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# Occurrence and Distribution of Heavy Metals in Natural Resources and its Impact on Health

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***Abstract*:- The Occurrence of heavy metals in its translocation in various components of ecosystem has been found potentially hazardous and great risk to human health. Toxicity testing methods have been developed from time to time using different procedures such as ecotoxicologic test method, acute toxicity test, chronic and sub chronic test. Sometimes special test have been conducted viz. metabolism, neurotoxicity, teratogenicity, carcinogenicity and mutagenicity. Heavy metals are known to be accumulated both in plants and human body. The study aims to explore the impact of some toxic heavy metals like Cadmium, Chromium, Lead, Copper, Manganese, Mercury and Arsenic. Environmental contamination of these metals due to intensive use in agriculture and other anthropogenic activities have been reviewed and discussed.**

***Keywords:- Heavy metals, Metabolism, Toxicity, Antioxidants, Bioaccumulation, metallothionin, Natural Resources***

## INTRODUCTION:

The Modern Society is known to exploit heavy metals ever since the civilization started. They are being used in a variety of ways in industries, agriculture, and food processing, medicine and house hold purpose. The rapid industrialization and use of these metals have led to release significant quantities in various comportments of the environment from where they entered in the human body through food chain, water and air. At the same time many of these metals are essential in physiological and biochemical processing viz. iron, copper and zinc etc. while other such as arsenic, mercury, cadmium, lead and chromium etc. are becoming toxic.

In recent years it is well noticed that heavy metals bio accumulated and deposited in the top soils adversely affects the whole ecosystem and ultimately translocate into ground water. These metals are taken up by flora and fauna resulting a great threat to crop plants, animals and human beings (Wong S.C.et al 2002). It is established that the plants have different abilities to accumulate most of the heavy metals in the different parts and found to be wide difference in the uptake and metabolism (Liu J.G. et al 2003, yu.H, 2006). The micronutrients viz Cu, Zn and Mn are mostly essential for both plants and animals in order to meet out physiological process and development of body. At the same time the use of polluted soil or water for cultivation of crop decreased overall productivity.

However such studies are lacking in the developing countries and therefore attempts have been made to explore the recent development on the occurrence, distribution and potential health hazards for the environmental and risk assessment into both producers and consumers.

Emphasis has been given towards the bioconcentration, bioaccumulation and translocation of heavy metals in the living organisms and its potential risk from the fly ash contaminated area ( Singh et al 2010 ).It has been reported in several studies that these heavy metals commonly occurred and distributed in water, soil and food above prescribed limit producing serious problems to human health viz. Nervous system disorders, cardiovascular effects, kidney dysfunction, hypertension, hepatic disorders, ulceration, teratogenic, cancer and phototoxic effects ( Tripathi !997, Barman 2000,Chary. 20008 ).

## PRINCIPLES OF THE ANALYSIS AND INSTRUMENTS FOR ESTIMATION

These metals can mainly be categorized into two methods depending on their nature i.e. nonvolatile metals ( Cd, Cr, Cu, Mn, Ni, Pb, Zn etc ) or volatile metals ( Hg, As etc ).Volatile metals can be analyzed on flame AAS or ICP , while non -volatile metals are analyzed on AAS or ICP equipped with Vapor Generation Assembly ( VGA ).Atomic Absorption Spectrophotometer(AAS)is one of the most versatile method for the quantification of these metals. The amount of the energy at the specific wave length absorbed in the flame which is proportional to the concentration of element over a limited range. In Inductively coupled plasma atomic emission spectrophotometer (ICP) aerosol is injected directly into the system subjecting to the constituent atoms to the temperatures of about 8000 – 10,000 $^0$ K resulted a complete dissociation of molecules.

Ionization of a high percentage of atoms produces ionic emission spectra. The efficient excitation provided by ICP result in low detection for many elements over a wide concentration range.

## SAMPLING AND ANALYSIS OF HEAVY METALS:

Concentration of these heavy metals may be determined in the different samples and assessment may be documented for the bioaccumulation factor and their translocation factor. At the same time risk assessment may be calculated by assessing the risk factor for the population consuming contaminated food. There samples may be digested after the addition of 15mL of triacid mixture $HNO_3$, $H_2SO_4$ and $HClO_4$ in a 5:1:1 ratio. After cooling the digested sample may be diluted up to 30mL with 2% $HNO_3$ and concentration of Pb, Cd, Cu, Cr, Mn and Zn may be determined by Atomic Absorption Spectrophotometer (AAS). The AAS value of blank without sample of each metal will be deducted from the sample value for make it final results. It is very

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important to note that all these analysis should be done with three replication for the purpose of statistical application of the data obtained. Bioaccumulation factor is the ratio of the concentration of the element in the corresponding sample .Translocation factor is calculated to determine relative translocation of metals in the food chain (APHA 2017, Bora and Tunay 2015) .

## RESULT AND DISCUSSION:

Heavy metals are known toxic contaminants found to be non bio and thermo degradable ultimately enters into the food chain system of natural resources leading to morbidity and mortality as well as accumulate many folds into the environment (Chung et al 2011). Occupations involved in the wet work are found to be great risk and high prevalence of dermal diseases have been noticed in southern India, Vietnam and Nam Dinh ( Trang et al 2007, Reddy et al 2013 )

The carcinogenic health risk is only assessed for exposure to arsenic because USEPA do not list the dermal cancer slop factors for Cd, Cr, Cu, Ni and Pb although they are identified as potential carcinogens ( Rudzi et al 2018 ) .
Health risks assessment are mostly categorized into non – carcinogenic and carcinogenic by calculating HQ and LCR respectively. The hazard index ( HI ) may be calculated from HQ, to estimate the risk of mix metal exposures ( Zakaria and HO 2015 ) , Expert committee on food additives ( JECFA ) has recommended the provision tolerable weekly intake of individual heavy metals to compare their pollution load in the human body ( Magamage et al 2017 ) .

## TRANSPORT AND METABOLISM OF HEAVY METALS :

The main source of human exposure of these metals is from drinking water . A series of adverse effects on human metabolism has been resulted from exposure which has been recorded from around the world These heavy metals when translocate along with pesticides residues into human further aggravate toxicity conditions ( singh et al 2017 ) . The general mechanism of toxicity is through the production of reactive species, the appearance of oxidative damage subsequent adverse effect on health .The accumulation of heavy metals such as lead, arsenic, mercury, cadmium and nickel may destroy the main metabolic process of human body. Redox reactions in biological system are adversely influenced. The free redical produced by these reactions cause oxidative damage to proteins, lipids , enzymes and DNA leading to the production of various diseases ( Fu and XI 2020 ). Following exposure to heavy metals their metabolism and subsequent excretion from the body depend on the presence of antioxidants (glutathione, A – tochopherol and ascorbic acid etc). Associated with the quenching of free radicals by suspending the activity of enzymes Catalase, peroxidase and superoxide dismutase (Jan et al 2015).

## DETOXIFICATION OF HEAVY METALS:

Toxic metals such as arsenic, cadmium, lead and mercury are ubiquitous have no beneficial role in homeostasis and contribute to non communicable chromic diseases. Peptide glutathione and mettalothionin chelate both essential and toxic elements as they are transported and excreted. It is established that developing procedure for the protection of biological system in metal polluted environment should be our understanding of cellular detoxification mechanism and to explore alternatives in natural product by gradual annihilation of these heavy metals from our surroundings. Attempts have been made to explore the literature from the various components for the cause of science and society.

## CONCLUSION:

Environmental pollution is a major challenge in modern society and at the same time contamination by heavy metals is a threat to natural resources including weathering, volcanic eruptions, mining, smelting, agricultural activities and found chain causing hazardous health due to their toxicity. Level of heavy metals above threshold affect microbiological balance and can reduce their fertility. This reveiw mainly focused the different dimension of the heavy metals with the particular emphasis for research in the field of environmental sciences and toxicology. Regular surveillance and monitoring should be conducted to record percapita of daily consumption of freshwater fish and other food items. Attempts may be made to minimize heavy metals load in the various ecosystem.
Mission oriented public awareness about the harmful effects of the toxicity on human health and environment may be expedited and effective treatment plant should be made compulsory with law enforcement before their final discharge into the water bodies.
Keeping in view of the overall situation of uptake, metabolism persistence and final kinetics of these heavy metals, more encouragement should be provided on scientific research sponsored from public and private sectors towards assessment and preventive measure in under to protect the human health and the environment.

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