

3. WASTEWATER TREATMENT

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There are two types of wastewater

- Domestic sewage
- Industrial sewage

Sewage

- ✓ Liquid waste that contains many different substances.
- ✓ Amount of organic materials in sewage is measured by BOD.
- ✓ Strength of sewage is measured by TSS.
- ✓ Plant nutrients are another impurity (N & P).
- ✓ Domestic sewage contains BOD:200 mg/l, TSS: 240 mg/l, N₂:35 mg/l and P: 10 mg/l.
- ✓ Industrial waste contains more BOD and TSS but depends on the source.

Purpose of Wastewater treatment

- The basic purpose of sewage treatment is to destroy pathogenic microorganisms and to remove most suspended and dissolved biodegradable organic materials.
- It is also necessary to recover water for recycling.

Steps involved in Treatment:

1. Preliminary Treatment
2. Primary treatment
3. Secondary treatment
4. Tertiary treatment
5. Sludge digestion

1. Pre-treatment

- **Screening:** Bar screens retain floating debris, bulky objects, etc that could clog pipes or damage mechanical equipment in the rest of the water treatment plant.
- **Grit Removal:** A grit chamber where small particles like sand, stones, etc. are allowed to settle.

2. Primary Treatment

- Suspended organic solids are removed by sedimentation in primary clarifiers.
- Sludge that settles down is removed and oil/grease is skimmed off from the top.
- Coagulants are added to remove tiny particles.
- About 60% of suspended solids and 30% of organic materials are removed.

3. Secondary Treatment

- Fine suspended particles and dissolved organic matter are removed.
- Biological treatment involves the use of microorganisms.
- Bacteria and protozoa consume the organic pollutants as food and convert them to CO₂, H₂O and energy. This process requires oxygen.

Secondary treatment methods

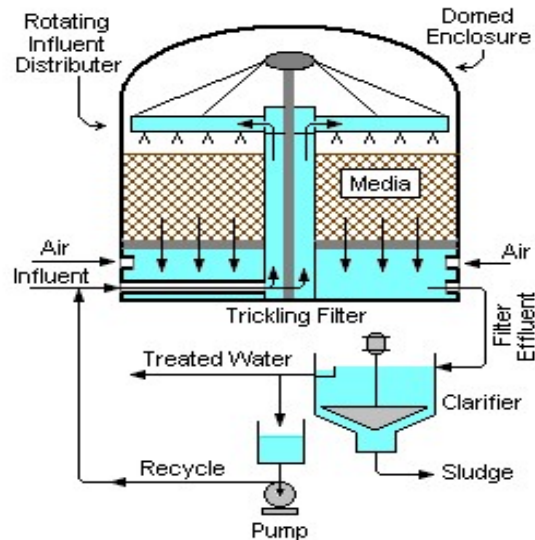
Two of the most common biological treatment systems are

- ✓ Trickling filter
- ✓ Activated Sludge

These remove about 85% BOD and TSS.

Trickling filter:

- ✓ The microbes remain attached to a surface while the waste water flows over them. It is a fixed growth system.
- ✓ As the primary effluent trickles downward through the bed of stones, a biological slime of microbes develops on the wastewater over these fixed biological growths and provides the needed contact between the microbes and the organics.
- ✓ The dissolved organics, thus removing – demanding substances from the wastewater. Air circulating through the void spaces in the bed of stones provides the needed oxygen for stabilization of the organics by the microbes.



Activated Sludge:

- ✓ It is a suspended growth system because the microbes are thoroughly mixed and suspended in the wastewater. Seeding of the activated sludge fed into effluent after primary treatment in aeration tank. The mixed liquor is aerated for about 6 hours, flows to the secondary or final clarifier. In which the activated sludge solids settle out by gravity.
- ✓ During the aeration coagulation of colloidal matter occurs initially. The settled sludge which is in an active state oxidizes the carbonaceous and nitrogenous matter into water, carbon dioxide and another stable compound.
- ✓ The microbes will readily absorb and decompose more organics by their metabolism. The effluent is discharged into secondary settling tank or clarifier for settling the humus and treated water is let out or sent to tertiary treatment (advanced treatment process to remove N, P).

4. Tertiary treatment

- This is used to mainly recover water for recycling.
- Sand filtration is done to remove fine solids.
- Different disinfection methods like ozonation, UV treatment, Chlorination (Bleaching powder, liquid chlorine, chloro amine) are used to remove bacterial impurities.
- It is finally discharged to the environment.

5. Sludge Digestion

- Sludge digestion is done to reduce volume and stabilize the organic matter.
- Sludge is digested anaerobically, giving CO_2 and CH_4 .
- Sludge volume is reduced as gases escape and liquid is formed.
- Well digested sludge contains N and P which are used as fertilizers.
- CH_4 is used as fuel.

