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ENVIRONMENTAL CHEMISTRY

- Any substance which causes pollution is known as a pollutant. A substance becomes a pollutant when it is present in concentrations harmful to the natural environment.
- Environmental pollution may be described as the contamination of the environment with the harmful wastes arising mainly from certain human activities.
- Atmosphere, which surrounds the earth is divided into different region.
  (i) troposphere (upto the height of ~10 km from sea level)
  (ii) stratosphere (between 10 and 50 km)
- Atmospheric pollution is generally divided into two categories:
  (i) Tropopheric pollution
  (ii) Stratopheric pollution

  and the tropospheric pollutants may be gaseous or particulate in nature.
- Gaseous air pollutants
  (i) Oxides of sulphur : SO_2, SO_3 with SO_2 is the major constituent of the mixture. SO_2 can cause acute irritation to the membranes of the eyes resulting in tears and redness. It is also responsible for the acid rain.
  (ii) Oxides of nitrogen : N_2 and O_2 do not react with each other at sea level but at temp > 1210°C, or lighting during thunderstorm they combine to yield significant quantities of nitric oxide (NO). It is oxidized by ozone to NO_2 which is extremely toxic to living tissues, textiles, and is also responsible for acid rain.
  (iii) Oxides of carbon :
    (a) Carbon monoxide is produced as a result of incomplete combustion of carbon and comes from the exhausts of motor vehicles.

    CO is poisonous because it combines with haemoglobin much more strongly than oxygen.

    CO can cause mental impairment, muscular weakness, dizziness and even death.

    (b) Carbon dioxide is a natural constituent of the atmosphere and is vital to all forms of plant life. CO_2 causes mild narcotic effects. Stimulation of the respiratory centre and leads to asphyxiation.
- Greenhouse Effect : It is the phenomenon in which earth's atmosphere traps the heat from the sun and prevents it from escaping into the outer space. The heat radiated by the heated surface cannot pass freely into space, because certain gases called greenhouse gases (such as CO_2, CH_4, O_3, CFC's) absorb it and add to the heating of the atmosphere.

  This greenhouse effect results in the increase in average global temperature and increase the incidences of infectious diseases such as malaria, sleeping sickness, dongue and yellow fever.
- Particulates in atmospheric pollution are of two types :
  (i) Visible particulates are the minute living organisms that are disposed in atmosphere. These include bacteria, fungi, moulds etc. Fungi can cause plant diseases.
  (ii) Non-visible particulates are formed either by the breakdown of larger materials or by the condensation of minute particles and droplets. There are four type of non-viable particulate in the atmosphere:
- Inhalation of small particles irritates the lungs and exposure to such particles for long periods of time causes 'scarring' or 'fibrosis' of the lung lining. This type of disease is well known in the industrial settings and is termed as "Pneumoconiosis'.
- Smog which describe the 'smoke-fog' like conditions are the best known examples of air pollution. There are two types of smogs:
  (i) Classical smogs : occur in cool humid climate as a result of build up of SO_2 and particulate matter from fuel combustion.
  (ii) Photochemical smog : occur in warm, dry and sunny climate as a result of the action of sunlight on the nitrogen oxides and hydrocarbons produced by automobiles and factories.
- There are three main components of photochemical smog: nitrogen oxides, ozone and organic derivatives such as acrolein, formaldehyde, peroxyacetyl nitrate (PAN). Of all the components of smog, PAN has the

highest toxicity to plants, attacking younger leaves and causing ‘bronzing’ and ‘glazing’ of their surface.

- Biochemical oxygen demand (BOD) is a measure of the dissolved oxygen that would be needed by the microorganisms to oxidise these compounds. BOD, therefore, is a measure of the contamination caused by the totality of those compounds which can be oxidized in the presence of microorganisms. The BOD is taken as a realistic measure of quality of water.
- In chemical oxygen demand (COD), the water sample is treated with a known quantity of an oxidizing agent $K_2Cr_2O_7$ in acidic medium. It oxidizes most of the polluting substances. The remaining $K_2Cr_2O_7$ consumed, the amount of oxygen used in the oxidation may be calculated. The results are expressed in terms of amount of oxygen, in ppm, that would be required to oxidize the contaminates. This is called COD.

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