The Not So Sexy Side of Winemaking: Cleaning and Sanitation

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WINEMAKING 101

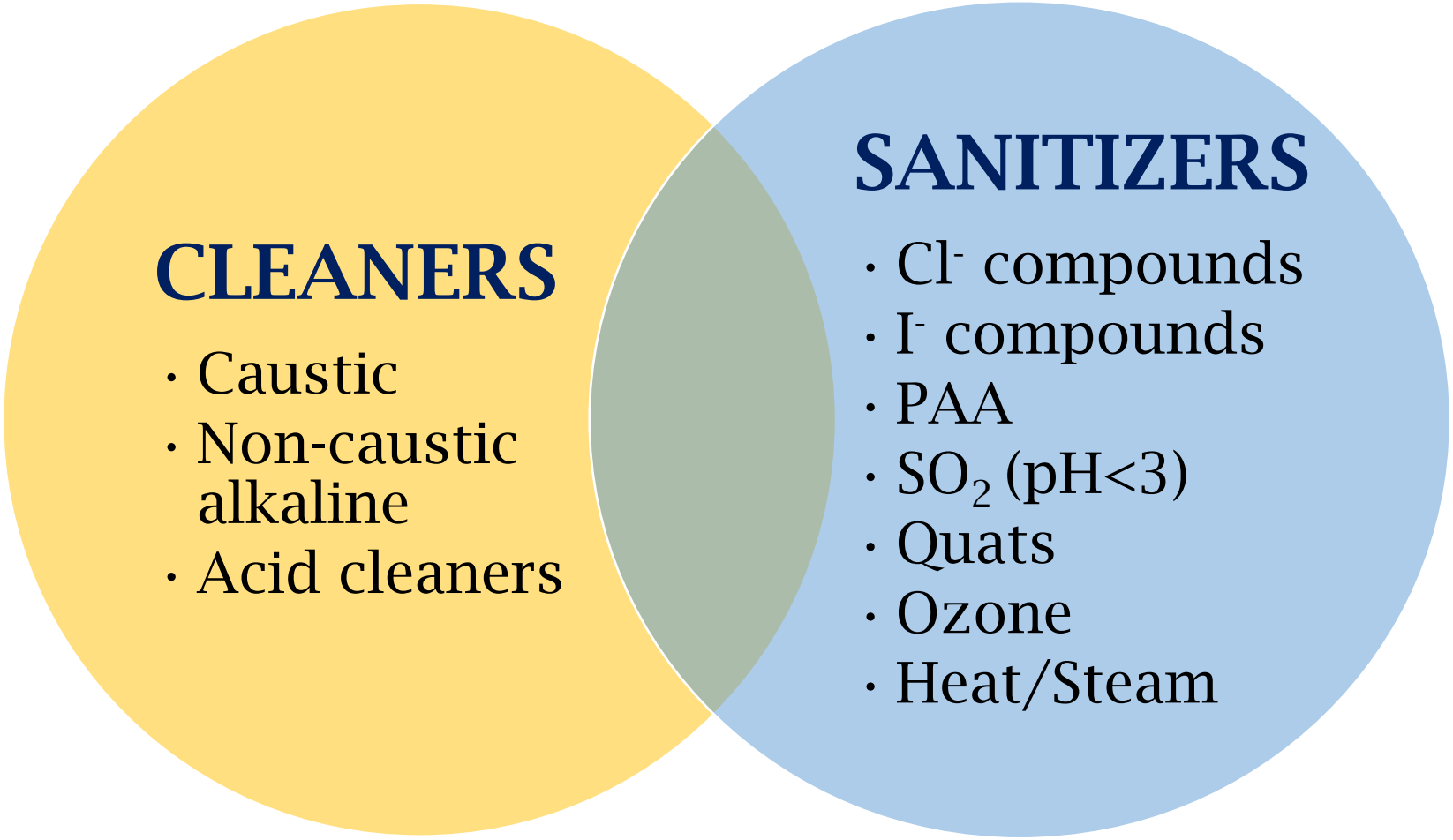
What They Think We Do:

What We Really Do:

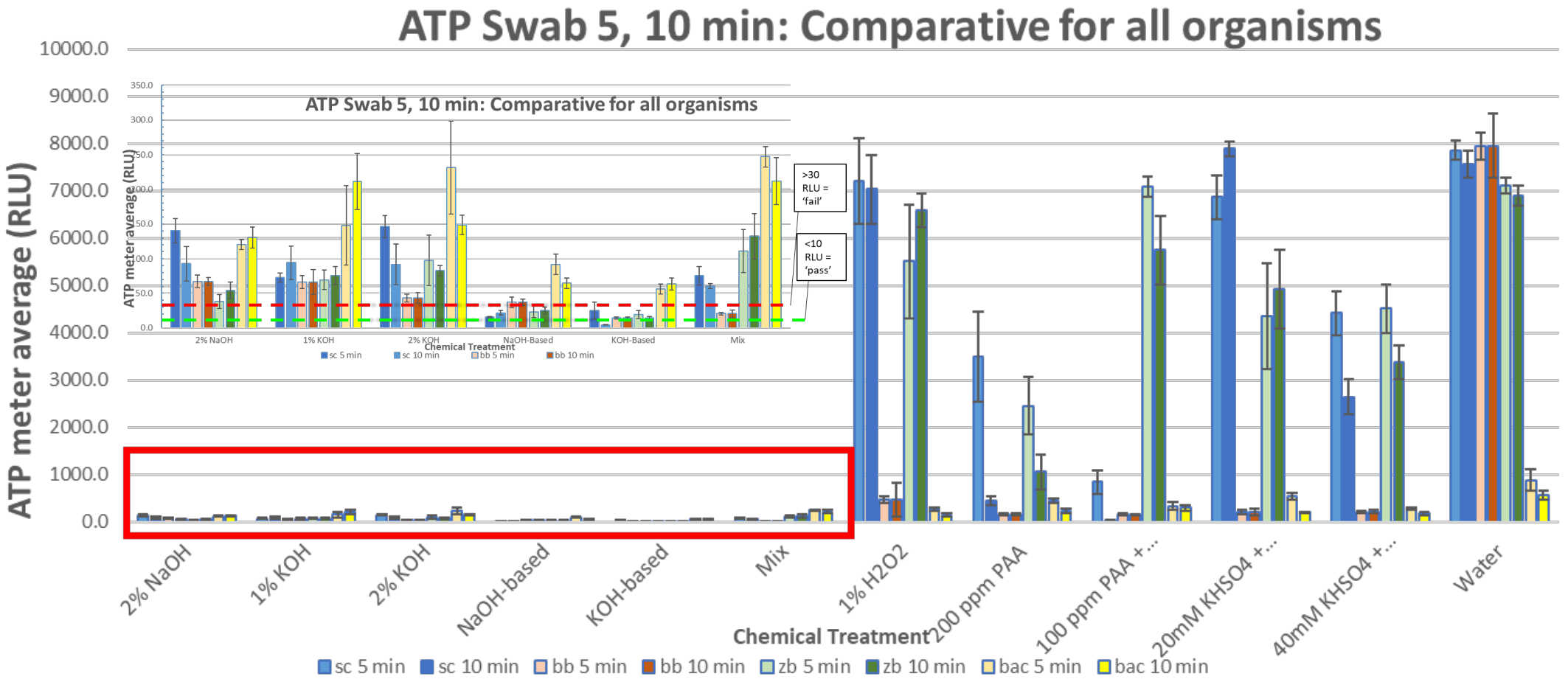
DEFINITIONS

- **Cleaning**
  - Process involving physical removal of organic and inorganic soils
- **Sanitizing**
  - Process involving inactivation of microbes
    - *Disinfection*– Reduction in harmful/pathogenic cells
    - *Sanitation*– Effective elimination of potential spoilage microbes (99.9%)
    - *Sterilization*– Elimination of all viable cells

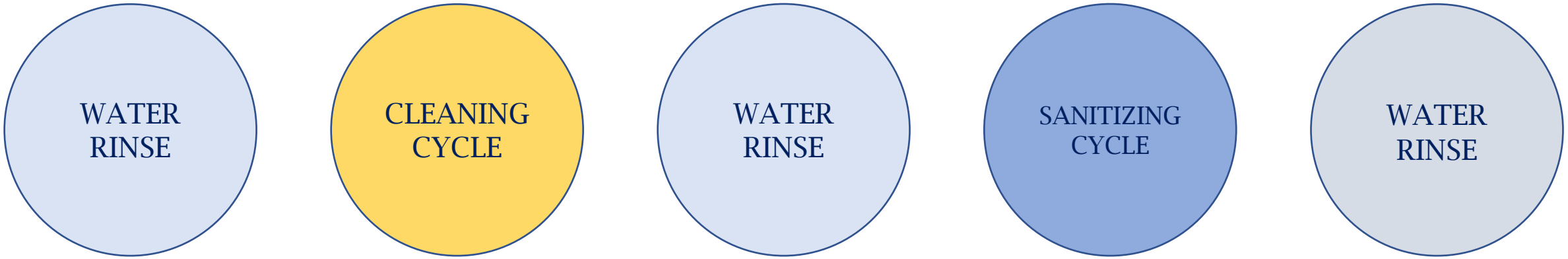
CLEANING AND SANITIZING CHEMISTRIES



CLEANERS VS SANITIZERS



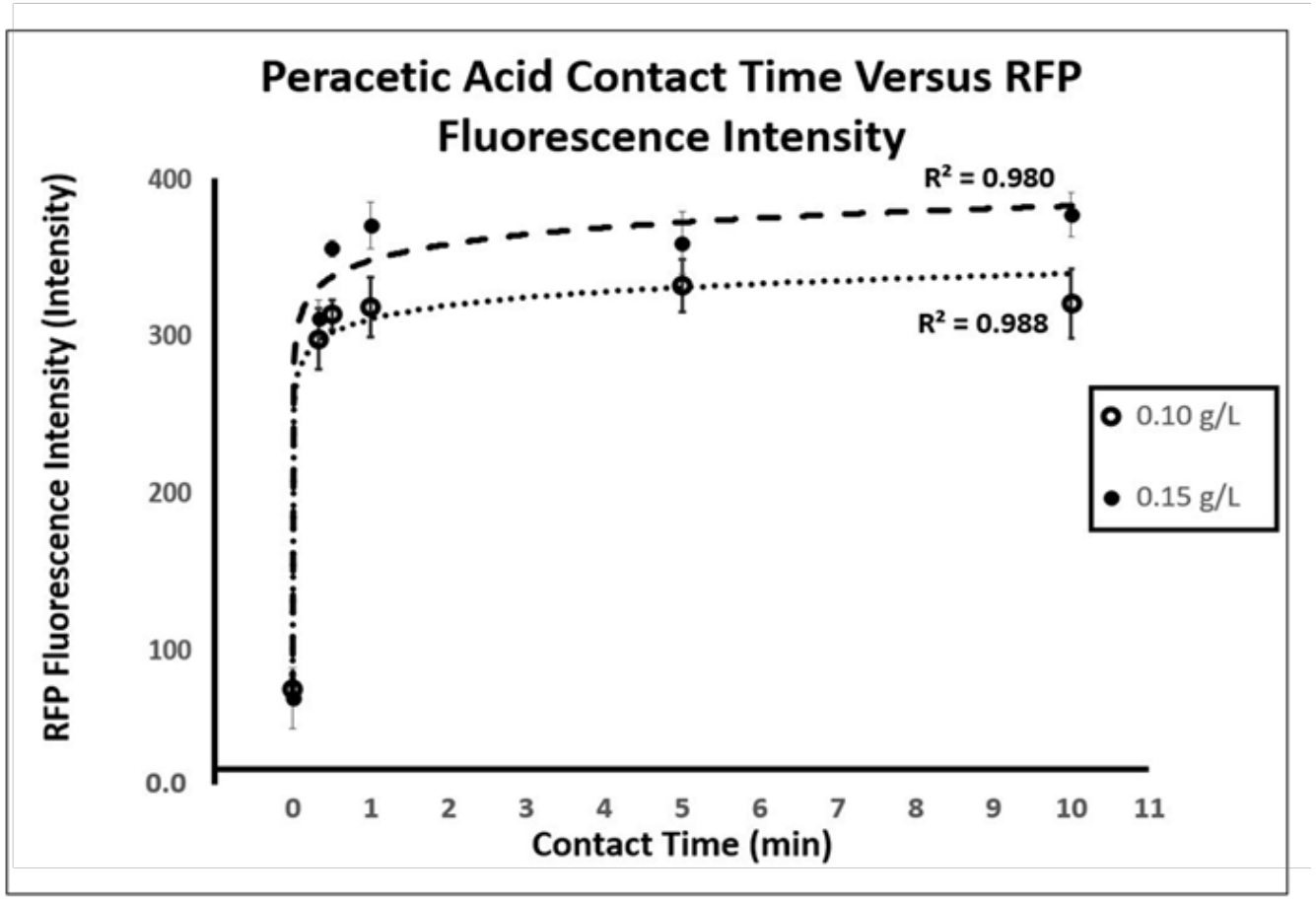
5-STEP CLEANING CYCLE



Example:
Rinse -> 440k (Non-Chlorinated KOH Based Cleaner) -> Rinse -> Citric Rinse -> Water -> Ozone Rinse

Example:
Rinse -> Percarb (Sodium Percarbonate) -> Rinse -> PAA -> Optional Water Rinse

TIME-KILL EXPERIMENTS: *S.CEREVISIAE*



WINERY TRIAL

Sample Legend:

ATP → | Plate Count →

Sample Locations:

TV1 – Interior of valve post. ATP and Plate swabs collected on opposite sides of valve

TV21 – Interior lip of port. Swabs collected on adjacent portions of lip.

TV22—Underside of upper tank surface, between port and walls.

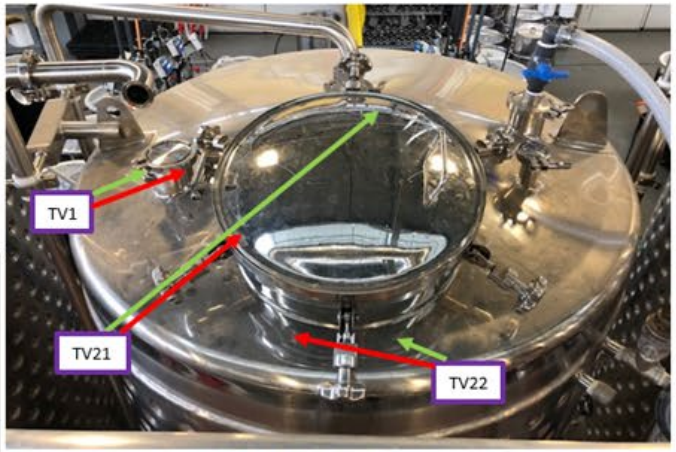
BV1—Interior of valves. Since swabs require ~10 cm^2 surface area samples were taken from different valves.

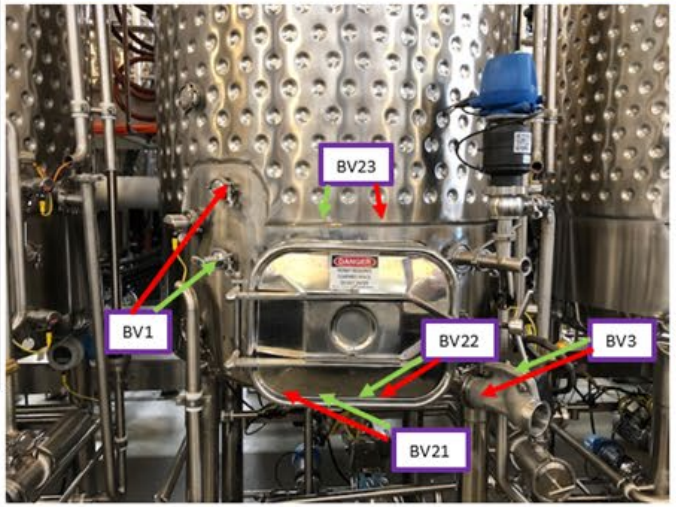
BV21—Bottom interior lip of tank port.

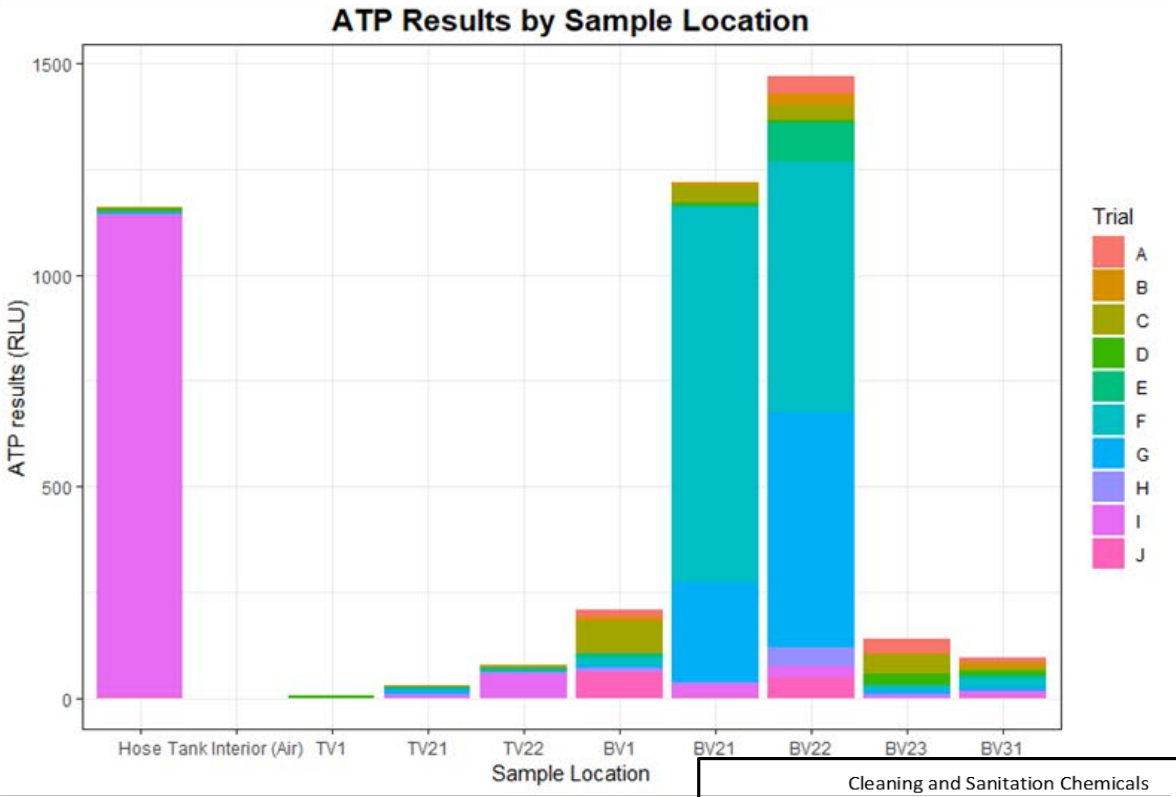
BV22 – Gasket of the port door.

BV23 – Interior surface of tank wall above port

BV3 – Upper (plate count) and lower (ATP) surfaces of the valve interior





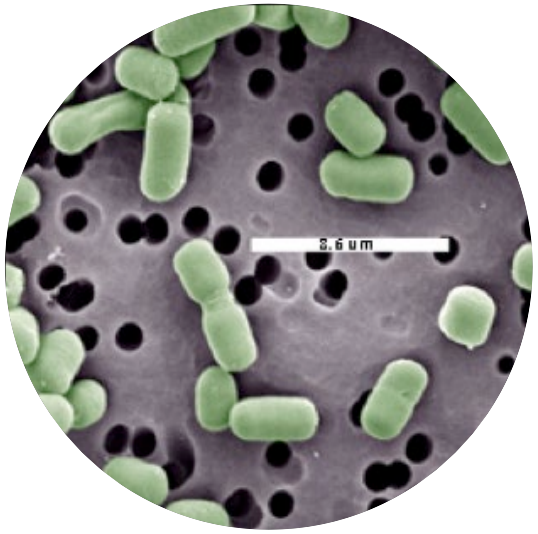


Cleaning and Sanitation Chemicals
5 Min 1% Potassium Caustic, 100 mg/L peracetic acid spray
5 Min 1% Potassium Caustic, 200 mg/L peracetic acid spray
5 Min 1% Potassium Caustic, 100 mg/L peracetic acid atomizer
10 Min 1% Potassium Caustic, 200 mg/L peracetic acid spray
5 min Potassium Carbonate, 100 mg/L peracetic acid spray

SPOILAGE THAT OCCURS DURING BARREL AGING

ACETIC ACID BACTERIA

- Acetic acid
- Ethyl acetate



LACTIC ACID BACTERIA

- Acetic acid
- Biogenic amines
- Mousy

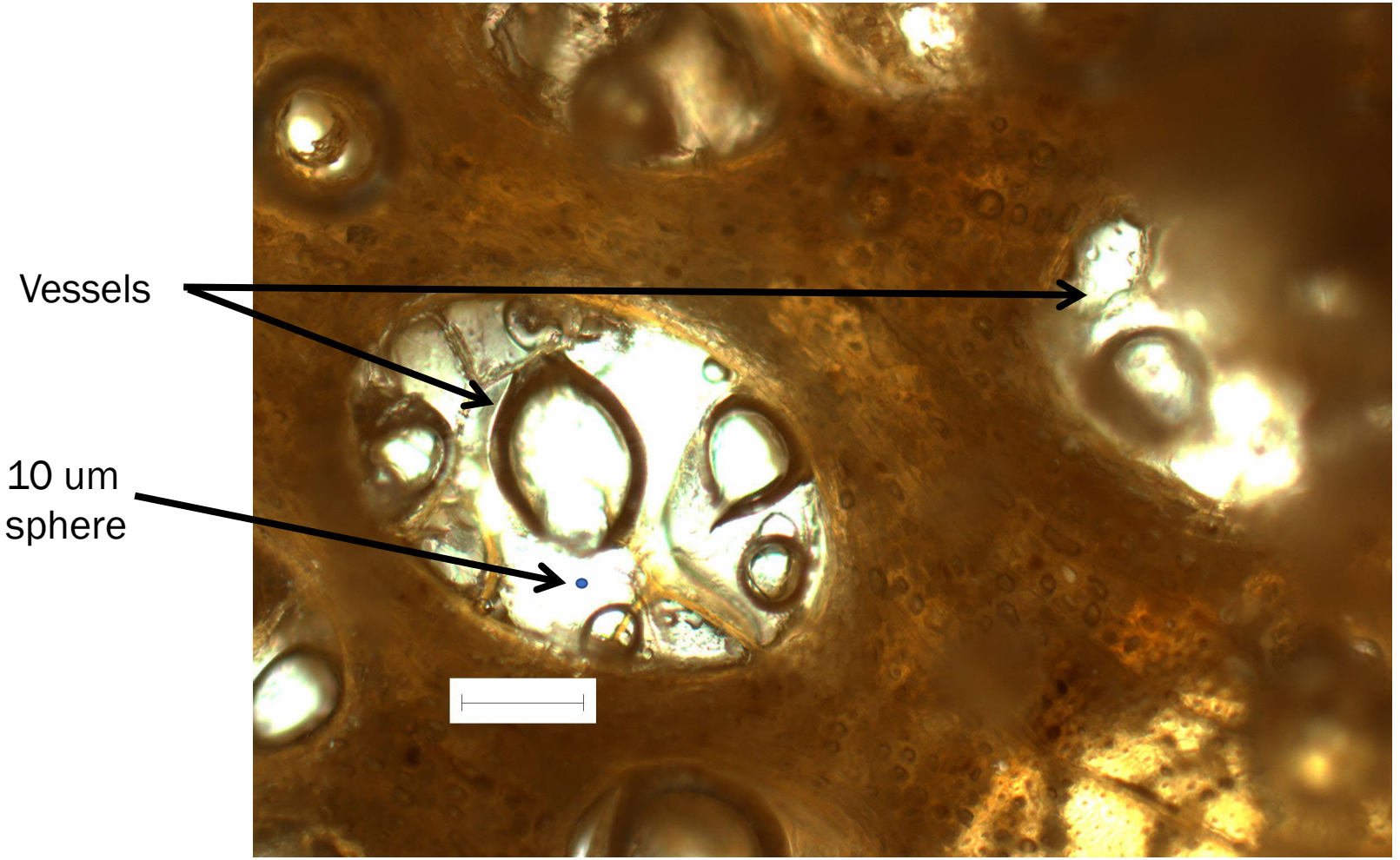
BRETTANOMYCES

- Acetic acid
- Volatile phenols
  - 4-EP
  - 4-EG
- Isovaleric acid

THE PROBLEM

- Wooden wine barrels have a porous surface
- Wine can infiltrate the porous structure to a depth of at least 6-8 mm
- Microbes can be carried into the wood structure with the wine

OAK CROSS SECTION 150X



EXPERIMENTAL DESIGN

- Identified 32 barrels from each winery with elevated levels of Brettanomyces and 4-ethylphenol
  - Winery A
    - average Brettanomyces; 52,000 cells/mL
    - average 4-ethylphenol; 820 ug/L
  - Winery B
    - average Brettanomyces; 240,000 cells/mL
    - average 4-ethylphenol; 1010 ug/L

EXPERIMENTAL DESIGN

- Four sanitation methods chosen at each winery; 8 barrels treated with each sanitation method
- Treated barrels filled with sterile filtered wine
- 4 barrels from each sanitation treatment stored at “cellar” conditions and 4 barrels stored at “accelerated growth” conditions
- 1 barrel from each 4-barrel group was not opened for the duration of the trial (6 months) and only sampled at the end as a control for cross contamination

BARREL SANITATION TREATMENTS WINERY A

- Standard treatment; 2 min hot rinse (160-180F) followed by 2 min cold water/ozone blend (4 ppm)
- Steam 3/3; steam treatment for 3 minutes, bung barrel for 3 minutes
- Steam 5/5; steam treatment for 5 minutes, bung barrel for 5 minutes
- Chlorine dioxide; 2 min hot rinse (160-180) followed by 2 min cold water/ClO_2 blend (10 ppm)

BARREL SANITATION TREATMENTS WINERY B

- Standard treatment; 1 min hot rinse (140F) followed by 3 min cold water/ozone blend (0.5-1 ppm)
- Steam 3/3; steam treatment for 3 minutes, bung barrel for 3 minutes
- Ozone 1 : 1 min hot rinse (140F) followed by 5 min cold water/ozone blend (3-4 ppm)
- Ozone 2: 1 min hot rinse (140F) followed by 5 min cold water/ozone blend (3-4 ppm), followed by 5 minutes ozone gas and sealed

EFFICACY OF BARREL SANITATION TREATMENTS

- Winery A: Steam 5/5 performed the best in regard to minimizing Brettanomyces growth and 4-ethylphenol production in the 6-month trial period under cellar conditions
- Winery B: Ozone treatment #2 (water/gas combo) performed the best in regard to minimizing 4-ethylphenol production in the 6-month trial period under cellar conditions
- No treatment utilized was successful in eliminating Brettanomyces from the barrels used in this trial*

CONCLUSIONS

- All wines tested positive for Brett at 6 months except Winery A unopened barrel (Steam 5/5, cellar conditions)
- Individual barrels are different and the sanitation treatment efficacy can vary from barrel to barrel
- Initial Brettanomyces contamination level plays a role in sanitation treatment success

Critical Control Points During the Winemaking Process

Monitoring key chemical parameters and microbe levels

Adjust chemical parameters when possible, and intervene early to manage microbe levels