White grape must oxygenation: set-up and sensory impact

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Abstract

Oxidation is a natural phenomenon occurring from 6 to 12 months of ageing. It is one of the main problems from which a white, a rosé or a sparkling wine can suffer, causing a radical change in the profile of the wine, both in terms of colour (increase in yellow hue), aroma (rosé / modification of aroma) but also taste (bitterness). Polyphenols - components shown as playing a major role in this phenomenon - have therefore seen their management become a major challenge in winemaking. In the last decades, several paths have been explored to control oxidation (hypoxia-oxidation, hyper-protection) but both have their limits [1]. Vivelys proposes a third intermediate way called O2CM (controlled oxygenation of musts), based on the measurement of the oxygen need of the must [2]. Thanks to our measuring tool called Clyofi, which approach is based on the functioning of polyphenoloxidase (PPO), we are able to first reduce the phenolic load to limit the risks and then use moderate or no doses of antioxidants to protect the wine. The O2CM strategy has proven to bring added value to the process by reducing the risk of early oxidations, enhancing the aromatic potential of juices rich in polyphenols, limiting the addition of antioxidant.

Introduction

Oxidation affects wines in a variable way, but those with a high concentration of polyphenols are more sensitive to it because of the role played by these components. Historically, this phenomenon was rather observed in warmer areas, where polyphenol synthesis is favored. It now affects all geographical areas and grape varieties that did not seem sensitive to it. Several causes can explain this spread. Firstly, global warming has accelerated the production of polyphenols, put the control in environmental parameters (lower yields, more advanced maturities), and finally extraction processes which have evolved to represent the potential of the grape (case of hyper-oxygenation) or to guarantee a stability of the profile over time (case of hyper-protection).

Two types of oxidative reactions take place in wine through its life: selective enzymatic reactions that occur early on must with a high oxygen consumption rate, and later and much slower chemical reactions that affect many more wine compounds. Vivelys has developed a Clyofi, a measuring tool that determines the amount of oxygen to be added to the must to promote these enzymatic reactions alone, in order to reduce sensitivity to subsequent chemical oxidation. With an approach based on the functioning of polyphenoloxidase (PPO), it is to enhance the elimination of phenol acids by the formation of condensation products that are then removed during settling [3]. The objective of the hyper-protective strategy is to preserve the must from oxidation via the use of antioxidants, thus maintaining its initial phenolic load. This requires the wine to be protected throughout its ageing, potential of the grape (case of hyper-oxygenation) or to guarantee a stability of the profile over time (case of hyper-protection).

A third, intermediate route therefore seemed interesting to explore: controlled oxygenation of musts or O2CM.

From Vivelys’ point of view, both of these strategies have limits and do not make it possible to develop the potential of the grape (case of hyper-oxygenation) or to guarantee a stability of the profile over time (case of hyper-protection).

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The following study will present the how-know accumulated over several years of oxygenation of musts from different grape varieties and different origins, to highlight the impact of O2CM strategy [3],[4],[5].

Material & Method

Implementation of must oxygenation treatment

Clyofi operates in 3 stages, beginning with the sampling in the settling tank, which will therefore be representative of all previous operations. Then the measurement starts with a controlled oxygen injection and the monitoring of its consumption speed by the sample. Finally the optimal quantity of oxygen to inject in the must in calculated, according to a mathematical algorithm developed by Vivelys. The quality of the measurement depends on several parameters, including SO2 and turbidity. Because SO2 inhibits PPO, an addition before the measurement results in “false negatives”. Then, turbidity being a source of PPO, the measurement must be carried out before settling. However, once the oxygen treatment has been made, and according to the measurement determined by Clyofi, it is essential to lower the dosage very carefully to eliminate the insoluble brown compounds formed. We generally recommend going below 70 HTU. Indeed, with the solvent effect of alcohol, these brown compounds can re-solubilize in the wine at the end of the alcoholic fermentation if their concentration was too important after settling.

Sensory analysis

Vivelys has been practicing/experimenting on the oxygenation on musts for about fifteen years. The know-how described further was obtained through multiple trials realized in an experimental cellar or in the cellars of our partners, on different grape varieties (Chardonnay, Sauvignon, Meriçan, Grenache, Marsanne, Vognier...) and in various wine-growing locations across the world (France, Spain, Italy, Portugal, Argentina, USA, Australia, South Africa). Tastings were performed by a picked and trained sensory panel of 6 to 12 people using SensyLab testing tool (Vivelys), between 2 months to 3 years after vinification.

Results

1. Impact on polyphenols concentration

Several years of study led to the definition of a measurement algorithm that determines an optimal dose, called “Clyofi dose”.

Figure 1. Polyphenols concentration (mg/L) of Gros Manseng, according to the dose of oxygen added to the must.

2. Impact on the wines profile

Effect on the “Fat” & “Thin” characters perception

The increase in fat perception is one of the most characteristic elements of the impact of O2CM.

Figure 2. Perception of a Fat (“Thick”) character (sensory panel average grade /5), according to the dose of oxygen added to the must.

In addition to these elements on the sensory impact of O2CM, the effect that might have a decrease in the sulfite content made possible by its application was also assessed. It notably showed a significant gain in sweetness.

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Conclusions

In conclusion, O2CM’s third way is interesting for several reasons:

- It limits the oxidative risk during ageing.
- It limits the addition of inputs, such as SO2.
- It enables to work on the aromatic profile of the wines, in particular on the fat in the middle-palate.
- It allows a better valorization of juices with significant economic consequences.

The O2CM is therefore a technique which brings added value to the process but which must be reasoned according to the production strategy defined by the cellar.

References