

# Sculpting and Restoring the Wine You Want

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*Presentation for Current Topics in Southern Oregon Winemaking  
– Identifying and Managing Common Cellar Concerns*

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# Thank you to our hosts –

- Southern Oregon Wine Institute / Umpqua Community College
- Oregon State University Extension Services
- Lane Community College
- OSU Southern Oregon Research and Extension Center



Oregon State University Extension Service



# In a perfect world...

- The vineyard produces grapes on an optimal ripening curve.
- The winery harvests them at the proper flavor maturity.
- Every step of the production process goes off without a hitch....



# Issues to address

- Alcohol adjustments
- Spoilage Organisms/Taint problems  
Acid,  
Acetate,  
4-Ethyl Phenol, 4-Ethyl
- Fine Tuning Items

Acetic  
Ethyl  
Brett (as well as  
Guaiacol)

# Alcohol Adjustments

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# Alcohol-Flavor Balance

*Alcohol has a profound effect on the taster's perception of a given wine's quality*

*For low-alcohol wines, increasing the alcohol:*

- *softens the perception of tannin and acidity,*
- *confers a mouth filling sweetness*

*Too much alcohol has a negative effect:*

- *masks flavor, aroma*
- *emphasising harsh, hot bitter characteristics*

*Remember – alcohol is the second largest component in the wine.*

# The problem of excess alcohol

- AWRI mean alcohol analyses
  - 12.4% in 1984
  - 14.2% in 2004 (with another 'sugar high' year in 2008)
- Prolonged or arrested primary and secondary fermentations
  - Higher levels of residual sugar
  - Microbiological spoilage potential
  - Increased VA potential
  - Brettanomyces taint potential
  - loss of SO<sub>2</sub> and oxidation
- Heavy and lack fruit flavor and freshness
- Dull, jammy and hot on the palate
- Age prematurely
- Increased intoxicating effect
- Extra taxes
- *But where to find that 'right' alcohol????*

# What is a 'sweet spot'?

Observed phenomena that perception of wine flavors and aromas change in a non-linear fashion with varying concentration of alcohol.

- *Alcohol concentration that maximizes the wine's perception as being well-integrated: enhanced fruit expression on the nose and palate improved mouth-feel;*
- *Varying the alcohol level by as little as  $\pm 0.1\%$  may be the difference between a 'sweet spot' or not;*
- *Varying the alcohol can also have a profound effect on the perceived style of a given wine;*
- *Development done by (among others) Vinovation; Memstar; Syrah trials by Fresno State; much field experience.*



# Sweet Spot samples

- Create samples of wines – either a low alcohol portion that the winery can then perform own blending trials on, or can make tasting samples at a range of alcohol levels (usually from 4 to 8 samples, 0.1% increments)
- Done using Microstar unit (from Memstar); lab scale unit.
- Can choose alcohol level winery wants before whole lot of wine is adjusted.

# Options for Alcohol Reduction

- Pick grapes earlier (but might not be at optimal maturity)
- Vineyard Management (but cannot control weather)
- Add water to crushed grapes; must (OK in California)
- Blending (but might not like how wines meld)
- Cellar evaporation
- Spinning cone distillation
- Separate permeate from wine with RO, and
  - Discard permeate and replace with water (not legal)
  - Distill permeate and recombine with wine
  - Transport ethanol from the permeate through a hydrophobic membrane, and recombine remaining permeate with the wine.

# Alcohol Reduction Technologies

## RO followed by Osmotic Transport (Memstar AA)

### Advantages

- Readily portable
- Lowest loss of treated volume (> 1% per percent ethanol)
- Very precise

### Challenges

- Difficult to reduce concentration to > 10%
- Creates “strip water” solution with 6% alcohol

## RO followed by Distillation

### Advantages

- Operates on partial volume

### Challenges

- Creates high-proof alcohol, local regulations

## Spinning Cone distillation

### Advantages:

- Operates on partial volume
- Tolerant of solids

### Challenges:

- Very high capital expenditure
- 2.4% loss of treated volume
- Not portable

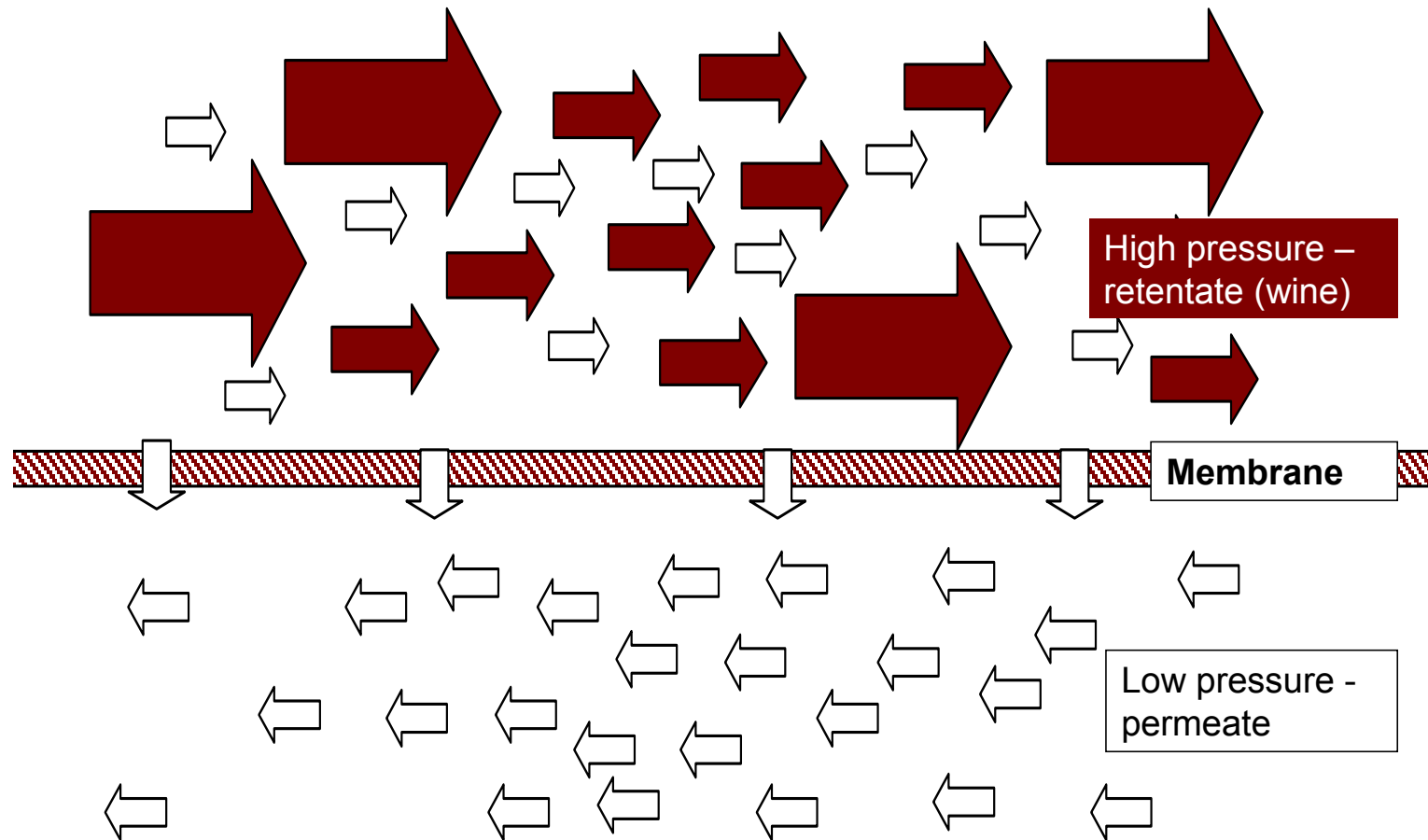
# Reverse Osmosis



- *“Liquid-phase pressure-driven separation process in which applied transmembrane pressure causes selective movement of solvent against its osmotic pressure difference.”*

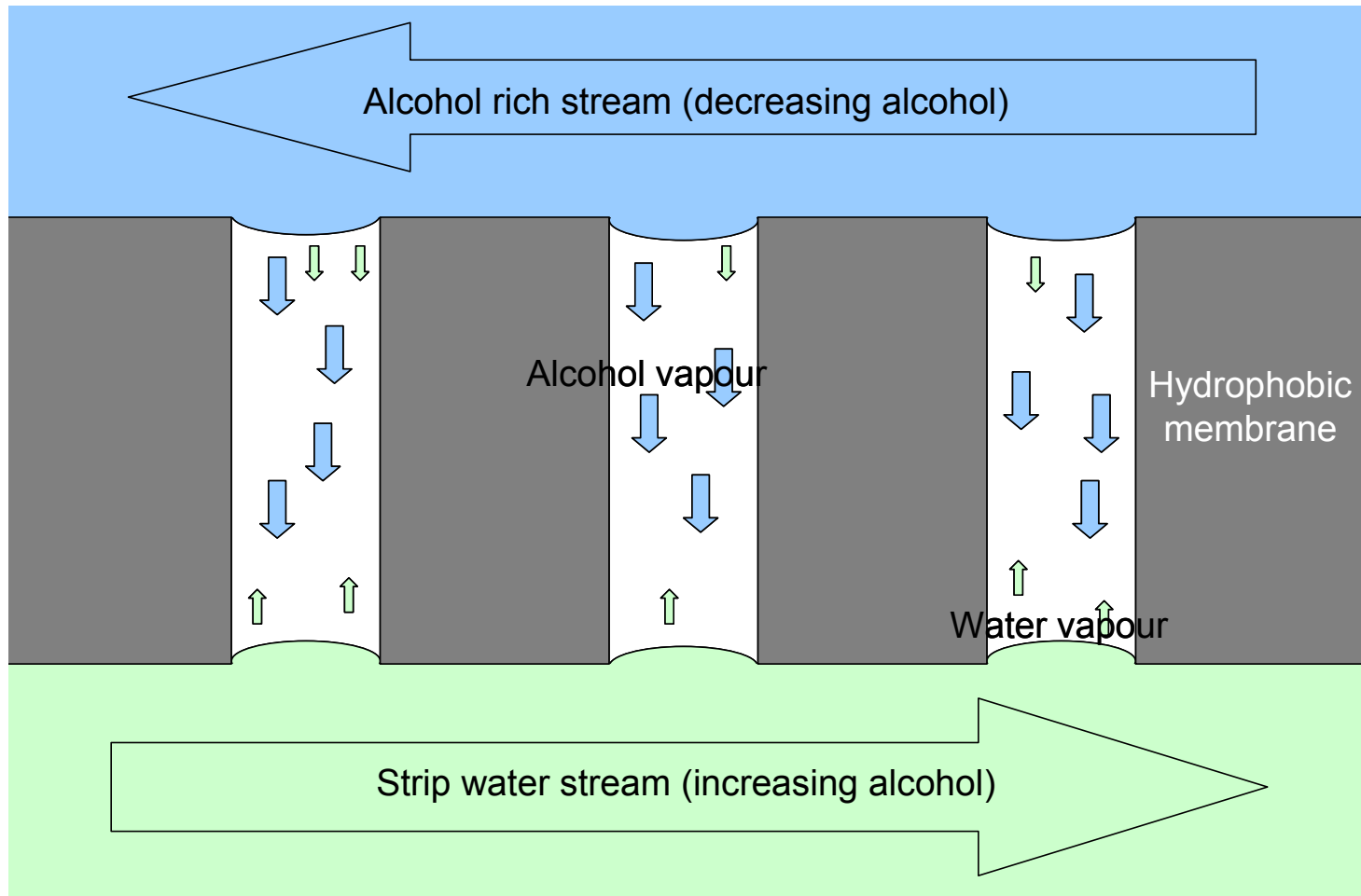
*IUPAC Recommendations 1996*

# Reverse Osmosis

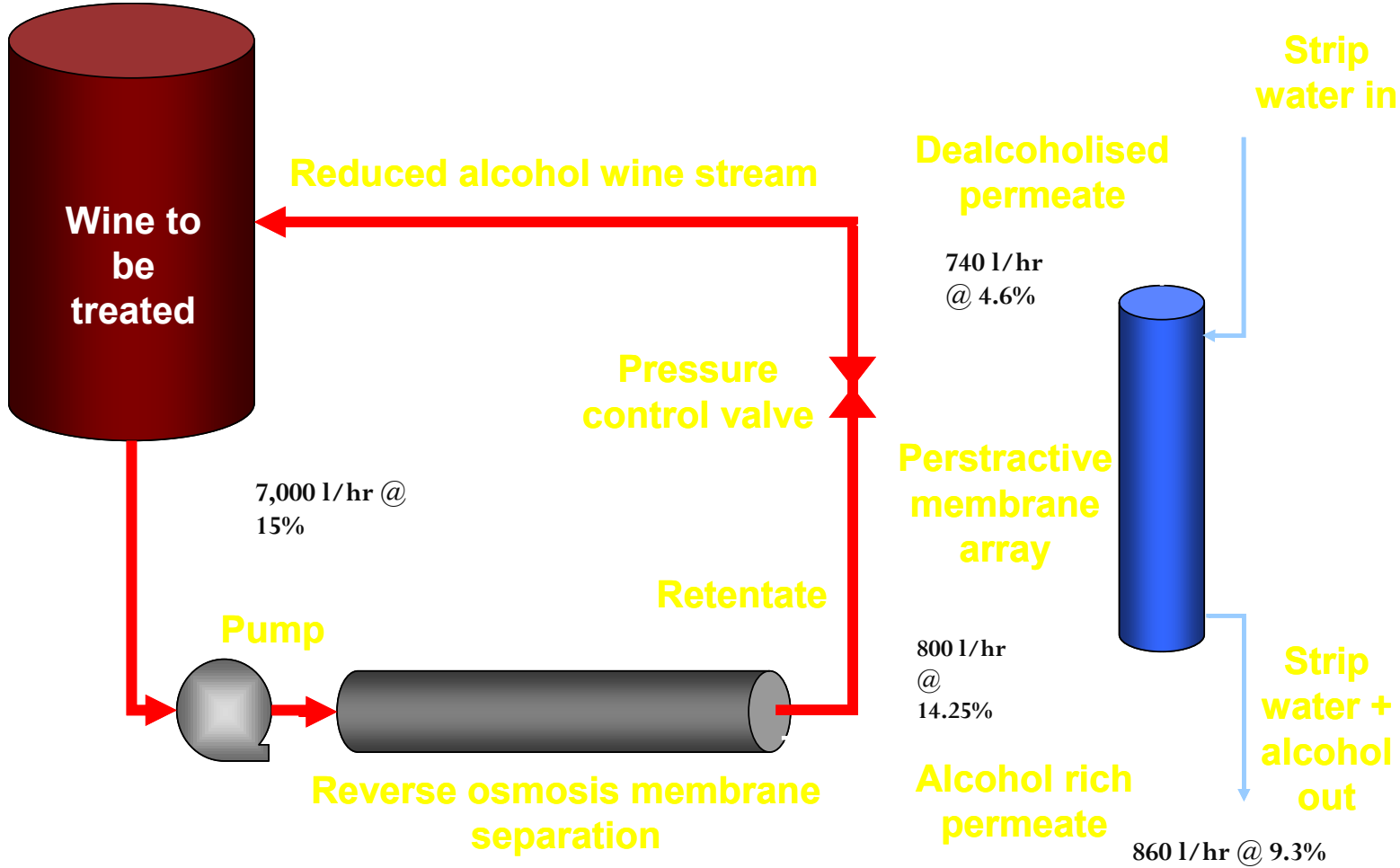


# Osmotic Transport

*(Referred to as Perstraction by the manufacturer)*



# Alcohol adjustment with Memstar, Typical performance



# Operations with Memstar AA

## Mobile Service

- Move your wine across the winery, not across the country.
- Work on largest possible volume, less extreme.
- Multiple lots are not a problem, no need to use blenders.
- Variety of sizes and capacities available.
- Wine should be clarified.
- Extensive experience.
- Equipped with safeties for overnight operation.
- Low equipment volume.



# Controlling Memstar AA

Alcohol adjustment is a function of duration

- Predicted duration calculated by change in concentration;
- Extensive experience with RO passage;
- Recovery is not difficult.
- Monitored with Alcoalyzer (or other equipment);
- Low equipment volume.

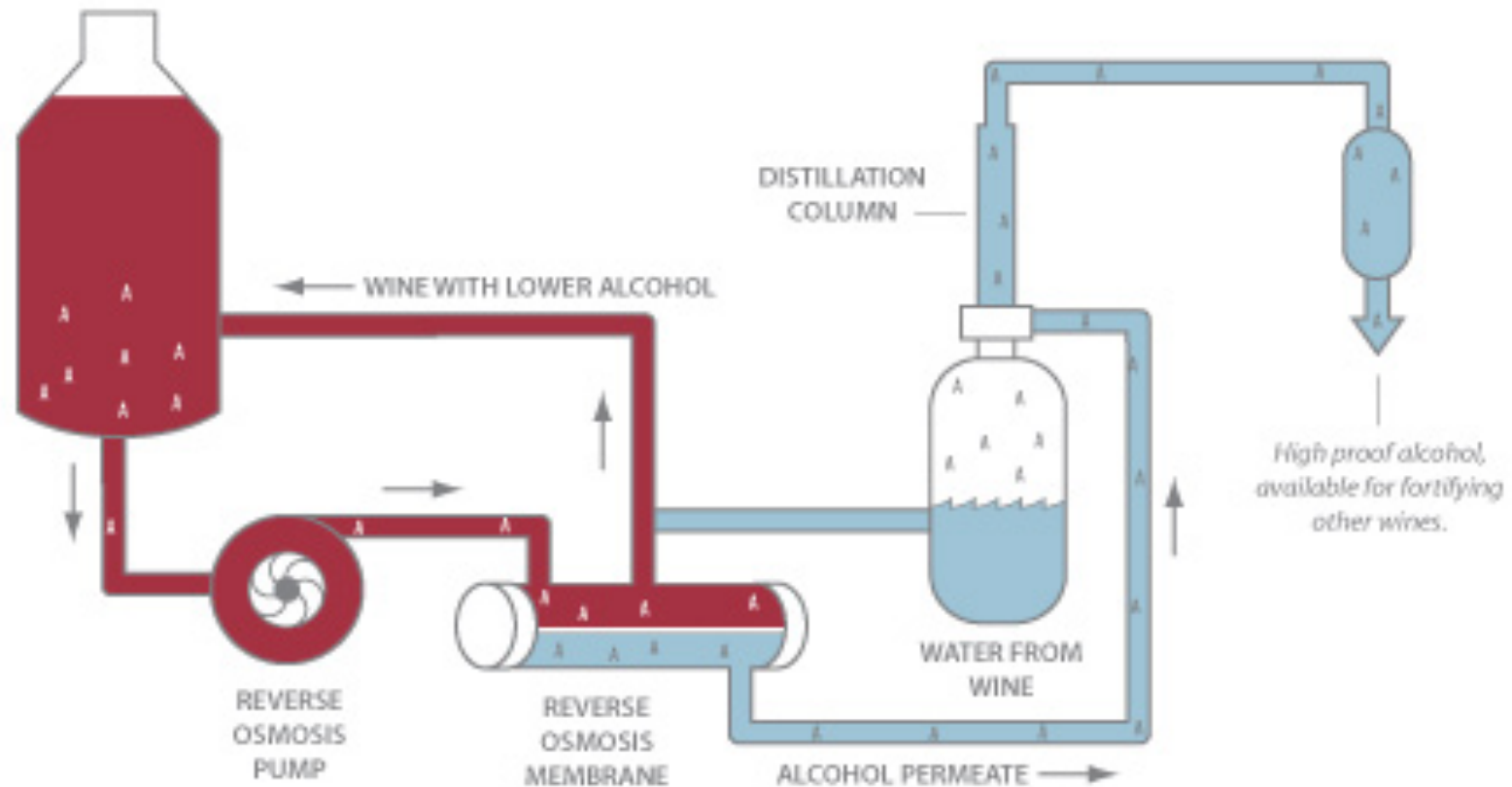
# The TTB and Osmotic Transport

- DSP applications are being processed within 90-120 days (provided TTB has all needed information)
- Each State has additional requirements
- Both components of the Memstar AA system are approved processes for winemaking.
- Both components are regulated as filters, not distillation columns-interchangeable.
- No high-proof alcohol to be managed.

# The Benefits of Memstar AA

- Your location  
System brought to winery. No “Vacation” for your wine. Can use Estate Bottled designation.
- Saves wine:  
Only ethanol is removed. The only loss of volume is that of the ethanol.
- Sweet Spot:  
Precisely controlled. Target can be hit every time.
- Simple plant:  
Memstar AA with Osmotic Transport does not require the temperature extremes of distillation. Utility requirements are less. Does not carry the regulatory burden of a distillation column.

# Alcohol Reduction by Reverse Osmosis followed by Distillation



# Operations with Distillation

## Established at Facility

- Not as readily mobile, set up at a large facility.
- Work on a smaller volume (of original wine)
- Well adopted to a reduction and back-blend strategy.
- Wine should be clarified.
- Creates a useful product.
- Distillation column may be used to distill strip-water from RO/Memstar Operations
- RO permeate may be created on one site and shipped to the distillation facility. Dealcoholized permeate is then returned and back-blended.

# Spoilage Organisms / Taint Issues

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# Microorganisms

- We are both reliant on and battling various microorganisms in our daily wine production.
- As we all know, we WANT the good ones and don't want the bad ones.
- Sanitation is the key to keep the bad ones at bay.
- Wine spoilage microorganisms are bacteria and yeast that produce off-flavors or aromas.
- It also includes beneficial yeast and bacteria that are growing where you do not want them to (such as ML or yeast fermentation in a wine that is bottled).

# Volatile Acidity (V A)

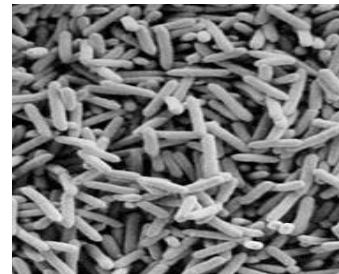
- **Symptoms:**

Vinegar aroma, finger nail polish remover aroma (ethyl acetate), cherry lifesavers.

- **Cause:**

Growth of *Acetobacter*, a bacteria that grows on the surface (mandatory aerobe). Converts ethanol to acetic acid and ethyl acetate. Grows best in high pH wines.

- Legal limits necessitate treatment





# Acetic Acid

- One of two principle acids of what is generally referred to as “V A” (or Volatile Acidity)
- **Acetic Acid  $\text{CH}_3\text{COOH}$  or  $\text{CH}_3\text{CO}_2\text{H}$**
- Generally occurs during cellar operations, but can come in on fruit (especially in challenging growing years).
- Typical note – Vinegar
- Wine needs to be fairly tight filtered (to remove Acetobacter).

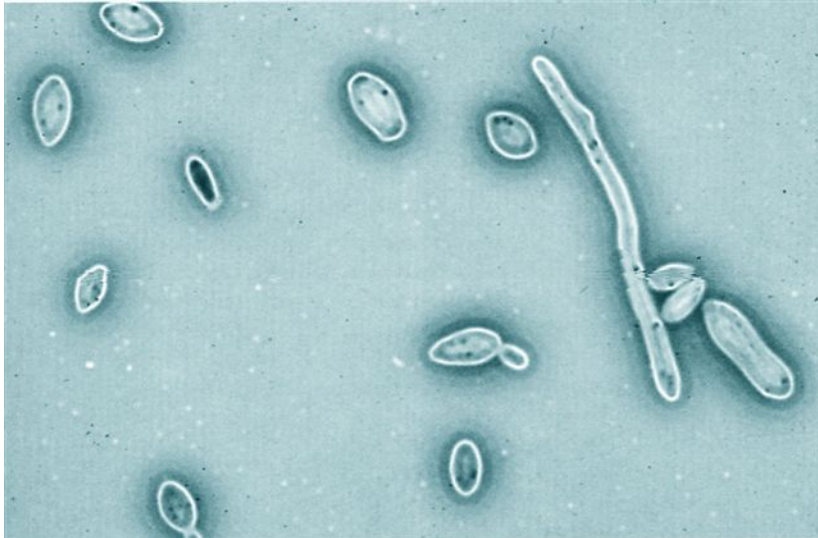
# Ethyl Acetate (E A)

- Other prevalent acid in V A; most often accompanies high production of Acetic Acid; on occasion can form without Acetic.
- **Ethyl acetate**       **$\text{CH}_3\text{COOC}_2\text{H}_5$  or  $\text{CH}_3\text{COOCH}_2\text{CH}_3$**
- Typical note – Nail polish remover
- When trying to reduce EA level, it comes out of wine at half the rate of Acetic.

# Brettanomyces/Dekkera (sporulating/non-sporulating)

- Symptoms:

May be spritzy, lack of fruitiness, horse sweat-BBQ sauce aroma, bitter metallic finish in reds, tuna fish smell in whites.



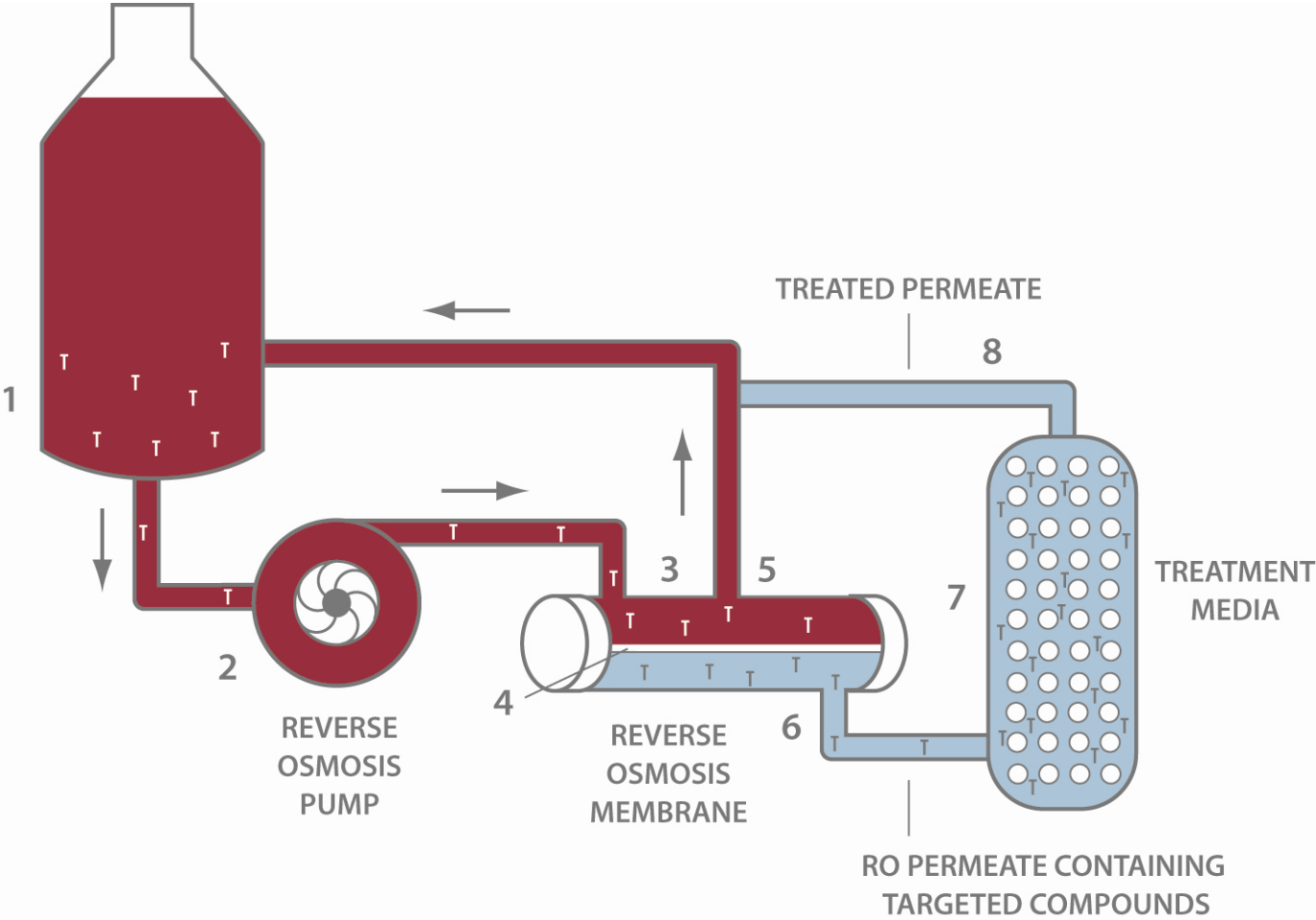
# Brettanomyces/Dekkera (continued)

- Grows primarily in dry, high pH, reds; throughout the wine (*not just at the surface*) Slow growing infection usually from dirty wooden cooperage, easily spread during topping.
- Can become a problem many years after bottling.
- Only bug that will grow in a dry, MLF complete wine, without oxygen.
- Can live in barrels (improperly stored), hoses (improperly stored), and even around the winery.

## *Brett* in premium reds?

- Some winemakers say a small amount *Brett* growth makes a wine more complex, more "French" in character; is it better or worse? Let's just say it is say it's a style.
- Some high-end wineries feel that rough treatment to eliminate *Brett* is worse than a little *Brett* growth.
- One researcher says French *Brett*. has less 4-ethyl phenol.

# Treating the wine



## Treating the wine (continued)

- Can be done on winery site – no special permits from TTB (covered in 27 CFR 24.248)
- VA (Acetic and Ethyl Acetate) reduction done with Reverse Osmosis and Anion Exchange column
- Brett, et. al., done with Reverse Osmosis and treatment media (currently found Carbon Block filters are best treatment)
- Closed loop system
- Winemaker can taste at intervals (brett, et. al.)

# Fine Tuning Items

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*Other filtrations available*



# Further fine tuning of the wine

- Ultra Filtration – browning reduction; tannin refinement; tint removal *membranes from 10K – 100K*
- Electrodialysis – tartrate removal; can also be configured for pH reduction
- Centrifuge – solids removal
- Cross Flow microfiltration – final polish filtration; eliminates need for DE

# Contact information

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