



Use of Micro-Oxygenation as a tool for Wine Maturation

7th Annual VinCO Conference

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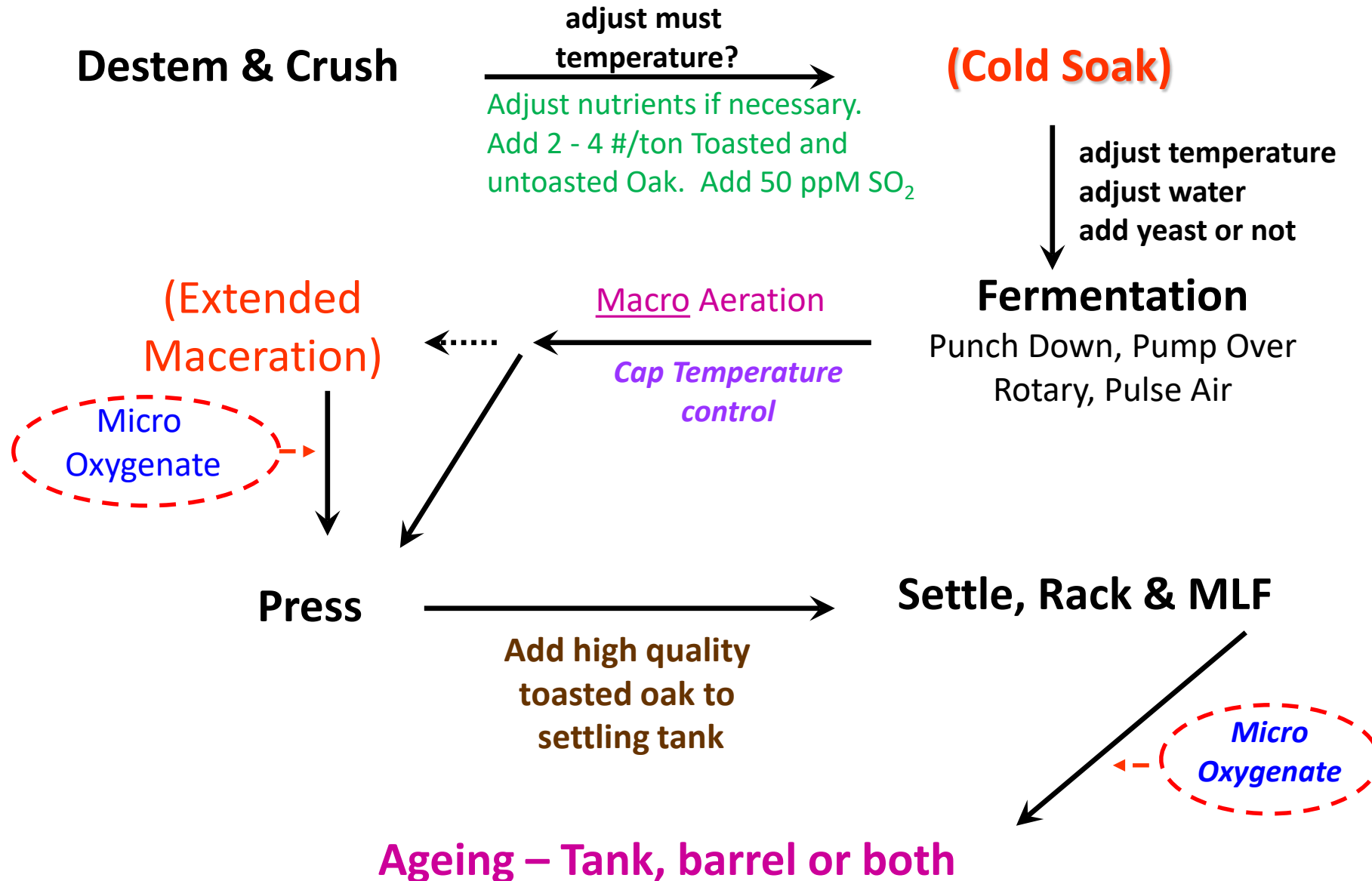
StaVin Inc.

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Outline

1. Wine Production Process
2. Definitions of Macro and Micro aeration.
3. Macro – The why what, when and where's
 1. examples
4. Micro Oxygenation
 1. Uses, misconceptions and limitations
 2. Timing and effects
 3. Monitoring
 4. When is it done?
 5. Gottcha's and unknowns!

Enhanced Red Fermentation Process



Definitions

- Micro oxygenation is below 100 mL/L wine/ month or ~ 3 mL/L/day
- Maybe a better definition of Micro-Oxygenation -
 - An amount of oxygen added to wine which does not increase dissolved oxygen (DO) of a wine or must.
- Therefore, Macro Oxygenation is any rate above which gives you an increase in DO, at least a transient increase in DO.

Why not Micro Oxygenation during Fermentation of Reds?

- Not enough volume sparged into the must to be useful.
- Not done often enough.
- Not as effective if done under the cap – more later.
- May have beneficial effects for white ferments.

Why Macro aerate a fermentation?

- Yeast health.
- Elimination of Carbon Dioxide
- Control (to a point) redox, thereby minimizing production of H₂S and other sulfides.
- Provide a pool of oxidized compounds capable of accepting electrons.
- Enable a higher and longer lasting concentration of acetaldehyde.
- Helps begin minimization of vegetative characters in resulting wine flavor and aroma.

Why Aerate in More Detail?

- It is well known that oxygen is required for synthesis of Sterols and unsaturated fatty acids (UFA) necessary for cell health.
- Interaction between oxygen, acetaldehyde and acetaldehyde competitors, furfural and propanal.
- Synergistic interaction between oxygen and nitrogen supplementation of fermentations
- Type of Nitrogen appears to play a role
- Effect of Oxygen on Resulting Lees reactivity
- More O₂ results in less reactive lees, minimizes problems with sulfides.

Why Air Not Pure Oxygen

- No need to add precise concentrations
- Cheap
- Excess gas appears to aid CO₂ evolution.
- Appears to provide enough control of redox.
- No issue of over use/oxidation.
- Addition of air vs. O₂ may not be as beneficial to advantageous microbe.

When is the best point in a fermentation to Macro aerate?

- Early
 - Pros
 - Best point to encourage yeast cell growth and enhance production of acetaldehyde.
 - PPO may still be active to modify polyphenolics.
 - Cons
 - Encourages growth of undesirable microbes, depending on [SO₂]
 - Potential problem with foaming.
- Middle
 - Pros
 - Eliminate excess CO₂.
 - Modify redox and minimize reductive conditions.

When is the best point in a fermentation to Macro aerate?

- Late

- Pros

- Helps maintain control of sulfides.
 - Eliminates excess CO₂, therefore minimizing “green”.

- Cons

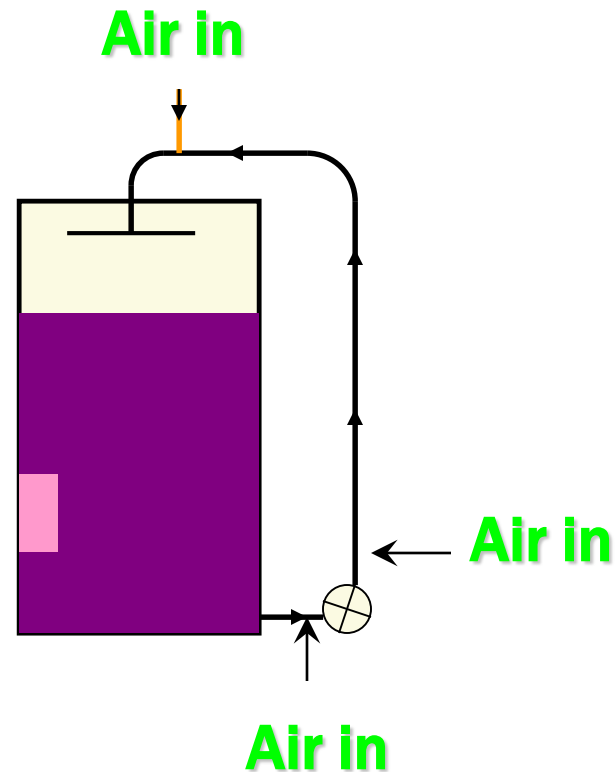
- May lose/oxidize aroma compounds
 - May encourage growth of undesirable microbes (Brett, Acetobactor)

- Throughout

- Control resulting yeast lees reactivity.
 - Helps minimize vegy characters.

Where should you aerate?

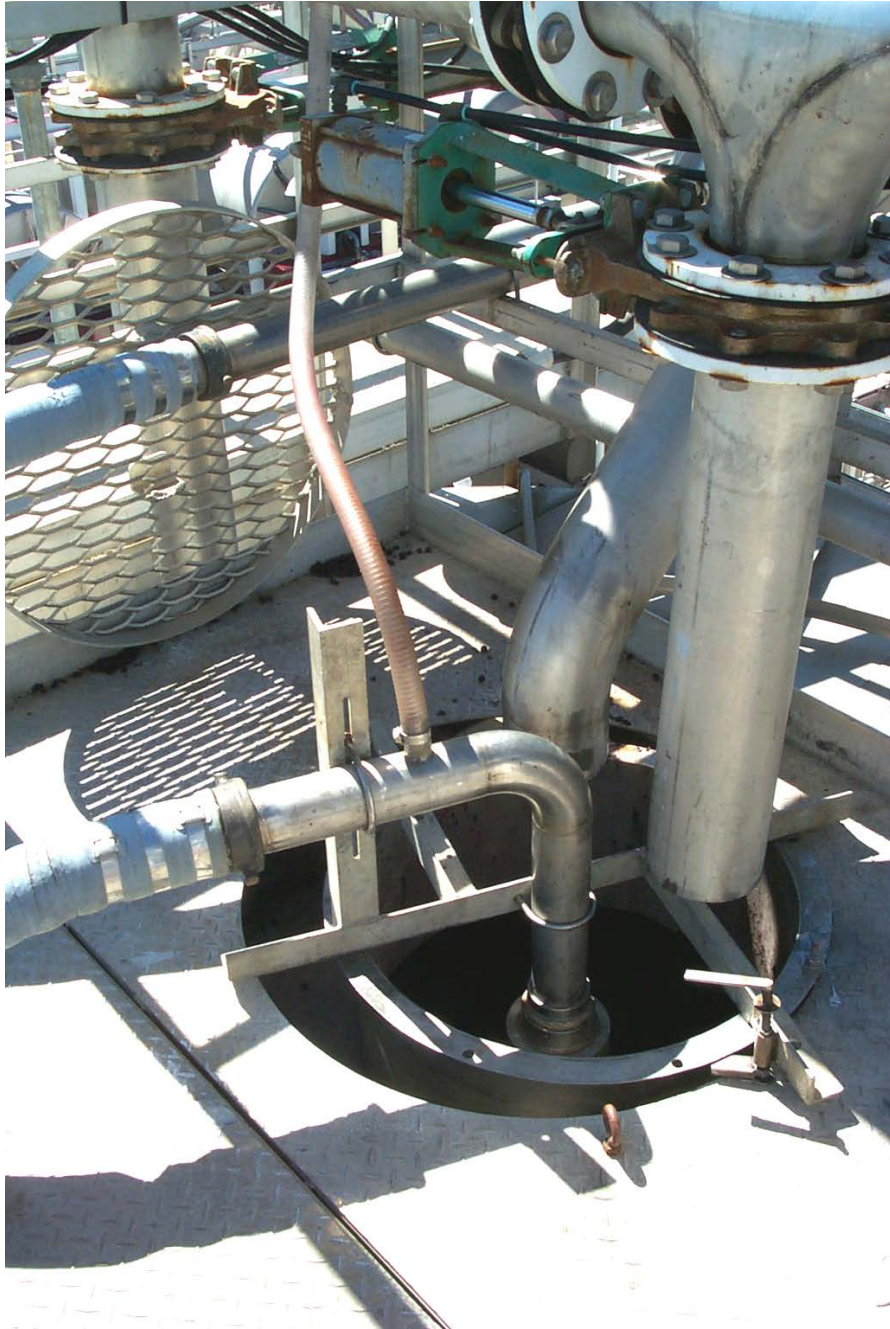
Pumpover w/aerator (too much is not enough)



Tub and screen does NOT
Provide sufficient aeration



Workable version of a Venturi device with no backflow preventor – need to match pump & pressure (courtesy Marcello Monticelli, Gallo Sonoma Winery).



**Irrigator with venturi
in place at Gallo Sonoma
Winery.**

**A Venturi can also be used to
induce a much more
efficient aeration when
racking.**

Mazzei Injector

An easy to use, no hassle venturi system for macro-aeration of fermenting must.

On Average the venturi will give you a 5 ppm increase in Dissolved Oxygen (DO)

500 Rooster Drive
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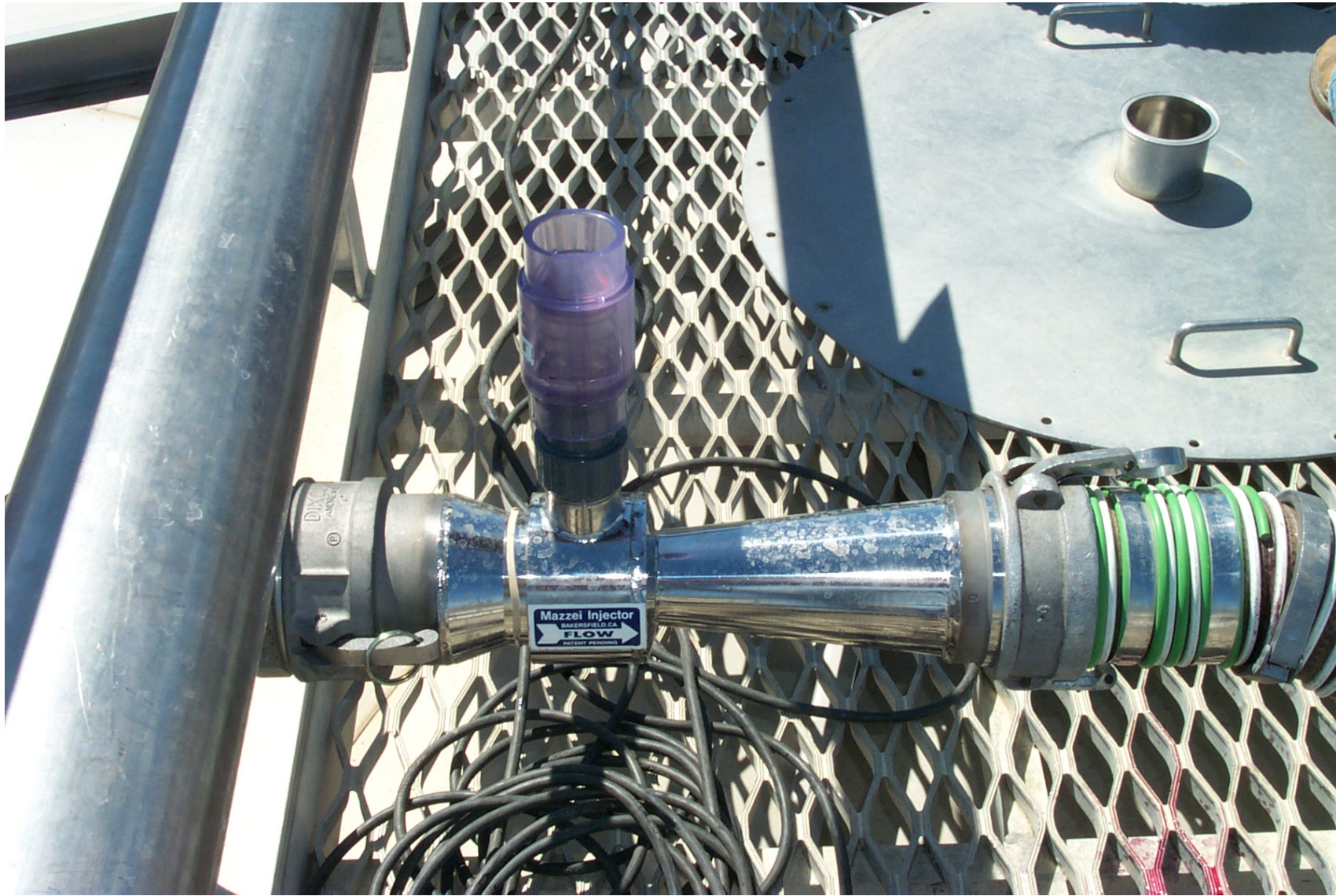
10/22/2009



Mazzei Injector in place with adapters to Tri-Clover fittings and check valve.



Note shut-off valve



March 6, 2007



80 ton Fermentors setup at Bodegas Campos Reale, El Provencio, Spain

Other Methods to Introduce Air or Oxygen into Fermentations

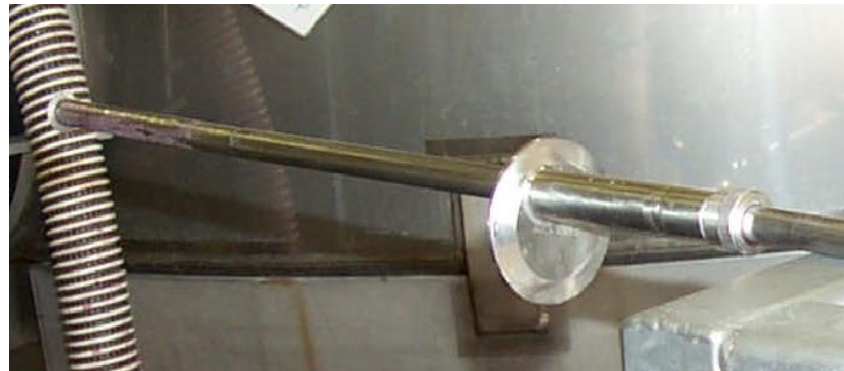


Inline injection of Oxygen into pumpover line. Sight glass allows the gauging of bubbling rate into must. Sparger was run at 20 psi

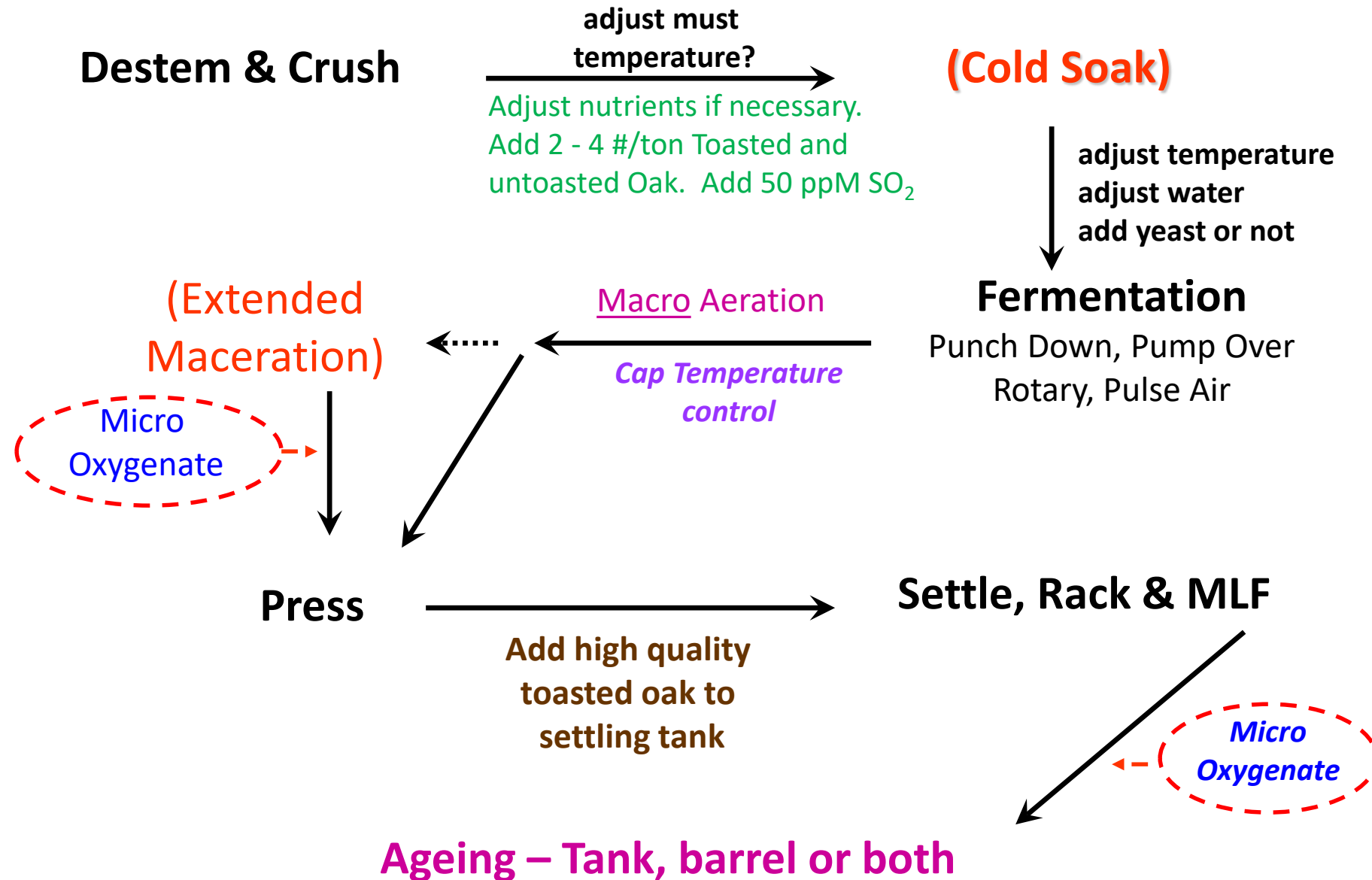


Sparger for Rotary Fermentors, Punch Downs, and for use before cap separation (Cold Soak)

Sintered stainless steel (8 -10 μ pore size) welded to steel tube with valve and connector for Oxygen and a tri-clover cap fitted with tube and friction fitting to adjust insertion into tank.



Enhanced Red Fermentation Process



Current Use of Micro-Oxygenation

- Used as method to help emulate barrel maturation (More air combined with oak).
- MOX controllers are better easier to control, more plentiful, task specific, and service is more readily available.
- Confidence has built with increased use of MOX and discussion among winemakers.
- Understanding task and generally accepted starting points has aided successful incorporation of MOX programs for wineries.
- When attempting to replace barrels, always mix MOX tanks and Barrel lots, learning what works best for a certain program.

Mis-Use and Over -Use

- While successful, it was sold as a cure-all for what ails a wine, it didn't!
- Problems arose with oxidation
- Microbial stability issues
- Generally mis-understood mode of action
- Trials too small
- Grapes in bad condition
- Winemakers too cautious
- No target end product
- Many wineries used an all or nothing approach, generally failing in the process!

The Task for the Tool

What is your task?

- Prepare wine for barreling
- Incorporate tank with barrels
- Eliminate barrels
- Influence wine character
 - Tannin
 - Color
 - Taste – herbaceous, sulfides
 - Maturation speed

Prepare wine for barreling

- Decrease green aromas and flavors
- Minimize sulfides
- Minimize racking and hence labor costs

Incorporate tank with barrels

- Maximize best barrels
- Eliminate older barrels
- Minimize labor and warehousing costs
- Minimize microbial issues
- Potentially gain better control of barrels

Eliminate barrels

- Understand tank sizing and numbers to maintain control for blending flavor and aromas
- Understand timing versus MOX dosing to obtain proper maturation for your timeline
- Determine your comfort level!!!!!!

Timing and Effect

- Vegy green
 - Vineyard>fermentation>pre-MLF>post MLF
- Sulfides
 - Fermentation>pre-MLF=post-MLF
- Color
 - Vineyard>fermentation>pre-MLF≥post-MLF
- Tannins
 - Depends greatly on previous treatment

Herbaceous- Green Characters

What are they?

- C6 alcohols & aldehydes
- Pyrazines
- Sulfides
- Certain nor-isoprenoids (β - damacenone)

Influence wine character

- ***Herbaceous /green character elimination***
 - Earlier is more effective but must have patience
 - pre-MLF 10-60 mL/L/month –till MLF starts
 - Post-MLF ~4 mL/L/month- till diminished
- ***Sulfide control***
 - Turbidity, temperature MOX rate
 - 6-10 mL/L/month for 1 week- till gone
- ***Tannin / Color***
 - 2-4 mL/L/month

What to Monitor

- A. Dissolved O_2** – good safety analysis but not necessary.
- B. Free & Total SO_2** – Measure 1 to 2 times weekly and chart to monitor rate of change. Rapid rate of drop indicates too high a rate of Oxygenation.
- C. Volatile Acidity** – Always get a bump in VA when Oak is used, if it keeps rising there may be a problem!
- D. Taste and Smell** – Still the best!
 1. Monitor of odor of acetaldehyde. Take half glass and set overnight with a watchglass cover and compare to a fresh sample the next day. Detection of acetaldehyde in old sample and not fresh sample means rate is about right. Detection in both samples indicate rate is too high and should be reduced. No detection indicate rate may be increased..
 2. After 3 month may sample and evaluate wine after mixing. Shutoff MOX and resample and evaluate after 1 week. If wine was fresh, fruity and open initially but closed now then MOX may be resumed and increased depending on timeline. If it remains open then initiate maintenance dosing till wine is required for blending.

When is the Process Done?????

- **Bottling schedules or sales and marketing usually provide the time line for a particular wine.**
- However, the best means of determining maturation is similar to making a wine using a barrel program.

Conditions to be aware of!!

- ***Turbidity & Reductive Character***

- If the wine has any reductive character it must be racked off the lees.
- If the wine has no reductive character it may be micro-ox'ed on light lees.
- Clean wines, low turbidity and sulfides respond faster to oxygenation.

- ***Temperature***

- Wines respond best between 14 & 18°C.
- Higher temperature yield faster results.
- Lower temperatures lead to slower reactions and increased solubilization of oxygen.

Hangtime Issues

- ***Overripe grapes allow little wiggle room for MOX***
 - higher pH – general sanitation issues
 - Potential color stability problems
 - Raisins and uneven ripening limit MOX for maturation and sulfides
 - Turbidity and settling issues
 - Over-extraction
 - Loss of fruity characters

What types of Mox equipment is out there?

Not a complete list but from an overview given at Unified a few years ago

Mox is Now Well a Developed & Available Technology

- Companies have developed better, easier to use, more robust Micro-Oxygenation systems.

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Oenodev

Fresh Thinking about Wine Aging...



Compact



VisiO2



See them at Booths
1216 & 1218



PARSEC

Micro-Macro-Oxygenators

The only equipment that measures oxygen by weight.



OxyGenius Plus



SAEn 4000.xx



Control Unit

SAEn 5000

Remote Unit



See them at the American Tartaric Booth – K3

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**Our New
8 Channel "OxBox"
Now Available!**

Micro-Oxygenation Unit The "Ox-Box"

The Ox-Box, used in conjunction with StaVin's oak integration system, is designed to replicate the micro-oxygenation of a barrel within tanks. Discriminating winemakers are provided an unparalleled opportunity to maximize their wines potential!

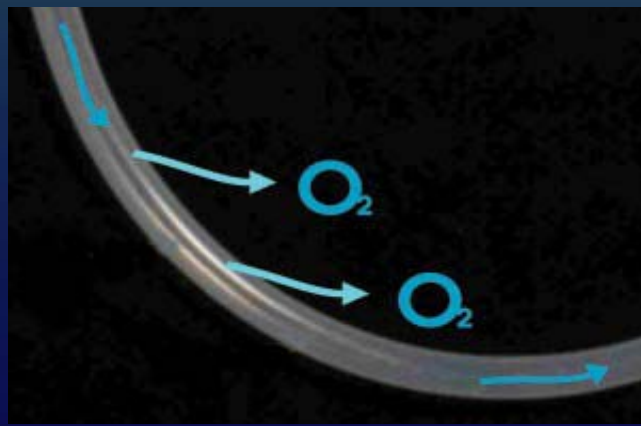
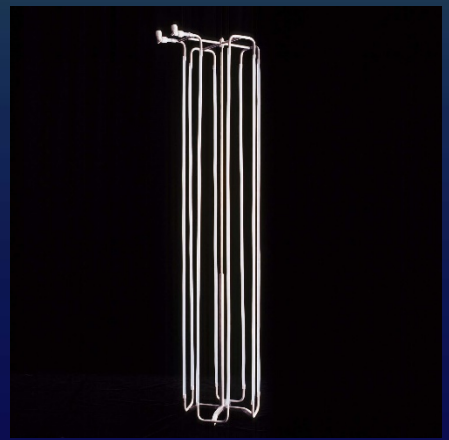
- 4 Channel Unit
- 8 Channel Unit
- Custom Sizes

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See them at Booth 1211

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O₂Mate Barrel and Tank Diffusion Systems



The membrane is made from polydimethylsiloxane. This has good and consistent permeability and very low self-fouling.

TANKMATE DIFFUSER

Permeable Tanks

- FlexTank USA – FlexTank OZ
- Pros-
 - Reasonable Barrel Replacement
 - Roughly Mimics a O₂ transfer of a Barrel
 - Stackable and reasonably durable
- Cons
 - Sealing openings is problematic – must be careful
 - No hold downs in side for Barrel Alternatives
 - No way to stop O₂ transfer – have to rack to Stainless



Thank you for your attention,
any questions?

