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RESEARCH ON THE QUALITY CHANGES OCCURED DURING THE FREEZING OF BLACK CURRANTS

Ardelean Alina Grigorita*

*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea, Romania, e-mail: alina_popa_alina@yahoo.com

Abstract

Black currant is a species that is suitable to freezing fact that allowed the performance of this method in two variants. In order to highlight the quality changes occured as a consequence of this preservation method, the main quality indices of the raw material and finite products have been assessed..

Key words: black currants, freezing, sugar syrup, soluble dry substance, total titratable acidity, vitamin C.

INTRODUCTION

Black currants due to their chemical composition have a nutritive and therapeutical value being considered a valuable source of iron, magnesium, potassium, phosphorus, vitamins C, A, K with a role in preventing the anaemia, cardiovascular diseases, in toning of the nervous, muscular and bone systems. They also have an anti-oxidant and immunity stimulating role, regulating the intestinal transit and contribute to the maintainance of the body weight (Ovidiu Bujor, Octavian Popescu, 1993, V. Sonea, I. Mircea, 1955).

Black currants are cultivated in only one cycle per year during the summer having a relatively short harvesting period (June-July) according to the variety. In order to benefit from the taste and active principles of these fruits during the whole year, they can be processed and preserved in different ways. One of these methods is freezing by which all the horticultural species can be preserved (Lenuţa Chira, 2000, Mihail Iancu, 2014, V. Sonea, I. Mircea, 1955 M. Popescu et.co., 1992).

Black currants belong to the category of fruits that are excessively perishable due to its thin epidermis and very strong breathing intensity. Thus, they can be kept refrigerated for 2-3 days .

By refrigeration, black currants are cooled and kept at temperatures close to the freezing point. During refrigeration, the metabolic processes, activity of endogenous enzymes and exogenous microorganisms are reduced

as intensity. The good efficiency of the refrigeration process can be noticed in the horticultural products as a reduced microbiological load. For this reason, it is paid a great importance to harvesting, transport and packaging. During these processes, the integrity of the black currants can be also maintained, thus preventing the loss of cellular juice. Therefore, the manual harvesting and the packaging in caskets are preferred. As regards the transport conditions from the harvesting point to the processing facility, the transport is performed by means of transport that are endowed with refrigeration systems. The refrigeration system with cold air allows the maintainance of the black currants in good conditions both during both the transport and the short storage period. In case the technological parameters of refrigeration are conducted appropriately, the quality of the black currants is not affected (Gheorghe Sarca, 2010, Ioan Mintaş, 2009, Potec, L. Roşu, T.A.Tudor, 1983, Purcărea C., 2008).

During freezing, the water from the products is transformed in ice crystals by giving up the heat to the freezing agent. The size and the way these ice crystals are disposed depend on the chosen freezing system, respectively by the freezing speed. The quality of the frozen finite products also depend on the freezing system. The systems that have high freezing speed allow the achievement of quality finite products, without losses of cellular juice during the defrosting phase (Dumitru Beceanu, Adrian Chira, 2003) .

The formation of the ice crystals takes place from the exterior to the interior of the horticultural products, with a certain speed, named freezing speed. According to this, the freezing can be slow, fast or very fast.

Slow freezing is achieved at teperatures ranging between -12^{o}... -15^{o} C and fast freezing at temperatures at -40^{o} C. During the slow freezing, some bigger and irregular ice crystals are formed, and they may penetrate the cellular membranes and cause losses of cellular juice during defrosting. Fast freezing determines the formation of little ice crystals, placed uniformly, so that the cellular membranes are not affected during defrosting and the products remain intact (Gh.Mihalca et co., 1980, Gherghi A., 1999, I. F. Radu, 1985) .

The freezing of black currants may be accomplished in fluid layer or in sugar syrup. The freezing point for black currants is of -1^{o} C. Black currants can be frozen with or without rachis. The preservation period in frozen state at a temperature of -18^{o} C is of 10-14 months for those that are frozen in fluid layer and of 18 months for those frozen in sugar syrup (Ardelean A. G., 2009, 2015, Marca Gheorghe, 2003, Vasile Lazăr, 2006) .

MATERIAL AND METHOD

The research was performed in 2017 within the Faculty of Environmental Protection.

The studies were focused on the Romanian variety Negre Mari. The bushes have a vigorous growth with bunches of medium size (8-11 berries/bunches). The fruits reach the technological maturity in the second decade of June.

The freezing was performed in two variants: freezing in the casserole, respectively freezing in sugar syrup. The finite frozen product is appropriate for the consumption after defrosting as well as in pastry shops.

The technological process includes the following stages: harvesting, transport, quantitative and qualitative reception, temporary storage in refrigeration conditions, sorting, washing, cleaning, packaging, freezing, storage and delivery.

For the freezing in sugar syrup, the technological process includes the same technological stages plus the dosing operation of fruits and sugar syrup. The sugar syrup was made in cold conditions with a concentration of 30%.

Packaging was performed in casseroles of 200 g.

Freezing was performed in a domestic freezer at a temperature of -18^{o} C, and it was kept for three months.

The main indices under study, for both the fresh and frozen samples, refer to the content of soluble dry substance, total titratable acidity and vitamin C content.

The determination of the main quality indices was performed both for the fresh and frozen fruit samples in the two variants.

For the fresh samples, the determinations were performed during the day of harvest and for the frozen ones, they were determined after three months of storage.

The determinations of the quality indices for the variant frozen in sugar syrup were performed after defrosting and clearing of the products from the sugar syrup.

The soluble dry substance was determined refractometrically.

The total titratable acidity was determined by its titration with an alkali in the presence of phenolphthalein as a colour indicator. In this respect, the cellular juice was extracted by grinding from the assessed sample. The previously-filtered cellular juice is titrated with a sodium

hydroxide solution n/10 in the presence of phenolphthalein until the appearance of pink colour.

The vitamin C content is determined by iodometric method. Thus, 15g of product to be assessed are weighed with the analytical balance from the intermediate sample which is grinded with 2 g of quartz sand and 10 ml of metaphosphoric acid until a homegenous paste is obtained. The mixture is passed through a calibrated flask of 50 ml and is brought to the sign with metaphosphoric acid. Then, the mixture is filtered and 10 ml are furtherly assessed. Two titration are further made.

The titration of the standard solution of ascorbic acid: in an Erlenmeyer glass, 10 ml of ascorbic acid, 20 ml of distilled water, two drops of hydrochloric acid solution 1M, 15 drops of amidon solution 1% are put together. They are all titrated with iodine solution until the change of colour into lavender blue.

The titration of the sample under study: the working technique is the one previously presented with the observation that the standard solution of ascorbic acid is replaced with 10 ml of sample to be filtered. Titration is also performed with iodine solution until the change of colour into lavender blue.

RESULTS AND DISSCUSIONS

The measurements performed upon the fresh fruits present the following values of the quality indices (Table 1).

Table no. 1

Main quality indices assessed for fresh black currants

No. Sample	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Average of samples**
S.U.S. (%)	11.5	11.0	10.5	11.5	11.5	11.0	10.0	10.5	10.5	11.5	10.9
Total titrable cidity (malic acid,%)	1.7	1.8	2.0	1.8	1.5	1.5	1.5	1.8	1.8	1.8	1.7
Vit. C (mg/100)	50	50	45	48	49	50	50	54	49	51	49.6

As regards the study of the main quality indicators obtained in the case of the finite frozen products in the two variants highlight their changes in comparison with the raw material (Table 2, Table 3)

Table no.2

Main quality indices assessed for frozen black currants

No. Sample	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Average of samples**
S.U.S. (%)	10.0	10.0	9.5	11.0	10.0	9.5	9.5	9.0	9.0	10.0	9.7
Total titrable cidity (malic acid,%)	1.5	1.6	1.7	1.5	1.2	1.2	1.1	1.6	1.5	1.6	1.4
Vit. C (mg/100g)	38	36	35	37	35	33	37	37	36	38	36.2

Table no.3

Main quality indices assessed for the black currants frozen with sugar syrup

No. Sample	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Average of samples**
S.U.S. (%)	11.0	10.5	9.5	10.5	11.0	10.5	9.5	10.5	9.5	11.0	10.3
Total titrable cidity (malic acid,%)	1.6	1.6	1.6	1.7	1.4	1.3	1.3	1.6	1.6	1.6	1.5
Vit. C (mg/100g)	40	39	38	40	38	36	40	39	37	41	38.8

Out of the comparative analysis of the obtained data, by the performed measurement upon the raw materials and frozen products in the two variants, it is noticed a decrease of the value of the soluble dry substance, which is more obvious in the case of the variant frozen without sugar syrup. The value of the total titratable acidity decreased for the processed variants, being slightly lower for the frozen variant. These slightly decreased values are due to the concentration of the cellular juice which becomes more acid. As regards the vitamin C content, it is noticed its decrease in both frozen variants with slighly higher values in the case of the variants frozen with sugar syrup.

CONCLUSIONS

The following conclusions can be drawn from the analysis of the main quality indices determined in the case of the raw material and products frozen in two variants.

1. Preservation by freezing in the domestic freezer determined a change as regards the content in soluble dry substance, total acidity and vitamin C.

2. The content of soluble dry substance in the samples slightly decreased with about 1.2 % for the frozen variant with sugar syrup and with 0.7% for the samples frozen in sugar syrup, which contributed to the increase of the nutritive value by an input of glucides.

3. The total acidity slightly decreased especially in the case of the samples that were frozen without sugar syrup, as a consequence of the cellular juice, becoming thus more acid.

4. The content in vitamin C decreased with about 24% in the case of the samples frozen without sugar syrup and with 20% for the samples frozen with sugar syrup. This differentiated decrease is due to the fact that the sugar syrup has a vitaminic protective role.

5. The aspect of the frozen fruits was maintained, the epidermis of the berries remained intact and there were no losses of cellular juice after defrosting. This aspect is due to the fact that a significant importance is paid to the harvesting, packaging and handling during the technological process. The packages (plastic casseroles) used for freezing have also ensured the good preservation of the berry integrity.

6. The taste of the frozen berries is little affected. It was preserved the balance sugar-acidity but the specific taste of the fresh fruits was lost.

The frozen samples in sugar syrup present a sweeter taste due to the added sugar.

7. The black currants is a species that is very suitable to the processing through freezing. The changes in quality that occured during the freezing being much more reduced comparatively to other processing methods (dehydration, lyophilization, processing under the form of juices, syrups, jellies, wine, jam, etc).

8. To limit the loss of cellular juice that quality of the frozen finite product, the usage of a fast freezing method is recommended.

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