HEAT AND MASS EXCHANGE OF PHASE ENVIRONMENTS IN THE THICKNESS OF THE LAYES GRAIN OF THE DRYER

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In the well-known technologies of domestic and foreign dryers, the influence of the actual pressure of the gas medium in the grain layer is either ignored or partially taken into account. Inaccuracies are attributed to errors in the drying process. However, the aerodynamic resistance factor is significant for a layer of loose materials of different thickness and mobility. It affects the moisture-absorbing capacity of working gases, and therefore the driving potential of interphase moisture exchange.

We investigated the deviations of the calculated values of the driving potential from the actual values on the bench.

For the possibility of checking the correctness of comparisons of theoretical and experimental data by the general public of scientists, below we present the calculation formulas we used on the influence of the aerodynamic resistance of the dewatered layer of bodies and the gradient of the flow of drying gases.

Under the conditions of grain drying in a dense slow-moving layer of mine direct-flow dryers, the speed of the drying agent at the inlet cross-section of the dewatered material varies in the range of 0.35...0.55 m/s, the thickness of the layer in the inter-box space is 0.25 m. Aerodynamic resistance was calculated according to a known formula in the range of variable pressure values from 600 Pa (for corn) to 2500 Pa (for castor). We additionally took into account the energy losses of the flow of drying gases associated with aerodynamic resistance:

a) difficulties in ensuring the specified operating modes of the drying unit;

b) different moisture content and driving potential of working gases in the cross section of the layer;

c) growth of the difference in velocities in the section of the dewatered layer;

d) inhomogeneity of the moisture of the dewatered material in the cross-section of the layer and

e) additional energy consumption of dehydration and deterioration of drying quality.

It was established that the actual deviations exceeded the estimated ones by 40-60%. This is quite significant. therefore, the mathematical models of drying were refined taking into account the aerodynamic resistance of the grain layer. The rate of evaporation of moisture in the slow-moving grain layer qn, taking into account the correction of deviations of the actual pressure values from the barometric pressure, should be determined by the formula:

$$q_{evap} = c\cdot(p_m - p_n)\cdot[B_o/(B \pm dP_i)], \quad (1)$$

Formulas for determining the amount of heat for moisture evaporation undergo similar corrections

$$Q_{evap} = W\cdot(I_{steam}+I_{liquid}),\ \text{kJ}, \quad (2)$$

where W is the amount of evaporated moisture, kJ/kg; I_{steam} = 2500 + 1,842 t. I_{liquid}; - enthalpy of steam at temperature t of spent drying agent, kJ/kg; I_{steam} = 2500 + 1.842 t., I_{liquid} - liquid enthalpy at grain temperature before drying, kJ/kg, $I_{liquid} = 4.19\ \theta$.

The aerodynamic resistance of the grain layer depends on its thickness and mobility. 2. The influence of aerodynamic resistance on interphase moisture exchange is 40-60% greater than the calculated values.