MODELING OF HEAT AND MASS-TRANSFER IN THE PROCESS OF DRYING OF COLLOIDAL CAPILLARY - POROUS MATERIALS

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Objective. Formulate the physical and develop a mathematical model of the process of drying phytoestrogenic raw materials.

Results.The process of convective drying is as follows, the hydro-processed crushed soybean is located on the pallet and the upper part of the surface of the material comes in contact with the heat-coolant(air) (Fig. 1).

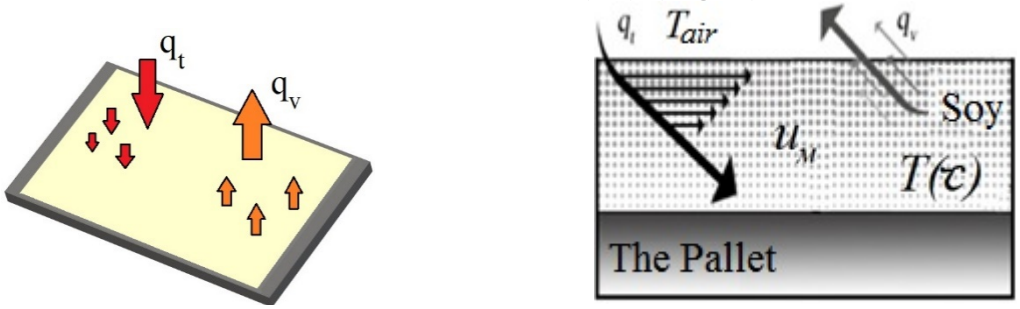

Figure 1. Scheme to the physical model of the convection drying process

Calculated studies of heat and mass transfer in the colloidal capillary-porous material (CCPM) related to the processes of convection drying of soya are performed on the basis of a numerical solution of a system of equations, which include:

- moisture transfer equation

$$\frac{\partial U}{\partial \tau} = div\left(a_m \cdot grad\left(U\right)\right) + div\left(a_m \delta_t \cdot grad\left(T\right)\right)$$

- energy transfer equation

$$c\rho\frac{\partial T}{\partial \tau} = div\left(\lambda \cdot grad\left(T\right)\right) + r\varepsilon\frac{\partial U}{\partial \tau}$$

This process involves the conducting of heat by convection from the heated air stream to the drying material. A sample of a material having the shape of a rectangular parallelepiped is placed in a drying chamber in which the heated heat carrier is fed.

The problem of mass transfer is considered to approximate one-dimensional task. The process is considered symmetrical with respect to the plane of symmetry of a rectangular sample. For the case of a relatively small sample thickness, as well as at low temperature gradients, the transfer of moisture by thermal diffusion can be neglected.

Conclusions. The physical model of heat and mass transfer in the process of CCPM drying is formulated. Calculation and experimental studies are conducted to compare their results. Comparison of the results of numerical simulation of convection drying of soybean samples with experimental results showed them satisfactory qualitative matching. At the same time, there is some discrepancy in the quantitative indicators of these results. Consequently, the

calculated model on the basis of the proposed system of equations can be used to definition the characteristics of the soybean drying process, such as time.