

STUDIES CONCERNING THE INFLUENCE OF THE MACERATION – FERMENTATION TECHNOLOGY ON THE ANTHOCYANS CONTENT AND COLOUR OF SOME RED WINES

STUDII PRIVIND INFLUENȚA TEHNOLOGIEI DE MACERARE – FERMENTARE ASUPRA CONȚINUTULUI ÎN ANTOCIANI ȘI A CULORII UNOR VINURI ROȘII

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Abstract. This study aims to determine the influence of fermentation maceration technology on anthocyanin content and colour of red wines. Wines were made from Feteasca neagră (*Vitis vinifera* L.) variety in Iași vineyard, harvests of 2007 and 2008, applying four methods of maceration-fermentation (classical maceration, maceration in rotating tanks, thermo-maceration, maceration with microwaves). The test results have shown that the process of maceration-fermentation influences the compositional characteristics of wines. Depending on the content of anthocyanin and wine colour determined by the CIE Lab76, the most coloured wines were obtained by thermo-maceration in 2007 and by maceration in rotating tanks in 2008.

Key words: anthocyanins, colour, maceration, Fetească neagră.

Rezumat. Studiul de față urmărește stabilirea gradului de influență a tehnologiei de macerare – fermentare asupra conținutului în antociani și a culorii vinurilor roșii. Vinurile au fost obținute din soiul Feteasca neagră (*Vitis vinifera* L.) din Podgoria Iași în anii 2007 și 2008, prin aplicarea a patru metode de macerare-fermentare (macerare clasică, macerare în cisterne rotative, termomacerare și macerare cu microunde). Rezultatele analizelor efectuate au arătat că procedeul de macerare - fermentare influențează caracteristicile de compoziție ale vinurilor. În funcție de conținutul în antociani și culoarea vinului determinată prin metoda CIE Lab76 s-au obținut cele mai bune vinuri prin termomacerare în anul 2007 și prin macerare în cisterne rotative în anul 2008.

Cuvinte cheie: antociani, culoare, macerare, Fetească neagră.

INTRODUCTION

The quantity of phenolic compounds in wines varies in large limits: 180 – 650 mg/L in white wines and 1060 – 5870 mg/L in red wines (Vinson and Hontz, 1995). Anthocyanins represent 38% of the phenolic compounds. Red wines

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contain monoglucosidic and diglucosidic anthocyanin monomers (anthocyanidins). The monoglucosidic anthocyanins are predominate: malvidol 50-60%, petunidol 10 to 15%, peonidol 8 to 10%, delphinidol 5 to 8% and cyanidol 1.5 to 3.5%. Diglucosidic anthocyanins are absent or present in very small quantities, up to a maximum of 5-15mg / L.

Red wines are characterized by an anthocyanin mark given by the anthocyanin percentages that make up the colour of the wine. This way, the authenticity of red wines can be controlled (Tardea, 2007; Pomohaci, 2000).

Anthocyanin content of grapes is dependent on grape variety and climatic conditions of the year. It can reach 5000 mg/kg at tinctorial grape varieties, of which 78% in grape skins, 20% in pulp and 2% in seeds. Transfer of colour substances from grapes' skin in musts is done by maceration; the duration of extraction process as well as the quantity of extracted anthocyanins depends on the maceration conditions (Cotea et al., 2009).

Thus, depending on the used maceration-fermentation technology for red wines, the anthocyanins level and wine colour is evaluated; by analyzing and comparing the results one can recommend the most effective maceration variant.

MATERIAL AND METHOD

For this study grapes from Feteasca neagra (*Vitis vinifera* L) variety from Iasi vineyard, harvested in 2007 and 2008 have been used, with following compositional characteristics: 196.2 g/L sugars and 7.86 g/L $C_4H_6O_6$ in 2007, and 182.9 g/L sugars and 7.95 g/L $C_4H_6O_6$ in 2008. Grapes were harvested manually and placed in wooden boxes, then they were transported and processed at the Oenology Laboratory of the University of Agricultural Sciences and Veterinary Medicine, Iasi.

Grapes were crushed and destemmed and the obtained musts were homogenised and processed differently, using four different maceration – fermentation methods: classical maceration, maceration in rotating tanks, thermomaceration and maceration with microwaves.

At the classical maceration and the maceration in rotating tanks the maceration time was 5 days until the grape skin does not release any more colour. At the thermomaceration variant, working temperature was 70°C for 30 minutes (Cotea, 1985), and at the variant of maceration using microwaves samples were subjected to 750W for 15 minutes.

The musts obtained this way were pressed with a hydraulic press and put in glass containers, where alcoholic and malolactic fermentation occurred. After the malolactic fermentation ended, wines were separated from deposit, conditioned, filtered and bottled.

After six months total antochyans content was determined using the pH variation method, anthocyanin profiles using HPLC technique and wine colour using CIE Lab 76 method. By calculating the chromatic parameters L, a, b, in CieLAB76 system one can evaluate the effect of maceration method on wine colour parameters.

A computer simulation of each wine colour was also conducted with DIGITAL COLOUR ATLAS software 3.0 on the basis of the calculated chromatic parameters.

RESULTS AND DISSCUTIONS

The obtained results after the anthocyanins content determination are presented in fig.1.

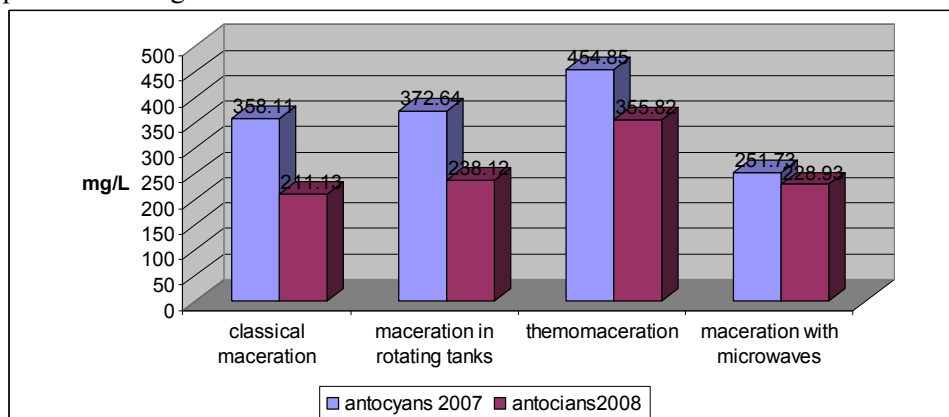


Fig. 1 - Graphical representation of anthocyanin content of wines obtained from Fetească neagră variety in 2007 and 2008

Anthocyanin concentration is highly dependent on grape variety and winemaking technology. Thus, after determining the concentration of anthocyanins in Fetească neagră (*Vitis vinifera* L.) wines it was found that the most extractive maceration tehnology in terms of content of anthocyanins, are thermomaceration with 454.85 g / L in 2007, respectively 355 , 82 g / L in 2008 and maceration in rotating tanks with values of 372.64 g/L in 2007 and 238.12 g/L in 2008.

The diferences between the two years regarding the anthocyanins content are due to temperature variations that occurred during grapes ripening and day-night temperature fluctuations, variations that were more favorable in the synthesis of anthocyanins in 2007 than in 2008.

Regardless of the technological process applied in analyzed red wines, one can note that the highest values are recorded for malvidin folowed by peonidin, petunidin, delphinidin and finally cyanidin (Tab. 1 and 2).

Also it is noted that a higher content of malvidin is obtained in the wines made by maceration with microwaves. It is also noted that malvidin, which is a main constituent of colour compounds in wine is more sensitive to thermal degradation, than cyanidin. For this reason, during wine maturation, one must take into consideration the effects of temperature on wine colour, choosing a method to protect it as much as possible.

Chromatic parameters of wine samples were calculated according to CIE Lab 76 method, depending on the absorption spectra recorded for each sample (Țârdea C., 2007). The results of L parameter show that the 2007 wines tend to be more opaque while in 2008 the wines have a higher luminosity (transparency). This is mainly due to anthocyanins content which had a lower concentration in that year (Table 3, 4).

Table 1

Area percentage values of the main anthocyanins in wines made from the Feteasca neagră variety in 2007

Sample	Dp-3-gl [%]	Cy-3-gl [%]	Pt-3-gl [%]	Po-3-gl [%]	Mv-3-gl [%]	Po-3-gl -acet [%]	Mv-3-gl -acet [%]	Po-3-gl -cum [%]	Mv-3-gl -cum [%]	Σ-acet. + Σ - cum.	Σ-acet. / Σ-cum.
Classical maceration	5,87	0,35	11,96	1,51	63,80	2,14	2,99	1,23	10,16	16,52	0,45
Maceration in rotary tanks	4,77	0,90	11,91	1,20	67,55	1,51	2,64	0,95	8,58	13,68	0,44
Maceration with microwaves	4,36	0,09	9,77	1,85	74,64	0,66	2,22	0,53	5,88	9,28	0,45
Thermomaceration	7,69	0,56	14,14	4,04	62,18	1,55	2,23	1,62	5,99	11,39	0,50

Table 2

Area percentage values of the main anthocyanins in wines made from the Feteasca neagră variety in 2008

Sample	Dp-3-gl [%]	Cy-3-gl [%]	Pt-3-gl [%]	Po-3-gl [%]	Mv-3-gl [%]	Po-3-gl -acet [%]	Mv-3-gl -acet [%]	Po-3-gl -cum [%]	Mv-3-gl -cum [%]	Σ-acet. + Σ - cum.	Σ-acet. / Σ-cum.
Classical maceration	10,45	1,63	11,64	11,72	56,65	0,53	0,61	1,97	4,81	7,93	0,17
Maceration in rotary tanks	10,63	3,02	11,98	14,37	52,48	1,85	0,49	1,67	3,51	7,52	0,45
Maceration with microwaves	10,05	1,62	13,74	10,62	55,55	0,87	2,11	1,52	3,92	8,42	0,55
Thermomaceration	11,57	1,14	12,99	11,12	53,34	0,59	1,95	2,08	5,23	9,84	0,35

If you were to order by colour the wines produced in 2007, the most coloured wines were obtained by thermomaceration, secondly wines produced by classical maceration, followed by wines produced by maceration in rotating tanks and last wines obtained by maceration with microwaves. This classification is not the same for wines produced in 2008. In this year, in first place are the wines obtained by maceration in rotating tanks, followed by those produced by maceration with microwaves, thermomaceration and finally wines produced by classical maceration. This sorting according to colour was made possible by colour differences calculated with ΔE 2000 formula (Tab. 5).

Table 3

Chromatic parameters values of wines produced by different maceration fermentation processes of Fetească neagră variety in 2007

Fetească neagră 2007	Computerised colour simulation	Luminosity L*	Cromaticity +a*/-a*	Cromaticity +b*/-b*	Saturation C*	Tonality H*	Intensity	Hue
Clasical maceration		27,47	59,69	40,59	72,18	34,22	7,24	0,44
Maceration in rotating tanks		33,45	62,50	37,93	73,11	31,25	5,43	0,50
Thermomaceration		24,25	57,19	39,18	69,32	34,41	8,60	0,44
Maceration with microwaves		56,55	47,91	22,43	52,90	25,09	2,18	0,75

Table 4

Chromatic parameter values of wines produced by different maceration fermentation processes on Fetească neagră variety in 2008

Fetească neagră 2008	Computerised colour simulation	Luminosity L*	Cromaticity +a*/-a*	Cromaticity +b*/-b*	Saturation C*	Tonality H*	Intensity	Hue
Clasical maceration		79,77	19,87	8,04	21,44	22,03	0,79	0,91
Maceration in rotating tanks		59,70	42,74	14,11	45,01	18,27	1,81	0,77
Thermomaceration		77,76	23,87	6,85	24,84	16,02	0,87	0,83
Maceration with microwaves		70,21	32,05	9,37	33,39	16,30	1,23	0,79

With DIGITAL COLOUR ATLAS 3.0 software based on chromatic parameters computerised colour simulation of each wine was calculated.

Analyzing the results presented in table 5 small colour differences between wines obtained by classical maceration and thermo maceration in 2007 are observed. Another relatively small difference (5.11) was recorded between the wines produced by maceration with microwaves - 2007 and those obtained by maceration in rotating tanks - 2008. It appears therefore that the wines ranked in last place in 2007 have nearly identical colour to wines occupying first place in 2008.

These colour differences recorded in the analyzed wines can not be noticed with the naked eye and therefore determining differences using the formula ΔE 2000 is beneficial.

By correlating the anthocyanin concentration values with wine colour intensity it is found that there is a directly proportional relationship between these parameters, as anthocyanin concentration is higher, the colour intensity will be more pronounced and vice versa.

Table 5

Values of colour sensorial differences with ΔE 2000 formula									
FETEASCĂ NEAGRĂ	No.	1	2	3	4	5	6	7	8
Clasical maceration – 2007	1	0,00	5,08	2,47	27,38	53,41	32,08	52,16	45,00
Maceration in rotating tanks- 2007	2	5,08	0,00	7,40	22,81	46,06	27,57	44,75	38,94
Thermomacertion - 2007	3	2,47	7,40	0,00	29,45	57,31	34,02	55,82	47,15
Maceration with microwaves - 2007	4	27,38	22,81	29,45	0,00	21,87	5,11	20,16	13,84
Clasical maceration - 2008	5	53,41	46,06	57,31	21,87	0,00	18,33	2,95	9,15
Maceration in rotating tanks - 2008	6	32,08	27,57	34,02	5,11	18,33	0,00	16,26	9,66
Thermomaceration - 2008	7	52,16	44,75	55,82	20,16	2,95	16,26	0,00	6,75
Maceration with microwaves - 2008	8	45,00	38,94	47,15	13,84	9,15	9,66	6,75	0,00
FETEASCĂ NEAGRĂ	No.	1	2	3	4	5	6	7	8

CONCLUSIONS

1. Values obtained by determining the anthocyanins profile reported that malvidin is found in the highest concentration, being influenced by the using of maceration-fermentation technology.

2. The wines produced in 2007 have a more intense colour than wines produced in 2008; this is due to a lower anthocyanin content;

3. Based on assessments made on technological variants for the production of red wines, maceration in rotating tanks is recommended; the obtained characteristics corresponds to technological requirements for this category of wines.

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