Process of Wastewater Management

In this article, you will learn about the process of Wastewater Management, What is Waste Water?, Types of wastewater plants, Industrial Wastewater Treatment Plant, Agricultural Wastewater Treatment Plant, Wastewater treatment process.

What is Waste Water?

Wastewater is water that is to be treated before using it in any form so that it should not cause any pollution. Wastewater comes from various sources, such as the waste we flush down in our toilets, waste coming from industries, rainwater which comes with other pollutants. There are various methods to treat wastewater.

Wastewater Treatment

Wastewater treatment is a process of treating water and removing impurities from it, to make it ready to use. The treatment process takes place in the wastewater treatment plants. There are various types of wastewater that can be treated at different wastewater plants. For example, domestic wastewater is treated in the sewage treatment plant. For industrial wastewater, the treatment takes place in the industrial wastewater treatment plant.

It is easier to treat domestic wastewater than industrial wastewater. But in today's era, due to the increasing number of personal care products, water is getting more polluted, hence increasing the number of impurities present in the water.

Water is a non-renewable resource. We need to sustain water in order to make it available for our future generations.

Types Of Wastewater Treatment Plant

Wastewater treatment plants may distinguish the type of wastewater being treated. There are different wastewater plants depending upon the impurities present in the water to be treated. The process includes physical, chemical, and biological treatments.

The types of wastewater plants are:

- Sewage treatment plants
- Industrial wastewater treatment plants
- Agricultural wastewater treatment plants

1. Sewage treatment plants

Sewage contains wastewater from households, businesses, and pre-industrial waste. The process of the sewage treatment plant is to remove containment from sewage and to produce an effluent that is suitable to discharge in the surroundings. There are various sewage treatments to choose from. These can range from decentralized systems (including on-site treatment systems) to large sewage systems involving pipes, pumps called sewerage, which conveys sewage to the water waste plant.

A large number of sewage treatment technologies have been developed in the past few years. The technologies can be grouped into high tech (high cost) versus low tech (low cost) options, though. To decide which sewage treatment process to choose engineers and decision-makers need to take into account technical and economical criteria, as well as quantitative and qualitative aspects of every step. The main criteria to construct a sewage treatment system are: desired effluent quality, expected construction and operating costs, availability of land, energy requirements, and sustainability aspects. **For example,** the activated sludge process achieves a high effluent quality but is relatively expensive and energy-intensive compared to waste stabilization ponds which are a low-cost treatment option but require a lot of land. The rural areas and developing countries use on-site sewage treatment. An advanced, fairly expensive, sewage treatment plant in a high-income country may include primary treatment to remove solid material, secondary treatment to digest dissolved and suspended organic material, tertiary treatment to remove the nutrients nitrogen and phosphorus, disinfection, and possibly even a fourth treatment state to remove micropollutants.

2. Industrial Wastewater treatment plants

Most industries produce wastewater. Industrial wastewater treatment is a process of treating wastewater by the industries. The treated water or (the effluent) is then sent back for reuse or as surface water sewage in nature. Some industries generate wastewater that can be treated by the sewage treatment plant. Most industrial processes such as petroleum refineries, chemical, and petrochemical plants have their own treatment plants so that pollutants concentrations are as per the regulations. This only applies to industries that produce organic wastes such as oil or grease, toxic pollutants such as heavy metals, and harmful chemicals for the environment such as ammonia. Most industries produce wastewater. Many industries have improved their wastewater management by redesigning their manufacturing process to decrease the pollution caused by them, through the process of pollution prevention. Pollution prevention is a technique to reduce the waste produced and released by industries in our environment. Sources of industrial wastewater include battery manufacturing, electric power plants, food industry, iron and steel industry, mines and quarries, nuclear industry, oil and gas extraction, organic chemicals manufacturing, petroleum refining and petrochemicals, pulp, and paper industry, smelters, textile mills, industrial oil contamination, water treatment, wood preserving. Treatment processes include brine treatment, solids removal (e.g. chemical precipitation, filtration), oils and grease removal, removal of biodegradable organics, removal of other organics, removal of acids and alkalis, removal of toxic materials.

3. Agricultural wastewater treatment plant

Agricultural wastewater treatment is a process of treating animal confined waste or surface runoff that may contain chemicals like pesticides, fertilizers, animal surrey, or water irrigation. Nonpoint source pollution includes sediment runoff, nutrient runoff, and pesticides. Point source pollution includes animal wastes, silage liquor, milking parlor (dairy farming) wastes, slaughtering waste,

vegetable washing water, and firewater. Many farms generate nonpoint source pollution from surface runoff which is not controlled through a treatment plant.

WASTEWATER TREATMENT PROCESS

The wastewater treatment process consists of **eight processes**.

Step 1- Bar Screening

The process of removal of large items to prevent damage to valves, pumps, and other equipment. The water treated in this process is water coming from homes by performing the activities such as flushing toilets, washing clothes, and utensils, etc. When the screening is done, the water is ready to enter the environment for reuse. The quality of the water is dictated by the Environmental Protection Agency (EPA) and the Clean Water Act, and wastewater facilities operate to specified permits by National Pollutant Discharge Elimination System (NPDES). According to the EPA, The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters.

Step 2- Screening

Remo**val of grit flowing in the water. Fine grits can be found in wastewater, the removal of grit is important as it can damage the equipment. Too small to be seen? This grit needs to be removed in the grit chamber. There are several types of grit chambers (horizontal, aerated, or vortex) that** control the flow of water, allowing the heavier grit to fall to the bottom of the chamber. The grit is physically removed from the bottom chamber when caught.

Step 3- Primary Purifier

In this process, the heavy organic waste is removed from the wastewater. After the grit removal, wastewater enters a large purifier where 25% to 50% of organic waste is separated out. These large clarifiers (75 feet in diameter, 7½ inches at the edges, and 10½ feet in the center as an example) allow for the heavy solids to sink to the bottom and the cleaner influent to flow. The effectiveness of the primary clarification is a matter of appropriate water flow. If the water flow is too fast, the solids don't have time to sink to the bottom resulting in a negative impact on water quality downstream.

Step 4- Aeration

The primary function of the aeration tank is to pump oxygen into the tank to encourage the breakdown of any organic material (and the growth of the bacteria), as well as ensure there is enough time for the organic material to be broken down. Aeration can be accomplished by pumping and defusing air into the tank or through aggressive agitation that adds air to the water. This process is managed to offer the best conditions for bacterial growth. Air is pumped into the aeration

tank/basin to encourage conversion of NH3 to NO3 and provide oxygen for bacteria to continue to propagate and grow.

Once converted to NO3, the bacteria remove/strip oxygen molecules from the nitrate molecules and the nitrogen (N) is given off as N2↑ (nitrogen gas).

One of the key parameters to measure in wastewater treatment is Biochemical Oxygen Demand (BOD). BOD is a surrogate indicator for the amount of organic material present and is used to determine the effectiveness of organic material breakdown. There are a number of other tests used to ensure optimal organic material breakdown (and BOD reduction) such as measuring pH, temperature, Dissolved Oxygen (DO), Total Suspended Solids (TSS), Hydraulic Retention Time (flow rate), Solids Retention Time (amount of time the bacteria is in the aeration chamber) and Mixed Liquor Suspended Solids.

Step 5- Secondary Clarifier

As the treated wastewater exits the primary purifier. The remaining wastes get extracted in this chamber. Here fine particles sink in the tank. These small solids are called activated sludge and consist mostly of active bacteria. Part of this activated sludge is returned to the aeration tank to increase the bacterial concentration, help in propagation, and accelerate the breakdown of organic material. The excess is discarded. The waster that flows out from the secondary purifier is according to the specifications of effluent.

Step 6- Chlorination (Disinfection)

Chlorine is added to kill any remaining bacteria in the contact chamber.

Step 7- Water Testing And Analysis

Although testing is a continuous process, to ensure proper specifications are met the water leaves the plants, final water testing and analysis is done, which includes testing of pH level, ammonia, nitrates, phosphates, dissolved oxygen, and residual chlorine levels to conform to the plant's NPDES permit are critical to the plant's performance.

Step 8- Wastewater Disposal

After meeting all the specifications. The wastewater is released into the environment for use.

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