Wine Flaw Sensory Evaluation

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Wine Flaw Sensory Evaluation

- Chemistry
- Sensory
- Causes
- Prevention-Management-Removal
Wine Flaw Sensory Evaluation

- Reduction
- Oxidation
- Volatile Acidity
- Nailpolish
- Brettanomyces
- Buttery
- Sorbate
- Geranium
- Lady Bug
- Cork Taint
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<td>Acetaldehyde</td>
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Sulfur in Wine

Reduced: electron-rich

- Hydrogen sulfide ($\text{H}_2\text{S}$)
- Elemental sulfur ($S$)
- Sulfides ($S^2-$)

Oxidized: electron-poor

- Sulfur dioxide ($\text{SO}_2$)
- Sulfate ($\text{SO}_4^{2-}$)
- Bisulfite ($\text{HSO}_3^-$)
Reduction
3x Sulfides

- Hydrogen Sulfide $\text{H}_2\text{S}$
- Mercaptans
- Disulfides
## Reduction Sulfides

<table>
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<tr>
<th>Sulfide</th>
<th>Odor Descriptors</th>
<th>In Wine μg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>hydrogen sulfide</td>
<td>rotten egg, sewage-like</td>
<td>0.9-1.5</td>
</tr>
<tr>
<td>ethyl mercaptan</td>
<td>burnt match, sulfidy, earthy</td>
<td>1.1-1.8</td>
</tr>
<tr>
<td>methyl mercaptan</td>
<td>rotten cabbage, burnt rubber</td>
<td>1.5</td>
</tr>
<tr>
<td>diethyl sulfide</td>
<td>rubbery</td>
<td>0.9-1.3</td>
</tr>
<tr>
<td>dimethyl sulfide</td>
<td>canned corn, cooked cabbage, asparagus</td>
<td>17-25</td>
</tr>
<tr>
<td>diethyl disulfide</td>
<td>garlic, burnt rubber</td>
<td>3.6-4.3</td>
</tr>
<tr>
<td>dimethyl disulfide</td>
<td>vegetal, cabbage, onion-like at high levels</td>
<td>9.8-10.2</td>
</tr>
<tr>
<td>carbon disulfide</td>
<td>sweet, ethereal, slightly green, sulfidy</td>
<td>5</td>
</tr>
</tbody>
</table>
Reduction
Hydrogen Sulfide

Copper fining possible!

- Boiling Point: -51°F
- State: it's a gas!
Reduction

Mercaptans

\[ \text{H}_2\text{S} + \text{Alcohol} = \text{Mercaptan} \]

\[ \text{H}_5\text{C}_2\text{-SH} \]

Copper fining possible!
Reduction

Disulfides

Mercaptan + Mercaptan = Disulfide

$H_5C_2\text{-S-S-}C_2H_5$

Copper fining NOT possible!
<table>
<thead>
<tr>
<th>Sensory Threshold</th>
<th>Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>H$_2$S</td>
<td>1 µg/L</td>
</tr>
<tr>
<td>Mercaptans</td>
<td>1 µg/L</td>
</tr>
<tr>
<td>Disulfides</td>
<td>30 µg/L</td>
</tr>
</tbody>
</table>
Reduction

*Sulfides*

**Causes**
- Juice nitrogen imbalances
- Fungicide (sulfur) residues
- Excess sulfate

**Remedies**
- Prevention!
- Aeration
- Copper Sulfate
Aeration/Splashing

- $\text{H}_2\text{S} + \text{Air}$
- Mercaptans + Air = Disulfides = bad idea!

Why?

In Barrel:
- Disulfides

In Bottle:
- Disulfides $\Rightarrow$ Mercaptans

Sensory Threshold
- 30 $\mu$g/L
- 1 $\mu$g/L
H$_2$S Prevention

- Assess juice nitrogen status
- Add juice nutrients selectively
- Lower elemental sulfur residues
- Reduce solids in whites
- Add SO$_2$ at crush
- Inoculate early/reduce inoculum
- Use low H$_2$S-producing yeast strains
- Lower fermentation temperature
- Aerate fermenting must
H₂S Prevention

After fermentation

• Rack off lees immediately if smelly
• Don’t aerate wine with mercaptans
• Test bulk wine for disulfides

Removal

• Add copper sulfate solution (Bench test!)
Oxidation

Chemistry

- Acetaldehyde

Sensory

- *Sherry*, nutty, bruised apple
- Sensory threshold: 100 mg/L
Yeast fermentation by-product
Oxidation of ethanol (alcohol) via oxidized phenolics

Causes

- Yeast fermentation by-product
- Oxidation of ethanol (alcohol) via oxidized phenolics

Prevention/Removal

- Proper free SO$_2$
- Air exclusion: aging/bottling/storage
Volatile Acidity  “V.A.”

Chemistry

- Acetic acid

Sensory

- Vinegar odor
- Spoilage threshold: 700 mg/L
- Legal limits: 1,400/1,200 mg/L

(27 CFR Part 4 Subpart C §4.21 a iv)
Volatile Acidity “V.A.”

Causes
- Yeast fermentation by-product
- Lactic acid bacteria
- Acetic acid bacteria

Prevention/Removal
- Clean fruit, SO₂ at crush, sanitation
- Avoid yeast stress
- Minimize fruit flies
- Reverse osmosis + ion exchange
Chemistry

- Alcohol + V.A. = Ethyl acetate

Sensory

- Nailpolish/remover odor
- Spoilage threshold: 150 mg/L vs. Acetic acid: 700 mg/L
Nailpolish
Ethyl acetate

Causes:
- Yeast fermentation by-product
- Lactic acid bacteria
- Acetic acid bacteria

Prevention/Removal:
- Clean fruit, SO$_2$ at crush, sanitation
- Avoid yeast stress
- CANNOT be fully removed
Brettanomyces

Sweaty saddle

Horse blanket

Band aid

Wet dog

Jock strap
Brettanomyces

Chemistry:
- Impact compound: 4-Ethylphenol

Sensory:
- Medicinal, band aid
- Threshold: 440 µg/L
Brettanomyces Yeast

En-wine-ronment:

- Residual Sugars (pentoses)
- Alcohol
- Vitamin *Thiamin* => low free SO$_2$
- Amino acids (including proline)
- Oxygen (air)

- Warm temperature (>50F)
- High pH => low molecular SO$_2$
- Low alcohol
Brettanomyces yeast + Grape/Oak components

Causes:
- Brettanomyces yeast
- + Grape/Oak components

Prevention/Removal:
- Proper free SO₂ based on wine pH
- Sanitation, monitoring of 4-Ethylphenol
- Barrel maintenance
- Sterile filtration
- Reverse Osmosis?
Brettanomyces
Wet Dog Odor
Brettanomyces

Volatile Phenols

GRAPE Phenolic Acids

- 4-Ethylphenol
- 4-Ethylguaiacol
- 4-Vinylphenol
- 4-Vinylguaiacol
- 2-Phenylethanol
- Vanillin
- Tyrosol
- Ethylcinnamate
- Benzaldehyde

GRAPE Vinylphenols

GRAPE Glycosides
Brettanomyces
Barrel maintenance
Diacetyl

Chemistry

- Diacetyl

Sensory

- Buttery, nutty, movie popcorn
- Desirable in certain wine styles
- Funk threshold: 5 mg/L
Buttery Diacetyl

**Causes:**
- Malolactic bacteria (mainly)

**Prevention/Removal:**
- Suppress malolactic fermentation w/ SO$_2$
- Use different malolactic strain
- Wait after ML has “finished” before SO$_2$
Geranium

Chemistry:

- 2-Ethoxy-hexa-3,5-diene

Sensory:

- Geranium leaves
- Threshold: 100 ng/L
Sorbate/Sorbic Acid

- **Yeast growth inhibitor:** 200 mg/L
- **Legal limit:** 300 mg/L
- **Sensory threshold:** 135 mg/L
- Some yeasts are resistant
- **NO** effect against *bacteria*
- Added as *potassium* salt (sorbate) (=> watch cold stability)
Geranium

Cause

- Sorbic acid + Malolactic bacteria

Prevention

- Avoid sorbate as preservative
- Use sorbate only with proper SO₂
- Add no earlier than day before bottling
- Always bubble test/sterile filter
- NO removal option from wine
Lady Bug
‘Ladybug taint’
a new wine off-flavour

G. J. Pickering 1,2, J.Y. Lin 2, G. Soleas 3, A. Reynolds 1,2,3, R. Riesen 4, I. Brindle 3.

1 Cool Climate Oenology and Viticulture Institute, 2 Department of Biological Sciences, 3 Department of Chemistry, Brock University, 4 Lake Erie Ecological Research Center, Youngstown State University, Ohio, USA, 5 Quality Control Division, Liquor Control Board of Ontario, Ontario.

How to distinguish MALB (Harmonia axyridis)
(Photos courtesy of Ker and Brewster, 2003)
Lady Bug

Chemistry:
- (Isopropyl)-Methoxypyrazine

Sensory:
- Asparagus, bell pepper, earthy, herbaceous, peanut
- Threshold: 10-15 ng/L
Lady Bug
*Methoxypyrazine*

**Cause:**
- MALB haemolymph

**Prevention/Removal:**
- Remove beetles before crushing, pressing, fermenting
- **NO** removal option from wine
Cork Taint

Chemistry:

2,4,6-Trichloroanisole

Sensory:

Musty, moldy, earthy

Threshold: < 5 ng/L
TCA

Keep out!

- Winery
- Barrel room
- Warehouse
- Tasting room
- Restrooms
- Everywhere else
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Samples in the Back!