

Sedimentation

Sedimentation is a physical water treatment process used to settle out suspended solids in water under the influence of gravity.

Basics

Suspended solids (or SS), is the mass of dry solids retained by a filter of a given porosity related to the volume of the water sample. This includes particles of a size not lower than 10 μ m.

Colloids are particles of a size between 0.001 μ m and 1 μ m depending on the method of quantification. Due to electrostatic forces balancing the gravity, they are not likely to settle naturally.

The limit sedimentation velocity of a particle is its theoretical descending speed in clear and still water. In settling process theory, a particle will settle only if:

1. In a vertical ascending flow, the ascending water velocity is lower than the limit sedimentation velocity.
2. In a longitudinal flow, the ratio of the length of the tank to the height of the tank is higher than the ratio of the water velocity to the limit sedimentation velocity.

There are four types of sedimentation processes:

- Type 1 - Dilute, non-flocculent, free-settling. (Every particle settles independently.)
- Type 2 - Dilute, flocculent. (Particles can flocculate as they settle.)
- Type 3 - Concentrated Suspensions, Zone Settling (Sludge Thickening).
- Type 4 - Concentrated Suspensions, Compression (Sludge Thickening).

Applications

Potable Water Treatment

Sedimentation in potable water treatment generally follows a step of chemical coagulation and flocculation, which allows grouping particles together into flocs of a bigger size. This increases the settling speed of suspended solids and allows settling colloids.

Waste Water Treatment

Sedimentation is often used as a primary stage in modern waste water treatment plant, reducing the content of suspended solids as well as the pollutant embedded in the suspended solids. Due to the large amount of reagent necessary to treat domestic wastewater, preliminary chemical coagulation and flocculation are generally not used, remaining suspended solids being reduced by following stages of the system. However, coagulation and flocculation can be used for building a compact treatment plant (also called a "package treatment plant"), or for further polishing of the treated water.

In the Activated Sludge treatment process, flocs being created through biological activity are collected in sedimentation tanks, generally referred to as Secondary Clarifiers or Secondary Sedimentation Tanks.

Technology

Sedimentation tanks can be of different shapes, often rectangular or circular. They are sized in order to have an optimal sedimentation speed. If sedimentation speed is too high, most particles will not have sufficient time to settle, and will be carried with the treated water. If the speed is too low, the tanks will be of an excessive size.

As turbulence is a damaging factor leading settled particles to go back in suspension, several devices are used to ensure a quiet flow, such as carefully designed water inlet with baffles.

Sedimentation may be made more efficient by the use of stacks of flat pieces that slope slightly upwards in the direction of flow, called lamellar separators. They are parallel and separated by a small distance.

These structures work in two ways:

1. They provide a very large surface area onto which particles may fall and become stabilized.
2. Because flow is temporarily accelerated between the plates and then immediately slows down, this helps to aggregate very fine particles that can settle as the flow exits the plates.

The use of lamellar separators may allow the use of a smaller sedimentation tank and may enable finer particles to be separated. Typically such structures are used for difficult-to-treat waters, especially those containing colloidal materials.

References:

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2. [^] [^] [^] U.S. Environmental Protection Agency (EPA). Washington, DC (2004). ["Primer for Municipal Wastewater Treatment Systems."](#) Document no. EPA 832-R-04-001.
3. [^] EPA. Washington, DC (2000). ["Package Plants."](#) Wastewater Technology Fact Sheet. Document no. EPA 832-F-00-016.

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