FRUITS AND VEGETABLES DRYING PROCESS WITH RENEWABLE ENERGY SOURCE APPLICATION

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Summary: The paperwork presents a drying tunnel type installation construction which uses as thermal energy source village households' agro alimentary wastes as: sawdust from vineyards and orchards, plum, peaches, cherry seeds, nut shells, sunflower seeds, etc. This installation is projected within a Technological Transfer project and implemented at a farmers' enterprise from the Nord of Moldova.

Keywords: fruits and vegetables drying, renewable energy, agro alimentary wastes, tunnel type dryer.

Introduction

In our days, worldwide, one could notice an intensive transfer from traditional energy sources to alternative ones, fossil fuels reserves diminution trend and traditional energy sources price augmentation. Referring to Republic of Moldova, alternative resources production is even more actual because of its dependence of energy sources import. The main alternative energy resource for Moldova is – biomass, whose potential can be find in a large gamma of resource categories as: wood, agricultural and livestock wastes, residues from agricultural crops and trees as well as energy crops. Generally Moldavian biomass potential is estimated to 50,43 PJ (Peta Joules), which is equivalent to about 55% of primal provided energy.

For Republic of Moldova, of a high importance is autochthon row material to food processing organization. Technological processes from this domain, mostly requires products thermal treatment, which is accompanied by high energy consumption. Special attention within this domain requires drying processes and installations, as those are ones of the biggest food industry energy consumers.

Judging from mentioned above, one can conclude that the usage of, after combusting pellets and agricultural wastes in dryers, thermal energy will bring considerable benefit to the agricultural sector and national economy generally. Moreover, the application of renewable resources within an industrial sector with high energy consumption, as drying is, will beneficially influence security and energetic independence of Republic of Moldova insurance.

At the moment there is a row of researches in drying domain, provided by Republic of Moldova scientists, including different projects financed by Science Academy of Republic of Moldova.

There were studies made and elaborated technological drying regimes of fruits, vegetables, medical and biological destination, stone fruit products, etc. Those elaborations where confirmed by mentioned products mathematical modeling.

Materials and methods

Because of the fact that humidity elimination from moist products, especially through thermal treatment, is accompanied by a high energy consumption level, dryers' orientation to renewable energy sources permits to reduce traditional energy consumption at a national level, environment pollution, energy crises negative impact on manufacturer.

Agricultural households' renewable energy sources usage (sawdust from vineyards and orchards, plum, peaches, cherry seeds, nut shells, sunflower seeds, etc.) in fruits and vegetables drying process was performed on tunnel type dryer with a filling ability of 1500 kg of row material (Fig. 1.).

Results and Discussion

Proposed drying installation is made of processing chamber 1 which contains the should be dried product, through processing chamber trolley movement mechanism 2, heat agent outlet canal 3 and agricultural wastes caldron 4.

The processing chamber is created of 9 sections with padded walls with thermo isolating material. The first and last sections are provided with a door for up and downloading the trolleys wit product. At the same time, three sections are equipped with process monitoring windows, in different parts of the chamber. There are also, on the inferior part of the chamber, slideways which ensure trolleys moving.

To the trolleys is applied an intermittent movement from the movement mechanism 2, which presents an electric motor with a worm gear and a threaded shaft. Thread shaft's length is equal to the length of the path covered by the trolley at a single activation. When the electrical motor turns on, the threaded shaft moves inside the processing chamber and pushes the trolleys, freeing the space in front of the uploading door.

The heat agent outlet canal is situated in the superior part of the processing chamber and is made of a durable material also padded with thermo isolating material. The heat agent is aspirated from the drying chamber through outlet one with the aid of three ventilators of the caldron. To assure necessary moisture level of the thermal agent, a part of the humid air is eliminated at the end of the drying chamber through evacuation pipe 5, equipped with an air flow control valve.

For agricultural wastes combustion one used a caldron, with air–air type heat exchanger, so that the heating agent doesn't contact with the combustion gases.

The caldron assures an air flow of 6000 m^3/h which has a maximum temperature of 95°C and assures a thermal power of 60kW. As combustible one can use: sawdust from vineyards and orchards, plum, peaches, cherry seeds, nut shells, sunflower seeds, etc., with a 35 mm degree of grinding and a moisture maximum of 15%.

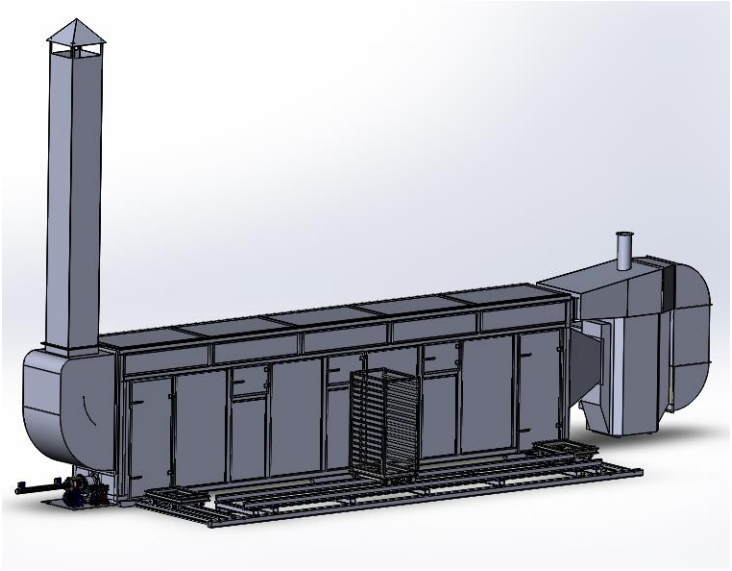

Fig. 1. Dryer's general view.

Uniform distribution of the heating agent through the whole transversal section of the processing chamber, is assured by the specific construction of between chamber and caldron connecting pipe (Fig. 2.). Inside the pipe, are installed four palettes, to which is applied an oscillating movement from an electric motor with eccentric. The amplitude and the frequency of oscillations are modified with the speed of the heating agent, in the way, that one avoids laminar flow and "dead zones" appearance.

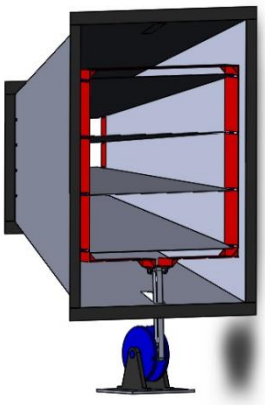

Fig. 2. Scheme of between chamber and caldron connecting pipe.

The dryer is equipped with an automation system, which permits to maintain

heating agent's constant temperature, moisture, and velocity in any processing chamber point. At the same time, it permits to online save and view by electronic means the temperature, humidity and velocity of the incoming and outgoing, in/from the chamber, thermal agent and also the temperature and humidity of the product in five different points of the processing chamber.

Conclusions

Following the implementation of fruits and vegetables dryer, based on pellets combustion energy source, and automation system of drying process predicts the following results:

- obtaining of a high quality final product, competitive on European market;
- fissile energy consumption reduction – energetic security assurance;
- agricultural wastes reduction – rural areas ecological security assurance;
- drying installation maintenance and reparation costs reduction;
- new working places creation.

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