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UV-VIS spectrophotometric evaluation of the impact of fruit and wood addition on fruit distillates

Thomas Dippong[1], Cristina Mihali[1*]

[1]Technical University Of Cluj Napoca, North University Center At Baia Mare, Faculty Of Science, 430122, 76 Victoriei Street, Baia Mare, Romania

Abstract

The paper aims to show the wood and fruit embedding technology in fruit distillates. The influences of mulberry wood on the antioxidant and esters content of plum distillates, and that of poplar wood on apple distillates, as well as cherry and pear additions to plum distillates were studied by UV-VIS spectra. An absorption maximum in the range of 271-277 nm was attributed to gallic acid, a polyphenolic compound. The absorbance values in this range were higher for the samples of fruit distillates maturated with mulberry and poplar wood and also for the samples maturated with cherries and pears showing the increase of polyphenolic compound content. The amount of esters expressed as ethyl acetate increased in the case of maturation of the fruit distillates with cherries and pears with positive effect on aroma characteristics of fruit distillates.

Keywords: UV-VIS spectra, plum distillates, apple distillates, wood embedding, fruit embedding

1. Introduction

Spirit drinks are alcoholic beverages whose concentration is obtained exogenously, either by the addition of refined ethyl alcohol from fermentation of agricultural raw material, or as a sum of alcoholic concentration by the addition of refined ethyl alcohol, and representing the weight in the alcoholic strength of the product, along with the alcoholic strength of flavorings, macerates, alcoholic fruit juices and the amount of endogenous ethyl alcohol from fruit distillates.

Plum distillate is an alcoholic beverage obtained through the fermentation and distillation of plum. It has the characteristics of the region of provenance and is of superior quality. The quality of distillates is influenced by the technological aspects of the manufacturing process [1,2]. The raw material for the distillates is well-grafted or common plums (*Prunus Domestica*), without earth particles or foreign bodies. These are suitably large fruits, ellipsoidal, ovoid or globular, laterally flattened or not, and with a superficial ventral furrow. The pulp is generally non-adherent to the kernel, yellowish, dense, and sweet.

The kernel is elongated, flattened, with an alveolar surface, with small central hulls [3]. A difference in the properties of plum cultivars will lead to different alcohol yields. Also, brandies obtained from fruit without kernels are of better quality when compared to those obtained by mashing the entire fruit [3,4]. Due to characteristics related to early/late harvest time, self/cross pollination, color of skin/flesh of the plum and chemical profile (antioxidant content), several different maturation parameters have been described for plums [1,5]. All alcoholic beverages derived from fermented fruit containing it [6,7]. The brandies obtained from fruit fermentation and marc distillation have a much more complex chemical composition than the fruits from which they derive [8-10]. The paper aims to show the wood and fruit embedding technology in distillates and, also, to emphasize the influence of wood and fruit on the composition of fruit distillates. The wood and fruit enriched the fruit distillate in polyphenolic compounds that are known for their ability of quenching free radical species and positive effect on health [11-15].

Corresponding author: *e-mail:* mihali.cristina@gmail.com; Phone: +40749137351

The novelty of the research in this paper consists in the presentation of wood embedding technique (mulberry tree and poplar) or entire fruit in the distillates bottles. The study of the influence of wood and fruit on fruit distillate composition was also accomplished with accent on the polyphenolic compounds evaluated by spectrophotometric analysis of fruit distillated assortments. The manufacturing of the plum distillate was presented in details.

2. Materials and Methods

Fruit distillates manufacturing process: Fruit distillate was obtained due to the alcoholic fermentation process of sugars. This is the result of microorganisms, which, during alcoholic fermentation, multiply and create deposits, either on the bottom of the fermentation vessel or on the surface of the liquid. Before being put in barrels, the cleaned, ripe fruit was mashed and passed through a mincing machine. The plum distillate was obtained during summer, the fermentation process occurring at a higher speed, the final mixture being ready to be distilled much quicker. The presence of fruit flies means that the mixture is not ready for distillation. Tart juice has to appear on the edge of the barrel, the mixture separating on the walls. If the juice is still sweet, the fermentation process is not complete. A sign that the mixture was almost ready to be poured into the distillates cauldron comes in the form of fruit flies turning into small, white maggots. Once the maggots have died due to the alcohol, the mixture was ready to be worked on. The distillate contains 3 parts: "forehead", "middle" and "tail". The forehead represents 1.5-2% of the distillate, with 70-72% ethanol, it is poisonous, with a large amount of methyl alcohol. The tail is weak with a very low alcoholic content and sour taste. The middle (good distillate) represents 40-50% of the total distillate, and when it starts to flow, it is filtered. Distillation stops when the tail has an alcohol content of below 15%. The forehead and tail are collected separately and added to the next decoction for distillation. This produces a distillates containing 30-35% ethanol with an ambiguous taste. During distillation, the content of the most volatile component is continuously reduced to zero. The boiling temperature of the mixture does not remain constant, because, as the most volatile components pass through steam during distillation, the temperature is constantly increased until it reaches the boiling point of the most volatile component. In fact, from a mixture of water and alcohol during boiling, the vapors emitted are richer in alcohol than the mixture they come from, which allows successive distillations starting from a very dilute mixture to produce liquids with a much higher alcohol concentration. In order to separate the various components of the mixture, it is necessary to continuously increase the temperature of the distillation boiler and to stop distillation when evaporation of a certain quantity of the alcoholic raw material has occurred. Aging was done in oak barrels, in which the distillates turns dark, yellow-brown, of pleasant and of harmonious taste.

The wood embedding technique consists in processing poplar and mulberry wood, in order to obtain handicraft objects, and their insertion into the distillates bottles using tweezers (Figure 1). Before the wood is processed, drying is recommended. It is very important to note that no varnishes and special paints are used for wood and the pieces have to be joined together by means of rivets instead of adhesive. After the addition of the distillates into the bottles in which the objects have been introduced, it gets a white to yellowish color.

The fruit embedding technique. The bottles are placed on the branches when the fruit is still small, and hanged down, connected with twine. The bottle neck was covered with adhesive tape to prevent water from entering. The fruit is covered, so as not to be damaged because of the sun. When the fruit is almost mature, the bottle is taken away from the tree, washed and filled with distillates. The fruit is not only decorative; it gives the drink its color, aroma and special properties. It contains vitamins and minerals that transmit to the beverage. Once sealed, the bottle can be kept for decades.

Types of obtained distillates: The following fruit distillates were analyzed: plum distillates 1 (PD1), plum distillates maturated with mulberry wood (PDM), apple distillates (AD), apple distillates maturated with poplar wood (ADP), plum distillates 2 (PD2), plum distillate maturated with cherries (PDC) distillates and plum distillate maturated with pears (PDP). The maturation under the influence of wood and fruit addition was conduct during 4 weeks. Then the UV spectroscopic analysis was performed for the maturated distillated in the presence of wood or fruit in comparison with control samples without fruit or wood addition.

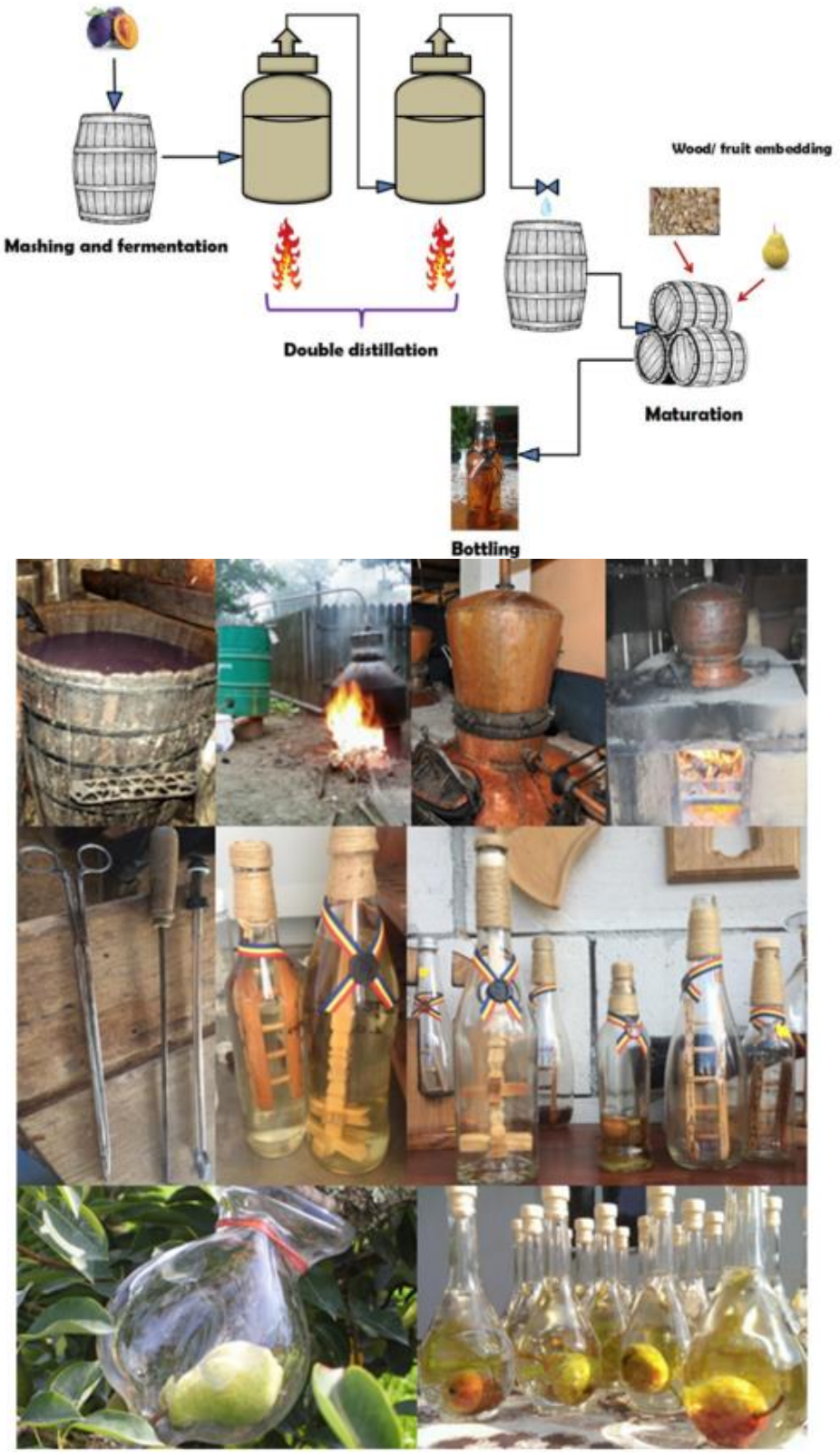

Figure 1. The steps for obtaining plum distillates (up), the wood (middle) and fruit (down) embedding technique

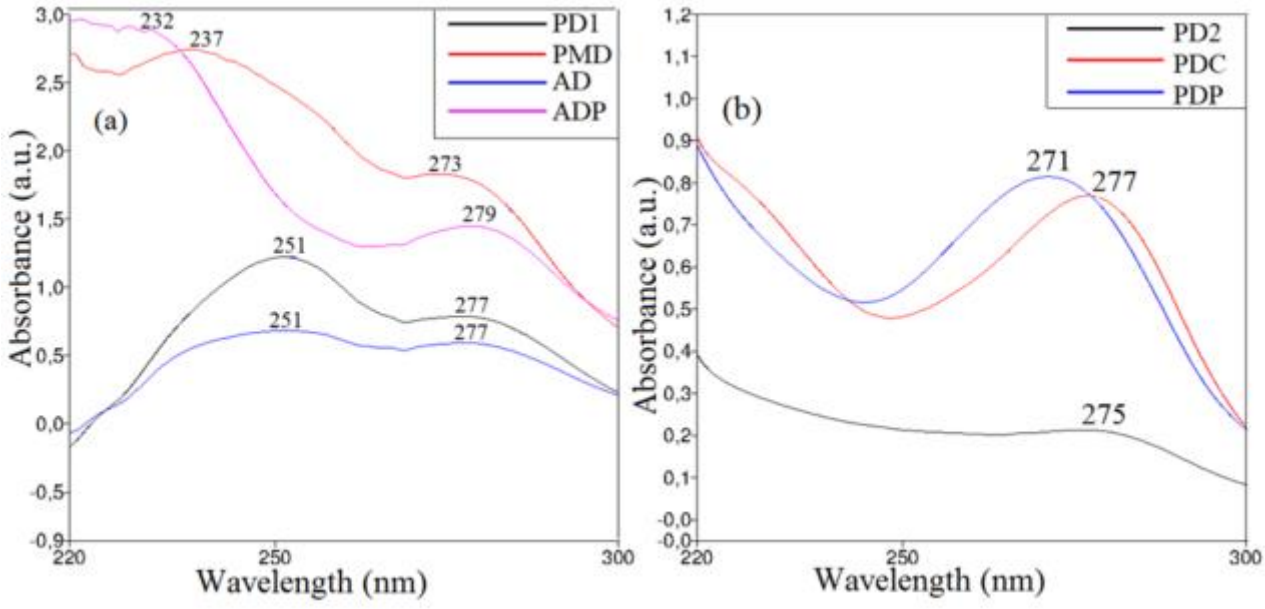

Figure 2. The UV spectra of that show the influence of wood (a) and fruit (b) on distillates quality

Table 1. The esters content of PD1, PDM, AD, ADP, PD2, PDC, PDP fruit distillates samples

Sample	PD1	PDM	AD	ADP	PD2	PDC	PDP
Esters (mg/L)*	383	388	432	442	382	395	402

* expressed as ethyl acetate

The UV-VIS spectra were plotted with a Perkin Elmer Lambda 20-25 spectrophotometer in the range of 200-800 nm. Before performing the measurements, a dilution of 1:5 for each sample is realized. UV WinLab software was used for the representation of spectra and the selection of the range of interest wavelengths.

The determination of the esters is based on their saponification reaction with sodium hydroxide, after removal of carbon dioxide from the sample to be analyzed.

4. Conclusions

The technology of obtaining plum brandies and of incorporating cherries and pears in the distillates was presented. According to UV-VIS spectrometric analysis, the composition of the chemical compounds showed a high variability, ascertaining that their ratio depends on the type of fruit, wood and the technological process to which the distillates is subjected.

The maturation of fruit distillates in the presence of wood or fruit increased the esters content and phenolic content with positive effect on sensory characteristics of alcoholic beverages and possible health benefits.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

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