ACADEMICIA: An International Multidisciplinary Research Journal
ISSN: 2249-7137 Vol. 11, Issue 11, November 2021 SJIF 2021 = 7.492
A peer reviewed journal

AN OVERVIEW ON GREENHOUSE EFFECT

Dr. S. R. Ali*

*Faculty of Engineering,
Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, INDIA
Email id: drsrali.engineering@tmu.ac.in
DOI: 10.5958/2249-7137.2021.02554.4

ABSTRACT

The Greenhouse effect is one of the most important factors in keeping the Earth warm because it prevents part of the planet's heat from escaping into space. Greenhouse gases and their effect on global warming is the subject of a research report. The Earth's average global temperature would be considerably cooler without the greenhouse effect and life on Earth as we know it would be impossible. Water vapor, CO2, methane, nitrous oxide (N2O), and other gases are examples of greenhouse gases. CO2 and other greenhouse gases wrap around Infrared radiation like a blanket, preventing it from escaping into space. The obvious consequence of greenhouse gases is a steady heating of the Earth's atmosphere and surface, resulting in global warming. One of the most amazing still occurrences in atmospheric science is the capacity of some gases, such as greenhouse gases, to be transparent to incoming visible light from the sun yet opaque to energy radiated from the earth. The presence of the greenhouse effect is responsible for making the planet a pleasant place to live. The research also demonstrates the significance of greenhouse gases in global warming.

KEYWORDS: *Atmosphere, Greenhouse Gases, Global Warming, Greenhouse Effect, Global Temperature.*

1. INTRODUCTION

The fact that Earth's average surface temperature is pleasant between the boiling and freezing points of water, making it suitable for our kind of life, cannot be explained simply by claiming that the planet Earth orbits the sun at just the right distance from it to absorb just the right amount of solar radiation. The mild temperatures are also the result of having the right type of environment. The atmosphere of Venus would create hellish, Venus-like conditions on Earth, while the troposphere of Mars would leave Earth shivering in a Martian-like cold frost(1–4). The greenhouse effect is shown in Figure 1.

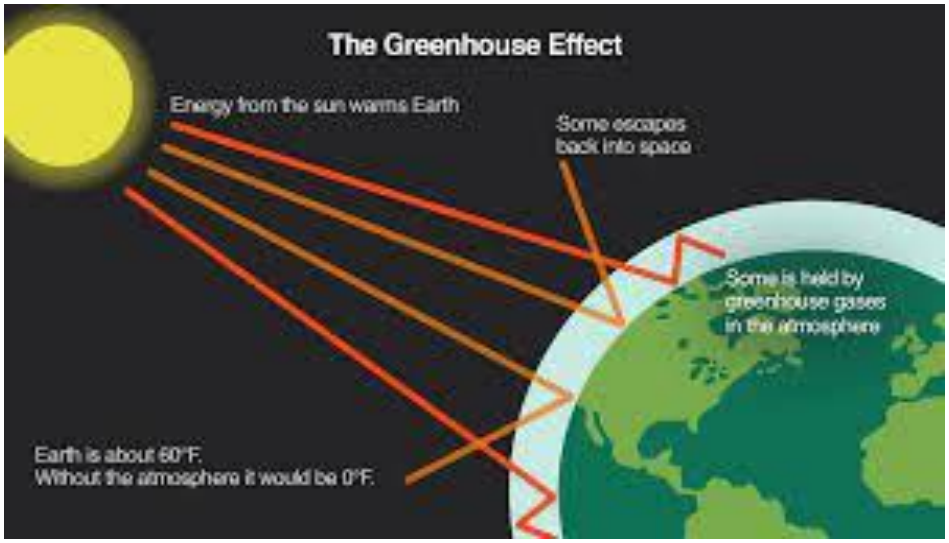

Figure 1: Illustrates the greenhouse effect(5)

Furthermore, portions of the earth's atmosphere serve as a thin shielding blanket, receiving just enough solar radiation to maintain the world average temperature in a pleasant range. The blanket on Mars is too thin, while the blanket on Venus is much too thick. The 'blanket,' as defined above, is a collection of atmospheric gases known as greenhouse gases, which absorb heat in the same way as the glass walls of a greenhouse do(6–9).

Inbound UV light readily penetrates through the greenhouse's glass walls and is absorbed by the plants and hard surfaces within. Weaker infrared (IR) radiation, on the other hand, has a hard time passing through the glass walls and becomes trapped within, warming the greenhouse. This result allows tropical plants to thrive in a greenhouse, even in the dead of winter.

By trapping heat in our atmosphere, the greenhouse effect raises Earth's temperature. This keeps the Earth's temperature higher than it would be if the Sun's direct heating was the sole source of warmth.The greenhouse effect is one of the most important factors in keeping the Earth warm because it prevents part of the planet's heat from escaping into space. The Earth's average global temperature would be considerably cooler without the greenhouse effect and life on Earth as we know it would be impossible. The difference between the Earth's actual average temperature of 14°C (57.2°F) and the anticipated effective temperature of -19°C (-2.2°F) with only the Sun's radiation gives us the greenhouse effect intensity, which is 33°C.

1.1 Foundations of Greenhouse Effect:

The combination of the sun's radiation with greenhouse gases such as carbon dioxide, methane, nitrous oxide, and fluorinated gases in the Earth's atmosphere causes the greenhouse effect. The greenhouse effect is caused by these gases' capacity to absorb heat.

Three or more atoms make up greenhouse gases. Because of their molecular structure, these gases may retain heat in the atmosphere and then transmit it to the surface, further warming the Earth. This continuous cycle of heat trapping points to an overall rise in world temperatures. The process, which is remarkably similar to how a greenhouse works, is the primary reason why the gases that may cause this result are referred to as greenhouse gases together(10–14).

1.2 Reaction Gas (Water vapor) of the Greenhouse Effect:

Carbon dioxide is one of the greenhouse gases to some degree. It consists of one carbon atom linked to two oxygen atoms on either side. The carbon dioxide molecule may absorb infrared light as soon as its atoms are firmly bound together, and the molecule begins to vibrate. The radiation will eventually be emitted by the vibrating molecule again, and it will most likely be absorbed by yet another greenhouse gas molecule. This absorption-emission-absorption cycle keeps the heat close to the surface, effectively shielding it from space cold.

Greenhouse gases include carbon dioxide, water vapor (H_2O), methane (CH_4), nitrous oxide (N_2O), and a few additional gases. They're all molecules made up of more than two component atoms that are loosely linked together enough to vibrate in response to heat absorption. The most important processes in the atmosphere (N_2 and O_2) are two-atom molecules that are too tightly bonded together to vibrate, and therefore do not absorb heat and contribute to the greenhouse effect.

1.3 Reduction of Greenhouse Gases:

The main goal of WWTPs is to comply with effluent regulations. To ensure the safety of the receiving water body. However, reducing GHG emissions from WWTPs requires a broader approach. The US Environmental Protection Agency estimates the amount of N_2O released by WWTPs. It accounts for around 3% of N_2O emissions from all national sources, making it the sixth biggest contributor to GHG emissions. To better understand how to successfully decrease GHG emissions from WWTPs and enhance the accuracy of GHG emission reporting procedures, proper GHG measurement is required.

Because of the rapidly rising pace of GHG emissions, climate change concerns have piqued people's attention. This has highlighted the need for new ideas and methods to better design, manage, and optimize WWTPs at the plant level.

1.4 Some Current Existing Challenges to Reducing Greenhouse Gases (GHG):

Controlling GHG emissions for various WWTPs is proving challenging at the moment. Uncertainty in measurement and a lack of transposable data continue to obstruct a proper and necessary GHG emission quantification procedure(15–18).

One suggestion for closing this gap is to utilize mathematical models, which provide helpful tools for measuring GHG emissions and evaluating various mitigation options before putting them into effect. GHG modeling may help with accurate measurement of GHG emissions and evaluating the impacts of various operating conditions for various WWTP designs. During the design, operation, and optimization of WWTPs, a wide portfolio of mathematical modeling studies has been created in recent years to incorporate GHG emissions.

1.5 The Solar Radiation:

The sun emits enormous amounts of energy into space over a broad range of wavelengths.

The visible and near-visible regions of the spectrum contain the majority of the sun's radiating energy. The visible light spectrum, which spans 400 to 700 nm, accounts for 43% of the total radiant energy released. Wavelengths shorter than visible account for just 7 to 8% of total

energy, yet they are very significant due to their high energy per photon. The more energy is contained in a shorter wavelength of light. As a result, ultraviolet light is very energetic (accomplished by breaking apart stable biological molecules and instigating sunburn and skin cancers). The remaining 49 to 50 percent of radiant energy is distributed across wavelengths longer than visible light wavelengths. These span from 700 to 1000 nm in the near infrared, 5 to 20 microns in the thermal infrared, and 20 microns in the far infrared. The atmosphere absorbs ultraviolet and infrared solar energy before it reaches the surface, yet it is transparent to visible light.

1.6 Greenhouse Effect:

In the late 1800s, atmospheric scientists coined the term "greenhouse effect." It was used at the time to describe the naturally occurring functions of trace gases in the environment and had no harmful consequences. The phrase "greenhouse effect" was not associated with concerns about climate change until the mid-1950s. In recent decades, we've heard a lot about the greenhouse effect in a bad light. The negative worries revolve on the potential consequences of a stronger greenhouse effect. It's essential to remember that life on Earth as we know it would be impossible without the greenhouse effect(19–22).

While the earth's temperature is affected by the greenhouse effect of the atmosphere, the amount of heating and cooling is influenced by a variety of variables, just as greenhouses are impacted by a variety of factors.

1.7 Greenhouse Gases and Global Warming:

Human activities generate greenhouse gas (GHG) emissions such as carbon dioxide, methane, nitrous oxide, and halogenated chemicals, and some do occur naturally. GHGs absorb infrared radiation and trap heat in the atmosphere, increasing the natural greenhouse effect, which is what causes global warming. This natural phenomenon warms the atmosphere and allows life on Earth to exist; otherwise, the low temperature would make life on Earth impossible.

"The climate system may be influenced by gas molecules that capture thermal infrared light in large quantities. Greenhouse gases are the name given to these types of gas molecules "Live Science spoke with Michael Daley, an assistant professor of Environmental Science at Lasell College. CO_2 and other greenhouse gases act like a blanket, capturing Infrared (IR) radiation and preventing it from escaping into space. The net result is a gradual warming of the Earth's atmosphere and surface, which is referred to as global warming.

Water vapor, CO_2, methane, nitrous oxide (N_2O), and other gases are examples of greenhouse gases. The burning of fossil fuels like coal, oil, and gasoline has significantly boosted the quantity of greenhouse gases in the atmosphere, particularly CO_2, since the beginning of the Industrial Revolution in the early 1800s, according to the National Oceanic and Atmospheric Administration (NOAA). "Deforestation is the second biggest human source of carbon dioxide in the atmosphere, ranging from 6% to 17%," Daley added.

1.8 The Greenhouse Effect be overturned:

Several experts agree that the devastation of the Earth's atmosphere and climate has long since passed the point of no return or is approaching the point of no return. "I agree that we have past the threshold where we can prevent climate change," says Josef Werne, an associate professor at

the University of Pittsburgh's department of geology and planetary science. From this point onward, Werne believes there are three options:

- Do nothing and enjoy the present moment.
- Become used to the shifting climate (which includes things like rising sea level and related flooding).
- Mitigate the effects of climate change by adopting aggressive measures that actually lower CO_2 levels in the atmosphere.

Keith Peterman, a chemistry professor at York College of Pennsylvania, and Gregory Foy, an assistant professor of chemistry at York College of Pennsylvania, think that the damage has not yet reached that stage and that international agreements and action may preserve the planet's atmosphere.

2. DISCUSSION

Greenhouse gas emissions have a wide range of environmental and health consequences. They contribute to respiratory illness caused by smog and air pollution, as well as contributing to climate change by trapping heat. Other consequences of climate change induced by greenhouse gases include extreme weather, food supply problems, and increasing wildfires. The 'greenhouse effect,' or global warming, occurs when the atmosphere traps heat emanating from the Earth toward space. Certain gases in the atmosphere act like greenhouse glass, allowing sunlight to flow through while preventing Earth's heat from escaping into space. Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and the so-called F-gases (hydrofluorocarbons and perfluorocarbons) as well as sulphur hexafluoride are included in the Kyoto basket (SF_6).

3. CONCLUSION

Water vapour, carbon dioxide, methane, nitrous oxide, ozone, and certain man-made compounds like chlorofluorocarbons are examples of greenhouse gases (CFCs). The absorbed energy heats the Earth's atmosphere and surface. Greenhouse gas emissions may be minimized by generating electricity on-site using renewable and other environmentally friendly energy sources. Rooftop solar panels, solar water heating, small-scale wind production, natural gas or renewable hydrogen fuel cells, and geothermal energy are all examples. One of the finest quiet processes in the atmospheric sciences is the ability of some suggested gases to be reasonably transparent to incoming visible light from the sun but opaque to energy radiated from the earth. This phenomenon, known as the greenhouse effect, is what makes the planet a pleasant place to live. Future greenhouse gas research should be prioritized, in my opinion.

REFERENCES:

1. Kaushal G, Singh H, Prakash S. High-temperature erosion-corrosion performance of high-velocity oxy-fuel sprayed Ni-20 Cr coating in actual boiler environment. Metall Mater Trans A Phys Metall Mater Sci. 2011;
2. Jyothi MN, Rai D V., Nagesh babu R. Identification and Characterization of High Temperature Stress Responsive Novel miRNAs in French Bean (Phaseolus vulgaris). Appl Biochem Biotechnol. 2015;

3. Kaushal G, Singh H, Prakash S. Comparative high temperature analysis of HVOF-sprayed and detonation gun sprayed Ni-20Cr coating in laboratory and actual boiler environments. Oxid Met. 2011;

4. Kaushal G, Singh H, Prakash S. High temperature corrosion behaviour of HVOF-sprayed Ni-20Cr coating on boiler steel in molten salt environment at 900°C. Int J Surf Sci Eng. 2011;

5. Mcculloch A, Last JM. Greenhouse Effect. Vol. 333, The Lancet. 1989. p. 1208–9.

6. Kweku D, Bismark O, Maxwell A, Desmond K, Danso K, Oti-Mensah E, et al. Greenhouse Effect: Greenhouse Gases and Their Impact on Global Warming. J Sci Res Reports. 2018;

7. Dunne JA, Jackson SC, Harte J. Greenhouse Effect. In: Encyclopedia of Biodiversity: Second Edition. 2013.

8. Song J, Wang Y, Tang J. A Hiatus of the Greenhouse Effect. Sci Rep. 2016;

9. Zuberi MJS, Ali SF. Greenhouse effect reduction by recovering energy from waste landfills in Pakistan. Renewable and Sustainable Energy Reviews. 2015.

10. Kukkonen JE, Kärkkäinen S, Dillon P, Keinonen T. The Effects of Scaffolded Simulation-Based Inquiry Learning on Fifth-Graders' Representations of the Greenhouse Effect. Int J Sci Educ. 2014;

11. Harris SE, Gold AU. Learning molecular behaviour may improve student explanatory models of the greenhouse effect. Environ Educ Res. 2018;

12. Zulfequar Ahmad Khan M. Causes and Consequences of Greenhouse Effect & Its Catastrophic Problems for Earth. Int J Sustain Manag Inf Technol. 2017;

13. Akitt JW. Some observations on the greenhouse effect at the Earth's surface. Spectrochim Acta - Part A Mol Biomol Spectrosc. 2018;

14. Aprea C, Greco A, Maiorino A. An experimental evaluation of the greenhouse effect in the substitution of R134a with pure and mixed HFO in a domestic refrigerator. Int J Heat Technol. 2017;

15. Goyal A, Singh R, Singh G. Study of High-Temperature Corrosion Behavior of D-Gun Spray Coatings on ASTM-SA213, T-11 Steel in Molten Salt Environment. In: Materials Today: Proceedings. 2017.

16. Khan UJ, Oberoi A, Gill J. Hybrid Classfication for Heart Disease Prediction using Artificial Intelligence. In: Proceedings - 5th International Conference on Computing Methodologies and Communication, ICCMC 2021. 2021.

17. Acharya S, Bali S, Bhatia BS. Exploring consumer behavior towards sustainability of green cosmetics. In: Proceedings of the 2021 1st International Conference on Advances in Electrical, Computing, Communications and Sustainable Technologies, ICAECT 2021. 2021.

18. Nanda AK, Singh J. Relationship Between Compressive Strength and Split Tensile Strength for Sustainable Concrete—A Case Study. In: Lecture Notes in Civil Engineering. 2021.

19. Gaurav A, Yadav MR, Giridhar R, Gautam V, Singh R. 3D-QSAR studies of 4-quinolone derivatives as high-affinity ligands at the benzodiazepine site of brain GABAA receptors.

Med Chem Res. 2011;

20. Jain UK, Bhatia RK, Rao AR, Singh R, Saxena AK, Sehar I. Design and development of halogenated chalcone derivatives as potential anticancer agents. Trop J Pharm Res. 2014;

21. Sharma S, Bajaj H, Bhardwaj P, Sharma AD, Singh R. Development and characterization of self emulsifying drug delivery system of a poorly water soluble drug using natural oil. Acta Pol Pharm - Drug Res. 2012;

22. Kumar A, Jain RK, Yadav P, Chakraborty RN, Singh BK, Nayak BK. Effect of gamma irradiation on the etching properties of Lexan and Makrofol-DE polycarbonate plastics. J Radioanal Nucl Chem. 2013;