
Global warming/green house effect

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Abstract

Environment is the sum of all social, physical, chemical, biological or economical factors which constitute the surroundings of man to both his creator and moulders of environment. This paper discusses on global warming and green house effect and suggests the way to control global warming and the steps to be taken to reduce the temperature of the earth. The produced CO₂ from industries and from several other sources is to be sent through separate pipe lines to glass chambers kept in open atmosphere and sunlight is to be supplied to it. When chlorophyll pigments are supplied through plant sources or through algae that survive in anaerobic conditions to the glass chamber, the incoming CO₂ will get converted into oxygen due to photosynthesis. The outgoing oxygen can be collected through outlets and can be used in hospitals and several other places. In this way we can control the level of CO₂ in atmosphere and thus reducing global warming.

Keywords: Global warming, Environment, green-house gas.

Introduction

The world 'environment' is derived from an old French word "Environ", which means "surroundings" or "encircle" or "natural world". According to the Encyclopedia Britannica, environment means the entire range of external influence acting on an organism, physical, biological and other organisms. There is a close relationship between man and environment. The term environment includes water, air, land and human-beings, other living creatures, plants, micro-organisms and property. Environment is the sum of all social, physical, chemical, biological or economic factors, which constitute the surroundings of man to both his creator and moulder of environment. In today's world, ethical values are decreasing day-by-day and man is becoming very selfish. Man with his self-centered thoughts is exploiting nature beyond its limits. He has forgotten the basic point that without nature all his discoveries and laws of science will go to a waste. The result is the change in the climatic conditions and abnormalities in the weather. It is high time for us to ponder over the impact of technology on the laws of nature and its climate.

Climatic change: Climate is the average weather of an area. It is the general weather conditions, seasonal variations and extremes of weather in a region. Such conditions which average over a long period for at least 30 years which is termed as called climate. The intergovernmental panel on climate change (IPCC) in 1990 and 1992 published the best available evidence about past climatic changes, the green house effect and recent changes in global temperature. It was observed that earth's temperature has changed considerably during the geological times and has experienced several glacial and interglacial periods. However, during the past 10,000 years of the current interglacial period the mean average temperature has fluctuated by 0.5-1°C over 100 to 200 year period. We have relatively stable climate for 1000s of years due to which we have practiced

agriculture and increased in population. Even small changes in climatic conditions may disturb agriculture that would lead to migration of animals, including humans. Anthropogenic (man-made) activities are upsetting the delicate balance that has established between various components of the environment. Greenhouse gases are increasing in the atmosphere resulting in an increase in the average global temperature. This may upset the hydrological cycle resulting in floods and droughts in different regions of the world, causing the sea level rise, changes in agriculture productivity, famines and death of humans as well as livestock.

The global change in temperature will not be uniform everywhere and will fluctuate in different regions. The places in higher latitudes will be warmed up more during the late autumn and winter than the places in tropics. Poles may experience 2 to 3 times more warmth than the global average, while warming in the tropics may be only 50-100% on an average. The increased warmth at poles will reduce the thermal gradient between the equator and high latitude regions decreasing the energy available to the heat engine that drives the global weather machine. This will disturb the global pattern of winds and ocean currents as well as the timing and distribution of rain fall. Shifting of ocean currents may change the climate of Iceland and Britain and may result in cooling at a time when the rest of the world warms. By a temperature increase of 1.5 to 4.5 per degree centigrade the global hydrological cycle is expected to intensify by 5 to 10%. Disturbed rainfall will result in some areas becoming wetter and the other areas drier. Although rainfall may increase, higher temperatures will result in more vapor-transpiration leading to an annual water deficit in crop fields.

Global warming: Troposphere the lowermost layer of the atmosphere traps heat by a natural process due to the presence of certain gases. This effect is called

greenhouse effect as it is similar to the warming effect observed in the horticultural greenhouse made of glass. The amount of heat trapped in the atmosphere depends mostly on the concentration of "heat trapping" or "greenhouse" gases and the length of time they stay in the atmosphere. The major greenhouse gases are carbon dioxide, ozone, methane, nitrous oxide, chlorofluorocarbons (CFCs) and water vapours. The average global temperature is 15°C. In the absence of greenhouse gases this temperature would have been -18°C. Therefore, greenhouse effect contributes a temperature rise to the tune of 33°C. The Heat trapped by the greenhouse gases in the atmosphere keeps the planet warm enough to allow us and other species to exist. The two predominant greenhouse gases are water vapour controlled by hydrological cycle and carbon dioxide controlled mostly by the global carbon cycle. While the level of water vapour in the troposphere has relatively remained constant, the level of carbon dioxide has increased due to human activities, which release methane, nitrous oxide and chlorofluorocarbons. Deforestation has further resulted in elevated levels of carbon dioxide due to non-removal of carbon dioxide by plants through photosynthesis. Warming or cooling by more than 2°C over the past few decades may prove to be disastrous for various ecosystems on the earth, including human beings, as it would alter the conditions faster than some species could adapt or migrate. Some areas will become inhabitable because of droughts or floods following a rise in average sea level. In 1968, with the danger of global warming becoming a threat, a panel was set up by the UN general assembly named the intergovernmental panel on climatic change (IPCC) to advise world leaders on global warming. In June 1977, the panel reported, "The balance of evidence suggests that there is a discernible human influence on global climate." Scientists are concerned that if there is an increase in these gases, particularly carbon dioxide, the earth's atmosphere will be warmed up to a dangerous degree as more heat is trapped on the earth's surface.

IPCC report, 2007: The fourth assessment report (AR4) of the United Nations intergovernmental panel on climate change (IPCC), 2007 has been prepared by more than 2500 scientific expert researchers from more than 130 countries during 6 year efforts. The report will be in four volumes prepared by 4 working groups. The schedule of release of the report of working group 1 has been in Feb 2007, working group 2 in Apr 2007, working group 3 in early May, 2007 and the synthesis report (AR4SYR) will be adopted by mid Nov 2007 during the 27th session of the panel. The report released on Apr 6, 2007 highlights the unequal availability of water, i.e. excess or lack of water leading to increase in droughts and floods. Glaciers in Himalayas will melt and the size and number of glacial lakes will increase. The mid latitude and semi-arid regions of the world will experience drier years. Africa will experience water stress. There will be

increased availability of water in moist tropics and high latitudes. Rain dependent agricultural produce will get a boost in North America. Sea level and human activities together will contribute to loss of coastal wetlands. Fresh water availability will decrease by 2050. More than a billion people will be at greater risk. The report assesses that 40% species will become extinct. Human health will be affected. There will be an increase in the number of deaths, diseases like diarrhea, cardiovascular diseases, etc.

Green house effect: The phenomenon which worries the environmental scientists is that due to the anthropogenic activities, there is an increase in the concentration of the greenhouse gases in the air which absorb infra-red light containing heat, which results in the re-radiation of much of the outgoing thermal infra-red energy, thereby increasing the average surface temperature beyond 15 degrees centigrade. The phenomenon is referred to as the enhanced greenhouse effect to distinguish its effect from the one that has been operating naturally ever since millennia. The greenhouse gases present in the troposphere which result in an increase in the temperature of air and the earth are discussed here:

Carbon dioxide: It contributes about 55% to global warming from greenhouse gases produced by human activity. Industrial countries account for about 76% of annual emissions. The main sources are fossil fuel burning (67%) and deforestation while the other sources are land clearing and combustion (33%). Carbon dioxide stays in the atmosphere for about 500 years. Carbon dioxide concentration in the atmosphere was 355 ppm in 1990 with an increase at the rate of 1.5 ppm every year.

Chlorofluorocarbons (CFCs): These are believed to be responsible for 24% of the human contribution to greenhouse gases. They also deplete the ozone layer in the stratosphere. The main sources of CFCs include leaking air conditioners and refrigerators, evaporation of industrial solvents, production of plastic foams, aerosols, propellants etc. CFCs take 10-15 years to reach the stratosphere and generally trap 1500 to 7000 times more heat per molecule than carbon dioxide while they are in the troposphere. This heating effect in the troposphere may be partially offset by the cooling caused when CFCs deplete ozone during their 65 to 110 years stay in the stratosphere. Atmospheric concentration of CFC is 0.00225 ppm that is increasing at a rate of 0.5% annually.

Methane (CH₄): It accounts for 18% of the increased greenhouse gases. Methane is produced when bacteria break down dead organic matter in moist places that lack oxygen such as swamps, natural wetlands, paddy fields, landfills and digestive tracts of cattle, sheep and termites. Production and use of oil and natural gas and incomplete burning of organic material are also significant sources of methane. Methane stays in the atmosphere for about 7 to 10 years. Each methane molecule traps about 25 times as much heat as a carbon dioxide molecule. Atmospheric



concentration of methane is 1.675 ppm, and it is increasing at the rate of 1% annually.

Nitrous oxide (N_2O): It is responsible for 6% of the human input of greenhouse gases. Besides trapping heat in the troposphere it also depletes ozone layer in the stratosphere. It is released from nylon products, from burning of biomass and nitrogen rich fuels (especially coal) and from the breakdown of nitrogen fertilizers in soil, livestock wastes and nitrate contaminated groundwater. Its life span in the troposphere is 140-190 years and it traps about 230 times as much heat per molecule as carbon dioxide. The atmospheric concentration of N_2O is 0.3 ppm and is increasing at a rate of 0.2% annually.

Impact of enhanced global effect: The enhanced greenhouse effect will not only cause global warming but also affect various other climatic and natural processes.

- a) **Global temperature increase:** It is estimated that the earth's mean temperature will rise between 1.5 to 5.5°C by 2050 if the input of greenhouse gases continues to rise at the present rate. Even at the lower value, earth would be warmer than it has been for 10,000 years.
- b) **Rise in sea level:** With the increase in global temperature sea water will expand. Heating will melt the polar ice sheets and glaciers resulting in a further rise in sea level. Current models indicate that an increase in the average atmospheric temperature of 3°C would raise the average global sea level by 0.2-1.5 m over the next 50-100 years. One meter rise in sea level will inundate low lying areas of cities like Shanghai, Cairo, Bangkok, Sydney, Hamburg and Venice as well as agricultural lowlands and deltas in Egypt, Bangladesh, India and China and will affect rice productivity. This will also disturb many commercially important spawning grounds, and would probably increase the frequency of storm damage to lagoons, estuaries and coral reefs. In India, the Lakshadweep Islands with a maximum height of 4 meters above the sea level may be vulnerable. Some of the most beautiful cities like Mumbai may be saved by heavy investment on the embankment to prevent inundation. Life of millions of people will be affected by the sea level rises who have built homes in the deltas of the Ganges, the Nile, the Mekong, the Yangtze and the Mississippi rivers.
- c) **Effects on human health:** Global warming will lead to changes in rainfall pattern in many areas thereby affecting the distribution of vector-borne diseases like malaria, filariasis, elephantiasis etc. Areas which are presently free from diseases like malaria; schistosomiasis etc. may become the breeding grounds for the vectors of such diseases. The areas likely to be affected in this manner are Ethiopia, Kenya and Indonesia. Warmer temperature and more water stagnation would favour the breeding of

mosquitoes, snails and some insects, which are the vectors of such diseases.

- d) **Effects on agriculture:** There are different views regarding the effects of global warming on agriculture. It may show positive or negative effects on various types of crops in different regions of the world. Tropical and sub-tropical regions will be more affected since the average temperatures in these regions are already on the higher side. Even a rise of 2°C may be quite harmful to the crops. Soil moisture will decrease and vapor-transpiration will increase, which may drastically affect wheat and maize production. Increase in temperature and humidity will increase pest growth like the growth of vectors for various diseases. Pests will adapt to such changes better than the crops.

Measures taken in the past to control global warming

In 1992, predictions about global warming led the United States and 160 countries to sign the first binding agreement dealing directly with climatic changes. According to the UN framework convention signatory the countries that have signed have agreed to voluntarily reduce greenhouse emissions to the 1990 level by the year 2000. In Dec 1997, government representatives signed a global climatic-change treaty in Kyoto, Japan, to reverse the rise in greenhouse emissions from human activities to eventually check the increase in temperature. USA and China are the two major countries contributing to global warming. The United States is 85% dependent on fossil fuels for its production. And China will equal the world's emissions in the next 20 years. India is one among the top five countries contributing to the greenhouse effect and the government is already adopting strict policies to curb Carbon dioxide emissions with the help of non-governmental organizations (NGOs). However, the efforts are only in bits and pieces as more than 90% of the population is not aware of global warming. Although Afforestation projects by the government are an effort in the right direction, there is a lot left to be desired.

Measures to check global warming

Cut down the current rate of use of CFCs and fossil fuel; Use energy more efficiently; Shift to renewable energy resources; Increase nuclear power plants for electricity production; Shift from coal to gas; Trap and use methane as a fuel; Reduce beef production; Adopt sustainable agriculture; Stabilize population growth; Efficiently remove carbon dioxide from smoke stacks; Plant more trees; Remove atmospheric carbon dioxide by utilizing photosynthetic algae.

Photosynthetic glass chamber

With the help of photosynthesis method we can reduce the percentage of CO_2 in the atmosphere. It is a big glass chamber in which plants, photosynthetic algae, small trees are cultured. The glass chamber is totally sealed to avoid the escape of air from inside. The small trees and plants are rooted outside the glass chamber.

Through this glass chamber we can convert carbon dioxide into oxygen to certain extent. By using this glass chamber we can reduce global warming and green house effect. Carbon dioxide plays a vital role in the increase of global warming. With the reduction of CO_2 , we can control global warming. With the introduction of photosynthetic glass chamber the release of smoke from smoke chamber can be reduced. The released gas from the industries is directly sent to this chamber. And the gas is processed through several processes to filter the harmful gases present in it. And the processed gas is passed through several compartments in the glass chamber. And the out coming refined gas is collected through an outlet and is used in several industries.

Photosynthetic glass chamber (Fig. 1) contains a main chamber made of glass. The total chamber is sealed properly. Main glass chamber contains lot of compartments (the incoming gas is sent through each chamber in series to get more efficiency in the production of oxygen). The inlet pipe consists of a glass bulb containing alkaline pyrogallol (this chemical has a property to absorb CO_2 & O_2). Thus CO can be easily removed from the chamber. Then the alkaline pyrogallol glass bulb is lightly heated to release the absorbed CO_2 . The gas is recycled to alkaline pyrogallol glass bulb to remove remained traces of CO . And the stop cock is removed to release the gas to the main glass chamber. With the help of photosynthesis process, CO_2 entering the chamber is converted into O_2 . After passing the gas through several compartments, the gas is sent out through outlets. The outlet pipe contains another glass bulb filled with potassium hydroxide (potassium hydroxide has a property of absorbing CO_2). With the help of this glass bulb, CO_2 is removed from the refined gas. By this, we can produce O_2 and reduce CO_2 from the atmosphere.

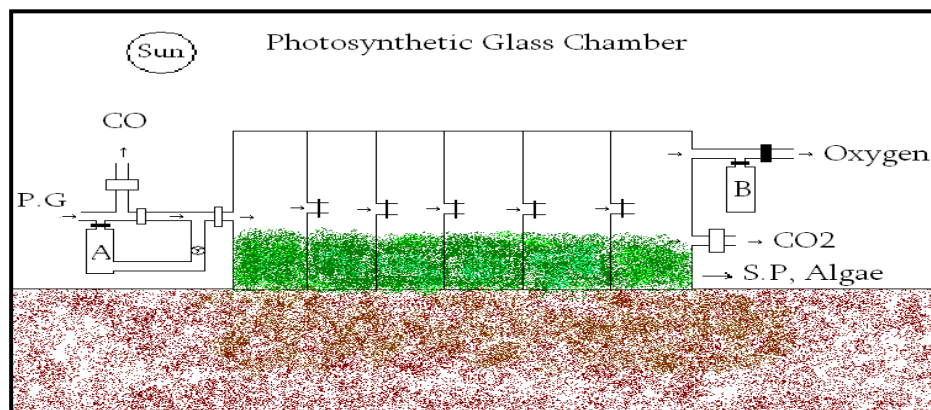
Conclusion

Current warming trends are unequivocal. It is very likely that greenhouse gases released by human

activities are responsible for most of the warming observed in the past 50 years. The warming is projected to continue and to increase over the course of the 21st century and beyond. Hence individual participation in the reduction of global warming is inevitable. Everyone should walk or use a cycle to cover shorter distances rather than using automobiles. One litre of petrol produces 2.17 kg of CO_2 . Walking, carpooling or using public transport will save at least 2 litres of petrol a week. This will stop the release of $2.17 \times 2 \times 52 = 225.68$ Kg of CO_2 into the atmosphere annually. From Antarctica in the south to the Arctic in the north, from the verdant rain forests to the baking deserts, every corner of our planet brims with life. Earth contains animals both big and small and birds which fly across continents and those that chirp in our gardens. To preserve this life sustaining planet eco-friendly life should be adopted and healthy environment is to be shaped. Planting trees have more benefits. They provide us the O_2 needed for our survival and purify our environment by absorbing CO_2 and other pollutants. They prevent soil erosion and reduce noise pollution. Day to day activities of human beings destroy these plants. Electricity used for our daily needs is generated by burning fossil fuels which creates pollution. Economic use of electricity will save forests from deforestation. There are different ways in which electricity can be used economically. Compact fluorescent lamps (CFL) consume one third the electricity consumed by regular bulbs. If every family in India replaces regular light bulbs with these CFL following an eco-friendly life our atmosphere can be made less polluted, our environment can be made greener and electricity can be saved which will protect us from power cuts.

Our Earth is the only planet where life has existed in the past and it is up to us to ensure that it flourishes even in the future. Government should take severe steps to control global warming. We should bring awareness among the people (including rural people) about the effects of global warming. They in turn will teach some other people. Every parent should plant one tree as a tribute to their new born babies and every adult in turn should plant a useful tree. Many countries have been taking lot of steps to bring awareness among people. Indian government has introduced environmental studies as a separate subject in several educational courses. However, students do not take environmental science as a serious subject. In order to develop awareness among people government should introduce environmental science as very important subject in all educational courses right from school education to post graduate education.

Fig. 1. Photosynthetic glass chamber



CO : Carbon monoxide; P.G. : Polluted Gas (Mixture of CO , CO_2 & Oxygen); CO_2 : Carbon dioxide; Glass Bulb 'A': Alkaline Pyrogallol Glass Bulb; Glass Bulb 'B': Potassium Hydroxide Glass Bulb; S.P. : Small Plants.