

CLEANING OF RAW OILS OBTAINED FROM LOCAL SOYA SEEDS

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Abstract. New methods for cleaning raw plant oils obtained from locally grown soya seeds have been studied. A stepwise technology for cleaning raw soya oils is proposed. As a result of the new research, high-quality indicators and alternative physical-chemical characteristics of the obtained soya oils were ensured.

Keywords. Local oilseed soya seeds, technological stages of vegetable oil production, quality indicators of refined oils, physical-chemical classifications.

Introduction. In our country, the volume of cotton fiber cultivation is being reduced, which requires growing other oilseeds in its place. In Uzbekistan, special attention is being paid to the cultivation of soya seeds as oilseeds, as well as to the extraction of vegetable oils from such seeds in oil and fat production enterprises. Locally grown oilseed soya seeds differ significantly from traditional varieties in terms of their quality indicators and physical-chemical composition [1, 2]. Therefore, it is crucial to develop new methods for cleaning oils extracted from raw soya seeds grown in local conditions and to implement these methods in production practice.

The processes of hydrating and refining raw soya oil with activated water and calcium soda solutions were carried out under laboratory and experimental conditions [3, 4].

For the research, a new technology for hydrating and refining raw material with activated water and sodium carbonate solutions was proposed [5, 6]. This technology was chosen and experimental studies were conducted due to the need to reduce technological losses, decrease costs (especially of rare sodium hydroxide), and improve the quality of refined oils [7].

The technological stages and processes for refining raw soya oil are shown in Figures 1 and 2.

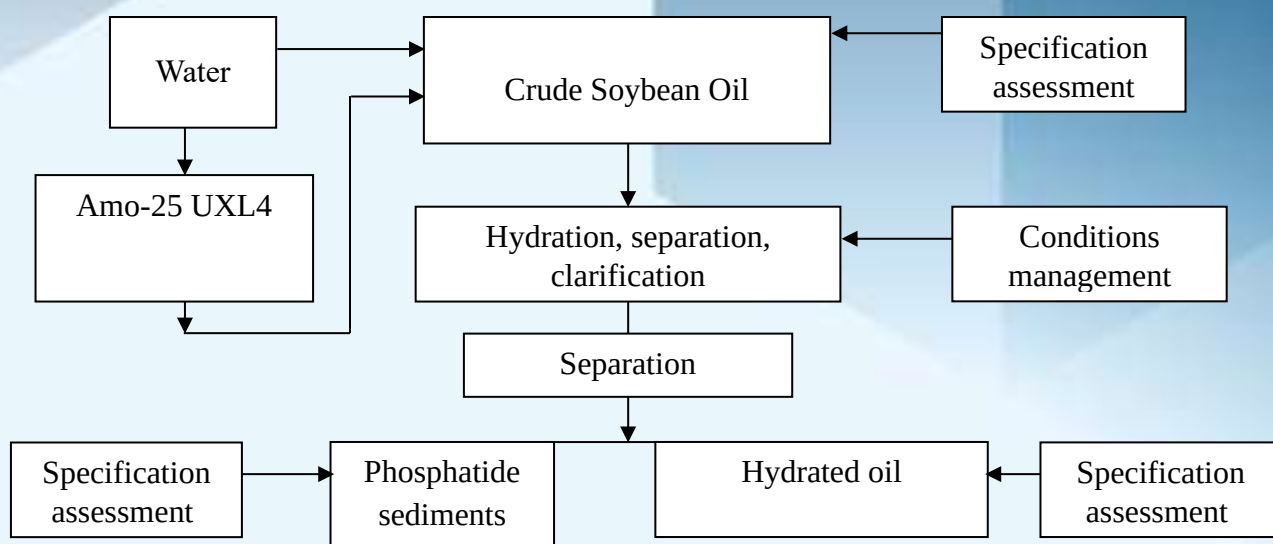


Figure 1. Technological stages of hydration of Raw Soy Oil

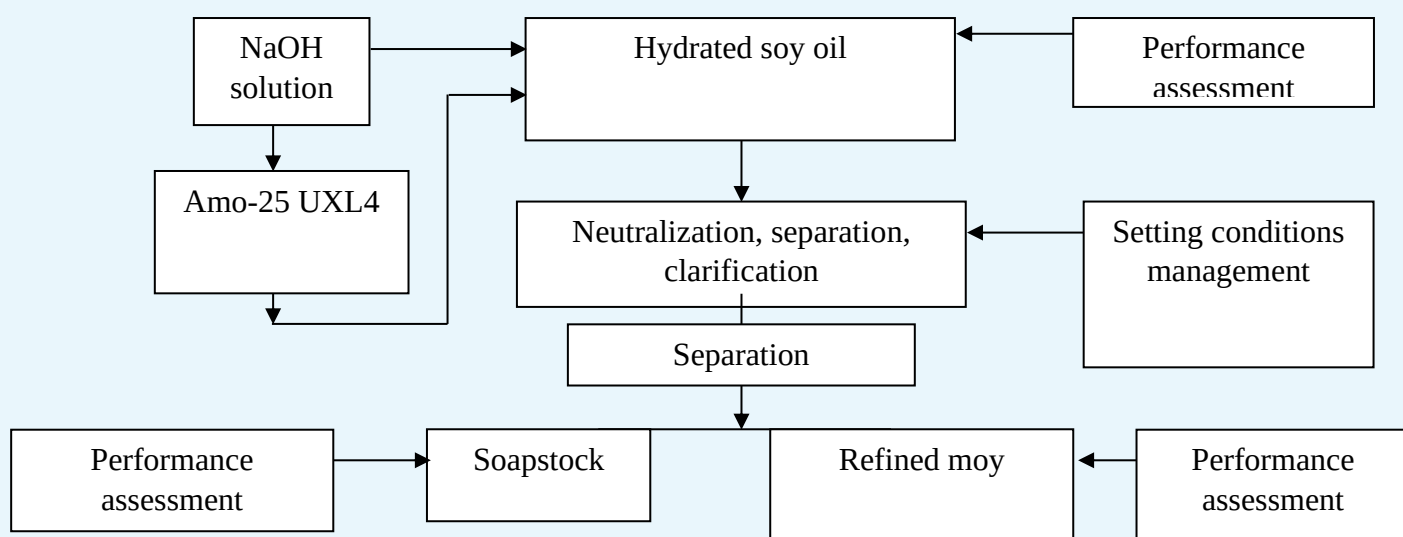


Figure 2. Technological stages of neutralization of hydrated soya oil

Hydration of raw soya oil with an activated water solution was carried out until the phospholipid content in the initial raw material decreased by 45-50% from its initial amount. Based on the initial phospholipid content in the raw oil, the theoretically calculated necessary amount of activated water was determined.

For the final refining of hydrated soya oil, the amount of alkaline solution required was determined based on the degree of reduction in acid number. The

necessary amount of alkaline solution and its excess were determined based on the acid number of the oil.

The research on the effect of sodium hydroxide solution concentrations (with and without electromagnetic field treatment) on the neutralization process by phase separation was conducted using the laboratory equipment shown in Figure 1.

The experiments were carried out as follows:

The pre-weighed raw soya oil was placed in a chemical beaker and heated using an electric heater, mixing with a stirrer. The required temperature was maintained according to the type of oil. When the required temperature was reached, activated water was added through a dropper funnel in the calculated amount, without stopping the stirring, to reduce the phospholipid and accompanying substance content in the oil. The temperature of the oil was then raised to 15-20°C, the stirring speed was reduced, and mixing continued for 2-5 minutes until the phospholipids formed and separated from the oil, settling down as a precipitate. The oil was then left to settle for 2 hours.

The hydrated oil was decanted, and its quality indicators and physical-chemical properties were determined. The precipitate, consisting of oil phospholipids, water, and other non-reacting accompanying substances, was transferred to a separate beaker for quality and physical-chemical analysis.

The neutralization of hydrated soya oil was carried out in the same device (Figure 1), with neutralization and phase separation. The fully refined oil was washed with a solution of citric acid and water to remove soap residue. Afterward, the purified oil was dried under vacuum, cooled, and analyzed.

The soapstock formed during the alkaline refining process was separated and analyzed.

The method for hydrating soya oil was carried out as follows:

First, the stirrer's required rotation frequency was set with the tachometer, and simultaneously the readings on the LATR 1 scale were recorded.

600g of the oil to be tested was weighed and placed in the hydrotator, covered with a lid. During stirring, the oil was heated. The electric heater was turned off when the temperature reached 5-10°C, preventing overheating. The frequency of stirring was

then increased, and the required amount of distilled water was added slowly through the five holes in the lid using a burette, until it reached the calculated value. Stirring continued with uniform intensity for 15 minutes, after which the frequency was reduced. Without stopping the mixing, the formation of precipitates was observed through a glass tube, as they separated from the oil and settled. When this happened, the stirrer was stopped.

The hydrated oil was allowed to settle at hydration temperature for 30 minutes, and the phospholipids were separated by decanting. The degree of hydration of the phospholipids was determined by comparing their initial and hydrated amounts. The difference between the initial and hydrated amounts, expressed as a percentage, represented the extraction level.

The neutralization of free fatty acids in soya oil was performed as follows:
The neutralization of free fatty acids in soya oil was carried out in a laboratory setup. 400g of hydrated oil was weighed, placed in a chemical beaker, and heated using an electric heater, with the temperature controlled to prevent overheating. The required amount of reagent was introduced slowly through a dropper funnel. The temperature was then raised by 15-20°C, the stirring speed was reduced, and mixing continued for 2-5 minutes, until a soapstock was formed, separating well from the oil and precipitating. Afterward, the stirrer was stopped, and the oil was left to settle. The neutralized oil was decanted, and the acid number was determined. The soapstock was transferred to a chemical beaker and analyzed.

The necessary amount of alkali (NaOH) required for neutralization was calculated using the following formula:

$$I = k.c. - 0.714m \quad (1)$$

Where:

- I = required amount of alkali, mg NaOH
- $k.c.$ = acid number of the oil, mg KOH
- 0.714 = conversion coefficient for KOH to NaOH, based on the molecular weight ratio of NaOH to KOH
- m = amount of oil, g.

Conclusion. The introduction of new technological methods for extracting vegetable oil from locally grown soya oilseeds resulted in the improvement of the quality indicators and physical-chemical classifications of the produced oils.

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