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RESEARCH ON THE INFLUENCE OF BLANCHING AND FREEZING OPERATIONS UPON THE MAIN QUALITY INDICES FOR BELL PEPPERS

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Abstract

The frozen bell pepper represents a canned option that is easily used for the preparation of various meals and its storage into the domestic freezers is easy occupying a relatively reduced space. During the technological process, some physical-chemical changes appear that determine a decrease of its nutritive value. These changes refer especially to the content in vitamin C that is reduced during blanching, freezing and storage.

Key words: bell pepper, freezing, blanching, quality indices, soluble dry substance, total acidity, vitamin C.

INTRODUCTION

Bell pepper represents a valuable source of vitamins and mineral salts: C, P, B1, B2, calcium, phosphorus and potassium. The content in capsaicin also makes it appropriate in the pharmaceutical industry, capsaicin tincture being used in the preparation of thermogene wool and of some antirheumatic ointments. The multitude of varieties of different colours represent a source for the extraction of different colours (Pochard, 1987, Doina Lascu, 2008).

The undertaken reseach highlight differentiated accumulations in these elements for different crop systems: in the field or protected environment. The accumulation is also differentiated in fruits, especially in vitamin C according to the varieties being included in the range 20-350 mg % (I.F.Radu,1985, R.Ciofu et al., 2004).).

The bell pepper is a vegetable species that can be cultivated during the whole year both in the field and in protected environment (glass houses, tunnels). In case of industrial use, the production in the field is preferred, especially summer-autumn crops due to lower market price.

Bell pepper belongs to the category of perishable vegetables and can be kept in refrigeration conditions for 7-10 days.

By refrigeration, the bell pepper fruits are cooled and kept at temperatures close to the freezing point. During refrigeration, the metabolic

processes, the activity of the endogenous enzymes and of the exogenous micro-organisms are reduced as intensity. The good efficiency of the refrigeration process can be observed for the horticultural products with reduced microbiological load. For this reason, it is important to pay a lot of attention to the harvesting process, transport and packaging. The packaging of bell peppers is made in caskets, so that their crushing to be avoided. The transport is done according to the distance until destination, by means of transport that are equipped or not with refrigeration systems. Refrigeration is made in the spaces equipped with installations that produce cold air. In case the refrigeration technological parameters are correct, the quality of the peppers is not affected (Ardelean A. G., 2009, 2013, 2015, Dumitru Beceanu, Adrian Chira, 2003, Gheorghe Sarca, 2010).

The peppers meant to be frozen must be flashy, succulent, sweet, with a taste and aroma specific to the variety, with a fine epidermis that is intensely and uniformly coloured that do not crack when blanching and freezing.

The peppers can be frozen under different forms according to their purpose: whole peppers meant for further processing, peppers to be filled in, peppers cut in four, in stripes, plates or cubes.

The freezing point of peppers is of -1.05^{o} C.

By freezing, the water from the products is transformed into ice crystals. Among the freezing systems, those with high-speed freezing are preferred because they allow the achievement of quality finite products. These freezing systems perform the freezing at low temperatures below -40^{o} C (Gh. Mihalca, et co., 1980, Gherghi A., 1999).

The freezing in domestic freezers is accomplished at temperatures of -15^{o}....-18^{o} C. This type of preservation is easy and in the case of peppers, quality finite frozen products can be obtained.

Capsicum is a species that is very suitable to the preservation by freezing. There are two ways to obtain the finite frozen product: blanched and unblanched variants.

Blanching has a series of advantages and disadvantage. Blanching helps in reducing the microbial load, the enzymatic activity, setting the colour, removes the air from the tissues, the structo-texture becomes more lax, so that the storage place is reduced, favours the osmosis and diffusion processes.The disadvantages of this operation refer to the solubilization of some compounds (vitamins and sugars) as well as the taste and aroma losses. Therefore, the steam blanching is preferred to the hot water blanching (Marca Gheorghe, 2003, Potec, et co., 1983, Vasile Lazăr, 2006, Purcărea C., 2008).

After blanching, the cooling of products is compulsory at 30° C to avoid the excessive soaking of the tissues, setting the colour and the removal of water drops on the products takes place.

For peppers, blanching is recommended at a temperature of 90° C, for three minutes.

MATERIAL AND METHOD

The research were undertaken in 2017 within the Faculty of Environmental Protection.

The determinations were done for Superb pepper variety, quasi-late variety, with a vigorous compact bush, with conical red fruits.

The technological process was conducted in two variants: with and without blanching. The phases of the technological process are the following: harvest, quantitative and qualitative reception, refrigeration, sorting, washing, cleaning, cutting, packaging, storage, delivery. In the case of the blanched variant, the blanching with hot water is performed at a temperature of 90° C for three minutes until a slight change in colour is noticed. The operation is done after cutting the pepper in stripes. After blanching, the cooling and separation of the water drops take place at the ambiental temperature.

The packaging was made in polyethylene bags.

The freezing takes place in the domestic freezer at a temperature of -18° C.The frozen products were kept for two months at a temperature of -18° C.

The main assessed indices both for the fresh samples and for the frozen ones refer to the loss in weight, content in soluble dry substance, titatratable total acidity and vitamin C content.

The weight was determined by weighing with the analytical balance. Samples of 100g were taken. The following weighing was performed for the frozen samples. Thus, immediately after taking them out from the freezer, the packages were wiped of ice and snow with a towel, after which the samples were weighed without opening the package (gross weigh). The packages were open and the content (sample and ice) were emptied in a bowl. The empty package was wiped of water and ice and was left to dry at the ambiental temperature. Then, they were weighed again. The net weight of the sample was calculated by making the difference between the gross weight and the weight of the empty package.

The soluble dry substance was determined refractometrically.

For the determination of the total titratable acididy, the cellular juice was extracted from the pepper by grinding after which it was filtrated and titrated with a sodium hydroxide solution of n/10 in the presence of phenolphthalein until the appearance of pink colour.

The vitamin C content was determined by iodometric method. Thus, 15 g of assessed product was weighed with the analytical balance out of the average sample which was then grinded with 2g of quartz sand and 10 ml of metaphosporic acid until a homogenous paste was obtained. The mixture was passed through a calibrated flask of 50 ml and was brought to the sign with metaphosphoric acid. Then, the filtration of the mixture was performed and 10 ml of which was used to be analyzed. Two titrations were furtherly performed.

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 starch solution 1% are put together. They are all titrated with a iodine solution until the change of colour into lavender blue.

Titration of the sample to be analyzed: the working technique is the one presented previously with the difference that the standard solution of ascorbic acid is replaced with 10ml of sample to be filtered. Titration is performed with iodine solution, too, until the change of colour into lavender blue.

RESULTS AND DISSCUSIONS

Physical-chemical determinations were performed for the fresh and frozen samples.

In the case of fresh samples, the following values of the assessed indices have been obtained (Table 1).

Table 1

Main quality indices assessed for raw material

Crt. no.	Assessed indices	Raw material-peppers				
		P1	P2	P3	P4	Average of samples
1	Weight (g)	100	100	100	100	100
2	Soluble dry substance (%)	4.2	3.9	4.0	4.1	4.0

3	**Titratable total acidity (%)**	1.3	1.4	1.3	1.2	1.3

In the case of the products preserved by freezing in the two variants, the values of the main quality indices changed (table 2)

Table 2

Main quality indices assessed in the preserved products

Crt. no.	**Assessed indices**	**Preserved products**			
		Frozen products		**Blanched and frozen products**	
		P3	**P4**	**P1**	**P2**
1	**Weight (g)**	90	89	83	79
2	**Soluble dry substance average of samples (%)**	2.9		2.2	
3	**Titratable total acidity average of samples (%)**	0.39		0.32	
4	**Vit C (mg%) average of samples**	121		106	

Out of the comparative study of the obtained data in the fresh and frozen fruits of capsicum, it is noticed a decrease of these values, some of them with positive effects. In this regard, it is highlighted the decrease of the preserved samples' weight and implicitly of the volume occupied in the storage places. Thus, for the blanched and frozen pepper samples it is noticed a decrease of the weight with 20g/sample and for the frozen samples with 10g/sample.

The soluble dry substance decreased with 1% for the frozen samples and with 1.8% for the blanched and frozen samples.

The total acidity increased with 0.91% for the frozen samples and with 0.98% for the blanched samples as a consequence of the cellular juice concentration that becomes more acid.

As regards the vitamin C content, it is noticed a decrease of its value, including for the blanched and frozen samples.

These decreases are due to the fact that vitamin C is hydrosoluble, the pepper fruits being submitted to the washing, blanching and defrosting processes. After blanching, the horticultural product is also cooled down at the ambiental temperature, fact that involves their exposure to the atmospheric oxygen with negative effects upon the vitamin C content.

CONCLUSIONS

The following conclusions can be drawn from the studies undertaken upon the main quality indices of pepper:

1. The nutritive value of this spec ies is due to its complex chemical composition in vitamins and minerals: C, P, $B1$, $B2$, K, P, Mg. Its therapeutical value is given by the presence of capsaicine used when producing thermogene wool and of some ointments used to meliorate the rheumatic symptoms. some colours are also extracted from the pepper fruits;
2. The operations of the freezing preservation technological process conducted in the two variants: with and without blanching, determined a series of physical-chemical and organoleptic changes of fruits;
3. The chemical changes refer to the content in soluble dry substance, titratable total acidity and vitamin C. The content in soluble dry substance decreased with 1.8% for the blanched and frozen samples and with 1% for the frozen samples. The value of the total acidity increased with 0.91% for the frozen samples and with 0.98% for the blanched samples, as a consequence of the concentration of the cellular juice which became more acid. As regards the vitamin C content, it decreased more for the blanched samples. The decrease of vitamin C content is due to, on the one hand, the fact that it is a hydrosoluble vitamin, the fruits being submitted to the washing and blanching operations. On the other hand, during the stripe cutting operations, some losses of cellular juice were recorded and exposure to the atmospheric oxygen, the vitamin C being oxidized;
4. Physical changes noticed in the frozen samples are dehydration, weight and consistency loss. Thus, the weight of the products decreased as a consequence of the loss of some important part of water from the fruit flesh through the formation of the ice crystals, fact that requires smaller storage spaces. The blanched and frozen pepper samples present a decrease in weight with 20g/sample and the unblanched samples recorded a decrease with 10 g/sample (the average of samples was considered when making the comparison). It is noticed a slight dehydration of the flesh. This dehydration is achieved through the evaporation of water from the flesh that takes

place during freezing and storage. To diminish this effect, the usage of some fast-freezing methods is recommended. During the storage, the frozen pepper fruits lose part of the water if they are in bulk or if they are packed in permeable packages. For this reason, the packaging of the pepper fruits was made in impermeable packages, in polyethylene bags which prevent their dehydration during their storage. The dehydration process has as a consequence the weight loss because the resulted water from defrosting cannot be integrated totally in the flesh anymore. The consistency of the frozen fruits is affected because by freezing ice crystals are formed in the intercellular spaces that affect the cell membranes and can determine the dissociation of cells and a partial loss of the cellular juice. For the blanched variants, the structo-texture is also softer in comparison with the unblanched variants. This aspect is due to the fact that the blanching operation which was performed with the aim to inactivate the enzymes and to extend the storage period determines changes in the structure of the pectic substances from the cell membranes, with a role in the maintenances of the flesh structo-texture;

5. The organoleptic changes refer to the aspect of the frozen peppers whose red colour is less intense with translucid aspect. This translucid aspect is more obvious for the blanched samples because their exposition to high temperatures in hot water, led to the decrease of the pigment content by diffusion. The taste is slightly changed, the frozen samples have lost the taste of fresh fruit. The aroma of the fresh fruits cannot be found in the frozen fruits;
6. The behavior of these species during the freezing technological process and the results of the research show the fact that the pepper is a species very suitable to freezing, including in the domestic freezers;
7. Physical-chemical and organoleptic changes are not significant when comparing the two preservation variants (blanched and unblanched variant);
8. All these changes in the pepper fruits during the technological process are more reduced in comparison with other processing and preservation methods (dehydrating, fermentation, lyophilization);
9. A significant difference consists in the extension of the preservation period up to 8-10 month for the blanched variant in comparison to 4-6 months for the unblanched but frozen variant.

REFERENCES

1. Ardelean A. G., 2009, Tehnologii de conservare a legumelor şi fructelor: îndrumător de lucrări practice, Treira Publishing House, Oradea
2. Ardelean A. G., 2013, Tehnologii de prelucrare şi conservare a legumelor şi fructelor, Publishing House, Oradea
3. Ardelean A. G., 2015, Tehnologii de prelucrare și conservare a legumelor și fructelor- Îndrumător de lucrări practice, Publishing House, Oradea
4. Dumitru Beceanu, Adrian Chira, 2003, Tehnologia produselor horticole- Valorificarea în stare proapătă şi industrializare, Economică Publishing House, Bucharest
5. Enciclopedia Alimentelor, 2008, Translated by: Doina Lascu, All Publishing House, Bucharest
6. Gh.Mihalca, R.Vieru, S.Băltărescu, D.Vasiliu, 1980, Congelarea Produselor Horticole şi prepararea lor pentru consum, Tehnică Publishing House, Bucharest
7. Gheorghe Sarca, 2010, Ambalaje şi design în indutria alimentară, Publishing House, Oradea
8. Gherghi A., 1999, Prelucrarea şi industrializarea produselor horticole, Olimp Publishing House, Bucharest
9. I. F. Radu, 1985, Tratat de tehnologie a fructelor şi legumelor, volumul I, Fructele şi legumele ca materie primă, Scrisul Românesc Publishing House, Craiova
10. Ioan Mintaş, 2009, Tehnica Frigului, Publishing House, Oradea
11. Marca Gheorghe, 2003, Tehnologia produselor horticole, AcademicPres Publishing House, Cluj-Napoca
12. Ovidiu Bujor, Octavian Popescu, 1993, Miracolele terapeutice ale plantelor, EDIMPEX-SPERANŢA SRL Publishing House, Bucharest
13. Potec, L. Roşu, T.A.Tudor, 1983, Tehnologia Păstrării şi industrializării produselor horticole, Didactică şi Pedagogică Publishing House, Bucharest
14. Purcărea C., 2008, Transformări biochimice importante în produsele agroalimentare în timpul procesării şi depozitării, Publishing House, Oradea
15. R.Ciofu et al., 2004, Tratat de legumicultura, Ceres Publishing House, Bucharest
16. Vasile Lazăr, 2006, Tehnologia păstrării şi industrializării produselor horticole, AcademicPres Publishing House, Cluj-Napoca