Fundamentals of Kinetics of Tomato Drying Process

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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. In recent years, in order to fully meet the needs of the population in food and other agricultural products, in particular, vegetable products, comprehensive measures are being taken in the vegetable sector. New innovative technologies for growing vegetable crops, including tomatoes, are being introduced. At present, more than 200,000 hectares of land in the country are planted with vegetables, of which 45.8% are tomatoes, with an average yield of 24 tons per hectare.

Keywords: Physicochemical properties, storage and processing, dehydration, farms, energy consumption.

Introduction. Nowadays, comprehensive measures aimed at expanding production, storage, processing and export of fruits and vegetables are being implemented in the country. When fruits and vegetables are dried, their valuable substances their appearance and color must be preserved. It is therefore necessary to deactivate some. According to the quality indicators of the data, vitamin C storage is especially ensured during drying. According to the recommendations of the World Health Organization, in developing countries, the norm is 400 grams of fruit and vegetables per person per day, or an average of 145 kg per year. The agricultural products grown in our country make up about 300 kg of vegetables, 75 kg of potatoes and 44 kg of grapes per capita. This figure is three times higher than the optimal, acceptable, consumption norm. It goes without saying that the export potential of agricultural products in our country is one of the highest. Analysis of the literature shows that the high level of competition in foreign fruit and vegetable markets requires the rapid introduction of modern techniques of agricultural technology and management of production and supply processes. In this regard, the task is to accelerate the implementation of industry programs on modernization of production, technical and technological re-equipment, the transition to international quality standards. In turn, this will ensure that our country has a stable position in both foreign and domestic markets [1].

Methods. Tomato is one of the vegetable crops with high nutritional value. Its ripe fruit is extremely tasty, dietary and contains various vitamins, mineral salts, organic acids and

carbohydrates. The biochemical composition of tomato red fruit is as follows: dry matter 0.6-6.6%, protein 0.95-1.0%, sugar 4.0-5.0%, oils 0.2-0.3%, cellulose 0.8-0.9%, ash 0.6%, organic (malic, citric) acids 0.5%, vitamin C (ascorbic acid) 19-35 mg / kg, carotene (provitamin A) 0.2-2 mg / kg, thiamine (V1) 0.3-1.6 mg / kg, riboflavin (V2) 1.5-6 mg / kg. But the composition of potato fruit is variable, it depends on factors such as crop navigation, fruit ripening level, harvest time, growing conditions and technology. Therefore, in the drying process, many face difficulties that can be solved by knowing the simple rules. Dried tomatoes can replace fresh ones, especially in the cold season. Let's figure out how to dry tomatoes in an electric dryer, oven, and grill or in the fresh air so you can enjoy a delicious and healthy product in the winter [2].

Depending on the navigation of the plant can be round-flat, round, plum-shaped or pear-shaped. The color of the skin and visible flesh can be red, pink, or a yellowish tinges mixed with different shades. Red fruit varieties are rich in vitamin A. Tomatoes are eaten fresh, pickled and marinated. It is an important raw material for the canning (processing) industry. Tomatoes are ripe when harvested and resistant to long storage. Therefore, after harvest, the period of its consumption can be extended for another 1.0-1.5 months. Before learning how to dry tomatoes, you need to figure out how to properly prepare them for the process. Tomatoes are very juicy vegetables, which can contain 93-95% moisture. However, the yield of tomato fruit is variable, depending on factors such as crop navigation, fruit ripening level, harvest time, growing conditions and technology.

Figure 1 Tomatoes of different shapes and colors

The fruit is divided into chambers. That is, the number of nests in which the seeds are located, as well as their size, shape and location, varies in different varieties. The smaller the rooms and the thicker their walls, the more secret the fruit and the number of seeds in each chamber and in the whole fruit may vary depending on the navigation of the tomato. Before learning how to dry tomatoes, you need to figure out how to properly prepare them for the process. Tomatoes are very juicy vegetables, which can contain 93-95% moisture. Therefore, in the drying process, many face difficulties that can be solved by knowing the simple rules. The fruits usually ripen in mid-July - early August. But it is better to wait until the average temperature drops to 11-13 ° C per day. Early harvesting of tomatoes will probably require additional ripening. If you allow them to rest, they can rot. It is determined by their chemical composition, including the amount of sugars and acids. The skin of all canned varieties should also be firm. Tomato is one of the vegetable crops with high nutritional value [3].

Its ripe fruit is extremely tasty, dietary and contains various vitamins, mineral salts, organic acids and carbohydrates. The biochemical composition of tomato red fruit is

as follows: dry matter 0.6-6.6%, protein 0.95-1.0%, sugar 4.0-5.0%, fats 0.2-0.3%, cellulose 0, 8-0.9%, ash 0.6%, organic (apple, citric) acids 0.5%, vitamin C (ascorbic acid) 19-35 mg / kg, carotene (provitamin A) 0.2-2 mg / kg, thiamine (V1) 0.3-1.6 mg / kg, riboflavin (V2) 1.5-6 mg / kg. The yield of tomato fruit is variable and depends on factors such as crop navigation, fruit ripening level, harvest time, growing conditions and technology. Tomatoes are eaten fresh, pickled and marinated. It is an important raw material for the canning (processing) industry. Once the tomatoes are harvested, they are ripe and ready for long storage.

It contains 4-8% dry matter, the main part of which is carbohydrates (glucose and fructose). The fruits also contain proteins (0.6-1.1%), organic acids (0.5%), connective tissue (0.84%), pectin (up to 0.3%), starch (0.07-0, 3%), minerals (0.6%). Choline reduces the amount of cholesterol in the blood, has a beneficial effect on the immune system and the formation of hemoglobin.

2 - pictures. Separation of fruits into chambers

Tomato is a heat-loving plant. For its normal growth and development, the flower is not pollinated when the air temperature is below 12 ° C and the relative humidity is high. Pollination of the flower is not observed even when the air temperature is above 35 ° C and the relative humidity is very low (20-25%). Tomatoes were originally invented in tropical countries and are much more heat demanding. Experiments have shown that when the temperature is below 15 ° C, the plant does not bloom, and below 10 ° C it stops growing. It also stops growing completely when the temperature rises above 30 ° C. The optimum temperature for the growth and development of potato is 20-25 ° C. Tomato is a light-loving plant, and when grown in the shade, the stem grows weak and long, does not bear fruit. Fruits weighing up to 70 g are small fruits, those weighing 70-100 g are medium-sized, and large fruits over 100 g are large fruits. It is good that the fruits of varieties that are consumed only in freshness are much larger. It does not matter if the fruit of canned varieties is large. For pickling and canning, small tomato varieties are recommended. Benefits of tomatoes large amounts of the antioxidant lycopene, and as you know, working it regularly reduces the risk of prostate cancer in men. Also, the use of tomatoes has a positive effect on the functioning of the male sex glands, so men feel better during intimacy [4].

The process of drying different varieties of tomatoes grown in the climatic conditions of Uzbekistan was studied and the results are shown in Table 1.

a) with seeds (in the field)

№	The initial mass of tomatoes, grams	Drying time, hours	Mass after drying, grams
1	70	2	65
2	65	4	55
3	55	6	45
4	45	8	40

5	40	10	35
6	35	12	30
7	30	14	25
8	25	16	20
9	20	18	15
10	15	20	10
11	10	22	10
12	10	24	10

b) without seeds (in field conditions) Table 2.

№	The initial mass of tomatoes, grams	Drying time, hours	Mass after drying, grams
1	55	2	45
2	45	4	40
3	40	6	35
4	35	8	30
5	30	10	25
6	25	12	25
7	25	14	20
8	20	16	15
9	15	18	10
10	10	20	10
11	10	22	10
12	10	24	10

The choice of a rational method of drying and the type of dryer meet the requirement to obtain a finished product with the specified characteristics in the operation of the dryer, which has technical and economic indicators reliability, low emission of gases into the atmosphere during operation or is to achieve total elimination. The dynamic equilibrium state in the drying and wetting processes is at its highest will be. During drying, the water vapor pressure on the surface of the material decreases and equilibrates tends to moisture. In the process of wetting, we observe the reverse process, that is, the water vapor pressure at the surface of the material increases and tends to equilibrium moisture. Moisture in a material is a mass on the surface that separates the phases from it permeability, and the flow of gas from the separating surface to the core - convective diffusion account. Diffusion of moisture in the material is not only the moisture retention gradient, rather under the influence of the temperature gradient [5].

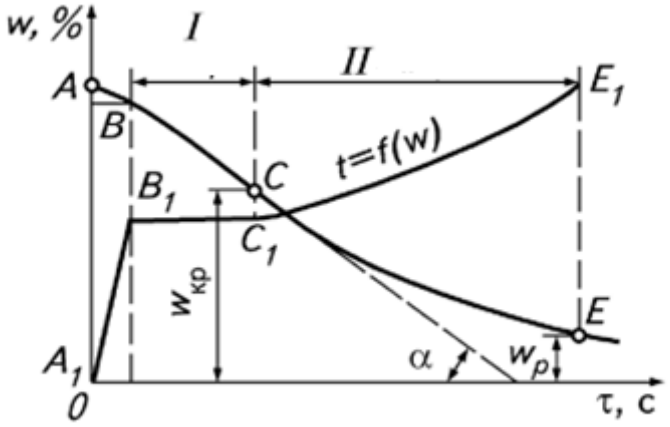

Figure 3. Drying curve

It is very difficult to express the diffusion in a material analytically. It is known that the speed of the drying process is the form of contact of moisture with the material and it depends on the mechanism of diffusion of moisture. Drying process kinetics with moisture retention of the material or change of average humidity after a certain period of time described. Typically, a drying curve is used to find the drying rate experimentally is constructed, then a differential drying speed curve is formed. In Figure 5, we found the relationship between material moisture (w) and construction time (τ) described. It is also in the picture that the temperature of the material depends on the humidity listed. A typical drying curve shows the different stages of the drying process consists of several parts representing. Drying of the material after a period of heating to room temperature (AB cross section) constant drying speed period begins (period I). This temperature of the material in the period is wet thermometer temperature tm (temperature curve cross section B_1 C_1 of the line) will be. Constant drying speed heat transferred during free moisture in the material spent on evaporation. Unchanged the drying speed cycle does not change tangent oblique straight line represented in the form (BC cross section).

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