Wastewater-Primary Treatment

Primary Treatment is defined as a wastewater treatment process that takes place in a rectangular or circular tank and allows those substances in wastewater that readily settle or float to be separated from the water being treated. This process achieves solids separation. The solids readily available to settle to achieve sedimentation will do so in a settling tank referred as a clarifier. On the other hand, solids readily available to float will do so in a flotation tank referred as a ***D***issolved ***A***ir ***F***lotation (***DAF***) Tank.

Facility treatment circumstances often require solids separation to occur fairly efficient and swift, consequently various specific chemicals are usually needed.

Coagulant, flocculent and also pH adjustment chemicals are specific to executing primary treatment processes.

Examples of chemicals used as coagulants are Aluminum Sulfate and Ferric Chloride and examples of flocculent chemicals are polymers.

Potential of Hydrogen (pH) is an expression of the intensity of the basic or acidic condition of a liquid.

A coagulant chemical causes very fine particles to clump to form a floc consisting of clumps of particles that have come together in chemical precipitation processes and forms a cluster. This coagulating process makes

it easier to separate the solids from the liquids by settling, skimming, draining or filtering.

Flocculent chemicals are used to gather together of fine particles after coagulation to form larger particles by a process of gentle mixing.

Solids Separation of Settle-able Solids and Floatable-able Solids:

Separation of Settle-able Solids is known as achieving sedimentation which is the process by which large particles are concentrated and settled by gravity separation to the bottom a wastewater treatment process unit known as a Clarifier.

Separation of Floatable-able Solids is known as achieving floatation which is the process by which solids in wastewater, weighing less than water, will naturally float to the surface of the wastewater treatment process unit known as a ***D***issolved ***A***ir ***F***lotation (***DAF***) Tank.

A further discussion of these principles, processes and process units is below:

pH:

Adjusting pH is one of the most commonly used treatment processes in an industrial wastewater treatment system.

Its purpose is primarily to optimize chemical reaction, such as those associated with precipitating heavy metals, oxidizing cyanide, reducing

hexavalent chromium, optimizing biological activity, preventing corrosion, reducing compounds (sulfate to hydrogen sulfide) or neutralizing an acidic or basic solution to bring it within required values.

Industrial waste usually contains acidic or basic/alkaline (caustic) materials that require neutralization before biological treatment or discharge to receiving waters or a POTW (***P***ublically ***O***wned ***T***reatment ***W***orks) collection system.

Certain alkaline or acid chemicals used for pH adjustment are below:

Alkaline chemicals commonly used are:

Lime in various forms is commonly used chemicals because of availability, low cost and high capacity.

Caustic Soda Liquid is a convenient, controllable, and commonly available chemical; bur expensive.

Acid chemicals commonly used are:

Sulfuric acid is cheapest and most readily available however it is strongly corrosive.

Hydrochloric acid is slightly yellow in color however it is poisonous.

Carbon Dioxide or Sulfur Dioxide applied in a gaseous form may be economical for neutralization of alkaline waters in certain industries.

Coagulant Chemicals:

The chemistry of coagulation consists of two processes - flash mix, coagulation.

Both of these processes are briefly explained below.

In the flash mixer, coagulant chemicals are added to the water and the water is mixed quickly and violently. The purpose of this step is to evenly distribute the chemicals through the water. Flash mixing typically lasts a short time.

After flash mixing, coagulation occurs.

During coagulation, the coagulant chemicals neutralize the electrical charges of the fine particles in the water, allowing the particles to come closer together and form large clumps. You may already be familiar with the process of coagulation from cooking. You can see coagulation occurring when preparing gelatin (jello) or when cooking an egg white.

Coagulant chemicals always change pH and are often referred as Primary Coagulants. Primary coagulants are often used in the coagulation process.

Chemically, coagulant chemicals are either metallic salts (such as aluminum or iron) or different forms of Lime.

Aluminum Sulfate or Ferric Chloride are examples of metallic salt coagulant chemicals and Calcium Hydroxide is a lime based coagulant chemical.

Flocculent Chemicals:

The chemistry of flocculating consists of the processes of flocculation.

This flocculation process is briefly explained below.

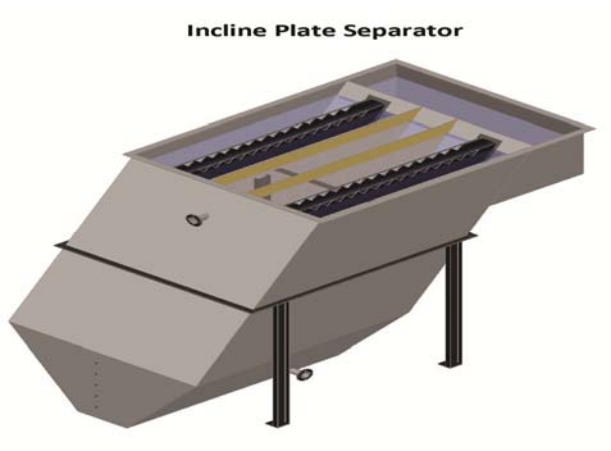
During flocculation, a process of gentle mixing brings the fine particles formed by coagulation into contact with each other. Flocculation typically lasts a relatively short time. The flocculation tank may have a number of compartments with decreasing mixing speeds as the water advances through the tank. This compartmentalized chamber allows increasingly large floc to form without being broken apart by the mixing blades.

Flocculent chemicals typically do not change pH and are often referred as Coagulant Aids which are often used in the flocculation process.

Chemically, flocculent chemicals are polymers.

Polymers are man-made organic compounds made up of a long chain of smaller molecules. Polymers can be either cationic (positively charged), anionic (negatively charged), or nonionic (neutrally charged.)

Separation of Settle-able Solids:



Separation of settle-able solids by sedimentation during primary clarification is the physical treatment process of removing settle-able solids

before biological treatment. This process is executed in a Primary Clarifier which is explained below:

Process wastewater enters the clarifier tank and settle-able solids (sludge) are collected on the bottom by a rake and removed via a sludge removal system. Effluent destined for biological treatment leaves the clarifier over a weir.

Potential range for percent removal in a primary clarifier is >85% settle-able solids and >35% suspended solids.

Clarifier efficiency is based on hydraulic detention time, temperature of the water, the design of the tank and the condition of the equipment.

Poor clarifier performance can be due to a variety of factors such as (1) hydraulic overload which decreases hydraulic detention time; (2) hydraulic under-load which doesn't allow the equipment to work efficiently; (3) sludge buildup which causes decreased tank volume detention time; and (4) highly concentrated waste streams.

Bypassing a clarifier, which means routing mill effluent directly to secondary treatment in an aeration basin, is done only in emergencies when clarifier equipment must be repaired or the sludge removal system is not able to process the sludge volume it receives. This scenario introduces high solids and elevated BOD levels into the biological treatment system and is not advised.

Separation of Float-able Solids:

Separation of float-able solids by flotation during primary clarification is the physical treatment process of removing float-able solids before biological treatment. This process is executed in a Dissolved Air Flotation Umit which is explained below:

Each industry generates different types and characteristic wastewater. Each has unique treatment opportunities.

Considerable study and supporting information must be analyzed before deriving the best solution to any wastewater treatment challenge.

A comprehensive wastewater study is often warranted. This is an up-front cost that must be recognized in order to manage all potential scenarios and to minimize future costs.

Dissolved air flotation (DAF) or micro bubble flotation technology is an effective, economical process for treating wastewater.

A DAF clarification system is comprised of three basic components: 1) process equipment, 2) chemical conditioning, and 3) the dissolved air or micro bubble process. Each component is crucial to the operation of a DAF clarification system.

A dissolved air flotation (DAF) clarifier separates suspended solids in wastewater. DAF clarifiers can be round or rectangular tanks. All DAF clarifiers have some internal mechanical components intended to speed up the removal of the suspended solids in the wastewater.

DAF clarifiers are excellent for removing fine suspended solids and for cleaning up water clarity problems. DAF clarified water is excellent for recycling, or for discharging to the city sewer system. It is important to understand DAF clarifiers need to receive wastewater with a relatively consistent flow and a stable wastewater loading.

It is essential that upstream wastewater mixtures be monitored, controlled and analyzed regularly before entering a DAF clarifier.

Coagulation mixing tanks and tube bundles are also common equipment ahead of DAF clarifiers. If coagulating and flocculating chemicals are added to the influent, they need mixing and retention time.

Extreme ups and downs in water temperature and pH can also impact performance of a DAF clarifier.

With an oily waste in the wastewater an oil-water separator may be needed ahead of the DAF EQ tank.

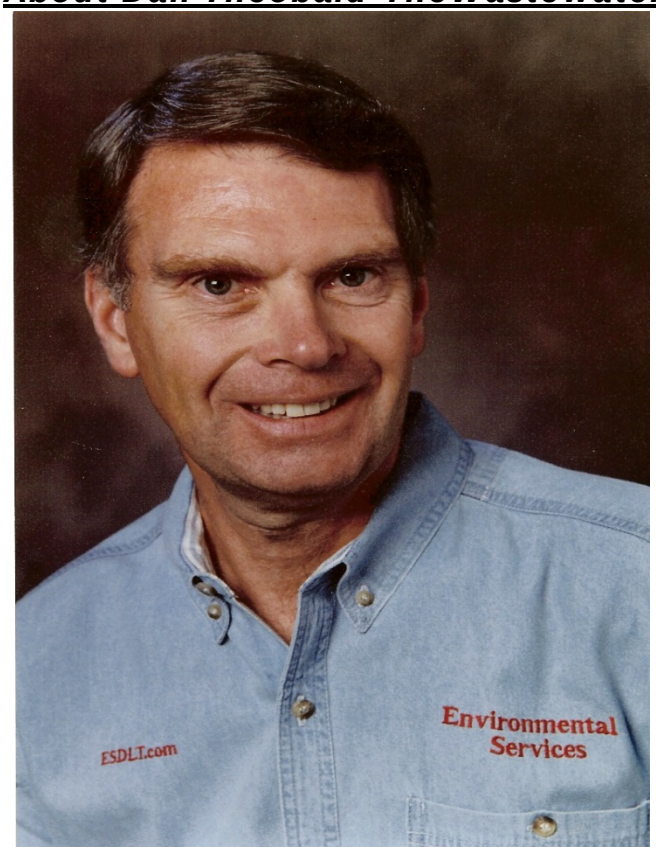
Pipe sizing needs to be engineered correctly.

Optimum DAF performance and chemical cost savings will be achieved when all necessary DAF auxiliary equipment is engineered and field piped properly.

Basic Wastewater Treatment with Primary Clarifiers or Dissolved Air Flotation Units can yield Discharge Results of BOD and TSS of <100 Parts Per Million.

Submit queries for achieving these results at your facilities to; ***Ask The WastwaterWizard*** !

About Dan Theobald-TheWastewaterWizard:



Known in the industry as "Wastewater Dan," Daniel L. Theobald, proprietor of Environmental Services, is a professional wastewater and safety consultant/trainer. He has more than 24 years of hands-on industry experience operating many variants of wastewater treatment processing units and is eager to answer submitted questions on water or wastewater and to share his knowledge about water conservation.

(http://www.esdlt.com/simple-steps-can-help-industries-conserve-water-by-esdlt-2/)

Theobald serves as an active consultant for industries looking to achieve and maintain improved wastewater treatment at reduced cost. He is a Lifetime Member of the Who's Who Registry of Professionals and holds numerous certifications from wastewater management regulatory boards and

professional organizations. Theobald contributed one chapter to the Water Environment Federation's (www.wef.org) Manual of Practice # 37 (MOP-37), a technical manual resource guide for biological nutrient removal, scheduled and published in 2013. He also authors an industry-related blog (**http://TheWastewaterWizardBlog.com/**).