BEST PRACTICES AND TIPS TO IMPROVE COLOR STABILITY

Why It Matters

The color of red wine comes from **anthocyanins** extracted from grape skins. These pigments are highly reactive: many factors can reduce color intensity and shift hue from vibrant red-purple to orange brown.

Mechanisms of Stabilization

Color stabilization occurs through two complementary processes:

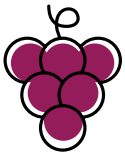
- **COPIGMENTATION** Electrostatic complexes between anthocyanins and cofactors (flavanols, hydroxycinnamates, polysaccharides). These interactions protect pigments during the early stages of vinification. It appears as the vibrant blue-purple hues in young wines. The bonds are semi-stable.
- **CONDENSATION** Formation of covalent bonds between anthocyanins and tannins, often via acetaldehyde bridges. Condensed color has darker red tones that hold with age. The bonds are more resistant to oxidation and provide long-lasting color stability.

KEY FACTORS INVOLVED:

- **Oxidation:** degrades free anthocyanins
- **Precipitation:** Anthocyanins, which carry a positive charge, bind with tannins to become stable. Active tannins also tend to bind with proteins in must or wine, leading to precipitation. The more reactive the tannins, the more they precipitate with proteins, which can indirectly contribute to color instability in the wine due to lost anthocyanin-tannin condensation potential.
- **pH shifts:** alters pigment structure and reduces color intensity

Winemaking Interventions by Phase

1 Pre-Alcoholic Fermentation



Anthocyanins protection

Anthocyanins are water-soluble and vulnerable as soon as the grapes are crushed. The addition of **AST** provides fast and effective antioxidant and antimicrobial protection during transport and reception.

EnartisZym COLOR PLUS, breaks down grape skins due to its pectolytic, cellulase, and hemi-cellulase activities, and secondary activities reduce protein reactivity, leaving more tannins available for stable pigment formation.

To form stable pigments, hydrolysable and condensed tannins like **EnartisTan ROUGE** contribute to color stabilization from the early stages of maceration.

2 Alcoholic Fermentation

Enhancing copigmentation and promoting condensation

Polysaccharides play an important role in these reactions: **EnartisPro TINTO**, made of immediately soluble mannoproteins, ellagic and grape seed tannins, is formulated to increase anthocyanin/tannin condensation, resulting in greater color intensity while enhancing a softer mouthfeel.

At the same time, supplementing tannins during fermentation promotes further copigmentation reactions. **EnartisTan XC**, an ellagic tannin with high affinity for anthocyanins, encourages these bonds, thus reinforcing color stabilization.

In addition, **macro-oxygenation** can stimulate tannin reactivity when applied during primary fermentation, supporting early condensation reactions between anthocyanins and tannins.

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3 Post-Alcoholic Fermentation

Oxygen management for stable pigments

MICRO-OXYGENATION
introduces oxygen in very small controlled doses to guide slower and gradual pigment stabilization. After malolactic fermentation it mimics the natural oxygen ingress of barrel aging. Oxygen promotes the slow oxidation of ethanol to acetaldehyde, which serves as a molecular bridge between anthocyanins and tannins providing a long-term color stability. Micro-oxygenation softens tannins, rounds mouthfeel, and helps aromas integration.

MACRO-OXYGENATION
a larger amount of oxygen over a shorter period of time, is added. At the end of alcoholic fermentation or in the short interval before malolactic fermentation, encourages rapid polymerization of anthocyanins and tannins, helping to "fix" unstable pigments into more permanent structures.

EnartisTan E during micro and macro-oxygenation enhances pigment fixation by providing reactive condensed tannins that readily form acetaldehyde bridges with anthocyanins, ensuring long lasting color intensity and resistant to oxidation.

ENARTIS RECOMMENDATIONS	OBJECTIVE	DOSAGE
AST Pre-Alcoholic Fermentation	Antioxidant protection, reduces overall SO_2 needs.	100-200 g/ton
EnartisZym COLOR PLUS Pre-Alcoholic Fermentation	Maximize phenolic extraction. Hydrolyzes proteins and reduces precipitation of tannins and pigments.	20-40 g/ton
EnartisTan ROUGE Pre-Alcoholic Fermentation	Intense antioxidant and antioxidasic activities, inhibits laccase and polyphenol oxidase (PPO), and protects color and aromatic compounds from oxidation.	100-400 g/ton
EnartisPro TINTO Alcoholic Fermentation	Promote anthocyanin/tannin condensation. Improved balance and complexity.	15-40 g/hL
EnartisTan XC Alcoholic Fermentation	Copigmentation and increased color stability.	100-400 g/ton
Micro-Oxygenation Post-Alcoholic Fermentation	Gradual polymerization via acetaldehyde bridges; tannin softening and integration.	0.5-3 mg/L/month
EnartisTan E Post-Alcoholic Fermentation	Support color stabilization via acetaldehyde bridges.	3-15 g/hL

ENARTIS ENGINEERING provides expertise and optimization of the process to tailor micro-oxygenat on protocols for optimal results.

Takeaway

Color stability is not achieved at one point in vinification, but through strategic interventions at every phase of vinification. Targeted enzyme use, tannin supplementation, antioxidant protection, and controlled oxygenation all contribute to a stable, vibrant, and long-lasting red wine color.

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