Filter press

Filter presses are sometimes called "Plate-and-Frame Filters" which describes the style of filters developed from the 1800's onwards. The majority of today's filters are more correctly called "Membrane Plate Filters".

Many processes in the food, chemical or pharmaceutical industries make products that are liquid-solid suspensions or slurries. These mixtures are a little like a runny mud or milk-shake. The solids in them do not dissolve in the liquid but are carried along in it. Filter presses separate the solids from the liquids so that the useful part can be processed or packaged.

Filter presses generally work in a "batch" manner. They are loaded with slurry before completing a filtering cycle and producing a batch of solid filtered material, called the filter "cake". The solid is removed, the press re-loaded with slurry and the batch cycle repeated.

A filter press uses increased pressure to maximise the rate of filtration and produce a final solid with a low water content. This is more efficient than filtration using a funnel and paper which utilises the low pressure caused by the weight of liquid above the filter paper.

Filter press operation

A filter press consists of a series of chambers containing square or rectangular filter plates supported in a frame. Once the filter chambers are loaded with slurry, the plates are forced together with hydraulic rams that generate pressures typically in the region of 100 pounds per square inch (70,000kg per m^2). For comparison, a car tyre would be inflated to around 30 pounds per square inch.

Each plate is covered by a material or membrane that acts as the initial filter when the press is in operation. As the solid filter cake builds up, the cake adds to the removal of fine particles. The solution coming through the filter, called the filtrate, will be very pure. If it is not wanted the filtrate can be drained away for safe disposal.

At the end of the compression, the solid filter cake can be removed. The whole process is often computer controlled to make it automatic or semi-automatic.

Applications

Foods industry	Vinegar	Fruit juice
	Honey	Soft drinks
	Water	Edible oil
Chemicals	Paints	Pigments
	Varnish	Lubrication oils
	Polishes	Ink
Pharmaceuticals and Cosmetics	Syrups	Soap
	Hand lotion	Proteins
	Shampoo	Perfume

Classroom contexts
These questions may provoke some discussion, or suggest further activities, within the classroom. Scroll down below the curriculum links for some suggested answers.

- Why do companies use filter presses rather than funnels and paper?
- Why do solid particles not go through the filter cloth or membrane in the filter press?
- A filter press contains many filter elements in the "filter stack". How does this make the press more efficient?
- Filter presses are used in the food industry. What are the types of things that might be filtered before they are bought?

Links to the Primary Science National Curriculum

Key stage 2

Sc3 - 3c (Materials)	How to separate insoluble solids from liquids by filtering.

Why do companies use filter presses rather than funnels and paper?
There are two main reasons. Firstly, the volumes used are generally very much larger than ever used in the classroom. It would be impractical to build a big enough filter funnel.
Using the press is also more efficient. The increased pressure in the press means that the solution is filtered a lot more quickly. A filter funnel relies on the pull of gravity to draw the liquid through the filter. This very quickly slows to a drip as the solid begins to build up on the filter paper.

Why do solid particles not go through the filter cloth or membrane in the filter press?
The solid part of the solution contains molecules that are too big to fit through the filter paper or membrane. It acts a little like a sieve. The liquid can easily pass through as the molecules are very small.

A filter press contains many filter elements in the "filter stack". How does this make the press more efficient?
By using many separate elements in the filter press it gives a large surface area for the filtering to happen over.

Filter presses are used in the food industry. What are the types of things that might be filtered before they are bought?
There are lots of things that would not be very pleasant to eat if they were "lumpy". The examples given earlier included: vinegar, honey, water, fruit juice, soft drinks, edible oil.