

CARBON DIOXIDE: THE HERO AND THE VILLAIN

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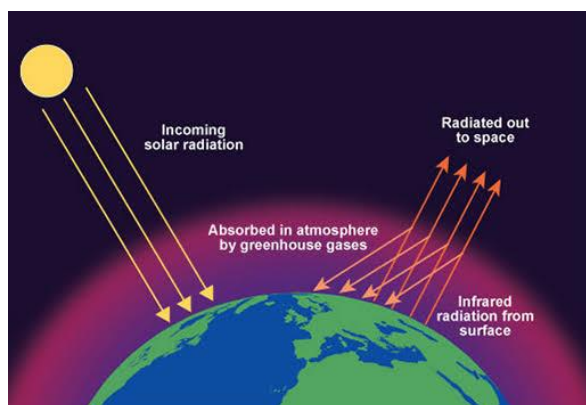
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CO₂ is used as a refrigerant, in fire extinguishers, for inflating life rafts and life jackets, blasting coal, foaming rubber and plastics, promoting the growth of plants in greenhouses, immobilizing animals before slaughter, and in carbonated beverages. It is a colourless gas and at low concentrations it is odorless. At sufficiently high concentrations it has a sharp acidic odour. At standard temperature and pressure the density of CO₂ is 1.98 kg/m³, about 1.67 times that of air.

In a balanced ecosystem the CO₂ released into the atmosphere is removed regularly by the green plants by photosynthesis. The major consumers of CO₂ gas from the atmosphere are green plants and oceans. The green plants absorb CO₂ gas from the atmosphere to prepare their food through the process of photosynthesis, while the oceans dissolve CO₂ gas to form carbonate rocks.

GREEN HOUSE EFFECT



A blanket of CO₂ gas exists in the lower part of the atmosphere (*i.e.* below 15 kms). When sunlight falls on the top of the atmosphere, the visible light and IR rays pass through the CO₂ layer and fall on the earth. Since the IR radiations have heating effect, they heat the earth and its various objects. The IR radiations of long wavelength emitted by the earth and its objects are absorbed by the CO₂ layer in the atmosphere. The layer of CO₂ gas in the atmosphere traps all the IR radiations coming from the earth's surface. These trapped IR rays heat the earth's atmosphere. This progressive warming up of the earth's surface and atmosphere due to the blanketing effect of CO₂ and certain other gases in the atmosphere is called Green House effect. Earth's atmosphere traps the heat from the sun and prevents it from escaping into the outer space.

The green house effect received its name because the earth's atmosphere acts much like the glass or plastic roof and wall of a green house. Sunlight enters a greenhouse through the transparent glass or plastic panes and heats the plants, but the heat emitted by the plants in

the form of IR radiation cannot pass through the glass or plastic panes. As a result, the inside temperature increases.

CAUSES OF GREENHOUSE EFFECT

The earth's atmosphere allows most of the sunlight that falls on it to pass through and heat the surface. But the heat radiated by the heated surface cannot pass freely into space because greenhouse gases such as CO₂, CH₄, O₃, chlorofluorocarbon compounds (CFCs) and water vapour in the atmosphere absorb it. Thus, they add to the heating of the atmosphere. The rise in temperature of the earth is very necessary for our existence on earth, because without it the whole earth would be converted into an extremely cold planet and consequently we shall not be able to have a normal life.

Very large quantities of CO₂ are introduced into the atmosphere through various processes. The burning of fossil fuels like coal, natural gas and petroleum is releasing about 6000 million tonnes of CO₂ in the atmosphere every year. Most man-made machines such as the automobile contribute more to the greenhouse effect, whether they run on petrol or diesel, release harmful gases into the atmosphere and damage the composition. These gases, in turn, create the greenhouse effect in the atmosphere.



The cultivation of land releases about 2000 million tonnes of CO₂ every year into the air, which is produced by bacteria. CO₂ is also discharged into the atmosphere through the eruption of volcanoes. Respiration of living organisms and decay of dead organisms also produce CO₂. Global deforestation is also contributing to an increase in the CO₂ content of the atmosphere because trees are essential to maintain a balance in the CO₂ level. As per the report of World Resources Institute the loss of forests contributes between 12% and 17% of annual global greenhouse emissions.



The destruction of the ozone layer by human-made chemicals, such as CFCs, halons, are allowing increased levels of harmful UV-B radiation to reach the surface of the earth. Increased levels of UV-B radiation could reduce the density of plankton in the oceans. Since plankton are the primary carbon sink of the planet, reduction in their density could result in less CO₂ being absorbed from the atmosphere and ultimately the percentage of CO₂ increases in the atmosphere.

The high rate of population growth has been indirectly responsible and one of the major causes of the Greenhouse effect. With the increase in population, the needs and wants of the people increase, therefore, this increases the manufacturing as well as the industrial

processes along with deforestation for housing as well as agricultural/grazing purposes. This results in the increase of the release of greenhouse gases which catalyze the greenhouse effect.

CONSEQUENCES OF GREENHOUSE EFFECT

The CO₂ gets confined exclusively to the troposphere. Hence, this large-scale increase in the atmospheric CO₂ concentration leads to abnormal global warming through enhanced greenhouse effect. It is estimated that if the input of CO₂ and other greenhouse gases into the atmosphere continues at the present rate, their atmospheric concentrations would double by about year 2050 and this would bring a 3°C rise in the surface temperature of the earth.

The evaporation of surface water increases, which further raises the temperature. Some areas of the world would experience abnormally high evaporation of water and unusual changes in oceanic currents and winds. Abnormal changes in weather patterns and seasons as well as increased desertification upset the ecosystem. Some regions of the world may lose up to 30% of the annual rainfall while some other region may experience very high rainfall. Increased CO₂ levels in the atmosphere are also expected to cause plants, undergoing photosynthesis, to take up the gas at a greater rate so that plants in warmer climates with adequate rainfall would grow faster. The whole climatic pattern of the world would change which adversely affects plants and animals.

Climatic changes would affect agricultural production adversely. Since some regions would become increasingly dry and some others increasingly wet, the whole agricultural pattern would be upset with a consequent drop in agricultural products. The biological production of ocean is decreased. The patterns of cropping are changed and affect the world food production.

Increase in oceanic temperature may cause the melting of polar ice caps, leading to an abnormal rise in sea levels around the globe. This may result in the erosion and submergence of low-lying coastal lands and islands. It has been estimated that the sea level may rise by 0.5 to 1.5 m in the next 50 to 100 years. The polar ice sheet which was extending to 12 million square kilometers now decreasing on a fast rate as well as many mountainous glaciers has been vanished or decreasing day by day.



It is clear from World Health Organization report that extreme high air temperatures contribute directly to deaths from cardiovascular and respiratory disease, particularly among elderly people. In the heat wave of summer 2003 in Europe for example, more than 70 000 excess deaths were recorded. As per the record in 2005 about 150,000 annual deaths worldwide have been tied due to climate change already. Climate related deaths are expected to cause approximately 250,000 additional deaths per year, from malnutrition, malaria, diarrhea and heat stress between 2030 and 2050; 38,000 due to heat exposure in elderly people, 48,000 due to diarrhea, 60,000 due to malaria, and 95,000 due to childhood under

nutrition. The main causes for these deaths are heat waves & droughts as well as floods and more powerful storms linked to climate change.



Higher sea levels would increase the frequency and severity of flood damages coastal areas, cause loss of soil replenishment and seawater intrusion into rivers and other aquatic systems near the ocean. Fish and other aquatic organisms may not be able to withstand the high temperature of waters. So, they will perish.



Climatic changes resulting in flood or drought, agricultural loss, homelessness and starvation would force people to move within and between countries. These refugees would cause very serious social and economic problems. An increase in average global temperature is likely to increase the incidence of infectious diseases such as malaria, sleeping sickness, dengue and yellow fever.

CONTROL OF GREENHOUSE EFFECT



The input of CO₂ into the atmosphere has to be controlled on a global basis and a global policy on industrialization, deforestation, *etc.* has to be adopted by all the nations of the world. We must develop industrial practices and means of transportation which are less dependent on fossil fuels and ultimately manage completely without them. Reducing use of fossil fuels would considerably reduce the amount of carbon dioxide produced as well as reducing the levels of the pollutants. Solar energy may be used as an alternative to the conventional fossil fuels. Planned forestation programmes should be implemented to reduce the CO₂ level, as trees act as natural 'sink' for CO₂ by utilizing it during photosynthesis.

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