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1. Environmental Contaminants

Monika Sharma

Chandigarh Engineering College,
CGC-Landran,
Mohali (Punjab), India.

Abstract:

Environmental contaminants have been emerged as a biggest issue in the demolishing the ecosystem. Various Physical, chemical and biological contaminates are having adverse effects on soil, air and water resources. Environmental contaminants are present in the environment at concentrations over the allowable limits, causing harm to the environment and endangering the health of humans, animals, and plants. Our ecosystem has become contaminated with many forms of toxins as a result of industrialization and usage of chemical fertilizers. Polyromantic hydrocarbons, heavy metals, Vinyl chloride, Benzene, polychlorinated biphenyls (PCBs), per fluorinated chemicals, and other pollutants are the major environmental contaminants. The unintentional release of these toxins into the environment causes the emergence of new diseases that endanger human health, as well as mass population death. In this chapter we will discuss about the types of Environmental contaminants and their role in polluting the environment.

1.1 Introduction:

Environmental contaminants are the substances that have been entered in to the environment by human activities. These contaminates can be physical (energy), biological (pathogenic bacteria, virus, invasive species), chemical and any other thing that has a negative impact on soil, air, water or living beings [1, 2]. Environmental contaminants are present in the environment above the permissible limits of concentration[3]. People's increasing desire to live comfortably finally fuels industrialization, resulting in the production of numerous chemical compounds. Because these newly synthesized chemical entities are foreign to naturally programmed biological systems, their exposure produces significant health impacts in the vast majority of living organisms [4-7].

1.2 Types of Environmental Contaminants:

1.2.1 Chemical Environmental Pollutants:

Chemical environmental pollutants are compounds that are present in food, water, air, or soil. They could be dangerous to humans and animals. Polychlorinated biphenyls (PCBs), dioxins, persistent chlorinated insecticides, brominated flame retardants, and metals such as arsenic, cadmium, lead, and mercury are examples of chemical contaminants. These are released into the environment by human activities or by natural processes and can harm ecosystems and human health.

Chemical pollutants are classified as estrogen analogues, dioxins, phthalates, polychlorinated biphenyls (PCBs), per fluorinated chemicals, polycyclic aromatic hydrocarbons (PAHs), brominated flame retardants, and heavy metals. In general, these toxins are directly discharged into the air, land, and water bodies, where they ultimately reach humans via respiration, skin contact, contaminated food, and drinking water. The accumulation of these toxicants in the environment has also become a severe danger since they penetrate the food chain when passed from prey to predator [8-10]. There are various chemical contaminants as follows:

A. Effect of Bisphenol A [BPA] And Phthalates:

Bisphenol A [BPA] and phthalates are prevalent in nature and are important components of plastic pollutants. A significant amount of BPA has been revealed in blood and urine samples from adults and children, as well as in amniotic fluid and breast milk, indicating that children are more vulnerable to the hazardous effects of BPA.

Several studies have found that BPA can have epigenetic effects on young children, rendering them infertile, and that their ability to operate Trans generationally is the cause of impairments in reproductive abilities that are handed down through several generations. According to research in rats, increased BPA concentrations have a direct deleterious influence on sperm count, motility, morphology, and DNA damage. Phthalates as like BPA were well characterized endocrine disruptors. Exposure to phthalates has been blamed for 40-69% of male infertility problems.

B. Effect of Organotin Compounds:

Large volumes of harmful OTCs have infiltrated diverse ecosystems as a result of increased industrial application. However, there has lately been evidence that urban and industrial wastewater, sludge, and landfill leachates are also significant sources of organotin. Physical, biological, and chemical clearance mechanisms all contribute to the persistence and spread of OTCs in the environment. Because of their high toxicity, broad usage, and direct input into the environment, OTCs are a source of worry.

OTCs enter the aquatic system through a variety of pathways. Several research on organotin pollution of rivers, lakes, and harbors have been done. TBT (tributyltin) and TPT (triphenyltin) have been used as biocides, agricultural fungicides, wood preservatives, and disinfectants in circulating industrial cooling water over the world.

They've also been employed as antifouling paints on ships. Nonpoint sources of organotin exposure in humans include contaminated dietary sources (seafood, shellfish), fungicides used on food crops, textiles, and industrial water systems, and antifungal agents used in wood treatment. The digestive tract is a significant channel via which humans are exposed to environmental toxins[12].

C. Effect of POPs in Marine and Freshwater Environments:

Persistent organic pollutants (POPs) are organic compounds of natural or anthropogenic origin that resist photolytic, chemical, and biological degradation. Examples include polychlorinated biphenyls (PCBs), dioxins and furans, many pesticides and certain metals, particularly mercury [13].

The occurrence and fate of fluorinated compounds in the aquatic environment is recognized as an important emerging contaminant issue. PFASs (polyfluoroalkyl) are bio accumulative and persistent, and have been found in a variety of environmental matrices, including freshwater [14] and marine waters [15].For individual compounds, forty PFASs from various classes are regularly found in the aquatic environment at quantities ranging from pictogram to Nano gram per liter (pg./L and ng/L, respectively)[11].

D. Effect of Vinyl Chloride as A Water Pollutant:

Vinyl chloride, also known as chloromethane, is a dangerous air and water polluter [109]. Vinyl chloride does not exist naturally in the environment, but it enters it as a byproduct of the plastics industry or as a result of bacterial decomposition of chlorinated solvents [16]. It was first manufactured in the United States in the 1920s, but its potential toxicity to humans was not recognized until the 1970s [17-18]. Despite its categorization as a recognized carcinogen, vinyl chloride is being produced in large quantities (>10 billion pounds per year) [19]. It is a colorless organic molecule that occurs as a gas at ambient temperature but is normally held under high pressure as a liquid [16]. Almost all vinyl chloride is generated for the production of polyvinyl chloride goods such as pipes, wires, and packaging materials. While most vinyl chloride evaporates into the atmosphere after being released into the environment, vinyl chloride has been found in groundwater near industrial operations, landfills, and other hazardous waste sites [19].

As a result, individuals can be exposed to vinyl chloride by inhalation of contaminated air or ingestion of vinyl chloride-containing drinking water. Small levels of vinyl chloride have also been discovered in both new and used tobacco smoke. Acute inhalation of very high quantities of vinyl chloride (10,000 ppm) can cause dizziness, fainting, and, in extreme situations, death. Acute dermatological exposure to vinyl chloride causes skin blistering and numbness. At this time, the acute health implications of swallowing vinyl chloride are unknown [16].

E. Effect of Benzene as Environment Contaminant:

Humans are chronically exposed to low levels of benzene within the atmospheric environment [18, 20-21]. Natural sources of benzene include forest fires and oil seeds, while anthropogenic sources include various industrial operations, automobile exhaust, and tobacco smoke. The ATSDR estimated that cigarette smoke constitutes approximately half of the United States' exposure to benzene [20]. Ambient outdoor air concentrations of benzene in the United States are reported to range from approximately 0.02–112 ppb, where higher levels of benzene are commonly present in urban environments Acute inhalation exposure to extremely high benzene concentrations (>10,000ppm) can result in mortality.

Lower levels of benzene exposure (700-3000 ppm) might cause eye irritation, disorientation, tachycardia, headaches, fatigue, dizziness, and fainting [146]. These health effects of acute benzene exposure fade as the exposure stops. Vomiting, gastrointestinal irritation, tachycardia, coma, sleepiness, and death can all be caused by acute or long-term oral benzene exposure. Red sores have been linked to dermal benzene exposure. Chronic benzene exposure has been linked to negative health effects on the hematological, immunological, and reproductive systems.

1.2.2 Physical Environmental Pollutants:

Physical environmental pollutants are chemicals or energies that pollute and harm the natural environment. Physical contaminants include, color, turbidity, temperature, suspended solids foam. They are present in water, air, soil, and food. Sediment, organic material, rocks, metals, chemicals, radioactivity, heat, sound, and light are some examples. Physical environmental pollutants can have an impact on human health by exposing people to dangerous levels of these substances or energies4. They can also have a negative impact on wildlife and ecosystems by altering their habitats and functions [22]. Small particles, whether of natural or anthropogenic origin, can pollute air and water resources. These particles pose a hazard to human health and to the environment in a variety of ways.

A. Particles in Air: Aerosols are particles suspended in air. These endanger human health primarily by respiratory inhalation and deposition in nasal and bronchial airways. Smaller aerosols enter the respiratory system more deeply and, in general, create greater health concerns than larger particles. Quartz (SiO2), a common natural substance and a key component of beach sand, may become an irritating airborne particle, creating a particulate-based illness. Silicosis is caused by occupational exposure to crystalline silica, and the size and morphologic properties of the particle have a role in respiratory issues. Construction workers, particularly those jack hammering or sand blasting building surfaces with a silica stream without sufficient nasal and mouth protection, are particularly vulnerable [23].

B. Particulate in Water: Suspended particles represent quite different dangers in water than aerosols. Inorganic particles enhance the turbidity of affected water, and the particles themselves can cause problems by regimenting in lakes, dams, reservoirs, and streams [23].

1.2.3 Biological Contaminants:

Biological contaminants are organism-caused pollutants that can harm the quality of air, water, soil, and food, as well as causing infectious or parasitic disorders. Biological pollutants include the following [23]

1. Bacteria
2. Molds
3. Mildew
4. Viruses
5. Animal dander and cat saliva

Living organisms or their byproducts that can impair the quality of air, water, soil, and food are examples of biological environmental pollutants. They have the potential to induce illnesses, allergies, and infections in humans and animals. Bacteria, viruses, fungi, protozoa, insects, and animal dander are some examples. They are detectable and manageable by the use of biological indicators or bioremediation procedures. Biological pollution is caused by pollutant discharges in solid, liquid, or gaseous phases. They are typically derived from processes that occur in:

- Various industries.
- Microbiological testing facilities.
- Food manufacturing.
- Agrarian laborers.
- Medical work, particularly in hospitals.
- Waste disposal.
- Waste water treatment.
- Any action involving live beings.

Some biological pollutants cause allergic responses, such as; hypersensitivity pneumonitis, allergic rhinitis, and allergic rhinitis. Infectious diseases like influenza, measles, and chicken pox are spread through the air. Molds and mildews produce poisons that cause disease. Biological contaminants can produce the following symptoms in humans:

- Sneeze and watery eyes
- Coughing, shortness of breath, dizziness, and fatigue are all symptoms of asthma.
- Fever and stomach issue
- Biological Contaminants Examples
- Biological pollution can be generated by a variety of biological pollutants, which are classed as follows based on their nature:

Bacteria: Pathogenic bacteria cause diseases like pneumonia as well as food-borne illnesses like salmonella. Protozoa are basic unicellular microbes that cause human disease. Malaria, amoebiasis, and sleeping sickness are only a few of the diseases produced by protozoa.

Virus: an infectious acellular agent that grows and develops within the cells of other species. They cause a vast range of illnesses in plants, animals, and humans, including AIDS, hepatitis, smallpox, and measles. Helminths are free-living worms or human parasites that cannot reproduce in humans as adults. Tapeworms, worms, and leeches are examples of parasites that can cause disease.

Fungi: Because fungi cannot synthesize their own nourishment, they must exist as parasites in living beings. These fungi are sometimes innocuous and do not cause infection. Pathogenic fungi, on the other hand, can affect any organ, but the most common are superficial infections of the skin or nails.

Arthropods: Mites are arthropods that can cause skin problems as well as act as allergen sources. The scabies mite causes an infectious skin illness called scabies.

A. Biological pollutants are classified into four classes based on the infection risk index:

- Biological agents are those that are unlikely to cause disease in humans.
- Biological pathogens that can cause disease in people, even if there are good therapies and they are not easily transferred.

- Biological infections in this group can cause serious sickness and spread, but treatments are often effective. Examples include the bacteria that cause tuberculosis, as well as the viruses that cause hepatitis and AIDS.
- Diseases are the most hazardous because they spread quickly and there are no effective therapies.

1.3 Conclusion:

To sum up, environment contaminants are the major sources which are polluting the environment. Environmental pollutants represent a severe threat to our planet's sustainability and the health of all living things. Environmental toxins can have an impact on the planet's air, water, soil, climate, biodiversity, and food security. They can also induce a wide range of diseases and problems in both humans and animals. To prevent additional damage and restore the natural equilibrium, we must embrace environmentally friendly practices and limit our consumption and waste. We must also promote research and development of clean and renewable energy sources, as well as phytoremediation techniques.

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