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Pressure Leaf Earth Filtration

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There are many different versions of earth filtration in a pressure vessel, with the most common types being pressure leaf filtration and candle filtration.

Fig 1. A Padovan horizontal plate earth filter.

This type of filtration was developed in the 1940's, and is still widely in use today. Certainly the advent of crossflow filtration has reduced the need for these filters, but their cost effectiveness and ability to change filtering medium still make them a viable option for many applications. The biggest drawback when compared to crossflow filtration is the use of a filtering medium, which is expensive not only to purchase but often in its disposal, and may also pose a health risk. The advantage of earth however is that you can change the filtering medium depending on your product.

Pressure leaf filtration has predominated in the wine industry, whereas the beer and industrial sectors have often tended towards candle filtration.

These machines are used for filtering products that tend to be relatively low in solids content. For products that have high solids then units such as rotary drum vacuum filters need to be used.

Filtering Principle:

Pressure leaf filters use a basic principle on which a "precoat" is produced on a support structure, and this then becomes the filtering medium. This precoat is usually made of either diatomaceous earth or perlite (commonly termed d.e), and a base precoat of a more fibrous nature (such as cellulose) is employed to provide a more stable structure. During filtration, more d.e is added into the system to stop the filtration

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surface from blocking. Diatomaceous earth and perlite tend to be roughly spherical in shape, so the fibrous material provides an interlocking support structure that is less susceptible to movement.

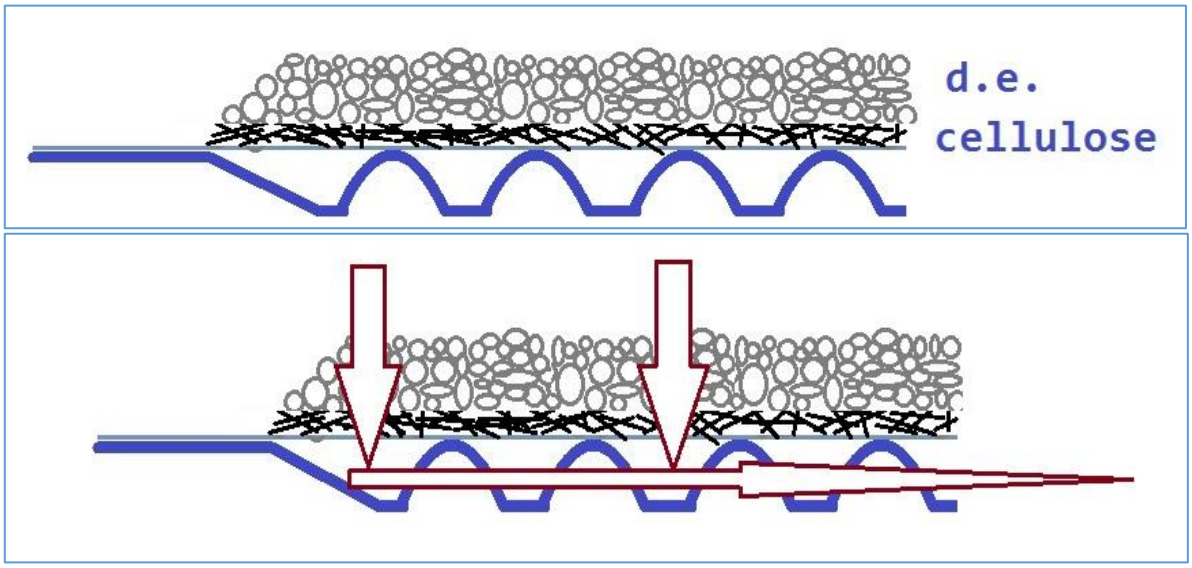

Fig 2. How precoat is applied to a filtration plate and the direction of filtrate flow

In pressure leaf filtration, the filtering plates are either horizontally or vertically mounted plates with a relatively fine mesh (usually 65 – 80 micron) covering the surface. In both instances it is a differential pressure that holds the medium onto the filtration screen. Vertical plates allow for this medium to be applied to both sides of the filter plate (allowing a smaller machine for a higher filtration area) however they are also susceptible to losing their medium if the pressure is even momentarily lost. Horizontal screens can tolerate pressure loss but only the upper surface of the filtration plate can be used.

Once the base precoat has been formed, the filtration process can be started. While filtering a continuous stream of d.e. must be added to the chamber in order to stop blocking. Without the addition of d.e during the filtration process, the surface of the precoat would simply block with the solids from the product.

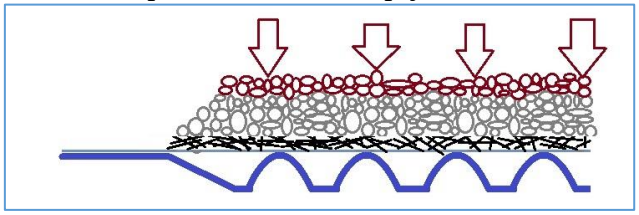

Fig 3. The filtering surface would completely block without the addition of d.e.

The dosing rate of d.e. can be adjusted, so for a product that has very low solids content, the amount of dosing would be minimal. For a product that has a higher solids content then the dosing rates would be higher.

During filtration there is a steady increase in the pressure required to force the filtration. When using these filters the operator should try and achieve a steady rate of increase in the filtration pressure. If too much d.e. is added during filtration, there will be very little pressure increase and the filtration will need to be stopped prematurely as there is a finite amount of d.e. that can be added. If the pressure increase is

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too fast, then the filtration will stop early due to maximum working pressure of the machine being reached. The ideal scenario is that filtration is completed when the maximum amount of d.e. added coincides with the maximum pressure achieved in the chamber.

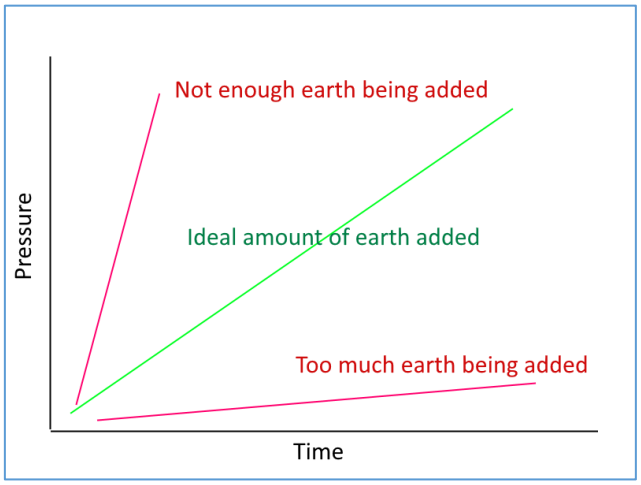

Fig 3. Pressure Vs Time for an earth filter.

At the end of filtration, the chamber will still be full of product. Often these machines have residual (or scavenger) filters that allow you to filter the chamber contents, thereby reducing your losses.

Once the residual product has been recovered, the machine must be emptied of all d.e. and a washing cycle initiated in order to clean the screens.

Development:

In essence, this type of filtration has not changed much since its original design. Machines supplied in the 1960's are very similar in construction to today's machines, with perhaps the exception of more advanced systems for d.e. removal and dosing. The nature of the filtration method doesn't really lend itself to improvements in design as it is extremely simple and reliable.

Crossflow filtration does provide the opportunity to replace earth filtration in many instances, however for these reasons the earth filter will still be viable for many years to come:

1. Relatively inexpensive to purchase
2. Higher flowrates per square metre
3. Ability to change the filtering medium from coarse to fine

Ridgelea has been supplying Padovan filters into the Australian Wine Industry for over 30 years, with machines ranging in size from 2 square metres up to 80 square metres.