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PRODUCTION OF DRIED FRUITS USING TECHNOLOGICAL EQUIPMENT

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Abstract: This paper examines the process of dried fruit production using modern technological equipment. Particular attention is paid to the stages of raw material preparation, drying modes and quality control of finished products. The advantages of automation of the production process, such as increased productivity, reduced losses of raw materials and ensuring stable product quality, are described. An analysis of the efficiency of various types of equipment used in food industry enterprises is provided. The results of the study can be useful for optimizing fruit drying technologies in industrial enterprises.

Key words: infrared drying, radiation, heating, untreated, heat transfer, solid body, processing, elastic pulp, hermetically sealed container, technological process, temperature, density, absorbed, processing, smell, preparation, canning, molecular, penetration.

Introduction. Small and medium-sized farms and peasant farms in the southeast of Uzbekistan annually produce more than 290 thousand tons of fruits, berries, and grapes. Moreover, the gross harvest of these products has a tendency to steadily grow. Part of the agricultural raw materials is used to make canned products, but a significant part of this harvest perishes due to the impossibility of its prompt processing. The population of the region traditionally prepares dried fruits, mainly for family consumption.

Industrial production of dried fruits using technological equipment for preparing fruits for drying and the drying itself is becoming more widespread. Artificial drying ensures the production of high-quality finished products.

At the same time, the used solar drying of products in the open air has a number of disadvantages. The main ones are the duration of the drying process, contamination of the dried products, large areas for placing the dried products and fairly high labor costs for this process. In addition, the drying of fruits and berries is short-term and seasonal in nature and, accordingly, the purchased equipment is economically unjustifiably idle for a long time, especially in winter and spring.

Dried fruits not only have a special taste, but also have many health benefits, such as helping to cleanse the blood and good for the digestive system, suitable for heavy people, such as sports, due to the high carbohydrate content. Cardiovascular diseases, high blood pressure.

Drying is a measure of evaporation of some of the water in vegetables to reduce the weight of the vegetables. But drying destroys a large amount of vitamin C, depending on each type of fruit and each drying method, the loss of vitamin C can be as much as 90%.

Dried fruits are essentially fresh fruits that have had the water removed, they are compact, lighter, easier to transport, preserve, and some of the nutrients in the fruit are dried out more.

1. Blanching (steaming)

Before drying, blanch vegetables frequently in hot water or steam to protect the quality of the product and reduce drying time. During blanching, due to the effects of heat and moisture, the physical and chemical properties of the material change in favor of moisture loss during drying: microorganisms are destroyed, and the enzyme system in the material is suspended (inactivation) to avoid damage to the product.

There are many types of yeast in fruits and vegetables, the most stable type of yeast is peroxidase yeast. Inactivation (suspending activity) of this enzyme inactivates other enzymes. To inactivate

the peroxidase enzyme, it is necessary to heat fruits and vegetables at a temperature above 750 ° C. For fruits rich in carbohydrates (potatoes...): blanching increases the porosity of vegetables due to the hydrolysis of pectin, causing a break in the bond between cell membranes.

The gelatinization of starch during blanching also speeds up the drying process. For vegetables containing pigments (carrots, peas, plums…), blanching preserves the color, limits discoloration or fading.

For fruits and vegetables with a thin wax layer on the surface (plums, lychees...), blanching loses the wax layer, creating tiny pains on the surface, thus enhancing the process of moisture exchange between the fruit and the lips of the surrounding field, resulting in a shorter drying time.

2. Chemical treatment

To prevent oxidation during drying, antioxidants such as sulfuric acid, ascorbic acid, sulfuric acid and sodium salts of sulfuric acid (such as metabanesulfite, bisunite, sulfite) are usually used.

Citric acid prevents discoloration without glaze. Sulfuric acid and its sodium salts have a strong reducing effect, which affects the oxidative enzyme activity group and slows down the enamel coloring reaction. In addition, they also prevent the formation of melanoidin (a substance that causes darkening) and stabilize vitamin C, preventing its absorption. The minimum SO2 content for oxidation resistance is 0.02% (by weight).

3. Drying temperature

Vegetables and fruits are poor heat-resistant products: at temperatures above 900°C, fructose begins to caramelize, melanoidin reactions occur, and strong polymerization of polymers occurs. At even higher temperatures, vegetables can burn. Therefore, the moderate drying mode is most often used for drying vegetables and fruits. Depending on the type of material, the drying temperature should not exceed 80 - 900°C. For blanched fruits and vegetables, to kill yeast, the initial drying can be brought to 1000°C after several hours of lowering to the appropriate temperature.

The drying process depends on the rate of temperature increase of the drying material. If the rate of heat increase is too high, the fruit surface will harden and prevent moisture from escaping. Conversely, if the growth rate is slow, the intensity of moisture removal is weak.

4. Air humidity

To improve the ability of air to absorb moisture, its relative humidity must be reduced. Drying is a method of increasing the hygroscopic capacity of air by increasing the temperature.

Typically, the air entering the oven has a humidity of 10-13%. If the humidity is too low, the vegetables will absorb or form a dry crust on the surface, which will negatively affect subsequent evaporation. But if the humidity is too high, the drying speed will decrease.

When the air comes out of the oven, it carries the moisture of the fresh vegetables, so the humidity increases (usually about 40-60%). If the exhaust air is too low, it will use energy; conversely, if it is too high, it is easy to get dew, which will damage the drying products. It regulates the humidity of the exhaust air by adjusting the speed of its circulation and the amount of fresh vegetables contained in the oven.

Infrared drying The most relevant and promising method at the moment is drying food products using infrared radiation. Infrared radiation of solids is caused by the excitation of molecules and atoms of the body due to their thermal motion. When infrared radiation is absorbed by the irradiated body, the thermal motion of atoms and molecules in it increases, which causes its heating. Energy is transferred from a body with a high potential for heat transfer to a body with a lower potential. For food products, the penetration depth of infrared rays reaches 6 - 12 mm. A small part of the radiation energy penetrates to this depth, but the temperature of the layer lying at a distance of 6-7 mm from the surface of the material increases much more intensively than with convective heating. Short-wave infrared rays have a stronger effect on food products both due to

the greater penetration depth and a more effective effect on the molecular structure of the products.

Infrared drying of food products, as a technological process, is based on the fact that infrared radiation of a certain wavelength is actively absorbed by water contained in the product, but is not absorbed by the tissue of the product being dried, so moisture removal is possible at a low temperature (40-60 degrees Celsius), which allows almost complete preservation of vitamins, biologically active substances, natural color, taste and aroma of the products being dried. Equipment for drying vegetables and fruits, meat and fish, grain, cereals and other food and non-food materials based on the use of infrared radiation is the most promising at present.

Drying products using this technology allows preserving the content of vitamins and other biologically active substances in the dry product at a level of 80-90% of the original raw material. With a short soaking (10-20 min.), the dried product restores all its natural organoleptic, physical and chemical properties and can be consumed fresh or subjected to any type of culinary processing. Drying products (drying vegetables and fruits, drying fish, meat, cereals, etc.) in this way makes it possible to produce a variety of instant food concentrates: first, second, third courses, snacks, porridges, cereals, vegetable and fruit powders that are used in the bakery, confectionery industry, as a component of dry baby food mixtures. Compared to traditional drying, vegetables processed by infrared drying after restoration have taste qualities that are as close as possible to fresh ones. In addition, powders that have undergone infrared drying have anti-inflammatory, detoxifying and antioxidant properties. The use of products that have undergone infrared drying in the dairy, confectionery, and bakery industries makes it possible to expand the range of food products with specific taste properties. Infrared drying produces products that do not contain preservatives or other foreign substances; these products are not exposed to harmful electromagnetic fields and radiation. Infrared radiation itself is harmless to the environment and humans, as is the equipment that uses it for drying fruits, equipment for drying vegetables, meat, fish, grain, cereals, etc.

The dried product is not critical to storage conditions and is resistant to the development of microflora. Dried products can be stored for up to a year without special packaging (at low ambient humidity), while the loss of vitamins is 5-15%. In a sealed container, the dried product can be stored for up to two years. Drying products reduces their volume by 3-4 times, and their weight by 4-8 times compared to the original raw material (depending on its type). The dried product restored by soaking in water can be subjected to any traditional culinary processing: boiling, frying, stewing, and can also be eaten raw or dry.

However, not only the properties of the resulting dried products deserve attention, but also the features of the equipment for drying products using infrared radiation and technological processes based on this principle. The technology of infrared drying of wet products allows almost 100% use of the energy supplied to the dried product.

Since the water molecules in the product absorb infrared rays and, when excited, heat up, that is, unlike all other types of drying, the energy is supplied directly to the water of the product, which achieves high efficiency, then with such heat supply there is no need to significantly increase the temperature of the product being dried, and the drying process can be carried out at a temperature of 40-60 degrees. Such drying of the product provides two advantages: firstly, at such temperatures the product is maximally preserved: cells are not torn, vitamins are not killed, sugar is not caramelized; secondly, low temperatures do not heat the drying equipment, that is, there is no heat loss through the walls, ventilation. At the same time, infrared radiation at a temperature of 40-60 degrees allows you to destroy all microflora on the surface of the product, making the dried product almost sterile.

In addition to all of the above, the drying equipment is universal and allows processing any plant and animal products to obtain quickly regenerated dry products. Vegetable drying equipment, fruit drying equipment, as well as all drying equipment used in this type of drying vegetables and fruits and other products, have the following advantages: the lowest specific energy consumption per 1 kg of evaporated moisture; less than 1 kW.h / kg (two times less than any drying units); drying of products is carried out at a low temperature - 50-60 degrees Celsius; drying of products is carried out at a high speed - 30-200 min; simplicity and reliability, low price and high payback.
Dried fruits **are** a completely natural product, which does not contain dyes, stabilizers, emulsifiers, nitrites and artificial additives. In fact, these are the same fruits, only without water. Of course, during the drying process, some vitamins are inevitably lost, but only some. While valuable microelements such as calcium, iron, sodium and magnesium, as well as fiber and pectin, are preserved in full.
Therefore, dried fruits are a real natural concentrate of useful substances. For example, just 50 g of dried cherries can satisfy the daily requirement for cobalt, vitamin B6 and magnesium, and several dried apricots - for potassium and iron.
Drying fruits is an inexpensive and simple way to store them. Dried fruits largely preserve the vitamins that are contained in fresh fruits, they are used for therapeutic nutrition for diseases of the heart, kidneys, liver, stomach.

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