Sulfides in Wine: Sources, Prevention, Correction

WI Fresh Fruit and Vegetable Conference 2020

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Good Morning!

- Chemistry of sulfides
- Sources and causes
- Detection and evaluation
- Winery scenarios and potential solutions

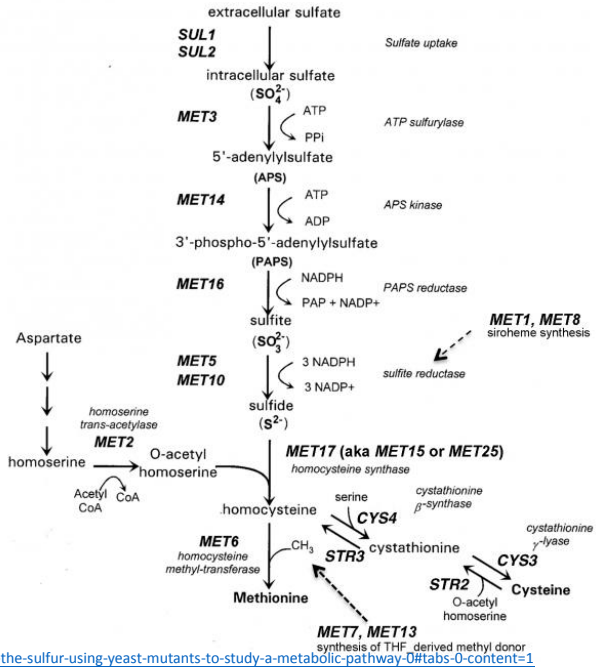
Sulfides!

Compound		Aroma
Hydrogen Sulfide		Rotten Eggs, Sewer Gas
Mercaptans	Methyl Mercaptan	Rotten Cabbage
	Ethyl Mercaptan	Burnt Match, Earthy
Disulfides	Dimethyldisulfide	Onions, Cooked Cabbage
	Diethyldisulfide	Garlic, Burnt Rubber
DMS		Canned Vegetables

- Does not make for enticing back label copy.

Hydrogen Sulfide

- Intermediate of yeast metabolism
  - Necessary for sulfur containing amino acids: methionine, cysteine
  - Under certain environmental conditions, excess hydrogen sulfide may be produced and excreted into the wine



https://www.coursesource.org/courses/follow-the-sulfur-using-yeast-mutants-to-study-a-metabolic-pathway-0#tabs-0-content=1

Sulfide Progression

- Mercaptans:
  - Hydrogen Sulfide and ethanol in the presence of acetaldehyde
- Disulfides:
  - Mercaptans and O_2

But…

- Is lack of Nitrogen solely responsible?

Maybe Not

- Residual vineyard sprays (elemental sulfur)
- Over sulfiting juice
- Very cold inoculations, improper acclimation
- High fermentation temperatures
- Over clarification of juice
- Not racking off pressing lees

And…

- Yeast compaction/settling in small fermenters
- Low DO at inoculation
- Extended lees contact
- Sulfur wicks used in cooperage
- Clear bottles
- Cursed varieties, nutrition, other thiols
- Other culprits to be determined

Evaluation

- Sulfide detection kit
  - Build your own or purchase pre-made (Gusmer)
- Notes:
  - Be careful when collecting samples
    - Oxygen
  - Take your time
    - Sensory fatigue
    - Evaluate at multiple times
    - Evaluate from high to low treatments
    - Bench trialing

	Glass 1	Glass 2	Glass 3	Glass 4
	Control	$CdSO_4$	$CuSO_4$	Ascorbic + CU SO_4
A	No Change	Odor is gone	Odor is gone	Odor is gone
B	No Change	No Change	Odor is gone	Odor is gone
C	No Change	No Change	No Change	Less odor or gone
D	No Change	Odor is gone	Odor is gone	Odor is gone
E	No Change	No Change	Less than 2	Less than 3 or gone
F	No Change	No Change	Less than 2	Less than 3 or gone
G	No Change	No Change	No Change	No Change

A: H_2S
B: Mercaptan
C: Disulfide
D: H_2S and Mer.
E: Mer. And Disulfides
F: All Three
G: None of the above

Notes On Treatments

- Dilute copper and add slowly, preferably during a transfer
- Consider adding treatments using multiple doses
- Use online calculators
- Oxidant, manage FSO2
- Recurrent sulfides after copper additions or high levels of copper may require carbon.

Scenario 1, What Would You Do?

- Hydrogen sulfide becomes apparent in during the first third of fermentation?

Scenario 1:

- H2S early in fermentation likely a nutrition issue
- Prior to fermentation, evaluate YAN
  - High and low YAN challenges
- During fermentation, split nutrient additions
- Add more N
  - DAP vs complex nutrient?
- Raise fermentation T
- Volatilize the H2S
- Stir lees

Scenario 2:

- H2S accumulation and approaching the end of fermentation
- What would you do?

Scenario 2:

- Nutrient additions will likely not improve the situation (beyond ½ sugar depletion)
- Aerate wine
- AWRI research on copper:
  - Copper may be added near the end of fermentation (~0 Brix) without harming the yeast (up to 5 ppm)
    - Sensory?
  - Yeast may bind residual copper, reducing copper levels in the final wine
- Rack off of fermentation lees
- Wait and see

Scenario 3:

- During barrel tasting, or blending trials, you notices sulfides, not just H2S.
- What would you do?

Scenario 3:

- If unsure about the sulfide types present, perform an aroma screen
- Rack wine if aging on lees
- Bench trial copper additions
  - If wine contains di-sulfides, wait to treat if aging further
  - Perform multiple bench trials
    - Use progressively smaller treatment ranges
- Avoid aeration

Scenario 3: Disulfides

- Disulfides have lower thresholds than mercaptans
- Reached worst possible scenario
- Relax and take your time with trials and treatments
- Will require ascorbic acid and treatments
  - Disulfides do not react with copper
  - May impact FSO2 evaluations

Scenario 3: Disulfide Treatments

Intensity	Ascorbic (ppm)	Copper ppm	g/L Carbon
Slight	10, 20, 30	0.1, 0.2, 0.3	0.02 to 0.03
Medium	20, 40, 60	0.3, 0.4, 0.5	0.03-0.06
Intense	50, 75, 100	0.4, 0.5, 0.6	0.4 – 0.8

- Gusmer recommendations

Disulfide Treatments

- Maintain FSO2 levels
  - Ascorbic acid and copper additions may promote oxidation
- Wait to add copper following ascorbic acid treatment
  - Up to a week
- Treat with carbon following copper treatment
  - Deodorizing vs. color removal
- Filter
- Counter fine with PVPP

Scenario 4:

- Sulfides prior to bottling
- What would you do?

Scenario 4:

- Aeration temporarily effective
- Copper addition may not be helpful
  - Haze, oxidation, sediment, increase presence of mercaptans

Other Notes:

- Some cold climate varieties are potentially cursed
  - Vinifera – Syrah
- May not be result of H2S from nutritionally deficiency
  - Thiol character of the variety
  - Avoid high thiol yeast strains
  - Enzyme treatment?
- Try H2S negative yeast?
- Bench trial Reduless if low H2S present

Questions?

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