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Studies on Heavy Metal Contents in Surface Water Bodies Especially Futala (Telangkhedi) Lake, Nagpur Region, Maharashtra, India

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ABSTRACT
Heavy metals are significant environmental pollutants, non-degradable, and can bioaccumulate in living organisms; hence they can contaminate the entire food chain. In the present study, variational level of occurrence of heavy metals like lead (Pb), chromium (Cr), Cadmium (Cd), iron (Fe), Zinc (Zn), Arsenic(As), mercury (Hg), copper (Cu) and manganese (Mn) estimated in Futala (Telankhedi) lake, Nagpur City, Maharashtra, India. Futala (Telangkhedi) lake is an essential ecosystem. Many organisms depend on freshwater for survival. Humans frequently depend on the same lake for many goods and services, such as fisheries, aquaculture, agricultural irrigation, and recreation activities. The monitoring was made for three months of viz—August, September, and October for the session 2019. The heavy metal content had trends upward and followed the sequence: Fe> Pb> Cr> Mn> Cu> Zn> Hg> As. The area under study receives domestic sewage (reduced) from pollution habitation, so also the activities like, vehicle, cattle washing, dumping of garbage, cloth washing, bathing, and idol immersion activities in large extent during and after various festivals during different seasons. Food chain polluted with toxic heavy metal is an essential route for humans exposure and may cause several dangerous effects on human beings and animals; hence constant monitoring and total ban on idol immersion activities are needed to maintain Futala (Telankhedi) lake water quality fit for useful purposes.

KEYWORDS: *Heavy metal, Anthropogenic activities, Religious activities, Lake water pollution*

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I. INTRODUCTION

Next to oxygen, water is an essential substance for human existence, and it is crucial for each thing on our planet to grow and prosper. Freshwater rivers, lakes, and groundwater are used to irrigate crops, provide drinking water, and act as a sanitation system. Although humans recognize this fact, we disregard it by polluting our rivers, lakes, and oceans. Most of the water resources are gradually becoming contaminated besides foreign materials on the surround. These include an organic matter of plant and animal origin, land surface washing, and industrial and sewage effluents. Rapid urbanized development and industrialization with improper environmental planning often lead to a discharge of industrial and sewage effluents into rivers and lakes. In addition to desertification, contamination is also reducing the volume of safe fishing, irrigation, and drinking water. [1]. The toxic heavy metals mixing the ecosystem may lead to accumulation, biomagnifications, and bioaccumulation. Heavy metals such as Fe, Cu, Zn, Ni, and other trace elements are essential for biological systems' proper function. Their deficiency or excess could lead to several disorders. Food chain damage by heavy metals has become a central problem in the recent era because of their potential accumulation in biosystems through contaminated water, soil, and air. Therefore, a better understanding of massive metal sources, their collection in the earth, and the effect of their presence in water, dirt, and on plant systems seem to be particularly essential issues of present-day research on risk assessment [2]. The primary sources of heavy metals are fruitage in their growth media like soil, air, nutrient solutions, etc. from which the roots or foliage takes these up." The acute water pollution problem has been caused by continuous growth in the anthropogenic impact on the natural environment and ecosystem. Heavy metals (HM) are frequently occurring with toxic damage. These compounds are not subject to destruction in the water body, i.e., they can only change their migration forms. That is why heavy metals are referred to as conservative substances toxic for hydrations and man. Depending on the ambient conditions, heavy metals can have different degrees of oxidation or act as various inorganic and organic compounds, or distributed between specific components of aquatic ecosystems

and bottom sediments. In this case, heavy metals mobility, toxicity, and acceptability for hydropic change appreciably, and, correspondingly, their ecological role in the water body changes, too.

India is a vibrant cultural country in which diverse cultural and religious festivals are organized. Idol is an image of a god that is used as an object of worship. After worship, these idols are immersed in water bodies. Icons constructed by plaster of Paris, clay, cloths, small iron rods, bamboo, and decorated with different paints such as varnish, watercolors, etc. can significantly alter the water quality after immersion. Pigments used to color these idols contain various heavy metals such as mercury, cadmium, arsenic, zinc, chromium, and lead. Mainly, red, blue, orange, and green colors contain mercury, zinc oxide, chrome, Pb, etc.are main carcinogens. Lead, chromium add in the water bodies through sindoor mean traditional red-colored beautifying powder, usually worn by married women also use in the festivals. The non-submerged materials released through Idol in the river and lake after decay results in eutrophication, high acidity, and heavy metal concentration. Pollution caused by Idol's immersion affects the ecosystem and kills the aquatic animal's fishes, damages plants, blocks the natural flow of running water, causing stagnation. The relationship between water quality and quantity composed an acute public health issue. The Worldwide, sickness associated with contaminated drinking water has been intensely researched, due to the casual connection with diseases such as cancer, congenital malformations, and endocrine disturbances, in addition to acute and chronic toxicity.[3] This paper intended to study water pollution with heavy metals in Futala (Telankhedi) lake, Nagpur, Maharashtra, India, for the session 2019.

1.1 STUDY AREA

Nagpur city spread in an area of about 220 Km^2. The road length of a town under the area NMC Nagpur is 1200 Kilometers. This city is situated o over the extent of 290 meters above sea level, rising to 350 meters towards Northwest, west, and Southwest. In many Nagpur city regions, tap water supply is not available, and people are dependent mainly on groundwater resources. Nagpur city (M.S.), containing several water sources.eg. Nag River, a tributary of Kanhan, takes its origin from Ambazari and flows east through Nagpur city. The Nag River water is completely polluted because of the draining of sewage into a river [4]. Lakes are a significant resource base of Nagpur city. Some of these used to supply water for drinking purpose like Gorewada lake and Wena tank. The water from Futala (Telankhedi) lake is used for irrigation, and water from the Ambazari lake used for industrial purposes. The Futala (Telankhedi) lake with a coordinate of 21°8'44"N and 79°03' 48"E is a closed water body. The Futala Lake spread over 60 acres. The Futala (Telankhedi) lake is located on the western side of the Nagpur city, as shown in fig. 1. The catchment area of the dam is 6.475 sq. Km. The length of the west weir is 8.0m. Futala (Telankhedi) lake can flood 34.42 hectares of cultivated agriculture land and Telenkhedi Garden. The initial purpose of irrigating nearby agricultural land was prominent among Futala (Telankhedi) lake.

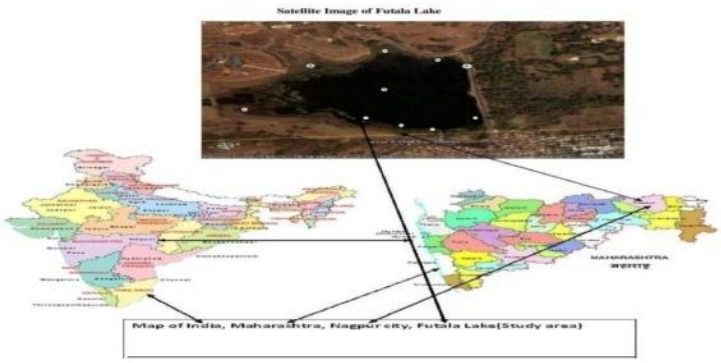


Fig. 1

1.2 PROBLEM ON HAND

The festival is a vital part of the rich and diverse cultural heritage of India. Idol worship has been in practice in India since ancient times. The religious scripts, mythology, and rituals have attempted to drive the importance of preserving nature by adoring it through the centuries. To the worship God and goddesses, only natural things like milk, curd, ghee, coconut, beetle, and river water are usually used. In India, idol immersion is another anthropogenic activity. Lord Viswakarma, Lord Ganesh, Goddess Durga, etc. are worshipped with all Hindu rituals and immersed in water bodies between August to October, respectively, every year. Ganesh idols engaged in a water body which includes lakes, river, etc. Consequent pollution of such water bodies has been a matter of concern. In addition to silting, toxic chemicals used in making idols tend to leach out and pose severe lake problems water pollutions. Studies carried out to assess the deterioration in lake water quality due to idols'

immersion have revealed that lake water quality deteriorates concerning conductivity, biochemical oxygen demand, and heavy metals concentration. Ganesh Chaturthi's gods' pollution also damages the ecosystem, kills fishes, other marine life, and harms different life depended on the water such as birds, animals, and human beings. Idols are immersed in lotic or lentic water bodies based on the difference in the water residence time and the flow velocity. However, in present-day scenarios, metals, ornaments, oily substances, synthetic colors, chemicals are used to make polish and decorate these idols for worship, followed by immersion of these idols in our surrounding aquatic environment, which gets severally affected. When the gods are immersed in water bodies, their colors, chemicals, and other components utilized in idol decoration dissolve and lead to significant water quality changes. Far earlier, the impact of pollution is seen during and after the festival season, when idols' immersion in these natural aquatic ecosystems destroyed the whole ecological balance. Futala (Telankhedi) lake is subjected to enormous anthropogenic stress and receives substantial domestic waste and sewage inputs. The other source in Nagpur city is, namely Gandhisagar lake, Naik Lake, Lendi lake, Sakkardara lake, and Khandan lake, In Naik and Lendi lake, the ingress of sewage from the nearby locality is rampant. The weeds have very much encroached both of these lakes. These resulted in the complete degradation of Lendi and Naik lake. The primary source in Nagpur city, which once used to be eco-friendly and useful purposed, has lost its grandeur and has become a nuisance source.[5] It is imperative to know the quality states of these lakes water to renovate them so that these services are useful to society. The study's level of pollution in heavy metal has been undertaken throughout the three months of August to October 2019.

1.3 MATERIALS AND METHODS [6].

To determine heavy metals in the lake water, 250 ml of surface water were collected in triplicate from each of the ten (S_1 to S_{10}) sites in the colored, sterilized bottle and preserved with adding 1.0 ml concentrated HNO_3. Suspended particulate matter separated by filtering water samples through 0.45 µm Whatman GFC filters. Sampling during pre-monsoon, monsoon, and post-monsoon. Selection usually was made in the morning and evening hours. Sample bottles were acid-washed a day before sampling day in 1-2% HNO_3 solution, rinsed in distilled water, and dried in a drying oven. During every sampling, a total of five samples of water was collected manually on a rowing boat by submerging pre-cleaned polyethylene (PE) bottles approximately 50 cm beneath the water surface and 8-9 feet deep from the bank of the lake by holding the bottles upward. Sample bottles immediately transferred to the laboratories for the estimation of various heavy metals content in lake water. For analyzing the heavy metal content of water, 100 ml of water samples, and digested using HNO_3 and $HC1O_4$ in a 5:1 ratio until the white fumes appear, the water digests were filtered and diluted to 10 ml with 0.1N HNO_3 solution. AAS then assayed the filtrate of water for Cd, Zn, Pb, Cu, Cr, Ni, Mn, and As. The AAS value of blank (without sample) of each metal deducted from the sample value for final calculations.

1.4 Quality assurance and quality control

Appropriate quality assurance procedures and precautions were carried out to ensure the results' reliability double distilled water used throughout the study. Glassware was adequately cleaned, and the reagents were of analytical grade. Reagents blank determinations used to correct the instrument readings.

1.5 Result and Discussion

The average result of all the heavy metal parameters in Futala Lake water presented in Table 2-5. Heavy metals are essential environmental pollutants, and their toxicity is a problem of increasing significance for ecological, evolutionary, and ecological reasons. In the present study, the level of occurrence of heavy metals like lead (Pb), arsenic (As), chromium (Cr), Cadmium (Cd). Iron (Fe), Zinc (Zn), copper (Cu), and manganese (Mn) estimated in Futala (Telankhedi) lake. Nagpur city, Maharashtra, India. The monitoring was made over three months of viz. August (pre-immersion period), September (immersion period), and October (post-immersion period), respectively. The sampling points were selected based on their importance.[7] Heavy metals are hazardous because of bioaccumulating. Bioaccumulation means to increase the concentration of a chemical in a biological organism over time, related to the chemical's concentration in the atmosphere. Compounds gather in living things any time they are taken up and deposited faster than broken down (absorbed) or excreted. Heavy metals can enter a water source by industrial and consumer waste, or even from acidic rain contravention down soils and discharging heavy metals hooked on streams, lakes, rivers, and groundwater. Heavy metal toxicity can result in injured or reduced mental and central nervous function, lower energy levels, and damage to blood configuration, lungs, kidneys, liver, and other vital organs. Long-term exposure may result in slowly continuing physical, muscular, and neurological degenerative courses that impersonator Alzheimer's disease, Parkinson's disease, muscular dystrophy, and several sclerosis. Allergies are not unusual, and repeated long-term contact with some metals or their compounds may even lead to cancer.

A) HUMAN EXPOSURE THROUGH FOOD, AIR, AND WATER [8]

Hazardous metal-polluted surface and underground water sources result in considerable soil pollution. Pollution increases when mined ores dumped on the ground surface for manual dressing Surface dumping exposes the metals to air and rain. The agricultural soils are polluted. These metals are taken up by plants and consequently accumulate in their tissues. Animals eat on such affected plants, drink polluted water, and aquatic lives cause dangerous metal-contaminated water and get such metals in tissues, and milk, if lactating. In summary, ultimately, the ecosystem is contaminated, along with their cycles of the food chain.

B) HEAVY METAL POISONING AND BIOTOXICITY [8]

The biotoxic effects of toxic metals refer to the harmful effects of heavy metals on the body when consumed above the bio-recommended limits. Although individual alloys exhibit specific signs of their toxicity, associated with Cadmium, lead, arsenic, mercury, Zinc, copper, and aluminum poisoning: gastrointestinal disorders, diarrhea stomatitis, tremor, hemoglobinuria causing a rust-red color to paralysis, vomiting, stool, ataxia, and convulsion, depression, and pneumonia when volatile vapors and fumes inhaled The nature effects could be toxic viz acute, chronic or sub-chronic), neurotoxic, carcinogenic, mutagenic or teratogenic.

i) Cadmium

Cadmium is toxic at a deficient level. In a human being, long live sustain cause, characterized by tubular proteinuria is renal dysfunction. High exposure obstructive lung disease, cadmium pneumonitis resulting from inhaled dust, fumes. Its characterized by chest pain, cough with a bubbly and blood-spattered band, and death of the facing lung tissues because of excessive accumulation of watery fluids. Cadmium is also associated with bone defects, viz; osteomalacia, osteoporosis, and spontaneous fractures; increased blood pressure, and myocardial dysfunctions.

ii) Lead

Lead metal showing significant toxin of the heavy metals, and the inorganic forms are absorbed through ingestion by food and water, and inhalation. A notably severe effect of Pb toxicity is its teratogenic effect. Lead poisoning also causes inhibition of hemoglobin synthesis, dysfunctions in the kidneys, joints by food and water, and inhalation. A notably severe result of Pb toxicity is a teratogenic effect. Pb poisoning also causes inhibition of the synthesis of hemoglobin; dysfunctions in the kidneys, joints and reproductive systems, cardiovascular system, acute and chronic damage to the central nervous system

iii) Zinc

Zinc metal reported the same signs of illness as lead and can quickly mistakenly diagnose as lead poisoning. Zinc is considered to be relatively non-toxic, especially if taken orally. However, the excess amount can cause system dysfunctions that result in impairment of growth and reproduction. The clinical signs of zinc toxicosis have been reported as vomiting, diarrhea, bloody urine, icterus (yellow mucous membrane), .liver failure, kidney failure, and anemia.

iv) Mercury

Mercury (Hg), a toxic metal, has a new knowledge of human biochemistry and physiology. Inorganic mercury forms cause spontaneous abortion, congenital malformation, and disorders (like corrosive esophagitis and hematochezia). Poisoning by its organic forms, including monomethyl and dimethylmercury, presents with erethism (an abnormal irritation or sensitivity of an organ or body.

C) PROBLEMS ASSOCIATED WITH HEAVY METAL POLLUTION [9]

Trace elements, in general, cause only local pollution problems. The environmental significance enhanced levels of items are judged in terms of the degree of toxicity, the extent of exploitation of the component, their application, and consequent mobilization into the air, water, and soil. Problems caused by heavy metals may be summed up in brief as follows :

1. Higher levels of heavy metals are dangerous to plants, animals, and the biosphere's microbial component.
2. Chronic and sub-lethal effects of heavy metals pollution at low concentrations may, at times, evade detection and general non-specific type of ailments follow, which avoid redressal.
3. Their persistence in the environment and subsequent transformation into the more toxic state are distinct possibilities.
4. Many heavy metals are rendered lipophilic due to the formation of conjugates with organic molecules. These provide them free access into a biological system and makes them more dangerous as they can readily take, up by living organisms

5. Bio-concentration and magnification in the biosphere may confront us with highly toxic levels of heavy metals. These may substantially damage our food supplies, water sources, and agricultural land.
6. Children are particularly susceptible to higher levels of heavy metals. With chronic or sub-lethal concentrations present in food, water, or air, these elements' higher burden may gradually build up in their bodies. These, in the long run, may reach toxic levels, or else it may interfere with therapeutically administered drugs given for the benefit of the individual concerned.
7. Synergistic effects, when two or more than two such elements are involved, may significantly enhance the heavy metals toxicity.
8. Carcinogenic, teratogenic, and mutagenic effects may occur even at a low concentration, often evading detection.

D) COMPOSITION AND INGREDIENTS OF PAINTS[10]

The dye is liquid, mastic composition, or liquefiable. Its application to a substrate in a thin layer converts to a solid film. It is most regularly used to protect color or provide texture to objects. After detailed work over the prepared Idol sent for the painting process. In its most basic form, dye consists of color (the pigment) and the glue in which the stain, oil hovering. Many paints, varnishes contain an ingredient that adds surface and immensity means fillers, a thinner (like solvent), and other additives, such as biocides and drying catalysts.

i) Pigments: Safely alternatives to the toxic compounds and heavy metals used to conventional color paint include natural dyes derived from plants, insects, iron oxides, and minerals. These are usually in powder form.

ii) Binders: Binders keep makeup glue to a surface. The vinyl and acrylic binders in commercial paints are derived from the by-products of refining crude oil. The adhesives in natural colors instead of linseed oil from pressed flax seeds, starch from flour, and casein, protein from milk.

iii) Fillers: Fillers are created texture and add bulk to the paint. Joint cartridges contain limestone, silica, marble, talcum, And powdered chalk. Clay is a favored protective material to couple with flour because it reinforces the binding capacity of starch, and it's profuse and potentially free if you have clay soil.

iv) Solvents: Solvents like thinners help achieve a workable consistency. The solutions in commercial paints are usually made from organic materials, but they will evaporate or "outgas," causing that new paint smell. The hazards are remarkably worse for a community who paint regularly. Natural solvents such as citrus thinners and crude oil are preferable, but they can still emit VOCs' low levels.

v) Additives: business paint, varnishes manufacturers commonly include some additives in their products, but they aren't obligatory to list them on the product. Such Additives include plasticizers, foaming and antifoaming agents, driers, and biocides that inhibit mold growth, and ingredients that progress water resistance or opacity.

E) Impact due to idol immersion on aquatic life

The idols are painted with oil paints of various colors that contain heavy metals that are non-biodegradable and bio-accumulate, and bio-magnify along the food chain. They are brutally neuro and nephrotoxic and some even carcinogenic. It is apparent that the heavy metals viz., copper, ferrous, calcium, magnesium, manganese, molybdenum, silicon, arsenic, iron, lead, chromium, nickel, Cadmium, Zinc, and mercury are used to prepare synthetic paints of different colors. The concentration of these metals (mg/1) rises in multiple folds after the immersion of idols. These metals are absorbed in the bodies of aquatic flora and fauna in the food chain. When these metals' levels exceed the tolerable limits, it results in a fish kill and other marine animals like snails, frogs, etc. which is a familiar scene for some post-immersion days. [11]

Table No. 1
Various materials contributed by idol immersion activities and its impact on the aquatic body[33]

Sr. No.	Materials contributed by immersion	Impact on the aquatic body
1	Plaster of Paris	Increases dissolved solids, contribute metals and sludge
2	Decoration material viz. clothes, polish, paint, ornaments, cosmetic items, etc.	Affect matters, trace metals like Zn, Pb, Fe, Cr, As, Hg, etc. metalloids and various organic and inorganic matter, oil, grease, etc.
3	Flowers, Garlands, oily substance	Increase floating suspended matter organic contamination, oil & grease, and various organic and inorganic matter.
4	Bamboo sticks, Beauty articles	Big pieces were collected and recycled while small pieces remained floating in the water or settled at the river bottom, inhabiting river flow.
5	Polythene bags/plastic items	Contribute suspended, settleable matter, and hazardous material to water and chokes the aquatic life.
6	Eatables, food items, etc.	Affect oil, grease, organics to water bodies.

F) UNDESIRABLE EFFECTS OF HEAVY METALS USED IN PAINTS

When Idol engrossed in water bodies, then lots of paints which used the making of the Idol, those paints are also added into the water source. These varnishes, colors paints do not dissolve easily in the water bodies. Moreover, these paints contain various heavy metals such as mercury, lead, arsenic, cadmium, chromium, zinc, etc. Through the food chain, these heavy metals get into human bodies. These heavy metals have lots of adverse effects on human bodies. Here are some results of some heavy metals mentioned below.

Table 2

Water quality (heavy metals) data collected and average pollution load from ten studied points in Futala (Telankhedi) lake during August (Pre-immersion period) 2019

Sites → / Parameters ↓	Inlet				Center	Corner				Outlet
	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}
Zinc (Zn)	0.08	0.02	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01
Copper (Cu)	0.011	0.012	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01
Lead (Pb)	0.24	0.14	0.32	0.62	0.01	0.08	0.031	0.021	0.016	0.022
Chromium (Cr)	0.03	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.04
Cadmium (Cd)	0.01	BDL	0.02	BDL	0.02	0.01	0.01	0.01	BDL	0.01
Manganese (Mn)	0.01	0.01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Iron (Fe)	0.82	0.32	0.24	0.12	0.16	0.08	0.06	0.24	0.16	0.18
Arsenic (As)	BDL	BDL	BDL	BDL	0.01	0.01	0.01	0.01	0.02	0.01
Mercury (Hg)	0.01	BDL	BDL	0.01	BDL	0.01	BDL	BDL	BDL	BDL

*** Note: All values expressed in mg/L, BDL-Below detectable limit**

Graph 1

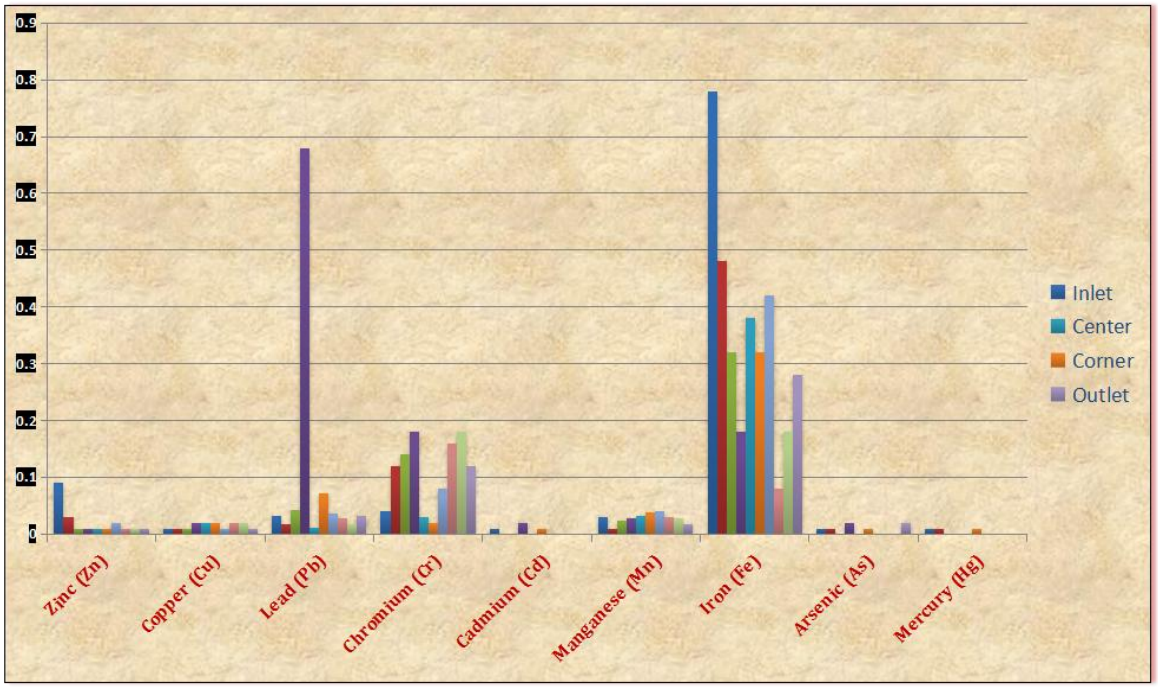


Table 3
Water quality (heavy metals) data collected and average pollution load from ten studied points in Futala (Telankhedi) lake during September (immersion period) 2019

Sites → / Parameters ↓	Inlet				Center	Corner				Outlet
	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}
Zinc (Zn)	0.09	0.03	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01
Copper (Cu)	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.02	0.02	0.01
Lead (Pb)	0.032	0.018	0.042	00.68	0.012	0.072	0.036	0.028	0.018	0.032
Chromium (Cr)	0.04	0.12	0.14	0.18	0.03	0.02	0.08	0.16	0.18	0.12
Cadmium (Cd)	0.01	BDL	BDL	0.02	BDL	0.01	BDL	BDL	BDL	BDL
Manganese (Mn)	0.031	0.01	0.024	0.028	0.033	0.038	0.04	0.031	0.028	0.018
Iron (Fe)	0.78	0.48	0.32	0.18	0.38	0.32	0.42	0.08	0.18	0.28
Arsenic (As)	0.01	0.01	BDL	0.02	BDL	0.01	BDL	BDL	BDL	0.02
Mercury (Hg)	0.01	0.01	BDL	BDL	BDL	0.01	BDL	BDL	BDL	BDL

*** Note: All values expressed in mg/L, BDL-Below detectable limit**

Graph 2

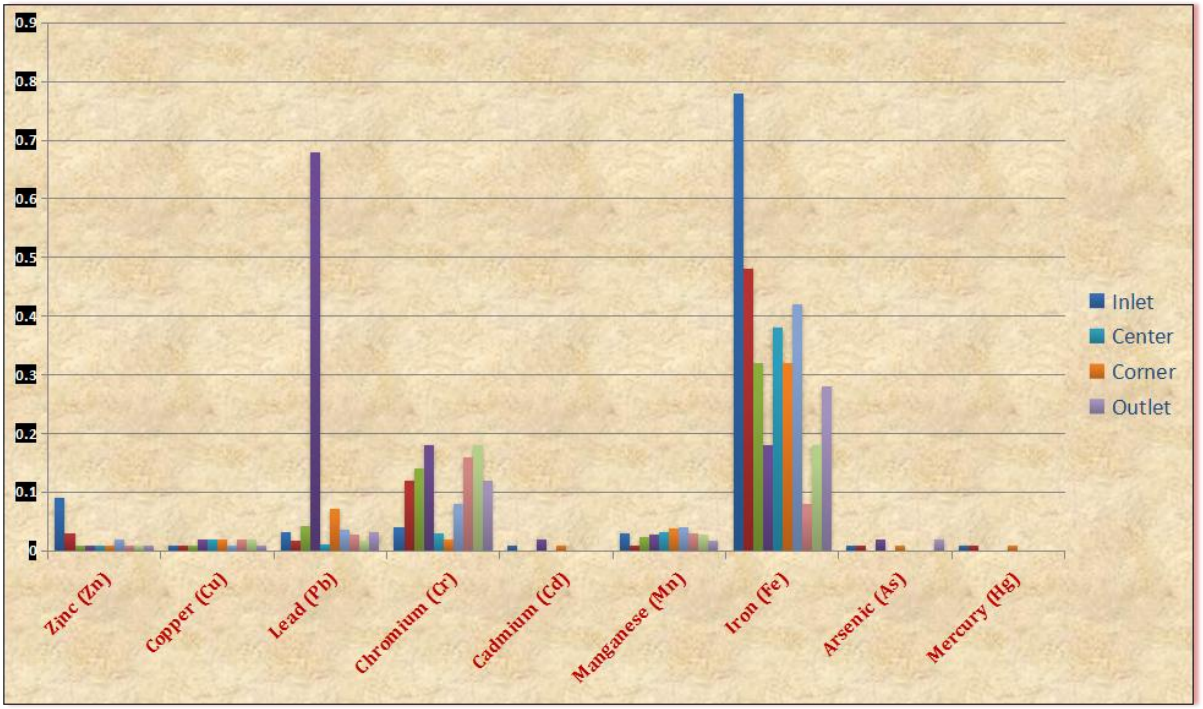
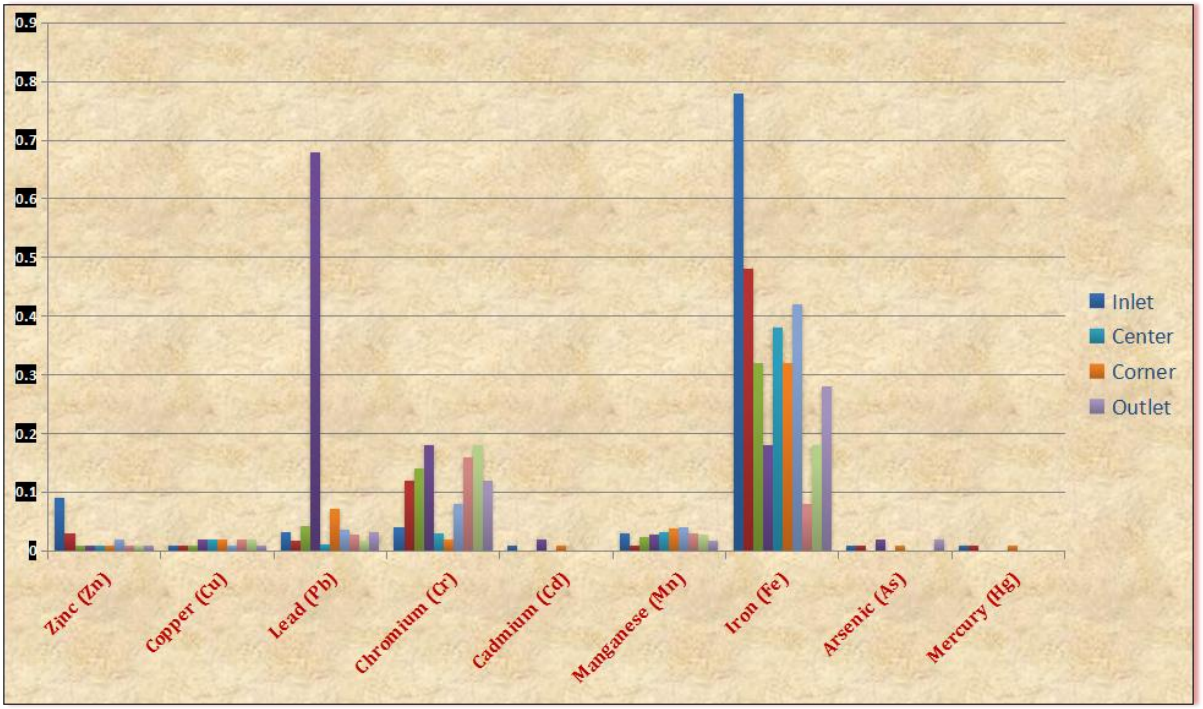


Table 4
Water quality (heavy metals) data collected and average pollution load from ten studied points in Futala (Telankhedi) lake during October (Post-immersion period) 2019

Sites → / Parameters ↓	Inlet				Center	Corner				Outlet
	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}
Zinc (Zn)	0.08	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01
Copper (Cu)	0.01	0.01	BDL	0.02	0.04	BDL	BDL	0.03	0.04	0.01
Lead (Pb)	0.026	0.012	0.036	00.55	0.016	0.058	0.024	0.012	0.012	0.024
Chromium (Cr)	0.04	0.10	0.01	0.16	0.01	0.02	0.06	0.12	0.18	0.12
Cadmium (Cd)	0.01	0.01	BDL	BDL	0.03	0.01	0.01	0.01	0.01	0.02
Manganese (Mn)	0.024	0.02	0.02	0.02	0.02	0.01	0.01	0.024	0.01	0.01
Iron (Fe)	0.72	0.42	0.12	0.12	0.24	0.16	0.18	0.20	0.18	0.10
Arsenic (As)	0.01	0.01	BDL	BDL	BDL	BDL	0.01	BDL	BDL	BDL
Mercury (Hg)	0.01	0.01	BDL	BDL	BDL	0.01	BDL	BDL	BDL	BDL

*** Note: All values expressed in mg/L, BDL-Below detectable limit**

Graph 3



i) Mercury (Hg):

Mercury contamination affects a severe health risk, particularly for kids and pregnant women. Humans threaten to ingest dangerous levels of mercury when they eat contaminated fish. Since mercury is odorless, imperceptible, and accumulates in the fish's red meat, it is not easy to perceive. It can't be avoided by adornment in the membrane or extra part. In a small dose, mercury may affect a child's growth, delay under your own

steam and conversation, reduction attention extent, and cause learning disabilities. Less common, high measure prenatal and infant exposure to mercury can cause mental retardation, cerebral palsy, deafness, and sightlessness. In adults, mercury is toxic, can negatively affect fertility and blood force regulation, and can cause memory loss, vision loss, tremors, and numbness of the fingers and toes. A new body of evidence suggests that mercury exposure may also lead to heart disease [12]. The mean concentration of Mercury (Hg, mg/L) in collected water sampled was BDL to 0.01 (August, Pre-immersion period); BDL to 0.01 (September, immersion period) and BDL to 0.01 (October, Post-immersion period) respectively for the session 2019.

ii) Cadmium (Cd):

A by-product of zinc production is Cadmium. Cadmium can induce origin bone demineralization through direct bone smash up or circuitously as an outcome renal dysfunction. Cadmium is mainly toxic to the kidney, especially to the proximal tubular cells, the main accumulation [13]. Drinking water with very elevated cadmium levels severely irritates the stomach, leading to vomiting, diarrhea, and occasionally death. consumption of lower Cadmium levels over a long period can lead to a build-up of cadmium in the kidneys. If the levels reach an adequately high level, the Cadmium will cause kidney spoil, also causes a skeleton to become fragile and break easily [14]. Ingesting high levels of Cadmium may lead to stomach irritation, vomiting, diarrhea, and even death. It also causes kidney damage and may be linked to some forms of cancer. Cadmium is relatively insoluble. Some of the element binds to the soil, and some stay in solution. It can stay in one's body for years and can also change forms within the body. Cadmium's average background level in unpolluted soil is about 250 ppb, and its highest levels found in leafy vegetables and potatoes. The mean concentration of Cadmium (Cd, mg/L) in collected water sampled were BDL to 0.02 (August, Pre-immersion period); BDL to 0.02 (September, immersion period) and BDL to 0.01 (October, Post-immersion period) respectively for the session 2019.

iii) Arsenic Metal (As):

Arsenic is the most toxic metal. disclosure to inorganic arsenic can cause various health effects, such as irritation of the stomach and intestines, a decreased invention of red and white blood cells, skin changes. Lung irritation recommended that the uptake of meaningful amounts of inorganic arsenic can exaggerate tumor development, especially the probability of development of skin cancer, lung cancer, liver cancer, and lymphatic tumor. Inorganic arsenic can spoil DNA [15]. Ingestion of large quantities can lead to gastrointestinal symptoms such as severe vomiting, spoil to the nervous system, and eventually death [16]. The mean concentration of Arsenic (As, mg/L) in collected water sampled were BDL to 0.01 (August, Pre-immersion period); BDL to 0.01(September, immersion period) and BDL to 0.01 (October, Post-immersion period) respectively for the session 2019.

iv) Zinc (Zn):

Excess amounts of zinc-lead can pilot to toxic metal poisoning. The National Institute of Health cites that gastrointestinal complaint is usually the most common side effects of zinc toxicity. Upset stomach, vomiting, and diarrhea are most frequent. These effects, chiefly nausea and vomiting, can start as soon as a half-hour after ingesting Zinc quantities. High doses of Zinc have been linked with decreased urine wast, which is the number one reason for hospitalization connected with zinc toxicity. sideways from vomiting and nausea. it leads to doziness, a harsh taste in the mouth, convulsions, low blood pressure, shortness of breath, and even shock. tragic treatment for toxic metal zinc poisoning involves fluids like water or milk to flush out the body, medications that counteract the effects of Zinc, and sometimes remove the stomach contents [17]. Short term exposure to Zinc may lead to stomach cramps, nausea, and vomiting. Long-term exposure to high levels may cause anemia, damage to the pancreas, and decrease lipoprotein cholesterol levels. Excess Zinc in one's body can also lead to the development of a copper deficiency due to the interactions within the body. Zinc has moderate bioaccumulation potential in aquatic organisms and does not magnify in the food chain. Zinc constitutes about 20-200 ppm of the earth crust, and Zinc background concentrations in most waters are less than 0.05 mg/L. The mean concentration of Zinc (Zn, mg/L) in collected water sampled was 0.01 to 0.08 (August, Pre-immersion period); 0.01 to 0.09 (September, immersion period) and 0.01 to 0.08 (October, Post-immersion period) respectively for the session 2019.

v) Lead (Pb):

it is a toxic material that poses an assortment of dangers for humans. First indemnity, the central and marginal nervous system, the body's ability and kidneys, to legalize vitamin D. Lead depressingly affect red blood cells' development. Very high levels of lead can trigger origin seizures, coma, and death. At lower levels of revelation, a child can be ill with developmental delay, lower IQ, hyperactivity, learning disabilities, behavioral problems, impaired hearing, and stunted growth [18]. Lead can penetrate a fetus through the placenta

of the mother. Because of this, it can cause severe damage to the nervous system [19]. Kids under the age of six are particularly at risk of lead poisoning and may have slowed development and reduced growth due to ingesting even small amounts of lead as their bodies absorb 50% of all that they ingest.
Other effects of lead poisoning include brain and kidney damage and gastrointestinal distress from short-term high-level exposure. Long term exposure to lead affects the blood, central nervous system, blood pressure, and vitamin D metabolism. It may also lead to reduced sperm count and spontaneous abortions. The mean Concentration of Lead (Pb, mg/L) in collected water sampled were 0.01 to 0.062 (August, Pre-immersion period); 0.018 to 0.068 (September, immersion period) and 0.012 to 0.058 (October, Post-immersion period) respectively for the session 2019.

vi) Copper :

Copper is necessary for the normal biological activity, and its deficiency is characterized by hypochromic microcytic anemia, which develops as a consequence of defective hemoglobin synthesis. Copper is required in most oxidative enzymes such as catalases, peroxidases, etc. and is also an essential part of several enzymes such as tyrosinase, which is involved in the formation of melanin, superoxide dismutase, amine oxidase, urease, and cytochrome oxidase. In plants, low copper levels are essential for the normal activity of many enzymes and chlorophyll synthesis. However, at a slightly higher concentration, copper is the most toxic element after mercury. Inhibition of growth occurs at concentrations of less than 0.1 ppm in the majority of plant species. The uptake of copper by plants is accelerated in calcium and magnesium ions but diminishes with a fall in pH. A higher concentration of copper is dangerous to blue-green algae since this metal tends to suppress nitrogen fixation. Short term exposure to copper may lead to gastrointestinal distress, decreased hemoglobin and erythrocyte levels in the blood (anemia), impaired immune systems, and even impotence. High doses of Cu may be potentially deadly. The mean Concentration of Copper (Cu, mg/L) in collected water sampled were 0.01 to 0.012 (August, Pre-immersion period); 0.01 to 0.02 (September, immersion period) and 0.01 to 0.04 (October, Post-immersion period) respectively for the session 2019.

vii) Manganese

Manganese novelties apply in ceramics, dry batteries, electrical coils, matches, glasses, dyes, welding rods, fertilizers, and an oxidizing agent. The combustion of fossil fuels is the primary source of manganese in this atmosphere. In manufacturing methods using manganese, its salts, and this metal as composts also contribute some manganese to the environment. Manganese is a mildly toxic metal about 2-9 mg of which is ingested by an average man daily. Pollution of Earth's Surface: Land and Water-Non-degradable Pollutants The largest concentration of this metal is met within the liver, kidney, pancreas, and intestines. It can readily cross the blood-brain barrier from where its removal takes a longer time than other parts of the body. The principal route of the evacuation of manganese is through bile and faucal! Matter. Manganese toxicity has observed in persons occupationally involved with mining, refining, and manufacturing units using manganese and its salts. Revelation to manganese dioxide in excess causes pneumonitis, while pathologic changes include necrosis of epithelial tissues followed-by mononuclear proliferation in the lungs. Chronic manganese exposures resulting from manganese dioxide's breath commonly over more than two years involve the central nervous system. The mean Concentration of Manganese (Mn, mg/L) in collected water sampled was BDL to 0.01 (August, Pre-immersion period); 0.01 to 0.038 (September, immersion period) and 0.01 to 0.024 (October, Post-immersion period) respectively for the session 2019.

viii) Chromium

Short term exposure to chromium can cause skin irritation and ulceration. Long term exposure to Cr can cause damage to the liver, kidneys, and also the circulatory and nervous systems. The mean concentration of Chromium (Cr, mg/L) in collected water sampled were 0.01 to 0.04 (August, Pre-immersion period); 0.018 to 0.020(September, immersion period) and 0.01 to 0.16 (October, Post-immersion period) respectively for the session 2019.

G) Entry routes

Heavy metals enter the plant, animal, and human tissues via air inhalation, diet, and manual handling. Motor vehicle emissions are a significant source of airborne contaminants, including arsenic, cadmium, cobalt, nickel, lead, antimony, vanadium, zinc, platinum, palladium rhodium. Water sources (groundwater, lakes, streams, and rivers) are polluted by heavy metals leaching from idol immersion activity, industrial consumer waste; acid rain can exacerbate this process by releasing toxic metals trapped in soils. Plants are exposed to heavy metals through the uptake of water; animals eat these plants; ingestion of plant and animal-based foods are the largest sources of heavy metals in humans. Through skin contact, from contact with soil, a potential source of toxic metal pollution. It can gather in organisms as they are hard to digest (process and eliminate). [20]

H) Detrimental effects

Heavy metal can bind to vital cellular components, such as structural proteins, enzymes, and nucleic acids, and interfere with their functioning. Symptoms and outcomes can vary according to the metal or metal compound and the dose involved. Broadly, long-term exposure to heavy toxic metals causes a carcinogenic to the human being, central and peripheral nervous system, and circulatory system effects. For humans, typical demonstrations associated with exposure to any of the "classical" heavy metals, or chromium (another heavy metal) or arsenic (a metalloid), are shown in the below table.

Table 5
Heavy Metals and their Acute and Chronic Exposure[21]

Elements	Acute exposure	Chronic exposure	Main article
Cadmium	Pneumonitis (lung inflammation)	Lung cancer Osteomalacia- softening of bones Proteinuria -excess protein in the urine, possible kidney damage	Cadmium poisoning
Mercury	Diarrhea Fever Vomiting	Stomatitis -Inflammation of gums and mouth Nausea Nephrotic syndrome -nonspecific kidney disorder Parageusia -metallic taste Pink Disease (pain and pink stain of hands and feet) Tremor	Mercury poisoning
Lead	Encephalopathy (brain dysfunction) Nausea Vomiting	Anemia Encephalopathy Foot drop/wrist drop (palsy) Nephropathy (kidney disease)	Lead poisoning
Chromium	Gastrointestinal hemorrhage (bleeding) Hemolysis (red blood cell destruction) actual renal failure	Pulmonary fibrosis (lung scarring) Lung cancer	Chromium toxicity
Arsenic	Nausea, Vomiting Diarrhea, Encephalophaty Multi-organ effects Arrhythemia Painful neurophathy	Diabetes Hypopigmentation / Hyperkeratosis Cancer	Arsenic poisoning

Urban lakes are inland aquatic systems supporting ecosystems through biodiversity sustenance and acting as sources of water in the learning season. Urban lakes get merge of extinction due to encroachments, siltation, and eutrophication from domestic and industrial effluents. These are subjected to varying degrees of degradation and pollution. The water quality deterioration in these lakes is mainly due to the discharge of untreated sewage, idol immersion activities, organic, bioinorganic, inorganic, and toxic pollutants of the industrial and domestic sources. Immersion of decorated idols as a part of religious activities reported being an essential source of heavy metal contamination in the Futala (Telankhedi) lake water.[22-24] The main component in paints include pigments, vehicles, and solvents. Stains are color contributing insoluble solids, containing heavy metals as one of the main constituents. The primary lead-containing pigments include red lead, leaded zinc oxide, white lead, chrome green, chrome yellow, and chrome orange. It is present in these pigments as oxides, carbonates, hydroxides, and chromates. Vehicles are the adhesives causing the dye to adhere to a surface. They comprise of synthetic and phenolic resins. Solvents are used to adjust the consistency of the paint. The most commonly used solutions are naphtha, mineral spirits, and oil. Generally, solvent-based paints contain 25% binders, 27.5% pigment, and 47.5% organic solvents.[25] These paints were used for coloring idols of Lord Ganesha and Goddess Durga, immersed in the lakes as a part of religious rituals. Further, the addition of organic matter viz leaves, stem, bark petals, flowers, etc.these activities increases COD and BOD levels, which in turn affect the aquatic ecosystem environment adversely.[26] The addition of Sindur in these water bodies (reported to contain lead and chromium) is very toxic to human beings even at low concentrations.[27-28]

These hazardous metals subsequently get adsorbed on silt-charged surfaces, and clay dissolves in pond water. If used for irrigation or as a modification, these toxic heavy metal-laden water and sediments can be translocated in plant parts and enter the human system through the food chain. The transfer factors of metals in plant systems vary with soil properties viz pH, microbial diversity, moisture, organic matter content, etc. and the physiology of the crop. The range of toxic heavy metals in edible plants following order: leafy vegetables > root crops > fruits. It reported that contaminated lake water for irrigation purposes infected the vegetables, cereals, and animal milk. Regular ingestion of toxic metal-contaminated food and water causes bio magnifications in human, animal systems and may affect normal physiological functions. In this context, a study was conducted to

determine the effect of idol immersion activities on the heavy metals contamination in Futala (Telankhedi) lake. There was significant seasonal variation in the metal concentration within the period. The dry season registered elevated levels of the metals as compared to the wet season. The metal concentration increased gradually from August to October in Futala (Telankhedi Lake). The rainy season's dilution effect due to storm run-off into receiving rivers and excessive evaporation of the surface water with its attendant pre-concentration of most of the metals may be responsible for the observed trend.[29] The continuous increase in heavy metal contamination of Futala (Telankhedi) lake waters is a cause of concern as these metals have a tendency to bioaccumulate in the tissues of various biota's and may also affect the distribution and density of benthic organisms as well as the composition and diversity of fauna communities.[30] People depend on a source of freshwater. It is a well-known fact that clean drinking water is essential for healthy living. As the world industrialized and its population has grown, water pollution has intensified many areas of surface water and groundwater contaminated with heavy metals. Heavy metals pollution causes damage to the nervous system, the kidney, and other metabolic disruption.

Drinking water quality is a common concern for people all over the world. These can survive days or even weeks without food, but only about four days without water. Nowadays, the correlation between water quality and quantity, health states, on the other hand, constitutes an acute public health issue. Water is never in a pure status. It always contains minerals, ground, air microorganisms originating from rocks. Human activities polluted water with various substances. But the water should be clean to ensure good health. Globalized, illness associated with unclean drinking water is intense research due to the causal relationship with diseases such as cancer, congenital malformations, and endocrine disturbances, in addition to acute and chronic toxicity. Intake water is safe for our health depends on which impurities[31]. The presence of toxic metals in aquatic environments has led to much concern over their influence on plants and animals living in these environments and indeed on man's need for wholesome water. Through the natural process of biomagnifications, minute amounts of metals become part of the various food chains, and concentration becomes elevated to levels, proving to be toxic to both humans and other living organisms. The accretion of these elements, many of which are highly toxic to animal life by aquatic plant life and the lower forms of marine animals, is one of man's less praise-worthy influences on the biosphere. Toxic heavy metals are stable and persistent environmental contaminants of coastal water and sediment. The level of toxicity in water is measured concerning the metallic elements present. Since the effect of these elements is cumulative, drinking water should contain none of these toxic metals. Apart from health hazards, water pollution could lead to severe economic and social consequences, including fish production, recreation, paralysis, and civil disorder.[32]

II. CONCLUSION

The toxic elements (heavy metals) enter the body mainly through water, food, and air. The contamination in Futala (Telankhedi) lake through domestic effluents, religious activities, and idol immersion, creating an uncongenial aquatic environment through water quality deterioration. The increased and COD levels in the lake water during the study reflect the importance of adding eco-friendly organic matter due to the idol immersion activities. Fe, Cr, Cd, and Pb concentrations in the lake water increased in the immersion period. Since heavy metals contamination is detrimental to the animal system even at low concentrations, public awareness regarding this problem is generated. Immersion of painted Idol and dumping of organic wastes in the lakes, as a part of religious activities, are immensely adding to Futala lake water quality deterioration. The heavy metal content had trends upward and followed the sequence: Fe> Pb> Cr>Mn> Cu> Zn> Hg> As. With the increase of nutrients from human pollution sources, Futala (Telankhedi) lake is becoming eutrophic, and the ecology type was altered, becoming into algae dominant lake. Still, the nutrients by internal releasing had only a buffer effect on the eutrophication of Futala (Telankhedi) lake compared with that from external human sources.

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REFERENCES

[1]. Prabu P.C. et al. EJETF Chemistry 8(9), 2009, 818-827.
[2]. Rajeshkumar Sharma, Madhoolika Agarwal and F.M. Marshall 2004, 7-8.
[3]. Michaela – Cristina Anton et al; Tomul III 2007, 64-67.
[4]. P.J. Puri, M.K.N. Yenkie, Rasayan Journal, 3(4), 2010, 800-810
[5]. P.J. Puri, M.K.N. Yenkie, S.P. Sangal, ijCEPr, 2(1), 2011, 34-39
[6]. APHA- A standard method for examination of water and wastewater, 21' edn. APHA, AWWA. WPCF. Washington (2005)
[7]. P.J. Puri, M.K.N. Yenkie, European J. F. Experimental Biology 5(2) (2015), 37-52
[8]. Rashmi Verma, Pratima Dwivedi RRST, 5(5) (2013), 98-99
[9]. P.J.Puri; M.K.N. Yenkie; L.S. Awale, Advance in Applied Sci Res 6(1) (2015) 15-26

[10]. Ecoeist. Water pollution caused by toxic chemical paints. Accessed 28/05/2014, accessed from http://e-coexist.com/products/ganesh-chaturthi/ganesh-2010/water-pollution-caused-by-toxic-chemical-paints.
[11]. Sayan Bhattacharya, Arpita Bera, Abhishek Datta, Uday Chand Ghosh 20(2),(2014), 234-263
[12]. Natural resources defense council. Accessed 30/05/2014, accessed from http://www.nrdc.org/health/effects/mercury/effects.asp.
[13]. Cadmium & its adverse effects on human health. Accessed on 30/05/2014, located from http://www.ncbi.nlm.nih.gov/pubmed/19106447
[14]. The encyclopedia of earth. Accessed n 30/05/2014, accessed from http://www.eoearth.org/view/article/153344.
[15]. Lenntech. Accessed on 30/05/2014, located from http://www.lenntech.com/periodic/elements/as.htm
[16]. Bhattacharya, S. et al., Toxicology and Environmental Chemistry 94(3) (2012) 429-441.
[17]. The effect of Zn. Accessed on 31/05/2014, edited from http://www. livestrong.com/article/29333-effects-much-zinc/.
[18]. Health Effects of Lead Exposure. Accessed on 31/05/2014, accessed from https://public.health.oregon.gov/HealthyEnvironments/Healthy Neighborhoods/Lead
[19]. Lenntech. Located on 1/06/2014, accessed from http://www.lenntech.com/periodic/elements/pb.htm
[20]. A. Bajpai, S.Pani, R.K.Jain, S.M. Mishra. 2003 Eco.Env, and Cons. 8(2), 157-159.
[21]. P.J. Puri, M.K.N. Yenkie, G.B. Sarote, Rasayan J.Chem 4(1) (2011), 147-152
[22]. C.S Clark., K.G Rampal. V.Thuppil. Environmental Research 102, (2006), 9-12
[23]. A Kumar, P. Pastore, Current Science 93(6) 2007, 818-822
[24]. A Kumar, Toxics Link Publication; (2007) 1-36
[25]. J.S. Johnson, N. Saikia, and R. Sahu CSE, New Delhi project report, (2009)
[26]. J. Desai and S.K. Tank, JED 4(4), (2010), 999-1007.
[27]. M. Bubicz, Aquatic Hydrobiology 24 (1982), 125-138
[28]. Bisweswar Gorain, Srijita Paul, CWE, 14(1), (2019), 143-148
[29]. D.B. Rana; M.K.N. Yenkie; P.J. Puri, IJAEMS 1(2017) 31-34
[30]. P.J.Puri; L.S. Awale, IJAEMS 1(2017) 27-32
[31]. P.J.Puri; R.G. Choudhary, M.K.N. Yenkie; 1(2), (2014) 385-397
[32]. Liv En Feng, Shen Ji, Liv Xiangqi, Sic, Series D Earth Science 49(1), 2006, 82-91
[33]. 'Parth Malavia & Minakshi Vaghani, 88, (2016), 478-482