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COTTON OIL REFINING METHOD

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ABSTRACT

A method for refining cottonseed oil sequentially with solutions of aluminate and sodium hydroxide, characterized in that in order to intensify the process, increase the yield and quality of refined oil, the solutions used are pretreated in an electromagnetic field. Known methods of refining vegetable oils and fats in the presence of various types of alkaline solutions and other chemical reagents by periodic and continuous methods in order to obtain refined fats of various qualities and chemical composition. Process intensification, increasing the yield and quality of refined oil. This goal is achieved by pretreating alkaline solutions of aluminate and sodium hydroxide in an electromagnetic field of various strengths in a two-stage crude cottonseed oil refining technology.

KEYWORDS: *Refined Cottonseed Oil, Crude Cottonseed Oil, Optimal Technological, Experiment, Partially Neutralized Oil, Process, Refining, Refining Method, Method, Neutralizer, Batch And Continuous Action, Concentration, Aluminate And Sodium Hydroxide Solutions, Excess, Food Processing, Final Refining, Two-Stage Gossypol Related Technology, Electromagnetic Processing, Analysis And Evaluation, Data, Feasibility.*

INTRODUCTION

The method of cottonseed oil refining by these methods is carried out on neutralizers of periodic and continuous action. In this case, the concentration of solutions of aluminate and sodium hydroxide, as well as their excess is selected depending on the initial acid number (mg. KOH / g) and color (red units) of crude cottonseed oil[1,2].

The disadvantages of these methods of refining cottonseed oil are the long duration of the neutralization of raw materials with alkaline solutions, low yield and quality of refined oil.

The closest in technical essence to the present invention is a method for refining cottonseed oil sequentially with solutions of aluminate and sodium hydroxide. This technological method of cottonseed oil refining consists of two stages[3,4].

At the first stage of the refining technology, a certain reduction in the content of free fatty acids (FFA) and substances accompanying the oil is achieved in order to obtain a partially neutralized oil. This is carried out by processing the raw material with an alkaline solution of sodium aluminate of various concentrations and excess.

At the second stage, the final refining technology of partially neutralized raw materials is carried out with an alkaline solution of sodium hydroxide of various concentrations and excess.

As a result of this method, a relative improvement in quality and an increase in the yield of refined oil are achieved.

The disadvantages of this method of cottonseed oil refining are that the total duration of processing of raw materials with alkaline solutions is 120 ... 240 sec; the yield of refined oil, depending on the initial acid number of the raw material (Kp = 6.9 ... 10.8 mg KOH / g), is 78 ... 87%. At the same time, the residual content of free fatty acids in the obtained oils ranges from 0.27 ... 0.31 mg KOH / g and their color value is 11 ... 13 CR units at 35 yellow in 13.5 cm layer[5,6].

In addition, high consumption of alkaline solutions for the processes of neutralizing raw materials and sequential refining modes reduce the nutritional value of refined oil.

The objective of the present invention is to intensify the technological process by reducing the duration of processing of raw materials with alkaline solutions, increasing the yield and quality of refined cottonseed oil. At the same time, achieving a reduction in the consumption of alkalis and an increase in the nutritional value of refined oil.

The problem is solved by the fact that in the two-stage cottonseed oil refining technology, the alkaline solutions of aluminate and sodium hydroxide used are pretreated in an electromagnetic field with a strength of 0.4 ... 2.8 A / m. The total duration of processing of raw materials with alkaline solutions is 90 ... 150 sec; the yield of refined oil, depending on the initial acid number of the raw material (Kp = 6.9 ... 10.8 mg KOH / g), is 81 ... 90%. At the same time, the residual content of free fatty acids in the obtained oils ranges from 0.07 ... 0.11 mg KOH / g and their color is 4 ... 9 CR units at 35 yellow in 13.5 cm layer[6,7,8,9].

This refining technology makes it possible to reduce the consumption of alkaline solutions for the processes of neutralizing raw materials and improves the process conditions.

In addition, according to the recommended method, an increase in the nutritional value of refined cottonseed oil is achieved.

The essence of the present invention is illustrated by the following examples.

The first stage of alkaline neutralization of crude cottonseed oil is carried out in a standard neutralizer. Partial alkaline neutralization of raw materials is carried out with sodium aluminate solution. In this case, an alkaline solution of sodium aluminate is pretreated in an electromagnetic field, using a typical electromagnetic device AMO-25 UHL4, which is widely used in food enterprises for processing aqueous solutions. The intensity of the electromagnetic

field in the apparatus is regulated by means of a BCA-5K rectifier, which is a necessary part of the apparatus.

Raw cottonseed oil with an initial acid number of 6.9 ... 10.8 mg KOH / g, unobservable color, content (%) of phospholipids 0.8 ... 1.4 is subjected to preliminary alkaline neutralization; free 0.30 ... 0.36 and bound 0.34 ... 0.39 gossypol and tocopherols 75 ... 85 mg 100 g. The process is carried out in order to partially reduce (by about half) the acid number and remove substances accompanying the oil. Taking this into account, the concentration and excess of alkaline solutions are set by calculation, depending on the initial acid number of the raw material.

The process of alkaline neutralization is carried out at 20 ... 22 ° C, with the duration in which the established decrease in the acid number of the raw material is ensured. Research is carried out without and with preliminary treatment of an alkaline solution in an electromagnetic field. At the end of the neutralization process, partially refined raw materials are defended and filtered from the formed sodium salts (soap stocks). Partially refined raw materials are washed from the remains of an alkaline solution and dried from free moisture, then it is subjected to physicochemical analysis. For the analysis of raw materials and products obtained, modern methods of physical and chemical research are used[7,8,9,10].

The results of the analyzes obtained are shown in Tables 1 and 2.

Analysis and evaluation of the data given in tables 1 and 2 indicate that the treatment of an alkaline solution of sodium aluminate lead to a decrease in the acid number of the partially neutralized oil. An increase in the strength of the electromagnetic field up to 1.6 A / m intensely affects the decrease in the acid number of the raw material, a further increase in this parameter insignificantly affects the studied parameter of the process. As a result of electromagnetic treatment, color is also improved and the yield of partially neutralized oil is relatively increased.

Electromagnetic treatment of an alkaline solution leads to an intensification of the technology of partial neutralization of crude cottonseed oil, that is, the duration of refining is somewhat reduced in comparison with the prototype.

The results of experimental studies confirm the feasibility and effectiveness of using the method of electromagnetic treatment of an alkaline solution of sodium aluminate in a two-stage technology for refining cottonseed oil.

TABLE 1 EFFECT OF ELECTROMAGNETIC FIELD STRENGTH ON THE RESULTS OF PARTIAL NEUTRALIZATION OF RAW COTTONSEED OIL

No.	EMF intensity, A / m	Results of partial refining of raw materials			Results of partial refining of raw materials		
		Acid number, mg, KOH / g	Chromaticity, red units at 35 yellow in 1 cm layer	Oil yield,%	Acid number, mg, KOH / g	Chromaticity, red units at 35 yellow in 1 cm layer	Oil yield,%
0		raw materials			raw materials		
		6,9	not looking.	-	10,8	not looking.	90,6
1	Without processing	3,7	37	95,0	6,1	52	90,9

2	0,4	3,6	35	95,2	5,8	41	91,2
3	0,8	3,4	33	95,5	5,4	37	91,6
4	1,2	3,1	30	95,9	4,9	35	92,0
5	1,6	2,7	25	96,6	4,3	31	92,8
6	2,0	2,6	21	96,7	4,1	28	92,9
7	2,4	2,6	19	96,8	4,0	27	93,0
8	2,8	2,6	18	96,8	3,9	25	93,1

The second stage of alkaline refining of partially neutralized cottonseed oil is carried out in a similar manner. The process of final refining of partially neutralized oil is carried out with an alkaline solution of sodium hydroxide. In this case, an alkaline solution of sodium hydroxide is pretreated in an electromagnetic field using an electromagnetic device AMO-25 UHL4. The intensity of the electromagnetic field in the apparatus is regulated using a BCA-5K rectifier[8,9,10]. Partially neutralized cottonseed oil with the following quality and physicochemical parameters is subjected to final refining (Table 2, No. 3):

Acid number - 3.9 ... 4.3 mg KOH / g;

Color - 31 ... 36 crotch units at 35 yellow in 1 cm;

Content,%:

phospholipids - 0.4;

free gossypol - 0.19;

bound gossypol - 0.27.

The process is carried out in order to obtain high quality refined cottonseed oil that meets the requirements of industry standards. Taking this into account, the concentration and excess of an alkaline sodium hydroxide solution are set by calculation, depending on the initial acid number of the raw material of partially neutralized cottonseed oil.

The final refining process is carried out at 20 ... 22^{0}C. The duration of stirring the reaction mass is set depending on the quality and yield of refined oil. Upon completion of the final refining technology, the refined oil is defended and filtered from the formed sodium salts (soap stock). The finally refined oil is washed from the residues of the alkaline solution and dried from free moisture, then it is subjected to physicochemical analysis.

TABLE 2 RESULTS OF PARTIAL NEUTRALIZATION OF CRUDE COTTONSEED OIL DEPENDING ON FROM THE DURATION OF STIRRING THE REACTION MASS

No.	Duration of neutralization, sec	Without treatment of alkaline solution in EMF						With the processing of an alkaline solution in an EMF stress. 1.6 A / m					
		Physicochemical indicators of partially neutralized oil					Partially neutralized oil	Physicochemical indicators of partially neutralized oil					Partially neutralized oil
		Acid number, mg,	Chromaticity,	Content,%				Acid number, mg,	Chromaticity,	Content,%			
				Phospho-	Free gossy	Associa				Phospho-	Free gossy	Associate	

		KOH / g	red units at 35 yellow in 1 cm layer	lipids	ypol	ted gossypol	yield, %	KOH / g	red units at 35 yellow in 1 cm layer	lipids	ypol	d gossypol	yield, %
1	0	6,9	not looking.	0,8	0,30	0,34	-	6,9	not looking.	0,8	0,30	0,34	-
2	30	6,2	51	0,7	0,27	0,33	98,6	5,5	42	0,6	0,23	0,30	98,8
3	60	5,7	47	0,5	0,23	0,30	97,5	3,9	36	0,4	0,19	0,27	97,7
4	90	4,6	40	0,4	0,20	0,26	95,4	3,2	29	0,3	0,17	0,21	95,6
5	120	3,7	33	0,4	0,19	0,25	93,4	2,6	18	0,2	0,15	0,19	93,6

For the analysis of refined oil, modern methods of physical and chemical research are used.

The results of the analyzes obtained are shown in tables 3 and 4.

TABLE 3 INFLUENCE OF THE ELECTROMAGNETIC FIELD STRENGTH ON THE RESULTS OF THE FINAL REFINING OF PARTIALLY NEUTRALIZED COTTONSEED OIL

NO.	EMF intensity, A / m	Final refining results			Final refining results		
		Acid number, mg, KOH / g	Chromaticity, red units at 35 yellow at 13.5 cm.	Oil yield,%	Acid number, mg, KOH / g	Chromaticity, red units at 35 yellow at 13.5 cm.	Oil yield,%
0		raw materials			raw materials		
		3,9	36	-	4,3		-
1	Without processing	0,27	11	93,4	0,31	13	91,2
2	0,4	0,20	9	93,5	0,29	12	91,3
3	0,8	0,13	7	93,6	0,21	11	91,5
4	1,2	0,10	5	93,7	0,15	10	91,6
5	1,6	0,07	4	93,8	0,11	9	91,8
6	2,0	0,07	4	93,9	0,11	9	91,9
7	2,4	0,07	4	93,9	0,11	9	92,0
8	2,8	0,07	3	93,9	0,11	8	92,0

Analysis and evaluation of the data given in Tables 3 and 4 indicate that the process of the final refining of partially neutralized cottonseed oil proceeds in mild technological modes. This achieves a significant reduction in the acid number and an improvement in the color of the refined oil. Treatment of an alkaline sodium hydroxide solution accelerates the final refining of the partial neutralized oil to an electromagnetic field strength of 1.6 A / m [6,7,8,11].

Electromagnetic treatment of an alkaline solution leads to an intensification of the technology for the final refining of partially neutralized cottonseed oil, that is, the duration of the refining of raw materials is somewhat reduced.

TABLE 4 FINAL REFINING RESULTS OF PARTIALLY NEUTRALIZED COTTONSEED OIL ON THE DURATION OF MIXING REACTION MASS

No.	Duration of neutralization, sec	Without treatment of alkaline solution in EMF			With the processing of an alkaline solution in an EMF, for example. 1.6 A / m		
		Acid number, mg, KOH / g	Chromaticity, red units at 35 yellow at 13.5 cm.	Refined oil yield,%	Acid number, mg, KOH / g	Chromaticity, red units at 35 yellow at 13.5 cm.	Refined oil yield,%
1	0	3,9	36	-	3,9	36	-
2	30	0,37	15	93,6	0,21	11	93,8
3	60	0,31	13	93,4	0,13	9	93,9
4	90	0,29	12	93,2	0,09	6	94,0
5	120	0,27	11	93,2	0,07	4	94,0

Thus, the development of technology for the refining of raw cottonseed oil by pretreating alkaline solutions in an electromagnetic field has achieved an increase in the quality and nutritional value of refined oil and ensured a reduction in the consumption of alkaline solutions used.

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