European Scholar Journal (ESJ)
Available Online at: https://www.scholarzest.com
Vol. 2 No. 5, MAY 2021,
ISSN: 2660-5562

REFINING OF COTTONSEED OIL OBTAINED BY EXTRACTION METHOD

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Article history:

Received: 2nd April 2021
Accepted: 20th April 2021
Published: 15th May 2021

Abstract:

Technological methods of refinement of raw cottonseed oil show that the quality and nutritional benefits of refined oil mainly depend on the content of free fatty acids, phospholipids, gossypol and its derivatives, as well as other substances. The reduction and complete removal of certain oil-related substances can significantly improve the performance of the final product. Refining the raw oil and ensuring high features of product also depend on the nature of the feedstock and the production methods for cottonseed oil. Today, the alkaline method of purifying vegetable oils and their by-products is widely used in the production of edible oils. However, the refining of cottonseed oil using an alkaline sodium hydroxide solution, as the author of the article states, is associated with high consumption of sodium hydroxide, a relatively low yield of refined oil, significant losses and consumption of energy resources.

Keywords: Refined cottonseed oil, raw cottonseed oil, experiment, partially neutralized oil, refining process, refining method, neutralizer, and concentration, solutions of sodium aluminate and sodium hydroxide, phospholipids, final refining, bound gossypol, electromagnetic treatment, extraction.

INTRODUCTION.

In Uzbekistan, comprehensive measures are being taken to develop the fat-and-oil industry, increase production volumes and expand the range of finished products in order to fully meet the needs of the population [1-6].

Specialists in the field of nutrition in our country and abroad give great importance to increasing the proportion of vegetable oils used in food, since they contain important essential or polyunsaturated fatty acids that have a beneficial effect on the human body.

Refining of raw cottonseed oil is a complex, multi-stage process based on physical, physical-chemical and chemical methods of processing oils and fats in order to improve their quality, nutritional and biological value, as well as improve their technological properties.

Taste, smell, color, transparency, iodine, acid and peroxide numbers, the amount of phosphorus-containing and unsaponifiable substances and moisture characterize the high quality of refined cottonseed oil.

Currently, the refining of raw cottonseed oil at fat processing plants is carried out using alkaline solutions of sodium hydroxide. The refining technology used in industrial practice is associated with a high consumption of an alkaline solution, a low yield of the final product, losses and significant heat and energy costs.

MATERIALS AND METHODS.

The shortage of caustic soda at the fat-processing plants of the Republic dictates to workers in science and industry the need to search for new, unconventional alkaline agents that are not inferior in technological and other properties to sodium hydroxide. The rational and efficient use of waste from the chemical and oil refining industries is of particular interest. Alkaline solutions of sodium aluminate obtained during the activation and regeneration of catalysts are of importance in this direction.

Crude oils always contain a variety of impurities.

Some of the impurities, together with the oil, are extracted and the seed cells under the action of elevated temperature, pressure and organic solvent. Therefore, commercial oil always contains phospholipids, waxes, dyes and decomposition products of these substances (free fatty acids, mono- and diglycerides and other substances).

The oil obtained from seeds also contains oxidation products of various lipid compounds. Their content depends on the quality of the seeds supplied for processing, and the intensity of the technological impact on the seeds when obtaining oil. In addition to soluble substances, commercial oil also contains mechanical impurities. The

process of cleaning oils from accompanying substances is called refining. Refining methods can be divided into physical, chemical and physical-chemical.

Raw cottonseed oil, obtained by the extraction of oil-containing raw materials, is significantly different in quality and physical-chemical composition from prepress oil. This is because, along with the oil, the solvent largely extracts the components accompanying it. In order to test the technology of partial neutralization of crude extraction oil with alkaline solutions of sodium aluminates, experimental studies were carried out in laboratory conditions.

The effect of concentrations (8-33%) of alkaline solutions of sodium aluminate on a decrease in the content of free fatty acids (K.n.), phospholipids (Phl), tocopherols (Tph), free (Fg) and bound (Bg) gossypol and change in color (Clr) partially neutralized oil.

As can be seen from the curves in Fig. 1 and Fig. 2, with partial neutralization of the extraction cottonseed oil, the concentration of alkaline solutions of sodium aluminate is higher than for the press oil. This is because more concomitant substances pass into the extraction oil than into the prepress oil.

Studies carried out under identical conditions of partial neutralization of prepress cottonseed oil show that, in this case, there is a decrease in the acid number, the content of related substances in the partially neutralized extraction oil. Effect is improved color of cottonseed oil. The most acceptable results are obtained when the concentration of the alkaline sodium aluminate solution is equal to 23%. Whereas for the press was used alkali with a 15% concentration.

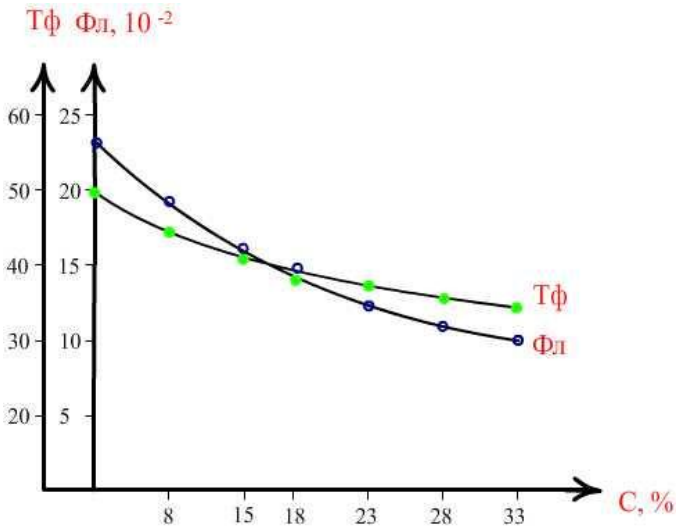

Fig.1. Change in the content of phospholipids (Phl) and tocopherols (Tph) in partially neutralized extraction cottonseed oil depending on the concentration (C) of alkaline solutions of sodium aluminate.

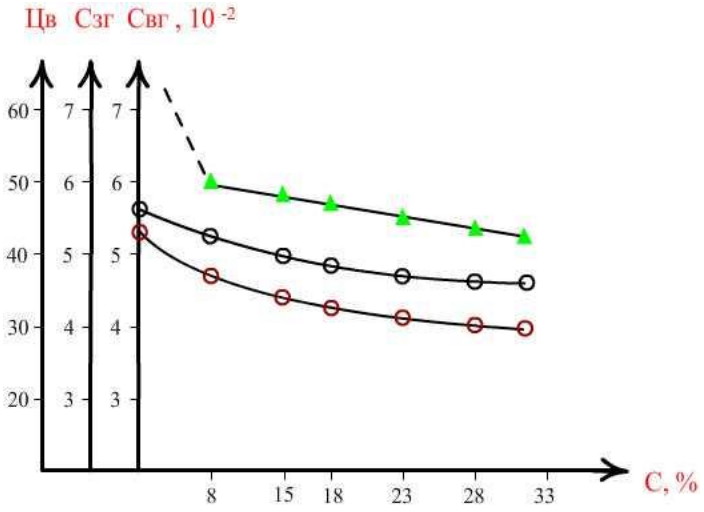

Fig. 2. Change in the content of free (Fgr), bounded (Bg) gossypol and color (Clr) in partially neutralized extraction cottonseed oil depending on the concentration (C) of alkaline solutions of sodium aluminate.

The studies were carried out using various extraction cotton oils, differing mainly in the initial acid numbers. The required concentration and excess of alkaline solutions of sodium aluminate were established depending on the initial acid number of the raw material. The results of experimental studies are shown in Table 1.

As shown, the data given in table. 1, and in this case, changes occur in the chemical composition and quality of the partially refined cottonseed oil. Alkaline solutions of sodium aluminates lead to a decrease in the acid number, the content of phospholipids, tocopherols, free and bound gossypol. This achieves an improvement in the color of the partially neutralized cottonseed oil. The most acceptable technological data are obtained by partial neutralization of crude extraction cottonseed oil with an initial acid number of no more than 5.8 mg KOH / g. This indicates that alkaline solutions of sodium aluminate show their reactivity up to a certain level of acid number and the content of substances accompanying in the original oil [7-13].

RESULTS AND DISCUSSION.

Taking into account these experimental data, further studies were aimed at studying the effect of an excess of alkaline sodium aluminate solution on the performance of a partially neutralized sample of crude extraction cottonseed oil. In this case, the excess of the alkaline sodium aluminate solution is selected in a relatively higher (40-150%). The results of studies to study the effect of an excess amount of an alkaline solution on the technological process of partial neutralization of the extraction oil are shown in Table 2.

Table 1

Results of refining cottonseed oil with alkaline sodium aluminate solution

№ P/p	Physical-chemical characteristics of crude oil					Refining parameters		Refined oil indicators						The yield of partially neutralized oil from the initial, %
	Acid number, mg KOH/g	Chromaticity, red units at 35 yellow. in 1cm. layer	Content, %			Concentration of NaAlO2 solution%	Yield alkali,%	Acid number, mg KOH / g	Chromaticity, red units at 35 yellow. in 1cm. layer	Content,%				
			Phospholipids	Free gossypol	Bounded gossypol					Phospholipids	Free gossypol	Bounded gossypol	Aluminum soaps	
1	4,2	39	0,7	0,13	0,16	16	20	3,7	27	0,35	0,08	0,10	Trays	98
2	5,8	47	0,9	0,23	0,28	22	40	4,4	31	0,47	0,16	0,15	Trays	97
3	6,1	52	1,3	0,45	0,30	25	60	4,9	37	0,68	0,27	0,17	Trays	94
4	7,9	n/a	1,9	0,56	0,50	31	80	5,5	46	0,95	0,33	0,26	Trays	91
5	14,8	n/a	2,8	0,71	0,93	43	100	8,1	52	1,50	0,55	0,66	Trays	88

Table 2.

Influence of an excess amount of an alkaline sodium aluminate solution on the cottonseed oil refining process

Excessive amount of alkali from its original amount, %	Physical-chemical characteristics						The yield of partially neutralized oil, depending on the original, %
	Acid number, mg KOH / g	Chromaticity, red units at 35 yellow in 1 cm layer	Content,%				
			Phospholipids	Free gossypol	Bounded gossypol	Aluminum soaps	
0 (the control)	5,8	47	0,9	0,23	0,28	-	-
40	5,1	31	0,7	0,20	0,25	Trays	97
60	4,4	27	0,5	0,19	0,23		95
80	4,2	24	0,4	0,17	0,21		94
100	3,8	23	0,4	0,15	0,19		93
120	3,6	22	0,3	0,10	0,16		92
150	3,6	21	0,3	0,10	0,14		92

Note: The concentration of sodium aluminate 23% and NaOH in the solution is 230 g / l.

The data obtained indicate that in the partial neutralization of the crude extraction cottonseed oil, an excess of the used alkaline solution of sodium aluminate with a concentration of 23% plays a large role. The results of the study established a decrease in the acid number of partially neutralized oil, as well as the content of phospholipids, tocopherols, free and bound gossypol in it. It should be noted that an excess of alkali has a significant effect on improving the color of partially neutralized cottonseed oil.[14-22]

A fundamentally new technology for alkaline refining of raw cottonseed oil has been developed, which consists in its neutralization in series with alkaline solutions of aluminate and sodium hydroxide.

The investigated technology has been improved with the use of pretreatment methods for alkaline solutions in an electromagnetic field of various strengths.

The results of new developments made it possible to reduce the consumption of alkaline solutions, reduce oil losses and improve its quality.

The optimal technological modes of partial neutralization of raw cottonseed oil have been determined, ensuring the maximum removal of phospholipids, gossypol and its derivatives, tocopherols from the raw material at the stage of preliminary refining. The technology of the final refining of partially neutralized cottonseed oil with an alkaline solution of sodium hydroxide has been investigated, its optimal concentration and excess have been established, which ensure an increase in the quality and nutritional value of the refined oil.

CONCLUSION.

The technological processes of partial and final refining of raw cottonseed oil with alkaline solutions of aluminate and sodium hydroxide with their preliminary processing in an electromagnetic field of various strengths have been improved. The optimal value of the EMF intensity has been determined, which ensures a high yield and quality of refined oil.

The physical-chemical and qualitative characteristics of soap stocks obtained in the technologies of partial neutralization and final refining of raw cotton oils have been evaluated.

REFERENCES

1. Technology of fat processing / N.S. Harutyunyan, E.P. Kornev and others - 2nd ed., Revised and added. // M .: Pishchepromizdat, 1998 . p. 452.
2. Research of changes in the quality indicators of bleached cottonseed oil and its products / S.Sh.Ismatov, F.G.Mamatkulov // Austrian Journal of Technical and Natural Sciences Scientific journal No. 3–4 2019 (March–April) p 16-20 ...
3. Refining of the extraction cottonseed oil. / S. Sh. Ismatov and K.Kh. Mazhidov // "Oil and fat industry" journal, Moscow, 2011, No. 4, p.19.
4. Raxmonov K.S., Zakvaski spontannogo brojeniya - effektyvnoe sredstvo profilak-tiki kartofelnoy bolezni xleba // Isabaev I.B. // Journal «Xranenie i pererabotka selxozsyrya» .- M., 2011.- № 12.- S.23-25.
5. Raxmonov K.S., Influence of a substrate of a nutrient medium on a composition of a population of microorganisms in spontaneous fermentation // Isabaev I.B., Axmedova Z.R.// Journal «Protection and processing of agricultural machinery». M, 2012 ..- № 9.- S.40-43
6. Rakhmonov KS, Analysis of typical sources of microbial contamination of bread // Scientific information of Bukhara State University. // 2014.- .-3.- S.37-43.
7. Raxmonov K.S. Kartofelnaya bolezn xleba i sposob eyo predotvrashcheniya // T.I. Atamuratova // Journal "Xlebopechenie Rossii". M, 2014.- № 5.- S.37-38.
8. Raxmonov K.S., Biotechnological aspects obespecheniya mikrobiologicheskoy chistoty xleba // E.Muratov, T.I. Atamuratova // Chemistry and chemical technology. 2015.- №2.- S.64-68.
9. Rakhmonov K.S. Wheaten ferments spontaneous fermentation in biorechnological methods // Isabayev I.B. // Austrian Journal of Technical and Natural Sciences. 2016. - № 7-8. - P. 9-12.
10. Rakhmonov K.S., Sposoby uluchsheniya sostava pitatelnoy sredy zakvasok dlya xlebobulochnyx izdeliy iz pshenichnoy muki // T.I. Atamuratova. Isabaev I.B // Xlebopechenie Rossii. 2016. –№2. - S.22-24.
11. Rakhmonov K.S., Optimization retsepturnogo sostava pshenichnyx sortov xleba s ispolzovaniem zakvasok spontannogo brozheniya // I.B.Isabaev, U.M. Ibragimov, Molchanova E.N // Xlebopechenie Rossii. 2018. –№3. - S.33-37.
12. I.B. Isabaev, Ispolzovanie kormovyx muchek v kachestve substrata pitatelnoy sredы pshenichnyx zakvasok v proizvodstve xleba // T.I.Atamuratova., Rakhmonov K.S. // Bukhara State University scientific information.- 2018. №2.- P.24-30.
13. K.S.Rakhmonov. Influence of leavens of spontaneous fermentation and phytoadditives on the provision of microbiological safety of bread // T. I. Atamuratova, N. R. Djuraeva, I. B. Isabaev, L. N. Haydar-Zade//Journal of Critical Reviews //2020, Vol.7, Issue 5, pp. 850-860.
14. S.K. Jabborova.Application of products of processing mulberries and roots of sugar beet in the production of cupcakes // I.B.Isabaev., N.R. Djuraeva., M.T. Kurbanov.,l.N. Khaydar-Zade., K.S. Rakhmonov //Journal of Critical Reviews //2020, Vol.5, Issue 5, pp. 277-286.
15. K.S.Rakhmonov. Application of phito supplements from medicinal vegetable raw materials in the production of drugs // T. I. Atamuratova., M.E. Mukhamedova., N.K.Madjidova., I.Sh. Sadikov //Journal of Critical Reviews //2020, Vol.7, Issue 12, pp. 934-941.
16. Djurayeva N, Mixtures of Vegetable Fat as a Potential Raw Material for Bakery// Barakayev N, Rakhmonov K,Atamuratova T, Mukhamedova M, Muzaffarova Kh. // International Journal of Current Research and Review// october 2020, Vol.12, Issue 19, pp. 140-148. DOI: http://dx.doi.org/10.31782/IJCRR.2020.12192

17. Djurayeva N, Plant-fat mixtures as a potential raw material for bakery production// Rakhmonov K, Barakayev N, Atamuratova T, Mukhamedova M, Muzaffarova Kh. // Plant Cell Biotechnology and Molecular Biology 2020 21(45-46), pp. 29-42
18. Ravshanov S.S, The impact of ultrasonic activated water on hydrothermal processing of wheat grains grown in dry climate conditions // Rakhmonov K.S., Amanov B.N. // Plant Cell Biotechnology and Molecular Biology 2020 21(45-46), pp. 29-42
19. Kuliev N.SH, Udk 664.8 baking properties and quality expertise wheat flour// Rakhmonov K.S. // *European Journal of Molecular & Clinical Medicine*, *2020,* Volume 7, Issue 2, Pages 6333-6340
20. Ravshanov S.S, The Effect Of Drinking And Activated Water On Field Scales Of Wheat Grains Grown In Arid Climatic Conditions// Rakhmonov K.S. Ergasheva H.B., Yuldasheva Sh. J.// *European Journal of Molecular & Clinical Medicine*, *2020,* Volume 7, Issue 3, Pages 3065-3070.
21. Rakhmonov K.S., Confectionery Products for Therapeutic and Preventive Purpose with Medicinal Herbs Uzbekistan// L.N. Khaydar-Zade., N.SH. Kuliev, G.H.Sulaymonova // Annals of the Romanian Society for Cell Biology, Vol. 25, Issue 2, 2021, Pages. 4126 – 4140.
22. Ravshanov S.S., Influence of the Use of Activated Water during Hydrothermal Treatment on the Quality of Bread// Rakhmonov K.S., Radjabova V.E., Pardayev Z.T. // Annals of the Romanian Society for Cell Biology, Vol. 25, Issue 2, 2021, Pages. 4091 - 4102