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DEVELOPMENT OF OLEOGELS WITH A REDUCED CONTENT OF SATURATED FATTY ACIDS

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Abstract. The issue of obtaining fat compositions with a reduced content of saturated and trans fats by the method of oleogelation has been studied. The relevance of complex research on the development of oleogels is substantiated. It has been established that oleogels in the near future can become substitutes for fats obtained by partial hydrogenation, interesterification or fractionation. Proposed fats to create a dispersed medium (fat base) oleogel, namely sunflower and palm oil, chicken fat. The expediency of using these fats is emphasized. The physicochemical parameters of sunflower and palm oils, chicken fat were experimentally determined, in particular, by the method of differential scanning calorimetry, the process of melting and crystallization of selected fats was analyzed. Particular attention is paid to the study of the melting and crystallization curves of these fats. The content of solid triacylglycerides (STG) in fats was experimentally established depending on temperature. It has been shown that the content of STG in palm oil is higher than in chicken fat (7.87 versus 3.27%), therefore it is proposed to use palm oil and chicken fat together with liquid oils, such as sunflower, to obtain oleogel fatty bases with melting temperature in the range of +(34–38)ºC. A mathematical model has been developed for the dependence of the melting point on the proportion of ingredients in the oleogel dispersed medium. A formulation of a dispersed medium with a melting point of +34.05°C was obtained, in which the content of ingredients (%, wt.) is: sunflower oil 15; palm oil 60; chicken fat 25. The effect of the content of the dispersed phase – vegetable wax – in the range from 1 to 5% on the melting temperature of the simulated oleogel disperse medium was studied. The results showed that the rational content of vegetable wax in the simulated oleogel is 1.5%. The use of the oleogelation method can help provide the fat composition not only with the required technological properties, but also by reducing the amount of saturated and trans fats – a positive fatty acid profile, and as a result, make the final food product more beneficial to human health. The resulting oleogel composition will be effective for use in flour and confectionery technologies instead of fats containing saturated and/or trans fats.

Key words: oleogel, sunflower oil, palm oil, chicken fat, melting, crystallization, vegetable wax.

Introduction. Formulation of the problem

Recently, in the food industry in general and in particular in the oil and fat industry of Ukraine, the problem of the quality and safety of food products has become particularly acute. And not the last role in this was played by Ukraine's entry into the World Trade Organization. More and more attention is being paid to the issue of obtaining fats and fatty components with a minimum content of trans fats (more precisely, trans fatty acids), because there is a connection between the consumption of fats, which contain an excessive amount of trans fatty acids in their composition, and an increased risk of developing cardiovascular diseases. Therefore, one of the priority tasks facing the World Health Organization (WHO) is the exclusion of industrially produced trans-fatty acids (TFA) from the composition of food products worldwide by 2023 [1]. The most effective and consistent way to eliminate industrially produced TFAs from food globally is through legislative and regulatory action to ban or severely restrict their use in all foods. In almost all countries of Western Europe, restrictions on the content of TFAs have already been introduced by law. On October 26, 2016, building on scientific research and the positive experience of Denmark [1], where in 2003 a mandatory 2% restriction on the presence of industrial trans fats in food was introduced, which led to a marked decrease in mortality from cardiovascular diseases, the European Parliament Resolution decided on the need to limit the content of industrially produced trans-isomers in fat-containing foods in the European Union. From April 02, 2021, new food safety rules came into force in the European Union, providing for the reduction of TFA content. The maximum limit set by the new regulation 649/2019 corresponds to 2% industrially produced trans fats per 100 g of total fat content in products intended for the final consumer and for supply to retailers.

In Ukraine, on 10/02/2020 (but the transition period is valid until 10/02/23), the order of the Ministry of Health of Ukraine dated 07/16/2020 No. 1613 "On Approval of the Rules for Adding Vitamins, Minerals and Certain Other Substances to Food Products", which is based on to EU Regulation 1925/2006. According to this Order: in food products intended for the final consumer and for supply to retail establishments, the content of trans-fatty acids that are not natural should not exceed 2 g per 100 g of the total amount of all fats contained in the food product. Until now, in Ukraine, the content of trans-isomers has been standardized only in spreads (no more than 8%) and some types of margarine, in particular, in hard sandwiches (no more than 8%). Also, the content of trans isomers is determined in confectionery fats, if this is due to the terms of the agreement or contract.

Based on the above, it has been established that the search for solutions to replace TFAs in food products without changing their technological and sensory properties, while maintaining interest and demand for consumer products and observing the requirements of the above-mentioned regulatory documents, is currently appropriate.

Today, snail meat is considered an expensive gourmet product, but the methods of controlling its quality and safety have not yet been developed.Ukraine is trying to become one of the leading exporters of Roman snails (*Helix pomatia*) in Europe [1]. There are large farms specialising in heliciculture, in processing, refrigeration, and packing of this species of edible snails [2]. However,in fact, methods of quality and safety control of this delicacy product have not been elaborated yet. At the same time, veterinary and sanitary expert examination of snail meat quality at different stages of processing and storage is a crucial issue [3]. Correct evaluation of meat purity is essential to assessthe condition of meat, its shelf life, and methods of processing. Numerous studies are dedicated to elaboration techniques of quick and affordable objectiveevaluation of the primary stages of meat and meat products spoilage [4].

Organoleptic methods allow distinguishing between the three degrees of snail meat freshness: fresh, questionably fresh, and stale [5]. Fresh snail meat has a light greycolour with a dense consistency. Depending on the type of snail, it has a tone from light to dark. It is very slippery [6]. The smell is specific, with the scent of the herb that the snail has been eating for the last 5–7 days. Questionably fresh meat has the signs of the initial stage of spoilage. The surface of the meat becomes greyer, there is less slime in it, and it gradually turns into a clear liquid [7]. Herbal smell is not so pronounced. The texture is slightly doughy [8]. It is not permitted to sell questionably fresh meat, and it is sanitary inspection authorities who decideabout its further use for processing [9]. Stale meat is recognised by distinctive offensive, sharp odour and dark grey colour. There is no slime in it at all, and it turns into turbid liquid. The consistency of meat is doughy.

Analysis of recent research and publications

Oils and fats are widely used in many food formulations. They are used to improve both nutritional and some technological characteristics of food products [2]. The current practice of dealing with trans fat problems, namely by reducing their content in the final product, is to replace trans fats with natural saturated fats or fats, which are usually obtained by blending, interesterification or fractionation of various hard oils, mainly palm oil. But the consumption of saturated fats, like TFAs, can have a negative impact on human health [3]. It is known that the consumption of saturated fats (except stearic acid) affects the level of cholesterol in the blood and leads to cardiovascular diseases [4]. Therefore, today WHO has recommended not only to exclude from the diet the main source of trans fats – partially hydrogenated oils and limit the consumption of TFAs to 1% of total fat intake, but also to limit the intake of saturated fats to 10% of total fat intake and replace saturated fats as sources of energy, on unsaturated fats (in particular, polyunsaturated) [1]. But not always polyunsaturated fats can become an alternative replacement for partially hydrogenated or saturated fats that have certain technological properties, such as structuring. The modern process of converting liquid oil into a solid gel using organogelators, the oleogelation method, can come to the rescue. Oleogels are gels, where the dispersed medium is oil, and the dispersed phase is complex organic compounds of a lipid nature, in particular, incomplete acylglycerols, wax-like substances, fatty acids, sterols, etc. [5]. Oleogels from liquid oils can have the technological properties of saturated fats and a positive fatty acid profile, which is characterized by a reduced content of saturated fatty acids and an increased content of polyunsaturated and monounsaturated fatty acids [6,7].

In [8], hazelnut oil oleogels obtained using both carnauba and vegetable (sunflower) wax were studied in detail. The textural, structural, thermal, and visual characteristics of the obtained oleogels have been established. For these waxes, a rational content was determined, which ensures high plasticity of oleogels. Within three months, the stability of oleogels in terms of texture and oxidation was studied both at a temperature of +4ºC and at +18-+20ºC. The obtained oleogels were compared with a commercial product.

In a study [9], extra virgin olive oil and wax esters obtained from soy fatty acid distillate (SFAD), a by-product of industrial processing of soybean oil, were used to produce oleogel. Esters of SFAD-wax (7, 10, 20% wt.) were tested as organogelators and their rational content was established. During 30 days of storage at a temperature of +4ºC, the mechanical properties of the oleogel were studied. It was established that the initial hardness of the oleogel was 3.8 N. At the end of the storage period, the hardness decreases to approximately 2.1–2.5 N. A rheological analysis was carried out, which proved that at a temperature of +20-+27ºC the resulting oleogel has solid properties. This oleogel is recommended for use in food products.

The work [10] provides the development and analysis of oleogels, where the dispersed medium was olive oil enriched with thyme and caraway spices, and the dispersed phase was sunflower wax. The general physicochemical, structural, thermal and rheological characteristics of oleogels are determined. It has been established that the addition of spices does not interfere with gel formation, stability and gelation time. The value of acid and peroxide numbers corresponds to the limits of acceptable values for extra virgin olive oil. The melting temperature of the oleogels was about +62ºC. Rheological analyzes proved that the obtained oleogels are quite stable at moderate frequencies, retain the gel-like state up to about +52 ºC and restore their shape after the force is removed.

In [11], the creation of oleogels using binary organogelators, beeswax and Chinese lacquer wax, was considered in various mass ratios: 100:0, 75:25, 50:50, 25:75, and 0:100. According to the authors [11], by changing the ratio of the components of a binary mixture of organogelators, one can obtain a large number of oleogels with different properties. Established rational ratios of beeswax: Chinese lacquer wax, in which there is no waxy taste in the mouth, namely 25:75 and 50:50.

In a study [12], food oleogels based on rice bran oil and beeswax were combined with palm oil at various ratios of 0:100, 17:83, 33:67, and 50:50. The resulting fat phase, which was characterized by a decrease in saturated fatty acids, was used in the technology of confectionery fillings with a low content of saturated fats. The behavior of crystallization and gelation of oleogels, their mixtures with palm oil and confectionery fillings, to which, in addition to oleogel and palm oil, sugar and grated hazelnuts are added has been studied. It was found that the maximum amount of palm oil that can be replaced by oleogel without losing the technological properties of the latter is 17%.

There is indeed a real need today for healthier, TFA-free, oxidatively stable solid fats that can maintain their structure at ambient temperatures. Based on the foregoing, it has been established that the oleogelation method is one of the promising ways to obtain solid fat without TFA and with a reduced content of saturated fatty acids. This method is new, easy to use and relatively cheaper. It has been established that various organogelators and their mixtures can make it possible to specifically adapt the behavior of oleogels and increase the possibility of their use in food products. It was found that the enrichment of oil with various spices does not affect the olegelation process. It has been established that oleogels can replace part of the palm oil and thus reduce the content of saturated fatty acids in the final food product. At the same time, studies on the creation of oleogels, where the disperse medium is a mixture of fats, are insufficiently covered in the literature. Therefore, research in this direction is important.

The purpose of this work is to study the development of an oleogel having a dispersion medium in the form of a mixture of vegetable oils and animal fat.

To achieve the goals set, the following **tasks** need to be solved:

– scientifically substantiate the choice of fats for creating a dispersed medium of oleogels;

– experimentally determine phase transformations for melting and crystallization processes with characteristic temperatures in selected fats;

– experimentally establish the content of STG in selected fats;

– mathematically calculate the formulation of the oleogel dispersed medium, which will have a melting point in the temperature range of +34-+38ºC;

– scientifically substantiate and experimentally establish the rational content of the dispersed phase in the oleogel.

Research materials and methods

For research, sunflower and palm oils, chicken fat and vegetable (sunflower) wax were used. Physico-chemical parameters of experimental samples of vegetable oils and chicken fat are given in table 1.

To study the processes of melting and crystallization, as well as to determine the STG of oil and fat samples, the method of differential scanning colorimetry (DSC) and the DSC Q-20 device from *TA Instruments* were used. The DSC method is based on measuring the difference in heat fluxes coming from a prototype and a reference sample. The rate of heating and cooling was 7.5ºC/min [13], the sample weight did not exceed 10 mg. All measurements were carried out with preliminary cooling in the chamber of the DSC instrument to a temperature below 8–10ºC than the initial temperature of the analysis. This temperature ensures that the instrument is calibrated for the rate of heating and establishes a precisely set temperature to start the study. For the crystallization process, liquid nitrogen with a temperature of -197.75ºC was used as a cooling agent. The research results were processed using the *TA Universal Analysis* software package, the resulting numerical data array was processed using the developed procedures for the *MathCad* package to analyze individual segments of DSC diagrams and directly compare them with each other. The error in determining the temperature values at characteristic points did not exceed ±0.5ºC. The information obtained makes it possible to determine the nature of the processes that occur in the experimental material and characterize its properties.

Table 1 – Physical and chemical parameters of prototypes

Indicator name, unit of measurement	Fat/oil		
	Chicken fat	Palm oil	Sunflower oil
Acid number, mg KOH/g, no more	0.6	0.3	0.13
Peroxide number, ½ O mmol/kg, no more	1.10	1.53	1.26
Mass fraction of moisture and volatile substances,%, no more	0.3	0.06	0.09
Melting point, ºC	+24.0	+44.0	-18.0

The consistency of solid fat products is determined by the indicator "content of solid triacylglycerols". According to the regulatory documentation, namely DSTU EN ISO 8292-1:2019 and DSTU EN ISO 8292-2:2019, STG is determined by the method of pulsed nuclear magnetic resonance (NMR), which replaced the laborious dilatometric method [14]. But in this work, the content of STG was determined, as in [15], by the DSC method, which does not require long-term sample preparation. The DSC diagram records the value of the specific heat flux in the processes of melting and crystallization depending on the temperature of the sample. As a result of processing the diagram, the dependence of the STG content on the melting and crystallization temperature is obtained in the form of a hysteresis loop, repeating the total dependence of the melting and crystallization processes [15].

To establish the rational content of fats in the dispersed medium, which ensures the melting point of the oleogel in the temperature range of +34-+38ºC, a second-order Scheffe simplex-lattice plan for a three-component mixture was used, which guarantees a uniform distribution of experimental points along a regular simplex. The melting temperature was used as the response function. For planning experiments and processing data, mathematical methods of the software package environment were applied *Statistica 8 (StatSoft, Inc.)*.

Results of the research and their discussion

In order to increase the biological efficiency of the oleogel, the following fats were chosen to create a dispersed medium: sunflower and palm oil, chicken fat. Sunflower oil – oil, which is produced in large quantities in Ukraine, is characterized by a high content of linoleic acid (up to 62%). Palm oil is the world's most widely used oil and is relatively inexpensive compared to other oils. The main fatty acids in palm oil are palmitic (up to 47%) and oleic (up to 42%). Almost the same content of palmitic and oleic fatty acids is a distinctive feature of the fatty acid composition of this oil. As a result of its significant STG content, palm oil is semi-solid at room temperature and highly resistant to oxidative deterioration. Chicken fat is a fat obtained (usually as a by-product) from the processing of chicken. Among the wide variety of animal fats, chicken fat is characterized by a high content of linoleic acid, the level of which ranges from 17.9% to 22.8%. In terms of quality indicators, chicken fat for food purposes is not only not inferior to palm oil, but also significantly surpasses it. Increasingly, in EU countries, chicken fat is being used instead of palm oil in the food industry, namely in the confectionery industry, the bakery and fat-and-oil industries, and the production of semi-finished meat products.

The process of melting and crystallization for the selected fats was studied by DSC in the temperature range: from -40ºC to +60ºC – for chicken fat, from -45ºC to +75ºC – for palm oil, from -60ºC to +15ºC – for sunflower oil. The choice of these intervals is related to the melting points of the selected fats.

Palm oil in the process of melting at temperatures above +15ºC has a solid consistency, which is proved by the appearance of the “a” peak (Fig. 1).

Peak “a” is characterized by an elongated shape and being in the temperature range from +15.65ºC to +46 ºC, with a small maximum at a temperature of +25 ºC. This peak shape indicates the presence of a diverse crystalline form and its modification, which is due to the triacylglycerol and fatty acid composition of this oil.

Therefore, when creating an oleogel formulation, the use of palm oil will increase the content of STG and reduce the introduction of an organogelator, namely vegetable wax. Simultaneously with Fig. 2 it was found that the crystallization temperatures of sunflower oil and chicken fat have negative values, which confirms the liquid or ointment-like consistency. According to fig. 1, 2, the temperatures of the peaks of phase transformations of experimental samples of fats are established. The results are presented in Table 2.

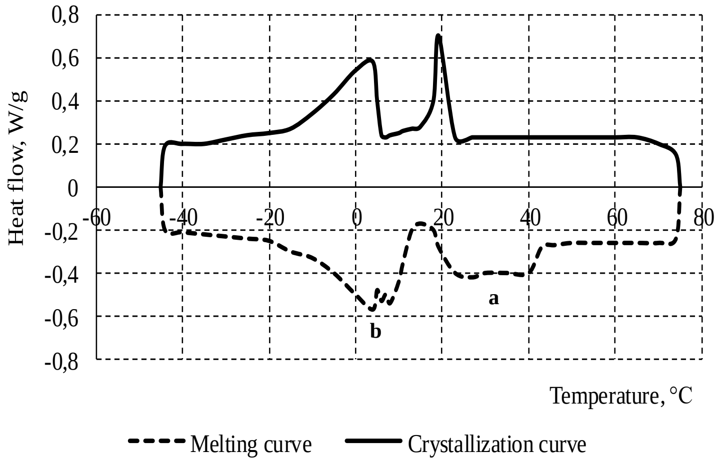
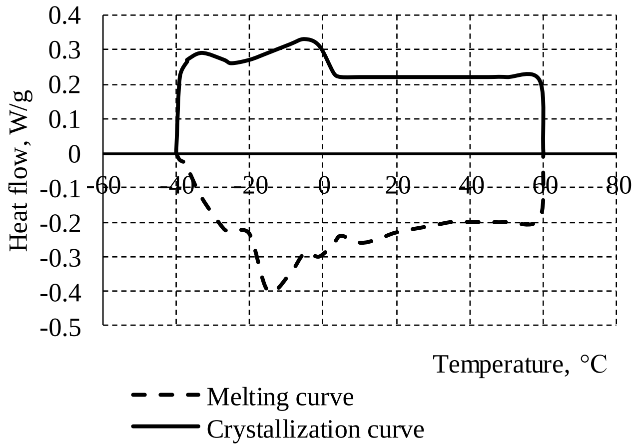
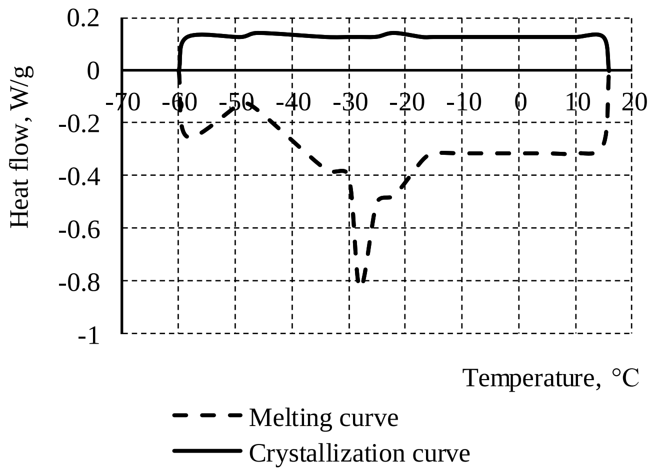


Fig. 1. Thermogram of the processes of melting and crystallization of palm oil



a)



b)

Fig. 2. Thermograms of melting and crystallization processes: a) chicken fat; b) sunflower oil

Table 2 - Temperatures of the peaks of phase transformations of the studied fat samples

Fat or oil	Melting temperature			Crystallization temperature		
	Number of peaks	Peak index	°C	Number of peaks	Peak index	°C
Chicken	2[1]	a	+11.00	2	a'	-7.15
		b	-15.07; -1.40		b'	-33.74
Palm	2[2]	a	+25	2	a'	+19.23
		b	+3.30; +5.56; +7.54		b'	+1.95
Sunflower	2	a	-27.95	2[1]	a'	-20.42; -19.18
		b	-35.26		b'	-42.91; -40.24

Footnote [1]One or two full-scale peaks are observed, in which two-humped peaks; [2]There is one full-scale peak, which has a three-humped top

In the selected fat samples, according to DSC diagrams, the content of STG was determined in the temperature range from -40 to +50ºC. The results are shown in Fig. 3.

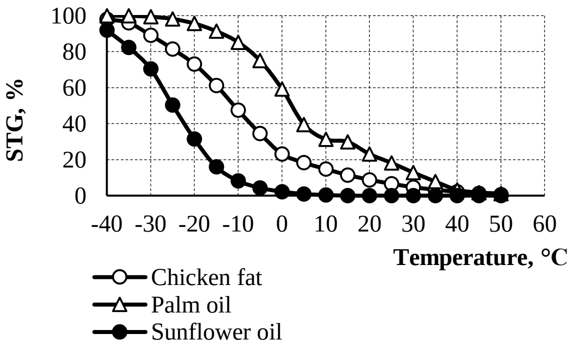


Fig 3. STG content in selected fat samples

With Fig. 3 it was found that the dependence of the STG content in palm oil, as well as the dependence of the STG content in chicken fat, is characterized by flatness. However, compared to chicken fat, palm oil has a high STG content (from 12.86 to 3.22% versus 4.72 to 2.18%) in the temperature range from +30ºC to +40ºC, which gives it an ointment-like consistency The melting temperature of palm oil (+44ºC) and chicken fat (+24ºC), which indicates the possibility of using them in mixtures with liquid oils to obtain a balanced dispersed medium of oleogel with a melting temperature in the range of +34–+38°C – the so-called consumer zone or zone of sensory felt – the temperature at which the product should completely melt, that is, the content of the solid fraction should not exceed 0.1–0.2%. Otherwise, the oleogel will acquire a "greasy" taste. It should be noted that the content of STG in sunflower oil in the temperature range from +30ºC to +40ºC is equal to 0. Thus, in order to establish a rational content of fats in the formulation of the dispersed medium of oleogel, which ensures the melting temperature of oleogel in the temperature range of +34–+38ºC, the melting temperatures of not only selected fats, but also their two-component mixtures are determined. The results are presented in the Table. 3.

Table 3 – Melting points of fats and two-component fat mixtures

Fat	Melting point, °C
Sunflower oil	-18.0
Palm oil	+44.0
Chicken fat	+24.0
Sunflower oil: Palm oil (50:50)	+34.3
Sunflower oil: Chicken fat (50:50)	+5.7
Palm oil: Chicken fat (50:50)	+33.7

Mathematical processing of the obtained data was carried out in the environment of the *Statistica 8* package (*StatSoft, Inc*.), as a result, a regression equation was obtained for determining the melting temperature (Y) from the component composition of the dispersed medium:

$$Y = -10.77 \cdot X_1 + 50.03 \cdot X_2 + 22.59 \cdot X_3$$

where X_1– sunflower oil content, mass fraction;

X_2 – palm oil content, mass fraction;

X_3 – content of chicken fat, mass fraction.

The adequacy of the obtained model was verified using analysis of variance, in which the coefficient of determination (0.88), *p*-level (0.040986) and *F*-criterion (11.118) were determined.

According to the obtained regression equation, a projection of the response surface of the dependence of the melting temperature on the proportion of components in the dispersed medium was constructed. The projection of the response surface is shown in fig. 4.

Using the software *Statistica 8* (*StatSoft, Inc.*) and the regression equation, the formulation of the fatty base of the oleogel with a melting point of +34.05°C was selected, in which the rational content of the components is: sunflower oil 15%; palm oil 60%; chicken fat 25%.

To study the effect of the dispersed phase – vegetable wax – on the melting point of the developed fatty base, oleogel models were created with a given content (% wt.) of wax from 1 to 5% (Fig. 5).

The processes of melting and crystallization of oleogels with different contents of the dispersed phase were studied by DSC. The melting temperatures of these systems have been established. The results are shown in Fig. 6.

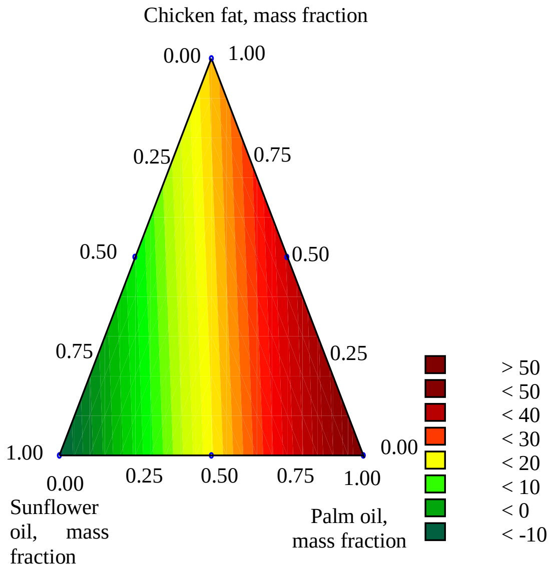


Fig. 4. Projection of the response surface of the dependence of the melting temperature on the fraction of components in the dispersed medium

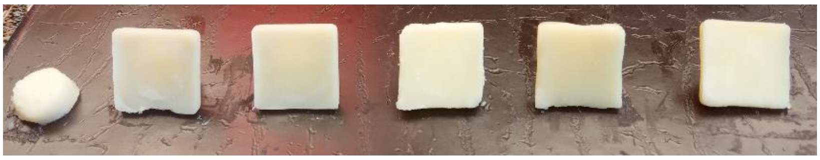


Fig. 5. Models of oleogels with different mixed wax: a – 0%; b – 1%; c – 2%; d – 3%; e –4%; f - 5%

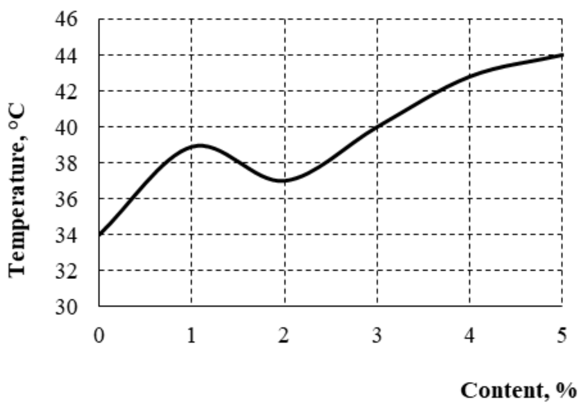


Fig. 6. Dependence of the melting point on the wax content in the oleoge

According to Fig. 6 it was found that when adding 1% of the organogelator, the melting point of oleogels increases by about 5ºC, and at 2% it decreases. Therefore, a wax concentration of 1.5% can increase the melting point and create an additional crystal structure for the developed three-component oleogel dispersion medium. A further increase in the content of the dispersed phase of the oleogel is not rational, because the melting point becomes higher than +38°C.

Conclusion

1. To create a dispersed oleogel medium, the selection of fats, which are a source of polyunsaturated and monounsaturated fatty acids, in particular sunflower and palm oil, chicken fat, is justified. The physicochemical characteristics of these fats have been experimentally established.

2. The process of melting and crystallization of selected fats was studied by DSC to create a dispersed medium of oleogels. It has been established that the melting curve of sunflower oil, in contrast to the melting curves of chicken fat and palm oil, has two full-scale peaks, but with only one hump. For chicken fat and palm oil, the melting curve is also characterized by two peaks, one of which has two and three humps, respectively. This indicates the presence of a diverse crystalline form and its modification. The reason for this is the triacylglycerol and fatty acid composition of these fats. Sunflower oil crystallization curves, like chicken fat and palm oil crystallization curves, have two full-scale peaks, but sunflower oil has two peaks each, while chicken fat and palm oil have only one peak each.

3. The dependence of the STG content in the selected fats on temperature has been established. It was found that at a temperature of +35 ºC, the content of STG in palm oil is higher than in chicken fat (7.87 vs. 3.27%), which indicates that this oil will have a greasy consistency at this temperature. As a result, when using palm oil together with liquid oils, such as sunflower, you can get a dispersion medium that will have a melting

point in the range of +34-+38°C.

4. A mathematical model has been obtained for the dependence of the melting point on the content of the components of the oleogel dispersed medium, which makes it possible to calculate the rational composition of the dispersed medium, which will ensure the melting temperature of the oleogel in the temperature range of +34–+38ºC. A rational content of the oleogel dispersed medium with a melting point of +34.05ºC is proposed, namely: sunflower oil (0.15); palm oil (0.60); chicken fat (0.25).

5. The effect of vegetable wax content in the range from 1 to 5% on the melting point of the simulated oleogel disperse medium was studied. A rational content of wax (1.5%) in the oleogel was established.

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РОЗРОБЛЕННЯ ОЛЕОГЕЛІВ ЗІ ЗНИЖЕНИМ ВМІСТОМ НАСИЧЕНИХ ЖИРНИХ КИСЛОТ

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Анотація. Досліджено питання отримання жирових композицій зі зниженим вмістом насичених та трансжирів методом олеогелювання. Обгрунтовано актуальність комплексних досліджень з розробки олеогелів. Встановлено, що олеогелі у найближчий час можуть стати замінниками жирів, які отримані шляхом часткової гідрогенізації, переетерифікації або фракціювання. Запропановано жири для створення дисперсного середовища (жирової основи) олеогелю, а саме соняшникову та пальмову олії, курячий жир. Підкреслено доцільність використання зазначених жирів. Експериментально визначені фізико-хімічні показники соняшникової та пальмової олій, курячого жиру, зокрема, методом диференційної скануючої калориметрії проаналізовано процес плавлення та кристалізації обраних жирів. Особлива увага приділена вивченню кривих плавлення та кристалізації вказаних жирів. Експериментально встановлено вміст твердих триацилгліцеридів (ТТГ) у відповідних жирах в залежності від температури. Показано, що вміст ТТГ в пальмовій олії є вищим, ніж у курячому жирі (7,87 проти 3,27%), отже запропоновано використовувати пальмову олію та курячий жир разом з рідкими оліями, наприклад, соняшниковою, для отримання жирових основ олеогелю з температурою плавлення в діапазоні +34-+38°С. Розроблено математичну модель залежності температури плавлення від частки інгредієнтів дисперсного середовища олеогелю. Одержано рецептуру дисперсного середовища з температурою плавлення +34,05°С, в якій вміст інгредієнтів (%, мас.) складає: соняшникова олія 15; пальмова олія 60; курячий жир 25. Досліджено вплив вмісту дисперсної фази – рослинного воску – в інтервалі від 1 до 5% на температуру плавлення змодельованого дисперсного середовища олеогелю. Результати показали, що раціональний вміст рослинного воску у змодельованому олеогелі складає 1,5%. Використання методу олеогелювання може допомогти забезпечити жирову композицію не тільки затребуваними технологічними властивостями, але і за рахунок зменшення кількості насичених та трансжирів – позитивним жирнокислотним профілем, і як наслідок – зробити кінцевий харчовий продукт кориснішим для здоров'я людини. Отримана композиція олеогелю буде ефективною для використання в технологіях борошняних та кондитерських виробів замість жирів, що містять насичені та/або трансжири.

Ключові слова: олеогель, соняшникова олія, пальмова олія, курячий жир, плавлення, кристалізація, рослинний віск.