STUDY REGARDING THE QUALITY OF CONCENTRATED APPLE JUICE OBTAINED AT SC AGRANA JUICE SRL OF VASLUI

STUDIU PRIVIND CALITATEA SUCULUI CONCENTRAT DE MERE OBȚINUT LA SC AGRANA JUICE SRL VASLUI

NECHITA CHEREŞ Diana[1]
e-mail: nechitaisctv@yahoo.com

Abstract. *Research was carried out in both USAMV Iassy and SC Agrana Juice SRL of Vaslui –company specializes in production of concentrated apple juice. This study aim is to determine the quality of concentrated apple juice obtained at SC Agrana Juice SRL and the compliance with the to european market requirements .For this purpose, samples of concentrated apple juice were taken and analysed during period of study. Physical-chemical determinations were made in order to evaluate if the final product obtained at SC Agrana Juice SRL Vaslui meets the quality requirements imposed by standards in force.*
Key words: quality, concentrated apple juice

Rezumat. *Cercetările au fost realizate atât în cadrul SC Agrana Juice SRL Vaslui-firmã specializatã în fabricarea sucului concentrat de mere cât şi în în cadrul USAMV Iaşi. Prezentul studiu urmãreşte determinarea calitãții sucului concentrat de mere obținut de firma vasluianã şi alinierea la cerințele pieței europene. In acest scop au fost prelevate probe din produsul finit obținut la SC Agrana Juice SRL. S-au efectuat analize fizico-chimice pentru aprecierea calitãții acestuia, pe baza standardelor în vigoare.*
Cuvinte cheie: calitate, suc concentrat mere

INTRODUCTION

Concentration of fruit juice is made for a dry matter content of 30-50% (65), the technical procedures used in concentration technology being: thermal concentration, crioconcentration (with change of phase) and the reverse osmosis (without change of phase) (Ashurst and Dennis, 1997).

Crioconcentration (Bes et al, 2006) is the concentration method with a phase change, that modifies in a more reduced proportion the chemical nature or organoleptic characteristics of the products transformed, but thermal method tends to be most spread technical procedure of concentration all over the world. It may be achieved in three stages of temperature (10-25 0 C, 40-100 0 C 0 c, 115-130) in two ways:

- normal vacuum- duplicate boilers;
- low vacuum, which may be continous or discontinous, in instalations-process called vacuum concentration; allows the reducing of the boiling point

[1] Department for Agriculture Vaslui, Romania

temperature, of the duration of the process, and the loss of flavours and nutrients are minimal (Beceanu, 2011).

The concentrated apple juice is the product obtained from apple juice through the physical elimination of some quantity of water content. If the product is meant for direct consumption, the water quantity eliminated is at least 50%.

The concentrated apple juice is a viscous limpid tasteless liquid lacking the caramel smell having the colour and consistency of bee honey and a dry substance content of about 65 ^{o}Bx. (OMAPDR no.768/2003).

By concentrating juices they obviously register low costs for manipulation and transport. At the same time, by concentration they also register a diminution of water activity leading to the increase of microbiological stability and extension of storage time in determined conditions. The so-called "commercially sterile juices concentrates" are meant for marketing (dilutable juices) (Ashurst, 2005). They also may be stored and used as a raw material for subsequent processing.

SC Agrana Juice SRL has used a performant concentration plant with quadruple effect also equipped with a distillation column designed to recover the characteristic flavour (which insures the best flavor recovering).Required evaporation heat is produced by thermal power plant of its own.

Under certain conditions - the vacuum of 10-100 MB and with the help of steam 40-105 ^{o}C- the capacity of the plant is about 450 t concentrated apple juice/24 h, bearing in mind that the maximum flow of the apple juice is 17000 L/h (SC Agrana Juice SRL - Instructions on technological process of obtaining concentrated apple juice).

MATERIAL AND METHOD

Qualitative determination for the final product –concentrated apple juice - has to be an objective exam and it supposed that a lot of physical-chemical determinations to be done. For this purpose, samples of concentrated juices were taken and analysed in the period under study: 2007-2009. All those samples were taken at random from those 8 storage tanks of stainless steel, with a capacity of 60 cubic metres, which are owned by firm, each sample being about 1 kg concentrated apple juice (table 1).

Table 1

Variants analysed and sampling date

YEAR	SAMPLING DATE	VARIANT
2007	12.09.2007	V1
	24.10.2007	V2
2008	14.10.2008	V1
	23.10.2008	V2
2009	02.10.2009	V1
	09.10.2009	V2
	02.11.2009	V3

Qualitative determinations for the concentrated apple juice were carried out at the Technology of horticultural products lab within USAMV Iassy and have involved

determination of titrating acidity (SR 8613-4:2009); the determination of dry soluble substance content by refractometric method (SR 2213-5:2009) and determination of ash content. At the same time, chromatographic analysis by CIE Lab-76 method was carried out at Oenology lab from USAMV Iassy, in order to establish the chromatic characteristics of the final product.

The CIE Lab-76 method makes it easier to understand the correspondence between visual impression of colour and numeric expression of chromatic parameters.These chromatic characteristics allow us to better understand about the degree of opalescence and thus about the degree of oxidation of the product concerned.The colour components are calculated on the basis of absorbance spectra recorded in the field of UV-VIS using a S-200 Analytic Jena spectropfotometer coupled with an IBM computer.The absorbance spectra have been digitised and processed with the help of the "VINCOLOR" improved program.The results of measurements shall be expressed by following chromatics parameters:

- L – brightness or psyhometric clarity;
- a– the coordinate of red-green complementary colours;
- b – the coordinate of yelow-blue complementary colours;
- C – chromaticity or colour saturation

RESULTS AND DISCUSSIONS

The main acids found in concentrated apple juice (tab. 1) are the malic acid, tatric acid, follow by the succinic acid, fumaric acid, citric acid, etc.-acids with lower concentration .The titrating acidity of apple juicies is mostly due to the presence of malic acid and this is also noticeable in the case of analyzed samples.

Table 2

Share of main acids identified in the concentrated apple juice for the period under study

Sampling date	Vari-ants	Malic acid g/l	Tartric acid g/l	Succinic acid g/l	Fumaric acid mg/100g	Acidity g/l
12.09.2007	V1	**4.90**	3.70	0.37	**2.50**	9.75
24.10.2007	V2	5.30	4.35	**0.29**	**0.60**	10.33
14.10.2008	V1	6.00	**2.56**	0.40	1.00	**9.05**
23.10.2008	V2	5.80	**4.60**	0.30	0.85	11.20
02.10.2009	V1	6.40	2.20	0.35	1.02	9.53
09.10.2009	V2	**6.87**	**4.60**	**2.00**	1.65	**11.95**
02.11.2009	V3	6.10	3.60	0.37	0.40	**10.60**

They were not recorded significant differences regarding the titrating acidity of concentrated juice samples expressed in malic acid g/100 g of product, from one year to the next - the average value of the parameter examined being 0.51 g malic acid /100g of product in 2007, 0.59 g malic acid /100g of product in 2008 and 0.65 g malic acid /100g of product in 2009.The minimum value of the 7 variants under study, was 0.47 g malic acid /100g of product, while the upper

limit of the parameter examined being 0.68 g malic acid /100g of product , in 2009.

Tartric acid- has been noticed in all 7 samples of concentrated apple juice with mean values ranging between 2.56-4,6 g/l, the contents of tartric acid being about 1.5 times smaller than content in malic acid.

Succinic acid- has been identified with less then 1 g/l values.

Citric and fumaric acids - the presence of small amount of these acids has been identified - they recorded 0,43 g/l as the highest value regarding the citric acid content and by µg order in case of fumaric acid ; the amounts of both these acids content identified as relatively devoid of matter.

Chemical determinations carried out on the seven variants of concentrated apple juice taken in the years 2007-2009, from different batches from S.C. Agrana Juice SRL Vaslui indicates the titrating acidity of compliance with STATE STANDARD No. 1073/70

Table 3

Soluble dry matter content (^{0}Bx) of the variants under study

SAMPLING DATE	VARIANT	SUS (^{0}BX)
12.09.2007	V1	**69.7**
24.10.2007	V2	**71.6**
14.10.2008	V1	70
23.10.2008	V2	69.9
02.10.2009	V1	69.8
09.10.2009	V2	70.0
02.11.2009	V3	70.2

In the case of concentrated juice, were not recorded significant differences between the variants analysed regarding the dry soluble content. Where there has been a near 70 S.U.S ^{o}Bx , the product is subjected to a new concentration in recirculation by Unipektin facility until the quantity of soluble dry substance considerably auguments up to the desired value(until it has reached the desired quality parameter).

Thus, for the concentrated apple juice variants under study , the minimum value regarding the dry soluble content was about 69,7 ^{o}Bx, while upper limit of the amount af dry soluble substance was 70,2 ^{o}Bx. (tab 3). SC Agrana Juice SRL company comply with the rules imposed by the STAS 5956/71.

Table 4

Mineral content (ash) of the variants under study(mg/g of product)

SAMPLING DATE	VARIANT	ASH CONTENT MG/G PRODUS
12.09.2007	V1	**3.47**
24.10.2007	V2	3.64
14.10.2008	V1	3.56
23.10.2008	V2	4.29
02.10.2009	V1	3.50
09.10.2009	V2	4.04
02.11.2009	V3	**4.41**

The ash content of samples collected in the period under study varied with values ranging between 3.47 - 4.41 mg/g of product. The bottom limit of ash content 3.47 mg/g of product was recorded in 2007, while highest value 4.41 mg/g of product was noticed in the last year of study (tab.4).

The mineral (ash) content increases as the technological process advances to obtain concentrated apple juice.

The chromatic characteristics of concentrated apple juice

The results of measurement regarding the chromatic characteristics of concentrated apple juice (tab 5) were expressed by following chromatics parameters.

Table 5

Results obtained by C.I.E Lab-76 method for the variants analysed in the period 2007-2009

Sample		Brightness L 0 (opaque 100 (transparent colourless)	Colour coordinates		Colour saturation
SAMPLING DATE	Variant		a red (+) green (-)	b yelow (+) blue (-)	
12.09.2007	V1	1,00	**-0,16**	0,25	0,30
24.10.2007	V2	**2,60**	0,11	**0,01**	**0,11**
14.10.2008	V1	0,20	1,61	3,16	3,55
23.10.2008	V2	0,90	0,11	1,08	1,09
02.10.2009	V1	**0.1**	**8.01**	**7.00**	**10.64**
09.10.2009	V2	0.5	2.67	1.71	3.17
02.11.2009	V3	1.3	0.18	0.08	0.20

Brightness L, characterizes the appearence of the product, its clarity. The brightness may have absolute values in the range 0 (for a sample Black opaque) to 100 (for transparent colourless samples).

The values obtained (tab. 5) are in compliance with the visual appearance of the concentrated apple juice.For the period under study, taken in the case of concentrated juice, brightness had values between 0.1 and 2.6, with an average of 0.95. The higher colouring intensity is the more the psyhometric clarity of product is lower.

C parameter, or more simply chromaticity or colour saturation shows that the test sample may have a more or less pure colour, meaninig is more or less mixed with white.

In relation with brightness L, chromaticity is in a negative correlation: the high brightness juicies have a low chromaticity and vice versa- juicies with high chromaticity, like the concentrated juice, are very low brightness.For instance, variants 1 of the year 2009 presented the lowest value of brightness 0.08.

For variants of concentrated apple juice analysed (fig. 5), the chromaticity C took values between 0,3 and 10.64, with an average value recorded of 2.73

The a parameter represents the coordinate of red-green complementary colours. This parameter often presents negative values for those samples in where green tonalities are prevailing over the red ones.

In fact, parameter a analysed for the concentrated juice indicated positive values (to red), with a single exception (V1-2007, slightly greenish)- for most of variants, the yelow-brownish tonalities predominate.

The b parameter represents the coordinate of yelow-blue complementary colours.

For variants of concentrated apple juice analysed (fig. 7), values of b parameter have ranged between 0.01-7.00, both the pozitive values and yelow tonalities have prevailed.

Average values have varied between a mimin located around 0.13 in 2007 and a maximum of 2,93, which indicates a brownish colour, higher values being appropriated for a more intense hue of yellow.

CONCLUSIONS

1. The average value of titrating acidity had an ascending trend, reaching 0.60 malic acid g/100 g of product in the concentrated juice.

2. In terms of dry soluble content were not recorded differences between the variants analysed because due to evaporation of a large content of water during the four stages of concentation, the quantity of soluble dry substance considerably auguments up to the desired value-70 ^{o}Bx. Otherwise the product will be recirculated trough the concentration device.

3. The positives values recorded for both *a* and *b parameters* indicate yellow-brownish tonalities and moreover the brightness values and C parameter values and are in concordance with the visual aspect of the concentrated apple juice.

4. According to the tests run, SC Agrana Juice S.R.L. of Vaslui obtains a high quality product which complies with the requirements of the standards in force.

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