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Comparative Study of Heavy Metal Content of Amba River Near Dharamtar Creek at Dolvi, Dist. Raigad (Maharashtra) India.

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Abstract: A study was carried out to assess the water quality in terms of the heavy metal content of Amba River near Dharamtar Creek at Dolvi, Dist. Raigad (Maharashtra), India. Heavy metals are probably harmful and insidious pollutants because of their non-biodegradable nature. Most of the heavy metals are toxic to many aquatic organisms and for human being. A study was therefore undertaken to assess the variation in some of the heavy metal contents of Amba river water near Dharamtar creek. Samples were collected mainly from this area in the year 2017-2018 and 2022-2023 brought to the laboratory for the analysis purpose. Selected metals like Nickel (Ni), Arsenic (As), Lead (Pb), Cadmium (Cd), Zinc (Zn) and Chromium (Cr) are estimated by using atomic absorption spectrometer, Perkin Elmer AA200. It was found that the concentration of few heavy metals of Amba River at creek exceeds the permissible limit slightly, whereas metal like Cd and Ni were below the permissible limits. The presence of heavy metal concentration in traces can be attributed to regular sand dredging activity in the creek. Creek being tidal water body and has good dissolved oxygen levels which can be sustained fish and other aquatic fauna. Overall water quality of creek at sampling location can be considered as supportive to the aquatic life. The quality of heavy metals in river water should be checked time to time; as heavy metal accumulation will cause numerous problems to living being. Therefore, passing awareness is needed for the betterment of water quality for the sake of its use.

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Key words: *Amba River water, Heavy metals, Dharamtar creek,, spectrometer. Water quality*

Introduction:-

"Water quality" is a term used here to express the suitability of water to sustain various uses or processes. Any particular use will have certain requirements for the physical, chemical or biological characteristics of water; for example, limits on the concentrations of toxic substances for drinking water use, (A. Gupta, D.K. Rai, R.S. Pandey, B. Sharma (2009) or restrictions on temperature and pH ranges for water supporting invertebrate communities. Water environment can be divided into surface and ground water. (Singh, R. K. (2003). Surface water bodies include Rivers, lakes, streams, creeks etc. whereas ground water is present beneath earth's surface in soil pores, stone fractures and aquifers (Lohani, M.B., Singh, A & et al 2008). Quality of water plays an important role in determining its use for various purposes. Hence it becomes essential to study quality of water in these resources in order to evaluate any chances of contamination (Krishna, A. K. and & P. K. Govil (2004).)From anthropogenic or developmental activities. The Crises of water pollution (Lohar P.S. (2000). by trace metal is now well known to be crucial all over the world and especially in a developing country like India,(Jadhavar, V.R. (2013)) everybody is facing the problem of ever widening threat of water pollution due to advance modern Technology, industrialization, civilization and urbanization (Nagajyoti, P.C., Lee, K.D. and Sreekanth, T.V.M., (2010).

Materials and Methods:-

Dolvi is located at 18°.42 86076′N & 73°02′ 47.3496 E Raigad district of Maharashtra near Pen Taluka. It has an average elevation of 12 meters (39 feet).This village is prettily situated in a hollow surrounded by wooded hills, on the right bank of the Amba River Existing Sub-creek and Amba River is the main water bodies under consideration as far as nature and location of the project was concerned. Creek water was sampled at three locations, upstream (CW1), at site (CW2) and downstream (CW3) during the year 2017-18 and 2022-2023. Analysis results indicated traces of heavy metals in sediment and water which can be attributed to regular dredging activity by the local

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dredgers in the creek. Other physico-chemical parameters indicated regional variations. Amba River is the only significant surface water body present in the vicinity of the proposed project. Hence, creek water sampling was carried out during the study period.

Creek water samples were collected at three locations within the impact zone to evolve a general background of the project sites. All water samples were collected in one-liter pre-cleaned plastic cans using Niskin sampler. After collection samples brought to the laboratory with utmost care. Sediment samples were brought into solution by treatment with conc HF-HClO4- HNO3-HCl and the metals were estimated on a Perkin Elmer (Optima 7300 DV) inductively coupled optical emission spectrophotometer (ICP-OES, plasma 7300 DV, Perkin Elmer, Singapore) (Loring and Rantala, 1992). For the estimation of mercury, sample was digested with aqua-regia followed by oxidation with potassium permanganate. Mercury was measured by cold vapor technique using flow injection mercury system (FIMS-400, Perkin-Elmer) (USEPA, 1979). Accuracy of methods was ascertained by simultaneous analysis of PACS-2 and BCSS-2, certified reference material (CRM, NRC-Canada) for trace metals and mercury in sediment.

Natural sediments always carry heavy metals to a varying degree depending on the source rock as well as the environment of deposition. This lithogenic contribution may be taken as a background for assessment of sediment contamination by anthropogenic metals.

Determination of trace pollutants such as heavy metals and organic compounds in water often reveals fluctuations as the concentrations depend on the location and time of sampling, the nature of the pollutant, and the chemical characteristics of water. Moreover, several pollutants get rapidly fixed to particulate suspended matter and/or hydrolyzed and thus removed from the water column. In several instances, it is observed that even close to a location of effluent release, the metal content in receiving water often decreases to a normal value assessing contamination through analysis of water, a difficult task.

This lithogenic fraction should be accurately known for the assessment of sediment contamination of metals through anthropogenic sources.

Then analysis was carried out to determine the concentration of various metals like Nickel (Ni),Arsenic (As), Lead (Pb), Cadmium (Cd), Zinc (Zn) and Chromium (Cr), in the present work. Atomic Absorption Spectroscopy (AAS) has proved itself to be the most versatile instrumental technique for the qualitative analysis of trace metal in liquid sample (APHA, AWWA 1998, . De, A.K, 1998, Skoog, et al., 1986).

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Photograph showing creek water sampling at site.

Results and Discussion:-

In the study areas following heavy metals in the creek water were analyzed in mg/lit and results obtained are given Table No.1 to Table No.3 and Fig.No.1 to Fig No.3

Table No.1 Shows the observed values of Heavy metals presents in creek water samples in the year 2017-18 and 2022-23 (Rainy Season).

Sr. No	Parameter	Unit	CW1	CW2	CW3	Standard mg/lit
1	Nickel	mg/L	<0.1	<0.1	<0.1	**0.02**
2	Arsenic	mg/L	<0.1	<0.1	<0.1	**0.01**
3	Lead	mg/L	<0.1	<0.1	<0.1	**0.01**
4	Cadmium	mg/L	0.065	0.075	0.01	**0.003**
5	Zinc	mg/L	0.0210	0.0125	0.0192	**5**
6	Chromium	mg/L	0.250	0.265	0.245	**0.05**

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Sr. No	Parameter	Unit	CW1	CW2	CW3	Standard mg/lit
1	Nickel	mg/L	<0.58	<0.89	<0.25	0.02
2	Arsenic	mg/L	<0.12	<0.52	<0.28	0.01
3	Lead	mg/L	<0.18	<0.12	<0.19	0.01
4	Cadmium	mg/L	0.85	0.56	0.89	0.003
5	Zinc	mg/L	0.35	0.47	0.64	5
6	Chromium	mg/L	0.27	0.42	0.78	0.05

Table No.2 Shows the observed values of Heavy metals presents in creek water samples in the year 2017-18 and 2022- 23(Winter Season)

Sr. No	Parameter	Unit	CW1	CW2	CW3	Standard mg/lit
1	Nickel	mg/L	<0.1	<0.1	<0.1	0.02
2	Arsenic	mg/L	<0.1	<0.1	<0.1	0.01
3	Lead	mg/L	<0.1	<0.1	<0.1	0.01
4	Cadmium	mg/L	0.072	0.085	0.01	0.003
5	Zinc	mg/L	0.0212	0.0142	0.0222	5
6	Chromium	mg/L	0.310	0.270	0.255	0.05

Sr. No	Parameter	Unit	CW1	CW2	CW3	Standard mg/lit
1	Nickel	mg/L	<0.1	<0.4	<0.18	0.02
2	Arsenic	mg/L	<0.5	<0.1	<0.12	0.01
3	Lead	mg/L	<0.18	<0.12	<0.19	0.01
4	Cadmium	mg/L	0.089	0.1	0.05	0.003
5	Zinc	mg/L	0.04	0.01	0.085	5
6	Chromium	mg/L	0.45	0.12	0.19	0.05

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Table No.3 Shows the observed values of Heavy metals presents in creek water samples in the year 2017-18 and 2022-23 (Summer Season)

Sr. No	Parameter	Unit	CW1	CW2	CW3	Standard mg/lit
1	Nickel	mg/L	<0.1	<0.1	<0.1	0.02
2	Arsenic	mg/L	<0.1	<0.1	<0.1	0.01
3	Lead	mg/L	<0.1	<0.1	<0.1	0.01
4	Cadmium	mg/L	0.095	0.086	<0.1	0.003
5	Zinc	mg/L	0.03	0.0148	0.0238	5
6	Chromium	mg/L	0.304	0.276	0.269	0.05

Sr.No	Parameter	Unit	CW1	CW2	CW3	Standard mg/lit
1	Nickel	mg/L	<0.1	<0.4	<0.18	0.02
2	Arsenic	mg/L	<0.5	<0.1	<0.12	0.01
3	Lead	mg/L	<0.18	<0.12	<0.19	0.01
4	Cadmium	mg/L	0.089	0.1	0.05	0.003
5	Zinc	mg/L	0.04	0.01	0.085	5
6	Chromium	mg/L	0.45	0.12	0.19	0.05

Nickel and Arsenic-

The Nickel concentration was recorded as < 0.1 mg/L in all three seasons In the 2017-18 data. But In 2022-23 The pollution of water with nickel and chromium arises from industrial sources or agricultural activities. It is regarded as essential trace metal but toxic in large amount to human health.(Mohod, C.V. and Dhote, J-2013) It is considered as carcinogenic to human [Salem et al; 2000]. It is also reported that high dose of nickel in rats and dogs were significantly decreasing their body weights (Ambrosr et al; 1976, Matkar, R.R. 2008).

Human Health is continuously affected by the sweeping distribution of Heavy Metal in our environment emanating from natural resources or result of artificial human activities (aliyan sani & Mustapha sani 2022).

Lead-

The Lead concentration was recorded as < 0.1 mg/L in all three seasons. Acute poisoning of lead is relatively rare and generally restricted to occupational setting. However, in 2022-23 Lead concentration recorded as < 0.14 in all three Seasons .Lead is toxic for aquatic organism but less than Cd and Hg. It is most dangerous heavy metal pollutant to humankind, but mainly as air pollutant. Leaded gasoline, pipes, fittings, solder and the service connections of some household plumbing systems contain lead that contaminates the drinking water mainly with lead and cadmium. It is dangerous element, it is harmful even in small amounts (Salem et al; 2000, Patil S.S. et al, 201).

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Cadmium-

The concentration of cadmium is high as 0.304 mg/L in summer season and is lowest as 0.01mg/L in rainy season.In 2022-23 the Concentration of cadmium is < 0.89 mg/lit. The higher levels of Cd obtained in the sample is might be due to contribution from other sources such as agricultural runoff (where fertilizers are used), leaching of Ni-Cd based batteries and other wastes (Eralagere et al; 2008).

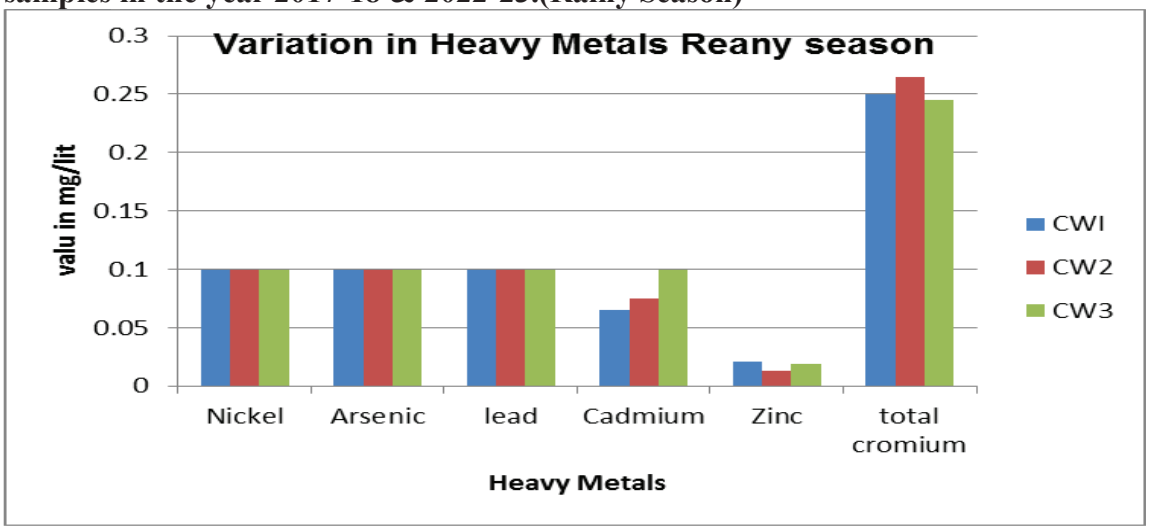
Zinc-

The highest concentration of zinc was recorded as 0.300 mg/L in summer season and lowest concentration was recorded as 0.0125mg/ i.e. rainy season. In the 2022-23 High Zinc concentration was <0.64 mg/lit recorded in Rainy Season. The presence of zinc increases cadmium toxicity and accumulation in aquatic plants. The highest mortality with cadmium was obtained when Zn: Cu ratio was one, has been studied by given a sub-lethal chronic load of zinc to fish by uptake from water (Vediya and Shrivastava, 2008, Patil S.S. et al, 2014).

Chromium-

The highest concentration of Chromium was recorded as 0.304 mg/L in the summer season and lowest concentration was recorded, as 0.245 mg/L in rainy season.In 2022-23 the high Chromium concentration was recorded < 0.78 mg/lit in rainy seasons. Chromium is generally moderately toxic to algae and other aquatic plants. The concentration of serum cholesterol is correlated with chromium in drinking water (Vediya and Shrivastava, 2008).

Figure No.1 Graphical representation of Heavy metals presents in creek water samples in the year 2017-18 & 2022-23.(Rainy Season)



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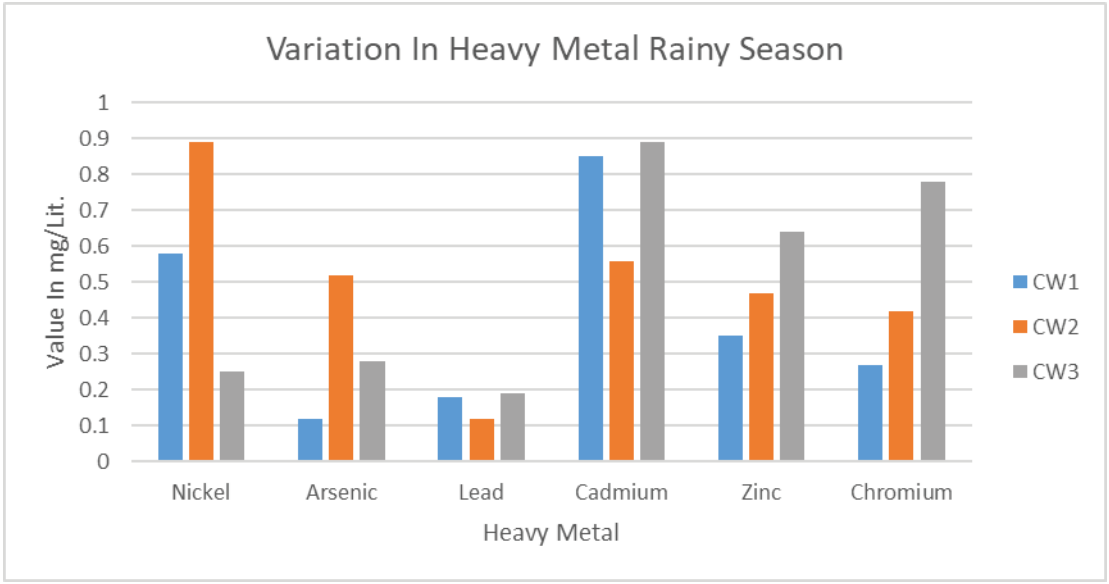
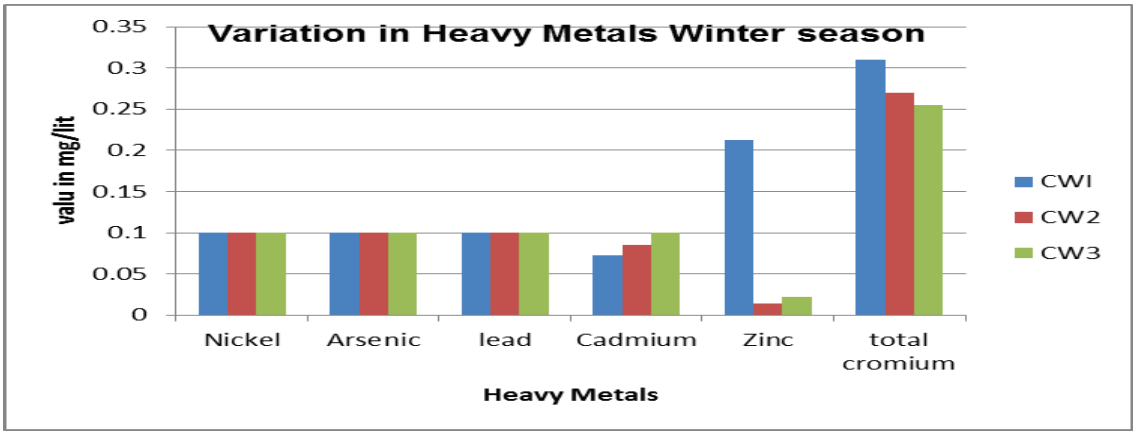


Figure No.2 Graphical representation of Heavy metals presents in creek water samples in the year 2017-18 and 2022-23 (Winter Season)



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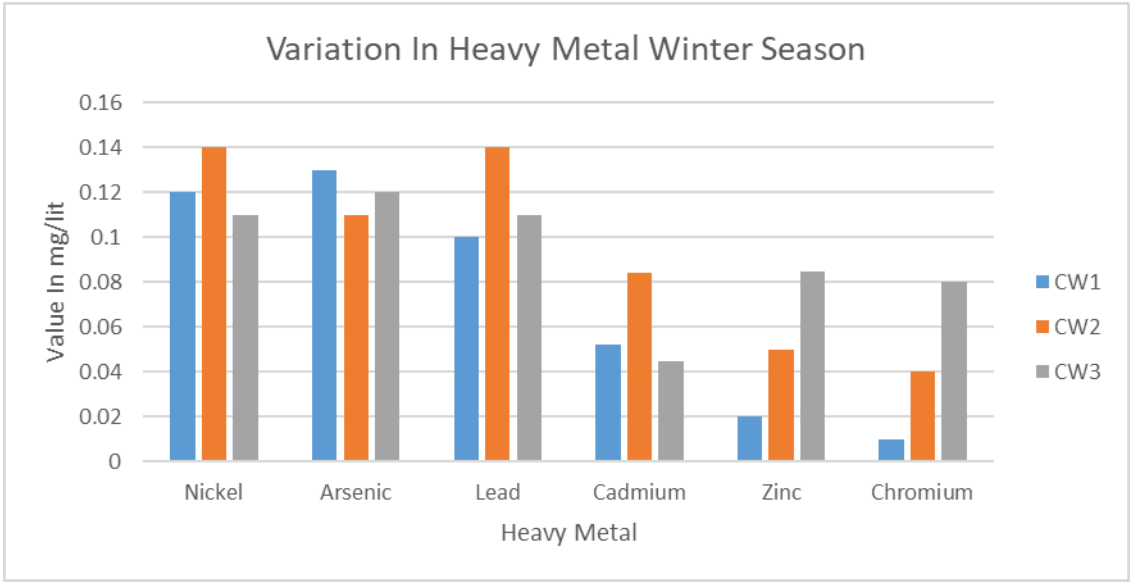
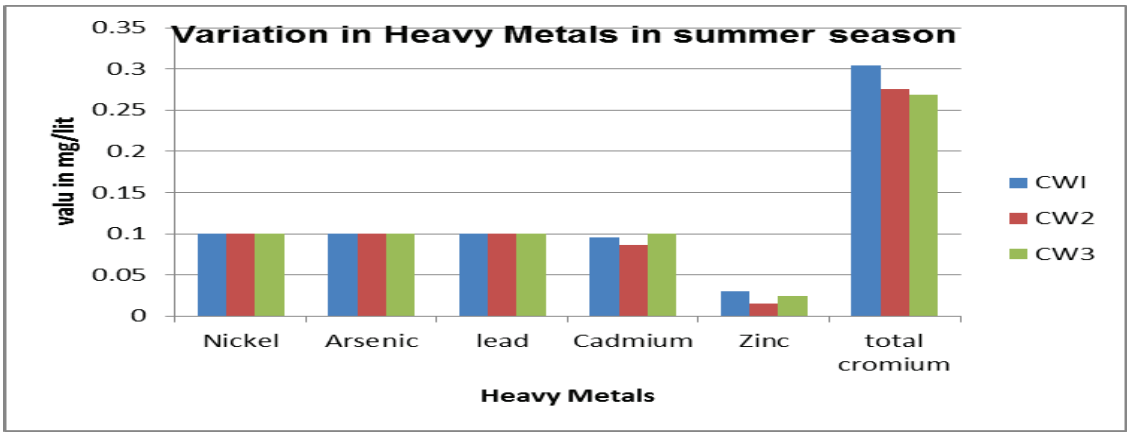


Figure No.1 Graphical representation of Heavy metals presents in creek water samples in the year 2017-18 and 2022-23 (summer season).



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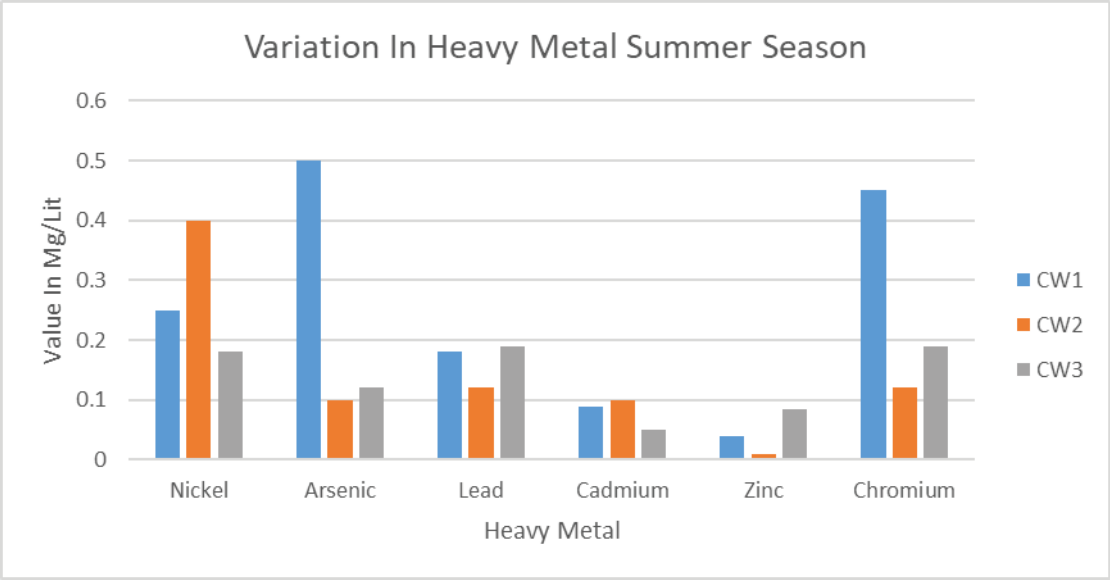

Conclusion:-

This study will help in understanding the amount of heavy metals being received in the river and its biological magnification in animals, particularly those at the lower level of food chain. This study will also help to make aware those local people or adjacent farmers for proper management of waste disposal and also to minimize use of synthetic inputs. The study indicated that increase in toxic waste day by day in river produced biological magnification in food chain, which is a challenge to scientists, policy makers, administrators and all those involved in the conservation of the environment. Construction activity near the left and right banks of the river needs to be checked, encroachments removed, and encroachers suitably resettled elsewhere. This will improve the drainage, and reduce pollution. However, a participatory approach in the management of the water body is desirable. Creating awareness among the people in the neighborhood, and attempting reorientation of the stakeholders towards the cause of conservation of the reservoirs are important from this point of view.

Overall water quality of creek at sampling location can be considered as supportive to the aquatic life. The quality of heavy metals in river water should be Continuous-monitoring need, as heavy metal accumulation will cause numerous problems to living being. Therefore, passing awareness is needed for the betterment of water quality for the sake of its use.

The three seasons i.e. from the 2018 to 2023 metal variation observation exhibited that the increase in concentration may highlight their deposition. The riverbank region had comparable metal contents. Overall data set of metal variation across the riverbed as well as riverbank reveals the estuary is interacting with multi factors associated with natural processes as well as anthropogenic activities.

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