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**RESEARCH OF SAFETY AND QUALITY PARAMETERS
OF THE MECHANICALLY SEPARATED POULTRY MEAT**

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The initial stage in the production of poultry products is cutting of carcasses into parts, the separation of meat from the breast and legs, the deboning of low-value raw materials by the separation of muscle and bone tissue. Mechanical deboning of meat and bone residues is performed in order to obtain valuable protein-containing raw materials – mechanically deboned meat, in particular, mechanically separated poultry meat. **Relevance of the topic** – Introduction of advanced technologies in the domestic poultry processing industry. **The subject of research** is the parameters of safety and quality of mechanically separated poultry meat. **The purpose of the work** is to study the safety and quality parameters of mechanically separated poultry meat, to determine the most acceptable physical and chemical parameters, including the content of bone inclusions, calcium and total phosphorus. **Research methods.** Determination of physical and chemical parameters of mechanically separated poultry meat: mass fraction of moisture, mass fraction of fat, mass fraction of protein, as well as microbiological parameters was carried out according to standard methods. Statistical processing of the results obtained was carried out on the basis of calculating the arithmetic mean values and the mean square error. **Research results** Under the action of the separation pressure, bone tissue is destroyed, and the smallest particles necessarily enter the meat mass as a result. The number and size of bone inclusions are regulated by normative documents and, accordingly, affect the quality and safety of mechanically separated poultry meat and products made from it. The greater the separation pressure, and hence the yield, the greater the total mass fraction of fat in mechanically separated poultry meat at the outlet is obtained, the decrease in the fat content and the degree of grinding brings its quality parameters closer to the characteristics of manually deboned and then minced meat. The most acceptable values of physical and chemical parameters of mechanically separated poultry meat have been determined: mass fraction of protein – 14%, mass fraction of fat – 12%, mass fraction of moisture – 73%; safety indicators: mass fraction of bone inclusions – 0.3%, mass fraction of calcium – 0.07%, mass fraction of total phosphorus – 0.25%. In terms of microbiological parameters, mechanically separated poultry meat met the requirements of “Microbiological criteria for establishing safety parameters of food products”.

Keywords: poultry meat, deboning, mechanically deboned poultry meat, mechanically separated poultry meat, bone inclusions

ДОСЛІДЖЕННЯ ПОКАЗНИКІВ БЕЗПЕЧНОСТІ ТА ЯКОСТІ
М'ЯСА ПТИЦІ МЕХАНІЧНО ВІДОКРЕМЛЕНОГО

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Початковою стадією виробництва продуктів із м'яса птиці є розділення тушок на частини, виділення кускового м'яса з грудки та ніг, обвалювання малоцінної сировини сепаруванням м'язової та кісткової тканини. Механічне обвалення м'ясо-кісткових залишків виконують з метою отримання цінної білкової сировини – м'яса механічної сепарації, зокрема м'яса птиці механічно відокремленого. **Актуальність теми.** Впровадження передових технологій в вітчизняній птахопереробній галузі. **Предмет досліджень** – показники безпеки та якості м'яса птиці механічно відокремленого. **Мета роботи** – дослідження показників безпеки та якості м'яса птиці механічно відокремленого, визначення найбільш прийнятних фізико-хімічних показників, зокрема масової частки кісткових включень, кальцію, та загального фосфору. **Методи досліджень.** Визначення фізико-хімічних показників м'яса птиці механічно відокремленого: масової частки волог, масової частки жиру, масової частки білка, а також мікробіологічних показників виконували згідно зі стандартними методами. Статистичне оброблення отриманих результатів виконували на основі підрахунку середньоарифметичних значень і середньої квадратичної похибки. **Результати досліджень** Під дією тиску сепарації відбувається руйнування кісткової тканини, внаслідок чого найдрібніші частинки неодмінно потрапляють у м'ясну масу. Кількість і розміри кісткових включень регламентується нормативними документами і, відповідно, впливають на якість та безпеку м'яса птиці механічно відокремленого та продуктів, вироблених з нього. Чим більший тиск сепарації, а отже і вихід, тим отримується більша загальна масова частка жиру у м'яса птиці механічно відокремленого на виході, зменшення вмісту жиру і ступеня подрібнення наближає показники його якості до характеристик фаршу ручного обвалювання. Визначено найбільш прийнятні значення фізико-хімічних показників м'яса птиці механічно відокремленого: масова частка білка – 14%, масова частка жиру – 12%, масова частка волог – 73%; показників безпеки: масова частка кісткових включень – 0,3%, масова частка кальцію – 0,07%, масова частка загального фосфору – 0,25%. За мікробіологічними показниками м'ясо птиці механічно відокремлене відповідало вимогам «Мікробіологічних критеріїв для встановлення показників безпеки харчових продуктів»

Ключові слова: м'ясо птиці, обвалювання, м'ясо птиці механічного обвалювання, м'ясо птиці механічно відокремлене, кісткові включення

Formulation of the problem. Proteins of animal origin are an important element of a healthy diet – of special categories, both children and the elderly people, as well as other

consumers [1-3]. Both world and national experience proves that the fastest and most acceptable from an economic point of view to provide the population with protein products of animal origin is the production of poultry meat and various foods from it – now 75% of raw materials used by Ukrainian meat processing enterprises are poultry meats [4].

According to [5], the production of poultry meat all over the world is growing every year, and the consumption of this is also growing, especially in the form of parts of carcasses and products of deep processing. It is known that the initial stage in the manufacturing of poultry meat products is the division of carcasses into parts, the separation of meat pieces from the breast and legs, the deboning of low-value raw materials by the separation of muscle and bone tissue. Mechanical separation of meat and bone residues is performed in order to obtain a valuable protein-containing raw material – mechanically separated meat, in particular, mechanically deboned poultry meat (MDPM), according to its physical and chemical properties, similar to minced poultry meat, separated from bones by hand. However, MDPM is distinguished by a high content of bone tissue, bone marrow, connective tissue and fat [6-8]. According to the EU regulations [9], the requirements for mechanical separation of meat obtained using methods that do not change the structure of meat and bone, and methods that change the specified structure and, thus, significantly increase the calcium content in comparison with hand-deboned meat, significantly differ. The nature of this difference can be determined only through scientific research [10-13]. According to the norms in force in Ukraine [14], all meat of mechanical separation is called “meat separated by mechanical means”. If the said separation is made without changing the structure of the tissues, such a mass is called “mechanically separated meat” (MSM), if the technical means did not allow such a change in the structure to be avoided, the mass is called “mechanically deboned meat”.

The deboning of meat is one of the most important stages of poultry processing, during which the skin, tendons, ligaments and muscles are separated from the poultry carcass using special hand tools and the mechanical equipment. Despite the fact that it is possible to carry out the separation of meat by hand, it is the mechanical separation process that allows preserving the maximum amount of vitamins in the minced meat (especially vitamins of groups C and B). The problem of effective separation of meat and bone raw materials entails a number of technological issues that certainly arise in production. Numerous studies, confirmed in practice, have revealed an inversely proportional dependence of the quality parameters of MSM on the output of finished products. The quality of separated poultry meat is most influenced by the amount of muscle tissue containing a large amount of protein. An increase in yield causes undesirable changes in the quality of mechanically deboned meat due to a violation of the ratio of its components, in particular connective tissue, bone tissue and bone marrow.

MSM is obtained by mechanical separation of flesh tissue from bones from eviscerated poultry carcasses or their parts, in which the calcium content is insignificantly higher than that for the minced meat (but not more than 0.07%). Accordingly, from MSM it is possible to produce semi-finished products intended for consumption with preheating, instead, MDPM can only be used for the production of meat products that undergo heat treatment. The MSM is not subject to the norms of regulatory documents that restrict or prohibit the use of mechanical deboned meat in sausages and other products of the minced meat [15].

Modern equipment for producing MSM is represented by separating devices with a sufficiently high pressure (up to 6 MPa – for belt separators, up to 12 MPa – for screw separators), which causes the destruction of bone tissue and the release of bone marrow, which leads to a change in the chemical composition of meat. Despite this, poultry meat, after mechanical separation, has the properties typical for conventional comminuted meats. Based on this, the study of technological modes of operation of equipment for the mechanical separation of poultry meat and their impact on safety and quality parameters is of scientific and practical interest. In general, the use of mechanical deboning of poultry carcasses and their parts makes it possible to increase the yield of raw meat by (20-25)% in comparison with manual

deboning [16]. On the other hand, it is very important for manufacturers of meat products to know the properties and composition of the mass obtained by mechanical deboning, since otherwise it is impossible to achieve a stable quality of products with its use [17].

The subject of research – safety and quality parameters of the mechanically deboned poultry meat.

The purpose of the study – research of safety and quality parameters of mechanically separated poultry meat, determination of the most relevant physical and chemical parameters, in particular the content of bone inclusions, calcium and total phosphorus.

Materials and methods. To solve this problem, experimental studies were carried out. To carry out the work, experimental industrial samples of mechanically separated poultry meat produced in industrial conditions by Khodorovsky Meat Processing Plant LLC and Vladimir-Volynskaya Poultry Factory PJSC were used as the object of research.

The determination of the MSM parameters was carried out using the following methods:

- determination of the mass fraction of moisture – according to DSTU ISO 1442:2005 [18];
- determination of the mass fraction of fat – according to DSTU 8380:2015 [19];
- determination of the mass fraction of protein – according to DSTU ISO 937:2005 [20];
- determination of microbiological indicators - according to DSTU EN 12824:2004 [21]; DSTU ISO 4833:2006 [22]; DSTU ISO 16649-2:2014 [23]; GOST 702.2.5-93 [24].

Statistical processing of the obtained results was carried out on the basis of calculating the arithmetic mean values and the mean square error.

The results of the study

In the industrial conditions of Khodorovsky Meat Processing Plant LLC and Vladimir-Volynskaya Poultry Factory PJSC experimental / industrial samples of mechanically separated poultry meat were made. Production of mechanically separated poultry meat was carried out on belt press separators of the BAADER type and on screw press separators of the LIMA type.

Analyzing the data of our own research and relying on the experience of producers and scientists working in the field of mechanical separation of meat and bone raw materials, we can highlight the main thing – the pressure of separation and its impact on the quality and safety of MSM.

Under the action of the separation pressure, bone tissue is destroyed, as a result of which the smallest particles necessarily get into the meat mass. The number and size of bone inclusions are regulated by regulations and, accordingly, affect the quality and safety of MSM and products made from it.

To ensure the development of high-quality and alimentary safe MSM, it is recommended to adjust the equipment to the norms of MSM yield and bone residue (Table 1).

Table 1

Recommended rates of MMV output and bone residue

Raw materials	Yield, % of raw materials	
	MSM	Bone residue
<u>Chickens, broilers:</u>		
2 category	73.0	26.8
lean	64.0	35.8
<u>Hens:</u>		
2 category	68.0	31.8
lean	66.0	38.5
<u>Carcasses, necks (without skin), wings:</u>		
hens, chickens, broilers, turkeys	60.0	39.8

The adjustment of the equipment for an increased meat yield of the mechanical separation of the cartridge carcass of poultry and its individual parts leads to an increased content of bone marrow and bone inclusions in the raw material, which in turn causes a significant deterioration in the quality of this type of raw material and products from it.

Order of the Ministry of Health of Ukraine on 08/06/2013 No. 694 "On the adoption of hygienic requirements for poultry meat and certain parameters of its quality" [14] regulates some safety and quality parameters, in particular the calcium content, the mass fraction of which in MSM should not exceed 0.07%.

The obtained research data confirm the relationship between individual parameters – the mass fraction of calcium and bone inclusions and their dependence on technological factors (yield, separation pressure). According to the research data, a diagram is built, shown in Figure 1, which shows the dependence of the main quality and safety parameters of MSM samples manufactured in different conditions (different yield values).

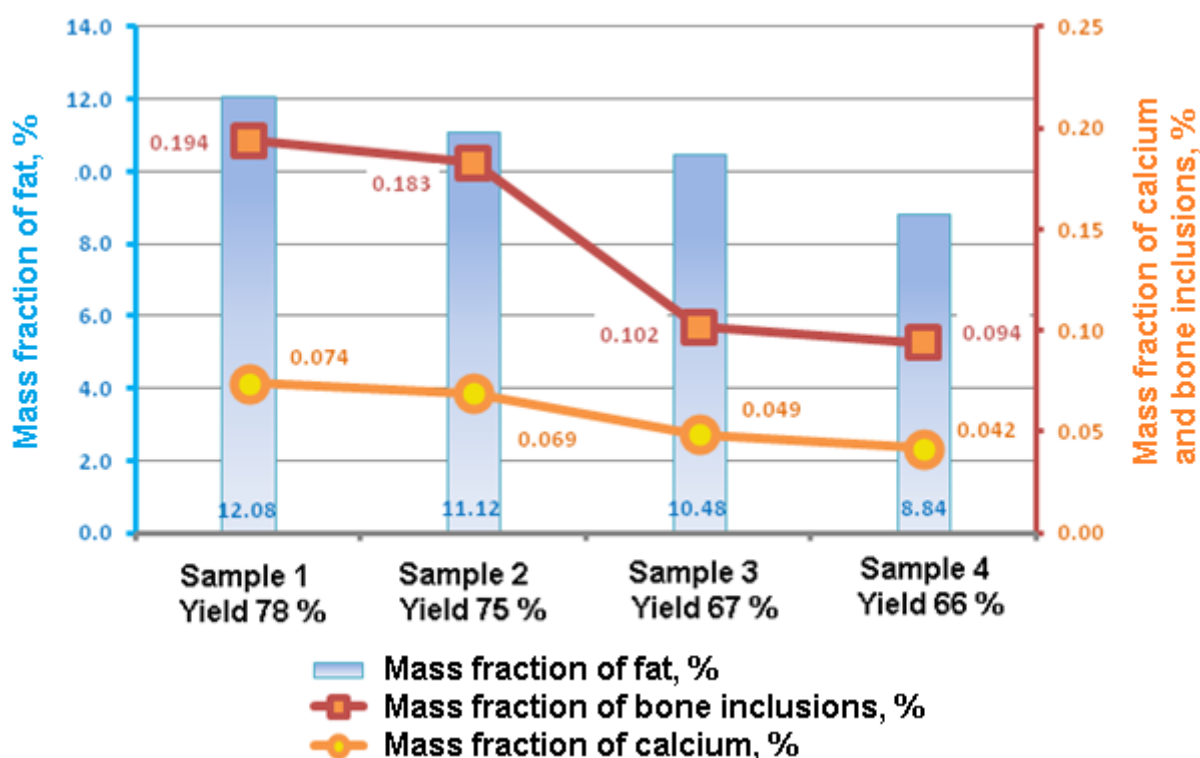


Fig. 1. Dependence of safety and quality parameters of MSM upon the yield of the processed mass

One of the most significant factors affecting the difference in quality parameters of the MSM in comparison with hand-deboned minced meat is a noticeable increase in the fat content, which is achieved by the ingestion of additional lipids from the bone marrow, subcutaneous adipose tissue, skin and abdominal fat into the separated meat. The higher the separation pressure, and hence the yield, the greater the total mass fraction of fat in the MSM at the outlet. Reducing the fat content and the degree of mincing brings the quality characteristics of the MSM closer to the characteristics of hand-deboned minced meat. This can be achieved by using raw materials with a lower fat content for the production of MSM and by reducing the processing pressure together with the speed of grinding the raw materials. Usually, such measures reduce the yield of the product for production, but significantly improve its quality.

Taking into account and analyzing the data of studies of samples produced at different enterprises, the most acceptable values of physical, chemical and safety parameters of the mechanically separated poultry meat were determined, these being shown in Table 2.

Table 2

Physical, chemical and safety parameters of the mechanically separated poultry meat

Unit of measurement	Parameter	Limit	Norm	Determination method
Mass fraction, %	Moisture	max.	73	DSTU ISO 1442:2005 [18]
	Protein	min.	14	DSTU ISO 937:2005 [20]
	Fat	max.	12	DSTU 8380:2015 [19]
	Calcium	max.	0.07	TU U 10.1 – 00419880 – 153:2020 [25]
	Phosphorus	max.	0.25	
	Bone inclusions, overall content	max.	0.3	
Mass fraction of overall mass of bone inclusions, %	≤ 500 μm	min.	98	
	> 500 μm, ≤ 750 μm	max.	2	
mg / 100g	Content of volatile fatty acids	max.	8	
% of iodine	Peroxide value	max.	0.25	
mg KOH / g of fat	Acid value of fat	max.	3	
°C	Mass temperature at the outlet of a separator	max.	8	

The values of the microbiological parameters of MSM (QMAFAnM, number of the bacteria of the group of *Escherichia coli*, pathogenic microorganisms, in particular bacteria of the genus *Salmonella*) comply with the requirements of “Microbiological criteria for establishing safety parameters of food products” [26]. The values of the microbiological parameters are given Table 3.

Table 3

Microbiological parameters of the mechanically separated poultry meat

Parameter	Norm	Determination method
The number of mesophilic aerobic and facultative anaerobic microorganisms (QMAFAnM), CFU in 1.0 g, not exceeding	from $5 \cdot 10^5$ to $5 \cdot 10^6$	DSTU ISO 4833:2006 [22]
Bacteria of the group of <i>Escherichia coli</i> , in 1.0 g	not allowed	DSTU ISO 16649-2:2014 [23]
Pathogenic microorganisms, in particular bacteria of the genus <i>Salmonella</i> , in 25 g	not allowed	DSTU EN 12824:2004 [21]
<i>L. Monocytogenes</i> , in 25 g	not allowed	GOST 702.2.5-93 [24]

Conclusion

Safety and quality parameters of mechanically separated poultry meat have been studied. The most acceptable values of physical and chemical parameters have been determined: mass fraction of protein – 14 %, mass fraction of fat – 12 %, mass fraction of moisture – 73%; safety indicators: mass fraction of bone inclusions – 0.3 %, mass fraction of calcium – 0.07 %, mass fraction of total phosphorus – 0.25%.

References

1. Pashneva, A. Y., Efimova, O. G. (2021). Food products of animal origin. *Gorin Conference. Innovative Solutions for Agrarian and Industrial Complex (24-25 February 2021)*, Vol. 3, 228.
2. Procópio, A. F., Fonseca, I. C., Picoli, L. T., de Mello, J. F. (2021). Deficiência no consumo de proteína de origem animal no envelhecimento. *Revista Faculdades do Saber*, 6(13), 911-921.
3. Elmadfa, I., Meyer, A. L. (2017). Animal proteins as important contributors to a healthy human diet. *Annual review of animal biosciences*, 5, 111-131. <http://doi.org/10.1146/annurev-animal-022516-022943>.
4. Bondar, S. V., Okhrimenko, Yu. I., Klishchova, T. Yu., Verbytskyi, S. B. (2015). Resultaty porivnialnykh doslidzhen vlastyvostei riznykh vydiv miasa ptitsi vidokremlenoho za dopomohoiu mekhanichnykh zacobiv [Results of comparative research of different poultry meats separated with the use of mechanical appliances]. *Prodovolchi resursy [Food Resources]*, 5, 64-71 [In Ukrainian].
5. Abaldova, V. A., Mazur, V. M. (2014). Razrabotka otechestvennykh pressov mekhanicheskoi obvalki miasa ptitsy: tekhnologiya i tekhnika [Development of domestic presses for the mechanical deboning of poultry meat: technology and technique]. *Ptitsa i ptitseprodukty [Poultry and Poultry Products]*, 5, 36-38 [In Russian].
6. Guerra, A., Andújar, G., Santos, R., Martín, M. (2003). *Carne de aves y cerdo deshuesadas mecánicamente: obtención, características y utilización*. La Habana : Editorial Universitaria, 134 p. [In Spanish]
7. Guerra, M. A., Martín, M., Herrera, H., de Hombre, R., Núñez de Villavicencio, M., Barrero, E. (2007). Efecto de la carne de ave separada mecánicamente sobre la calidad de hamburguesas. *Ciencia y Tecnología de Alimentos*, 17(2), 22-25. [In Spanish]
8. Bondar, S., Voitsekhivska, L., Okhrimenko, Yu., Verbytskyi, S. (2018). Vliianie konstruktsii i tekhnologicheskikh rezhimov raboty separiruiushchikh ustroystv na kachestvo miasa ptitsy mekhanicheskii otdelenogo [Effect of design and technological regimes of functioning of separating appliances on quality of mechanically separated poultry meat. *Mekhanika i tekhnologii [Mechanics and Technologies]*, 4(62), 78-89 [In Russian].
9. Council E.U. Regulation (EC) No 853/2004 of the European parliament and of the council of 29 April 2004 laying down specific hygiene rules for food of animal origin. (2004). Eur. Union, 55-205.
10. Cegiela, A., Kuczynska, N., Pietrzak, D. (2014). Zastąpienie surowca wieprzowowego w kielbasach homogenizowanych przez mięso drobiowe oddzielone mechanicznie, uzyskane po separacji wysoko- i niskociśnieniowej. *Żywność Nauka Technologia Jakość*, 21(3), 123-135. <https://doi.org/10.15193/zntj/2014/94/123-135>. [In Polish].
11. Henckel, P., Vyberg, M., Thode, S., Hermansen, S. (2004). Assessing the quality of mechanically and manually recovered chicken meat. *LWT-Food Sci. and Technol.*, 37(6), 593-601. <https://doi.org/10.1016/j.lwt.2004.01.006>.
12. Yeresko, G., Cherednichenko, G., Bondar, S., Verbytskyi, S. (2017). Effect of raw materials nomenclature and their temperature upon safety and quality parameters of mechanically separated poultry meat. *Ukrainian Journal of Food Science*, 5(1), 6-16. <https://doi.org/10.24263/2310-1008-2017-5-1-3>.
13. Nagy, J., Lenhardt, L., Korimová, L., Dičáková, Z., Popelka, P., Pipová, M., Tomková, I. (2007). Comparison of the quality of mechanically deboned poultry meat after different methods of separation. *Meso*, 9(2), 92-95.
14. Nakaz pro zatverdzhennia hihienichnykh vymoh do miasa ptitsi ta okremykh pokaznykiv yoho yakosti [Order on the adoption of hygienic requirements for poultry meat and certain parameters of its quality] of 08 August 2013 № 694 / Ministry of Health of Ukraine.

Registered in Ministry of Justice on 13 August 2013 № 1379/23911. Available at: <http://zakon.rada.gov.ua/laws/show/z1379-13> [In Ukrainian].

15. Sychevskiy, M., Voitsekhivska, L., Kopylova, K., Verbytskyi, S., Okhrimenko, Yu. (2021). Criterial features of the structural characteristics of fine-textured poultry meat. *Food Science and Technology*, 15(1), 91-100. DOI: <https://doi.org/10.15673/fst.v15i1.1965>.

16. Khvyliya, S. I. (2001). Problemy otsenki kachestva miasa mekhanicheskoi obvalki [Problems of quality evaluation of mechanically deboned meat]. *Vsio o miase [All about Meat]*, 4, 5-7 [In Russian].

17. Ortiz, L. (2021). Cómo evaluar una materia prima a través de su ficha técnica. *CarneTec*. Disponible en: <https://www.carnetec.com/Industry/Blogs/Details/101818>. [In Spanish]

18. DSTU ISO 1442:2005 *Miaso ta miasni produkty. Metod vyznachennia vmistu vology (kontrolnyi metod) [Meat and meat products. Determination of moisture content (reference method)]*: in force from 2008-03-01. K. : Derzhspozhyvstandart Ukrainy, 2007. 8 p. [In Ukrainian].

19. DSTU 8380:2015 *Miaso ta miasni produkty. Metod vyznachennia masovoi chastky zhyru [Meat and meat products. Method for measuring the mass fraction of fat]*: in force from 2017-07-01. – K. : DP UkrNDNTs, 2017. 9 p. [In Ukrainian].

20. DSTU ISO 937:2005 *Miaso ta miasni produkty. Metod vyznachennia vmistu azotu (kontrolnyi metod) [Meat and meat products. Determination of nitrogen content (reference method)]*: in force from 2007-07-01. – K. : Derzhspozhyvstandart Ukrainy, 2007. 10 p. [In Ukrainian].

21. DSTU EN 12824:2004 *Mikrobiologhiia kharchovykh produktiv i kormiv. Horizontalnyi metod vyiavlennia Salmonella [Microbiology of food and animal feeding stuffs Horizontal method for the detection of Salmonella]*: in force from 2005-07-01. K. : Derzhspozhyvstandart Ukrainy, 2007. 21 p. [In Ukrainian].

22. DSTU ISO 4833:2006 *Mikrobiologhiia kharchovykh produktiv i kormiv dlia tvaryn. Horizontalnyi metod pidrakhunky mikroorhanizmiv. Tekhnika pidrakhuvannia kolonii za temperatury 30 °C [Microbiology of food and animal feeding stuffs. Horizontal method for the enumeration of microorganisms Colony-count technique at 30 °C]*: in force from 2007-10-01. K. : Derzhspozhyvstandart Ukrainy, 2006. 11 p. [In Ukrainian].

23. DSTU ISO 16649-2:2014 *Mikrobiologiya harchovih produktiv i kormiv dlya tvarin. Gorizontal'nij metod pidrahuvannya β -glyukuronidaza-pozitivnih Escherichia coli. Castina 2. Tekhnika pidrahuvannya kolonij za teperaturi 44°C z vikoristannyam 5-bromo-4-hloro-3-indolil- β -D-glyukuronidu [Microbiology of food and animal feed. Horizontal method of counting β -glucuronidasepositive Escherichia coli. Part 2: Technique for counting colonies at a temperature of 44°C using 5- bromo-4-chloro-3-indolyl- β -D-glucuronide]*: in force from 2015-07-01. K. : DP UkrNDNTs, 2014. 11 p. [In Ukrainian].

24. GOST 702.2.5-93 *Miaso ptitsy, subprodukty i polufabrikaty ptichi. Metody vyiavleniia i opredeleniia kolichestva listerell [Poultry meat, edible offal, ready-to-cook products. Methods for detection and quantity determination of Listeria]*: in force from 1995-01-01. M. : IPK Izdatelstvo Standartov, 2010. 7 p. [In Russian].

25. TU U 10.1 – 00419880 – 153:2020 *Miaso ptytsi mekhanichno vidokremlene. Tekhnichni umovy [Mechanically separated poultry meat. Specifications]*: in force from 2020-08-20. K. : IPR NAAN, 2020. 28 p. [In Ukrainian].

26. *Nakaz pro zatverdzhennia Mikrobiologichnykh kryteriiv dlia vstanovlennia pokaznykiv bezpechnosti kharchovykh produktiv [Order on the adoption of Microbiological criteria for establishing safety parameters of food products]* 19 July 2012 № 548 / Ministry of Health of Ukraine. – Registered in Ministry of Justice on 3 August 2012 № 1321/21633. Available at: <http://zakon.rada.gov.ua/laws/show/z1321-12#Text> [In Ukrainian].