

Composition of sewage

- Sewage consist of about 99.9% water and 0.1 % solids, the solids are either organic or inorganic. The organic solids consist of about 65% protein, 25% carbohydrate and 10% fats.
- Faeces and to a less extent urine contain millions of intestinal bacteria and small numbers of other organisms
- The organic mater contributed per person per day in domestic wastewater is approximately 110g of suspended solids and 90g of BOD in communities where substantial portion of the household kitchen waste is discharged to the sewer system

Collection of Sewage

- Sewage is conveyed in pipes known as sewers from its place of production to its place of treatment and disposal.
- The sewers are usually in network of underground conduits. They are either of the separate or combined system
- Pattern of sewer network
- Type of system
- Street layout
- Topography
- Location and type of treatment works

Wastewater Treatment

- The major categories of treatment steps include:
- Preliminary treatment: this removes materials that could damage plant equipment or would occupy treatment capacity without being treated.
- Primary treatment: this removes settleable and floatable solids
- Secondary treatment: this removes BOD, dissolved and colloidal suspended organic matter by biological action.
- Advanced wastewater treatment: this uses physical, chemical and biological processes to remove additional BOD, Solids and nutrients.
- Disinfection: this removes microorganisms to eliminate or reduce the possibility of disease when the flow is discharged
- Sludge treatment: this stabilizes the solids removed from wastewater during treatment, inactivates pathogenic organisms and reduces the volume of the sludge.

Wastewater Treatment

- Preaeration: Often adopted to achieve and maintain an aerobic state, strip off hydrogen sulphide, agitate solids, and reduce biochemical oxygen demand
- Chemical addition: The purpose of adding chemicals is to improve settling, reduce odour, neutralize acids or bases, reduce corrosion, reduce BOD, improve solids and gases removal, reduce loading on the plant, add or remove nutrients and aid downstream processes.
- Equalization: This helps to reduce or remove the wide swings in flow rates normally associated with wastewater treatment plant loading, it minimizes the impact of storm water flows.

- Primary treatment: The purpose primary sedimentation or clarification is to remove settleable organic and floatable solids. Normally, each primary clarification unit can be expected to remove 90% settleable solids, 40% to 70% TSS and 25-35% BOD
- Process Description: Wastewater enters a settling tank, solids that are heavier than water settle to the bottom while those lighter than water floats on top. Settled solids are removed as sludge and floating solids are removed as scum. Detention time, temperature, tank design and condition of the equipment controls the efficiency of the process.
- Types of sedimentation tank
- Septic tank
- Imhoff tank
- Plain settling tank or clarifiers

Measuring Plant Performance

- The performance efficiency or percent removal is always used to evaluate how a plant or treatment unit process is operating.

$$= \frac{\text{Influent concentration} - \text{effluent concentration}}{\text{Influent concentration}} \times 100$$

$$\% \text{ volatile matter reduction in sludge} = \frac{(\% \text{ VM}_{\text{in}} - \% \text{ VM}_{\text{out}}) \times 100}{\{ \% \text{ VM}_{\text{in}} - (\% \text{ VM}_{\text{in}} \times \% \text{ VM}_{\text{out}}) \}}$$

- Hydraulic Detention Time: This refers to the average length of time (theoretical time) a drop of water, wastewater or suspended particles remain in a tank or channel

$$= \frac{\text{water or wastewater in tank}}{\text{flow rate through the tank}} = \frac{\text{volume}}{\text{flowrate}}$$