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INTENSIFICATION OF THE PREDISTILLATION PROCESS VEGETABLE OIL MISCELLA

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ABSTRACT

Today, the world is experiencing a high growth in the production of vegetable oil, which is one of the leading ones in the food production industry. Distillation in the extraction system in vegetable oil plants is one of the most complex and energy-intensive processes. Therefore, the introduction of intensive methods necessary for the production of vegetable oils, the creation of modern equipment and technology is of scientific and practical importance.

Much attention is paid to research to improve vegetable oil production technologies based on scientific and technical achievements, and to the creation of new, energy-efficient designs of technological equipment. In this aspect, the search for solutions to technical and technological problems associated with expanding the production of high-quality vegetable oils that meet the requirements of international standards at oil and fat enterprises is also of particular importance.

Extensive scientific research is being carried out around the world to improve existing technologies for the production of vegetable oil, make full use of the individual performance of technological equipment, and create modern new designs of devices.

In this regard, special attention is paid to maximizing solvent extraction at the stages of distillation of micelle vegetable oil, improving methods for organizing the process, and creating new, intensive and energy-efficient designs of technological equipment with improved hydrodynamic parameters.

Today, in order to increase the volume of vegetable oil production and improve its quality, a number of works are being carried out to improve complex technologies for processing oilseed vegetable raw materials, re-equip oil and fat industry enterprises with modern technologies and highly efficient technological equipment

Recently, throughout the world there has been a high growth in the production of vegetable oil, which is one of the leading in the production industry after the establishment of independence in the Republic of Uzbekistan at agricultural processing enterprises, special attention is paid to the development of new methods for obtaining high quality products from local raw materials, in particular, new types of energy-saving technologies.

The action strategy for the development of the Republic of Uzbekistan identifies and sets objectives for the priorities of economic development and liberalization. In this regard, large-scale research work is underway to study the structure of hydrodynamic phase flows in the apparatus for metabolic processes, and to create a new highly efficient method and equipment for the distillation of vegetable oil micelles that meet the requirements of world markets.

As part of the implementation of the Food Industry Development Program, on the basis of the Decree of the President of the Republic of Uzbekistan dated January 28, 2022 No. PF-60 “On the Development Strategy of New Uzbekistan for 2022-2026”, tasks were set to increase their range from 898 to 1100. Accordingly, scientific research, aimed at improving the process of distillation of cottonseed oil and creating an effective device, are of current importance in order to increase production volumes and increase the types of high-quality vegetable oil.

Many oil extraction plants have technological lines that include the following processes: preparation of oilseed material for pressing (moisture-heat treatment), frying, degreasing of oilseed pulp, which is carried out by preliminary pre-pressing and extraction of pre-pressed cake with extra-gasoline.

Thus, during the extraction of forex cake, the resulting material is subjected to distillation. One of the most complex and energy-intensive processes in vegetable oil plants in the extraction system is distillation.

For the production of vegetable oils, the introduction of intensive methods is the main task. Standard characteristics of vegetable oils include: mass fraction of moisture and volatile substances, acid number, color number, iodine number, mass fraction of non-fat impurities, fluorine-containing and unsaponifiable substances.

Heat treatment in the production of vegetable oils is the main process affecting the quality and type of product, therefore it is necessary to study the properties and composition of vegetable oils when studying the distillation process.

Distillation is the process of heat treatment of a solution of oil in a solvent. It consists of converting the solvent into a vapor state, removing the vapors and condensing them. The solvent must be removed from the oil as completely as possible at the lowest possible temperatures in the shortest possible period of time. Distillation is carried out in two periods: preliminary and final distillation.

In the first period, evaporation is carried out, which obeys all the known laws of this process and can be carried out both at atmospheric pressure and under rarefaction. During this period, the miscella should reach such a concentration that the boiling point does not exceed 1000C.

In the second period, hot water vapor is additionally used, so the process patterns are different. The system will consist of three components: solvent, oil, water, which represent three phases: two liquid (miscella, water) and one vapor - solvent. According to the phase rule, such a system has two degrees of freedom. This means that two parameters can be changed without disturbing the equilibrium, in this case the total pressure and the concentration of the miscella.

Typically, the process of distillation of vegetable oils is carried out in the modes of atomization, flowing and rising in a film and distillation in a layer.

The kinetics of the process of separation of the components of a solution of vegetable oil and a low-boiling hydrocarbon solvent depends on the mass transfer between the solution and a mixture of superheated water vapor and solvent. Various types of distillers are used in oil extraction production.

The most important indicators of the efficiency of using distillers are capital investments, energy costs, in particular, costs associated with the supply of superheated water vapor to the distiller for contact processing of miscella and the quality characteristics of the resulting oil.

The capital investment in distillation equipment is approximately proportional to its size and inversely proportional to the mass transfer rate. The latter depends on the nature of phase equilibria and is proportional to the mass transfer coefficient and the contact area between the phases. An increase in mass transfer occurs under conditions of increased turbulence of the flow in one or both phases and at high speeds of their relative movement.

When using steam nozzles to spray miscella in the cavity of the distiller, a large phase contact surface and very high (up to 100 m/s) velocities of droplets flowing around a co-current flow of superheated water vapor near the mouth of the nozzle nozzle are obtained.

At a constant flow rate of the sawn liquid, the intensity of interfacial mass transfer can be adjusted by changing the temperature and flow rate of water vapor supplied to the nozzle. Prolonged overheating of the oil in the distiller negatively affects its quality indicators; however, for the evaporation of the solvent, the surface of the drop must be slightly overheated relative to the temperature corresponding to the conditions of phase equilibrium. The latter depends on the pressure in the evaporation zone and on the concentration of the solution on the surface of the drop.

The driving force for mass transfer from a droplet to the external vapor medium is the difference in the partial vapor pressures of the volatile component at the surface of the droplet and at a distance from it. The higher the partial vapor pressure of the volatile component in the external flow of the vapor mixture, the lower the diffusion mass flow of the evaporated component on the surface of the drop, and the higher the temperature and concentration of the evaporated component on the surface of the drop, the greater the value of its vapor pressure near this surface. Process streams of the vapor mixture in the distiller must be selected taking into account the factors noted above.

The sequence of processes for producing vegetable oil is very complex and consists of a large number of energy-intensive processes. Energy costs in oil production generally account for 30-50% of the cost of all costs, and the miscella distillation process accounts for a significant portion of this.

From the entire production cycle of vegetable oils, distillation uses modes with the highest level of operating temperatures and the longest residence time of the oil in zones of intensive heat treatment.

At certain stages of miscella distillation, the oil comes into direct contact with the coolant - water vapor. The impact on oil of such basic factors as temperature, process time, heating and cooling rates, and the presence of oxygen largely determines its final quality. It is important to preserve the most valuable natural properties in the oil during the production process.

The processes of heat and mass transfer during the distillation of miscella are decisive both in the design and modernization of equipment and in the creation of methods for controlling technological processes.

To obtain oil with standard output parameters, a certain steam flow rate through the bubbler is set for a given process duration. However, an increase in the time of heat treatment of oil with a temperature of more than 80-850 C has a negative impact on its quality, and the yield of oil after refining decreases.

The quality of the resulting vegetable oil during the distillation of miscella depends both on the technological parameters of the process - the temperature of the oil and the duration of processing of the miscella, and on the content and composition of lipids extracted during extraction from the extracted material - phospholipids, carotenoids and other fat-soluble pigments, as well as on the content of vitamins and provitamins, as well as lipid oxidation products, etc.

Thermal effect on these groups of lipids leads to their change and not only reduces the quality of the oil, but also significantly complicates the distillation of miscella.

Despite many research works on the study of vegetable oils that undergo oxidation when exposed to moderate temperatures, there are not very many research works devoted to the effects of high temperatures. Therefore, these unresolved issues still need to be explored.

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