Water Filtration

- Filtration is used to separate nonsettleable solids from water and wastewater by passing it through a porous medium
- The most common system is filtration through a layered bed of granular media, usually a coarse anthracite coal underlain by a finer sand.

Water Filtration

Filters may be classified according to the types of media used as follows:

- ***Single-media filters***: These have one type of media, usually sand or crushed anthracite coal.
- ***Dual-media filters***: These have two types of media, usually crushed anthracite coal and sand.
- ***Multi-media filters***: These have three types of media, usually crushed anthracite coal, sand, and garnet.

Water Filtration

Filters may be classified according to the types of media used as follows:

Water Filtration

- In water treatment all three types are used; however, the dual- and multi-media filters are becoming increasingly popular.
- Particle removal is accomplished only when the particles make physical contact with the surface of the filter medium.

Water Filtration

- Filtration was actually developed prior to the discovery of the germ theory by Louis Pasteur in France.
- Louis Pasteur (1822 - 1895) was a French chemist and microbiologist.
- He is remembered for his remarkable breakthroughs in the causes and preventions of diseases.

Water Filtration

- In the 1700s, the first water filters for domestic application were applied. These were made of wool, sponge, and charcoal.
- In 1804, the first actual municipal water treatment plant designed by Robert Thom, was built in Paisley, Scotland.
- The water treatment was based on slow sand filtration, and horse and cart distributed the water.
- Some three years later, the first water pipes were installed.

Water Filtration

- Another problem for Thom was to provide a supply of pure, filtered water for domestic use and for sugar refineries which were a major source of employment in the area.
- The slow sand filters then in use were frequently chocked by algal growths, so he devised and built self-cleansing sand filters in which the algal scum could be removed by reversing the direction of flow of the water, a principle still in use today.
- Some three years later, the first water pipes were installed.

Water Filtration

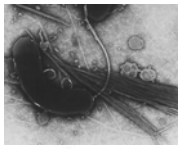
- In 1854 it was discovered that a cholera epidemic spread through water.
- The outbreak seemed less severe in areas where sand filters were installed.
- British scientist John Snow found that the direct cause of the outbreak was water pump contamination by sewage water.
- He applied chlorine to purify the water, and this paved the way for water disinfection.

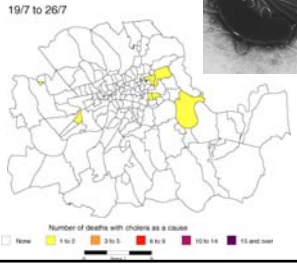
Water Filtration

- John Snow (1813 - 1858) was an English physician and a leader in the adoption of anaesthesia and medical hygiene.
- He is considered to be one of the fathers of epidemiology, because of his work in tracing the source of a cholera outbreak in Soho, England, in 1854.

Water Filtration

Water Filtration



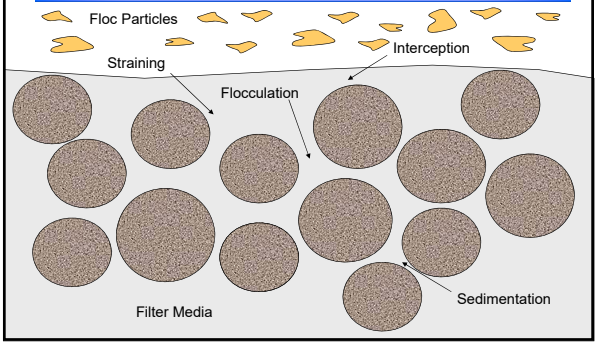


Water Filtration

How does filtration work?

Let's examine the physical and chemical mechanisms of filtration

Water Filtration



Water Filtration

- Larger particles may be removed by straining
- Particles may also be removed by sedimentation
- Others may be intercepted by and adhere to the surface of the medium due to inertia
- Filtration efficiency is greatly increased by destabilization or coagulation of the particles prior to filtration

Water Filtration

Gravity Granular-Media Filtration

- Gravity filtration through beds of granular media is the most common method removing colloidal impurities in water processing
- Initially, surface straining and interstitial removal results in accumulation of deposits in the upper portion of the filter media

Water Filtration

Gravity Granular-Media Filtration

- Because of the reduction in pore area, the velocity of water through the remaining voids increases, shearing off pieces of capture floc and carrying impurities deeper into the filter bed
- The effective zone of removal passes deeper and deeper into the filter

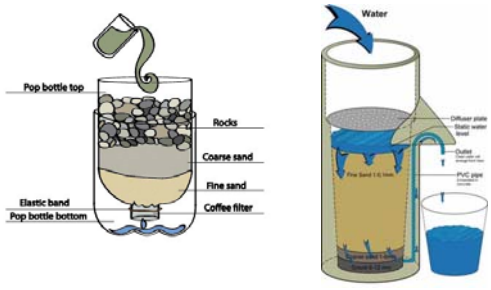
Water Filtration

Gravity Granular-Media Filtration

- Eventually, clean bed depth is no longer available and breakthrough occurs, carrying solids out in the underflow and causing termination of the filter run

Water Filtration

Gravity Granular-Media Filtration



Water Filtration

Turbidity

- Turbidity is a measurement of the clarity of water run
- Clouded water is caused by suspended particles scattering or absorbing the light
- Turbidity is an indirect measurement of the amount of suspended matter in the water

Water Filtration

Turbidity

Water Filtration

Turbidity

- However, since solids of different sizes, shapes, and surfaces reflect light differently, turbidity and suspended solids do not correlate well.
- Turbidity is normally gauged with an instrument that measures the amount of light scattered at an angle of 90° from a source beam.
- The units of turbidity are usually in Nephelometric Turbidity Units (NTU).

Water Filtration

End of Part 2

Any Questions?