

Quality Parameters of Sewage

Wastewater parameters are the wastewater quality standards for safe disposal at different sites. Understanding the quality parameters of sewage is necessary to know the quality standards of wastewater. Based on these quality standards, disposal of the sewage is carried out.

Quality parameters of sewage can be classified into physical, chemical and biological quality parameters based on their different characteristics. The quality of sewage is mentioned in the [GATE CE syllabus](#). It may also depend on the source of the generation. For example, industrial sewage contains many chemicals, but domestic sewage mainly contains biological constituents.

Physical Quality Parameters of Sewage

The physical quality parameters of sewage are the standard qualities of wastewater that can be identified physically just by observing sewage. Physical quality parameters consist of the colour of sewage, odour and temperature, etc. Solids present in sewage can be classified as suspended solids and dissolved solids. Usually, dissolved solids are classified under the category of chemical parameters, but suspended solids are categorized as physical parameters. Here few physical quality parameters of sewage are listed below.

- Threshold Odour Number (TON) = $(V_s + V_D)/V_s$

V_s = The volume of the sewage

V_D = The volume of distilled water or odorless water.

- **Total Solids, Suspended Solids and Settleable Solids**

(i) $S_3 = S_1 - S_2$

(ii) $S_2 - S_4 = S_5$

Where,

- S_3 = Dissolved solids plus colloidal or filterable solids in mg/lit
- S_2 = Non-filterable solids in mg/lit
- S_1 = The total amount of solids in mg/lit
- S_4 = Volatile suspended solids, in (mg/lit.)
- S_5 = Fixed solids

Chemical Quality Parameters of Sewage

The chemical quality parameters of sewage are the standard qualities of wastewater identified with the help of laboratory tests using different chemicals. Chemical quality parameters include acidity, pH, hardness, alkalinity, chloride content, dissolved oxygen, etc. Dissolved oxygen demand can be due to biological activities, chemical reactions, etc. Here few chemical quality parameters of sewage are listed below.

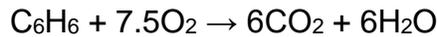
- Chemical Oxygen Demand

It can occur due to biodegradable organic matter or non-biodegradable matter.

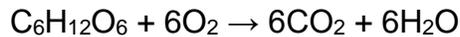
$K_2Cr_2O_7$ and H_2SO_4 are added to determine the chemical oxygen demand.

- Theoretical Oxygen Demand

Benzene



Glucose



- Biochemical Oxygen Demand (BOD)

$BOD = (DO_i - DO_f) \text{ Dilution factor}$

Where,

- BOD = Biochemical oxygen demand in ppm or mg/lit.
- DO_i = Initial dissolved oxygen in mg/lit.
- DO_f = Final dissolved oxygen in mg/lit.

Dilution Factor = Volume of the diluted sample / Volume of the undiluted sewage sample

The rate of depletion of biochemical oxygen demand can be related to the following equation as $dL_t/dt = -kL_t$

Where,

k = Rate constant signifying the rate of oxidation of organic matter, which depends upon the nature of organic matter and temperature. Its unit is per day.

L_t = O_2 equivalent of organic matter present after t days.

$$L_t = L \cdot (10)^{-K_D t}$$

Where,

- k_D = Deoxygenation constant.
- L = Organic matter present at $t = 0$

Biological Quality Parameters of Sewage

The biological Quality parameters of sewage are the biochemical parameters obtained with the help of biological activities. Biological quality parameters of sewage include the virus, bacteria, algae, Most Probable Number(MPN), etc. With the help of proper observation of these parameters, diseases spreading due to poor-quality sewage can be controlled.

The most probable number test is used to determine the biological qualities of the wastewater. With the help of the MPN test, the count of E-coli bacteria is observed. These are not harmful bacteria, but they indicate the presence of other harmful bacteria. 3 samples (ex. 100mL, 10mL, 1mL) are taken for the MPN test.

Decomposition of Bio-degradable Organic Matter

The decomposition of bio-degradable organic matter can be done either by the process of anaerobic decomposition or by aerobic decomposition. Aerobic decomposition is also a significant topic for the [GATE exam](#). It can be carried out with the help of aerobic or facultative bacteria, while anaerobic decomposition can be carried out with the help of anaerobic bacteria or facultative bacteria. These processes of decomposition are explained below.

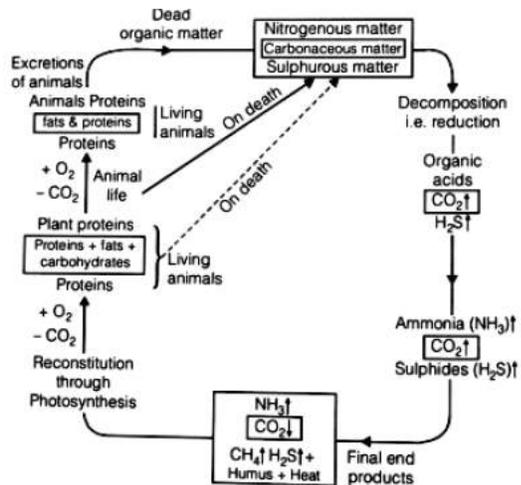
- Aerobic Decomposition

(i) Nitrogenous organic matter $\rightarrow \text{NO}_3^- + \text{NH}_3\uparrow + \text{Energy}$

(ii) Carbonaceous organic matter $\rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{Energy}$

(iii) Sulphurous organic matter $\rightarrow \text{SO}_4^{2-} + \text{Energy}$

- Nitrogen Cycle under Aerobic Decomposition



- Anaerobic Decomposition

- (i) Nitrogenous organic matter \rightarrow N₂ \uparrow + NH₃ + Organic Solids + Heat Energy
- (ii) Carbonaceous organic matter \rightarrow CO₂ \uparrow + Heat Energy
- (iii) Sulphurous organic matter \rightarrow H₂S \uparrow + Heat Energy
- (iv) Organic acids \rightarrow CH₄ \uparrow + CO₂ \uparrow + Heat Energy