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ENARTIS NEWS
GOOD WINE STORAGE PRACTICES

Bulk wine storage in cellars can often be challenging. Protecting all the efforts made from the vineyard to end of fermentation with longer storage periods it is necessary to provide consumers with a great wine experience.
We all know wine is 'alive' and is constantly changing with time. Consequently the ability to guarantee and provide lasting quality during this time needed prior to release of a new vintage is difficult. The three most important factors for winemakers to manage are to slow down ageing, prevent any negative microbial impact and avoid reductive character formation.

SLOW WINE AGEING

Ageing is an effect of oxidation. Oxidation is a redox reaction catalyzed by metals like Cu^{+} and Fe^{2+} that converts oxygen into highly reactive radicals capable of oxidizing several organic compounds, thus making wine age. White wine color becomes darker, losing its green, youthful hue; varietal and fresh aromas lose intensity and turn into sweet, caramelized sugar, honey and hay notes. In red wine, ageing is characterized by the development of prune and stewed fruit flavors with a weakened palate and an increase in brown/orange hues. To keep wine young as long as possible, it is necessary to adopt strategies capable of blocking oxidation mechanisms. This means:

- Avoid oxygen solubilization by minimizing wine contact with air and using inert gasses.
- Manage dissolved oxygen before it can damage wine.
- Remove metals that transform oxygen into dangerous free radicals.
- Reduce the content of catechins, the main substrate of oxidation.
- Scavenge free radicals.
- Stabilize redox potential.

Consume Dissolved Oxygen

Oxygen solubilization in wine is the first step of oxidation. In winemaking, it is possible to use oxygen scavengers like ascorbic acid, hydrolyzable tannins and inactivated yeast that rapidly react with oxygen and convert it into harmless forms before it can damage wine compounds.

Remove Pro-Oxidant Metals

Iron and copper are the catalysts responsible for transforming oxygen into the free radicals which are responsible for the appearance of browning, loss of aromatics and increase of acetaldehyde. The copolymers of polyvinylimidazole and polyvinylpyrrolidone (PVI/PVP) and activated chitosan can adsorb these pro-oxidant metals and limit ageing.

Reduce the Content of Catechins

Catechins are the wine compounds that oxidize first. Their oxidation causes the formation of quinones, strong oxidants responsible for the increase of brown hues and for oxidation of aromatic compounds. Decreasing wine catechin content helps to preserve fresh color and aroma for a longer period.

Scavenge Free Radicals

Free radicals like hydrogen peroxide, hydroperoxyl radical, quinones and hydroxyl radical are generic oxidants that are much stronger than oxygen. Tannins are very effective in capturing radicals and limiting their effects.

Stabilize Redox Potential

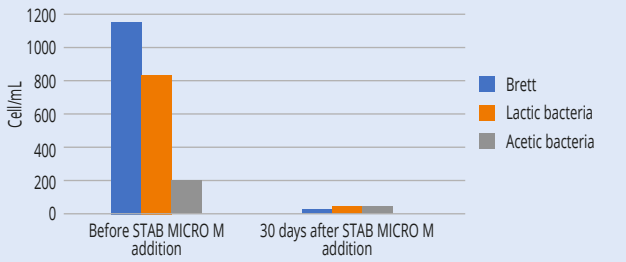
With ageing, wine redox potential tends to increase. Stabilizing wine redox potential will preserve the vibrant and fresh characteristics of youthful wines. Fine lees, ascorbic acid, SO_2 and specific tannins, such as **EnartisTan SLI** and **Hideki**, can lower or stabilize wine redox potential and prolong its shelf-life.

PRODUCT		EFFECTS				
		Consume O_2	Remove or Block Metals	Remove Catechins	Block Free Radicals	Stabilize or Lower Redox Potential
CLARIL HM	Fining agent made of PVI/PVP and activated chitosan		✔	✔		
ENARTISSTAB SLI	Blend of inactivated yeast, PVPP and oak tannin	✔	✔	✔		✔
ENARTISTAN SLI	Tannin extracted from untoasted America oak	✔	✔		✔	✔
HIDEKI	Blend of antioxidant and antimicrobial tannins	✔	✔		✔	
CITROSTAB rH	Blend of citric acid, ascorbic acid, potassium metabisulphite and gallic tannin	✔	✔		✔	✔

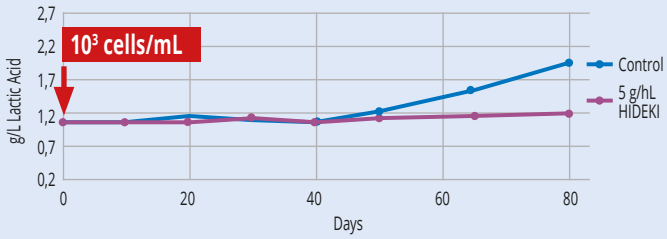
PREVENT NEGATIVE MICROBIAL IMPACTS

The management of SO_2 with regards to legal limitations, can be problematic with bulk wine storage over extended periods of time. This is specifically with regards to organoleptic changes such as increased volatile acidity, volatile phenols and unwanted malolactic fermentation caused by microbial spoilage. The use of activated chitosan based fining agents such as **EnartisStab Micro M** and a tannin with microbiostatic actions like **Hideki** helps to effectively control spoilage microorganisms without having to use sulfur dioxide.

EnartisStab Micro M
Prevents contaminant growth during wine ageing
(red wine treated with 5 g/hL EnartisStab Micro M before transfer to barrel)



Variation of lactic acid content



Hideki limits lactic acid bacteria growth thus delaying or preventing malolactic fermentation onset. (Red wine with 0.07 ppm molecular SO_2).

AVOID REDUCTION

Reduction is one of the most common problems during wine storage. The presence of hydrogen sulfide, mercaptans and disulfide, when close to or above the sensory threshold, decreases wine overall sensory quality. It is important to know how to prevent or treat this defect before it becomes irreversible.
The first step is to recognize the cause of sulfur off-aromas before deciding on further treatment. A simple trial consists of taking the wine with sulfur off-aromas, pouring it into four glasses where one glass is the control, copper sulfate is added to the second, **EnartisTan Elevage** to the third and the fourth glass is treated with ascorbic acid and **EnartisTan Elevage**. The results can be interpreted in the table below.

Test for recognizing the origin of wine sulfur-off aromas.

		Case 1	Case 2	Case 3
Glass 1	**Control Wine**	Off-aroma	Off-aroma	Off-aroma
Glass 2	**Copper Sulfate** (1 g/hL)	**Clean aroma**	**Clean aroma**	Off-aroma
Glass 3	**EnartisTan Elevage** (2 g/hL)	Off-aroma	**Clean aroma**	Off-aroma
Glass 4	**Ascorbic Acid** (5 g/hL) + **EnartisTan Elevage** (2 g/hL)	Off-aroma	**Clean aroma**	**Clean aroma**
Conclusion about the origin of the off-aroma		**H_2S**	**Mercaptans**	**Disulfides**
Suggested Treatment		Aeration - Inert gas sparging - Revelarom	Revelarom - EnartisTan Elevage - EnartisTan SLI - EnartisTan Max Nature - EnartisTan Cœur de Chêne	Reduction to mercaptans by ascorbic acid addition followed by the suggested treatment for mercaptans

Recommended Treatments

How to Remove H_2S

- *Aeration* and inert gas sparging contribute to the volatilization of H_2S, but be aware of the loss of other positive volatile aromas.
- *Copper* reacts with H_2S. This reaction may require the addition of copper in excess, which can also affect fruity volatile thiols and catalyze oxidation reactions, leading to premature ageing. Recent studies show that copper-sulfide complexes are not readily removed by racking and can even pass through some types of filtration. To minimize the risk of residual copper, rather use a fining blend containing copper such as **Revelarom**. The unique combination of organic and inorganic fining agents present in its formulation helps to effectively remove the copper-sulfide complex and prevent residual copper accumulation in finished wines.

How to Remove Mercaptans

- *Aeration* leads to the transformation of low sensory threshold mercaptans to less pungent disulfides. This might initially appear to improve organoleptic quality, but disulfides can still impart off-aromas and be hard to remove.
- *Copper* reacts with certain mercaptans and helps to decrease their perception. The same considerations made for H_2S treatment with copper applies to mercaptans.
- *Tannins*, especially ellagic and condensed tannins, can bind and react with mercaptans to form odorless complexes. These complexes are very stable over time and do not risk appearing as post bottling sulfur off-aromas. **EnartisTan Elevage** (ellagic tannin obtained from light-toasted French oak), **EnartisTan SLI** (ellagic tannin from untoasted American oak) and **EnartisTan Cœur de Chêne** (ellagic tannin from toasted French oak) are very effective in scavenging mercaptans and can successfully replace the addition of copper prior to bottling. **EnartisTan Max Nature** (condensed tannin extracted from exotic wood) is another option particularly recommended for treating easy-to-drink, light wines.

How to Remove Disulfides

Disulfides should first be treated with approximately 50 mg/L of ascorbic acid to convert them to a more reactive compounds such as mercaptans. Afterwards, it is possible to adopt any of the solutions described above for treating mercaptans.

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