

QUALITY INDICATORS OF SOYBEAN OIL OBTAINED FROM SOYBEAN SEEDS

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Abstract

The main quality characteristics of vegetable oil obtained from soybean grain are investigated in this article. The physicochemical properties of the oil, including the number of acids, peroxide content, iodine content, saponification number, moisture and impurities were analyzed. Also covered the importance of soybean oil in the food industry and the factors that determine its quality. The article serves as an important scientific basis for the evaluation of the safety and consumer suitability of soybean oil.

Keywords: Soybean oil, quality indicators, acidity, peroxide number, iodine quantity, saponification rate, refining, oxidation, vegetable oils, food industry.

Introduction

Soybean (*Glycine max*) is a leguminous family and is one of the most important oilseeds and protein crops worldwide. It is mainly grown on a large scale in countries such as United States, Brazil, Argentina, China, and India. Soybean grain is distinguished by its high nutritional value, since it contains not only fat, but also protein substances up to 35–40%. For this reason, soybean is a raw material that is strategically important for both the food and feed and technical industries. Soybean oil is one of the most important products for soybean grain, and it is produced by pressing (mechanical method) or extraction (extraction by solvent). The most commonly used method in the industry is the extraction using hexane, as this method provides the extraction of oil with a high yield. Soybean grain contains on average 18–22% fat, which may vary depending on the variety, climatic conditions, soil fertility and agrotechnology. The resulting raw soybean oil undergoes a refining process as it contains phospholipids, free fatty acids, pigments and odor compounds that can degrade quality of the oil. Soybean oil is of great importance in the food industry because it is rich in unsaturated fatty acids, which are essential for the human body. In particular, the presence of linoleic (Omega-6), oleic (Omega-9) and linolenic (Omega-3) acids makes it a biologically high value product. These fatty acids play an important role in improving the functioning of the cardiovascular system, reducing cholesterol levels and regulating overall metabolism. In addition, soybean oil contains natural antioxidants — tocopherols (vitamin E), which serve as a defense against oxidation of the oil. This contributes to the relatively long shelf life of soybean oil. Soybean oil is widely used not only as a food product, but also for other industries of the industry. For example, he says:

- In the manufacture of margarine and mayonnaise
- In the confectionery industry
- in canned food
- In pharmaceutical and cosmetic products
- In the industrial oils and paint industry



widely used. In particular, its high iodine content makes it belong to the group of semi-drying oils, which is an important technical property in the varnish paint industry. Soybean oil is a chemically complex mixture of natural lipids, with triglycerides making up the bulk of it. Triglycerides are complex ethers formed by the combination of three fatty acids with a glycerol molecule that are the main energy source of fat. The chemical composition of soybean oil determines its physicochemical properties, nutritional value and industrial application. The largest share in soybean oil is occupied by unsaturated fatty acids. They are very important for the human body and are actively involved in biological processes. The main fatty acids of soybean oil include:

Linoleic acid (Omega-6) — soybean oil contains about 50–60% of its content. This acid is one of the essential fatty acids that are not synthesized in the body and must be taken externally. It participates in the structure of cell membranes, improves skin condition and supports the immune system. At the same time, it also plays an important role in the regulation of cholesterol metabolism.

Oleic acid (Omega-9) — soybean oil contains around 20–30% of the content. This acid is beneficial for the cardiovascular system, helping to reduce the amount of "bad" cholesterol (LDL) in the blood and increasing the level of "good" cholesterol (HDL). Oleic acid also improves the oil's stability to oxidation.

Linolenic acid (Omega-3) — 5–10% of the population. This acid is bioactive and is considered crucial for brain function, nervous system and heart health. Omega-3 fatty acids have anti-inflammatory effects and regulate many metabolic processes in the body.

Saturated fatty acids — in the form of palmitic and stearic acids, it makes up 10–15%. They serve as a source of energy, but an excess of them can have a negative effect on the body. In addition to fatty acids, oil contains a number of biologically active substances, which further enhance its quality and physiological relevance.

One of the most important components — **tocopherols (vitamin E)** is considered to be a Tocopherols are a strong natural antioxidant and protect the oil from oxidation and the fermentation process. For this reason, soybean oil is considered more stable than some other vegetable oils. In addition, vitamin E protects cells in the human body from free radicals, slows down skin aging and strengthens immunity. Soybean oil also **Phospholipids (lecithin)** There are also available. Lecithin is a basic component of cell membranes and plays an important role in the functioning of the nervous system, brain cell function, and proper metabolism of fats throughout the body. In industry, lecithin is often used as emulsifier, which means it has properties to combine water and oil. In addition, in the composition of soybean oil **Sterols** As present, they reduce the absorption of cholesterol in the intestines and reduce the risk of cardiovascular diseases. The presence of these substances makes soybean oil among the functional food products. A small amount of soybean oil **Pigments** It also occurs. These include chlorophyll and carotenoids. These pigments affect the color of the oil and their amount depends on the degree of refining. Bleached (refined) soy oil becomes light yellow in color.



Soya moyidagi yog' kislotalar tarkibi

Kislotalar turi	Yog' kislotalar miqdori, % m.m.	
	Bo'lish mumkinligi	O'rtacha
To'yingan:		
Laurin	0,1	0,5
Miristin	0,5	0,2
Palmitin	7-12	10,7
Stearin	2-5,5	3,9
Araxidon	1,0	0,2
Begen	0,5	-
To'yinmagan		
Palmitoolein	10,5	0,3
Olein	20-50	22,8
Linol	35-60	50,8
Linolein	2-13	6,8
Eykozen	1,0	0,5

As for its biological value, soybean oil is a very important product for the human body. Unsaturated fatty acids from its composition are considered "essential" and cannot be synthesized in the body and are obtained exclusively through food. That is why soybean oil occupies an important role in a proper diet. Also, the high biological activity of soybean oil is explained by its positive effect on the cardiovascular system, nervous system and metabolism. It is important for balancing cholesterol levels, improving blood circulation and maintaining the overall energy balance of the body.

The quality of soybean oil is determined by its chemical composition as well as physicochemical indicators. These indicators are important for the evaluation of the oil 'high quality, shelf life, oxidation resistance as well as technological properties'. In industrial practice, special laboratory analysis for quality control of soybean oil is performed and based on its results a conclusion is made about the overall quality of the oil. One of the most important indicators of soybean oil is the number of acid. The number of acidity is expressed by the amount of potassium hydroxide, which is spent to neutralize the free fatty acids contained in 1 gram of oil. This indicator reflects the degree of hydrolysis process taking place in the oil. In the storage process, under the influence of moisture and enzymes, triglycerides are broken down, free-standing fatty acids are formed and, as a result, the number of acids increases. If a low acid count indicates that the oil is fresh and of good quality, a high indicator indicates that the deterioration process of the product has begun.

Peroxide number is also one of the important indicators in evaluating the quality of soybean oil. It shows the amount of primary oxidation products formed in the oil, namely peroxide and hydroperoxide. Soybean oil is prone to oxidation under the influence of oxygen, light and high temperature, which results in the formation of peroxides. If a low peroxide count indicates that the oil is fresh and stable, its increase means that the oxidation process is intensified and the quality of the oil is degraded. In such oils, an unpleasant smell and taste may appear.



The iodine count is an important indicator that determines the chemical nature of soybean oil. This figure represents the content of iodine that permeates unsaturated bonds per 100 grams of oil. Soybean oil acquires a high iodine count due to the high concentration of unsaturated fatty acids. This puts it in the group of semi-drying oils. A high iodine content increases the sensitivity of the oil to oxidation, but at the same time expands its potential application in the technical industry, especially in the production of paints and varnishes.

Saponification number is also one of the important physicochemical parameters of soybean oil, it refers to the amount of potassium hydroxide required for complete cooling of 1 gram of oil. This indicator allows you to determine the average length and composition of the fat molecules. By the number of saponifications, information about the chemical structure and technological properties of the oil is obtained.

Another important factor that affects the quality of soybean oil is its moisture content and volatile substances. An increase in moisture content accelerates the process of hydrolysis of the oil, as a result of which free fatty acids increase and the quality of the product decreases. In addition, moisture creates favorable conditions for the development of microorganisms, which leads to rapid deterioration of the oil. Therefore, during production, the oil undergoes special drying and cleaning steps. Mechanical impurities also have a bad effect on the quality of soybean oil. They may contain dust, grain residues, proteins and other solid particles. Such mixtures reduce the transparency of oil, accelerate the oxidation process and reduce the shelf life. Therefore, mechanical impurities are lost by filtration and refining processes at a maximum. The organoleptic indicators of soybean oil, such as color, odor and transparency, are also important in evaluating its quality. Raw soybean oil can often be an orange or green tint, which is due to the pigments it contains, namely chlorophyll and carotenoids. And after the refining process, the oil turns light yellow, cleans of foreign odors, and acquires a transparent appearance. The change of color and smell is mainly associated with oxidation processes, which is a sign of a deterioration in the quality of the oil.

Conclusion

Soybean grain oil has a high nutritional value, its quality is assessed by a number of physicochemical indicators. Indicators such as acid, peroxide content, iodine content and saponification count are important for determining freshness, oxidation point as well as chemical composition of oil. The refining process serves to improve the quality of the soybean oil and remove harmful and impurities from it. As a result, the oil becomes more consumable, stable and safe. In general, the correct assessment of the quality of soybean oil and full control of its technological processes are the main factors for obtaining a high-quality product.

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