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ANALYSIS OF EFFECTIVE MECHANISMS FOR HOMOGENIZATION OF EMULSIONS

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The process of homogenization in order to obtain finely dispersed emulsions is widespread in various industries. Homogenization is used in agriculture, chemical, processing, pharmaceutical industries, etc. [1]. However, the process of obtaining finely dispersed emulsions by homogenization has become the most widespread in the processing and food industry. Homogenization allows you to prevent stratification during storage of such food products as: egg melanges and mixtures based on them; combined condensed milk; mixtures for ice cream (preparation of the mixture "milk base - vegetable fat"); mayonnaise, margarine, ketchup and other sauces.

In the dairy industry, the process of milk homogenization is one of the most important technological processes in the production of drinking sterilized and pasteurized milk, sour milk products, ice cream, milk preserves, cheese production, etc. Homogenization of fat particles to microscopic sizes increases the nutritional value of milk, as well as improves its sensory and taste properties. After homogenization, milk acquires a more uniform color, taste and fat content; its consistency improves, the intensity of white color increases; the appearance of a fat film during boiling decreases, which in turn preserves milk solids and increases digestibility (in terms of fat digestion, homogenized milk corresponds to boiled milk). The quality of products using homogenized milk is much higher.

Today, the industry widely uses valve homogenizers in technological lines for obtaining finely dispersed emulsions [2]. The design of the device allows for high-quality dispersion of emulsions, but the analysis of valve homogenizers showed that they have significant disadvantages: significant overall dimensions and weight, high metal content, high energy consumption, rapid wear of the working surfaces of the valve, and a rather high cost of the equipment.

According to the type of valve homogenizers, screw ones also work. So, we can conclude that the energy consumption in such an apparatus will not be much lower, compared to the valve one, however, the efficiency of homogenization in these types of homogenizers is only about 48%.

Ultrasonic homogenizers are also used to disperse the fat phase of milk, in which homogenization is based on ultrasonic cavitation. With the

help of ultrasound, it is possible to obtain not only emulsions, but also finely dispersed suspensions. The simplest and most economical source of ultrasound is a hydrodynamic emitter, in which ultrasonic oscillations are formed as a result of the vibration of a metal plate under the action of a liquid flow. Electricity consumption in homogenizers with hydrodynamic emitters is an order of magnitude lower than in valve ones.

Another mechanism for dispersing the fat phase of milk is rotary-pulsation apparatus (RPA). Milk under pressure in such homogenizers is fed into the rotor cavity and passes through the rotor and stator channels. However, milk that is homogenized in rotary-pulsation devices has a rather wide spectrum of distribution of fat globules and has rather large proportions of fat, which in turn negatively affects the production of some types of food products.

The next type of homogenization equipment is a countercurrent jet homogenizer. It consists of two coaxially located nozzles, where milk is pumped under pressure.

Dispersion of the fat phase of milk in a countercurrent jet homogenizer occurs in the emulsifying channel when the flow rate changes, when exiting the channel, and when the jets collide. However, the disadvantage of this type of homogenization is: foaming, which occurs during countercurrent-jet homogenization, industrial inadequacy (especially of countercurrent-jet homogenizers).

One of the most promising types of dispersing equipment is a pulsating homogenizer [2]. The principle of operation of this homogenizer is that the emulsion passes through the channels of the shock piston, which performs reciprocating movements.

Tests of the pulsating homogenizer showed that it creates a pressure disturbance with an intensity of 1.5 MPa at a frequency of 50 Hz in the homogenized medium, and the average diameter of fat globules after processing in this device is 0.5 μm.

So, the conducted analysis showed that today there are quite a lot of devices for homogenizing milk. In our opinion, the most promising is the pulsating homogenizer, which makes it possible to obtain a high degree of homogenization of milk with relatively little energy consumption.

References:

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