

17. Environmental Chemistry

1. Introduction of pollutants into the environment that cause undesirable changes and have harmful effects on plants, animals, and human beings is called environment pollution.

2. Pollutants are the waste materials, which cause pollution. They are of two types: biodegradable (food and garden waste, human waste) and non biodegradable (plastic, glass, heavy metals, etc.).

3. **Atmospheric pollution are of two types:**

1. Tropospheric pollution (Troposphere → lowest region of atmosphere)
2. Stratospheric pollution (Stratosphere → above the troposphere)

Tropospheric pollution

1. Gaseous air pollutants → Oxides of sulphur (mainly SO_2), oxides of nitrogen (mainly NO , NO_2), hydrocarbons, oxides of carbon (CO , CO_2)

CO binds to haemoglobin to form carboxyhaemoglobin, which is more stable than oxygen-haemoglobin complex. It reduces the oxygen carrying capacity of blood.

Greenhouse gases → CO_2 , methane, ozone, chlorofluorocarbon (CFCs), water vapours, nitrous oxide.

Oxides of sulphur and nitrogen combine with rain water to form acid rain ($\text{pH}=5.6$).

2. Particulate pollutants → Dust, mist, fumes, smoke, smog, etc.

Smog (the word derived from smoke and fog). It is of two types:

- 1) Classical smog (Also called reducing smog)
- 2) Photochemical smog (Also called oxidising smog)

Photochemical smog causes irritation of eyes, headache, chest pain, cough, difficulty in breathing, damage to plant life and corrosion. It can be controlled by using catalytic converter in automobiles and by plantation of plants like Pinus, Juniperus, Pyrus, etc.

Stratospheric pollution:

Ozone layer is depleted due to the excessive use of chlorofluorocarbons.

Effects of ozone layer depletion:

1. Skin cancer, cataract, damage to fish production
2. Increase of evaporation of water
3. Damage of paints and fibres
4. Harmful mutation of cells

Water pollution:

- Ways to identify polluted water:
 - Foul smell
 - Bad taste
 - Oil or grease floating on the surface
 - Excessive algal growth
 - Growth of weeds
- Sources of water pollution:
 - Point sources: Sewage discharge pipes, oil spills, household and industrial waste, etc.
 - Non-point sources: Acid rain, agricultural run off, thermal pollution
- Cause of water pollution:
 - Pathogens: Enter water from sewage and animal excreta, for example, *E.Coli* and *S.faecalis*
 - Organic wastes: Leaves, grass trash, etc. reach water with run off
 - Chemical pollutants: Heavy metals dissolved in water, acids and raw salts, organic chemicals, fertilizers, etc.
- Water quality parameters:
 - pH value
 - Bacteria
 - Hardness
 - Dissolved oxygen
 - Biological oxygen demand
 - Turbidity
- Ways to Control Water Pollution
 - Proper treatment of sewage before its discharge in water bodies.
 - Neutralization of chemicals released from factories.
 - Gravity settlement and screening processes helps in removal of heavy floating solids.
 - Oxidation of organic matter for its removal.
 - Destruction of pathogens by ultraviolet radiations.

Soil pollution:

Pesticides → Synthetic toxic chemicals used in agriculture to control damages caused by insects, rodents, weeds, and various crop diseases. E.g. DDT

Herbicides → Chemicals used to control weeds. E.g.: Sodium chlorate (NaClO_3), sodium arsenite (Na_3AsO_3)

Domestic waste can be used as manure

Green Chemistry:

Green chemistry is a way to protect our environment from chemicals and wastes by utilizing the knowledge and principles of chemistry and other sciences.