

Separation Anxiety

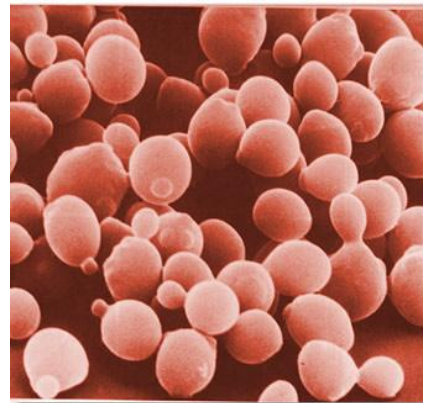
Observational Insights
to Understanding Wine Filtration

Filtration Goals

-Clarity



-Stability



-Efficiency

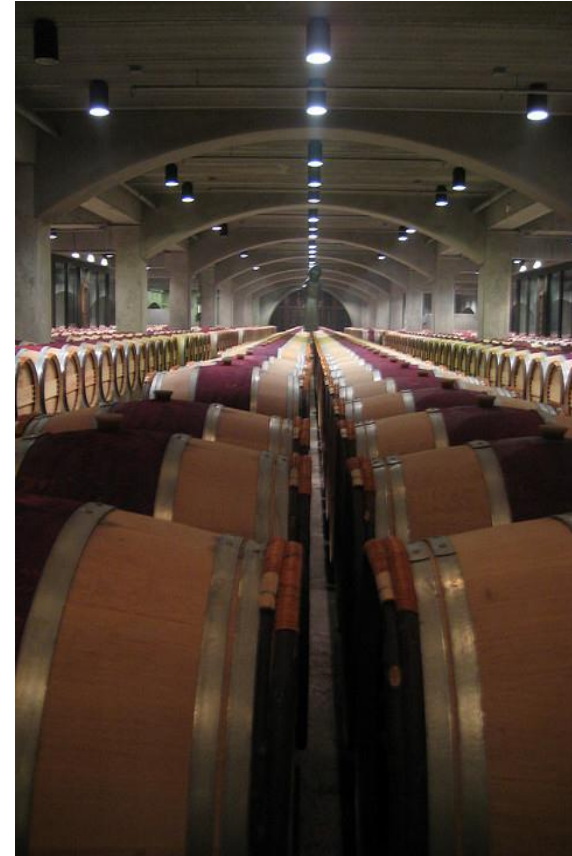


Scott Labs' Specialty

- Filtration sales since 1965
- 90% of our filters used in winemaking
- Global awareness of process
 - Fermentation
 - Packaging
 - Bottling
- Our concern is for the wine, not for the filter.



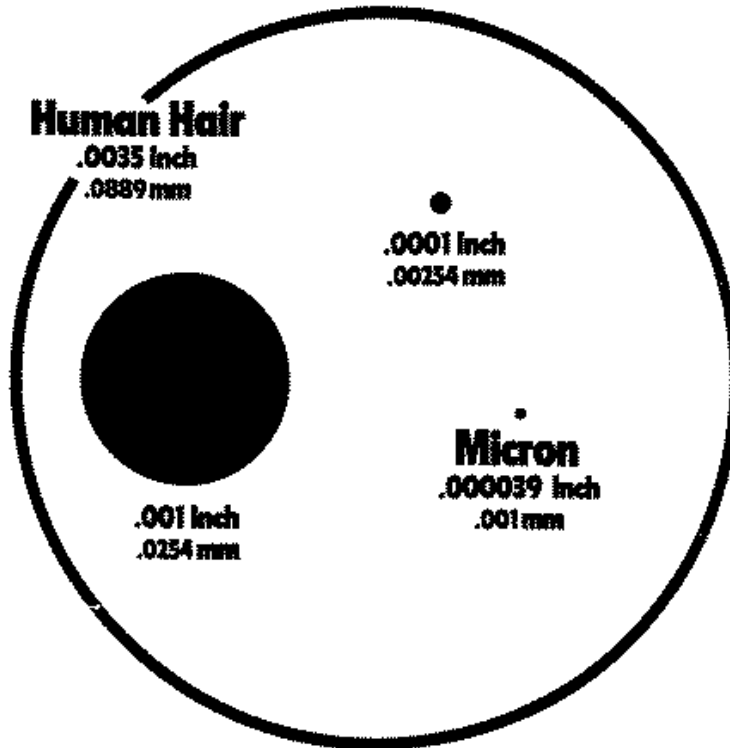
The Winemaking Process



Micron or μm

How big is a Micron?

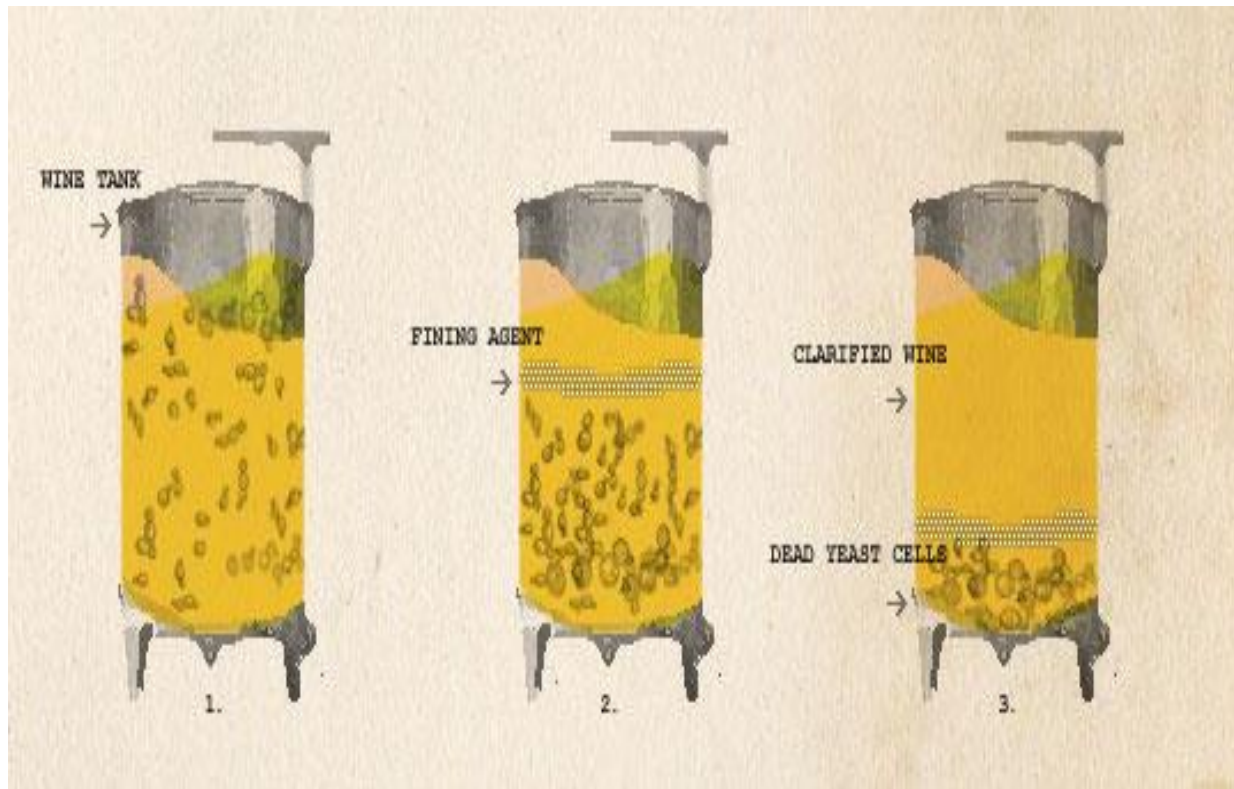
2,000 times size



Suspended Solids

- Grape pulp – 20 to 200 micron, gelatinous
- Tartrate crystals – 5 to 500 micron, rigid
- Protein precipitates – 2 to 20 micron, gelatinous
- Yeast – 1 to 2 micron, gelatinous
- Bacteria – 0.5 to 0.8 micron

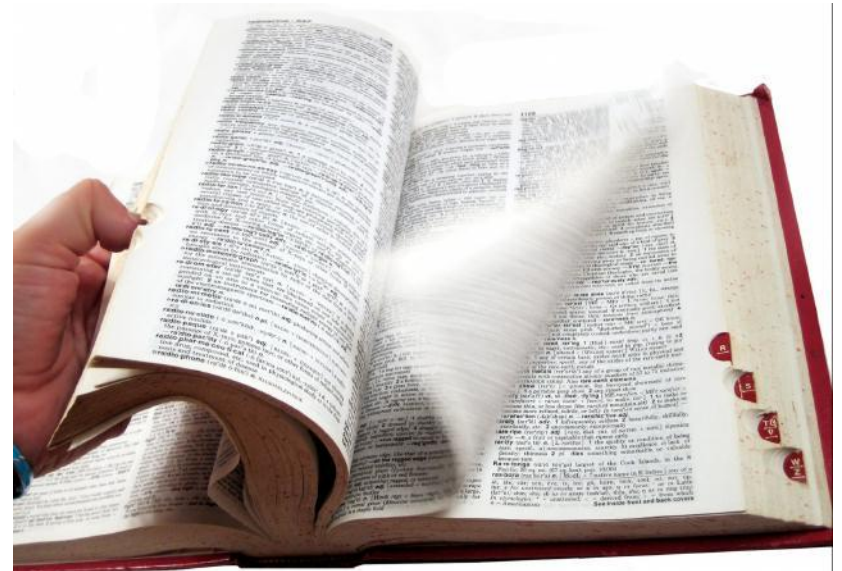
Clarification and Stabilization



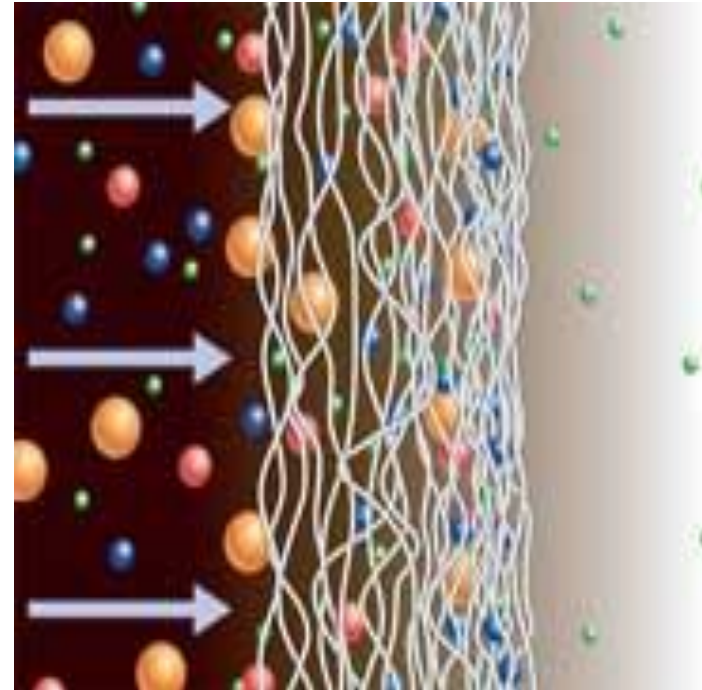
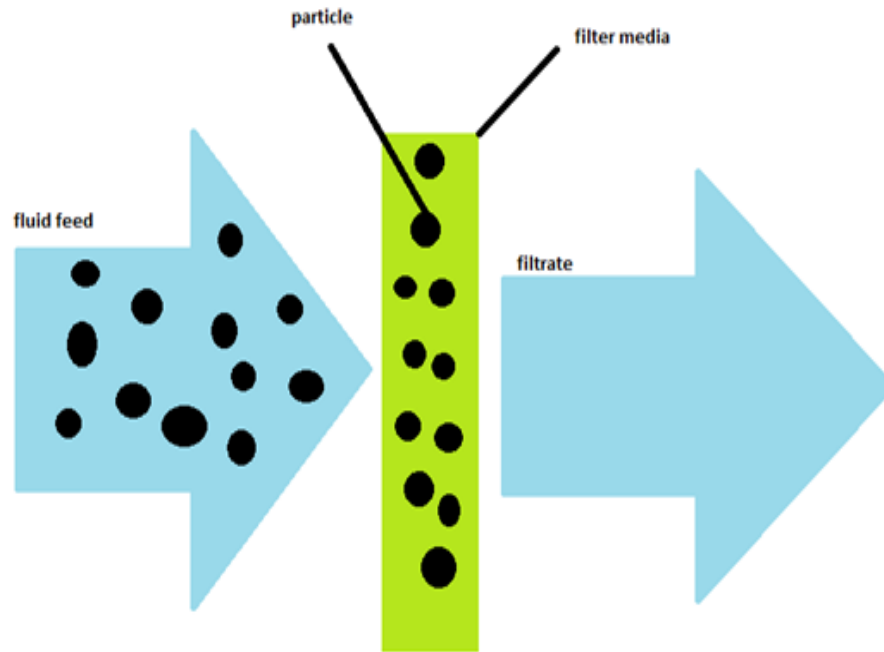
Fining agents
Temperature
Gravity
Racking

Glossary

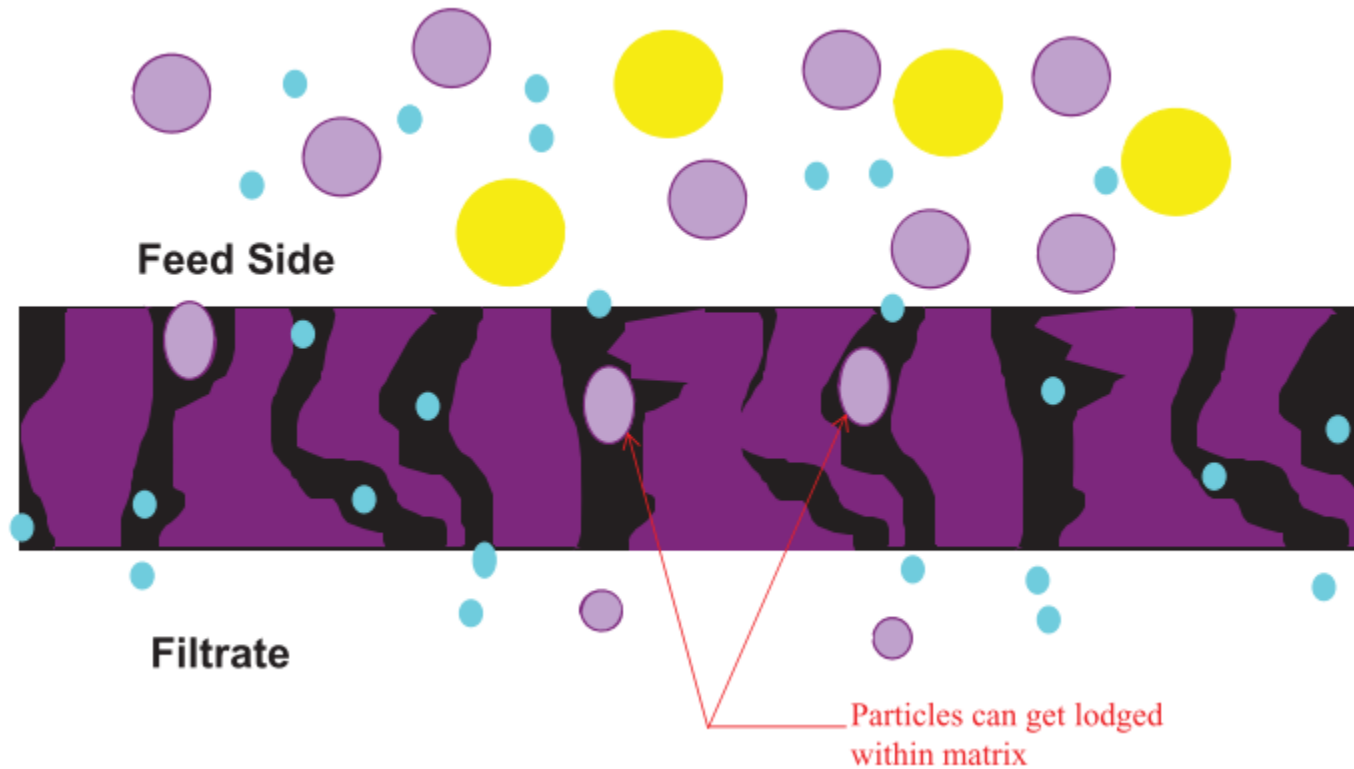
- Depth and Membrane Filtration
- Absolute/Nominal
- Rough, Polish & Sterile
- Integrity testable



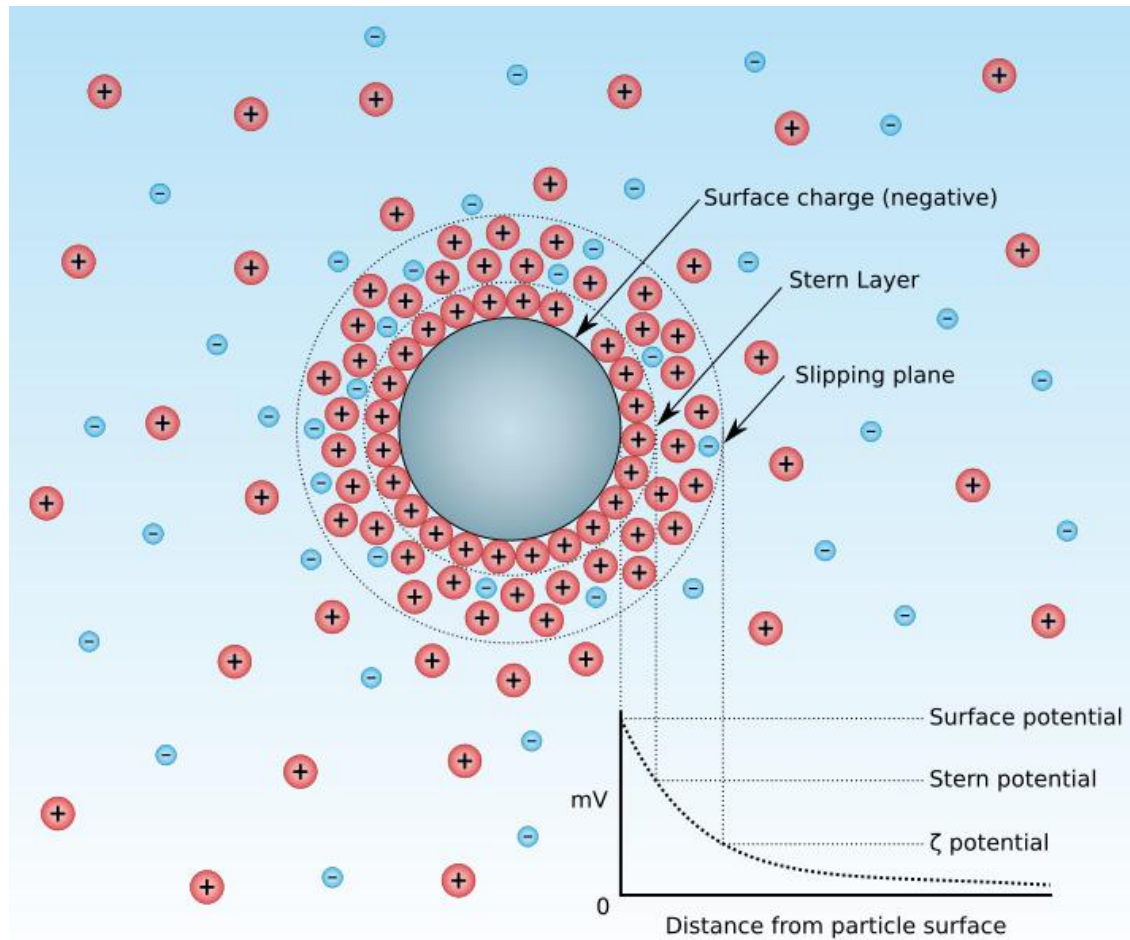
How does depth filtration work?



The labyrinth or tortuous path

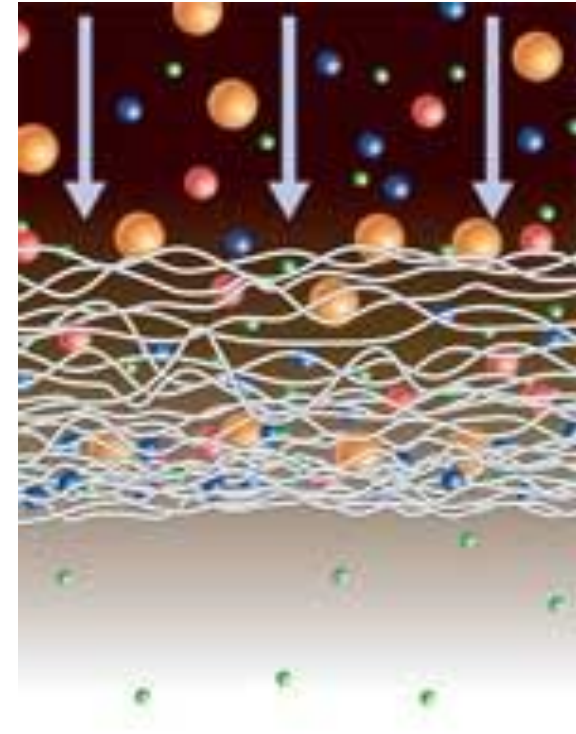


The charge on DE



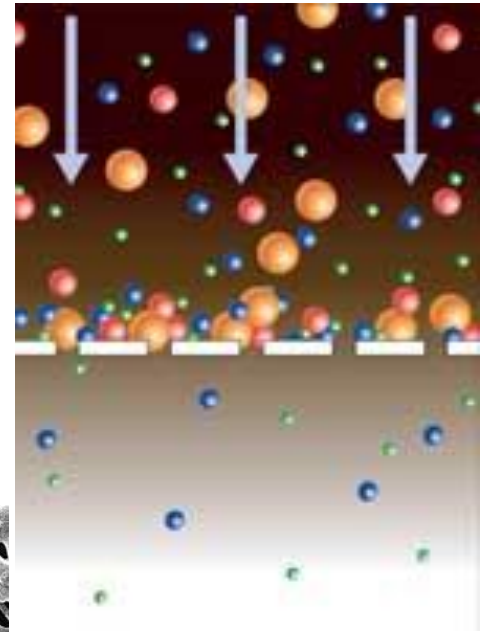
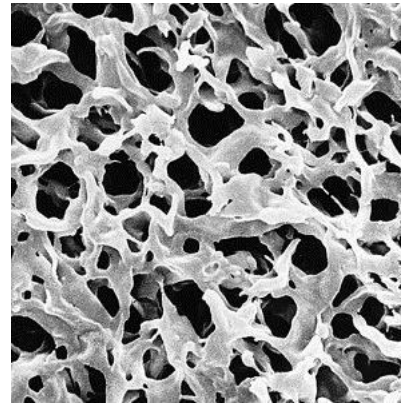
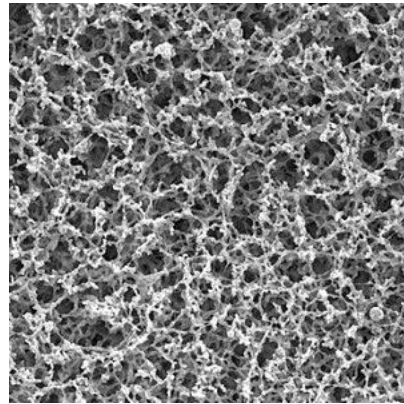
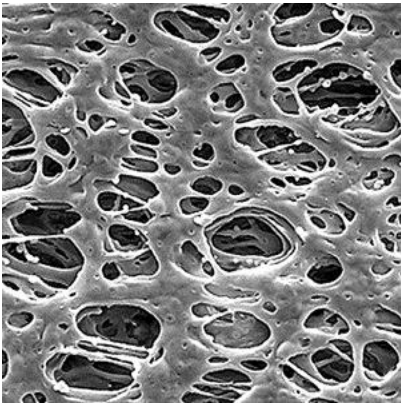
Depth Filtration

- Goal – Removing Solids
- “Dirt holding capacity”
- Example: Filter pad media ;
DE Filtration ; PP cartridges.



Membrane Filters

- High precision / accuracy
- Very low dirt holding capacity
- Examples: X-Flow, PES, PVDF, Glass matrix. Cellulose Acetate

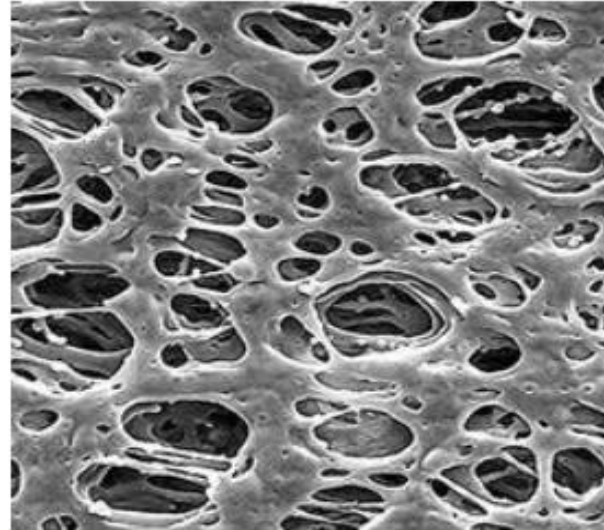


Oenococcus oeni on membrane surface

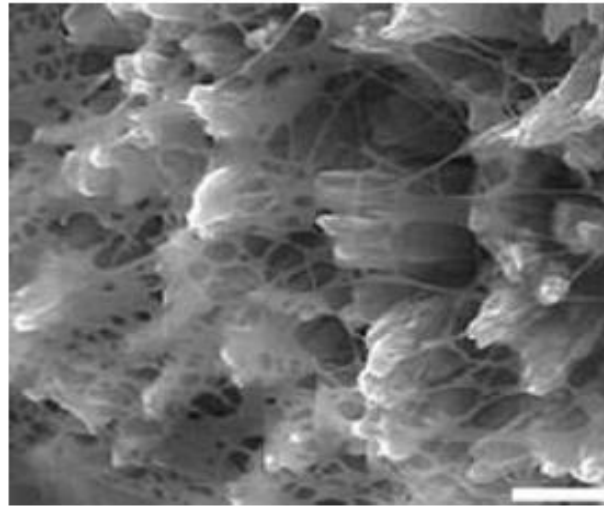


Glucans

Clean PES membrane



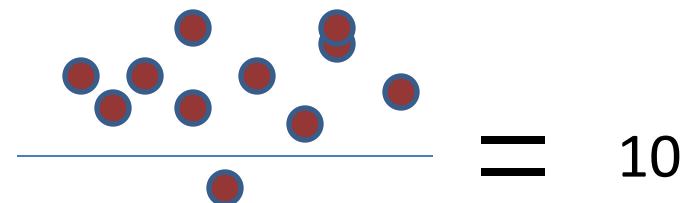
PES membrane
fouled with glucans
from *Botrytis*



“Nominal vs Absolute”

- Beta ratings

$$\beta_x = \frac{n_{\text{Upstream}} \geq X \mu\text{m}}{n_{\text{downstream}} \geq X \mu\text{m}}$$



- Testing methodology
 - Typically spherical Glass or Nylon beads of a determined size passed under lab pressures
- Nominal = NOT absolute
- Absolute = maximum sized glass sphere (Absolutely nothing larger than the micron rating will pass through the membrane)

Titer Reduction Values

- Goal-based classification
- The best current method to distinguishing between similar but different filters
- 10^6 vs 10^9



Absolute/Nominal vs. Titer Reduction Value

– Two Filter Carts. Same grade, different Titer value:

- **Seitz XLII 0.45**
- **10^9** reduction of *Serratia marcescens*
- 99.99999999% reduction

- **Brand X 0.45**
- **10^6** reduction of *S. marcescens*
- 99.9999% reduction



Example #1

- Take an example of a wine exhibiting 100,000 cells/ml. Expect the following for the Seitz XLII 0.45:
- Reduction of 99.99999999% at 10^9 would yield 0.0001 cells per ml **OR:**

- .075 bugs per bottle

$$\begin{array}{r} 100,000 \text{ cells/ml} \\ \times \quad 0.000000001 \\ \hline 0.0001 \text{ cell/ml} \end{array}$$

$$\begin{array}{r} 750 \text{ ml/bottle} \\ \times \quad 0.0001 \text{ c/ml} \\ \hline 0.075 \text{ cells/bottle} \end{array}$$

Example #2

- Now try Brand X 0.45 with a titer reduction of 10^6 at :
 - Reduction of 99.9999% would yield 0.1 cells per ml
- OR:**
- 75 bugs per bottle

100,000 cells/ml	750 ml/bottle
x <u>0.000001</u>	x <u>0.1 c/ml</u>
0.1 cell/ml	75 cells/bottle

Is this an important difference ? Maybe.

Rough, Polish and Sterile

ROUGH	POLISH	STERILE/SANITIZING
Greater than 5 micron	Between 1-5 micron	Less than 1 micron
<ul style="list-style-type: none"> -Turbidity reduction -Excessively cloudy -Visible solids removal -Heavy Yeast removal 	<ul style="list-style-type: none"> -Brightness -Final clarity -Yeast Population reduction 	<ul style="list-style-type: none"> -Brilliance -Yeast “sterility” -Bacteria log reduction or “sterility”
<p>DE: 1 Darcy Lenticular & Pads: K700 and up Cartridges: Polypropylene</p>	<p>DE: 0.3-0.4 Darcy Lenticular & Pads: K100 through K300 Cartridges: Glass or PP</p>	<p>DE: 0.1-0.2 Darcy Lenticular & Pads: EKS through KS80 Cartridges: PES</p>

HUMAN HAIR: 55 μ

Common PVPP: 25 μ

Saccharomyces: 1-5 μ

Denococcus: 0.5-1 μ



Filtration options

- Pads
- Lenticular
- DE Filter
- X-Flow
- Cartridge

POWER

WINE LOSS

CAPITAL

MEDIA COST

LABOR

DISPOSAL

Filter Pads



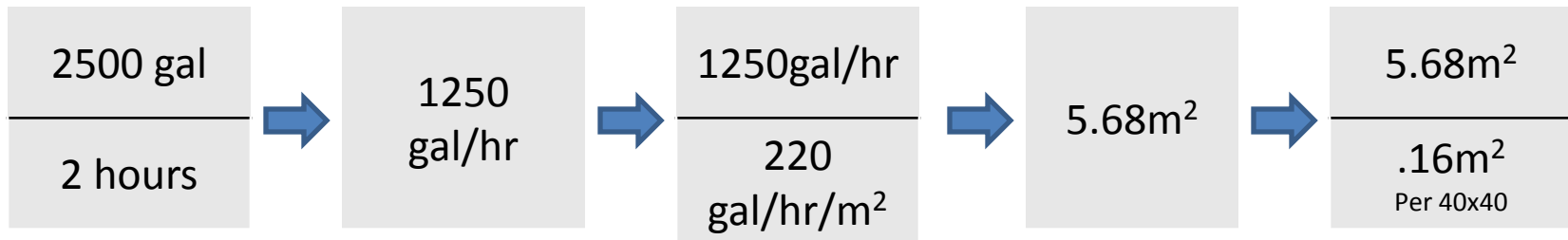
- Preformed Depth Filters
- Rated from 0.2-55 microns
- Cellulose, DE, Perlite, Resin (or some combo)
- **Pro:** Pre-formed; repeatable; low capital costs
- **Neutral:** Medium media cost
- **Con:** Leakage loss; Disposal; Setup time; Space

Plate & Frame Filter



Assumed Conditions* – Pad Media

- Average filter capacity period: 2 hours
- Optimal flow rate per m² pad media
 - Sterile: 125 gal/hr/m²
 - Polish and rough: 220 gal/hr/m²
- Example: 2500 gallons of red wine to polish



RECOMMENDED USE OF AT LEAST 36 40X40 FILTER SHEETS

*This reality does not exist



Filter pad regeneration

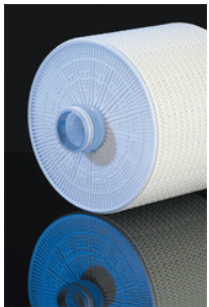
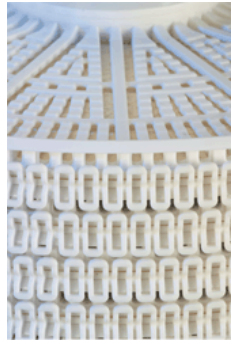
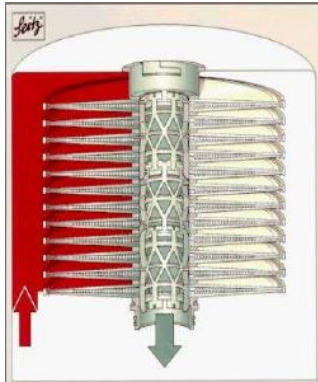
- 15 minute cold water forward flow
- 15 minute warm water (120F) forward flow
- 20-30 minutes sanitizing with 180F water
- Cool down the pads (slowly) after sanitizing otherwise microbes will breed overnight.
(at 78 – 115F you can increase the population from 1 cell to 4 trillion overnight.)

Efficiency Tips - Pads

- Pre-rinse cycles
 - 2.0 pH with Citric and up to 1000ppm SO₂
- **DO NOT MIX GRADES WITHOUT CROSSOVER**
- Replace “H” Gaskets every two years OR when hardening of rubber occurs
- Regeneration
 - Forward flushes of 120F
 - If Backflush, DO NOT exceed 7PSI
- Use 2-stage filtration when possible



Lenticular Filters



- THE SAME MEDIA AS PADS
 - Modular format with 2 adapter types
 - **Pro:** Quick setup/breakdown; repeatable; low capital costs; some backflushable; storable;
- VERY LOW LOSS**
- **Con:** Higher upfront media costs; disposal

Lenticular Filter



Efficiency Tips - LENTICULAR

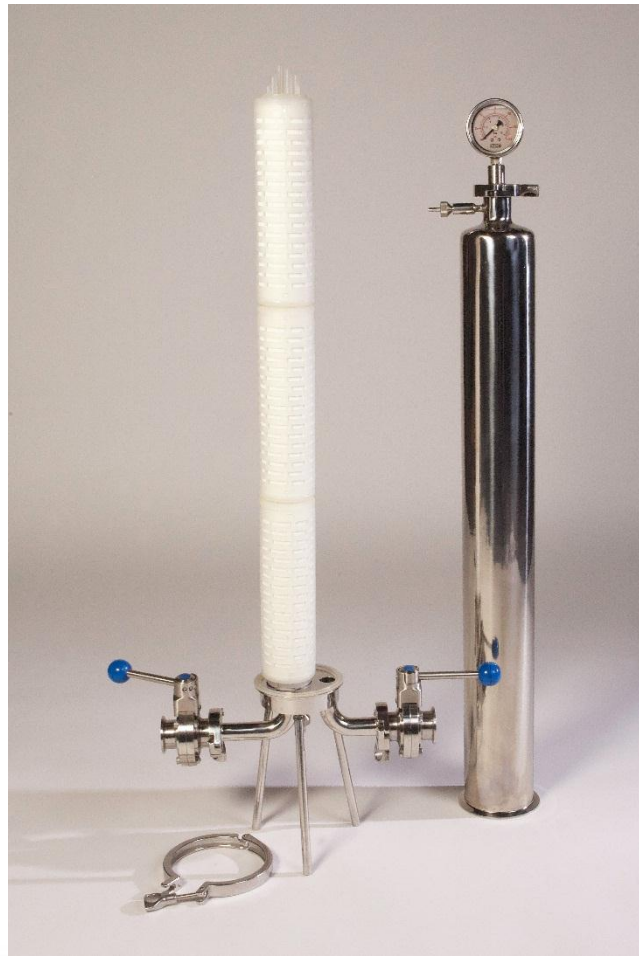
- Be flexible with housings
 - Size filtrations to minimize cost/filtration
- Regeneration
 - Forward flushes of 120F
 - If Backflush, DO NOT exceed 7PSI (use backflush plate for maximum support and efficiency)
- 12” vs 16” modules.
- Different height center posts, dual grade modules.

Cartridges



- Very low dirt holding capacity
- Very high precision and accuracy
- Often polymer based and sold for “T-style” housings in our industry (single open end)
- **PRO:** Standard for bottling; repeatable; regenerable; storable; high filterable surface
- **CON:** Poor for high solids; High media cost

Cartridge Filter & Housing



Integrity Testable

- IS THERE A **HOLE** IN MY FILTER!?

- Tests

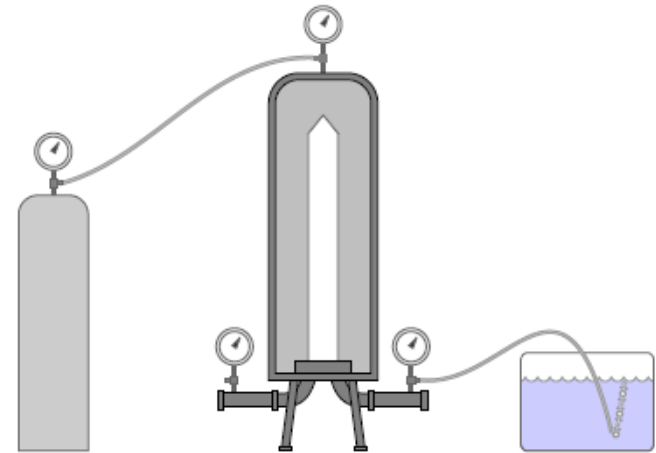
- Pressure diffusion

- Bubble point

- Pressure hold

- Same physics. Differs

- in which part of flow spectrum they examine.



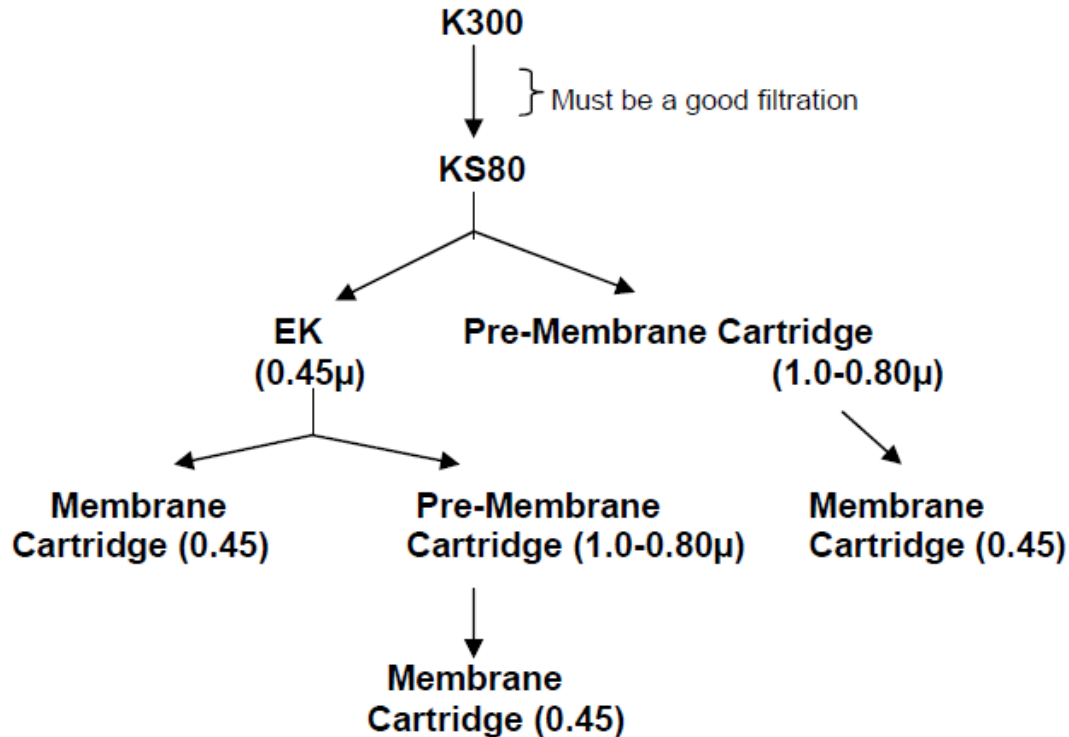
- These tests should be preformed BEFORE and AFTER a filtration on membrane filters <1 micron.

Efficiency Tips - Cartridges

- REGENERATE AND STORE
 - Decrease expenses
 - Regenerate with Cleanskin K and store in EtOH (cheap vodka) or a pickle of Acid and SO₂.
- If storing in SO₂, remove gaskets
- In line Regeneration
 - Forward flushes of 130F
 - Backflush depth filters, but use hold-down or Code 7
- **Do not wait more than 24 hours after “pre-filtration”**
- Integrity test membranes BEFORE AND AFTER

Sample Filtration Strategies

Most Common Routes for Pad Filtration in Whites:



Record Keeping

- Maintain Notes

- Date, Wine, Vintage
- Where the wine is in process
(i.e. after two rackings or stuck MLF)
- Record filter type; capacity; grade; operator
- Track original/terminal Differential Pressure (dP)
- Periodically record:
 - Gallons filtered
 - dP for each filter stage



Contacts

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