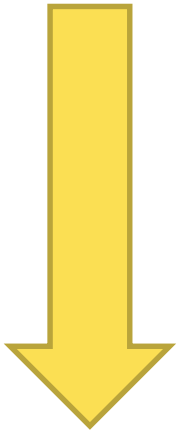
80/20 rule

- In Business, 20% of your customers account for 80% of your revenue
- In Winemaking:
  - 80%: producing sound wine. The basics include good sanitation, healthy fermentations, proper DO/pH/SO2 management, and microbial control
  - 20%: beyond sound wine. This is balance, aroma/bouquet, mouthfeel, color, etc.

Increasing Shelf Life

- A wines inherent shelf life is determined by:
  - ↑ Shelf Life = ↑alcohol +↑tannins +↑ SO2 +↓ pH +↓ Microbes + ↓ DO
    - Of these, which can the winemaker control the MOST/EASIEST



  - DO (minimize movements, use of inert gasses, DO measurement)
  - SO2 (exogenous additions for anti-microbial & anti-oxidant activity)
  - Microbial populations (fining/settling, sanitation, filtration, inhibitors/sterilants)
  - pH (exogenous addition of tartaric/malic, picking schedule, vineyard practices)
  - Tannins (skin contact practices, exogenous additions)
  - Alcohol (picking schedule, exogenous sugar adds, yeast choice, ferm practices)

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Increasing Shelf Life: Sanitation

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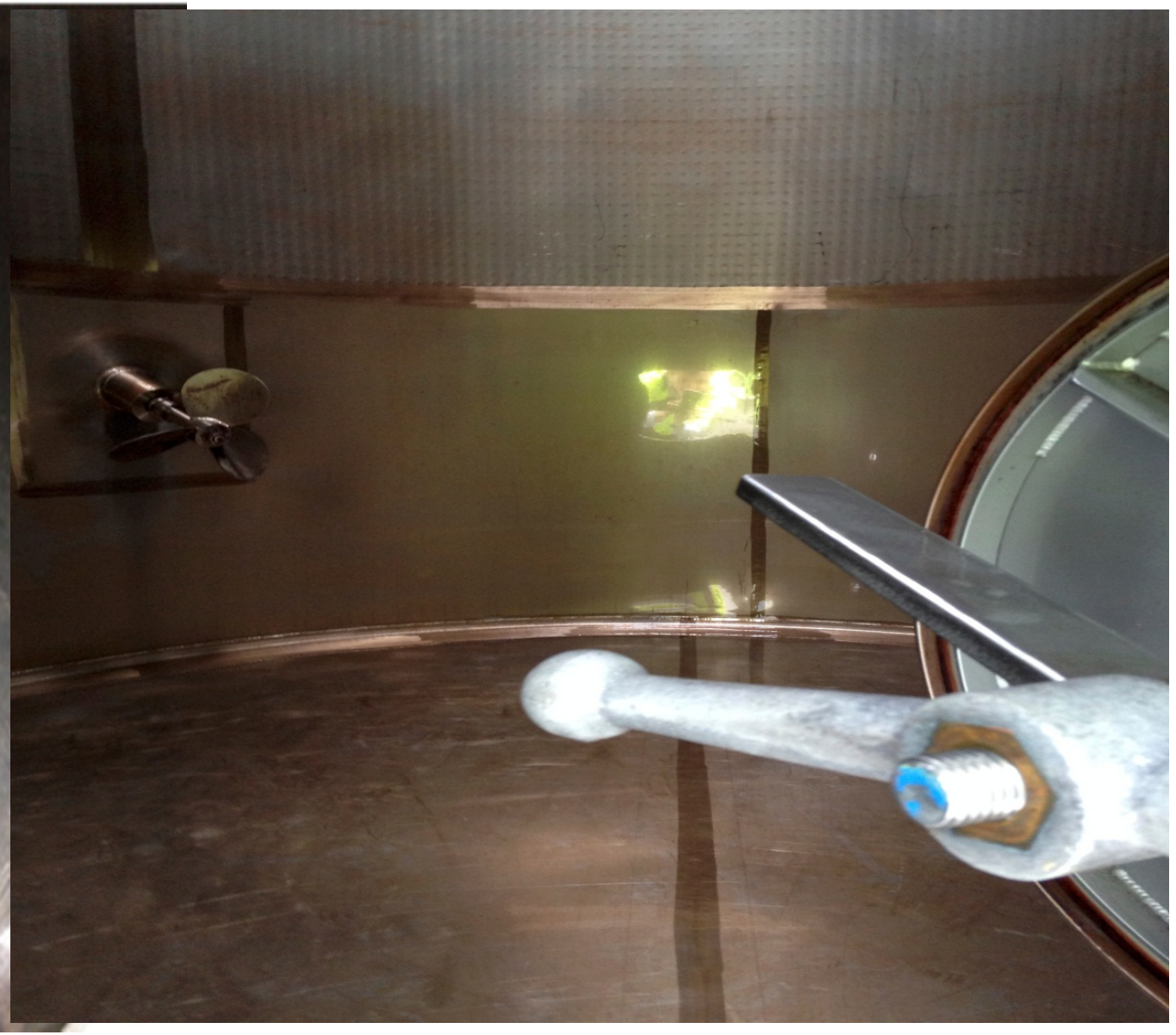
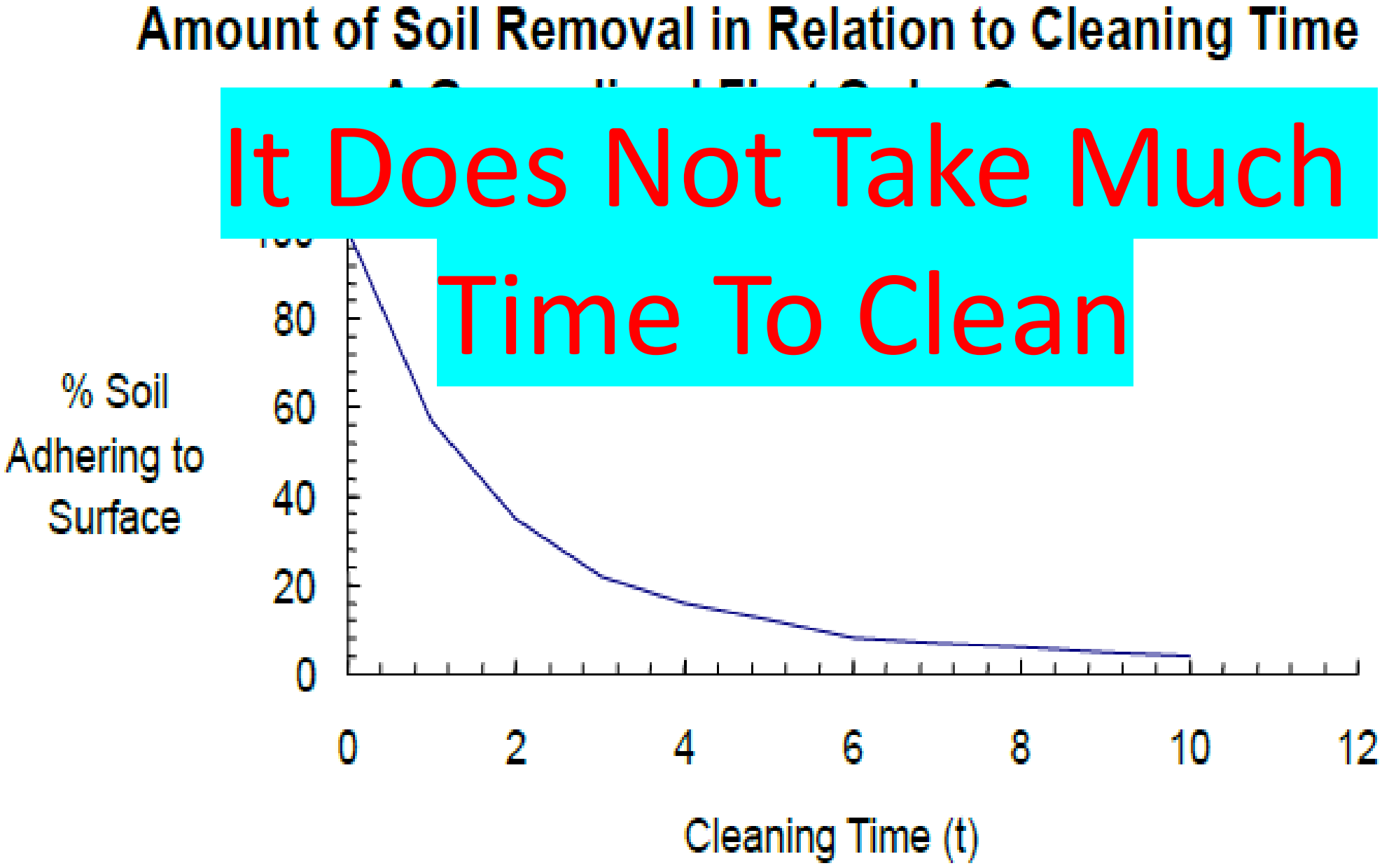
Increasing Shelf Life: Sanitation




Amount of Soil Removal in Relation to Cleaning Time
It Does Not Take Much Time To Clean
% Soil Adhering to Surface
80
60
40
20
0
0
2
4
6
8
10
12
Cleaning Time (t)

Increasing Shelf Life: Sanitation

- Ozone
  - Great surface and air sanitizer
  - Can be dangerous to human health
  - Hard on gaskets, orings, etc
  - Surface must be CLEAN for ozone to work

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Increasing Shelf Life: Minimizing Spoilage

- Texas wines: Elevated pH's (>3.6) greatly encourage microbial growth and are much more likely to spoil

pH and Wine characteristics

	Low pH (3.0 – 3.4)	High pH (3.6 – 4.0)
Oxidation	Reduced	Increased
Color Strength	Increased	Reduced
Type of Color	Ruby	Browner
Protein Stability	More Stable	Less Stable
Bacterial Growth	Less	More

Ref: Elsenmann 1999

pH Control

- Getting pH values below 3.6 has numerous benefits
  - Microbial inhibition is greatly increased
  - Cold stability:
    - <3.65pH: TA goes down (up to 2g/L) and pH drops by as much as .2 units
    - >3.65ph: TA goes down and pH increases
  - Anti microbial activity of SO2 is greatly increased by lower pH levels
- pH's above 3.6 allow for significantly more spoilage
- According to Thermo-Orion: pH meters have an accuracy of appx .5pH units. Thus, a reading of 3.6 could be 3.55-3.65

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pH and SO2 Relationship

pH and SO2 are intrinsically linked

(as shown in table)

Free SO2, while a strong inhibitor is just that.

NOT A YEAST KILLER

Many winemakers consider 0.8 molecular SO2 as a "safe zone"

- The levels needed for higher pH are above the sensory threshold (~60ppm)

The levels of Free SO2 needed for microbial control may push legal limits throughout the lifespan of a wine

There is a well intentioned movement to limit the amount of SO2 that is added to wine

>This, in part, is due to the perception that people are "allergic" to Sulphur

>but can one be allergic to something that is not a protein?

	White Wine 0.8ppm molecular SO_2	*Red Wine* 0.5ppm molecular SO_2
pH	**Free SO_2 (ppm)**	**Free SO_2 (ppm)**
2.9	10	6
3.0	13	7
3.1	16	10
3.2	21	12
3.3	26	14
3.4	32	17
3.5	40	23
3.6	50	30
3.7	60	37
3.8	77	47
3.9	97	62
4.0	>120	83

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Barrel Aging

- The “angels share”
  - We top on a regular basis to prevent oxidation
  - What happens when you open the bung?
    - Typically a vacuum has developed
    - How much Oxygen is in a vacuum?
- So are we doing more damage than good?
- If we go to barrel ~50ppm FSO2, but have high DO + O2 rich headspace, FSO2 can deplete almost completely
  - This leaves very little FSO2 for antimicrobial and antioxidative activity
    - This equals high spoilage risk

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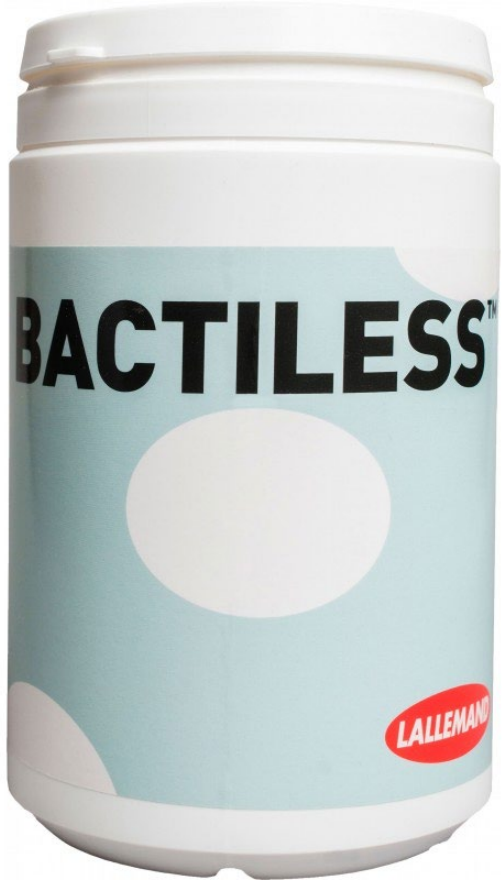
Barrel Aging

- Tips:
  - Topping wine should be low DO, and have adequate SO2
    - Should also be “clean” wine w/o microbial populations
  - Based on experience, a winemaker may want to add SO2 during topping
  - Prior to filling barrel, inert headspace with Ar, CO2, N2
    - Alternatively, once filled, sparging with high purity N2 can “rip” DO down
  - Install gas port in bung to inert headspace prior to opening barrel
    - w/o this, O2 rich air will rush into barrel when bung is pulled

Cellar Practices

- Monitor DO levels before and after
  - Transfers
  - Additions
  - Fining
  - Receiving bulk wines
- Pumps, fittings, setups can all impact O2 pickup
- Minimize headspace

Increasing Shelf Life: Enological Products



- DO mitigation: sparging, inert gas, SIY.
  - ***PURE-LEES LONGEVITY™*** Oconsumption rate for a dose rate at 40 g/hL is 1.7 mg/L dissolved oxygen. If the dose rate is doubled, the level of O consumption also increases. Consumption rate by this SIY yeast = 0.7 mg/L O per hour.
- Increase tannin load: exogenous addition
- Chitosan products: Bactiless, No Brett Inside

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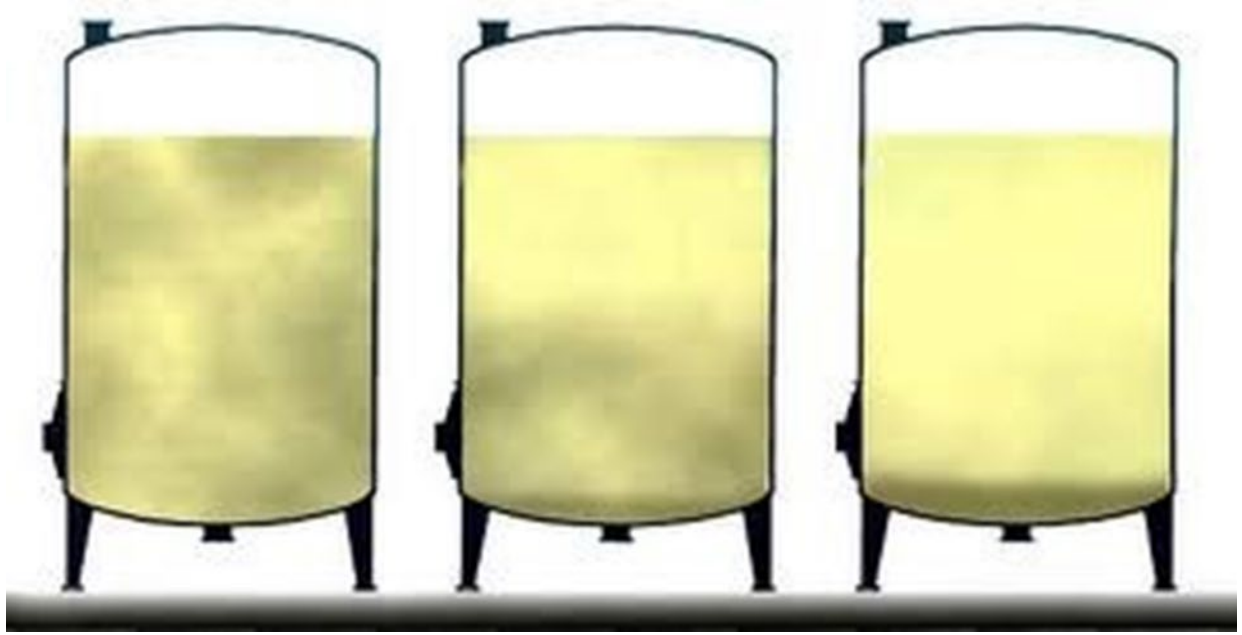
Increasing Shelf Life: Microbial Control

Settling



Filtration

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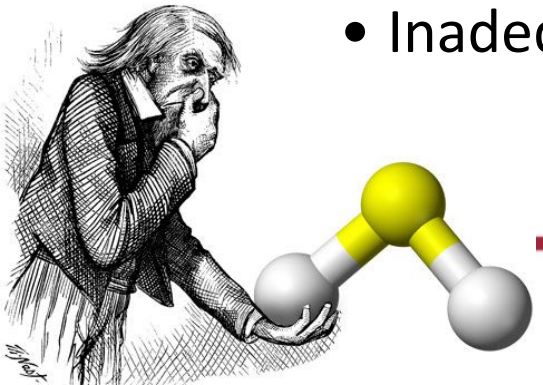
Improving Shelf Life: Controlling Volatile Sulfur Compounds (VSC)

- Sources of VSC:
  - Vineyard Sprays
  - Stressed fermentations
    - Nutrition
    - Yeast strain
    - Lees contact
    - High ferm temps
    - Inadequate aeration during ferm

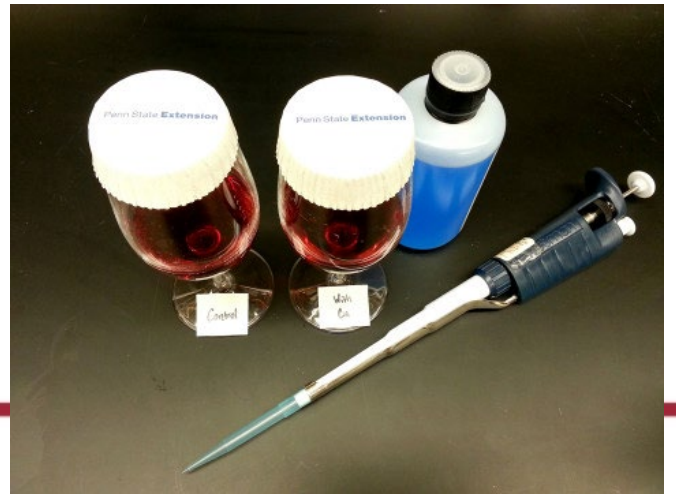
Volatile Sulfur Compounds (VSCs)		
Compound	**Structure**	**Aroma**
Hydrogen sulfide	H—S—H	Rotten egg
Methanethiol	H_3C—SH	Cooked cabbage
Dimethyl sulfide	H_3C—S—CH_3	Cabbage
Dimethyl disulfide	H_3C—S—S—CH_3	Cauliflower
Dimethyl trisulfide	H_3C—S—S—S—CH_3	Garlic
Methyl thioesters		Cooked cauliflower Cheesy Chives



VSC: Prevention and Remediation

PREVENTION

- Proper nutrition
  - High YAN is not enough
- Fermentation Control
  - Temperature control
- Yeast Strain Choice
  - Low/no producers



REMEDIATION

- Reduless
- CuSO4
  - Oxidative catalyst

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VSC: Expression

- Does Splash Racking Actually Work?

$H_2S \xrightarrow{+O_2}$ mercaptans and thiols $\xrightarrow{+O_2}$ Disulphides

lower sensory perception threshold -> higher sensory perception threshold

Conversely

Disulphides $\xrightarrow{-O_2}$ mercaptans and thiols $\xrightarrow{-O_2}$ H_2S

This is what is commonly referred to as “reduction”

Control your DO, get the wines reductive in the cellar, treat VSC = less likely to form in the bottle

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