



Laccase Issues During the 2011 Harvest – A Winesecrets Whitepaper

Laccase is an enzyme formed by *Botrytis cinerea* on grape surfaces in the vineyard. It is a polyphenol oxidase and is responsible for browning in white wine and loss of pigmentation in red wine. The 2011 harvest was marked by high levels of bunch rot, leading to laccase issues both during and after fermentation.

Tyrosinase is the polyphenol oxidase (PPO) that is most familiar to winemakers. The PPO is formed in the grape skin and is the same enzyme responsible for browning in apples and bananas. It is typically responsible for browning in white juice. Oxygen exclusion, SO₂ or hyperoxidation are effective mitigation steps to avoid issues with tyrosinase. Under hyperoxidation, juice is introduced to as much air as possible with the oxygen converting caffeic and coumaric acids to quinones which readily polymerize and fall out of solution.

Laccase is more difficult to address than tyrosinase. Characteristics that make laccase problematic include:

- Laccase is stable in wine due to its alcohol tolerance. This makes laccase a potential threat post-fermentation.
- The enzyme is resistant to SO₂. High rates of SO₂ can be applied to scavenge the oxygen in a wine, preventing the browning reaction. SO₂ will not affect laccase and once SO₂ is consumed, the enzyme will promote the phenolic polymerization reaction.
- Laccase can react with many substrates. Under hyperoxidation, the few substrates that tyrosinase uses (caffeic and coumaric acids) are consumed and the reaction cannot proceed. Laccase can use a broad range of phenolics along with ascorbic acid as a substrate.
- Bentonite fining will not remove laccase.
 - Laccase has an iso-electric point of 2.5.
 - At wine pH, laccase has a negative charge.
 - Bentonite has a negative charge and bonds with positively charged proteins to remove them during fining.

Heat treatment (20 seconds at 60 °C) of juices, musts and wine will denature the enzyme and prevent the browning reaction. The effectiveness of this treatment is documented in Australian & New Zealand Grapegrower & Winemaker and can be found [here](#).

Ultrafiltration at 50,000 Daltons can remove the enzyme from juice or wine. The process is best used on young wines, while the phenolics responsible for color and flavor have yet to polymerize to a large degree. Ultrafiltration (UF) will remove laccase (70,000 Daltons) and any large, brown polymerized phenolics, restoring a wine's color and eliminating the threat of laccase during aging.

Winesecrets is exploring the use of protein fining to reduce laccase concentration. Due to the low iso-electric point of the PPO, laccase is negatively charged in wine, making bentonite fining ineffective. Use of a positively charged protein fining agent may reduce laccase concentration in wine. Protein fining should be followed with centrifugation to remove the agglomerated laccase-protein complex. Wineries should then treat the stabilized wine with bentonite to remove residual protein.

Winesecrets offers both heat treatment and Ultrafiltration to address your laccase issues. For more information or to request services, contact Winesecrets at www.winesecrets.com.