THE EVOLUTION OF THE BIOLOGICALLY ACTIVE COMPOUNDS DURING THE STORAGE OF PRESERVED FOODSTUFFS

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Abstract
The paper deals with the investigation of the antioxidant activity evolution and the biological active compounds in the preserved foodstuffs such as juice with pulp and fruit souses, vegetable pasts and vegetable juice. The evolution of the biologically active compounds especially of the antioxidants during processing and storage of the final products depends on many factors, such as the oxidation processes. Depending on the oxidation-reducing properties of thee environment, the stability and the content of ascorbic acid, polyphenols, anthocyanes, carotenes eventually is affected. Considering that the primary materials represents a complex systems, the aim of this study was to investigate the evolution of the biologically active compounds during storage by determining the antioxidant capacity using the method developed in the department of „Preservation Technology", Technical University of Moldova. The method is based on the chemical thermodynamic laws by establishing an equilibrium between two separate systems – products and the standard system. The initial amount and the evolution of the biologically active compounds presents strong relationship. The biologically active compounds were the most stable in the peach sauce and white sea-buckthorns together with the tomatoes and paprika juice.

Keywords: antioxidant activity, biologically active compounds, preserved foodstuffs

1. INTRODUCTION

The vegetal primary material and the products there of represent the most important sources of antioxidants in human diet. Antioxidants are chemical compounds from different classes. The most known antioxidants are: polyphenols, carotene, anthocyanes, ascorbic acid, etc. By inhibiting the free radicals such as R·, ROO·, O_2·, OH· they have play a positive role in the human body and may help prevent the gastrointestinal diseases, cardiovascular diseases but they are also able to unblock the oxidative stress [1, 2, 3].

During food storage but also during food processing, the amount and the activity of the antioxidants may decrease. The mechanism behind the damages of the antioxidants is tightly related to the oxidation process which takes place via a plethora of oxidation reduction reactions. Considering that the chemical composition of the vegetable products is extremely complex in terms of antioxidants but also of pro-oxidants and other compounds, it is necessary to elaborate an index useful for the establishment of the stability of all the antioxidants.

Nowadays, there are a number of methods available for the determination of the antiradical activity of the antioxidants: Oxygen Radical Absorbance Capacity (ORAC), Trolox Equivalent Antioxidant Capacity (TEAC), Ferric Reducing Antioxidant Power (FRAP) etc. [4, 5]. However, the issue regarding the determination of the stability of the antioxidants in the vegetable products is not completely solved.

The aim of this study was the investigation of the evolution of the biologically active compounds during storage by determining their antioxidant capacity.

2. MATERIALS AND METHODS

The experiments were performed on preserved foodstuffs such as juice with pulp and fruit sauce - „Peach and sea-buckthorn sauce" „Peach and sea-buckthorn juice", „Tomatoes and paprika paste", „Tomatoes and paprika juice". The samples were stored at room temperature. The changes in the phisico-chemical properties were determined for a period of 12 months.

The following parameters were determined: dry matters, pH, titrable acidity, β-carotene, ascorbic acid and the antioxidant capacity. The method used for the determination of the antioxidant capacity was developed in the department of Preservation Technology, TUM [6].

The method is based on the chemical thermodynamic laws by establishing an equilibrium between two separate systems – products and the standard system. For this two electrochemical cells were used. In each cell contained two electrodes: one of platinum and one of silver. The silver electrodes were connected, while the platinum electrodes were connected to the potentiometer. In one cell the sample was introduce while in the other cell the standard system (fig. 1). The standard has been used as natural bioantioxidant L-hidroascorbic acid.

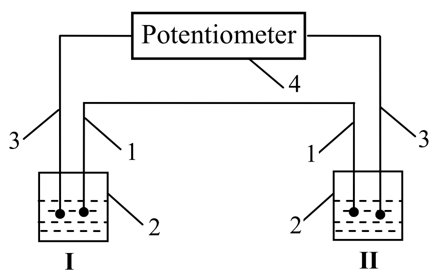

Figure 1. The diagram of the electrochemical cells: 1. – AgCl electrodes; 2. – electrochemical cells; 3. – Pt electrodes; 4. – potentiometer

The antioxidant activity was expressed using the K coefficient in equivalents of ascorbic acid mg/ g DM:

$$K = \frac{C_1 \times V_1 \times m_1}{m_2 \times C_2 \times m_3} \quad (1)$$

where: C_1 – the concentration of the standard solution, mg/ml;
C_2 – the dry matter, g/g;
V_1 – the volume of the standard solution equal to the redox potential of the investigated system, ml;
m_1 – the mass of the sample after dilution, g;
m_2 – the mass of the control, g;
m_3 – the mass of the sample, g

3. RESULTS AND DISCUSSIONS

The phisico-chemical parameters of the investigated products were determined after sterilization and during storage for a period of 12 month (table 1 and figures 2 to 7).

Table 1. The phisico-chemical indices of the investigated products

Products	DMsol., %	pH	Titrable acidity, %
Peach and sea-buckthorn sauce	19,36±0,70	3,85±0,05	0,56±0,05
Peach and sea-buckthorn juice	19,93±0,11	3,84±0,05	0,58±0,14
Tomatoes and paprika paste	26,38±0,24	4,32±0,16	1,61±0,11
Tomatoes and paprika juice	6,19±0,11	4,58±0,03	0,34±0,02

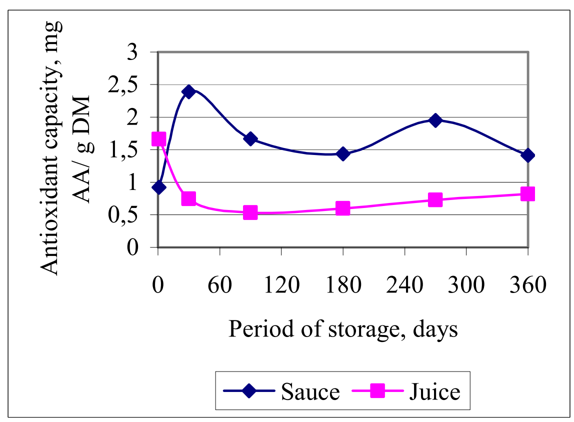

Figure 2. The evolution of the antioxidant activity during storage of the peach and sea-buckthorn juice and sauce

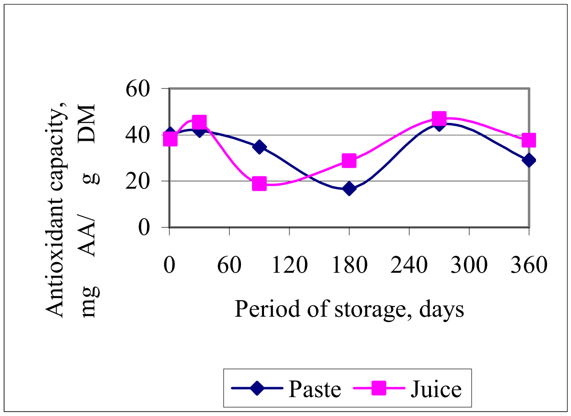

Figure 3 The evolution of the antioxidant activity during storage of the tomatoes and paprika paste and juice

From the results obtained for the evolution of the antioxidant activity it can be seen that no clear trend can be seen. The antioxidant activity for the peach and sea-buckthorns sauce, the tomatoes and paprika paste and sauce is increasing during the first 30 days of storage.

After 6 months storage he K value for the peach and sea-buckthorns juice decreased with about 64% while for the sauce with just 40%. In the case of the tomatoes and paprika paste a decrease of about 58% could be registered while for the sauce a decrease of just 24% was observed. The increase of the antioxidant activity can be probably due to the increase of the temperature of the storage environment.

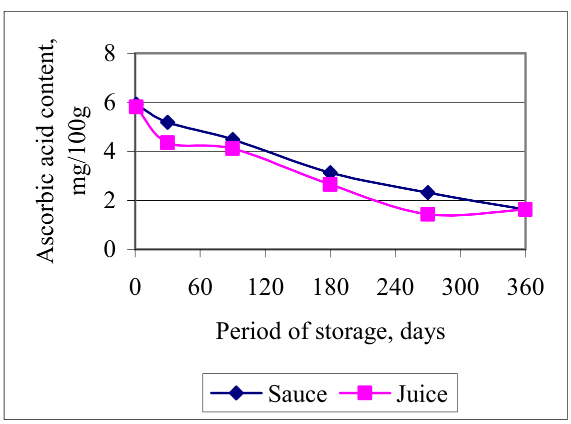

Figure 4. The evolution of the ascorbic acid content during storage of the peach and sea-buckthorn juice and sauce

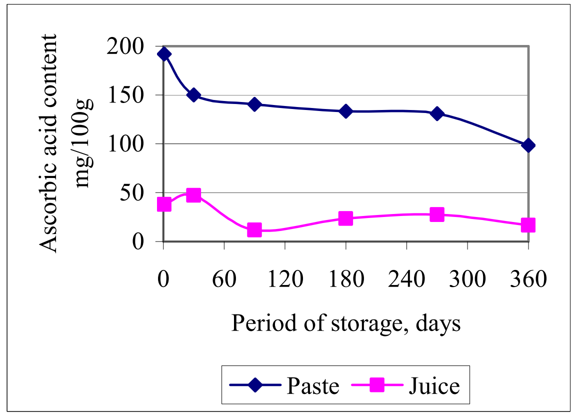

Figure 5. The evolution of the ascorbic acid content during storage of the tomatoes and paprika paste and juice

Simultaneously with the determination of the antioxidant activity, the amount of ascorbic acid was determined (fig. 4, 5). After 1 month storage, the amount of ascorbic acid decreased with 25% for the peach and sea-buckthorns juice, with 13% for the peach and sea-buckthorns sauce, 30% for the tomatoes and paprika paste and 39% decrease for the tomatoes and paprika paste. After 6 months storage, the content of ascorbic acid decrease to 55 and 47% respectively for the peach and sea-buckthorns sauce and juice while for the tomatoes and paprika paste and juice respectively 30 and 39 %. A further decrease in ascorbic acid content was observed during the following 6 months of storage with 72 and 73% respectively for the peach and sea-buckthorns sauce and juice, while for the tomatoes and paprika paste and juice a decrease to respectively 49 and 56% was registered.

The evolution of the β – carotene content in the analyzed samples reflects the evolution of the antioxidant capacity during storage (fig. 6, 7). After one month storage, the content of β – carotene decreased with 72% for the peach and sea-buckthorns juice and with 44% for the peach and sea-buckthorns sauce. For the tomatoes and paprika paste similarly a decrease was observed with 52% for the paste and 28% for the juice.

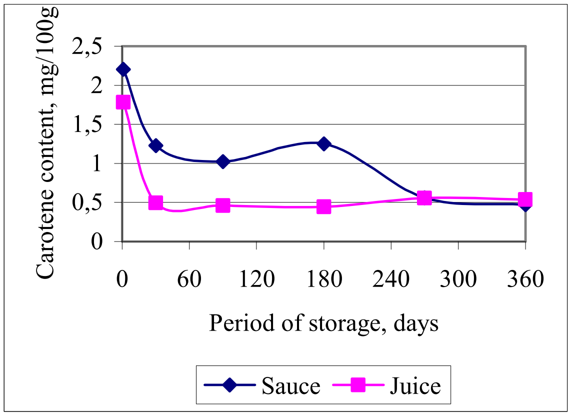

Figure 6. The evolution of the β – carotene content during storage of the peach and sea-buckthorn juice and sauce

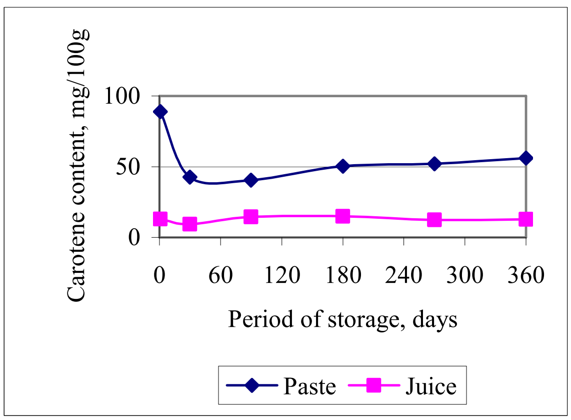

Figure 7. The evolution of the β – carotene content during storage of the tomatoes and paprika paste and juice

A further decrease in β – carotene content was observed during the following 6 months of storage up to 75 and 43% for the peach and sea-buckthorns juice and sauce respectively. For the tomatoes and paprika paste a respective decrease to 44 % was observed while for the juice no significant changes were observed. Finally, after 12 months storage the β – carotene content decreased for the peach and sea-buckthorns juice with 70% and for the sauce with up to 78%, for the tomatoes and paprika paste and juice with 37 and 1% respectively.

4. CONCLUSIONS

1. It was observed that the evolution of the antioxidant capacity and of some biologically active compounds (ascorbic acid, β – carotene) had a complex trend.
2. A relationship between the content and the evolution of the biologically active compounds as well as of the antioxidant activity.
3. The biologically active compounds (ascorbic acid, β – carotene) were more stable in the peach and sea-buckthorns sauce and the tomatoes and paprika juice.

5. REFERENCES

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