODUCTS**

ABSTRACT

of the thesis submitted by Eleonora Okuskhanova in partial fulfillment of the requirements for the degree of Doctor of Philosophy by specialty 6D072700 – Technology of food products

Relevance of work. In President Nursultan Nazarbayev's Address of January 10, 2018, "New Development Opportunities in the Conditions of the Fourth Industrial Revolution", the agro-industrial complex faces the task of increasing labor productivity, exporting processed agricultural products and entering the world markets with high-quality finished products. In present days, the development of the food industry in Kazakhstan is becoming the urgent issue with regards of joining to the Eurasian Economic Union (EEU) and the World Trade Organization (WTO), and also with relation to changes in the internal environment - in the face of growing the population and given this growing demand for food products and changes in the structure of consumption towards more quality and diverse food products.

Developing new food products is aimed to improve the nutritive and biological value, physico-chemical and functional properties, safety and accessibility of food products. Currently, the meat market is represented with limited number of meat products, both as functional and dietary as therapeutic and prophylactic foods. The main motive of consumers for the acquisition of functional products is an increased interest in foods that help prevent chronic diseases such as cardiovascular diseases, obesity, Alzheimer's disease and osteoporosis, or providing an optimal level of health, for example enhancing immunity, etc. At the same time, the application of various technological methods in the food production process, ensuring the reduction of production time, energy, water and increasing economic efficiency becomes relevant. Such processes as microwave treatment, pulsed electric fields, high hydrostatic pressure, ultraviolet radiation, electric heating and ultrasound treatment are entered to food processing line. In the meat industry, the use of ultrasound treatment can improve the quality of the product, by changing the physical, biochemical, rheological properties, the process of mass change, salting, inactivating the pathogenic microflora, and reducing the production cycle.

At present, in recipe of meat products is widely used non-traditional meat (deer, maral, yak, rabbit, turkey, etc.), meat by-products, food additives - protein preparations of various origins, polysaccharides and other components, protein-oil emulsions (POE), protein supplements, etc. The production and use of POE in the technology of meat products has a huge potential in matters of improving the consumer properties of finished products.

Object of the study: maral meat, beef rumen, protein-fat emulsion, minced maral meat with POE, meat pates.

Purpose and objectives of the study. The goal of the thesis work is the development of technology and formulation of maral meat pâté with addition of protein-oil emulsion using ultrasound treatment of meat and meat by-products.

To achieve this goal, the following tasks are considered:

- to study the nutritional and biological value, the microstructure character of the maral's meat which grown in East Kazakhstan region;
- to study the effect of ultrasound treatment on functional-technological and rheological properties of meat and meat by-product;
- to study the effect of the formulation components on the functional and technological and rheological properties, nutritional and biological value of protein-oil emulsion (POE);
- to study the influence of POE on the qualitative and structural-mechanical characteristics of model pate mass to determine the appropriate degree of replacement of meat by POE;
- to develop a recipe and technological scheme for the production of maral meat pâté based with addition of POE;
- to study the nutritional and biological value, structural and mechanical characteristics and microbiological characteristics of meat pate;
- to carry out approbation and introduction into the technological process of production of new meat pates;
- to develop standards, regulations and specifications for the production of meat pate.

The main content of the work. The thesis consists of five chapters, in which all the tasks are consistently solved.

The review of scientific and technical literature analyzed the trend in the production of meat products based on non-traditional types of meat; the characteristics of maral meat and its use in the meat product recipe were given; the feasibility of using ultrasound in the meat industry for improving the qualitative indicators was noted; the analytical review of literature data on the use of protein-oil emulsions in the technology of meat products was presented.

Methods of research. In the second chapter, the characteristics of the objects of research are presented, and a scheme for performing the experiments is given. Experimental studies were carried out in 3-5 multiple repetitions. The obtained data were processed by the method of mathematical statistics. A set of generally accepted and standard methods of research were used in scientific work: physico-chemical, microbiological, structural-mechanical, sensory characteristics using modern analytical instruments (mass spectrometer with inductively coupled plasma "Varian 820-MS", high-performance liquid chromatograph "Shimadzu LC -Prominence ", low-vacuum scanning electron microscope "JEOL JSM-6390LV "). The results of the studies were processed by statistical analysis and mathematical modeling.

Theoretical and experimental part. In the third chapter of the thesis work the experimental results on studying the food and biological value of maral meat and beef rumen are examined. The results of the influence of ultrasound influence on structural-mechanical and functional-technological properties of meat and meat by-product are given, where the positive dynamics of these properties are established.

In the fourth chapter, a technology for obtaining the protein-oil emulsion has been developed, the optimal ratio of the protein and fatty fraction of POE has been determined experimentally by studying the chemical, amino acid and fatty acid compositions. Optimization of the composition of POE by mathematical modeling was carried out.

In the fifth chapter, the qualitative characteristics of different treatments of minced meat with replacing maral meat by POE were studied. The recipe and technology for the production of canned meat "Maral meat pate" has been developed. It has been revealed that, according to the nutritional value, the maral meat pate is a low-calorie food with a low fat content (9.09%). The results of studies of organoleptic, physico-chemical, microbiological indicators and the safety of canned meat fully meet the requirements of the regulatory documents. The standards, regulations and specifications for a new maral meat pate (ST RGP on PHV 3992 1917 27 002-2018) has been developed.

The appendix contains the test report, certificates of industrial approbation and introduction of technology, tasting of "Maral meat pate", the standard, regulations and specifications.

Scientific novelty of the work consists in the rational use of non-traditional meat (maral meat), secondary products of meat production (beef rumen) in meat pate technology. The expediency of using ultrasound treatment for tenderizing of muscular fibers of maral meat and beef rumen is proved. The formulation and technology of the protein-oil emulsion based on the beef rumen and its further use in maral meat pâté is substantiated.

Scope: the results of research can be used in the conditions of meat processing plants, sausage plants, mini-shops of public catering.

Practical effect of work: it has been developed the technology of production of protein-oil emulsion and meat pate with using of POE. The standard, regulations and specifications for the production of pâté from maral meat has been developed (ST RGP na PVH 3992 1917 27 002-2018). The pilot batch of pâtés from maral meat with the addition of protein-oil emulsion was produced. The results of the work were approved and tested in manufacturing environments of LLP "Semipalatinsk meat-packing plant" in Semey.

Personal contribution of the author consists in setting the scientific goal and objectives of the study, in the selection and analysis of patent and scientific literature, in conducting theoretical and experimental studies and processing results; in carrying out pilot-industrial tests and practical implementation of results, in the preparation of

standard, regulations and specifications and publications on the topic of the thesis work.

The application of work. The main results of the thesis work are presented at the International research-to-practice conference: "Innovative technologies in the food industry: science, education and production" (Voronezh, Russia, 2016); VII International Scientific and Technical Conference "KAZAKHSTAN-COLD 2017" (Almaty, 2017); III International Scientific and Practical Conference "Scientific Issues of the Modernity" (Dubai, United Arab Emirates, 2017); "Actual problems of food production: the state and development prospects" (Semey, 2017); "Food security in the context of new ideas and solutions" (Semey, 2017).

Publications. On the theme of the thesis 13 research papers were published, including: 4 articles in journals recommended by the Committee for Control in Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan; 2 articles in the journals included in the Web of Science and Scopus database and having a nonzero impact factor; in 5 materials of international scientific-practical conferences; received 1 patent of the Republic of Kazakhstan for utility model No. 1536 "Meat pate and the method of obtaining it", received an Application for the grant of a patent of the Republic of Kazakhstan for utility model No. 2018 / 0139.2 dated March 3, 2018. "A method for producing a protein-oil emulsion and a method for producing meat pates using a protein-oil emulsion".

Structure and scope of the dissertation. The thesis consists of introduction, review of scientific and technical and patent literature, experimental research methods, discussion of the results, conclusions, references, including 203 titles. The work is presented in 153 pages of computer text, contains 30 tables, 20 figures and 14 applications.