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TECHNOLOGY HYDRODYNAMICAL DEVICES FOR MANUFACTURE OIL MINI-SHOPS AGRARIAN SECTOR

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Proved and developed technological model natural vegetable oil purification methods developed hydrodynamic unit for comprehensive treatment of vegetable oils and high-quality edible oils using simple equipment and malovartisnoho in mini-workshops agriculture.

Keywords: hydrodynamic emitter, acoustic wave reflector, sunflower oil, hydration.

Introduction. The problem of a high quality sunflower oil is particularly relevant for Ukraine as a strategic product manufacturer. Currently, a mini-shops and collective farms widespread simplified technology for vegetable oils (sunflower, canola, soybean, etc.), Based on a simple and malovartisnomu equipped. However, this technology does not include subsequent purification of oil, bringing it to the quality of performance in accordance with GOST 1129-93 "Sunflower oil. Specifications. "Solids content and carcinogens [1,2].

Problem. For high-quality edible oils it should be possible to clear of related substances, ie, solids, phosphatides, waxes, soap and hydrophobic substances factions. State standard production provided hydrogenated vegetable oil (PO), which are allocated in the process phosphatides and other adverse substances [1]. The content of related substances, including phosphatides, varies widely, depending on their type. Phosphatides easily dissolved in RO temperatures continue their preparation are spontaneously [2] stand out. Precipitation formed rapidly deteriorate due to occurrence of intense oxidative, enzymatic and hidrolytychnyh [3] processes. The most common method of extraction of phosphatides RO is hydration. This process combines methods of treatment RO water or highly dilute aqueous alkaline solutions and salts. In industrial practice using a variety of modes that differ from each other in the number hidratuyuchoho reagent, its composition, etc. Often used for hydration RO purified distilled water in order to save costs, but does not always get the required product quality [2]. At the heart of hydration phosphatides are complex physical and chemical transformations influenced reagents.

The purpose of research: To prove and develop technological model of oil purification plant physical methods, develop hydrodynamic integrated treatment plant for vegetable oils and high-quality edible oils using simple and malovartisnoho equipment.

Table 1. **Zmist phosphatides of vegetable oils.**

Oil	The content in vegetable oils phosphatides, %		
	Forpressovom	Ekspellernom	Ekstraktsiynnom
Sunflower	0.2 - 0.8	0.6 - 1.2	0.8 - 1.4
Hlopkov	0.5 - 1.6	1.4 - 1.9	2.0 - 2.5
Soybean	1.1 - 2.1	2.7 - 3.4	3.9 - 4.5
Flax	0.19 - 0.46	0.64 - 0.87	0.8 - 1.62

The results of research. One promising avenue is how sorbtsyonnoho RO purification using different composition and origin of reagents (distilled water, aqueous solutions of alkalis, salts, acids, adsorbents - perlite, natural clay, etc.). As devices and devices commonly used separators, centrifuges and filters, including ceramic membrane microfilters, filters, multi-stage cleaning, hydrodynamic Coagulating and other equipment. To select the most effective reagent for hydration PO tested the following materials and technologies for special installation with hydrodynamic coagulator [3,4].

1. Hydration vegetable oil was carried out with the addition of distilled water and a solution of salt. The amount of water for hydration oil constituted 0.5 to 3% by weight, and the application of salt and its solutions using concentrations of 0.5 to 1% in an amount of from 2 to 6% by weight of the PO. Mode settings: oil pressure 0,5-4 kg / cm2, the processing time - 0.5 hours; Temperature 60-65 ˚ C.
2. Reahent- mineral water containing sodium salts in the amount of from 2% to 6% by weight OM. Hours of operation: oil pressure in the system - 0,5 ÷ 4,0 kg / cm2; processing time - 0.5 hours; temperatura- 60-65 ˚ C.
3. Reagent - dry white grape wine of up to 10% (depending on the nature and content of the oil it phosphatides) - optimal number of 2 to 6% by weight PO. Modes: Coagulators pressure -up to 4 kg / cm2; temperature-60-65 ˚ C (possible "cold" oil hydration, the temperature in the shop 18-20 ˚ C).
4. Oil hydration processed Page aminouksusnoyu acid taken the molecular ratio of 1.2 to -3.0 sulfur content. Modes similar claim. p. 1, 2, 3.
5. Reagent - citrate-phosphate buffer solution with pH 7.75 in quantities of 0, 1 - 20 wt. % Or emulsifier in an amount of 0,001-5 wt%. (Sodium dodecyl sulfate). The aqueous medium of pH 3 ÷ 7, preferably pH 4 ÷ 6. The optimal number of buffer - 20 grams per liter of oil (the number of selected trial analysis of acid number of oil according to GOST 54 - 76 and peroxide number GOST 26593 (ISO 3960)). Defined physical and chemical properties of sunflower oil samples treated with reagents to claim. P. 1-5. The most effective was the method and reagent for n. 5. The results of the analyzes are shown in Table 2. From Table. 2 shows that the physical and chemical properties of oil treated by the method of claim 5 citrate - fosfatnym reagent meet the standard and are hydrated to first grade sunflower oil. Encouraging results were obtained in n. N. 1, 2, 3 reagents tested, but they require more comprehensive test. The studies and synthesis methods and equipment established a rational agent to improve the quality of vegetable oils, including

tsytratyno phosphate buffer solution with pH 7.75. The optimum composition of the reagent set optimum modes hidratatora.

Table 2. **Fizyko-himychni performance tests of oil.**

Name of indicators	Hydrated oil	Oil treated with a reagent to claim. 5.
	GOST 1129-93 norm for first grade	Citrate-phosphate
Acid number, mg. KOH / g, not more	4.0	2.4
Peroxide number m.mol / kg 0.5, not more	10	8.5

The proposed equipment and modes of hydration can be used in mini-workshops agricultural production, farmers and farms [4,5]. The amount of water needed for hydration, depends on the nature and content of the oil it phosphatides. In each case it is determined in the laboratory by trial hydration. In general, we can assume that the amount of water for hydration is from 0.5 to 6%. For sunflower oil, it ranges from 0.5 to 3% [4,5] .pri hydration using salt water solution used its concentration from 0.5 to 1.0% in an amount of from 2 to 6% by weight of oil [1, 5]. The temperature of the oil affects the process of hydration. So at low temperature due to the high viscosity of the oil phase separation difficult. High temperature leads to a decrease in hydration, peptization dispersed phase and repeated its dissolution in oil. Optimum temperatures for sunflower oil is 45 -50 ° C [4,5]. In the presence of reactant molecules in oil phosphatides, hidrofilnistyu having more than glycerides diffusing to the surface drops of reagents, gradually saturating it. This hydrophilic part oriented to the reagent and hydrocarbon radicals of fatty acids (hydrophobic) - to oil droplets forming on the surface of the lipid reagent layer. This reduces the interfacial energy so that it is impossible in oil dispersion. It is observed in the case of the reagent in oil is not enough. In such structures usually involved fosfatydholiny other phosphatides with pronounced surface activity. If the reagent in enough oil, then mixed monomolecular layers formed hydrated phosphatides and glycerides. Free energy in such a system is high and reaches at a ratio glycerides - 30:70 phosphatides. The system negatively unstable. Reducing free energy carried by coagulation of particles, and the whole system is divided into two phases: oil and phosphatidic emulsion. This mechanism does not exclude the occurrence of a chemical reaction between the reactants and phosphatides. This kind of interaction with the reagent phosphatides especially characteristic of those forms that form in oil dissociation by hydrophilic interactions. To a lesser extent observed for assotsiatov constructed by hydrogen bonds between polar molecules phosphatides parts. Thus, the "oil - phosphatides" is in dynamic equilibrium until external factors (interaction hidratuyuchoho reagent medium heat, etc.) will not lead to disruption of the equilibrium [2,3,5]. Number of reagent needed for hydration depends on the type of oil and phosphatides content in it. In each case it is determined in the laboratory by trial hydration. In general, we can assume that the amount of reagent on the hydration of from 0.5 to 6%. For

sunflower oil, it ranges from 0.5 to 3%. When using a hydration salt using its aqueous solutions concentration of 0.5 to 1% in an amount of from 2 to 6% by weight oil. The temperature of the oil affects the process of hydration. Thus, at low temperature, the high viscosity of the oil phase separation difficult. High temperature leads to a decrease in hydration, peptization dispersed phase and repeated its dissolution in oil. Optimum temperatures for sunflower oil is 45-50 degrees respectively. This process can be implemented on the technology developed on the basis of physical methods with special centrifugal devices [4] hidratsiynoho cleaning method using phosphatide concentrate and belting filtering twomain one-unsaturated fatty acids and microfiltration oil. The technological model of oil purification physical methods shown in Figure 1.Based shown in Fig.1 technological models developed at the patent Ukraine hydrodynamic machine for cleaning of vegetable oil complex [3,7,8]. Schematic diagram of the setup is shown in Figure 2. It includes a pumping station 1, the collector-distributor 2, 3. heater centrifuge 4, 5 and technological tank capacity 21 degasser 7, 9 block filters, vacuum gauge 6, 8 hydrodynamic sources, unit closures taps 10, 11, 12, 13, 14, 15, 17, 22, 18, 19 and 16. The temperature sensor hydrodynamic radiator 7 operates at low pressures (1.5-2.0 kg/cm^2) Using coagulation phosphatides, mechanical impurities and toxins. Hydrodynamic radiator circuit shown in Fig. 1.

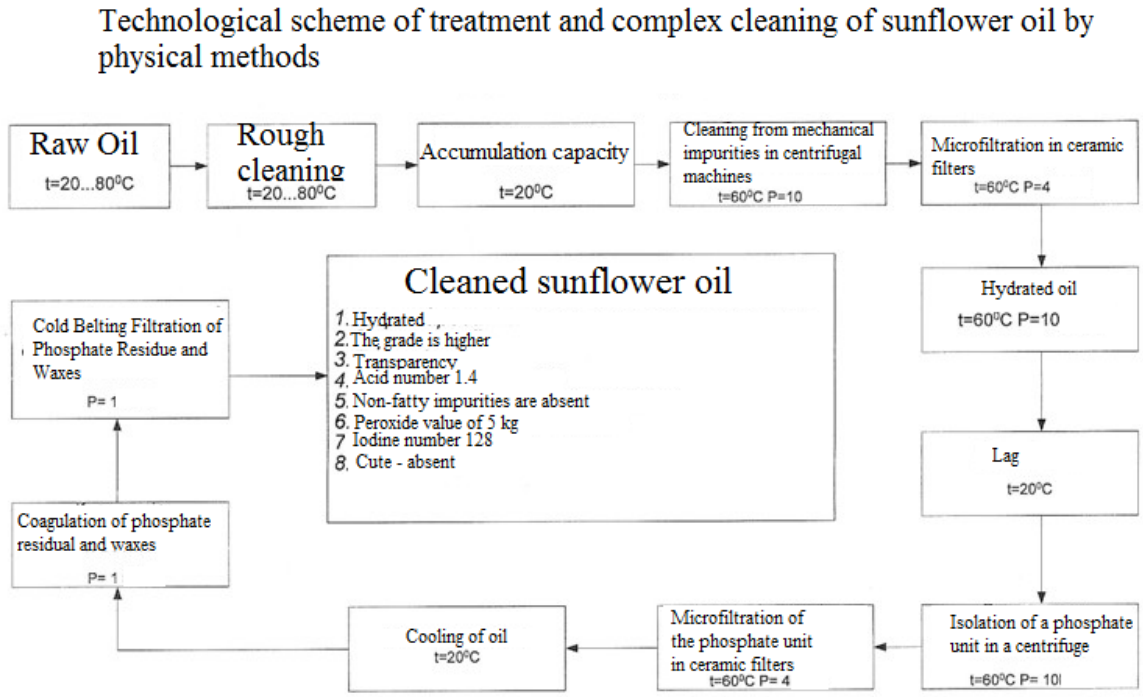

Fig.1. The technological scheme of complex treatment of oil.

Emitter has input nozzle 2 defined passable chopping (Fig. 2). Emitter going as hydrodynamic pipe sections clamped flange 4 Coupling bolt 5 between the sect RUDE OIL ed footwear sealed ring 6. The output of cavitator installed valve 7 for pressure regulation and the staff. Work emitter based on generating

disturbances in a liquid environment (in this case - oil) in the form of a velocity field with periodic interruption of current. These perturbations Back to render action on the basis of current nozzles facilitates automatic mode. The mechanism of sound radiation perturbations may vary depending on the design of the radiator. Hydrodynamic radiator is installed vertically, access to the mountain. The diameter of the initial section D_2 More than input D1, ie D2> D1. proportional pressure oil radiator inlet P1 and P2 pressure output, adjustable valve 3.

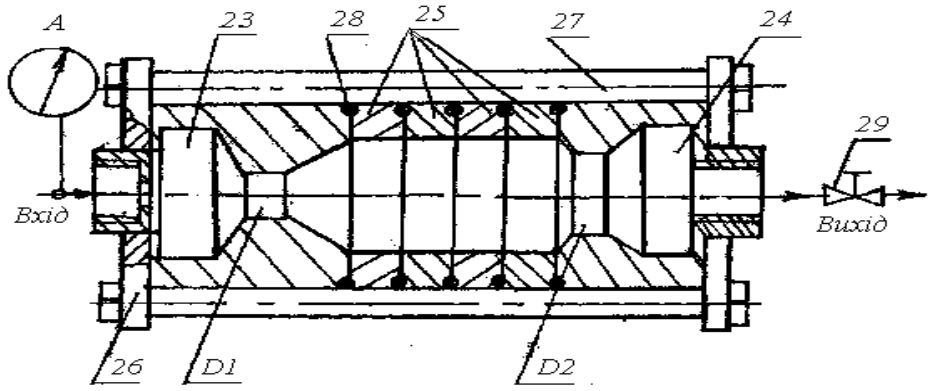

Fig. 2. Scheme hydrodynamic radiator.

Oliyeochyschuyucha installation (Fig.3) works as follows. Oil (feedstock) from the external capacitance 21 is transferred to an open valve 15 and enters the manifold vsasuyuchu pump 1 pumping manifold is connected to the collector 2. The collector 2 includes shut-off control valve through valve 10 enters the oil radiator 8, Crane 11 connected to a degasser 7, valve 12 connects the filter unit 9, the crane 13 delivers oil to nahnitatelya 3 and valve 14 connected to a centrifuge 4. Drain the oil from the aforementioned devices made of technological tank 5, which is connected to the pump station 1 by means of a crane 16 also technological tank is equipped with 5 vacuum stations 6 and vacuum shut-off valve 17. The pressure in the system is controlled by pressure gauge 18 and 19, the level of vacuum Vacuum-20 oil temperature measured by a temperature sensor 16. Masloochyschuyucha plant operates in the following modes: remove the water and lehkokyplyachyh fractions; waxes coagulation and mechanical pulley house; cleaning of oils and other contaminants mehanichnh neblahopryyemnyh substances; fine cleaning and lighting oils. Removing moisture and volatile substances from oil are as follows: open valves 15 and 13; other cranes overlap; includes pump station 1. This oil from an external source is supplied to the tank 5 via pump 1 feed carried out to a specified level. After filling the oil tank 5 taps 13 and 15 overlap and valve 16 is opened, and the oil from the tank is fed to the pump 5 1 and continue through elektronahnitatel 3, it is connected to the electrical grid using starter. Oil is heated to the melting point wax. Monitoring the temperature of heating oil is made using a thermal sensor featuring 15 oil after heating to the desired temperature electric 3 switch from the electrical grid. Open valve 11 to enable degasser 7, while gradually opens valve 13 until the oil pressure gauge magnitude of 18 to 16 kg / cm2. After the stable operation include vacuum station and open the tap 17, the level in the tank 5 vakuma control using a vacuum pump at work 20 1 vacuum in

the tank 5 accumulator pressure can vary and should be adjusted valve 13 valve 22 under vacuum gauges prerkryvayetsya.

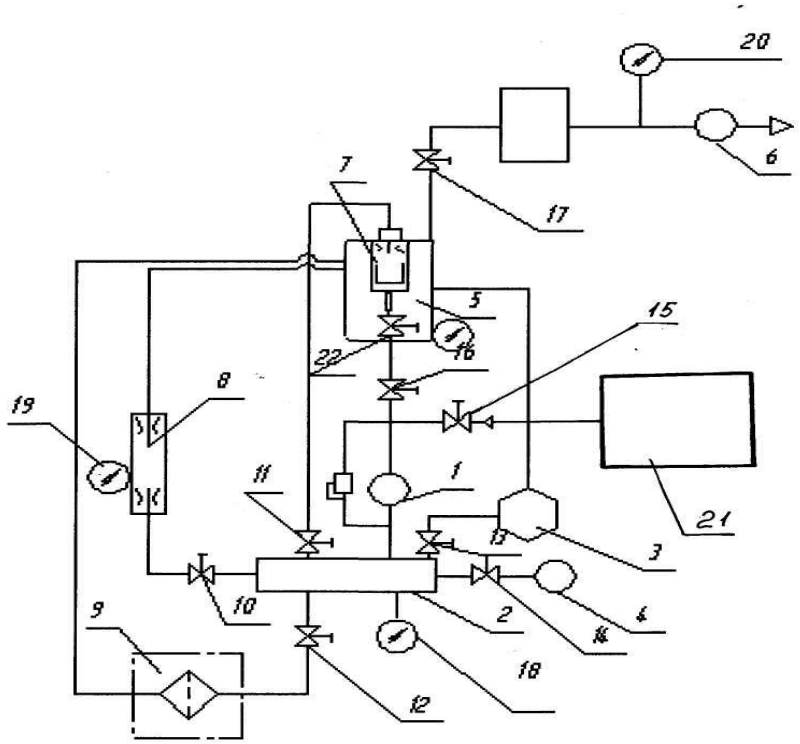

Fig. 3. Installation for the integrated treatment of oil.

Removal of mechanical impurities.

Removal of mechanical impurities is done using the filter centrifuge 9 or 4 for this:

open the faucet completely 13;

block valve 11;

open valve 10, and the included transmitter 8;

adjusting the valve opening 13 to set the pressure gauge 19 value of 8 kg / cm 2.

After processing the oil radiator 8 treatment produced oil through the filter unit 9 as follows: fully open valve 13; blocked valve 10 and 11;

open valve 12 gradually overlaps valve 13 and set the pressure in the reservoir size 2 2-3 atm., which is controlled by manometer 18, while the installation is in cyclic mode;

Cleaning oil additionally performed using the centrifuge 4.

Coagulation waxes and mechanical impurities exercise:

without heating oil (heater off) at a temperature below the melted waxes;

pressure fuel to the emitters P = 1.5 atm ... ..2., the optimal ratio of P1 and P2 pressure to be P1 / P2 = 3 ... 4 kg / cm2;

emitter position - vertical; Oil processing mode coagulation - 30 min .;

pressure oil accumulator 6-8 kgm / cm2.

Subtle lighting and cleaning oil is carried out: by connecting block 9 filtration (filter set is set based on oil and purpose cleaning); pressure not more than 5 kgm /

cm2 (optimal pressure 2,0 ... .2,5 kg / cm2); oil temperature - 60 0C; oil differential pressure before and after the filter is not more than 1.5 kg / cm2.

Experimental obrazets developed systems tested in production. The obtained encouraging results [4,5,6,7] .Kompleksno refined oil meets the requirements of GOST 1129-93 "Sunflower Specifications." Finished products for their performance refers to the highest grade. In addition, the unit provides ecologically pure vegetable oil to non-waste technology in farming conditions, the effectiveness of the method of obtaining highlighted environmentally friendly vegetable oil in storage organoleptic qualities and taste of the product box. This effect is achieved by using only the production of oil physical and mechanical processes without the use of chemical treatment. Technology realized a compact unit, which is made by modular - block type, which is easy to manage.

Technical characteristics of the installation:

1. output of: 150-450 l / h;
2. residual maintenance mechanical impurities less than 0.005% by weight. residual water content in oil - no.
3. consumable strength of 9.5 kW;
4. raw material - sunflower and other oilseeds;
5. staff - one operator.

Conclusions. Complex refined oil meets the requirements of GOST 1129-93 "Sunflower. Technical requirements. "Finished products for their performance refers to the highest grade. Installation provides ecologically pure vegetable oil to non-waste technology in farming conditions, the effectiveness of the method of obtaining highlighted environmentally friendly vegetable oil in storage organoleptic qualities and taste of the product box. This effect is achieved by using only the production of oil physical and mechanical processes without the use of chemical treatment. Technology realized a compact unit, which is made by modular - block type.

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ТЕХНОЛОГИЯ И ГИДРОДИНАМИЧЕСКИЕ АППАРАТЫ ДЛЯ ПРОИЗВОДСТВА РАСТИТЕЛЬНОГО МАСЛА В МИНИ-ЦЕХАХ АГРАРНОГО СЕКТОРА

С.М. Уминский, Павлишин П.Н.

Ключевые слова: гидродинамический излучатель, аккустическая волна, отражатель, посолнечное масло, гидратация.

Резюме

Обоснована и разработана технологическая модель доочистки растительного масла физическими методами, разработана гидродинамическая установка для комплексной очистки растительных масел и получения высококачественных пищевых масел при использовании простого и недорогого оборудования в условиях мини-цехов аграрного сектора.

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Summary

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