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G. S. Kenenbay, U. Ch. Chomanov, A. T. Mambeshova, B. B. Omirzhanova

LLP "Kazakh Research Institute of Processing and Food Industry", Almaty, Kazakhstan.

E-mail: u.chomanov@rfp.kz, gkenenbay@mail.ru,
aseltleyberdievna18@gmail.com, omirzhanova61@mail.ru**INVESTIGATION OF PHYSICO-CHEMICAL PROPERTIES
OF MELTED ANIMAL FATS OF CATTLE**

Abstract. The results of a study of melted animal fats of cattle are presented. As the objects of study used beef perinephric and internal fat. To assess the physical and chemical quality indicators of the feedstock, standard determination methods were used. In solving the global food problem, fats, as well as food products created on their basis, take second place after grain and the entire range of crops. Fats are one of the most important components in the production of combined foods that determine their nutritional value and taste. Fats are widely used in various fields: for processing various culinary products, for the production of certain types of sausages, canned meat and milk-based baby food.

The main focus of the study of fats is the study of physico-chemical properties in the process of cleaning, processing and storage. The physicochemical properties of animal fats determine the conditions for their production, and to a certain extent they depend on the mode of processing fats.

The suitability of animal fats largely depends on their physical properties. Fats are soluble, lighter than water, insoluble in water, soluble in organic solvents and have low thermal conductivity. Fats are soluble, lighter than water, insoluble in water, soluble in organic solvents and have low thermal conductivity. In laboratory conditions, the physicochemical properties (moisture, density, refractive index, viscosity, acidity) of beef fat obtained from slaughter of cattle were studied.

The density of unrefined fats is higher than that of refined fats. The density of fats characterizes the composition of the fatty acids that make up the triglyceride molecule. The viscosity of fats and oils depends on the molecular weight of the fatty acids that make up triglycerides. With an increase in the molecular weight of fatty acids, viscosity increases and decreases with an increase in the number of double bonds.

The viscosity of natural fats is essential in establishing the natural purity of fat. The refractive index of fats depends on their composition and physico-chemical properties. With increasing molecular weight and unsaturated fatty acids, the refractive index increases. In laboratory studies, determining the amount of moisture and acidity is most important.

The moisture content in the fat is ballast, which accelerates its destruction during storage. Thus, the main task of producing fat for various purposes is the production of high-quality, fatty foods, in addition to meeting technological requirements, taking into account their biological properties and their metabolism in the body.

Key words: melted fat cattle, temperature, density, viscosity, acid number, refractive index.

Annotation. The results of a study of melted animal fats of cattle are presented. As the objects of study used beef perinephric and internal fat. To assess the quality of the feedstock used standard methods for determining physico-chemical quality indicators.

Introduction. The main directions in the development of technology of production of melted animal fats is the production of high-quality edible fat with preservation of physiologically unsaturated fatty acids, phosphatides, vitamins in it, as well as the production of high-quality greaves.

Fats and oils have always been important in human nutrition. In solving the world food problem, they, as well as the food products created on their basis, occupy the second place after the grain and the whole range of grain crops.

In the production of combined foods one of the most important components that determine their nutritional value and taste are fats. By regulating the fatty acid composition, it is possible to obtain combined foods rich in essential fat nutrients [1].

Food animals melted fats are widely used in various fields: for cooking products, in the production of certain types of sausages, canned meat and cooking fats, baby food products based on milk, in the production of antibiotics, etc. [2].

Food animals ghee as raw materials used for the production of high molecular weight alcohols, which in turn are used to produce surfactants (surfactants).

In recent years, the technology has spread, providing for the use of raw fat in the production of protein-fat emulsions for the production of minced meat products. This technology has two positive factors: the possibility of waste-free use of raw fat as a food raw material and a reduction in heat consumption compared with the melting of fat [3].

Objects and research methods. The main direction of research of fats is the study of physical and chemical properties in the process of melting, processing and storage. Physical and chemical properties of animal fats determine the mode and conditions of their production and, to a certain extent, themselves depend on the mode and conditions of processing of raw fat. The suitability of fats obtained in animal slaughter for various technological purposes depends mainly on their physical properties.

The specific gravity of animal fats ranges from 0.915-0.964 (at 15°). The higher the specific gravity of fat, the higher the content of glycerides of lower acids, oxic acids and unsaturated acids, and the stronger the degree of unsaturation. When changing the temperature of liquid fat, its specific gravity varies depending on the change in its volume, the coefficient of volumetric expansion of fat on average is 0.0007. During oxidation, the specific gravity of fat increases, during hydrolysis it decreases.

Fats are fusible substances, lighter than water, insoluble in water, soluble in organic solvents, have low thermal conductivity. Animal fats-solid, vegetable fats (oils) – liquid. The composition of animal fats are predominantly saturated acids: stearic C17H35COOH, palmitic C15H31COOH.

At room temperature, fats (mixtures of triglycerides) are solid, greasy or liquid substances. Like any mixture of substances, they do not have a clear melting point (i.e. melt in a certain temperature range). Only individual triglycerides have a specific melting point.

The consistency of fats depends on their composition: solid fats are dominated by triglycerides with saturated acid residues having relatively high melting points; liquid fats (oils), on the contrary, are characterized by a high content of triglycerides of unsaturated acids with low melting points [4].

Fats in the body are involved in complex metabolic processes and together with other substances (proteins, carbohydrates, etc.) participate in their normal course. The properties of fats are due to the structure of triglycerides, as well as the presence of biologically active compounds (phospholipids, sterols, Tocopherols, karatinoids, etc.). The main structural element of triglycerides are fatty acids.

They differ in the length of the carbon chain, the number and position of the double bonds, and the spatial configuration. This determines their physical and chemical properties and nutritional value.

The chemical composition and properties of animal fats vary depending on the type of animal, although chemically all animal fats are triglycerides of higher fatty acids, i.e. esters of glycerol and carboxylic acids, having molecules from 6 to 26 carbon atoms. In addition to triglycerides, animal fats also contain phosphatides, cholesterol, dyes, vitamins A (retinol), D (calciferol), E (tocopherol), F (essential fatty acids).

Widely used in the oil and fat industry, are cow milk fat, lard, beef, lamb and bone fat.

Among the rendered animal fats the most widespread were pork, beef and mutton of the highest, 1 grade, as well as bone fat. Animal clarified fats differ in properties, for example beef and mutton fats have increased refractoriness and hardness.

This is due to the composition of triglycerides, in which a significant part is occupied by high-molecular saturated fatty acids. In connection with the growth of living standards and changes in the nature of food decreases the demand for animal fats. However, they are important as an integral part of meat products.

Results and its discussion. (moisture, density, refractive index, viscosity, acid number) of beef fat after melting, which were obtained during the slaughter of cattle in the production shops of IE "Manashov", were investigated in the laboratory.

Physico-chemical parameters of melted animal fats are shown in table 1.

Table 1 – Physico-chemical parameters of melted animal fats

Beef fat	Moisture %	Density, r/cm^3 (at $T^\circ\text{C}$)	Refractive index	Acid number, mg CON	Viscosity at 20°C , $\text{PA} \cdot \text{s}$
Perirenal	0,2	1047(20°C)	1,33291	1,5	0,0150 ³
Internal	0,3	890 (45°C)	1,33291	1,3	0,0150 ³

Animal fats are lighter than water, their density (at 45°C) ranges from $0.895 - 1060 \text{ g/cm}^3$. When the temperature increases or decreases by 1°C , the fat density changes by 0.0007 . This property of fats is used in heat treatment.

The relative density of animal fat is determined at 45°C using a hydrometer. In fat chemistry, density (in kg/m^3) is usually defined as the ratio of the mass of fat at 20°C to the mass of the same volume of water at 4°C .

From table 1, you can see the moisture content of perinephric fats is less than internal, the density of perinephric fats was 1047 g/cm^3 at 20°C thus the density of internal fats we determined at 45°C temperature since the internal fat cools quickly is not possible to determine the density, that is, the density was 890 g/cm^3 . When determining the refraction and viscosity exponential number is the same, and the acid number is the difference.

Fat density characterizes the composition of fatty acids included in the triglyceride molecule. The density of fats decreases with increasing molecular weight and increases with increasing unsaturation of fatty acids that make up triglycerides. In addition, the presence of hydroxyl groups in the fatty acid radical, formed during oxidation, leads to an increase in density. With an increase in the content of free fatty acids formed during the hydrolysis of glycerides, the density of fats decreases. The density of unrefined fats is higher than refined fats.

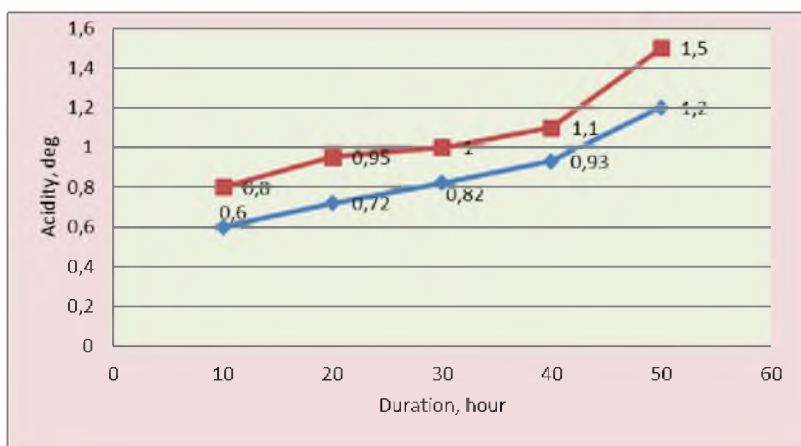
The refractive index of fats depends on their composition and physical and chemical properties. With increasing molecular weight and content of unsaturated fatty acids refractive index increases.

The temperature at which the fat is studied also has an impact on this indicator. The refractive index of fats is higher than that of the fatty acids isolated from them. The refractive index of fat is affected by the temperature at which the observation is made. The refractive index characterizes the ability of fat to refract a beam of light passing through it. The refractive index of fats is determined by a universal Refractometer at 40°C , oils – at 20°C .

The viscosity of the fat depends on the temperature. As the temperature increases, the viscosity decreases, and the fluidity of fat increases. This property is used in determining the diameter of pipelines and pump capacity, as well as in determining the temperature regimes of processing edible fat.

The acid number characterizes the freshness and goodness of fat and fat-rich foods.

Acid number denotes the number of milligrams of potassium hydroxide, going to neutralize the fat contained in the free fatty acids. The higher the acid number, the more free (non-glycerin-bound) fatty acids there are, i.e. the lower the fat quality. A high value of the acid number is an indicator of intensive hydrolysis of fat.



Change of acidity of melted animal fat during storage.
Blue line is internal fat. Red line is kidney fat

The acid number of fat of higher grades should not be more than 1,2, the first grade-2,2. In fats of the highest grade humidity does not exceed more than 0,2%, and in pork - 0,25. The moisture content of more than 3% in edible fats of the first grade is not allowed. Changes in acidity of melted animal fat during storage are shown in figure.

The acidity of cattle fats was determined by the length of time from 10 hours to 50 hours. In the study of the internal fat of cattle acid index starts from 0.6 degrees to 1.2 degrees. The acid number of perinephric fat is from 0.8-1.5 deg.

Composition fatty acids animals fat differs in dependence from animal, his gender, age and others.the Main difference animal fat from of plant – greater content saturated fatty acids (above all, stearinovy and palmitinovy).

The composition and quantitative ratio of fatty acids in glycerides determine the basic physical and chemical properties of fats, their nutritional value and resistance to storage. With a higher content of unsaturated fatty acids, fat has a low melting point, a soft consistency, a higher biological value, but the storage resistance of such fats is lower.

The contents of fatty acids of rendered animal fats in the Kazakh Japanese center at KazNAU were determined. The fatty acid content of animal ghee is shown in table 2.

Table 2 – Content of fatty acids in rendered animal fats, %

Fatty acids	Perirenal	Internal
Saturated		
Lauric (C12H24O2)	0	0
Myristic (C14H28O2)	3,18	3,4
Palmitic (C16H32O2)	28,56	20
Stearic (C18H36O2)	28,04	25
Arachine (C20H40O2)	0,19	–
Pentadecyl (C15H30O2)	0,40	0,45
Palmitoleic	1,82	3
Margarine	1,146	1,4
Tetradecene	0,31	
Alaudinova	3,54	
Begenova (C21H43COOH)	0,064	
Unsaturated		
Oleic (C18H34O2)	27,30	47
Linoleic (C18H30O2)	0,88	3
Linolenic (C18H30O2)	0,53	01
Arachidonic (C20H32O2)	0,3	0,1

Conclusion. According to the study, animal fats contain significantly more saturated fatty acids.

According to our research animal fatty acids such as perinephric and internal fatty acids are significantly separated from each other. For example, according to table 2, you can compare the amount of myristic fatty acid in the perinephric and internal fats, the difference is small, and in palmitic and stearic acid the difference is ± 8 . There are some fatty acids that are larger than intrinsic or larger than perinephric fats. At the same time, there are fatty acids that contain perinephric fats whereas internal fats do not have them. Solid saturated acids—stearic and palmitic in different amounts are included in all fats. In much smaller quantities and, moreover, not all fats are other saturated acids—lauric and myristic.

Liquid unsaturated fatty acids are the most widely distributed in nature. Of the unsaturated fatty acids in all fats contains oleic acid, having in its molecule one double bond. Oleic acid is usually found in fats in significant amounts (for example, in lard up to 50%), and sometimes prevails (for example, in olive oil up to 85%) of the total fatty acids.

Among other unsaturated fatty acids should be noted arachidonic acid, which contains four double bonds. In vegetable oils, this acid is practically not contained in animal fats it is also small.

Thus, the main objective of the production of edible fats and oils for various purposes, along with the implementation of technological requirements, is to create high-grade, high-quality fat products, taking into account their biological properties and metabolism in the body.

Of the laboratory studies, the most important is the determination of moisture and acid number. The moisture contained in the fat is a ballast, and when storing the product accelerates its spoilage.

Г. С. Кененбай, У. Ч. Чоманов, А. Т. Мамбешова, Б. Б. Омиржанова

ЖШС «Қазақ қайта өңдеу және тағам өнеркәсіптері ғылыми-зерттеу институты», Алматы, Қазақстан

ІРІ ҚАРА МАЛДЫҢ ЕРІТІЛГЕН МАЙЛАРЫНЫҢ ФИЗИКА-ХИМИЯЛЫҚ ҚАСИЕТТЕРІН ЗЕРТТЕУ

Аннотация. Ірі қара малдың ерітілген майларының зерттеу нәтижелері келтірілген. Зерттеу объектілері ретінде сиыр малының бүйрек және ішкі майлары пайдаланылды. Шикізаттың сапасын бағалау үшін, физика-химиялық сапа көрсеткіштерін анықтаудың стандартты әдістері қолданылады.

Май – организмге қуат беретін астың түрі. Тәулігіне аспен бірге қабылданатын майдың 70%-ы жануарлар майы. Қазіргі таңда азық-түлік проблемасын шешуде, майдың негізінде жасалған азық-түлік өнімдері астықтан және барлық дақылдардан кейін екінші орын алады. Аралас тамақ өнімдерін өндіруде олардың тағамдық құндылығы мен дәмін анықтайтын маңызды компоненттердің бірі – майлар.

Майлар – тамақ өнімдерінің, тағамдық құндылығы мен дәмін анықтайтын маңызды компоненттердің бірі болып саналады. Май құрамындағы май қышқылдарының құрамын реттеу арқылы майдан маңызды қоректік заттарға бай аралас тағамдарды алуға болады. Бұл технологияның жағымды факторы бар: шикізатты ысырапсыз пайдалану мүмкіндігі.

Майлар әртүрлі салаларда: кулинарлық өнімдерді өңдеу үшін, шұжықтардың белгілі бір түрлерін, ет консервілері мен сүт негізіндегі нәресте тағамдарын өндіруде кеңінен қолданылады. Майларды зерттеудің негізгі бағыты – тазарту, өңдеу және сақтау процесінде физика-химиялық қасиеттерін зерттеу.

Жануарлардың майларының физика-химиялық қасиеттері оларды өндіру режимі мен шарттарын анықтайды және белгілі бір дәрежеде олар шикі майды қайта өңдеу режиміне байланысты болады. Жануарлардың, союдан алынған майларының жарамдылығы негізінен олардың физикалық қасиеттеріне байланысты. Майлар – ерітінді заттар, судан жеңіл, суда ерімейді, органикалық еріткіштерде ериді және жылу өткізгіштігі төмен.

Зертханалық жағдайда ірі қара мал сойған кезде алынған, ерітілген сиыр майының физика-химиялық қасиеттері (ылғал, тығыздық, сыну көрсеткіші, тұтқырлық, қышқыл саны) зерттелді.

Тазартылмаған майлардың тығыздығы тазартылған майларға қарағанда жоғары. Майлардың сыну көрсеткіші олардың құрамына және физика-химиялық қасиеттеріне байланысты. Молекулалық салмақтың және қанықпаған май қышқылының жоғарылауымен сыну көрсеткіші де жоғарлайды. Зертханалық зерттеулерде ылғал мен қышқыл санын анықтау ең маңызды болып табылады. Майдың құрамындағы ылғал – бұл балласт, өнімді сақтау кезінде оның бұзылуын тездетеді.

Осылайша, әртүрлі мақсаттарға арналған майларды өндірудің негізгі міндеті технологиялық талаптарды орындаумен қатар, олардың биологиялық қасиеттері мен организмдегі метаболизмін ескере отырып, жоғары сапалы, май өнімдерін жасау болып табылады.

Түйін сөздер: ірі қара малдың ерітілген майы, температурасы, тығыздығы, тұтқырлығы, қышқыл саны, сыну көрсеткіші.

Г. С. Кененбай, У. Ч. Чоманов, А. Т. Мамбешова, Б. Б. Омиржанова

ТОО «Казахский научно-исследовательский институт перерабатывающей и пищевой промышленности», Алматы, Казахстан

ИССЛЕДОВАНИЕ ФИЗИКО-ХИМИЧЕСКИХ СВОЙСТВ ТОПЛЕННОГО ЖИВОТНОГО ЖИРА КРС

Аннотация. Представлены результаты исследования топленых животных жиров КРС. В качестве объектов исследования использовали говяжий околопочечный и внутренний жир. Для оценки физико-химических показателей качества исходного сырья использованы стандартные методы определения.

В решении мировой продовольственной проблемы жиры, а также пищевые продукты, созданные на их основе, занимают второе место после зерна и всей гаммы зерновых культур. Жиры являются одним из важнейших компонентов при производстве комбинированных продуктов питания, определяющих их пищевую ценность и вкусовые достоинства.

Жиры широко используются в различных областях: для обработки различных кулинарных изделий, для производства определенных видов колбас, мясных консервов и детского питания на молочной основе. Основным направлением изучения жиров является изучение физико-химических свойств в процессе очистки, переработки и хранения. Физико-химические свойства животных жиров определяют условия их производства, и в определенной степени они зависят от режима переработки жиров. Пригодность животных жиров во многом зависит от их физических свойств. Жиры являются растворимыми веществами, легче воды, нерастворимы в воде, растворимы в органических растворителях и обладают низкой теплопроводностью.

В лабораторных условиях были изучены физико-химические свойства (влажность, плотность, показатель преломления, вязкость, кислотность) жира говядины, полученной при убое скота.

Плотность нерафинированных жиров выше, чем рафинированных. Плотность жиров характеризует состав жирных кислот, входящих в молекулу триглицерида.

Вязкость жиров и масел зависит от молекулярной массы жирных кислот, входящих в состав триглицеридов. С увеличением молекулярной массы жирных кислот вязкость увеличивается и снижается с увеличением числа двойных связей. Вязкость натуральных жиров имеет существенное значение при установлении природной чистоты жира. Показатель преломления жиров зависит от их состава и физико-химических свойств. С увеличением молекулярной массы и ненасыщенных жирных кислот показатель преломления увеличивается. В лабораторных исследованиях определение количества влаги и кислотности является наиболее важным. Содержание влаги в жире составляет балласт, что ускоряет его разрушение при хранении.

Таким образом, основной задачей производства жира различного назначения является производство высококачественных, жирных продуктов, в дополнение к удовлетворению технологических требований с учетом их биологических свойств и их метаболизма в организме.

Ключевые слова: топленый жир КРС, температура, плотность, вязкость, кислотное число, показатель преломления.

Information about authors:

Kenenbay G.S., Candidate of Technical Sciences, Head of the Laboratory of Plant Production Technology, KazNIIPPP, Almaty, Kazakhstan; gkenenbay@mail.ru; <https://orcid.org/0000-0002-8332-8102>

Chomanov U.Ch., Doctor of Technical Sciences, Professor, Academician of the National Academy of Sciences of the Republic of Kazakhstan, Head of the Department of Processing and Storage Technologies for Crop and Livestock Products, KazNIIPPP, Almaty, Kazakhstan; u.chomanov@rfp.kz; <https://orcid.org/0000-0003-1639-3817>

Mambeshova A.T., Senior Researcher, Laboratory of Plant Technology, KazNIIPPP, Almaty, Kazakhstan; aseltleyberdievna18@gmail.com; <https://orcid.org/0000-0002-2306-8337>

Omirezhanova B.B., Researcher, Laboratory of Plant Production Technology, KazNIIPPP, Almaty, Kazakhstan; omirezhanova61@mail.ru; <https://orcid.org/0000-0001-6118-3128>

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