

## A study into different sources of heavy metal pollution

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### Abstract

India has seen a dramatic rise in industrial pollution, which has inspired us to conduct a systematic and extensive investigation of pollution of dangerous heavy metals in soil samples. Biomagnification causes these heavy metals to enter the human food chain, which in turn has an impact on the flora and fauna.

**Keywords:** - Pollution, metals, groundwater, soil.

### 1. Introduction

Soil pollution means the presence of chemicals or substances present in the soil at higher than tolerable concentration, affecting non-targeted life forms. Soil pollution is the third most serious threat in Europe and North Africa, fourth in Asia, fifth in the North West Pacific, sixth in North America and Latin America (Rodriguez-Eugenio, 2018). Along with significant contributions to soil pollution by anthropogenic activities, some soil pollution is also caused by natural processes. Soil pollution is not measured or observed directly, so it is a hidden danger and must be continuously watched. The changing agrochemical and industrial developments add new contaminants to soil. All over the world, the soil is contaminated by urbanization, industrialization, mining, and chemicals used in agriculture. In urban areas, the soil has been used for dumping solids and liquid waste with the wrong notion that the pollutants being out of sight and left in the ground will not pose any health problem and will disappear after some time without having any impact on the environment. The primary source of soil pollution is anthropogenically accumulated contaminants to the level of great concern. The detection of soil pollutants becomes difficult and expensive due to the diversity and transformation of organic compounds in soil by biological activity into diverse metabolites (Srouf, 2018). The effect of soil pollution varies depending on the soil properties (Rodriguez-Eugenio, 2018). The accumulation of pollutants like organic compounds, heavy metals, etc., decreases crop production and enters the food chain due to bioaccumulation and biomagnifications. Also, the excess presence of these metals pollutes surface and groundwater.

### 2. Trace Element in The Soil

The crust of the Earth is mostly composed of metals. As metal-based businesses grew, the environment was polluted and people and the ecosystem were exposed to hazardous levels, posing a possible health concern to both humans and wildlife. For mineral elements, plants rely on the soil. Mineral rich soils are a rich source of most critical components. A list of important elements may be broken down into major elements such as calcium and magnesium, as well as trace elements like copper, manganese, boron, and iodine, as well as micronutrients such as sulfur, phosphorus, and Sulphur. Plants and animals need all of these things to thrive and stay healthy. Toxic to the animals that eat the plants that contain them is another category of elements. Selenium, lead, thallium, arsenic, and fluorine are all elements in this group. Trace element contamination of soil is now universal in urban areas. Soils which contain high concentration of As and Cd occur naturally in a few places and soils with high level of lead sometimes occurs in areas where ore of lead are present.

### 3. Heavy Metal Pollution

Among the various types of contaminants, pollution caused by heavy metals poses a serious threat to the humanity. Metals which have a density greater than 5 and mass number greater than 23 are termed as heavy metals. Some of the most common heavy metal pollutants listed by the Environment Protection Agency (EPA) are As, Cd, Cr, Cu, Hg, Ni, Pb and Zn.



Heavy metals are non-biodegradable in nature, form stable complexes and cause undesirable effects. Trace quantities of certain heavy metals, such as Cr, Cu, Mn, Ni and Zn (referred to as micro-nutrients or essential trace elements) are required for the normal metabolic functioning of the living systems. But when their concentration exceeds certain critical limits, they become toxic and cause various health hazards. The presence of such potentially hazardous heavy metals in water usually affects its potability and palatability.

#### 4. Sources of Heavy Metals

The natural channels are erosion, weathering, and anthropogenic channels, including industrial, agricultural, medical, metallurgical, etc. (Masindi and Muedi, 2018). Figure 1 shows the different sources of heavy metals. Thus, it is clear that human activities are much more responsible for soil pollution. Ore processing is the beginning of heavy metal contamination. Compared to intense human activities, heavy metals' natural sources from weathering and leaching are of little consideration. The “volatile biodegradable and recalcitrant organic compounds, toxic metals, plants and agricultural chemicals, suspended solids, microbial pathogens, and parasites” are the major pollutants in surface water. Toxic metals, due to their bioaccumulation in living tissues and their harmful effect on the environment, are serious concerns. The problems of heavy metals aggravate because they cannot be degraded by natural processes and persist in soil.



Figure-1 Various sources of heavy metals classified as anthropogenic and natural sources.

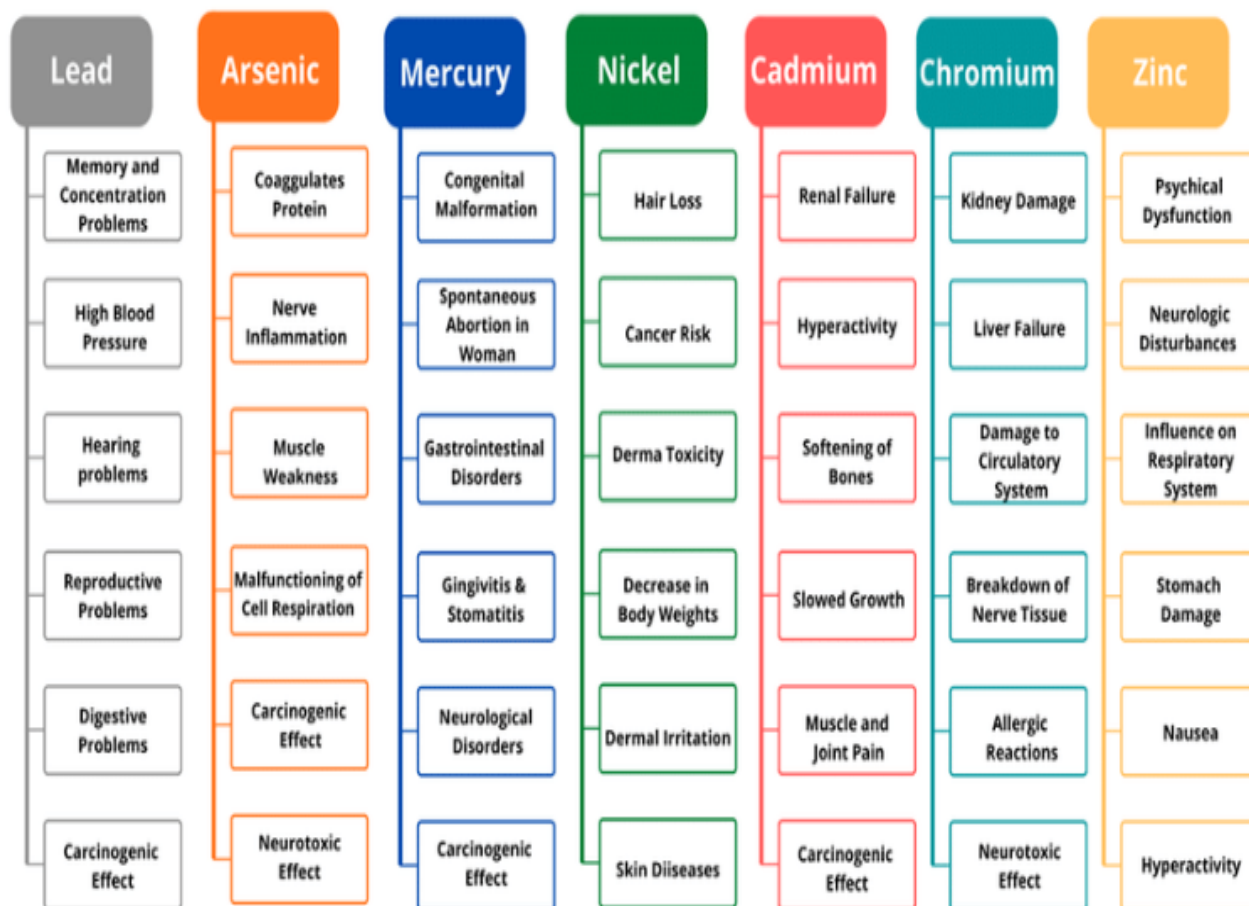


Figure-2 Toxic Effects of Heavy Metals on Human Health

Diabetes, Alzheimer's disease, and many types of cancer are just a few of the many ailments that have been linked to the increased intake of heavy metals. Copper, lead, aluminum, zinc, mercury, cadmium, and arsenic poisoning have all been linked to the following symptoms: gastrointestinal (GI) dysfunctions; diarrhea; stomatitis; shivering and pneumonia. Muscular dystrophy, Parkinson's disease, and multiple sclerosis may all progress more slowly with time if exposed to the same conditions. Long-term exposure to any metal or its compounds has been linked to an increased risk of developing cancer.

The heavy metals mixed with soil and water slowly contaminate groundwater. Heavy metals are added to rivers by industries like metal processing, paints, pigments, pulp, paper tanneries, plastic, rubber, textile, thermal, power plants, and mining. The excessive use of pesticides and fertilizer in agriculture is also a source of heavy metals mixed in soil.

As the heavy metals are non-degradable, their accumulation in living bodies beyond certain limits causes ill health effects. The heavy metals accumulation in the body "leads to fatal diseases like extensive lesions in the Kidneys, anemia, effect on nasal mucous membrane, pharynx congestion, nephritis, renal tumor, increased blood pressure, cardiovascular diseases and eyelids edema". Many authors have reported that heavy metals in the body can cause even cancer and malfunctions of different body systems. The hormones' synthesis and metabolism are also affected by heavy metals.

## 5. Conclusion

Mineral rich soil is necessary for the proper growth of plants. Abundance of selected minerals increases fertility of soil which in turn increases agricultural yield. But some heavy metals are harmful and needs to be discarded properly instead of being directly dumped into the soil. This problem needs immediate attention so as to curb it timely.

## Conflict of Interest

No conflict of interest in this manuscript.

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