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DEVELOPMENT OF A HELIO WATER HEATER DRYING UNIT FOR DRYING CAPIARIAN POROUS MATERIALS

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Abstract
The article is written about the developed technique and technology by the authors. Installation allows you to get high-quality end products. Low-temperature dehydration allows maximum preservation of useful biologically active substances in the final products. The capabilities of an infrared-heated solar water heating dryer are described. The unit is designed for drying medicinal and agricultural plant materials. The installation diagram is given and the principle of operation is described. An efficient plant for drying medicinal plants with preservation of their medicinal properties, taking into account the thermophysical properties of the materials under study, is proposed. The technological parameters of the drying process are determined. Recommendations on the use of the developed drying plant are given.
Keywords:dryer, equipment, drying, water heating, helio, technology.

1. Introduction

Around the world, 40% of pharmaceutical products are made from medicinal plants. At the same time, according to WHO, today about 60% of drugs consist of more or less plant substances. With the intensive development of chemistry, nano- and other high technologies, this share does not fall, and due to the production of biologically active additives (BAA), the need for medicinal raw materials only grows [1].
Currently, the share of such drugs in the pharmaceutical markets of developed countries is 50-60%. Only 3% of drugs produced by domestic manufacturers contain local natural plant components, and they are faced with the task of correcting this situation. One of the widespread methods of processing these products is their drying. Today, an important global task is the development of processes and apparatus for drying forest products, including medicinal plants [2, 3].
Currently, various methods of drying raw materials are used in world practice. The food industry uses a variety of drying plants, as well as a variety of materials that are dehydrated. Among the known designs of dryers in food technology, convective dryers are widely used, in which the dried material flows around a stream of a heated drying agent - air, flue gases, etc. [4-8]. All convective dryers differ: by the method of organizing the process (periodic and continuous operation); in the direction of movement of the dried material and drying agent (direct-flow and counter-current); by pressure in the drying chamber (atmospheric and vacuum); by type of drying agent (air, gas, steam) [9-16.].

2. Methodology

The theoretical basis [17] of calculations of the thermophysical processes of heat and mass transfer during the drying period of medicinal plants require knowledge of the specific values of the coefficients of heat and moisture exchange. Obtaining these values is possible only in the process of conducting special laboratory, semi-industrial and full-scale studies.

We carried out part of the experimental studies of the drying process of plant materials in the laboratory of Tashkent State Technical University. The main requirement for these experiments was the most accurate reproduction of the processes of heat and mass transfer during infrared convective drying of medicinal plants in a water heating infrared dryer.
The developed infrared-heated solar water heating dryer allows the process of dehydration and fixing the optimal parameters of dried medicinal plants to be carried out [17]. This installation allows you to conduct research: the dynamics of heat and moisture transfer in a layer of a drying medicinal plant; values of specific moisture capacity

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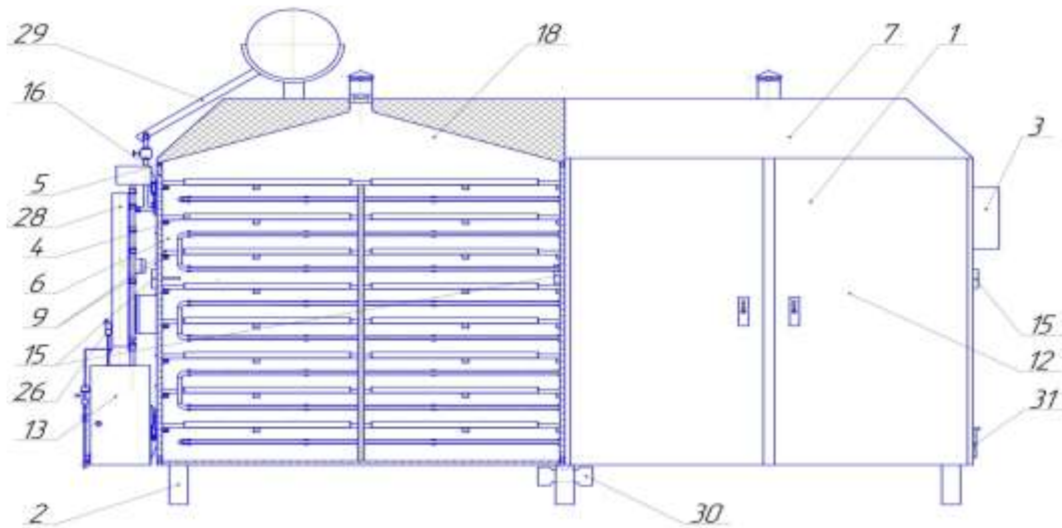
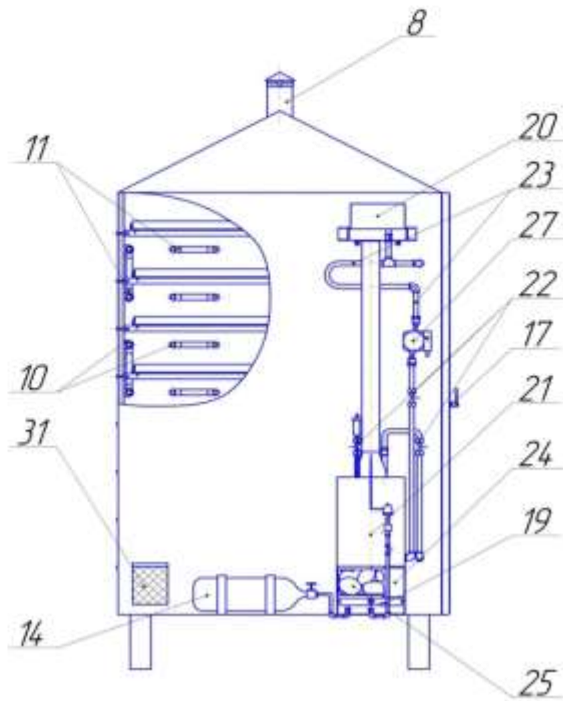
and moisture conductivity of grass; aerodynamic resistance of the layer depending on the moisture and density of the dehydrated plant.



A



B

C

1-drying chamber; 2-legs installation; 3-built-in control panel with current inventory; 4-pallets for recyclable materials; 5-frame camera; 6-inner mesh; 7 outer cladding; 8-vent pipe; 9-tier with limiter; 10-bracket for attaching the irradiation unit; 11-irradiation node infrared radiation; 12-doors; 13-heating boiler; 14-gas boiler; 15-thermometer; 16 heat-insulating layer; 17-helm locking the door; 18-inner chamber ceiling; 19-automatic burner device; 20 expansion barrels; 21-heat exchanger systems; 22 ball valves; 23 pipelines; 24-door boiler; 25-heat battery; 26-steam vent (air vent); 27-circulation pump; 28-chimney (chimney); 29-solar collector; 30-vibrator; 31-holes for ventilation.

FIGURE 1. Pilot industrial solar water heating dryer

The infrared-heated Helio water-heating dryer runs on natural gas (or coal, wood, briquettes, electricity, oil products) using a boiler. The proposed solar water heating drying equipment is shown in Fig. 1 A, B, C.

The heat carrier is supplied to the drying unit by a line with heat-conducting pipes. Metal tubes withstand prolonged exposure to active elements released from the product during the drying process. Heat transfer pipes are attached to the frame of the drying chamber by means of special fasteners. Hot water is used as a heat agent. Removable pallets are placed in the water drying oven.

After loading the raw materials in the chamber, the boiler of the dryer is ignited. The heating temperature reaches up to 90-100 0C. With such heating, the temperature inside the drying chamber reaches the required value up to 60-65 0C. This temperature is considered optimal for drying medicinal plants [18-20]. In order to maximize the preservation of the final product during the drying process, the temperature is maintained automatically using a thermostat, which is located in the chamber.

3. Result andDiscussion

The installation takes into account the adsorption properties of substances saturating the drying products, i.e. determined by their own rate of adsorption and desorption of substances in the wet state, in accordance with which set the drying mode of the product. The result is a product with a layered distribution of the substances contained in the product, which allows you to maximize the preservation of useful biologically active substances in the composition of the final product.

In the process of experimental studies, patterns of changes in the intensity and speed of drying of medicinal plants were studied, which made it possible to determine the moisture content of the material at any time and representing a qualitative picture of the course of the drying process in its various periods.

Installation allows you to get high-quality end products. In addition, low-temperature dehydration allows you to maximize the preservation of useful biologically active substances in the final products.

Our solar water heating dryer allows us to intensify the technological process of drying plant materials from herbs, tubers, fruits and flowers; reduce losses of processed raw materials by up to 25%, save up to 80-90% of biologically active substances and receive quality products with improved presentation and chemical composition, solve the problem of energy and resource conservation by bringing it to the required, due to the use of flue gases or solid fuel.

4. Conclusion

Production tests have confirmed the effectiveness of the developed drying plant that implements the proposed drying method. With the introduction of additional installations, this effect can be repeatedly surpassed. It should be taken into account the increase in employment due to the creation of new jobs - operators to service equipment.

The use of a solar water heating dryer, which is not associated with the consumption of fuel or electric energy, not only accelerates the drying process, but also increases the profitability of the technology for the preparation and processing of medicinal plants.

In addition, the economic efficiency of drying medicinal plants using convection due to the preservation of biologically active substances is much higher compared to natural and other drying methods, also due to a significant reduction in current losses.

Thus, the introduction of the proposed type of equipment and technology is economically justified and can be recommended for use in other similar economic entities, small businesses, agriculture and forestry, food and pharmaceutical industries.

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