

WASHINGTON STATE UNIVERSITY
EXTENSION

Winery Equipment

Lecture 8 - Filters

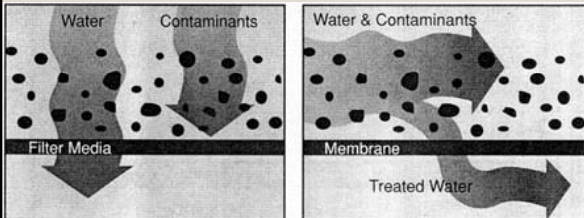
Gordon Taylor and Carter Clary



Uses of Filters

- Potassium bi-tartrate Crystals 1-10um
- Clarification – Remove particles 1-10um
- Remove particles/colloids 1-5um
- Pre-filtration 2um
- Final filtration 0.45um
- Bottle washers 0.2um

Flow Through vs. Crossflow Filtration

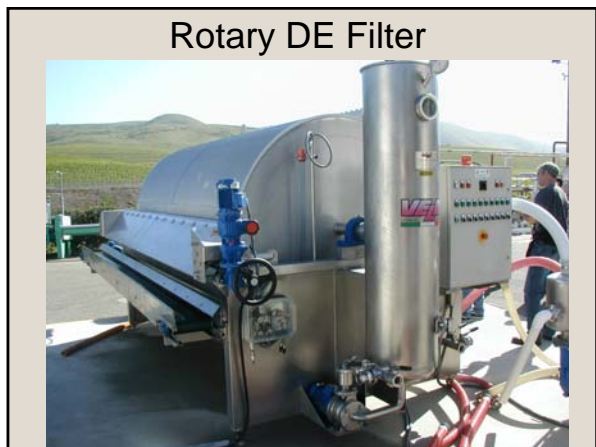


http://www.gewater.com/library/tp/712_Understanding_Crossflow.jsp

DE Filter



Rotary DE Filter



DE Filter in Operation



Spent DE Removal



Pad Filtration



Pad Frames



Crossflow Filtration



Why Filter?



General rule: Clarity is perceived by the consumer as a sign of quality. Wine consumers evaluate clarity in the glass (point of consumption), and under much greater scrutiny.

Filtration

- **Clarification** is removing solid matter from a liquid.
- **Filtration** is basically passing a liquid through a filter.
- Filtration process is the methodical separation of largest to smallest undesirable particulate material from liquid.
- Sound, good quality fruit will always clarify and filter with better results than poor quality fruit.

Pressure and Flow

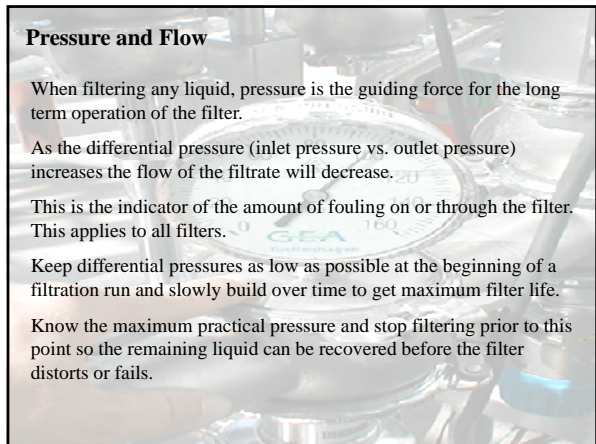
When filtering any liquid, pressure is the guiding force for the long term operation of the filter.

As the differential pressure (inlet pressure vs. outlet pressure) increases the flow of the filtrate will decrease.

This is the indicator of the amount of fouling on or through the filter. This applies to all filters.

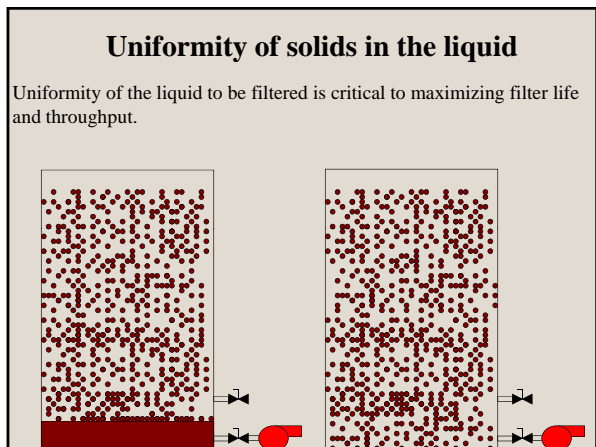
Keep differential pressures as low as possible at the beginning of a filtration run and slowly build over time to get maximum filter life.

Know the maximum practical pressure and stop filtering prior to this point so the remaining liquid can be recovered before the filter distorts or fails.



Uniformity of solids in the liquid

Uniformity of the liquid to be filtered is critical to maximizing filter life and throughput.



Diatomaceous Earth Filtration

Deposits are mined from chalk like sedimentary rock of single-celled aquatic plant life known as diatoms. The fossilized diatom structure are delicate perforated shapes excellent for the capture of fine solids.

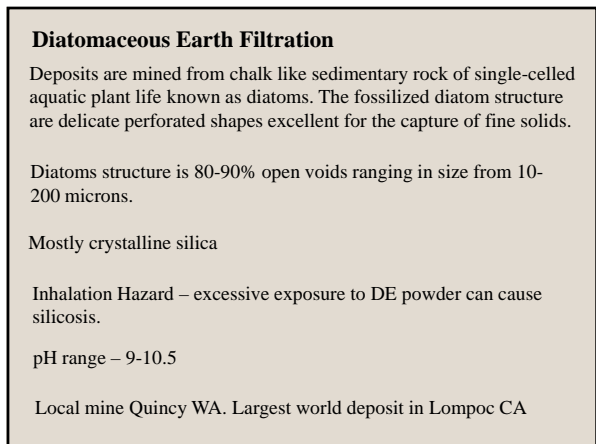
Diatoms structure is 80-90% open voids ranging in size from 10-200 microns.

Mostly crystalline silica

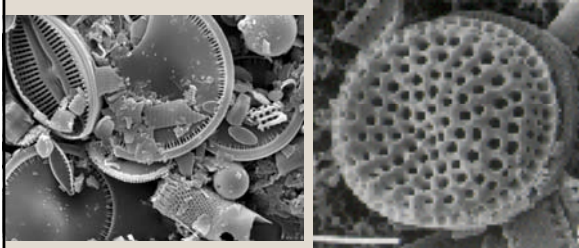
Inhalation Hazard – excessive exposure to DE powder can cause silicosis.

pH range – 9-10.5

Local mine Quincy WA. Largest world deposit in Lompoc CA



Close up of Diatomaceous Earth - DE



Pressure leaf filter

Filtration of low to high solids loading.

Uses a rigid fine mesh screen (septum) to build a DE (diatomaceous earth) filter cake.

Keeping the septum clean improves layering of DE cake and removal of spent filter cake.



Horizontal Screen Filters

Similar in function to pressure leaf DE filter but in a mobile design. Can be used for coarse to polish filtration.

Horizontal screen filters come in a range of sizes to fit the winery or juice plants needs.

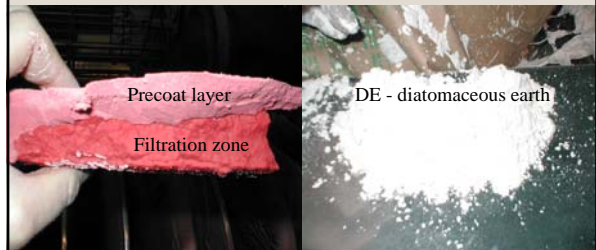


Pressure leaf filter

Clean DE cake is formed on the screen (precoat layer) then the juice or wine with solids are mixed with the DE to form the filtration layer.

Precoat can be put on with a water DE mixture or using filtered juice or wine.

DE comes in several grades from coarse to very fine.



Pad Filters (depth)

Common in small wineries, comes in various sizes and porosity.

Wine has been typically racked to maintain a long filter life.

Surface area depending on # of plates used and the pad filter size and porosity.

Grooves in plate help to distribute flow evenly over filter area.

Can be equipped with a diversion plate for double filtration coarse followed by fine filtration in one pass.



Polish Filtration

Pad Filters (depth)

Surface Filtration – particles are mechanically sieved out near the surface of the sheet.

Depth Filtration – particles are entrapped in the tortuous fibrous random porous structure.

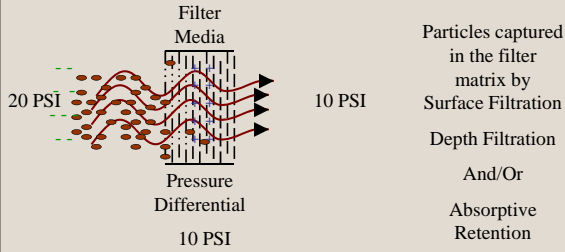
Adsorptive Retention – negative charge particles are attracted and held to the positive charge of the filter sheet.

Filter pads should be rinsed, and sanitized prior to product use.

Use the lowest differential pressure possible to get the the maximum filter life and the desired results without rupturing the filter media.

Perpendicular Flow Filtration

Flow path of wine through a filter media capturing the particulate in the filter pathways.



Polish Filtration

Depth Filters



Gusmer Cellulo - Cellu-Stack Cartridges and Housing



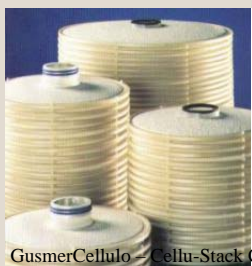
Typical filter sheets

Polish Filtration

Depth Filters

An alternative to the pad filter press, a closed system, minimizes product leakage, low hold up volume, & reduced labor cost.

Higher cost for cellu-stack cartridges than filter pads.



GusmerCellulo - Cellu-Stack Cartridges



Carbac® Cellu-Stack® Filters

Membrane Filters -absolute Sterile filtration

Although pad filters come in a range of pore sizes down to 0.2 micron often a sterile pleated filter are used.

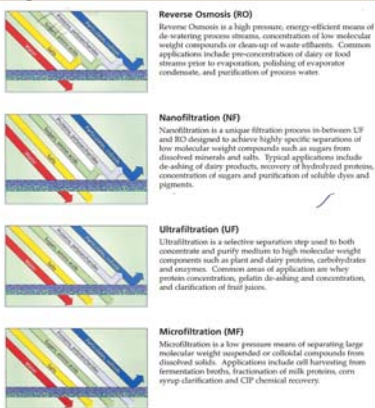
These cartridge filters are typically used just prior to bottling to ensure the wine is free of spoilage organisms.



The pleated design increases the surface area and extends filter life. The membrane may have a cellulose, pre-filter over it to help extend the filter if heavier solids are present. Membrane filters lots are challenged test to ensure sterility but bubble point or diffusion test prior to use is recommended.



Membrane separation – Microfiltration to Reverse Osmosis



Things to remember

- Start with coarse filter pad and then move down to finer filter.
- Start slow and keep your differential pressure low for the longest life.
- Use citric acid to remove the paper taste from pad filtration.
- Follow the manufacture directions for pretreatment of filters.
- Sweet wines typically are filtered to 0.45 micron then through an absolute filter prior to bottling.
- Take your time and do this step correctly.
- Don't pour wine from the drip pan back into your wine (will have a paper taste).
