EXPERIMENTAL AND SIMULATION MODELING OF THE HEAT EXCHANGE PROCESS WHILE BOILING VEGETABLE JUICE

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The main heat exchange process of the proposed method for the production of concentrated products from vegetable raw materials is boiling in a vacuum evaporator of periodic action with an improved design of the steam mixer. The mixer is a spiral metal tubular design with the ability to pile into its cavity.

The dependence of a heat transfer coefficient on the number of turns of the mixer, during the production of separate concentrates from vegetable raw materials is determined.

The efficiency of using a device with a simple and reliable construction for mixing and heating viscous food products is proved. Also it helps to reduce the length of the product processing and improve quality of the finished product due to better mixing and intensification of heat transfer process by using spiral metal tubular designs for the supply of coolant, which contributes to the increase of the contact area of the product with heating elements.

The scrapers are located on the helix in such a way that they block each other while driving. When rotating the mixer, the scrapers move near the surface of heat exchange wall of the apparatus, forming a screw surface, which facilitates the turbulization of the wall laminar layer of the product, which it prevents from sticking, eliminates stagnant zones, resulting in temperature equalization and uniform flow of the process.

As a result of the experiments, dependence of the heat transfer coefficient on the number of revolutions of the developed mixer was investigated, the analysis of which allowed to determine the efficiency of the use of a new design of the mixing device. This became a practical basis for systematic dynamic modeling of temperature field changes during the boiling up of vegetable juice. The simulation results were obtained using Vensim system analysis software.

Duration of the actual exit to the stationary mode of heating was controlled experimentally by means of the vacuum evaporator. Comparison of the results of physical and simulation modeling proves the prospect of the crystallization of system analysis tools for the study of heat exchange processes.

Keywords: concentrated juice, temperature field, mixing device, heat transfer, simulation, system analysis.