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ENARTIS NEWS
EXTEND WINE SHELF LIFE

One of the main questions for the winemaker at the end of fermentation is: how can I preserve wine to stay fresh, young, and attractive until it is bottled? Answering this question is even more important nowadays as the current situation across the world makes it difficult to predict when wine goes on 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. No matter the colour, oxidation causes big changes in wine quality which are all associated to the loss of youthful character. In white wines, oxidation produces browning, pinking, development of bitterness, increase of acetaldehyde, loss of varietal and fresh aroma. In red wines, oxidation is characterised by the development of prune and stewed fruit flavours, together with a flattened palate and an increase of brown/orange hues.

In order to put in place an effective strategy to extend wine shelf life, it is useful to quickly recap the chemistry of wine oxidation.

Compounds involved in the wine oxidation process are oxygen, phenolic compounds, iron, and copper.

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

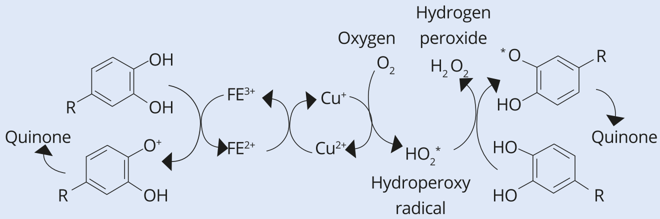

Fig. 1: Scheme of the oxidation process of polyphenols according to Danilewicz (2007)

Iron in association with **copper** are the two transition metals that convert oxygen into free radicals.

Phenolic compounds, and mostly those containing a cathecol 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 yellow pigments responsible for wine browning. Free radicals oxidize other wine compounds among which alcohol, that turns into acetaldehyde, responsible for an unpleasant herbaceous aroma, and SO_2 that turns into sulphate loses any antioxidant and antimicrobial effect.

SOLUTIONS FOR EXTENDING WINE SHELF LIFE

Knowing the chemistry behind wine oxidation, we can imagine that an effective strategy to prevent it consists in 4 possible actions.

Minimize oxygen solubilisation

Avoiding exposure to air, preventing the solubilisation of oxygen in wine is the first step to prevent oxidation. In addition to inerting with gas, there is the possibility of doing some sort of chemical inertisation. Ascorbic acid and inactivated yeast are extremely quick in consuming oxygen before the oxidation of wine compounds begins (Fig. 2).

Fig. 2: EnartisStab SLI protects wine from oxidation and slows down ageing. Wine after 6 months ageing on shelf. On the left, control and on the right, wine treated with 20 g/hL of EnartisStab SLI.

Eliminate oxidation catalysts metals

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

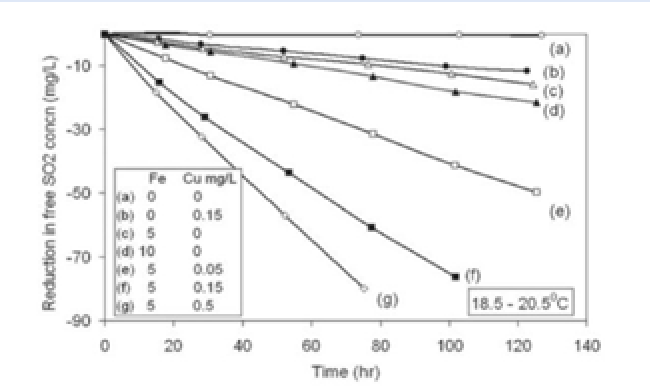

Fig. 3: Importance of copper and iron on wine oxidation (from Danilewicz, 2007): while oxygen exposure of a wine-model solution does not cause free SO_2 oxidation (line a), the addition of copper and iron (lines e, f and g) results in a rapid decrease of free SO_2. The two metals together produce a greater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

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

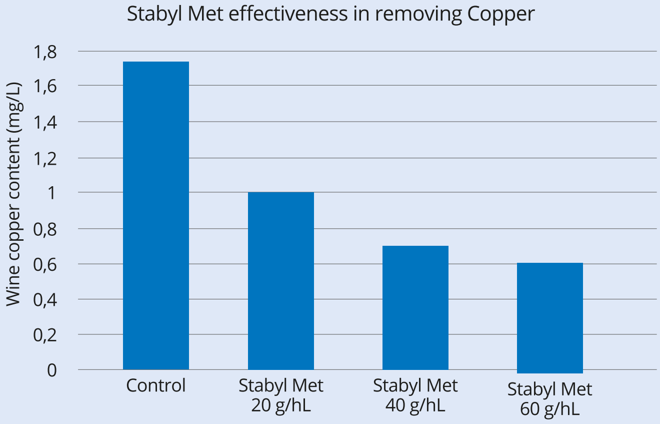

Fig. 4: Stabyl Met effectively reduces wine copper and iron content.

A similar result can be achieved in a more "natural" way, using activated chitosan. Also, ellagic tannins and citric acid are quite effective in taking the two metals out of the game 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 the wine to oxidize. Because of the action of free radicals, quinones form from these phenolic compounds. They are responsible for the darkening and the qualitative decay of wine. Removing phenolic compounds, thanks to the adsorbing action of PVPP, activated chitosan and PVI/PVP means increasing the wine's resistance to oxidation (or oxidative stability).

Block free radicals

Free radicals are rapid, powerful, and non-specific oxidants, capable of oxidising any organic compound present in wine: aromatic compounds, polyphenolic substances, alcohols, etc.

Tannins, particularly the ellagic ones, are very effective in capturing the radicals and limiting their effects and for this action they can be a valid alternative to the use of sulphur dioxide (Fig. 6).

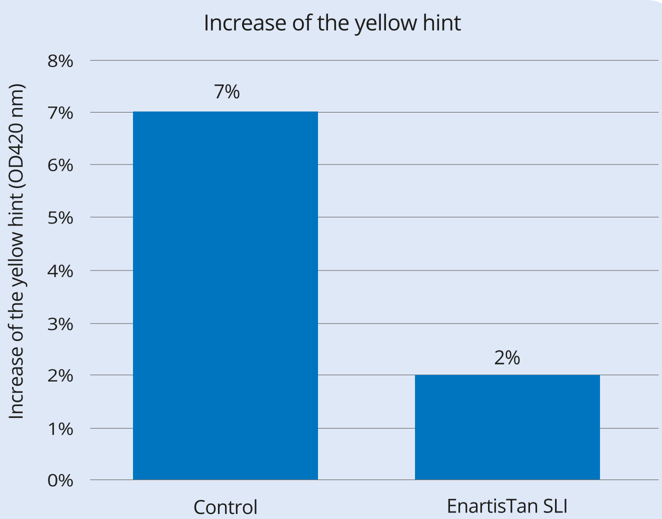

Fig. 6: EnartisTan SLI protects the wine from oxidation limiting the increase of yellow color. White wine containing 5 ppm iron and no SO_2. Measurement done 6 days after 2 rack offs.

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	●	●	●	
	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-Q	Pea protein, activated chitosan			●	●
	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	●	●		●

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