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The influence of fusel oil content on the quality of wine and wine distillate

Mariam Loladze *

Georgian Technical University Scientific-Research Institute of Food Industry, Tbilisi, Georgia.

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Abstract

Organoleptic (qualitative) properties of European, Imeretian and Kakhetian types of wines and wine distillates do not depend on the fusel oil content. During maturation of wine and wine distillate on the grape must and in the oak barrel, there is not observed any correlative connection between the fusel oil quantitative content and tasting indicators.

When grape must is undergoing maturation in qvevri, the wine quality received from it is steadily improving, and this regularity is equally fair for all the types of wines.

To receive high quality wine distillates from European, Imeretian and Kakhetian type wines, distillation should be carried out immediately after fermentation is over, without their further maturation. Furthermore, the highest quality wine distillate is obtained using Imeretian method of grape processing.

The distillates produced via distillation of Imeretian and Kakhetian types of wines, represent not cognac, but Georgian national beverage – chacha distillates.

During both Imeretian and Kakhetian wine distillates ageing in oak barrels, there is received higher in quality chacha distillate, in comparison with cognac wine distillate.

Keywords: Fusel Oil; Wine; Distillate**;** Higher alcohols; Organoleptic properties

1. Introduction

Fusel oil is a by-product of alcoholic fermentation, it contains the monoatomic aliphatic alcohols (C3-C10), esters and other compounds - up to 40 components, out of which 27 [1] have been identified to date. However, the higher alcohols account are 85% of the total Fusel oil complex. The presence of the excess of these alcohols gives wine and wine distillates a roughness.

The main determinant of the chemical composition of wine distillate is the wine-material distillation. In the distillation process, as a result of the interaction of individual components of the wine, the composition of its volatile components significantly changes [2].

The distillation process makes it possible not only to separate the ethyl alcohol from the wine, but also to enrich the alcoholic distillate with volatile components formed from the wine-material as a result of thermal effect [3].

Amount of a fusel oil in raw spirit is higher than in the starting wine-material. During the fractionation of the crude alcohol, the main mass of the fusel oil passes to the heads and hearts fractions, the content of higher alcohols in the tails fraction and in the cube residue of the wine-material distillation is slight [4].

* Corresponding author: Mariam Loladze

It is worthy to note, that it is the fusel oils that gives the distilled alcoholic drinks a characteristic taste and aroma. Without these substances cognac and whiskey, as well as Georgian chacha and other distilled beverages represent rectified alcohols diluted with water-diluted – Russian «vodka».

In the recent past, wheat vodka was considered to be the most harmless alcoholic beverage, because as a result of rectification, the fusel oil content in it is minimized. At the same time, it has remained unclear why 70% of individuals with alcohol disorder and addiction are especially consumers of vodka [5].

Recent studies have shown that fusel oil protects the body from the harmful effects of ethyl alcohol, activates the liver before alcohol has a negative destructively effects on the body. The purer poison (in our case ethyl alcohol) is, the more dangerous it is and causes rapid addiction to alcohol [7,8].

Components present as minor impurities in cognac, whiskey and chacha vodka, in other distilled beverages, prevent the development of alcohol dependence in the human body and in this sense positively effect on the safety of drinks [7].

Also, it has been established that natural and synthetic ethyl alcohols are practically almost the same in acute toxicity (lethal, narcotic effect, ability to provoke the development of an acute post-toxic state) [6].

The data available in the literature [5, 7] allows with a high probability to assert that the Russian alcoholic beverage «Samogon», produced by traditional technology, from point of toxicity practically does not differ from the high purity aqueous solution of rectified ethyl alcohol - «vodka». In fact, high quality "Samogon" is the analogue of the vast assortment of the distilled beverages produced on the industrial scale in the different countries worldwide (cognac, whiskey, calvados, rum, tequila, chacha, grapa and etc.). It is worth noting, that in the countries, where the consumption of such distilled beverages is widespread, the mortality rate associated with alcohol is much lower than in Russia, where the rectified ethyl alcohol diluted in water – vodka, is considered as a popular drink [5]. The same is true about the Finnish vodka «Finland», which is also produced from the high purity rectified ethyl alcohol.

2. Research Results and discussion

We have investigated the influence of maceration duration of various types of wines in qvevri on the content of fusel oil and its main component – isoamyl alcohol in wine and wine distillate. As the research objects there were used 3 types of wine – European (grape juice fermentation without must), Imeretian (fermentation of grape juice with 5% of must) and Kakhetian – wine produced via fermentation of the whole must. The distillation of these wine-materials produced appropriate wine distillates.

The studies conducted have shown, that if in the wine-material, for example the fusel oil content is between 280-410 mg/l, in the distillate obtained after the distillation of the same wine this component is much higher (1400 – 2500 mg/l).

The curves showing the dynamics of fusel oils content are absolutely different in nature. If the curves showing the dynamics of the content of fusel oils in wine, have the form of a single-dome curve for all types of wines (European, Imeretian, Kakhetian), in the respective wine distillates collection of higher alcohols undergoes differently. In particular, in Imeretian type wine with the increase of time of maturation (maceration) on must, the fusel oil content in the wine distillate decreases, on the contrary, via distillation of those received from European and Kakhetian type wine-materials – increases.

All these show the transformations that undergoes during the wine-material distillation. In other words, distillation process does not represent the process of wine volatile substances unchanged transfer into distillate.

Also, there was established that during the ageing of European and Kakhetian type wine distillates the content of fusel oil during the first 1 year decreases, and then during the second year increases and reaches almost the starting amount. What about Imeretian type wine distillate, during this last's ageing in oak barrel, the fusel oil content slightly but still increases.

From the data of fig. 1, B is visible that the highest quality wine is received from grape processing via Imeretian method (Fig. 1,A). From the same figure it is visible that all, European, Imeretian and Kakhetian type wines should be distilled as soon as fermentation is over, without their further keeping for maceration on the must. During the ageing of both Imeretian and Kakhetian wine distillates in the oak barrel, there is received the higher quality wine distillate compared to the cognac wine distillate.

In the introduction part, based on the existing literature data, the indisputable fact is convincingly substantiated that fusel oil is a necessary concomitant component of distilled alcoholic beverages. Also was outlined the fact that their presence contributes to reducing hangover syndrome and alcohol dependence syndrome comparing to the beverages produced on pure ethyl alcohol.

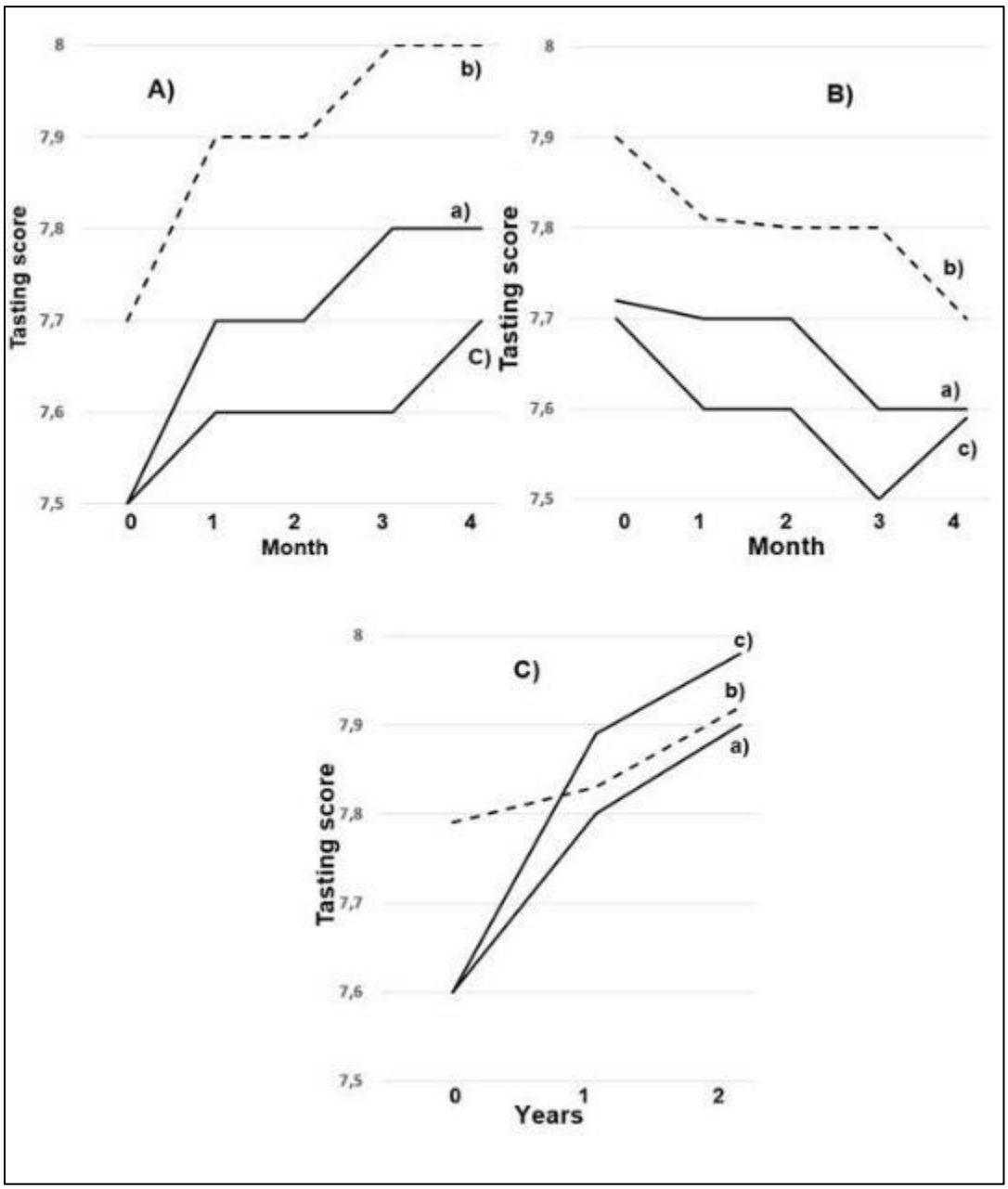

Figure 1 Quality indicating diagrams for European (a) , Imeretian (b) and Kakhetian (c) types of wines and wine distillates, during wine maturation on the must and distillate ageing in the oak barrel; A- wines maturation in qvevri; B – distillates of the same wines; C – ageing of distillates in oak barrel

Regarding (What about) the influence of the fusel oil on wine and wine distillates quality, any correlative relation between fusel oil amount and organoleptic properties of these beverages here – aroma and taste – that is determined with tasting evaluation of beverages, is not found. This fact, probably, can be explained that on one side the compounds extracting from the solid parts of grape must, as well as from the oak barrel staves actively intermediate with components of the grape wine and grape alcohol in it (wine distillate), on the other side – some volatile compounds (alcohols, esters) effect on the extractive substances [9].

All these transformations also gets complicated by the fact that oxygen dissolved in wine-material and spirit interacts with many volatile and non-volatile substances, as a result of that appear the various substances [9].

Except the chemical processes during chacha spirits ageing in oak barrels there are undergoing the intensive physical transformation – evaporation of water, alcohol and groups of volatile substances. As a result of this, is concentrated the content of hardly volatile and non-volatile substances, that complicates the investigation of chemical processes and influences on its results [9]. All above mentioned excludes the ability to find the any kind of regularity (correlative relation) between fusel oil quantitative content and tasting evaluation. in both cases for wine and distilled from them distillates.

According to A. Sirbiladze recommendation, to produce cognac alcohol there should be used Imeretian type wine [8]. Different opinion expressed A. Lashkhi, according to which in order to produce the cognac alcohol the usage of Kakhetian type wine is advised [10]. It is underlined that beverages received from both Imeretian and Kakhetian type wine-material distillates, in accordance with the European Union requirements, can not be called cognac; because firstly Cognac is the French drink named after the place of origin and the main thing – in order to receive this distillate, the fermentation of grape juice on the whole must (Kakhetian type wine) or on its part (Imeretian wine) is not allowed. Distillate received after the distillation of these type wines represents the Georgian National beverage – chacha distillate. As it is shown below, Kakhetian and Imeretian chacha distillates give the ability to receive the higher quality alcoholic beverage, in comparison with the well-known French beverage – cognac.

From the data of fig. 1, B it is visible that European, as well as Imeretian and Kakhetian type wines should be distilled immediately after fermentation, without their further maceration on the must. The highest quality wine is received via grape processing by Imeretian technique (Fig. 1, A).

During both Imeretian and Kakhetian wine distillates ageing in the oak barrel, there is obtained higher quality wine distillate compared to cognac wine distillate.

3. Conclusion

Organoleptic (qualitative) indicators of European, Imeretian and Kakhetian type wines do not depend on the fusel oil quantitative content in them. During maturation (the ageing) of wines and wine distillates on the grape must and in oak barrel there is no noticeable correlative relation between fusel oil quantitative content and tasting score.

During grape must ageing in qvevri received from it, wine quality steadily increases, and this regularity is equally fair for all the types of wines.

To receive high quality wine distillate from European, as well as from Imeretian and Kakhetian type wines should be distilled immediately after fermentation is over without their further maceration. As well (herewith), the highest quality wine distillate is received via Imeretian technique of wine distillate processing.

During the ageing of the distillates received from distillation of Imeretian and Kakhetian type wines in oak barrels, there are received higher quality chacha distillates, compared to cognac wine distillate. The highest quality wine distillates are produced via distillation of wine produced with Kakhetian technology, that is not cognac, but Georgian national beverage – chacha distillate.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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