M.-A. Poiana. Scientifical Researches. Agroalimentary Processes and Technologies, Volume XI, No. 2 (2005), 457-462

STUDIES REGARDING THE POSSIBILITIES TO PREVENT SOME ACCIDENTS CAUSED OF IRON IN THE RED WINES

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Abstract

This paper presents a study about the possibilities for reducing of iron content from some types of red wine (Burgundy, Pinot Noir, Merlot), because an iron content range between 12-25 mg/l could be the cause of some physics-chemical deficiencies. In this situation the reducing of iron content from wine by different treatments (by addition of $K_4[Fe(CN)_6]$, bran addition and phytin addition) is needed. The iron content from obtained wine was different reducing in accord with the used treatment. The toxic treatment with $K_4[Fe(CN)_6]$ could be successfully replaced with phytin treatment.

***Key words**: red wine, phytin, iron content, ferric deficiencies*

Introduction

The ordinary content of iron in wine is between 2 to 6 mg/l, but accidentally the content can rise to 20-30 mg/l and sometime to 60 mg/l. It is known that an iron content range between 12-25 mg/l can be the cause of some physics-chemical flaws. Also, an iron content range between 12-25 mg/l could be the cause of some physics-chemical deficiency. These unwilling modifications are: the forming of ferric phosphate that is the cause for appearance of white precipitate; the combination of Fe^{3+} with the tannins results the blue precipitate; the combination of Fe^{3+} with colorant substances from wine results the dark precipitate (Cotea, 1985; Pomohaci et all, 1990).

In wine industry, the ferric deficiency are avoided from decreasing the iron amount by treatment with $K_4[Fe(CN)_6]$ or bran of wheat (Pomohaci et all, 2000, Pomohaci et all, 2001). The first procedure presents of some disadvantages because the substance introduced in wine is toxic and the second procedure is difficult because the starch present in bran form the colloids, which affects the wine aspect (clarity).

The researches from this paper had as purpose the investigation of methods for iron content decreasing in the red wines. The paper represents an original approach for reducing the iron content of wines using of different methods: classical method by kaliumcyanide addition, the bran of wheat addition and the phytin addition. In all situations the iron content was decreased by precipitation in the ferric phytate form.

This precipitate was easily separated because is insoluble in aqueous medium. Many authors, (Konietzny et all, 1995; Tashmenov, 1990; Wagner and Kuhn, 1984), assert that phytin are major component with phosphorus from cereals and is enough especially in bran. In the situation of phytin addition the iron content from wine was decreased by precipitation in the ferric phytate form. The phytin reacts with Fe^{3+} leading to ferric phytate, an insoluble precipitate that is easily removed by filtering of wine.

Experimental

For to obtain the must (the liquid that is used to create a wine) were used the black grapes (the kind Burgundy, Merlot and Pinot Noir) from the west part of Romania, vineyard Recas, Timis. The harvest year was 2003. In this paper the winemaking in red was leaded by thermo-maceration. The thermo-maceration was conducted at 70°C for 30 minutes. After this time, the temperature was decreased until the start value (18-20°C). After the separation of husks of grapes, sawing the must with the liquid that is in alcoholic fermentation from other vessel started the must fermentation.

The principal effects of thermo-maceration are: the intensification of extraction in absence of some alcoholic gradient, the changes of phenolic substances compositions and enzymatic activity. Also, appear the modifications in organoleptic characteristics of wines. The intensification of extraction is more evident after some level of temperature. Through this method the must became rich in compounds that impress the red color and are used for yeast nutrition (Cotea, 1985; Escudier, 1999).

In this study it was determined the iron content in wine at initial time, following the treatments of wines with $K_4[Fe(CN)_6]$, phytin and bran for decreasing of iron content from initial value to final imposed value (4 mg/l). To observe which methods from all this is the best the iron content was determined. The ferric iron content (Fe^{3+}) from wine it was determined by a spectrophotometric method based on followed principle: the ferric salts together with kaliumsulphocyanide, in acid medium, gives ferric sulphocyanide, which gives a maximum extinction at 467 nm.

Stock solutions was prepared by dilution of 0.7022 ± 0.0001g of $FeSO_4 \cdot (NH_4)_2 \cdot SO_4 \cdot 6H_2O$ in 100 ml bi-distillate water, 10 ml sulfuric acid 96%, 5 ml nitric acid conc. and adding bi-distillate water to 1000 ml that corresponding to a concentration of 100 μg Fe/ml. The etalon solutions were obtained by successive dilutions with concentration between 0-9 μg Fe/ml (Spiridon et all, 1981).

In accord with Tashmenov (1990), for phytin obtaining, the bran of wheat (25 g) were shaken for 30 min. with 150 ml of 0.75% HNO3. The extract was separated off and 25% aq. NH_3 was added to pH 7. The precipitated phytin was filtered off, washed with distilled H_2O and dried at 80°C for 1h. The content of phytin (approximate 4%) was determined by weighing.

Phytin is a white amorphous powder, odorless and tasteless, almost insoluble in water, soluble in dilute mineral acids and in some organic acids. The treatment with phytin, although is not usually, presents the advantage that is rapid and efficient. Theoretical, for 1 liter wine, must to use 5 mg phytin to decrease the iron amount with 1mg. Because the phytin reacts well with ferric iron, with some days before the treatment, the wine has to be aired to favor the oxidizing of ferrous ion (Fe^{2+}) to ferric ion (Fe^{3+}).

The treatment with bran of wheat needed 4 g/l bran of wheat: this dose two times were applied (Pomohaci et all, 2000). For classical treatment of wine with $K_4[Fe(CN)_6]$ was needed 7.56 mg substance for decreasing the iron content with 1mg/l (Pomohaci et all, 2001). In all cases, the wine is maintained 5 and 10 days for resting, followed of the separation and filtration.

It was obtained tree types of red wine: Burgundy, Merlot and Pinot Noir. For all this it was determined: total acidity, volatile acidity, reducer sugars, the unreduced extract, total alcoholic degree, the content of free and total SO_2 and iron content.

Results and Discussions

In the time of fermentation after thermo-maceration it was determined the evolution of sugar content (g/l) showed in the figures 1, 2 and 3 and the features of the obtained red wines are presented in the table 1. From the obtained results were appreciated the intensity and the rhythm of fermentation process. These are in relation with the start material characteristics, the yeast charge and choused method for fermentation. The fermentation process was uniform, the time needed for red dry wines obtaining was 6 days.

It was observed that the obtained wines are dry (reducer sugar content <4 g/l), ruby-red, bright and vivacious in appearance, with purple reflections and with a well structure. After characterization showed in the table 1 it was observed that from all kind of grapes results the wines with superior quality.

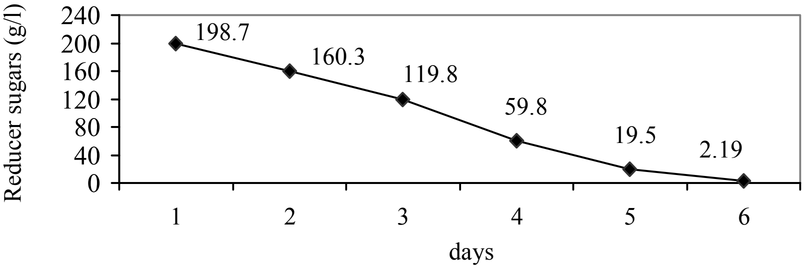

Fig. 1. Evolution of reducer sugars content in the time of fermentation process (after thermo-maceration) for must from Burgundy grapes

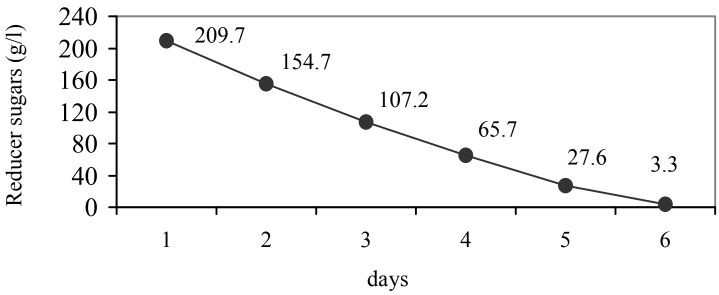

Fig. 2. Evolution of reducer sugars content in the time of fermentation process (after thermo-maceration)for must from Merlot grape

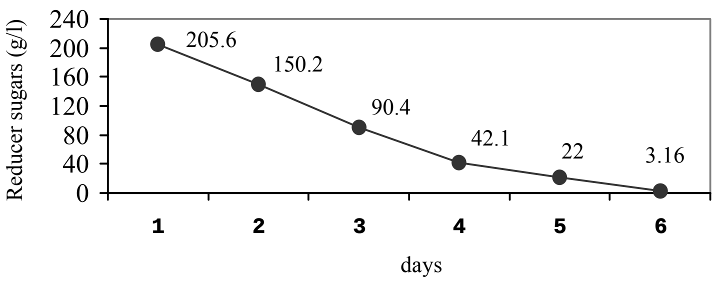

Fig. 3. Evolution of reducer sugars content in the time of fermentation process (after thermo-maceration) for must from Pinot Noir grapes

The biggest iron content was found in Burgundy (20.7 mg/l) but in the all situation the iron content was more to 6 mg/l. The theoretical amounts of K_4 [Fe(CN)$_6$], phytin and bran needed for decreasing of iron content from initial value to final value (4 mg/l) were showed in the table 2. The results obtained after the treatments applied are present in the table 3. From this table, it was observed that the iron content is different decrease.

Table 1.The presentation of red wines characteristics

The features of red wines	Burgundy	Merlot	Pinot Noir
Total acidity (g/l sulfuric acid)	3.35	3.42	3.29
Volatile acidity (g/l in CH_3COOH)	0.96	0.89	0.92
Reducer sugars (g/l)	2.19	3.30	3.16
The unreduced extract (g/l)	22.5	21.2	20.1
Total alcoholic degree (% vol.)	11.5	10.5	10.5
The content of free SO_2 (mg/l)	25.7	27.6	28.6
The content of total SO_2 (mg/l)	170.4	159.6	150.2
Fe (mg/l)	20.7	18.2	16.8

Table 2. The theoretical amount of $K_4[Fe(CN)_6]$, phytin and bran needed for decreasing of iron content from initial value to final value (4 mg/l)

The type of wine	$K_4[Fe(CN)_6]$ (mg/l)	Phytin (mg/l)	Bran of wheat (g/l)
Burgundy	126.25	83.5	4.00
Merlot	107.35	71	4.00
Pinot Noir	96.77	64	4.00

Table 3. The iron content after the treatment of wine with $K_4[Fe(CN)_6]$, phytin and bran

The red wine	After 5 day for resting			After 10 day for resting		
	Fe (mg/l) **1**	Fe (mg/l) **2**	Fe (mg/l) **3**	Fe (mg/l) **1**	Fe (mg/l) **2**	Fe (mg/l) **3**
Burgundy	6.8	7.2	12.1	5.0	5.1	11.3
Merlot	5.4	6.1	10.6	4.3	4.6	9.1
Pinot noir	5.9	6.5	11.3	4.9	4.8	10.4

1 - classical procedure, with $K_4[Fe(CN)_6]$;

2 - the procedure with phytin;

3 - procedure by addition of wheat bran.

The results obtained in the case of phytin addition is comparable with the result obtained in the situation of $K_4[Fe(CN)_6]$ addition (the iron content was decreased with 65-70% in the case of 5 days for rest and 75-77% in the situation of 10 days for rest. The best results, in the case of phytin use, it was obtained for Burgundy wine (rest time was 10 days). The rest time has an important role for the completion of react between iron and $K_4[Fe(CN)_6]$ or phytin. The result obtained by addition of bran is unsatisfactory (the iron content was decreased with 42-46% % in the case of 5 days for rest and 54% for rest time - 10 days. On that account the wine quality could be depreciate. The procedure classical with $K_4[Fe(CN)_6]$ can be replaced by procedure with phytin addition with good results.

Conclusions

- The iron content was different decreased depending on the treatment applied and the time allocated for rest.
- The toxic treatment with $K_4[Fe(CN)_6]$ can be with success replaced with easy treatment with phytin which is fast obtained from the wheat bran.
- The procedure with bran addition is not recommended because the iron content is too tittle decreased and the red wines are troubled because the remains of starch find in bran.

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