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ENARTIS NEWS
COLOR STABILITY MANAGEMENT FAQ

WHAT IS WINE COLOR?

Wine color is comprised of many different types of pigments that are present in various proportions depending on wine age, chemical composition and adopted vinification processes.

Anthocyanins: as the only red pigments present in grapes, these molecules play a vital role in determining wine color during the first stages of vinification. They are very sensitive to oxidation and, over time, become unstable due to degradation and precipitation reactions. These reactions cause a color shift from a red-purple hue to orange-brown.

Co-pigments: these are complexes formed between anthocyanins and cofactors (flavonols, hydroxycinnamates and/or colloids) via weak electrostatic bonds. Co-pigments play an important role in protecting anthocyanins from oxidation during the first stages of fermentation. A large portion of color in young red wines originates from these “semi-stable” pigments.

Condensed pigments: these can be formed via direct covalent bonds between anthocyanins and tannins or via acetaldehyde bridges. For these interactions to occur, there needs to be condensed grape tannins present in must or wine. Condensation leads to pigments and color complexes which are stable and resistant to oxidation.

WHAT DOES A SACRIFICIAL TANNIN DO?

Sacrificial tannins are mixtures of hydrolyzable and condensed tannins designed to be added during the early stages of maceration. When grapes are crushed, anthocyanins, proteins and low molecular weight skin tannins are among the first compounds extracted. The hydrolyzable (ellagic and gallic) tannins act as oxygen and free radical scavengers, preventing and protecting anthocyanins from oxidation. The condensed tannins, instead, contribute to the formation of stable pigments by combining with anthocyanins. They have two roles:

1) Precipitate grape proteins thus preventing freshly extracted skin tannins (one of the most effective tannins for color stability) from precipitating.
2) Participate in stabilization reactions (mainly co-pigmentation) to form more stable color pigments.

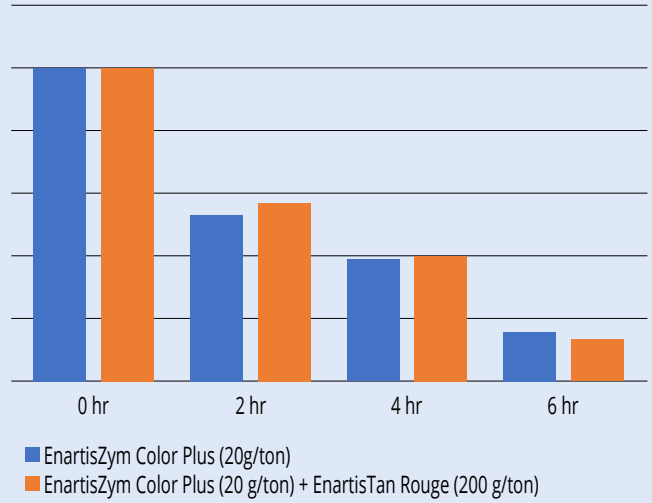
WHY SHOULD I USE A MACERATION ENZYME?

Anthocyanins and tannins are the compounds responsible for color stability. Anthocyanins are present in cells of the skin of the grape. They are small, water-soluble molecules that are extracted early in the process. Tannins are located in both grape skins and seeds. Tannins can have very different structures and dimensions. The smallest tannins can be extracted quite easily, while larger tannins require physical breakage of berry skin cells to allow diffusion into must. Maceration enzymes are preparations containing pectolytic, cellulase and hemicellulase enzyme activities. Their application ensures a deeper and faster degradation of berry cell walls, facilitating the diffusion of anthocyanins and, more importantly, accelerated extraction of tannins into must. More tannins in solution contributes to improved long-term color stability.

CAN EXOGENOUS TANNIN ADDITION INTERFERE WITH MACERATION ENZYME ACTIVITY?

The addition of tannin does not have a significant effect on maceration enzyme activity (graph 1). The sacrificial tannin that we add on grapes in the vineyard or at the crusher is going to react with oxygen, free radicals and grape proteins. In any case, it is recommended to add one ingredient (enzyme or tannin) at the time, homogenize it and then add the following one.

Graph 1: Pectolityc activity of EnartisZym Color Plus



Graph 1: Pectolityc activity of EnartisZym Color Plus added alone or together with a sacrificial tannin. Trial done in a white juice for a better accuracy of results. Enzyme and tannin were added consecutively.

HOW CAN PROTEASE ACTIVITY HELP COLOR STABILITY?

The presence of secondary protease activity in a maceration enzyme can help degrade grape proteins and reduce their reactivity with grape tannins. As with the sacrificial tannin, their addition into must contributes a larger quantity of grape tannins, thus favoring the formation of stable color pigments.

HOW CAN MACRO-OXYGENATION IMPROVE COLOR STABILITY?

The addition of controlled amounts of oxygen to wine promotes the production of acetaldehyde, a product of ethanol oxidation. This compound acts as a bridge in polymerization reactions involving tannins and anthocyanins, creating stable condensed pigments responsible for a desired red-mauve color.

IS MACRO-OXYGENATION TIMING IMPORTANT?

When the objective of macro-oxygenation is to improve color stability, timing is essential. The time frame between the end of alcoholic fermentation and the start of malolactic fermentation is the best stage to apply macro-oxygenation to encourage anthocyanin-tannin polymerization via acetaldehyde bridges. This period is best due to:

- Warmer temperatures promoting faster reactions.
- It is the stage where there is maximum concentration of free anthocyanins and grape tannins.
- There is no or little SO_2 present which can hinder ethanol oxidation or bind with acetaldehyde and anthocyanins, thus inhibiting polymerization and condensation reactions.

What should I do to produce a color stable wine?

WINEMAKING STAGE	REACTIONS	ENARTIS PRODUCTS
HARVEST	Prevent oxidation of color/phenolic compounds with antioxidant protection.	100-150 g/ton of AST
RECEPTION/CRUSHER	"Sacrificial" tannin reinforce SO_2 antioxidant effect and eliminate proteins that would react with grape polyphenols, thus protecting grape tannins.	150-200 g/ton EnartisTan FP, EnartisTan Rouge or EnartisTan Fermcolor
	Maceration enzymes improve grape skin tannin extraction, favoring anthocyanin/tannin reactions and stabilizing color pigments. The protease activity decreases proteins capacity to react and precipitate grape tannins.	30 g/ton of EnartisZym Color Plus
ALCOHOLIC FERMENTATION	At the first stage of alcoholic fermentation, anthocyanins are extracted much faster than tannins. To encourage the stabilization of anthocyanins via condensation, increase the concentration of grape tannin. To encourage the stabilization of anthocyanins via co-pigmentation, increase the concentration of tannin and utilize mannoproteins.	Condensation: 200 g/ton of EnartisTan Color or EnartisTan V Co-pigmentation: 150 g/ton of EnartisTan XC 200 g/ton EnartisPro Uno Condensation & copigmentation: 250-400 g/ton of EnartisPro Tinto
AFTER AF, BEFORE MLF	At this stage, short macro-oxygenation encourages the formation of stable color compounds produced by the condensation between free anthocyanins and tannins via acetaldehyde bridges.	10 g/hL EnartisTan E

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