About Color Stability

The initial color of red wine is mainly due to anthocyanins, extracted from grapes during the winemaking process. Anthocyanins are highly unstable and able to react fast with other wine compounds resulting in loss of color. Stabilization of wine pigments can occur via co-pigmentation or condensation. Co-pigmentation is the enhancement of color due to formation of complexes between anthocyanins and cofactors such as flavonols, hydroxycinnamates and/or colloids via electrostatic bounds. These molecules, considered 'semi-stable' pigments, are sensitive to alcohol and pH change. Condensation leads to more stable pigments. They can be formed via direct bonds between anthocyanins and tannins or under oxidative environment via acetaldehyde bridges.

During winemaking, anthocyanins are extracted early in the liquid phase at a faster rate than tannins (Figure1). This results in an accumulation of free anthocyanins early in the process that need to be stabilized by using antioxidant, sacrificial tannins and increasing the concentration of tannins in the early stage of winemaking.

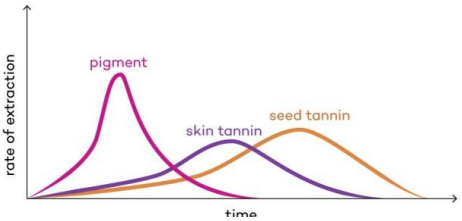

Figure 1: Phenolic extraction kinetics during fermentation of red grapes. (Cheynier, 1997b)

Moreover, formation of polymeric pigments can be enhanced by the presence of acetaldehyde which creates stable bonds between anthocyanins and tannins. This process is accelerated by the use of micro-oxygenation after pressing which favors the oxidation of ethanol into acetaldehyde.

Different categories of polyphenols:

Non-flavonoids: Majoritary hydroxycinnamates in grapes, the non-flavonoids are the preferred substrate for polyphenol oxidase and usually the first compounds involved in the oxidation of grape juice.

Flavanoids: Localized in skins and seeds, flavonoids include three main groups: tannins, flavonols and anthocyanins.

- The tannin group contains complex combinations of catechins found in grape seeds and skins, correctly described as condensed tannins.
- Found in grape skin, flavonols are known as co-factors for the color-enhancing phenomenon known as co-pigmentation.
- Anthocyanins are found mostly in grape skins and are the main source of colored pigments in red wine.

Hydrolysable tannins: Derived from wood, they are constituted of gallic acid or ellagic acid moieties. The hydrolysable tannins are capable of quickly reacting with oxygen and prevent oxidation of pigments.

What is a "sacrificial" tannin?

When grapes are crushed, proteins are released and bind first with tannins to precipitate. The first tannins available are the skin tannins, which are usually the most interesting for future wine structure and mouthfeel. Sacrificial tannins are added on grapes and react with proteins, thus preventing the freshly extracted skin tannins from precipitating.

Improving Color Stability Guidelines:

HARVEST	100-150 g/ton of AST or SO_2 Prevent oxidation of color/phenolic compounds with antioxidant protection.
COLD SOAK	150-200 g/ton of **Enartis Tan Rouge** "Sacrificial" tannins reinforce SO_2 antioxidant effect and eliminate proteins that would react with grape polyphenols, thus protecting grape tannins. These hydrolysable tannins are highly reactive as oxygen radical scavenger and inhibits oxidasic enzymes.
	30 g/ton of **Enartis Zym Color Plus** Maceration enzymes improve grape skin tannin extraction, thus increasing grape tannin content, favoring anthocyanin/tannin reactions and stabilizing color pigments. The proteasic activity decreases proteins capacity to precipitate grape tannins.
YEAST INOCULATION	150-200 g/ton of **Enartis Pro Tinto** At the first stage of alcoholic fermentation, anthocyanins are extracted much faster than tannins. To encourage the stabilization of anthocyanins via co-pigmentation and condensation and protect the anthocyanins, increase the concentration of grape tannin and use mannoproteins.
AFTER AF - BEFORE MLF	10 g/hL **Enartis Tan V** Increasing the level of reactive seed tannin will increase the speed and the amount of stable pigments formed. **1-4 mg/L/day of oxygen for 4-7 days** At this stage, short macro-oxygenation encourages the formation of stable color compounds produced by condensation between free anthocyanins and tannins through acetaldehyde bridges. Oxygen will oxidize ethanl in acetaldehyde <u>Requirements:</u> • No SO_2 addition • Warm temperature • No yeast activity • No ML bacteria activity • Healthy grapes Check VA, Malic Acid and tasting everyday. If VA or Malic acid move = stop MOX. As soon as acetaldehyde (green apple, bruised apple, nutty aroams) is noticed = stop MOX.