

CHAPTER - III

SOLID WASTE MANAGEMENT

3.1 Wastewater Treatment

Sewage treatment refers to the processes adopted for removing the impurities present in the sewage water. Municipal sewage treatment consists of the following steps:

1. Preliminary treatment
2. Primary treatment
3. Secondary treatment (or) Biological treatment
4. Tertiary treatment
5. Sludge Digestion

1. Preliminary Treatment

The main objective of this treatment is to remove the materials like wood, paper and plastic and floating materials such as, oils, grease, soap, etc. present in the sewage water.

Screening

In this process, the wastewater is allowed to pass through large screens having holes. By this process, floating materials like wood, paper and plastics are removed.

Skimming

The process of removal of floating matters, such as oils, grease, etc. in skimming tanks is called as skimming.

2. Primary Treatment

Fine suspended matters cannot be removed by the preliminary treatments. Hence primary treatment is carried out. In this process, the wastewater from the previous stage is passed into large sedimentation tanks (Settling tanks) and the water is allowed to stand undisturbed for several days. The solid materials settle at the bottom. About 50-60% of total suspended impurities and 50% of pathogens and toxic contaminants are removed by this process.

3. Secondary (Biological)Treatment)

The purpose of secondary treatment is to remove the suspended solids that did not settle out in the primary tanks and the dissolved BOD that is unaffected by physical treatment. Microorganisms are used for the biological treatment of wastewater. Microorganisms, such as bacteria and protozoa, consume the organic pollutants as food. They metabolize the biodegradable organics and convert them into carbon dioxide, water and energy and utilize them for their growth and reproduction. For this aerobic natural process sufficient amount of oxygen is required.

Tricking filter and the activated sludge are the most common Biological treatment methods.

a) Trickling Filters

Trickling Filters are rectangular or circular in shape. They are about 2 m deep. They are filled with either a coarse /crushed rock or large anthracite coal or blast furnace slag or broken bricks or graded clinkers. To collect the effluent there is a under drain system provided at the bottom.

Working of Trickling Filter

The sewage which is to be treated is allowed to trickle over the filtering medium by means of rotating arm distributor. As the trickled sewage starts percolating through the filtering media, microorganisms present in the sewage grow on the surface of aggregates using organic material of the sewage as food. Aerobic condition is prevailed and the purified sewage is removed from the bottom. The Trickling filters are either r trickling filters remove 90% of BOD.

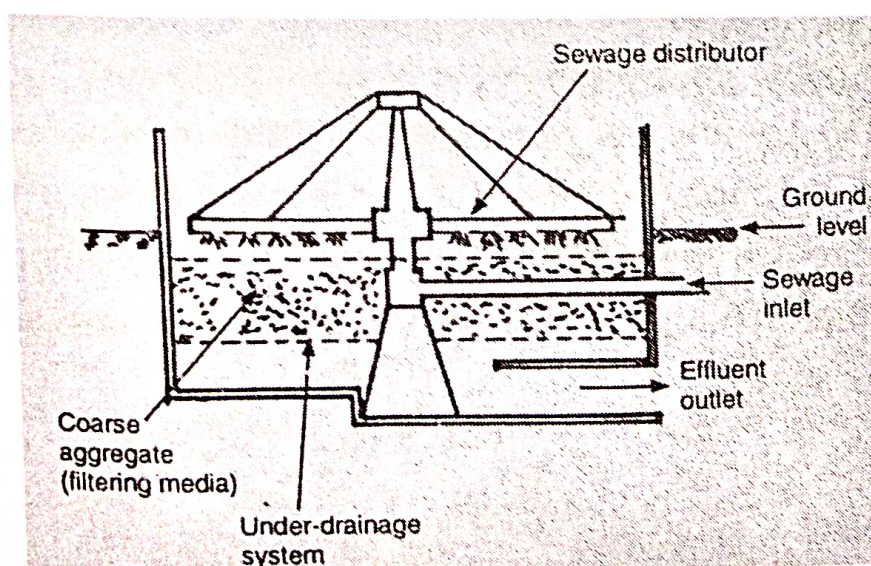


Fig 3.1 Trickling filter

b) Activated Sludge Treatment

Activated sludge process is based on the principle that if an adequate amount of oxygen or air is passed through sewage containing microorganisms, complete aerobic oxidation occurs. But the process is very slow. However if the oxidation process is carried out in the presence of small amount of sludge from the previous oxidation process which contains organic matters inhabited by numerous bacteria, the oxidation process takes place at a much faster. In this process, sedimented sludge is mixed with the proper quantity of activated sludge and the mixture is taken into the aeration tank in which the water is continuously aerated for 4 to 6 hours. During this oxidation process, oxidation of the suspended organic matter takes place. During this process, nitrogen is converted into nitrites and nitrates. After aeration, the affluent is sent to the sedimentation tank, where sludge is deposited and clean and non-putrifying liquid is drawn off.

Tertiary Treatment

After the Primary and the Secondary treatment process, the liquid is taken into Tertiary process. The main objectives of the process are to decrease the load of nitrogen and phosphorous compounds present in the effluents. The following steps are adopted for achieving the same.

i) Precipitation

In this process, the effluent from the secondary treatment process is treated with calcium oxide(lime) which reacts with phosphorous compounds forming insoluble calcium phosphate, which settles at the bottom of the tank which can be filtered off.

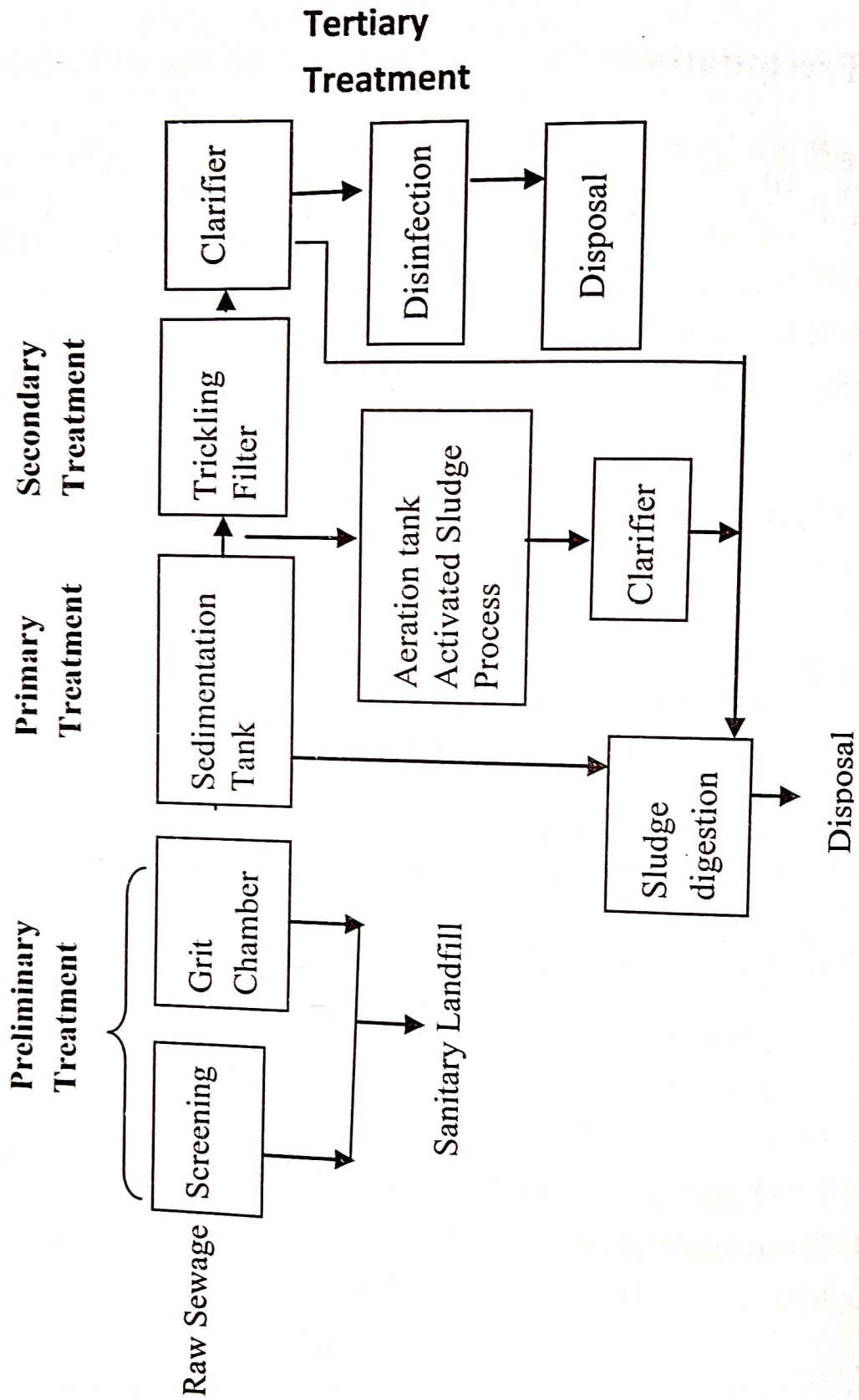
ii) Nitride Stripping

In this process, ammonia gas is removed. This is achieved by passing the effluent through a metal tower having number of baffle plates.

iii) Chlorination

In this process, the water from the nitrogen stripping process is treated with chlorine to kill the microorganisms that is present in the sewage water.

The so treated water is finally discharged into rivres/lakes.

**Layout of Municipal Sewage Treatment Plants**

Disinfection

After passing through primary and secondary treatment, disinfection of wastewater with sodium hypochlorite and sodium bisulphate makes it fit for discharge on to the land surface. After disinfection and dechlorination, the effluent is ready to be discharged on land surface that can be done by either spray irrigation or surface-water discharge.

Three disinfection methods are presently available. They are

- i. Chlorination
- ii. Ozonization
- iii. UV treatment

Sludge Digestion

The sewage sludge is large in bulk and contains putrescible substances and living organisms. Also the sludge is an excellent soil conditioner and it can be used as a fertilizer on farmland. However, it needs additional treatment to make it suitable. This treatment is called Sludge digestion and takes place in large, enclosed tanks.

The main objective of sludge digestion is to break the organic matter of the sludge into liquid and simple compounds which are stable and unfoul in nature. Digestion significantly reduces the sludge quantity. This process removes about 99.8% coli forms.

A by-product of the sludge digestion process is methane gas. This can be burned to produce electricity. The electricity can

be used to heat more sludge or to provide heat and light for the treatment works. Sometimes more energy is produced than the required. The surplus is sold to the electricity companies.

Sludge and scum from the primary treatment are thickened in *gravity thickeners* and those from the secondary treatment are thickened in *centrifuges*. To increase it's efficiency, polymer is added in the secondary thickening process.

Sewage Disposal

The sewage is disposed of either in natural water bodies or on land.

i. Dilution

This method is possible when the required quantity of natural water is available near the town. While selecting this source of disposal, care should be taken that the sewage should not pollute the nature of the water. The following points are to be considered while using this type of disposal method.

- a. The municipal area must be situated near the sea, river or lake.
- b. The sewage reaching the disposal point must be fresh and non-septic.
- c. The depth of water must be sufficient at the point of disposal.

- d. During flood periods the receiving water should not cause any backward flow into the sewers.
- e. Sewage should not affect the aquatic life.

ii. Land Treatment: In this method, the sewage is evenly spread on the land surface. This method is cheap and does not require natural water courses. The main disadvantages of this method are requirement of large area of land and soil sickness.

Following methods can be adopted in the land treatment.

- a. Spray Irrigation
- b. Surface Irrigation
- c. Sub-soil Irrigation
- d. Flooding
- e. Lagooning

The following points must be considered while disposing the sewage by land treatment:

- i. The ground water should not get contaminated.
- ii. There should not be any deterioration of the soil properties.
- iii. The pathogenic infection should not spread among the farm workers or the consumers of sewage farm products.