STUDIES OF THE INFLUENCE OF THE DIFFERENT SELECTED YEAST ON THE AROMATIC COMPOUNDS FROM CIDER

STUDIU PRIVIND INFLUENŢA DIFERITELOR PREPARATE LEVURIENE FOLOSITE ÎN TEHNOLOGIA DE PRODUCERE A CIDRULUI ASUPRA COMPUŞILOR DE AROMĂ

TUDOSE-SANDU-VILLE Ş.,[1] NICULAUA M.[2], COLIBABA Cintia[1], ANDRIEŞ M. T.[1], ZAMFIR C.I.[2], LUCHIAN Camelia Elena[1], COTEA V. V.[1]
e-mail: andriestibi@yahoo.com

Abstract. *Cider is an alcoholic beverage made from the fermented juice of apples and whose production technology does not differ greatly from that of wine. This study wants to identify the influence of selected yeast to aroma compounds from cider. The cider samples were obtained by 110L of apple juice after classic fermentation. It was divided into seven glass containers of 15 liters of juice and subjected to fermentation. It was used seven types of selected yeast: V1-Fermativ Blanc Aromatique Sodinal®, V2-Lalvin Rhone 2056 Yseo Lallemand®, V3-Maurivin AB®, V4-Yseo Cross Evolution Lallemand®, V5-Fermactive Thyol Sodinal®, V6-Afinity ECA5 Levure-Yeast®, V7-Fermactive RBR®. The primary fermentation lasted for two weeks at a constant temperature of 18 ° C. The secondary fermentation happened after bottling. The cider aroma compounds were analysed by gas chromatography. It should be noted that it is not possible to carry out the quantitative analysis of the flavor compounds, so that the areas of the peaks corresponding to the identified compounds were used. It has been studied how the area increases depending on the yeast strains used. The results show a high content of flavor compounds of the group of alcohols, esters and acids in all seven variants. Of all seven variants of levurian preparations, it was noted in the experiment with a high number of aromatic compounds in V3-Maurivin AB®.*
Key words: cider, aromatic compounds, selected yeast

Rezumat. *Cidrul este o băutură slab alcoolică ce se obţine prin ferementarea sucului de mere şi a cărei tehnologie de obţinere nu diferă foarte mult de cea a vinului. Scopul acestei lucrări este de a identifica influenţa diferitelor preparate levuriene asupra compuşilor de aromă din cidru. Variantele experimentale supuse studiului s-au obţinut prin tehnologia clasică de fermentaţie la sec în damigeană utilizându-se aproximativ 110 L suc de mere pasteurizat, împărţit în mod corespunzător în şapte damigene, a câte 15 L de suc şi supus fermentării. S-au utilizat şapte tipuri de levuri selecţionate astfel: V1-Fermativ Blanc Aromatique Sodinal®, V2-Lalvin Rhone 2056 Yseo Lallemand®, V3-Maurivin AB®, V4-Yseo Cross Evolution Lallemand®, V5- Fermactive Thyol Sodinal®, V6-Afinity ECA5 Levure-Yeast®, V7-Fermactive RBR®. Fermentaţia*

[1]University of Agricultural Sciences and Veterinary Medicine Iasi, Romania
[2] Research Centre for Oenology, Romanian Academy - Iaşi, Romania

primară a durat două săptămâni, la temperatura constantă de 18° C . Cidrul obținut după prima fermentație a fost separat de pe drojdii şi îmbuteliat, alături de „licoarea de tiraj" pentru declanşarea fermentației secundare. Pentru analiza compuşilor de aromă din cele şapte variante experimentale de cidru obținute folosind diferite suşe de levuri selecționate s-a utilizat gaz-cromatografia. Trebuie menționat faptul că nu este posibil să se efectueze analiza cantitativă a compuşilor de aromă, astfel că s-au utilizat ariile picurilor corespunzătoare compuşilor identificați. S-a studiat cum creşte aria în funcție de suşele de levuri folosite. Rezultatele obținute indică un conținut ridicat de compuşi de aromă din grupa alcoolilor, esteri şi acizi în toate cele şapte variante. Din toate cele şapte variante de preparate levuriene s-a remarcat în urma experimentului efectuat cu un număr ridicat de compuşi aromați, V3-Maurivin AB®.
Cuvinte cheie: cidru, compusi de aromă, preparate levuriene

INTRODUCTION

Native from France, cider is known as an alcoholic drink made from apples. In France, about 2 million hectoliters are produced annually of which half is marketed. The main French regions producing cider are: Normandy, Brittany, the Land of the Loire, the Basque Country etc. (Lagrang, 1995). In order to obtain cider, it is preferable to use apple varieties with a lower sugar content, which at maturity have a dense pulp and a tawny taste (Delambre, 2001). From apples harvested with low quantity of sugars or fallen, a cider with lower sensory and quality properties will be made. Therefore, raw material preparation operations are important because the quality of the raw material influence on the quality characteristics of the final product - the cider (Lagrang, 1995).

It should be noted that the fermentation of the apple juice is done immediately after clarification and filtration and it is recommended that the alcoholic fermentation be carried out with the selected yeast (Stănciulescu, 1973). The rate of fermentation of sugars depends on the characteristics of yeast strains, the amount of inoculum, the physiological state of the culture, the concentration in the wort extract and its composition, the fermentation temperature, the pressure, the shape of the container (Hough, 1995).

Saccharomyces cerevisiae is known as Saccharomyces cerevisiae variety ellippsoideus or Saccharomyces elipsoideus and is the most important yeast for fermentation of musts. Yeasts of this species have an ellipsoidal shape, but globular or elongated cells can also be encountered. The yeasts have a high yield, averaging 1 ml of pure alcohol from 17 g of sugars (Cotea, 1985). The fermentation temperature should be between 15 and 18 °C, but it is preferable that after the start of the fermentation, the temperature should be lower at 10-12 °C. A low fermentation temperature has the following advantages: flavors do not volatilize, some of the harmful microorganisms work harder and the cider obtained will be finer, more "silky" (Neacşu *et. al.,* 2012).

These flavors are mostly attributed to classes of compounds such as higher alcohols, aldehydes, ethyl esters of fatty acids, fatty acids, ketones, monoterpenes and volatile phenols (Andujar-Ortiz *et. al.*, 2009).

MATERIAL AND METHOD

The purpose of this study was to obtain data on aromatic compounds composition from cider obtained from apples using different selected yeast. The raw material was 110L of apple juice harvested in 2017.
The apple juice was divided into seven glass containers of 15 liters of juice (tab. 1) and subjected to fermentation.

Tabel 1

The main compositional characteristics of apple juice used to obtain experimental variants of cider

Compositional characteristics	Value
Sugar (g/L)	142.6
Total acidity (g/L malic acid)	3.35
pH	2.6
Density (g/cm^3)	1.062
Malic acid (mg/L)	2.57
Glucose (g/L)	36.2

In every glass container was introduced a selected yeast: V1-Fermativ Blanc Aromatique Sodinal®, V2-Lalvin Rhone 2056 Yseo Lallemand®, V3-Maurivin AB®, V4-Yseo Cross Evolution Lallemand®, V5-Yseo Cross Evolution Lallemand®, V6-Fermactive Thyol Sodinal®, V7- Afinity ECA5 Levure-Yeast® (tab. 2).

Table 2

Quantity and selected yeast used to samples

Sample	Selected yeast	Quantity (g/15L)
V1	Fermativ Blanc Aromatique Sodinal®	2.25
V2	Lalvin Rhone 2056 Yseo Lallemand®	4.80
V3	Maurivin AB®	4.50
V4	Yseo Cross Evolution Lallemand®	3.75
V5	Fermactive Thyol Sodinal®	2.25
V6	Afinity ECA5 Levure-Yeast®	6
V7	Fermactive RBR®	2.25

In this mode we was obtained seven samples of cider. The primary fermentation lasted for two weeks at a constant temperature of 18 °C. After completion of the alcoholic fermentation, the cider was separated from yeast and then was bottling. For secondary fermentation which was happened in bottle we used same selected yeast which used to primary fermentation.

For each sample taken after filtration and decarbonation of the sample, physicochemical analyzes (***2015), determination of flavor compounds were performed.The aromatic compounds in these ciders were identified using the Shimadzu GC-2010 equipment coupled with the QP2010 Plus spectrophotometer.

RESULTS AND DISCUSSIONS

Even if apples juice intended for cider had homogeneous composition characteristics, the composition of the cider is different due to the different yeast used.

Product analyzes were performed after primary fermentation before bottling and after the second fermentation. The main physical-chemical parameters of the analyzed ciders samples are shown in table 3.

Table 3

The main compositional characteristics of experimental cider variants after the second fermentation

Sample	Total acidity (g/L malic acid)	Volatile acidity (g/L acid acetic)	pH	Density ρ_{20}^{20}	Alcoholic strength (%vol.)	Sugar (g/L)
V_1	1.97	0.51	4.2	0.9961	7.53	1.91
V_2	1.91	0.49	4.1	0.995	7.23	4.05
V_3	1.71	0.48	4.1	0.9951	7.92	4.15
V_4	1.87	0.48	4.1	0.9963	8.11	4.22
V_5	2.22	0.54	4.1	0.9961	6.97	3.5
V_6	1.59	0.42	4.2	0.995	7.1	4.19
V_7	2.54	0.39	4.2	0.9999	7.66	3.8

Once the volatile compounds was extracted, they was analyzed by gaz-cromatography. The cromaptographic system is composed by an injector, a column inside an oven and a detector. An acquistion system collects the information that arrives to the detector. The simple mode to identify volatile compounds is comparing retention times of the interest peaks with those of pure standard compounds. All analysis was performed in duplicate. Resulted of volatile compounds are presented in table 4.

Table 4

The volatile compounds identified in cider samples

Identified compound		
Acids	**Alcohol**	**Esters**
acetic acid	ethyl alcohol	isoamyl acetate
hexanoic acid	isobutanol	ethyl caprylate
octanoic acid	4-methyl 2-pentanol	ethyl caprate
n-decanoic acid	3-methyl-1-butanol	3-methylbutyl octanoate
lauric acid	phenylethyl alcohol	ethyl myristate
heptanoic acid	2-methyl 1- propanol	ethyl palmitate
	1-hexanol	hexyl acetate
	2-hexanol	9-ethyl *decanoate*
	1-octanol	ethyl hexanoate
	1-decanol	ethyl stearate
	benzenetanol	

Cider esters have formed both during fermentation and during storage. At temperatures of 10 °C, it is possible to develop esters that will impress the product fructose, and at temperatures of 15 °C there may appear those that give smells of sweet, waxy. Isoamyl acetate is found in all seven experimental samples, but predominantly V3 variant, giving them a pleasant smell of bananas, sweet fruits, pears, being highly fragrant. Ethyl caprylate was identified in most samples

(except variants V4 and V6). These will have a fruity odor, apricot, banana, pear, and sometimes it can develop a smell of wine, cognac or even wax. The ethyl caprate present in all seven cider samples makes them smell of grapes, apples and in some cases they can develop odors that can be associated with cognac or wax scents. The presence of octanoate 3-methylbutylester in most samples except for the V5-Fermactiv Thyol Sodinal® sample and a high concentration in V3 indicates that they will have a sweet green fruit smell, but there will also be notes of pineapple and coconut. Ethyl palmitate found in six samples except sample V3. It gives a less pleasant smell of soap, lard or tallow, with a weak dairy taste, if the perception threshold is exceeded. The occurrence of these substances in cider, as is the case with ethyl palmitate, should be avoided as far as possible, as they lead to its qualitative impairment. Hexyl acetate present only in samples obtained with Lalvin Rhone 2056 Yseo Lallemand® and Maurivin AB® strains gives rise to a fresh, apple, pear, and sweet taste of banana peel. Ethanol hexanoate is present only when the Maurivin AB® variant is used and indicates that fruit flavors, pineapples, sometimes with green banana shades may develop.

Alcohol 3-methyl-1-butanol, which gives a pleasant smell, is found in a high proportion in the variety of Maurivin AB® yeast strain. The high amounts of phenylethyl alcohol present in the experimental variants, except for the fermented RBR® variant, give them a floral, fresh honey odor. The hexanol present in the variants used with AB®, Fermactiv Thyol®, Afinity ECA5 Levure-Yeast® and Fermactiv RBR® results in a fruity odor but also in a light cauliflower. The 1-octanol present only in samples V3 and V7 gives the cider an odor of freshly cut grass, melon with a slightly spicy tinge and a slightly green, fruity taste.

The 1-decanol present only in the last sample has the property of giving it a floral, sweet, orange odor.

Acetic acid, present in all cider samples, leads to increased volatile acidity and imparts a gentle odor and an unpleasant taste. This is found in the largest quantity in the sample where the yeast used was Afinity ECA5 Levure-Yeast®, the content of this sample in acetic acid being at least 10 times higher than most samples. The presence of hexanoic acid in experimental variants, with the exception of variant V3, may lead, if the acidity of this acid increases, to flavorings of sour, if the values of this acid would exceed the perception threshold. Along with octanoic acid, n-decanoic acid may also contribute to the formation of odors, which may lead to unpleasant, sour, odorous odors if the perception threshold is exceeded. This acid is found in the largest quantity in the sample using the yeast strain Lalvin Rhone 2056 Yseo Lallemand®.

Lauric acid, present only in four of the seven samples, gives rise to a bacon flavor of coconut.

Heptanoic acid, found in Maurivin AB® and Yseo Cross Evolution Lallemand® seedlings, gives them sweet, fruity, pineapple flavors.

CONCLUSIONS

The present paper presents the influences of different yeast strains selected on the aroma content of the seven variants of cider obtained in the U.S.A.M.V. Oenology Laboratory of Iaşi Romania and the determination of their compositional characteristics.

Following the results, we can conclude that:

Although the same raw material was used to obtain the seven variants of cider, some of the results obtained from the physico-chemical analyzes show wide variations, as in the case of the alcoholic concentration which varied after the secondary fermentation from 7.1 to 8.23 vol. alcohol. These differences are given by yeast strains used for fermentation. The most extractive cider variants are those obtained with Yseo Cross Evolution Lallemand® yeasts (V4) and Fermactiv RBR® (V7), from which they result that they have a large amount of glycerol among other non-reducing compounds, the cider being (for variant V4, the total extract extract and the non-reducing extract are 19.3 g / L and 15.08 g / L respectively), while variant V7 records values of 27.1 g / L and 23.3 g / L).

Following the application of the gas-chromatographic method on cider samples, one can notice that the predominant flavor of these is fruit (especially apples, pears) and floral. The esters identified in the experimental samples impart to them fruity hues, the most important of which is isoamyl acetate which is found in all samples in high quantities, and in particular gives the aroma of bananas, pears, apricots.

From the structure point of view, the V3- Maurivin AB® variant presents the highest values of volatile compounds, resulting in the best balance of the existing components, which gives the product higher quality than the rest of the obtained variants.

This study can be further explored by using other levurian species (possibly isolated from Romania) or by modifying the technological process including other fruits along with apples. It has also been proposed to use other apple varieties that can confer higher acidity or other aromatic profile.

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