OREGON WINE SYMPOSIUM

PORTLAND

Brettanomyces Management in the Winery

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Brettanomyces – All About Risk Management

- Understanding your current risk exposure
  - Identifying extant and potential vectors.
  - Making an honest assessment of your sanitation regime.
- Assess your risk tolerance
  - What can your style of winemaking allow?
  - What would you be willing to lose?
  - What would you be willing to sell? And to whom?
- What can you prevent?
  - What tools are currently at your disposal?
  - Making the business case for preventative equipment.

Addressing Brettanomyces in the Winery

- Assuming that the desired result is maximally reducing Brettanomyces growth in wine, a winemaker's approach should include the following:
  - Prevention
  - Detection
  - Treatment

Brettanomyces Prevention

Strategies, methods and metrics

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Physical and Chemical approaches as Prevention

- Elimination of substrates
- Sulfite management
- pH and its relation to SO2
- Lees exposure
- Temperature
- Ethanol concentration

Elimination of Substrates

- Consumption of all reducing sugars
  - Healthy inoculum
    - Commercial vs “spontaneous” yeast
    - Use of O2 during fermentation
    - Temperature control
  - Post-fermentation RS concentration
    - Ideally below LOD for your available method (eg <0.10 g/L for most enzymatic tests)
- Out-competing other microflora
  - MLF timing

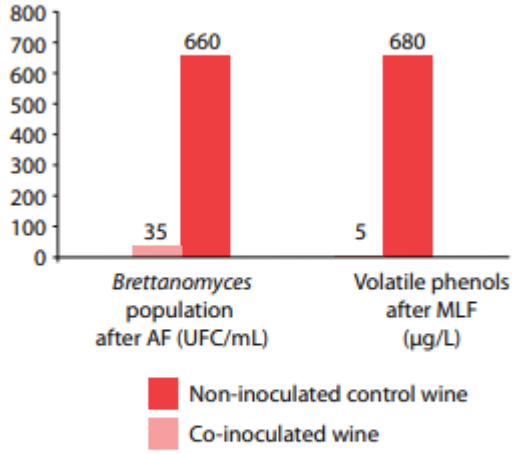

Figure 1. Population of *Brettanomyces* and concentration of volatile phenols in a Cabernet Franc before and after MLF

	Spontaneous fermentation	AF with a strain of selected yeast and specific nutrients
Brettanomyces population (UFC/mL)	6×10^3	6×10^1
4-Ethyl phenol (µg/L)	430	45

Table 1. Interest in utilizing a selected yeast starter and specific nutrients for better control of the microbial ecosystem. (Analyses conducted at the end of AF. Renouf 2006)

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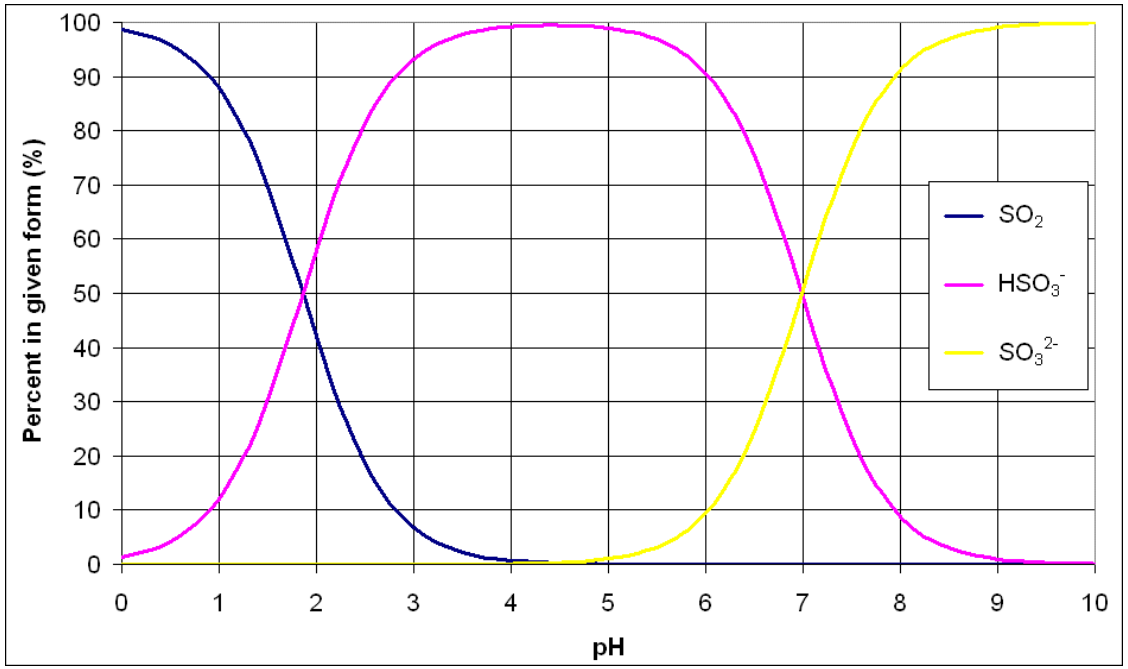
Sulfite Management

- Common/General Guidelines for SO2 Management
  - Maintaining safe mSO2 levels
    - 0.8-0.9 ppm for whites and roses
    - 0.5-0.6 ppm for reds
  - Timing and rate of sulfite additions
    - One large initial sulfite addition vs multiple small additions
    - Rapid MLF allows for earlier sulfite addition

pH and its Relationship with mSO2

- mSO2 as an antimicrobial agent
  - Larger % [mSO2] at lower pH
  - Practical wine pH for safer [mSO2]
    - For reds, <3.8, preferably under 3.65
      - For pH of 3.65, 42 ppm fSO2 is 0.6 ppm mSO2
    - For whites/roses, <3.45, preferably <3.3
      - For pH of 3.45, 40 ppm fSO2 is 0.6 ppm mSO2



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Other means of prevention

- Lees Exposure
  - Timeliness of racking
  - Lees condition/% composition
- Temperature
  - Temperatures above 65F can facilitate Brett growth, even at reasonable [fSO2]
- Ethanol Concentration
  - Not necessarily as practical as other means of prevention

Sanitation

- Barrel cleaning and maintenance
  - Steaming
  - Ozone
  - Dry Storage and wet storage
- Tanks and other storage formats
  - Typical cleaning regimes
  - log 4 kills
- Pumps, fittings, lines and other winemaking implements
  - What are you cleaning weekly/monthly/yearly?

Managing vectors for Brettanomyces

- Acquiring new storage formats or winemaking equipment
  - Tanks
  - Barrels
  - Fittings, valves, etc
- Bulk Wine
  - Origin
  - Wine Chemistry
  - Quarantine and testing

Brettanomyces Detection

Assays and analysis

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Sensory Analysis

- What constitutes “threshold”
- Frequency of sampling
  - Representative sample size (barrel lots, etc)
  - Importance of sampling individual formats

Table 2. What is the sensory detection threshold for Brett compounds?

	Aroma threshold (µg/L)[1]		
	4-EP	4-EG	4-EC
French Bordeaux Cabernet Sauvignon[2]	605	110	
Australian Cabernet Sauvignon[3]	368	158	774
Australian green Cabernet Sauvignon	425	209	1131
Australian oaky Cabernet Sauvignon	569	373	1528

1. ASTM three-alternative forced choice method, ascending concentration series. 2. Chatonnet *et al.* 1992. 3. Bramley *et al.* 2007

Detection in the Lab

- Brett-selective plating
  - Actidione agar-based media
- ETS Scorpions
  - Actionable interpretation of results
  - Can detect VNC
- Invisible Sentinel
  - Turn-key PCR assay
  - Rapid turnaround for results

Chemical Analysis

- Consumption/ratio of fSO2 to tSO2
  - 1:2 or 1:3 typical
  - 1:5+ suggest binding to other biological activity
- Quantification of Volatile Phenols
  - Good proxy for Brettanomyces growth
  - Must be interpreted in context of exposure to oak

Brettanomyces Treatment

Isolation, Inhibition, and removal

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Isolating Brettanomyces Infections

- Quarantining confirmed infections
  - What's touched what?
  - Establish a testing regime and follow up
- Persistent infections on equipment and storage formats
  - Disposal of infected vessels – Don't sell Brett barrels to colleagues, make planters
  - Log 4 kill, not just for tank surfaces
  - Sterilization vs Sanitization

Inhibition and Removal of Brettanomyces

- Inhibition
  - Increasing fSO2/mSO2 concentrations
  - Sorbic acid
  - DMDC (Velcorin)
- Removal
  - Chitosan and racking
  - Filtration

Volatile Phenol Removal/Minimization

- Reverse Osmosis
  - Selective media for filtrate
- Activated Charcoal
- Esterified Cellulose polymers
- Silica fining
- Blending below threshold