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## PRINCIPLES AND METHODS OF PRESERVING BERRIES

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**Abstract:** Lately, the issue of a rational alimentation represented a large debated theme both by the specialists and the rest of the world. Something more, nutrition in the first years of his life leaves its mark on the rest of life, sometimes with irreversible negative consequences. Preservation of food accounted for humanity, along its entire history, a matter of particular importance. People, for living, must eat, but food is not available to them throughout the year, it must be preserved for periods that are missing. Therefore, one of the first occupations that people have had to learn was surplus food preservation. This paper presents some of the most common methods of preserving berries, drying or freezing, and its purpose is to draw attention to the importance and need of fruit for human's rational nutrition.

**Key words:** conservation, berries, freezing, drying.

### 1. INTRODUCTION

Lately, a particular importance was given to issues of preserving berries, because they have a fresh life fairly limited. Berries with a high water content 75-90% form a favorable environment for microorganisms that have a harmful action on quality, significantly reducing their shelf life. Berries are mostly resistant storage little fresh due to chemical components, which is a favorable environment for growth of microorganisms, producing their alteration. Also, because during the season can not be processed into finished products (jams, compotes, jellies, juices and soft drinks), all fruit that are harvested, some of them are kept in semi-state. Conservation of semiconservated fruits are protected from the harmful alteration phenomenon and so they also keep the main characteristics taste, smell, appearance, texture and in particular, the nutritional value.

### 2. MATERIAL AND METHOD

#### 2.1. Methods and procedures of conservation berries

Conservation means foodstuffs that can keep time more or less long by physical treatment, chemical or biochemical.

Cans are divided into two categories:

- Canned themselves: are preserved in microorganisms and enzymes are completely destroyed, being able to keep unlimited theoretical and practical point of view of a period of a few years. These cans are produced by sterilization.

- Semi-canned: are cans that have limited shelf life from a few weeks to more than 2 years. Shelf life ceases as soon as preservative agent disappears. This category include products preserved by freezing, marinating, pickling, preserving cleaning, freezing.[5]

The means of stopping or preventing alteration phenomenon aim to preserve nutritional value and their organoleptic characteristics. Not all known means can be applied, because some do not ensure remain in good condition, others have difficulty implementing practical or too costly.

The means of preventing spoilage are physical, chemical and biological.

- Of the means physical part: heating, cooling, reducing the moisture content (through dehydration or concentration), sterilizing filtration action radiation, the use of vacuum, high pressures, gas, etc.;

- The group of chemicals includes: salting, adding sugar, adding ethyl alcohol, artificial acidification and antiseptics action;

- As biological means are known lactic acid fermentation and the alcoholic.

a) Preserving berries by physical means:

Mention of these methods:

- Refrigeration, ensuring slowing of life processes of fruit and microorganisms through storage at temperatures below + 6°C. Temperatures most suitable for cold storage of berries are between + 2°C and -1°C. Cold storage (refrigeration) prevents spoilage of fruit for a period of several weeks. To processing centers berries in forestry units refrigeration is achieved through cold rooms or refrigerators with automatic temperature and relative humidity, which must not exceed 90%;

- Freezing fruit means bringing in a state of latent life by freezing temperatures -18°C the -35°C when water freezes slowly juice cells;

- Dehydration is the process by which a physical conservation of the water is removed fruit gradually until reaching a fruit umiditaate more than 15%. Life is much slower microorganisms fruit for dehydration, but after wetting they recommence their activities. The fruit is dried at temperatures 45-65°C;

- Concentration is everything a reduction in water content and apply juices concentration berries (raspberry, blueberry, blackberry), combined with the addition of sugar in a concentration of 60-70%. In practice forestry units not currently using radiation, vacuum, high pressures and gases as they are expensive processes that require special equipment and is not economically justified by the volume of berries that would preserve these procedures.

b) Preserving berries by chemical means:

Preservatives are chemical substances added in very small quantities -up to 0,2%- changes very little or no nutritive and organoleptic properties of the fruit, stopping development and microorganisms. Their action is conditioned by environmental factors, the species of microorganisms, like the preservative and the dosage used.

In our country it is not allowed to use chemical preservatives, canned fruit deleterious for human health.

Typically, chemical preservatives have antiseptic, so do not stop fermentations where the fruit used as raw material in fermentation entered.

Chemical preservation action is influenced by the stage of development of microorganisms, chemical compositions and fruit acidity or alkalinity that is conserved ,their psysical condition, temperature and the drive time. In particular, chemical preservatives manifests its action by inactivating enzymes produced by microorganisms.

Chemical preservatives used to conserve wild berries:

- Sulfur dioxide and calcium bisulphite;
- Sodium benzoate;
- Formic acid;
- Alcohol.

Preservatives used should be chemically pure. Also, it is not permissible to use two same food preservatives. A good preservative must meet the following condtions:

- Do not be harmful to human doses administered;
- To be effective, meaning to have conservation power;
- To keep the power of conservation throughout necessary;
- Do not enter into chemical combinations with preserved product components;
- Do not even affect the nutritional and organoleptic properties of the product preserved;
- To be able to prepare,administer, carry and easy to remove;
- To be able to get easily and not expensive.

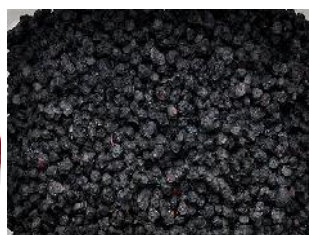
The conservation of forest fruit is limited use of chemical preservatives to conserve quantities of fruit preparations in the form of legs, marcs and juices, fruits that are not fit for recycling fresh.

c) Berries are not preserved by biochemical means. Lactic acid fermentation is used in pickling products and alcoholic fermentation in winemaking and fruit brandies.

## 2.2. Technology dehydration (drying) fruits. Conservation drying berries



1-Cranberry red



2-Black blueberries



3-Raspberry



4-Blackberries

Figure 1, 2, 3, 4: Dried berries [9]

A long tradition in Romania formed on the fruit preservation by drying. In households natural fruit drying was done using solar heat so that conservation costs were pretty low.

Dried fruits were often used in traditional Romanian diet. Specific climatic conditions of the area where it is located Romania, with 4 seasons (winter, spring, summer and fall) with a single agricultural crop year, determined that in ancient times people worry about the preservation of fruit to secure food during the period between two harvests, especially during the cold period.

Drying fruit in Romania has a very extensive history. It is understood that the man put his early problem for the cold preservation of products harvested in summer and autumn. Gradually were invented most effective methods to dry some fruit crops using rudimentary methods at the start and perfected later.[2]

Drying is the oldest method of preserving fruit. Along with other modern methods of conservation, appeared later drying was maintained until today, the difference from the past consisting of improving technology and means of drying.[4]

One of the easiest ways to preserve fruit quality is to preserve by drying or dehydrating. While drying is based on heat transfer in natural water plant products to the external environment, dehydration implies that the same transfer is performed under a strict human control, through the use of appropriate technical equipment.

If natural drying basic heating is solar or other renewable energy heat, dehydration or electricity is used mainly that contained mainly in non-renewable sources and less renewable sources.

- *The importance of conservation by drying fruit*

The drying means removal of a significant amount of water contained in fruits, both on the surface and the inside thereof so as to be able to obtain optimum preservation humidity, the fruit may be 16...25%. [2]

- *The requirements that are imposed in drying berries are:*

- Technological processes for the preparation of dried berries must preserve certain their original qualities, such as nutrients, taste, smell, color, etc.;
- Drying of berries must comply with prescribed temperature for each product;
- During drying, the fruit does not end odor, color or taste to depreciate their quality;
- Dried fruit to retain ownership of reversibility, that can absorb new volume as largest water lost by drying.[5]

- *Drying influence on the quality of berries*

Processing of the texture of the dried berries of the most important is due to the reduction of the water content and thermal effect as such. Changes and significant impairments also occur in terms of flavors. Also, some changes affect the value of such food:

- Proteins undergo denaturation proportion of which depends on temperature and which has the effect of reducing digestibility;

- Carbohydrates losses ranging from 1,26 to 13,3% depending on the species;

- Vitamins, in particular vitamin C can be destroyed up to 50%; these losses occur during proper drying.

- *Drying fruit preservation advantages*

- Is the easiest way and the reach of every household;
- Does not require expensive facilities and with some knowledge of the drying technique to give the product quality, which prolong consumption of fruit throughout the winter;[4]

- Dehydrated products can be restored to the shape, appearance and qualities close to those experienced before drying the rehydration;

- Storing them poses no great problems because their volume is reduced significantly after completion of drying 15-20 times the fresh weight reduction and transport 8 times (for example, two kilos of raw fruit after dehydration will have only a quarter of the original volume);

- A good long-term preservation of its organoleptic characteristics;

- Have a much greater validity than frozen or canned;

- Dehydrated and stored in optimal conditions, the fruit can be eaten even after a few years;[2]

- During fruit with very high yields, the excess of products, instead of being lost, is recovered drying, this form being able to keep long;

- Dried fruit can be consumed as such, but also as ingredients for cakes or other preparations, contributing to confer more powerful flavors. They also can turn into powder and then add to sauces or soups. Another use could be adding dried fruit yoghurts, both for appearance, and especially to taste.

- *The disadvantages of conservation drying fruit*

- Can not dehydrate all fruits, except do those rich in vegetable fat, because can become accomplished.



**Figure 5, 6, 7, 8:** Dried berries [9]

### 2.2.1. Drying technology using solar heat

Drying technology using solar heat is practiced on an industrial scale in warmer countries around the Mediterranean (some with a good level of development).

Even in our country, temperate climate, where the sun does not heat strong enough to dehydration faster, focusing sunlight with a mirror system can certainly give the required temperature for drying fruits properly.

For good drying sun products are selected places most sheltered household, remote roads to protect them from dust, sheltered from strong winds and permanent, but where there is a slight air movement (not in closed places) and mostly sunny throughout the day.

The fruit for drying naturally, using solar heat, place in thin layers on slatted or wire mesh lath, overlapping 10-12 grills loaded with fruit. Natural drying lasts depending on the species, up to 15 days.

Examples of media that can be placed for drying fruit using solar heat:

- Mats fixed on single frames. The disadvantage is that the mats be stained and soaked with what's juice dripping during drying fruit;

- Barbecues stronger and long lasting can be made of wattle. They gently wash and well;

- Wooden frames that stretches over galvanized wire mesh cloth that sits tifon. Tifonul has the advantage of having easy wash so always ensure that they worked in clean condition;

- Slats can be made of fir slats.

- *The advantages of drying in the sun*

- Drying in the sun remains the cheapest and simplest method for households in rural areas where the atmosphere is cleaner than in more populated centers.

- *The disadvantages of drying in the sun*

- Proceeds from drying in the sun are poorer than those obtained by using artificial heat. The heat from the sun is not too strong, around 50°C;

- Time required for drying in the sun darkens products lead to some blackening;

- Drying in the sun is limited and dependent on the weather;

- During exposure to the sun, can be added dust, mold spores, insect invasions and flies carrying germs.

### 2.2.2. Drying technology using artificial heat

Air heating using fuel and electricity offers many possibilities for fruits, from the simplest installations, handy household, industrial facilities to complex, high capacity.

Drying with heat produced by burning fossil enables rigorous control temperature and airflow, and the drying time. Such factors -heat- drying and air-currents can be dosed after the requirements of each species that pace of dehydration products fall within the optimum time needed to obtain a higher quality.

Driving the drying process by using artificial heat, regardless of the type of equipment they work with, requires constant supervision and careful, because there is no possibility of lifting the air temperature above the permissible limit and consequently damage (depreciation) product.

Using a thermometer and fire properly adjusting the temperature in the drying device, drying will take over as stable around the average indicated. There are deviations from this rule, namely:

- The temperature must be higher than the average drying temperature is required the product, 10-15°C at first when entering the facility grates fruit. This is required because the cold grates and products, absorb more heat in the early drying and sudden temperature drops in the installation. After some time the temperature starts to rise and continue to be maintained in media indicated;

- The temperture should be reduced from the average indicated, by the end of the drying when . It notes that some products begin to wrinkle, although drying is not yet finished (the fire was too fast and too high temperature air stream). Also, for the uniform drying of the products, it is often necessary to change the screens to each other (the top down and vice versa). This is especially true in small installations (domestic) drying, where. Is not always achieved adequate humidity of the heated air streams.



If in such cases is not controlled dehydration riding on some obsolete products are produced gratings, shriveled and even burned, while the other grills are still insufficiently dehydrated.

- *The advantages of artificial drying*

- Artificially heating the air by burning fuels or electricity, in order drying fruit, leads to superior results due to the possibility strongest warming air to 60-80°C so activates evaporation of water and also increases the velocity of the hot air, so water loss products subject to drying is faster;
- During the shorter the drying causes and better quality products, they no longer get brown;
- Providing quality products;
- It is much faster;
- Drying with artificial heating being performed indoors and not outdoors (like sun drying) dusting and contamination of microorganisms are no longer feasible.

- *The disadvantages of artificial drying*

- Heating the air is too high temperature harmful products subjected to drying, so forced dehydration it is taking place, which leads to undesirable changes in the contents of and the loss largely to nutritional qualities, and the fruit will not be dehydrated, but "ripe";
- If drying is done at a very high temperature and product dries quickly, they shrink (Wrinkle) at their surface suddenly and forms a hard crust that prevents the loss of water. If drying is not done correctly, it distorts the flavor and color;
- Requires attention and understanding from workers.[4]

### 2.3. Fruit freezing technology

- *The influence of freezing use on the quality of berries*

Both in terms of maintaining the nutritional and sensory traits (taste, smell, etc.) freezing is superior to other currently used methods (sterilization, curing, smoking, drying, etc.). Freezing least influences on the chemical composition and amount of food in general. Also sensory qualities (taste, aroma, color) are kept almost entirely. Some impairments are found in terms of texture. Keeping fruit at a temperature above the freezing point, not allowing their preservation than the maximum extension of a few months. By lowering the temperature below the freezing point products can be extended for longer preservation, between 9 and 12 months.



1-Cranberry red

2-Black blueberries

3-Raspberry

4-Blackberries

**Figura 1, 2, 3, 4:** Frozen berries [10]

- *The advantages of freezing*

- Cold does not bring significant changes in nutritional value and sensory qualities (except accidents and failure to comply with basic rules). Instead, other methods (dehydration, sterilization, adding sugar, etc.) have repercussions reflected in nutritional value and sensory characteristics, diminished relative to feedstocks in manufacturing;
- Foods preserved by cold (refrigerated or frozen) is very close to natural products;
- Frozen products have another advantage, namely that many of these products are ready cleaned, cleaned, portioned and requires no prior conduct of these operations;
- Usability, especially in the winter season, the fruit of poor or non-existent, as berries, at the time, which ensures rational nutrition;
- Ease of supply and achieving savings in time, the possibility of buying quantities larger to represent the needs for several weeks.[3]

- *The disadvantages of freezing*

- The main disadvantage is the cost of freezing berries;
- Berries having a high water content may lose consistency after being thawed;
- You can not know for sure if we purchase foods they were kept correctly and did not partially thawed during transport or storage of different merchants.[8]

- *The action of low temperatures on microorganisms*

In general, microorganisms supports better temperature drops below 0°C than the temperature rise over 100°C. The weaker bacteria which are still not destroyed, but only inactivate. It was found that some bacteria can

withstand even the temperature liquid air (-190°C). Are highly resistant spores of bacteria and molds, which after a long storage at -190°C, brought to optimum development conditions, germinate normal. Yeasts also can adapt to low temperature.

- *The action of low temperature on the enzymes*

To freezing temperature, most of the enzymes retain their activity with a lower intensity. Even very low temperatures do not destroy the enzymes, these showing increased activity after thawing than before freezing.

- *The action of low temperatures on plant tissue*

In order to freeze all water existing in the fruit, it is necessary to carry out a temperature of -60°C. In practice never without the use of freezing temperatures so low because there is degradation of protein substances and preservation can be provided at much lower temperatures.

Freezing fruit is at -18°C or -20°C because extensive research has found that in this case the effect of cold on cytoplasm is minimal.[3]

Freeze fruit water volume increases by 8-10%. This increase in volume affects structure product. The ice crystals formed will be higher, the bad will influence the structure.[1]

- *The influence of freezing rate on plant tissue*

Depending on the speed of freezing distinguish:

- Freezing slow

In slow freezing, the rate of penetration of the crystal formation temperature and the product is very low, the duration of the order of days. As a result forms large crystals which deform the tissue product. The exert pressure on the cell vacuole and it gives water from plasma that cold freezes the action and thawing is hard reabsorbed. Therefore, slowly frozen products give a greater amount of juice to thaw. At the same time the product is presented deformed, because the tissue is destroyed.

- Quick Freezing

If rapid freezing, the time is only a few hours depending on the volume of product and device used.

The time of freezing of the fruit which are packed in packets is 120 minutes. In the quick-freezing, crystals are formed both between the fibers and cells at the same time, and inside the cell, so the amount of juice dispensed from the cell as a result of the mechanical action of ice is very low. In this way it explains why thawing frozen products, the amount of juice that forms is very small, and the tissue is not presenting significant degradation.

- Ultra-fast freezing

Ultra-fast freezing consists in freezing food within a few tens of seconds up to one minute by immersion in liquid nitrogen or nitrous oxide. The investigations found that the experimental transformations undergone rapid freezing of protoplasm are lower because its degradation is lower.

Today, frozen fruits are used only for quick-freezing, both because it allows for upper secondary quality products and because it has greater productivity.



5-Red currant

6-Black blueberry

7-Rosehip

8-White seabuckthorn

**Figure 5, 6, 7, 8:** Frozen berries [10]

The fruits can be frozen:

- bulk:

- Advantages: it allows a more rational use of packaging, achieving higher productivity and products of superior quality;

- Disadvantages: evaporation losses are higher.

- placed in different packages:

- Advantages: a much greater degree of hygiene such fruit packed in cartons duplex vellum with folding waterproof bottom dip in paraffin or plastic bags;

- Disadvantages: the making of fruit plants freezing decreases productivity due to abstinence cold penetration in the product.

Fruit for freezing undergo preliminary treatment consisting of washing, sorting and removing non-edible parts. Packaging is done before or after freezing, depending on the species and freezing method used.

**Table 1:** Data on freezing berries

Fruit	Tratament preliminar	Duration freezing [minutes]	Shelf life -18°C [months]
Cranberry red, Black blueberries	Washing and sorting	4-6	9-10
White seabuckthorn, Rosehip	Washing-cleaning-blanching (sometimes)	10	9-10
Red currant, Black blueberry	Washing separation beans	7	10-14
Blackberries, Raspberry	Sorting-cleaning	6	8

### 2.3.1. Defrosting berries

To defrost the fruit there are several possibilities, namely:

- thawing at room temperature.;
- Thawing in hot air;
- Thawing in hot water;
- Thawing by high frequency.

The ideal method is the method of thawing by high frequency, but is not economical. Fruit is recommended thawing at room temperature. The defrost air has the disadvantage that it allows the appearance of the product changes and the enzyme removes a greater quantity of juice.

- *Transformations occurring thawing*

After thawing, the fruit tissue has suffered much due to shriveling and disposal of juice. The juice obtained from the thawing, should be used because it contains a significant amount of nutrients. In general the biochemical processes occurring after thawing intensity altering the product in short time. Therefore it is recommended to consume fruits immediately after they have been thawed. In thawed products, microorganisms grow very quickly.[3]

## 3. CONCLUSIONS

- Dried fruits have a beneficial effect on the human body, the most important physiological actions referring to: the effects of hydration; the diuretic effect, the content of potassium, magnesium and sodium salts; alkaline effect; the effect of mineralization, the intake of minerals; laxative effect, because the fibers contained; tonic action, the vitamins contained;

- As some dried fruit quality "Sun" (classic method) and those dehydrated "forced" to the help of technical equipment may occur significant differences, it is necessary to label finished products to be specified how to remove moisture;[2]

- The nutritional value of frozen fruits is very well maintained, as the time from harvest to Freezing is very small, takes several hours. Frozen fruit immediately after collection do not lose nutrients as much as the frozen;[6]

- Frozen fruits are a useful choice, efficient and healthy, they are more "fresh" than those from the hypermarket because they halved their vitamin content every 48 hours after harvest, even if kept in the refrigerator. Frozen as soon as possible after they have been collected, they are richer in vitamins than "fresh" in stores. [7]

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