AIR POLLUTION :

INTRODUCTION :-

Life & the atmosphere have evolved side by side on the planet earth. The atmosphere that surrounds our planet is one of the factors that makes the planet hospitable towards life. Because the life giving atmosphere surrounds us so intimately, we abuse it without thought to burn not only the food in our bodies but also the coals in our furnaces & the gasoline in our cars. Also we have used it to carry away our wastes.

For proper growth & other demands not only human but all organisms depend on environment. So the environment should be balanced in all respects. If there is any change in the components of environment by the contamination of substances which make or will make the environment harmful for the organisms is called Pollution.

The substances which cause pollution are known as Pollutants. Pollutants may be chemical wastes, biological products & physical agencies.

HISTORICAL BACKGROUND :-

The history of pollution begins with the industrial revolution or more accurately with the entire broad spectrum of Economical & social changes that began slowly in the 11th Century & is still with us today.

Instrumental observations regarding the fluctuation of climates are available for about 300 yrs. From these observations it has been estimated that

the mean temp? of the northern part increased by about 0.5°C from 1900 & has fallen by 0.3°C during the last 50 yrs.

DEFINETION :—

Pollution has been defined variously. Some of the definations are —

1. Any increase in impurities in the environment is called Pollution.
2. Any thing which makes polluted to the environment is called Pollution.
3. National research Council committee (1966) defined Pollution as —

"It is an undesirable change in the physical, chemical or biological characteristics of our land, air or water which will or may be harmful for life."

Pollution can also be defined as an undesirable change in physical, chemical or biological characteristics of our water & land that may or will adversely affect human life, industrial progress, living conditions & cultural assets.

POLLUTANTS :—

A constituent at the wrong amount at a wrong place or at a wrong time is called Pollutant.

Eg:- Dust (dust, or etc), smoke, Chemicals & other factors.

TYPES OF POLLUTANTS :—

Pollutants are of two types —

(1) Biodegradable :- Pollutants that capable of

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being removed or degraded by biological or microbial (bacteria & fungi) actions.
Eg :- Sewage, etc.

(2) **Non-degradable** :— The substances which are not normally acted upon by microbes. They are of two types —

(A) Wastes — Eg :- glasses, plastic, aluminium canes, etc.

(B) Poisons — Eg :- Radioactive substances, Pesticides, Smog, heavy metals etc.

TYPES OF POLLUTION :—

There are several types of Pollution —

(1) Air Pollution.
(2) Water Pollution.
(3) Soil Pollution
(4) Noise Pollution.
(5) Mercury Pollution.
(6) Radioactive Pollution.

(1) **AIR-POLLUTION** :— ① Air pollution is defined as —

"The occurrence of foreign particles or gases in the atmosphere which are harmful to man, vegetations, animals & buildings."

Air is the main constituents for human survival so the air should be pure & clean. The air which we inhale contained not only O_2 but also N_2O, SO_2, CO_2, CO & H_2S etc & dust particles. The effect of these may be quite considerable.

Thus an increase in the impurities in the natural air is called air pollution.

The sources of air pollution are very large & of different types. Some of them are. —

(1) Industrial Pollutants —

The pollutants discharged into the air from industrial chimneys & powerhouses are CO, CO_2, SO_2, H_2S & hydrocarbons. These gases are produced due to burning of coke & petroleum & by combustion of & Ignite coal at thermal power stations. Dust & fumes released from metallurgical processes are loaded with lead(Pb) Cr, Ni etc.

(2) Mobile Combustion Source :—

The sources include locomotives, aircrafts & automobiles etc. Automobiles release carbon. CO, NO & hydrocarbons. Every gallon of petrol consumed by automobiles produces 5 pounds of CO, 15 L of NO which is sufficient to pollute 800 - 2000 L of air

(3) Burning of fuels :—

Fossil fuels (coal) provide us energy for cooking, heating & lighting of our houses. Among fossil fuels Coal & Oil are the major source of energy. Coal on combustion produces CO_2, incomplete combustion yields CO & variety of Hydrocarbons including CH_4. Burning of coal produces SO_2 & ash also.

(4) Agricultural Activities :—

About 60-65% of CO_2 is produced from burning of forest &

(3)

Swamps & grasslands. About 40% CH_4 is produced from Paddy fields & from burning of biomass. Spraying & dusting for pests & weeds control emit organic phosphates, chlorinated hydrocarbons, arsenic & Pb into the air.

(A) Ionizing radiations :—

Ionizing radiations like Alpha, Beta & Gamma rays are produced during nuclear explosions, During Scientific experiments & pre testing of atomic weapons.

(B) Suspended Particulate Matter (SPM) :-

SPM is a major air pollutant. Dust is generated from sources such as coal dust, cement dust, Silica dust etc. A huge amount of dust is also blown by transport vehicles.

MAJOR AIR POLLUTANTS AND EFFECTS OF AIR POLLUTION :-

Carbon monoxide

(1) Carbon-Monoxide (Co) → It is produced due to incomplete combustion of fuel (Industries, Motor vehicles & oil refineries). Natural sources of this gas are various plants & animals. Higher animals produce some carbon monoxide from haemoglobin break down. Some cert Co is also released from bile juice. Break down of photosynthetic pigment in algae also releases some Co.

In blood it has a high affinity for haemoglobin & thus replaces Oxygen. The gas is fatal over 1000 Ppm (part per million)

causing unconsciousness in an hour death in few hours. when in higher concentration causes headache & slows down physical & mental activities & form carboxy-haemoglobinate.

(2) Carbon dioxide (CO_2) —

CO_2 in large concentration may be a health hazard & can also be responsible for rise in atmospheric temperature. It is released from combustion of fuels & also produce during respiration.

(3) Sulphur dioxide (SO_2) —

The gaseous SO_2 is oxidised to SO_3 which on combination with water form H_2SO_4. The presence of increasing concentration of H_2SO_4 vapours leads to acid rain.

High Concentration of SO_2 causes irritation to the eyes & respiratory tract leading to Asthma & Bronchitis etc. High concentration of SO_2 causes disappearance of chlorophyll & break down of cell. SO_2 is also involved in the erosion of building materials & limestone, marble, the slate used in roofing & deterioration of deterioration of statues.

(4) Hydrogen Sulphide (H_2S) →

The chief source of H_2S are decaying vegetation & animal matter specially in aquatic habitats. About 30 million tons of H_2S is released by Oceans & 60-80 million tons per year by land. Industries emit about 3 million tons every year.

At low concentration H_2S causes headache, Nausea, collapse, Coma & final death. Higher concentration may cause Diorrhea & Pneumonia. Diarrhoea, Pneumonia

(5) Aerosoles :— These are chemicals present in air in the form of vapour. They are also emitted from jet planes & contains chloro-fluoro carbon. Chloro-fluoro carbon are also used in refrigeration.

(6). Fluorides :— Fluorides are released during refinement of Alluminium rock, phosphates etc.
In small amounts fluorides are beneficial for teeth in man. However, higher level becomes toxic & cause fluorosis. fluorosis

(7) Benzo pyrene :— It is a type of carcinogen produced in tobecco smoke, industrial effluences & automobiles exhausts.

(8) Metal ores :— Many metals & ores are present in air in form of particles. eg:- Ni, Cd, Sn, etc Pb, Hg, Zn etc. These are released as fumes from industries. fumes
These metal ores cause damage to nervous system, liver, eyes etc. Infants may be deformed.

(9) Smoke :— The smoke constitutes 10-15% of air pollution. The smoke makes heavier & darker to the atmosphere with fog. The smoke combines with fog to form Smog.

Smoke + fog (6) (Smo + og) Smog

The hydrocarbon with NO in presence of U.V light produce Ozone (O_3) & other organic compounds. This process is known as Photochemical reaction.

Hydrocarbon + NO $\xrightarrow{U.V\ light}$ Ozone Complex + Other Organic Complex.

STEPHEN (1956) detected a highly phytotoxic compound from atmosphere i.e. PAN (Per-Oxy-acyl nitrite). The Ozone & PAN cause serious problem for plant etc.

(10) Ozone :- Ozone in the stratosphere is responsible for protecting the earth from high energy U.V radiations. O_3 found in troposphere has warming effect. Ozone at concentration of 0.02 PPm destroys chloroplasts cells; O_2 injured mucus membrane.

CONTROL OF AIR POLLUTION :

(i) Sulphur free & lead free fuel should be used for motor vehicles.

(ii) In factories, chimneys should be tall to reduce the rate of pollution at ground level.

(iii) To remove the particulate matter in the smoke, it should be filtered before release of into the air.

(iv) Plantation should be done on a large scale.

(v) Trees use CO_2 & release O_2 & purify the air.

(vi) Control equipments like gravity settling tank or porous filters & electrostatic precipitators should be installed.

in factories to minimise the air pollution
viii) Cyclone Operator, Cloth filters should be used for dust & fine particles.
viii) Mask should be worn in foggy & smoky Weathers.
ix) Proper management should be done for industrial wastes.
x) Use of Pesticides & Herbicides should be rationalised
xi) Restricted use of radioactive substances

EFFECTS OF AIR POLLUTION :-

(1) On Atmosphere :—
(i) By air pollution, weather condition is effected.
ii) Due to polluted air less amount of short waves solar radiations (visible & U.V light) reach to the earth.
iii) It is accepted on world level that due to air pollution heat balance of the earth is being disturbed.
iv) It also leads to Green-house effect & depletion of ozone layer.

(2) On Plants :—
(i) Due to SO_2 pollution growth of some plants is effected.
(ii) Presence of O_3 & NO damage the tissue of many plants.
iii) Due to presence of particles in air less amount of sun-light reaches on earth for photosynthesis.
iv) Fluoride in air destroy the leaf tissue.
v) The hydrocarbons lead to the pre-mature leaf fall & fruit drop.

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(vi) Lichens are sensitive to air pollution. They are grown as pollution indicator.

(vii) Pollutants can also break down the waxy coating on leaves that help to prevent excessive water loss & damage from pests, disease, drought etc.

(3) On Human & Other vertebrates :-

(i) SO_2 causes irritation in respiratory system which proves fatal.

(ii) In damp, foggy climate peoples may suffer from Chronic Bronchitis.

(iii) Carcinogens present in polluted air may cause lung cancer.

(iv) Due to abundance of Ozone in air Headache & dryness of throats take place.

(v) CO, Pb exerts adverse effect on mice, horses & men.

(4) On building and Statues :-

(i) SO_2 is also involved in the erosion of building materials & lime stone marble, the latter is used in roofing & decoration of statues.