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RESEARCH OF THE STORAGE TECHNOLOGY OF REFINED SUNFLOWER OILS

Mamatkulov F.G.*, IsmatovS.Sh., MaidovK.Kh.****

KarshiEngineering-Economical Institute*

Bukhara Engineering-Technological Institute**

Hydration technology of sunflower oil using water activated by influence of the electromagnetic field intensity has been proposed. Stability of oil indicators during long-term storage has been established.

***KEYWORDS**: sunflower oil, storage, quality indicators, stability, process temperature, physical-chemical characteristics.*

INTRODUCTION. Vegetable oil oxidation products, which include carbonyl compounds, low molecular weight acids, alcohols, polymerization and condensation products, are the main reasons for the decrease in the biological value and safety of oils consumption [1-3].

During oxidation in oils, essential fatty acids are destroyed: linolenic, linoleic, arachidonic, related to biologically active substances; vitamins - a - tocopherol and carotenoids, which are antioxidants and contribute to the stability and preservation of the quality of oils during storage [4, 5]. In oxidized oils, unpleasant tastes and odors appear, which are brought by aldehydes and ketones.

There are various reasons that accelerate the processes of oil oxidation, these include: free fatty acids, which increase the process of decomposition of tocopherols; increasing the temperature of technological processes and during storage; exposure to light and oxygen in the air; the quality of water used in the technological processes of refining, etc. [6, 7]

Refining technological processes have a significant impact on the preservation of oxidative stability, nutritional and biological value of vegetable oils [8, 9]. Therefore, their parameters should be optimized and contribute to the preservation of the native properties of refined oils, to ensure their stability during storage for the longest possible time.

OBJECTIVE. The purpose of this study was to determine the degree of oxidative stability of four samples of sunflower oil hydrated by the recommended method and the traditional method, as well as neutralized by the proposed method and the traditional one.

The essence of the recommended method was to treat the used alkaline solutions by exposure to an electromagnetic field strength of 1.6A/m.

Objects of research are raw sunflower oils, alkaline refining technology, shelf life of refined oils, quality indicators and physical and chemical characteristics.

RESEARCH METHODS

In the study of the quality and physico-chemical characteristics of raw materials and refined oils, modern methods of analysis and evaluation were used.

RESULTS AND DISCUSSION

Samples were studied depending on the temperature of initiated oxidation, the surface and depth of contact with atmospheric oxygen, and also during storage.

The optimal technological parameters of the processes of hydration of phospholipids and neutralization of free fatty acids of sunflower oil were established, in which the most effective results were obtained. The study of the oxidative stability of a sample of hydrated sunflower oil was carried out at temperatures of 68-71 °C, and neutralized - at temperatures of 70-75 °C. To evaluate the results obtained, the oxidative stability of samples of hydrated and neutralized sunflower oil was studied by traditional methods.

In table.1.and 2. the results of studies are given, the analysis of which shows that the time of oxidative stability of sunflower oil hydrated according to the recommended method increased by 45 minutes, neutralized - by 50 minutes, and the oxygen diffusion rate for both samples decreased by 1.5 times.

Table 1

The influence of temperature on the oxidative stability of sunflower oil samples hydrated according to the recommended and traditional methods

Thenameofindicators	Hydrationofsunfloweroil			
	conventionalmethodattemperature		recommendedmethodattemperature	
	68°C	73 °C	68 °C	73 °C
Stabilitytime (min)	235	228	190	182
Amount of oxygen absorbed (mm/min)	7,1	8,2	10,6	11,8

Table 2

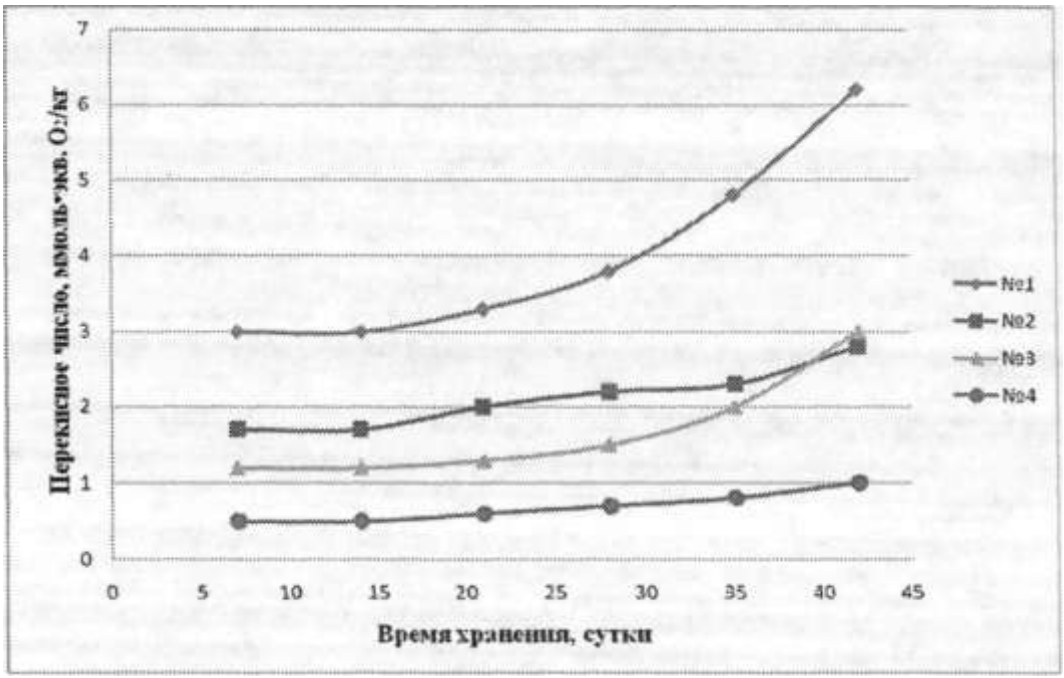
The effect of temperature on the oxidative stability of sunflower oil samples neutralized by the recommended and traditional methods..

Thenameofindicators	Oxidative stability of sunflower oil when neutralized according to::			
	recommended method at a temperature		The traditional way at a temperature	
	70° C	75°C	70 °C	75 °C
Stabilitytime (min)	270	265	220	213
Amount of oxygen absorbed (mm/min)	5,4	5,8	8,8	9,7

A study was made of the degree of oxidation of the obtained samples of refined sunflower oil in terms of an indicator determined by the sum of the doubled value of the peroxide value (PC) and the anserine value (AN). The normalized value of this indicator is in the range from 1 to 15 units, the excess of which indicates the loss of safe quality properties of the oil.

The peroxide number of oil (PC) shows the presence of peroxides and hydroperoxides in it - primary oxidation products formed as a result of the addition of active oxygen to fatty acids. The normalized value of this indicator should not exceed 10 mmol equiv. O2 /kg.

The obtained data on peroxide numbers of hydrated and neutralized samples of sunflower oil according to the recommended and traditional methods when stored for 42 days at a temperature of 20±2°C are shown in Fig.1. An analysis of the dependences of changes in the peroxide numbers of oils on the storage time shows that the processes of primary oxidation in samples of sunflower oil refined according to the recommended method proceed 2 times slower. So FC hydrated according to the recommended method of oil by the end of the shelf life amounted to 2.8 mmol • equiv. Og / kg, and according to the traditional - 6.1 mmol * eq. Og/kg. The FC of the oil neutralized according to the recommended method by the end of the shelf life was 1.2 mmol “eq. Og / kg, and according to the traditional - 2.4 mmol * eq. kg.



Graph. 1. Changes in peroxide numbers in sunflower oil samples during storage:
No. 1 and No. 3 hydrated and neutralized according to the traditional method;
No. 2 and No. 4 hydrated and neutralized according to the recommended method

The anisidine number of oil (AN) characterizes the concentration of aldehydes and ketones in it. This is one of the main indicators of the quality and safety of the oil, and its high value allows us to conclude that it has a long shelf life or unsatisfactory storage conditions, temperature and other influences. The normalized value of this indicator should not exceed 3 units.

The obtained data of anisidine numbers of hydrated and neutralized samples of sunflower oil according to the recommended and traditional methods when stored for 42 days at a temperature of 20 ± 2°C are shown in Fig.2. An analysis of the dependences of changes in the anisidine numbers of oils on the storage time shows that the concentration of aldehydes and ketones in a sample of sunflower oil hydrated according to the recommended method is 1.5 times lower by the end of the storage period than in a sample hydrated according to the traditional method and is, respectively, 1 .8 units and 2.6 units. And in the oil sample neutralized according to the recommended method by the end of the storage period, it is 1.8 times lower than in the sample neutralized according to the traditional method and is, respectively, 1.5 units. And 2.8 units.

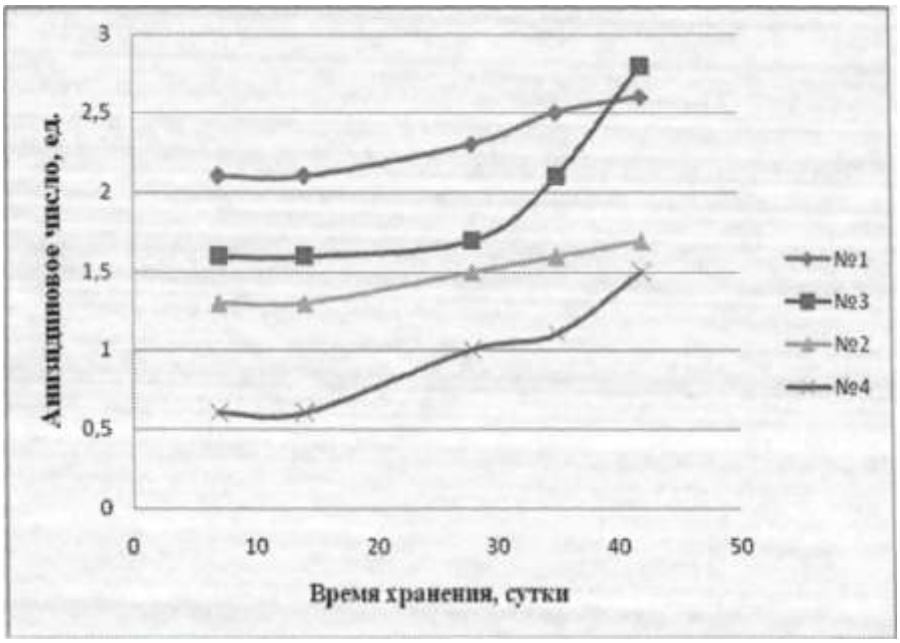


Fig.2. Change in anisidine numbers in sunflower oil samples during storage:

No. 1 and No. 3 hydrated and neutralized according to the traditional method;

No. 2 and No. 4 hydrated and neutralized according to the recommended method

In table 3.Indicators of oxidative stability of samples of sunflower oil hydrated and neutralized according to the recommended method are given, obtained during their storage for 42 days at a temperature of 20± 2°C in a glass flask without access to light. The analysis of the data obtained shows that the most intensive oxidation processes occur in samples of hydrated and neutralized sunflower oil in the traditional way, since by the end of the storage period the indicators of the oxidation rate and the total degree of oxidation in the samples of refined oil according to the recommended method were more than 2 times lower.

Table 3.

Indicators of oxidative stability of refined sunflower oil during storage

Thenameofindicators	The content in the sample of sunflower oil			
	hydrated		neutralized	
	Traditional way	recommended way	Traditional way	recommended way
Thenameofindicators				

Peroxide number mmol]/g O/kg	3,0	1,9	1,3	0,5
Anisidinenumber, units	2,1	1,3	1,7	0,7
Degree of oxidation, "toh", units	8,1	5,1	4,3	1,7
Oxidationrate, mm3/min	2,5	1,5	1,2	0,7
28 daysofstorage				
Peroxide number mmol 1/2 O/kg	3,8	2,1	1,5	0,6
Anisidinenumber, units	2,3	1,5	1,9	1,0
Degree of oxidation, "totox", units	9,9	5,7	4,9	2,2
oxidationrate, mm/min	2,9	1,6	1,3	0,8
42 daysofstorage				
Peroxide number mmol]/g O/kg	6,1	2,8	2,4	1,2
Anisidinenumber, units	2,6	1,8	2,8	1,5
Degree of oxidation, "toh", units	14,8	7,4	7,6	3,9
Peroxide number mmol]/g O/kg	6,9	2,5	2Д	1,1

Thus, the use of the influence of the electromagnetic field strength in the technology of sunflower oil refining ensures the stable preservation of quality indicators for a long time.

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