Types of water pollution, Sources of water pollution, Classification of water pollutants, Characteristics of wastewater

1. Water pollution

Water pollution is the contamination of water bodies (e.g. lakes, rivers, oceans and ground waters). Water pollution occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful compounds.

2. Types of water pollution

2.1. Surface water pollution

Surface water includes natural water found on the earth's surface, like rivers, lakes, lagoons and oceans. Hazardous substances meeting this surface water, dissolving or mixing physically with the water can be called surface water pollution.

2.2. Ground water pollution

When humans apply pesticides and chemicals to soils, they are washed deep into the ground by rainwater. This gets to underground water, causing pollution underground. This means when we dig wells and bore holes to get water from underground, it needs to be checked for ground water pollution.

3. Causes of water pollution

- Industrial Waste
- Sewage and Wastewater
- Mining Activities
- Marine Dumping
- Accidental Oil Leakage
- The burning of fossil fuels
- Chemical fertilizers and pesticides
- Leakage from Sewer Lines

- Global Warming
- Radioactive Waste
- Urban Development
- Leakage from the Landfills
- Animal Waste
- Underground Storage Leakage
- Eutrophication
- Acid Rain

4. Sources of water pollution

4.1. Point source

Contaminants that enter a water way from a single, identifiable source, such as pipe or ditch. Examples of sources in this category include discharges from sewage treatment plant, a factory or a city storm drain.

4.2. Non point Sources

Refers to diffuse a contamination that does not originate from a single discrete source. A common example is the leaching out of nitrogen compounds from fertilized agricultural lands. Nutrient runoff in storm water from sheet flow over an agricultural field or a forest are also cited as examples of NPS pollution.

4.3. Transboundary pollution

Most types of pollution affect the immediate area surrounding the source. Sometimes the pollution may affect the environment hundreds of miles away from the source, such as nuclear waste, this is called transboundary pollution.

5. Classification of water pollutants

1. **Oxygen-depleting substances**: organic waste, used by aerobic microorganisms in presence of oxygen.

2. **Water soluble inorganic substances:** These include

   - Salts, acids, compounds of heavy metals. Acidity caused by industrial discharges (especially sulphur dioxide from power plants). Presence in soil (via polluted water) of these substances reduce agricultural harvest, as well as to arouse corrosion of the metals.

   - Inorganic nutrients for plants include water soluble nitrates, phosphates, which are promoters of eutrophication. Ammonia from food processing waste.

3. **Organic substances:** Oil products, petrol, plastic, pesticides, solvents, detergents, etc.

6. Characteristics of Wastewater

Wastewater (or waste water) is any water that has been contaminated by human use. Wastewater is "used water from any combination of domestic, industrial, commercial or agricultural activities.

Wastewater is 99.9% water and 0.1% solids. The main task in treating the wastewater is simply to remove most or all this 0.1% of solids. The three main characteristics of wastewater are classified below.

6.1. Physical characteristics of wastewater

i.   **Color -** Fresh sewage is normally brown and yellowish in color but over time becomes black in color.

ii.   **Odor –** Wastewater that includes sewage typically develops a strong odor.

iii.   **Temperature -** Due to more biological activity, wastewater will have a higher temperature.

iv.   **Turbidity -** Due to suspended solids in wastewater, wastewater will have a higher turbidity, or cloudiness.

6.2. Chemical characteristics of wastewater

Wastewater contains different chemicals in various forms as mentioned below.

i.   **Chemical Oxygen Demand (COD)** - is a measurement of the oxygen required to oxidize soluble and particulate organic matter in water

ii.   **Total Organic Carbon (TOC)** - TOC is a measure of carbon within organic materials.

iii.   **Nitrogen** - Organic nitrogen is the amount of nitrogen present in organic compounds.

iv.   **Phosphorous** - Organic phosphorous (in protein) and inorganic phosphorous (phosphates, PO4-)

v.   **Chlorides** (Cl-)

vi.   **Sulfates** (SO4-2)

vii.   **Heavy metals**

- Mercury (Hg)
- Arsenic (As)
- Lead (Pb)
- Zinc (Zn)
- Cadmium (Cd)
- Copper (Cu)
- Nickel (Ni)
- Chromium (Cr)
- Silver (Ag)

Analyzing the physical and chemical characteristics of wastewater plays a critical role in the wastewater treatment process.

6.3. Biological characteristics of wastewater

i.   **Biochemical Oxygen Demand (BOD)** - BOD is the amount of oxygen needed to stabilize organic matter using microorganisms.

ii.   **Nitrogenous Oxygen Demand (NOD)** - NOD is the amount of oxygen needed to convert organic and ammonia nitrogen into nitrates by nitrifying bacteria.

iii.   **Microbial life in wastewater** - Wastewater contains the following microbes:

- Bacteria
- Protozoa
- Fungi
- Viruses
- Algae
- Rotifers
- Nematodes

iv.   **Oil and Grease** - Oil and grease originate from food waste and petroleum products. The amount of oil and grease in raw wastewater varies from 10 to 109 mg/L.

7. Type of wastewater from household

Type of wastewater	Source of wastewater
Gray water	Washing water from the kitchen, bathroom, laundry (without faeces and urine)
Black water	Water from flush toilet (faeces and urine with flush water)
Yellow water	Urine from separated toilets
Brown water	Black water without urine or yellow water