EMMISSION AND ABSORPTION OF GREENHOUSE GASES BY SOIL, ECOLOGICAL PROBLEMS

Sulaymanov Sunnatulla
Tashkent State Technical University
Doctor of technical sciences, professor

Orinova Sadokatoy Kobuljonovna
Institute of Andijan Machine building, Faculty of Transport and Logistics Doctoral student of "Labor protection" department
sadokaturinova1983@gmail.com

Abstract: *Soils are a source and sink of greenhouse gases (GHG) such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Since the volumes of concentration and flux can be large, accurate quantitative estimates are need- ed to obtain the data on global GHG fluxes required for forecasting global changes and climate studies. This review shows the role of soils as one of the important sources and regulators of the content of CH_4, CO_2, N_2O in the tropo- sphere, and also presents the main methods for monitoring greenhouse gases. The influence of natural and anthropogen- ic factors on the emission and absorption of CH_4, CO_2, N_2O by the soil cover has been analyzed. Original diagrams are presented showing the global fluxes of CH_4, CO_2, N_2O by various ecosystems, including the pedosphere. The estimation of methane emission and distribution of its content in the main types of soils of the Rostov region is carried out. The mechanisms of CH_4, CO_2, N_2O generation in soils and their possible influence on the calcium-carbonate balance, which plays an important role in the regulation of biogeochemical processes in the pedosphere, are considered. The performed analysis and generalization of research data on various types of soils makes it possible to shed light not only on their contribution to the global methane emission, but also to approach the understanding of processes and parameters that are important from the point of view of agrochemistry, such as, in fact, carbonate-calcium equilibrium and redox poten- tial in modern soils. An inventory of sources and an assessment of the inter-reservoir gas mass transfer in the pe-dosphere- atmosphere system allows one to start developing a strategy to reduce greenhouse gas emissions that will help curb the rate of global climate change.*

Key words: *Greenhouse gases, carbon dioxide, methane, nitrous oxide, fluxes, emissions, soils.*

Introduction. Global climate change has been the central topic of many scientific studies over the past decades. According to modern concepts, an increase in the concentration of greenhouse gases in the atmosphere, caused, among other things, by anthropogenic activities, leads to an intensification of the greenhouse effect, as a result of which its average global temperature gradually increases. The Earth's climate has never been constant. Even in the absence of anthropogenic impact, it changed noticeably. The presence of naturally occurring greenhouse gases such as H2O, CO2, CH4, N2O and O3 in the Earth's atmosphere ensured the existence of the greenhouse effect in the pre-industrial period [1]. The greenhouse effect refers to the absorption by the atmosphere of thermal radiation from the earth's surface and the re-radiation of part of this absorption back to the earth's surface, thereby preventing the loss of the flow of this radiation into space. With an increase in the content of greenhouse gases in the atmosphere, the amount of thermal radiation absorbed by them and, consequently, re-emitted towards the earth's surface increases, which in turn leads to an increase in air temperature at the earth's surface [1, 2]. An increase in the temperature of the surface layer of the atmosphere is the most noticeable of all changes in climate variables, and is far from the only one. Other changes include an increase in temperature amplitudes (increasing climate continentality); changes in precipitation (the level of precipitation increases on average across the planet, but decreases in dry regions), as well as an increase in the unevenness of precipitation; a general reduction in the area of mountain and surface glaciers, as well as thawing of permafrost; rising sea levels; increase in the frequency and intensity of hydrometeorological natural disasters [3].

According to a number of authors [3, 4], most of the atmospheric methane and other greenhouse gases are of biogenic bacterial origin, so its emission into the atmosphere is completely controlled by flows from the earth's surface. Today, the pedosphere is one of the least studied sources of emission of biogenic methane and other greenhouse gases into the atmosphere. . Both in foreign and domestic scientific literature, there is a fragmentary nature of data assessing the emission and consumption of greenhouse gases by various types of soils and there is no unified methodology for measuring greenhouse gas fluxes, which negatively affects the quality of data comparison, obtained experimentally. Meanwhile, at the present stage of development of civilization, it is extremely important to properly study soils as possible a possible source of greenhouse gases, from the point of view of the contribution of the pedosphere to the process of global warming. Greenhouse gas emissions from soils also need to be studied to calculate global budgets, since 35% of CO2, 47% of CH4, 53% of N2O and 21% of nitrogen oxide (NO) corresponding to global annual emissions are attributed to soil degassing [5].

The main greenhouse gases of atmospheric and soil air. Greenhouse gases (GHGs) include atmospheric chemical compounds of natural and anthropogenic origin that absorb and emit radiation in the same infrared range as the earth's surface, atmosphere and clouds.

Carbon dioxide (CO2), methane (CH4)and nitrous oxide (N2O) are considered to be the main "anthropogenic" greenhouse gases, the increase in concentration in the atmosphere, which, according to some scientists, is one of the main causes of global climate change [1, 5]. Currently, the contribution of carbon dioxide to the enhancement of the greenhouse effect is about 80%, methane – 18–19%, the remaining 1–2% comes from nitrous oxide, some other gases and ozone [4]. The greenhouse effect of different gases can be summarized by comparing their impact with that of CO2. For methane, the conversion factor is 21, for nitrous oxide – 310, and for some fluorinated gases – even several thousand [6]. The greenhouse effect of different gases can be summarized by comparing their impact with that of CO2. For methane, the conversion factor is 21, for nitrous oxide – 310, and for some fluorinated gases – even several thousand [7].Greenhouse gases remain in the atmosphere for quite a long time; their life span is many decades. Once a greenhouse gas enters the atmosphere, it can remain there for a very long time, thereby contributing to further climate change. CO2 emission from soil is determined by the respiration of soil microorganisms and plant roots, while the activity of heterotrophic microorganisms that mineralize soil organic matter accounts for approximately 70% of soil CO2 emission. The total CO2 flux from the soil includes several components: microbial decomposition of root exudates and root remains, root respiration of plants, microbial decomposition of humic substances, additional microbial decomposition of humus due to the increased activity of microorganisms in the rhizosphere. CO2 emission can be an indicator of the intensity of decomposition of soil organic matter and allows us to characterize one of the most important aspects of the biological carbon cycle.

Materials and methods for studying greenhouse gases (CO2, CH4 and N2O) in the soil - ground air system. Let us consider the most well-known methods for determining the release of gases from soils and analyze their strengths and weaknesses. In general, greenhouse gas emissions from soils are measured directly in the field and in laboratory conditions (chamber technology and micrometeorological methods), using space-based and airborne measurements, and are also calculated using empirical and process-oriented models. Taking into account the relevance and reliability of data on soil respiration, the chamber method is the most preferable, since its results allow us to obtain more specific factual information.

Rice. 1. Methods for studying greenhouse gases: a) closed chamber system;

Soil temperature also plays a critical role in the variation of greenhouse gas emissions from soils[8] An increase in soil temperature to certain values leads to an intensification of greenhouse gas emissions and further contributes to their absorption. which is a positive feedback reaction to increased microbial metabolism. The emission of methane and N2O is additionally stimulated by an increase in the rate of soil respiration with increasing soil temperature, which leads to a decrease in the concentration of O2 in the soil. Positive. This temperature effect may be due to a lack of water in the soil, since water is needed as a transport medium for nutrients needed by microbes. Nitric oxide and CO2 emissions increase exponentially with temperature [9]. N2O emissions increase with temperature up to approximately 37 °C; after this, denitrification and N2O emission decrease.

Conclusion. 1. Despite significant advances and an increased number of studies on the topic of the analytical review, there are still many unresolved problems that researchers face when calculating CO2, CH4 and N2O emissions from soils. All factors influencing the processes of emission and consumption of CO2, CH4 and N2O by soil cover have not been fully studied.

2. An analytical review of the literature showed a small amount of data, especially regarding greenhouse gas emissions from soils and their measurements in the field using chamber systems. In addition, there is an obvious lack of information about methane emissions from soils occupied by various agricultural crops. The need to study greenhouse gas emissions from fields occupied by other crops seems necessary. Most wetland experiments measured only CH4 emissions. There are very few measurements of other greenhouse gases.

3. The main methods for determining greenhouse gas emissions from soils are analyzed: the camera method, space sensing, modeling and micrometeorological. All of them have some methodological shortcomings. Today, there is no generally accepted methodological basis for determining gas emissions from soils. At the same time, according to the authors, the chamber method is the most preferable for carrying out the procedure for measuring gas emissions from soils.

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