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IRSTI: 65.53.01 https://doi.org/10.48184/2304-568X-2024-3-58-66

METHODS OF MARAL (CASPIAN RED DEER) DRIED BLOOD PRODUCTION BY SUBLIMATION AND EVALUATION OF ITS QUALITY

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The presented article represents the results of a thorough investigation aimed at a deep understanding of the process of producing dried maral blood using the sublimation method. The main focus is on analyzing the technological aspects of this method and evaluating the chemical and biological properties of the resulting product. The results of the conducted research led to the conclusion that the sublimation method is an effective and promising means of preserving the biologically active components in dried maral blood. This assessment is based on a careful analysis of various product characteristics, including protein content, trace elements, and other important constituents. Scientific measurements and comparisons with standards, including physicochemical analysis, and other methods, allowed establishing that dried maral blood obtained by the sublimation method exhibits a high degree of preservation of biologically active substances. This confirms its potential for use in various fields such as medicine, the food industry, and cosmetology. Such results are of significant importance for the scientific community and industry as they confirm the prospects and effectiveness of this production method, which can contribute to the development of new technologies and products in the future. Ultimately, the conclusions drawn confirm the prospects for the widespread use of dried maral blood in various fields, including medicine, the food industry, and cosmetology. These findings are of great significance for the scientific community and industrial circles, as they emphasize not only the importance of this

production method but also open up new horizons for further research and development in the field of biologically active products.

Keywords: sublimation, dried maral blood, production technology, biologically active substances, physicochemical analysis, product quality, medical application, food industry, cosmetology, method efficiency.

СУБЛИМАЦИЯ ӘДІСІМЕН МАРАЛДЫҢ (КАСПИЙ БҰҒЫСЫНЫҢ) КЕПТІРІЛГЕН ҚАНЫН ӨНДІРУ ТӘСІЛДЕРІ ЖӘНЕ ОНЫҢ САПАСЫН БАҒАЛАУ

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Бұл мақалада маралдың кептірілген қанын сублимация әдісімен өндіру процесін терең түсінуге бағытталған мұқият зерттеудің нәтижелері келтірілген. Бұл әдістің технологиялық аспектілерін талдауға және алынған өнімнің химиялық және биологиялық қасиеттерін бағалауға баса назар аударылады. Жүргізілген зерттеулердің нәтижелері сублимация әдісі маралдың кептірілген қанындағы биологиялық белсенді компоненттерді сақтаудың тиімді және келешегі зор құралы болып табылады деген қорытындыға келуге мүмкіндік берді. Бұл бағалау өнімнің әртүрлі сипаттамаларын, соның ішінде ақуыз, микроэлементтер және басқа да маңызды құрамдастар мөлшерін мұқият талдауға негізделген. Физикалық-химиялық талдау мен басқа әдістерді қоса алғанда, ғылыми өлшемдер және эталондармен салыстырулар сублимация әдісімен алынған кептірілген марал қанының биологиялық белсенді заттардың жоғары сақталу дәрежесіне ие екенін анықтауға себептесті. Бұл оның медицина, тамақ өнеркәсібі және косметология сияқты әртүрлі салаларда қолданылу мүмкіндігін растайды. Мұндай нәтижелер ғылыми қауымдастық пен өнеркәсіп үшін үлкен маңызға ие, өйткені олар болашақта жаңа технологиялар мен өнімдерді дамытуға ықпал ететін осы өндіріс әдісінің болашағы мен тиімділігін растайды. Қорыта келе, бұл тұжырымдардың медицина, тамақ өнеркәсібі және косметологияны қоса алғанда, әртүрлі салаларда кептірілген марал қанын кеңінен қолдану перспективасын растайтынын атап өткен жөн. Бұл тұжырымдар ғылыми қауымдастық пен өнеркәсіптік орта үшін үлкен маңызға ие, өйткені олар осы өндіріс әдісінің маңыздылығын атап қана қоймайды, сонымен қатар биологиялық белсенді өнімдерді одан әрі зерттеу және дамыту үшін жаңа көкжиектер ашады.

Негізгі сөздер: сублимация, кептірілген марал қаны, өндіру технологиясы, биологиялық белсенді заттар, физикалық-химиялық талдау, өнім сапасы, медициналық қолдану, тамақ өнеркәсібі, косметология, әдістің тиімділігі.

СПОСОБЫ ПРОИЗВОДСТВА СУШЕНОЙ КРОВИ МАРАЛА (КАСПИЙСКОГО БЛАГОРОДНОГО ОЛЕНЯ) МЕТОДОМ СУБЛИМАЦИИ И ОЦЕНКА ЕЕ КАЧЕСТВА

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В данной статье представлены результаты тщательного исследования, направленного на глубокое понимание процесса производства сушеной крови марала методом сублимации. Основное внимание уделяется анализу технологических аспектов этого метода и оценке химических и биологических свойств получаемого продукта. Результаты проведенных исследований позволили сделать вывод о том, что метод сублимации является эффективным и перспективным средством сохранения биологически активных компонентов в сушеной крови марала. Данная оценка основана на тщательном анализе различных характеристик продукта, включая содержание белка, микроэлементов и других важных составляющих. Научные измерения и сравнения

с эталонами, включая физико-химический анализ и другие методы, позволили установить, что сушеная кровь марала, полученная методом сублимации, обладает высокой степенью сохранности биологически активных веществ. Это подтверждает ее потенциал для использования в различных областях, таких как медицина, пищевая промышленность и косметология. Такие результаты имеют большое значение для научного сообщества и промышленности, поскольку они подтверждают перспективность и эффективность этого метода производства, который может способствовать разработке новых технологий и продуктов в будущем. Подводя итоги, следует отметить, что сделанные выводы подтверждают перспективность широкого использования сушеной крови марала в различных областях, включая медицину, пищевую промышленность и косметологию. Эти результаты имеют большое значение для научного сообщества и промышленных кругов, поскольку они не только подчеркивают важность этого метода производства, но и открывают новые горизонты для дальнейших исследований и разработок в области биологически активных продуктов.

Ключевые слова: сублимация, сушеная кровь марала, технология производства, биологически активные вещества, физико-химический анализ, качество продукта, медицинское применение, пищевая промышленность, косметология, эффективность способа.

Introduction

In modern society, there is a growing interest in utilizing natural resources with skill and efficiency. This interest not only drives the development of new processing methods and technologies but also fuels the search for valuable products that can be derived from these resources. In this context, one of the most attractive and promising research directions is the production of dried maral blood using the sublimation method.

The choice of this topic is justified by several factors. Firstly, dried maral blood is a unique product of natural origin, possessing high biological activity and valuable therapeutic properties. While traditional methods of its production exist, the sublimation method as a technological process remains relatively underexplored and requires further research and optimization.

The relevance of the topic is confirmed by both practical and theoretical significance. Dried maral blood has already demonstrated its effectiveness in treating various diseases, including anemia, immunodeficiencies, and aiding in rehabilitation after traumatic conditions. However, existing production methods can be enhanced by employing the sublimation method, making this topic pertinent for further investigation.

The aim of the research is to thoroughly examine the methods of producing dried maral blood using sublimation technology and to assess the quality of the resulting product. We aim not only to expand our understanding of the sublimation process in the context of maral blood production but also to introduce new methods and approaches that can be applied to optimize this process and improve the quality of the resulting product. Ultimately, we hope that our findings will have significant implications for medical practice, the food industry, and other sectors where the use of dried maral blood may be beneficial [1].

Materials and research methods

For this study, the main materials consist of data from existing scientific research and methods developed previously. Literature analysis involves searching and analyzing relevant scientific articles, publications, and reports related to the production of maral blood dried by sublimation method.

The research question is: "Which sublimation methods of maral blood can be effectively adapted to develop a universal and efficient production formula for dried maral blood?"

The proposed hypothesis (thesis) is that by combining and adapting existing sublimation methods, it is possible to develop a universal and efficient production formula for dried maral blood, ensuring high quality and biological activity of the product.

The stages of the research include the following actions: gathering and analyzing existing scientific data and methods of maral blood sublimation; identifying key parameters of the sublimation process and technological aspects affecting the product quality; combining and adapting existing methods to develop a universal formula for producing dried maral blood; conducting experiments to test the effectiveness of the proposed formula; analyzing the results and comparing them with existing data.

Research methods include: literature review and analysis of scientific research; experimental modeling of the sublimation process; statistical analysis of the obtained results.

Expected research outcomes include the development of a universal and efficient production formula for dried maral blood, as well as confirmation of its quality and biological activity through experimental studies.

Results and discussion

The introduction to the method of producing dried maral blood by sublimation begins with a review of the historical context of research in this field. Continuous interest in the process of producing dried maral blood is reflected in the extensive accumulated research experience conducted over a long period. Examining historical aspects allows for an assessment of the evolution of methodologies and approaches in this sphere, as well as identifying key moments and mechanisms that have influenced the development of dried maral blood production.

Building on retrospective analysis, the choice of the sublimation method for producing dried maral blood is justified by its potential effectiveness and prospects in preserving the biological active components of the raw material. The sublimation method represents a technological strategy aimed at optimizing the process of obtaining the product while preserving its qualitative characteristics. The rational selection of the method is based on its ability to extract and preserve valuable bioactive compounds, which actualizes its application in various industrial sectors and scientific research [2].

In addition to promising opportunities, the sublimation method is also accompanied by certain limitations that need to be considered during the implementation of the process. These limitations include technical aspects, such as the need for specialized equipment and complexities in process setup, as well as potential losses of biologically active substances during processing. This implies the need for a comprehensive approach to the application of the sublimation method to optimize the process and minimize its limitations, considering specific contextual conditions and research objectives.

It is worth noting that the theoretical foundations of the sublimation process play a significant role in the development of methods for producing dried maral blood. The concept of sublimation represents a phase transition in which a substance directly converts from a solid state to a gaseous state, bypassing the liquid phase, under specific temperature and pressure conditions. The fundamental principles of sublimation include the sublimation of the substance itself and the subsequent re-crystallization of vapors on the surface, resulting in the formation of a thin solid film [4].

When a solid substance is subjected to certain conditions, such as heating or reducing atmospheric pressure, the energy applied to the substance converts it directly into vapors without transitioning to the liquid phase. This process is called sublimation. When the substance vapors reach a cold surface, they re-crystallize, forming a thin layer of solid substance.

In the context of producing dried maral blood, the application of sublimation allows for the extraction of important components from the raw material, such as proteins, enzymes, and trace elements, while preserving their biological activity. This method ensures a higher level of preservation of bioactive substances compared to traditional drying methods, making it attractive for application in the pharmaceutical and food industries. Thus, understanding the theoretical principles of sublimation enables the effective application of this process in the production of dried maral blood to preserve its biological activity and enhance product quality.

In turn, the physico-chemical aspects of maral blood sublimation constitute a complex set of parameters that influence the process and the quality of the final product.

An important aspect is the chemical composition of the raw material, including the content of proteins, enzymes, hormones, and trace elements. These components play a key role in determining the biological activity of dried maral blood. During sublimation, it is necessary to consider the degree of their preservation and changes under the influence of environmental factors.

The morphological structure of the raw material is also significant because it determines the surface availability for the sublimation process and the uniform distribution of heat and moisture in the material. Optimal morphology ensures efficient evaporation and preservation of valuable components [3].

Physical properties of the raw material, such as density, particle size, moisture, and texture, also influence the sublimation process. They determine the rate of moisture evaporation, heat transfer, and

mass transfer in the system, affecting the efficiency of the process and the quality of the product.

In the process of sublimation, environmental factors such as temperature, pressure, and time play a significant role. Optimal sublimation conditions should be selected considering the specificity of the raw material and the requirements for the final product. Monitoring and regulating these parameters allow achieving maximum process efficiency and preservation of bioactive substances.

It is also worth noting that the optimal temperature in the process of maral blood sublimation typically ranges from 50 °C to 70 °C. This temperature range provides sufficient energy for moisture evaporation from the raw material while minimizing the loss of bioactive components. It should be noted that at higher temperatures, protein denaturation and other sensitive components may occur, negatively affecting the quality of the final product.

Pressure also plays a significant role in the sublimation process. Typically, pressure ranging from 100 to 200 millibars provides sufficient intensity of evaporation while preventing excessive destruction of bioactive substances. Pressure variation can control the evaporation rate and, consequently, influence the yield of valuable components and product quality [6].

Exposure time, i.e., the time during which the raw material is subjected to the sublimation process, is also an important parameter. The optimal time depends on the characteristics of the raw material and the requirements for the final product but usually ranges from several hours to a day. Prolonged exposure time may lead to the loss of bioactive components due to overheating or oxidation, while too short exposure time may not ensure complete moisture evaporation and extraction of all valuable components from the raw material [7].

Each stage of the production technology of dried maral blood by sublimation method plays an important role, starting from raw material preparation and ending with the final packaging of the finished product.

The preparation and pretreatment of raw materials, such as maral blood, are crucial stages in the production process of dried blood by sublimation method. This stage begins with careful selection of raw materials, where the quality and purity of the material are checked. Cleaning the raw material from impurities and microorganisms is critical because even a small amount of impurities can adversely affect the quality and biological activity of the final product. Various purification methods, such as filtration, centrifugation, or sedimentation, may be used for this purpose [8].

After the raw material is cleaned, excess moisture is removed. Excess moisture can lead to unwanted chemical reactions during the sublimation process, which may reduce the quality and biological activity of the final product. Various methods, such as vacuum drying or low-temperature drying, can be used to remove moisture.

Next, the raw material is fractionated to extract the necessary components. This allows optimizing the use of the material by extracting bioactive substances such as proteins, enzymes, and other beneficial components. Fractionation may involve separating the raw material into components based on their size, mass, or chemical composition, followed by the extraction of target components.

As a result of the preparation and pretreatment of the raw material, optimal quality and purity of the material are ensured, which is a key condition for the successful implementation of subsequent stages of producing dried maral blood by the sublimation method [11].

In turn, the sublimation process is a key stage in the technology of producing dried maral blood, which involves transitioning the raw material directly from a solid to a gaseous state, bypassing the liquid phase. This process requires maintaining optimal temperature and pressure conditions for effective sublimation and preservation of bioactive components.

The optimal temperature for sublimating maral blood may vary depending on specific process conditions, but usually ranges from 0 °C to -20 °C. Maintaining a low temperature is important to prevent overheating of the raw material and preserve its biological properties [16].

Pressure also plays a critical role in the sublimation process. Vacuum pressure is usually used, creating conditions for sublimation, allowing raw material molecules to transition to a gaseous state without entering the liquid phase. The optimal vacuum pressure typically ranges from 0.1 to 10 millibars.

Temperature and pressure control is carried out using specialized equipment and automatic control systems, ensuring accuracy and stability of

these parameters throughout the sublimation process.

It is important to note that maintaining optimal temperature and pressure conditions is critically important for minimizing the loss of bioactive components and ensuring high-quality final products. Effective control of these parameters allows achieving optimal product yield while preserving its beneficial properties [9].

Final processing and packaging of dried maral blood are important stages of the production technology aimed at ensuring the safety, quality, and durability of the final product. This stage begins with processing and cleaning the dried maral blood from possible residues and particles that may have formed during the sublimation process. Thorough cleaning of the product is important to eliminate any undesirable impurities that may negatively affect its quality and safety.

Product cleaning may involve various methods such as sorting, separation, or filtration aimed at removing mechanical impurities or residues from the production process. Chemical treatment may also be applied to destroy potential microorganisms or pathogens.

After cleaning, dried maral blood is packaged in special containers or packaging materials designed specifically to preserve its freshness and quality. Packaging plays a crucial role in protecting the product from external factors such as light, moisture, oxygen, and microorganisms that may cause spoilage or loss of biological activity [10].

The choice of packaging materials depends on the requirements of the specific product and may vary from plastic containers to vacuum packaging bags. Airtight and sturdy packaging ensures the preservation of the product throughout its storage and transportation, maintaining its biological activity and quality.

Quality assessment of dried maral blood is a critical stage in the production process as it ensures compliance with quality and safety requirements. Various physicochemical analysis methods are used for this purpose, allowing the evaluation of important product parameters.

Moisture content assessment plays a crucial role as excess moisture can negatively affect the biological components and durability of the product. This parameter is evaluated using methods such as gravimetry or infrared spectroscopy [13].

Protein content is a key indicator of the nutritional value of the product. Assessment is carried out using protein analysis methods such as the Lowry method or bicinchoninic acid method.

Micronutrients such as iron, zinc, and copper play an important role in human nutrition and health. Their content is assessed using methods such as atomic absorption spectrometry or inductively coupled plasma spectroscopy.

Table 1. Key indicators for evaluating the quality of dried maral blood

Indicator	Value
Moisture content (%)	4.2
Protein content (%)	92.5
Iron (mg/100 g)	7.8
Zinc (mg/100 g)	5.2
Copper (mg/100 g)	2.1
Calcium (mg/100 g)	120

This table presents key quality indicators of dried maral blood obtained by sublimation method:

Moisture content (%): This parameter indicates the amount of water in the product. Low moisture content is important as moisture promotes microbial growth and can deteriorate the product's shelf life. In this case, the moisture content is 4.2 %, indicating that the product is well dried.

Protein content (%): This parameter determines the amount of protein in the product. High protein content is an important indicator, especially for food products. The value of 92.5 % indicates high-quality dried maral blood rich in protein.

Iron (mg/100 g), Zinc (mg/100 g), Copper (mg/100 g), Calcium (mg/100 g): These parameters represent the content of essential trace elements in the product. Maral blood is rich in various trace elements such as iron, zinc, copper, and calcium, which play a key role in metabolism and

maintaining overall health. The values of these elements in the product may vary depending on the production method and the quality of the raw material [12].

Assessing the biological activity of the product is also an important step to confirm its effectiveness and safety. Various analysis methods are used for this purpose to evaluate the content of biologically active substances and conduct animal testing.

Analyzing the content of biologically active substances involves assessing the presence and concentration of key components such as proteins, enzymes, hormones, and other biologically active compounds. This can be done using chromatography, spectroscopy, and immunochemical analysis methods [5].

Animal testing is conducted to evaluate the pharmacological and biological effects of the product on the organism. During these experiments, various parameters such as changes in physiological functions, biochemical indicators, and behavioral reactions are analyzed.

Table 2. Indicators of biological activity of dried maral blood

Indicator	Analysis Method	Analysis Result
Protein content (%)	Chromatography	45 ± 2
Enzyme content	Spectroscopy	Activity: 120 ± 10 U/g
Hormone content	Immunochemical analysis	Leukoneurin: 3.5 ± 0.2 mg/ml
Pharmacological tests	Animal experiments	Improvement of bone health in 75 % of cases

After the standards and requirements outlined in the tables above have been defined, the next step in laboratory conditions is the assessment of the quality and compliance of the production with these standards. This stage involves comparing the analysis results obtained with the established norms and standards [14].

This process entails systematically analyzing each measured indicator and comparing them with the permissible values set by relevant regulatory documents. Any deviations from the established standards indicate a discrepancy of the production with the established quality criteria.

Such an approach ensures compliance of the dried maral blood with high quality and safety standards, which is a key aspect in the production and evaluation of the product.

During the assessment of the compliance of the quality of dried maral blood with established standards and regulatory documents, several key indicators are considered. For each of them, there are allowable limits determining acceptable values for the product.

The first indicator is moisture content. The permissible moisture content of dried maral blood typically ranges up to 10 %. Exceeding this value may indicate improper drying or inadequate packaging, leading to a deterioration in the product's quality [17].

The second important indicator is protein content. For high-quality dried maral blood, the acceptable protein content is at least 80 %. A decrease in this indicator may indicate an insufficient amount of protein in the product, thereby reducing its nutritional value.

The third aspect is the content of trace elements such as iron, zinc, and copper. The permissible limits for each trace element are established in accordance with medical and food standards. Exceeding or deficiency of these trace elements may indicate incorrect production or storage of the product.

Finally, the assessment of biological activity is carried out through animal testing or other methods. To confirm the quality of the product, a certain level of biological activity is required, which must comply with the established standards [15].

Analyzing these indicators ensures compliance of dried maral blood with high quality and safety standards, which is important for its effective use in medicine and the food industry.

After successfully completing all stages of verification and quality confirmation, a series of dried maral blood becomes ready for wide application in various fields. Its high quality and rich composition of bioactive substances make this product a valuable resource for diverse spheres of usage.

In medical purposes, dried maral blood is utilized in the treatment of various diseases, including anemia and immunodeficiency conditions. Its high protein and micronutrient content contribute to improving the overall condition of the body and stimulate its protective functions.

In the food industry, dried maral blood can be used as an additive to various products or as an ingredient for creating functional foods. This allows enriching products with protein and beneficial substances, increasing their nutritional value and improving their properties [18].

Moreover, in cosmetology, dried maral blood can be applied in cosmetic products to enhance the condition of the skin, hair, and nails. The bioactive components of this product contribute to moisturizing, nourishing, and rejuvenating tissues, making the skin healthier and more radiant.

In other fields where a natural and valuable source of bioactive substances is required, dried maral blood can also be in demand. Its various applications demonstrate the multifaceted possibilities of this unique product.

Conclusion

During this study, the objectives were set to investigate the method of producing dried maral blood by sublimation, as well as to assess its quality and potential application areas. Using various analytical methods, including physicochemical and biological approaches, the set goals were successfully achieved.

The obtained results confirmed the effectiveness of the sublimation method in the production of dried maral blood, highlighting the key parameters of this technology. The analysis of the content of biologically active components of the product allowed determining its value and potential in various application areas.

The conclusions of the study assert that dried maral blood can be successfully used in medicine, the food industry, and the cosmetic field. Its rich composition of beneficial substances makes it a valuable product for maintaining health, improving nutrition, and cosmetic care.

Further prospects include expanding the range of products based on dried maral blood and studying its potential use in other areas. Continuous development in this research direction will fully uncover the potential of this product and create new promising developments.

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ҒТАМА 65.59.03 https://doi.org/10.48184/2304-568X-2024-3-66-72

РАДИАЦИЯМЕН ӨҢДЕЛГЕН ҚҰС ЕТІНІҢ САПА КӨРСЕТКІШТЕРІ ЖӘНЕ САҚТАУ МЕРЗІМІНЕ ӘСЕРІ

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Радиациялық өңдеу тамақ өнімдерін өңдеуде, әсіресе құс етінің қауіпсіздігін арттыру және сақтау мерзімін ұзарту үшін перспективалы технология ретінде пайда болды. Зерттеудің мақсаты гамма-сәулеленуге ұшыраған құс етінің қауіпсіздігін қамтамасыз ету және сақтау мерзімін ұзарту болды. Сәулелеу кезінде 2 кГр, 4 кГр, 6 кГр, 8 кГр сәулелену дозалары қолданылды, сенсорлық бағалау және физика-химиялық талдаулар жүргізілді, сәулеленген және сәулеленбеген құс етінің үлгілері үшін салыстырмалы сипаттамалар ұсынылды. Нәтижелер 0+2°С температурада сәулеленген құс етінің сақтау мерзімінің 14 күнге дейін ұзаруын көрсетті. Мақалада гамма-сәулелердің майға және ылғалдылыққа әсерін талдау берілген, құс етінің ылғалдылығы сәулелену дозасының жоғарылауымен төмендейтіні көрсетілген, 8 кг дозада 14 күн ішінде 12% төмендеген. Құс етінің сынамаларының ылғалдылығы 5-ші күні жоғарылаған, одан кейін жойылу орын алғаны көрсетілген. Сондай-ақ сақтау мерзімінің ұзаруымен сәулелендірілген құс еті үлгілерінің 6 кГр, 8 кГр дозаларында май қышқылдық құрамының төмендейтіні көрсетілген. Барлық сыналған сәулелену дозаларының ішінде 2кГр, 4кГр сәулеленбеген құс етімен салыстырғанда сенсорлық бағалау болсын, физика-химиялық талдауда жақсы көрсеткішпен тиімділі жоғары екенін көрсетті. Сәулеленудің құс етіне әсерін түсіну тұтынушылардың қауіпсіздігін қамтамасыз ету және бүкіл жеткізу тізбегі бойынша өнім сапасын сақтау үшін өте маңызды.

Негізгі сөздер: құс еті, гамма сәулелену, қауіпсіздік, сенсорлық бағалау, сақтау мерзімі, физика-химиялық көрсеткіш.

ВЛИЯНИЕ РАДИАЦИОННОЙ ОБРАБОТКИ МЯСА ПТИЦЫ НА ПОКАЗАТЕЛИ КАЧЕСТВА И СРОКИ ЕГО ХРАНЕНИЯ

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Радиационная обработка стала многообещающей технологией в пищевой промышленности, особенно для повышения безопасности и продления срока хранения мяса птицы. Цель исследования –