Water treatment is the process of making water ready for human use. While there are several critical aspects, sedimentation water treatment is of particular importance. It is essential to understand the whole water treatment process in order to ensure the process is completed safely and efficiently for the general public.

Sedimentation

Sedimentation is the process of separating small particles and sediments in water. This process happens naturally when water is still because gravity will pull the heavier sediments down to form a sludge layer. However, this action can be artificially stimulated in the water treatment process. This mechanical assistance is called thickening.

Why Is Sedimentation Used?

The sedimentation process is used to reduce particle concentration in the water. The advantage of sedimentation is that it minimizes the need for coagulation and flocculation. Typically, chemicals are needed for coagulation and flocculation, but improved sedimentation controls the need for additional chemicals. Additionally, sedimentation can be used after coagulation to increase the effectiveness of ongoing filtration in the process.

Technical Aspects of Sedimentation

Although sedimentation is an accepted process within the water treatment industry, it is still theoretical. The process can be varied depending on the concentration of particles. For example, small concentrations often settle unhindered or without mechanical assistance. As concentrations increase, there are more hindrances to settling and additional support will be needed to aid the process.

Types of Sedimentation Tanks

Sedimentation water treatment requires the use of specialized tanks. A sedimentation tank provides the necessary support to make sure that the particles settle. Sedimentation will happen naturally over time, but water treatment requires a tank to streamline the process.

Horizontal Flow Tank

Horizontal flow tanks are the simplest option. These rectangular tanks allow water to flow horizontally, ensuring that particles are separated from the water during the movement through the tank. This way, the sediment has been collected

before the water leaves the far end of the tank. The tank is equipped to clean the sediment out periodically in order to allow the process to continue.

Multi-Layer Tank

A variation of the horizontal flow tank is the multi-layer tank. The process is still the same in a multi-layer tank. However, multiple decks have been built in the tank. Water is passed from one layer to the next until the sediment is properly separated.

Radial Flow Tank

Radial flow tanks approach this process differently. These tanks are circular, and sediment is moved centrally to be collected and discharged. Radial tanks can be enhanced for flocculation and recirculation in some cases.

Settling Tank

Another tool used for sedimentation is a settling tank. A settling tank is inclined to assist with the collection of sediment. Inclined settling tanks can be unhindered, which means they may work without additional mechanical stimulation. Instead, the process is facilitated by the size of the tank, the depth of the water and the placement of the inclined plates at the bottom. The flow of the water can move in multiple directions depending on the sedimentation needs.

Ballasted Sedimentation

Ballasted sedimentation is another option. This is preferred when additional flocculation is needed to help with coagulation. Ballasted sedimentation relies on the application of high molecular weight polymers. These polyelectrolytes are used to increase particle density, which promotes separation. In particular, ballasting agents are used. In most cases, this is a fine sand or Bentonite.

Floc Blanket Sedimentation

Another option is floc blanket sedimentation. These tanks look like inverted pyramids and feature a short vertical section. Floc is circulated in the tank, attracting particles. Eventually, the floc and sediment turn into sludge on the floor. Because of the shape of these tanks, the suspension is moved downward into the pyramid and eventually discharged.

Sirofloc®

Finally, a Sirofloc® process can also be used. This process is used selectively for waters with little mineral turbidity. In a Sirofloc® process, fine magnetite is prepared with high acidity. This attracts certain particles in the water. As water is passed through a magnetic field, the magnetite particles start to clump together. Then, the water is passed through a radial flow tank to allow the magnetite to be collected. One great thing about a Sirofloc® process is that the collected magnetite can then be recycled for a fresh batch.

How Can Cloud-Based SCADA Help With Sedimentation?

Understanding types of sedimentation and the options for a sedimentation tank is only part of the process. Sedimentation is only one aspect of water treatment. In order to facilitate the overall process, cloud-based SCADA software offers critical tools and data measurement capabilities.

SCADA is a supervisory computer system that continuously collects and analyzes data. SCADA systems that operate in the cloud are faster and more efficient, streamlining plant operations. When SCADA is used to oversee sedimentation, the process can be monitored and controlled via the computer system for real-time changes that enhance the process of water treatment.

The Purpose Of Coagulation In Wastewater Treatment

Coagulation plays a vital role in the wastewater treatment process, allowing for solids removal and dewatering, water clarification, lime softening, and sludge thickening.

With the help of other specialized chemicals and mechanical filtration methods, coagulants help companies maintain a consistent and reliable source of clean water to support their industrial processes. Rather than having to pay another company for costly water treatment, coagulants enable efficient, on-site water treatment, providing:

- Long-term process sustainability
- High water reclamation with near closed-loop systems
- Significant cost and efficiency savings

Coagulation

Coagulation is a somewhat simple chemical process that involves bringing insoluble materials together by manipulating the charges of particles, by adding iron or aluminum salts, such as aluminum sulfate or ferric sulfate, to a wastewater stream. The primary purpose of using a coagulant besides removing vary fine particles from suspension is that this process results also in less turbidity of the water, i.e. clearer water.

With coagulants' positive charge, the negatively charged particles in the water are neutralized. This causes the suspended solids in the water to bind together into larger flocs. These larger flocs begin to settle at the base of the water supply. The larger the size of the particles, the quicker the floc settles.

Coagulation helps to remove a number of different pollutants that cause your water to become dirty or toxic, including:

- Organic compounds and certain dissolved organic materials, commonly referred to as Natural Organic Matter (NOM) or Dissolved Organic Carbon (DOC)
- Suspended inorganic precipitates like iron and some metals
- Certain viruses and bacteria

Through coagulation, industrial water supplies are put into the perfect chemical state for easy mechanical filtration. Once the flocs settle at the bottom of your clarifier, equipment like a filter press can then take those larger clumps of aggregated particles and remove them, delivering clean water back into your system.

When used together, coagulants, clarifiers and filter presses offer maximum water reclamation of over 95 percent. With so little water actually discharged with the solids, you can create a nearly closed-loop process.

Types of coagulants used in water treatment

In order to use coagulation in your water treatment, you have to apply coagulants to chemically initiate the process. These specialty chemicals should be formulated to meet your specific water quality application based on a particle analysis of your dissolved/suspended solids.

The biggest factor in selecting a coagulant is choosing between organic and inorganic coagulants.

Organic Coagulants

Organic coagulants are best used for solid-liquid separation. They are also good options to use when trying to reduce sludge generation. Being organic in nature, these coagulants offer the added benefits of working at lower doses and having no effect on the pH of your water.

Organic coagulants are typically based on the following formulations:

- **PolyAMINEs and PolyDADMACs** – These cationic coagulants work by charge neutralization alone and are the most widely used organic coagulants. PolyAMINEs and PolyDADMACs neutralize the negative charge of colloids in your water, forming a spongy mass called a "microfloc." Since they only coagulate through charge neutralization, they don't offer any advantages in regard to the sweep-floc mechanism (explained later with inorganic coagulants).

- **Melamine Formaldehydes and Tannins** – These natural coagulants work somewhat similarly to inorganic coagulants in that they both coagulate colloidal material in the water and also contribute their own precipitated floc. This sweep-floc precipitate can absorb organic materials such as oil and grease while coagulating unwanted particles together in your water. Since the precipitate dewaters everything to low moisture concentration, these coagulants are great for operations that generate hazardous sludge, such as what's found in oil refineries.

Inorganic Coagulants

Inorganic coagulants are typically cheaper than their organic counterparts, making them a cost-effective solution for a broad range of water treatment applications. They are especially effective when used on raw water with low turbidity.

When added to water, inorganic coagulants form aluminum or iron precipitates. These help to clean the water by absorbing impurities in the water as they fall. This process is known as the "sweep-floc" mechanism. However, this can add to

the overall sludge volume that must be treated and removed, so it's not the right choice in every scenario.

The main types of inorganic coagulants include:

- **Aluminum Sulfate (Alum)** – As one of the most common water treatment chemicals used in industrial processes, alum is the go-to coagulant choice for many. Manufactured as a liquid, alum's crystalline form is created when the liquid is dehydrated. It should be noted that alum is mildly hazardous and has similar health effects/corrosion characteristics as diluted sulfuric acid.
- **Aluminum Chloride** – This coagulant works similarly to alum, but it's more expensive, hazardous and corrosive. As such, it's usually only picked as a second choice in processes where alum could not be used.
- **Polyaluminum Chloride (PAC) and Aluminum Chlorohydrate (ACH)** – These inorganic coagulants are best used for more basic water supplies.
- **Ferric Sulfate and Ferrous Sulfate** – While ferric sulfate is more commonly used, both iron coagulants work similarly to aluminum coagulants. Ferrous sulfate is typically a good choice in applications where you need a reducing agent or excess soluble iron ions are required.
- **Ferric Chloride** – Since it is generated as a waste material from steel making operations, ferric chloride is the least expensive inorganic coagulant. However, it's only used in facilities that can handle its reputation as the most corrosive and hazardous inorganic coagulant.

Once you have the right coagulant, you add these chemicals to your dirty water and mix rapidly. That way, the coagulant is quickly and easily circulated throughout the water.

The residuals or by-products of these coagulants generally do not pose a water quality issue, so long as they were applied properly and with the right dosage. This is why having a water treatment expert is key. Professionals who are experienced with wastewater treatment can even set up the coagulation process so that the coagulant chemicals are removed with the floc during filtration.

Flocculation and floatation

Flocculation is a water treatment process where solids form larger clusters, or flocs, to be removed from water. This process can happen spontaneously, or with the help of chemical agents. It is a common method of stormwater treatment, wastewater treatment, and in the purification of drinking water.

One of the requirements for treated water leaving wastewater plants is the removal of suspended solids. Small solid particles affect the colour of the water and carry impurities into our natural water sources like rivers and the ocean.

Phosphorus content must also be limited in wastewater as a release of phosphorus into rivers promotes algae growth. Uncontrolled releases of phosphorus have been known to cause mass die-offs of fish and other aquatic life.

Some industrial applications generate high levels of phosphorus in their wastewater, which may even require pre-treatment before releasing it to wastewater treatment plants.

Cleanawater offers a wide variety of wastewater equipment and solutions. Find out more here.

Working of flocculation

Flocculation is based on a chemical process. It involves adding chemicals to the wastewater in sequence and allowing tiny solid particles to collect together in a larger mass called a floc. As a treatment of wastewater, flocculation is carried out in stages.

STAGE 1

Suspended solid particles in wastewater are negatively charged. In the first stage of flocculation, a coagulant like aluminium sulphate is added to the wastewater. The positively charged coagulant molecules neutralize the negatively charged solid particles suspended in the water. Neutralising these particles paves the way for them to flocculate together into a larger mass.

STAGE 2

The wastewater must be agitated with mixers. High energy mixing is required initially to ensure that the coagulant spreads throughout the water. When flocculation is in progress the mixing energy is reduced to prevent the mass of particles from separating again.

STAGE 3

Once floc is beginning to form, a polymer chemical is added to the wastewater. Polymers bridge the flocculant from micro to macro flocculant, meaning that the mass of particles collecting together gets bigger. This chemical also binds the collected mass together so that it does not easily disintegrate even when the water is slightly agitated.

STAGE 4

After flocculation is complete, the large solid masses can be removed from the wastewater stream. This is done either through settling where the floc drops to the bottom for removal or through the use of filters which capture the floc in the filter material. Care must be taken when cleaning the filters to ensure that the phosphorus rich floc is contained and treated.

flocculation used in waste water

Sydney Water is one of the water authorities in the Australian context that uses flocculation for wastewater treatment. Their specific focus is on removing phosphate in the final stages of treatment. Sydney Water uses sand filters for

removing the floc from treated wastewater. They backwash the filters every 24 hours to remove the accumulated floc. Backwash water is returned to the primary treatment section of the plant where the floc is removed with other solids.

Phosphate enters our wastewater systems from human and animal waste, detergents and food residues. Food and Beverage plants are therefore prime sources of phosphate in wastewater. Flocculation is a key method for the removal of phosphate from this wastewater, which can be done at the Food and Beverage plant itself before discharging wastewater to the sewer.

Cleanawater wastewater solutions

Cleanawater offers a number of solutions for the wastewater industry to help keep wastewater within specification:

Chemical dosing, in particular pH dosing, is a common method of wastewater treatment. Regulations require treated wastewater to be in a neutral pH range when discharged into the environment.

Our dosing systems can be set-up as in-line or in a recirculating configuration. Both alkaline or acid dosing are available to correct for low or high pH respectively. But dual systems can also be installed where there are fluctuations in pH that cross over from alkaline to acid and vice versa at different times.

Disinfection is a process that kills off remaining bacteria in wastewater streams. Cleanawater uses a chlorine-based system to achieve a high level of disinfection.

This protects workers and the general public from potential health hazards associated with unwanted bacteria in the wastewater system. It is particularly important where water is recycled for use.