BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Publicat de
Universitatea Tehnică „Gheorghe Asachi” din Iaşi
Volumul 65 (69), Numărul 2, 2019
Secţia
CHIMIE şi INGINERIE CHIMICĂ

THE ADVANTAGES OF THE HOUSEHOLDS PRESERVATION FOR VEGETABLES AND FRUITS

BY

CLAUDIA COBZARU, CLAUDIA FELICIA CHIHALĂU and CORINA CERNĂTESCU*

"Gheorghe Asachi" Technical University of Iaşi, Romania,
"Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection

Received: January 30, 2019
Accepted for publication: May 2, 2019

Abstract. This study presents the benefits of preserving vegetables and fruits in households. Experimental data show that, compared to industrially preserved food, the products preserved in households have the advantages of simple preparation methods, without adding additives but having the same shelf life as industrial cans or maybe even longer and that can be obtained after a personal recipe.

Keywords: industrial conservation *vs.* preservation in households; vegetables; fruits; canned vegetables; canned fruits.

1. Introduction

According to the literature, the notion of homemade preservation jars means those products that are made in a household kitchen. The household preservation is done according to the same principles as in industry.

For example, the household preparation of a jam begin with high temperature treatment (the principle of destruction of micro-organisms), by boiling the fruits, then continues with the adding of protective substances (such as, sugar that leads to the creation of an environment where any non-destructed spores cannot develop) and ends with the isolation from the external environment

*Corresponding author; *e-mail*: ccernatescu@yahoo.com

(packing the product in a sealed container that does not allow the penetration of external micro-organisms). If the product is stored in suitable conditions such as darkness, coolness and in an airy and dry place, it may have a warranty period the same or even higher than the ones industrially obtained (Gherghi, 1998).

Unlike the most industrial conservation methods, that are mainly mechanical, all processes being automated and on a large scale, the household methods of preserving products are applied to smaller amounts and without adding preservatives or other additives (Gherghi, 1998). Moreover, comparing to the industrial preserves, those household made have some advantages such as: the ingredients have been chosen according to personal tastes; the preparation and hygiene of the ingredients were carried out at the level of their own claims; work technology was based on the chooser recipe, tools and inventory; hygienised vessels used for preserving are their own choice (Beceanu and Chira, 2003).

Among the methods applied for the households preservation of products can be listed (Beceanu and Chira, 2003): freezing, chilling, marinating, concentrating, over salting, drying, milling, etc.

Considering these aspects, the main objective of this paper was to highlight the advantages of households preserving of vegetables and fruits, compared to those industrially preserved. This was done by measuring the total acidity, vitamin C, sugar, salt and vinegar amount for the most usual preserved cans in households (eggplant stew, tomato juice, cucumber in vinegar, strawberry jam and sour cherries compote) and comparison of the experimental data with those obtained for commercially available canned food.

2. Experimental

The raw materials needed for the household preservation process were purchased from a local producer in Iaşi. The auxiliary materials needed to obtain household cans (vinegar, vegetable oil, sugar, spices and salt) were bought from the supermarket. All reagents required for analysis were from Merck.

For comparison, the same type of preserved food, industrially made, was purchased from the supermarket. To remove any confusion, the preserved vegetables and fruits used in the analysis were noted as follows (Table 1):

Table 1

Denotations Used for Canned Vegetables and Fruits Analyzed

Nr. crt.	Product	Denotation	
		household	industrial
1.	Eggplant stew	ZVG	ZVI
2.	Tomato juice	SRG	SRI
3.	Cucumbers in vinegar	COG	COI
4.	Strawberry jam	DCG	DCI
5.	Sour cherries compote	CVG	CVI

The preparation of the analyzed samples was carried out according to a method described in the literature (Cobzaru, 2017). To this end, a certain amount of processed product was introduced into a 250 mL flask, diluted with distilled water, and then the contents were homogenized very well. Thereafter, the mixture was filtered to obtain the sample which was further used in the assays. Exceptions were the cucumbers in vinegar where they were first grounded.

For the *determination of total acidity*, a certain amount of the analyzed sample was measured into an Erlenmeyer flask, then distilled water (to reduce the color of the extract) and 1% alc. sol. of phenolphthalein were added and titrated with NaOH sol. 0.1 N until the color of the solution persist for a few seconds. Total acidity (AT) was calculated applying the formula described in literature, using the corresponding constant for the predominant acid in the analyzed product (Cobzaru, 2017).

In order to *measure the amount of sucrose* from the preserved products, the total and the reducing sugars were determined. Before determining total sugar in the analyzed samples, they were first subjected to the inverting process that occurs by using concentrated hydrochloric acid. Thus, a certain amount of sample was introduced into a 100 mL volumetric flask, and then concentrated hydrochloric acid was added. The sample was heated on a water bath, at 60°C, for 5 minutes, and then neutralized with 1% sol. NaOH using phenolphthalein as indicator and then filled with distilled water to the mark. Next, the inverted solution thus obtained was placed in a 250 mL Erlenmeyer flask, after which Fehling I and Fehling II solutions were added, and boiled for 3 minutes. Finally, the obtained greenish blue solution was titrated with 0.1 M potassium permanganate until a drop of excess permanganate colored it pink.

The amount of inverted sugar, corresponding to the determined copper, was obtained from the Bertrand table, the value for the inverted sugar being necessary for calculating the total sugar content, according to the formula described in the literature (Cobzaru, 2017). Determination of the reducing sugar was performed by using the same method as above, but the sample was not subjected to the inverting procedure. For the determination of sucrose, the subtraction of reducing sugar from total sugar was made.

To *analyze vitamin C*, an amount of analyzed sample was added to a 100 cc flask and then brought up to the mark with starch / HCl solution. A well-measured volume of the sample was taken and titrated with a 0.01 N iodine solution until the occurring blue staining persisted for a few seconds. The amount of vitamin C in 100 g of product was calculated with the relation described in the literature, using the volume of iodine required for the titration (Cobzaru and Horoba, 2011).

Before *measuring the amount of acetic acid*, we had to *establish the acidity* because the latter is a vital information required to calculate the amount of acetic acid. So, the sample to be analyzed was placed in a vial and diluted with boiled then cooled distilled water, titrated with NaOH in the presence of phenolphthalein. The low acidity sample was further subjected to titration with 0.1 N NaOH sol. in the presence of phenolphthalein until the pink color persisted for 1 minute. The high acidity sample was first diluted with distilled water and then titrated with 0.1 N NaOH in the presence of phenolphthalein. Finally, the amount of acetic acid was calculated with the equation described in the literature (Cobzaru, 2017).

To measure the salt amount in industrial and household preserves, we proceeded as follows: a well-measured amount of sample was placed in a 250 mL Erlenmeyer flask, a solution of potassium chromate was added and then titrated with silver nitrate, under vigorous stirring, until the color of the solution has passed from pale straw to red brick. As in the previous case, the amount of salt was calculated with the relation described in the literature (Cobzaru, 2017).

3. Results and Discussions

3.1. Determination of Total Acidity

Table 2 shows the total acidity and pH of the samples analyzed.

Table 2
The Total Acidity and pH for the Analyzed Products

No.	Product	Total acidity, %	pH
1.	ZVI	0.0521	1.83
2.	SRI	0.0730	1.15
3.	COI	0.0990	1.70
4.	DCI	0.0494	2.03
5.	CVI	0.0583	1.42
6.	**ZVG**	**0.0300**	**2.97**
7.	**SRG**	**0.0516**	**2.36**
8.	**COG**	**0.0603**	**2.21**
9.	**DCG**	**0.0212**	**3.25**
10.	**CVG**	**0.0305**	**2.89**

As can be seen from Table 2, the total acidity in industrial preserved products is higher than in those household preserved. This can be attributed to the organic acid content of the raw materials used and their pH, as well as to the thermal preservation treatments. According to the literature, the content of organic acids varies greatly depending on the species, variety and climatic conditions. Furthermore, the organic acids influence thermal preservation treatments because the correlation of pH with temperature causes inactivation of enzymes and microorganisms (Cobzaru and Horoba, 2011).

The pH value (Table 2) shows that the household preserved products have a higher pH than those industrially obtained, which makes them easier to consume by people suffering from digestive disorders.

3.2. Determination of Sucrose

Table 3 presents the experimental data obtained in the determination of sucrose from the analyzed samples.

Table 3
Experimental Results Obtained in the Determination of Sucrose

No.	Product	Sucrose, %
1.	ZVI	5.2
2.	SRI	15.67
3.	COI	2.75
4.	DCI	28.5
5.	CVI	9.9
6.	**ZVG**	**3.4**
7.	**SRG**	**9.9**
8.	**COG**	**0.74**
9.	**DCG**	**20.87**
10.	**CVG**	**6.07**

As seen in Table 3, the sucrose values for industrially produced products are higher than those obtained in households, which makes these products not tolerated by some consumers. In the case of household cans, the dosage of sugar can also be made according to the preferences of those who consume the products, while in industry the same recipe must be respected.

3.3. Determination of Vitamin C

Although it is considered to be a quantitative analysis method, it is not very precise because in vegetal products there are other oxidable substances (reducing agents). Furthermore, vitamin C may also be oxidized rapidly during the preparation of the sample for analysis. That is why experimental results are estimative. Table 4 shows the amount of vitamin C found in the analyzed samples.

Table 4
Amount of Vitamin C in Analyzed Samples

No.	Product	Vitamin C, mg/100 g sample
1.	ZVI	4.69
2.	SRI	4.62
3.	COI	4.64
4.	DCI	5.28
5.	CVI	5.94
6.	**ZVG**	**3.30**
7.	**SRG**	**3.69**
8.	**COG**	**3.05**
9.	**DCG**	**4.62**
10.	**CVG**	**2.64**

The data from Table 4 shows that the products preserved in households have a lower content of vitamin C than those industrially preserved. This explains that vitamin C has been rapidly oxidized both during treatments applied to preserved products and in the preparation of samples for analysis. The higher content of vitamin C in products industrially preserved can be attributed to its use as an additive.

3.4. Determination of the Acetic Acid Amount in the Preserved Solution

Table 5 presents the experimental data obtained.

Table 5
The Acetic Acid Content of the Preservative Solution

No.	Product	%, g acetic acid
1.	ZVI	0.54
2.	SRI	0.84
3.	COI	0.90
4.	**ZVG**	**0.36**
5.	**SRG**	**0.42**
6.	**COG**	**0.72**

From the experimental data presented in Table 5, it can be observed that industrially preserved products have a higher amount of acetic acid than those obtained in the household. This can be attributed to the raw materials used, but also to the processing and storage of the final product. Instead, household products are processed much more carefully and raw materials are of good quality and dosed according to the consumer's preference.

3.5. Determination of the Salt Content of the Preserved Products

Table 6 presents the experimental data obtained

Table 6
Salt Content of the Preservative Solution

No.	Product	Salt, %
1.	ZVI	0.584
2.	SRI	0.467
3.	COI	0.642
4.	**ZVG**	**0.525**
5.	**SRG**	**0.350**
6.	**COG**	**0.292**

From the experimental data presented in Table 6, it can be observed that the industrially preserved products have a much higher amount of salt than those obtained in the household. Large quantities of salt in industrial preserved products can be attributed to processing and conservation. Instead, in the household, although salt is also used as a preservative, it is much more carefully added, its preservative property being probably compensated by longer thermal processes.

4. Conclusions

Industrial and household products were analyzed for measuring the total acidity, vitamin C and sugar. For some cans (eggplant stew, tomato juice and cucumber vinegar), the analysis of the salt and vinegar content was made. The total acidity values of the industrial preserved products are higher than those preserved in the household, possibly due to the organic acid content of the raw materials used and their pH, as well as to the thermal preservation treatments.

Sucrose values for industrial products are higher than those obtained in households, which makes these products not tolerated by all consumers. Products preserved both industrially and in households have a very low vitamin C content, due to the fact that vitamin C has been rapidly oxidized both during the treatments applied to preserve products and in the preparation of samples for analysis. Also, industrial products have a higher amount of acetic acid and salt than those obtained in the household, which is explained by the way of processing, storage and raw materials used.

REFERENCES

Beceanu D., Chira A., *Technology of Horticultural Products, Fresh Valorification and Industrialized*, Ed. Economica, Bucharest, 113-124 (2003).

Cobzaru C., *Processing of Fruits and Vegetables. Practical Applications*, Ed. Pim, Iași (2017).

Cobzaru C., Horoba E., *Natural Extracts. Practical Applications*, Ed. Pim, Iași (2011).

Gherghi A., *Use of Horticultural Products, Interface Between Production and Consumption*, Rev. Hortinform, **3**, 45-49 (1998).

AVANTAJELE CONSERVĂRII LEGUMELOR ŞI FRUCTELOR ÎN GOSPODĂRII

(Rezumat)

Acest studiu prezintă avantajele conservării legumelor şi fructelor în gospodării. Datele experimentale arată faptul că, în comparaţie cu conservele obţinute industrial, produsele conservate în gospodării prezintă avantajele unor preparate simple, fără conservanţi având acelaşi termen de valabilitate ca şi conservele industriale sau poate chiar mai mult şi care se pot obţine după o reţetă proprie.