REFINING OF COTTONSEED OIL OBTAINED BY EXTRACTION METHOD

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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 aluminates 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 aluminates 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 aluminates solution is equal to 23%. Whereas for the press was used alkali with a 15% concentration.

![Graph](image1.png)

**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 aluminates.

![Graph](image2.png)

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

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 aluminates 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 aluminates 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

<table>
<thead>
<tr>
<th>Excess amount of alkali from its original amount, %</th>
<th>Physical-chemical characteristics of crude oil</th>
<th>Refining parameters</th>
<th>Refined oil indicators</th>
<th>Content,%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acid number, mg KOH / g</td>
<td>Chromaticity, red units at 35 yellow in 1 cm layer</td>
<td>Concentration of NaAlO2, mg KOH/l</td>
<td>Content,%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Phospholipids</td>
<td>Free gossypol</td>
<td>Bound gossypol</td>
</tr>
<tr>
<td>0 (the control)</td>
<td>5,8</td>
<td>47</td>
<td>0,9</td>
<td>0,23</td>
</tr>
<tr>
<td>40</td>
<td>5,1</td>
<td>31</td>
<td>0,7</td>
<td>0,20</td>
</tr>
<tr>
<td>60</td>
<td>4,4</td>
<td>27</td>
<td>0,5</td>
<td>0,19</td>
</tr>
<tr>
<td>80</td>
<td>4,2</td>
<td>24</td>
<td>0,4</td>
<td>0,17</td>
</tr>
<tr>
<td>100</td>
<td>3,8</td>
<td>23</td>
<td>0,4</td>
<td>0,15</td>
</tr>
<tr>
<td>120</td>
<td>3,6</td>
<td>22</td>
<td>0,3</td>
<td>0,10</td>
</tr>
<tr>
<td>150</td>
<td>3,6</td>
<td>21</td>
<td>0,3</td>
<td>0,10</td>
</tr>
</tbody>
</table>

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.

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