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ENARTIS NEWS
WINE STABILITY 360°

The commercial success of a bottled wine largely depends on how it appears. A clear wine, with a crisp color and without any sediment is surely appreciated by everyone. However, producing a perfectly stable wine is not a simple matter and requires many controls, labor and time. Here is an overview of the main causes of wine instability, methods for their identification and recommended treatments.

Before starting: stable wine + stable wine is not = to a stable blend

Two wines that are individually stable might not be stable together. Blending leads to the creation of a new wine having chemical-physical characteristics and a chemical-physical balance different from the individual original wines. Finish your blend and make appropriate adjustments before starting stability checks.

Assessing wine stability prior to bottling

White and rosé wine	Red wine
Protein stability	Color stability
Oxidative stability	Calcium stability
Calcium tartrate stability	Potassium tartrate stability
Potassium tartrate stability	Microbial stability
Microbial stability	

PROTEIN STABILITY

Proteins responsible for wine instability are produced by grapes. Their content varies with every vintage, grape variety, soil, climate and vineyard practices. For this reason, wines need to be checked every year individually to determine the correct dosage of bentonite.
Furthermore, changes in wine temperature, alcohol content or pH impact protein solubility and can lead to their precipitation and haze formation. That is why, protein stability must be checked in the finished blend.

Testing protein stability

The most common method to test wine protein stability is the heat test. The conditions can be very different for temperature, duration and for the joint use or not of tannin. Therefore, the quantity of bentonite needed to stabilize the wine significantly varies according to the conditions of the test. When wine is going to be tartrate stabilized with potassium polyaspartate (KPA) or CMC, we recommend using the heat test with tannin:

a. Take a sample of filtered wine with turbidity < 1 NTU
b. Measure turbidity (T1) with a nephelometer (turbidimeter).
c. Take 20 mL of wine and add 1 mL of a 5% gallic tannin solution (Tannin solution contains: 5 g EnartisTan Blanc in 100 mL of distilled water. After preparation, filter the solution through a 0.45 µm membrane. This solution can be kept for 1-2 months).
d. Heat the sample in a water bath up to 80°C and maintain this temperature for 30 minutes.
e. Let the wine sample cool down to room temperature.
f. Measure turbidity (T2).
g. The wine is stable when T2-T1< 10 NTU.

This stringent test prevents the need for an additional bentonite fining that may be necessary due to the interaction between protector colloid negative charges and residual wine proteins.

Treatments for protein stability

Protein stability can be improved early in the winemaking process utilizing tannins and enzymes with protease activity but bentonite still remains the most effective available tool. Nevertheless, bentonites are not all equal and some can be more effective than others in removing proteins. That is why, when running preliminary bentonite fining trials in the lab it is important to use the same bentonite that is intended to be used in the cellar.
Warning: even though bentonite calcium release is generally not high, when using a large amount, it can impact calcium tartrate stability. That is why we recommend to protein stabilize the wine first and then check and treat, if necessary, for calcium stability.

Enartis solutions for getting wine protein stability

Product	Composition	Main features
CLARIL ZW	Vegan fining agent made from plant protein enhanced with chitosan and sodium activated bentonite.	It is designed for the clarification of white and rosé wines that are meant to be tartrate stabilized with colloid addition (potassium polyaspartate and CMC). It improves protein stability and removes unstable colloids that can affect wine clarification and filterability.
PLUXCOMPACT	Sodium-calcium bentonite.	Good fining and protein removal properties with limited volume of lees. In red wine, it is recommended to eliminate unstable color compounds.

COLOR STABILITY

Color sedimentation in bottle is a problem which normally affects young red wines due to their richness in free anthocyanins that, by polymerization with other compounds, can form insoluble aggregates. Very often color sedimentation happens simultaneously with tartrate precipitation.

Testing color stability

For checking wine color stability, it is recommended to run a very simple test:

a) Filter 100 mL of wine through a 0.45 microns membrane.
b) Measure turbidity (T1) with a nephelometer (turbidimeter).
c) Place 100 mL of wine in the drop shaped flask or in a 125 mL white glass bottle.
d) Put the sample in the fridge at -4°C.
e) After 24 hours, check the presence/absence of sediment. Presence of an amorphous dark red sediment indicates that wine is color unstable.

Normally, a color stability test is run in parallel with the cold test for evaluating potassium bitartrate stability. In this case, a wine is considered fully potassium bitartrate and color stable if after 6 days at -4°C there is neither the presence of crystals nor the presence of color.

Treatments for color stability

There are two ways to improve color stability.

In case of very color unstable wines, the safest solution is to do a fining with 10-20 g/hL of **Pluxcompact**. With its negative charge, this bentonite is able to react with the positive unstable colloids involved in color precipitation (proteins and anthocyanins in the form of flavylium) and precipitate them without affecting wine quality and color intensity.

Alternatively, any gum Arabic verek of the **Maxigum** range creates a coating of the colloid particles that prevents them from agglomerating and precipitating. Preliminary laboratory trials, to test gum arabic stabilizing effect with the help of the color stability test, are crucial to find the correct addition rate.

Enartis Verek gums for wine color stabilization

	Maxigum F	Maxigum Plus
Composition	Liquid preparation of Verek Gum.	Liquid preparation of Verek Gum and mannoproteins
Color Stabilization	♦♦♦♦	♦♦♦♦
Filterability	♦♦♦	♦♦♦
Other Characteristics	Highly filterable and applicable before microfiltration.	Highly filterable and applicable before microfiltration. Softens tannins and reduces dryness.

OXIDATIVE STABILITY AND PINKING POTENTIAL

White and rosé wines can contain phenolic precursors that as a consequence of exposure to air during bottling can cause noticeable changes in color. Certain varieties, and especially wines made under reductive winemaking techniques, are more prone to these alterations, and in most cases these changes are not reversible. Prevention is key to avoid this issue.

Testing Oxidative Stability

This test evaluates the sensitivity of wine to browning. Procedure is the following:

1) Zero the spectrophotometer with plastic cuvette filled with water.
2) Fill a 10 mm plastic cuvette with protein stable and 0.45 µm filtered wine leaving a 4 mm headspace.
3) Seal the cuvette with its cap and measure the absorbance at 420 nm.
4) Place the cuvette in the oven at 50°C.
5) Each day, read the absorbance at 420 nm until the wine increases in absorbance by 0.15 units.

Wines that increase in absorbance by 0.15 units within 4 days are likely to be unstable.

Testing Pinking Potential

A rapid and easy test consists in

- adding 0.375 mL of a 3% hydrogen peroxide solution to 150 mL of wine.
- Place the wine in an oven at 40°C for 15 minutes.

If the color turns to pink, wine is sensitive to pinking.

Treatments for oxidative stability

Also in this case, it is possible to chose between a subtractive and an additive strategy.

The subtractive strategy is to treat wine with corrective finning agents such as PVPP, caseinate, co-polymers of polyvinyl imidazole polyvinylpyrrolidone and chitosan.

- **Stabyl MET** is a product based on PVI-PVP, an insoluble polymer that can bind metals and reduce the catalytic effect they have in the oxidative reactions leading to pinking and browning.
- **Claril HM** is a fining agent that benefits from the synergistic actions of chitosan and PVI-PVP to reduce the concentration of iron, copper, hydroxycinnamic acids and catechins, which are key players in the process of oxidation.
- **Claril SP** is a a complex clarifying agent consisting of bentonite, PVPP and potassium caseinate, recommended for the prevention of the oxidative phenomena associated with wine phenolic components.

The alternative additive strategy is to use substances that are able to block the oxidative process triggered by the oxygen dissolved in the wine at bottling.

Citrostab rH is a pre-bottling coadjunct specifically designed to prevent pinking appearance in bottle. It can be used to "consume" the dissolved oxygen before it can cause wine compound oxidation.

EnartisTan SLI is a tannin extracted from untoasted American oak that is very effective in scavenging oxygen and free radicals and in stabilizing wine redox potential thus preventing premature ageing and sulfur off flavors. It can be used to replace SO_2 addition in a natural and healthy way.

TARTRATE STABILITY

The presence of tartrate crystals is probably the most common cause of bottled wine rejection. Lately we have observed an increase of calcium tartrate precipitation probably due to a general increase of wine average pH. Calcium tartrate and potassium bitartrate instabilities require different identification tests and treatments.

Testing calcium tartrate stability

Often, a calcium content of 80 mg/L for white wines and 60 mg/L for red wines is used to classify wines between stable and unstable. As a matter of fact, calcium alone is not enough to understand whether a wine is stable and it may happen that wines having a calcium content lower than the warning level may form sediment. A simple lab test can give a better indication of wine stability.

- Analyze wine calcium content (Ca1). In the case of white and rosé wine, run the test on protein stable wines.
- Take a 100 mL sample of wine and add 0.4 g of micronized calcium tartrate.
- Stir for 15 minutes and store the sample at -4°C for 24 hours.
- At the end of the cooling treatment, filter the wine using 0.45-micron membrane and analyze calcium content (Ca2).
- Calculate ΔCa = (Ca1-Ca2)

ΔCa < 15 ppm	Stable
15 ppm < ΔCa < 25 ppm	Lightly unstable
ΔCa > 25 ppm	Very unstable

Treatments for calcium stability

Temperature has little effect on calcium tartrate precipitation. For this reason, cold stabilization is not a reliable method to prevent it. An easy way of reducing wine calcium content below the risky limit consists of seeding **Enocristal Ca**, a pure micronized calcium tartrate. Enocristal Ca accelerates the formation of crystals and their precipitation. The treatment does not require chilling and can be done at cellar temperature (10-15°C).

Testing potassium bitartrate stability

Wine tartrate stability can be quickly tested by Mini Contact test or wine conductivity measurement. This test requires the use of a special lab equipment where a sample of filtered wine is held at 0°C and the drop in conductivity is observed following addition of potassium bitartrate crystals. When a drop in conductivity is above 30 µS wine is considered unstable.

Alternatively, you can use the following cold test:

a) Filter 100 mL of wine on a 0.45 microns membrane.
b) Place 100 mL of wine in a drop shaped flask or in a 125 mL white glass bottle.
c) Put the sample in the fridge at -4°C for 6 days.
d) Observe daily for the presence of crystals at the bottom of the bottle.

Absence of crystals after 6 days indicates that wine is potassium tartrate stable.

The cold test is recommended to evaluate the stability of wines treated with protector colloids such as potassium polyaspartate, CMC and mannoproteins.

Treatments for potassium bitartrate stability

To reduce the risk of KHT precipitation, various techniques can be used. Subtractive techniques - cold treatment and electrodialysis - all rely on the removal of tartaric acid and/or potassium from wine. These methods can be expensive, require a lot of water, impact wine organoleptic quality, and might need more time than expected.

Additive techniques, based on the addition of protector colloids which inhibit the formation of tartrate crystals, are more respectful of wine quality than subtractive methods, speed up wine preparation and dramatically reduce labor, wine losses, energy and water consumption.

Enartis solution for calcium tartrate (CaT) and potassium bitartrate (KHT) stabilization.

SOLUTIONS		APPLICATION				
		KHT REMOVAL	KHT STABILIZATION	CAT REMOVAL	CaT STABILIZATION	COLOR STABILIZATION
AMT PLUS QUALITY	Metatartaric acid		✓		✓	
ENOCRISTAL Ca	Micronized calcium tartrate			✓		
ENOCRISTAL SUPERATTIVO	Rapid crystallizer for cold stabilization of tartrates, containing neutral and acidic potassium tartrates.	✓				
CELLOGUM LV20	20% solution of highly filterable CMC		✓			
ZENITH UNO	10% solution of A-5D K/SD potassium polyaspartate		✓			
ZENITH COLOR	5% solution of A-5D K/SD potassium polyaspartate and gum Arabic Verek		✓			✓

MICROBIAL STABILITY

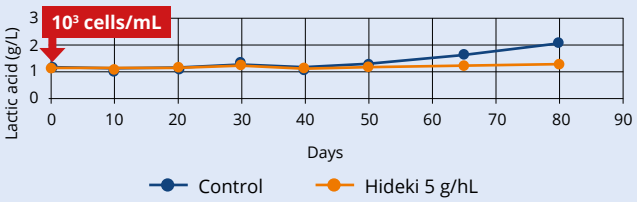
Microbial stability is achieved by employing yeast and bacteria-proof levels of filtration at bottling. Commonly, inline 0.45 µm absolute membrane filters are recommended to avoid the presence of contaminants in bottle. Microbial issues are more common in bottled wines that haven't gone through sterile-filtration prior to bottling, in wines that have residual sugar and in wines where sterile filtration failed.

Preventative treatments for microbial stability

When final filtration is larger than 0.45 µm and bottling wines with residual sugar, the use of antimicrobial agents is highly recommended to minimize the risk of re-fermentation, haziness and sediment formation in bottle.

Potassium sorbate, DMDC, SO_2 are all quite effective for controlling yeast and bacteria but their application is limited in some markets like for example organic and allergen-free wines. Recently, the development of a new tannin, **Hideki**, allows you to have a natural and allergen-free tool to be used at bottling to reduce the risk of oxidation and bacterial alterations.

HIDEKI: interferes with lactic bacteria growth



Antibacterial effect of Hideki in a wine with 4 ppm of free and 0.07 ppm of molecular SO_2

For finishing: Weigh the impact of last-minute modifications

Many last-minute modifications can compromise ready-for-bottling wine stability.

- Total acidity adjustment with tartaric acid addition may result in loss of tartrate stability. Playing with malic or lactic acid is much safer.
- Adding even a small fraction of wine can destabilize protein and tartrate stability in white and rosé wines and tartrate and color stability in red wines.
- Follow supplier's suggestions for various tannin and dosages to use at bottling.
- If you cannot avoid last-minute modification, it is better to postpone bottling and take the time to re-check wine stability.

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