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Deoxygenation of red wine by treatment with nitrogen

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Abstract

This article presents the results about the influence of de-oxygenation process on antioxidante properties of red wine, untreated Pinot noir, represented by: phenolic complex content and redox potential values. As research methods we were used following: potentiometric method and determination of substances by spectral estimation. There were used next treatements of wine: nitrogen treating, sulphitation and administration of ascorbic acid. Treatments were performed in the original wine and wine treated with nitrogen. Data results indicate that the technological treatments highly have influence is the administration of ascorbic acid in the deoxygenated wine.

Keywords: deoxygenation, redox potential, total phenols, nitrogen, sulphitation, ascorbic acid

1. Introduction

Oxidation phenomena, depending on the presence of oxygen, affect the evolution of wines. Controlled oxidation contributes to the stabilization of colour and to the reduction of astringency in red wine, as during ageing in barrels or in micro-oxygenated vats. In contrast, protection from oxygen would seem to be necessary for white wines that are to be drunk young [7,8].

Finally, it is commonly accepted in oenology that marked oxidation has an adverse effect on wine quality. Several authors showed also that 2 mg/L of oxygen moreover on white wines involved significant sensory modifications after a few months [2,3,9].

Therefore, various studies undertaken to characterize the appearance of dissolved oxygen during operations performed on wines show that bottling is one of the most critical phases [4,9], especially as once the bottles have been sealed, the only remaining means for mastering the evolution of wines are the storage parameters (closure permeability, temperature, relative humidity, light, etc.).

On one side, the presence of O2 in the wines, following its dissolution, is not a stable state in time. Dissolved oxygen is gradually consumed by various substrates, mainly polyphenols [5]. The disappearance of floral flavours is faster under the effect of

oxygen additions even at 15°C and at the organoleptic level, aromatic deteriorations arrive before chromatic deteriorations [7]. Controlled aeration may enhance phenol polymerization, influencing both color stability and suppleness in red wines [10].

Deoxigenation is important in wine making, because it modify the organoleptic indices and aspect of wines and it influences the oxidation – reduction potential. The redox potential is measure of the tendence of the molecules, or ions, to gain or lose electrons.

Carbon dioxide, nitrogen, and argon are used in wine production in three ways: sparging, blanketing, and flushing [6]. Sparking involves the introduction of very fine gas bubbles to help remove dissolved oxygen or CO_2 or ocacasionally to add CO_2.

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When fine bubbles are dispersed, a parial pressure develops between the sparging gas (usually N_2) and the dissolved gas (usually O_2). The difference in partial pressures causes the dissolved gas to leave the wine. The effectiveness of sparging is dependent on the wine, temperature, time, gas volume, and bubble size [11].

2.Material and Method

The aim of this article is to reduce the redox potential values of wine to minumum possible. For analysis as material served untreated red wine Pinot Noir, produced by red wine making technology, harvest 2009.

Oxidation-reduction potential value was determined by potentiometer method using HANNA 211. Total phenols were determinate by spectral estimation.

Technological treatments applied to red wine Pinot Noir included:

- Treatment with nitrogen at 20 ^{0}C for 30 min.
- Treatment with different doses of 5% solution SO_2: 25 mg/L, 50 mg/L, 75 mg/L.
- Treatment with ascorbic acid: 25 mg/L, 50 mg/L, 75 mg/L. Measurements were made after three days of treatment.
- Treating with cold wines was done by keeping over three days at temperatures:-5 ^{0}C, 0 ^{0}C, 5 ^{0}C.
- Pasteurization was carried out by maintaining the samples at 80 ^{0}C for 30 min., later followed by sudden cooling.

3.Results and Discussion

*Treatment with nitrogen***.** For Deoxygenation, we used special construction where we could to rule the process of addition N_2 from a gas balloon in container.

The initial specific and after treatment with nitrogen indices are presented in table A.

Table A. Specific indices of Pinot Noir

Indices	Initial	Treated
Total phenols, mg/L	2000	1950
Total anthocyanins, mg/L	266	255
Ionized anthocyanins, mg/L	15,94	15,4
Redox potential, mV	180	165

The reduction of red-ox potential value decreased only by 8, 33 %, because the wine was young and the oxygen penetration was not possible, it was protected by SO_2.

*Treatment with cold.*To determine the influence of dissolved oxygen at low temperatures, wine and deoxygenated wine further were treated with cold (fig. A).

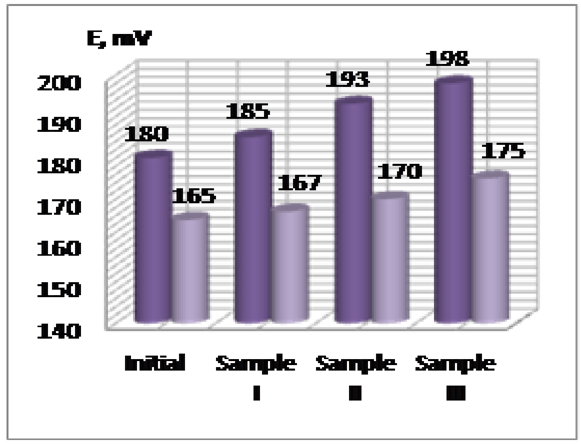

Figure A. The red-ox potential values of initial wine and treated with nitrogen wine after cold treatment.

Further treatment of the deoxigenated wine Pinot Noir with cold (specified in 2) did not significantly influence the redox potential values, increased by 5.7%, but the values of initial wine increased by 10 % in comparation with initial sample. Increase caused by activation of oxygen bound as peroxide and increasing concentration component [Ox] of red-ox systems [10].

Treatment with SO_2. Sulfur dioxide is a strong reductant. It is important to establish its influence on the oxidation - reduction process in wine.

Figure B shows that the red-ox potential values of deoxygenated wine were reduced by 32.7% in comparison with the initial wine by 38.3%.

Therefore, sulphitation is a key factor in regulating the oxidation - reduction mechanism of action which arises from SO_2 with O2, so protect wine from oxygenation [1].

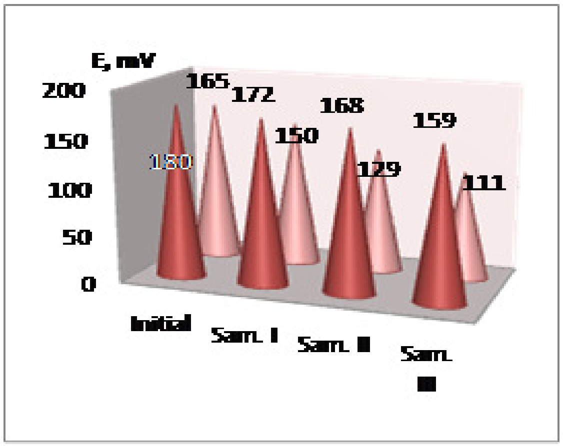

Figure B. The red-ox potential values of initial wine and treated with nitrogen wine after cold treatment

Administration of ascorbic acid. We have resorted to check the antioxidant properties of ascorbic acid in such heterogeneous systems as wine.

Table B. The red-ox potential values after the administration of ascorbic acid in wines

Sample	*E_1, mV*	*E_2, mV*
Initial	180	165
I	145	123
II	123	115
II	103	100

The values of red-ox potential (table B), for deoxygenated wine Pinot noir has been reduced by 39, 3 % and for initial wine approximately 44, 4 %. So, the administration in wines of ascorbic acid has been influenced the oxidation-reduction potential values more than sulphitation.

4.Conclusion

We can conclude, after made experiments, that: the treatment with nitrogen of wine did not have a major influence, but, in combination with ascorbic acid administration has been reduced the red-ox potential values by 44, 4%.

Use of sulfur dioxide as an antioxidant contributed to reducing oxidation-reduction potential values depending on the dose.

Red-ox potential on treatment with cold wine registers an average increase of 10 %. Increase caused by activation of oxygen bound as peroxide and increasing concentration component [Ox] of red-ox systems.

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