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RESEARCH ON THE AGING PROCESS OF WINE DISTILLATE

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Abstract: *The quality of the aged wine distillate essentially depends on three factors: the quality of the raw material, the distillation technique and the aging method. Only young and high-quality white wines, which are free of physicochemical, biochemical or smell-related defects, are used in order to obtain aged distillates. The aim of this paper is to conduct a study regarding the time needed for the physical properties of a distillate subjected to ultrasound processing to acquire the physical properties of an aged distillate.*

Key words: *distilled wine, amplitude, pH, density.*

1. Introduction

Cognac is aged distilled wine, with an alcohol content of38 – 50 % vol. Cognac is characterized by a yellowish-golden-amber colour and it has a delicate vanilla flavour which, along with other pleasant characteristics, considerably increase its olfactory and gustatory value [1], [3].

In Romania the aged distilled wine is known as "vinars". "Vinars" is a strong alcoholic beverage, obtained through the distillation of certain varieties of wine. The distillate obtained is stored in oak barrels for several months, a process which enhances its gustatory qualities. Likewise, this preservation method is durable even under unfavourable conditions of transportation, storage as well as under unfavourable climatic conditions. The first mention of the wine distillate and its preparation dates back to 1630, in the South-East of France. The wine trade with England and the Scandinavian countries was conducted on the Charente River. "Fire water", as the distillate obtained from wine was called at that time, was an affordable product in terms of transportation costs. Wine distillates have been given a wide range of uses due to their organoleptic properties and chemical composition [1].The quality of the aged wine distillate as finished product depends on three factors: the quality of the raw material, the distillation technique and the aging method [6]. Only young and high-quality white wines, which are free of physicochemical, biochemical or smell-related defects, are used in order to obtain aged distillates. The wines used for distillation need to have: an alcohol content of less than 10 % vol. (preferably 8–9 % vol), low volatile acidity (below 0.4 g/l in H_2SO_4) high fixed acidity (6 – 7 g/l H_2SO_4). The wine should not be rich in tannins, and the non-reductive extract should not exceed 16 – 17 g/l; the

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content of residual sugar should be below 2 g/l, the amount of SO_2 should be as limited as possible and the amount of iron should not exceed 4 mg/l [5], [7].

Specific natural factors as well as a very rigorous technology contribute to obtaining wine with the qualities and characteristics mentioned above. The northern wine-growing regions are more favourable as the acidity of grapes is not too diminished through combustion. Excellent results are obtained when plantations are located on calcareous soils. Only high quality varieties of white wine are used; the grapes accumulate small amounts of sugars but the acidity levels are high. In the famous French vineyard Cognac the main varieties of grapes used are Folle Blanche, Saint Emillion and Colombard. These grapes produce low-alcohol wines, with high levels of acidity and very thin in terms of the extraction process. In our country the wine-growing regions with suitable varieties of grapes are: Odobeşti and Panciua rea with the grape varieties Plăvaie and Galbenă; Sibiu area and the Apold vineyard with the grape varieties Feteasca regală and Iordovana; Drăgăşani area with the grape varieties Gordan, Braghina and Băşicata; Huşi with the grape varieties Plăvaie and Zghihara [2], [3].

2. Materials and Method

In order to carry out the experimental research two samples of wine distillate, of 115 ml each, were subjected to the ultrasonic processing with the help of the ultrasound equipment used to process food liquids. The first sample was ultrasonicated at 30% amplitude and the second sample was ultrasonicated at 60% amplitude for a period of 12 days, one hour/day.

Experimental research was carried out for each of the two samples. The main parameters were determined before processing the distillate as follows: pH, relative density and alcohol content.

To highlight the difference between the raw distillate processed by using ultrasound equipment and the distillate aged in oak barrels, the properties of a distillate aged for a period of three years in an oak barrel were determined.

In order to obtain raw distillate from wine, a distillation and rectification equipment was used (figure 1).

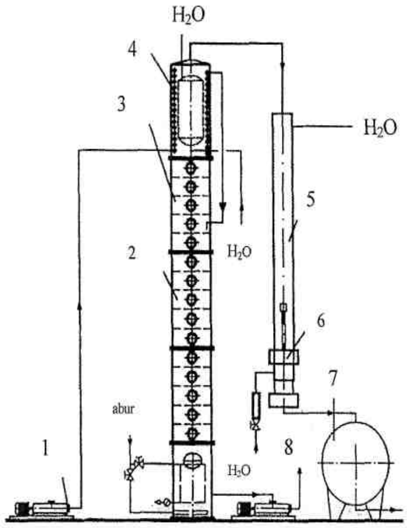

Fig. 1. *Distillation and rectification equipment (continuous installation).*

The component parts are as follows: Number 1 represents the mash pump which has the role to continuously feed the installation which is marked with number 2; number 3 indicates the rectification section; the dephlegmator, graphically marked with number 4, is placed at the top of the rectification section; the water circulates through the dephlegmator coils to cool the vapours resulted from distillation in such a way that only the vapours rich in alcohol should reach the condenser illustrated by number 5.

Once the distillation process has started and the access of the raw materials has been adjusted, the operation is carried out continuously as long as the equipment is supplied with steam and raw material.

The alcohol content of the condensate may be read on the alcoholmeter that is found in the control lamp marked with number 6, then the alcohol is collected in a cistern, graphically illustrated by number 7; the cistern has a meter for measuring the amount of alcohol; at this stage the alcohol is pumped into tanks.

The mash is removed from the distillation with the pump 8. A set of sieves separates the water from the mash; the water is recycled through a system of pumps in the dephlegmator placed at the upper side of the equipment.

The ultrasound equipment was used to age the raw wine distillate (figure 2).

Fig. 2.*Equipment used for ultrasonic processing of wine distillates*

The equipment is made up of an electronic signal generator, VCX 750 type, piezoelectric amplifier which generates ultrasound and to which different types of amplifiers with different geometric configurations may be attached. The ultrasonic amplifier may also be attached a removable tip made of titanium.

The equipment includes an amplitude control device which enables us to set the desired level of ultrasonic vibrations at the tip of the probe.

In order to measure the pH of the distillate samples, a pH - PHT 810 meter manufactured by Ebro in Germany was used.

In order to determine the density of the two samples a cylindrical pycnometer with the capacity of 50 ml was used. Due to the fact that the volume is influenced by temperature, measuring the density with the pycnometer depends on the determination of the mass of a constant volume of liquid (with unknown density) and distilled water (with known density) maintained at the same temperature.

The alcohol content of the distillate expressed in mass percent (% mass) is determined by considering the relative density of the distillate at a temperature of + 20 °C in relation to water at + 4 °C.

The alcohol content, expressed in percent by volume (% vol.), at +15° C of the distillate is determined by taking account of the actual alcohol content expressed in mass percent (% mass), which is independent of temperature.

3. Results and Discussions

Experimental research was conducted for each of the two samples. The main parameters were determined before processing the distillate as follows: pH, relative density and alcohol content.

The values of the raw distillates are shown in table 1.

Values of raw distillate Table 1

Raw distillate	
Density, g/cm³	0,9331
PH	4.45
Alcohol content, % vol.	40,93
Sugar, % dry substance	13.20
Sugar, g/l	115.2

Values of vinars Table 2

Vinars	
Density, g/cm³	0,9352
PH	4.02
Alcohol content % vol.	40
Sugar, % dry substance	15.10
Sugar, g/l	136.4

The values of the distillate aged in oak barrel are presented in table 2.

After the ultrasonic processing, the relative density was determined for each sample with the help of the pycnometer; the pH and the alcohol content of the distillate were determined from the table, depending on the relative density of the liquid.

The results are illustrated in table 3.

The experimental research showed that the density value increases as the processing time of the distillate increases; a decrease in the alcohol content was observed due to increased density.

The researchers also found that the density of the distillate increases faster at higher amplitude, in inverse ratio to the variation of alcohol content (fig.5).

By looking at the results of the experimental research related to density and alcohol content (figure 3), it can be seen that, provided that the raw distillate is ultrasonicated at an amplitude of 60%, it will acquire the properties of the aged distillate after 6 hours and provided it is ultrasonicated at an amplitude of 30%, it will acquire these properties in 11 hours.

It should be noted that we do not consider sugar content because as compared to the ultrasonicated distillate, the distillate aged in oak barrel (vinars) was previously conditioned.

The experimental research also showed a decrease in pH over time (Figure 4).

The values of the distillate subjected to ultrasonic processing Table 3

Time, h	Density, g/cm³		PH		Alcohol content, % vol.		Sugar, % dry substance		Sugar, g/l	
	A=30%	A=60%	A=30%	A=60%	A=30%	A=60%	A=30%	A=60%	A=30%	A=60%
1	0.9333	0.9335	4.37	4.32	40.97	40.87	13.10	13.00	114.1	113.1
2	0.9334	0.9339	4.31	4.28	40.92	40.68	12.90	12.70	112	109.9
3	0.9336	0.9342	4.27	4.23	40.82	40.57	12.80	12.50	111	107.8
4	0.9339	0.9345	4.22	4.19	40.67	40.28	12.60	12.23	108.8	104.3
5	0.9340	0.9349	4.17	4.14	40.59	40.13	12.50	11.98	107.8	101.5
6	0.9342	0.9352	4.12	4.10	40.49	39.94	12.37	11.73	106.0	99.5
7	0.9344	0.9356	4.07	4.05	40.39	39.75	12.24	11.48	104.42	96.34
8	0.9346	0.9359	4.02	4.01	40.29	39.56	12.11	11.23	102.84	93.58
9	0.9348	0.9363	3.97	3.96	40.19	39.37	11.98	10.98	101.26	90.82
10	0.9350	0.9366	3.92	3.92	40.09	39.19	11.85	10.73	99.68	88.05
11	0.9352	0.9370	3.87	3.87	39.99	39.00	11.72	10.48	98.1	85.29
12	0.9354	0.9373	3.82	3.83	39.89	38.81	11.59	10.23	96.52	82.53

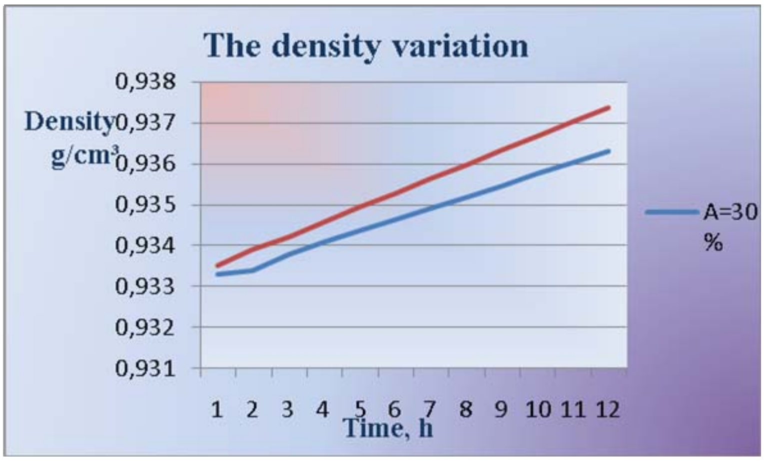

Fig. 3. *Density variation according to amplitude*

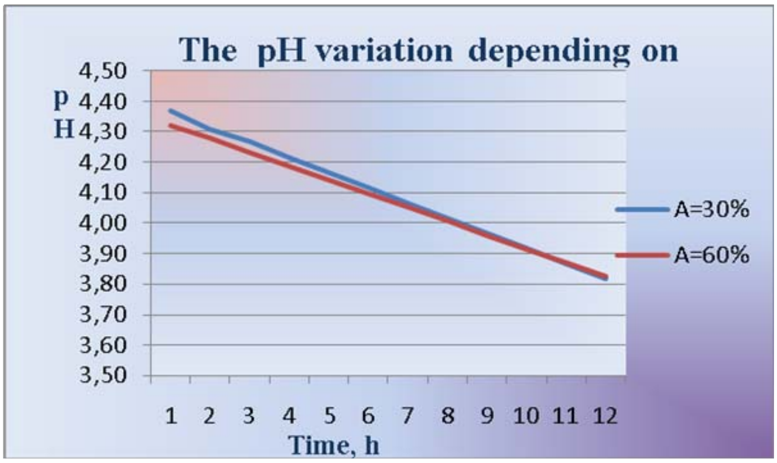

Fig. 4. *Alcohol variation according toamplitude*

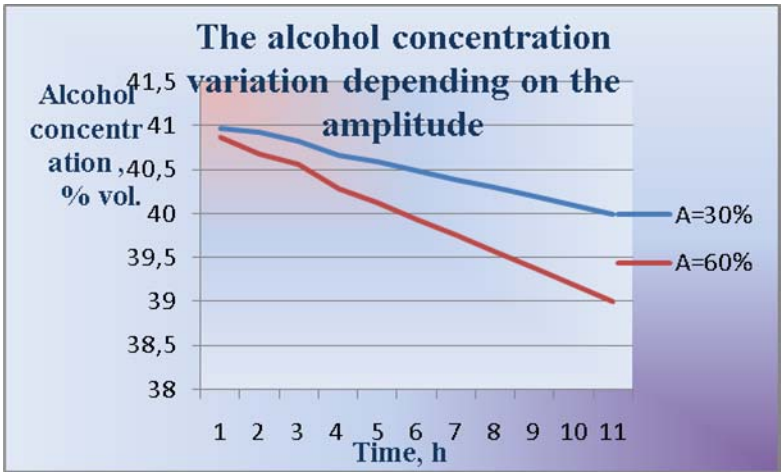

Fig. 5. *Alcohol variation according toamplitude.*

4. Conclusions

The quality of the aged wine distillate as a finished product depends on three factors: the quality of the raw material, the distillation technique and the aging method. The density value increases as the processing time of the distillate increases and the distillate density increases rapidly at higher amplitude.

The alcohol content and the pH of the distillate subjected to ultrasonic processing is in inverse ratio to its density.

At an amplitude of 60% the raw distillate will acquire the physical properties of the aged distillate after 6 hours and at an amplitude of 30% it will acquire these properties in 11 hours.

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