Section 2. Food processing industry

https://doi.org/10.29013/AJT-22-9.10-18-21

Akhmedov Azimjon Normuminovich,
Doctor of Technical Sciences, Professor
of the Department of Food Technology of Products
of the Karshi Engineering and Economic Institute, Karshi, Uzbekistan

Atakulova Dilfuza Tursunovna,
Associate Professor of the Department of Food Technology
of Products of the Karshi Engineering and Economic Institute,
Karshi, Uzbekistan

Kholmurodova Zubayda Diyorovna,
Associate Professor of the Department of Food Technology
of Products of the Karshi Engineering and Economic Institute,
Karshi, Uzbekistan

Shaymardonova Gulmira Xudoynazarovna,
3 rd year student of Karshi Institute of Engineering
and Economics, Food Technology, Karshi, Uzbekistan

ANALYSIS OF CHLOROPHYLLS IN LOW QUALITY COTTONSEED OIL

Abstract. This scientific article presents information about the effect of increasing the amount of cotton seed pods on the quality of cotton oils obtained from I–IV cotton seeds. In particular, in the processing of low-grade cotton seed in JSC "Karshi oil-extraction", the pulpiness of the pulp is 4.3–6.0% higher than the usual one, or the degree of crushing of the pulp obtained from low-grade cottonseed is 5.5–6, 5 percent higher. With the introduction of reverse goods, cottonseed bolls are partially reduced, but this has been shown to be insufficient to significantly reduce the bolls of the pressed material.

The color of low-quality cottonseed oil was found to be 20–21 red units higher than the color of ordinary (I–II grades) cottonseed oil by 7–8 blue units. Particular attention should be paid to the difference in pigments in the blue units that condense the processes of cleaning the obtained oils with alkali and bleaching with activated adsorbents.

Keywords: chlorophyll, alkali, blue units, red units, cotton seeds, cotton oils, JSC "Karshi yog-extraction", JSC "Koson oil-extraction".

Introduction

The main task of the oil industry of the Republic of Uzbekistan is to produce environmentally friendly, competitive, high-quality products for the population. Training of qualified personnel is of great importance in performing this task. Oil processing technology includes a number of production processes. Among them, the most important are oil refining, hydrogenation, production of margarine and margarine products, mayonnaise, fatty acids, glycerin and soap.

During the production of cottonseed oil, dark-colored crude oils are more often obtained, where, along with gossypol and its derivatives, pigments of chlorophyll and its derivatives are present [1, p. 23–26].

The content of chlorophyll and its derivatives in crude oils depends on the conditions of their extraction and the maturity of cotton seeds.

When chlorophyll is treated with alkali, colorless substances are not formed, which must be borne in mind when choosing an industrial method for bleaching vegetable oils containing a significant amount of chlorophyll.

$$C_{32}H_{30}ON_4Mg\begin{cases}COOCH_3\\COOC_{20}H_{39}\end{cases}\xrightarrow{Alkali}C_{32}H_{30}ON_4Mg\begin{cases}COOH\\COOH\end{cases}+\begin{matrix}CH_3OH\\C_{20}H_{39}OH\end{matrix}$$

Chlorophyll a *Chlorophyllin a* *Phytol*

$$C_{32}H_{28}O_2N_4Mg\begin{cases}COOCH_3\\COOC_{20}H_{39}\end{cases}\xrightarrow{Alkali}C_{32}H_{28}O_2N_4Mg\begin{cases}COOH\\COOH\end{cases}+\begin{matrix}CH_3OH\\C_{20}H_{39}OH\end{matrix}$$

Chlorophyll to *Chlorophyllin to* *Phytol*

When chlorophyll is treated with acids, magnesium is split off from its molecule. The acute action of acids leads to the formation of pheophytin a and pheophytin b. It is assumed that it is the presence of pheophytins that is the reason for the green color of vegetable oils.

There is a close relationship between the rancidity of oils and their chlorophyll content. Chlorophyll can act as a photosensitizer when oils are exposed to light. According to [2, p. 11–16], chlorophyll in the light is a stimulator of oxidation, while in the absence of light it does not affect the oxidative process. The accelerating effect of chlorophyll on the oxidative rancidity of fats is delayed by the addition of antioxidants.

In the presence of phenolic oxidation inhibitors, chlorophyll is a positive synergist. However, when illuminated, it exhibits negative synergism.

Partially, chlorophyll is removed from oils during alkaline refining and more completely when they are treated with natural sorbents. The color intensity of oils can be significantly weakened by the action of solar radiation and γ-radiation. γ-radiation is especially effective, which opens up the possibility of practical use of this method for decolorizing technical green oils.

Solutions of chlorophylls in organic solvents have characteristic absorption spectra in the region of 400–500, 600–700 nm. Therefore, the spectrophotometric method is currently one of the main methods used in the study and analytical determination of chlorophylls [3, p. 77–78].

Materials and methods. The article uses modern methods of chemical, physico-chemical and other analyzes with the processing of the results by statistical methods [4, p. 107].

We have studied the content of chlorophyll and its derivatives in oils obtained from ordinary (grades I and II) and low-grade (grades III and IV) cotton seeds. Sampling was carried out during the normal operation of the JSC "Karshi yog-extraction" and JSC "Koson oil-extraction". The analyzes of these samples and the resulting oil were carried out according to the "Guidelines for research methods ..." [4, p. 107].

Results. The results of the analysis of the content of the husk in the petal mint and pulp are presented in table 1.

From Table. Table 1 shows that at both enterprises, when processing ordinary (I–II varieties) cotton seeds, the content of husks in the petal, mint and pulp is much lower than when processing low-grade (III and IV varieties) seeds. For example, in the joint venture JSC "Karshi oil-extraction" the huskiness of the petal during the processing of low-grade cotton seeds is 4.3–6.0% higher compared to the traditional one. Or the puddleness of mint obtained from low-grade cotton seeds is higher by 5.5–6.5% compared to the usual one. With the introduction of reverse goods, the huskiness of the pulp is partially reduced, but this is not enough to significantly reduce the husk content in the pressed material.

Table 1.– Changes in the content of husks (huskiness) in the petal, mint and pulp obtained from ordinary (I–II varieties) and low-grade (III–IV varieties) cotton seeds

Business name	Husk content (huskiness),%					
	when processing ordinary (I–II varieties) cotton seeds (control)			when processing low-grade (III and IV grades) seeds		
	in a petal	in mint	in the pulp	in a petal	in mint	in the pulp
JSC "Karshi oil-extraction"	12.1–12.6	15.0–18.7	13.5–14.3	16.4–18.6	21.5–24.3	20.1–21.5
JSC "Koson oil-extraction"	11.8–13.5	15.5–19.2	13.8–15.7	16.8–18.9	22.3–25.8	21.2–22.4

Comparison of data for two enterprises shows that when processing low-grade cotton seeds in petal, mint and pulp, the husk content (husk content) increases by about 5–7% compared to the traditional one. This negatively affects the quality of the resulting oil, in particular, increases the content of chlorophyll and its derivatives, which are presented in (table 2).

Table 2.– Change in the mass fraction of chlorophyll and its derivatives in oils obtained from ordinary and low-grade cotton seeds by pressing methods

Business name	Mass fraction of chlorophyll and its derivatives in oils obtained from:%	
	when processing ordinary (I–II varieties) cotton seeds (control)	when processing low-grade (III and IV grades) seeds
JSC "Karshi oil-extraction"	0.5 ÷ 0.6	1.1 ÷ 1.2
JSC "Koson oil-extraction"	0.6 ÷0.7	1.2 ÷ 1.3

From Table. (Table 2) shows that in oils obtained from ordinary medium-fiber cotton seeds, the mass fraction of chlorophyll and its derivatives is contained within 0.5–0.7%, and in oils obtained from low-grade cotton seeds – within 1.1–1.3%. The increased content of green pigments in the composition of raw cottonseed oil complicates the processes of its alkaline refining and bleaching with activated adsorbents.

Table 3.– Change in the color of oils obtained from ordinary and low-grade cottonseeds

Business name	Color at 70 yellow oils obtained from:			
	conventional (I and II varieties) cotton seeds		low-grade (III and IV grades) cotton seeds	
	red units	blue units	red units	blue units
JSC "Karshi oil-extraction"	60.5	4.7	81.9	11.3
JSC "Koson oil-extraction"	63.7	5.5	85.2	13.7

Unfortunately, in practice, the content of husks in mint, pulp and others is often not regulated, due to which the color of the resulting crude oil significantly deteriorates. We confirm the data (Table 3.)

obtained by measuring on a color calorimeter of the Lovibond type.

Table 3 shows that the color of oils obtained from low-grade cotton seeds is approximately 20–21 red units and 7–8 blue units higher compared to the color of oils obtained from ordinary (I–II varieties) cotton seeds. Particular attention should be paid to the difference in pigments in blue units, which condense the processes of alkaline refining of the obtained oils and their bleaching with activated adsorbents.

Discussion and Conclusion. Thus, summarizing the results of this study, we can state that in order to improve the processes of alkaline refining of cottonseed oils and their bleaching, it is necessary to stabilize the content of the husk in the composition of the petal, mint and pulp. At the same time, it is necessary to select the optimal amount of the return product introduced into the fryer. it also contains substances that color the resulting oil in red and blue colors.

High-temperature processing of pulp leads to the formation of new derivatives of chlorophyll with other components, which complicates subsequent processing of cottonseed oil. Therefore, in order to increase the yield and quality of the resulting oil, it is necessary to improve the processes of processing low-grade cotton seeds and obtaining oils for various purposes from them.

References:

1. Akhmedov A. N. Investigation of indicators of cottonseed oil obtained by pre-pressing from low-grade cotton seeds // Universum: Technical Science. – Issue: 4(61). – April, 2019.– Moscow, 2019.– P. 23–26.
2. Akhmedov A. N., Abdurahimov S. A. The study of the grinding process of rushanka from the nuclei of cotton seeds of different varieties. Journal Chemistry and Chemical Engineering.– No. 3. 2018.– P. 11–16.
3. Abdurahimov S. A., Ergasheva D. K., Nazirov A. N. Spectral evaluation of the qualitative composition of refined oils. Izvestiya vuzov. Food technology,– No. 6. 1990.– P. 77–78.
4. Rzhekhin V. P. and others – L. Guidance on research methods, technochemical control and accounting of production in the oil and fat industry // Under the general editorship of prof.: VNIIZH-1967. I.– 585 p.