ABSTRACT

Wine is both a product of art, but also of science, a melange between individual creativity and technological innovation. However, the wine industry is above all a business in which the oenologist should be initiated both the "artistic" aspects of wine production and the economic ones. In order to achieve this goal, the winemaker will take into account both intrinsic factors such as grapes, oenological practices applied, winemaking process and extrinsic factors: consumers, globalization. Among the intrinsic factors, great importance are given to the oenological practices (prefermentative treatments, postfermentative treatments) that helps the oenologist in creating a wine with a certain level of quality, a wine in which he can put his creativity in value.

The present study has as main objective the study of phenolic and aromatic compounds in experimental wines obtained from two traditional grape varieties Fetească albă and Fetească regală, following the application of prefermentative treatments. Fetească albă and Fetească regală are two traditional grape varieties found in most vineyards in Romania, but they have not succeeded in imposing on international level as the well-known varieties Sauvignon blanc, Chardonnay, Riesling de Rhin etc.

Wines made from Fetească albă grapes are characterized by finesse and balance, and at the olfactory and gustatory level is noted the presence of citrus flavors, lime blossom, field flowers, hay, ripe apricots. As for the wines obtained from the Fetească regală, they are distinguished by a high acidity, which gives a characteristic, freshness and well−defined taste. These wines are also characterized by the presence of floral notes such as rose petals and field flowers.

The present paper is structured in two parts: the first part refers to current notions about the conditioning treatments applied in the wine industry and a second part of personal contributions in which are presented the objectives proposed in this study, the organizational framework, the materials and the methods used, the discussions on the results obtained and, last but not least, the conclusions.

In order to carry out the present study it was proposed to obtain experimental wines from Fetească albă and Fetească regală grape varieties by applying seven prefermentative treatments namely: treatment with β-glucosidic and pectolytic enzymes, treatment with bentonite, treatment with glutathione, tannin treatment and short-term maceration, coal treatment, gelatin and tannin treatment, and treatment with clarification enzymes and short-term maceration. Thus, from each grape variety, eight experimental variants of wines were made of which a sample constituted the control sample. It is necessary to mention that the grape raw material and the must obtained and used in the experimental variants of Fetească albă and Fetească regală did not present the technological characteristics necessary for obtaining high quality wines. In the first step, the usual physical and chemical parameters were determined both for grapes and musts and for the wines obtained. Also, the experimental variants were analyzed chromatically by using CIELab76 method, and in order to identify and quantify the main olfactory and taste characteristics an aromatic profile of wines was made by organoleptic analysis.

In the second step, the experimental variants were subjected to a more detailed composition analysis using assay methods such as gas chromatography and high performance liquid chromatography.

The grapes from Fetească albă and Fetească regală harvested in the years 2014 and 2015 were subjected to a specific wine-making process in white with the mention that for some variants a short maceration was applied. It is worth mentioning that the must obtained from the processing of the Fetească regală grapes 2014 showed a high value of total acidity (10,92 g/L tartaric acid), this characteristic being experinced later in the corresponding exprimental variants. Also, values below 170 g/L of sugars were determined for the musts obtained from Fetească regală grapes 2014 and 2015.

The alcoholic concentration in the case of the Fetească albă experimental wines 2014 showed values over 11% volume alcohol, but in the Fetească albă variants 2015 only the control variant had a value of over 11% vol. alcohool the other experimental wines presented values below 11% and even below 10% vol. alcohol. Interestingly, the treatment with coal determined the lowest values of the extract and generally the majority of Fetească albă experimental variants exhibited low extract values below 19 g/L, so the wines could be characterized as being deficient body wines, without extract, thin wines.

The experimental wines of Fetească regală 2014 and 2015 recorded values below 10% volume alcoohol and the extracts values calculated for these variants were below

19 g/L. The determination of the D280 index or the total polyphenol index (I.P.T.) and the Folin-Ciocâlteu index was performed in order to highlight the influence of prefementative treatments on the content of polyphenolic compounds. As expected, the minimum values of the two indices (IPT and IFC) were determined for the Fetească regală variants 2014 and 2015 treated with coal (V5, A5), due to its clarification and discoloration properties, but also that the addition of coal was achieved at the maximum allowable OIV limit of 1 g/L.

The study of the chromatic parameters revealed in the experimental wines the predominance of the green-yellow nuances, except the variant treated with tannin (V4) and with tannin and gelatin (V6) where the red-yellow tones predominated. A bracket opens to indicate that the clarity parameter (L) for wines refers to the existence or non-existence in the analyzed mass of colloidal matter that gives an unpleasant visual sensation of turbidity. A value of clarity close to 100 suggests that wines are clearer, colorless and therefore more processed. Regarding the analyzed samples, the highest values of the clarity parameter (L) were recorded for the wines subject to the prefermentative treatment with coal.

Gas-chromatography made possible to determine important classes of flavor compounds in the analyzed experimental wines, among which terpenes and terpenic derivatives, esters, alcohols, acids, aldehydes etc.

The qualitative and quantitative presence of terpenes and terpenic derivatives in the experimental variants of Fetească regală and Fetească albă was limited due to the specificity of the varieties: they are neutral grape varieties, so they do not exhibit specific varietal flavors such as Muscat Ottonel and Tămâioasă românească varieties.

In spite of this, the presence of limited quantities of three terpenic compounds, namely linalool, hotrienol and α-terpineol, whose quantitative variation was between 0 and 0,72 mmol / L was detected in the experimental samples of Fetească regală. The presence of terpenes and terpenic derivates could also be detected in the Fetească albă 2014 and 2015 samples. Thus, a number of common terpenic compounds have been identified such as linalool, nerolidol, citronelol, α-terpineol, which of course presented different quantitative models variations ranging from 0 to 0,7 mmol / L.

Most of the esters identified in the experimental samples of Fetească regală are fatty acid esters: ethyl caprate, ethyl laurate, ethyl myristate, ethyl palmitate, ethyl heptanoate etc., chemical compounds characterized by pleasant, fruity, floral, wax and honey tones that impress them on wines. These compounds also contribute to the sensory finesse of the studied variants.

Referring to the Fetească albă samples analyzed, it was possible to ascertain the predominance of esters resulting from the degradation process of fatty acids as well as the methyl esters resulting from the transesterification process of fatty acids with methanol. In addition, the presence of important esters resulting from the degradation process of amino-acids and esters resulting from cellular carbon metabolism can be observed. Among the esters identified some of them were found in significant quantities namely: ethyl caprylate, ethyl lactate, ethyl caprate, diethyl succinate, ethyl myristate etc. The bentonite treatment (V2; A2) determined the presence of higher amounts of ethyl caprate and ethyl phenyl acetate and the treatment with tannin (V4; A4) determined higher concentrations of ethyl pelargonate, ethyl palmitate, ethyl lactate and ethyl myristate. Concentrations of esters have increased following application of coal treatment (V5; A5) namely: diethyl malonate, ethyl hexanoate, isoamyl octanoate, butyl caprylate, propyl octanoate.

The gas-chromatographic analysis of Fetească regală samples showed the presence of more than 10 alcohols, most of them being higher alcohols resulting from the fermentation process, which together with the esters contribute to the organoleptic body of the studied wines. Observing the palette of alcohols identified in the Fetească regală samples, it was possible to ascertain the predominance of the compounds that give the wines the vegetal, fruity and floral aromas. Glycerol, one of the most important products after ethanol, resulting from the fermentative process due to the action of yeasts and which offers a certain degree of mealiness was found in almost all samples of Fetească regală 2014, but not in those obtained in 2015. Also, the prefermentative treatments applied conducted to the decrease of glycerol: the highest amount was identified in the control sample (1,07 mmol / L) and after apllying the β-glucosidic and pectolytic enzymes treatment, the amount of glycerol diminished below the detection limit of the device.

Referring to Fetească albă samples glycerol was detected only in 2015 variants, and concerning the alcohols the total number exceeded 20, being found greater amounts of: propanol, isobutyl alcohol, 3-methyl-1-butanol, 1-hexanol, 1-nonanol, phenyl ethyl alcohol, 2-methyl-1-butanol, 1-hexadecanol. It is also worth noting the presence of fatty alcohols such as: 1-octanol, 2-octanol, 1-decanol, 1-hexadecanol, more likely resulting

from the fermentation process, having as a probable source the waxes present on the peel surface of the grapes.

In the case of the acids identified in Fetească regală samples, the prevalence of fatty acids can be ascertained: caproic acid, caprylic acid, decanoic acid, myristic acid etc., and low amounts of unsaturated fatty acids or even nonexistent in the case of some variants due to the fermentation process where these fatty acids are used for the growth and survival of yeasts.

Caprylic acid, hexanoic acid, capric acid are fatty acids that were identified in larger quantities and in all experimental variants of Fetească albă, of course with some quantitative variations. However, on the whole, no significant quantitative variations could be observed in the pre-treated samples compared to the control samples (V0; A0).

Quantitatively speaking in the Fetească regală variants the bentonite treatment (V2; A2), and the clarification enzymes treatment (V7; A7) led to an increase in the amount of benzaldehyde determined. Also, the same model of quantitative variation of this compound was also observed in experimental Fetească albă samples.

High performance liquid chromatography allowed the identification of 9 organic acids in the experimental variants of Fetească regală and Fetească albă: oxalic acid, tartaric acid, malic acid, shikimic acid, lactic acid, acetic acid, citric acid , succinic acid and fumaric acid. It is worth noting that the application of prefermentative treatments did not lead to major quantitative changes towards the values determined on control samples (V0; A0).

Regarding the phenolic compounds in the Fetească albă and Fetească regală experimental samples, flavonoid, non-flavonoid and stilbenes compounds have been identified only in the free form, but not in the esterified form. Non-flavonoid compounds include benzoic acids (gallic acid, vanilic acid, protocate acid, gentisic acid, siringic acid, p−hydroxybenzoic acid), cinnamic acids (p-coumaric acid, ferulic acid, caffeic acid) and stilbenes (*trans*-resveratrol). The flavonoid compounds identified were flavonol (quercitin) and 3-flavanol (catechin and epicatechin).

Quantitatively speaking higher levels of p-hidroxibenzoic acid, gentisic acid, vanilic acid, caffeic acid, gallic acid and ferulic acid were identified in the Fetească albă and Fetească regală wine samples. Interestingly, tanning treatments (V4; A4) led to a quantitative increase of phenolic compounds by reference to the control sample (V0; A0) and even in some cases (gentisic acid) to a doubling. The amount of *trans*-resveratrol underwent a significant increase in Fetească regală samples following the clarification and a short-term maceration (from V0−4,26 μg / L; A0−5,05 μg /L at V7 −59,46 μg /L; A7−77,31 μg /L). In the Fetească albă samples a different quantitative variation pattern was found, so the treatment with clarifying enzymes led to a decrease in the

trans-resveratrol content, and the tannin treatment caused a quantitative increase of this compound. Coal treatment has had a tough impact in terms of quantitative diminishing of identified phenolic compounds.

The ANOVA statistical analysis was applied in order to observe if the prefermentative treatments had a significant influence on the presence of phenolic

compounds in the experimental variants. In this case, for both the Fetească regală and the Fetească albă variants, values of α (significance) equal to or less than 0,05, meaning significant, were obtained. Thus, it can be said that the applied treatments significantly influenced the quantitative presence of these chemical compounds in the analyzed variants. Moreover, for a higher accuracy of the obtained results, homogeneity tests were applied as well the Levene test and the Brown-Forsythe test.

The sensory analysis aimed to evaluate the positive or negative influences of the prefermentative treatments on the organoleptic skeleton of the studied experimental samples. The organoleptic analysis of Fetească regală samples revealed the predominance of fruity tones: ripe fruit, green fruits and a higher acidity that contributes to their freshness. The green fruits aroma was felt stronger in the sample treated with clarification enzymes and short-term maceration (V7; A7), the bentonite treatment (V2; A2) determined a stronger mineral sensation and the treatment with charcoal (V5; A5) has led to a decrease in wine flavors, texture and persistence. Honey tones were better expressed in the control sample and in the samples treated with pectolytic and β-glucosidic enzymes. Applying tannin treatment and short-term maceration has led to an increase in mealiness probably due to the balance between tannins, fatty acids and glycerol.

Fetească albă samples revealed a high acidity and the predominance of fruity, wild flowers and honey notes. It is worth mentioning that in the case of the control sample a higher degree of maliness was felt, and the hay note was experienced more intensely in the experimental variant treated with tannin and short-term maceration.