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Wine Taints of Aging
Brettanomyces and Oxidation

The following is a recap of the talk given by Linda Bisson, Wine Flavor 101 Course Director and Professor, U.C. Davis
January 15, 2015

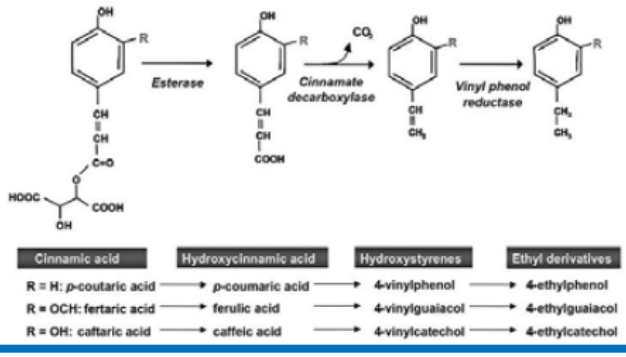
Brettanomyces Impacts on Wine

- Loss of 'fruit', 'floral' & 'honey' aromas
- Loss of negative aromas
- Increase in overall complexity
- Acetic acid, vinegar aroma
- Spice and smoke aroma
- Chemical, Plastic, Band Aid aroma
- Metallic, bitter taste
- Mousiness

Chemicals Produced

Chemical Type	Odor Impact	Detection Threshold
Ethyl Phenol	Chemical, Band Aid, smoke, burnt, medicinal, spicy	0.14 to 0.62 ppm
Vinyl Phenol	Leather, burnt, metallic, woody	0.1 to 15 ppm
Fatty Acid	Barnyard, sweat, rancid, solvent, sewage	5 ppm
Pyridine	Mousy, rancid tortilla chips, crackers	2 to 18 ppb
Aldehyde	Solvent, burnt rubber, air freshener	1 to 100 ppm
Long Chain Alcohol	Floral, fruit, chemical, furniture polish	0.1 to 50 ppm
Ester	Fruit, floral	0.1 to 100 ppm
Terpene	Spicy, floral, resin	0.1 to 0.5 ppm

Vinyl and Ethyl Phenols Derive from Cinnamic Acids



Compounds Produced by Brett in Wine

- Signature spoilage compounds - ethyl phenols, vinyl phenols
- Other spoilage compounds – acetic acid, ethyl acetate, fatty acid, carboxylic acid
- Compounds that are positive – Esters, higher alcohols, terpenes

Brettanomyces Aromas in Wine

- Horse sweat
- Leather
- Earthy
- Medicinal
- Band Aid
- Smoky
- Tobacco
- Barnyard
- Putrid
- Lilac

Oxidative Taints

- Off-colors:
  - pink
  - brown
- Off-flavors:
  - Aldehyde (nutty)
  - Rancid (oxidized fatty acid)
  - Hamster fur/stale tortilla chips
  - Chemical notes

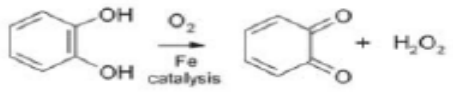
Oxidative Taints

- Function of oxygen exposure and wine's ability to consume oxygen
- Related to phenolic content
- Impacted by other factors such as pH
- Some oxidation reactions are desired; not all lead to defects = a delicate balance!

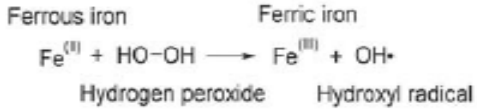
Oxidative/Reductive Reactions in Wine

- Chemical Oxidation/Reduction
  - Cascade initiated by molecular oxygen
  - Electron rearrangements in absence of oxygen
- Enzymatic (biological) Oxidation
  - Polyphenol Oxidase (PPO; Tyrosinase) (plant)
  - Laccase (*Botrytis* & molds)

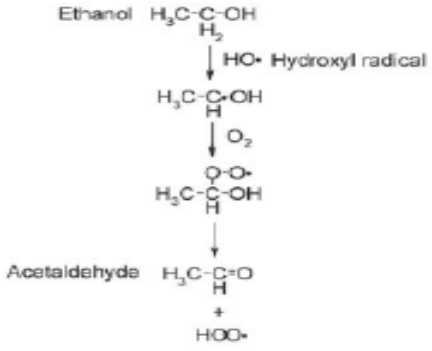
Formation of Acetaldehyde



Danilewicz 2007



Waterhouse and Laurie 2006



Waterhouse and Laurie 2006

Enzymatic Oxidation

- PPO = tyrosinase/catecholase
- Laccase = *p*-phenoloxidase/diphenol oxidase
- Some overlap of substrates
- PPO mostly associated with off-colors; Laccase can give both off-colors and off-odors

PPO versus Laccase

- PPO is inhibited by sulfite
- PPO is inactivated by ethanol
- Laccase has a broader range of substrates than PPO
  - Broader range of off-color compounds formed
  - Can oxidize phenol-glutathione complexes
- Laccase is still active in wine post-fermentation