

Sewage and domestic wastes, treatment and reuse

- Sewage is defined as waste water/matter from domestic or industrial establishments that is carried away in sewers and drains.

Composition of Sewage

- Sewage effluents contain a wide variety of dissolved and suspended impurities from municipal/domestic waste, rainwater and anything washed down.
- Eventhough, the quantity of sewage disposed varies from place to place, the **chemical characteristics remain** similar.
- In general, sewage contains **dissolved solids, suspended solids, nutrients (N, P), sulphate, chloride and heavy metals (Fe, Cu, Co, Zn, Pb, Ni), bacteria and viruses.**
- Sewage consists of 99% water and 1% solids. Of the solids present in sewage, 70% are organic and 30% are inorganic in nature.
- The organic fraction contains proteins (60%), carbohydrates (20%) and fats (10%). The inorganic fraction contains grit, salts and metals.

Components	Concentration (ppm)
Total Suspended Solids	200-300
Biological Oxygen Demand (BOD)	200-250
Chemical Oxygen Demand (COD)	350-450
Nitrogen	25-60
Phosphorus	5-10
Oil and Grease	80-120

Measurement of Organic Pollution/ Assessment of Sewage Impact

- Organic pollution can be measured by a number of chemical and biological parameters, which are directly related to the level of organic matter present in the water.
- Measurement of organic pollution is made by four ways ,these are:
- **Biochemical Oxygen Demand (BOD):**
- BOD is defined as the rate of removal of oxygen by microorganisms in the aerobic degradation of organic matter in waters. It is measured as the difference in the oxygen between the initial sample and after its incubation for five days at 20oC or for three days at 27oC.

- **Chemical Oxygen Demand (COD):**
- It is a measure of the oxygen requirement of organic matter in the sample that is susceptible to oxidation by strong chemical oxidants like potassium permanganate, ferric sulphate, potassium iodate and potassium dichromate.
- **Total Oxygen Demand (TOD):**
- TOD refers to the total quantity of oxygen required to burn the whole sample. TOD analyzers are used to measure residual oxygen continuously in the stream of gases coming out as gas effluent after burning the sample.
- **Biological Indices of Organic Pollution:**
- Biological indicators (bioindicators) are considered to be organisms which by their own presence or absence indicate the existence in abundance of a particular critical factor.

- **Shannon and Wiener's Diversity Index**
- **The index is based on the number and relative dominances of various species present in water.**

- **Diversity index (H) = $\sum p_i \times \log_2 p_i$**
- **$p_i = n_i/N$**
- **n_i = Number of individuals of a species**
- **N = Total number of individuals of all the species**
- **$\log_2 = \log_{10} \times 3.322$**

- **The decline in the value of index is taken as an evidence of pollution**
- **- Value above 3 indicate clean water**
- **- Value less than 3 indicate pollution**

- **b) Odum's Index**

- Odum's index = $(\text{Total number of species in a sample} / \text{total number of individuals of all species}) \times 100$
- The values decrease with rise in the level of pollution.

- **c) Saprobic Index**

- Classical "Saprobic Systems" have been evolved originally and this forms a basis for the "Indicator Organisms Concept".
- The proliferation of polychaete, *Capitella capitata*, absence of interstitial copepods and the ratio between the micro and macro fauna are some of the basic characteristics for assessing sewage impact.