International Journal in Physical and Applied Sciences
Volume 13 Issue 02, Feb 2026 ISSN: 2394-5710 Impact Factor: 8.202
Journal Homepage: http://ijmr.net.in, Email: irjmss@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal

Environmental Elements; An Analytical study

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Abstract ---

When we see the words "Environmental Chemistry" several question come to mind:

What do we understand as Environmental Chemistry?

Why is important that we understand and know Environmental Chemistry?

What areas of knowledge are related to Environmental Chemistry, and how can we use this concept?

In this research paper we consider these questions and try to explain what many scientists have come to agree on, as to the meaning of Environmental Chemistry. It is clear that Environmental Chemistry encompasses a number of fields of chemistry and chemical processes that take place in soil, water, air, and living systems. Our Earth is a reaction vessel, in which complex reactions take

place. It can also be considered a close system, in which atoms and molecules are neither created nor destroyed, and a balance in maintained. The atoms and molecules are always located in some environmental compartment, combined in different compounds, present in different physical states, or accumulated in organism. They are transported through.

Local, regional and global mass flow

Horizontal and vertical mass transfer in the atmosphere, hydrosphere and lithosphere, following different pathways and exchange mechanisms among different environmental compartments.

Complex spatial and temporal physical phase equilibria.

Chemical transformations of biotic and abiotic nature, using air and water as their mobile phases and equilibrating media.

Key words – Atmosphere , Environmental, chemistry

Introduction ------

All the chemical reactions that take place in the environment – and that are directly related to the natural cycling and transformation of the elements on Earth – are identified as Environmental chemistry. Likewise, the transformation or chemical interactions and processes of (a) substances introduced by human activity into the environment , (b) natural compounds, or (c) living organism are included in this concepts.

In the natural cycles of elements and molecules, the biochemical and chemical transformation have been recycling the elemental compounds for millennia, maintaining a balance and a cycling rate that allows natural ecosystem and organism to coexist, Originally, the concept of Environmental Chemistry focused on

Reactions related to the "biogeochemical cycles"

Reactions the may affect the growth of plants and the sustainment of organism

Reactions and processes that involve geochemical formations and transformations.

However, the ever-increasing complexity of bio-chemical and chemical process has changes this focus, and a wider range of views and new aspects are incorporated into the concept.

The term "environment" refers to the external surrounding in which an organism or a community of organism lives. It encompasses the physical, chemical, and biological factors that influence the growth,

Components of the Environment

The environments consists of two main components: Abiotic components and Biotic components.

Abiotic Components : These are non living factors, such as: Light , Temperature, water, Air, Soil, Minerals.

Biotic Components : These are living factors such as: Plants animals, microorganisms, Fungi

Importance of Environmental Studies

Environmental studies are crucial for understanding the complex relationship between living organisms and their environment, It helps us:

To understand the effect of human activities on the atmosphere, Environment studies help us comprehend the effect of human activities, such as pollution, deforestation and climate change, on the environment and to develop sustainable solutions: By understanding the environmental implications of human activities, we can develop sustainable solutions to mitigate the negative impacts and promote environmental conservation. And it preserve biodiversity and Environmental studies help us understand the importance of preserving biodiversity and the consequences of losing it.

It improve human health Environmental studies also helps us understand the impact of environmental factors on human health and develop strategies to improve environmental health.

Environmental Studies encompass various branches, including:

Ecology: The study of the relationships between living organism and their environment.

Environmental Sciences: The study of the natural world and the impact of human activities on the environment.

Conservation Biology: The study of the preservation and protection of biodiversity.

Environmental Chemistry : The study of the chemical process that occur in the environment.

Environmental Physics: The study of the physical process that occur in the environment. Environmental studies are essential for understanding the complex relationships between living organisms and their environment. By studying the environment, we can develop sustainable solutions to mitigate the negative impacts of human activities and promote environmental conservation.

Some definitions of the environment:

Formal Definitions

United Nations Environment Programme (UNEP): "The environment is the aggregate of surrounding things, conditions, and influences that affect the development, growth, and survival of living organism."

Environmental Protection Agency (EPA) : The environment is the sum of all external factors, both living and non-living, that affect an organism"

World Health Organization (WHO) : "The environment is all the physical, chemical and biological factors external to a person, and all the related factors impacting behaviors."

Informal Definitions

Natural Environment: The natural world around us, including air, water, land, plants, animals and microorganism.

Physical Environment : The external surrounding is which an organism lives, including climate, geography and natural resources.

Biological Environment: The living components of the environments, including plants, animals, microorganisms, and ecosystems.

Key Aspects of the Environments

Ecological : The environments is a complex system of interconnected components.

Dynamic : The environment is constantly changing due to natural and human-induced factors.

Interdependent : Human well-being is closely linked to the health of the environment.

Here are the elements of the environment :

Lithosphere (Land)

Definition: The lithosphere is the outermost solid layer of the Earth, comprising rocks, minerals and soil.

Components: Rocks, minerals, soil, landforms and geological structures.

Functions: Supports plant growth, filters water, regulates climate and provide natural resources.

Hydrosphere (Water)

Definition : The hydrosphere is the components of the earth that comprises all forms of water, including oceans, lakes, rivers, groundwater, and atmospheric water vapor.

Components: Oceans, lakes, rivers, groundwater, glaciers and atmospheric water vapor.

Functions: Regulates climate, supports plant and animal life, and influences weather patterns.

Atmosphere (Air)

Definitions: The atmosphere is the layer of gases surrounding the Earth, extending from the surface up to a height of about 10,000 Km.

Components: Nitrogen (78%), Oxygen (21%), Argon (0.9%), Carbon di oxide (0.04%) and other gases.

Functions: Regulates temperature, filters sunlight, and supports plant and animal life.

Biosphere (Living Organisms)

Definition: The biosphere is the component of the Earth that comprise all living organism, including plants, animals, microorganisms, and ecosystems.

Components: Plant, animals, microorganism, fungi, and ecosystems.

Functions: Support life, regulates climate, and influences the Earth‟s geochemical **cycles other Environmental Elements.**

Pedosphere (Soil) : The layer of soil that covers the Earth‟s surface, supporting plant, growth and filtering water.

Cryosphere (Ice) : The components of the Earth that comprises all forms of ice, including glaciers, sea ice, and frozen ground.

Anthroposphere (Human Made Environment) : The component of the Earth that comprises all human made structures, including buildings, roads and bridges.

Here‟s an in depth introduction to an analytical study of environmental elements:

Environmental Elements : An Analytical Study

The natural environment comprises various elements that interact and influence one another. These environmental elements are crucial for sustaining life on Earth. This analytical study aims to delve into the intricacies of these elements, exploring their characteristics. Interrelationships, and impact on the environment.

Environmental Elements: The Primary Environmental elements are:

Lithosphere (Land) : The solid outer layer of the Earth, comprising rocks, minerals, and soil.
Hydrosphere (Water): The Earth‟s water systems, including oceans, lakes, rivers, groundwater, and atmospheric water vapor.
Atmosphere (Air) : The gaseous envelop surrounding the Earth, composed of nitrogen oxygen, carbon di oxide and other gases.

Biosphere (Living Organisms): The realm of life on Earth, encompassing plants, animals, microorganisms and ecosystem.

Interrelationships Among Environmental Elements

These elements interact and influences one another through various processes, including:

Water Cycle: The continuous movement of water between the hydrosphere, atmosphere, and lithoshpere.

Carbon Cycle : The exchange of carbon dioxide between the atmosphere, biosphere and lithosphere.

Nutrient Cycles: The movement of essential nutrients, such as nitrogen and phosphorus, between the biosphere, lithosphere and hydrosphere.

Energy Flow: The transfer of energy from the sun to the biosphere, driving ecological processes and influencing the environment.

Human Impact on Environmental Elements

Human activities have significantly impacted the environments, leading to :

Climate change: The increasing levels of greenhouse gases, primarily carbon dioxide, are altering global temperatures and weather patetrns.

Pollutions: The release of pollutants, such as industrial waste, agricultural runoff, and vehicle emissions, is contaminating the environments and harming ecosystems.

Deforestation and Land Degradation: The clearance of forests and degradation of land are leading to loss of biodiversity, soil erosion, and decreased water quality.

Overexploitation of Resources: The excessive use of natural resources, such as water, minerals and fossils fuels, is depleting these resources and threatening their long-term sustainability. The environmental elements are interconnected and interdependent, forming a complex system that support life on Earth. Understanding these elements and their relationship is crucial for addressing the environmental challenges we face today. This analytical study aims to provide a comprehensive examination of the environmental elements, exploring their characteristics, interrelationships, and impacts on the environment.

Definition of Biosphere

The biosphere is the global sum of all ecosystem on Earth, encompassing all living organism and their interactions with the physical environment. It is the zone of life on Earth, extending from the upper atmosphere to the deepest parts of the ocean.

Components of Biosphere:

Lithosphere: The outermost solid layer of the Earth, comprising rocks, minerals and soil.

Hydrosphere: The component of the Earth that comprises all forms of water, including oceans, lakes, rivers, groundwater, and atmospheric water vapor.

Atmosphere : The layer of gases surrounding the Earth, extending from the surface up to a height of about 10,000 Km.

Living Organisms: All forms of life, including plants, animals, microorganism, fungi and protists.

Character of the Biosphere

Interconnectedness : The Biosphere is a complex system, with all components interacting and influencing one another .

Diversity : The biosphere supports an incredible range of ecosystem, from the freezing tundra to the hottest deserts.

Dynamic: The biosphere is constantly changing, with processes such as evolution, climate change, and human activities shaping its characteristics.

Importance of the Biosphere

Support Life: The biosphere provides the necessary conditions for the exists, including air, water, food, and shelter.

Regulates Climate: The biosphere plays a critical role in regulating the Earth‟s climate, with processes such as photosynthesis and respiration influencing the atmosphere.

Provides Natural Resources: The biosphere is the source of many natural resources, including food, water, minerals, and energy.

Threats to the Biosphere

Climate Change: Human activities such as burning fossils fuels and deforestation are leading to climate change, with potentially devastating consequences for the biosphere.

Biodiversity Loss; The loss of biodiversity, primarily due to human activities such as habitat destruction and pollution, is a major threat to the biosphere.

Pollution: The release of pollutants, such as chemical and plastic, is harming the biosphere, with many species facing extinction due to pollutions.

Analytical Study : Environment Elements

Without our atmosphere, there would be no life on earth. Two gases make up the bulk of the earth‟s atmosphere: nitrogen (78%), and Oxygen (21%), Argon, Carbon dioxide and various trace gases make up the reminder. Scientist divided the atmosphere into four layers according to temperature, troposphere, stratosphere, mesosphere, and thermosphere. The temperature drops as we go

Up through the troposphere, but it rises as we move through the next layer, the stratosphere. The farther away form earth the thinner the atmosphere gets.

TRPOSPHERE

This is the layer of the atmosphere closest to the Earth‟s surface, extending up to about 1015 Km above the Earth‟s surface. It contains 75% of the atmosphere‟s mass. The troposphere is wider at the equator than at the poles. Temperature and pressure drops as you go higher up the troposphere.

The Tropopause: At the very top of the troposphere is the tropopause where the temperature reaches a (stable) minimum. Some scientist call the tropopause a “thermal layer” or “cold trap” because this is a point where rising water vapor cannot go higher because it changes into ice and is trapped. If there is no cold trap, Earth would loose all its water!

Most of what we call weather occurs in the troposphere. The uneven heating of the regions of the troposphere by the Sun causes convection currents and winds. Warm air form Earth‟s surface rises

and cold air above it rushes in to replace it. When warm air reaches the tropopause. It cannot go higher as the air above it (in the stratosphere) is

warmer and lighter…… preventing much air convection beyond the tropopause. The tropopause acts like an invisible barrier and is the reason why most clouds form and weather phenomena occur within the troposphere.

STRATOSPHERE

This layer lies directly above the troposphere and is about 35 Km deep. It extends from about 15 to 50 km above the Earth‟s surface. The stratosphere is warmer at the top than the bottom. The lower portion has a nearly constant temperature increase with altitude because of absorption of sunlight by ozone.

This temperature increase with altitude is the opposite of the situation in the troposphere.

The ozone Layer: The stratosphere contains a thin layer of ozone molecules (with three oxygen atoms) which forms a protective layer shielding life on Earth from the Sun‟s harmful ultraviolet radiation. But this ozone layer is being depleted and is getting thinner over Europe, Asia, North American and Antarctica. “Holes” are appearing in the ozone layer.

MESOPHERE

Directly above the stratosphere, extending from 50 to 80 km above the Earth‟s surface the mesosphere is a cold layer where the temperature generally decrease with increasing altitude. Here in the mesosphere, the atmosphere is very rarefied nevertheless thick enough to slow down meteors hurtling into the atmosphere, where they burn up, leaving fiery trails in the night sky.

THERMOSPHERE

The thermosphere extends from 80 km above the Earth‟s surface to outer space. The temperature is hot and may be as high as thousand of degree as the few molecules that are present in the thermosphere receive extraordinary large amounts of energy from the Sun. However, the thermosphere would actually feel very cold to us because if the probability that these few molecules will hit our skin and transfer enough energy to cause appreciable heat is extremely low. The thermosphere corresponds to the heterosphere, a zone where there is no uniform distribution of gases. In other words, the gases are not well mixed; instead they are satisfied that is layered, in accordance to their molecular masses. In contrast, the gases in the homosphere (consisting of the troposphere, stratosphere and mesosphere) are uniformly distributed.

The early Greeks considered “air” to be one of four elementary substances; along with earth, fire and water, air was viewed as a fundamental components of the universe. By the early 1800s, however, scientist such as John Dalton recognized that the atmosphere was in fact composed of several chemically distinct gases, which he was able to separate and determine the relative amount of within the lower atmosphere. He was easily able to discern the major components of the atmosphere: nitrogen, oxygen, and a small amount of something incombustible, later shown to be argon.

The development of the spectrometer in the 1920s allowed scientists to find gases that existed in much smaller concentrations in the atmosphere, such as ozone and carbon dioxide. The concentration of these gases, while varied widely from place to place. In fact, atmospheric gases are often divided

up into major, constant components and the highly variable components, as shown in Table 1and Table 2.

Nitrogen (N2) 78%

Oxygen (O2) 20.95

Argon (Ar) 0.93%

Krypton %

Table: Constant Components, Proportions remains the same over time and locations Carbon dioxide (CO2)0.038%

Water vapor (H2O) 0-4%

Methane (CH4) trace

Sulfur dioxide (SO2) trace

Ozone (O3) trace

Nitrogen oxides (NO, NO2 N2O) trace

Although both nitrogen and oxygen are essential to human life on the planet, they have little effect on weather and other atmospheric processes. The variable components, which make up far less than 1 percent of the atmosphere, have a much greater influence on both shortterm weather and long term climate. For example, variations in water vapor in the atmosphere are familiar to us as relative humidity. Water vapor, CO2, CH4, N2O and SO2 all has an importance property: they absorb heat emitted by Earth and thus warm the atmosphere, creating what we call the "greenhouse effect. "Without these so-called greenhouse gases, the Earth‟s surface would be about 30 degrees Celsius cooler – too cold for life to exist as we know it.

Though the greenhouse effect is sometimes portrayed as a bad thing, trace amounts of gases like CO2 warm our planet‟s atmosphere enough to sustain life, Global warming, on the other hand, is a separate process that can be caused by increased amounts of greenhouse gases in the atmosphere.

In addition to gases, the atmosphere also contains particulate matter such as dust, volcanic ash, rain, and snow. These are, of course, highly variable and are generally less persistent than gas concentrations, but they can sometimes remain in the atmosphere for relatively long periods of time. Volcanic ash from the 1991 eruption of Mt.

Pinatubo in the Philippines, for example, darkened skies around the globe

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