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INSTALLATION FOR PROCESSING OF LIQUID FOODSTUFF BY IR AND UV RADIATION

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Among the methods of treatment of liquid foods to be noted aktinizatsiyu, i.e. impact on the product by radiation in the ultraviolet and infrared region of the electromagnetic spectrum to obtain a predetermined or desired effect.

A method for processing of liquid foodstuffs with ultraviolet (UV) radiation can significantly reduce the level of radiant energy. However, application of this method has some limitations, because the absorption of high energy photons (compared to IR) in the molecular structure to occur more substantial changes lead to separation of electrons from atomic groups possibly splitting the molecules into atoms.

The purpose of research - development of systems for the treatment of liquid food IR and UV radiation.

Materials and methods of research. The analysis shows that the process and the processing efficiency of the liquid food product due to the following factors:

1) the nature of the impact: the impact of the energy spectrum, which may be localized in a specific narrow band, or a variation of exposure ranges in the UV and IR electromagnetic field; radiation intensity; exposure;

2) the physico-chemical and biological properties of the liquid to be treated: an indicator of absorption; maximum permissible dose values;

3) the purpose or set of tasks that are put in the processing liquid.

The main objective is to achieve a bacterial purity of the starting material while at the same time, can be tasked with producing structural changes in the product, allowing to achieve the desired technological effect.

There are a number of technologies, which is carried out together IR and UV treatment. This effect may alternate in time or occur simultaneously. For example, when pasteurization is carried out initially water washing process

equipment, UVB treated, then the product is processed by infrared radiation and the final phase - washing the equipment with water or aqueous solutions with UVB.

To implement the various techniques and conditions of processing liquid foods requires a wide range of equipment. For each case the choice of equipment rather difficult task. If the quality of the IR when handling liquid product is characterized by the temperature at the outlet, the FIM for this indicator depends on a combination of different factors.

On this basis, there is a need to create systems that meet the following requirements:

- The possibility of integration into existing production lines;
- Separate or combined effect of IR, UV to the product;
- The use of radiation sources and of different power spectrum;
- The use of a multistage exposure to the product in the process.

The results of research. Such a system of process equipment can be constructed on the basis of the use of the basic elements and modules. Under the basic elements meant interchangeable set of infrared and ultraviolet emitters inserted into a separate module. On this basis we can construct a universal technical system that meets virtually any technological problems. Features of this system can be estimated as follows. If n - number of interchangeable emitters and k - number of modules, the possible number of combinations and, accordingly, will impact the methods nk. This approach allows us to realize the opportunities for varying the parameters of exposure, taking into account the biological characteristics of the processed product and technological challenges: the spectrum, the energy, the power of the radiation exposure time.

One method of radiation treatment of a liquid - carrying out it in a thin layer.

Figure 1 shows a unified unit 1, includes a source of infrared radiation 2 up to 4 kW, the temperature of the radiating body in the nominal mode of 650-800 °

C. The design of the module also allows you to use the standard sources of UV radiation.

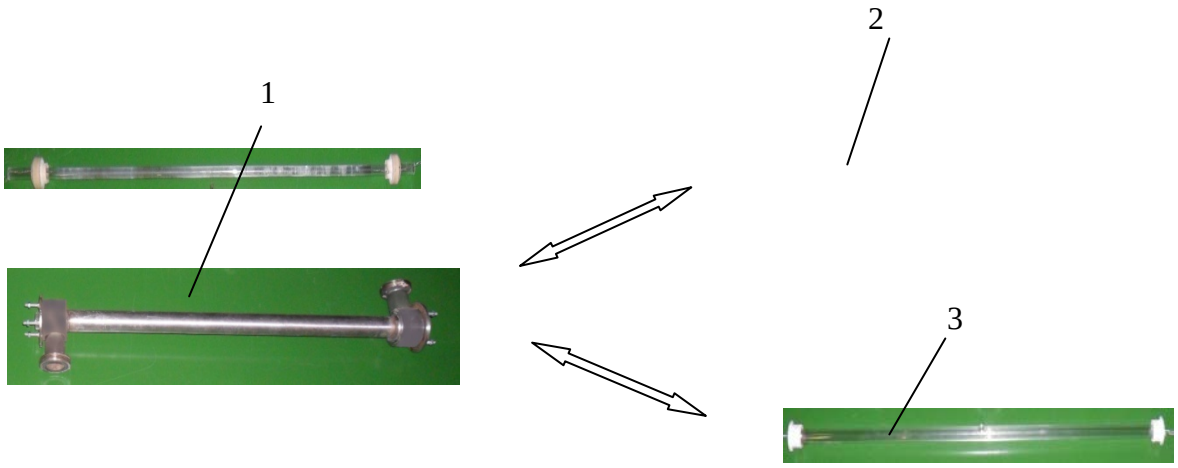

Fig.1. Standardized unit radiator:

1 - unified unit; 2 - IR emitter; 3 - ultraviolet emitter

Design feature allows to create a system consisting of several modules interconnected in series, parallel, or a combination, which allows to increase the treatment time and product efficiency, moreover, unlike existing systems, possible joint effects of IR and UV radiation. You can use different types of lamps with different power, spectral characteristics, depending on the tasks and objectives set in the processing of liquid product.

Exposure to ultraviolet radiation (UVR) on the processed product must be within a certain range of the spectrum (wavelengths), strictly dosed with the aim of creating an environment with the necessary characteristics. For each specific case it is necessary to optimize the UV radiation within a certain range to obtain the maximum energy output. The effectiveness of the impact depends on the degree of exposure.

This optimization depends on the goals that you want to receive as a result of exposure to UV radiation, for example, the maximum increase of vitamin D3 in the processing of the milk, reducing the bacterial contamination to permissible values, destruction of pathogenic microflora, and others. The technological effects of

exposure to UV radiation depends on the rate of photochemical reactions and radiation dose .

One of the urgent tasks is to process liquid UVI with the aim of decontamination. The highest germicidal efficacy for different groups of microorganisms are sources of UV radiation in the wavelength range 240-280 nm.

Application of UV radiation for the treatment of a significant number of liquid food products to reduce bacterial medium is limited due to the small penetration capability. For example, for maximum milk δmaks layer of radiation penetration is less than 0.1 mm. Correct processing mode by increasing the irradiation dose leads to biochemical changes, such as the appearance of off-tastes and odors, and in this case, the product must be subjected to heat treatment.

For thermoradiation pasteurizers characterized by a high degree of localization of energy, which allows a much higher density of energy impacts, reduce processing time and eliminate several steps of transfer and energy conversion. A particular advantage is that in such devices, once the entire portion of the processed liquid, so no local hot spots. Figure 2 shows a general view of the pasteurizer to process liquid in a thin layer, which consists of three modules aligned with the IR emitters, and traditional circuit layout of process equipment, including receiving tank, a recuperative heat exchanger, pump and control system of the regime of thermal processing of the product, allowing maintain the desired temperature Pasteurization in the range of 60-95 ° C.

Use of the regenerative heat exchanger in flow diagram pasteurizer significantly reduce the power of the heating elements and the power consumption for heating. For the preparation and disinfection of process water for the purpose of washing equipment in the pasteurizer unit included an additional uniform UVI. The energy of the UV radiation, it is necessary for disinfection, is considerably smaller than during the heat treatment.

Fig.2. Apparatus for the pasteurization of liquid IR thin layer

Conclusions

On the basis of the unified module that allows you to use a variety of infrared and ultraviolet emitters can create installations for handling liquids, realizing opportunities variation of the process parameters of radiation: the spectrum, the energy, the power of the radiation exposure time.

The modular design allows the installation to expand its functionality: to process liquid food products with different physical-chemical and biological properties; performance can vary over a wide range depending on the number of modules included in its composition; simple design allows you to integrate into existing production lines; possibility of multi-stage impact on product.

Modular systems can be applied in small farm product processing, and the large specialized complexes.