

METHOD OF INCREASING ENERGY EFFICIENCY OF EMULSION DISPERSION PROCESS

Palianychka Nadiia, Candidate of Technical Sciences, Associate Professor
Verkholantseva Valentyna, Candidate of Technical Sciences, Associate Professor
Dmytro Motorny Tavria state agrotechnological university, Melitopol

Dispersion is a common process used in agriculture, pharmaceuticals, chemicals, cosmetics, food and other industries to obtain fine emulsions. The dispersing process takes place with the help of various mechanical devices: homogenizers, emulsifiers, mills, centrifugal pumps, etc.

In agriculture, emulsification, for example, is an integral part of the production of oil and concentrated pesticide emulsions. In the cosmetic industry, dispersion is an important technological process in the preparation of aromatic compositions from oils that are very difficult to combine.

In the food industry, the process of obtaining fine emulsions by homogenization allows to obtain a homogeneous structure and prevent delamination during storage of food products such as: egg melange and mixtures based on them; condensed milk of combined composition; mixtures for ice cream (preparation of the mixture "milk base - vegetable fat"); mayonnaise, margarine, ketchup, etc. In the dairy industry, the homogenization process is one of the main technological processes for the production of sterilized and pasteurized milk, fermented milk products, ice cream, canned milk, cheese, etc.

Due to homogenization, milk acquires a more uniform color, taste and fat content; its consistency improves, the intensity of white color increases; the appearance of a fatty film at boiling decreases that in turn keeps dry substances of milk and digestibility increases (on an indicator of digestion of fat homogenized milk corresponds to boiled). The quality of products using homogenized milk is much higher.

However, along with the fact that this process is very important, it is also quite energy consuming. This is because valve homogenizers are still used by companies for homogenization. And they are known to have fairly high energy consumption, more than 7 kW / t of product. Moreover, the existing modern analogues are not much more effective in this regard.

Therefore, the study of ways to reduce energy consumption for the process of obtaining fine emulsions while maintaining the high quality of the finished product is a very important issue.

In recent years, on the basis of the Department of Equipment for Processing and Food Production named after Professor F. Yalpachyk Dmytro Motorny Tavria state agrotechnological university, the issue of increasing the energy efficiency of the homogenization process is being studied and relevant research is being conducted.

As a result of analytical and experimental studies, it was found that to reduce energy consumption for the homogenization process, while obtaining high quality of the finished product, it is possible through the use of impulsive homogenization.

The device for pulse homogenization of milk (Fig. 1) consists of a working chamber of the impulse homogenizer 4 with pistons-percussion 5, which are driven in oscillating motions through the rod 9 by the drive 8.

The main piston-percussion is rigidly attached to the rod, and the additional is connected to the main by means of a spring. To be able to adjust the oscillation frequency of the piston-drummer uses a DC motor. An adjustable crank is used to change the oscillation amplitude of the piston-drummer. In the lower part of the chamber is a valve for draining milk after homogenization 6 in the container 7.

Milk in the working chamber of the homogenizer from the receiving tank 1 is fed by the pump 3. The valve 2 is used to supply milk under the required pressure to the pump and the working chamber of the homogenizer.

Cylindrical holes and conical holes in the form of two cones turned with smaller bases towards each other were used for experimental research.

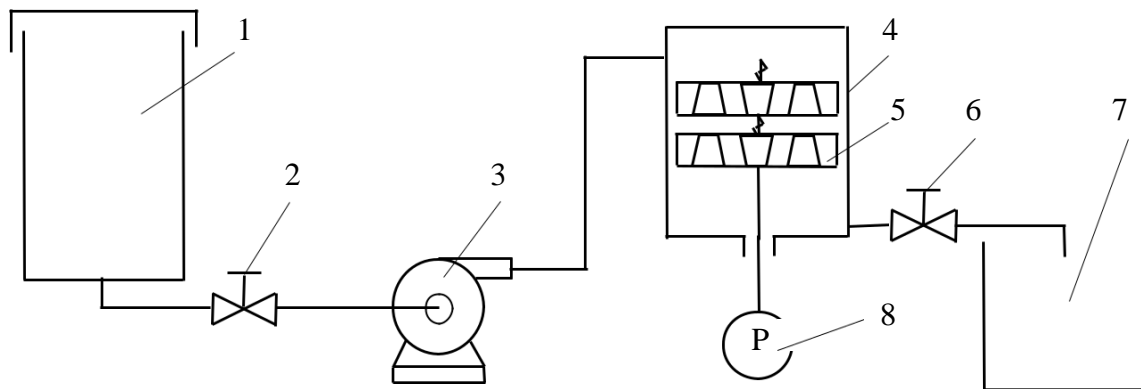


Fig. 1 - Schematic diagram of the installation for the study of impulsive homogenization of milk:

1,7 - technological tanks; 2, 6 - bypass valves; 3 - pump; 4 - working chamber of the homogenizer; 5 - percussion pistons; 8 - pulse drive

Dispersion of milk fat globules in the pulse type of the homogenizer occurs due to the gradient of the emulsion flow rate, which occurs due to pulse oscillations of the piston-drummer. The design of this type of homogenizer is made in such a way that when achieving high-quality dispersion of milk fat, energy consumption will be 1.5–2 kWh / t, which in turn is 20-40% lower than that of analogues.

Experimental studies (on the example of milk) confirm the obtained analytical parameters, and show that the degree of homogenization of milk processing in a impulsive homogenizer is $H_m = 4... 5$, and energy consumption for the process is 0.82 J / kg.

Therefore, as a result of research it can be concluded that to increase the energy efficiency of the process of obtaining emulsions can be used by impulsive homogenization.