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STUDY OF THE INFLUENCE OF THE USE OF VARIOUS CATALYSTS IN THE HYDROGENATION OF SAFFLOWER OIL ON THE COMPOSITION OF FODDER AND TECHNICAL FAT

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Abstract
The method of hydrogenation of safflower oil is rational, however, there are difficulties in this method, i.e. physic-chemical parameters and the yield of hydrogenated oil do not meet the requirements of the standard. Therefore, increasing the hydrogenation efficiency of safflower oil is an urgent task.

Keywords: Soybean oil, linoleic acid, hydrogenation, glyceride, antioxidants, fatty acids.

Introduction

Refining vegetable oils involves the neutralization of substances that are not recommended in the oil. Satellite substances in oils include phosphatides, fatty acids, pigments, various non-soapy substances, and some substances that are synthesized during plant growth and oilseed [5-31]. Technological parameters (temperature, humidity, pressure, etc.) in the refining process, many of these substances change their properties, not only affecting the quality of the oil but also reducing the possibility of their effective use as a secondary product [2-14].

One of the most important challenges facing the refining process is to preserve the naturalness of the by-products and to use them efficiently as a by-product, while purifying the oil from unwanted substances. The complete refining cycle includes: release of phosphatides; cleaning from waxy substances; separation of free fatty acids; cleaning from dyes and odors [7-15]. Good-colored oils are added with an aqueous solution of 1.0-10% phosphoric acid in an amount of 0.2-2.5% of the oil mass, hydrated at a temperature of 25-300 °C, and then the density of the hydrated oil is 1200-1600 kg / m^3. The method of refining with sodium silicate

has been developed (12). The amount of sodium silicate added is 0.3-2.0% by weight of oil. As the oil content decreases, so does the quality [11-24]. He developed a unique technology for refining cottonseed oil and missella. According to this technology, the oil obtained from low-quality seeds is first forrafined before treatment with anthranylic acid. Missella is forrafined at a temperature of 50-70 °C, press oil with an alkaline solution at 20-90 °C. The forrafined oil is first treated with anthranyl acid at 75-95 °C for 30-40 min, then cooled to 25-40 °C and alkalinely refined [17-32]. The color of the refined oil was 5-6 red units in a 13.5 cm cuvette, and the yield of refined oil averaged 84%. When refined twice without pre-refining, no good results were obtained. The oil color is 12-13 red units, and the yield is only 72% [12-23]. A method of forrafination with monoethanolamine was recommended to improve the yield and quality of refined oil. According to this method, 0.5-1.0% of monoethanolamine is added to black oil and the acid content of the oil is reduced to 3.2 times [4-10]. The use of alkali metal borohydrides in the refining of vegetable oils has been shown to improve odor, taste, and color. The amount of borohydrides is 0.005-0.2% of the oil mass [9-21]. Indian scientists have proposed the enzymatic esterification of free fatty acids with glycerin instead of chemical and physical refining. The following optimal conditions for biorefine are indicated: stoichiometric amount of glycerin; Residual pressure equal to 4 mm Hg; 70 °C temperature; enzyme concentration 10-15%. The biorefined oil is then treated with alkali to whiten it [16-28].

In the refining of sunflower oil, a method was developed to first treat the acidic agent with an aqueous solution, precipitate phosphates and separate waxy substances, and then treat it with perlite in a ratio of 500: 1-1500: 1 to the oil mass. 0.005-0.5% citric acid is added as an acidic agent [19-26]. The following methods are used in industry for the alkaline refining of vegetable oils: neutralization of oil in periodic neutralizers and precipitation of soapstock; emulsion neutralization of oil (missella) and alkali acceleration in reactor-turbulizers and continuous separation of neutralized oil from soapstock; intensive mixing of alkali and oil in the reactor-turbulizer, a combination method that involves the subsequent processes in the periodic neutralizer and the separation of soapstock in the periodic neutralizer. In the oil and gas industry of the republic, the combined method is usually used, and in some enterprises emulsion refining is used 13-34]. The main problem encountered in industry in the alkaline refining of cottonseed oil is the refining of its color. Separation of gossypol altered products is especially

difficult in the purification of cottonseed oil. The solution to these problems is the use of adsorption refining as well as forrafination and alkaline refining. Adsorption is the saturation of a substance in the volume or surface of a solid [3-35]. The adsorption properties and the absorption rate depend on the storage of small pores in the adsorbent. The surface of activated carbon is composed of micro-, permeable-, and macropores. Adsorption in coal is mainly determined by the impact dispersion forces. Depending on the particle size and structure, activated carbon can be used for gases, recuperation, and lighting. Activated charcoal is obtained from solid fuels, wood waste and bone waste, coconut shells, as well as fruit seeds [1-18]. Soil materials are used to separate the dyes in the liquid medium. Hence the name 'justifying soil'. Bleaching soils are used in the oil refining industry to refine, regenerate, and refine refined oils such as grease, transformers, and the like [6-25].

Until the late 1980s, refining of nutrient oils with bleaching soil was considered to be the main goal of color removal. It is currently used with adsorbents to remove phosphatides, free fatty acids, pesticides, metal oxides, and oxidation derivatives [20-27]. The effect of activated soil on the release of b-carotene in vegetable oils has been studied. The soil was extracted from montmorillonite and activated with concentrated sulfuric acid. It has been shown that b-carotene adsorption is a chemical process in which the adsorbent acts on-carotene as an oxidation catalyst [8-22]. Various methods of regenerating used bleaching soil have been studied: washing with organic solvents; Regeneration in an autoclave in an air stream at 200 °C with oxygen at a pressure of 0.5 Mpa and treatment with water at a temperature of 170-270 °C [30-33]. Currently, adsorption refining is used in the deep purification of vegetable oils not only with associated products, but also in the purification of environmentally friendly substances, including pesticides [29]. There are so many types of oils. They differ mainly in origin, as mentioned above, so there can be two types of animal fats and vegetable oils. Fats and oils that are melted, pressed, and dissolved in organic and solvent from animal and plant cells also contain other lipids (satellite substances) in a dissolved form and are called crude oils and fats. Glycerides of fatty acids make up 95-97% of crude oils and fats [38]. Animal fats can be of several different origins, including fats from animal bodies, milk, poultry, and fish. Vegetable oils, in turn, can be obtained from seeds and fruit bodies. Fats and oils differ from each other mainly in the presence of fatty acids and their constituents, which are glycerides. There are three types of glycerides in fats: co-glycerides, bicolicerides, and triglycerides,

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the most abundant of which are triglycerides, which form the basis of fats. The ratio of glycerides depends on the stage of biosynthesis in the cells or the quality of storage of the extracted fats or oils.

The differences in fats are mainly in the amount of fatty acids and their amounts, and the following table is an example of a common fat. However, these general indicators do not fully reflect the properties of fats. In order to fully understand the properties of fats, we need to know the exact components of the fats obtained, the quality of the animal or plant and the temperature, pressure and other factors that affect the technology at the time of their production. A complete understanding of the above reasons is possible only through knowledge of petrochemistry [36].

The fatty acids that make up any fat or oil can be divided into two main groups according to the amount of that fat or oil:

– Base fatty acids (two to three), each of which contains from 20% to 90% of fatty acids.
– Secondary fatty acids, each containing 0.1% to 10% of fatty acids.

Fatty acids are more or less present in all oils (specific to all oils: palmitin, stearin, olein, linoleic acid) and only in certain oils or fats (specific to some oils). can be. For example, ricinoleic acid, which is unique to castor oil.

Table 1. The fatty acid content of fats

№	Name of oils and fats	Saturated fatty acids,%				Unsaturated Fatty Acids,%			
		Araxin	Miristin	Steorin	Palmitin	Olein	Linol	Linolen	And others
1	Cottonseed oil	-	0-5	2-5	20-23	29-36	34-57	-	-
2	Soybean oil	0.4-1	-	3-5	6-8	25-36	52-65	2-3	-
3	Sunflower oil	-	-	1,5-5,5	3,5-11,5	23-50	42-66	-	-
4	Corn oil	-	-	6	5-18	23-49	48-56	-	-
5	Olive oil	-	1.2	1.0	9.7	80.0-88	7.5	-	Lignoserin 0.4
6	Kanakunjut (kostor) oil	-	-	0,3-2	-	3-9	3	-	Risinol 80-94
7	Flaxseed oil	-	6-11	2-8	5-11	13-35	8-30	30-67	-
8	Sheep oil	-	2-4	25-31	25-27	32-43	3-4	-	-
9	Beef oil	-	2.5-2.8	24-29	27-29	Trans 43-44	2.5	-	-
10	Horse oil	-	-	7	29	55	7	-	-

A specific feature of the processes of liquid-phase hydrogenation of vegetable oils and fats used in the fat processing industry is the use of highly dispersed catalysts suspended in raw materials.

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The area of use of hydrogenated fats in developed countries is expanding dramatically. This is due to the great diversity of the raw material base and the improvement of the technology of catalytic hydrogenation. It should be noted that a large assortment of lards produced in the USA and Western European countries is determined by the desire to more fully satisfy the very wide needs in the production of salad oils, oils for canning, margarines, culinary, confectionery and bakery products, as well as soap, cosmetic and chemical industries. Hydrogenation of refined press safflower oil was carried out in a pilot laboratory setup. To carry out the experiment, first, the calculated amount of oil is loaded into the reactor, and a dipstick for the catalyst filled with the required amount of catalyst suspension is inserted into the nozzle. Upon reaching the predetermined hydrogenation temperature, hydrogen is supplied to the reactor from a cylinder through a reducer, a gas meter, and a purification system consisting of three Tishchenko flasks connected in series. According to the readings of the gas meter, the required rate of hydrogen supply to the reaction medium is set. Then the faucet is opened and the catalyst is introduced into the reactor. The moment of loading the catalyst is taken as the start of the hydrogenation process [37].

After 30 minutes, the first sample of hydrogenate is taken through the sampler using a syringe, then subsequent samples are taken every 15 minutes in an amount of 10 ml. To do this, the tap "k" is quickly opened and closed in order to displace the hydrogenation product that has stagnated in the sampler. After sampling, the faucet is opened again to displace the hydrogenation product with a hydrogen jet. The selected hydrogenate is immediately filtered at a temperature of 70-100 °C through a paper filter to separate it from small particles of the catalyst. The filtrates of each sample are collected in separate bottles for analysis.

Throughout the experiment, the uniformity of the hydrogen supply per unit time is periodically checked according to the readings of the gas meter. Taking into account the significant influence of thermodynamic factors on the direction of the process of hydrogenation of safflower oil and in order to establish the optimal conditions for hydrogenation on powdered catalysts, we studied the influence of the nature and amount of the catalyst, the duration of hydrogenation, (temperature) on the saturation process rate and the quality of the resulting lard. The effect of the amount of catalyst on the rate of the hydrogenation process (expressed in terms of Δ n.h.) of safflower oil and the physicochemical parameters of the hydrogenate was studied. Hydrogenation was carried out at a constant temperature of 200 °C.

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Experimental Part

The results obtained showed (Table 2) that with an increase in the amount of catalyst from 0.1 to 0.6% by weight of the hydrogenated oil, the iodine number of the hydrogenate decreases, from 70.5 to 57.4% of iodine, while the melting point and acid number increase, respectively, from 44.3 to 50.50C and from 1.5 to 2.0 mg KOH.

Table 2. The effect of the amount of catalyst on the speed of the process and the performance of lard

Amount of catalyst, %	Iodine number, % I2	Δ Iodine number	Melting point, °C	Acid number, mg KOH
0,1	70,5	67,1	44,3	1,5
0,2	64,4	73,2	47,5	1,7
0,4	60,3	77,3	49,7	1,8
0,6	57,4	80,2	50,5	2,0

In the next series of experiments, we studied the effect of the duration of hydrogenation on the rate of the saturation process and the performance of the hydrogenate at a catalyst amount of 0.2% by weight of the hydrogenated oil and a constant temperature of 200 °C.

From the data of table 3 it can be seen that with an increase in the duration of hydrogenation, the iodine number of the hydrogenate decreases, the melting point decreases and the acid number increases, therefore, the amount of free fatty acids increases.

Table 3. Influence of hydrogenation duration on the rate of saturation and indicators of lard

Duration of hydrogenation, min	Iodine number, %I_2	Δ Iodine number	Melting point, °C	Acid number, mg KOH
30	97,1	40,5	29,1	0,85
60	80,5	57,1	38,1	1,0
90	64,4	73,2	47,5	1,7
120	57,4	80,2	51,4	2,1
150	51,2	86,4	55	2,3

To study the effect of temperature, hydrogenation was carried out on an FA catalyst, in the temperature range of 160–240 °C, with a constant catalyst amount of 0.2% by weight of the oil. The results are shown in table 3.

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Conclusion

Hydrogenation of soybean oil is a more complex process, in the presence of a highly active catalyst, a violation of the relationship between the melting point of the hydrogenate and the amount of iodine, ie the "delay" of the melting temperature. In other words, when a product with the required amount of iodine is obtained, its melting point and hardness will be much lower than expected.

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