# The prospects of using various wooden pipes in the processes of substance exchange

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**Abstract.** This study introduces a novel approach to oil layering during the final distillation of vegetable oils using spherical wooden nozzles in the deodorizing champir. The nozzles, which move continuously due to the extraction of oil from the upper part of the device and the release of water vapor from the lower part, are shown to increase the contact surface between the liquid and vapor phases. This is demonstrated through the use of mulberry, walnut, and California nibs. The mobile floating wooden nozzles are found to enhance the interaction between the phases, leading to improved distillation outcomes.

## 1 Introduction

In the world, vegetable oils are important among the nutrients consumed by humans. today, the demand for consumer oils, including soybean, palm, sunflower, canola and cottonseed oils, is growing at a high rate. According to the recommendation of the Food Institute of the Russian Academy of Medical Sciences, the consumption of vegetable oils should be 13 kilograms per capita per year, but this indicator has been 9÷10 kilograms in recent years. Also, the possibility of residues of organic chlorinated pesticides and toxins in the oils obtained from plant raw materials grown in unfavorable climatic and agrochemical conditions determines the need for deodorization of oils and fats. For this reason, special importance is attached to the solution of technical and technological problems related to the production of vegetable oils whose quality meets the requirements of international standards in edible oil enterprises.

The deodorization stage is a decisive and final process in the complex technology of refining oils and fats. The main essence of deodorization is the process of removing odorous substances that determine the unique taste and smell of various fats and oils from their composition. the study of cleaning processes is of great importance. these processes were studied by the authors of scientific studies

The final dezodaration processes for cottonseed oil and the equipment used in industrial practice for their implementation have their limitations. Further improvements in the traditional way of technological equipment may not yield the expected results in practice. Achieving significant technological results in this area requires a new approach to the dezodaration of cottonseed oil miscellas and further development of the theoretical and

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practical basis of the process, the organization of the process in new, highly efficient methods, and the development and introduction of new types of intensive equipment.

Based on mathematical modeling of the dezodaration process and computer study of models, methods have been determined for creating compact devices with rational design and technological parameters, reducing the consumption of structural materials used in the manufacture of dezodarators, saving energy resources. In order to reduce the boiling point of the miscella during the process, taking into account the insolubility of the components of the mixture in water, high-temperature water vapor is added to its composition in an open manner as an additional component. In the final stage of the dezodaration process, the driving component is separated according to the equilibrium state between the liquid and vapor phases.

In deodorized oils, sometimes the taste and smell return to the oil (reversion). The phenomenon of reversion occurs due to insufficient completion of the deodorization process, as well as due to the effect of contact of oil with atmospheric oxygen. It is known from practice that if air enters the deodorizer due to a small leak between the connecting parts, the value of the residual pressure in the device is 1.5÷2 mm. sim. above despite the fact that, at high temperatures, there is a possibility of oxidation of the oil, which has a negative effect on its quality.

## 2 Materials and methods

Floating nozzles have the ability to process at higher speeds than fixed nozzle columns. In which the increase in gas velocity causes the expansion of the sphere layer, but ensures a decrease in the gas velocity in the nozzle layer. 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[2]. Mobile (abstract boiling layer) devices are used for gas and dust cleaning. Characteristics of the main types of nasadka bodies are given. It should be noted that one of the positive aspects of the device is the imperceptible change in hydraulic resistance even when the gas speed changes over a large interval (0.9÷5 m/s). In fixed nozzle columns, venturi and other types of devices, with increasing gas velocity, hydraulic resistance also increases significantly, usually according to the square law of resistance. Devices with mobile nozzles are more effective for cleaning gases from dust and harmful chemical components. The movable nozzle prevents solid particles and resinous substances from settling in the working zone of the devices. Devices with mobile nozzles are widely used in various technological processes, including the cleaning of ash and carbon (2) oxides from landing gases, cleaning in the production process of fibrous polymers, and similar processes. Devices with mobile nozzles consist of several layers of nozzles placed on a support-distribution grid. At the top of the device there is a limiting grid that prevents the nozzles from leaving the device with the gas flow. The distance between the bars in a stationary state is 0.1÷0.2 the height of the nozzle layer. In the working condition, the nozzle does not look like a dense floating layer, but rather a thin layer. In this case, spherical objects made of plastic with a diameter of up to 100 mm are used as nozzles. Cylindrical nozzles of the type of rashig ring are also used. Sometimes cubic nozzles can also be used. The nozzle made of polymer materials, which are used in many cases, has a small weight and a small specific density (100÷900 kg/m$^3$). The characteristics of some types of nozzles are presented in the table. A floating nozzle passes through the abstract boiling layer at lower gas velocities than fixed nozzles. The presence of movable nozzles in the devices allows operation in wide ranges of gas velocity (from 1.5 to 9 m/s) and irrigation density from 5 to 200 m$^3$ (m$^2$·s) [3].

# 3 Results and discussion

Indicators are of great importance for deodorized oils. it is difficult to distinguish such oils fromorganoleptic each other by taste and smell. Researches on the creation of physical and chemical methods of evaluation of deodorized oils by taste and smell have not yet yielded positive results. for this reason, the quality of deodorized oil is evaluated on a scale of 50 points according to the following signs: without any taste and smell - 47÷50 points, with a noticeable defect in the taste of the oil - 43÷46 points, and the oil has a weak sour taste - 41÷42 points. Deodorized oil is usually rated at 44 or higher. Oils rated at 43 points are allowed to be used in processing. But deodorizers with a lower score, for example, are not recommended for use in the preparation of margarine products [4-6].

**Table 1.** Different nozzle characteristics for mobile nozzle devices.

| № | Nozzle type | Size, mm | Weight, g | Density kg/m$^3$ | 1 m$^3$ number of nozzles in size, thousand pieces | 1 m$^3$ mass in volume, kg |
|---|---|---|---|---|---|---|
| 1 | Empty plastic balls | 30 | 4 | 280 | 43 | 172 |
| | | 40 | 5 | 150 | 18 | 90 |
| 2 | Foamed plastic | 30 | 4 | 300 | 43 | 194 |
| | | 40 | 10 | 300 | 18 | 180 |
| 3 | Rubber balls | 25 | 7 | 800 | 75 | 525 |
| | | 40 | 18 | 540 | 18 | 324 |
| 4 | Plastic Rashig's circle | 40x40x2 | 12 | - | 12 | 144 |
| | | 40x20x2 | 6 | - | 24 | 144 |
| 5 | WOODEN Nozzles | | | | | |
| Mulberry | | 15 | 13.5 | 430 | 200 | 300 |
| Walnut | | 15 | 15.06 | 510 | 200 | 430 |
| California | | 15 | 13.72 | 450 | 200 | 320 |

As it can be seen from the table, wooden nozzles are smaller compared to other nozzles, the dimensions of the cylindrical plastic rod ring are 40x40x2 mm, while the wooden nozzles are spherical and have a diameter of 15 mm. 1 m$^3$ of cube-shaped wooden nozzles is about 200,000 pieces. The use of a large number of floating wooden nozzles is effective in increasing the contact surface between the liquid and vapor phases during heat and mass exchange processes [7].

a) 10 piece b) 20piece c) 30 piece

**Fig. 1.** The amount of oil absorbed into the nozzles.

Wooden nozzles are more absorbent than plastic nozzles. Therefore, we studied the level of oil absorption of the wooden nozzles themselves.In terms of oil absorbtion, mulberry nozzles performed better than others in terms of oil absorbtion. Nuts absorbed less fat. We have seen that California has absorbed oil moderatey. Out of all the tires, ten pieces were taken out to study the level of oil absorption and all were numbered from one to ten. The obtained nozzles were first weighed separately on an analytical balance in a dry state, and then immersed in the extraction oil for 48 hours. After that, the nozzles were shaken and weighed individually again on an analytical balance. Table 2 shows the results of extraction oil absorption of wooden nozzles.

**Table 2.** The level of extraction neck absorption of wooden nozzles.

| **Dry mass of nozzle, g** | | | | | |
|---|---|---|---|---|---|
| | 10 | 20 | 30 | 40 | 50 |
| Mulberry | 13.54 | 25.24 | 38.03 | 50.12 | 62.92 |
| Walnut | 15.06 | 31.1 | 47.36 | 63.71 | 79.78 |
| California | 13.72 | 27.84 | 40.08 | 54 | 66.15 |
| The mass of the nozzle after swallowing oil for 48 hours, g | | | | | |
| Mulberry | 14.8 | 28.31 | 40.68 | 53.9 | 68.21 |
| Walnut | 18.69 | 36.85 | 57.77 | 78.1 | 95.36 |
| California | 13.95 | 29.51 | 46.55 | 60.48 | 75.69 |
| The mass of the nozzle after swallowing oil for 72hours, g | | | | | |
| Mulberry | 13.7 | 27.74 | 41.07 | 55.3 | 68.78 |
| Walnut | 18.99 | 38.82 | 57.71 | 77.39 | 97.43 |
| California | 16 | 28.77 | 44.22 | 59.94 | 77.74 |
| The mass of the nozzle after swallowing oil for 168 hours, g | | | | | |
| Mulberry | 13.94 | 28.23 | 41.67 | 55.59 | 69.59 |
| Walnut | 20 | 39.57 | 60 | 77.25 | 99.15 |
| California | 16.83 | 31.91 | 48.36 | 64.16 | 79.4 |
| The mass of the nozzle after swallowing oil for 192 hours, g | | | | | |
| Mulberry | 15.94 | 29.93 | 43.83 | 58.21 | 72.41 |
| Walnut | 20.84 | 39.71 | 58.93 | 80.49 | 99.69 |
| California | 17.05 | 35.27 | 50.08 | 63.87 | 80.2 |

Showed that the mass of the samples taken from different places of the prepared wooden nozzles was different, and the amount of extracted oil absorbed by them was also different. 10 dried mulberry pods are the largest 13.54 g in mass, which is 14.80 g in 48 hours. It corresponds to 11% of its mass. 10 dry pods prepared from the tree are the largest 15.06 g in mass, which is 18.69 g in 48 hours. This corresponds to 21% of its mass. The largest 13.72 g mass of dried 10-piece from california is 13.95 g over a 48-hour period. This corresponds to 7% of its mass

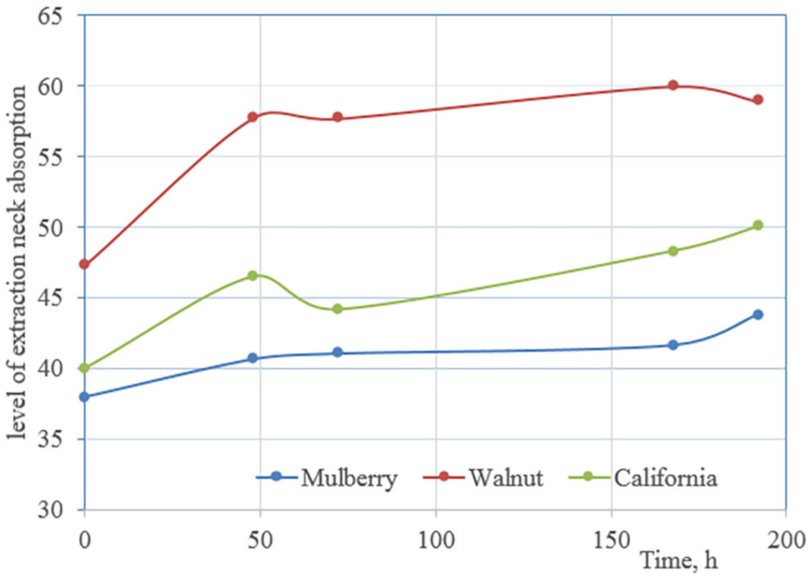


**Fig. 2.** The level of extraction neck absorption of wooden nozzles.

It can be seen from the graph that the upper curve shows the amount of extractable oil absorbed by the juice, given in order of growth by the dry mass of the juice. Shows that the level of oil absorption of nozzles is not directly proportional to its dry mass in conclusion, it can be said that the level of oil absorption of different wooden nozzles is not directly proportional to its mass, but depends on the structure and porosity of the wood. Taking into account the use of 5,000 wooden nozzles per 1 $m^3$ capacity of the deodorizing chamber of the final distiller, the absorbed oil is 1.2 l.

## 4 Conclusion

As a result of the movement of the nozzles in the accumulated oil layer, small steam bubbles formed from the liquid layer are raised, and a mixture in the state of "steam-oil foam" is formed. At this time, due to the intensive collision of phases, volatile substances diffuse from the oil droplet to the surface of the mixture foam. As a result, the distillation process is accelerated and the conditions for its implementation are improved.

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