

# ENVIRONMENTAL ISSUES

## INTRODUCTION

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- Any change in physical, chemical and biological characteristics of the [environment](#) which harm the human life is called **pollution**.
- **Contamination** is the presence of harmful organisms or their toxins that cause disease.
- Pollution is of two types: **natural** and **man made**.
- **Natural pollution** is caused by natural sources. E.g., Volcanic eruptions, emission of gas  $\text{NO}_x$ ,  $\text{O}_3$ , UV rays, cosmic ray etc.
- **Man made or anthropogenic pollution** is caused by human activities. E.g., Burning of fuels, deforestation, pesticides, fertilizers, etc.
- **Pollutant** is any substance or chemical responsible for causing pollution.
- **On the basis of form of their occurrence**, pollutants are divided into two categories –
  - **Primary pollutants** : These are present in the same form in which they are produced. e.g., carbon monoxide, DDT.
  - **Secondary pollutants** : These are formed by reaction between the primary pollutants in the presence of sunlight, e.g., PAN, Ozone,  $\text{HNO}_3$ ,  $\text{H}_2\text{SO}_4$  etc. Nitrogen oxides and hydrocarbons react photochemically to produce peroxyacetyl nitrates (PAN) and ozone.The secondary pollutants may be more toxic than the primary one. The phenomenon is called **synergism**.
- **On the basis of their degradation**, pollutants are divided into two categories –
  - **Biodegradable pollutants** : Pollutants which are decomposed or degraded by biological or microbial action, e.g., domestic sewage, clothes, paper, etc.
  - **Non-biodegradable pollutants** : Pollutants which are not decomposed or degraded by living organisms or micro-organisms. E.g., DDT, glass, plastics, aluminium cans, phenolic compounds, pesticides, radioactive substances, heavy metals like mercury, lead, cadmium etc.
- **On the basis of their existence in nature**, pollutants are divided into two categories –
  - **Quantitative pollutants** : These are naturally present in nature and are also added by man. These become pollutants only when their concentration reaches beyond a threshold value in the environment, e.g.,  $\text{CO}_2$ .
  - **Qualitative pollutants** : These are not present in the nature but are added in nature only due to human activities, e.g., insecticides, fungicides, herbicides etc.
- **On the basis of emission of pollutants**, pollution is of following type -
  - **Point source** : Pollution from a single point. E.g., chimney, municipal sewer.
  - **Line source pollution** : E.g., roads due to automobile exhausts.
  - **Area source pollution** : E.g., mining areas, industrial areas.
  - **Diffuse source pollution** : It is over a large area. E.g., pesticides and fertilizers.
- **On the basis of environmental study**, pollution is of the following types –
  - Air pollution
  - Water pollution
  - Soil pollution
  - Noise pollution
  - Radioactive pollution

## AIR POLLUTION

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- Air pollution is the occurrence or addition of foreign particles, gases or pollutants in the air which have an adverse effect on human beings, animals, vegetation etc.

- The two main categories of air pollutants are gases and particulates.
- The **gaseous materials** include various gases and vapours of volatile substances or the compound with a boiling point below 200°C.
- **Particulate matter** consists of solid particles or liquid droplets (aerosols) small enough to remain suspended in air, e.g., soot, smoke, dust, asbestos, fibres, pesticides, some metals (including Hg, Pb, Cu and Fe) and also biological agents like tiny dust mites and flower pollen.
- Atmospheric particles having diameter  $> 10\text{ }\mu\text{m}$ , generally settle out in air less than a day, whereas particles with diameters of  $1\text{ }\mu\text{m}$  or less can remain suspended in air for weeks.
- Suspended particulate matter in the lower atmosphere (troposphere) causes and aggravates human respiratory illness, like asthma, chronic bronchitis etc.

## MAJOR AIR POLLUTANTS AND THEIR EFFECTS

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### CARBON MONOXIDE (CO)

**Source :** It is the main air pollutant (or most poisonous gas) released from the smoke of automobile.

**Effect :** Carbon monoxide is a highly toxic gas it combines with haemoglobin of the blood and blocks the transportation of oxygen. Thus, it impairs respiration and it causes death due to asphyxiation when inhaled in large amounts.

### UNBURNT HYDROCARBONS (3,4 BENZOPYRINE, CH<sub>4</sub>, BENZENE)

**Source :** These are mainly released from automobiles and burning of fossil fuels (coal, petrol, diesel). Methane (CH<sub>4</sub>) is the most abundant hydrocarbon in atmosphere and its main source is marshy area and paddy field.

**Effect :** Hydrocarbons cause lung cancer.

### NOTES

Polynuclear aromatic hydrocarbons is an important hydrocarbons and it also causes lung cancer i.e. this is carcinogenic.

### ETHYLENE

**Effect :** Falling of leaves without particular reason, falling of flowering bud before time.

### NITROGEN OXIDE (NO, NO<sub>2</sub>)

**Source :** Burning (combustion) of fossil fuel in automobiles. It forms about 10% of pollutants.

**Effect :** These nitrogen oxides form photochemical smog in the atmosphere and release ozone. Nitrogen oxide is also responsible for acid rain. Entry of nitrogen oxides and ozone in humans causes respiratory problems such as emphysema, bronchitis, swelling of lung and lung cancer etc.

## SULPHUR OXIDE (SO<sub>2</sub>, SO<sub>3</sub>)

**Source :** These are most harmful gaseous pollutants, the main source of sulphur oxides are coal burning, smelters, oil refineries. It forms about 18% of total air pollutants.

**Effect :** Lichens and mosses do not grow in SO<sub>2</sub> polluted areas. Lichens and mosses are indicator of SO<sub>2</sub> pollution. Oxides of sulphur produce acid rain and smog in the atmosphere.

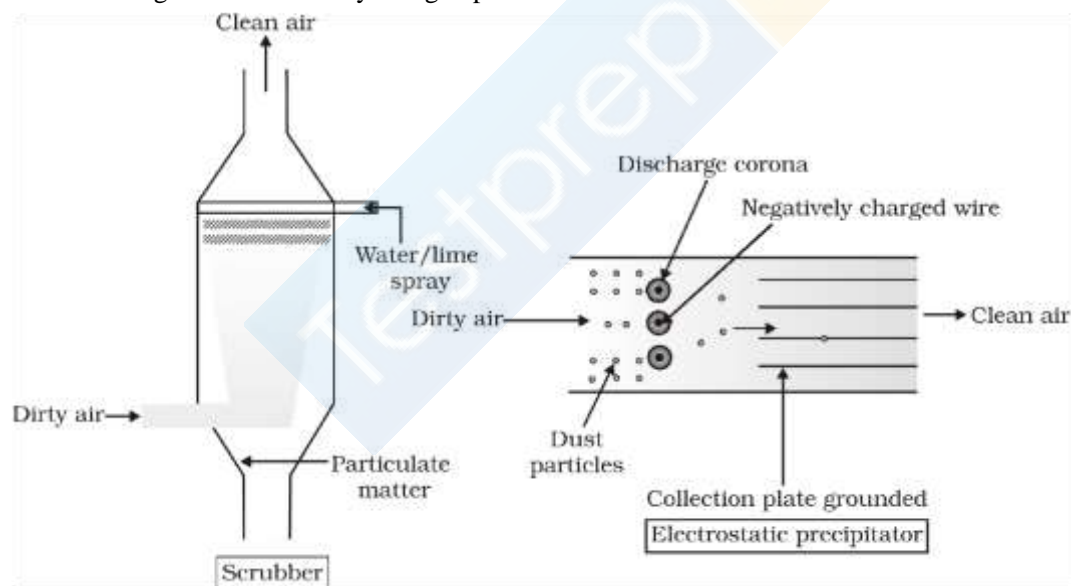
**Smoke :** SO<sub>2</sub>, SO<sub>3</sub>, NO<sub>2</sub>, NO, CO, CO<sub>2</sub>

## CONTROL OF AIR POLLUTION

### CONTROL OF PARTICULATE MATTER

Two devices are used to remove particulate air pollutants – **Arresters** and **Scrubbers**

- **Arresters** are used to separate particulate matter from contaminated air. Arresters are of different types
  - **Cyclonic separators and trajectory :** These are commonly used to separate out particular matters from industrial emissions with minimum moisture content. These separators work on the principle of dust separation by centrifugal force.
  - **Electrostatic precipitator :** It is the most efficient device to remove fine particulate pollutants. Electrostatic precipitation devices work on the principle of electrical charging of dust particles and collecting it on a differently charged platform.



*Fig. : Electrostatic precipitator*

- **Scrubbers** are used to clean air for both dust and gases. Wet and dry are the two types of scrubbers that are used for dust separation.

### CONTROL OF GASEOUS POLLUTANTS

Combustion, absorption and adsorption techniques are used to control gaseous pollutants.

- **Combustion** : In the combustion process, oxidisable gaseous pollutants are completely burnt at a high temperature. Petrochemicals, fertilizers, paints and varnish industries use combustion control of gaseous pollutants.
- **Absorption** : In this technique, gaseous pollutants are absorbed in suitable absorbent materials.
- **Adsorption** : This technique is applied to control toxic gases, vapours and inflammable compounds that could not be efficiently removed or transferred by a aforesaid technique. Such air pollutants are adsorbed on large solid surfaces.
- **Some other methods are :**
  - Engines should not be kept started when vehicles are in rest condition.
  - Barium compound mixed with petrol reduces the smoke.
  - It is also very essential to check the quality of gases released from the factories.
  - Industries should not be established at one place.
  - The smoke should be released into the atmosphere after filtration and purification (by cyclone collector or electrostatic precipitators).
  - To separate particles larger than 50µm, gravity settling tanks or porous filters are being used.

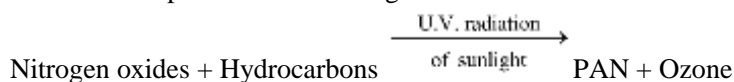
## EFFECT OF AIR POLLUTANTS

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Air pollutants are involved in causing four major environmental effects : Smog, acid rain, greenhouse effect (global warming), and ozone layer depletion.

### SMOG

- It is produced by the combination of smoke and fog.
- It causes silverying/glazing and necrosis in plants, allergies and asthma/bronchitis in human.
- Smog is of two types
  - **Classical or London smog or Sulphurous smog** – It occurs at low temperature and contains  $\text{H}_2\text{S}$ ,  $\text{SO}_2$ , smoke and dust particles. In it, secondary pollutants are absent. It was **first observed in winter months** at London in 1905. It is formed due to domestic and industrial combustion of coal.
  - **Photochemical smog or Los Angeles smog** : It was first observed in the mid day at Los Angeles in 1943. The cause of this smog was thought to be due to combustion of petroleum in automobiles. Photochemical smog occurs at high temperature over cities and towns. It is formed by the reaction of two air pollutants - nitrogen oxides (mainly  $\text{NO}_2$ ) and hydrocarbons (HC) that react with one another in the presence of UV radiations of sunlight to produce ozone ( $\text{O}_3$ ) and PAN (peroxy acetyl nitrate) which constitute the photochemical smog.



Ozone and PAN are commonly referred to as oxidants. Breathing ozone affects the respiratory and nervous system, resulting in headache, respiratory distress and exhaustion. It also causes irritation in eyes and asthma. Ozone is known to destroy crops of potato, Alfalfa and spinach to the extent of 50%. It also damages leaves of tobacco, tomato and pine and also the grape fruits. Besides, the PAN also blocks Hill's reaction of photosynthesis.

### ACID RAIN