DETERMINATION OF THE DENSITY OF RECYCLED PETROL IN VEGETABLE OIL PRODUCTION PLANTS

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Abstract: The article examines methods for determining the density of the extraction benzine collected during the distillation of vegetable oil miscella. The influence of this parameter on the process is analysed both theoretically and practically. During the study, the density of the recycled benzine was compared at various temperatures, with details on its efficiency and application provided. Taking into account that the parameters of the recycled solvent (petrol) have a direct impact on the production process, Practical work is being carried out to improve the distillation apparatus in order to make the distillation of vegetable oil miscella more efficient.

Keywords: Extraction, miscella, distillation, solvent, density, hydrostatic method, areometer.

Annotatsiya: Maqolada o‘simlik moyi missellasini distillatsiyalash jarayonida yig‘ib olinadigan ekstraksion-benzinning zichligini aniqlash usullari o‘rganilgan. Ushbu parametrni jarayonga ta’siri nazariy va amaliy jihatdan tahlil qilingan. Tadqiqot davomida qayta ishlatiladigan benzin zichligi turli haroratlarda solishtirilib, ularning samaradorligi va qo‘llanilishi bo‘yicha tafsilotlar yoritilgan. Qayta ishlatiladigan erituvchi (benzin) ning parametrlari ishlab chiqarish jarayoniga bevosita ta’sir ko‘rsatishini nazarda tutib, o‘simlik moyi missellasini distillatsiyalash jarayonini yanada samaraliroq tashkil etish uchun distillator qurilmalarini takomillashtirish bo‘yicha amaliy ishlar olib borilmoqda.

Kalit so‘zlar: Ekstraksiya, missella, distilyatsiya, erituvchi, zichlik, gidrostatik usul, areometr.

Аннотация: В статье рассматриваются методы определения плотности экстракционного бензина, полученного при дистилляции растительного масла мицеллы. Влияние этого параметра на процесс анализируется как теоретически, так и практически. В ходе исследования сравнивалась

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плотность рециркулируемого бензина при различных температурах, при этом подробно описывались его эффективность и применение. Учитывая, что параметры рециркулируемого растворителя (бензина) оказывают непосредственное влияние на производственный процесс, ведутся практические работы по усовершенствованию дистилляционного аппарата с целью повышения эффективности дистилляции растительной масляной мицеллы.

Ключевые слова: экстракция, мицелла, дистилляция, растворитель, плотность, гидростатический метод, ареометр.

INTRODUCTION.

Today, one of the most important stages in vegetable oil production plants is the extraction process. In oil-extraction plants, oil-bearing seeds are pressed to extract the oil from the plant seeds. The resulting cake is extracted with an organic solvent to produce vegetable oil. In extraction, n-hexane or a similar ‘extraction benzine’ is typically used as the solvent. The oil solution in benzine produced during the extraction process is called a miscella. The benzine in the miscella is recovered by distillation. One of the main physicochemical characteristics of extraction benzine is its “density”, which directly affects the solvent's volatility, the viscosity of the emulsion, the rate of diffusion, and the oil separation process. In the extraction workshop, the solvent is condensed and reused several times. For this reason, its density must remain stable within certain limits during the technological process. In many cases, an increase or decrease in the solvent's density indicates the presence of heavy substances, water or mechanical impurities in its composition. There are three methods for determining the density of petrol, the most common of which is by calculation using an areometer. Refractometers typically measure the liquid's refractive index, which is dependent on its density. In laboratory conditions, an experiment is conducted using the hydrostatic method based on precise measurements, which is particularly useful for checking the presence of additives (e.g., alcohol) in petrol.

Experimental part. A sample of reused benzene was taken from the extraction workshop of the oil refinery for the experiment. The experiment was conducted in the laboratory of the Department of Food Technology at Namangan State Technical University. Initially, the factory-supplied sample, which contained small amounts of oil and pipe rust, was decontaminated of these impurities and, using a funnel, pured into a clean, chemically inert 0,5-litre vessel. The sample, now poured into a tall cylindrical container, had its density measured using an aerometer and recorded in a table. The measurement was taken three times to obtain an average value.

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Figure 1. density measurement process.

The density of a liquid mixture, provided it does not undergo significant physical or chemical changes on mixing and its volume is assumed to be equal to the sum of the component volumes, can be approximately calculated. Using this formula, the difference in consentrations can be determined:

$$\frac{1}{\rho_M} = \frac{\bar{x}_1}{\rho_1} + \frac{\bar{x}_2}{\rho_2} + \cdots, \qquad (1)$$

$$\frac{1}{\rho_M} = \frac{0{,}95}{0{,}661} + \frac{0{,}5}{1000} = 1{,}437 + 0{,}005 = 1{,}4375$$

Here, x_1, x_2,….. are the mass fractions of the mixture's components, ρ_M, ρ_1, ρ_2 - are the densities of the mixture and its components, respectively.

When asseeing the density of liquid mixture, if no chemical reaction occur between the components upon mixing and no volume changes are observed, the volume of the mixture is assumed to be equal to the sum of the volumes of the individual components. Under these conditions, the density of the mixture can be approximated based on the mass and volume properties of the components.
The mass fractions of the components of a mixture, the density of the mixture, and its components.

Results. According to the result of the experiments conducted, the density of the reused extraction benzine was in the following range of values:

Table.

Measurement (g/cm³)	Temperature, °C	Density from measurement, ρ (g/cm³)
1	20	0.661
2	23.5	0.663
3	23.6	0.666

As can be seen from the table, by taking the average value we select 0.661 g/см^3 at a temperature of 20 °C. you can see this process in Figure 2.

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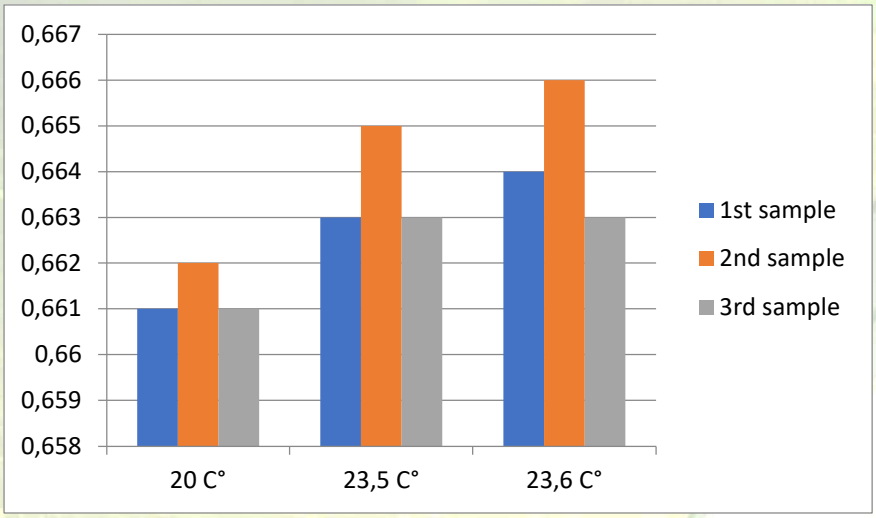


Figure 2. Temperature dependence of density.

This result fully corresponds to the permissible value for extraction benzine according to GOST 3134–78 (0.650–0.680 g/cm³).

Discussion. The measurement results indicate that the density of the recirculated petrol is within the normal range; however, it was found that the 500 ml of petrol sampled contained 6.69 g of water and additives. This necessitates consideration of the following factors.

¬ water contamination is minimal but present;

¬ The efficiency of the condensation system is adequate, but this appears to be a small amount, which is very important in production. If the density decreases, the efficiency of the condensers and the cooling system must be reviewed;

¬ if the density increases, deeper purification in the distillation block or optimisation of the temperature regime in the column is required, and practical and theoretical research is being conducted in this regard;

Conclusion. Studies have confirmed that the density of reused benzine in the extraction workshop must be regularly monitored. This parameter directly influences the stability of the technological process, the improvement of the micelle quality and the increase in oil separation efficiency. According to the obtained results, the density of the reused benzine is 0.661 g/sm³, fully meeting the standard and deemed safe for the continuation of the technological process. These results contribute to reducing energy consumption at the plant, cutting solvent waste and increasing extraction efficiency. By knowing the composition of the benzene recovered during distillation, its adverse impact on subsequent processes can be quantified. Scientific research is being conducted in this regard.

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