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Research Article

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The Main Results of the Study of the Processes of Deodorization of Vegetable Oils using Wooden Nozzles

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Abstract

The article presents for the first time the prospect of using floating movable wooden nozzles in the processing of vegetable oil during the final distillation of vegetable oils in the layer. In the deodorization chamber, extraction oil is supplied from the upper part of the apparatus, and sharp water vapor is supplied from the lower part of the apparatus, as a result of which there is a continuous movement of nozzles in the layer. It is proved that movable float wooden nozzles serve to increase the contact surface between the liquid and vapor phase. Also studied the hydrodynamics of the deodorization process in the "liquid-vapor-floating nozzle" system with the participation of floating wooden nozzles, the dependence of the distribution of wooden nozzles of different sizes on the device height, heat and duration of the mass exchange process.

1. Introduction

In the production of vegetable oils, efforts are made to increase the contact surfaces of the affected phases by accelerating heat and substances exchange. The increase in contact surfaces is directly proportional to the amount of substance moving from one phase to another, according to the basic formula of substance transfer. In the final distillation of vegetable oils, it is effective to accelerate the process by using wooden nozzles floating in the layered part of the distiller [1].

It is known that various floating nozzles are currently used mainly in the oil refining industry to accelerate the processes of heat and substances exchange, in the process of absorption and purification of dust gases. It is also advisable to use contaminated environments as well as processes operating under high pressure. In this case, the nozzle is usually made of hollow polyethylene, polypropylene, polystyrene and other plastics, as well as porous rubber, which hangs at a sufficiently high velocity of the gas. As a result of their intensive interaction, such a nozzle is practically not contaminated [2].

Floating nozzle devices have the ability to perform the process at a much higher speed than stationary nozzle columns. In this case, an increase in the gas velocity leads to an expansion of the balloon layer, but a decrease in the gas velocity in the nozzle layer is ensured. Therefore, increasing the gas flow rate (up to 3-5 m/s) in such devices does not lead to a significant increase in their hydraulic resistance [3,4].

It is known that the final distillation process is carried out in three stages. Initially, the mistsella, heated to a temperature of 110-115°C, is sprayed using a sprayer under a pressure of 0.3 MPa. Evaporation of the solvent occurs from droplets of fine mistsella, which have a large surface area in the area between the phases. Then the highly concentrated mistsella drops fall on the heated shield, moving in the opposite direction with the sharp water vapor and flowing down in the form of a film. This is followed by an additional driving process of the solvent in the mistsella. The remnants of the solvent fall into the remaining oil deodorization chamber. Here the oil layer is processed using a barboter with heated water vapor heated on a surface with a flow pipe with a height of 400-450 mm. In the deodorization chamber, the solvent residue in the oil is completely removed.

In the deodorization chamber, the oil is kept at a temperature not exceeding 115 °C. Acute water vapor pressure is 0.02-0.03 MPa, temperature is 170-190 °C. Prolonged prolongation of the process under high temperature will adversely affect the quality of the oil. It is also difficult to intensively mix sharp water vapor with oil. As a solution to the above problems, we recommend the use of floating wooden nozzles in the deodorization chamber of the final distillation process, in the layer.

Plastic, foamed and rubber nozzles are recommended for use only in the chemical and oil and gas industries, it is not advisable to use such nozzles in the food industry, as such nozzles emit harmful substances when heated, which is extremely dangerous to human health [5]. Therefore, it is recommended to use floating wooden nozzles in the processes of mass transfer in the food industry, in particular in the final distillation of vegetable oils, and scientific work is being done in this direction.

Wooden nozzles are made of white birch material, in the form of a cube. The edges of the nozzle have been machined in order to reduce the resistance and accelerate the rotational movement. Its dimensions are 15x15x15 mm.

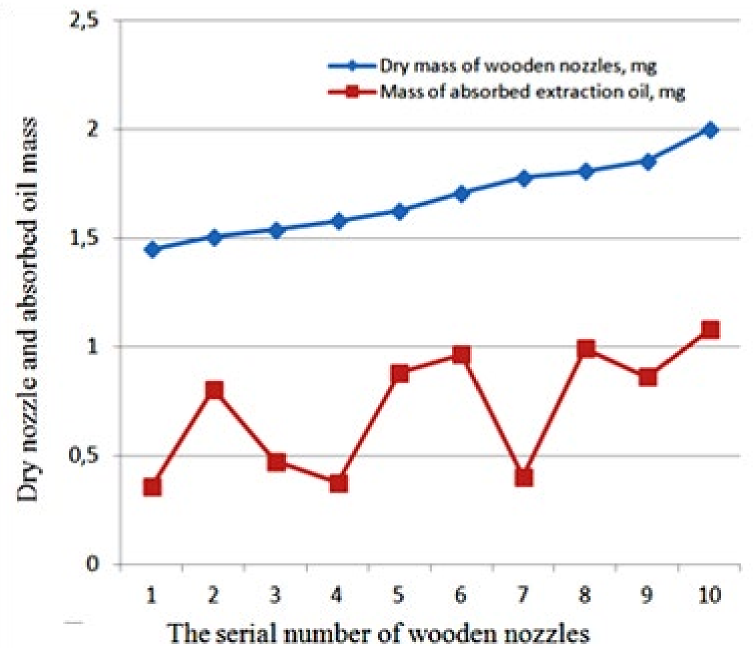

Figure 1. Graph of the dependence of the mass of wooden nozzles on oil absorption

Its dimensions are 15x15x15 mm, average weight is 1.5 g, density is 430 kg/m^3, number of nozzles per 1 m^3 is 200,000, mass per 1 m^3 is 300 kg.

Wooden nozzles are more oil-absorbing than plastic nozzles. Therefore, we studied the oil absorption rate of wooden nozzles themselves. Of all the nozzles prepared, ten were selected to study the level of oil absorption, and all were numbered from one to ten. The resulting nozzles were first weighed in a separate analytical balance in a dry state and then immersed in extraction oil for 48 h. The nozzles were then shaken and weighed separately on an analytical balance.

The mass of samples taken from different locations of the prepared wooden nozzles varied, and the amount of extraction oil absorbed into them also varied. The fourth-order digital nozzle had the largest mass, 1,999 g, which absorbed 1,082 g of extraction oil. This is 54% of its mass. The seventh-order digital nozzle had the smallest mass, 1,451 g, which absorbed 0.356 g of oil. This is 24% of its mass. In general, the average value of total wood nozzles is 0.7205 g.

As can be seen from the graph, the upper curve is given in the order of growth of the dry mass of the nozzles, while the lower curve retains the location of the absorbed oil. The oil absorption rate of the nozzles maintains that the unbing is not proportional to the dry mass. For example, the area of oil absorbed in the dry mass of nozzles 1, 2, 5, 7, 10 also increased. However, nozzles 3, 4, 6, 8, and 9 can be seen to have absorbed a small amount of oil into their mass. It can be said that the rate of extraction oil absorption of wooden nozzles does not depend directly on its mass, but depends on the structure, porosity of the wood. Considering that the capacity of the deodorization chamber of the final distiller is 0.55 m^3, using a capacity of 2,000 wooden nozzles, the absorbed oil is only 1.5 l. It is cost effective [10,11].

One of the main factors in obtaining quality oil in the process of deodorization of vegetable oils is the short-term processing of this oil. Prolonged storage of oil at the high temperatures leads to darkening of the color, changes in its composition. Therefore, it is necessary to increase the contact surface between the liquid and vapor phases in order to carry out mass exchange processes in a short time. There are several methods to increase the contact surface. In this study, ways to increase the use of floating movable wooden nozzles were studied [6,7].

In periodic deodorants the oil layer on the steam drum is large and the steam contact with the oil depends on the velocity or pressure of the steam supplied in deodorants. But the speed of the oil supplied is limited. If steam is supplied at high speed, the amount of oil that sticks to the steam coming out of the deodorizers or the losses increase [8,9].

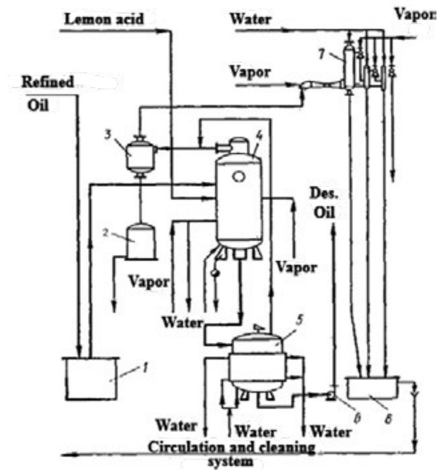

Figure 2: Technological Scheme of Periodic Deodorization Process of Vegetable Oil

2. Methods

Technological scheme of periodic deodorization is shown in figure 2. The refined oil to be deodorized is filled from the tank (1) by vacuum in a volume of 5 t into a floating wooden nozzle deodorizer (4). Before using the deodorizer a vacuum is created in the system and an open water bottle is supplied from the drum at the bottom of the deodorizer while the oil temperature continues to be heated after the oil temperature exceeds 100 C in order to prevent condensation of the supplied open water vapor when the deodorization process is complete, the deodorized oil to cool to the refrigerator (5). In the refrigerator, the oil is cooled by water and pumped (6) falls into a tank designed for the deodorized oil. The vacuum in the system is generated using a block of ejectors (7). The steam-air mixture coming out of the deodorizer is sucked into the vacuum system through the drip tray (8). Oil droplets trapped in the drip tray (3) are collected in the drip tray (2). The water supplied to the capacitors of the ejector system flows continuously to the barometric tank (8).

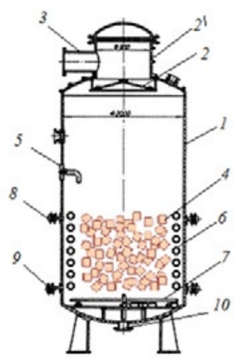

Figure 3. Periodic deodorizer with floating wood nozzle

In the a periodic deodorizer and precooling are performed in series. Given that the main heat and mass exchange in the process. Line are carried out in the deodorizer and the floating wooden nozzles are tested in this deodorizer. We will explain the device in a detail .The deodorizer consists of body, nozzles, cover. The desolator cap has green house (2) and is equipped with a nozzle (3) for connection to the vacuum line, it serves to expel the used idol, along with the odorous substances. At the bottom of the tank is a drop separator (2) which traps oil drop lets that are combined with the idol phase.

On the outside of the hard ware wall a heating coil is installed to prevent condensation of volatile vapors. In order to accelerate the process of heat and mass exchange, movable wooden nozzles (4) were placed inside the column. At the bottom of the desolator is mounted the open flat drum (7) in order to distribute water vapor across a liquid phase. The wall of the apparatus is a two-row coil (6) in the form of a close circle, each of which has a heating surface of 6-8 m^2.

The intensive movement of floating wooden nozzles and the size of the heating surface allow to heat the oil at a speed of 160-270 C accelerating the processes of heat and mass exchange. Also installed in parallel with these coils, coils serve to cool the deodorized oil. Coil supplied with closed water vapor (8) through a pipe and condensate is removed through a pipe. The oil is fed to the apparatus through the nozzle (5) and the processed oil is discharged through the nozzle (10) for a certain period of time. The total capacity of the deodorizer is 9 m^3 and, 5 tonn of refined oil is poured into it before starting the process. Deodorizer thermometer equipped with a vacuum meter and a sampling device. Indicators of floating moving wooden nozzles are given in. Once the temperature reached 180 °C, the deodorization process began. The residual pressure in the apparatus should not exceed 0,65 kPa (5 mm wire top).

3. Results

The whole device is heated by means of a nozzle. Steam consumption after heating is 0,07 kg/sec is optimized. The pressure is monitored by a vacuum meter on the line. In order to heat the first oil, the coil is first supplied to the coil by means of a valve and when the first oil is heated to 180 °C, the process is continued in the second stage, and a high-pressure water bottle is given. The heating process is controlled by a thermocouple mounted on the pan and heated to temperatures above 220 °C. When the planned value is reached, the valve closes and the steam consumption is adjusted to the mode by means of the valve. The system is created by means of a vacuum ejector block. The foot-air mixture from the deodorizer is pumped into the vacuum system through a dropper. Droplets of oil trapped in the drip tray collect in the drip tray.

The chaotic movement of the nozzles in the open foot column ensure the intensive mixing of the liquid and these phases and halves the duration of the heating process (Figure 2).

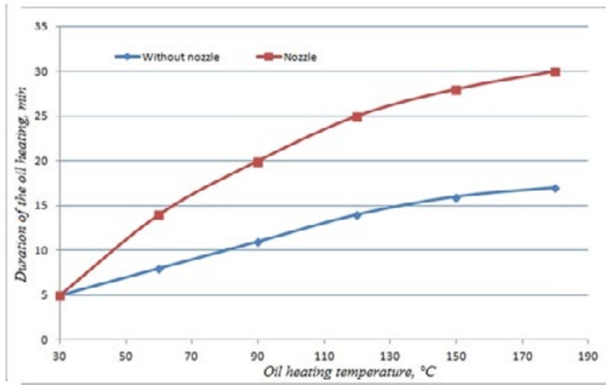

Figure 4: Changes in the Process of Heating the Oil Over Time

After the deodorization process is commpleted a closed water bottle is used to cool the nack of the given coil. In order to accelerate the cooling process, an inert gas is expected to be cooled by an inert gas from an open water bottle. At the same time, the movmement of the nozzles reduced the duration of the cooling process from 60 to 35 minutes. At the end of the experiment, vacuum valve in the line is closed. Ready-made oil samples are taken from the tank by to 1.75 hours. During the process, fluid flows are monitored through surveillance windows.

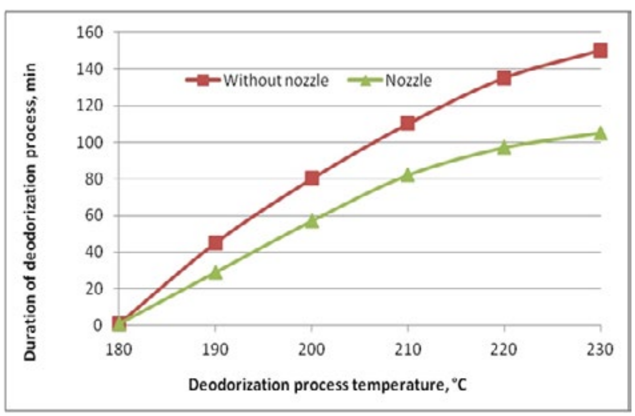

Figure 5: Changes in the Process of Oil Deodorization Over Time

It is obtained from refined 1st grade cottonseed oil as first deodorizing oil. Its acid number is 0,3 mg KON. According to the state standard, the number of deodorized fatty acids should not exceed 0.2 mg KOH.

The experiment were carried out at constant fluid flow, oil temperature 240°C, ammunition pressure 0,67 kPa, open water vapor 0.06-0.08 kg/sec. The results of experiments with modified technological parameters are shown in 1 table.

№	Temperature, °S	Pressure kPa	Oil quatity,	Open water vapor consumption, kg\sec	The number of acid seconds in the fineshed oil determined in the experiment mg KON
1	180	0,67	5	0,07	0,24
2	200	0,67	5	0,07	0,21
3	220	0,67	5	0,07	0,20
4	240	0,67	5	0,07	0,19
5	180	1,33	5	0,08	0,28
6	200	1,33	5	0,08	0,25
7	220	1,33	5	0,08	0,22
8	240	1,33	5	0,08	0,21
9	200	2,0	5	0,06	0,28
10	220	2,0	5	0,06	0,24

Table 1: The Results of the Experiments

Initially, the experiments were performed when the oil temperature was heated to 220 °C. When the average pressure in the apparatus is 0,67 kPa, the number of acids in the finished oil is reduced to 0,020 mg KOH, when the consumption of open water is given at a rate of 0,07 kg/sec. When the oil consumption was increased to 0,08 kg/sec, 220 mg KOH was obtained. When the pressure was 2,0 kPa and the open water, but consumption was reduced to 0,06 kg/sec. acid count was 0,28 mg KOH. Deodorizer efficiency is determined by the cycle duration. The duration (min) of the deodorization cycle without and without nozzles is given in table 2 below.

Indicatior	Without nozzle	nozzles
Heating (200 °S until) and on deodorization	40	25
Deodorization	150	105
Cooling (attaching to the receiving cooler)	60	35
Cycle duration , min (hours)	250 (4,17)	165 (2,75)

Table 2: Duration of the Deodorization Cycle without Nozzles

4. Discussion

At the present, Namangan tola-texstil LLC uses periodic adjusters. With it parameters of the new deodorant can be observed in 3 table.

Parameter name	Without nozzles	Nozzles
You go out of mode	Cycle	Cycle
Product consumption, t	5	5
Process duration, min	250	165
Dimensions	Height: 5000 *mm* Height: 5000 *mm*	Height: 5000 *mm* Diametr: 2000 *mm*
Open water consumption	0,07 *kg/s*	0,06 *kg/s*
Working temperature	220-240^{o}S	200-220^{o}S
Pressure	0,7-1,3 *kPa*	1-5 *kPa*

Table 3: Parameter Deodorization Process Without Nozzles and With Nozzles

The deodorizing product is various parameters of cottonseed oil at the inlet and outlet of the existing and new deodorizer are given in Table 4.

Exiting deodorizer and product indicators at the inlet and outlet of the proposed device.

№	Indicators	Cotton oil	
		High type	1st type
1.	Clarity	Transparent	Transparent
2.	Smell and taste	odorless, the taste is typical of unscented butter	
3.	Colors: - in red, not much	7	10
4.	The numbers of the acid, mg KON, not much	0.2	0.2
5.	Non-oil substances (sediment by weight), %, not much	Not available	
6.	Moisture and volatile matter mass, %, not much	0.1	0.1
7.	Soap (quality analysis)	Not available	
8.	Sony iodine, gr 100	101-116	101-116
9.	Non-soapy substances, %, not much	1,0	1,0
10.	Extraction oil boiling point, °S, not less	234	232

Table 4: Deodorized Neck Quality Indicators

5. Conclusion

In short, experiments have shown the effectiveness of a floating wooden nozzle device compared to exiting deodorizers. As a result of processing cottonseed oil in a new periodic device, various volatile components in the finished oil were reduced in a short time, which led to an improvement in the quality of the oil is coming. Based on the experiments conducted proposed facility, proposals for industrial construction were developed.

References

1. Yusupbekov, N. R., Nurmuhamedov, H. S., Zokirov. S. G. (2015). Kimyoviy texnologiya asosiy jarayon va qurilmalari. "Fan va texnologiya". 848 bet.
2. Zaminyan, A. A., Ramm, V. M. (1980). Absorbers with a fluidized nozzle. M.: Chemistry. 184 p., ill.
3. Laptev, A.G., Farakhov, M.I., Mineev, N.G. (2010). Fundamentals of calculations and modernization of heat and mass transfer plants in petrochemistry. Monograph. – Kazan: Kazan. state energy univ. 574 p.
4. Ya, L., Zhivaikin, V. B. Sazhin, M. B. Sazhina, M.A. Aparushkina, M.A. Kipnis, V.A. Kurpas. (2010). Packed columns with movable (fluidized) packing Advances in chemistry and chemical technology. Volume XXIV.No. 5 (110) art. 120-122.
5. Qodirov, Y., Raximov, M. (2013). Yog`larni qayta ishlash texnologiyasi. Darslik. -T.: "Iqtisod-Moliya". 300 b.
6. Texnologiya pererabotki jirov / N.S. Arutyunyan, Ye.P. Kornena. A.I. Yanova i dr. - 2nd edition, revised and enlarged. - M.: Piщepromizdat, 1998. - 452 s: il.)
7. Calculations of equipment for oil production: educational aids / S.V. Butova, I.A. Sorokina, N.V. Korolkova, M.N. Shaxova. – Voronej: FGBOU VO Voronejskiy GAU, 2017. – 151 s.
8. Vasileva, G.F. (2000). V191 Deodorization of oils and jelly (Preface by d.t.n. N. S. Arutyunyana) - SPb: GIORD. 192 s.
9. Makhmudovich, K. V., Dilfuza Alimovna, I. (2017). "Mathematical modeling of the equilibrium state of extraction gasoline and fatty acids" Science Time, no. 4 (40). pp. 209-213.
10. Sultanov, S. Khamdamov, A. M., Artikov A. A. (2022). Efficient use of floating wooden packings in intensifying mass transfer processes. *Universum: technical sciences*. No. 4-7 (97). P. 46-48.
11. Hamdamov, A. M., Igamberdieva, D. A. (2020). Mathematical modeling of the process of final distillation of a multi-stage rotary-disk apparatus. *Scientific Bulletin of Namangan State University.* Vol. 2. - No. 3. – P. 128-135.
12. Makhmudovich, K. A., Akramzhanovna, S. D. (2020). "Modeling the process of deodorization of fatty acids of cottonseed oil" Universum: technical sciences, no. 11-2 (80). pp. 94-98.
13. Khamdamov, A. M., Karimkhon Kizi, A. O. (2021). Omon Abduvaliyevich Mansurov, Sardor Hudayberdiyevich Sultonov 2021. Simulation of a Multistage Distillation Process in a Rotary Disc Device. *Annals of the Romanian Society for Cell Biology.* 5939–5948