SHORT COMMUNICATION

AN UPDATES TO GREENHOUSE EFFECT AND GREEN HOUSE GASES

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Received-06.04.2018, Revised-25.04.2018

Abstract: Warming of the lower atmosphere (troposphere) and earth's surface is due to greenhouse effect. It is a natural phenomenon and vital to life. An increase in the concentration of greenhouse gases in the atmosphere may lead to problems. The present article is an introduction and updates to the concept of greenhouse effect and greenhouse gases.

Keywords: Atmosphere, Greenhouse effect, Greenhouse gases, Energy

INTRODUCTION

An increase in the amount of certain gases particularly synthetic gases results in the absorption of infrared radiations reflected from the surface of the earth. This leads to an enhanced heat-trapping capacity of the atmosphere, a phenomenon called greenhouse effect with a consequent increase in global temperature. One of the major consequences of this is melting of snows in the Polar Regions and increases in global sea-level. The gases responsible for greenhouse effect are called greenhouse gases.

Radiant energy

The main forms of energy are (1) Radiant energy (2) Heat energy (3) Chemical energy (4) Mechanical energy.

The source of all energy for the living being on the earth is the sun. Nuclear fusion of hydrogen atoms into helium atoms in the sun produces enormous amounts of energy which is radiated out in all direction in the form of electromagnetic radiations called solar radiation or solar energy. A very small portion of this radiation (solar energy) reaches into the earth's atmosphere. Radiation in the wavelength range 390 nm to 720 nm is visible. We are receiving energy continuously from the sun through electromagnetic radiation. Out of the electromagnetic radiation that reaches earth's atmosphere is dissipated[1] :

(1) 30% reflected back to the space
(2) 47% absorbed by atmosphere land and seas
(3) 23% used in evaporating water
(4) <1% of the remained radiation drives the wind and streams
(5) 0.01% (approximate) of radiation is used in photosynthesis.

Greenhouse Effect-basic Idea

Warming of the lower atmosphere (troposphere) and earth's surface by a complicated process that involves sunlight, gases and particles in the atmosphere is termed as greenhouse effect.

Electromagnetic radiations of short wavelength (320-390 nm, visible and short 1R) from the sun when comes to the earth's atmosphere, near about one third of it is reflected back to the space. Out of the remaining radiations some absorbed by the atmosphere. But mostly are absorbed by the surface of the earth. Now the earth radiates radiations of longer wavelengths (2000-40,000 nm). The earth here is acting like a back body and a good radiator. In accordance with the nature of black body, the earth absorbs all the radiations coming to it and radiates radiations of longer wavelengths to outer area[2].

The wavelength of radiation emitted depends on the temperature of radiating body. Sun which is very hot emits radiations of short wavelengths (UV, visible and short 1R). Almost all these radiations after passing through the earth's atmosphere reach to the surface of the earth and warms it. The earth is nowhere nearly as hot as sun.

Now the earth radiates the heat back into the atmosphere in the form of radiations of long wavelength (IR or heat) which is much more easily absorbed by the earth's atmosphere as completed to short wavelength radiation thereby increasing the temperature of the surface of the earth[3].

A part of the IR or heat energy radiated by the earth goes to the space but much of it does not passes through the layers of atmosphere's greenhouse gases to outer space and gets absorbed by the greenhouse gases present in the atmosphere. This heats up the earth's atmosphere and helps to warm the earth's surface and troposphere, maintaining it more (33°C) warmer than it would otherwise be (-18°C). This natural greenhouse effect is vital to life.

Advantage of Green-house Effect

Life on the earth is not possible without the natural greenhouse effect as it maintains earth's average temperature of 15°C a more hospitable instead of -18°C. Therefore, credit of life on the earth goes to greenhouse gases. But when concentration of greenhouse gases in the atmosphere increase problem arises[4].

Named "Greenhouse Effect"

In cold places plants, flowers, vegetables and fruits are grown in glass covered areas called greenhouse. A greenhouse (glass house) remains warms even when the temperature of outside stays low. Sunlight

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enters in greenhouse through transparent glass and strike the ground. It is not possible for the reflected 1R radiation or heat to transmit out through glass as a large portion of 1R is absorbed by the glass. This absorbed 1R warms the interior of greenhouse to take care of its ground plants and other contents. The natural greenhouse[3] on a global scale is similar to a greenhouse and the activity of atmospheric greenhouse gases resembles to the activity of glass panels of a greenhouse.

Properties required for gas to become a Greenhouse Gas

Greenhouse gases are transparent to visible light only but can absorb much of re-radiations i.e. radiations of long wavelength radiations (4000-20,000 nm). The properties needed for a gas to become greenhouse gases may be summarised as here under[5]:

1. Dipole nature of the gas.
2. Extremely strong, broad absorption band spectrum of the gas which overlaps with some of the wavelengths of heat radiations.
3. Transiction between vibrational energy levels.
4. Vibrational molecular spectrum of the gas should be produced.
5. Vibrational-rotational spectrum of the gas should be produced.

CO_2 and gases like CO_2 have an extremely strong, broad absorption band spectrum. Absorption of electromagnetic radiation in the infrared region by a greenhouse gas leads to the transitions between the vibrational energy levels of that gaseous molecular spectrum. But transition between two vibrational energy levels is accompanied by a change in rotational energy level and thus that gaseous molecule produce vibration-rotation molecular spectrum. Two types of vibrational frequency are noticed viz.

(i) Bond streching vibration: Streching of bonds takes place in bi-atomic molecules.

(ii) Angle bonding vibration: A change within a angle takes place in tri-atomic molecules[6].

Sources, relative contribution and effectiveness of Greenhouse Gases

Atmosphere greenhouse gases are found in nature. New sources of greenhouse gases as well as emission of completely new greenhouse gases come from modern industry and lifestyle. Carbon di-oxide, methane, Nitrous Oxide, Ozone, Halocarbons and water vapour are the most important greenhouse gases.

Methane (CH_4)
Carbon di-Oxide (CO_2)
Nitrous Oxide (N_2O)
Halocarbons
Surface Ozone (O_3)
Water Vapour

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