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Results of Studying the Process of Treatment of Sunflower Oil with Alkaline-Carbamide Solution

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ABSTRACT: To ensure the implementation of the above decisions to meet the needs of the population in vegetable oil and high-quality fat and oil products, the number of fat and oil companies in the country has increased by 4 times over the past 2 years. Although cottonseeds are one of the main raw materials for oilseeds in the country's oil and fat industry, today the area under non-traditional oilseeds such as sunflower, soybeans, sorghum, and rapeseed is expanding. This, in turn, allows the maximum use of the production capacity of fat and oil companies.

KEYWORDS: pre-press, extraction, hydration, urea solution, refining, different concentrations of urea solution, colour indicator, amount of volatile components, flash point, caustic soda, concentration.

I. INTRODUCTION

Following the Decree of the President of the Republic of Uzbekistan dated September 9, 2020, No. PP-4821 "On measures for the accelerated development of the food industry of the republic and the full provision of the population with high-quality food products on the expansion of industrial agricultural production for 2021 - 2023, taking into account domestic demand for agricultural food products in the republic“ [1].

Additional to the above, in the Decree of the President of the Republic of Uzbekistan dated January 16, 2019, No. PP-4118 "On additional measures for the further development of the fat and oil industry and the introduction of market management mechanisms for the industry", the development of a strategy for the development of the fat and oil industry as a single complex for the processing of oilseeds and the production of fat and oil products, as well as the implementation of measures for the widespread introduction of modern market mechanisms in the industry [2].

II. MATERIALS AND METHODS

To ensure the implementation of the above decisions to meet the needs of the population in vegetable oil and high-quality fat and oil products, the number of fat and oil companies in the country has increased by 4 times over the past 2 years.

Although cottonseeds are one of the main raw materials for oilseeds in the country's oil and fat industry, today the area under non-traditional oilseeds such as sunflower, soybeans, sorghum, and rapeseed is expanding. This, in turn, allows the maximum use of the production capacity of the oil-fat company [3-5].

Oilseeds, which are a type of crop, are one of the most important raw materials for oil and fat and other industries. While palm, soybeans, sunflowers, olive oil, cottonseeds, rapeseed, and other oilseeds are used on an industrial scale for the production of vegetable oil, other types of unconventional raw materials for the pharmaceutical and medical industries, pumpkins, almonds obtained from agricultural seeds, are widely used [6-8].

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An important consideration arises here. In the conditions of market relations, large enterprises are faced with the problem of a shortage of raw materials and transportation. Small businesses cannot separate the oil by extraction.

This is due, firstly, to capital investments in the construction of special equipment, and secondly, to the creation of environmentally friendly production, technical and fire safety, high energy consumption.

When considering the above problems and literature, analyzing trends in the development of enterprises in the livestock and fat-and-oil industries, it is important to increase the economic efficiency and productivity of small enterprises in a market economy, the economic viability of enterprises [9-11].

To adapt oilseed companies to market conditions, oilseed companies provide funds to farmers who have signed contracts to grow oilseeds, especially soybeans and sunflowers, and provide them with quality oilseeds. Since sunflower is one of the most valuable oilseeds and the use of the created opportunities, the cultivation of sunflower as the main and auxiliary crop is growing from year to year. The processing of sunflower seeds, which occupies a high place among unconventional oilseeds, is one of the urgent problems of cleaning its components. The high content of chlorophyll and phosphatide granules in sunflower oil obtained by pressing and extraction causes some problems in the alkaline refining of sunflower oil. In particular, the high content of phosphatides in the composition adversely affects the emulsification of the oil during refining and the separation of soapstock during alkaline refining. The composition of the sunflower oil obtained for the experiment is shown in Table 1.

Table 1. Quality indicators of sunflower oil obtained for the experiment

№	Name	Unit of measurement	Pre-pressed oil	Extraction oil
1	Number of acid	mg KOH	0,85	1,02
2	Color indicator	Number J2	25	40
3	Content of phospholipids	%	0,5	0,65
4	Number of mechanical additive	%	0,1	0,2
5	Moisture and number volatile content	%	0,21	0,26
6	Flash point	°C	-	200

To maximize the purification of sunflower oil from raw materials and increase the yield of refined sunflower oil, research was carried out on the technology of for-refining by refining sunflower oil using a carbamide solution.

When refining sunflower oil, the following laboratory device was used [3-5]. For the experiments, sunflower oil, obtained mainly by the extraction method, was widely used.

When mixed with sunflower oil, the urea solution was slowly added in the required amount using a meter designed for the urea solution.

The mixing process lasts 10-12 minutes. The solution of oil and urea was removed from the mixer, and the precipitated sunflower oil was formed at 35 ... 40 ° C for precipitation.

After cleaning from impurities in the composition, the sunflower oil was treated with a solution of caustic soda in the required amount using a meter designed for alkaline refining. The required consumption of the alkaline solution was calculated based on the acid number of sunflower oil obtained in the experiment [4].

One of the main indicators of the quality of sunflower oil is the colour index of this oil. A comparison was made between the results of a study on the colour change of a hydrating oil that had been purified using a urea solution.

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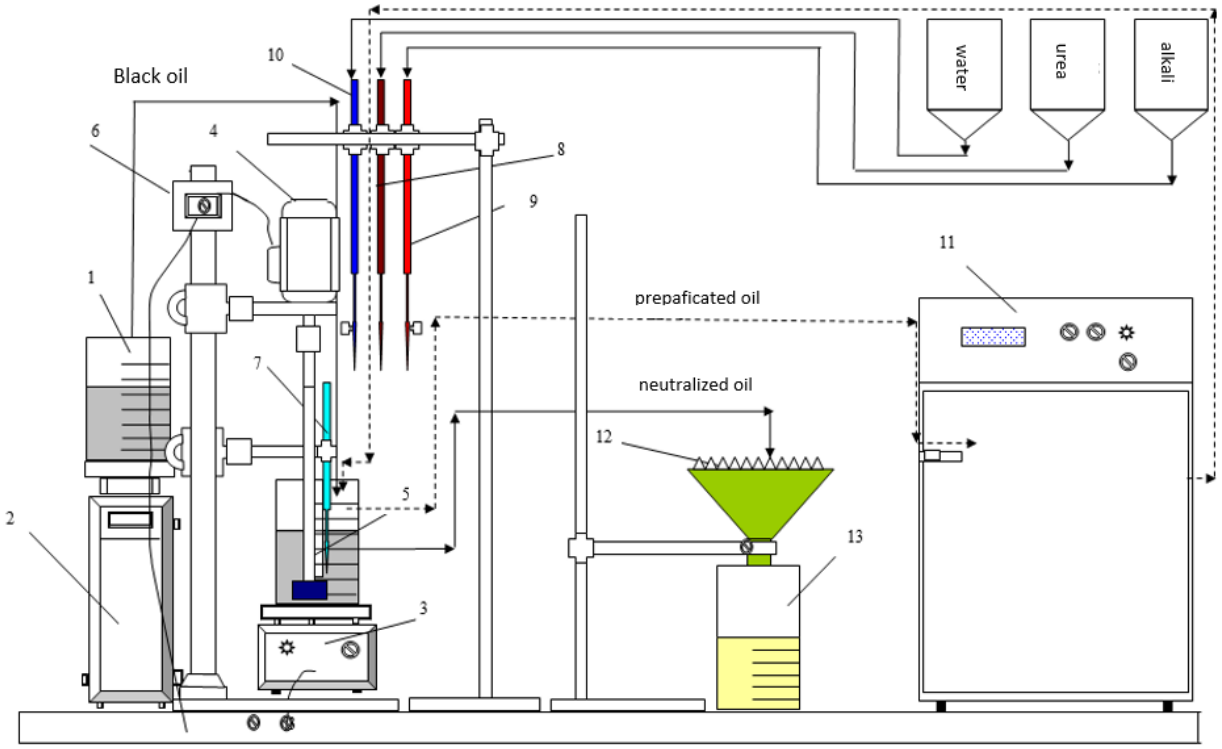

1 - chemical glass (700 ml); 2 - technical scales; 3 - electronic heater; 4 - mixer engine; 5 - mixers; 6 - rheostat; 7 - thermometer; 8 – the measure of solution for carbamide; 9 - measure for alkali solution; 10 – water meter; 11 - thermostat; 12 – filter paper; 13- the glass of pure oil.

Figure № 1. Laboratory plant for sunflower oil refining

One of the main indicators of the quality of sunflower oil is the colour index of this oil. The results of the study of the change in the colour index of the hydrated oil obtained by preparatory processing using a solution and traditional technology were compared. In addition to the quality of the oil, the output of economically refined oil to the factories is no less important. The yield of refined oil depends not only on the initial parameters of the oil obtained for the experiment but also on the concentration of caustic soda used in the alkaline refining process. For the positiveness of the above parameters, based on experiments, its concentration and consumption were determined when using a urea solution in the refining process. The experimental results are presented in Table 2.

Table 2. Concentration and consumption of urea solution

The concentration of urea solution, %	Solution consumption,% (relative to oil mass)	Refining indicators		
		Relative to oil mass,%	Color, number J2	Acid number mg KOH
10	1	94,7	30	0,93
	2	94,2	30	0,91
	3	93,8	25	0,90
20	1	94,7	30	0,45
	2	94,4	20	0,15
	3	93,2	10	0,15
30	1	93,8	25	0,27
	2	93,5	20	0,25
	3	91,7	15	0,18

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III. RESULTS AND DISCUSSION

It can be seen from the table that as the concentration of the urea solution and the consumption concerning the mass of oil increase, the efficiency of oil purification deteriorates. When the concentration of the urea solution was 10% at 3% oil consumption, the oil colour index was 25 iodine number, with an increase in concentration by 30%, and at a solution consumption of 3% by weight of the oil, this indicator decreased to 15 iodine number. However, we see that the difference between the yield and consumption of refined oil has decreased to 2.1%. Based on the experiments, we assumed that the concentration of the urea solution was conditionally 20%, as a crystalline reagent, 0.2%, and the consumption was 2% concerning the mass of the oil. The results of experimental alkaline refining (hydration) of sunflower oil are shown in the table. The obtained oils were neutralized under the same conditions with an alkali concentration of 150 g / l and consumption of caustic soda of 3.5 and 5.0 kg / t. The experimental results are presented in Table 3.

Table 3. Experimental and control indicators of refiled oil

Experiment	Caustic soda consumption, kg / t	Refining indicators		
		Oil out,%	Color, number J2	Acid number, mg KOH
1. Primary oil				
1	3,5	93,7	13	0,18
2	5,0	93,1	9	0,14
2. Hydrated oil (control)				
3	3,5	92,2	10	0,13
4	5,0	91,6	8	0,13
3. Force Refined (experimental) oil				
5	3,5	94,4	9	0,13
6	5,0	94,0	7	0,10

As can be seen from the table, the colour index of the original oil obtained for the experiment (experiments 1 and 2), hydrated oil (control) (experiments 3 and 4) and refined oil using a urea solution (experiments 5 and 6) did not change significantly. The yield of refined oil was 92.2% and 91.6% in the hydrated control oil, while in the test oil it was 2.2-2.4% higher than in the control. Experiments have shown that at a caustic soda consumption of 5.0 kg / t, the oil yield is 0.9% higher than the calculation of alkaline purification of the initial oil and the oil obtained as a result of the experiment. The fact that the colour index of the oils in the second sample and the preprocessed (experimental) oil obtained for the first oil is equal to the same amount of iodine in the oils of the fifth sample is economically explained by a decrease in the consumption of caustic soda at the expense of 25%. Thus, the introduction of the technology for the purification of the urea solution in comparison with the traditional technology for the purification of locally produced sunflower oil makes it possible to reduce the consumption of caustic soda by 25%.

IV. CONCLUSION

This, in turn, increases the oil yield by 0.9% compared to the original oil using traditional technology. The fact that the consumption of the urea solution for refining is 2% with the oil mass, and the concentration is 20%, leads to a change in the amount of the outgoing oil by 1.5-3%.

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