ABSTRACT

Wine is a passion, a career, a hobby, a drink, a meal companion, an investment or simply a fun way to get away from the demands of everyday life. For others, it is a way of remembering, allowing them to rememorate events and there are also those who simply enjoy its hedonistic pleasures.

Low-alcohol wines can be interesting products and can benefit consumers, while also having the potential to reduce alcohol consumption and thus help reduce alcohol-related harm. These represent a new fast growing sector, due to the major awareness by the population of the serious long-term effects of alcohol consumption. Further research and marketing efforts are needed to raise awareness of the availability and quality of these products.

The main objective of this study was to study the possibilities of obtaining low alcohol wines, using as raw material grape must from Muscat Ottonel variety from Iasi vineyard, concentrating it by reverse osmosis and then blending it in established quantities to obtain the proposed variants. There are tendencies and concerns to reduce wine consumption compared to other non-alcoholic or low content products. This situation is also explained by the evolution in the demographic structure of the society by increasing youth presence in the total population, increasing the urbanization process, the emergence of the need to protect the consumer against alcohol excesses.

The overproduction of wine in Europe and the tendency to decrease the consumption of wine requires the diversification of products based on must and wine with low alcohol content. Due to the increase in the share of spirits in total consumption, a counterbalance will appear that will try to increase this the consumption and the orientation towards a certain market segment. The need for such products also arises due to the development of automobiles and the manifestation of alcoholism with its implications.

This work is structured in two parts: the first part referring to the current concepts regarding the stages and how to obtain low alcoholic beverages based on wine and a second part in which personal contributions are presented, the objectives proposed in this study, the organizational framework, the used materials and methods, the discussions on the results obtained and last but not least the conclusions.

According to the research purpose and objectives, to organize a comparative experiment in which the experimental factor will be the quantity of must concentrated with ten graduations, the experimental variants were coded as follows: VSA1 to VSA10. VSA meaning low alcohol wine.

The experiment was repeated in two years, respectively 2016, 2017. In each sample the quantity of must as well as the amount of water extracted from must was calculated in such a way that the alcoholic concentration of the wine obtained increased from 2,5 % by volume in the case of variant 1 with 0,5 % to 7 % in the case of variant 10.

In the first stage, the usual physico-chemical parameters for the must as well as for the wines obtained were determined. The experimental variants were also analyzed chromatically by the CIE Lab76 method, and for the identification and quantification of the main olfactory and gustatory characteristics, the aromatic profile of the wines was realized, through organoleptic analysis. Then, the experimental samples were subjected to a more detailed composition analysis using analytical methods such as: gas chromatography and high performance liquid chromatography (analysis of the metal content of wines, analysis of organic acids in wines).

The Muscat Ottonel grapes were harvested in 2016 and 2017 and were subjected to specific vinification process for white aromatic wines. After obtaining the must, it was concentrated by reverse osmosis, using Flavy ML^{TM} plant produced by *Vaslin Bucher*, up to a concentration of 308,3 g/L sugars.

There was a significant difference between all samples for alcoholic strength. In the first sample, wines with 2,5 % were obtained. Then, each sample has an alcohol content with a volume of about 0,5 % higher than the previous one.

According to the data obtained from these analyzes it turns out that the main objective of obtaining low alcoholic beverages, based on wine with an alcoholic concentration in the case of VSA1 is 2,5 % alcohol volume (± 0,1 % alcohol volume) and then to increase by about 0,5 % volume of alcohol in the following variants, up to 7 % volume of alcohol in case of VSA 10 (± 0,1 % volume of alcohol) was met.

As the experimental samples obtained in the two years of study showed values of reductive sugars that were below 4 g/L, according to the OIV legislation they are classified in the category of dry wines. In this case, due to the low alcohol concentration, the low reductive sugar content and the density, the results obtained from the calculation of the non-reductive extract was below 2 g/L.

Following the analysis performed on the samples taken in the study, the following metals were identified:

Zinc content registered a maximum in the first sample VSA1 (320 μg/L-2016; 314 μg/L-2017) and then gradually decreased in the other samples, reaching a minimum in the case of VSA10 (15 μg / L -2016; 12 μg/L-2017). The maximum zinc limit of 5000 μg/L was not exceeded in any way.

In wine, iron can be found between 2 and 15 mg/L. The analyzed drinks had a higher content for those obtained in 2016 compared to 2017, for all variants. Maximum iron content was recorded for VSA1-790 μg/L- 2016 and a minimum of 400 μg/L for VSA7-2017.

Copper presented values that varied as follows: in the case of beverages obtained in 2016 and 2017, it presented maximum values in the case of VSA1 variant 426 μg/L-2016; 341 μg/L-2017, then decreased to 105 μg/L-2016; 110 μg/L-2017 in the case of the VSA9 variant. Copper was below the maximum permissible limit of 1000 μg/L.

Lead value increased progressively from the first sample VSA1 to VSA5 with a minimum content of 66 μg/L-2016; 70 μg/L-2017 and a maximum content of 118 μg/L-2016; 128 μg/L-2017. This increase is then found again starting with VSA6 with a minimum content of 94 μg/L-2016; 114 μg/L-2017 and a maximum content in the VSA9 sample of 120 μg/L-2016; 128 μg/L-2017. The lead content did not exceed the maximum value of 200 μg/L.

In the case of beverages obtained in 2016, the minimum amount of calcium was determined in the case of variant VSA2 – 12 mg/L and a maximum of 25 mg/L-VSA6. The variants obtained in 2017 showed a minimum of 10 mg/L-VSA3 and a maximum of 18 mg/L-VSA7.

The highest amounts of potassium, for the samples obtained in 2016, were registered for VSA8-140 mg/L, VSA9-141 mg/L, VSA3-143 mg/L. The same variants had the highest content for the samples obtained in 2017. The lowest potassium content was determined in VSA3-83 mg/L for 2016 and 103 mg/L for 2017.

Sodium concentrations fluctuated, registering a minimum content for the ninth sample VSA9-216 mg/L for 2016 and for 2017 a minimum is also recorded for the VSA9 variant of 226 mg/L and a maximum of 354 mg/L for VSA5 variant for both 2016 and 2017.

The manganese quantity in the obtained samples presented values at the level of micrograms, with minimum limits for both 2016 and 2017 in the case of variants: VSA3-269 μg/L-2016 respectively 279 μg/L- 2017; VSA4-276 μg/L-2016 respectively 279 μg/L-2017 and maximums in VSA8-383 μg/L-2016 respectively 365 μg/L-2017.

The increase in the amount of magnesium was directly correlated with the amount of permeate and retentate that entered the variants. A linear increase of the magnesium content is observed for both years, VSA1-144 mg/L-2016 respectively 140 mg/L-2017 and ends with maximum for the VSA10-230 mg/L- 2016 respectively 231 mg/L-2017.

The lowest nickel quantity in 2016 was determined for VSA10-53 μg/L and in 2017 for VSA6-67 μg/L. The maximum nickel content for 2016 was determined in VSA2-86 μg/L and in 2017 for VSA5- 94 μg/L.

High performance liquid chromatography allowed the identification in the experimental variants of low alcohol wines, a number of 7 organic acids namely: lactic acid, tartaric acid, citric acid, malic acid, succinic acid, acetic acid and fumaric acid. The highest

quantities of tartaric acid were identified for both years of production in the case of VSA10, respectively: 2,8 g/L − 2016 and 2,9 g/L − 2017.

In the case of the analyzed samples it can be seen that malic acid was identified in quantity that fluctuates within very small limits (1,3 g/L) in the ten variants and in the two years of production.

In most samples of low alcoholic beverages based on wine, in 2016 and 2017, fumaric acid showed values above 9 mg/L, except for the sample VSA1 2016 – 10,4 mg/L and the samples VSA1, VSA2 2017 with the lowest content. of fumaric acid 8,9 mg/L respectively 8,9 mg/L.

In both 2016 and 2017 low alcohol beverages based on wine, lactic acid varied very little between a minimum of 0,32 g/L VSA1, VSA2, VSA3, VSA4 and a maximum of 0,36 g/L VSA10 for the year 2016. In the samples obtained in 2017 the quantities of lactic acid determined were close to those of the previous year. Thus, the highest concentrations of lactic acid were determined in the experimental variant VSA10 0,36 g/L and a minimum in the variants VSA5, VSA6 of 0,31 g/L.

It can be seen that the acetic acid increased in relation to the amount of permeate and retentate that entered the mixture to obtain the samples. Thus, in the case of low alcoholic beverages obtained in 2016, a minimum was registered for VSA1 – 0,34 mg/L and a maximum for VSA10 – 0,48 mg/L. For the samples obtained in 2017 the minimum registered was 0,34 mg/L - VSA1 and the maximum of 0,49 mg/L - VSA10.

In the samples of low alcoholic beverages based on wine 2016 and 2017, the amount of citric acid has undergone small variations, respectively in the range 0,38 and 0,44 g/L.
Following the analysis and observations, the amounts of succinic acid identified in both low-alcoholic beverages based on wine 2016 and 2017 did not vary much, quantities of over 0,50 g/L being detected in all experimental variants.

Analyzing the chromatic parameters, especially the parameter „L” (clarity) for each experimental variant, we can say that the obtained drinks are clear and clear.

By making a strict reference to the samples of low alcoholic beverages obtained in 2016, it can be seen that the variants VSA1, VSA2 presented the highest values of parameter „L” (clarity), so they have a higher degree of limpidity. On the other hand, the VSA9, VSA10 variants have the lowest values of the same clarity parameter. In the case of the samples of low alcoholic beverages obtained in 2016, all ten variants presented shades of yellow- green. This assertion can also be sustained by the color simulation carried out using the Digital Color Atlas 5.0 software. Parameter „b”, correlated with chroma (C) has the same trends of variation. Regarding the Hue parameter (H), it presented, for all samples, negative values, being in accordance with the parameters „a” and „b”. The luminosity parameter for the samples of low alcoholic beverages obtained in 2016 did not vary within wide limits, respectively between 0,01 for the sample treated with coal and 0,08 for VSA9, VSA10. The tint parameter ranged

from a minimum of 2,04 for the VSA1 sample and a maximum of 4,56 for the VSA10 sample. This parameter had a continuous increase, starting with VSA1 until the VSA10 test. By observing and analyzing the parameters obtained for the 2017 tests, for each experimental variant, it can be seen that they had values close to the parameters recorded in 2016.

Visually the low alcoholic beverages based on wine had close colors for the same variants of the two years of vinification. This is due to the quantities to be retentate and the permeate that have entered the coupage to obtain the variants. The low alcoholic beverages obtained in wine during the two years of vinification, presented values of the chromatic parameters similar to those of a white wine.

Organoleptic analysis of low-alcohol wine samples revealed the predominance of green and citrus fruits. The highest sensations were those of acidity, because, due to the low alcohol content, it was the main sensation felt by the taster.The balance of the sensations perceived in the mouth cavity, represented by texture and the persistence of the taste was appreciated with grades exceeding 4 points, starting with the 7th version of vinification.

As a result of these tastings, it was established that the vinification variants of the "low alcohol wines" that have the character of wine are: VSA 7 - VSA 10 (5,5 – 7 % alcohol volume)

In the other variants, the low limits of the alcohol concentration, but also low values of the extract, determined at the organoleptic level certain deficiencies such as: low persistence, insufficiently expressed body, lack of unctuosity, high astringency. The sweet taste was noted with lower notes, due to the fact that the wines were considered to be "dry".

The statistical analysis of the results was performed using XLSTAT software and the Office Excel package by applying the Anova-One way method. The hypothesis of equality of the means of the analyzed samples is thus tested, allowing the comparison of specific values by determining the significant differences. The statistical methods approached are applied to a single set of variables in order to identify the variables in the coherent subsets that are relatively independent of each other.

The purpose of the statistical test is to accept or reject the "null hypothesis", to the detriment of the "alternative hypothesis".

In order to perform the statistical tests, the veracity of the following hypotheses was verified:

1. null hypothesis (H0): the values obtained are independent, without a significant difference;
2. alternative hypothesis (H1): the values obtained are dependent, presenting significant differences.

From the point of view of statistical interpretation, the results of the Anova-One way test on the physico-chemical composition of the samples obtained in the two years of study, by testing the hypothesis of equality of means of the analyzed samples, show statistically significant differences in most indicators. studied ($p < 0.05$), except for volatile acidity and density. The latter have a significance threshold exceeding the reference value of 0.05, rejecting

the null hypothesis (the values analyzed are similar). This situation is identical in both years of study. It can be said that the physico-chemical parameters that showed a degree of coefficient less than 0.05 are dependent on the level of alcohol concentration of the wines analyzed and, in general, on the applied oenological practices.

Regarding the content of experimental samples in metals (non-metallic ions and heavy metals, respectively) according to the Anova-One Way test, statistically significant differences are observed ($p < 0.05$) in all variants studied, regardless of the year analyzed . It is thus indicated that the level of metal ions in wine is significantly influenced by its alcoholicconcentration.

Following the results obtained on the content of non-metallic ions, it can be noticed that there is a perfect correlation between Mg and K ions for 2017 but also a very weak correlation between Ca and Na ions. In 2016, the data indicate weak correlations between the analyzed compounds.

Regarding the content of heavy metals in the samples resulting in 2016, it can be noted the presence of a high and very high positive correlation between Fe and Zn ions ($r = 0.785$), Fe and Cu ($r = 0.896$) and high negative correlations between ions Zn and Pb ($r = -0.785$), Fe and Pb ($r = 0.737$), Cu and Pb ($r = -0.642$).

In 2017, high positive correlations were obtained between Fe and Cu ions ($r = 0.752$) and high and very high negative correlations between Pb and Fe ions ($r = -0.777$), Pb and Cu ($r = -0.688$), Zn and Pb ($r = - 0.858$).

By the correlations obtained, it can be said that the evolution of the results after the experiment is to some extent uniform.

Following the application of the Anova One Way test, the content of organic acids recorded in the analyzed samples showed statistically significant differences ($p < 0.05$), except for lactic acid ($p > 0.05$) which rejects the null hypothesis. This indicates a major influence of the level of alcohol concentration on the organic acids in the wine, with the exception of lactic acid which will have similar values.