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.

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.

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.

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.

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.
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 choked 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.

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.

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.

How does filtration work?

Let’s examine the physical and chemical mechanisms of 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

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

- 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

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

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.

- 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).

End of Part 2
Any Questions?