Eutrophication

Pollution of water by nutrients such as phosphate from detergents and fertilizers acceierate the growth of algae and other plants in river water. This reduces the dissolved oxygen and adversely affect aquatic life. This phenomenon is known as eutrophication.

International Standards for Drinking water

The quality of drinking water is very important for human health. The following table shows the maximum concentration of certain ions and metals permitted in drinking water.

International standards for drinking water.

Substance present in drinking water	Upper safety limit
1. Fluoride ion	1 ppm or 1 mg. dm^{-3}
2. Sulphate ion	< 500 ppm
3. Nitrate ion	50 ppm
4. Lead	50 ppb
5. pH	between 5.5 and 9.5
6. Zn	5 ppm
7. Fe	0.2 ppm
8. Mn	0.05 ppm
9. Cu	3 ppm
10. Al	0.2 ppm
11. Cd	0.005 ppm

- Excess of NO_3^- in drinking water can cause disease such as blue baby syndrome (methemoglobinemia).
- Excess of lead can damage kidney, liver and reoproductive system.
- Excess of sulphate causes laxative effect.
- Concentration of fluoride ions upto 1 ppm is good in drinking water because it prevents tooth decay. The fluoride ions make the enamel on teeth harder by converting hydroxyapatite $[3Ca_3(PO_4)_2 . Ca(OH)_2]$ present on the enamel of the teeth to harder fluorapatite $[3Ca_3(PO_4)_2 . CaF_2]$

Soil Pollution

Any substance which destroys the quality and mineral content of the soil or which disturbs the biological balance of the organisms in the soil is referred to as soil pollutant.

Soil pollution has adverse effect on plant growth. Soil pollution is mainly due to (i) Indiscriminate use of fertilizers, pesticides etc. (ii) Dumping of waste materials.(iii) Deforestation.

Pesticides

Pesticides are toxic chemicals used to kill or stop the growth of unwanted organism. After the second World War, **DDT** was widely used to control insects and crop diseases. Later other chemicals such as **Aldrin** and **Dieldrin** were introduced. But these compounds are all non-biodegradable.

Herbicides

These are compounds used to control weeds. Sodium chlorate ($NaClO_3$) and sodium arsenite (Na_3AsO_3) were used for many years as herbicides. Since they are toxic and not environment friendly, they are not used much.

Control of environmental pollution

Environmental pollution can be controlled to a large extent by proper waste management. Both industrial and domestic wastes need treatment for safe disposal. (i) Recycling of industrial wastes not only saves the cost on raw materials but also reduces waste disposal costs. Collection and recycling of glass, metal scrap, plastics etc. are some examples of industrial recycling. (ii) Sewage water is filtered to remove large solids and then allowed to settle. (iii) Biodegradable wastes are to be converted into compost.

GREEN CHEMISTRY

Green chemistry is the programme of developing new chemical processes or making improvements in the already existing processes so as to make them less harmful to human health and environment. Green chemistry does not employ toxic reagents or solvents or severe reaction conditions. It uses mild environment friendly conditions such as microwaves, sunlight, sound waves, enzymes etc for chemical processes.

Thus, green chemistry is a production process that would bring minimum pollution to the environment.

Green chemistry in day to day life

(i) Dry cleaning of clothes

Tetra chloroethene ($Cl_2C = CCl_2$) was earlier used as solvent for dry cleaning. This compound contaminates the ground water and is suspected to be carcinogenic. Its use has been replaced by liquefied CO_2 along with a suitable detergent which is less harmful. Similarly, for bleaching of clothes in the laundary, H_2O_2 is being used which gives better results and makes use of less amount of water.

(ii) Bleaching of paper

Earlier, chlorine gas was used for bleaching paper which is highly toxic chemical. Its use has been replaced by hydrogen peroxide along with a suitable catalyst.

(iii) Synthesis of chemicals

Ethanal is now commercially prepared using environment friendly chemicals and conditions, i.e., by one step oxidation of ethene in the presence of ionic catalyst in aqueous medium.

$$CH_2 = CH_2 + O_2 \xrightarrow[Pd\,(II)/Cu\,(II)\ \text{in water}]{catalyst} CH_3CHO\ (90\%)$$

Keep in Memory

- Environmental pollution is the contamination of our surroundings with substances that have harmful effects on plants, animals and human beings
- The lowest region of atmosphere extending up to the height of 10km from sea level is known as **troposphere.** The region above this between 10 and 50km above sea level is known as **stratosphere.**
- Troposphere pollution is due to gaseous pollutants (e.g., oxides of S, N and C) or particulate pollutants (e.g., dust, mist, fumes smoke and smog)
- SO_2 causes respiratory diseases such as asthma, bronchitis, etc. and cause irritation to the eyes.
- NO_2 is a lung irritant and is also harmful to various textile materials.
- CO binds to haemoglobin of blood to form carboxyhaemoglobin. This reduces the oxygen carrying capacity of blood finally leading to death.
- **Green house effect** is the phenomenon in which earth's atmosphere traps the heat from the sun and prevents it from escaping into outer space resulting in the rise of atmospheric temperature. This causes global warming.
- Some green house gases which trap infrared radiation are CO_2, CH_4, O_3 and chlorofluoro carbons.
- Rain water has a normal pH of 5.6 due to the dissolution of CO_2 in water and formation of carbonic acid. When the pH of rain water drops below 5.6, it is called **acid rain.** It is due to the dissolution of SO_2 , NO_2 , etc present in polluted air.\
- Smog is a mixture of smoke and fog containing particulates
- Classical smog is a mixture of smoke, fog and SO_2 . It has reducing property.
- Photochemical smog is produced due to the action of sunlight on nitrogen oxides and hydrocarbons. It has oxidising property.
- The major constituents of photochemical smog are oxides of nitrogen, ozone, formaldehyde, PAN, etc.
- The upper stratosphere consists of O_3 which protects us from the harmful UV radiation

- The main reason for ozone layer depletion is due to the release of chlorofluorocarbon compounds (CFCs) known as freons.
- The major water pollutants are disease causing pathogens (bacteria, etc) that enter water from domestic sewage.
- Bacteria decreases the dissolved oxygen content of water
- Biochemical oxygen demand (BOD) is the amount of O_2 required by mico-organism to oxidise the organic matter present in polluted water.
- Clean water has BOD value less than 5 ppm and polluted water will have higher BOD value
- Pollution of water by phosphate from detergents and fertilizers increase the growth of algae and other plants in river water. This reduces the dissolved oxygen of water and affect aquatic life. This is known as **eutrophication.**
- The maximum limit of nitrate in drinking water is 50 ppm. Excess nitrate can cause disease called methemoglobinemia or 'blue baby' syndrome.
- Soil pollution is mainly due to excess use of fertilizers and pesticides and dumping of waste materials.
- $NaClO_3$, $NaAsO_3$, etc are used as herbicides
- Green chemistry is the programme of developing new chemical processes or making improvements in the existing processes so as to make them less harmful to human health and environment.
- Due to the influence of 'Green chemists' chlorine containing solvents used for dry cleaning are replaced by liquid CO_2. H_2O_2 is now used for bleaching paper instead of harmful chlorine.