# Municipal sewage treatment Process

## Unit-3 Applied microbiology


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## Municipal sewage treatment Process

Municipal sewage treatment is carried out in 3 steps namely, primary/mechanical treatment, secondary/ biological treatment, and tertiary /final treatment.

### A. Primary (Mechanical) Treatment

When the sewage arrives at a sewage treatment plant, it is first subjected to mechanical (or physical) means, viz., flowing, dilution and sedimentation to remove its coarse solid materials. The sewage is passed through a solid series of filters of graded openings and then allowed to flow through sedimentation units (tanks, basins etc.).Coarse solid materials are concentrated in and collected from sedimentation units; these particulate materials are from called sludge'. Following sedimentation, the sludge and liquid affluent are processed separately during secondary treatment.

### B. Secondary (Biological) Treatment

This is purely a biological treatment of mechanically-treated sewage and concerns microbial activity. This treatment accomplishes two important phases, namely, aerobic phase and anaerobic phase. The aerobic phase consists of aerobic digestion of sludge by, various filters (e-g Trickling Filters), Oxidation Ponds and Activated

Sludge Process, and the anaerobic phase is represented by Anaerobic Digestion of Sludge.

## I. Aerobic Phase of Secondary Treatment

### a. Aerobic Digestion in Trickling Filters

Trickling filters consist of generally 6-10 feet deep bed of crushed stone, gravel, slag, or similar material. The sewage effluent is sprayed over the surface of the the bed; the spraying saturates the effluent with oxygen.The bed surface becomes coated with aerobic microbial flora consisting of microalgae, microfungi, bacteria and protozoa. As the effluent seeps over, the aerobic microbes degrade the organic matter. However, the treated effluent collected at the bottom of the tank is passed to sedimentation tank and, like activated sludge process, the effluent follows tertiary treatment. Aerobic digestion of sewage organic matter in a trickling filter is a very slow process.

**b. Oxidation Ponds:** Oxidation pond sewage-treatment is recommended for small communities in rural areas where suitable and sufficient land is available. Oxidation ponds (also called Lagoons or Stabilization Ponds) are generally 2-5 feet deep shallow ponds designated to allow direct wind action and algal growth on the sewage effluent. Oxygen supplied from air and produced as a result of algal photosynthesis fulfils biochemical

oxygen demand (BOD) of sewage effluent and thus helps in maintaining aerobic condition in sewage effluent. In such condition the aerobic microbes grow rapidly and digest organic matter. Chlorella pyrenoidosa is a common algal representative grown in oxidation ponds.

C. Activated Sludge Process In this process the mechanically treated sewage effluent (sewage liquid) is pumped. into a sedimentation or settling tank wherein the sewage flocs and settles out. A portion of sewage 'floc' is returned to activate a new and the batch of mechanically treated sewage effluent and the rest is pumped to activated sludge digester where air is blown by several jets. Thus, in the presence of plentiful oxygen, oxidation of sewage effluent is brought about by aerobic microorganisms which break down organic matter to CO2, ańd H20. Now the effluent is passed through a sedimentátion tank. Though about 90% of the organic matter of the effluent is digested via this process, the effluent still contains considerable amount of nitrate and phosphate etc. It is, therefore, not safe to discharge effluent at this stage into a large body of water as both nitrate and phosphate can cause eutrophication. Now the effluent which lookş clear at this stage, is subjected to tertiary (final) treatment for further purification.

## II. Anaerobic Phase of Secondary Treatment

Anaerobic Digestion of Sludge-The sludge collected after primary (mechanical) treatment of sewage is subjected to anaerobic(oxygen-free) digestion in separate tank designed especially for the purpose. Since anaerobic condition prevails in this tank, the anaerobic microbes bring about digestion of organic matter by degrading them to soluble substances and gaseous products (methane, 60-70%$CO_2$ 20-30%; and smaller amounts of Hydrogen and Nitrogen). This gas mixture can be used for operating power of the sewage plant or as a fuel.

**C. Tertiary (or Final) Treatment** -Since the aerobically treated sewage effluent during secondary treatment process still contains sufficient nitrate, phosphate etc, it is subjected to chemical treatment for disinfection. The chemical treatment is followed by chlorination to kill microorganisms, if any are present. The effluent after tertiary treatment is now a clean water and is considered microbiologically safe even for human is consumption.

# Activated Sludge: When we vigorously aerate sewage the finely suspended and colloidal material (including microbes) it forms aggregates called "floccules' collectively result in the formation of sewage floc. When this sewage floc is sedimented and then inoculated in a fresh place in shorter time duration than the previous one. As a result of the repetition of this process i.e, inoculation of sedimented floc again to a fresh aerating "sewage, a stage is reached where 'complete flocculation of. a fresh sewage takes place in very short time duration,eg, a few hours. These particles of sedimented floc are called activated sludge end consist of large number of very actively metabolizing bacteria, yeasts, molds end protozoa. The use of activated sludge is of great significance in biological treatment of sewage as it reduces aeration period of sewage to 4-8 hours.