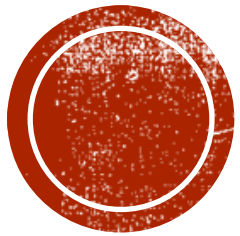
# $SO_2$ AS A TOOL IN A TEXAS WINERY: THEORY & PRACTICE

Presented by
SETH URBANEK, WINEMAKER
WEDDING OAK WINERY



# THEORY

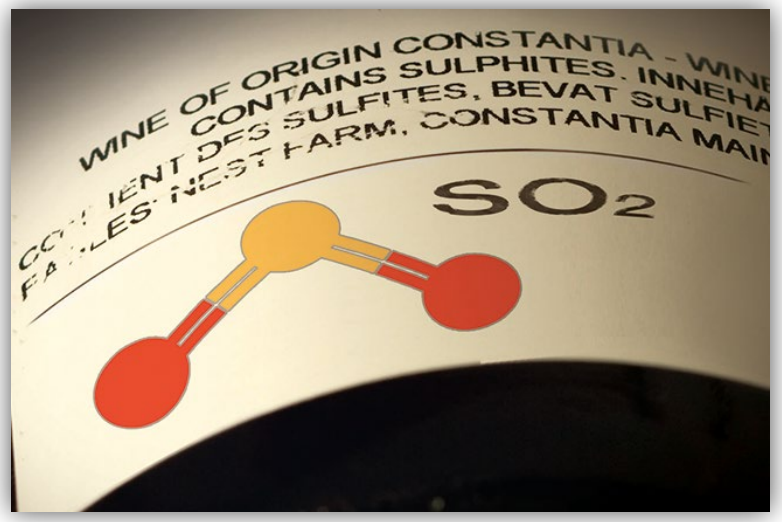
# $SO_2$ (SULFUR DIOXIDE) – THE GOOD, THE BAD, AND THE UGLY

Anti-Oxidant

Anti-microbial

In short, a preservative

- Sulphur has been used since Roman times
- It is present in almost all fermented products and in many prepared foods
- Why do people say they are allergic to Red Wines and sulfites?
  - White wines typically have higher $SO_2$ levels
  - Red wines that undergo native or spoilage MLF have higher potential for biogenic amines



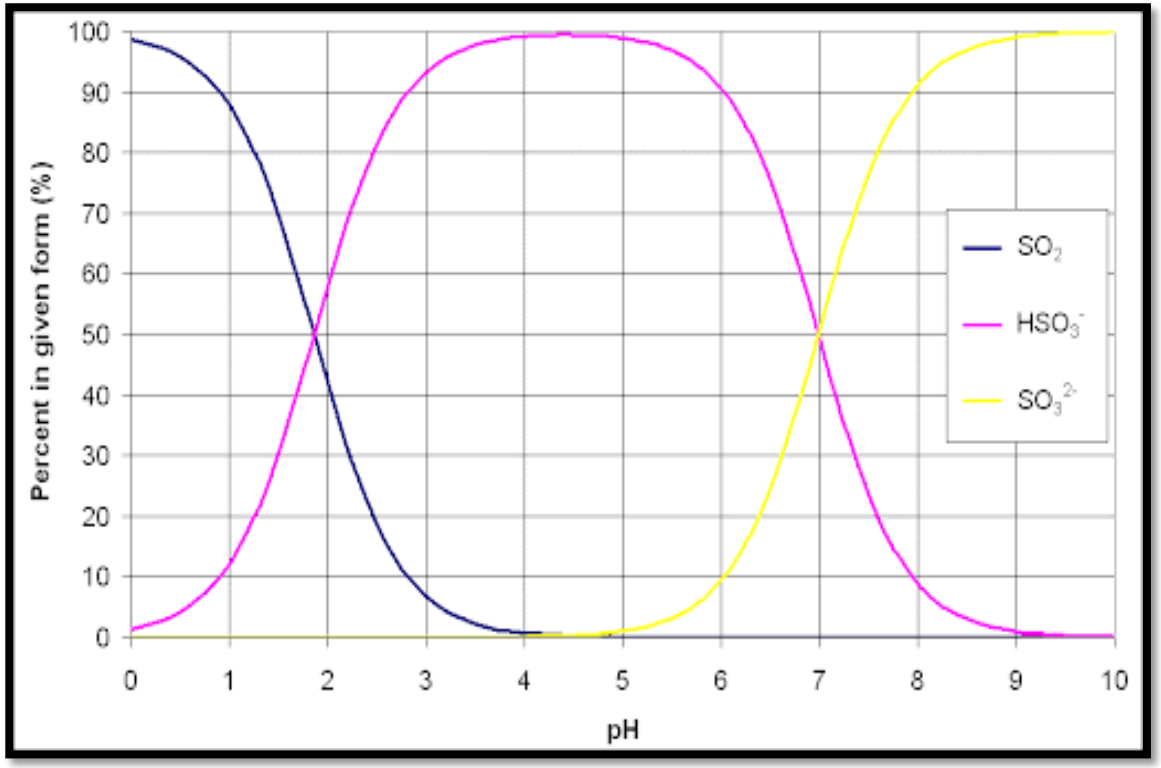
# APPLICATION METHODS

- Gas (100% $SO_2$) – DANGER!
- Powder – usually Potassium Metabisulfite (KMBS)
  - 57% by weight $SO_2$
  - Oxidizes over time
    - 50% in reality?
- Stock Solution
  - Useful for multiple additions at once (e.g. barrels)
  - Remember that powder weight!
    - Ex: 6.6% solution

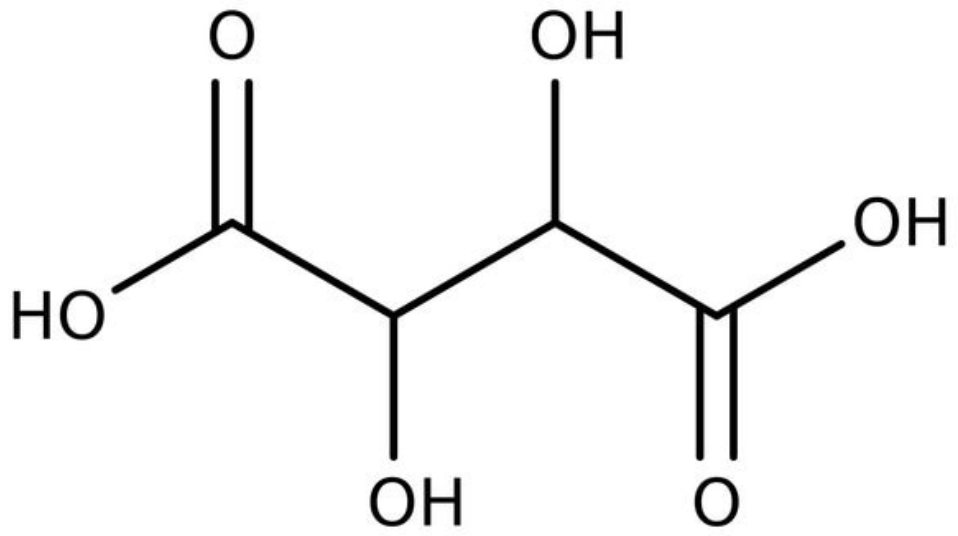
# $SO_2$ CHEMISTRY IN WINE

- $SO_2$ species' availability after addition to wine is pH dependent
  - Reminder: pH is an inverse logarithmic scale that measures the concentration of hydrogen ions in a solution (acidity)
  - Wine pH is typically 3.0-3.7
  - Texas wine is a whole different animal

- Molecular – Anti-microbial ($SO_2$)
- Free – Bisulfite ($HSO_3^-$) "free" to interact with components in wine (aldehydes, quinones, pigments, etc.)
- Bound – Bisulfite ($HSO_3^-$) that is tied up by said components
- Other – Sulfite ion ($SO_3^{2-}$) negligible at wine pH



# A QUICK ASIDE ON ACID

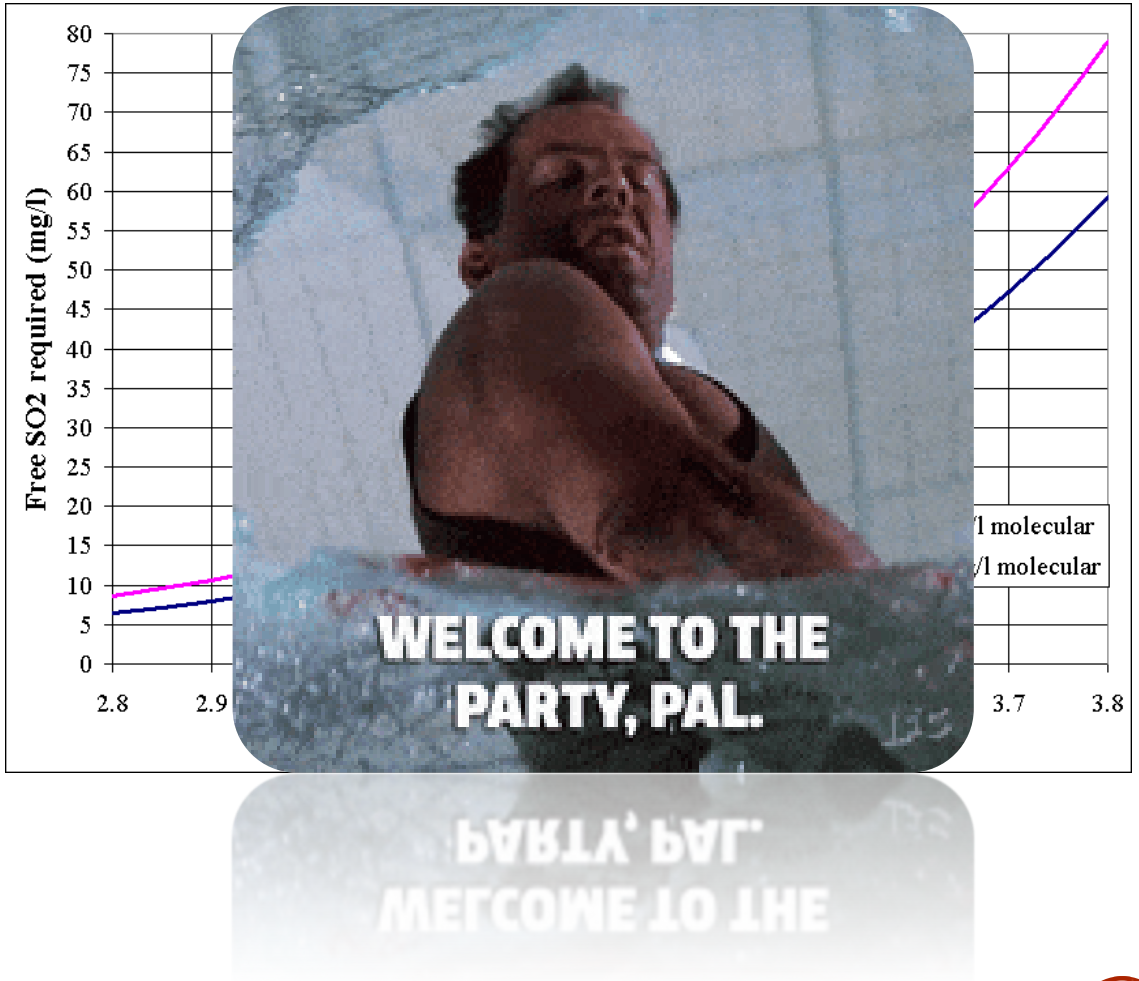



- So my pH is a problem, can't I just fix that?
  - WHY YES! BUT NO….
- pH vs Titratable Acidity (TA)
- Acidulation using Tartaric Acid (as opposed to other species)
  - 1g/L $H_2T$ lowers pH 0.1 and raises TA 1g/L
  - Ex: 1g/L $H_2T$ takes a wine from 3.95 and 5.0 ⟶ 3.85 and 6.0

# MORE ON WHAT $SO_2$ DOES

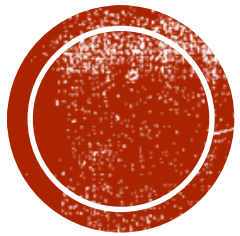
- Free vs Total $SO_2$
  - Total $SO_2$ is the combination of *free* and *bound* $SO_2$ (legal limit of 350ppm in USA)
  - Total $SO_2$ can contribute to negative sensory impact on wine (i.e. smell of burnt match) at high concentrations (~60-80ppm)
  - Free $SO_2$ remains free to interact with components in the wine (e.g. biproducts of oxidation)
    - Molecular $SO_2$ (your anti-microbial) is a function of how much free $SO_2$ you have (see chart)
      - NOTE: "the book" stops at pH 3.8
      - AND you'd need A LOT of Free $SO_2$, not to mention keeping Total in mind to get there…

***WELCOME TO THE TEXAS WINE INDUSTRY!!***



# RECAP AND THOUGHTS ON THEORY


- MOLECULAR $SO_2$ is an anti-microbial…. You got none….
- When you add $SO_2$, some will be Free, some will get bound up (can bind to pigments!)
- The Free stuff is useful as an anti-oxidant… that's it…. Thanks Texas wine pH!
- Regularly monitor Free and Total $SO_2$
  - Aeration-Oxidation is easy and cost-effective monitoring apparatus



# PRACTICE

# THE OTHER SIDE OF THE COIN

- When to add
  - Juice – limit Polyphenol Oxidase (PPO) & annoy undesirable microbes (30-50ppm)
  - After Alcoholic Fermentation (AF), if Malolactic Fermentation (MLF) not desired OR after MLF, if desired (50-80ppm)
  - During extended aging (constant target of 20-35ppm free)
  - After oxygen exposure….


- Oxygen Exposure, eh?
  - Dissolved Oxygen will eat up your $SO_2$, so we should try to mitigate that…

Action in cellar Dissolved O2 (mg/L):

Topping 1

Pumping 1 - 2

Filtration 0.5 - 2.5

Racking 2 - 5

Racking with $O_2$ 4 - 8

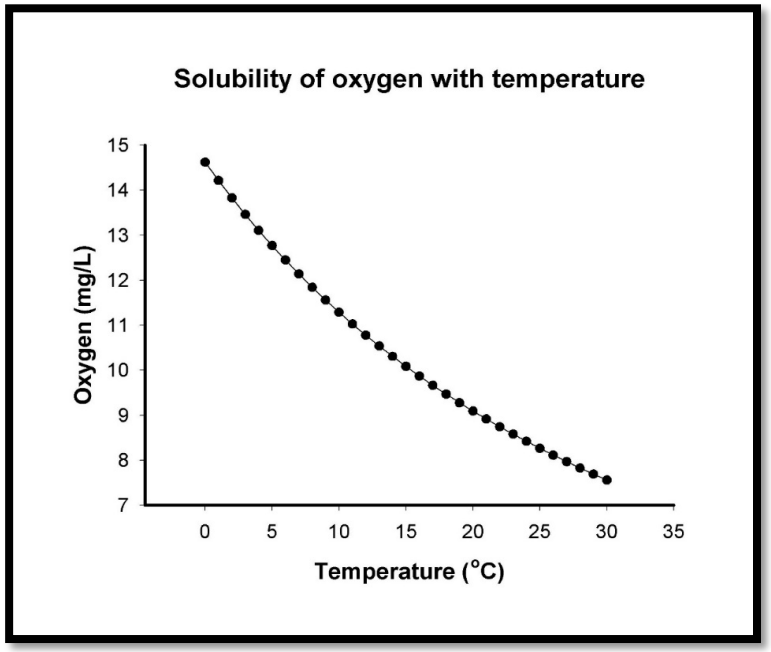
Cold stabilization 3.5 - 6

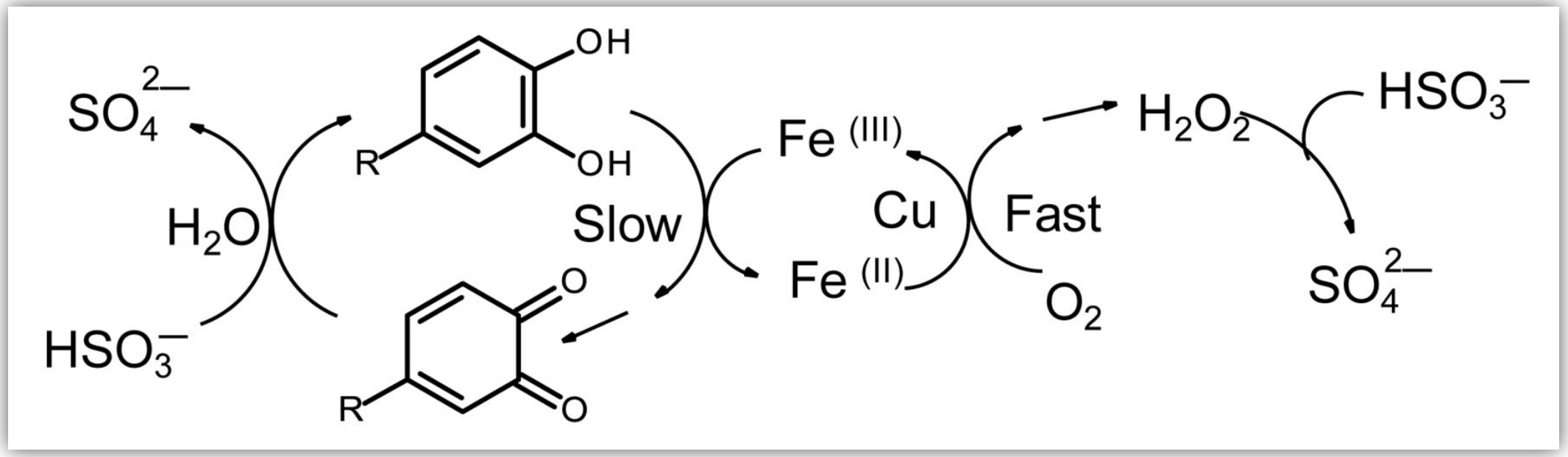
Bottling 0 - 4

Transport (full tank) 0 - 6

# D.O. OR D.O. NOT…

- Dissolved Oxygen (DO) can be monitored in the cellar!
  - DO Meter
  - Monitoring Total $SO_2$ - 1mg $O_2$ : 4mg $TSO_2$
- DO can be managed in the cellar!
  - Mitigate headspace in tanks
  - USE INERT GAS – gas choice matters!
  - Manage wine temperature






# A QUICK ASIDE


**Have a bunch? They can act as a protective agent!**

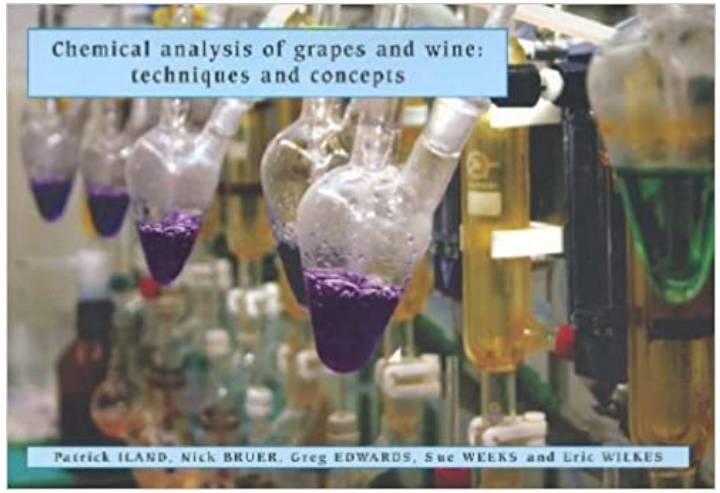
- Example: tannic red wines hold up well to oxidation

**Not a whole lot? They act as a participant in your oxidation reaction**

- Example: white wines with elevated tannin content may oxidize faster

# FINAL USE & STRATEGY

- Use $SO_2$ as a tool in the toolkit
- Don't Mess with Texas wines – their pH is a problem
- Explore other oxidation and microbial mitigation strategies as well
  - Oxidation
    - Can choose to remove tannins from white wine via macro-ox or fining (PVPP, Casein, Albumen, Isinglass, etc)
    - Use inert gas to keep DO low
    - Low temperatures mean more dissolved gas
    - Oxidation reaction fining (remove Cu/ Fe)
    - Monitor DO and $SO_2$ levels
  - Microbes
    - Low DO wine is unfriendly to many microbes
    - Non-saccharomyces yeast at harvest can limit growth
    - Other ways to limit microbial growth (e.g. lysozyme, chitosan)
    - Low temperature retards microbial growth




# $SO_2$ MONITORING

- When?
  - Juice
  - After AF, if no MLF
  - After MLF
  - Every 4-6 weeks during aging
  - After a DO pickup event
  - https://www.youtube.com/watch?v=M_VLsGiA5Og&list=PL3ahyvW-3wQo_THUj9i4tvMpedtsuyCFk&index=8
  - https://www.youtube.com/watch?v=6lGduKQYtmg&list=PL3ahyvW-3wQo_THUj9i4tvMpedtsuyCFk&index=9

# QUESTIONS?

seth@weddingoakwinery.com