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Comparison Efficiency Between The Descriptions Of "Air Heaters" Used In Combined Solar Dryers

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Abstract— *In the work, the specified features of the temperature regime in the drying chamber showed that when the coolant moves in the chamber, both the temperature and humidity regime of the air and the temperature and drying rate of the product change, and the drying rate is almost proportional to the increase in air humidity. On the basis of the studies carried out, simplifications were obtained in describing the drying process, which make it possible to more reasonably carry out engineering calculations in the design of the dryer, in particular, to set the input and output air humidity, to determine the length (or height) of the drying chamber.*

Keywords— Drying rates, (temperature and humidity) at the inlet and outlet, saturation of water vapor, partial pressure, amount of heat, air volume, length of the working chamber.

1. INTRODUCTION

The paper presents a method for calculating the drying rate and its change along the length of the chamber. However, this example does not take into account the change in the moisture content of steam in the air and its effect on the drying rate. It can be noted that at present, when calculating the thermal parameters of the dryer, the balance equation of the formula is used in which the productivity (or the average drying rate) and air parameters (temperature and humidity) are set at the inlet and outlet of the dryer. As a result of the calculation, the mass air flow and the heat required for drying are determined [1.2.3.4]. To determine the overall dimensions of the dryer, the drying time of the product or the drying rate and its dependence on time must be known. One of the main elements of solar dryers used to dry agricultural products is solar air heaters.

2. MAIN PART

Air heaters used in convective solar fruit dryers are called 'hot boxes'. Improving the efficiency of solar fruit dryers depends on the design of air heaters.

The study of the thermal regime of solar air heaters is also one of the key issues in choosing the right design. The study and verification of the characteristics of solar air heaters is given in many works. [1,2]

However, to date, the dependence of the heat regimes of air heaters on the material and construction has not been studied. Therefore, in this study, two types of air heaters of the same size, one made of wood and the other made of metal, lose heat and work. The efficiency of the two air heaters is the same, the size is: 1900x700x200mm provided that no heat escapes.

THEORETICAL RESEARCH

That is, the heat loss of a wooden "hot box" is determined by the following equation.

$$Q_{iyyo}=Q_{iysh}+Q_{iytag}+Q_{iyyot} \quad (1)$$

Here:
Slope is the heat loss of a wooden "hot box"
Bending is the heat loss of a heat-conducting glass surface
Heat loss is the loss of heat from the bottom of a "hot box"
Qiyat is the loss of heat from the side of a "hot box"
The heat loss of a double-layer heat-conducting glass surface is determined as follows.

$$Q_{iysh}=K_{sh}(t_i-t_t) \quad (2)$$

Here Ksh is the coefficient of heat loss in the heat-conducting glass part, which is determined as follows.

$$K_{sh}=\frac{1}{\frac{2\delta_{sh}}{\lambda_{sh}}+\frac{1}{\alpha_1}+\frac{1}{\alpha_2}+\frac{\delta_i}{\lambda_i}} \quad (3)$$

Here dsh is the glass thickness, a1 and a2 are the internal and external thermal conductivity coefficients.
The heat loss from the bottom of the appliance is as follows.

$$Q_{i.y.tag} = K_{tag} (t_{tag} - t_t) \quad (4)$$

Here

$$K_{tag} = \frac{1}{\frac{\delta_t}{\lambda_{tag}} + \frac{1}{\alpha_1} + \frac{\delta_k}{\lambda_k} + \frac{\delta_{mst}}{\lambda_{mst}} + \frac{1}{a_1}} \quad (5)$$

Thermal conductivity of the bottom of the device
dt is the thickness of the bottom of the box (mm)
The heat loss from the side is determined as follows.

$$Q_{yon} = K_{yo.st}(t_u - t_t) \quad (6)$$

Here Kyo.st is the heat transfer coefficient by.
tu- is the temperature inside the heat box.

$$K_{yo.st} = \frac{1}{\frac{1}{a_{t1}} + \frac{\delta_m}{\lambda_m} + \frac{1}{a_1} + \frac{\delta_k}{\lambda_k} + \frac{\delta_{mst}}{\lambda_{mst}}} \quad (7)$$

3. Conclusion

Heat loss from a wooden base is a double layer of heat-conducting glass when the inside temperature is tu = 45-50o and the outside temperature is to = 28-30o. $Q_{i.y.sh}$=223 vt.s.

That is, heat loss from the bottom and side walls of the device.

$Q_{i.y.yon}$=424,3 vt.s.

The metal hot box is secured with mineral glass and cardboard to prevent heat loss, and the heat loss is determined using formula (1).

Experiments show that the heat loss of a hot metal box is as follows

$Q_{i.y.m.}$=170,6 vt.s

The total heat loss is Qi.y.m. = 170.6 + 223 = 393.6 watts.

The difference in heat loss in a hot box made of wood and metal, because the selected glass is a cheap and good heat-retaining material to ensure that no heat escapes.ΔQ= 30,7 vt.s
The formula shows that a hot box made of metal loses 13% less heat than a "hot box" made of wood.

4. References

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