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OZONE LAYER OR OZONE SHIELD

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A B S T R A C T

This article addresses questions about the problem of ozone layer depletion. We will look at questions such as what is the ozone layer. How it is formed. Its destruction. The causes of exhaustion and how the process of exhaustion itself occurs. Consequences of ozone layer destruction. How to avoid this destruction of the ozone layer. And also international efforts to solve the problem of ozone holes.

K E Y W O R D S

Ozone layer; hydrochlorofluorocarbon; chlorofluorocarbon; ozone shield; Chapman cycle; stratosphere; ultra-violet rays; ultraviolet radiation; non-melanoma skin cancer.

Introduction

The ozone layer, or ozone shield, is the region of Earth's stratosphere that absorbs most of the sun's ultraviolet radiation. This area contains a high concentration of ozone (O_3) compared to other parts of the atmosphere. The ozone layer is primarily found in the lower stratosphere, approximately 10 to 35 kilometers above Earth, although its thickness varies seasonally and geographically. The ozone layer formed in the Earth's atmosphere 1.85-0.85 billion years ago, when enough oxygen accumulated in it due to photosynthesis. The ozone layer is formed as a result of the conversion of atmospheric oxygen (O_2) into ozone (O_3), this process is called the “Chapman cycle”. Oxygen is photolyzed by ultraviolet rays to form an oxygen radical. The oxygen radical then reacts with molecular oxygen and forms an ozone molecule. Thus, ozone is constantly created and destroyed through the "Chapman cycle", which is a natural process.

The decrease in ozone concentration and thinning of the ozone layer is called ozone depletion. Its destruction is one of the most serious environmental problems facing the Earth. This is also the main reason that leads to global warming. Since the 1970s, ozone layer depletion has attracted the attention of scientists, environmentalists, and the global community at large. It is noted that in the area of the south pole the ozone layer is destroyed by approximately 40-50%. This significant reduction is called the "ozone hole."

The ozone hole over Antarctica has reached a size three times the size of Brazil. This follows from data from the Copernicus remote sensing program. Satellite measurements taken on September 16 showed that the area of ozone depletion had reached 26 million square kilometers.

The main factors that lead to the destruction of ozone gas in the ozone layer are:
1. Low temperatures
2. Increased chlorine levels
3. Increased levels of bromine gas in the upper stratosphere
4. But one of the most important reasons for the destruction of the ozone layer is the production and emission of chlorofluorocarbons, hydrochlorofluorocarbons, halogens, etc. This accounts for almost 80% of the total destruction of the ozone layer because it contains or produces a chlorine (Cl) atom.

All of these ozone-depleting substances remain stable in the lower atmosphere, but when they reach the stratosphere, they are exposed to ultraviolet rays. This causes them to break down and release free chlorine atoms, which react with ozone gas. The destruction process itself occurs under the influence of solar radiation, i.e. ultraviolet rays, chlorofluorocarbons, hydrochlorofluorocarbons, they break down and form Cl atoms, which react with the ozone molecule and form chlorine monoxide (ClO). ClO reacts with oxygen free radicals to form a chlorine atom and molecular oxygen. Because the Cl atom acts as a catalyst, one Cl atom can destroy 100,000 ozone molecules. Ultraviolet rays falling directly from the sun onto the earth consist of ultraviolet A and B rays, which affect all organisms on earth and lead to bad consequences. Affects plants. Ultraviolet radiation affects the physiology and development of plants. Sometimes small spots may appear on plants, which are also caused by ultraviolet rays. Ultraviolet rays also affect plant growth. These changes may have important consequences for the competitive equilibrium of plants, herbivores, plant diseases, and biogeochemical cycles. Next comes the impact on the marine ecosystem. Phytoplankton, which form the basis of aquatic food webs, are exposed to ultraviolet radiation, making it impossible for such aquatic organisms to survive. Ultraviolet rays have been found to harm fish, crabs and other marine animals in the early stages of development. But the most serious consequence is a decrease in reproductive capacity. Most importantly, there is a negative impact on human health. Depletion of the ozone layer increases the amount of ultraviolet radiation reaching the Earth's surface. Laboratory studies have shown that ultraviolet radiation causes non-melanoma skin cancer and plays an important role in the development of malignant melanoma. Non-melanoma skin cancer is a common type of cancer that starts in the top layer of the skin. The main types are basal cell carcinoma and squamous cell carcinoma. Non-melanoma skin cancer is often easy to treat. Ultraviolet radiation is also associated with the development of cataracts - clouding of the lens of the eye. Some types of skin cancer are also caused by these harmful ultraviolet rays. Ultraviolet radiation affects materials. Synthetic polymers and natural biopolymers are adversely affected by ultraviolet radiation and are destroyed. But today the materials are protected to some extent by special additives. If the amount of ultraviolet radiation increases, their destruction will accelerate. Ultraviolet radiation has a major impact on the climate. Due to increased exposure to ultraviolet rays, acid rain occurs. The snow is melting. But in general, there is complete global warming.

Research suggests that the phased withdrawal of almost 99% of banned ozone-depleting substances has ensured the preservation of the ozone layer and, as a result, reduced human exposure to harmful ultraviolet rays. If current policies continue, the ozone layer is expected to recover to 1980 levels (the approximate date of the ozone hole) by about 2066 over the Antarctic, by 2045 over the Arctic, and by 2040 over the rest of the world. Fluctuations in the size of the Antarctic ozone hole,

especially between 2019 and 2021, were mainly due to meteorological events. However, since 2000, the Antarctic ozone hole has been slowly improving in terms of area and depth. “It is truly fantastic news that the ozone layer is on track to recover, according to the latest quadrennial report,” said Meg Seki, executive secretary of the United Nations Environment Programme's Ozone Secretariat. – The impact of the Montreal Protocol on mitigating the effects of climate change cannot be overestimated. Over the past 35 years, the protocol has become a true protector of the environment. The Scientific Assessment Panel's assessments and reviews remain a vital component of the protocol's work, helping to inform policy and decision makers.” The Montreal Protocol is a global agreement to protect the Earth's ozone layer by phasing out the chemicals that destroy it. It came into force in 1989 and is one of the most successful global environmental agreements. Thanks to the joint efforts of governments around the world, the ozone layer is on the path to recovery. In addition, other environmental and economic advances have been achieved thanks to the protocol. The Panel's tenth addition is scientifically assessed to confirm the positive impact the treaty has already had on the global climate. The 2016 supplementary agreement, known as the Kigali Amendment to the Montreal Protocol, requires a phase-out of the production and consumption of certain hydrofluorocarbons. These substances do not directly destroy ozone, but are powerful gases that contribute to climate change. Scientists believe that this amendment will avoid warming of 0.3-0.5 °C by 2100 (not taking into account the contribution of emissions in 2023). “Action to protect the ozone layer sets a precedent for further action to combat climate change. Our success in phasing out ozone-depleting chemicals shows what can and must be done urgently to phase out the use of fossil fuels, reduce greenhouse gas emissions and limit rising temperatures,” says World Meteorological Organization Secretary-General Professor Petteri Taalas. September 16 is International Day for the Preservation of the Ozone Layer. The motto of the International Ozone Layer Day was: “Save the sky: protect yourself - protect the ozone layer.” A UN panel of experts has reported that the Earth's ozone layer will recover by the 2060s.

Conclusion

Ozone in the stratosphere absorbs some of the sun's biologically harmful ultraviolet radiation, which helps protect living organisms on the Earth's surface. To avoid depletion of the ozone layer, you should limit the movement of personal vehicles to reduce emissions of harmful substances into the atmosphere, and use public transport to reduce environmental pollution and global warming. Environmentally friendly household or other cleaning products should be used. You should also avoid excessive use of pesticides. It is necessary to replace CFCs with other materials that are less harmful. The production and use of chemicals that destroy the ozone layer must be stopped. It is important to plant and grow more trees. Excessive use of air conditioners should be prevented. These actions will further have a beneficial effect on preserving the ozone layer.

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