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CONVECTIVE-CONDENSATION METHOD OF DRYING HEAT-SENSITIVE MATERIALS

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The goal was the creation of the drying technology that provides energy savings, the intensification of the drying process and receiving the finished product of high quality.

In the work energy-saving convection-condensing the method for continuous drying of heat-sensitive materials is submitted, which includes changes of temperature and moisture content of the drying agent and is conducted in two stages. In the first stage the drying agent into chamber is supplied at a predetermined rate w_{c0}, by moisture content d_{c0}, pressure P_{c0} and temperature T_{c0}, that is substantially higher than the maximum allowable T* for the material. The parameters of the drying agent should be selected so that the wet bulb temperature $T_м$ was lower than T*. The first drying step is completed, when the temperature at the outer boundary of the body approaches the value T*, and the steam partial pressure $P_{пс}$ in the drying agent and respectively, the moisture content d_c reaches a value at which the change of the moisture content on the surface of the material is practically not observed. In the second stage the drying agent is supplied, pre-dried to a low moisture content and is heated to a sufficiently high temperature. This temperature is chosen as high as possible, but such that its impacts could prevent overheating of the body at the second stage above the value T*.

To implement the proposed convection-condensation method of drying is necessary to have a graphs of change in moisture content and temperature of the drying agent. These graphs are determined depending on the type of material, its geometric and thermophysical of characteristics, initial values of temperature and moisture, of the velocity , temperature and humidity of the drying agent, the tape speed and geometrical parameters of the drying chamber. Experimental finding of such graphs presents considerable difficulties. The rational way of their preparation is based on the use of mathematical modeling. The article presents a mathematical

model of the dynamics of heat and mass transfer, phase transformations and shrinkage during drying of colloidal capillary-porous bodies in a co-current belt dryer, the adequacy of which is confirmed by comparing the calculated and experimental data. It was built on the basis of the substance of the transport equation W (weight of the components, momentum, energy) obtained in earlier papers of the authors and N.I . Nikitenko.

The mathematical model includes the differential equations of energy and mass transfer the components of related substance in the porous material and the continuity equation, head loss along the length of the channel, the equation of state and of balance of power for drying agent. To close the mathematical model is used obtained on the basis of the molecular theory of radiation transfer NI Nikitenko the formula for the intensity of evaporation of moisture in the bulk of the porous material and on its surface, for the diffusion coefficient of the liquid phase, of the capillary pressure and of liquid condensate layer thickness, for the area of contact of the liquid and gas phases in the pores of the body.

To determine the mean temperature, moisture, pressure, drying gas velocity in a certain section along the z drying chamber used balanced equation for the elementary volume $\Delta V = S_c \Delta z$, S_c – sectional area of the channel, X – duct height. The numerical method and calculation program is created.

The results of numerical simulation indicate that the adequacy of the mathematical model and the possibility of its use for charting changes in moisture content and temperature of the drying agent to arrange the drying of the proposed method of various heat-sensitive materials according to their geometrical and thermal characteristics, the initial values of the temperature and moisture content, speed, temperature and humidity of the drying agent, of the tape speed and geometrical parameters of the drying chamber.