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INSTALLATION FOR MICROFILTRATION OF VEGETABLE OILS

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Summary. The development concerns equipment for oil fat processing industry, namely a device for the final stage of clearing of vegetable oils (sunflower, soybean, rape, nut, palm, and so forth) from mechanical impurities, hydrophilic and cancerogenic substances and other adverse components. The installation can be used basically in mini-shops and farms, branches of oil fat processing industry for the manufacture of high-quality products.

Key words: vegetable oil, microfiltration, microfilter.

INTRODUCTION

Vegetable oil which has passed the previous clearing off mechanical impurity and, in part, from adverse impurity has poor quality which does not meet the requirements GOST - 1129-93 (Oil sunflower. Specifications). It cannot be used in quality foodstuff, without improvement of its quality, for example, without use of microfiltration at the final stage of its manufacture.

The working hypothesis develops that an opportunity of improvement of technology of oil clearing on a micro-basis can be offered by filtration through ceramic membranes which would ensure a high quality product (for GOST - 1129-93). The purpose is an improvement of microfiltration technology for vegetable oil in conditions of a mini-shop. Certainly, the aim can be achieved by a device for clearing vegetable oil of mechanical impurities, namely a device for separating solid mechanical impurities from vegetable oil with the help of centrifugal forces [1] (Russian patent - 95102288, 1997.02.15, RU).

MATERIALS AND METHOD

The device for clearing vegetable oil of mechanical impurities contains a case in which the rotor on a washer, extending to the top, is established, cone-shaped, punched, with filtering flexible surface, collecting capacities for the cleared oil and for the mechanical impurities, joining pipe, the conic case which extends from top to bottom and with the help of quickly demountable hermetic unit is joined to a washer with formation of a cavity. In the top part of the case channels for the collection of the cleared oil are made, and in the bottom part of the case on the rack with a pipe, a washer is executed for gathering fine heavy fraction, and in the cavity in the central part of the case

a rotor is established, rigidly fixed on a washer whose external surface is protected by a cone-shaped wall which extends to the bottom; the top edge of the wall is hermetically rigidly joined (attached) to the top part of the face-punched rotor, and in the bottom edge of the wall there are channels for connection with the rotor cavity.

The basic lacks of this installation are: complexity of design and manufacturing, low reliability because of the presence of rotating parts, complexity of maintenance service as a result of bad access to the working elements, which requires balancing highly on a turnaround rotor. Having such serious lacks, the installation 95102288/13 [1] has not found application by manufacturers of vegetable oil. The nearest analogue installation for clearing vegetable oils is Russian patent - 2046130[1] (1995, 10.20, RU) [2]. For the decrease of metal consumption of the equipment of installation and the charge of the electric power in the installation the system's capacities for separating impurities from oil by hydro-filtration were developed, a soluble complex and washing water, capacities for chemical reagents, block capacities for oil and account capacities for chemical reagents which are placed level with glass for the control and regulation of the charge of the given quantity of oil. Also, chemical reagents and static amalgamator, which ensures mixing of the given quantity of oil and chemical reagents, are used. The main lack of the installation 2045130[1] [2] is the use in technological process of clearing oil of the chemical reagents negatively influencing quality of production and health of the consumer. Apart from that, in connection with the use of chemical reagents recycling adverse from the ecological point of view of waste products of manufacture is required. The installation, together with the additional process equipment (capacities, connecting armature and so forth) has unreasonable dimensions in view of its accommodation, low efficiency of technological process and bad productivity, because of unsatisfactory access to units witholding time and preventing effective maintenance.

RESULTS OF RESEARCH

The problem of drawing up of installation is raised, for a proper development of microfiltrations of vegetable oil with the purpose of obtainment of a high quality product and an increase of efficiency of technological process of clearing [3]. In Fig. 1. the basic circuit of the offered installation for micro is offered to a filtration of vegetable oil. The installation consists of the hydraulic and pneumatic systems mounted on the platform of moving carriage 1.

The hydraulic system consists of the centrifugal pump 2 which is activated by the electric motor 3, filter 4 rough clearings, connected with an output to the pump 2 and to the block of ceramic filters 5, 6, 7 thin clearings, which are fed with the help of hoses connected with an entrance collector 8, and at the output are equipped with an initial collector 9, output filter 4, rough clearings connected with an entrance collector 8 through the gate 10 input to the pump 2 which incorporates a hose 11 to capacity 12 clearing oils, and an output of a collector 9 through the gate 13 and a flexible sleeve 14 connecting to tank 15 for the cleared oil. For release of air in an entrance collector 8 there is established 16. The pneumatic system serves for clearing blocks 4, 5, 6, 7 from pollution by microfiltrations. The pneumatic system contains the compressor 16 which is actuated by the electric motor 17, input of the compressor 16 through the filter

18 the output - with a receiver 19 for compressed air is informed with an atmosphere, and outputs of a receiver 19 through gates 20, 21 connected to an initial collector 9. In the bottom part of a receiver 19 the crane 22 for release of the condensate is established.

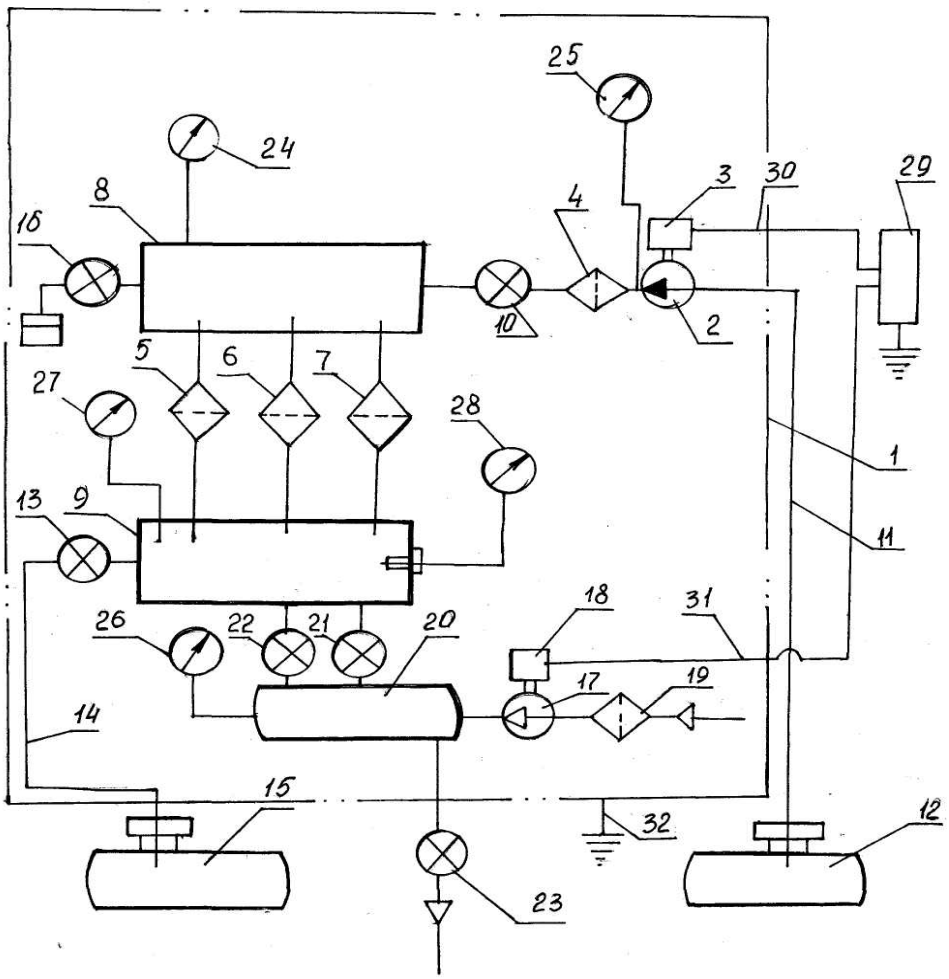

Fig. 1. Installation for a microfiltration of vegetable oil

For the control of the above-described working device of hydraulic and pneumatic system, manometers 23, 24, 25, 26 for oil temperature are established, supervised by the remote thermometer 27 whose gauge is established in the entrance collector 9.

The power consumption for the engine 3, the pump 2 and the engine 17 compressor 16 moves from the switchboard 28 mounted on a separate rack. Conductors lead to a control panel due to demountable sockets. Grounding installation is controlled from the control panel through connecting conductors 29, 30, and also an additional conductor 31 which leads to the probe which is hammered into the ground.

The installation works as follows:

Installation drive to capacity 12 with the cleared oil 12 and entrance hose 11 pumps 2, and an initial hose 14 leads to tank 15 for cleaned oil. The probe of grounding of installation hammered into the ground 31 and the wire leads to the case of installation 1. It openes into entrance and target gates 10, 13 - blocks of thin clearing. The crane 16 for release of air opens. The crane 23 of emis-

sions of the condensate from the receiver of 20 pneumatic systems opens. 22 pneumatic systems are closed, the crane 21 and the plug 30 of the cable is inserted into the socket of a control panel 29. Button " start-up " of the electric motor 3 drives of the pump 2 is pressed and follows an output of air through the crane 16. At occurrence of liquid the crane 16 is closed. The temperature of oil should not be higher than 60-65 ˚C.

During clearing it is necessary to watch the work of installation. At occurrence of smudges of oil, knocks, extraneous sounds, vibration, it is necessary to switch off the electric motor of the pump, by pressing the button " stop " and to remove malfunction [4, 5].

Pressure of oil in a highway on an input of the block microfilters reaches 0,7 MPa and is supported by the blocking system apparatus. Oil circulates in the block microfiltration, passes through ceramic filtering elements on which pollution settle, and then the pumped oil moves into the tank for the ready product. The process of microfiltration of oil proceeds before capacity reduction microfiltration, the purge of filters by air in the return stream for their subsequent use is then carried out. In a mode of a purge of filters, the installation works as follows:

Having blown blocks of microfiltration it is carried out each 7 hours of continuous work of installation in the following order for which it is necessary:

- To exclude the electric motor 3 drives of the pump 2;
- To close entrance and target gates 10 and 13;
- To include the electric motor 18 drives of the compressor 17;
- To close the crane 23 a condensate from the receiver;
- To watch indications to pressure in the receiver behind the manometer 26;
- When the pressure reaches 3,5 - 4 mBar to open the crane 16 and release air into entrance collector 8 of blocks 5, 6, 7 of thin clearings;
- To open gates 21, 22 so that there are submissions of air from the receiver 20 in the entrance
- Collector 9;
- tiTo close crane 16 and having opened gate 10, to blow the block 4 rough clearings.
- To include electric motor 18 of compressor 17. To open crane 23 for the condensate from receiver 20.
- To close gates 21 and 22.
- To open gate 13 on an input of collector 9 and crane 16 release of air to obtain a liquid.
- To include the electric motor 3 to pump 2, to fill in blocks of filtration 4, 5, 6, 7 with an additive, then to exclude the electric motor 3 to pump 2.
- To close the gate 13 on an entrance collector 9.
- To include the electric motor 18 compressors 17, having made pressure in the receiver 20 of 3,5-4 MPa
- To open gates 21, 22 pneumatic systems and, secondly, to blow blocks 4, 5, 6, 7 filters of thin and rough clearing and to exclude the electric motor 18 drives of the compressor 17.
- At the polluted block microfiltration to remove filter cartridges 5, 6, 7 and to wash out them in a special solution with disposable clearing.

Installation for microfiltration is approved in conditions of the manufacture, the received results are determined [6]. The subtlety of filtration in the block microfiltration up to 0,5 x 10^{-6}, an output of finished goods is compatible with GOST 1129-93 (Oil sunflower specifications)

CONCLUSIONS

The essence of development of the installation for microfiltration of oil is hydrostation, technological capacities, the block microfiltration from membrano - ceramic filters and compressors,

hydraulic and pneumatic highways, the control panel of the equipment. The technical result consists in an increase of efficiency of thin clearing oil, with simplification of design and reduction of overall dimensions of installation and decrease of time needed on realization of technological process. Moreover, it offers a possibility to receive high quality transparent oil, improving its nutritious properties, thus the period of storage of the ready product (microfiltered oil) is increased.

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INSTALACJA DO MIKROFILTRACJI OLEJÓW ROŚLINNYCH

Streszczenie. Przedstawiono projekt instalacji do finalnego oczyszczania olejów roślinnych (słonecznikowego, sojowego, rzepakowego, orzechowego palmowego) z zanieczyszczeń mechanicznych, hydrofilnych, kancerogennych i innych niepożądanych domieszek. Proponowana instalacja może być stosowana przez jednostki dystrybucji, gospodarstwa rolne oraz zakłady produkcji olejów tłuszczowych.

Słowa kluczowe: olej roślinny, mikrofiltracja, mikrofiltr.