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Technological fureseat of shocked frozen blueberry

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Abstract

The present paper deals with shock freezing method used in blue blueberries introduced to Gvara-Khutsubani fruit and vine collective nursery in humid subtropical region of Georgia, particularly, how to artificially freeze and preserve blueberries so that to retain their biological, hygienic, organoleptic properties properly, also, paper investigates what are recommended temperature and moisture regimes and thermophysical parameters used in shock freezing method. It is well-known that Georgia is bent on joining the EU, that is why, significant attention is paid to producing safe and standardized products. In order to preserve high quality in raw materials and products while shock freezing, it is necessary to correctly opt the ripeness level of the fruit and permanently control biologically active substances during processing. All afore-mentioned factors will greatly contribute to introducing highly competitive product to market and existence of suitable marketing conditions does not rule out the export of this product. As a result of experimental research and fast freezing method on –35°C, we have got the type of fruit preserving parameters which thoroughly meet the standard characteristics of blueberry frozen by means of shock freezing method.

Keywords: Blueberry, shock freezing refrigerator, HACCP

Introduction

Blueberries are perennial flowering plants, usually prostrate shrubs that vary in size with either deciduous and evergreen leaves. Blue blueberries such as: Patriot, Duke, Elizabeth, Early blue, Legacy, Chandler, Chauntecleer are successfully cultivated in the west seaside regions of Georgia on those areas which used to belong to tea plantations. Blue blueberries thrive on every type of soil but provide their maximum yield on acidic soil.

Blueberry is not demanding towards the light and humidity, it is special for its superficial root system and frost resistance. Propagation of its seedlings is possible in laboratory by means of cell culture in test-tube.

Blue blueberries contain sugar (Glucose, Fructose), catechins, pectins, apple, lemon, milk acids, flavonoids, ascorbic acid, B, D vitamins and other useful mixtures. Fruit is sour-sweet, it can be eaten in raw condition and can be canned in different ways, for example as juice, compote, extract, congealed dry liquid etc. [1]

materials and methods

The present paper aims at choosing optimal shock freezing regime for blue blueberries introduced to Gvara-Khutsubani fruit and vine collective nursery in humid subtropical region of Georgia, in the process of research we have used refractometric and titration methods. We have defined reducing sugar, sucrose, tan and dry substances. We have used shock freezing method in following breeds: Patriot, Duke, Elizabeth, Legacy, Chandler, Chauntecleer. [2]

In order to produce high quality products, it is important to process blueberries in line with HACCP methods. We have formed the group of 4 people, who provided product description and its implementation,

monitored blueberry processing by means of HACCP method [3] and developed the following scheme on blueberry processing:

- Download blueberries by means of bunkers;
-Sort blueberries based on their size;
-Wash blueberries;
- Cool blueberries;
-Develop transportation system for blueberries;
-Freeze blueberries;
-Pack and preserve blueberries;

We have tested above named scheme at place, carried out the analysis of expected threats, elaborated control measures, figured out critical control points, named correction methods, developed rechecking procedures.

One of the common methods of fruit packaging is freezing, as it helps to retain satisfactory quality (organoleptic traits and biologically active substances) during storage on not more than -18℃. As a result of freezing berries lose 1-2% of their primary weight. Preserving time (commonly from 7 to 12 months) of frozen product depends on its type and peculiarities. Shock freezing method enables us to retain highest quality in frozen food, evading sticking of fruits on each other and guaranteeing high quality ready-made product. [3]

Shock freezing process of blueberry consists of three stages. Freezing carried out from +20 to 0, then from 0 to -5 ^{0}C and in the end from -5 to -18 ^{0}C. Temperature control was carried out through DIGITAL THERMOMETER. On the first stage from +20 to 0, food is being cooled and temperature is falling down gradually. In the aftermath of temperature drop from 0 to -5^{0}C, cooled product morphs from liquid into firm condition. Heat dissipates actively but temperature falls slightly and 70% of product fraction is being crystalized. This is the beginning phase of freezing. As for the final stage, product cools from -5 to -18℃ and reaches its final frozen condition. [4]

On the territory of Gvara special shock freezing refrigerators have been installed as a result of ENPARD financing. Freezing period starts from 2.5 hour. The most important factor is time, as there is organic link between product quality and freezing period. Crystal size of ice, enzymatic and structural changes in product depend exactly on time. Basis of shock freezing method is to dissipate heat from product on low temperature -30 ± 35℃. There is air in chamber which intensively blows air into space. [5]

It should be noted that there is no sense in temperature fall in the aftermath, as it results in product deformation and volume lose. One of the common methods of fruit packaging is freezing, as it helps to retain satisfactory quality (organoleptic traits and biologically active substances) during storage on not more than -18℃, providing retention of its organoleptic characteristics and biologically active substances[6].

Technological scheme of shock freezing is as following:

wash ⇨ dry ⇨ pack ⇨ freeze ⇨ by fridge chamber -18; -25^0 C⇨freeze ⇨ shock freezing by refrigerator (30-35^0 C

Fruits which are distributed for processing must not be over-ripe or with bruised spots. From the angle of biochemical data, deeply frozen blueberries almost get closer to their primary indicators, as freezing of water hampers chemical reactions. [7] Newly harvested berries are taken from boxes and put on inspection table to sort them out. As for useless berries, they are put in boxes for further utilization. Rest of the food is washed in special bath. As for the second bath, it serves for blanching the fruit to retain product quality and disactivate enzymatic systems. Then, berries are gently put on non-corrosion steel plate and directed to plastic boxes. After shock freezing, berries do not lose their nutritional value, they change condition turning from elastic into firm fragile condition. After shock freezing, blueberry is represented as ready-made or semi-finished product.

Biochemical analysis of samples

Blueberries distributed as four samples are frozen in shock freezing refrigerator from 0 to -350℃.[8] Samples are taken before freezing. Sample #1 is put into boxes without packaging. Sample #2 is put into polyethylene packages. Sample #3 is put into open polyethylene packages and boxes. Sample #4 is put into box surrounded with open polyethylene.

Samples were frozen on -35℃. We have studied biochemical composition of the product after taking the fruit out of shock freezing refrigerator. Biochemical composition of samples before shock freezing are demonstrated in table 1

Table 2

deals with the biochemical analysis of frozen blueberry

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Table 1

Sample #	Reducing sugar m/w	Sucrose m/w	Tan %	Dry substance %	Method name
I	6.1	1.0	83.8	16.2	ISO 2173-2013
II	6,1	1.0	83.8	16.2	ISO 6557-1-84
III	6,2	1.0	83.8	16.2	ISO 750-2013
IV	6.8	0.9	83.8	16.2	ISO 6557-2-84

Sample #	Reducing sugar m/w	Sucrose m/w	Tan %	Dry substance %	Method name
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RESULTS

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By means of shock freezing method fruit quality is retained for a long time and correspondingly is useful in almost every season. [9]

Figure #2 shows the time period (June, July, August) on the axis of abscissa when the blueberry is frozen. As for the axis of ordinate, it shows the anthocyanin composition in fruit after getting its frozen condition.

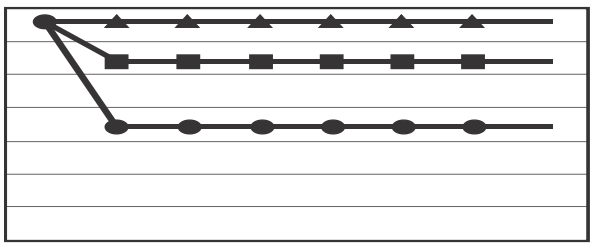

Figure #2. Change of Anthocyanins in blueberry after its preservation in dry and frozen condition (fruit dried in naturally fruit dried artificially $(50-60℃)$ frozen fruit)

According to 8 months of observation on frozen product it has been established that organoleptic features such as color, taste, flavour do not change, moreover, composition of anthocyanins have been totally retained.

DISCUSSION

Chemical indicators of above-mentioned samples prove that despite different type of packaging, composition of reducing sugar was lessened by 1 unit and sucrose by 0.1 unit in shocked fruit. Also, tan and dry substance was slightly reduced, which indicates on the uniqueness of shock freezing method. It provides the retention of product nutritional value, et. al). As chemical reactions are usually hampered because of water freezing, deeply frozen blueberry turns to its primary indicator and maintains its flavour.

Conclusion

Optimum period of taking blueberry samples from Gvara-Khutsubani vine and fruit nursery has been determined by technical maturity, which thoroughly coincides with consumption maturity period. The most significant thing of shock freezing method is heat dissipation on low temperature. Chamber contains air which blows air intensively into space. We have to note that there is no sense in temperature drop in the aftermath, as it causes the loss of product volume. Distinctive features of shock freezing method are: reduction of freezing period by

3-10 times, reduction of losing the product by 2-3 times, personnel reduction by 25-30 %, package period reduction, high velocity of cooling in the process of shock freezing, makes it possible to turn from liquid into firm condition. At this time, small icy crystals are being formed. Product remains unchanged, which is impossible in case of using ordinary freezing method. As a result of 8-month observation on frozen product it has been established that organoleptic features such as color, taste, flavour do not change, what is more, composition of anthocyanins are totally retained. Fast freezing method is attractive for business sector in agriculture. Farmers can either sell the part of their fruit immediately or freeze and sell them certain time later. It is clear that in order to get the high-quality frozen fruit, various installations are in motion and what is the most important, it has been proved that food value, color, flavor and texture is maximally preserved as a result of shock freezing method.

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