ENARTIS NEWS

EXTENDING WINE SHELF LIFE

One of the main questions for winemakers at the end of fermentation is: "How can I keep wine fresh, young, and appealing until it is bottled?". Answering this question is even more important now as the supply chain situation across the world makes it difficult to predict when a wine will hit the market. Below are some simple and low-cost strategies that can be put in place to extend wine shelf life.

WINE OXIDATION MECHANISM

Extending wine shelf life means protecting wine from oxidation. Regardless of the color, oxidation causes significant changes in wine quality which are all associated with the loss of youthful characters. In white wines, oxidation produces browning, pinking, development of bitterness, increase of acetaldehyde, and the loss of varietal and fresh aromas. In red wines, oxidation is characterized by the development of prune and stewed fruit flavors, together with a flattened palate and increase of brown/orange hues.
To put an effective strategy to extend wine shelf life in place, it is helpful to quickly recap the chemistry of wine oxidation. Some of the most important compounds involved in the oxidation process are oxygen, phenolics, iron, and copper.

Oxygen is the starting point. Its solubilization in wine is necessary to start the process, however, oxygen is not able to directly oxidize wine compounds. It needs to be converted into stronger oxidants like superoxide radical, hydroperoxyl, hydroxyl radical or hydrogen peroxide (Fig. 1).

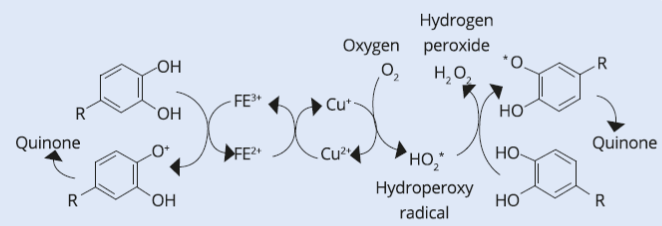

Fig. 1: Scheme of the oxidation process of polyphenols according to Danilewicz (2007)

Iron and **copper** are the two transition metals that convert oxygen into free radicals.
Phenolic compounds, and mostly those containing a catechol system (hydroxycinnamic acids such as caffeic acid, and flavanols such as (+)-catechin, (-)-epicatechin, (+)-gallocatechin, (-)-epigallocatechin) are the main substrates of oxidation. The oxidation of phenolic compounds leads to the formation of quinones, which condense directly with nucleophilic polyphenols to produce melanin pigments responsible for wine browning. Free radicals oxidize other wine compounds including alcohol, that turns into acetaldehyde, which is characterized as an unpleasant bruised apple aroma. Acetaldehyde also binds to SO_2 converting it to sulphate. This decreases any antioxidant and antimicrobial effect of the SO_2.

SOLUTIONS FOR EXTENDING WINE SHELF LIFE

Through understanding the chemistry behind wine oxidation, we know that an effective strategy to prevent it consists of four possible actions:

Minimize Oxygen Solubilization

Avoiding exposure to air, thus preventing the solubilization of oxygen, is the first step to prevent oxidation. In addition to using inert gases, it is possible to use ascorbic acid and inactivated yeast to consume oxygen before it can react with wine compounds (Fig. 2).


Fig. 2: Control (left) and wine treated with 20 g/hL of EnartisStab SLI (right). Picture six months after shelf ageing EnartisStab SLI protects wine from oxidation and slows ageing.

Eliminate Oxidation Catalysts Metals

Iron and copper are the real catalysts responsible for oxidation of wine. Oxygen is a weak oxidizer which, due to iron and copper, can be converted into free radicals capable of rapidly oxidizing SO_2 and any organic compound present in wine (Fig. 3).

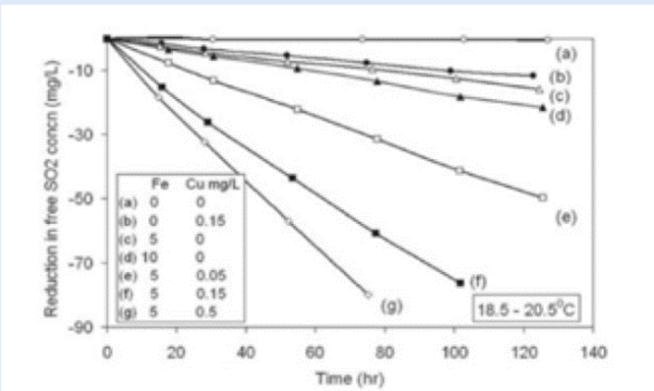

Fig. 3: Importance of copper and iron on wine oxidation (from Danilewicz, 2007): while oxygen exposure of a wine-model solution does not cause free SO_2 oxidation (line a), the addition of copper and iron (lines e, f and g) results in a rapid decrease of free SO_2. The two metals together produce a greater decrease than the sum of rates observed when they are tested singularly (lines b, c and d).

Co-polymers of polyvinylimidazole and polyvinylpyrrolidone (PVI/PVP) are very effective in absorbing these pro-oxidant metals (Fig. 4) and limiting the oxidation process.

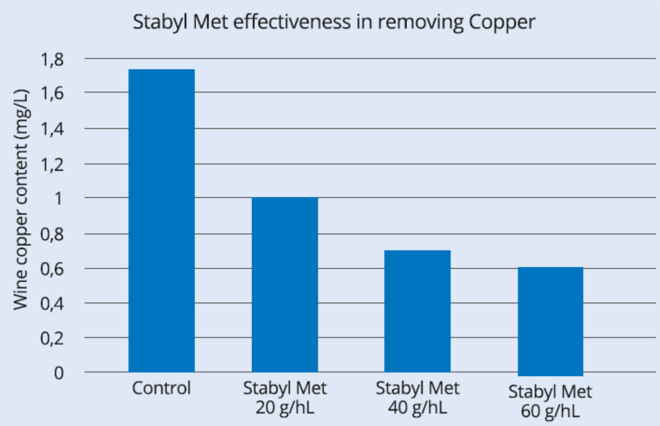

Fig. 4: Stabyl Met effectively reduces wine copper and iron content.

A similar result can be achieved in a more "natural" way, using pre-activated chitosan. Additionally, ellagic tannins and citric acid are quite effective in reducing the two metals by chelation, while pea protein specifically removes iron (Fig 5).

	Dosage	ppm Fe+++	Removal of Fe (%)
Test		22.40	……..
CLARIL AF	40 g/hL	14.53	35%
PROTOMIX AF	40 g/hL	14.54	35%
COMBISTAB AF	40 g/hL	13.57	39.4%
PLANTIS AF	40 g/hL	13.26	40.8%
Potassium caseinate	40 g/hL	13.22	41%

Fig. 5: Pea protein Plantis AF and blends containing pea protein remove iron (Fe) to an extent similar to potassium caseinate.

Reduce the Content of Oxidizable Polyphenols

Catechins and hydroxycinnamic acids are among the first compounds in wine to oxidize. Because of the action of free radicals, quinones form from these phenolic compounds. They are responsible for darkening and reduced quality of wine. Removing phenolic compounds, due to the adsorbing action of PVPP, activated chitosan and PVI/PVP means increasing wine resistance to oxidation (or oxidative stability).

Block Free Radicals

Free radicals are rapid, powerful and non-specific oxidants capable of oxidizing any organic compound present in wine: aromatic compounds, polyphenolic substances, alcohols, etc.
Tannins, particularly ellagic tannins, are very effective in capturing radicals and limiting their effects and therefore they can be a valid alternative to the use of sulfur dioxide (Fig. 6).

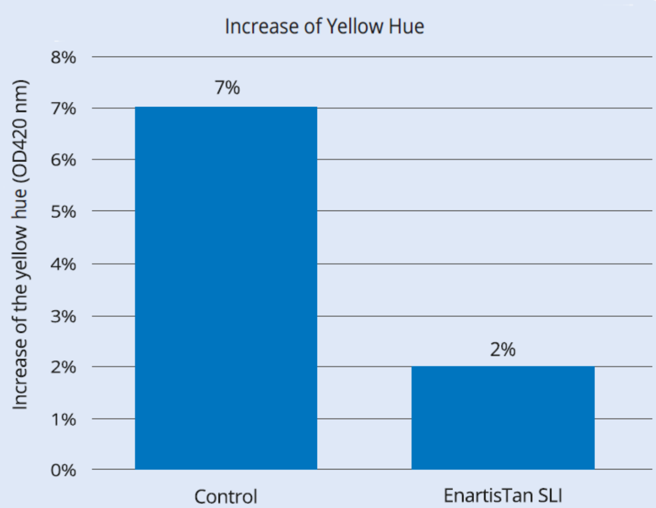

Fig. 6: EnartisTan SLI protects the wine from oxidation limiting the increase of yellow color. White wine containing 5 ppm iron and no SO_2. Measurement done six days after two rack offs.

ENARTIS TOOLS FOR EXTENDING WINE SHELF LIFE FROM MATURATION TO BOTTLING

Phase	Product	Composition	Effect: Scavenging of O_2	Effect: Scavenging of Free Radicals	Effect: Removal of Polyphenols	Effect: Elimination of Catalyst Metals
Storage in Bulk	**AST**	Potassium metabisulphite, ascorbic acid, gallic tannin	●	●	●	
	SURLÌ ONE	Inactivated yeast	●			●
	ENARTISSTAB SLI	Inactivated yeast, PVPP, oak tannin	●	●	●	●
	INCANTO NC CHERRY	Inactivated yeast, oak and condensed tannins	●	●		●
	INCANTO NC WHITE	Inactivated yeast, oak and condensed tannins	●	●		●
	ENARTISTAN SLI	Tannin extracted from untoasted American oak	●	●		●
	HIDEKI	Selected and purified gallic, ellagic and condensed tannins	●	●		●
Fining	**PLANTIS AF**	Pea protein			●	●
	CLARIL AF	Bentonite, PVPP, pea protein			●	●
	STABYL MET	PVI-PVP			●	●
	CLARIL HM	PVI-PVP, activated chitosan			●	●
Bottling	**CITROSTAB rH**	Citric acid, ascorbic acid, potassium metabisulphite, gallic tannin	●	●		●
	ENARTISTAN SLI	Tannin extracted from untoasted American Oak	●	●		●
	HIDEKI	Selected and purified gallic, ellagic and condensed tannins	●	●		●

For more information, please call Enartis USA's technical services at (707) 838-6312.

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