RESISTANCE MOISTURE DIFFUSION DECREASE IN THE CAPILLARIES OF THE BODIES BY INCREASING THEIR PRESSURE

Igor GAPONYUK[1*]

National University of Food Technologies, department of grain storage and processing, Kyiv, Ukraine

[*]Corresponding author: Igor Gaponyuk, *zenidtar@gmail.com*

In the processes of grain drying, energy is lost to overcome the resistance of moisture diffusion in the capillaries of the body. These losses can exceed the cost of grain dehydration. As the drying speed increases, energy losses to overcome diffusion resistance increase.

Diffusion resistance is even greater in large grains, in particular corn and beans. These problems are characteristic of drying technologies of domestic and foreign dryers. Technological methods of changing the heat vector are used to reduce diffusion resistance. However, such methods do not solve the problem in essence. A method of reducing moisture diffusion resistance by changing the pressure in grain capillaries has been established.

The essence of our hypothesis lies in the connection of the intracapillary moisture diffusion resistance with the intracapillary pressure (dilution) of the capillary-porous colloidal bodies. According to our assumptions, rarefaction may occur in the cavities distant from the grain surface, which prevents the diffusion of moisture from the inner to the surface layers of the dehydrated body. To calculate the vapor pressure of capillary-bound moisture, located directly in the capillaries of the grain body and above its surface, under isothermal conditions and a slight temperature difference, it is more convenient to use Thomson's formulas. Our experimental studies on a bench installation at variable values of the energy of the flow of working gases $v_{work\ gas.}$ = 0...3.4 m/s and their temperature range $t_{work\ gas}$ = 45 –180 ºC, the dependence was confirmed and the numerical values were specified under the conditions of the convective method of dehydration from the variable factors of the humidity of the dehydrated body W0, its linear dimensions, the rate of dehydration and the content of cavities in the dehydrated body. On the basis of experimental data, for the period of constant rate of dehydration of a capillary-porous colloidal body, we obtained a mathematical description of the dependence of the state of the intracapillary gas pressure on the initial moisture content of this body and the energy of the working (drying) gases.

In conclusion: 1. Additional losses of grain drying energy are associated with the internal resistance of moisture diffusion in the capillaries of the body.

2. Internal moisture diffusion resistance increases with increasing grain size and drying speed.

3. By increasing the pressure in the grain capillaries, the resistance to moisture diffusion can be reduced. 4.In experimental conditions, the relationship between moisture diffusion resistance and pressure in grain capillaries has been proven. 5.The equation describing the diffusion of moisture, taking into account the pressure in the grain capillaries, was obtained.