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Planning Of Experiments And Description Of Instruments Used For A Device That Ensures Microclimate In Poultry Buildings

A. B. Sattarov.
Samarkand state architecture-construction
university PhD doctoral.
sattorovakbarali68@gmail.com

Abstract: Based on research conducted to ensure optimal microclimate parameters in poultry buildings, a plan and sequence of tasks were developed for conducting experiments on processing and cooling the external air parameters supplied to the newly created device. As a result of research on ensuring optimal microclimate parameters in poultry farms, a plan and a sequence of tasks were developed for conducting experiments to process and cool the parameters of external air supplied to the created device. After normalizing the temperature and humidity indicators, modern measuring instruments with high reliability of measurement results were selected to determine the operational efficiency of the equipment. Various outdoor air parameters were adopted to assess the equipment's performance under different conditions.
Keywords: vermiculite material, vermiculite nozzle, heat and mass transfer, convective heat transfer, water evaporation.

In the process of ensuring the microclimate parameters of poultry buildings to carry out the sequence of works planned to be carried out in the Laboratory of the Department of Mechanical Engineering to carry out test work on the energy-efficient structure developed to ensure optimal microclimate parameters in poultry buildings, in order to ensure direct air cooling by water evaporation, several. At the beginning of the research work carried out on the developed device, the air cooling unit of our water-humidified air cooling unit was developed based on the process of direct air cooling using water for conducting experimental work. (Fig. 1).

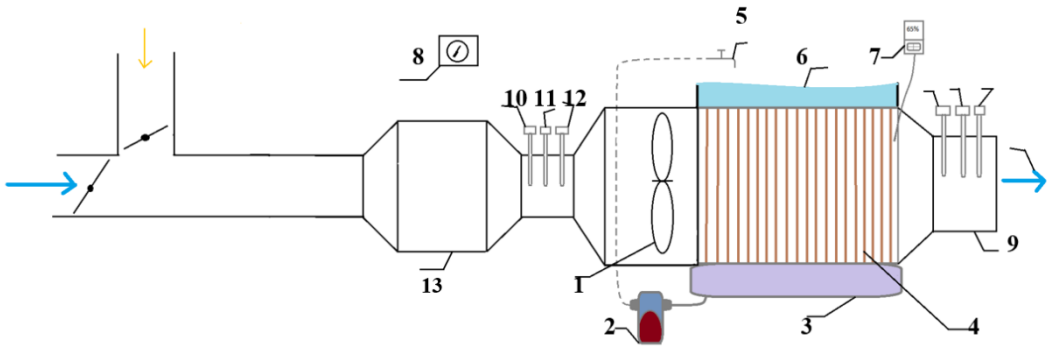

Figure 1. General characteristics of a device for humidifying air using water made of vermiculite material.

1 - fan; 2-water pump; 3-water collector tank; 4-vermiculite nozzle; 5-return water; 6 - water supply; 7-HTC-2-thermometer hygrometer; 8-BASETech WT-034 stopwatch; 9 - outlet air duct; 10-testo405i thermoanimometer; 11-TA298-psychrometer; 12-testo405i thermometer; 13-Air flow regulator.

To ensure optimal microclimate parameters in poultry buildings, we will carry out the process of determining the efficiency of the developed energy-saving air humidification and cooling equipment during external air treatment in the following sequence:

- after water supply begins to the nozzle made of vermiculite material, the time for complete moistening of the nozzle's surface is determined by the water absorption properties of the vermiculite material;
- the drainage of water from the top of the nozzle is continued until the process of complete humidification of the feed water along the nozzle surface is completed;
- the parameters of the external air (temperature, relative humidity) supplied to the device are measured, and the results of each measurement are recorded;

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- the velocity of external air flow is measured using a TESTO405i thermoanemometer at the entrance and exit points of the equipment;
- to maintain consistent air velocity and temperature in the equipment's air ducts, it is necessary to ensure uniform fan movement and system operation for a duration of 7-9 minutes;
- the results obtained from each experiment conducted on the created equipment were measured five times with a three-minute interval, and the obtained results were compared with each other;

To ensure the effective operation of the developed air humidification and cooling device at various external air parameters, we will take the temperature of the incoming air at different values from 28°C to 45°C.

As a result of processing the parameters of the external air supplied to the equipment, we determine the air cooling capacity of the device using the following formula.

$$\Delta t = t_{in} - t_{out}$$

After determining the cooling power of the device's external inlet air, it is determined that the nasal surface provides cooling. In such processes, the energy of the external incoming air, which is used to increase the relative humidity of the incoming air by evaporating the water absorbed by the nozzle under the influence of the heat exchange process of the external air supplied to the building, moving on the surface (surface) of the vermiculite nozzle.

The air supply pipelines to the poultry farm used suction fans that moved the air at a speed of 4-5 m/s. Due to the fact that the air flow velocity entering the developed device from the outside is different, as well as taking into account the change in air flow under the influence of fan pressure, pipes are installed to balance the air flow in the air channels of the water-air cooling device. To achieve optimal microclimate parameters in the interior of the building, it is necessary to create the necessary amount of air and evenly control its movement. We do this by changing the speed of the air by changing the movement of the fan.

The developed device was used to determine the temperature of the outdoor air supplied to the poultry farm building using HTC-2 thermometers. The temperature values of the air at the inlet and after the nozzle were determined by installing the device at the air inlet, in front of the fan, and behind a special nozzle made of vermiculite using a thermometer. Here, the parameters of the external air (temperature and humidity) were taken at different values (28.32.35.39.43°C). The equipment's capacity for air humidification and cooling was also determined. The volume of air supplied to the building is also an important parameter in ensuring the microclimate in poultry farms. To determine the amount of air supplied to the building, we must also determine the speed of the air supplied to the equipment. For these measurements, we will use a TESTO405i thermoanemometer. We carry out measurements with this measuring device in cases where the air temperature is between -20°C and +50°C.

The limit for determining the air velocity of a measuring instrument is 0.....15m / s is gacha. TESTO405i is the measurement detection error (±0.05 m/s to 0.1 m/s) of our structure.

The temperature and relative humidity of the air supplied to the poultry farm through a vermiculite nozzle were measured using a HTC-2 thermometer hygrometer, a digital temperature and humidity measuring device. The HTC-2 digital thermometer, the hygrometer, measures the temperature and humidity limit of the device with accuracy in the range of external temperature from -50 to +70 °C, internal temperature from -10 to +50 °C (the temperature measurement error is from ±0.1 to ±0.5 °C), the relative humidity limit is from 20% to 99% (the relative humidity measurement error is from ±1.5 to ±2.5%).

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Figure 2. Determination of material moisture content on an HTC-2 electronic thermometer-hygrometer with a LCD display.

The rate of air velocity is also an important parameter in creating a microclimate. To adjust this norm, we will determine the speed of air movement in the air ducts of the device using a TECTO405i digital anemometer. An anemometer device is installed to measure air velocity before and after the air supply fan to the building.

The technical measurement accuracy of the TECTO 405i anemometer is as follows: the limit of air movement measurement is from 0 to 15 m/s (measurement error from ±0.1 to 0.3 m/s, 5%), the operating temperature is in the range of -20 to +50 °C, the size is 200x30x41 mm.

The following parameters were taken as the main parameters of the outdoor air supplied to the equipment during the research of the productivity of the equipment, which increases the relative humidity of the outdoor air by lowering the temperature by evaporating water to provide a microclimate in poultry farms, as well as the processes of convective heat exchange and heat and mass transfer of the equipment:

- the temperature and relative humidity parameters of the external air supplied to the equipment:
- the parameters of the change in external air parameters after processing with a nozzle:
- the effectiveness of the developed device for processing external air and the water-absorbing properties of the nozzle made of vermiculite material and its porosity:

As a result of research conducted to ensure a microclimate in poultry farms, a plan of work was developed for conducting experiments to determine the porosity of vermiculite material and its water absorption properties for the attachment part of the developed energy-saving humidification air cooling unit. Experiments have determined the ability of the feed air to be cooled for a long time by moistening under the influence of the speed of water movement from the surface of the nozzle and its water absorption, as well as the geometric dimensions of the nozzle. To determine the high water absorption of the selected vermiculite material for the nozzle, the parameters of the inlet and outlet of the processed air, instruments with a high degree of accuracy were selected during the measurement process, and the most optimal parameters of the device parameters were selected.

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