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ENARTIS NEWS
EXTEND WINE SHELF LIFE

Extending wine shelf life is one of the main objectives for winemakers post- fermentation. The current difficulties with supply chains across the world, makes it hard to predict when a wine will be on the market. The past few years many winemakers have been asking the question: how can I keep wine fresh, young, and appealing until it is bottled?

Following some simple and low-cost strategies winemakers can dramatically improve wine shelf life.

MECHANISM OF WINE OXIDATION

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, increased 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 an increase in 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 oxidation process, however, oxygen is not able to directly oxidize wine compounds. It needs to be converted into stronger oxidants like superoxide radicals, hydroperoxyl, hydroxyl radical or hydrogen peroxide (Fig. 1).

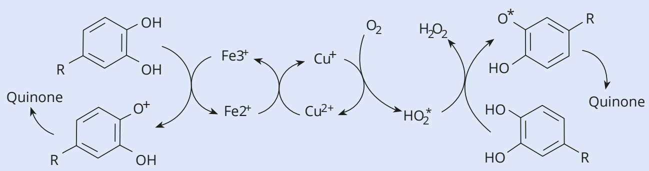

Fig. 1: The oxidation process of polyphenols according to Danilewicz (2007)

Iron and **copper** are the two transition metals that convert oxygen into free radicals.

Phenolic compounds, 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 effects of 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:

1. 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).

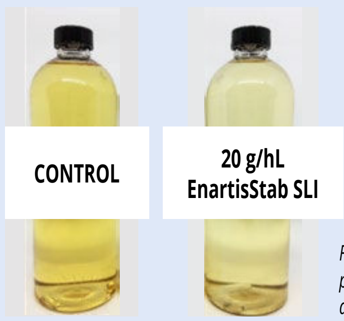

Fig. 2: After six months, EnartisStab SLI protects wine from oxidation and slows ageing.

2. Eliminate Oxidation Catalyst Metals

Iron and copper are the real catalysts responsible for wine oxidation. 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 compounds present in wine. Levels as low as 0.05 mg/L of copper have been shown to dramatically impact the rates of oxidation in model wine (Fig. 3).

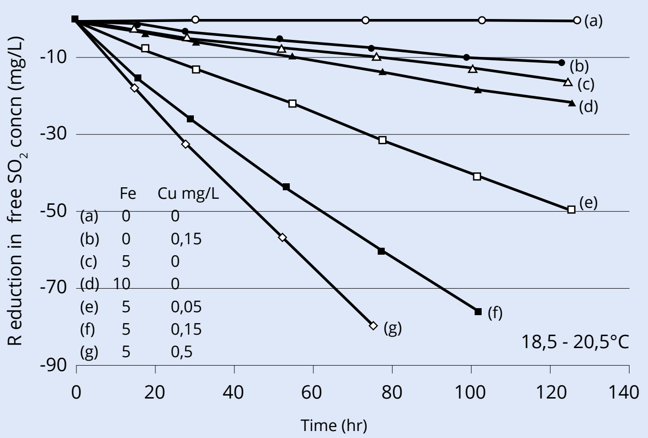

Fig. 3: The importance of copper and iron on wine oxidation (from Danilewicz, 2007). While oxygen exposure of a wine-model solution does not cause free SO_2 oxidation (line a), the addition of copper and iron (lines e, f and g) results in a rapid decrease of free SO_2. The two metals together produce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

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

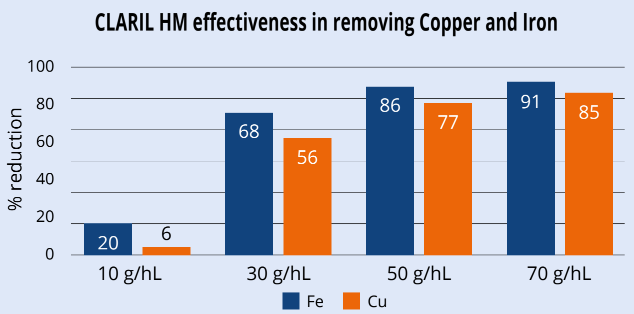

Fig. 4: Claril HM effectively reduces wine copper and iron content, preventing oxidations and haze. The combination of PVI/PVP and chitosan helps to increase its action on iron removal.

A similar result can be achieved in a more "natural" way using fining agents with pea protein and 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 (Table 1).

	Control	Combistab AF	Plantis AF	Potassium Caseinate
Dosage		40 g/hL	40 g/hL	40 g/hL
ppm Fe+++	22.40	13.57	13.26	13.22
Removal of Fe (%)		39.4%	40.8%	41%

Table 1: Pea protein Plantis AF and blends containing pea protein remove iron (Fe) similar to potassium caseinate.

3. Reduce the Content of Oxidizable Polyphenols

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

4. Block Free Radicals

Free radicals are rapid, powerful and non-specific oxidants capable of oxidizing any organic compound present in wine: such as aromatic compounds, polyphenolic substances, alcohols, etc.
Tannins, particularly ellagic tannins, are very effective in capturing radicals and limiting their effects therefore they can be a suitable alternative to the use of sulfur dioxide (Fig. 5).

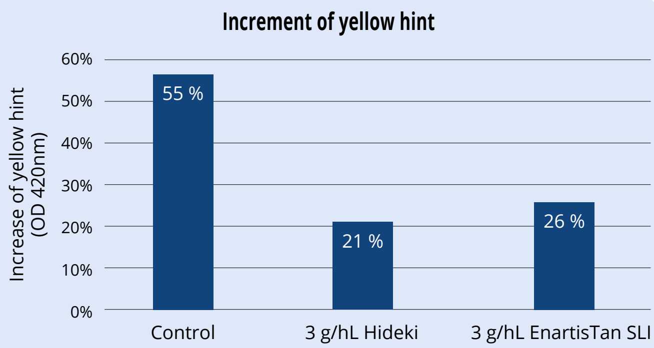

Fig. 5: Hideki and EnartisTan SLI protect wine from oxidation, limiting the increase of yellow color. White wine containing 6 ppm iron, 0.6 ppm copper and 19 mg/L Free SO_2. Measurement done after five days at 35°C and two rack-offs.

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Enartis tools for extending wine shelf life from maturation to bottling

PHASE	PRODUCT	COMPOSITION	EFFECT			
			Scavenging of O_2	Scavenging of Free Radicals	Removal of Polyphenols	Elimination of Catalyst Metals
STORAGE IN BULK	AST	Potassium metabisulphite, ascorbic acid, gallic tannin	●	●		
	ENARTISSTAB SLI	Inactivated yeast, PVPP, oak tannin	●	●	●	●
	INCANTO NC WHITE	Inactivated yeast, oak and condensed tannins	●	●		●
	INCANTO NC CHERRY	Inactivated yeast, oak and condensed tannins	●	●		●
	ENARTISTAN SLI	Tannin extracted from untoasted American oak	●	●		●
	HIDEKI	Selected and purified gallic, ellagic and condensed tannin	●	●		●
FINING	PLANTIS AF-Q	Pea protein, activated chitosan			●	●
	PLANTIS AF	Pea protein			●	●
	COMBISTAB AF	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 tannin	●	●		●

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