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HEAVY METALS CONTAMINATION AND ENVIRONMENTAL HEALTH RISK

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Introduction:

The term "heavy metal" is refer to any type of metals and metalloids that is containing high atomic weight due to their high density ranging is 3.5 to 7 cm^{-3} an very toxic at low concentration like mercury, cadmium, arsenic thallium, chromium and lead. It is mainly found in earth's crust and non- degradable material. They insert into human body by accumulation of water, air and food also. It is play a very important role in human metabolism system and animals as well as but their higher quantity amount can create toxicity in human health and create hazardous in environment. Heavy metals are recognized as hazardous metals due to the quality of bioaccumulation and non- biodegradable.

River are the basic and major need for flora and fauna therefore indiscriminate discharge of some noxious pollutants in water body as well as environment which make water to be contaminated badly to remove the pollutants from water body has been become a major issues on globally. River water are major resources of naturally and anthropogenic discharge which is carrying large amout of organic, inorganic, organometalloids, and solid material such as sediments which is ultimate sink of heavy metals due to containing clay material. River water is along with sediments also get contaminated due to the majorly discharge of heavy metals by naturally and anthropogenenically.

In globally heavy metal pollution in water and sediments has been become serious threat for our environment and human beings also (Singh *et al.* 2005), in water body a large quantity of heavy metal toxicity creates bioaccumulation which get adverse and long term persistent impact on living beings and ecosystem. (Carman *et al.* 2007). Sediments are increasingly recognized as carriers and possible sources of contaminants in the system. Human activities (urbanization, industrialization, mining, etc.) promote the accretion of polluted sediments in the nearby river system, which is considered to be a safe disposal site for contaminated sediments.

Freshly deposited sediments are recognized as ultimate sink of carrier and possible sources of pollution in system such as suspended material that is because of long residence period. Such manmade activities like as (urbanization, industrialization, mining, etc.) are increasingly the accretion of sediments toxicity (Singh *et al.*1997).

Sources of heavy metals:

In river system an untreated industrial discharge, sewage, agricultural runoff and unsafe mining activities are contributed to promote the more addition of heavy metals. In natural processes heavy metal pollution in river sediments occurring due to the weathering and erosional processes of rock strata and soil demineralization in river ecosystem .second one natural factor are responsible for contamination is atmospheric deposition of particulate matters present which is present in air (Idrees, 2009).

The acceleration of anthropogenic activities such as discharge of industrial and agricultural waste, sewage, infrastructure and rapid economic development is because of addition of higher concentration of heavy metals in riverine body considerably. (Gao *et al.* 2014; Yang *et al.* 2012). Maiz *et al.* 1997 has been reported that area of road side, mining, smelting and other industrial sites are contain major metals pollution due to the runoff from these areas contaminate transferred the river sediment rapidly and therefore accumulate in human body through food chan. The environmental risks of metal contamination in sediments are of great concern due to their direct and indirect impacts over ecosystem.

Metals are also get reverse impact by directly and indirectly this that is become major environment risk for worldwide. It can originated growth retardation, impaired reproduction and lower species diversity of aquatic organisms (Praveen *et al.* 2007). Major sources of different heavy metals and their adverse effects on human beings are provided in table 1.

S. No.	Pollutants	Major Resources	Effect On Human Health
1	Lead (Pb)	Paint, pesticide, batteries, crystal and glass preparation	Cognitive impairment in children, peripheral neuropathy in adults, developmental delay
2	Copper (Cu)	Electroplating, pesticide production and mining	Headache, nausea, vomiting, diarrhoea and kidney malfunctioning
3	Zinc (Zn)	Effluents from electroplating industries, sewage discharge, the immersion of painted Idols	Vomiting, diarrhoea, liver and kidney damage
4	Nickel (Ni)	Stainless steel manufacturing units, electroplating factory discharge	Neurotoxin, genotoxic and carcinogenic agent Ni-dermatitis
5	Cadmium (Cd)	Electroplating, preparation of Cd-Ni batteries, control rods, shields within nuclear reactors and television	Kidney and liver damage, renal dysfunction, gastrointestinal damage
6	Chromium (Cr)	Mines and electroplating	Gastrointestinal, hepatic, renal, neuronal damage

Source: Malik *et al.* 2014.

Analytical tools for evaluation of toxic metal contamination of sediment:

The geochemical fractionation of metals in sediments or soils and sludge refer to a technique to evaluate the level of pollution and their probability level of transferring water body and biota.

There are different analytical tools use to analyze for check metal contamination toxicity in sediment. The most common approach to estimate Geoaccumulation index (Igeo), Pollution load index (PLI), Contamination factor (CF), Modified degree of contamination (mCd). The Igeo estimate extent of sediment contamination with respect to background shale value of element. The PLI gives information about contamination of sediment by all the metals species combinedly. The extent of heavy metal contamination in sediment is expressed in term of contamination factor (Banu *et al.* 2013). Abrahim and Parker (2008) proposed mCd to overcome the limitation of Cd. The details of these pollution indices are described in table 2.

Geoaccumulation Index (Igeo): A common approach to estimating the enrichment of metal concentrations above background or baseline concentrations is to calculate the geoaccumulation index (Igeo) as proposed by Müller (1969).

Degree of Contamination (Cd): Hakanson (1980) proposed an overall indicator of contamination based on integrating data for a series of seven specific heavy metals and the organic pollutant PCB. This method is based on the calculation for each pollutant of a contamination factor (Cf).

Significance of fraction study:

To obtain information in about the way and binding strength of metal association with the sediments , soils and sludge therefore , along with total metal contamination , and studies are performed to identify and quantify the form in which metal is present in sediments to gain a more precise and also process of transportation, deposition of metals in sediments. We can be aware from metal contamination by use of these analytical techniques and afterward we can remove the metals from aquatic media by remediation and removal processes.

Table No. 2. The details of pollution indices are given in table.

Index/Factor	**Formula**	**Notation**	**Threshold Value**
Geoaccumulation Index (Igeo	Igeo = log2 Cn / 1.5Bn	Cn: concentration of metal in sediment sample Bn: background value of metal, 1.5: constant factor to minimise variation in background data due to lithogenic effect	Igeo ≤ 0: uncontaminated, 0<Igeo< 1:uncontaminated 1<Igeo< 2: moderate contaminated, 2 <Igeo< 3: moderate to heavy contaminated, 3 <Igeo< 4: heavy contaminated, 4 <Igeo< 5: heavy to extremely contaminated, Igeo> 5: extremely contaminated (Muller 1969)
Polluti on load index (PLI)	PLI = (Cf1x Cf2 x Cf3— CfN)1/N	N= number of metals Cf = contamination factor	PLI < 0: unpolluted, 0 < PLI ≤ 1: baseline level of pollutant present, 1< PLI ≤ 10: polluted, 10 < PLI < 100: highly

			polluted, PLI > 100 progressive deterioration of environment (Tomlinson *et al.* 1980)
Contamination factor (CF)	CF = Cmsample le/Cm background	Cm sample = on centration of given metal in sediment Cm background = concentration of metal in background sediment	CF < 1 low contamination ; 1≤CF<3: Moderate contamination; 3≤CF<6: considerablecontamination; CF6: Very high contamination (Hakanson, 1980)
Modified degree of contamination (mCd)	mCd= $\sum_{i=1}^{i=n} C \quad f$ /n	n = number of analysed element, i = element, Cf = contamination factor	mCd<1.5: zero to low degree of contamination; 1.5<mCd<2 :low degree of contamination; 2<mCd<4:moderate degree of contamination ; 4<mCd<8:high degree of contamination; 8<mCd<16:very high degree of contamination; 16<mCd<32: extremely high degree of contamination; mCd≥ultrahight degree of contamination (Abrahim and Parker, 2008)

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