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Making classic wines from Georgian and French varieties of grapevine

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Abstract

Authenticity is an important factor in determining the value of food products and nutritional components or additives [3, 4]. In addition to the control of products correct labeling, the compliance with good oenological practices should be taken into account. Analytical methods can be used to determine whether wines are mixed with each other, or if their production is modified by the addition of water, alcohol, sugar, etc.

Different grape varieties: „Chardonnay'', „Chinuri'' and „Kakhuri Mtsvane'' were selected for the study. Classic wines were made from these grape varieties. Sepage of the Chinuri and Chardonnay varieties was carried out, and from the variety Kakhuri Mtsvane varietal wine was made. The main chemical parameters were determined in the wines, based on the objectives of the study. The obtained results were used to compared wines with each other. In the wines the ratio of carbon isotopes $^{13}C/^{12}C$ was also determined in order to establish their falsification.

According to experimental results it was established that the main chemical parameters of the studied wines correspond to the standard requirements. The wines are distinguished by the organoleptic properties characteristic of the variety.

Keywords: Wine; Chemical Parameters; Kakhuri Mtsvane; Chardonnay; Chinuri.

1. Introduction

Wine is one of the ancient beverages with centuries-old history. Georgia is a classic wine country, rich in grape varieties that can be used to obtain high-quality classic wine [1].

Production of a quality wine is of topical issue, due to the increased demand for the product. Various factors affect wine quality, such as location, grape variety, vineyard maintenance, etc. Bringing grapes to the required condition, i.e. ripening, properly conducting the winemaking process and storing the wine in ideal conditions is another very important prerequisite [2, 3].

The production of competitive alcoholic beverages and wine is important for the international market, which implies the determination of various chemical parameters and their possible falsification. For this purpose, studying the ratio of stable carbon isotopes in wine is of great interest. $^{13}C/^{12}C$ ratio helps to determine the origin of wine, or whether a given wine is made from grape raw material [4].

Knowledge of the distribution of isotopes in the biosphere and biomass is necessary to determine the geographical origin of wine. Since certain biological and physical processes separate heavy and light isotopes, which leads to a change in their ratio, the isotopic composition of a product can provide information about its origin. In particular, correlating

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these data with climatic ones, as well as determining stable isotopes in wine, can provide an idea of the product origin [5].

Analytical methods are based on measuring the relative abundance of isotopes (carbon, hydrogen, oxygen, etc.) in the product or its component.

A mass-spectrometer is used to determine the isotope ratio. It consists of an ion source, an elemental analyzer and a detector. An inert gas - high-purity helium - is used as the mobile phase. According to the ISO standard, there is a special wine standard with δ 26,92. This standard allows to ensure that the device is working properly; it also calibrates the standard CO_2, which later is used to measure the $^{13}C/^{12}C$ of an unknown sample [6].

1.1. Grape varieties

Different grape varieties were selected for the study: the Georgian wine varieties ,,Chinuri'' and ,,Kakhuri Mtsvane'' and the French grape variety – ,,Chardonnay'', grown in Georgia.

,,Chinuri'' is of special attention among Georgian grapes due to its high yield. Wine produced from Chinuri grapes is of light brown color, gentle, with a soft taste, and is distinguished by a balanced alcohol and acidity.

,,Kakhuri Mtsvane'' produces the most delicate and aromatic table wine among the white varieties of Georgian vine. High-quality wines of both European and Kakhetian types are made from it. It is used to improve other varieties of wines.

,,Chardonnay'' is a French white grapevine variety. In Latin, Chardonnay means "thorn place". Both high-quality table wine and champagne are made from it. Chardonnay's one of the mighty characteristics is its versatility - it adapts and thrives in a wide range of climatic conditions and soil types [7].

1.2. Winemaking technology

Great attention was paid to the selection of grapes, since high-quality and healthy material is essential for producing quality wine. It is also very important to choose the right time of harvesting.

After the grapes were picked, they were transported in special boxes, which hold about 15 kg. Placing grapes in boxes protects from damage and also aerates them. After the harvest appeared at the factory, it was sorted, and then berries were separated from stem to prevent tannins mixing with the juice. After this procedure berries were crushed; the released must was collected into a receiving tank. The residue underwent additional processing. Later the obtained must was separated into fractions. First fraction – sweet juice was added an enzyme – the natural catalyst, which speeds up the grape juice clarifying process. Also potassium metabisulphate (cadefit, sulfur) was added to protect the juice from oxidation. Meanwhile, the second fraction was placed in a separate stainless steel tanks with a water cooling system. The must was cleaned of the residues of berry skin, pedicels, and dust from the vineyard. 24 hours later the must was separated from the sediment and was added cultured yeast. Thus the fermentation took place under controlled conditions and the wild yeast as not able to lead undesirable fermentation. the amount of decomposed sugar was checked daily and tested organoleptically. At the end of the fermentation, received product was removed from the lees to 0.7 bar, and sulfitation was performed. Test fermentations for protein stabilizers were done, processing wines in different quantities in bottles, and the dosage that gave the best results was chosen. Wine was treated with bentonite for protein stability and filtered. the temperature of the wine in the cistern was brought to -2 -4 degrees and the wine stone was added. A few days later it was filtered. A stability control on protein and crystals was conducted. Before bottling, a full analysis was done once again. During bottling, the line was flushed with sulfuric solution and steam.

1.3. Chemical analyses

The main chemical parameters of the wines produced were determined:

- Alcoholic strength (V%) - OIV- MA-AS312-01A;
- Total acidity - OIV- MA-AS313-01;
- pH;
- Sugar - Bertrand's method;
- Sulfur dioxide - OIV-MA-AS323-04B;
- Volatile Acidity - OIV- MA-AS313-02;
- The ratio of the stable carbon isotope $^{13}C/^{12}C$ in wine by mass spectrometry method.

2. Results and discussion

The determination of chemical parameters is of great importance for the quality of wine. The alcohol content determines how resistant the wine is to diseases. The titratable acidity is responsible for the taste of the wine and prevents the growth of microorganisms there. According to measurements alcohol content in Chinuri and Chardonnay wines was 11.10 % and in pure Kakhuri Mtsvane – 11.90 %; The titratable acidity in the first ones was 5.80 g/l, and in Kakhuri Mtsvane – 5.00 g/l (Table No. 1).

As for the astringents, it is very important index, especially in white wine. Its control is essential, because it must never exceed 1.00 g/l. In case of the studied wines this index was in ranges of norm: 0.32 and 0.50 g/l (Table No. 1).

The amount of sugars is responsible for the type of obtained wine. Generally it ranges from 5.00 to 5.80 g/l. The sugar content in experimental wines indicates that they are of dry type. pH directly determines the stability of the wine, the pH indicator in the produced wine was 3.46 and 3.40. Free sulfur ranges from 26.00 to 28.00 g/l, and the total sulfur - between 106.00 -116.00 g/l (Table No. 1).

Table 1 Determination of chemical parameters in wines

Chemical parameter	Chinuri / Chardonnay	Kakhuri Mtsvane
pH	3.46	3.40
Total acidity	5.80	5.00
Volatile Acidity	0.32	0.50
Sugar	5.00	5.30
Alcoholic strength	11.10	11.90
Free sulfur	26.00	28.00
total sulfur	106.00	116.00

The ratio of the stable carbon isotopes $^{13}C/^{12}C$ was determined in the wine samples (Table No. 2). The obtained results clear that the wine samples correspond to the established norms (from -26 to -30).

Table 2 The ratio of the stable carbon isotope $^{13}C/^{12}C$ in wine

Wine samples	The ratio of the stable carbon isotope 13C/12C
Chinuri / Chardonnay	-27.30
Kakhuri Mtsvane	-26.80

The ratio of stable isotopes in wine remains unchanged over time. The ratios of stable isotopes of hydrogen, oxygen and carbon in wine are used to identify a number of frauds; in particular, the use of manufactured alcohol, chaptalization with beet or cane sugar, irrigation or false claims about the origin of the wine. For Georgian wine, $\delta^{13}C$ usually ranges from -26 to -30 (Figure No. 1).

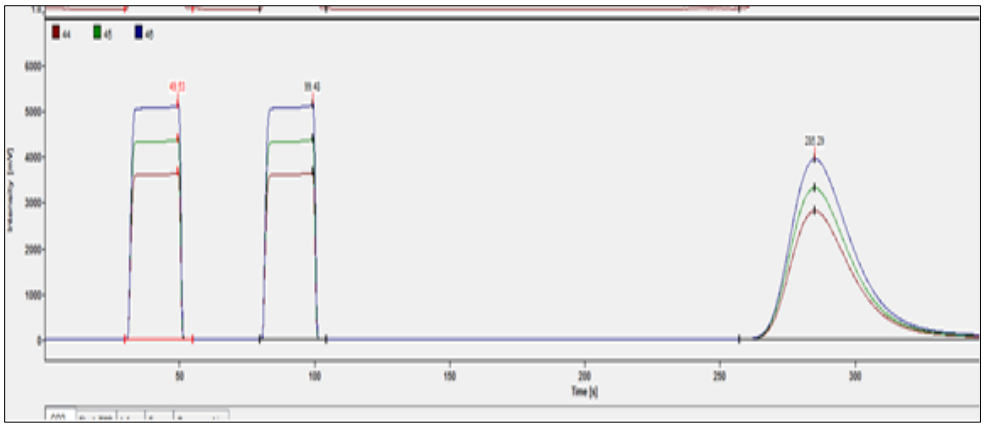

Figure 1 Chromatogram of a wine sample

3. Conclusion

According to main chemical parameters the wines produced during experiment meet the established standard. According to the determined ratio of carbon stable isotopes, it was demonstrated that the wines produced within the frame of the study comply with the established norms.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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