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Observations on the phenolic stabilization of Red Wines - Consequences on preparation for bottling

>>> Since the 1980s, red winemaking practice has been geared towards wines rich in phenolic compounds. However, this phenolic material is not always stabilized and conserved, and many finished wines in bottle do not match up to their initial, and wished-for, character. Inadequate aging in relation to the extracted compounds, and the presence of certain colloids, contribute to poor stabilization of the phenolic fraction, which is not sufficiently taken into account during the different stages before bottling. <<<

■ Findings

Studies based on the preparation of wines for bottling[1] have shown that many wines are not sufficiently aged, stabilized or prepared to go through this process without difficulty, which in many cases can lead to deterioration in quality[2] (color, expression, structure).

The composition of red wines results from the maceration of the solid parts of the grape (skin and seeds) from which many aromatic, phenolic and polysaccharide components are extracted. Some of these compounds are solubilized while others are in a colloidal solution that can take 3 forms: a solubilized and stable form (sought after); a solid form, eliminated by the lees during racking, fining or filtration; and a so-called "metastable" intermediate form that can evolve over time to one or other of the previous forms. In the case of reduced solubilization, it can also be eliminated: by sedimenting with other compounds (pectin and / or potassium bitartrate crystals), during fining, or during filtration. Thus, the wine can be modified according to the adaptation of aging and enological practices.

■ Acquisition of red wine stabilization during aging

During aging, through natural changes and enological operations, wines must fulfill the potential of their initial qualities, and at the same time acquire different stabilities: color, clarity, filterability, microbiological and tartaric; as well as refining their overall tannic balance and taste.
Acquiring these stabilities requires a minimum "aging" time, and certain conditions including the introduction of air / oxygen, racking, degassing, but also the elimination of certain colloids including the pectin. For red wines, aging is at the same time empirical and based on various studies[3, 4]; but too often there are defects in the stability of the phenolic / coloring matter making up agglomerates, which then cause cloudiness and difficulties in clarification and filtration, damaging to the final quality of the wine[5].

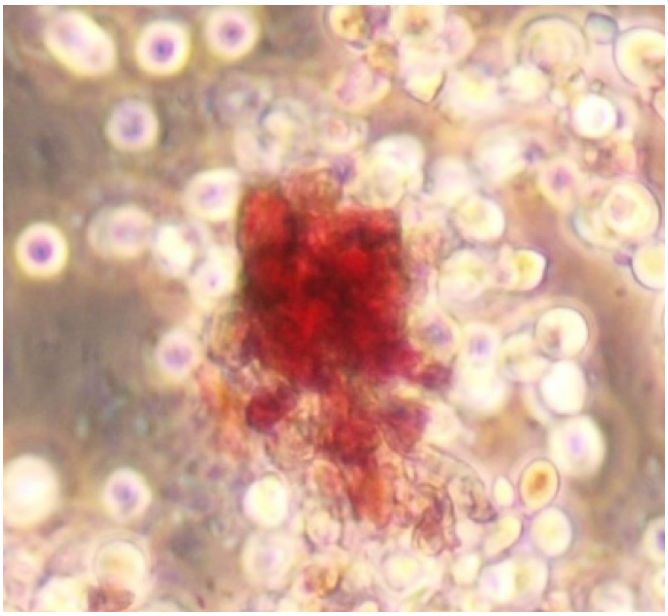


Figure 1. Example of yeast + coloring matter agglomerates (Photo: Excell / Sarco – OLYMPUS BX41 microscope - OLYMPUS E520 camera).

■ Defective stabilization: main precipitations (excluding particles)

➔ **General case:** precipitation of the non-solubilized colloidal fraction, essentially comprising: certain tannins and anthocyanins, generally associated with yeasts (Figure 1), sometimes also with the involvement of potassium bitartrate, and polysaccharides.

The largest clusters are found in the lees (with loss of color that can be significant), and the smallest can remain in suspension and contribute to difficulties with clarification[6]. Their persistence in suspension, through the support effect, can also lead to the maintenance or even growth of certain microbial populations (including yeasts, particularly *Brettanomyces*, or lactic acid bacteria).

➔ **Case of red wines produced by blending with press wine:** the evolution of wines in which press wine is included shows deterioration in turbidity, filterability, color and hue (Table 1).

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The addition of press wine can enrich various elements including potassium, but also various polysaccharides, including pectin. This colloid inhibits clarification by maintaining high turbidity and poor filterability; and this on its own, but also by forming clusters with the coloring matter and certain tannins[7]. Pectin is therefore involved both directly and indirectly, in phenolic stability and in negative color changes, by the formation of "pectin-polyphenol" agglomerates. In addition, this also changes the hue (H = A420/A520), giving wines with a more orange color as from 5 % press wine; but it can also result in effects beyond the color itself, on the overall appreciation of the wines, without any precise and linear relationship having been established, however. Finally, in terms of tasting (particularly at blending), the presence of pectin can give the illusion of "fatness", which is not stable and does not persist in bottle.

Table 1. Evolution of Turbidity, Filterability, Color and Hue in a red wine according to the percentage of press wine. (1) Color and hue at constant SO_2 (25 mg/L) - (2) 2015 Côtes de Bordeaux wine, 13.75 % vol. TA 3.35 g/L H_2SO_4, pH 3.72 (3) The turbidity and filterability values require a minimum of 2 filtrations - (4) The turbidity and filterability values require a minimum of 2 to 3 filtrations.

		Pectin test	Turbidity NTU	Filterability CC (10^{-5} s/L²)	Color (1) $\sum A_{(420+520+620)}$	Hue (1) A_{420}/A_{520}
JANUARY 2016 *Blending before aging in 1-year barrel.*	Control wine (2) 2015	Negative	87	121	14.5	0.56
	Addition of 5 % Press Wine	Positive	105	184	14.3	0.62
	Addition of 10 % Press Wine	Positive	116	206	14.1	0.66
FEBRUARY 2017 *Removal from aging*	Control wine 2015	Negative	17	67	13.8	0.62
	Addition of 5 % Press Wine	Positive	38	104	11.2	0.77
	Addition of 10 % Press Wine	Positive	52	126	10.5	0.84
MAY 2017 *After fining 3.5 g/L egg albumin*	Control wine 2015	Negative	8	34	12.8	0.63
	Addition of 5 % Press Wine (3)	Negative	27	88	10.2	0.85
	Addition of 10 % Press Wine (4)	Negative	32	106	9.2	0.96

➔ **Case of blends with younger wines:** the above observations can also be found when blending with younger wines (legal under the so-called 85/15 rule - the O.I.V. international standard for wine labeling), which may also contain pectin, with the same negative consequences.

➔ **Evidence of poor evolution in certain vintages:** all these observations can be related to the deterioration in quality observed in certain vintages, including 2009, 2011 and 2015 (in Bordeaux, France). Atypical weather conditions could have generated the presence of tannins and polysaccharides (including pectin), leading to more difficult overall stabilization, and to faster and more marked evolution. It may be thought, therefore, that these phenomena of difficult clarification and stabilization could become more frequent with climate change.

➔ **Phenolic / coloring matter stability test:** the cold test (48 h at 4 °C) demonstrates the instability of phenolic matter and tartrates, but does not differentiate between them, which deserves to be improved.

■ Pectin elimination

For better clarification and phenolic stability, the absence of pectin should be sought systematically and as soon as possible after vinification, for free-run wine and especially for press wine. A pectin test can be carried out. Pectin can be removed by cold stabilization or the use of enzymes. Pectinases come in various concentrations, and can have complementary β-glucanase type activities to degrade glucans (large polysaccharides also inhibiting clarification and contributing to poor filterability) originating from *Botrytis* or yeasts.

■ Conclusion

The production of red wines must focus not only on the extraction of polyphenols or on blending with the sole aim of achieving the greatest concentration, but it must also take into account the colloidal fraction and adapt aging conditions in order to achieve the fastest and most complete clarification and stabilization. Phenolic stabilization depends on many parameters, including the presence of certain polysaccharides, including pectin, and this can lead to negative phenolic (or even microbiological) changes. A visual deterioration in color and hue can then be seen, with the loss of certain phenolic compounds, but also a change in organoleptic perception, overall balance, and the best development in bottle. ■

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