

Environmental Pollution by Heavy Metal and Its Impacts in Human Life

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Abstract -

Environment can be referred to the surroundings within which human exist. Environmental pollution by heavy metals has become a global issue in the recent years as it affects public health. Heavy metals constitute a very heterogenous group of elements widely varied in their chemical properties and biological functions. Heavy metals are released into the environment in the form of flue gas or slag due to the combustion of some heavy metals-bearing fuels and migrated among the atmosphere, water and soil, causing various environmental pollution, such as fossil fuels (like coal), heavy oil, leaded gasoline, garbage power generation, etc. Contamination of aquatic and terrestrial ecosystems with toxic heavy metals is an environmental problem of public health concern. This article comprehensively reviews the different aspects of heavy metals as hazardous materials with special focus on their environmental persistence, toxicity for human life and bioaccumulative potential. Dietary intake of many heavy metals through consumption of plants has long term detrimental effects on human health. Metal pollution has harmful effect on biological systems and does not undergo biodegradation. This article will serve as a valuable educational resource for both undergraduate and graduate students and for researchers in environmental sciences.

Keywords - Environment, heavy metals, biodegradation, fossil fuels, health

Introduction -

The environment is the surroundings where humans, plants, animals and micro-organisms live or work. It is composed of the land, the Earth's atmosphere and the water. Environmental contaminants, as well as pollutants, are chemicals that are present at higher levels than in any section of the environment^{1, 2}. The environment has been

seriously polluted by several pollutants such as inorganic ions, organic pollutants, organometallic compounds, radioactive isotopes, gaseous pollutants and nanoparticles². Heavy metals (HMs) are natural constituents of the earth crust and biologically important at trace levels³. Heavy metal pollution is one of the greatest consequences of industrializations⁴. The environmental issues related to heavy metals contamination are becoming serious in developing countries due to increase in geologic and anthropogenic activities. These activities increased the concentration of these elements to amount that are harmful to the environment⁵. Heavy metal contaminants can easily impact people residing within the vicinity of the source via suspended dust or direct contact⁶. Environmental pollution by heavy metals has become a global issue in the recent years as it affects public health. Especially with the continue increase in anthropogenic activities such as industries and urbanization which releases pollutants in to the environment without control and effects remedies⁷.

A list of heavy metals according to their density of being greater than 5 g/cm³ and which are more common in our everyday life are:

- Titanium
- Vanadium
- Chromium
- Manganese
- Iron
- Cobalt
- Nickel
- Copper
- Zinc
- Arsenic
- Molybdenum
- Silver
- Cadmium
- Tin

- Platinum
- Gold
- Mercury
- Lead

Heavy Metal -

Heavy metals are chemical elements with a specific gravity that is at least four to five times the specific gravity of water at the same temperature and pressure⁸. Heavy metals are metals or metalloids⁹. Metals have been widely used in agriculture, industry, medicine and other sectors, to the effect that they have been dispersed into the environment including our atmosphere, waters and soils^{10, 11}.

Heavy Metal Pollution -

Pollutants may enter the ecosystem in various ways and will enter into the hydrosphere, lithosphere and atmosphere. The problem of environmental pollution due to toxic metals is of major concern in most major metropolitan cities. Heavy metals plays an important role as its concentrations in air, soil and water are continuously increasing due to anthropogenic activities¹². Air pollution has long been recognized as a lethal form of pollution. Heavy metal mobilization in the biosphere by human activities has become an important process in the geochemical cycling of these metals¹³.

Soil contamination by heavy metals is of most important apprehension throughout the industrialized world¹⁴. Heavy metals are the main group of inorganic contaminants and a considerable large area of land is contaminated with them due to use of sludge or municipal compost, pesticides, fertilizers, and emissions from municipal wastes incinerates, exudates, residues from metalliferous mines and smelting industries¹⁵. The mechanism and path of the formation of pyromorphite from heavy metal lead in soil are mainly elaborated¹⁶. The concentrations of the HMs in the soil were found to be vary significantly with the seasons (winter, spring, summer, and autumn)¹⁷.

Water pollution can be defined in many ways. All metals are toxic at higher concentrations and their presence in water lead to water pollution¹⁸. Heavy metals are highly persistent, toxic in trace amounts, and can potentially induce severe oxidative stress in aquatic organisms¹⁹.

Effects of Heavy Metal on Human life -

Excess of metal pollutants deposited on soils may be transformed and transported to vegetation and from plants they pass on to animals and human being. Heavy metal exposure to human occurs through three primary routes namely inhalation, ingestion and skin absorption²⁰. Uptake of heavy metals by plants and subsequent accumulation along the food chain is a potential threat to animal and human health²¹. Heavy metals become toxic when they are not metabolized by the body and accumulate in the soft tissues²². HMs leads to the environment's ability to foster life being reduced as human, animal, and plant health become threatened²³. Water pollution by heavy metals has many human origins, such as the burning of fossil fuels, exhaust gases of vehicles, mining, agriculture, and incineration of solid and liquid wastes²⁴. Chronic level ingestion of toxic metals has undesirable impacts on humans and the associated harmful impacts become perceptible only after several years of exposure²⁵. Various microorganisms have been reported as efficient candidates for bioremediation of heavy metals through natural attenuation either by bioaccumulation, biotransformation or biosorption²⁶. The geoaccumulation index values showed a moderately polluted soil with Pb and Zn, but most contributing to the ecological risk were Cd with 63% and Hg with 19%²⁷.

Conclusion -

The problem of environmental pollution due to toxic metals is of major concern in most major metropolitan cities. Pollution of the natural environment by heavy metal is a worldwide problem because these metals are indestructible and most of them have toxic effects on living organisms and plants, when they exceed a certain concentration. Heavy metals uptake by plants and successive accumulation in human tissues and biomagnifications through the food chain causes both human health and environment concerns. This review highlights some significant concerns regarding human health associated with heavy metals.

Acknowledgement -

The authors would like to express heartfelt thank to principal, Dr. B. D. Ahirwar and Dr. Sunita Singh, Head of the Zoology and Biotechnology, Government Girls Post

Graduate College of Excellence, Sagar, (MP) India, for giving us encouragement and guidance in preparing the manuscript.

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