DYNAMICS OF VITAMIN C CONTENT DURING THE TECHNOLOGICAL PROCESSES OF "ROMANIAN PEPPERS IN VINEGAR" FABRICATION

DINAMICA VARIAȚIEI CONȚINUTULUI DE VITAMINA C PE PARCURSUL PROCESELOR TEHNOLOGICE DE FABRICARE A PRODUSULUI „GOGOŞARI ÎN OȚET"

PATRAŞ Antoanela[1]*, BĂETU Alina Loredana, BĂETU M. M.
*Corresponding author e-mail: apatras@uaiasi.ro

Abstract. *The content of vitamin C in processed horticultural products is influenced by multiple factors. Besides the factors concerning the raw material (cultivar, climatic conditions, agricultural practices, harvesting and storage techniques), the processing and preservation technologies are essential. The objective of the present study is to analyse the variation of vitamin C content during the technological processes of obtaining the product "Romanian peppers in vinegar". The samples from 5 different steps of the technological flow were supplied by a company for processing vegetables and fruits (S.C. Contec Foods S.R.L. Tecuci), during two consecutive years. The finished product was also analysed after storage at two temperatures (10 °C and 25 °C), by using two different methods for vitamin C assessment. The results proved that vitamin C content decreased by 76% during the technological flow. All technological phases decreased the content of ascorbic acid, but the most important reduction was registered after the thermal processing (blanching and pasteurization). The storage of the finished product for 3 months determined the diminution of vitamin C content: at 10 ºC by 5% and at 25 ºC by 14%.*
Key words: ascorbic acid, technological flow, storage, temperature, *Capsicum annuum Gogoscharii*

Rezumat. *Conținutul de vitamină C al produselor horticole procesate este influențat de numeroşi factori. În afara factorilor privind materia primă (soiul, condițiile climatice, practicile agricole, tehnicile de recoltare şi păstrare), tehnologiile de procesare şi conservare sunt esențiale. Obiectivul prezentului studiu este analiza variației conținutului de vitamină C pe parcursul proceselor tehnologice de obținere a produsului „Gogoşari în oțet". Probele din 5 stadii diferite ale procesului tehnologic au fost furnizate de o companie de procesare a legumelor şi fructelor (S.C. Contec Foods S.R.L. Tecuci), pe parcursul a doi ani consecutivi. Produsul finit a fost, de asemenea, analizat după păstrarea la două temperaturi (10 °C şi 25 °C), folosind două metode diferite pentru determinarea vitaminei C. Rezultatele au dovedit scăderea conținutului de vitamină C cu 76% pe parcursul fluxului tehnologic. Toate etapele tehnologice au scăzut conținutul de acid ascorbic, dar cea mai importantă reducere a fost înregistrată după procesarea termică (blanşare şi pasteurizare). Păstrarea*

[1]University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

produsului finit timp de 3 luni a determinat diminuarea conținutui de vitamină C: la 10 °C cu 5% şi la 25 °C cu 14%.

Cuvinte cheie: acid ascorbic, flux tehnologic, păstrare, temperature, *Capsicum annuum Gogoscharii*

INTRODUCTION

The Romanian pepper (*Capsicum annuum Gogoscharii*) is a sweet pepper and a bell pepper representative only for a group of countries: Romania, Republic of Moldova, Republic of Bulgaria, Hungary and Republic of Serbia. It is rich in antioxidants as vitamin C, polyphenols, but also in vitamins A, B (including B_9 or folic acid) and iron, potassium, magnesium, zinc, selenium (https://www.horticultorul.ro/legume/gogosarul/).

The vitamin C or ascorbic acid is necessary for the good function of human body, and at under-normal level, metabolic disorders are registered, e.g. in the biosynthesis of collagen, carnitine and some neurotransmitters or in the iron absorption during digestion. Also, the immunity response is affected and the body is more susceptible to influenza virus and to coronavirus COVID-19. This vitamin is an important antioxidant, able to decrease the lipid peroxidation, to reduce the inflammatory response and to manifest anticarcinogenic properties. Being a water-soluble vitamin, it cannot accumulate as deposits in the body, so it needs to be introduced every day from food.

We can find ascorbic acid in fresh vegetables and fruits. In peppers, there is an important quantity of vitamin C which accumulates at early stages of maturation and increases as the pepper reaches maturity (Marin *et al.*, 2004). At maturity, after harvest it registers a constant decrease during storage, which can be delayed at lower temperature. For example, at 20–22 °C, the daily loss of vitamin C is about 1.5%, while at 10 °C the daily diminution is around 0.8% (Cuciureanu, 2010). It is very unstable during any technological process of food preparation and especially at thermal processing (blanching, pasteurisation, etc.).

The present study analyses the changes in total vitamin C content during five different phases of the technological flow of the product "Romanian peppers in vinegar" fabrication. It also compares the ascorbic acid content in the finished product after storage during 3 months at 10 and 25 °C.

MATERIAL AND METHOD

The studied material is represented by 5 phases of the technological flow of "Romanian peppers in vinegar" fabrication: raw material (RM), washed peppers (W), after cutting and removing inedible parts (C), after blanching with hot water at 70 °C for 3 min (B) and the finished product, "Romanian peppers in vinegar", after pasteurisation by maintaining at 95 °C the inside temperature of filled and closed jar for 15 min. From the finished product, two different samples were analysed: the peppers (PFP) and the coating liquid (CL) represented by the vinegar solution enveloping the peppers. In order to assess the stability of ascorbic acid in the finished product, it was analysed after 3 months of storage at 10 and 25 °C. The samples were

supplied during two consecutive years, by the company S.C. Contec Foods S.R.L. Tecuci.

The total vitamin C content (TVCC) was analysed by two methods: the titrimetric assay using 2, 6 dichlorophenol indophenol (2,6 DCFIF) (standards: ISO 6557-2: 1984 and ISO 6557-1: 1986) and the reflectometric assay (RQ) using the Reflectoquant RQFlex from Merck (Eberhardt et al., 2000). Results were expressed as mg/100 g fresh weight and are means of 3 determinations ± standard deviation.

RESULTS AND DISCUSSIONS

Figure 1 presents the total ascorbic acid content (TVCC) during the five phases of the technological flow of "Romanian peppers in vinegar" fabrication (analysed by two methods and during two consecutive years).

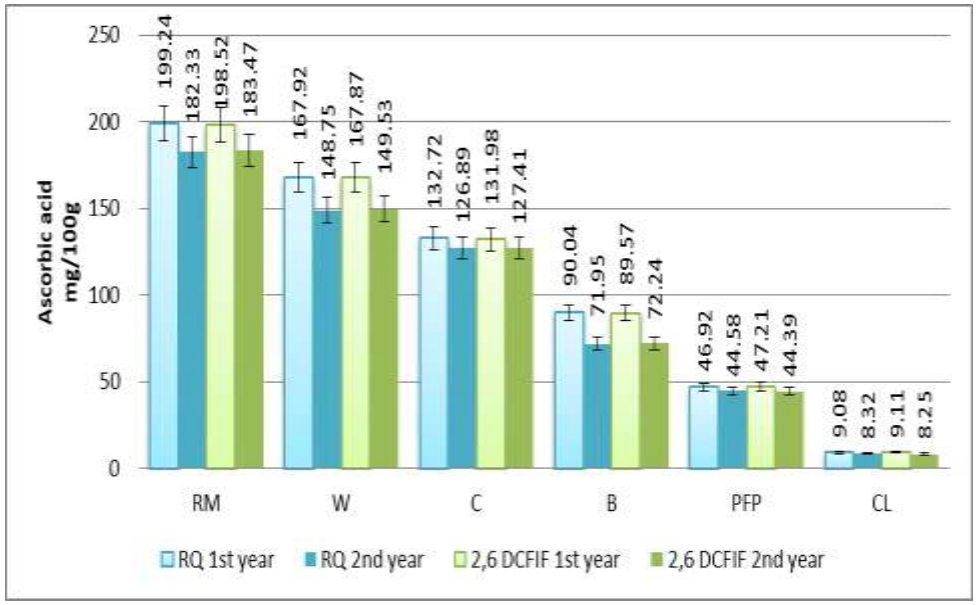

Fig. 1 Dynamics of ascorbic acid content during the technological flow of "Romanian peppers in vinegar" fabrication: raw material (RM), washed peppers (W), after cutting and removing inedible parts (C), after blanching (B), the peppers of finished product (PFP) and the coating liquid (CL) during two different years by 2,6 dichlorophenol indophenol (2,6 DCFIF) and Reflectoquant (RQ) methods. Results are means of 3 determinations ± standard deviation

The two analytical methods (2,6 DCFIF and RQ) gave similar results with insignificant differences. TVCC is smaller in the second year during all steps of processing, due to the quality of the raw material, which contains 8% less vitamin C (around 183 mg/100 g compared to 199 mg/100 g in the first year). This variation may be the consequence of differences concerning pepper cultivar, pedo-climatic conditions, fertilizers and used technologies, harvest procedure and especially, the duration and conditions of storage before processing. Every

procedure decreased the vitamin C content (fig.1): washing (W), by 15.6 – 1st year and 18.6% - 2nd year, cutting (C), by 21.1% - 1st year and 14.8% – 2nd year, blanching (B), by 31.8% - 1st year and 43.3% - 2nd year, pasteurization to obtain the finished product, by 47.8% - 1st year and 38.2% - 2nd year. As expected, the thermal procedures (blanching and pasteurization) decreased mostly TVCC, between 31 - 48%. The vitamin C content in the peppers of finished product had a mean value of 46 mg/100 g (which represent about 24% of the initial TVCC) and in the coating liquid, of 9 mg/100 g (less than 5% of initial TVCC). So, more than 71% of the initial quantity of ascorbic acid (of RM) is lost during the technological flow.

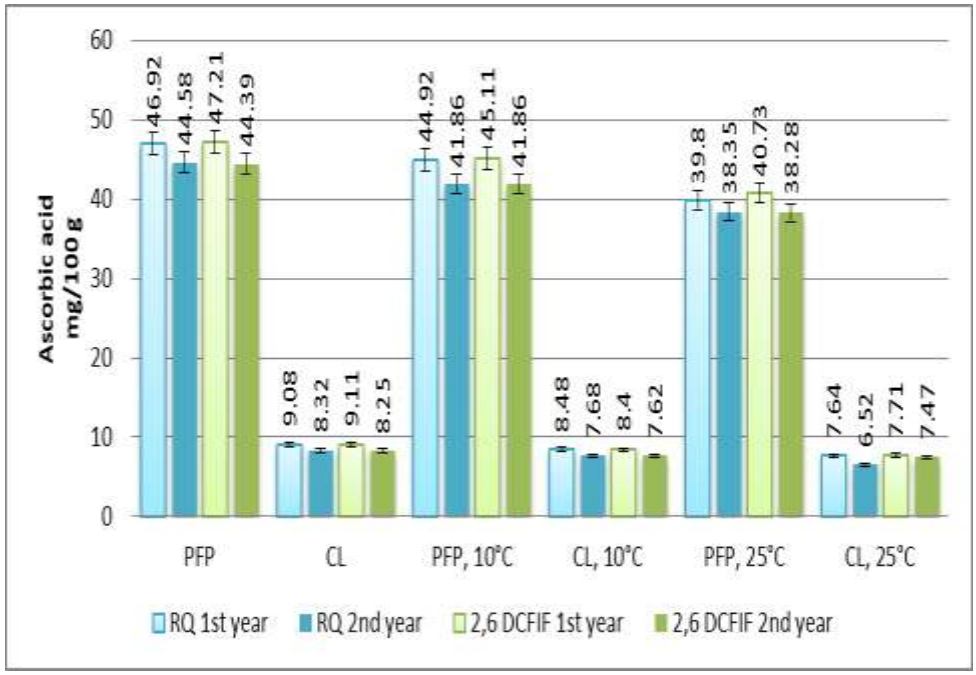

Fig. 2 The ascorbic acid content after 3 months of storage of the finished product at 10 and 25 °C, in the peppers of finished product (PFP) and in the coating liquid (CL) - samples from two different years, assessed by 2,6 dichlorophenol indophenol (2,6 DCFIF) and Reflectoquant (RQ) methods - Results are means of 3 determinations ± standard deviation

The 3 months storage of the finished product diminished the TVCC of peppers by 5.1% at 10 °C (final mean content of 43.44 mg/100 g) and by 14.2% at 25 °C (final mean content of 39.29 mg/100 g). The TVCC of coating liquid was decreased by 7.4% at 10 °C (final mean content of 8.05 mg/100 g) and by 15.6% at 25 °C (final mean content of 7.34 mg/100 g) (fig. 2).

Very similar results were obtained in previous study (Patraş *et al.*, 2018) concerning the technological flow of "Cauliflower in vinegar" fabrication. It was stated that the finished product had 22 - 25% of the initial cauliflower's ascorbic

acid and the most important losses were due also to blanching and pasteurization. It is to be mentioned that the initial TVCC of cauliflower was only 70 – 74 mg/100 g, while Romanian peppers in present research have 182 – 199 mg/100 g. The finished product "Cauliflower in vinegar" had TVCC of 16 – 18 mg/100 g (and the coating liquid around 6 mg/100 g), while in the present study, the "Romanian peppers in vinegar" have 44 – 47 mg/100 g (and the coating liquid 8 – 9 mg/100 g). Also, during the storage of finished product was noticed similar behaviour (Patraş *et al.,* 2018).

Thoroughgoing studies are necessary in order to establish the detailed evolution of vitamin C during the technological processes (including the interconversion of different forms of ascorbic acid) and all compounds issued by its degradation.

CONCLUSIONS

1. The vitamin C content of the raw material decreased by 76% during the technological flow of "Romanian peppers in vinegar" fabrication (almost 5% of the initial vitamin C was found in the coating liquid, while 71% was lost).

2. All technological phases decreased the content of ascorbic acid, but the most important reduction was registered after the thermal processing: blanching (31.8% - 1st year and 43.3% - 2nd year), and pasteurization for the obtaining of finished product (47.8% - 1st year and 38.2% - 2nd year).

3. The storage of the finished product for 3 months determined the diminution of vitamin C content at both temperatures. The storage at 10 ºC decreased the ascorbic acid content in Romanian peppers by 5% and the storage at 25 ºC, by 14%.

***Acknowledgments**: The author would like to thank the Francophone University Agency (AUF) and the S.C. Contec Foods S.R.L. Tecuci for the analysed samples.*

REFERENCES

1. Cuciureanu R., 2010 - *Igiena alimentului*, Editura Performantica, Iaşi, p.63.

2. Eberhardt M.V., Lee C.Y., Liu R.H., 2000 - *Nutrition: antioxidant activity of fresh apples.* Nature, 2000, 405 (6789), p. 903-904.

3. Marín A., Ferreres F., Tomás-Barberán F. A., Gil M. I., 2004 - *Characterization and quantitation of antioxidant constituents of sweet pepper (Capsicum annuum L.).* Journal of Agricultural and Food Chemistry, 52(12), p. 3861-3869.

4. Patraş A., Băetu M., Băetu A. L., 2018 - *Stability of the ascorbic acid content during the technological flow of the product "Cauliflower in vinegar".* Lucrări Ştiinţifice, Universitatea de Ştiinţe Agricole şi Medicină Veterinară "Ion Ionescu de la Brad" Iaşi, Seria Horticultură, 61(2), p. 467-470.

5. *, 1984,** *ISO 6557-2:1984, Fruits, vegetables and derived products - Determination of ascorbic acid content - Part 2: Routine methods,* Standard de stat România. https://www.iso.org/standard/12957.html.

6. *, 1986,** *ISO 6557-1:1986, Fruits, vegetables and derived products - Determination of ascorbic acid - Part 1: Reference methods,* Standard de stat România. https://www.iso.org/standard/12956.html

7. *,** https://www.horticultorul.ro/legume/gogosarul/