RESEARCH REGARDING THE CHANGE OF SOME PHYSICAL-CHEMICAL INDICES IN FROZEN WHITE CABBAGE

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

The frozen leaves of the white cabbage offer a minimum preparation time in the case of stuffed cabbage, being already blanched. Their storage in the domestic freezers is easy, occupying a reduced volume. During the processing operations, some physical-chemical changes determine a decrease of the nutritional value. These changes refer especially to the content in vitamin C that is reduced during blanching, freezing and storage process.

Key words: white cabbage, blanching, freezing, weight, soluble dry matter, pH, vitamin C.

INTRODUCTION

The white cabbage is a vegetable species that is suitable to freezing. This can be frozen under different forms: whole leaves or divided into strips. After freezing it can be used in the preparation of different meals (garnishes, leaves for stuffed cabbage, etc).

During the freezing processing as well as during the defrosting, important changes of physical-chemical nature take place, especially when it is combined with blanching.

The physical changes observed in the white cabbage are dehydration, weight and consistency loss.

Dehydration is accomplished by the evaporation of the water from leaves that takes place during the freezing and storage process. The used of a fast freezing method is recommended to decrease this effect. During the process of storage, the frozen leaves loose water if they are bulk or packed in permeable packages. The packaging of the frozen leaves in impermeable packages prevents their dehydration during storage. The dehydration process has as a consequence the weight loss because the water resulted after defrosting cannot be totally integrated in the leaves anymore.

The consistency of the frozen leaves is changed because by freezing, some ice crystals are formed in the inter-cellular spaces that affect the cell membranes and can determine the dissociation of the cells and the loss of the cell juices during defrosting. During the blanching operation that is made with the purpose of enzymatic inactivation, also some changes take place in the structure of the pectic substances from the cell membranes with a role in maintaining the leaves' consistency.

Among the important chemical changes that take place during the technological flow, we mention: changes in the pH, colour, and vitamin loss.

The changes in pH appear as a consequence of the increase in the cellular juice concentration and of the surplus of citric acid.

The changes in colour occur as a consequence of the browning process that is due to polyphenoloxidase that acts especially upon flavonoids. The blanching operation of the leaves, as well as their treatment with citric acid, are necessary to prevent the browning process.

The research made on the vitamin content revealed that by freezing, vitamin loss takes place, vitamins being soluble in water, but the loss is far less in comparison with other processing procedures. The vitamin loss in leaves takes place especially during blanching, due to their solubility in water and their chemical degradation.

MATERIAL AND METHOD

De Buzau cabbage variety has been used in the present research.

The raw matter comes from the field autumn crop, being harvested at technological maturity.

The research was made upon the whole leaves of cabbage both in fresh and processed state after a storage period of two months.

The finite frozen product was used in the preparation of stuffed cabbage.

The stages of the technological flow are: quantitative and qualitative reception; sorting, cleaning, washing, removal of cob, removal of leaves, blanching, package preparation, dosage, packaging, freezing, storage, delivery.

Blanching was performed in hot water at a temperature of 90ºC, for three minutes. After blanching and cooling, the cabbage leaves were packed in polyethylene bags.

Freezing was done in a domestic freezer at a temperature of - 18ºC, for two months.

The main analysed indices, both for the fresh and for the processed samples, refer to weight loss, content of soluble dry matter, pH and vitamin C content.

The weight was determined by analytical balance. Some samples of fresh leaves of 500g that were dried at environmental temperature have been collected. The next weighing was performed for the frozen samples. Thus, immediately after taking them out from the freezer, the packages were cleaned from ice and snow with a towel, after which the samples were weighed without opening the package (gross weigh). Then the packages were opened and the content (sample and ice) was emptied in a bowl. The

empty package was wiped from water and ice remainings and it was left to dry at the environmental temperature, after which they were weighed again. The net weight of the sample was calculated making the difference between the gross weight and the weight of the empty package.

The soluble dry matter was determined refractometrically.

The pH was determined by the pH-meter.

The vitamin C content was determined by iodometric methods. Thus, out of the average sample, 15 g of analysed product are weighed with the analytical balance which is pestled with 2 g of quartz and and 10 ml of metaphosphoric acid, until a homogenous paste is formed. The mix is passed through a calibrated flask of 50 ml and is brought to the sign with metaphosphoric acid. Then, the next step is the filtration of the mix, out of which 10 ml are used for further analyses. Furthermore, two titrations are performed.

The titration of the standard solution of ascorbic acid: 10 ml of ascorbic acid, 20 ml of distilled water, 2 drops of acid hydrochloric acid 1M, 15 drops of starch solution 1% are put into an Erlenmeyer glass. The mix is titrated with iodine solution until the change of colour to aubergine-bleu (V).

The titration of the analysed sample: the working technique is the one presented previously with the specification that the standard solution of ascorbic acid is replaced with 10 ml sample to be filtered. The titration is performed with iodine until the change of colour to aubergine-blue (V_1).

$$\text{Vit. C mg/ 100 g product} = 10 \times V_1 \times 5 / V \times m \times 100$$

RESULTS AND DISSCUSIONS

The analysis samples were made on the second day from sampling, and the results present the average of determinations.

The physical-chemical features analysed for the fresh cabbage leaves are presented in table 1.

Table no. 1

Main indices under study in the fresh leaves of white cabbage

Sample no.	1	2	3	4	5	6	7	8	9	10	Average of samples
Weight (g)	500	500	500	500	500	500	500	500	500	500	500
S.U.S. (%)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
pH	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Vit. C (mg/100g)	99	102	98	101	103	100	99	101	100	100	100.3

The physical-chemical features analysed for the frozen cabbage leaves are presented in table 2.

Table no. 2

Main indices under study in the frozen leaves of white cabbage stored for two months

Sample no.	1	2	3	4	5	6	7	8	9	10	Average of samples
Weight (g)	215	218	201	210	215	217	217	216	215	216	214
S.U.S. (%)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
pH	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Vit. C (mg/100g)	69	71	69	72	72	70	70	71	69	69	70.2

The analysis of the achieved results for the white cabbage samples that were processed by freezing indicates a decrease of the parameter values under study, some of them with positive effects. With respect to this, it can be mentioned the decrease of weight and implicitly of the volume of the processed products, fact that allows the saving of the occupied space during the freezing chain.

As regards the analysis of the chemical parameters, a decrease of their value is noticed.

CONCLUSIONS

The following conclusions can be drawn from the analysis of the achieved results on the quality changes in the frozen samples of whole white cabbage leaves:

1. By blanching and freezing, some weight losses are observed of about 42,8% in the variant processed under the form of whole leaves. These weight losses are due to the dehydration of the frozen product that losses water from the leaf tissue, water that is replaced by the oxygen from the environment, so that browning processes of tissues take place. To prevent this problem, the blanching operation is performed before freezing.

2. The content in soluble dry substance (s.u.s.) is reduced with 1%.

3. The change of the pH is due to the concentration of the cellular juice, the last one becoming more acid.

4. The content in vitamin C is reduced, especially due to the blanching operation, the vitamin C being a hydro-soluble vitamin that is lost in the blanching water. A chemical degradation also takes place during blanching and freezing.

5. As regards the aspect of the processed leaves, they have a lighter colour, with a translucent aspect. The taste has changed altogether with the blanching and freezing operations, the taste of fresh cabbage being lost. The consistency of the leaves has changed, becoming softer, fact that facilitates their rolling.

6. White cabbage is a species that is very suitable to freezing processing. The blanching operation is absolutely compulsory due to its positive effects upon the leaves: inactivates the oxidative enzymes contributing to the maintenance of the organoleptic features (taste; colour); softening the structo-texture, fact that determines the volume reduction of the vegetal product; the better preservation of the vitamin C content during freezing; decrease of the micro-organisms number on the product. The cooling operation is compulsory after blanching because the excessive softening of the leaf tissues is avoided and the surplus of water on the leaves is removed.

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