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# OBTAINING A COMPOSITION OF EMULSIFIERS TO INCREASE THE DURABILITY OF MARGARINE EMULSION

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*The aim of the study is to obtain a composition of emulsifiers from local raw materials for the production of margarine. The article presents the results of the influence of the composition of the resulting emulsifiers on the stability of the margarine emulsion. The main components of the resulting emulsifier compositions were soy lecithin, mono- and diglycerides obtained from cottonseed oil and beef fat by glycerolysis with glycerin. At the same time, three different margarine recipes were selected to determine the effect of the developed emulsifier compositions on the stability of the obtained products. Lecithin, in addition to emulsifying abilities, also has antioxidant properties, which increases the shelf life of the resulting margarine. Furthermore, a variety of analyses were carried out to determine the effect of the amount of soybean lecithin in the emulsifiers on the basic physical and chemical parameters of the resulting margarines. It was found that with an increasing of the unsaturated fatty acids on the fatty bases of margarine products, the consumption of the emulsifier increases proportionally, but the shelf life of the resulting product decreases.*

**Keywords:** emulsifiers, margarine, soybean lecithin, acid value, peroxide value, fatty acids, shelf life

# ПОЛУЧЕНИЕ КОМПОЗИЦИИ ЭМУЛЬГАТОРОВ ДЛЯ УВЕЛИЧЕНИЯ СТОЙКОСТИ МАРГАРИНОВОЙ ЭМУЛЬСИИ

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*Целью исследования является получение композиции эмульгаторов из местного сырья для производства маргарина. В статье представлены результаты влияния состава получаемых композиции эмульгаторов на стойкость маргариновой эмульсии. Основные компоненты получаемых композиции эмульгаторов составляли соевый лецитин, моно- и диглицериды, полученные из хлопкового масла и говяжьего жира методом глицеролиза с глицерином. При этом подобрали 3 разных рецептур маргарина для определения влияния разработанных композиции эмульгаторов на стойкость получаемых продуктов. Лецитин кроме эмульгирующих способностей так же имеет антиоксидантные свойства, что увеличивает срок хранения получаемых маргаринов. Далее были проведены ряд анализов для определения влияния количество соевого лецитина в составе эмульгаторах на основные физико-химические показатели получаемых маргаринов. Установлено, что с увеличением ненасыщенности жирных кислот жировых основ маргарина, то расход эмульгатора увеличивается пропорционально, но срок годности получаемого продукта уменьшается.*

**Ключевые слова:** эмульгатор, маргарин, соевый лецитин, кислотное число, перекисное число, жирные кислоты, срок хранения

# MARGARIN EMULSIYASINING BARQARORLIGINI OSHIRISH UCHUN EMULGATOR KOMPOZITSIYALARINI OLISH

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*Tadqiqotning maqsadi margarin ishlab chiqarish uchun mahalliy xomashyodan emulgator kompozitsiyasini olish. Maqolada margarin emulsiyasining barqarorligiga olingan emulgator kompozitsiyalarining tarkibini tasiri natijalari keltirilgan. Olingan emulgator kompozitsiyalarining asosiy komponentlari soya letsitini, glitserin bilan glitseroliz usuli orqali paxta moyi va mol yog'idan olingan mono- va diglitseridlar tashkil etgan. Shu bilan birga, ishlab chiqilgan emulgator kompozitsiyalarini olinadigan mahsulotlarning barqarorligiga ta'sirini aniqlash uchun 3 xil margarin retsepturasi tanlandi. Letsitin, emulsiyalash qobiliyatidan tashqari, antioksidant xususiyatlariga ham ega, bu esa olingan margarinlarning saqlash muddatini oshiradi. Shundan so'ng emulgatorlar tarkibidagi soya letsitini miqdorining olingan margarinlarning asosiy fizik-kimyoviy ko'rsatkichlariga ta'sirini aniqlash uchun bir qator tajribalar o'tkazildi. Margarin yog'li asosi yog' kislotalarining to'yinmaganlik darajasi ortishi bilan emulgatorning sarfi mos ravishda oshishi, ammo olingan mahsulotning saqlash muddati kamayishi aniqlangan.*

**Kalit so'zlar:** emulgator, margarin, soya letsitini, kislota soni, perekis soni, yog' kislotalari, saqlash muddati

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## Introduction

At present time, a great deal of attention is paid to solving a number of problems with the creation of products of a curative and preventive nature [1-4]. To achieve this, the best solution is to enrich food products with biologically active substances to obtain a product with the desired properties [5-7]. These substances improve the biological value of the resulting product, and at the same time play a role as a stabilizer and structure-forming agent [8-10].

Food producers face of challenges that need to be solved [11, 12]. For instance, to increase the production of food products enriched with biological additives, where their nutritional and biological value increases in concurrently, to improve their taste qualities, to increase the range of production, to improve technology and technological processes, to introduce new developments that will increase the value of the product produced [13-17].

Fat-and-oil products are the main sources of energy compared to carbohydrates and proteins and play an important role in the human body, and are implicated in many metabolic processes [18, 19]. The most important factor determining the value of oils and fats is their fatty acid composition, as well as their associated products (phospholipids, vitamins, sterols, etc.) which increase their biological advantages [20-22]. For healthy nutrition of the human body, it is necessary to consume fats optimized for

fatty acid composition, where their melting point does not have an index higher than human temperature and should be absorbed as much as possible when consumed [23]. However, not all common vegetable oils, animal fats and their processed products completely meet these requirements [23, 24]. The animal fats, butter, margarine, spreads produced currently have a low content of linoleic acid from the point of view of the physiological value necessary for proper human nutrition [25]. At the same time, a number of vegetable oils (soybean, safflower, linseed, etc.) are known for their high content of polyunsaturated (linoleic, linolenic, etc.) fatty acids, which these days are entitled like ω-3, ω-6 and ω-9 [26]. Products derived from modified fats and natural vegetable oils in some sense meet the requirements of standards, nutrition sciences, etc., except from the point of view of the physiology of human health, the enrichment of these products with unsaturated fatty acids is relevant [27].

**Methods**

The stability of margarine emulsions derived using a composition of emulsifiers was determined using a centrifuge. The resulting emulsion was centrifuged for 3 minutes at a speed of 3 thousand per minute. After the process, the percentage of the emulsion was determined and the fat phases separated into one and the same.

The peroxide value of the obtained margarine was determined by [28]. The anisidine value of the obtained margarines was determined by [29]. The acidity of the obtained margarines was determined by [30].

**Results and discussion**

To obtain a fat base of margarine without trans acid content, we selected 3 types of vegetable oils and fats in various ratios:

model No. 1 – beef fat : cotton palmitin : soybean oil = 20:20:60;

model No. 2 – beef fat : cotton palmitin : soybean oil = 10:20:70;

model No. 3 – beef fat : cotton palmitin : soybean oil = 10:10:80.

The fat base of margarine obtained by conventional mixing eventually separates from each other, where the solid fraction is separated from the liquid. This process also affects the quality and presentation of the resulting product. To prevent the separation of the fraction, it is necessary to transform the entire component into one single one. To achieve this, the method of interesterification was used, where fatty acids are redistributed between glycerols, and eventually it is possible to obtain solid fat compositions with various physical and chemical and organoleptic properties. The advantage of this method is that it allows you to obtain fat bases without (or with minimal) trans-acid content, where the final product may contain a large amount of polyunsaturated fatty acids.

Further, we have created a number of compositions of emulsifiers obtained from local products for margarine products, the composition of which is presented in table 1.

**Table 1**

**Formulations of emulsifier compositions for margarine emulsion**

| The code of the composition | The contents of the components in the composition, % | | |
|---|---|---|---|
| | Soybean Lecithin | Mono- and diglyceride from cottonseed oil | Mono- and diglyceride from beef fat |
| CE-1 | 33 | 67 | - |
| CE -2 | 50 | 50 | - |
| CE -3 | 67 | 33 | - |
| CE -4 | 33 | - | 67 |
| CE -5 | 50 | - | 50 |
| CE -6 | 67 | - | 33 |
| CE -7 | 34 | 33 | 33 |
| CE -8 | 50 | 25 | 25 |
| CE -9 | 25 | 50 | 25 |
| CE -10 | 25 | 25 | 50 |

In the table 1 includes possible types of industrial production of emulsifier compositions from local products that are not difficult to obtain.

To determine the optimal ratio of components in the resulting composition of emulsifiers, it is necessary to conduct a number of studies. At the same time, for all samples, the processes of obtaining an emulsion product, i.e. temperature, mixing, cooling, etc., should have the same indicator.

Further, using the composition of emulsifiers at different ratios, we obtained margarine, which were analyzed, where we determined the stability of the emulsion. The results obtained are shown in Figures 1, 2 and 3.

Figures 1, 2 and 3 show that for three types of fat bases, the developed compositions of emulsifiers have different effects on their emulsion. For instance, for model No. 1, the best composition of emulsifiers are CE-10, which consists of 25% soybean lecithin, 25% mono- and diglycerides from cottonseed oil and 50% mono- and diglycerides from beef fat, and for model No. 2 34% – CE-7 from soybean lecithin, 33% mono- and diglycerides from cottonseed oil and 33% mono- and diglycerides from beef fat and for model No. 3 – CE -9 consists of 25% soybean lecithin, 50% mono- and diglycerides from cottonseed oil and 25% mono- and diglycerides from beef fat. This can be explained by the fact that in each of the fat bases of margarine, the fatty acid composition differs from each other and this also affects the emulsifying ability of different types of developed emulsifier compositions.

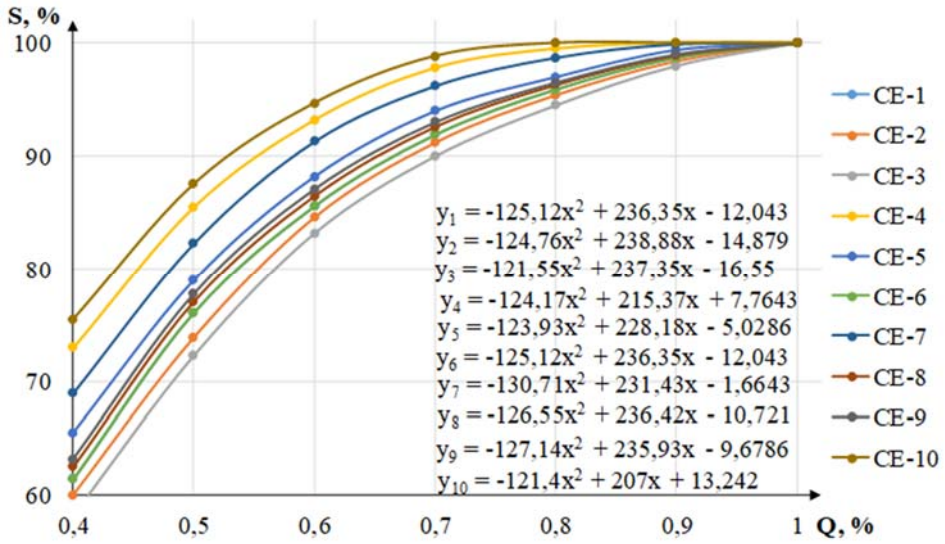



**Figure 1. The effect of the consumption of the emulsifier composition on the stability of the emulsion of low-calorie margarine model No. 1.**

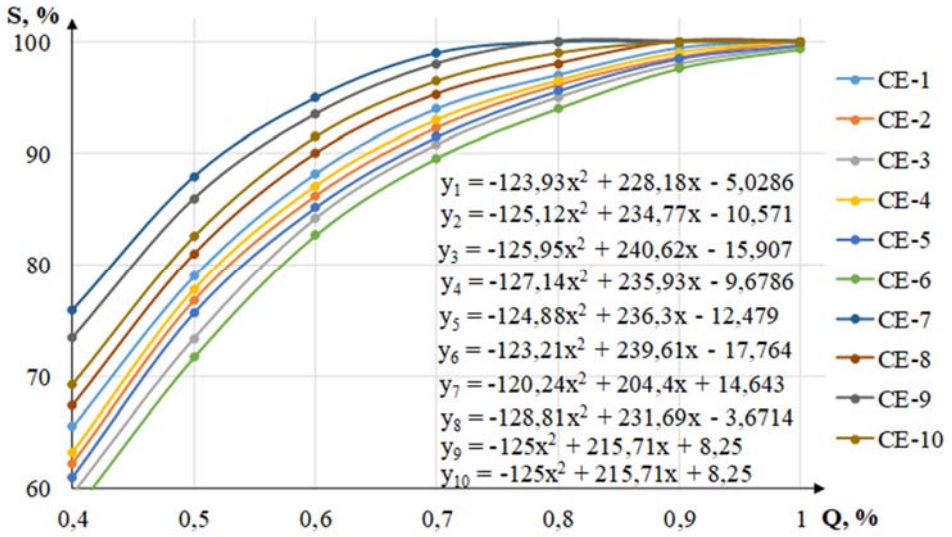



**Figure 2. The effect of the consumption of the emulsifier composition on the stability of the emulsion of low-calorie margarine model No. 2.**

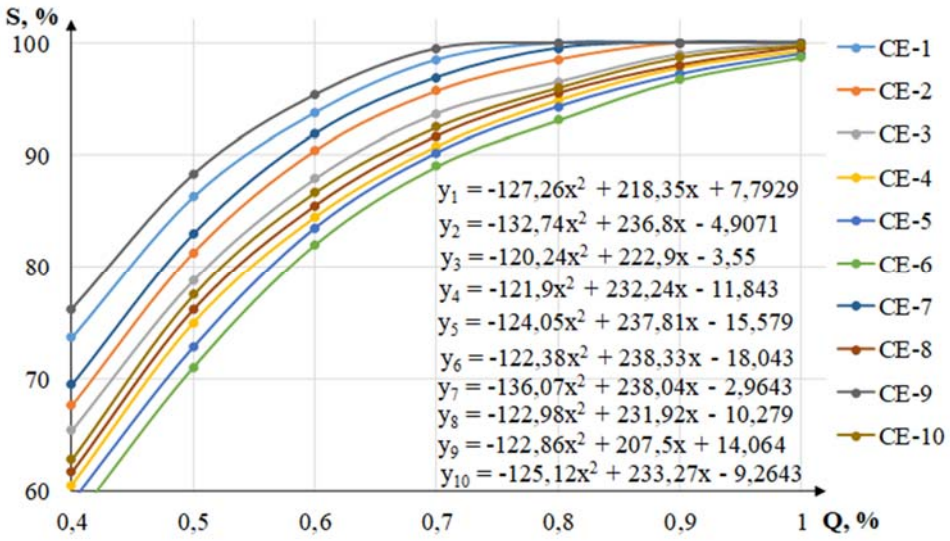



**Figure 3. The effect of the consumption of the emulsifier composition on the stability of the emulsion of low-calorie margarine model No. 3.**

Since margarine is one of the perishable products, additives with antioxidant properties (phospholipids, carotenoids, etc.) are widely used in its composition. It is known that lecithin, in addition to surface-active properties, is also an antioxidant, which also has a good effect on the shelf life of margarine products.

Considering the above, we have conducted a number of studies to determine the antioxidant properties of soy lecithin in various quantities at an emulsifier consumption of 1 per cent of the emulsion weight. In addition, quercetin, which was obtained from red onion, was used as a natural antioxidant. The results obtained are illustrated in figures 4, 5 and 6.

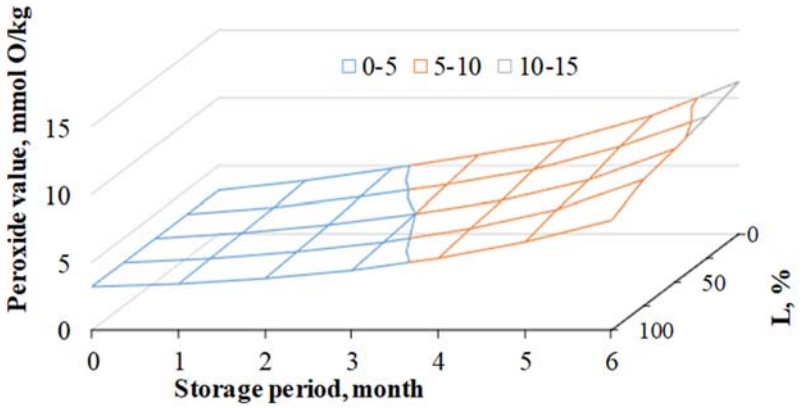



**Figure 4. The effect of soybean lecithin content in emulsifiers on the peroxide value of the resulting margarine, model No. 1.**

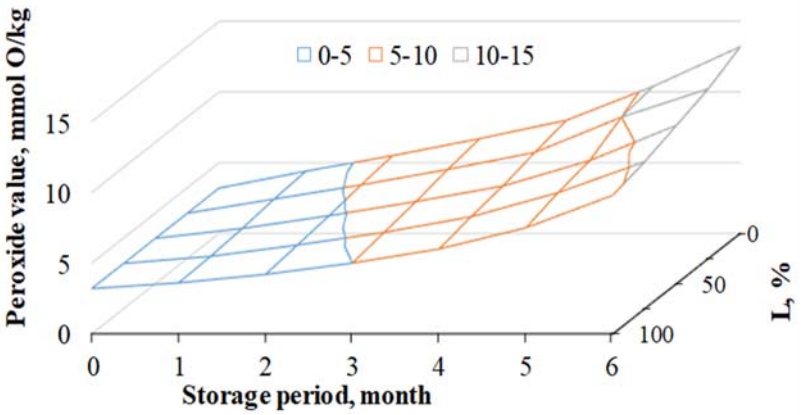



**Figure 5. The effect of soybean lecithin content in emulsifiers on the peroxide value of the resulting margarine, model No. 2.**

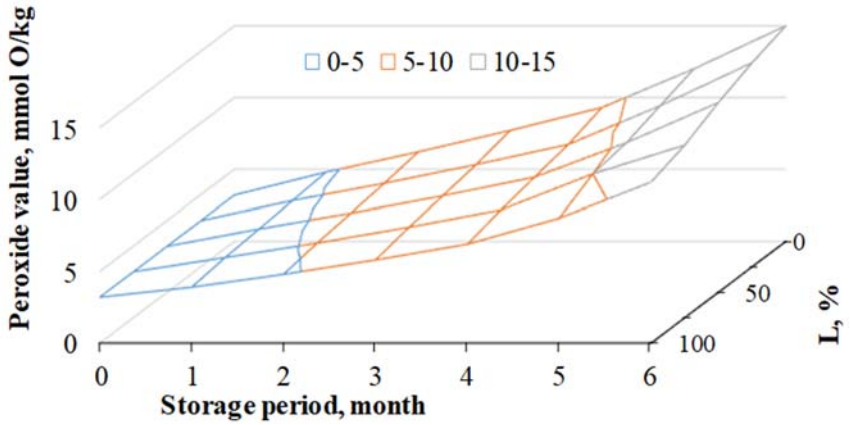



**Figure 6. The effect of soybean lecithin content in emulsifiers on the peroxide value of the resulting margarine, model No. 3.**

In the figures 4, 5 and 6 have been showed that the higher the phospholipid content in the emulsifier, the stability of the resulting products increases, which confirms its peroxide value. It should be taken into account that the more unsaturated fatty acids in margarine, the faster the oxidation process takes place, as can be seen in model No. 3. As can be seen from the results of the study, the average shelf life of the resulting margarine can be chosen for more than 4-5 months, where its peroxide value meets the requirements of the norm.

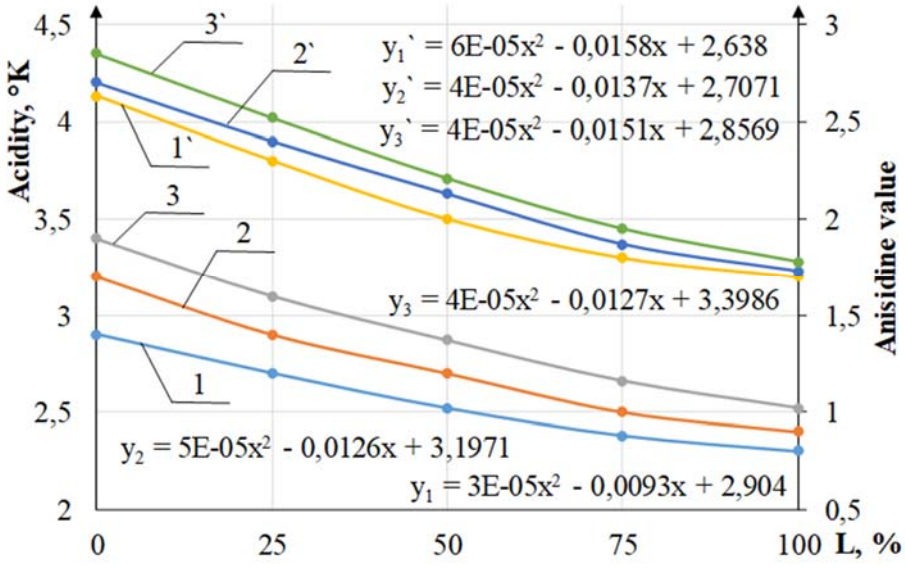
In addition to the peroxide values of the products obtained, there are also secondary oxidation products (anisidine value) and acidity, which also needs to be taken into account when storing low-calorie margarines.

Further, we investigated the effect of the amount of soy lecithin in the emulsifier at a consumption of 1% by weight of margarine on its acidity and anisidine value during storage, where the resulting emulsion product was stored in the refrigerator for 5 months. The obtained data are presented in Fig. 7.

It is clear from figure 7 that with an increasing in the amount of soybean lecithin in the emulsifier, it acts well on its shelf life. When storing margarine for five months, its acidity and anisidine value do not exceed standard indicators.

## Conclusion

Thus, the results of the tests suggest that it is possible to advise using emulsifiers that have been produced rather than ones that have been imported. The study's findings demonstrated that when using various margarine fat bases, the choice of emulsifiers is made individually and that the stability of the resultant emulsion is




**1, 2, 3-acidity; 1`, 2`, 3`- anisidine value;**
**1, 1`-mod. No. 1; 2, 2`-mod. No. 2; 3, 3`-mod. No. 3**
**Figure 7. The effect of soybean lecithin content in emulsifiers on the acidity and anisidine value of the resulting margarine at five months of storage.**

significantly influenced by the fatty acid content of the resulting oil. Additionally, it was discovered that the shelf life of the resultant margarine increased with the amount of soy lecithin in the emulsifier composition. At the same time, it should be remembered that while the shelf life of the finished product declines with an increase in the unsaturation of fatty acids in the fatty bases of margarine, the consumption of the emulsifier increases accordingly.

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