СЕКЦІЯ 5. МОДЕЛЮВАННЯ РОБОЧИХ ПРОЦЕСІВ В ТЕПЛОТЕХНОЛОГІЧНОМУ, ЕНЕРГЕТИЧНОМУ ОБЛАДНАННІ ТА ПРОБЛЕМИ ЕНЕРГОЗБЕРЕЖЕННЯ

ANALYSIS OF HEAT TRANSFER INTENSITY IN EVAPORATORS WITH A PLATE HEAT EXCHANGER

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The problems of energy efficiency for various purposes heat and power plants are of particular importance nowadays.

Energy-intensive heat and power plants include, among other facilities, evaporators, which are widely used in operation lines of chemical, food and pharmaceutical industries.

Intensification of heat exchange processes and reduction of energy consumption in the process of evaporation first of all are associated with the improvement of the structural elements of evaporators. To use an evaporator heating chamber of plate type is a way of improving the evaporator's efficiency. In general, plate heat exchangers have higher heat transfer coefficients and lower metal consumption compared to tubular heat exchangers.

One of the possible solutions for low and medium capacity plants is the application of evaporators with a wide-channel gasketed heat exchanger, the surface of which is made of different geometry plates. The special corrugation of the plates and the optimal distance between them provides a strong turbulization and, thus, intensifies heat transfer. Such evaporators provide high quality of the final product and can be successfully used for the evaporation of thermolabile and highly viscous liquids. Despite a number of advantages, applying this type of heating chambers is limited by the lack of knowledge and engineering methods for these chambers calculating.

As an object of study, a sugar syrup evaporator with a wide-channel plate exchanger and boiling inside the channels was considered.

Previously conducted experimental studies and analysis of the operation of evaporators with a plate heating surface suggested that the intensity of heat transfer is most influenced by the effective temperature difference, the thermodynamic evaporation constant, and the thermophysical properties of the solution.

The following ranges of variable parameters were used:

- 8–20 °C for effective temperature difference,
- 0,123–0,487 °C for thermodynamic evaporation constant,
- 2,700–15,000 W/m^2 for thermal load,
- 80–130 °C for heating steam temperature,
- 16–160 kg/h for solution flow rate,
- 70–110 ^{o}C for solution initial temperature.

To reduce the number of influencing parameters, a dimensional analysis method was used, as a result, the criterion equation for heat exchange processes in the channels was obtained. The processing of experimental results allows estimating the depth of parameters influence.