INNOVATIVE TECHNOLOGICA
METHODICAL RESEARCH JOURNAL
ISSN: 2776-0987 Volume 2, Issue 12, Dec., 2021

# STUDY OF THE PROCESS OF SAMPLE REFINING AND DEODORIZATION OF SUNFLOWER AND SOYBEAN OILS

Zufarzhon Zafarovich Kodirov
Assistant, Fergana Polytechnic Institute Republic of Uzbekistan
150100 Fergana, Uzbekistan, st. Fergana, 86,
qodirovzufar93@mail.ru

Mamadjanova Iroda Rakhmatovna
Fergana Polytechnic Institute Republic of Uzbekistan
Republic of Uzbekistan, Fergana
qodirovzufar93@mail.ru

Khusanova Nafisa Saydillaevna
Assistant Fergana Polytechnic Institute, Republic of Uzbekistan, Fergana
E-mail: xusanovanafisa1989@gmail.com

**Abstract**
In our study, it was found that increasing the duration of the deodorization process of sunflower and soybean oil leads to a decrease in the acid number, color and peroxide content of the deodorized oil. The deodorization process lasted 85 and 90 min, with an acid count of 0.3 and 0.25 mg KOH / g, an iodine color of 8 and 6 mg, and a peroxide count of 4 mmol of active oxygen / kg. formed. In the process of refining sunflower oil obtained by extraction, the concentration of alkaline solution was 150 g / l, and the excess was 30%, the yield of refined sunflower oil was 94.3%, acidity 0.18 mg KOH, color 25 mg iodine.

**Keywords:** fatty acids, sunflower oil, deodorization, soybean oil, potassium hydroxide, sodium bicarbonate.

## Introduction

The main direction of technical development in the field of vegetable oil production is the introduction and improvement of existing technologies for the processing of non-conventional oilseeds, which will significantly increase the efficiency of technological equipment [1].

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After the independence of the republic, a part of the land was allocated for grain crops. As a result, in recent years, the volume of deliveries of cotton seeds to the processing industry has reached 1.5 million tons per year. Oilseeds are only 55-60% supplied with cotton seeds. This requires the search for new types of fat and protein raw materials for processing in the industry and relevant agricultural crops. The solution to this problem depends not only on the prospects of the oil and gas industry, but also on the development of the mixed feed industry. One such crop is sunflower, which contains 33-57% fat and 20.8% protein. The oil extracted from sunflower seeds is not inferior to cottonseed oil in terms of taste and quality [3-5].

With this in mind, theoretical and experimental research aimed at improving the technology of purification and deodorization of vegetable oils, including sunflower oil, is relevant to the industry [6].

Deodorization is the loss of specific taste and odor characteristics, allowing the production of "deodorized" oils and fats that cannot be separated or identified by taste or smell. Deodorant plays an important role in the preparation of oils for the production of margarine, mayonnaise, canned and salad oils [8-11].

The different quality of refined oils and fats, as well as the diversity of requirements for the refined product, indicate the need to use different stages of refining processes or different combinations of individual operations in each case. This, in turn, underscores the importance of technological samples, including sample hydration, neutralization, and bleaching [7-9].

The development of a refining regime for any vegetable oil, including sunflower oil, has led to the development of methods for the separation of non-fatty substances in the presence of glyceride oils. At present, methods for the separation of phosphatides in a continuous and continuous process are well developed. These methods achieve a level of phosphatide release that is sufficient to prepare the oils for hydrogenation. The method of neutralizing free fatty acids with alkaline solutions is also not difficult [12-14].

Sunflower oil is one of the best types of vegetable oils. It has a low solidification point and a high percentage of unsaturated fatty acids. It is added to salads, veneers, various sauces and stews, fried fish and vegetables, and used in a variety of pastries. Sunflower oil is available in unrefined, refined and deodorized form. Refined sunflower oil is transparent, golden or light yellow in color, does not form sediments during storage, has a faint odor of seeds [2-10].

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**Experimental Part**

The following concentrations of alkaline solution were used to determine the effect of alkaline solution concentration and its increase on the yield and quality of refined extraction sunflower oil: 150 g / l and 20%, 25%, more than 30%, 200 g / l 20 % more, 250 g / l more than 20%, 300 g / l more than 50%.

The results of the study on the effect of alkali solution concentration and its increase on the yield and quality of refined sunflower oil are given in Table 1.

Table 1: Effect of alkali solution concentration and its increase on quality indicators of refined sunflower oil

| № | Alkaline solution concentration g / l | Excess alkali,% | Acid number mg, KOH | Color of iodine mg | Output of refined oil,% |
|---|---|---|---|---|---|
| **1** | 150 | 20 | 0,40 | 30 | 96,5 |
| **2** | 200 | 20 | 0,35 | 30 | 95,2 |
| **3** | 250 | 20 | 0,33 | 30 | 96,3 |
| **4** | 150 | 25 | 0,27 | 25 | 94,8 |
| **5** | 150 | 30 | 0,18 | 25 | 94,3 |
| **6** | 300 | 50 | 0,15 | 25 | 94,5 |

As a result, an increase in the concentration and alkalinity of the alkaline solution leads to a decrease in the acidity and color content of refined sunflower oil, as well as a decrease in the release of refined sunflower oil.

With an increase in the alkali solution from 20% to 30% at the same concentration of 150 g / l of alkali solution, the acid number of the refined oil decreases from 0.4 mg KOH to 0.18 mg KOH, the color count of iodine decreases from 30 mg to 25 mg, and the fat reduces the yield from 96.5% to 94.3%.

At a concentration of 200 g / l in excess of 20% of alkali, the acid content of refined oil is 0.35 mg of KOH, the color number is 30 mg of iodine and the separation of fat is 95.2%. At the same volume of more than 20% alkaline solution, the number of colors remains the same at 30 mg of iodine, the separation of refined fuel increases to 96.3%.

Under relatively severe conditions of refining, more than 50% of the concentration of 300 g / l alkali solution reduces the acid number to 0.15 mg KOH, the color count to 25 mg of iodine, and the oil separation is 93.5%.

Analysis of the results of the study showed that for the refining of sunflower oil obtained by this extraction method should be used alkaline solution with a

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concentration of more than 30% of 150 g / l, while refined sunflower oil is 94.3%, acid number is 0, 18 mg KOH and the number of colorants is 25 mg of iodine.
After refining in an alkaline solution, if the soap is washed poorly in the oils, the soap will retain its taste, and the oil will retain its taste when used with large amounts of bleach or in prolonged contact with it [4-11].
Therefore, we studied the deodorization process of refined sunflower oil based on the following data: Color - 15 mg / iodine, acid number - 0.6 mg KOH / g, peroxide number - 12 mmol a.k.a. / kg. The effect of the deodorization process duration on the deodorization process sunflower oil quality parameters was studied. The deodorization process was carried out for 60-90 minutes at 2-3 mm Hg of the residual pressure in the periodic deodorizer in steam heated to 230 ºC under production conditions. The results obtained are presented in Table 2.

Table 2: The effect of the duration of the deodorization process on the quality of sunflower oil

| № | Duration of deodorization, min | Acid number mg, KOH | Color of iodine mg | Peroxide soni mmol a.k \ kg |
|---|---|---|---|---|
| **1** | 60 | 0,58 | 15 | 12 |
| **2** | 65 | 0,53 | 15 | 12 |
| **3** | 70 | 0,48 | 14 | 10 |
| **4** | 75 | 0,41 | 12 | 7 |
| **5** | 80 | 0,34 | 10 | 5 |
| **6** | 85 | 0,30 | 8 | 4 |
| **7** | 90 | 0,25 | 6 | 4 |

As a result, increasing the duration of the process leads to a decrease in the acidity, color and peroxide content of the deodorized oil. At 85 and 90 min, the acid count was 0.3 and 0.25 mg KOH / g, the iodine color was 8 and 6 mg, and the peroxide count was 4 mmol of active oxygen / kg. These parameters meet the requirements of GOST-1129-2013. The analysis of the results of the study allowed to determine that in order to deodorize this extraction sunflower oil, periodic deodorization should be carried out at a temperature of 230 ºC in steam heated for 85-90 minutes with a residual pressure in the deodorizer not exceeding 2-3 mm Hg.

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**Soybean oil Refining Technology**

Alkaline cleaning of soybean oil can be done in crude or hydrated oil. Because the soy lecithin market is much smaller than potential production, in the U.S., in practice, in the absence of lecithin, soybean oil is purified by lecithin leaching. The traditional explanation for this is that the loss of neutral oil during crude oil refining is less than the loss during hydration and subsequent refining of refined oil [12-17].

The following alkalis have been studied: sodium hydroxide, potassium hydroxide, and sodium bicarbonate. Sodium hydroxide is currently the only substance used in soybean oil refining processes. It is very important to choose the amount and concentration of NaOH to use in the processing of soybean oil.

The use of hydroxide solutions to remove non-glyceride substances and free fatty acids is an effective method, but it can cause hydrolysis or saponification, which leads to increased losses during the cleaning process. The overall goal of alkaline treatment is to achieve maximum quality with minimal losses.

Primary refined soybean oil is a pure oil from which all free fatty acids and non-fatty substances are purified by chemical action and physical or mechanical separation. The main requirements for refined soybean oil are given in Table 3.

Table 3: Quality indicators of primary refined soybean oil

| № | Name of pointers | Value |
|---|---|---|
| 1 | Free fatty acids,% | 0,1 |
| 2 | Color, red unit. | 3,5 |
| 3 | Non-soapy substances,% | 1,5 |
| 4 | Humidity and volatiles, % | 0,1 |
| 5 | Flash temperature, ºC | 250 |

Refined soybean oil is a pure, clear oil from which all coloring substances and related materials are removed by adsorption and deodorization, which gives the oil an unpleasant odor and taste. Requirements for fully refined and refined soybean oil are given in Table 4.

Table 4: Quality indicators of fully refined soybean oil

| № | Name of pointers | Value |
|---|---|---|
| 1 | Free fatty acids,% | 0,054 |
| 2 | Color, red unit. | 2,0 |
| 3 | Non-soapy substances,% | no |
| 4 | Humidity and volatiles,% | 0,1 |
| 5 | Flash temperature, ºC | 250 |

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In our oil companies, soybean oil is obtained by squeezing soybean petals and extracting soybean meal using extraction gasoline. At this stage, the product undergoes a lot of heat treatment. The resulting unrefined soybean oil is difficult to clean, we have studied the method of processing soybean oil obtained by the press method. The quality parameters of the starting oil are as follows: = 2.6 mg / KOH, Color - 60 mg of iodine, moisture - 0.15%. Neutralization of soybean oil obtained by the press method at a temperature of 55-60 ºC, the purification process was carried out for 30 minutes using a solution of caustic soda from 110 g / l to 140 g / l with a concentration of more than 20% of the theoretically required amount. After refining the refined oil, the soapstock was separated, the oil was washed with warm, softened water, condensate to a neutral state, and then dried at a temperature of 100-105 ºC. The results of determining the effect of alkali solution concentration on iodine purification levels, reducing oil loss, and increasing the output of refined soybean oil are presented in Table 5.

Table 5: Effect of alkali solution concentration on refined soybean oil quality indicators

| № | Alkali concentration, g / l | Acid number, mg KOH / g | Color, mg iodine | soapstock inclination,% | refining oil output% |
|---|---|---|---|---|---|
| 1 | 110 | 0,38 | 30 | 34,5 | 90,6 |
| 2 | 115 | 0,35 | 28 | 35,0 | 91,0 |
| 3 | 120 | 0,32 | 25 | 33,2 | 91,3 |
| 4 | 125 | 0,29 | 22 | 32,5 | 91,6 |
| 5 | 130 | 0,27 | 20 | 32,5 | 92,4 |
| 6 | 135 | 0,27 | 20 | 33,0 | 92,0 |
| 7 | 140 | 0,26 | 20 | 33,0 | 91,5 |

From the data in the table, it can be seen that as the concentration of caustic soda solution increases, the acidity and color of the refined soybean oil decreases and the yield increases, with the highest results obtained when the alkaline solution concentration is 130 g / l.

## Conclusion

During the refining of sunflower and soybean oil, as the concentration of caustic soda solution increased, the acid content and color of the refined soybean oil decreased, and the yield increased, with the highest results when the NaOH solution concentration was 130 g / l. Increasing the duration of the deodorization process of

ISSN: 2776-0987 Volume 2, Issue 12, Dec., 2021

sunflower and soybean oil leads to a decrease in the acid number, color and peroxide content of the deodorized oil. At 85 and 90 min, the acid count was 0.3 and 0.25 mg KOH / g, the iodine color was 8 and 6 mg, and the peroxide count was 4 mmol of active oxygen / kg. In the process of refining sunflower oil obtained by extraction, the concentration of alkaline solution was 150 g / l, and the excess was 30%, the yield of refined sunflower oil was 94.3%, acidity 0.18 mg KOH, color 25 mg iodine.

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