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Evaluation of Trace Elements in the Proximity of River Indrayani, Pune District, Maharashtra, India

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Abstract

Heavy metals are naturally occurring elements. Due to their multiple applications, these elements are widely distributed in the environment. Heavy metal pollution have been caused in our rivers, soils and environment due to the rapidly growing metal and agricultural industries, heavy use of fertilizers, pesticides and improper waste management. Agricultural and industrial operations, land filling, mining and transportation, agricultural run-off are the initial sources of heavy metals in ground water. These heavy metals are not readily degradable in nature and accumulate in the animal as well as human bodies to a very high toxic amount. Some of the heavy metals have an effect on biological activities and growth, and due to some heavy metals severe diseases such as cancers, skin diseases, nervous system get damage.

Keywords: Heavy metals, fertilizers, agricultural run-off, biological activities, etc.

INTRODUCTION

Huge amount of industrialization, with economic prosperity sets the prime goal, and it has created some secondary and intolerable problems like heavy metal contamination. Here, industrial wastewater is the major contributor to contamination of aquatic and terrestrial ecosystems with toxic heavy metals like copper, Iron, lead, manganese, zinc, and mercury.[10] Water pollution refers to contaminants which enters a water body from one or many sources. Major sources are like human activities, sewage water, industrial wast water, agricultural runoff and many more. Generally, water pollution

occurs when pollutants are released to the ground and make their way in to ground water. In many parts of the world, the well-being of people and ecosystems poses hazard due to water pollution and water born diseases. Majority of the world, s population depends on ground water for drinking and other house hold activities.[6]. If we consider the rural area having less population staying on the bank of river, but using large amount of fertilizers and pesticides which contaminates the water. Due to rain water, these surface runoff get mixed with near by water resource and hence pollutes the water body. Eutrophication is caused due to this water pollution, phosphate is major contributor in eutrophication process. If the concentration of phosphates is increased, algae growth is observed. Also, due to high range of fertilizers, dissolved oxygen in river water gets decreased. Another important source of water pollution is domestic sewage and for this major source is urbanization and industrial effluents. A huge amount of untreated sewage water is thrown directly into the river body. This untreated water is having toxins. Due to this untreated water, the entire water system get polluted and it harms the ecosystem. If we consider the industrial source, through effluents so many pollutants along with oily and greases are mixed with water body. Through these industrial effluents heavy metals are entering into the water body.

Heavy metals cannot be degraded and they get accumulated inside the living organisms.[1] Through the food chain, fish contaminants can rich humans. Heavy metals are found naturally in the earth, s crust. Due to indiscriminate human activities, their geochemical and biochemical balance has drastically changed and they enter our drinking water supply. Broadly, heavy metals are nothing but metallic elements which are toxic and are having a high density. Some of the heavy metals are required by human body but in trace amount. Heavy metals such as cobalt, copper, zinc and manganese are required by human body in trace amount but the excessive amount of these heavy metals can be detrimental to human health.[14]. If drinking water is contaminated with mercury, lead, cadmium, arsenic, nickel, chromium, major health problems may be created to public health.

Now a days, access to safe drinking water is one of the most important challenge in front of entire world. As per geographical study near about 70% of the earth, s surface is covered by water, which is salty, but what about rest of the water is it potable. Only 3% water is suitable means fresh water. Depending the chemical behaviour of the heavy metals, its toxicity depends. When heavy metals enter in to human body, they forms complexes organic compounds inside the human body and loose their molecular functions characteristics.

LITERATURE REVIEW

While studying the water quality of rivers and lakes of Nigeria with respect to heavy metals, Isa Baba Koki and Amina Salihi Bayero (2015) says that, due to exposure of heavy metals for a longer time period causes a diseases like cancer and kidney failure. Durgesh Raj Mohan (2022) studied the physico-chemical and heavy metals of Agra District area. He says that, Iron was found above the desirable limit for drinking purpose. Copper content was under the desirable limit except one station. Also, arsenic and zinc concentrations were observed within the limit at all the sampling stations.

Aniket Khatangale and et.al. (2023) says that, removal of heavy metals from wastewater needs different techniques. Industrial wastewater is the major contributor to contamination of aquatic life and the entire ecosystem with toxic heavy metals like, copper, zinc, lead, mercury, cadmium, and arsenic. Their bio-accumulative nature is dangerous to the aquatic life. Hence, it is essential to remove or recover these heavy metals from the wastewater by using any suitable method.

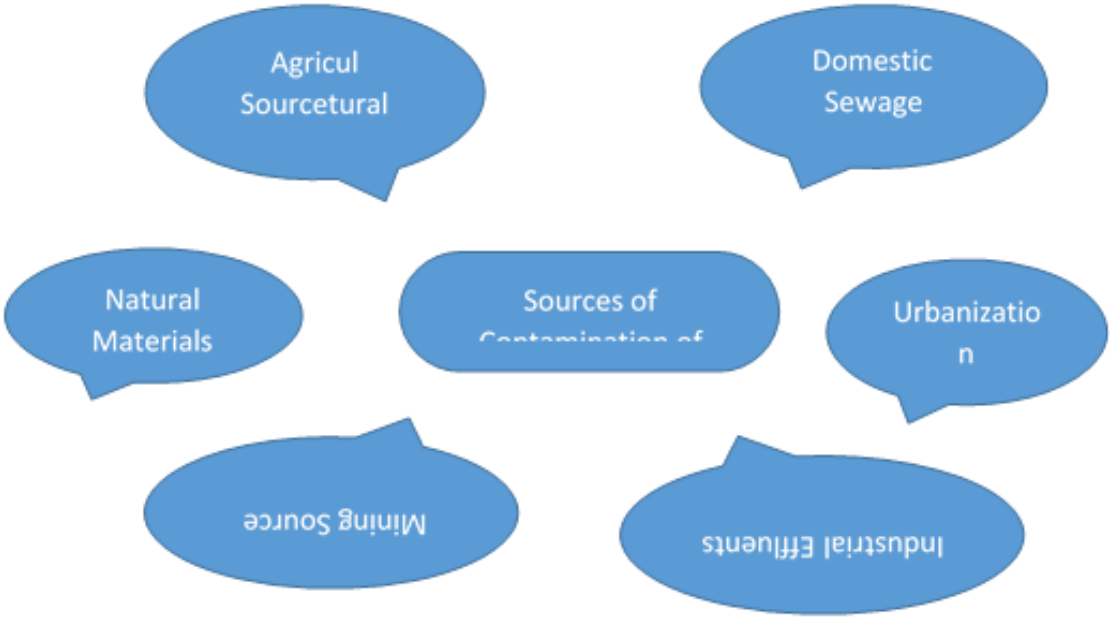
In the determination of contamination level of heavy metals contaminants in the river water of Baro river at Gambella Town, Ethiopia (2018). Endale Tesfaye says that, the major causes of this contamination may be industrial wastes and domestic waste from rural and urban areas. In this study chromium, lead, cadmium were observed in the collected river water samples. But the concentration of these heavy metals was within the desirable limit except chromium. At two sampling stations chromium was observed beyond the desirable limit.

Anubhav Singh and et.al. (2022) in the book chapter, The Toxicity of Environmental Pollutants says that heavy metals get distributed to various areas to various pathways. Also, he says population, development and rapid industrialization are the causes of the water contamination. In lakes, rivers and ground water these heavy metals are mixed. Disposal of high metal wastes, growing industrial areas, leaded gasoline and paints, sewage sludge, usage of fertilizers, pesticides, E-waste, waste water from irrigation, coal, etc. Due to the presence of the toxic metals some of the problems observed. Neurotoxicity can damage kidneys. Due to huge amount of exposure of heavy metals liver and lungs can get damaged, bones can become fragile and chances of cancer increases.

STUDY AREA

Indrayani River is one of the oldest river in the state of Maharashtra. The river has its origin near Lonavala in Maharashtra. This river is associated with great saints, saint Tukaram and saint Dnyaneshwar. River Indrayani merges with Bhima river when it passes through the places Viz. Dehu and Alandi. The river is considered to be sacred river. Now a days river have faced many difficulties due to increase in the industrialization and other activities taking place in and around this holy river.

Graphical presentation of Sources of contamination:



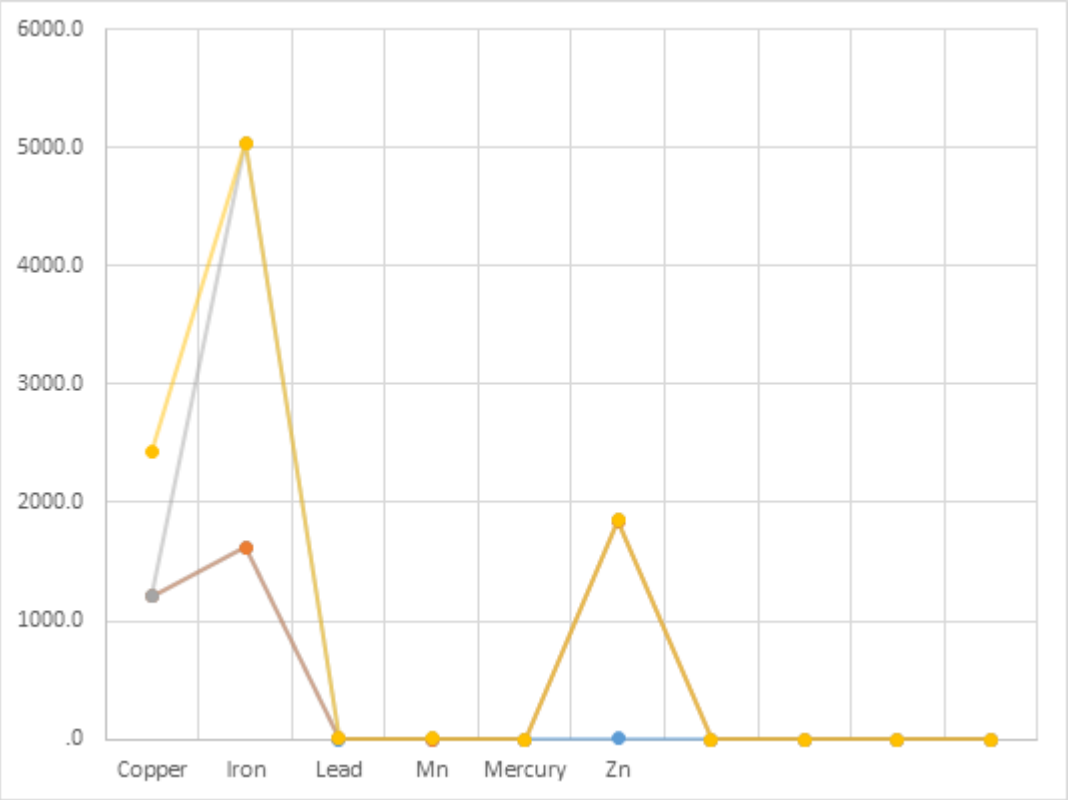
EXPERIMENTATION

For this study water samples were collected from different locations of Indrayani River. A random sampling technique was used for the collection of samples from various sampling stations. A care was taken, while selecting of sampling station that, which will give better results. The samples were collected in a plastic bottles. Before the collection of samples, plastic bottles were washed properly and rinsed with de-ionized water. The collected water samples were tasted for the heavy metals like Copper, Iron, Lead, Manganese, Mercury and Zinc.

Observation Table:

Heavy Metals	Sampling Station 1	Sampling Station 2	Sampling Station 3	Sampling Station 4	Sampling Station 5	Sampling Station 6	Sampling Station 7
Copper	1.206	1.781	0.994	1.347	2.01	1.738	1.216
Iron	1.621	1.738	0.983	1.184	3.421	2.361	2.76
Lead	1.12	1.18	1.09	1.14	1.21	2.01	1.98
Mn	0.087	0.935	0.847	0.093	0.631	0.423	0.638
Mercury	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zn	2.78	1.387	1.843	2.38	2.19	2.68	2.47

Graphical Presentation of Observed Heavy Metals:



RESULTS AND DISCUSSION

Heavy metal concentration was studied for the Indrayani river water in the summer2022. Indrayani River water was studied for heavy metals like copper, iron, lead, manganese and mercury. In so many ways the world is being polluted, and major contribution is of human activities. By various ways these heavy metals reach to human health and shows the adverse effects on human health.

Copper:

Copper is a soft material. It is a part of our civilization. It is easily mixed with other metals to form an alloy. Copper is one of the essential element for the human health. Near about 1.2 mgs of copper a day to help enzymes transfer in energy cells[5]. More than this amount of copper is toxic. Major use of copper is in electric cables, planes and space vehicles, coins. Copper is highly resistant to corrosion.

Iron:

Iron makes up 5% of Earth, s crust. The average quantity of iron in the human body is about 4.5 gms. Iron naturally present in many foods. It is most essential component of hemoglobin. Iron is essential for physical growth, neurological development and for synthesis of hormones[3], [13]. Low birth weight, premature birth and many other risk

factors are observed due to iron deficiency during pregnancy[18]. Blood donors, who frequently donate blood are at high risk due to iron deficiency. Also, patients having Cancer are at risk.

Lead:
Lead occurs naturally in the environment. Lead has many industrial, agricultural and domestic applications. Now a days the biggest source of lead poisoning in children comes from dust and chips from deteriorating lead paint. Lead is present in water body especially associated with silver, generally in mining area. Other sources of lead are gasoline, solder, paint, lead-acid battery manufacturing industries. Lead spread through soil and air is of great health hazard [17]. Major source of lead is combustion from automobiles and aircraft's. The nervous system is the basic target of lead poisoning. Many researchers have shown the adverse effects of lead on children and adults. Here observed values are in the range of 1.09-2.01mg/L.

Manganese:
Manganese is a chemical element with symbol Mn. It is naturally present in many foods. It is hard, brittle, silvery metal, used particularly in stainless steel. Accumulation of mitochondria present in nerons is done by the manganese. Basically, Mn is a trace mineral which is present in tiny amount in the body. It is found mostly in bones, liver, kidneys and pancreas. Mn helps the human body from connective tissue, bones, blood clotting factors, when it is in a permissible limit. The human body contains 10 to 20 mg of Mn. Mn deficiency is very rare in humans. There is not a single evidence which shows Mn toxicity due to high intake of Mn[9].

Mercury:
In the environment human as well as animals are exposed to various chemical forms of mercury. These various ways are like environmental pollution, industrial and agricultural operations, food contamination and dental care. Broadly mercury is utilized in electrical industry, dentistry and other various industrial processes. Initially it was used in the paint, batteries and pesticides. Methyl mercury observed from eating fish is in the gastrointestinal tract. Major human body parts where mercury can attack are liver and kidneys.

Zinc:
Zinc is naturally available in some foods.It is one of the essential mineral. Zinc is required for the catalytic activities of enzymes. The amount of zinc in human body is in the range of 1.5 gms to 2.5 gms[16].The important and richest food sources of zinc includes fish, eggs and diary products, meat and sea food[12]. On the other hand fruits and vegetables contain very little amount of zinc. Excessive intake of zinc causes nausea, vomiting, headache and many more[12].

Conclusion:
By studying the river water for the trace metals, it is observed that, due to urbanization,

industrialization, agricultural run-off, various trace elements are getting mixed with river water body. As per the study of human health some of the trace elements are required on daily basis. Here, the observed values are within the desirable limit.

REFERENCES

[1] APHA (American Public Health Association), Standard methods for the examination of water and waste water, 20th ed., American Public Health Association, Washington, 1998.

[2] Aniket Khatangale and et.al. (2023) A Review of various techniques for the removal of heavy metals from waste water. International Journal of Novel Research and Development (IJNRD). 8(6): d846-d851

[3] Aggett PJ. Iron. In: Erdman JW, Macdonald IA, Zeisel SH, eds. Present Knowledge in Nutrition. 10th ed. Washington, DC: Wiley-Blackwell; 2012:506-20.

[4] Anubhav Singh and et.al. (2022) Heavy metal contamination of water and their toxic effect on living organisms. The Toxicity of Environmental Pollutants. Intech Open, Nov 30, 2022. doi. 1, 0.5772/intechopen. 105075

[5] BIS 1991.IS:10400, Indian Standards for drinking waters, Bureau of Indian Standard, New Delhi, India, 1991.

[6] Biswal D., Muralidhar J. and Patra (1998). Heavy metal concentration in sediment water of river Kusei, Indian Journal of Environmental Health, 40, 349-358.

[7] Durgesh Raj Mohan and Ashish Kumar (2022) Physico-chemical and heavy India, Journal of Applicable Chemistry, 11 (1): 22-27

[8] Endale Tesfaye and et.al. (2018). Physico-chemical Analysis of Baro River Water and other potable water of Gambella Town, Ethopia. International Journal of Advanced Research. 6 (12): 628-637

[9] Finely J.W. and et.al. (2003) Dietry manganese intake and type of lipid do not affect clinical or psylogical neuropsychological measures in healthy young women. J Nutr. (2003) ; 133, 2849-56

[10] Hellawel, M. J. (1988). Toxic substances in rivers and streams, Environmental Pollution, 50, 61-85

[11] Isa Baba Koki, Amina Salihi Bayero (2015) Assessment of water quality in rivers and lakes with respect to heavy metals and general water quality parameters: A Review. International Journal of Scientific Research, 4 (7): 135-140

[12] King JC, Cousins RJ. Zinc. In: Ross AC, Caballero B, Cousins RJ, Tucker KL, Ziegler TR, eds. Modern Nutrition in Health and Disease. 11th ed. Baltimore, MD: Lippincott Williams & Wilkins; 2014:189-205.

[13] Murray-Kolbe LE, Beard J. Iron. In: Coates PM, Betz JM, Blackman MR, et al., eds. Encyclopedia of Dietary Supplements. 2nd ed. London and New York: Informa Healthcare; 2010:432-8.

[14] Nuray Emir Akbulut and et.al. (2011) Accumulation of heavy metals with water quality parameters in Kızılırmak River Basin (Delice River) in Turkey, Environ Monit Assess 173, 387-395.

[15] Patil B.H. and Srivastava V.S. (2004). Accumulation of heavy metals through industrialization, International Journal of Chemical Sciences, 2(4), 637-641.

[16] Ryu M-S, Aydemir TB. Zinc. In: Marriott BP, Birt DF, Stallings VA, Yates AA, eds. Present Knowledge in Nutrition. 11th ed. Cambridge, Massachusetts: Wiley-Blackwell; 2020:393-408.

[17] S D Jadhav, and M S Jadhav (2014). Study of Heavy Metals in Neera River at Sarola Bridge and Untreated Urban Sewage Water, Journal of Applicable Chemistry, 3 (2): 794-797.

[18] WHO, (2001) World Health Organization. Iron Deficiency Anaemia: Assessment, Prevention, and Control. World Health Organization.