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Advantages of Quick-Freezing Technology of Cherry

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***Abstract:** In this work, experimentally studied and analyzed the difference between freezing and quick-freezing in samples of cherries. The data on the change of carbohydrates and ascorbic acid in the period of storage of frozen products. Graphic data indicate that the lowest losses of ascorbic acid and sugars are observed in samples of quick-frozen cherries. Data analysis shows that in long-term storage in samples of frozen cherries, resistance to harmful microorganisms is higher than in samples frozen in a conventional chamber, with the same storage mode.*

***Keywords**: cherry, quick-freezing, freezing, ascorbic acid.*

I. INTRODUCTION

In Uzbekistan, among the exported fruits, the part of cherries is very high. It should be noted that in 2018, Uzbekistan was among the four largest world exporters of cherries, only to three countries in terms of exports: Chile, the United States and Turkey. Surveys of market participants and careful work with the data show that in 2018 about 45-50 thousand tons of cherries were exported from Uzbekistan, although some market sources say even about 55-60 thousand tons of exports.

However, the problems of the business of growing cherries do not end, but rather begin. Moreover, here we need not only large investments, but also knowledge. That most difficult – it is necessary to break traditions on manual packing of production and to watch that at all stages process was controlled ideally. With low labor costs and a surplus in Uzbekistan, such investments often seem illogical. However, the human factor is very important to eliminate or minimize, if you want to be successful in supplying cherries to countries that are demanding on product quality.

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What is bad is that there is not enough advanced technology in Uzbekistan, as well as a very low capacity for fruit processing. This has a direct impact on the course of export.

The biggest problem is the cooling, storage, sorting and packaging of products. Such problems can reduce the production of cherries, if not find alternative solutions. Suffer from it Uzbek gardeners, often, will be forced to sell cherries at a low price, especially for small producers.

One solution to these problems is to develop and apply new types of freezing products. Freezing allows you to delay the sale of agricultural products in time and move the place of sale in space. Freezing is necessary to strive first to preserve its nutritional and taste properties. To do this, it is necessary to achieve maximum reversibility of the phenomena occurring in the freezing process.

There are many types of freezing in today's days: slow, quick-freezing (shock freezing). Recently, according to the results of the research, the quality of the product-shock freezing is in the lead. Shock freezing technology opens up entirely new possibilities.

Usually, the technology of quick-freezing of fruits and vegetables includes 3 main stages: Cooling, pretreatment and quick-freezing.

In this work, we compared the change of some elements of the chemical composition of frozen and quick-frozen cherries during storage, and their impact on quality.

MATERIALS AND METHODS

A. Material

For the experiment, we chose cherry varieties Bull's eye. 1 kg. With the caliber of 2.2 cm, Dark red color with a round shape.

B. Cooling

Cooling of the product occurs from +20°C to 0°C. In refrigerating chambers at 0° C and enhanced air circulation, fruits arriving at a temperature of 25° C were cooled to 0° C for 22 hours. The duration of cooling depends on the cooling method (vacuum cooling – 20-25 minutes, hydro cooling – 30 minutes, and others).

C. Pre-treatment

Chilled cherries were kept in a 7% solution of ascorbic acid and 0.1% salt for about an hour. Pretreatment to preserve the natural color and flavor of frozen fruits during long-term storage and after defrosting, and to reduce losses of vitamin C.

D. Freezing

Traditional freezing technology, implemented in the form of so-called low-temperature refrigeration chambers at a temperature in the chamber -18 °C. The freezing time in the refrigerating chambers is 2.5 hours.

The freezing process has passed the front speed of the freezing area at normal (medium) – 1-5cm / h, and the freezing point in the center of the product has reached to -6°C.

E. Quick-Freezing

Tunnel-type shock freezing chambers are equipment that uses the principle of forced air-cooling of a product that moves continuously through the tunnel. This ensures a uniform distribution of cold air in a given volume. The freezing rate was 100 cm / h, a cryogenic superfast freezing that is carried out in cryogenic liquids (Freon).

F. Determination of Total Carbohydrates

The total quantity of carbohydrates in the cherries were determined by phenol sulfuric acid methods.

G. Ascorbic acid

Vitamin C (ascorbic acid), were analyzed using the HPLC system (Agilent 1260 Infinity HPLC, USA) equipped with a UV Vis detector. Results were calculated on a dry weight basis.

II. RESULT AND DISCUSSION

Chilled cherries were kept in a 7% solution of ascorbic acid for about an hour. After swelling of the excess antioxidant solution, the cherries were sent to freeze. Freezing there are two temperature ranges in the center of the product: 0 to -5 °C; -5 to -18 °C.

At the first stage, there is a transition from the liquid phase to the solid phase at temperatures from 0 to -5 °C. The work on heat extraction from the product is very significant, but the temperature of the product practically did not decrease, and about 60% of the liquid fractions of cherries crystallized.

At the second stage, the freezing took place at product temperatures from -5 to -18 °C. The temperature decrease was again proportional to the work performed by the refrigeration machine. Traditional freezing technology, implemented in the form of so-called low-temperature cold rooms at a temperature of -18 °C. The freezing time in the cold rooms was 2.5 hours. In the initial stage, the process was faster than in the future. At a temperature of -15°C, about 77% of the water contained in the fruit turned into ice.

In the second method, the freezing rate of cherries was 100 cm/h, cryogenic ultrafast freezing, which is carried out in cryogenic liquids (freon). During ultrafast freezing, the formation of ice crystals did not occur, the effect of vitrification (glazing) of water in the protoplasm of cells was observed.

Storage of frozen and quick-frozen cherries was carried out at a temperature of -18°C, in special low-temperature chambers at a relative humidity of 96%.

In the period of 1, 3, 6, 9, 12 month, the chemical composition of the sample, in particular carbohydrates and ascorbic acid, was tested. Since the content of ascorbic acid in cherries is very high compared to other vitamins.

The biggest advantage of frozen fruits is the low loss of vitamins compared to other types of canning and storage. Loss and change of native forms of ascorbic acid in cherries, slowly frozen in a conventional chamber, reaches during storage at -18°C, within 3 months decreased by only 1.6%, within 6 months of loss of the mass fraction of vitamin C, reached 4%, after 9 months increased by 9.4%, after 12 months is 26.8%.

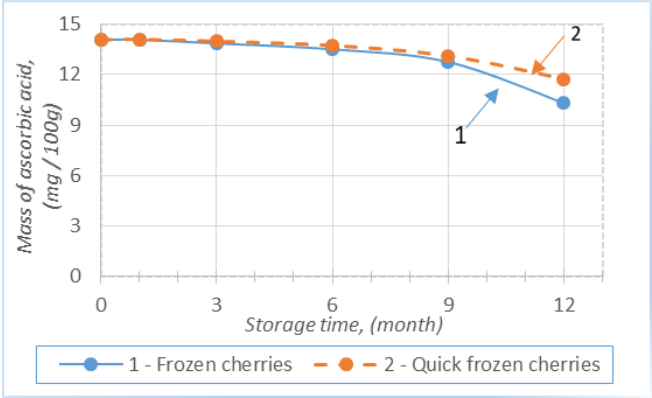

Fig. 1. Reducing the native form of ascorbic acid in frozen cherry samples during storage

In samples of quick-frozen cherries, these indicators during storage at -18°C, within 3 months decreased only by 0.7%, within 6 months the mass fraction of vitamin C, reached 2.5%, after 9 months increased by 6.9%, after 12 months is 16.7%. The obtained data shows that the change in the native form of ascorbic acid develops after 6 months of storage. Within 12 months in samples of quick-frozen cherries, the ascorbic acid index decreased by 16.7%, and in cherries, slowly frozen in the usual chamber, the loss of ascorbic acid within 12 months was achieved by 26.8% (Fig.1.).

Losses of ascorbic acid in quick-frozen products are proportional to the storage time and increase in logarithmic dependence during storage. The reasons for the undesirable decrease in ascorbic acid in frozen fruits are associated with a violation of the enzymatic oxidation-reduction process. Although when freezing the activity of enzymes decreases quite sharply.

Figure 1 shows the dynamics of the decrease of vitamin C in samples of quick-frozen and frozen in the usual way, cherries at different periods of freezing.

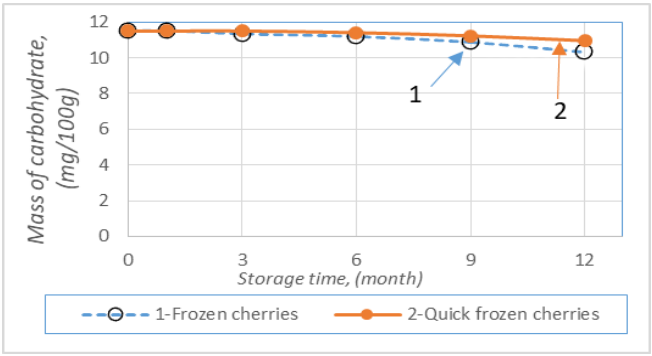

Fig. 2. Comparison reduction of native form of carbohydrate composition in frozen cherry samples during storage

Based on these graphs, we can again conclude that the least loss of vitamin C over time observed in samples of frozen cherries.

Changes in the carbohydrate composition of frozen cherries occurred during storage. In cherries, frozen in the usual chamber, the mass content of carbohydrates, within 6 months decreased by 2.7%, and the mass fraction of sugars after 9 months increased by 5.4%, after 12 months 10.7%.

In cherries frozen during quick-freezing, the mass content of carbohydrates within 6 months decreased by only 0.8%, and the mass fraction of sugars after 9 months increased by 2.3%, after 12 months 4.7%.

Figure 2 shows the nature of changes in the content of carbohydrates in frozen samples of cherries with quick-frozen method and frozen in a conventional chamber. The graphs show that carbohydrates have the greatest loss in cherries frozen in the usual way, after 12 months is 10.7%. In samples of quick-frozen cherries, the carbohydrate loss is 4.7%.

Graphic data indicate that the lowest loss of sugars observed in samples of frozen cherries.

As well as the results of experiments, shows that over long periods of storage, the level of dry soluble substances, sugars can continue to decline. Reduction of carbohydrates in the storage period occurs mainly due to the process of respiration, i.e. the formation under the influence of enzymes of carbon dioxide and water due to oxygen in the air and cherries in the sugars. The degree of respiration also depends on the storage temperature and humidity.

III. CONCLUSION

Data analysis shows that in long-term storage in samples of frozen cherries, resistance to harmful microorganisms is higher than in samples frozen in a conventional chamber, with the same storage mode.

Based on the results obtained, it can be concluded that compared to the characteristics of frozen cherries and cherries stored during the year, cherries stored after rapid freezing significantly exceed cherries stored after conventional freezing. Native preservation of carbohydrates and ascorbic acid in cherries stored after rapid freezing more.

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REFERENCES

1. Alhamdan, A., Hassan, B., Alkahtani, H., Abdelkarim, D., Younis, M. (2018). Cryogenic freezing of fresh date fruits for quality preservation during frozen storage. *Journal of the Saudi Society of Agricultural Sciences*, 17 (1), pp. 9-16.
2. Anderson, B.A., Sun, S., Erdogdu, F., Singh, R.P. (2004). Thawing and freezing of selected meat products in household refrigerators. *International Journal of Refrigeration*, 27 (1), pp. 63-72.
3. Becker, B.R., Fricke, B.A. (1999). Freezing times of regularly shaped food items. *International Communications in Heat and Mass Transfer*, 26 (5), pp. 617-626.
4. Bárcenas, M.E., Rosell, C.M. (2006). Effect of frozen storage time on the breadcrumb and aging of par-baked bread. *Food Chemistry*, 95 (3), pp. 438-445.
5. Cao, X., Zhang, F., Zhao, D., Zhu, D., Li, J. (2018). Effects of freezing conditions on quality changes in blueberries. *Journal of the Science of Food and Agriculture*, 98 (12), pp. 4673-4679.
6. Cristofori, V., Montagnini, D., Cammilli, C., Costanza, M.T., Bignami, C.(2011). Investigations of agronomic traits in italian sweet cherry cultivars Acta Horticulturae 918, pp. 759-764.
7. Cubero, J., Toribio, F., Garrido, M., Barriga, C., Rodríguez, A.B. (2010). Erratum to Assays of the Amino Acid Tryptophan in Cherries by HPLC-Fluorescence, Food Analytical Methods 4(4), p. 626.
8. Dimaano, M.N.R., Watanabe, T. (2002). The capric-lauric acid and pentadecane combination as phase change material for cooling applications. *Applied Thermal Engineering*, 22 (4), pp. 365-377.
9. Lakshmisha, I.P., Ravishankar, C.N., Ninan, G., Mohan, C.O., Gopal, T.K.S. (2008). Effect of freezing time on the quality of Indian mackerel (Rastrelliger kanagurta) during frozen storage. *Journal of Food Science*, 73 (7), pp. S345-S353.
10. Liu, Z., Li, A., Wang, Q., Chi, Y., Zhang, L. (2017). Experimental study on a new type of thermal storage defrosting system for frost-free household refrigerators. *Applied Thermal Engineering*, 118, pp. 256-265.
11. Valeriu, D., Cristian, I.C., Gelu, C., Marcel, D., Emilia, C.O. Theoretical and experimental study on cryogenic freezing of berries. *European Conference of Systems, ECS'10, European Conference of Circuits Technology and Devices, ECCTD'10, European Conference of Communications, ECCOM'10, ECCS'10*, pp. 171-174. 2010.
12. Sherzod Mamatov, Mirolim Aripov, Ulugbek Kadirov, Sadriddin Turabdjanov, Ulugbek Mannanov.(2019). The Using Infrared Radiation on the Freeze-Drying of Cherry. International journal of Innovative technology and Exploring engineering, Vol.9, Issue 2. pp. 1628-1630.

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