

The branch of chemistry which deals with the study of various chemical phenomena occurring in the environment is called *environmental chemistry*. It deals with the study of the origin, transport, reactions and effects of chemical species in the environment.

Environmental pollution

The term environmental pollution is the contamination of our surroundings with substances that have harmful effects on plants, animals and human beings. This is one of the most serious problems facing humanity and other life forms on our planet today. The effects of pollution due to harmful wastes are increasing at a fast rate and if we fail to control these effects human existence would be in danger.

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.

Atmospheric pollution

Atmosphere which envelopes the earth is divided into different regions. The lowest region, called the **troposphere** extends to the height of about 10 km from sea level. Above this lies the **stratosphere** at a height between 10 - 50 km above sea level. The troposphere contains about 80% of the total mass of air and almost all of the water vapour. The stratosphere contains nitrogen, oxygen, ozone and a little water vapour. The presence of ozone in the stratosphere prevent the harmful UV radiation of the sun from reaching the earth's surface.

Tropospheric pollution

Tropospheric pollution is due to the presence of undesirable substances in the air. Tropospheric pollutants may be gaseous or particulate in nature. The major gaseous and particulate pollutants are:

(i) *Gaseous air pollutants*: Oxides of sulphur, nitrogen and carbon, hydrogen sulphide, hydrocarbons, ozone and other oxidants.

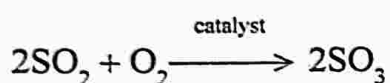
(ii) *Particulate pollutants*: Dust, fumes, spray, smoke etc.

Gaseous air pollutants

1. Oxides of sulphur

SO₂ gas is released into the atmosphere through volcanic eruptions and through combustion of sulphur containing fossil fuels. Even at lower concentrations, SO₂ causes respiratory diseases such as asthma and bronchitis. It can cause cough, irritation of eyes, shortness of breath etc. It damages vegetable crops and affects plant growth.

Presence of particulate matter in polluted air oxidises SO₂ to more harmful SO₃



This oxidation is also promoted by ozone and hydrogen peroxide.

2. Oxides of nitrogen

At higher temperatures (above 1200°C) produced during lightning, N₂ and O₂ of air can combine to form significant amounts of nitric oxide (NO). When fossil fuel is burnt in automobile engines, N₂ and O₂ combine to form NO. NO reacts immediately with oxygen to form NO₂. Higher concentration of NO₂ damage the leaves of plants and decrease the rate of photosynthesis. Nitrogen dioxide (NO₂) is harmful to textile fibres and metals. NO₂ has irritating effects on lungs and can cause respiratory diseases in children. The most harmful effect of NO₂ is in the production of photochemical smog.

3. Oxides of carbon

Carbon monoxide is formed as a result of incomplete combustion of carbanaceous materials. It is mainly released into air by automobile exhaust. Carbon monoxide is highly poisonous because it binds to haemoglobin to form carboxy haemoglobin. This reduces the oxygen carrying ability of haemoglobin. This oxygen deficiency results in headache, weak eye sight, cardiovascular disorder and finally will lead to death.

Carbon dioxide is a natural constituent of the atmosphere and is vital to all forms of plant life. CO₂ is released mainly by the combustion of fossil fuels such as coal, oil etc. Excess of Carbon dioxide is removed by green plants during photosynthesis. Deforestation and burning of fossil fuels increase the amount of CO₂ level and disturb the balance in the atmosphere. The increased level of CO₂ in the atmosphere is mainly responsible for global warming

Green house effect

Though carbon dioxide is not toxic, the excess concentration of it can lead to changes in climatic conditions, especially by raising the global temperature. *Greenhouse 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.*

The earth's atmosphere allows most of the sunlight that falls on it to pass through and it heats the surface of the earth. But the heat radiated by the heated surface in the form of infrared radiation is absorbed by green house gases such as CO_2 , CH_4 , O_3 , chlorofluoro carbon compounds (CFC), water vapour etc. Thus these gases prevent the heat radiation of the earth to go out in space.

As more and more infrared radiations are trapped, the atmosphere becomes hotter and the global temperature rises up. This is known as **global warming**. There has been a marked increase in the levels of carbon dioxide in the atmosphere due to severe deforestation and burning of fossil fuels. An increase in average global temperature is likely to increase infectious diseases such as yellow fever, dengue fever etc. Global warming may lead to melting of polar ice caps which in turn will result in an increase of water level in oceans, lakes, etc.