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Characterization of different assortments of distilled alcoholic beverages from Banat region (Romania)

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Abstract

The aim of this work was to give the analyzed products (different distilled alcoholic beverages from Banat region, Romania) a better appreciation because of the great organoleptic properties they possesses. The finished product specific to Banat, is palinca and is an alcoholic drink with at least 50% vol (alcohol levels), obtained through the specific process of fruit fermentation and double distillation, without the addition of sugar, other sweeteners or synthetic flavors, with natural coloring (from the barrel).

These drinks are highly competitive worldwide with other similar products such as whiskey or different American distilled spirits.

In order to obtain these distilled beverages we used different types of raw materials such as apricots, quince and peaches. In comparison we described other products well known and consumed in Romania like liqueur, cognac, whiskey, gin, maraschino.

After distillation, the palinca must undergo a maturation process at least for six months, in barrels and it is not allowed to touch metal or plastic surfaces, in order to preserve its specific aroma. A very big advantage of this product is that it is a "clean" product, without any additives.

In this paper, a case study was carried out regarding the determination of the alcohol concentration (using a densimeter, pycnometer and alcohol meter) as well as the determination of the heavy metal content: Zn, Cu, Pb, Cd from obtained distilled beverages, using the atomic absorption spectrometry method in air-acetylene flame.

Key words: distilled beverages, antioxidants, polyphenols, chromatographic analysis.

1. Introduction

The major goal of the food industry is to find an efficient methodology to add value to food, most of the time, during processing. Food processing should lead to minimal loss of nutrients and of course, the final product should have a value that covers the cost of processing, but also ensures a certain profit.[2,10]

Many fruits are perishable and therefore processing to extend their shelf life or to prepare more secondary products is one of the most effective approaches and challenges. Moreover, the world population being in continuous growth, an increase in the global market of alcoholic beverages is also expected.[6,8,10]

Alcoholic drinks are considered liquid food products that have a percentage of ethyl alcohol in their composition. In the category of natural alcoholic beverages, we can mention brandies, known by the locals as pălincă, țuică, horincă (traditional alcoholic beverages from Romania), alcoholic beverages based on wine, cognac or natural rum. Also, in the same category of natural alcoholic drinks we can include industrialized drinks, which represent a slightly modified version of the basic recipe (liqueurs or flavoured brandy).[3,5]

Natural strong alcoholic drinks, also called brandies, are drinks obtained by distilling the juices obtained from the fermentation of fruits

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and grains. Due to this distillation, brandy has higher alcohol content than other types of drinks.[2,11]

Brandy (țuica) is a natural alcoholic drink, found very often in Romania, with a variable alcohol concentration between 25 and 50 degrees. This traditional Romanian drink is clear, colourless, but can have a yellowish tint, due to the storage in mulberry and oak barrels. The aroma must be specific to the raw material (fruit) from which it is obtained, being more pronounced in aged varieties. For the production of brandies, almost all kinds of fruit are used, due to the content of fermentable sugar from their composition. The most popular brandies are obtained from: plums, apples, apricots, cherries, strawberries, quinces, blackberries, peaches and other fruits.[3,4,5,7,8,9]

The volume of distillates varies according to temperature and alcohol strength. Thus, regardless of the alcoholic strength, at 15ºC, all distillates have the real volume, without contractions and expansions.[5,9]

Brandy can have magical health effects if it is prepared cleanly and consumed in small quantities. It is not recommended that brandy therapy become a habit, and increasing the therapeutic dose can lead to alcoholism. Thus, brandy must be regarded as a medicine towards which the necessary attitude must be taken.[1,3]

2. Material and methods

A case study was made regarding the determination of the alcoholic concentration and the content of metals: Zn, Cu, Pb, Cd in different varieties of brandy (obtained from apricots, quinces and peaches). The brandy samples were purchased from local producers, from the Banat area of Romania.

The determination of the alcoholic concentration (strength) of brandy samples was carried out by density measurements of distillate, through several methods, namely: determination with a densimeter or thermodensimeter, determination with a pycnometer and determination with an alcohol meter.

2.1. Determination of alcohol concentration (strength) using a densimeter or thermodensimeter

The method is based on Archimedes' law, according to which there is a direct proportionality between the force that pushes a body immersed in a liquid and the mass of the displaced liquid. The brandy sample of which the density is to be determined, is transferred into a transparent glass cylinder, into which a densimeter (or thermodensimeter) is inserted, keeping a close eye on it until it starts to float freely, without touching the walls of the cylinder. When the densimeter stops oscillating in the vertical plane, the division tangent to the surface of the liquid is read, at the upper part of the meniscus, which directly indicates the density of the brandy sample. For a better precision, the experiment is repeated 3-4 times.

2.2.Determination of alcohol concentration using a pycnometer

The method is based on weighing a well-determined volume of liquid. The pycnometer is washed with distilled water, dried in a stream of hot air in an oven, kept in a desiccator for 20 - 30 minutes and weighed on an analytical balance with a precision of 0.01g, noting the mass with m_1. The pycnometer is filled with the brandy sample exactly until the excess comes out through the capillary with which the plug of the pycnometer is provided. After the excess is wiped off with a filter paper, the pycnometer is weighed again with the sample, noting the mass with m_2. The determinations must be carried out at a temperature of 25°C. The density of the brandy samples are calculated with the relationship:

$$d[g/cm^3] = \frac{m_2 - m_1}{V}$$

m_1 = the mass of the empty pycnometer (g);
m_2 = mass of the pycnometer with the analysed sample (g);
V = the volume at which the pycnometer is calibrated (mL).

2.3. Determination of alcohol concentration using an alcohol meter

The brandy sample is carefully poured into a clean and dry cylinder or washed with the product to be analysed. The clean and dry alcohol meter, held by the upper end, is carefully inserted into the sample, so that it does not touch the walls of the cylinder. The temperature of the sample is determined and the alcoholic concentration (apparent) of the product is read. To determine the real alcohol concentration, which the alcohol meter would show if the temperature of the sample during the determination had been 15°C, a conversion table is used, which takes into account the value of the apparent alcohol concentration and the temperature at which the determination was made.

2.4. Determination of heavy metals from brandy samples

The content of heavy metals: Cu, Pb, Cd and Zn from the brandy samples were measured with the method of air-acetylene flame atomic absorption spectrophotometry. For the determination it was used a monolamp soft CONTR AA 300 spectrometer in an air-acetylene flame. HNO_3 (65%), bi-distilled water and a multielement standard solution from Merck (Germany) were used for the determination. Approximately 100mL of the brandy sample was acidified with 1mL of HNO_3 solution, after which the heavy metals from the sample were determined. The determined values were read directly from the spectrometer-sampling curve. Working conditions (wavelength, air-acetylene flow, volume of the sample vaporised in the flame) were in accordance with the apparatus manufacturer's recommendations.

3. Results and Discussion

The experimental results obtained after determining the alcoholic concentration of brandy samples using the three determination methods are presented in table 1. These results were obtained after the temperature correction and the density/alcohol strength correlation.

Table 1. Alcohol concentration values (V, %) for brandy samples, determined by the three methods

Analysed brandy sample	Method of determination			Average values
	With densimeter	With pycnometer	With alcohol meter	
Apricots brandy	38,52	39,15	39,02	38,89
Peaches brandy	35,44	35,85	35,75	35,68
Quince brandy	40,92	41,31	41,50	41,24

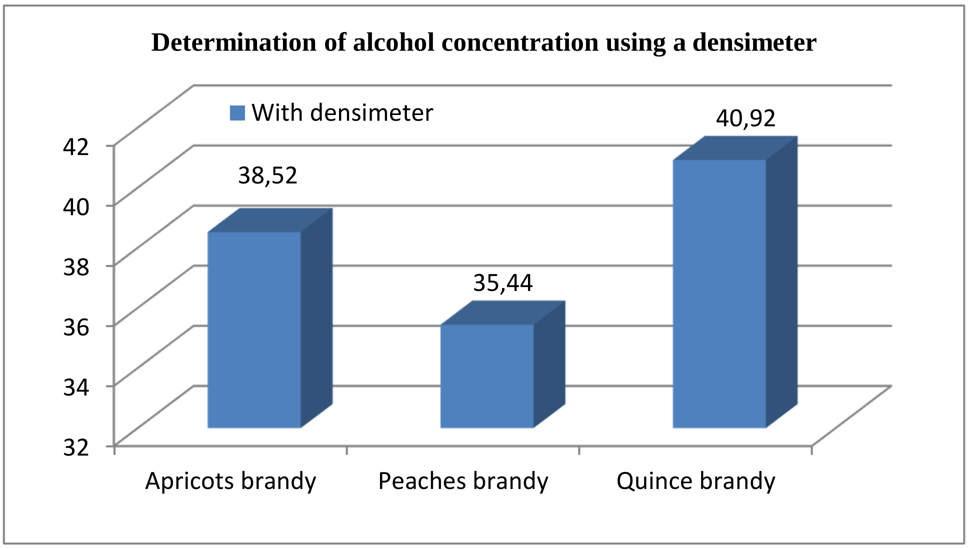

Figure 1. Values of alcohol concentration (V, %) determined with a densimeter

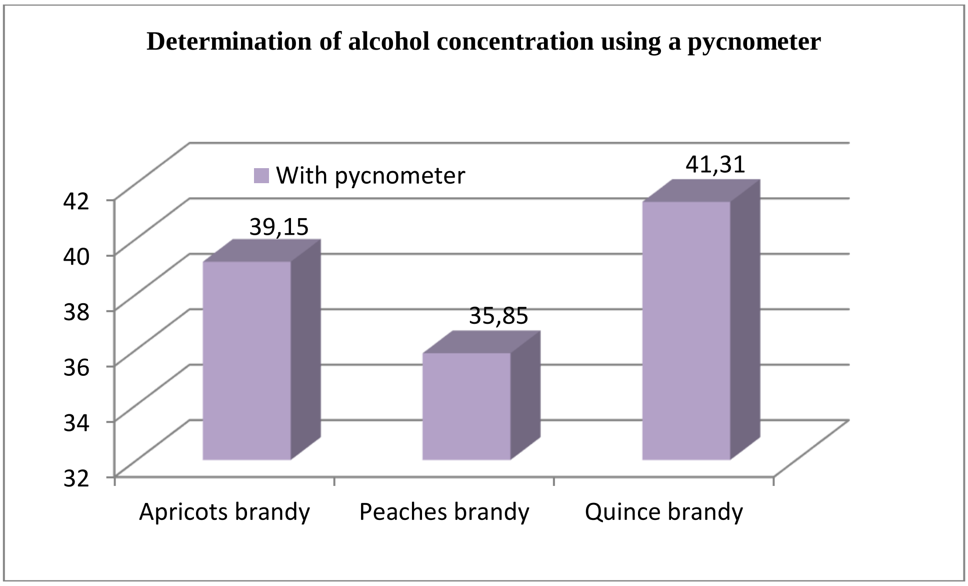

Figure 2. Values of alcohol concentration (V, %) determined with a pycnometer

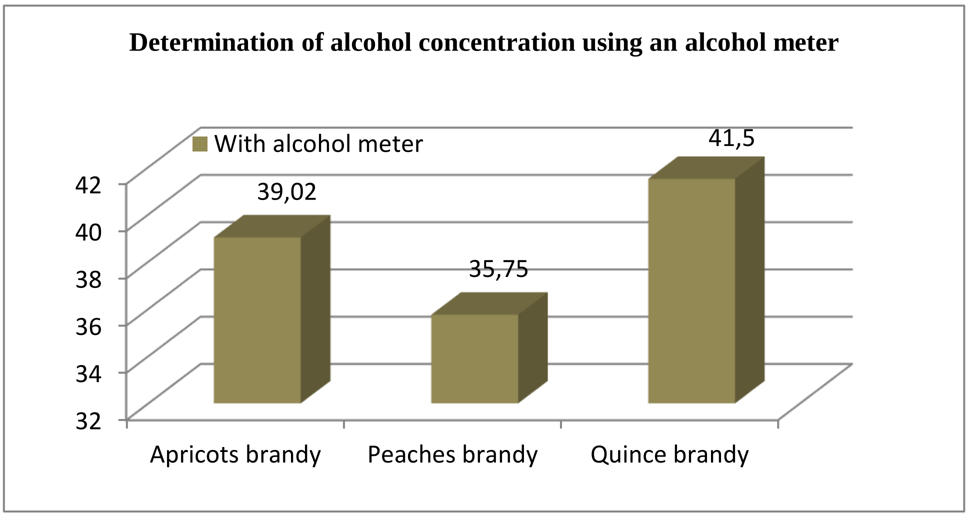

Figure 3. Values of alcohol concentration (V, %) determined with an alcohol meter

Analysing the experimental results obtained for the 3 brandy samples, it can be seen that the determined values are close. As such, all three methods can be successfully used to determine alcohol concentration. However, in order to obtain accuracy results, as close as possible to the real values, it is recommended to use the method of determination with the pycnometer, even if the other two determination methods are much more expeditious.

Regarding the alcoholic concentration, respectively, the strength of brandies obtained by fermentation and distillation of fruits, this depends mainly on the process of obtaining these spirits as well as on the nature of the fruits used as raw material: peaches, apricots and quince, but also depends on the volume of distillate resulting after fermentation. When from approximately equal quantities of fermented material, close volumes of brandy are distilled, using similar working procedures, the concentration of the final product depends on the sugar content of the fruit.

Therefore, a higher alcohol concentration is noted in quince brandy. Apricots brandy and peaches brandy follow in terms of alcoholic strength, the latter having the lowest concentration.

The values obtained from the analysis of heavy metals (Cu, Zn, Pb, Cd) in the brandy varieties studied are presented in table 2.

Table 2. Concentrations of heavy metals (mg/L) from the analysed brandy samples

Analysed brandy sample	Heavy metal (mg/L)			
	Cu	Zn	Pb	Cd
Apricots brandy	1,155	1,250	0,075	< 0,01
Peaches brandy	1,250	1,155	0,080	< 0,01
Quince brandy	1,355	1,205	0,085	< 0,01
Maximum allowed limit	**5,00**	**5,00**	**0,30**	**0,01**

4. Conclusion

An important topic for modern food engineering is the presence of contaminating metallic elements in food products, especially heavy metals. Thus, there is a real interest in identifying and eliminating them from human food and implicitly from distilled alcoholic beverages. Toxic metals can end up in alcoholic beverages from inappropriate containers in which they are prepared, stored and transported. Brandy, resulting from the distillation of the juice obtained from the fermentation of fruits in boilers, is often contaminated with large amounts of toxic metals: Hg, Cd, Pb, Sn, or potentially toxic: Cu and Zn, which once in the body cause serious metabolic disturbances, generating serious diseases. As a result, brandy, considered as food, consumed in recommended quantities, becomes a potential source of toxic or potentially toxic substances, with a serious impact on the human body.

Lead and cadmium, heavy metals with pronounced toxic character, were determined in very low concentrations. Analysing the concentration of each individual element in the fruits from which the brandy varieties were obtained: apricots, peaches and quince, no clear differences were reported. This is due to the small and very small contents of detected metallic elements, of the order of ppm and even ppb. Comparing the experimental values obtained with the maximum limits allowed by the Order of the Ministry of Health no. 975/1998, we find that these values are far below the values imposed by this normative act.

It can be concluded that the brandy varieties analyzed do not present a risk of contamination with heavy metals. This is due to the lack of polluting agents of anthropogenic and geogenic nature, but also to the normal fermentation-distillation process and the hygienic quality of the copper basins and barrels in which these natural distilled alcoholic beverages are prepared and stored.

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