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THE USE OF SOLAR DRYERS IN THE DEVELOPMENT OF TECHNICAL CREATIVITY OF STUDENTS IN PHYSICS LESSONS

Khamdamova Nozima Muqimovna
Associate Professor of the Bukhara State Pedagogical Institute,
Doctor of Philosophy (PhD) Pedagogical Sciences

Abstract
This article provides a systematic analysis of the use of alternative energy sources in various sectors of the economy in the development of technical creative competencies of students in physics and extracurricular activities. In the education system, the pedagogical possibilities of technical thinking in the development of technical creative competencies of students, the design, construction and modeling of models and models of various devices used in production are studied. Innovative educational technology, creative technology, brainstorming, development of recommendations for improvement with the help of modern tools, pedagogical based on.

Keywords: devices of alternative energy sources, technical creativity, competence, design, physics, environment, natural resource.

Introduction

It is necessary to pay attention to the fact that information about alternative energy sources provided to students is given on the basis of a certain system. Before providing information about the design and operation of low-temperature devices based on solar energy calculated from alternative energy sources, it is necessary to familiarize students with information about the design and operation of the "Hot Box" [3, p. 179] . The operation of many low-temperature devices designed for alternative energy sources powered by solar energy is based on the “Hot box” workflow.

The prospects for the use of solar energy in the national economy are rapidly developing in our republic and abroad in subsequent years. Since solar energy is environmentally friendly energy, it is used in greenhouses, salt water extraction, drying fruits and vegetables, obtaining electricity from solar panels and other areas [4, p. 127]. Currently, one of the main tasks facing specialists in the field of alternative energy is to increase the efficiency of existing solar installations.

There are opportunities to use alternative energy sources devices in explaining the topic "Phenomena in the atmosphere" from grade 9 physics. Once the topics in the tutorial on the topic are given, the training materials and tools on solar greenhouses and alternative energy dryers appropriate for the topic can be used. We will explore the possibilities of using solar dryers in explaining this topic from these devices.

Relative humidity plays an important role when drying fruits using alternative energy sources. Let us dwell on getting acquainted with some aspects related to drying fruits. First of all, let's get acquainted with the physical content of the construction process. When the material is wet, they contain water molecules that characterize moisture, and when dried, it is necessary to evaporate this amount of water from fruits and vegetables, such as mulberries, apples, grapes, tomatoes [5, p. 2669].

But in order to evaporate water from materials, it is necessary to expend some energy on them. The amount of energy consumed depends on how the liquid (water) is bound to the material. Evaporation at the initial stages of the drying process occurs according to Dalton's law, similar to evaporation from open water surfaces, i.e.

$$W = \beta S(P_1 - P_n)\frac{760}{P}\text{ г/соат} \qquad \text{(one)}$$

In this formula: W- the amount of evaporated water; $\beta$is the evaporation coefficient; S– evaporation surface; $P_1$is the saturated vapor pressure at the evaporation temperature; $P_n$is the partial pressure of air vapors; P- barometric pressure.

The difference between saturation steam pressure and partial steam pressure is of great importance in the process of drying materials.

The effect of relative humidity on the drying process is as follows: since the drying of the material occurs as a result of the evaporation of water from this material, the lower the relative humidity of the air, the faster the evaporation and, as a result, reduce the drying time. Therefore, in drying chambers, they try to reduce the relative humidity of the air through ventilation.

The next thermodynamic parameter of the drying process is the drying potential. During the adiabatic evaporation of water due to the internal energy of the surrounding air, the following physical process occurs.

1. Evaporating water gradually increases the partial pressure of water vapor in the air and the vapor content (relative humidity).

2. During evaporation, the air temperature decreases, since heat is consumed due to the internal energy of the air.

3. In this case, the temperature of the water (and material) changes and becomes equal to the temperature of the wet bulb in the psychrometer. Thus, it is equal to the wet bulb temperature. So, wet bulb temperature is the temperature at which water evaporates. The difference between dry and wet bulb readings Δtdetermines the air's ability to absorb water vapor.

Therefore, this difference is called the drying potential and is expressed as follows:

$$\Delta t = t_{\text{қ}} - t_{\text{ҳ}} \qquad (2)$$

So, $\Delta t$the greater the dehumidification potential, the greater the evaporation of water in a given space, but $t_{\text{қ}} = t_{\text{ҳ}}$if it is present $\text{ц} = 100\%$(relative humidity of one hundred percent), the construction process stops. It should be noted that the readings of a wet thermometer are about half a degree lower than those of a real psychrometer [1, p. 80].

Another important factor in the drying process is the drying mode. Drying mode includes temperature, relative humidity and speed of the heat carrier (air). For example, as the relative humidity of the air increases, so does the drying time.

Below we will get acquainted with the drawings and workflows of dryers related to the above.

Despite extensive research in the field of drying agricultural products using solar energy, there are still unsolved problems. For example, due to the lack of development of an effective technology for storing and processing products in many farms, some of the ripened products go to waste. Fruits and vegetables have been known to be dried outdoors since ancient times. This method is commonly referred to as the solar-air method.

Currently, fruits and vegetables are dried in the solar-air method. This method is simple and convenient, carried out without additional expenditure of energy by sunlight during the period of fruit ripening. To obtain a high-quality dried product, the fruits are dried in dryers with artificial heat using the solar-air method. Such drying devices operate on the basis of the thermal energy of fossil fuels (coal, gas, etc.).

Also dryers powered by renewable energy are used to dry fruits and vegetables. If drying is carried out using these dryers, then a certain amount of fossil fuel resources will be saved and the level of environmental pollution with exhaust gases will be reduced [6, p. 81].

The main requirement for all types of dryers is the intensification of the drying process, increasing their efficiency and improving the quality indicators of the dried products.

There are several types of solar dryers in terms of design. 1. Box type. 2. Camera type. 3. Combined (year-round) drying-greenhouse.

According to the workflow: 1. Radiation. 2. Radiative-convective. 3. Convection dryers are available.

Dryers are identical in principle of operation. Due to solar energy, the air in the drying chamber is heated and, as a result of convective heat transfer, heat is transferred to wet fruits and the dried product. Then, due to the increase in temperature of wet fruits or wet materials, water begins to evaporate from them, that is, a drying process occurs. Some damp materials placed in the drying chamber absorb the rays falling on their surfaces. Therefore, a partial radiation-convective method is also implemented in the drying chamber.

With convective heat transfer, the air in the dryer simultaneously plays the role of a heat-carrying (carrying) substance and a medium that perceives water vapor. Since relative humidity plays an important role in the drying process, it is necessary to pay attention to the sources that create it.

The natural air humidity in solar dryers varies for two reasons: the amount of water vapor in the outdoor air and the water vapor released by fruits and moist materials during the drying process. For example, at the initial stages of drying apples, 0.08-0.1

kg of water is released from one kilogram of wet fruits, which passes into the air of the chamber. As a result, the relative humidity in the chamber gradually increases [1, p. 82].

The regulation of relative humidity in solar dryers has its own characteristics: if the chamber is constantly ventilated, then the heat received from solar energy will spread to the sides, on the contrary, if it is constantly closed, then the relative humidity will increase and the construction process will slow down. way down. Therefore, most dryers periodically ventilate.

It should be said that in the summer months, when airing, a certain amount of heat goes into the chamber with outside air. If we take into account the amount of incoming air $L_0$and the heat stored in it I_0, then the total heat balance of the device will be as follows:

$$Q_{ўт} + LJ_0 = Q_1 + Q_2 + Q_3 + Q_4 + Q_5 \quad (3)$$

In this equation: Q_1- the amount of heat required to evaporate water from the material (fruit); Q_2- the amount of heat required to heat the material; Q_3- the amount of heat leaving the dryer with air; Q_4- the amount of heat released (transferred) to the environment during the day; Q_5- the amount of accumulated (accumulated) heat in the device.

The temperature and humidity conditions in solar dryers mainly depend on solar radiation, outdoor temperature, air humidity , type of dryer and other factors. These factors change throughout the day. Therefore, the regulation of the temperature and humidity regime of solar dryers is one of the important tasks. The quality of dried fruits and vegetables depends on the temperature and humidity conditions in the drying chamber, pre-treatment of fruits and other influences. To solve this problem, scientists from the Bukhara State University created a continuously operating automated solar dryer for fruits (Fig. 1) [2, p. 26].

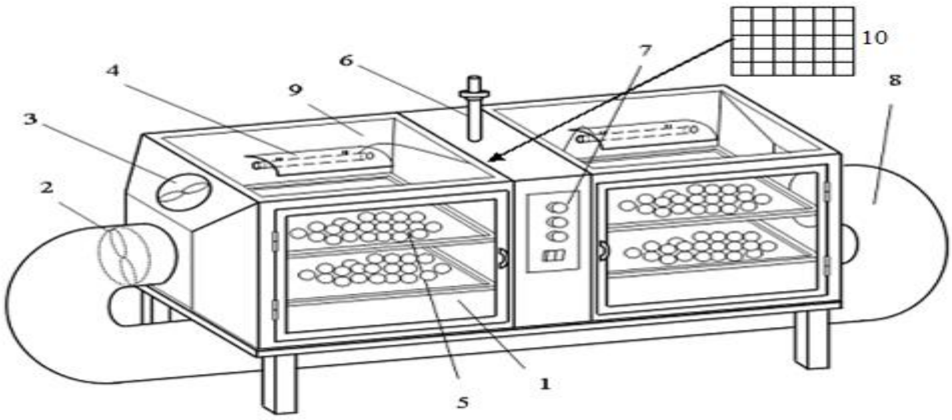

Figure 1. Schematic diagram of the drying device. 1 - drying chamber, 2,3 - fans, 4 - IR lamp with reflector, 5 - food tray, 6 - contact thermometer, 7 - control panel, 8 - rotating airflow tube, 9 - fiberglass, 10 - photo battery.

Let's get acquainted with the results of calculating the technical indicators of this device. Processes inside the device are controlled automatically. The maximum temperature inside the chamber was 62 ^{o} C. In the recirculation mode , the temperature difference along the height of the chamber was 4-6 $^{\circ}$ C. It is determined that the speed of the coolant is 1-1.5 m per second, and the relative humidity of the air is 35%. From 14:00 to 16:00 the temperature will drop to 30-34 ^{o} C. Naturally, at low temperatures, the rate of fruit formation also decreases. To maintain a constant rate of fruit formation in the chamber, an additional heat source (IR lamps) was used. When the temperature drops below 35 ^{o} -40 ^{o} C, the thermostat turns on the IR lamps. If necessary, the lamps can be connected to the network at any temperature not higher than 70 ^{o} C using a regulator. IR lamps are used for continuous operation of the instrument. The energy required to use the device is produced by converting solar energy into electrical energy using a photocell [2, p. 27]. The quality of dried fruits in this machine differs from other types of machines.

Students should be able to express their thoughts and opinions about everyday life experiences, observe physical phenomena and processes, independently use various tools and devices, use devices, discuss problems, offer their own solutions, independently design alternative energy sources devices and encourage their manufacture. The use of various problem tasks in the study of new material in the course of classes contributes to the active manifestation of students' interest in the issue being studied and to increase their interest in independent research.

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