ASPECTS CONCERNING THE VARIATION OF PHENOLIC COMPOUNDS AND COLOR PARAMETERS, ACCORDING TO MACERATION METHOD, IN WINES OBTAINED FROM FETEASCĂ NEAGRĂ GRAPE VARIETY

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Abstract

This study analyses the way in which different maceration-fermentation methods (ultrasounds maceration, microwave maceration, thermomaceration, classical maceration) influence the extraction of phenolic compounds and the color of Feteasca neagră wines. In order to underline the variation of phenolic compounds and color parameters the following determinantions were carried out: D280 index, Folin Ciocalteu index, anthocyans according to pH variation , anthocyans profile, phenolic acids and Cielab76 color determination.

The obtained data showed that there are differences between the results' values in the wines obtained through the four maceration-fermentation procedures. Microwave maceration and thermomaceration have been proved to be the most extractive for phenolic and color compounds.

Key words: Feteasca neagră, phenolic compounds, color parameters, microwave, ultrasounds.

The phenolic compounds are a large range of substances with an important role in defining red wines quality. Phenolic compounds affect the color, astringency, hardness, taste and antiseptic properties of wine (Cotea, D.V., 1985; Di Stefano et all, 1989; Ribereau-Gayon, J. et all., 1972). To achieve the extraction of color we have used various types of maceration: microwave and ultrasonic maceration, classical and thermoceration. The color extraction depends on the contact time with marc and microwave power, the time, the ultrasonic frequency maceration , and the temperature at thermomaceration.

MATERIAL AND METHOD

The researches on the influence of microwave, ultrasound, conventional maceration, termomaceration, which influence the wine color were made in November 2009 - January 2010, in the Oenology Laboratory of University of Agricultural Sciences and Veterinary Medicine Iaşi and were on obtained dry red wine samples of Feteasca neagră grapes, from the wine center Copou harvest in 2009, before and after malolactic fermentation. The wines were obtained under specific technology for obtaining high quality red wines (Cotea D.V., Sauciuc J., 1988; Pomohaci N., et all, 2000).The experiment was carried in three stages: preparation of mark for the 5 variants: V1-ultrasound maceration, 2 variants of irradiation, V2-irradiation at 750 W on 10 minutes and V3-irradiation at 750 W on 17 minutes, V4-termomaceration (90°C) and V5-classical maceration, then inoculation with enzymes Zymoclaire G (Sodinal, 2 g / hl mark) for a high degree of extraction and clarification of musts and selected yeast *Saccharomyces bayanus* Fermactive Rouge (Sodinal; mustuială 20 g/100 kg mark), followed by soaking at 20 ° C for one day. He followed the pressure mark in a hydraulic press followed by alcoholic fermentation, malo-lactic fermentation with *Oenoncocucus Oeni* inoculation(Sodinal; 0.1 mg/L), sterile filtration, addition of 30 mg / L SO2 and bottling in dark bottles of 0.75 L. After three months (after which the visual appearance of tartaric precipitation was analysed) the physico-chemical analyses were made. The physico-chemical analyses were made under international and state standards and specific literature. The Samples obtained after malolactic fermentation were noted: V1'-ultrasound maceration at 37 kHz for 15 minutes, V2'-microwave maceration at 750 W for 10 minutes, V3- microwave maceration at 750 W for 17 minutes, V4'-thermomaceration, V5'-classical maceration. The chemical determination were performed before and after malolactic fermentation: reductive sugars, total acidity, volatile acidity, wine density, dry extract, non reductive extract, alcoholic concentration. The others determinations was anthocyans determination by pH variation method, the total content of phenolic compounds determination by Folin Ciocalteau Index, D_{280} Index, determination of the color parameters by CIE Lab. 76 method , anthocyans profile and phenolic acids determination by high performance liquid chromatography (HPLC) (Di

Stefano, Cravero, 1989; Massimo Castellari et all, 2002; Ţârdea C., 2007).

RESULTS AND DISCUSSIONS

The analyses were performed before and after malolactic fermentation in order to underline the influence of malolactic fermentation on the composition of wines and of the phenolic compounds. The phenolic compound varies during malolactic fermentation depending on maceration type. In the table 1 are presented the physico-chemical analysis of Feteasca neagră wines before malolactic fermentation and after malolactic fermentation in the table 2. It can be observed a slight decrease of acidity after malolactic fermentation caused by a decrease of density and a the decrease of reductive sugar, caused by alcoholic fermentation, developed simultaneously malolactic fermentation.

Table1

Physico-chemical characteristics of Feteasca neagră wines before malolactic fermetation

Sample	Alcohol % vol.	Total acidity g/L $C_4H_6O_4$	Volatile acidity g/L $C_2H_4O_2$	Relative density g/mL	Reductive sugars g/L	T.D.E. g/L	N.E g/L
V1	6,70	0,62	0.9921	3,44	22,20	18,76	12,54
V2	5,95	0,59	0,9927	3,96	20,90	16,94	11,56
V3	6,63	0,66	0.9923	2,94	21,90	18,96	12,32
V4	7,44	0,58	0,9923	3,96	20,30	16,34	11,79
V5	6,86	0,51	0,9945	2,94	24,80	21,86	11,34

Table 2

Physico-chemical characteristics of Feteasca neagră wines after malolactic fermetation

Sample	Alcohol % vol.	Total acidity g/L $C_4H_6O_4$	Volatile acidity g/L $C_2H_4O_2$	Relative density g/mL	Reductive sugars g/L	T.D.E. g/L	N.E g/L
V1′	5,18	0,73	0.9920	3,44	21,90	18,46	12,50
V2′	4,75	0,71	0.9924	3,96	20,10	16,14	11,56
V3′	5,44	0,68	0 .9922	2,94	21,60	18,66	12,27
V4′	6,10	0,59	0.9922	3,96	19,30	15,34	11,51
V5′	5,96	0,54	0.9941	2,26	24,00	21,74	11,38

In *figure 1* are presented the anthocyans determined by pH variation method and V3 has the highest quantity of anthocyans and after malolactic fermentation, the anthocyans present a slight decrease. The D280 and Folin Ciocalteau index determinations value can be seen in the figure 2 and the V3 has the highest total phenolic compounds and V1 has a the lowest quantity of total phenolic compounds with 28,31 value and Folin Ciocalteau index is reprezentative - 27, 05 which shows that the ultrasounds favors the reductive phenolic compounds extract.

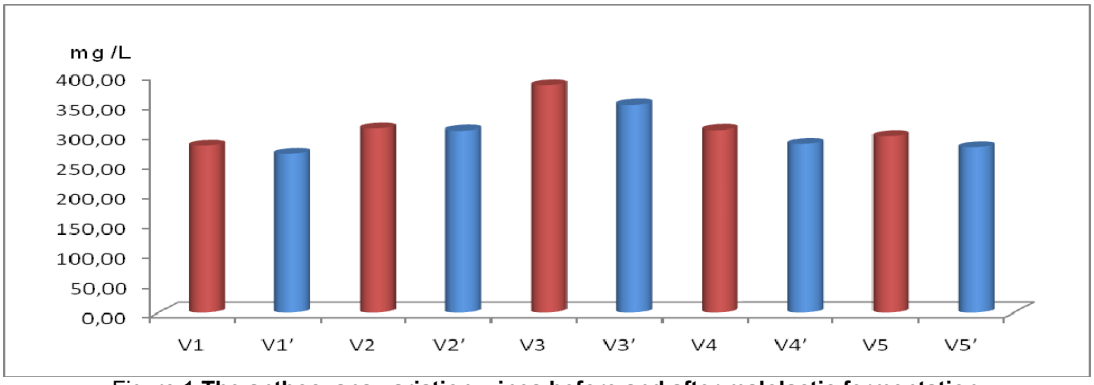

Figure 1 **The anthocyans variation wines before and after malolactic fermentation**

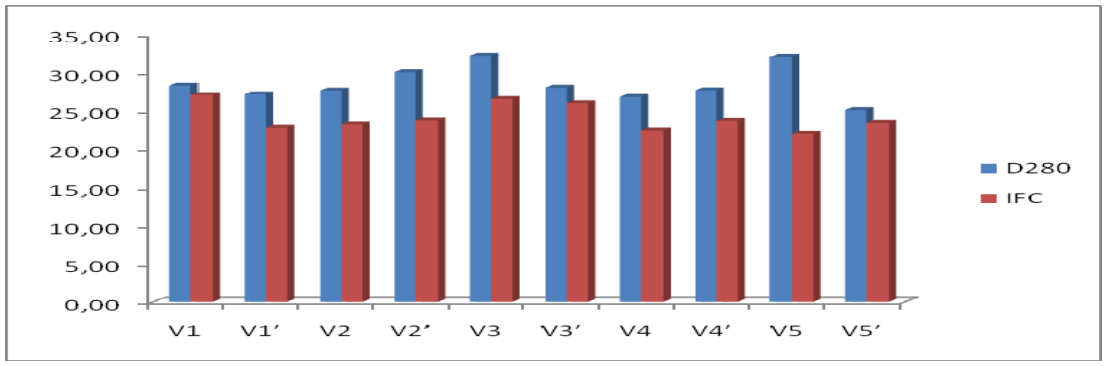

Figure 2 **The variation of D280 and Folin-Ciocalteu index before and after malolactic fermentation**

The color parameters have a variation correlated with used maceration type (figure 3), but after malolactic fermentation appear a slight decrease of intensity value (figure 4). The parameter a (red-green) and b (yellow-blue) have not a constant variation during malolactic fermentation. The third variant present significant values of color parameters at 17 minutes microwave maceration type.

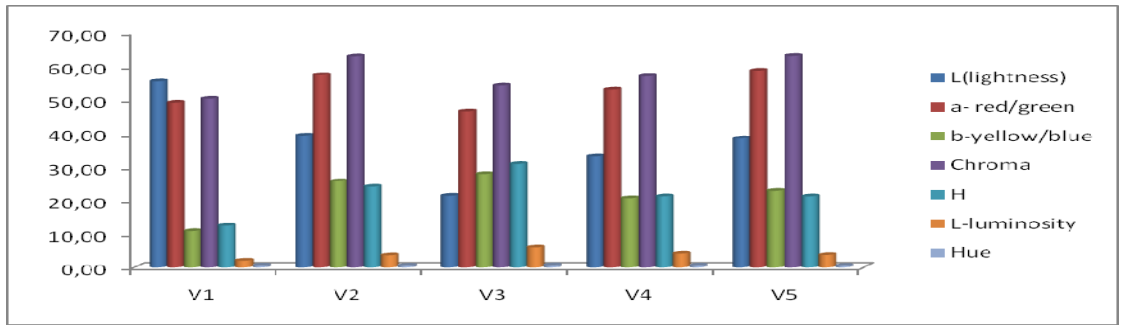

Figure 3 **Chromatic parameters CIE Lab 76 of Feteasca neagră wines before malolactic fermentation**

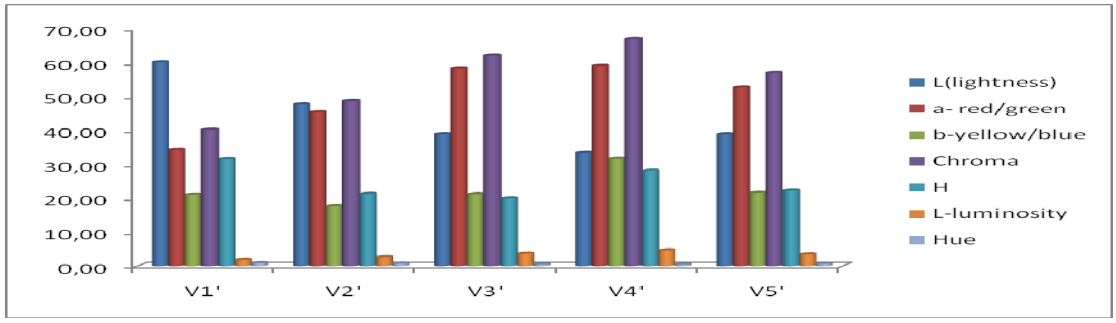

Figure 4 **Chromatic parameters CIE Lab 76 of Feteasca neagră wines before malolactic fermentation**

In the third table are presented the quantity and quality of monoglucosidic anthocyans, esterified anthocyans (acetylated and coumarilated) from Feteasca neagră wines before malolactic fermentation. The third variant has the higest semnificative values with microwave treatment at 750 W for 17 minutes. After malolactic fermentation the quantity values of the anthocyans decreased, the acetylated and coumarilated anthocyans sum is highest at thermomaceration and classical maceration. It means that the classical maceration type favors esterified anthocyans extraction. The quantity determinations of phenolic acids shows that the microwave treatment is favorable for phenolic acids extraction. The gallic acid has significant values but the variation of phenolic acids are not constant.

Table 3

The anthocyans (mg/L) in Fetească neagră wines before and after malolactic fermentation

Sample	Dp	Cy	Pt	Po	Mv	Po-a	Mv-a	Po-cm	Mv-cm	ΣAnt.-acet. +Ant.-cum.	ΣAnt.-acet./ ΣAnt.-cum.	Mv/ ΣMv-COOR	ΣAnt./ ΣAnt.-COOR
V1	3,32	0,35	8,97	3,03	75,60	0,37	3,16	0,60	4,59	8,72	0,68	9,75	10,46
V2	3,52	0,44	8,47	3,47	76,02	0,45	4,73	0,27	2,62	8,07	1,79	10,34	11,39
V3	4,48	0,49	10,57	3,80	73,77	0,41	3,30	0,32	2,85	6,89	1,17	11,99	13,52
V4	3,97	0,48	9,71	3,69	77,17	0,83	3,96	0,01	0,20	4,99	23,62	18,56	19,04
V5	2,69	0,53	8,23	3,28	79,89	0,61	4,19	0,01	0,57	5,38	8,40	16,80	17,60
V1′	3,28	0,30	9,11	3,01	77,23	0,38	2,96	0,36	3,38	7,08	0,89	12,18	13,12
V2′	3,42	0,55	8,72	3,58	76,69	0,45	4,58	0,12	1,90	7,05	2,50	11,83	13,18
V3′	3,91	0,34	10,08	3,50	76,75	0,42	3,40	0,10	1,51	5,42	2,38	15,64	17,44
V4′	3,48	0,67	9,03	3,23	73,82	1,00	4,43	0,49	3,86	9,78	1,25	8,90	9,23
V5′	3,37	0,01	8,44	3,45	76,08	0,80	4,34	0,35	3,16	8,65	1,46	10,14	10,56

Dp - delphinidin ; Cy – cianidin; Pt – petunidin; Po – poenidin; Mv – malvidin; Mv-a, malvidin-acetylated; Po-cm, poedinidin cumarilated; ΣAnt.-acet.+Ant.-cum., the amount of the anthocyans acetylate and cumarilated, ΣAnt.-acet./ΣAnt.-cum, report of the acetylated and cumarilated anthocyans, Mv/ΣMv-COOR, report of the monoglucozid malvidin and the amount of esterified malvidin, ΣAnt./ΣAnt.-COOR-report of the amount of simple and esterified anthocyans.

Table 4

Phenolic acids (mg/L) in Fetească neagră wines before and malolactic fermentation

Sample	gallic acid	protocatechic acid	p - hydroxybenzoic acid	gentisic acid	vanillic acid	caffeic acid	clorogenic acid	syringic acid	p-cumaric acid	ferulic acid
V1	4,186	0,935	0,020	3,173	26,355	3,408	2,159	3,533	3,284	0,469
V2	5,177	1,186	0,004	10,921	21,173	3,213	1,198	4,545	2,894	0,375
V3	6,848	0,824	0,006	0,282	25,359	4,751	2,033	4,748	4,152	0,518
V4	13,176	0,822	0,020	0,278	15,070	0,617	0,979	6,082	0.4204	0,457
V5	7,454	0,961	0,016	10,158	10,210	0,573	0,840	5,249	0,443	0,397
V1′	3,983	0,704	0,026	3,020	22,808	3,265	1,329	3,590	3,168	0,205
V2′	5,007	0,899	0,008	12,038	19,441	3,267	1,034	4,571	3,002	0,494
V3′	8,063	0,593	0,012	0.2237	20,616	4,065	1,514	4,647	3,767	0.3886
V4′	12,508	0,803	0,032	0.2301	13,810	0,496	0,919	6,213	0,374	0,413
V5′	9,010	0,779	0,016	8,068	10,092	0,492	1,180	5,409	0,392	0,353

CONCLUSIONS

This study proved that the microwave treatment has an important influence on wine color. The malolactic fermentation affects the wines' color with a slight decrease in the quantity of phenolic compounds, phenolic acids and anthocyans. The quality and quantity of phenolic acids is not constant, these variations are caused by the different maceration technologies, which influnce in different ways the extraction of these compounds.In the case of wine variants obtained through 750 W irradiation, it can be observed that the time and power of the irradiation influenced in a directly proportional manner the wine color.The wine variants obtained through classic maceration methods have no significant differences in color. The wine samples that were processed using ultrasounds and microwave maceration treatments have high color differences, obtaining a new type of wine.

BIBLIOGRAPHY

Cotea, D.V., 1985 - *Tratat de Oenologie*, vol. 1. Editura Ceres, Bucureşti.

Cotea D.V., Sauciuc J., 1988 - *Tratat de Oenologie*, vol. 2. Ed. Ceres, Bucureşti.

Di Stefano, Cravero, Gentilizi, 1989 - *Metodi per lo studio dei polifenoli dei vini*.

Di Stefano, Cravero, 1989 - *I composti fenolici e la natura del colore dei vini rossi.*

Pomohaci, N., Stoian, V., Gherghiţă, M., Sîrghi, C., Cotea, V.V., Năməloşanu, I., 2000 - O*enologie vol.1 – Prelucrarea strugurilor şi producerea vinurilor,* Editura Ceres, Bucureşti.

Ribereau-Gayon J., Peynaud E., Sudraud P., Ribereau-Gayon P. 1972 - *Traité d'oenologie. Sciences et techniques du vin*, tome 1. Analyse et controle des vins. Ed. Dunod, Paris.

Castellari, Massimo, Sartini, Elisa, Fabiani, Alessandra, Arfelli, Giuseppe, Amati, Aureliano, 2002 - *Analysis of wine phenolics by high-performance liquid chromatography using a monolithic type column,* Universita di Bologna, Dipartimento di Scienze degli Alimenti, Italy.

Ţârdea C., 2007 - *Chimia şi analiza vinului*, Editura "Ion Ionescu de la Brad", Iaşi.

***** 2009 -** *Compendium of International Methods of Analysis of Wine and Musts*. O.I.V., Paris.