

THE INFLUENCE OF THE STORAGE PERIOD UPON THE QUALITY OF FRESH FRUITS

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Abstract

Fresh fruits are one of the indispensable components of man's| rational nourishment. The nourishing value of the freshly eaten fruits is due to the chemical components of the latter which are easily accessible to the human body and to which a series of taste and olfactory excitative factors are added which make the fruits be savoured with pleasure any time during the day or any time during any season.

Fruit storage represents an assembly of technological operations performed with the aim of maintaining the quality of the fruits for the freshly estate consumption, an admissible time interval according to each fruit species and type, as well as for expanding the consumption period.

The study related to the influence of the storage period upon the quality of fresh fruit has been performed in laboratory conditions, for three species of fruits: strawberries, apricots and raspberries, each one having two variants of work and which have benn refrigerated and kept at a temperature of approximately 2°C.

Key words: perishable fruits, refrigeration, fruit quality, controlled atmosphere, period of storage

INTRODUCTION

The majority of fruits are considered functional food as they contain one or more substances that have the role to diminish the risk of a disease or the role to improve the way the human body functions. (Banu C., 2010).

The ability to store fruits is influenced by their specific features, by the features ability to regenerate, by their chemical composition and by the relation between the chemical elements, by the maturation degree, by the intensity of the metabolical processes, etc. Very perishable fruits (strawberries) or easily perishable fruits (apricots, raspberries) which have a very sensitive tissue at any mechanical trauma have got a high content of water and a high metabolical activity. (Marca Gh., 2004).

The fruit storage must ensure the prolongation of the storage time of fruit quality. In order to maintain a high biological and nourishing value of fresh vegetal products there must be a permanent control of the physiological and metabolical processes. The decrease of the respiratory metabolism of the fruits leads to the prolongation of the storage period. Fruit storage must ensure the prologation of the fruit quality storage time. (Tuțulescu F., 2013).

The most important factor that makes a fruit able to be stored in a freshly estate is the fruit's active natural immunity, as well as each type of fruit's specific metabolism. The passive immunity has also got an important role being determined by the specific features of the epicarp, by the structural and texture like features and by the maturation degree. (Banu C., 2009).

When at low temperatures a lot of physical transformation appears in food products, determined especially by the heat and mass transfer during the chilling process. As a consequence of the fact that fruits are chilled, unwanted transformations of the natural pigments may appear as well as consistency and form modifications. (Niculiță P., Mona Popa, 2002).

Temporary storage of the strawberries is done in frigorific warehouses at a temperature of 0-2 °C, relative humidity of the air being 85-90% and a powerful ventilation. The storage period is of 3-6 days according to the fruit's health degree, the maturation degree at which the fruit has been harvested, the moment and the way the fruit has been harvested. (Lazăr V., 2006).

The storage of the apricots is done in frigorific warehouses that have a normal atmosphere as well as in warehouses that have controlled atmosphere. The introduction of the fruits in the warehouses is to be done in the shortest time possible after they have been harvested and with as little handling as possible. (Potec I. et al., 1983).

The controlled atmosphere links the effect of the low temperature, of the high relative humidity, of the high content of carbon dioxide and of the low content of oxygen, factors which inhibit the breathing and the sweating process. The intensity of the sweating process of the agricultural products is higher during the period immediately after the harvest. As the water from the fruits disappears, the juice from the fruits' cells gets concentrated, the osmotic pressure increases and the intensity of the breathing process decreases. (Burzo I., 1986).

The optimum conditions for apricots which can be realised only in frigorific warehouses are; temperature -0,5...+0,5°C and RH of 85-90%, the storage period being of 10-15 days according to the harvesting moment. When establishing the storage period one has to keep in mind that in 10-15 days even fruits that had been kept at a temperature of +1°C may lose their flavor and some of their tasty features and that between 4-7 °C these losses become even more obvious. (Beceanu D. și Chira A.).

Raspberries are stored for a very short period of time, for 2-3 days, in frigorific conditions at a temperature of -0,5-0°C and at a relative humidity of 85-90%, some species being able to be kept even for 7 days. A modern way of transporting them and storing them is their intensive treatment with CO₂, which reaches a level of up to 20%. CO₂ manifests a

repressor effect upon the main micro organisms which alter the raspberries during their capitalization period.(Beceanu D. et all, 2008).

MATERIAL AND METHOD

In order to analyse the quality of the fruits according to the period of their storage we have taken into consideration 3 types of fresh fruit: strawberries, apricots and raspberries, each of them containing two variants of work, the fruits having been purchased from the fruit market.

The fruits were stored refrigerated at a temperature of about 2°C, for a period of 3 days for the raspberries, 7 days for the strawberries and for the apricots in the Faculty of Environmental Protection's laboratory called: Food Preservation Methods

The determinations have been performed the moment the fruits have been purchased and after the 3 day storage period for the raspberries and 7 day storage for the strawberries and apricots:

1.Determining the organoleptic characteristics;

2.Determining the chemical-physical indicators of the fruits: the soluble dry substance, acidity, content of C vitamin.

In order to determine the organoleptic characteristics: taste, consistency, smell, color and form, we have used as indicators grades from 1 to 10 and the proportionality factors have been the following: taste – 3, consistency -3, smell – 2, color – 1 form – 1.

inorder to determinethe quantity of soluble dry substance from the fruits, expressed in brix degrees, we have used the refractive method.

In order to determine the quantity of acidity, expressed in grams of malic acid/100ml we have treated the samples with a solution of NaOH in the presence of Phenolphthalein as an indicator.

In order to determine the amount of C vitamin existent in the fruits we have treated the C vitamin with a solution of iodine having amidone as an indicator. In the presence of the iodine the C vitamin oxidizes, iodine decreases and it is expressed in mg/100ml.

RESULTS AND DISCUSSIONS

1. Determining the organoleptic characteristics of the fruits

The qualifications obtained for the 3 types of fresh fruits and after these fruits have been stored and refrigerated are registered in table 1.

In what the organleptic characteristics are concerned we have noticed the following: fresh fruits have got grades between 9 and 10, having specific form and color, their texture and consistency were ferm, they had specific smell and taste and while they were stored they got grades between 7 and 9.

Table 1

Organoleptic notes				
No. of samples	Type of fruit	Organoleptic note		
		Fresh fruit	Fruits stored for 3 days	Fruits stored for 7 days
1.	Strawberries V1	9	-	7
2.	Strawberries V2	9,5	-	8,5
3.	Apricots V1	9,5	-	8
4.	Apricots V2	10	-	9
5.	Raspberry V1	10	9	-
6.	Raspberry V2	9,5	8	-

During storage the organoleptic characteristics register lower grades: the raspberry got the grades 9 at V1 and 8 at V2 after 3 day storage and after 7 day storage the strawberry got a 7 for V1 and the apricots got a 9 for V2.

The raspberry is a very perishable fruit which can be stored for a very short period of time in refrigeration conditions that is why the determinations have been done after this fruit has been stored for only 3 days because after this period of time this fruit is not good for consumption.

The fruits have well preserved their color in comparison to the fresh ones, due to the lack of air which leads to the oxidation of the fruits.

The texture and the consistency of the strawberry and apricot pulp present signs of softening as the fruits have been matured by transforming the carbohydrates and protopectin into pectin. In the raspberry's case its texture became soft due to its over maturation during storage.

The pulp has a lower content of juice due to water losses and the taste and flavor lost their intensity.

1. Content of soluble dry substance

The content of soluble dry substance of the analyzed fruits is presented in table 2.

Table 2

The content of soluble dry substance of the fruits				
No. of samples	Type of fruit	Fruit storage period		
		Fresh °Brix	Pstored for 3 days °Brix	Stored for 7 days °Brix
1.	Strawberries V1	8,1	-	7,5
2.	Strawberries V2	10,9	-	13,6
3.	Apricots V1	7,2	-	9,00
4.	Apricots V2	12,5	-	13,5
5.	Raspberry V1	7,5	7,00	-

6.	Raspberry V2	11,1	10,5	-
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From the data analyzed we can notice that fresh fruits present variations of the content of dry substance, even within the same species of fruit, as well as after the storage period.

At the fresh strawberries the content of soluble substance has the value of 8,1°Brix at V1 and 10,9°Brix at V2.

After having been stored for 7 days, sample V1's soluble substance decreases to 7,5°Brix, and at sample V2, the content of soluble substance increases to 13,6°Brix.

At fresh apricots the content of soluble substances has been of 7,2°Brix for sample V1 and of 12,5°Brix at sample V2, and after 7 days of storage their content increases to 9°Brix at sample V1 and to 13,5°Brix at sample V2.

At the fresh raspberry the content of soluble substance has been of 7,5°Brix for V1 and of 11,1°Brix for V2, and after a 3 day storage the content of the soluble substance decreases to 7,00°Brix for V1 and to 10,5°Brix in the case of V2.

During storage the poli carbohydrates are hydrolytically degraded into mono carbohydrates having as a result the content's increase in soluble carbohydrates which are later degraded because they get oxydized and the total quantity decreases.

2.2. The acidity content of the analyzed fruits

The measurable content of acidity for the three types of analyzed fruits is presented in table 3.

Table 3

No. of samples	Type of fruit	Period of fruit storage		
		Fresh g malic acid/100 ml	Stored for 3 daysg malic acid/100 ml	Stored for 7 daysg malic acid/100 ml
1.	Strawberries V1	0,80	-	0,70
2.	Strawberries V2	0,70	-	0,60
3.	Apricots V1	0,90	-	0,70
4.	Apricots V2	0,70	-	0,60
5.	Raspberry V1	1,20	1,10	-
6.	Raspberry V2	1,10	0,90	-

From the presented data one can notice that the acidity of the fresh fruits has got values between 0,70 g malic acid/100 ml at the strawberries V2 and at apricots V2 and of 1,20 g malic acid/100 ml at the raspberry V2.

For the refrigerated fruits the acidity presents lower values, being between 0,60 g malic acid /100 ml at strawberries V2 and apricots V2, and it is of 1,10g malic acid/100ml at V1 for raspberry.

It can be noticed that the higher values of acidity are registered for the fruits that have got a lower content of soluble dry substance within each species, the values being the same for the fresh fruits as well as for the ones kept refrigerated.

2.3.Content of C vitamin

The content of C vitamin for the 6 variants of analyzed fruits is presented in table 4.

Table 4

Content of C vitamin				
No. of samples	Type of fruit	Fruit storage period		
		Fresh mg/100g	Stored for 3 days mg/100g	Stored for 7 days mg/100g
1.	Strawberries V1	53,90	-	46,60
2.	Strawberries V2	58,64	-	51,26
3.	Apricots V1	11,36	-	8,33
4.	Apricots V2	13,27	-	10,56
5.	Raspberry V1	19,55	17,62	-
6.	Raspberry V2	24,61	21,34	-

The content of C vitamin in the fresh fruits presents variations between 11,36mg/100g at apricots V1 and 58,64 mg/100g at strawberries V2.

After the fruits have been stored for 3 days and for 7 days respectively in what the apricots are concerned the content of their C vitamin decreases from 11,36mg/100g to 8,33mg/100g in case of V1 and from 13,27mg/100g to 10,56 mg/100g, in case of V2; at strawberries the content of C vitamin decreases at V1 from 53,90 mg/100g to 46,60mg/100g, and at V2 from 58,64 mg/100g to 51,26mg/100g; in what the raspberry is concerned the content of C vitamin in the fresh fruit is of 19,55mg/100 g at V1 and it decreases after 3 days of storage to 17,62mg/100g, and at V2, from 24,61 mg/100g, it decreases to 21,34mg/100g.

The content of C vitamin decreases while the fruits are stored as the C vitamin is soluble in water and at a long contact with the air it decomposes itself.

CONCLUSIONS

Fruits form one of the indispensable elements of man's sensible nourishment. The nourishing value of the fruits eaten in their raw estate is due to their chemical components which are easily accessible to the human body, to which a series of visual, olfactory and taste excitatives are added which make the fruits be consumed with pleasure any time of day or any season.

Fresh fruits have a high content of water (75-95%) which gives them freshness and softness but at the same time they present an unwanted environment which can lead to unwished reactions that can affect their chemical composition as well as their quality.

Carbohydrates which exist in a percent of 75% from the dry substance are greatly represented by simple sugars. The presence of simple carbohydrates in fruits and in vegetables contribute to the shortening of their storage period as the simple sugars are organic substances that can be easily decomposed by their own enzymes or by the enzymes of micro organisms.

In what the organoleptic characteristics are concerned fresh fruits have got grades between 9 and 10, having specific form and color, their consistency and texture were firm, they had characteristic smell and taste. And between the storage period they got grades between 7 and 9.

The content of dry substance presents variations at the fresh fruits, even within the same species of fruit, as well as after the fruits have been stored. The content of soluble dry substance is between 7,2°Brix at fresh apricots V1 and 12,5 °Brix at fresh apricots V2, and after the storage it is between 7,5 °Brix at strawberries V1 and 13,5 at apricots V2.

In the case of refrigerated fruits the acidity presents lower values between 0,60 g malic acid /100 ml at strawberries V2 and at apricots V2, and it reaches 0,90g malic acid/100ml at raspberry V2.

Fruits that have got a lower content of soluble dry substance register higher values of acidity within each species in what the fresh fruits are concerned as well as in what the refrigerated fruits are concerned.

The content of C vitamin decreases while fruits are stored as the C vitamin is soluble in water and after a long period of contact with the air it decomposes itself.

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