

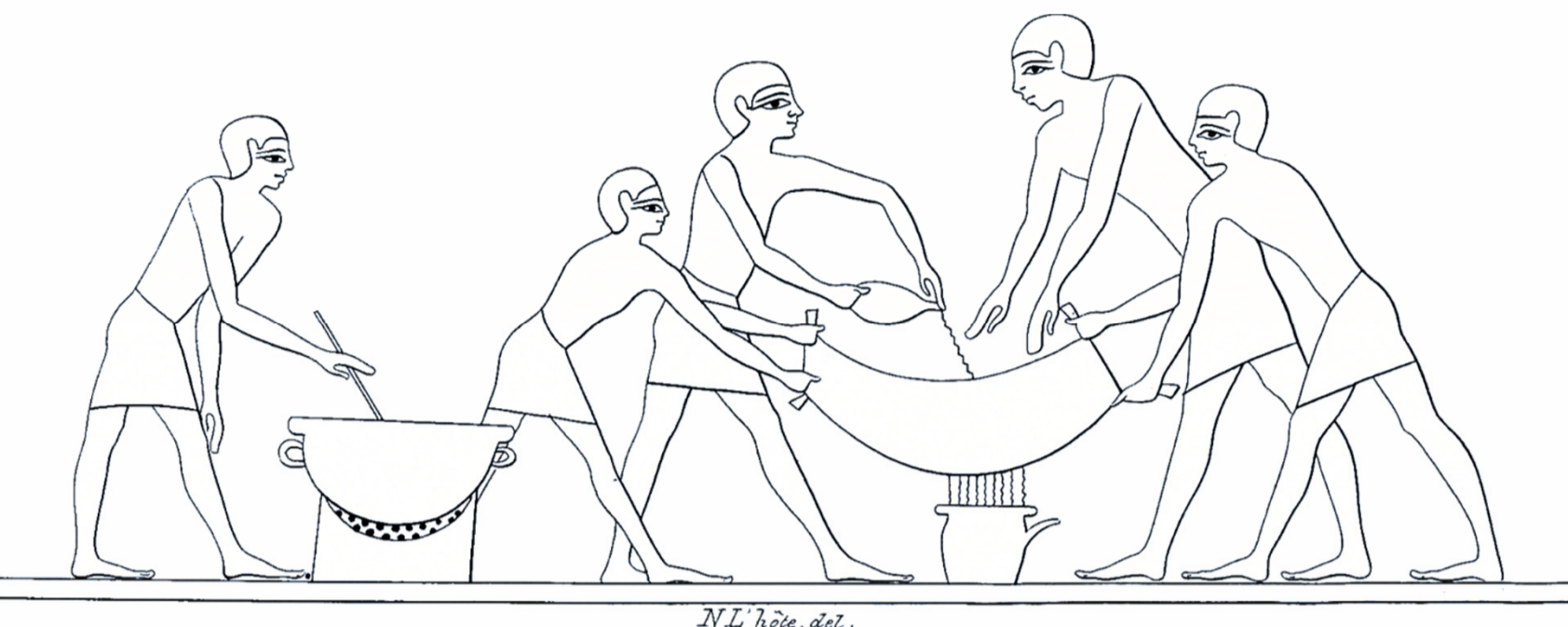
Filtration: past and present



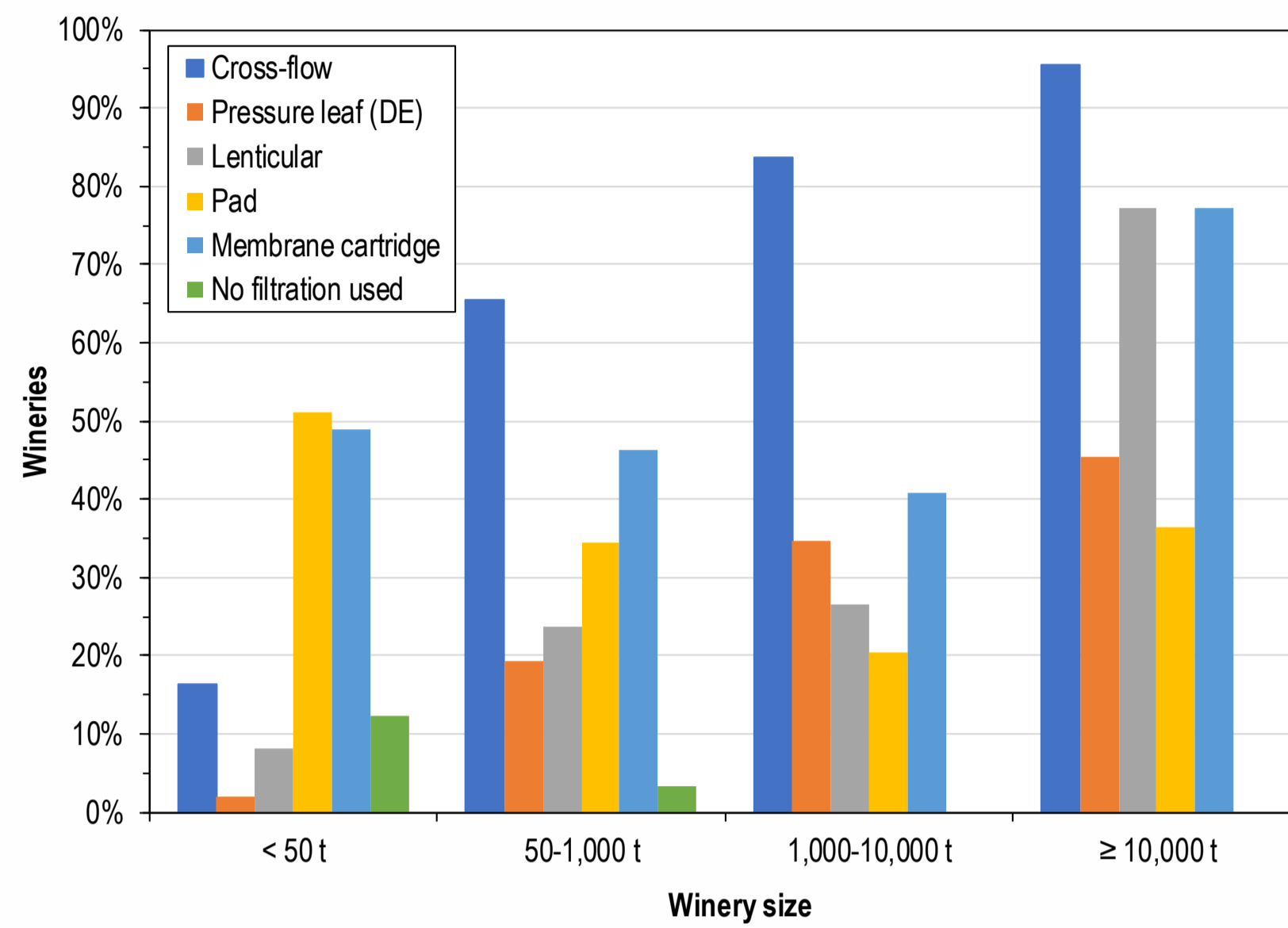
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Crude filtration has been used since ancient times



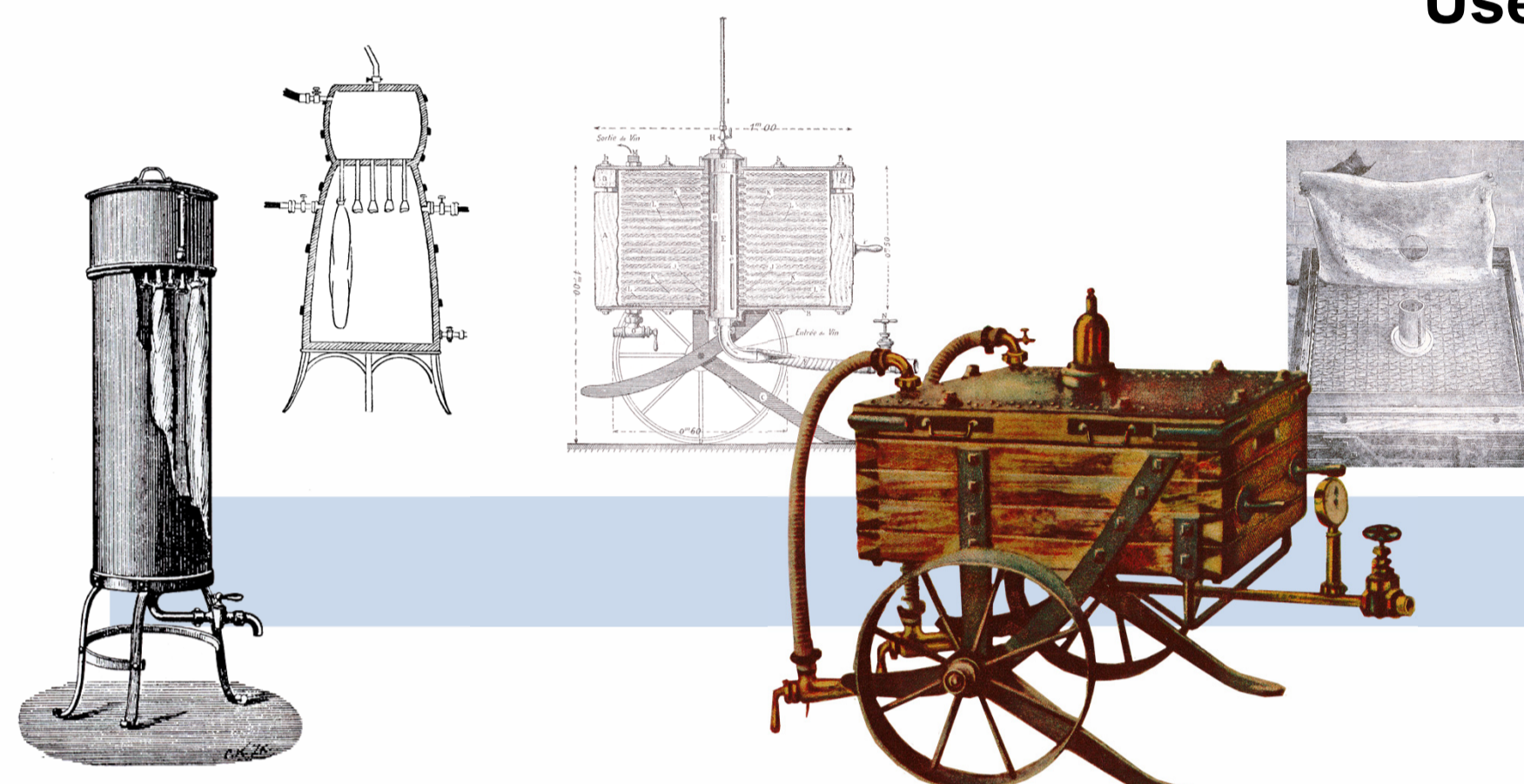
Use of wine filtration methods by Australian wineries in 2016 (excluding lees) (www.awri.com.au/survey)

Collage: French term for fining derived from the Greek word for glue (proteins used for fining were used as glues in the past).



Filtration instead of just fining and settling

Until the late 19th century, most wine was not filtered.

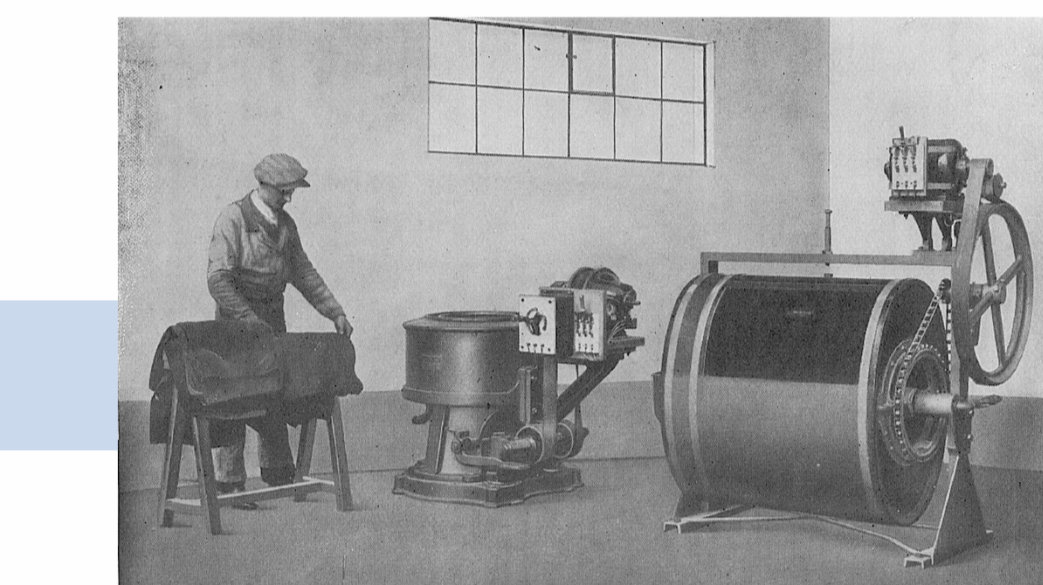


Dutch bag filter

This was the earliest modern era filter. Filtration was via multiple suspended cloth bags. The cleaning of bags was a major issue.

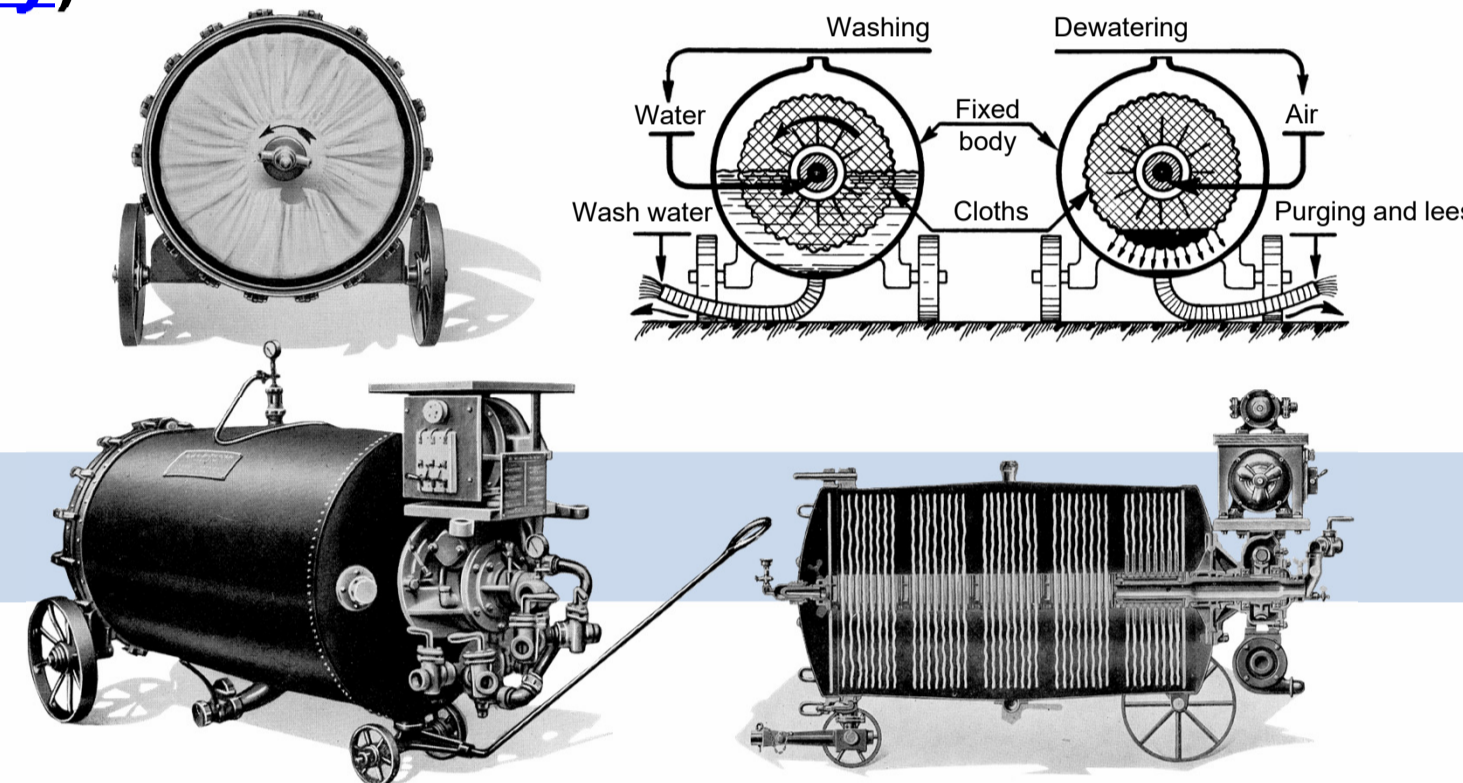
Bordeaux filter

Layers are stacked on top of each other to create extra surface area instead of using suspended bags.



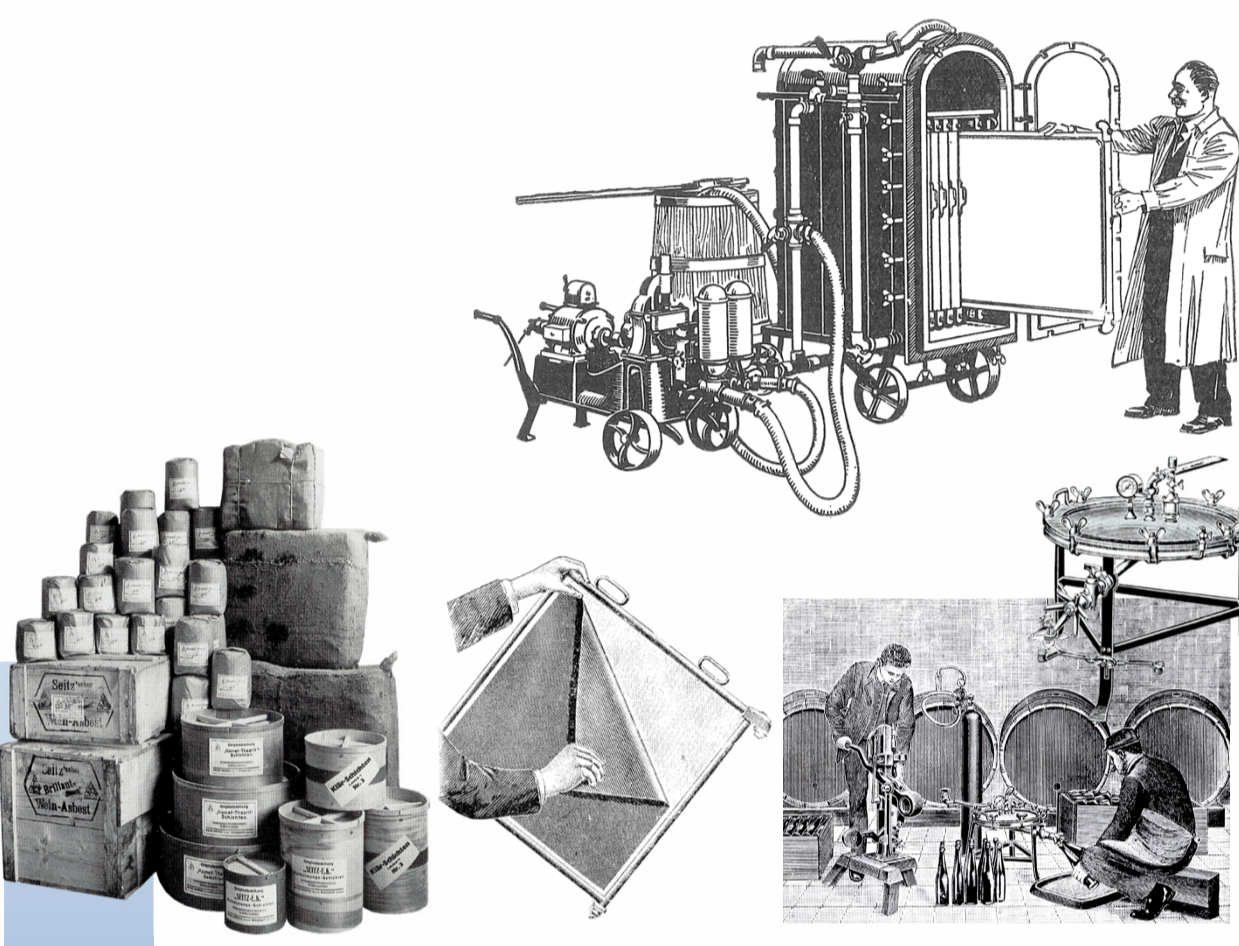
Filter cloth and/or pulp cleaning

Filter disassembly and cleaning of cloths (and cellulose pulp filter aid in some systems) was a major task despite equipment to assist with the process.



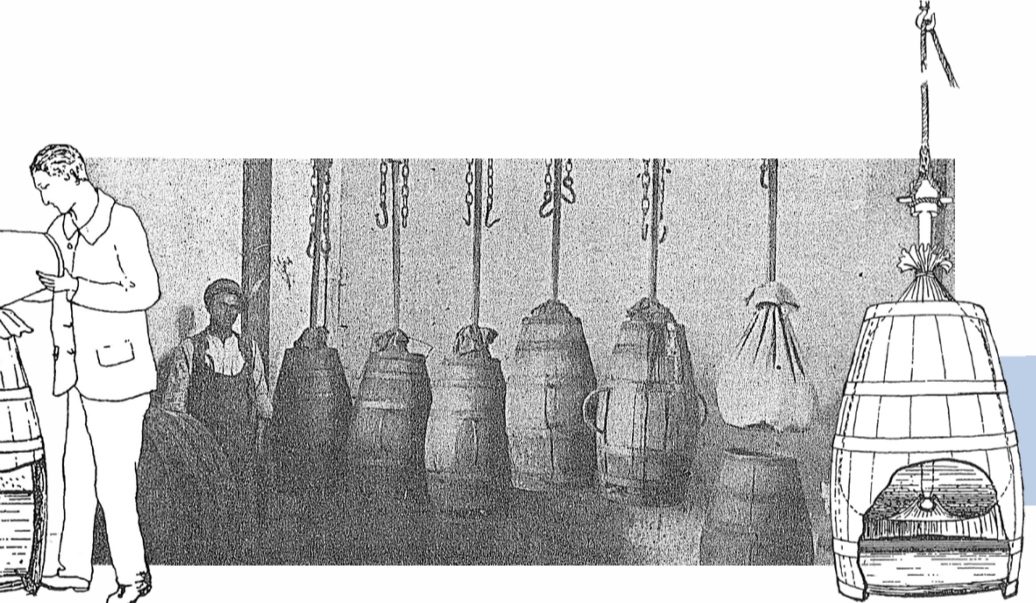
In situ cleaning of filter cloths

Systems were designed that allowed cloths to be cleaned without having to disassemble the filter.



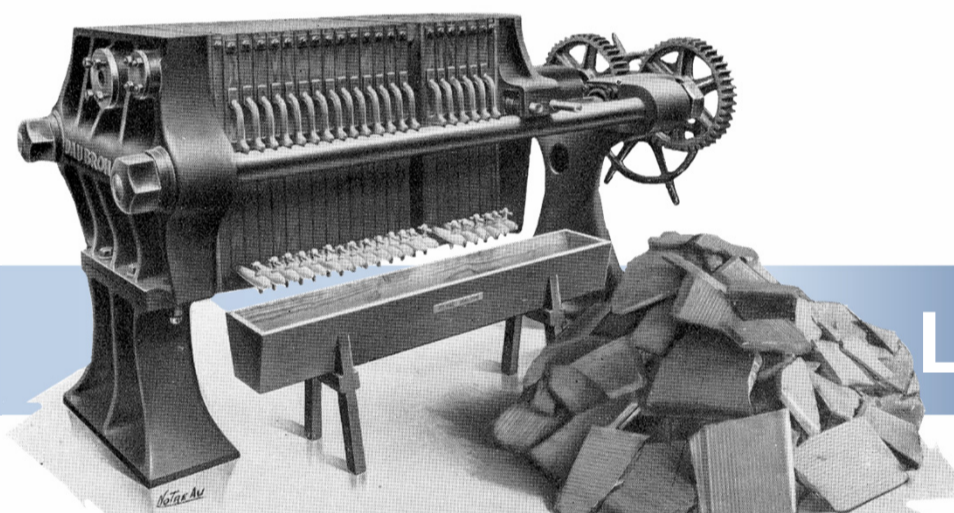
Loose asbestos

The Seitz brothers developed Asbestos as a filter aid in the 1890s. It removed particles by adsorption that were not removed by other filter aids. Despite having been added as a loose material (possibly in combination with cellulose), it formed a mat on the wire support that could easily be peeled off after filtration.



Early lees filtration

Filtration was used on lees before it started to be used on wine. The Sicilian lees filter shown used the weight of a barrel to squeeze the liquid in a bag of lees out into a barrel.



Filter press

A filter press creates lots of surface area by dividing the feed up into different layers. It also provides a convenient way of discharging the cake - by releasing the pressure when finished.



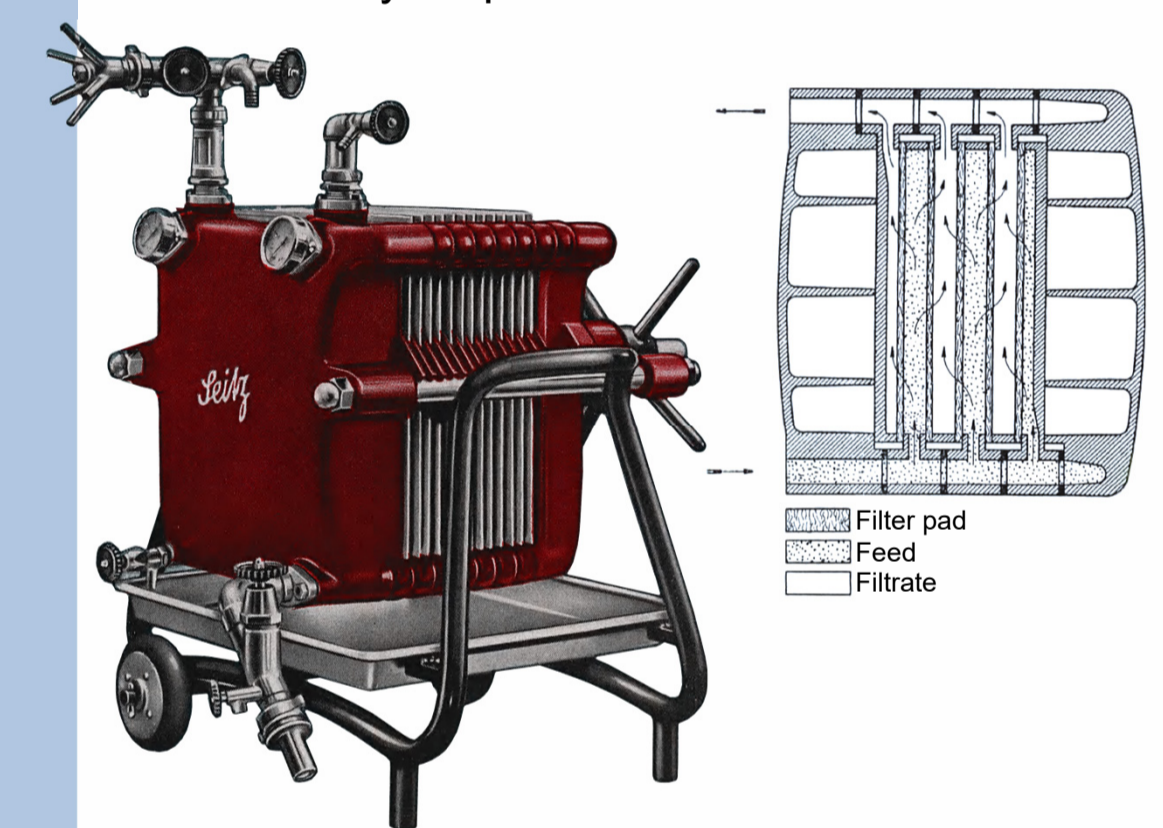
Rotary drum vacuum filters

Rotary drum vacuum filtration (RDVF) was introduced to the wine industry in the 1970s for lees reprocessing, although these filters had been used in other industries since the early 20th century. Other industries often used a design with a continuous cloth belt to support the filter aid rather than the fine stainless mesh on modern wine industry RDVFs. The RDVF is very effective at quickly processing thick lees with quite low labour requirements, but it can result in product oxidation and dilution. Initially diatomaceous earth was used as the filter aid, but later perlite became more common.

Asbestos-free pads

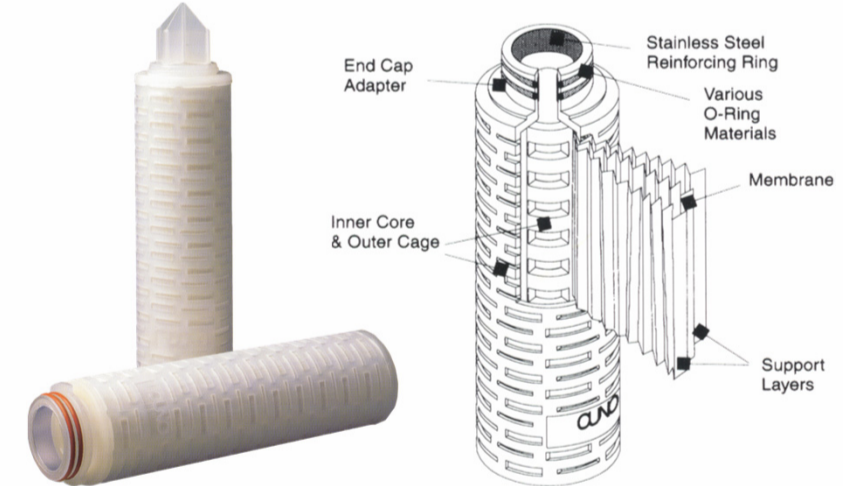
Public health concerns about the use of asbestos led to filter manufacturers developing alternatives in the 1970s. These consisted of combinations of cellulose, diatomaceous earth, and perlite, bonded together with resins that gave them a charge in an effort to mimic that of asbestos.

ASBESTOS FREE



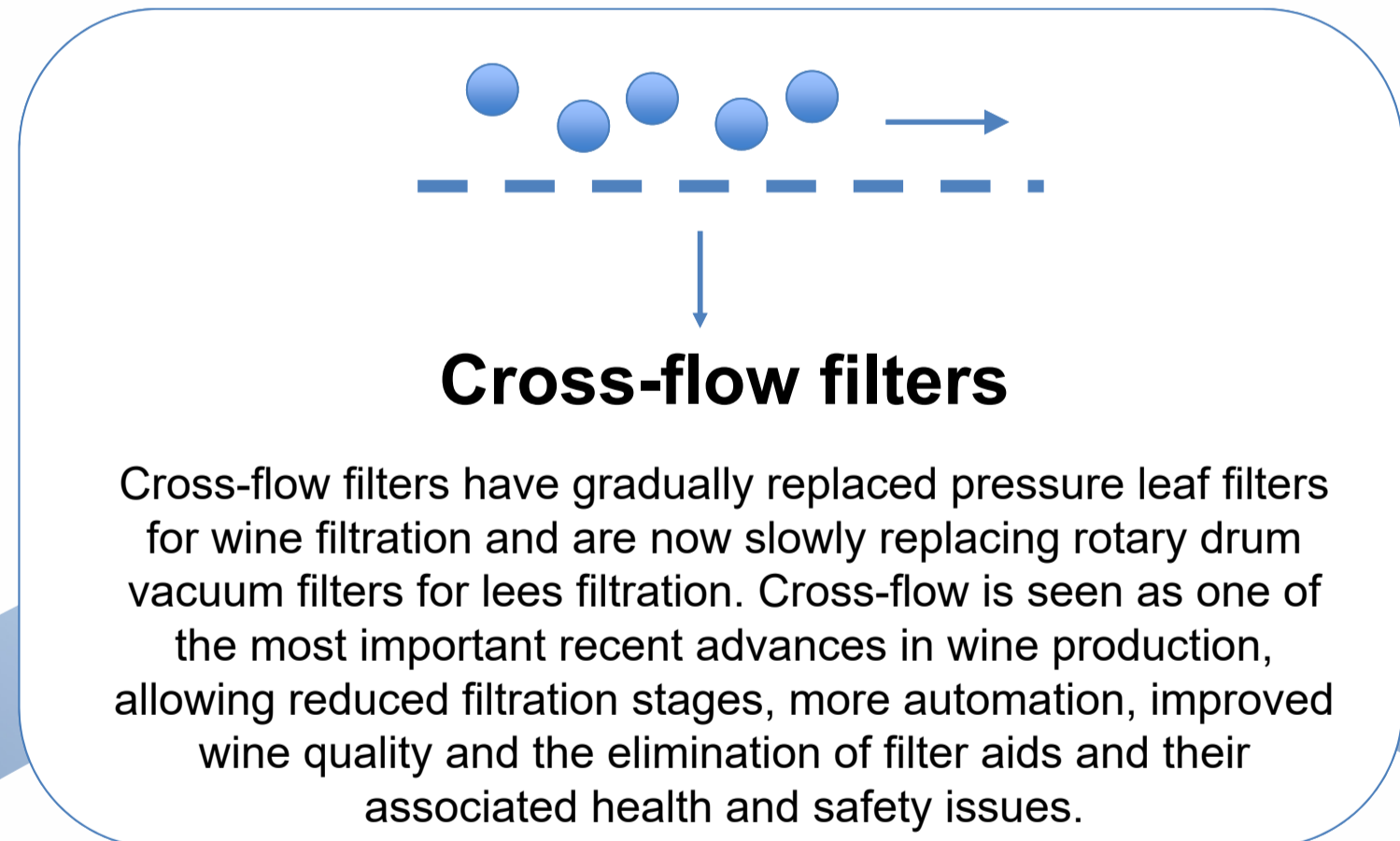
Asbestos pads

Before WW1, cellulose-asbestos filter pads were developed that allowed sterile filtration of drinking water. These were perfected and sold for juice and wine filtration from the 1920s. Pad filters allowed different levels of filtration depending on the asbestos level in the cellulose-asbestos pads. Seitz EK grade asbestos filter pads allowed for sterile filtration. Additional frames were available if diatomaceous earth filtration was to be performed on the same equipment.



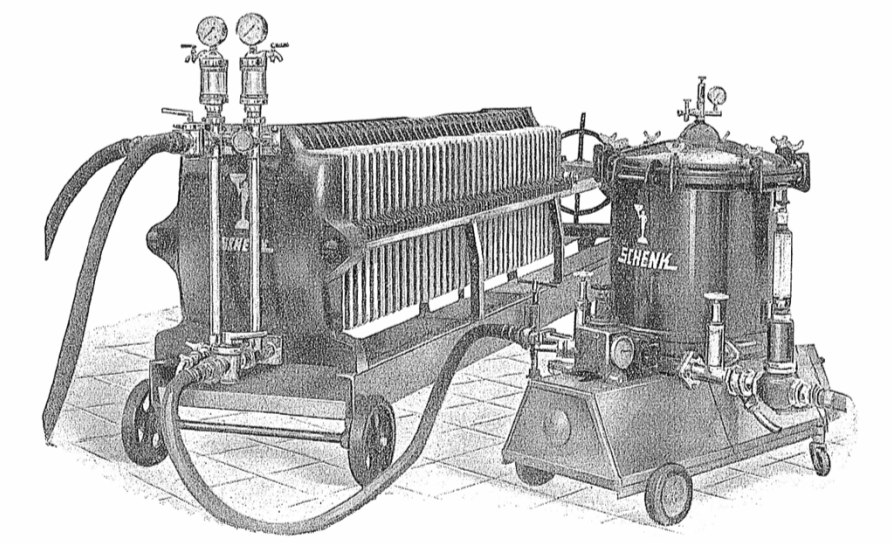
Membrane cartridges

Membrane microfiltration had mainly been a laboratory technique until the development of pleated membrane cartridges by Gelman in the 1970s. These made industrial applications feasible as the pleats maximise the surface area in each cartridge and the cartridge format is easy to manage. Membrane cartridges are mainly used as a safety filtration, rather than for removing many solids.



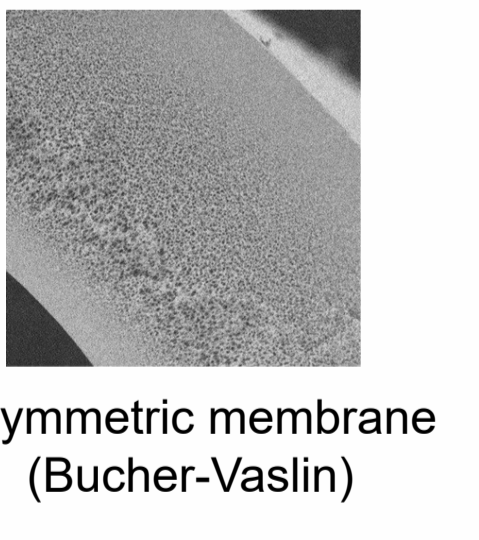
Lenticular modules

Lenticular modules are an evolution of pad filtration, in a more user-friendly and closed system. Service life is extended because the pads can be cleaned and stored *in situ* after use.

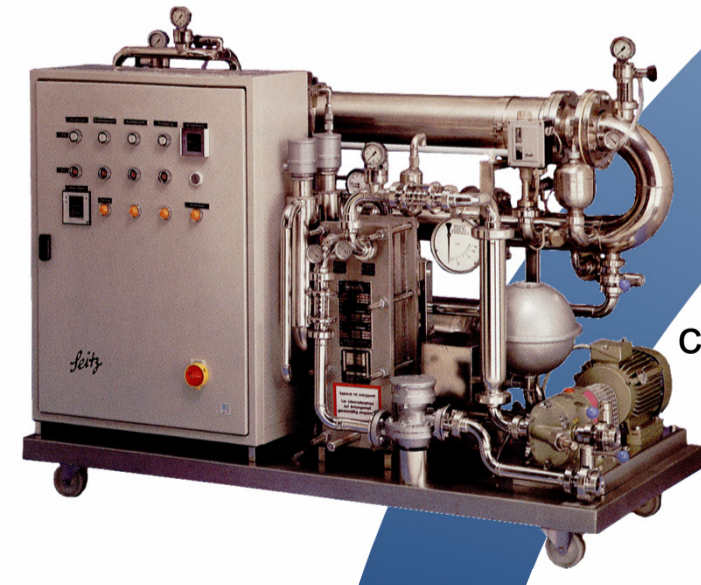


Body feed

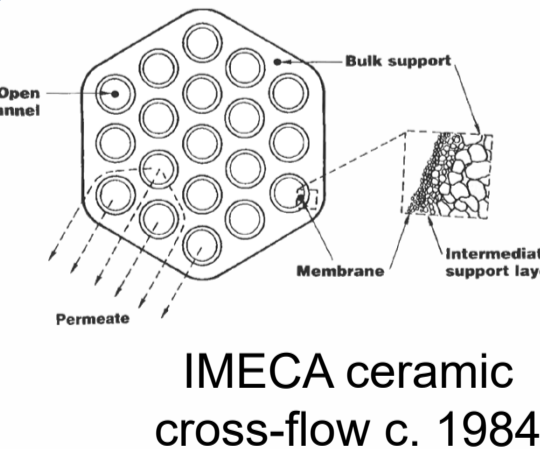
Traditionally a wine was just fined or a pre-coat was added to a filter (e.g. cellulose or asbestos) before filtration. The adoption of continuous dosing of a body feed of diatomaceous earth extended the filtration cycle length by continually providing fresh unfouled filter cake. This technique was widely adopted from the 1950s.



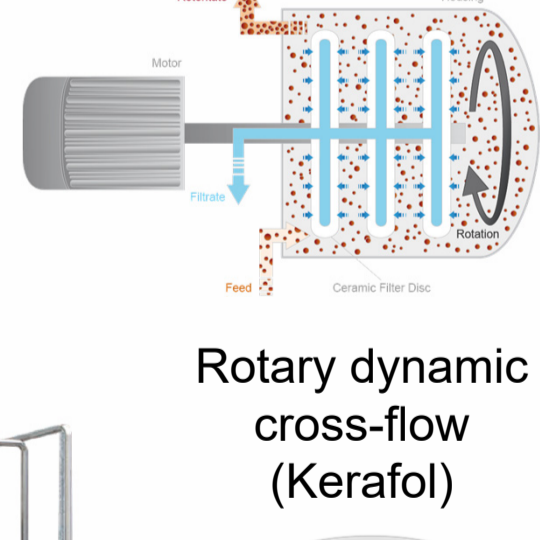
Asymmetric membrane (Bucher-Vaslin)



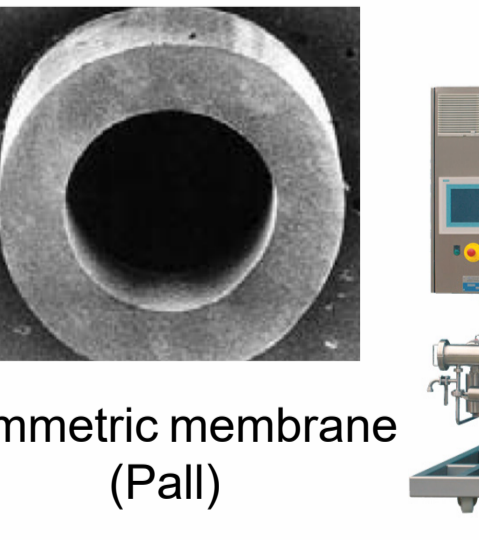
Seitz cross-flow c. 1987



IMECA ceramic cross-flow c. 1984



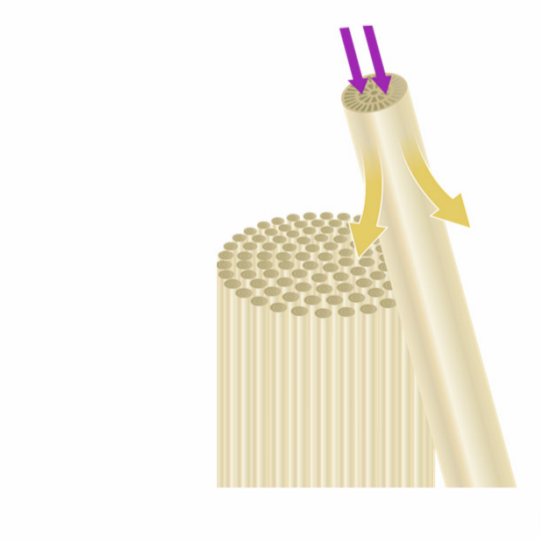
Rotary dynamic cross-flow (Kerafol)



Symmetric membrane (Pall)



Modern Pall cross-flow



Modern Della Toffola ceramic cross-flow

Polymeric cross-flow membranes

Polymeric cross-flow filters have been widely adopted in Australia for wine filtration. Modules with capillaries are standard. Variants suitable for processing lees with bottom-up instead of top-down flow and wider diameter capillaries are now also being used.

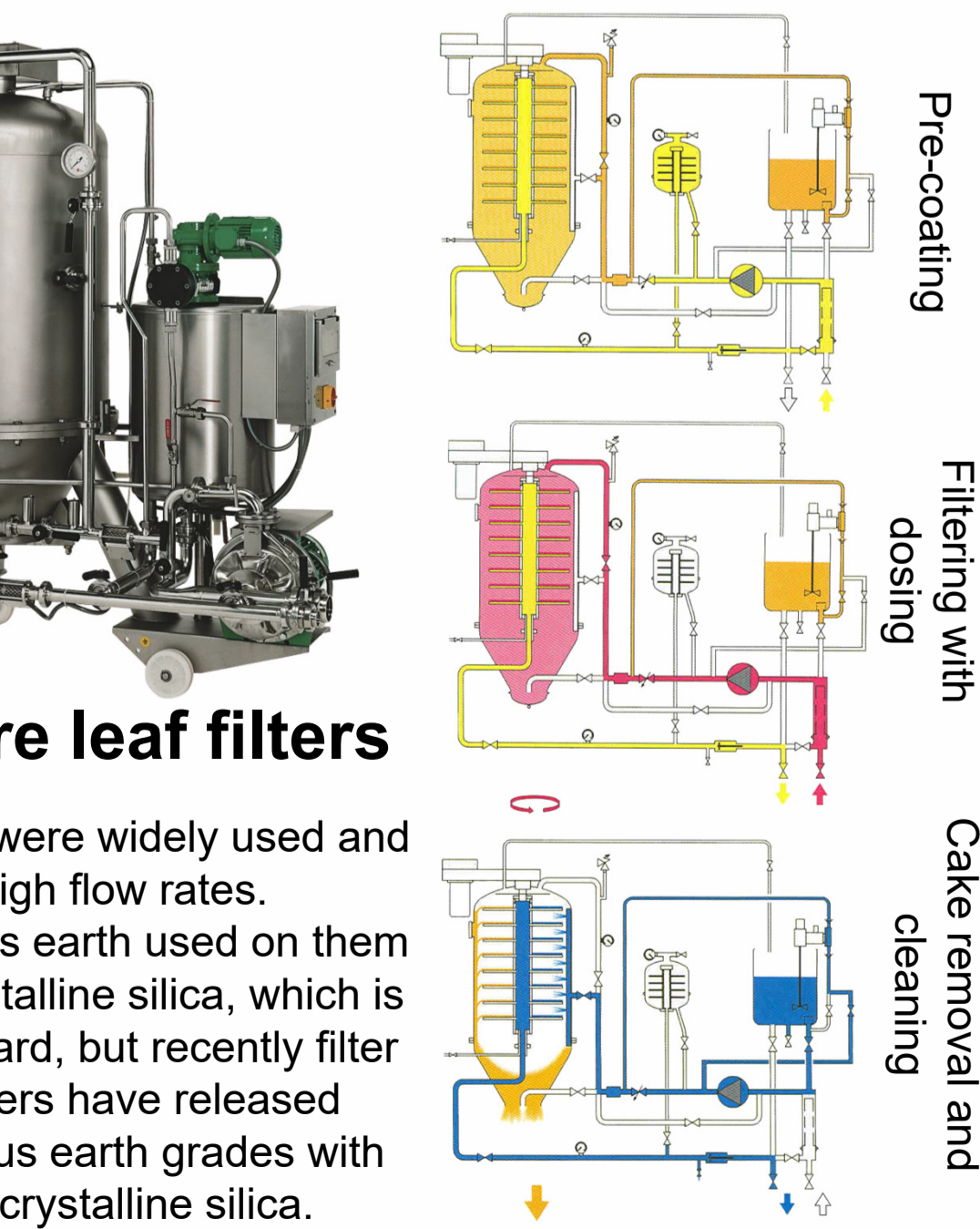
Ceramic membranes were developed in France for uranium enrichment in the 1950s. In the 1980s, the technology was adapted to other applications including wine clarification. Ceramic elements are multi-channel with filtrate passing through an active layer into a supporting structure and then out of the element. Units with different channel diameters are available to facilitate wine and lees processing. Rotary ceramic filters are also available that generate cross-flow action by rotation of the filtration surface rather than by pumping liquid through a channel across the surface.

Metallic cross-flow membranes

Wide-bore cross-flow filters with a stainless steel support structure and titanium dioxide filter layer have been sold by Graver and used in several brands of lees filtration equipment. More recently, filters with a titanium support structure and a titanium active layer have been developed, aimed at both wine and lees processing. It is of interest to see how well they perform, as if successful they could be a major step forward.

Pressure leaf filters

These filters were widely used and give high flow rates. Diatomaceous earth used on them contains crystalline silica, which is a health hazard, but recently filter aid suppliers have released diatomaceous earth grades with minimal crystalline silica.



Acknowledgements: Winery staff and suppliers that provided information and the AWRI library.

Article: This poster is a summary only - a more detailed article may be written in the future.

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