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ANALYSIS OF THE COMPOSITION OF FRUITS AND VEGETABLES DURING THE DRYING PROCESS

Abduraxmonov O. R.[1], Mizomov Muhammad Saydulla o`g`li[2], Adizova M. R.[3]

[1] Doctor of Technical Sciences, Professor, Bukhara Engineering-Technological Institute

[2] Assistant of Bukhara Engineering-Technological Institute

[3] Teacher of Bukhara Engineering-Technological Institute

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ABSTRACT

The article gives scientifically grounded recommendations on the preservation, processing of fruit and vegetable products. Also, there are scientifically sound proposals and recommendations on existing problems and solutions in the system.

Analysis show that the existing drying methods in the drying process of fruits and vegetables have an efficiency of 60-70% development is a topical issue in the field of agricultural processing. IR convective drying ensures the preservation of vitamin C and carotenoids in particular. In the study of acoustic IR - convective drying process of vegetables, parameters such as acoustic and heat flux density, radiation, wavelength and speed, product thickness affect the processing time and product quality. Based on the thermoradiotic analysis of carrots, an IR generator with a maximum wavelength of 1.1 μm of radiation is selected because vegetables are more efficient in their permeability and absorption under the influence of a wavelength of 1.1 μm. Previous studies show that when the thickness of the product is 3 - 4 mm, the air velocity is 4 sm. The process is slower because the air speed is small. If it is high, the dried product will fly away [1].

Introduction. A comparison of ultraviolet and convective drying when the air is constantly driven to the surface of the material shows that ultraviolet drying is faster when the acoustic flow rate is consistent with the constant air flow rate because the boundary layer thickness for acoustic flows is smaller than the hydrodynamic boundary layer. In order to make the Kadini IR-convection drying process more efficient, experiments had carried out under acoustic conditions. The study is conducted in the following order:

a) IR - convective drying method with pre-acoustic treatment in pulsed mode.

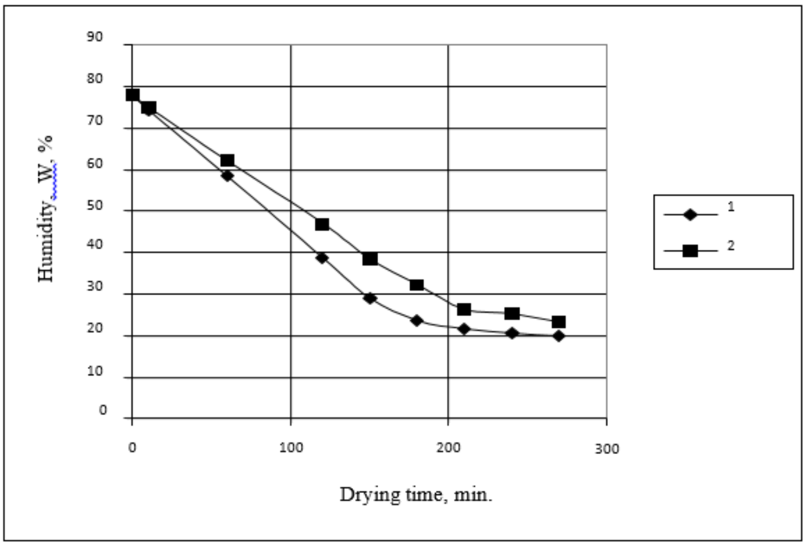
b) IR convective drying method without acoustic treatment.

Acoustic processing is carried out at a frequency of 6000 Gts for 3 minutes, in which the pumped air velocity formula is equal to the specific load formula (Fig.1). As can be seen from the graph, the drying time of pumpkin product is 3.5 hours, and the resulting humidity is 19 - 20%. Drying time during acoustic treatment is 4.5.

When drying the squash by acoustic processing, the drying rate is 0.37 [% / min], Wkr, meaning when the point Wpdl = 31%, at which time it is 0.21 [% / min], as Wqol = 41%.

Fig.1. Use of different energy streams when drying the product:

1. at f = 6000 Gts. drying of the instrument by acoustic treatment for t = 3 min;
2. Drying without initial processing.



Influence of different types of energy flows on the drying process:

The basics of thermodynamics and a number of studies show that the importance of the drying process tends to equilibrium W_p at each point of the wet product. We studied how the moisture content of a melon product changes over time. The results of the experiment showed that the intensity of the process in drying the pumpkin product decreases as it approaches the resulting moisture. The equilibrium state is 0.

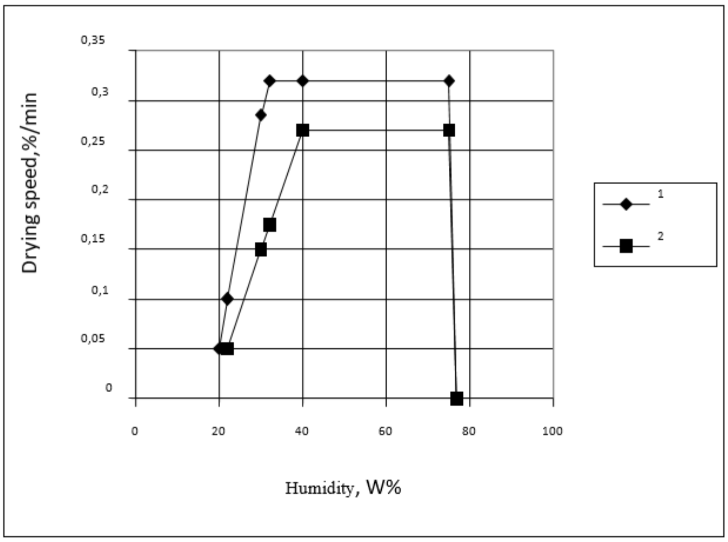


Fig.2. Use of different energy streams when drying the product:

1. at f = 6000 Gts. drying of the instrument by acoustic treatment for t = 3 min;

2. Drying without initial processing.

In this regard, the change in humidity of the product is in the form of a curve in Figure 1.2.

As a result of the analysis of this line, an event (point B), which means that the material heats up at the beginning of the process, i.e. when the humidity drops, plays an important role. The change in moisture content of the melon at a constant drying rate has a characteristic indication that it depends on the thickness of the layer.

For example, when the drying rate is constant, the layer thickness will be W = 27% for 140 minutes at b = 4 mm, W = 31% for 150 minutes at b = 6 mm, and residual moisture W = 34% for 190 minutes at b = 8mm. As the layer thickness increases, the drying time increases to 30 - 50 minutes q = 1500 W / m^2 The temperature of the product is 65 – 720 C. The effect of product thickness on drying on its moisture content during drying: Q = 2,0 кW/m^2

1: $\delta = 4$,*мм* 2: $\delta = 6$ *мм*, 3: $\delta = 8$ *мм*

In acoustically treated specimens (curve 2), the moisture content of quince fruit drops to 27% in 135 min, and in untreated specimens (curve 1) to 30% in 180 minutes. While drying, the temperature at q = 1.5 kW / m^2 is 67 C. The effect of specific load on the drying process was also studied. An increase in specific load extends the duration of the drying process. The above method of drying can also be used for drying pears. Drying time is 4 hours. The drying resistance of many agricultural products plays an important role in determining the initial components of the products, as well as the preservation of their structural mechanical properties [2]. The studies varied the process parameters in the following range: acoustic vibration frequency f = 5000 to 700 Gts, loading from 4 to 8 kg / m^2, air temperature from 50 to 650 C, acoustic processing duration from 2 to 4 min. until. These threshold values were selected based on the conducted experiments. Analysis of the literature shows that the main parameters of the drying process are constant speed N drying coefficient K and critical humidity Wkr based on experimental results developed a method of drying carrots for different values of heat flux density and loading [3].

The process was studied by a mathematical design method in order to obtain a mathematical expression representing the drying rate and the relationship of the relative humidity of the product to the factors affecting the process. The experimental plan of the factors with physical dimensions and in dimensionless views is given in the table. Based on the results of the experiment, the average value of the drying rate constant N in the first period of the process was expressed for N, the drying coefficient K in the second period of the process, and the critical humidity W. The obtained bonds fully describe the combined acoustic IR-convective drying of carrots and allowed to calculate W_{kr}, N, K with an error of up to 5%.

$$W_{кр} = 48{,}3 - 4{,}625x_1 - 0{,}125x_2 + 2{,}875x_3 + 1{,}375x_1x_2 + $$
$$+ 1{,}375x_2x_3 - 0{,}125x_1x_3 + 0{,}875x_1x_2x_3$$
$$N = 0{,}97 + 0{,}088x_1 + 0{,}01x_2 - 0{,}0362x_3 - 0{,}0412x_1x_2 - $$
$$- 0{,}0287x_2x_3 - 0{,}00375x_1x_3 - 0{,}0212x_1x_2x_3$$
$$K = 0{,}91 + 0{,}0925x_1 + 0{,}05x_2 + 0{,}0175x_3 + 0{,}02x_1x_2 + $$
$$+ 0{,}015x_2x_3 + 0{,}0025x_1x_3 + 0{,}01x_1x_2x_3$$

Analysis of the experimental results shows that maximizing the duration of acoustic processing, loading and the supplied air temperature will result in non-uniform drying of the product, while minimizing the value will result in complete drying of the product. When not acoustically treated, the air temperature does not affect the drying rate N: the coefficient K increases by 6.7%, the critical humidity decreases by 1.04 times, and when the acoustic treatment in pulsed mode, the drying rate increases by 10%, the coefficient K increases by 12.7% and humidity increases by 1.2 m. An increase in the heat flux density from 0.8 to 2.5 kW / m^2

has very little effect on the Wkr, N, K values (table 1).

	Indicators	τ, мин	x_1	$t_в$, ^{0}C	x_2	$\sigma, кг/м^2$	x_3
	Maximum	4	+1	65	+1	8	+1
	Minimum	2	-1	50	-1	3	-1
	Average	3	0	57	0	5	0

One of the main indicators of a dried product is its moisture content and it determined by the method of drying. This method is widely used and it is based on the fact that the product under test loses moisture at atmospheric pressure at a temperature close to 100 C or at a much lower temperature under vacuum. Along with water vapor, volatile substances such as alcohol, ether, ammonia, carbon monoxide are also lost during drying. When heated, volatile briquettes are formed from non-volatile substances as a result of a chemical process. Bonds that are less stable on drying oxidized by oxygen in the air. To accelerate the loss of moisture from the product, it is recommended to mix the weighed product with washed and sufficiently heated quartz sand in order to increase the evaporation surface, as well as to prevent the formation of crusts that prevent drying [4].

Conclusions. The factors influencing the drying of fruits and vegetables during scientific research had aimed at continuous control of moisture during dehydration and improving the quality of the product. The process of growing and canning seasonal fruits and vegetables that are edible and beneficial to human health studied theoretically.

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