ISSN 2518-1491 (Online),
ISSN 2224-5286 (Print)

ҚАЗАҚСТАН РЕСПУБЛИКАСЫ
ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫНЫҢ

Д.В. Сокольский атындағы
«Жанармай, катализ және электрохимия институты» АҚ

Х А Б А Р Л А Р Ы

ИЗВЕСТИЯ

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
РЕСПУБЛИКИ КАЗАХСТАН

АО «Институт топлива, катализа и
электрохимии им. Д.В. Сокольского»

N E W S

OF THE ACADEMY OF SCIENCES
OF THE REPUBLIC OF KAZAKHSTAN

JSC «D.V. Sokolsky institute of fuel,
catalysis and electrochemistry»

SERIES
CHEMISTRY AND TECHNOLOGY

2 (455)

APRIL – JUNE 2023

PUBLISHED SINCE JANUARY 1947

PUBLISHED 4 TIMES A YEAR

«ҚР ҰҒА Хабарлары. Химия және технология сериясы»
ISSN 2518-1491 (Online),
ISSN 2224-5286 (Print)

Меншіктенуші: «Қазақстан Республикасының Ұлттық ғылым академиясы» РҚБ (Алматы қ.).Қазақстан Республикасының Ақпарат және қоғамдық даму министрлігінің Ақпарат комитетінде 29.07.2020 ж. берілген **№ KZ66VPY00025419** мерзімдік басылым тіркеуіне қойылу туралы куәлік.

Тақырыптық бағыты: *органикалық химия, бейорганикалық химия, катализ, электрохимия және коррозия, фармацевтикалық химия және технологиялар.*

Мерзімділігі: жылына 4 рет.

Тиражы: 300 дана.

Редакцияның мекен-жайы: 050010, Алматы қ., Шевченко көш., 28, 219 бөл., тел.: 272-13-19 *http://chemistry-technology.kz/index.php/en/arhiv*

Редакцияның мекенжайы: 050100, Алматы қ., Қонаев к-сі, 142, «Д.В. Сокольский атындағы отын, катализ және электрохимия институты» АҚ, каб. 310, тел. 291-62-80, факс 291-57-22, e-mail:orgcat@nursat.kz
Типографияның мекен-жайы: «Аруна» ЖК, Алматы қ., Мұратбаев көш., 75.

«Известия НАН РК. Серия химии и технологий».
ISSN 2518-1491 (Online),
ISSN 2224-5286 (Print)
Собственник: Республиканское общественное объединение «Национальная академия наук Республики Казахстан» (г. Алматы).
Свидетельство о постановке на учет периодического печатного издания в Комитете информации Министерства информации и общественного развития Республики Казахстан **№ KZ66VPY00025419,** выданное 29.07.2020 г. Тематическая направленность: *органическая химия, неорганическая химия, катализ, электрохимия и коррозия, фармацевтическая химия и технологии.*
Периодичность: 4 раз в год.
Тираж: 300 экземпляров.
Адрес редакции: 050010, г. Алматы, ул. Шевченко, 28, оф. 219, тел.: 272-13-19 *http://chemistry-technology.kz/index.php/en/arhiv*

Адрес редакции: 050100, г. Алматы, ул. Кунаева, 142, АО «Институт топлива, катализа и электрохимии им. Д.В. Сокольского», каб. 310, тел. 291-62-80, факс 291-57-22, e-mail:orgcat@nursat.kz Адрес типографии: ИП «Аруна», г. Алматы, ул. Муратбаева, 75.

News of the National Academy of Sciences of the Republic of Kazakhstan. Series of chemistry and technology.
ISSN 2518-1491 (Online),
ISSN 2224-5286 (Print)
Owner: RPA «National Academy of Sciences of the Republic of Kazakhstan» (Almaty).
The certificate of registration of a periodical printed publication in the Committee of information of the Ministry of Information and Social Development of the Republic of Kazakhstan **No. KZ66VPY00025419,** issued 29.07.2020.
Thematic scope: *organic chemistry, inorganic chemistry, catalysis, electrochemistry and corrosion, pharmaceutical chemistry and technology.*
Periodicity: 4 times a year.
Circulation: 300 copies.
Editorial address: 28, Shevchenko str., of. 219, Almaty, 050010, tel. 272-13-19 *http://chemistry-technology.kz/index.php/en/arhiv*

Editorial address: JSC «D.V. Sokolsky institute of fuel, catalysis and electrochemistry», 142, Kunayev str., of. 310, Almaty, 050100, tel. 291-62-80, fax 291-57-22, e-mail: orgcat@nursat.kz Address of printing house: ST «Aruna», 75, Muratbayev str, Almaty.

NEWS OF THE NATIONAL ACADEMY
OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN
SERIES CHEMISTRY AND TECHNOLOGY
ISSN 2224–5286
Volume 2. Number 455 (2023), 124–142
https://doi.org/10.32014/2023.2518-1491.169
UDC 637.5

© M.K. Kassymova, R.S. Alibekov, Z.I. Kobzhasarova, G.E. Orymbetova*, K.A. Urazbayeva, 2023
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HALAL BEEF SAUSAGE PRODUCTS USING MALT

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Abstract. The purpose of the study is to develop a technology for beef sausages using malt with improved organoleptic and nutritional properties, as well as to study the content of the mineral composition of the product. To obtain reliable results of the study, the following methods were used: moisture determination method according to GOST 9793–2016 “Meat and meat products. Methods for determination of moisture content”, acid number determination method according to GOST R 55480–2013 Meat and meat products.Method for determination of acid value, inductively coupled plasma mass spectrometry. Experimental production of cooked sausages showed that the use of vegetable raw materials of the enricher in the preparation of sausages makes it possible to rationally use meat raw materials, reduce the cost of production, and improve the nutritional and biological value of products, which affects the organoleptic indicators of products. According to research, the use of malt sausage is optimal, as it participates in creating the basis of a balanced ratio of the main food components.

Keywords: sausage, malt, minerals, beef, method, determination, results, GOST, meat

Financing: This study was carried out under the the financial support of the research project “Complex waste-free processing of agricultural raw materials of animal and vegetable origin” within the framework of Programme Targeted Funding of the Republic of Kazakhstan No. BR18574252.

Conflict of interest: The authors declare that there is no conflict of interest.

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Аннотация. Зерттеудің мақсаты органолептикалық және тағамдық қасиеттері жақсартылған уытты пайдаланып сиыр етінен жасалған шұжықтар технологиясын жасау, сонымен қатар өнімнің минералдық құрамын зерттеу болып табылады. Зерттеудің сенімді нәтижелерін алу үшін келесі әдістер қолданылды: ылғалдылықты анықтау әдісі МЕМСТ 9793–2016 «Ет және ет өнімдері. Ылғалдылықты анықтау әдістері», МЕМСТ R 55480–2013 Ет және ет өнімдері бойынша қышқыл санын анықтау әдісі. Қышқылдық мәнін анықтау әдісі, индуктивті байланысқан плазмалық масс-спектрометрия. Пісірілген шұжықтардың тәжірибелік үлгілері байытқыш ретінде өсімдік шикізатын пайдалану ет шикізатын ұтымды пайдалануға, өнімнің өзіндік құнын төмендетуге, өнімнің тағамдық және биологиялық құндылығын жақсартуға мүмкіндік беретінін

көрсетті, бұл өнімдердің органолептикалық көрсеткіштеріне әсер етеді. Зерттеулерге сәйкес, уытты шұжықтарда пайдалану оңтайлы болып табылады, өйткені ол негізгі тағамдық компоненттердің теңгерімді қатынасының негізін құруға қатысады.

Түйін сөздер: шұжық, уыт, минералдық құрам, сиыр еті, әдіс, анықтау, нәтижелер, МЕМСТ, ет

Қаржыландыру: Бұл зерттеу«Мал және өсімдік тектес ауыл шаруашылығы шикізатын кешенді қалдықсыз қайта өңдеу» ғылыми-зерттеу жобасыбойынша жүргізілді. Қазақстан Республикасының Нысаналы қаржыландыру бағдарламасы аясында қаржыландырған (Грант № BR10262555).

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ХАЛЯЛНЫЕ КОЛБАСНЫЕ ИЗДЕЛИЯ ИЗ ГОВЯДИНЫ С ИСПОЛЬЗОВАНИЕМ СОЛОДА

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Аннотация. Цель исследования — разработка технологии колбасных изделий из говядины с использованием солода с улучшенными органолептическими и питательными свойствами, а также изучение содержания минеральных состав продукта. Для получения достоверных результатов исследования использовали следующие методы: метод определения влажности по QOST 9793–2016 “Meatandmeatproducts. Methods for determination of moisture content”, метод определения кислотного числа по QOSTP 55480–2013 Meat and meat products. Methodfordeterminationofacidvalue, масс-спектрометрия с индуктивно-связанной плазмой. Опытная выработка вареных колбасных изделий показала, что использование растительного сырья обогатителя при приготовлении колбасных изделий позволяет рационально использовать мясное сырье, снизить себестоимость продукции, улучшить пищевую и биологическую ценность продукции, что сказывается на органолептических показателях продукции. Согласно исследованиям, использование солода в колбасных изделиях является оптимальным, так как способствует созданию основы для сбалансированного соотношения основных пищевых компонентов.

Ключевые слова: колбаса, солод, минеральный состав, говядина, метод, определение, результаты, ГОСТ, мясо

Финансирование: Данное исследование выполнялось согласнонаучно-исследовательского проекта «Комплексная безотходная переработка сельскохозяйственного сырья животного и растительного происхождения» в рамках Программы целевого финансирования № BR18574252

Introduction

Currently, sausages and delicacie products are considered to be a large and dynamically developing trade direction of industrial goods in the market of Kazakhstan. They have a long tradition and their market position influences other industrial products.The production of sausages is highly competitive, and small private entrepreneurs and well-known large institutions work intensively in this area.Sausage products are considered an important barometer in the diet of the population.In the conditions of the rapid development of the economy, the consumption of sausage products also increases significantly;and if the financial situation of people worsens, the demand for sausages will decrease accordingly. In the production of domestic sausages, selected types are in great demand among the population.The share of boiled andsemi-smoked sausages accounts respectivelyfor 38.6 % and 18,1 % (2015 g.). At the same time, per capita consumption of sausage products is increasing every year.

Consumption of sausage products is subject to seasonal fluctuations. The intensity of use increases before the holidays, as well as during the cold season. In summer, meat products are replaced with vegetables and fruits. To balance such fluctuations, meat production in winter increases by 2–3 times compared to summer.

The range of Kazakhstani sausages is wide. Can sell sausages of dozens of brands from the same industry.At present, according to the consumption of the main types of sausages in Kazakhstan, the share of semi-smoked sausages is approximately 45 %, sausages and wieners 14 %, boiled sausages 35 % and other types of sausages and delicacies 6 % (Analysis of the sausage market in Kazakhstan – 2023) (Figure 1).

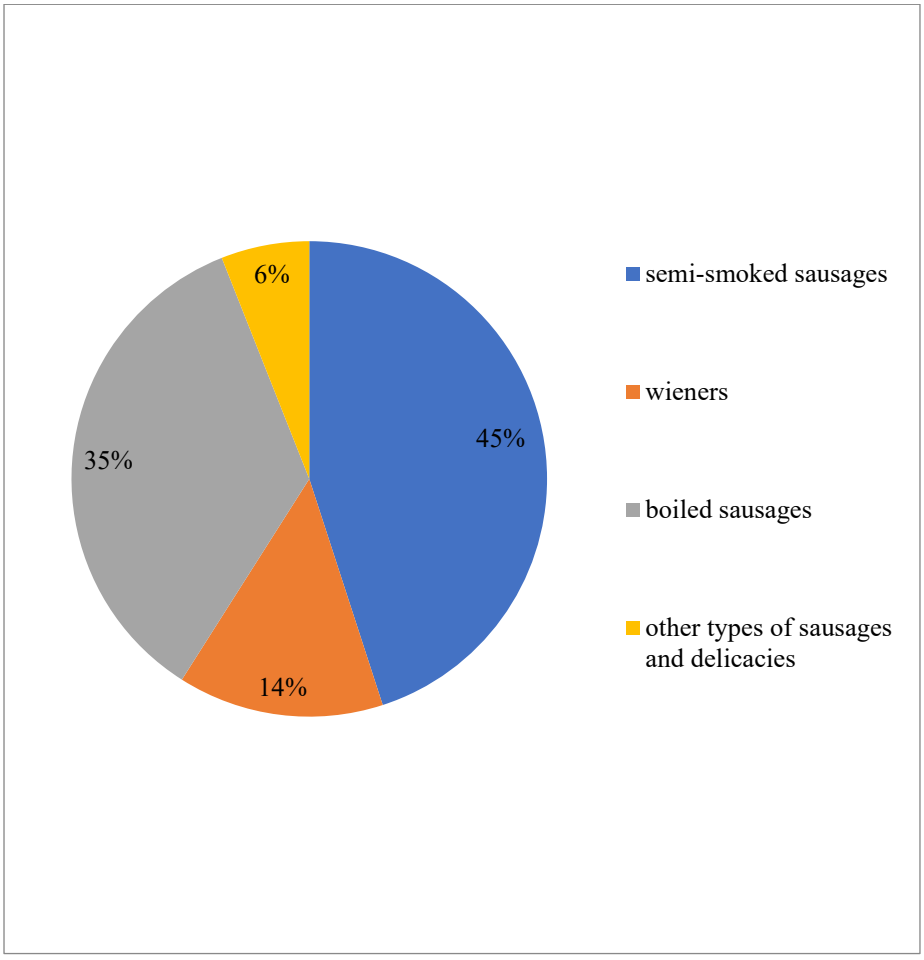


Figure1-Segmentation of consumption of sausages in Kazakhstan

Currently, the production of meat products has increased significantly, including the production of sausages, which are developing in several directions:

1. use of new types of raw materials and food additives;
2. increase the range of products;
3. mastering new equipment and technologies (Zheleuova, 2021; Orymbetova, 2019; Alibekov, 2018).

New types of raw materials are used to stabilize and emulsify minced meat, to replace the meat equivalent and improve the quality of meat (Kassymova, 2020; Bakharev, 2006).

The introduction of non-traditional plant families (pumpkin, sweet pepper, eggplant, tomato, carrot, etc. and products of their processing) into the composition of meat products will undoubtedly make it possible to obtain active

amino acid complexes that provide physiological completeness and high digestibility of products in biological terms (Uzakov, 2008; Beisenbaev, 2014).

The nutritional value of mechanically processed meat is higher than that of conventional meat. Adding 5–25 % mechanically ground meat to minced beef improves its flavor and texture. The bone fat formed during mechanical deboning of beef gives the product a new quality, and the amount of calcium in its content increases (Velichko, 2019; Kobzhasarova, 2021).

There is information about the use of different ingredients in the production of sausages (Slozhenkina, 2015; Bobreneva, 2003; Gordynets, 2004; Khamagaeva, 2006; Dumin, 2002). When developing new types of meat products, one of the criteria for evaluating their recipes is the normalization of the chemical composition of the product from the standpoint of the optimal ratio of protein and fat. The solution of this problem is facilitated by the directed use of protein preparations to improve the functional properties of minced meat. At the same time, the lack of muscle protein in minced meat is compensated by an increase in moisture binding capacity, water holding capacity and fat-retaining capacity, as well as an increase in the stability of sausages during storage, an increase in the volume of production while reducing the consumption of meat raw materials, increasing nutritional value and reducing the cost of the product.

The development of recipes for sausages with a pumpkin protein-carbohydrate complex was based on modern principles of healthy nutrition, based on the selection of certain types of raw materials and their ratios that would provide the required quality characteristics of the product. To confirm the feasibility of using the pumpkin protein-carbohydrate complex, as well as the correctness of the chosen level of their introduction, we conducted studies, including the determination of the general chemical composition and studies on the organoleptic evaluation of finished boiled sausages.

In relation to protein substances, their bioavailability for assimilation by the body, the availability of digestive bonds cleaved by the action of enzymes and bioactivity are distinguished.

The bioavailability of proteins is characterized by their ability to be broken down under the action of digestive enzymes into separate fragments (amino acids and peptides), which can be resorbed by the intestinal wall and assimilated by the body. Bioactivity characterizes the ability of the product to stimulate the processes of internal metabolism, secretory activity.

Thus, the correlation between the biological value of proteins and their amino acid composition can be valid only if the rates of digestion by digestive tract enzymes, the digestibility of components and their bioactivity are sufficiently high.

The bioavailability of protein and the degree of its absorption depends on many factors. In particular, it is due to the nature of the protein and its structure: connective tissue proteins are broken down worse than muscle proteins; native - worse than denatured.

Changes in the physical structure of meat (the degree of dispersion due to grinding) and the biochemical structure of the protein (denaturation), increase the availability of components to the action of digestive enzymes (Baitukenova, 2021; Zinina, 2015; Boreskov, 2000).

Also, premium-segment sausages are practically not produced in Kazakhstan. Demand for elite meat products - natural, "meat-containing", healthy has grown. For a healthy lifestyle, first of all, the quality of products is important, not their price.

In this regard, the use of methods of mechanical processing of raw materials and new types of food additives are considered relevant.

The purpose of the study is to develop a technology for beef sausages using malt with improved organoleptic and nutritional properties, as well as to study the content of the mineral composition of the product.

To obtain reliable results of the study, the following methods were used: moisture determination method according to GOST 9793–2016 "Meat and meat products. Methods for determination of moisture content", acid number determination method according to GOST R 55480–2013 Meat and meat products.Method for determination of acid value, inductively coupled plasma mass spectrometry.

Materials and methods

Experimental samples were prepared using the additive with the following mass fraction based on meat: 0,5 %, 0.7 %, 1.0 %, 1.25 and 1.5 %.

The scanning electron microscope is based on the use of a pre-formed thin electron beam (probe) whose position is controlled by electromagnetic fields. This control (scanning) is in many ways similar to the scanning process in television kinescopes.The electron probe sequentially passes over the surface of the test sample (Bykov, 2012).

Under the influence of beam electrons, a number of processes occur that are characteristic of a given material and its structure. These include the scattering of primary electrons, the emission (emission) of secondary electrons, the appearance of electrons that have passed through the object (in the case of thin objects), and the appearance of characteristic radiation. In a number of special cases (luminescent materials, semiconductors), light radiation also occurs.

Registration of electrons leaving the object, as well as other types of radiation (characteristic, light) provides information about the various properties

of micro-sections of the object under study. Accordingly, the display systems and other elements of scanning microscopes differ depending on the type of detected radiation.

Synchronously with the sweep of the electronic probe, an image is built on the computer monitor (the brightness of the pixel on the monitor is proportional to the magnitude of the recorded signal). For example, in the case of a scanning electron microscope in the secondary electron current indication mode, the value of the secondary electron current determines the depth of brightness modulation on a computer monitor. A scanning electron microscope of this type allows you to obtain an increase of 5–1,000,000 times with sufficient image contrast.

The resolution of scanning electron microscopes of this class is determined by the diameter of the electron probe and the sample material and is 10 angstroms.

Organoleptic and physic-chemical parameters of finished products were determined accordingly according to GOST R 52196-2017 (Uvarova, 2007).

Results and discussion

Experimental production of cooked sausages showed that the use of vegetable raw materials of the enricher in the preparation of sausages makes it possible to rationally use meat raw materials, reduce the cost of production, and improve the nutritional and biological value of products, which affects the organoleptic indicators of products.

Sensory evaluation of a food product by its organoleptic propertiesaffects the choice and demand of consumers much more than thechemical composition and nutritional value. Therefore, the results of the effect of the combined extract on the organoleptic characteristics of the studied meat product are ofsignificant value (Zheleuova, 2021).

The results of the assessment of organoleptic indicators of new products are presented in Table 1.

Table1 - Organoleptic indicators of new products

Nameofindicator	Characteristics of the organoleptic properties of control and model samples					
	#1 Control sample	Model sample #2- with the addition of 0.5% malt	Model sample # 3 with the addition of 0.7% malt	Model sample #4- with the addition of 1% malt	Model sample #5 with the addition of 1.25 malt	Model sample #6- with the addition of 1.5% malt
Appearance	Long loaf with a clean, dry surface	dry clean	dry clean	The surface is even, clean and dry, no damage to the shell		
Sectionalview	Darkpink	Darkrosered	Darkrosered	Uniformly colored and mixed minced meat from pink-red color without gray spots	Uniformly colored and mixed minced meat from pink-red color without gray spots	Uniformly colored and mixed minced meat from pink-red color without gray spots
Consistency	resilient	resilient	resilient	resilient, homogeneous elastic	resilient, homogeneous elastic	resilient, homogeneous elastic
Tasteandsmell	Peculiar to this type of product, without foreign taste and smell, with the aroma of spices, moderately salty	Peculiar to this type of product, without foreign taste	Peculiar to this type of product, without foreign taste	Peculiar to this product without foreign taste and smell, with the aroma of spices	Peculiar to this product without foreign taste and smell, with the aroma of spices	Peculiar to this product, juicy in taste

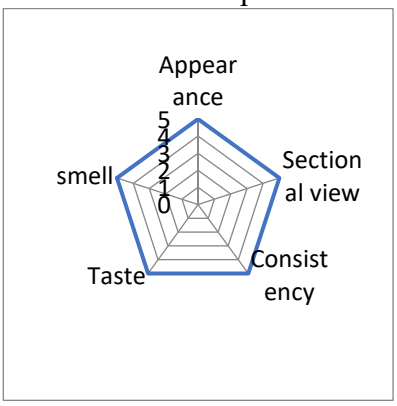
According to organoleptic indicators(table 1, figure 2), samples # 3-5 with an additive content of 1.0–1.5 % showed the best result, i.e.bystructures, consistency, texture, as well as by the complex sensation in the oral cavity caused by the taste, smell and texture of the food product.

To obtain accurate and reliable numerical values of product quality indicators established by the organoleptic method, it is necessary to use the method of evaluating food products according to several quality indicators, in which their estimates, expressed in points. The method allows you to set the

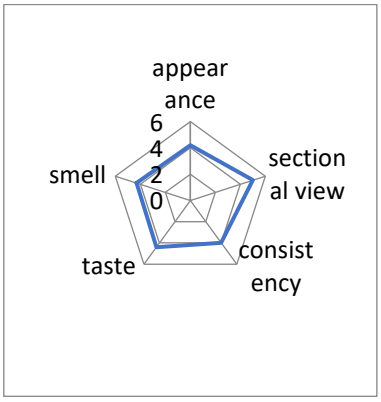
levels of partial (for individual indicators) and general (for a set of indicators) quality.

The results of the sausage evaluation method presented in Figure 2.

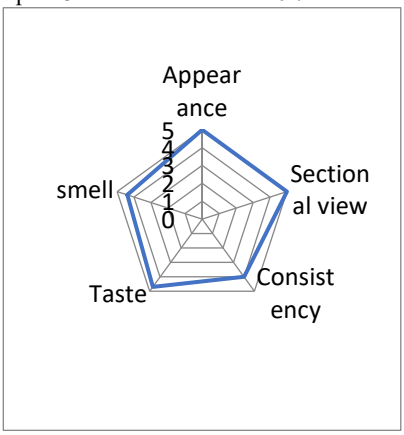
Control sample #1



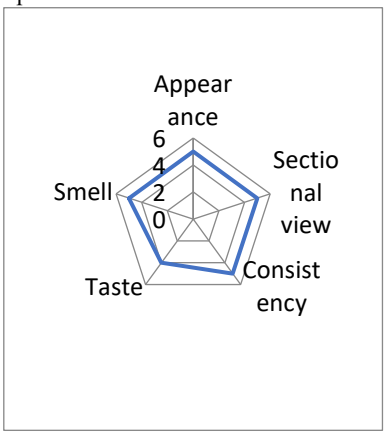
Model sample #2- with the addition of 0.5% malt



Model sample #3 with the addition of 0.7 % malt



Model sample #4- with the addition of 1 % malt



Model sample #5 with theaddition of 1.25 malt

Model sample #6- with theaddition of 1.5 % malt

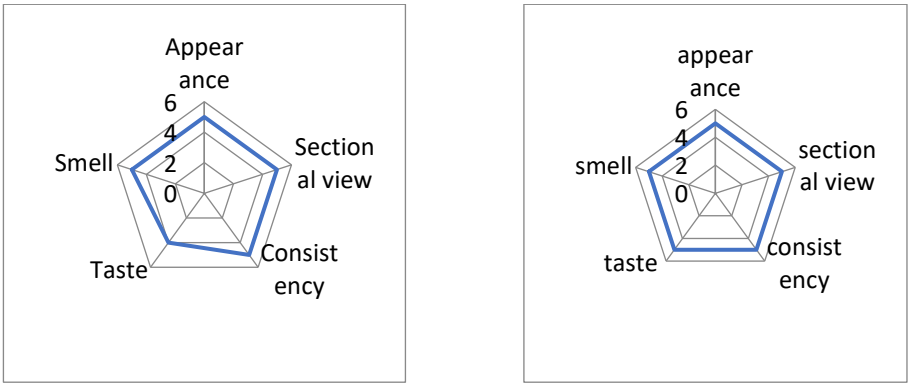


Figure 2 - Organoleptic evaluation

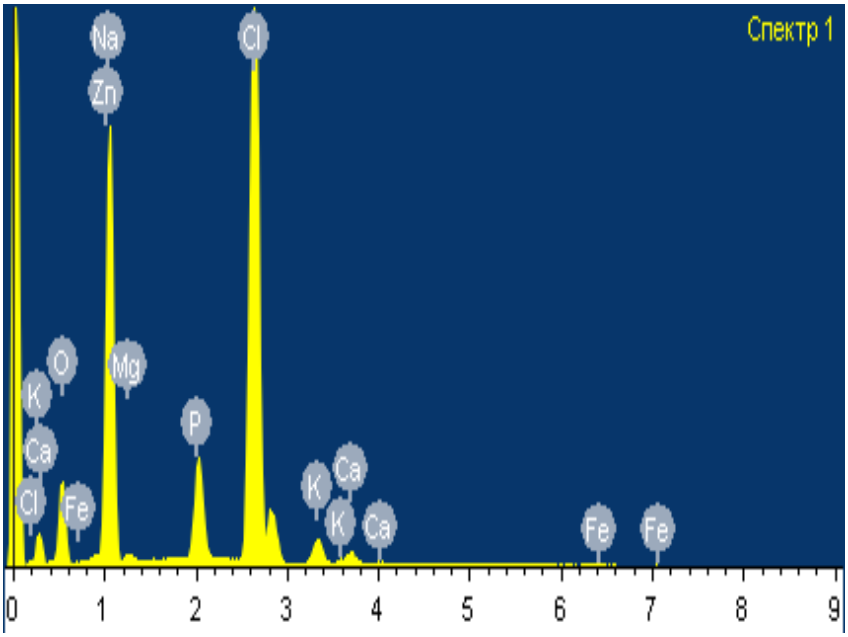
According to the results of the method for evaluating sausage products, which are presented in Figure 2, it can be seen that with the addition of malt 1 and 1.25 % they are inferior only in taste to samples with the addition of 1.5 % malt.

Table 2 shows the physico-chemical indicators of boiled sausage prepared with the addition of malt powder.

Table 2 - Physical and chemical indicators of boiled sausage prepared with the addition of additive powder

Indicators	Control sample	Model samples				
		№1	№2	№3	№4	№5
Mass fraction of ash in terms of dry substance, %	1,0	2,0	2,0	2,1	2,1	2,1
humidity	72	65,5	65	62	62	62
pH	7,0	6,9				
Mass fraction of table salt in terms of dry substance, %	3,1	3,1				
Water-holding capacity, %	85	85	84	84	83	83

The pH value of halal cooked sausages was determined from model samples. As a result, all samples of sausages have a neutral environment and amounted to pH=6.9.


Спектр 1
Na
Zn
Cl
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Mg
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Ca
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Ca
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Fe
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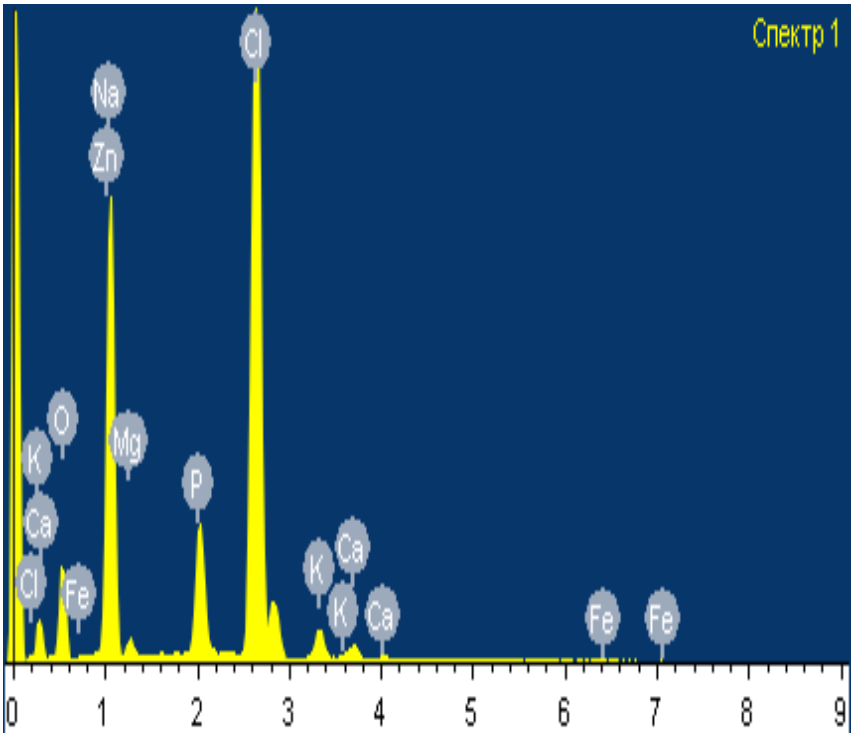
8
9


Спектр 1
Cl
Na
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Ca
Cl
Fe
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K
Ca
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9

In the control sample, the moisture content of finished sausages was 72 %. Based on the research work, for the model sample № 1, the humidity was determined and is equal to 65.5 %, for the model sample № 2–65.0 %, for the model samples № 3–5, the humidity was 62 %.

The amount of table salt in boiled sausages did not change with an increase in the mass fraction of the addition and amounted to 3.1 %.

The analysis of the obtained results showed that at the rate of nitrite content in boiled sausages not more than 0.005 %, the acceptable level of nitrite content is found in the samples.

The most important factors determining the quality and yield of sausages are the degree of meat grinding and the correctly selected moisture content of minced meat. Boiled sausages have on average acceptable quality with minced meat stability of at least 85 % by weight, water-holding capacity of about 85 % of the total moisture content in minced meat. In this case, the water-holding capacity in the model samples is in the range of 83–85 %.

Finished sausages are stored at a temperature of 0–12°C and air humidity of 75–78 % for no more than 10 days.

The amount of macro- and microelements in the finished product was determined using an electron microscope. An electron microscope is an instrument that allows you to obtain a high-precision image of the surface of a sample. Since the image obtained in an electron microscope is three-dimensional, it is convenient to study the structure of the surface.

X-ray pattern of samples taken with an electron microscope are shown in Figure 3.

(a)control sample b (model sample)

Samples	elements composition, %								
	O	Na	Mg	P	Cl	K	Ca	Fe	Zn
Control sample (a)	24,35	26,49	1,57	7,31	33,21	8,5	1,48	0,16	0,14
Model sample (b)	29,75	22,4	1,74	10,17	26,22	9,09	2,30	0,14	0,36

Figure 3 - X-ray image of samples taken with an electron microscope

According to the chemical results obtained in the ICP-MC mass spectrometer of the samples and as content it was observed that the amount of

macro and microelements in the sausage product enriched with the use of malt increased.

The amount of macro and micronutrients in the studied finished product was studied under an electron microscope. An electron microscope is a tool that allows you to take a high-precision image of the surface of a sample. Because the image obtained in the electron microscope is three-dimensional, it is convenient to study the structure of the surface.

According to research, this type of raw material is optimal and is made on the basis of a balanced ratio of the main food components, which ensures good digestion and digestibility of the stomach.

Conclusions

Experimental production of cooked sausages showed that the use of vegetable raw materials of the enricher in the preparation of sausages makes it possible to rationally use meat raw materials, reduce the cost of production, and improve the nutritional and biological value of products, which affects the organoleptic indicators of products. According to research, the use of malt sausage is optimal, as it participates in creating the basis of a balanced ratio of the main food components.

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www:nauka-nanrk.kz
http://chemistry-technology.kz/index.php/en/arhiv ISSN 2518-1491 (Online), ISSN 2224-5286 (Print)

Заместитель директор отдела издания научных журналов НАН РК *Р. Жәлиқызы*
Редакторы: *М.С. Ахметова, Д.С. Аленов*
Верстка на компьютере *Г.Д. Жадырановой*
Подписано в печать 05.07.2023.
Формат 60x88$^{1}/_{8}$. Бумага офсетная. Печать – ризограф. 11,0 п.л. Тираж 300. Заказ 2.

Национальная академия наук РК
050010, Алматы, ул. Шевченко, 28, т. 272-13-19