

## RESEARCHES ABOUT THE SUGARS CONTENT EVOLUTION IN DIFFERENTS VEGETABLES-RAW MATERIALS FOR THE FERMENTED JUICES

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### Abstract

*The influence of the storage time on the quality of carrots - from the point of view of the sugars amount and the sweetness degree - has been studied. From fresh carrots originated in the vegetable basin of Dambovita area has been obtained juice, which was also analyzed. The coefficient of the multiple correlation R2 was determined.*

### INTRODUCTION

The lactofermented juices are obtained from vegetables through the lactic acid fermentation of the sugars which are metabolized under the micro-organisms enzyme action in lactic acid as principal product.

The lactic acid participates at the specified flavour but he has some nutritional implications: decrease the intestinal pH, intensified the secretion of the digestion enzymes, inhibit the harmful micro-organisms, prevent the undesired fermented processes, increase the phosphorus and calcium assimilation [9].

The lactic acid fermentation process depend on the important number of factors, the most important being the chemical composition of the raw material. These composition varied depending on the species and the storage time [10]. Consequently, is important to know the evolution of the sugar content in the but of establishing the moment when there are degradate through adulteration [6].

The juices obtained from carrots and fermented from differents strains of lactic acid bacteria were considered possible foods in France [7], [8]. Also all the vegetables which content at least 1% reducing sugars can be submit at the lactic acid fermentation [3].

Carrot flavor is affected by free sugar content, volatile constituents and free amino acids. Fresh and processed carrot flavor is associated with elevated sugar content [5].

Depending on the sugars content which characterized the analyzing species there are selected the raw materials with a high content of fermentescible sugars.

### MATERIALS AND METHODS

Fresh vegetables were purchased in a local fruit vegetable market in Romania, in September. The carrots were stored at steady temperature and relative humidity, and were also analyzed in April, respectively in June.

The carrots were weight and specifically conditioned by washing, scrubbing and elimination of non-edible pieces. After this treatment (that is usually performed in the enterprises of vegetables processing, particularly from each species) the carrots were biochemical analyzed.

The juices were obtained by pressing crushed vegetables, with a home-made apparatus.

The samples were named like this: C1- fresh carrots purchased in September; C2-carrots stored seven months at 20 degrees C; C3-carrots stored nine months at 20 degrees C; JC1-juice obtained by pressing from sample C1; JC2-juice obtained by pressing from sample C2; JC3-juice obtained by pressing from sample C3.

The chemical analysis performed both at the carrots and at the fresh juice were the following:

determination of reducing sugars content, expressed in g/100g - by the Schoorl method, after a previous treatment with lead acetate  
determination of total sugars content, expressed in g/100g - by the Schoorl method, after the inversion of saccharose  
determination of total acidity, expressed in g acid malic/100g - by the visual titration with a 0,1N solution of NaOH using phenolphthalein indicator

The sweetness degree was calculated by dividing the total sugars content to the total acidity.

The coefficient of the multiple determination  $R^2$  was calculated using Lotus 1-2-3 Help programme [1].

## RESULTS AND DISCUSSIONS

The sugars content - both reducing and total - decrease along the analyzed period (figure 1). The explication consists on the one hand of the hydrolysis of saccharose and on

the other hand of monoglucides utilisation in the oxidative processes.

The intensity of these processes depends on the species and the sort, being also influenced from some external factors: the temperature, the air composition of the storage rooms, the relative humidity of the air etc.

The decreasing of the sugars content during the accounting processes is accompanied by the energetic value reducing, by the textural firmly decreasing and the commercial value on the whole.

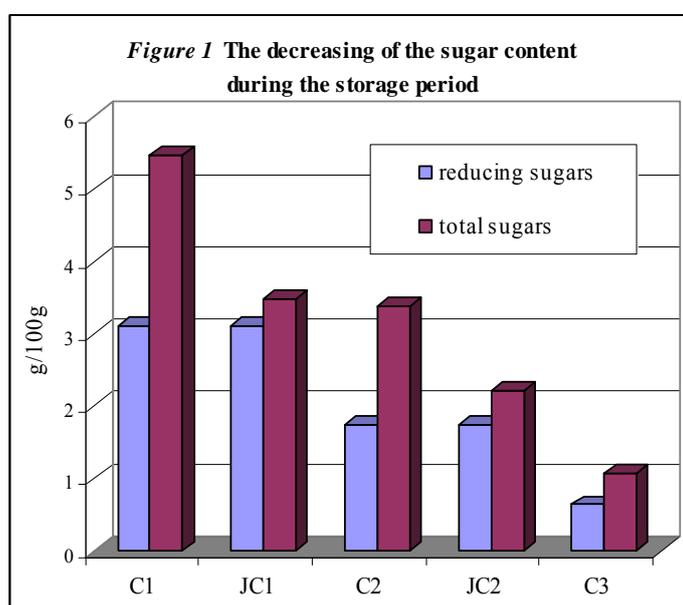


Figure 1. The decreasing of the sugar content during the storage period

**Table 1**  
**The percentage losses of the sugars in the squashing**

The sample	Reducing sugars	Total sugars
C1	0	36,33
C2	0	34,71
C3	31,25	31,35

The juice extraction from the carrots caused important losses of sugars content (table 1). This is an important argument from the capitalization this sort of waste - the squashing - in another but than in the animals feed.

In all the cases the total sugars losses are important and they are varied around the value of 35%.

Analyzing comparatively the data from table 1 result that the juice extraction at the initial moment and after seven months caused losses only of the saccharose (the monoglucides are find complete in the juice). However, after nine months of the storage period of carrots an important percentage of reducing sugars pass through the squashing. This fact can be explained from the modification of the textural firmly (due of

the water losses) which prevent the obtaining of juice and diminish the extraction efficiency.

The quality of the carrots - from the point of view commercial and technological -

depends both on the sugar content and the sweetness degree. The correlation between the two parameters is rendered in the figure 2.

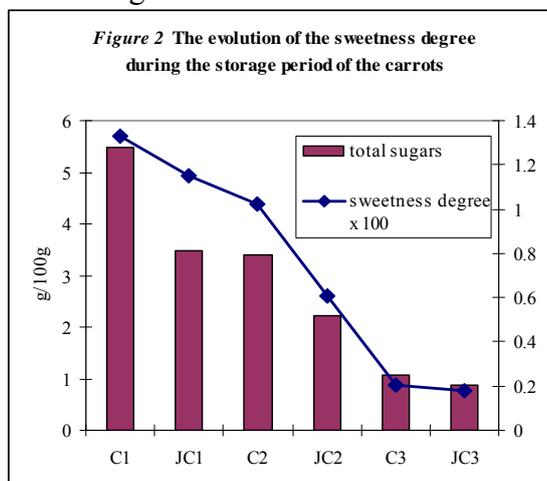


Figure 2 - The evolution of the sweetness degree during the storage period of the carrots

The sweetness degree represents 76% from the initial value after seven months of the carrots storage and only 15% after nine months. Concerning the evolution of this quality parameter in all the juice samples, it can be observed that the decreasing is about 53%, respectively 15% at the analyzed periods of time. From the data established in June the curve has a slowly decreasing.

Comparatively, the juice extraction caused a significant loss of the sweetness degree: 86,5% in the case of the fresh carrots purchased in September.

The organic acids content influence both the sensorial quality of vegetables (through the act on the flavour) and the technological processing. On the growth period of vegetables it can be observed an accumulation of the free organic acids, but on the maturity period it happens a decreasing of the acidity due of the consumption in metabolism process [4]. It is known also that the organic acids' burning depends on their

kind, the malic acid being easily oxidized than citric acid.

A similar evolution can be observed after seven months of the carrots storage. However at the end of the analyzing period the total acidity (expressed as malic acid) increase (table 2). The explication consists on the hydrolysis of pectic substances and the appearance of the important amounts of pectic acid at the end of the storage period of time.

The correlation between the sweetness degree and the total sugar content, respectively the acid content can be realised through graphically representation. The correlation can be verified and measured through the statistical methods, the model of the mathematic regression being one of the most used.

**Table 2**  
**The total acidity content in the analyzed samples – carrots and juices**

Sample	c1	jc1	c2	jc2	c3	jc3
g malic acid/100g	0,041	0,0301	0,033	0,036	0,053	0,05

**Table 3**  
**Calculated regression**

Regression Output:		
Constant		80,064572
Std Err of Y Est		6,9748118
<b>R Squared</b>		<b>0,9881381</b>
No. of Observations		6
Degrees of Freedom		3
X Coefficient(s)	22,428385	-1643,3969
Std Err of Coef.	2,2342657	415,57421

The dependent variable (y) was the sweetness degree; the independent variables were the sugars content (x1) and the acid content (x2). The regression model is showed in the table 3 and figure 4.

The R2 value indicate a participation quota of the independent parameters on the sweetness degree about 0,99. Result that the correlation beetwen the analyzed parameters is very strong.

**CONCLUSIONS**

The method of juice extraction from carrots has a significant influence on the non-reducing sugars content so long the vegetables are fresh. Consequently, the influence on the quantity of fermentescible substrat of the lactic acid process it isn't major. However, the influence about the flavour and the sweetness degree is important.

Practical, the analyzed vegetables can't be used as raw material for the lactic acid fermentation.

After nine months of storage the carrots at 20 degrees C they have only 20% from the initial amount of sugars and the sweetness degree decrease with 84,7%.

The R2 value showed a strong relation beetwen the sugar content, the malic acid content and the sweetness degree.

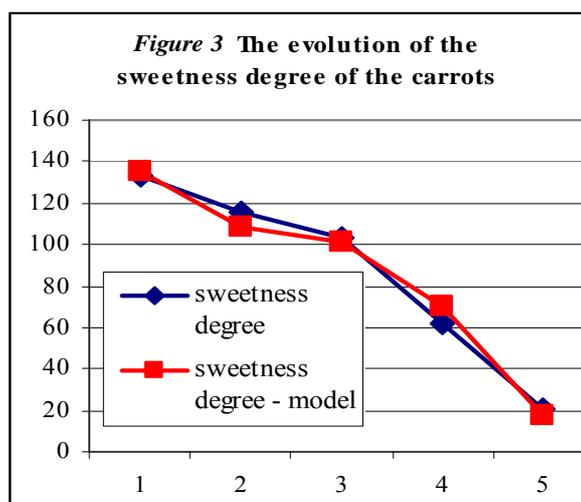


Figure 3 The evolution of the sweetness degree of the carrots

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