

## STUDY OF THE ANALYSIS PROCESS OF THE COMPOSITION OF FATS AND OILS USED IN MARGARINE PRODUCTION

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**Annotation.** This article presents the scientific results and research process related to the compositional analysis of fats and oils used in the production of margarine under laboratory conditions. It is well known that the quality and nutritional value of margarine depend not only on technological factors but also directly on the quality of the raw materials used. For this reason, in our research, we set the objective of studying the composition of the raw materials applied in margarine production.

**Keywords:** Interesterified fat, margarine, palm oil, milk fat replacer, soybean oil.

Margarine is a water-in-oil emulsion in which the aqueous phase is stabilized within a network of solid fat crystals, and the water phase is dispersed as fine droplets throughout the liquid fat. For margarine production, vegetable oils such as cottonseed, soybean, sunflower, corn, rapeseed, and palm oils are commonly used [1, pp. 213–252].

It is well known that the quality and nutritional value of margarine depend not only on technological factors but also directly on the quality of the raw materials and ingredients used [2, p. 7].

For use as primary raw materials in laboratory experiments, various fats and oils produced by domestic oil-processing enterprises — including butter, soybean oil, and cottonseed oil with different quality characteristics — as well as imported palm oil and “Efko” brand milk-fat substitute were selected. The physicochemical parameters of the fats and oils used in the experiments are presented in Table 1 [3, pp. 815–817].

*Table 1*

### Physicochemical characteristics of fat-containing raw materials

Sample Serial Number	Type of fat or oil	Iodine Value, % J <sub>2</sub>	Acid value, mg KOH	Moisture and Volatile Matter Content., %	Melting point, °C	Hardness, g/cm
1	Soybean oil	135,7-137,1	0,20-0,26	0,20-0,21	-7	-

2	Cottonseed oil	108,5-110,7	0,22-0,41	0,16-0,31	1	-
3	Butter	46,3-48,7	0,21-0,23	0,15-0,20	32-33	140-142
4	Milk fat replacer	65,2-68,7	0,21-0,24	0,28-0,30	34-35	130-135
5	Palm oil	57,9-58,8	0,25-0,30	0,18-0,20	38-40	178-182

According to the data presented in Table 1, the iodine value of vegetable oils ranges from 108.5 to 137.1 % I<sub>2</sub>. In contrast, the iodine value of fats varies from 46.3 to 68.7 % I<sub>2</sub>. Their melting temperatures were recorded within the range of 32 °C to 40 °C.

The quality indicators (QI) and other physical properties of fats and oils directly depend on their fatty acid composition and the structural arrangement of triglycerides. The proportions of saturated and unsaturated fatty acids within fats and oils determine their physical characteristics. Taking this into account, we compared the fatty acid composition of the fats and oils used in our experiments. For this purpose, the methyl esters of fatty acids isolated from the fats and oils were analyzed using gas-liquid chromatography, and their quantitative composition was determined. The obtained results are presented in

*Table 2.*

#### **Fatty Acid Profile of the Oils and Fats Utilized in the Research**

Fatty acids %	Butter	Palm oil	Milk fat substitute	Cottonseed oil	Soybean oil
C <sub>12:0</sub> + C <sub>14:0</sub>	10,9	1,3	16,8	0,8	0,3
C <sub>16:0</sub> + C <sub>16:1</sub>	29,5	44	21,2	23,7	11
C <sub>18:0</sub>	12,4	4,5	6,3	2,6	3,9
C <sub>18:1</sub>	25,8	39,2	20,7	18,5	22,8
C <sub>18:2</sub>	2,7	10,1	14,3	53,2	50,8
C <sub>18:3</sub>	0,1	0,4	5,7	0,4	6,8
Other fatty acids	18,6	0,5	15,0	0,8	4,4

According to the data presented in Table 2, the total amount of saturated fatty acids in natural vegetable oils and fats—primarily due to palmitic (C<sub>16:0</sub>) and stearic (C<sub>18:0</sub>) acids—ranges from 14.9% (in soybean oil) to 48.5% (in palm oil). In natural butter and milk fat substitutes, in addition to palmitic (21.2% to 29.5%) and stearic (6.3% to 12.4%) acids, lauric and myristic acids (C<sub>12:0</sub>, C<sub>14:0</sub>) are

present in amounts ranging from 10.9% to 16.8%, while other fatty acids (such as caproic, caprylic, and capric acids) constitute 15.0% to 18.6%.

The content of unsaturated fatty acids ranges from 70.4% to 72.1% in cottonseed and soybean oils, and from 28.6% to 40.7% in fats.

It is well known that the use of interesterified fats provides effective results in producing margarines with a regulated trans-fat content. Taking this into account, the experiments utilized ready-made interesterified products manufactured by “Chirchiq Grand Savdo” LLC.

According to the technological regulations, mixtures of palm oil and soybean oil in an 80:20 ratio were interesterified at 70–80°C under vacuum conditions (150–200 mmHg) in the presence of 0.3% powdered sodium ethylate catalyst (relative to the oil mass).

The resulting interesterified fats were refined at 70–80°C using a 100 g/L NaOH solution. The physicochemical parameters of the interesterified samples were analyzed in the laboratory, and the obtained results are presented in Table 3.

*Table 3.*

**Physicochemical Characteristics of the Interesterified Samples**

Iodine Value, % J <sub>2</sub>	Acid Value, mg KOH	Moisture and Volatile Matter Content., %	Melting point, °C	Hardness, g/cm
75,8-78,2	0,61-0,78	0,16-0,25	33,2-36,1	166-174

According to the data presented in Table 3, the iodine value of the interesterified fats ranged from 75.8 to 78.2 % I<sub>2</sub>, their melting temperature was 33.2–36.1 °C, hardness ranged from 166 to 174 g/cm, and the acid value was 0.61–0.78 mg KOH. All parameters of the interesterified fats meet the requirements for fats used in margarine production.

The fatty acid composition of the interesterified fats was determined using gas chromatography.

The obtained data are presented in Table 4.

*Table 4*

**Fatty acid profile of the interesterified samples**

Fatty acid composition					
C <sub>12:0</sub> + C <sub>14:0</sub>	C <sub>16:0</sub> + C <sub>16:1</sub>	C <sub>18:0</sub>	C <sub>18:1</sub>	C <sub>18:2</sub>	Other Types of Fatty Acids
0,8-1,1	36,1-37,5	4,3-4,8	35,2-35,9	18,2-18,4	2,6-2,9

According to the data presented in Table 4, the mass fraction of palmitic acid in the interesterified fats ranged from 36.1% to 37.5%, representing the highest proportion. This is

explained by the presence of palm oil in these interesterified fats (see Table 1). Additionally, stearic acid accounted for 4.3–4.8%, oleic acid 35.2–35.9%, and linoleic acid 18.2–18.4%. The mass fraction of lower molecular weight fatty acids was 0.8–1.1%, while other fatty acids constituted 2.6–2.9%. Understanding the fatty acid composition of interesterified fats is important, as it directly determines their melting temperature, hardness, and quality indicators (QI) characteristics.

### References

1. Silva, T.J.; Barrera-Arellano, D.; Paula, A.; Ribeiro, B. Margarines: Historical approach, technological aspects, nutritional profile, and global trends. *Food Res. Int.* 2021, 147, 110486.
2. In 2018, the President of the Republic of Uzbekistan issued Decree No. PQ-2832, dated March 14, 2017, concerning measures to expand soybean cultivation and increase soybean production in the country for the period 2017–2021.
3. Kubankova G.B & Khodirova G.A (2023). Influence of germination on the amino acid composition of soybean. *Food processing industry.* 90-94. 10.52653/PPI.2023.12.12.018.