

## TECHNOLOGY OF DEODORIZATION OF SOYABEAN OIL

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### ABSTRACT

The technology of deodorization of local soybean oil has been studied. Soybean oil is obtained from soybean seeds grown locally. For deodorization, oils were obtained under production conditions. Studies conducted in laboratory and production conditions. The effect of pressure, temperature and duration of the deodorization process on the quality indicators of deodorized oil has been studied. Equipment and technological lines for the deodorization of local varieties of soybean oil have been selected. Research in production tests carried out on a bubbling device consisting of tubes with holes for bubbling steam into oil. To maintain absolute pressure during deodorization, steam ejector vacuum systems were used. The effectiveness of such systems on soybean oil ranged from 75 to 95%. Distillates deodorization ranged from 0.25 to 0.50% of the raw materials supplied to the deodorizer. In experiments, tocopherols and sterols were isolated from the distillate and fatty residue of water from a barometric condenser. The use of tocopherols as food antioxidants was carried out by comparison with other food and synthetic products. The results obtained ensured an increase in the quality and perfection of the technological processes of deodorization of soybean oil.

**Keywords:** Local soybean oil, deodorization technology, laboratory and pilot plants, technological regimes, quality and physical-chemical characteristics of deodorized oil, deodorized oil distillates and their use.

### INTRODUCTION

Deodorization is an oil treatment process with steam, in which good quality steam, obtained from deaerated and properly treated water, is injected into soybean oil at low absolute pressure and high enough temperature to distill off free fatty acids (FFA) and odorizing substances and separate these volatile substances from the oil flow [1-3].

The role of deodorization in obtaining and refining of food fats and oils is that deodorization is the last stage of the preparation of oil for use as an ingredient in margarines, shortening, salad oils, frying oils, confectionery fats and many other foods [4-5]. Deodorized oil can be considered as ready for various classification parameters, depending on the characteristics and tastes of the consumer market of a particular region or country. In some regions they like oil with pronounced taste and smell, in others they prefer oil with characteristic color [6].

Studies of the technology of deodorization of soybean oil, obtained based on soybean seeds, are of both scientific and practical interest.

Soybean oil was deodorized in a laboratory setup.

To analyze the composition of the original and deodorized soybean oils, modern methods of physical-chemical research were used [7, 8].

The quality indicators and the fatty acid composition of the initial and refined samples of local varieties of soybean oils are given in Table 1.

Table 1. The composition of raw and refined local varieties of soybean oils

Components	Crude oil	Refined oil
Triglycerides	95-97	More than 99
Phosphatides	1.5-2.5	0.003-0.045
Unsaponifiables:	1.6	0.3
Plant Sterols	0.33	0.13
Tocopherols	0.15-0.21	0.11-0.018
Hydrocarbons (squalene)	0.014	0.01
Free fatty acids	0.3-0.7	Less than 0.05
Traces of metals, mg / kg:		
iron	1-3	0.1-0.3
copper	0.03-0.05	0.02-0.06

The intervals of variation of the working parameters of the process of deodorization for the production of high quality oils given in table 2.

Table 2. Soybean oil deodorization conditions

Absolute pressure, mm hg	1 – 6
Temperature, ° C	252 – 266
Duration of exposure, min	15 – 16
Stripping steam,% of oil mass	1 – 3

The effect of each parameter on the deodorization process is studied.

Pressure does not have a perceptible effect on quality if the deodorizer operates at an absolute pressure in the range from 1 to 6 mm hg. It is established that pressure is higher than 6 mm hg even in the range of 7 to 9 mm hg will lead to problems with quality, such as the appearance of undesirable taste and smell.

Deodorization temperature is a parameter that can be considered as variable. It directly affects the vapor pressure of volatile components that must be removed. By increasing or decreasing the temperature, one can achieve a correspondingly lower or higher rate of removal of odorizes. The duration of exposure during deodorization is the time during which the raw material is at the deodorization temperature and at a given flow rate of bubbling steam. The effectiveness of bubbling depends on the ability of the devices to thoroughly mixing steam and oil. In modern equipment, the duration of exposure is from 15 to 60 minutes. This time refers to the oils entering the deodorization after chemical (alkaline) refining and with a FFA content of less than 1%.

To obtain the highest quality deodorization product, it is necessary that the raw materials are also of better quality. Improper or inadequate processing at any stage of the process can lead to a change in quality and even to permanently spoiled oil entering into deodorization.

Soybean oil contains about 0.1% tocopherols, and at a deodorization temperature of 260 to 265 ° C, from 40 to 50% of this amount will be removed.

By-products of deodorization of soybean oil consist of a mixture of phosphatides, unsaponifiable substances, free fatty acids and soap.

The value of each by-product depends on its composition.

Distillates of deodorization range from 0.25 to 0.50% of the raw materials fed to the deodorizer. They consist mainly of unsaponifiable substances and some fatty acids. Distillates of deodorization are volatile organic substances released as a valuable by-product in soybean oil deodorization (Table 3).

Table 3. Distillates of deodorized soybean oil

Component	Molecular weight, g / mol	Relative volatility
Fatty acid	280	2.5
Squalene	411	5.0
Tocopherol	415	1.0
Sterol	410	0.6
Sterol ester	675	0.038
Butter	885	Insignificant

The recovery efficiency of distillates of deodorization is very high. In experiments, tocopherols and sterols were recovered from distillate and from the fatty residue of water from a barometric condenser. 98% of tocopherols and more than 95% sterols were recovered from the distillate.

In table.4 is shown that soybean distillates contain 18% sterols, of which 44% is stigmasterol. The approximate composition of the sterol components of soybean oil is as follows: 20% campesterol, 20% stigmasterol, 53%  $\beta$ -sitosterol, 4%  $\delta$ -avenasterol and 3%  $\delta$ -stigmasterol.

Table 4. Composition of distillates of deodorization of soybean oil, %

Components	Soybean oil
Non-pollinated substances	33
Tocopherols	11.1
$\alpha$ – tocopherols	0.9
Sterols	18
Stigmasterol	4.4

Sterols are used in production of pharmaceuticals

Soybean oil is characterized by a special chemical composition. Soybean oil with such chemical composition is easily subjected to deodorization technology. In deodorization of soybean oil distillates containing in its composition substances with functional properties are obtained.

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