ASPECTS REGARDING THE VARIATION OF CHROMATIC CHARACTERISTICS DURING MALOLACTIC FERMENTATION IN RED WINE

ASPECTE PRIVIND VARIAȚIA CARACTERISTICILOR CROMATICE ÎN TIMPUL FERMENTAȚIEI MALOLACTICE A UNOR VINURI ROŞII

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Abstract. *The study presents information concerning the chromatic characteristics' variation of some red wines during their malolactic fermentation. six red wines were used from Bujoru-Viile and Iaşi-Uricani vineyards, which were physical-chemically analysed before and after malolactic fermentation. The research proved that there appear some modifications in main composition characteristic, total acidity and volatile acidity, real acidity (pH), malic and lactic acid. At the same time; in correlation with these values, a variation in wines' colour is observed meaning a decreasing of phenolic compounds (the anthocyans, the total polyphenolic index, D_{280}, Folin-Ciocâlteau index) and a modification of chromatic characteristics (intensity and hue) and chromatic parameters (L, a, b, C, H^0). The variation of characteristic and chromatic parameters is analysed in accordance with gelatin treatments for fining red wines and with specific reactions which appear in red wines evolution.*

Key words: malolactic fermentation, phenolic compounds, organic acids, chromatic parameters.

Rezumat. *În lucrare se prezintă date referitoare la variația caracteristicilor cromatice ale unor vinuri roşii în timpul fermentației malolactice. Pentru studiu s-au folosit şase vinuri roşii, provenite din podgoriile Bujoru-Viile şi Iaşi-Uricani, care au fost supuse analizelor fizico-chimice atăt înainte cît şi după fermentația malolactică. Sunt evidențiate o serie de modificări ale principalele caracteristici de compoziție: aciditate totală şi volatilă, aciditate reală (pH), acizii malic şi lactic. Concomintent, în corelație cu valorile acestora se constată o variație a culorii vinurilor redată prin diminuarea conținutului de compuşi fenolici (antociani, indicele de polifenoli totali D_{280}, indicele Folin-Ciocâlteau), precum şi modificări ale caracteristicilor cromatice (intesitatea şi nuanța culorii) şi ale parametrilor cromatici (L, a, b, C, H^0). Variația caracteristicilor şi a parametrilor cromatici este apreciată şi în fiuncție de influența tratamentului de limpezire cu gelatină a vinurilor roşii studiate cât şi de reacțiile specifice care au loc în timpul evoluției acestora.*

Cuvinte cheie: fermentație malolactică, compuşi fenolici, acizi organici, parametrii cromatici.

INTRODUCTION

Malolactic fermentation or biological deacidification represent malic acid's degradation in lactic acid and carbon dioxide in wine.

As cited in literature [3, 6, 7], malolactic fermentation in red wines is a positive process because: it confers roundness to the wine by diminishing its astringency; it generally strengthens the wine's color although the anthocyans' and tannins' content drops; it leads to a convenient deacidification, assuring biological stability towards lactic bacteria.

Analysing the chromatic characteristics' variation during malolactic fermentation had as main objective obtaining data that would contribute to explaining the aspects mentioned above regarding red wine's color. Therefore, analysing the wine's color is done in regard to" phenolic compounds content (anthocyans, total poliphenolic index, Folin-Ciocâlteau index), chromatic characteristics (color intensity and hue) and chromatic parameters (L, a, b, C, H^0).

MATERIAL AND METHOD

The experiments were done during 2008 in the Oenology Laboratory of UA Iasi.

Six red wines, harvest of 2008 were studied: three (Burgund mare, Băbească neagră, Pinot noir) from Uricani-Iaşi vineyard and three (Cabernet Sauvignon, Merlot, Fetească neagră) from Bujoru-Viile vineyard. The wines were processed in pilot station conditions.

The research took 30 days/ wine.

At the end of the alcoholic fermentation (after 7-15 days), selected malolactic bacteria (BMS) *Oenococcus oeni*, were added to the wine (1.0 g/hL). The wine samples were stored at 18-20 ºC, for 30 days. In the beginning (IFM) and at the end of malolactic fermentation (DFM), samples of each wine were taken for analysis.

At the end of the malolactic fermentation, as soon as the values of malic acid reached specific values, the bacterial activity of the wine was stopped by racking and treatment with sulphur dioxide and gelatin.

Physical-chemical analyses were recorded for each wine sample: total acidity, volatile acidity, pH, malic acid, lactic acid, tartaric acid, citric acid, free and total sulphur dioxide, non-reductive extract) as well as color analyses: (anthocyans, total phenolic compounds, D_{280} and F_C indices), before (ÎFM) and after fermentation and at 10 days after the fining treatment (DFMf). The analyses were done according to known standards [15, 16] and literature [11, 12, 14].

The chromatic parameters were calculated according to CIE Lab 76 method, regarding the registered absorption spectrum of each wine sample. The used device SPECORD S200 and computer.

RESULTS AND DISCUSSIONS

Wine samples' main characteristics are presented in table 1.

The variation of the total phenolic content and specific indexes (F_C - Folin Ciocâlteau, D_{280} – total poliphenolic index) and anthocyans' content are presented in figure 1.

Over the 30 days of malolactic fermentation and another 10 days after the gelatin and sulphur dioxide treatment, the total phenolic compounds' content

(g/L) modified as follows: Burgund mare wine showed a decrease of 17.30 % at DFMf; Băbească neagră wine was down 19.52 % at DFMf; Cabernet Sauvignon wine had a decrease of 22.42 % at DFMf; Merlot wine registered a decrease of 23.36 % at DFMf; Fetească neagră wine noted a decrease of 24.66 % at DFMf; Pinot noir wine had a decrease at DFMf of 26.58 %.

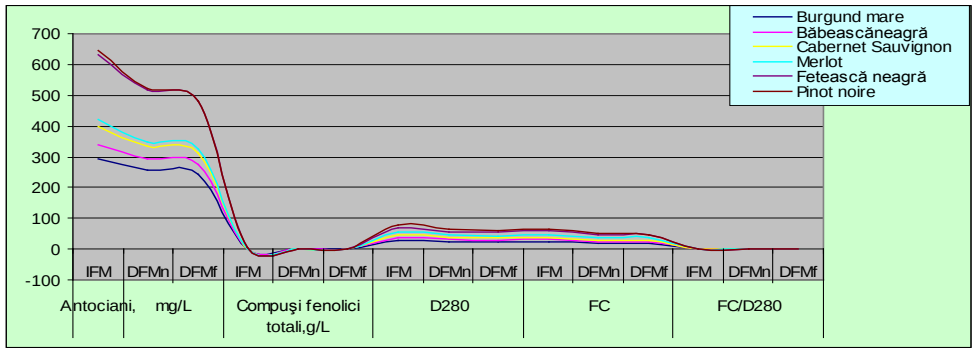

Fig. 1. Variation of phenolic compounds content in studied wines during malolactic fermentation

*) IFM – before malolactic fermentation; DFMf – after gelatin and sulphur dioxide treatment, DFMn - after malolactic fermentation

D_{280} index represents the phenolic compounds index while Folin-Ciocâlteu (F_C) index is specific only to phenolic compounds with reductive properties that are directly correlated to a decrease in the total phenolic compounds that also evolved decreasingly. The anthocyans content (mg/L) modified itself as follows: Burgund mare wine shaped a decrease of 16.44 % at DFMf; Băbească neagră wine registered a decrease of 18.28 %; Cabernet Sauvignon showed a decrease at DFMf of 21.88 %; Merlot wine had a decrease of 22.40 % at DFMf; Fetească neagră drops 23.56 % at DFMf, Pinot noir wine registered a decrease of 25.34 % at DFMf.

The variation of chromatic characteristics during malolactic fermentation is presented in table 2.

From these data, one can notice that light's intensity at a 1 cm vial had s lightly increasing values over the 30 days of malolactic fermentation and a decreasing values after the fining process.

Although through-out the experiment a diminishing of the total phenolic compounds contest takes place, it has a reverse, increasing evolution. It is believed that this increase in color intensity is due to the increase in pH value, as a result of acidity decrease in analysed wines.

Color hue is defined as rapport A_{420}/A_{520} and it has decreased over the 30 days of malolactic fermentation and it has increased during the fining treatment.

Table 1

Variation of main composition characteristics of analysed wines during malolactic fermentation

Composition characteristics	*)	Wine sample					
		Burgund mare	Băbească neagră	Cabernet Sauvignon	Merlot	Fetească neagră	Pinot noir
Total acidity, g/L $C_4H_6O_6$	IFM	10,42	8,15	6,94	5,95	6,71	6,78
	DFMf	8,43	6,62	5,71	5,21	5,79	5,76
Volatile acidity, g/L $C_2H_4O_2$	IFM	0,46	0,42	0,62	0,46	0,41	0,43
	DFMf	0,57	0,59	0,75	0,63	0,56	0,55
Real acidity, (pH)	IFM	3,003	3,212	3,341	3,509	3,522	3,451
	DFMf	3,266	3,342	3,485	3,631	3,674	3,613
Malic acid, g/L	IFM	3,90	3,02	2,32	1,61	2,02	2,22
	DFMf	0,64	0,50	0,42	0,37	0,44	0,42
Lactic acid, g/L	IFM	0,38	0,44	0,56	0,54	0,71	0,46
	DFMf	2,66	2,21	1,93	1,48	1,88	1,79
Non-reductive extract g/L	IFM	21,05	21,83	23,65	25,10	24,62	24,01
	DFMf	19,54	20,39	22,28	23,75	23,07	22,52

Table 2

Chromatic characteristics variation in analysed wines during malolactic fermentation (O.I.V. method)

Chromatic characteristics	*)	Wine sample					
		Burgund mare	Băbească neagră	Cabernet Sauvignon	Merlot	Fetească neagră	Pinot noir
Color intensity (1 cm)	IFM	7.12	9.59	10.53	11.21	12.22	13.59
	DFMn	7.36	10.10	11.13	12.01	13.16	14.89
	DFMf	6.99	9.35	10.18	10.70	11.77	12.74
Hue A_{420}/A_{520}	IFM	0.65	0.67	0.67	0.67	0.60	0.59
	DFMn	0.59	0.62	0.64	0.61	0.56	0.55
	DFMf	0.64	0.64	0.68	0.69	0.63	0.60
Hue α	IFM	53.67	60.50	62.37	63.80	69.81	72.65
	DFMn	59.52	64.86	65.86	68.82	73.17	75.59
	DFMf	54.48	62.48	60.85	59.92	67.79	70.10

*) IFM – before malolactic fermentation; DFMf – after gelatin and sulphur dioxide treatment, DFMn - after malolactic fermentation

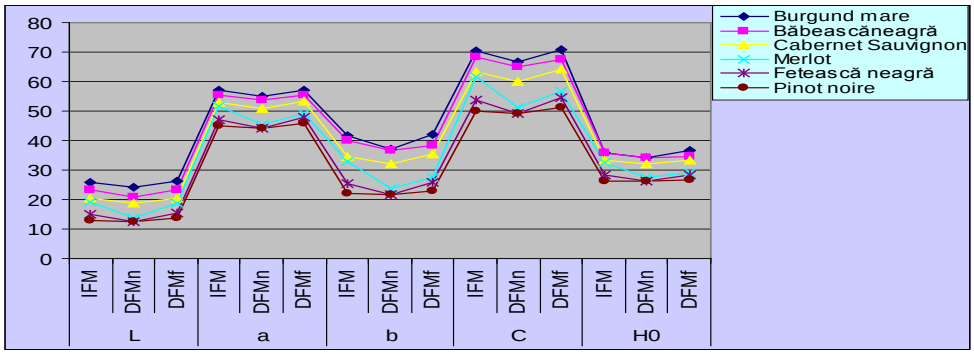

Fig. 2. Chromatic characteristics variation in analysed wines during malolactic fermentation (CIE Lab. 76 and CIE LCH^0 methods)

*) IFM – before malolactic fermentation; DFMf – after gelatin and sulphur dioxide treatment, DFMn - after malolactic fermentation

At the end of the malolactic fermentation (DFMn), luminosity has slightly diminished its values, while after the gelatin fining treatment and the sulphur dioxide treatment (DFMf, the values increase due to pH modifications and total phenolic compounds content.

In fig.2 are presented the variation of chromatic characteristics. Chromatic parameter **a**, situated on the red-green coordinate, has relatively high positive values and it obviously reflects red hues' preponderance over green hues. It has a similar evolution to luminosity, due to color modifications throughout the experiment.

Chromatic parameter **b**, situated on the yellow-blue coordinate, has a similar evolution to parameter **a**. As all chromatic parameter **b** 's values are positive, blue hues are preponderant to yellow ones due to the diminishing of the total phenolic compounds' values but they are still sufficiently colored.

The values of chromaticity **C** had similar evolutions with the chromatic parameters **a** and **b**, specific to each wine, as it was calculated in regard to them. The values of the Hue **H°** have a similar evolution to **a** and **b**. Taking into consideration the value of the hue's angle **H°** = 90° (determined in control wine sample), corresponding to the color "pure yellow", one can observe that the wines with **H°** < 90°, they are visually determined as "bluish". Clear red is the stringer when the hue's angle is closer to zero, thus less influenced by yellow.

CONCLUSIONS

Malolactic fermentation is a positive aspect in red wines as it assures biological stability of red wines towards lactic bacteria. It also lead to a convenient deacidification, rounding the wines also by diminishing their astringency (lowering of the tannins' content) and also by improving the wine's color.

Although throughout the experiment a diminishing of the total phenolic content takes place, the color's intensity is increasing. It can be said that this happens due to the increase of pH's value as result of a decrease in acidity.

The hue, A_{420}/A_{520}, has evolved decreasingly to color intensity, over the 30 days of malolactic fermentation, while after fining, it registered an increase.

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