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CHOOSING ACCEPTABLE PARAMETERS FOR EXPERIMENT ON NEW ENERGY-SAVING VACUUM SUBLIMATION DRYING EQUIPMENT

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Abstract:

Objective. The purpose of the project was to increase the capacity of our country on fruit and vegetable expositions, to research drying devices in order to increase their economic efficiency by reducing the energy consumption of existing devices, to create a new energy-saving vacuum sublimation drying device and to improve the technological process regimes.

Methods. In carrying out the study, methods of collecting data on the subject, studying national and foreign experience, systematic analysis of literature, generalization and recording of practical results were used.

Results. In this article, the optimal parameters for experimenting with a new energy-efficient, improved vacuum sublimation drying equipment developed by researchers are reflected.

Conclusion. The analysis of the data obtained shows that the total energy and operational costs in the sublimation drying method are higher than in other drying methods (except for dielectric drying). Therefore, this method of drying is used for drying materials (meat, fruits, vegetables, medicine and pharmaceutical products), which are valuable substances, resistant to high temperatures and whose biological properties must be preserved for a long period of time. But in this process, the product retains almost 98% of vitamins in itself, and its appearance practically does not change.

Keywords. Vacuum, sublimation, energy saving, freezing, drying chamber, pump, barometer.

Introduction. Today, the requirements for the cultivation of agricultural products, their processing, the production and safety of quality food products are increasing year by year. In order to meet the country's ever-increasing demand for high-quality food products, it is necessary to create modern technological processes with high efficiency and automated management, which ensure obtaining high-quality products [1]. Drying is the most energy-consuming, complex physico-chemical and technological process in which heat and matter exchange states are interrelated. The main thing in drying products is to preserve their properties and increase their quality. Sublimation drying is the only viable method for obtaining dry form for most thermolabile biological materials. The reason is that in this case the quality of the product is maximum, it is easily regenerated when it is moistened, and the initial properties of the dried product such as smell, taste, color, nutritional and biological value are preserved [2].

Methods. In carrying out the study, methods of collecting data on the subject, studying national and foreign experience, systematic analysis of literature, generalization and recording of practical results were used.

Discussions. Sublimation is the process by which a substance changes from a solid state to a liquid state directly to a gas (or vapor) state. The process of dehydrating materials under high vacuum while freezing is known as sublimation drying. In such conditions, the moisture contained in the material is in the form of ice, and then this ice turns directly into vapor without changing to a liquid state. Sublimation drying as a technological process includes the following stages: material preparation, freezing, placing in a sublimation chamber, sublimation drying and packaging.

The first stage is preparation of fruits for drying. Before drying, it is necessary to pay attention to the fact that the fruits are not overripe, there are no worms, there are not many defects and they are in a clean state.

The second stage - the Subkhan variety apricot selected as a research object was placed on dryer sheets and -40°C frozen to room temperature in a laboratory freezer called Arctico. The process depends on the ambient temperature and lasts up to 8 hours. If the external environment is above 25°C , the freezing rate will be lower.

The task



It is designed for freezing all kinds of agricultural products, fruit and vegetable products.

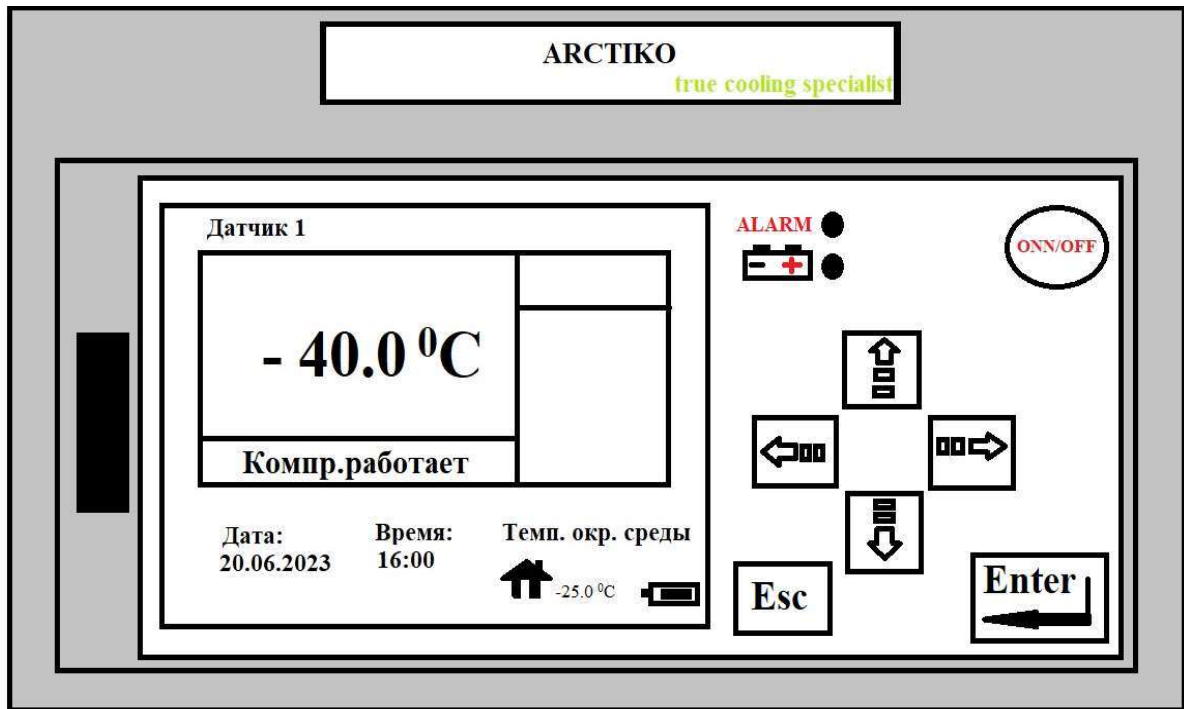
Model
LAF 700

1.1 - picture

Technical classification

No	Indicators	
1	Style	Arctiko
2	Country of manufacture of the device	Germany
3	Cooling technology	The air is forced
4	Temperature range ($^{\circ}\text{C}$)	-10 / -40
5	Electricity consumption (Volts)	230
6	Maximum ambient temperature ($^{\circ}\text{C}$)	25
7	Capacity (Liter)	618
8	External dimensions WxDxH (mm)	740x870x2017
9	Internal dimensions WxDxH (mm)	600x685x1505
10	Power (Watt)	735
11	Mass (kg)	138

After placing the product in the freezing chamber, it was started in the following order:



1.2 - picture . Refrigerator control panel

- a) ON / OFF button is pressed;
- b) the password is typed;
- c) enter button is pressed.

After the product is sufficiently frozen, the freezing chamber is turned off in the same way.

The third stage - the product was removed from the freezing chamber and placed in the drying chamber, and the temperature inside the chamber -30°C was adjusted. To bring the temperature inside the chamber to negative level, the freezing knob on the electroplate was turned and the indicator reading was brought to 30 and the temperature was raised according to the table below.

				1.1 - table
No	time (hours)	chamber temperature (° C)	Vacuum (kPa)	
1	4	-30	0.1	
2	4	-20	0.1	
3	4	-10	0.1	
4	4	-5	0.1	
5	4	0	0.1	
6	4	5	0.1	
7	4	10	0.1	
8	4	20	0.1	
9	4	30	0.1	
10	12	35	0.1	

It can be seen that after placing the product in the drying chamber, the temperature inside the chamber was brought to a positive (+) level for a certain period of time. In this case, the sequence of the process goes as follows:

- a) the chamber freezing system is turned off;
 - b) I turned on the water pump;
 - c) I turned on the heater;
 - g) I brought the indicator to the required amount.
- I raised the temperature according to the plan.

After the drying process of the product is completed, the procedure for turning off the dryer is:

- a) closing the hose where water enters the pump;
- b) I slowly introduced air through the screw on the top of the chamber until the barometer reading passed 15:00 clockwise;
- c) I turned off the pump.

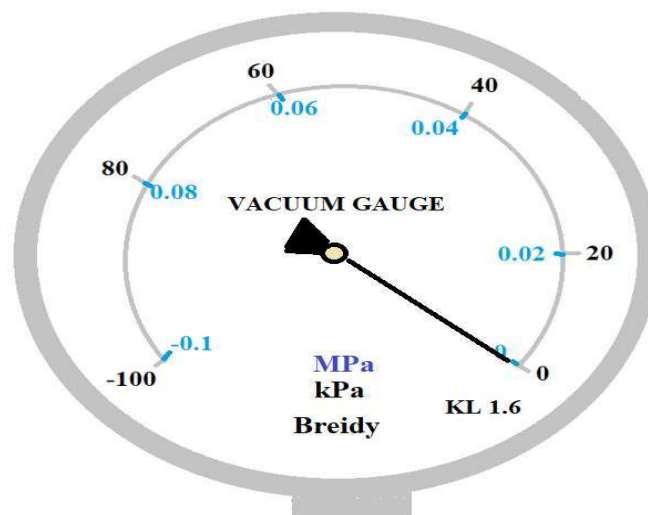


Figure 1.3. Vacuum gauge

Summary. Sublimation drying of fruits and vegetables has higher overall energy and operating costs than other drying methods (except dielectric drying). Therefore, this drying method is used for drying valuable substances, materials resistant to high temperatures and whose biological properties must be preserved for a long time (meat, fruit, vegetables, medical and pharmaceutical products). When products are dried in this way, their parameters such as taste, appearance, smell, size and nutritional content remain almost unchanged.

During the experiment, it was reflected that the drying of food products by sublimation method has a number of advantages:

- useful properties of products are almost completely preserved;
- product weight kama yadi, it is convenient to transport products;
- it is not necessary to store in the refrigerator, after freeze-drying, the products can be stored for a long time without refrigeration;
- the product sale is carried out under favorable conditions will increase. Even in retail outlets that do not have refrigerators, products can be sold due to the possibility of non-refrigerated storage.

It is possible to save product features.

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