THE IMPACT OF THE VARIOUS TECHNOGICAL PROSESSES ON THE PHENOLIC COMPLEX OF RED WINES

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Abstract: Phenolic compounds play an important role in the composition and quality of red wines. In this research have been studied various technological processes of the production of red wines and its impact on the phenolic complex. It has been found that the maximum content of phenolic substances and anthocyanins is present in the raw wines produced by the thermomaceration method.

Keywords: must, red raw wine, variety, maceration, alcoholic fermentation, phenolic complex, anthocyanin compounds

Introduction

An important point in making red wine is that the alcoholic fermentation occurs together with the seeds and grape skins, which give the wine its color. The production of red wines is conditioned by three main processes:

- maceration of pulp and alcoholic fermentation;
- malolactic fermentation.

Grape mash maceration and fermentation gives to red wines four specific properties: color, astringency, extraction and aroma, which distinguishes them organoleptically from white wines. Also, red wines are characterized by a lower acidity, due to the malolactic fermentation that reflects on the basic character of the red wine – the softness.

In winemaking, the process of maceration or „skin contact" is used to increase the concentration of phenols in wine.

Depending on the technological particularities of maceration and fermentation management, winemakers can obtain red wines through: traditional maceration, cryomaceration, thermomaceration, enzyme maceration, sulfur maceration etc.

Phenolic compounds play an important role in the composition and quality of red wines. The phenolic compounds in grapes contribute to the taste, color and mouthfeel of the wine. They are found especially in the seeds, skins and the bunches of grapes. Their quantity increases rapidly during the ripening of the grapes [4,5].

The objective of the study was to evaluate the influence of the maceration-fermentation processes on the quality of red wines and especially the enhancement of the phenolic compounds extraction.

Materials and methods

Raw wines have been obtained from Cabernet-Sauvignon red grape variety collected at „Purcari Winery" using general technologies of winemaking [4].

Have been tested 3 maceration-fermentation methods on grape mash: cryomaceration, traditional maceration and thermomaceration. The cryomaceration of must has been done at 5 – 10°C in 1 – 2 days, the cooling of grapes after harvest – at 0 –

3°C. The traditional maceration has been done at 30 – 32°C during 5 days, thermomaceration – at 70°C in 1 – 4 days.

The determination of the total content of polyphenolic, anthocyanin compounds and chromatic characteristics of wine has been done according to Compendium of International Methods of Analysis – OIV [6]. The chromatic characteristics of red and rosé wines are described by the intensity of color and shade.

The spectrophotometric analysis has been performed using PG Instruments T70 UV/VIS Spectrophotometer.

Results and discussions

Cabernet-Sauvignon grapes are characterized by a rich content of phenolic compounds, which easily pass into the liquid phase and ensure high organoleptic characteristics of wines. For the same variety of grapes, the content of phenolic compounds is variable, depending on the variety, degree of maturation of grapes, climate, culture system of the vine and vinification techniques [4].

The total content of polyphenolic and anthocyanin compounds, as well as chromatic characteristics of wine – the intensity of color (IC) and the shade (NC) has been determined by spectrophotometric measurements [3]. The obtained results are shown in table 1.

Table 1. *Specific and chromatic characteristics of raw wine*

The method	IPT*	Phenolic compounds**, mg/dm^3	Antho-cyanins, mg/dm^3	IC	NC
Cryomaceration (V_1)	**73,0**	**1585,92**	**178,1**	**19,340**	**0,637**
Traditional maceration (V_2)	**62,4**	**1453,76**	**177,4**	**16,809**	**0,577**
Thermomaceration (V_3)	**84,9**	**1781,8**	**214,0**	**21,587**	**0,740**

* –Total polyphenol index; ** – Phenolic compounds are expressed in gallic acid equivalents

For the determination of the total content of polyphenolic compounds the absorbance is measured at 280 nm, for the determination of the total content of anthocyanin compounds – at 520 nm [3] and straightly correlated with respective content.

A spectrophotometric method whereby chromatic characteristics are expressed conventionally as follows [3, 6]: the intensity of color is given by the sum of absorbencies using a 1 cm optical path and radiations of wavelengths 420, 520 and 620 nm; the shade is expressed as the ratio of absorbance at 420 nm to absorbance at 520 nm.

The maximum value of phenolic compounds has been obtained in the case of thermomaceration (V_3 – 1781,8 mg/l), the minimum values has been obtained by the traditional maceration (V_2 – 1453,76 mg / l).

The absorption spectra show that the wine produced by the thermomaceration method has a higher content of specific and chromatic parameters.

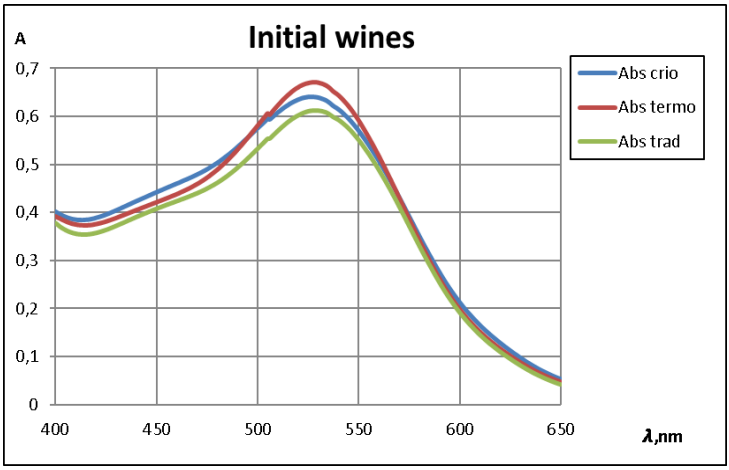

Fig 1. *The absorption spectra of the red wines produced by: cryomaceration, traditional maceration and thermomaceration*

The content of total phenolic compounds (TPC), phenolic cinnamic compounds (PCC), and phenolic flavonoid compounds (PFC) has been determined in order to assess the impact of maceration processes on these parameters. If was necessary, the samples have been diluted and measured spectrophotometrically. The obtained results are shown in the table 2.

Table 2. *The variation of phenolic substances content in the raw wines*

Parameters	**Cabernet-Sauvignon**		
	cryomaceration	**traditional method**	**thermomaceration**
optical absorption, 280nm	0,288	0,266	0,322
optical absorption, 320nm	0,116	0,102	0,120
A 280 SFT	53,7	49,2	60,4
TPC, mg/dm^3, gallic acid	1585,9	1453,7	1781,8
A 320 SFC	21,9	19,04	22,62
PCC, mg/dm^3, caffeic acid	219,0	190,4	226,2
A 280 SFF	39,1	36,5	45,3
PFC, mg/md^3, catechin	2741,2	2561,0	3172,4

The results show that the richest content of phenolic cinnamic and phenolic flavonoid compounds has been observed in the wine produced by the thermomaceration method.

Heat treatment is one of the most traditional physical processes of influencing raw wine material and wine. Heating increases the extraction of anthocyanins and other phenolic substances. The process can be easily monitored and directed.

The diffusion coefficient of anthocyanins in wines produced by traditional method (maceration – fermentation) is $0.03 \times 10^{-7} m^2/c$, but in wines produced by thermomaceration is much higher. In traditional red wine production the process of fermentation takes place simultaneously with maceration, but thermomaceration provides the separation of maceration from fermentation.

The applying thermomaceration method (V_3) consisted in heating up to 70° C and maintaining this temperature for 1 – 4 hours. In this way, the maceration phase anticipated the alcoholic fermentation. At the same time, Lafase Termo liquide enzymes have been added to this wort, which produces transformations useful for the evolution and quality of the future wine. Under the action of pectolytic enzymes, pectic substances present in the form of colloidal macromolecules are cleaved into substances with lower molecules and the viscosity of the must and wine is greatly reduced. Maintaining a quantity of wort (25 – 50%) is necessary to ensure its fluidity while forming the medium in which the components in the solid parts [1, 2] are disseminate and dissolve.

The results obtained in the proposed experiments (table 1) show that the heating of the must at 70°C for 1 – 4 hours extracts well the anthocyanins and the oxidation processes is inactivated. By thermomaceration, the total polyphenolic indices are the maximum value of 84.9, the concentration of anthocyanins is 178.1 mg / l. It can also be mentioned that simultaneously with the extraction action of the color and the oxidoreductase activity inactivation, the thermomaceration at 70°C for 1 – 4 hours can be successfully used also in the years with unfavorable conditions for the curing of the grapes, damaged crops, situations in which balanced wines with no particular taste and odor can be obtained that would diminish their quality and naturalness. By thermoinduction (V3) the rapid destruction of cell walls and the diffusion of polyphenols in the grape marc is achieved.

Conclusions

The climatic conditions of Purcari wine region are favorable to the cultivation of red grape varieties, for example Cabernet – Sauvignon and for production of wines with a high content of sugar and phenolic compounds.

On the basis of the study, at the Enology department, have been implementated three technological schemes of production of red raw wines by thermomaceration, cryomaceration and traditional maceration.

The processing of red grapes influences the specific and chromatic characteristics of raw wine. The maximum content of phenolic and anthocyanin compounds has been found in the raw wines produced by the thermomaceration method.

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