STUDIES ON THE QUANTITY OF TANNINS IN SOME RED WINES OBTAINED THROUGH DIFFERENT MACERATION-FERMENTATION TECHNOLOGIES IN IASI VINEYARD

STUDII ASUPRA CANTITĂŢII DE TANINURI LA UNELE VINURI ROŞII DIN PODGORIA IAŞI OBŢINUTE PRIN DIVERSE TEHNOLOGII DE MACERARE-FERMENTARE

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Abstract. *The study has analysed wines produced from four black grape varieties (Cabernet Sauvignon, Merlot, Fetească neagră and Băbească neagră) from Iaşi vineyard. The wines were obtained by applying different maceration-fermentation techniques: classical maceration-fermentation, ROTO-maceration, thermo-maceration and microwave maceration. The obtained wines were analysed after the second racking, in order to evaluate the tannins level through several spectral analysis methods. At the same time, parameters specific for red wines were determined: total polyphenolic index, Folin-Ciocâlteu index, pH and total anthocyans quantity. The results showed the presence of higher quantities of tannins in the wines obtained by thermo-maceration and microwave maceration versus wine samples obtained through ROTO-maceration and classical maceration-fermentation.*

Key words: Iaşi, tannin, maceration

Rezumat. *Studiul a analizat vinuri obţinute din patru soiuri de struguri Cabernet Sauvignon, Merlot, Fetească neagră şi Băbească neagră din podgoria Iaşi. Vinurile au fost obţinute în urma folosirii diferitelor tehnici de macerare-fermentare: macerare-fermentare clasică, macerare în cisterne rotative, termomacerare precum şi prin aplicarea maceraţiei cu microunde. Probele de vin au fost analizate după pritocul al doilea. Nivelul taninurilor a fost evaluat prin diverse tehnici de analiză spectrală. Au fost determinati şi alti parametri specifici vinurilor roşii: indicele polifenolic total, indicele Folin-Ciocâlteu, pH-ul şi cantitatea totală de antociani. Rezultatele obţinute demonstrează prezenţa unor cantităţi mai mari de tanin în variantele procesate prin termomacerare şi macerare cu microunde în detrimentul probelor obţinute prin rotovinificare şi macerare-fermentare clasică.*

Cuvinte cheie: Iaşi, taninuri, macerare

INTRODUCTION

Tannins are phenolic compounds that are found in all of vine's organs and are responsible for the astringency sensation, especially in red wines. They are water soluble and form colored compounds that have the capacity to precipitate

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proteins, inhibit enzymes' activity and contribute together with the alcohols and acids in wine conservation (Pomohaci N., 2005).

The tannin quantity in the must depends on the contact period between the stalks, skins and seeds and also on the processing technology of the grapes.

According to the quantity in which they are present, fact that depends on the category and wine type, tannins contribute in a positive but also negative manner to the sensorial characteristics of the wine (Cotea D. V., 2009).

According to the used maceration-fermentation technology in red wine production the tannin level is evaluated through analysis and comparison of results choosing in the end the most efficient method.

MATERIAL AND METHOD

The wines of four grape varieties were taken into study, two of them being local (Băbească neagră – variant V_1 and Fetească neagră – variant V_2) and two being cosmopolitan (Cabernet Sauvignon – variant V_3 and Merlot – variant V_4). The grapes were harvested at technological maturity from Copou and Bucium viticultural centers.

The grapes were divided in 4 equal parts and several maceration-fermentation were used in order to evaluate the influence of the technology on the tannins composition and on the physical-chemical characteristics.

The used maceration technologies were: classical maceration (code V_{x1}), microwave maceration (code V_{x2}), thermo-maceration (code V_{x3}) and roto-tanks maceration (code V_{x4}).

During the thermo-maceration technology, the working temperature was 70 ^{o}C for 30 mins, while, during the microwave maceration, the grape samples were treated at 750 W for 15 mins. The classical maceration and roto-tanks maceration were done over a period of 5 days until the grape skin showed no more color variation. After the end of the alcoholic fermentation, the wine was racked into glass vessels kept at room temperature in order to stimulate malolactic fermentation. After 7-8 days, the wine was filtered and bottled with an Enomatic Tenco device.

Immediately after, a dose of 40 mg/L sulphur dioxide per bottle was used, the bottles were corked with a Mini T.S. device 6 months after bottling; the wines were analyzed to evaluate the physical-chemical parameters and also some specific macro parameters of tannins.

The following parameters were evaluated: volatile and total acidity, pH, alcoholic concentration, total dry extract and non-reductive extract. The used analytical methods are according to the European standards and those of the OIV.

During the characterization of the phenolic compounds, a series of spectrometric analyses for evaluation of the total polyphenolic index, Folin-Ciocâlteu index (Flanzy M., Poux C., 1958) and total anthocyans quantity -pH variation method- was performed. An Analytik Jena S200 spectrometer was used. The total poliphenolic index or D280 represents a global photometrical determination of all phenolic compounds present in wines, determined by a direct analysis of wine's absorbency at 280 nm reported at water's absorbency. In the case of red wines, a dilution is made or quartz vials are used, that have an optical distance less than 10 mm. The equivalence of epi-cathechine can be expressed by using a calibration curve of 280nm.

The Folin-Ciocâlteu index represents a kinetic determination of compounds with reductive properties that are oxidized by phosphomolybdate and phosphotungstate mixture, when, after a 30 minutes, an equilibrium is attained and a blue complex realized in a sodium basic medium. This complex absorbs at 750 nm

and according to the quantity of the compounds present in the wine sample, the necessary dilutions will be made in order to obtain reproducible results in the linearity of the detector (spectrophotometer).

To evaluate the tannins' content, two spectrometric analyses were done to determine the tannins in epicatechine equivalent units. A used method (Sarneckis C. J., 2006) was the one where tannins are precipitated with methylcellulose, by evaluating spectral differences at 280 nm, while their concentration can be determined with a calibration curve.

Wine's turbidity is much influenced by the tannins' quantity and in order to have an alternative method of estimating the macromolecules' concentration, this photometrical method of tannins' evaluation was also proposed (De Freitas V. A. P., 1995)

Another analysis method for the tannins composition is based on the Bate-Smith reaction (Bate-Smith E. C., 1954) that has as basis an oxidative depolimerisation reaction. The proanthocyanidols were calculated with the help of a calibration curve, found in specialized treatises (Ţârdea C., 2007).

The HCl index is used to reflect the tannins' polymerisation state in wines. This method is based on the instability of procyanidines in a concentrated clorhidric acid environment, where the precipitation speed depends on the polimerisation degree.

By calculating the chromatic parameters of the CieLAB76 system, L, a, b, the effect of the maceration method on the colour parameters of the wine can be registered.

RESULTS AND DISCUSSIONS

Table 1 presents the results of the physical chemical analysis of the studied wines. The volatile acidity (g/L acetic acid) has values between 0.27 g/L (V_{14}) and 0.38 g/L (V_{31}), while the same results expressed in g/L tartaric acid are between 5.02 g/L (V_{11}) and 8.98 g/L (V_{21}).

Table 1

Results of the physical chemical analysis

Technology for grape variety/Physical chemical parameters	Volatile acidity g acetic ac./L	Total acidity g tartaric ac./L	pH	Alcohol % vol.	Total dry extract g/L	Non-reductive extract g/L
V_{11}	0.33	5.02	3.79	11.2	21.6	18.93
V_{12}	0.29	5.99	3.56	11.1	24.8	22.57
V_{13}	0.28	5.44	3.69	11.4	24.5	21.59
V_{14}	0.27	5.14	3.71	11.1	20.9	18.85
V_{21}	0.33	8.98	3.56	13.45	42.1	38.42
V_{22}	0.27	7.42	3.61	13.1	34.6	31.83
V_{23}	0.33	7.33	3.65	13.6	34.9	32.1
V_{24}	0.33	8.44	3.54	13.1	45.7	41.84
V_{31}	0.38	6.07	3.71	10.15	29.2	27.02
V_{32}	0.27	7.42	3.60	10.41	33.1	30.57
V_{33}	0.25	7.25	3.57	10.4	31.8	29.3
V_{34}	0.32	6.24	3.65	10.2	28.4	26.16
V_{41}	0.30	6.74	3.49	12.9	26.8	23.4
V_{42}	0.34	7.84	3.40	13.2	30.2	27.99
V_{43}	0.31	7.29	3.51	12.6	30.5	27.79
V_{44}	0.30	7.12	3.41	12.7	27.4	24.13

The pH of the wines varies between 3.41 (V_{41}) and 3.79 (V_{11}). The lowest values of the alcoholic concentration were found in Cabernet Sauvignon wines (10.15 % vol. (V_{31}) and 10.41 % vol. (V_{32})), as the grapes were harvested earlier due to unfavorable climatic conditions, when the sugar content was of 178.3 g/L. The Băbească neagră and Cabernet Sauvignon wines obtained by roto-tanks maceration have minimal values for the total dry extract and non-reductive extract while the values of the same indices in samples obtained through microwave maceration are maximal. The samples obtained from Feteasca neagră have maximum values in microwave maceration while at samples obtained from Merlot, the minimal values are found in variants processed through classical maceration and the highest in thermal processed samples.

Figure 1 presents the evolution, in percentages, mg/L epicatechine for the D280 and IFC, in order to evaluate the influence of the applied technology upon wines. The local varieties have the same distribution of values between the classical and roto tanks compared with thermal maceration of the four technology options evaluated. A particular case is at Merlot wines when the classical and thermal procesys presents lower values than microwave and roto tanks. Values are discussed in terms of D280 percentage (can be discussed in the same manner for IFC). With few exceptions, it can be generalized, theat heat maceration variants have higher significant values for IFC.

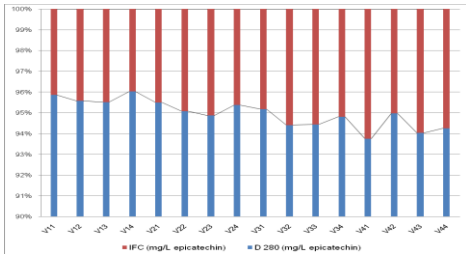

Fig. 1 – Percentual evolution of parameters D280 and IFC

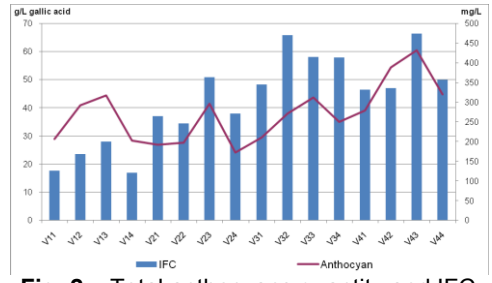

Fig. 2 – Total anthocyans quantity and IFC evolution

Figure 2 presents the quantitative results for IFC (g/L galic acid) and total anthocyans quantity (mg/L) in the studied samples. Analyzing the graphical distribution from the figure, it can be said that in the thermal variants (indexed 2 and 3 at V_x) the highest quantities of anthocyans are found and also the highest quantities of compounds with reductive properties (the anthocyans ratio is according to the grape variety of which the wine was made). In the Băbească neagră wines, higher values appear at anthocyans than IFC values. By comparing the data of figures 1 and 2 it can be seen that the highest quantity of anthocyans is obtained by applying classical thermo-maceration, but in the case of Cabernet Sauvignon wines, the microwave maceration technique can also be efficient.

Figures 3 and 4 present an evaluation of tannins present in wine samples. For evaluating the total quantity of tannins the methyl cellulose method was used. The level and tendency that these compounds have in wine are showed in fig. 3.

High values of the HCl index are found in wines obtained through microwave maceration from local grape varieties. Small quantities of the same index are registered in the wine samples obtained from cosmopolitan grape varieties. High values (>25%) of this index represent already polymerized tannins or with an tendency for precipitation, while small values (<10%) represent the presence of monomerical tannins.

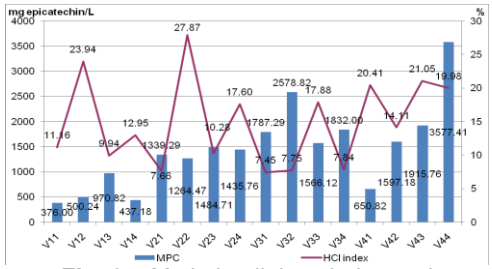

Fig. 3 – Methyl-cellulose index and clorhydric index variation

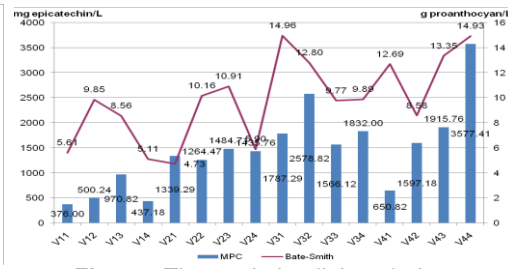

Fig. 4 – The methyl-cellulose index compared to Bate-Smith reaction values

Figure 4 presents the results of an oxidative depolimerisation test (Bate-Smith) compared with the results obtained in the methylcellulose precipitation test. Some of the applied technological variants induce the appearance of superior polymeric structures especially in wines obtained through thermal macerations from local grape varieties. The high value of V_{31} (the result of the oxidative polimerisation reaction), compared to HCl index, can be explained through the fact that the wine obtained through this method has suffered a slight acetic fermentation, probably at the same time with the alcoholic fermentation (this is the sample with the highest values in volatile acidity from V_{3X} variants, low alcohol and total acidity). Due to the significant tannin quantity, the value of Bate-Smith reaction is higher. Analysing the two figures (3 and 4), one can note that cosmopolitan grape varieties present higher tannins indeces that have superior implications like a better stability in time for maturation compared to the wines obtained from local grape varieties.

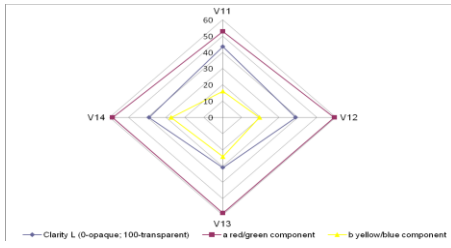

Fig. 5 – Orthogonal distribution of color parameters L, a, b in V_{1x}

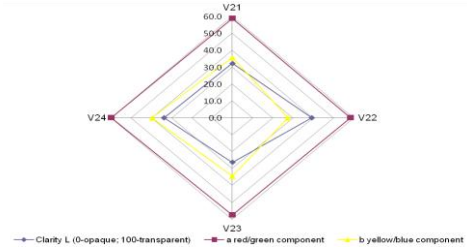

Fig. 6 – Orthogonal distribution of color parameters L, a, b in V_{2x}

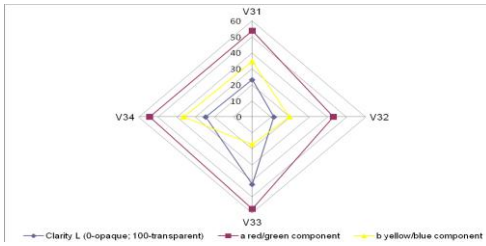

Fig. 7 – Orthogonal distribution of color parameters L, a, b in V_{3x}

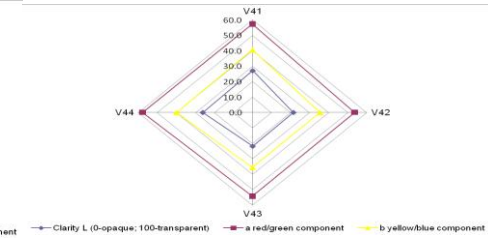

Fig. 8 – Orthogonal distribution of color parameters L, a, b in V_{4x}

Figures 5, 6, 7, 8 are spatial distributions of colorimetric characteristics of the wines obtained by different maceration techniques. Figure 7 shows that there is not an ortogonality of the parameters and that, implies a significant variation of the wine's colour taking into consideration the applied maceration technique. The small colorimetric differences can be noticed only in the case of V_2 (Fetească neagră) and V_4 (Merlot).

CONCLUSIONS

1. The thermal and microwave maceration in red wines, compared with classical maceration techniques, leads to the extraction of higher quantities of phenolic compounds – tannins – in wines;

2. Cosmopolitan grape varieties are richer in phenolic compounds than local grape varieties. The use of modern maceration fermentation methods can enrich the quality of obtained wines as well as the bioactive character of some varieties with less potential (Băbească neagră).

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