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## SAUSAGE MEAT PRODUCT ENRICHED BY JIDA

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*The development strategy aimed at creating the independence of the use of our raw materials by domestic meat producers is currently achieving the following goals: building modern production facilities and introducing new primary and processing technologies; expanding the assortment of meat products. The scientific research works carried out during the development of technology for the production of meat products by replacing a certain amount of beef or chicken with vegetable raw materials are important. Production of meat products based on these raw materials allows effective use of local raw materials, production of functional products and expansion of the range of meat products. The purpose of the study is to consider the features of the production technology of sausage meat product enriched with jida. The article presents the processing of the meat product production technology by enriching its composition with raw materials of vegetable origin - jida powder and the analysis of the mineral*

content of the finished product. The research work was carried out at the "Food Engineering" department of the M. Auezov South Kazakhstan University and at the "Construction and Biochemical Materials" regional test laboratory of engineering profile. Raster electron microscope (REM) and inductively coupled plasma mass spectrometry (ICP-MS) methods were used to determine the amount of mineral substances in meat products - sausage. The specialty of this work is the technology of product production using vegetable raw materials to enrich the content of meat products - sausages with minerals. Vegetable raw material - jida powder, by using it in the production of functional meat products, enriches the mineral content of meat products, and also by replacing a small part of meat raw materials, contributes to increasing the yield of the product. Jida powder is a vegetable raw material that is soluble in cold water and rich in dietary fiber, vitamin C, flavonoids and organic acids and does not cause losses in the production of food product. Jida powder production technology consists of: cleaning berries from dust and impurities (passing them through a sorting fan); crushing (optimal duration of berry crushing in the IV-1 crusher  $\tau = 52-65$  sec, rotation speed of the working body 12000 rpm); drying (dry in the sun for fruits with a high sugar content).

**Keywords:** sausage, jida powder, milling, mineral composition, sausage.

### ЖИДЕМЕН БАЙЫТЫЛҒАН ЕТ ӨНІМІ - СОСИСКА

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*Отандық ет өнімдерін өндірушілердің өз шикізатымызды пайдалану тәуелсіздігін құруға бағытталған дамыту стратегиясы қазіргі уақытта келесі мақсаттарға қол жеткізуде: заманауи өндіріс орындары салынып, біріншілік және қайта өңдеудің жаңа технологиялары енгізу; ет өнімдерінің ассортиментін кеңейту. Сыыр еті мен тауық еті негізіндегі өсімдік шикізатымен байытылған ет өнімі өндірісі технологиясын жасау барысында ғылыми-зерттеу жұмыстары жүргізілуде. Аталған шикізаттар негізіндегі ет өнімін жасау жергілікті шикізатты тиімді пайдалануға, функционалдық бағыттағы өнім жасауға және ет өнімдері ассортиментін кеңейтуге мүмкіндік береді. Зерттеудің мақсаты - жидемен байытылған сосиска ет өнімін өндіру технологиясының ерекшелігін зерттеу. Мақалада құрамын өсімдік тектес шикізат – жиде ұнтағымен байыту арқылы ет өнімін өндіру технологиясын өңдеу және дайын өнімнің минералдық құрамын талдау келтірілген. Зерттеу жұмыстары М.Әуезов атындағы Оңтүстік Қазақстан университетінің «Тамақ инженериясы» кафедрасында және «Конструкциялық және биохимиялық материалдар» инженерлік бейінді аймақтық сынақ зертханасында жүргізілді. Ет өнімі -сосиска өнімінен минералды заттардың мөлшерін анықтауда растрлық электронды микроскоп (REM) және индуктивті – байланысқан плазмалы масс – спектрометрия (ICP-MS) әдістері қолданылды. Бұл жұмыстың ерекшелігі азаны минералдық заттармен қамсыздандыруын жоғарлату үшін, ет өнімі - сосиска өндіру технологиясында өсімдік компонентін қолдану болып табылады. Жиде ұнтағын өсімдік шикізаты ретінде функционалдық бағыттағы ет өнімдерін өндіру технологиясында қолдану ет өнімінің минералдық құрамын байыту, сонымен қатар ет шикізатының белгілі бір бөлігін алмастыру процесін жүзеге асырады және ол өнімнің шығымын арттыруына ықпал тигізеді. Жиде ұнтағы суық суда еритін, тартылған етке қосу үрдісінде шығын тугызбайтын, құрамында тағамдық талшық, С дәрумені, флавоноидтар және органикалық қышқылдар бар өсімдік тектес қоспа. Жиде ұнтағын өндіру технологиясы жидені шаңнан және қоспалардан тазарту (сұрыптау желдеткішінен өткізу); ұсақтау (IV -1 ұсақтағышта жидені ұнтақтаудың оңтайлы ұзақтығы  $\tau = 52-65$  сек, жұмыс органының айналу жылдамдығы 12000 айн/мин); кептіру (күнде кептіру-құрамында қанты көп жидектер үшін) процесінен тұрады.*

**Негізгі сөздер:** сосиска, жиде ұнтағы, куттирлеу, минералдық құрам, шұжық.

## РАЗРАБОТКА ТЕХНОЛОГИИ ОБОГАЩЕННОГО МЯСНОГО ПРОДУКТА – СОСИСКИ, С ИСПОЛЬЗОВАНИЕМ ПОРОШКА ДЖИДЫ

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*В настоящее время стратегия развития, направленная на создание независимости использования собственного сырья для отечественных производителей мяса, достигает следующих целей: строительство современных производств, внедрение новых первичных и перерабатывающих технологий; расширение ассортимента мясной продукции. Проводятся научно-исследовательские работы по разработке технологии производства мясных продуктов на основе говядины и курицы, обогащенных растительным сырьем. Производство мясных продуктов на основе данного сырья позволяет эффективно использовать местное сырье, производить функциональные продукты и расширять ассортимент мясной продукции. Цель исследования - изучить особенности технологии производства мясного изделия сосиска, обогащенного джидой. В статье описана технология переработки мясного продукта путем обогащения его состава сырьем растительного происхождения - порошком джиды и проведен анализ минерального состава готового продукта. Исследования проводились на кафедре «Пищевая инженерия» Южно-Казахстанского университета имени М. Ауэзова и в региональной испытательной лаборатории инженерного профиля «Конструкционные и биохимические материалы». Методами растрового электронного микроскопа (РЭМ) и масс-спектрометрии с индуктивно-связанной плазмой (ИСП-МС) определяли содержания минеральных веществ в мясном продукте - сосиске. Особенностью данной работы является разработка технологии производства продукта с использованием растительного сырья для обогащения содержания мясных продуктов (сосиски) минеральными веществами. Растительное сырье – порошок джиды. При его использовании в производстве функциональных мясных продуктов обогащается минеральный состав, а также замещая незначительную часть мясного сырья, увеличивается выход продукта. Порошок джиды представляет собой добавку растительного происхождения, которая растворяется в холодной воде, не вызывает потерь в процессе добавления в фарш, содержит пищевые волокна, витамин С, флавоноиды и органические кислоты. Технология производства порошка джиды состоит из: очистки джиды от пыли и примесей (прохождение через сортировочный вентилятор); дробления (оптимальная продолжительность дробления джиды в дробилке ИВ-1 составляет  $\tau = 52-65$  с, частота вращения рабочего органа 12000 об/мин); сушки (сушка на солнце для ягод с высоким содержанием сахара).*

**Ключевые слова:** сосиска, порошок джиды, куттирование, минеральный состав, колбаса.

### Introduction

Currently, market of meat products in our country is significantly developed. In our country, market is aimed at creating the independence of domestic meat producers in the use of our own raw materials. A strategy for the development of industry has been developed, which considers number of different solutions for development of production. Thus, the following goals are currently being achieved:

- construction of modern production facilities, introduction of new primary and recycling technologies;
- expanding assortment of meat products.

Various segments such as commercial meat, processed meat products and various semi-finished products are included in the meat products market. Sausage products take big place among them.

The market of sausage products is filled with products of Russian and foreign manufacturers, and domestic manufacturers occupy up to 90% of the entire market. Today, the consumer has a lot of choice: about 6,000 types of sausage are offered on store shelves.

Meat products are frequently consumed products and are important in human nutrition. The demand for such products does not decrease, but only increases, which is primarily explained by its high nutritional value and taste.

And children love sausage. As one of sausage products, expansion of ingredient set of product recipe is necessary to eliminate contradictions such as the chemical composition and cost of product, keeping the percentage of individual ingredients unexpensive expensive [1-3].

The optimal ratios between calcium and phosphorus, calcium and magnesium are 1: (1.5-

1.7) and 1: (0.5-0.7), respectively. There is no other product in nature with this ratio. The ratio of calcium and magnesium in bread, meat and potatoes is 1:2, in milk and kefir - 1:0.1, in many vegetables and fruits - 1:4.5. Achieving such a ratio is very difficult when formulating recipes, so it is important to simplify these criteria.

It has been proven that the functional properties of meat products can be increased with the use of plant raw materials [4]. The jida is a sugary berry useful for the body, it contains mineral salts of phosphorus and potassium, also important amino acids, tannins and organic acids. The chemical composition of jida includes ascorbic acid, and the peel contains alkaloids, dyes and tannins.

The conducted literature review showed that production of functionally oriented meat products enriched with vegetable raw materials is one of the promising directions of today's meat production [5,6]. In this regard, scientific research work is being carried out during development of technology production of meat products enriched by raw jida vegetable raw materials based on beef and chicken. The production of meat products enriched with vegetable raw materials makes it possible to use local raw materials rationally, to create functional meat products and to increase the segment of meat products.

The purpose of work is to consider the peculiarities of the production technology of sausage meat product enriched by jida.

#### **Materials and research methods**

Research on the mineral composition of sausage with jida powder was carried out at the "Food Engineering" department of M. Auezov South Kazakhstan University and at the "Construction and Biochemical Materials" regional test laboratory of engineering.

Methods for determining amount of mineral substances in sausage products: scanning electron microscope (REM) and inductively coupled plasma mass spectrometry (ICP-MS) method.

Raster electron microscope (REM) or scanning electron microscope is an electron microscope designed to obtain an image of the surface of an object with a size of up to 0.4 nanometers, as well as information about the composition, structure and some other properties of surface layers. The operating principle of a scanning electron microscope is based on the fact that an electron beam of different energies emanates from it.

Unlike an optical microscope the magnification power of a modern microscope reaches 1,000,000, which is tens of times higher than the

resolution of the optical device; the ability to create the greatest depth of field; can keep large objects clearly and evenly in focus and produce high-quality photos. Which means a scanning electron microscope is a device that can show what optical microscopy cannot see.

Today, the scanning electron microscope is used in all fields of science and industry, from biology to materials science.

Different structures and types of REMs are known, manufactured by number of companies, equipped with different types of detectors. In our case, resolution of an optical microscope (ability to distinguish small particles) is limited by the wavelength of visible light photons. The most powerful optical microscopes can see particles with a size of 0.1–0.2  $\mu\text{m}$  [7]. If you shorten the wavelength that illuminates the research object, you can see fine details. Instead of photons, electrons with a much shorter wavelength can be used for this. Electron microscopes are the result of this idea.

Inductively coupled plasma mass spectrometry (ICP-MS) is a very fast, efficient and highly sensitive method for simultaneous quantification of many elements in wide concentration range of liquid, solid and gaseous samples. This method is possible and has wide scope of application [8].

#### **Review literature**

An analysis comparing the addition of rosemary oleoresin (200 ppm) to an antioxidant mixture of butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT) (200 ppm) and citric acid in frozen and freeze-dried breakfast sausages made from 18% mechanically deboned turkey showed positive results in the freeze-dried sausages. It has been known to inhibit lipid oxidation during 5 weeks of storage [9].

To investigate the effect of three proteases (*Streptomyces griseus* proteinase E, *Aspergillus oryzae* aspartyl proteinase and papain) on protein degradation and sensory characteristics of dry fermented sausages fermented with water-soluble, non-protein, 5% phosphorous tungstic acid soluble, 5% sulfosalicylic acid soluble and total volatile basic nitrogen content. confirmed that it increases and stabilizes until the end of maturity (26th day) [10]. Nitrogen values were always higher in the sample supplemented with aspartyl proteinase compared to samples supplemented with the other two proteases, and changes in total free amino acids were seen at 5% sulfosalicylic acid. According to the results of electrophoretic studies, proteolysis of high molecular weight

myofibrillar and sarcoplasmic proteins was more observed in samples with added protease. This was especially intense in papain.

Sausage product prepared with established quality indicators: improved organoleptic properties, increased protein and balanced amino acid composition, i.e. results of research aimed at developing a new product have proven the positive effect of grown wheat, corn seeds and kelp [11].

It is known that with introduction of new standards, traditional range of requirements for the classification and quality of cooked sausages has changed [12].

The selection of special antioxidants of plant origin has not yet been proven at stage of creating technological plan for production of sausage products.

### Results and discussion

Additives should have an antioxidant effect, convenient for the manufacturer to use so that they do not require preparation costs for introduction into minced meat. Such mixtures are dry powders of vegetable origin with a slight characteristic odor, which dissolve easily in cold water and form an aqueous extract. They are introduced into minced meat during cooking (at the last stage, the biologically active substances that make up the mixture are less exposed to mechanical effects).

Jida powder is plant-based mixture that dissolves in cold water, does not cause losses in process of adding it to minced meat, contains dietary fiber, vitamin C, flavonoids and organic acids. The production technology of jida powder consists of the following stages: cleaning of jida from dust and impurities (passing through a sorting fan); crushing (optimum duration of jida crushing in the IV-1 crusher  $\tau=52-65$  sec, rotation speed of the working body 12000 rpm); drying (drying in the sun for fruits with a lot of sugar).

The chemical composition of vegetable ingredients differs mainly with carbohydrates, proteins, lipids, biologically active substances (organic acids, mineral substances, polyphenols).

Generally, value of finished product obtained as result of drying is influenced by biologically active substances and protein.

Almost all of mineral substances and cellulose included in biologically active substance are preserved during drying process [13,14]. And most of rest undergo changes such as partial hydrolysis, enzymatic blackening, and changes in composition.

The mineral composition of jida is rich: amount of macro and microelements K - 370 mg; Ca-65 mg; Na – 32 mg; Mg - 69 mg; Te is 1.5 mg. It contains vitamin C ( $10.0\pm 0.1$  mg), vitamin A ( $5.0\pm 0.1$  mg), vitamin E ( $3.5\pm 0.1$  mg) and  $\beta$ -carotene ( $8.0\pm 0.1$  mg).

According to GOST R 52196-2003, use of sodium nitrite in range of 5.0-7.5 mg/100 g is provided for in sausage recipe. Traditionally, sodium ascorbate is used in amount of 50-100 g/100 kg of minced meat, glucose or sugar in amount of 100-200 g to adjust color of meat product (intensification of product color formation process).

Based on experimental data, optimal amount of sodium nitrite, sodium ascorbate and sugar was set at 7.5 g, 100 g and 50 g, respectively, per 100 kg of minced meat. According to GOST, sugar should be 100-200 g. The remaining amount was supplemented with berry powder. In this case, amount of sodium nitrite does not exceed the maximum permissible value (0.005%), also intensity and stability of color of minced meat with acceptable organoleptic characteristics. However, use of sodium ascorbate and sugar-sugar in large quantities does not affect the sodium nitrite residue and the intensity of the color of minced meat. Taking into account the organoleptic characteristics, optimal amount of table salt for sausage was determined to be 2.6 g/100 g of minced meat. The following technological scheme was used in the production of sausages (Fig. 1).

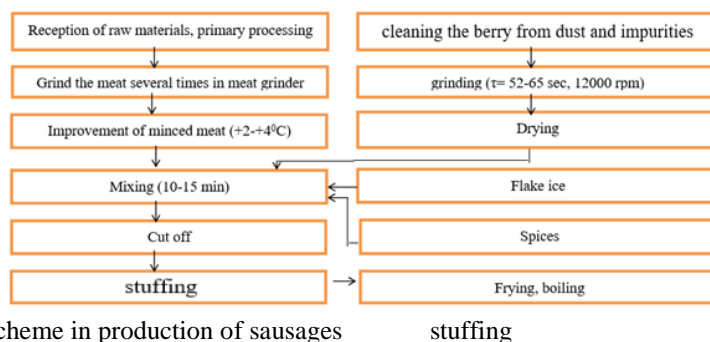


Figure 1. Technological scheme in production of sausages

The mineral composition of the obtained product is given in Figure 2.

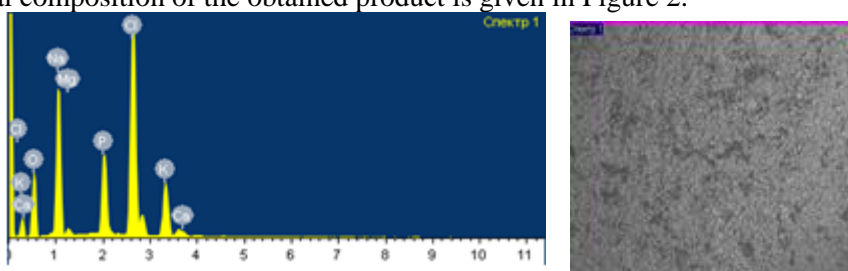


Figure 2. Mineral composition of sausage without additives

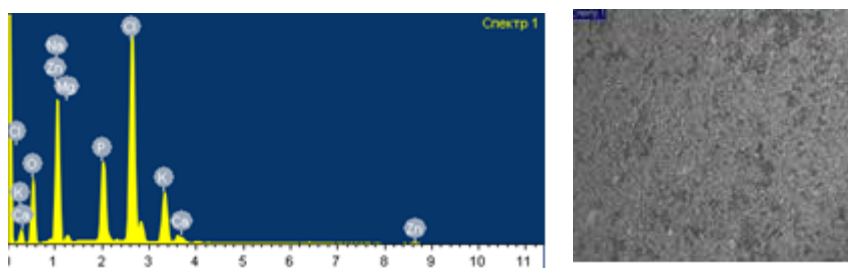


Figure 3. Mineral composition of sausage with 1% admixture

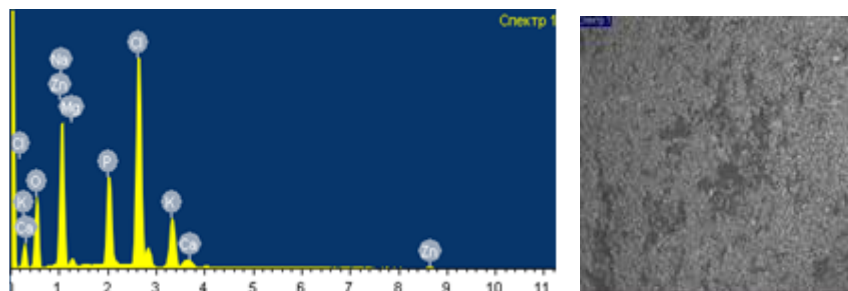


Figure 4. Mineral composition of sausage with 3% admixture

The mineral composition of the sausage also changed as the amount of mixture - jida powder increased. When jida powder was added to finished product, zinc appeared and its amount was 0.56 and 0.78% by weight, respectively. In addition, amount of magnesium is 1.03% by weight, from 1.11 to 1.11%, and amount of phosphorus is 8.92, respectively; 9.08; 9.57% by weight; potassium - 8.25; 8.63; 8.97, and calcium - 0.75; 0.74; It was 0.97% by weight. Basically, the ratio of calcium and magnesium, calcium and phosphorus in sausage is 1:0.88, respectively; It was 1:9.9. Calcium must also be in balance with potassium. The balance of calcium with potassium and magnesium is an important factor in prevention of cardiovascular diseases.

If 40% of magnesium is metabolically active in body, remaining amount can be mobilized to maintain homeostasis [15-19]. As the amount of calcium increases, magnesium

deficiency occurs. However, ratio of calcium and magnesium is preserved in sausage. Therefore, we think that there will be no problem. In addition, Ca-Mg balance plays an important role in Ca-P metabolism.

The content of phosphorus in sausage was 8.9-9.6% by weight. That is, product is rich by phosphorus.

#### **Conclusion**

An analysis of the mineral composition of the sausage product with the addition of berry powder, which is similar to flour, was made. The analysis showed that berry powder differs in carbohydrates, proteins, lipids, biologically active substances (organic acids, mineral substances, polyphenols). This fact revealed that it is effective and possible to use berry powder as an additive in the production of meat-vegetable sausages.

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The authors declare that there is no conflict of interest.

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## ҚАЗАҚСТАННЫҢ ҚҰРҒАҚ ӨНІРЛЕРІНДЕ ТАМАҚ ӨНІМДЕРІН ӨНДІРУ ШИКІЗАТЫ РЕТІНДЕ ҚҰМАЙ ДАҚЫЛЫНЫҢ ҚОЛДАНЫЛУ ПЕРСПЕКТИВАСЫ

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*Жаһандық жылыну өзімен бірге жаһандық тәртіптегі құрғақшылықты да алып жүреді. Олардың ықпалында соңғы жылдары бүкіл Еуропа, Ресей мен Қазақстанның Азиялық бөлігі де болды. Мұның бәрі бұрын кең таралмаған дәстүрлі емес дақылдарға да назар аударудың уақыты келді дегенді білдіреді. Соңғы кездері әлемнің әртүрлі елдерінде көбірек қызығушылық танытатын осындай мәдениеттердің бірі – құмай. Қазақстан үшін құмай жаңа емес, бірақ қалыптасып жатқан табиғи – климаттық жағдайларда ол азық-түлік саласында едәуір орын алуы мүмкін. Мақалада құмай ұнын қолдана отырып печенье жасау туралы зерттеулер келтірілген. Дегустациялық бағалау бойынша жоғары орташа баллды көрсеткіш 1 нұсқада (50% - бидай ұны және 50% - құмай ұны) – 4,52 балл болғанын көре аламыз және ол ұнтақтылығымен, жағымды дәмімен және хош иісімен сипатталады. 2-ші нұсқада (100% - құмай ұны) сәйкесінше 4,28 балл, бақылау үлгісі кезінде (100% - бидай ұны) - 4,32 балл анықталды. Ылғалдылық көрсеткіші бойынша бақылау үлгісі -11,3%, 1 және 2 нұсқаларында шамамен бірдей көрсеткіштермен, 8,1% және 8,3% болғанын анықтадық. Суды сіңіру көрсеткіші бидай ұны мен құмай қоспасын 50:50 қатынасында және тек бидай ұнынан жасалған өнімде қолданған кезде ең жоғары болды, сәйкесінше 210,2% және 204,9% көрсетті. Өткізілген тәжірибе дәстүрлі емес шикізатты – дәнді құмайды печенье өндірісінде пайдалану перспективасын көрсетті, бірақ өндіріс рецептері мен технологияларын одан әрі зерделеуді және жетілдіруді талап етеді.*

Негізгі сөздер: құмай, тағамдық құндылық, ылғалдылық, су сіңіруі, дәннің сапасы.

## ПЕРСПЕКТИВНАЯ КУЛЬТУРА СОРГО КАК СЫРЬЕ ДЛЯ ПРОИЗВОДСТВА ПИЩЕВОЙ ПРОДУКЦИИ В ЗАСУШЛИВЫХ РЕГИОНАХ КАЗАХСТАНА

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*Глобальное потепление несет с собой и засухи глобального порядка. Под их влиянием в последние годы оказалась практически вся Европа и часть Азиатской территории России и Казахстана. Все это говорит о том, что пришло время более пристально присмотреться к культурам, которые раньше не были широко распространены. Одной из таких культур, к которым в последнее время все больше проявляют интерес в самых разных странах мира, является сорго. В статье приведены исследования применения муки из сорго при приготовлении песочных печений. Дегустационная оценка показала наибольший средний балл у 1 варианта (50% - пшеничная мука и 50% - мука из сорго) – 4,52, что характеризовалось рассыпчатостью, приятным вкусом и ароматом, у 2-го варианта (100% - мука из сорго) соответственно*