

POLLUTION AND ITS CONTROL

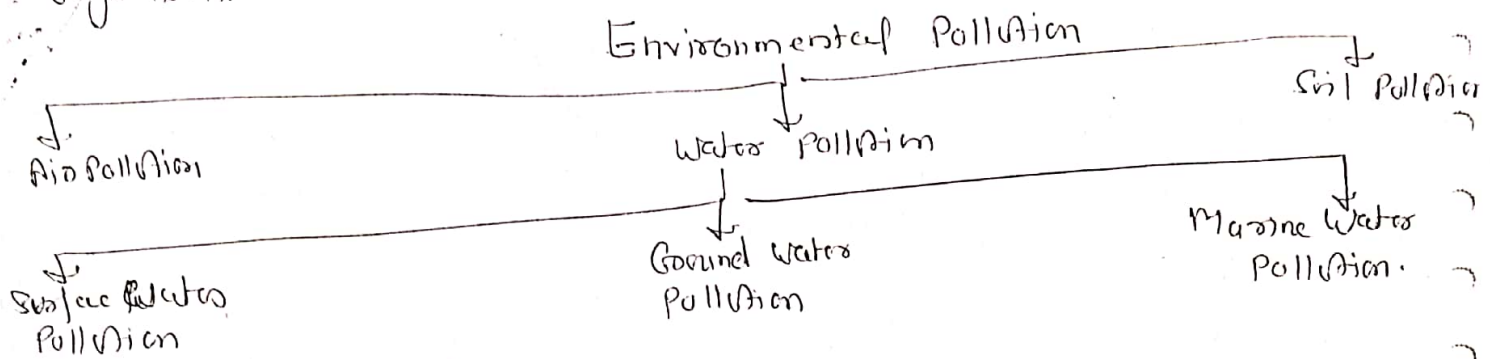
Broadly, environment consists of four segments

- 1) Atmosphere
- 2) Hydrosphere
- 3) Lithosphere
- 4) Biosphere

1. Atmosphere → Atmosphere is a dynamic system, changing continuously. It is a thin layer of gases which is a great source of all living things on the planet. Major gases in the atmosphere are nitrogen (78%), oxygen (21%), while the minor components are argon (0.94%), carbon dioxide (0.03%) and some trace gases. The important of this atm is to maintain the heat balance of earth, through absorption of radiations emitted by sun and reemitted from the earth.
2. Hydrosphere → This includes all types of water resources. Most of the water on this planet is stored in ocean (97%) about 2% in polar ice caps glaciers, while only 1% is available as fresh water. Water representing the medium of life on earth and it is continuously purified by evaporation and precipitation.
3. Lithosphere: - This is the outer surface of earth which consists of earth crust and soil. Soil is the major means of living source which comprises a complex mixture minerals, organic matter, air and water.
4. Biosphere - Biosphere contains all living organisms and their various interaction with the other components of environment i.e., atm, hydrosphere and lithosphere. The total no. of existing species in the biosphere is about three million. Biosphere can be divided into two parts biotic (producers, consumers and decomposers) and abiotic.

POLLUTION → Pollution refers to the occurrence of an unwanted change in the environment because of the action or presence of a pollutant. It produces impure, dirty or unclean objectionable.

conditions which affect adversely any one of the environment by the organisms.



Pollutant → A substance or effect introduced into the environment in significant amounts in solid, semi solid, liquid, gas or sub molecular particle. ~~form which has a~~ The pollutants are commonly introduced into the environment by ways of point sources (pipes, water streams etc) and area sources (Automobile exhaust, domestic waste etc). ~~the type~~ type of pollution.

- 1) Additive effect:— The combination of two or more chemicals results in additive effect where the combined toxicity can be predicted simply by adding their toxicities ($1+1=2$)
- 2) Synergistic effect:— The interaction between two or more chemicals becomes more toxic than can be predicted ($1+1 > 2$)
- 3) Antagonistic effect:— The results when the toxicity of one of the chemicals is reduced by the other making the combination less toxic, than can be predicted ($1+1 < 2$).

Contamination:— Contamination refers to the introduction of undesirable materials to a medium making it unfit for a practical use. For eg, contamination of air by hydrocarbon exhaust from automobiles.

Cause of pollution:— Due to activities of man (rapid industrialisation) / increase of population and deforestation which the pollution caused by natural way as forest fire, volcanic eruption, earth quake, strong winds, natural organic and inorganic ~~decomposition~~ decay.

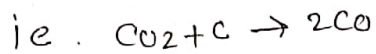
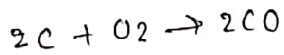
Air Pollutants : → (i) Primary Pollutants
(ii) Secondary Pollutants.

(i) → The P.P. are released directly from the source into the air in a harmful form. Such as ^{matter} ash, smoke, dust, fumes, mist, spray etc. Inorganic gases. Such as CO, NO_x, hydrocarbons, SO_x.

S.P. (ii) They enter the air as are formed in the atm. by chemical interactions among pri. pol. and normal atmospheric constituents. i.e. SO₃, NO₂, O₃, -CHO, peroxides of various sulphates and nitrate salts.

(iii) CO is colourless, odourless, tasteless. At low concentrations it is extremely toxic to humans and other animals. It is 96.5% as heavy as air and not soluble in water.

incomplete combustion of fuel (coal, oil, gas, charcoal etc.)



Dissociation of CO₂ at high temp.



Toxic effect : → heart diseases, anaemia & respiratory problems, birth defects, mental retardation etc.

CO₂ → More than 90% of CO₂ emitted presently is from respiration system of plants and animal cells. CO₂ is not a conventional pollutant as it is usually considered nontoxic and innocuous. CO₂ gas is considered nontoxic but approximately 50% to 60% of the ~~atm~~ anthropogenic greenhouse effect is attributed to CO₂ gas. The average global temp. increase considerable which is a serious threat to this planet.

Greenhouse effect → Green effect is the trapping of heat by the atm. The temp. at the earth surface is determined by

(i) the amount of sunlight earth receives

(ii) " " " " " " reflects

(iii) Retention of heat by the atm.

(iv) Evaporation and condensation of water vapour

The ultraviolet sunlight that reaches the earth warms both the atm. and the surface. The greenhouse gases cannot stop these UV

rays as they are very ~~short wave lengths but they can be~~ ^{short wave lengths but they can be} ⁽⁴⁾ checked by the ozone which is not sufficient enough. The amount of sunlight earth reflects are having long wave lengths (IR) which can be trapped by the green house gases like CO₂ along with water vapour, CH₄, ~~HO~~, ~~nitro~~, ~~oxide~~ of CFCs (chloro fluoro carbond). Because of these green house gases, the average global temp. at the earth's surface increases considerably.

Control of Air Pollution

- ① Raw Material Change - (a) Pure grade of raw materials should be bypassed used to remove undesirable impurities -
- ② Processual raw materials should be used.
- ③ Process changes →
- ④ Equipment replacement
- ⑤ Particulate emission control

Water Pollution

Water has always been vital for living organisms existence. The no. of incidences of concern has been continually increasing and smaller and smaller concentrations of many substances are attracting attention. Water pollution may be defined as any physical, chemical and biological change in water quality of by other substances that adversely affects living organisms.

For determination of water quality, characterization of water is essential which involves -

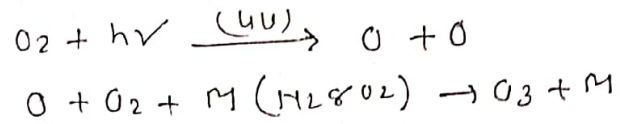
- (a) the dynamic distribution of chemicals in the aqueous phase.
- (b) Accumulation and release of chemicals in the aqueous phase.
- (c) Sorption behaviour of bottom sediments by aquatic biota
- (d) Input and output from land and atmosphere.

A long no. of pollutants and their effect are very strongly correlated. Let us be clearly

1. Organic pollutants
2. Inorganic pollutants
3. Sediments
4. Radioactive substances
5. Thermal pollutants

① Effect of water

Ozone: Ozone is non toxic, non flammable and stable in the atmosphere. Ozone is an important species in the stratosphere (20 km above earth's surface) acting as a protective UV radiation shield for living organisms on earth. Ozone is formed



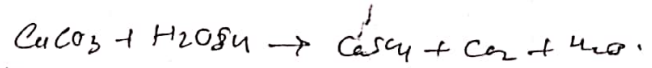
where M is this body. Ozone absorbs the short wave length radiation. CFC were the prime suspect for causing ozone depletion. It is believed that one molecule of CFC is capable of destroying 1,00,000 molecules in stratosphere. The +ve aspect of O₃ is that it produces the photochemical smog which are harmful to plants, animals and human beings.

Acid Rain: → the contribution factors for the acid rain are pollutants like CO₂, CO, SO_x, NO_x. When these pollutants enter the atmosphere are converted into their corresponding acids.

- 1) $2SO_2 + O_2 + 2H_2O \rightarrow 2H_2SO_4$
- 2) $4NO_2 + O_2 + 2H_2O \rightarrow 4HNO_3$
- 3) $HCl(g) + H_2O \rightarrow HCl(aq)$
- 4) $2CO + 2H_2O + 2O_3 \rightarrow 2HCO_3$

When HNO₃ & H₂SO₄ combine with HCl generally acidic ppt. is called acid rain which is a major pollution problem locally.

Effect of Acid Rain: It causes extensive damage of structural materials like marble, lime stone, mortar, slate etc. for eg.



H₂SO₄(l) or HNO₃(l) & HCl is highly effective.

Acid rain also causes eye irritation and accelerates the rate of corrosion of metals.