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Comprehensive Analysis of Trace Metal of Godavari River Water at downstream of Paithan, Aurangabad District Maharashtra (India)

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ABSTRACT: River water is often used as source of potable water in many regions at global level. The aim of this research work was to know the concentration level of trace metals in river 2021 and its role in contamination of water. For present research work spectrophotometer was used. The work carried out in January 2021 to December 2021. The concentration of metal like Iron, copper, manganese, lead, cadmium, zinc and fluoride were analyzed. Some metals in drinking water can be useful for the humans but heavy metal concentration can lead to serious health issues and problems. The Godavari river water samples were collected from Paithan city of Aurangabad district. The fluoride has the highest of the concentration of 18.55 $\mu\text{g/L}$ in a year then the iron with 4.75 $\mu\text{g/L}$, lead with 4.67 $\mu\text{g/L}$, copper with 4.62 $\mu\text{g/L}$, manganese with 2.24 $\mu\text{g/L}$, zinc with 2.03 $\mu\text{g/L}$ and cadmium with 0.23 $\mu\text{g/L}$. Contamination of freshwater sources like rivers, lakes by trace metals is the major issue at global level which has attracted policy makers and researchers because of the toxicity associated with them as well as their bio accumulation potential.

KEYWORDS: concentration, heavy metals, trace metals, contamination

I. INTRODUCTION

River water is one of the most important sources of drinking water in most of the countries. Rivers acts as major water resources, not only in terms of drinking water supply but also in terms of their function in recreational activities. Higher concentrations of trace metal levels in the freshwater makes them completely unsuitable for human consumption, livestock and irrigation. Heavy metal contamination of rivers with sediments have been interlinked to several artificial activities that occur both far and close to the natural resource such as human settlements, farms, game reserves, mining industries, storm water runoff, and wastewater treatment facilities. The presence of some metals in potable water is desirable to certain extents for proper maintenance of human health and even in almost all the developments. Presence of some metals in water even in trace amounts having severe negative effects in terms of their high degree of toxicity. The poisoning effect of toxic metals from polluted drinking water has evolved as one of the major health hazards in last few decades [2]. Metals are non-degradable and accumulates in the human body system, causing damage to nervous system and internal organs [8]. The detrimental diseases like Edema of eyelids, tumour, congestion of nasal mucous membranes, pharynx, stuffiness of the head, gastrointestinal, muscular, reproductive, neurological and genetic malfunctions arise by some of these heavy metals which have been documented [9] [10] [11]. Though some of the crucial metals like Cu, Fe, Mn, Ni and Zn are very essential as micro nutrients for life processes in plants and the microorganisms, while many other metals like Cd, Cr and Pb have no known physiological activity, but they are proved harmful beyond a particular limit [12] [13]. Among the inorganic contaminants of the river water, trace metals studies are getting huge scope for their non-degradable nature and often accumulate through tropic level causing a noxious biological effects [1]. Rapid urbanization and industrial development during last few years have provoked some serious concerns for the ecological systems. Heavy metals contamination in river is one of the prominent issues in many fast-growing cities, because maintenance of water quality and sanitation infrastructure decrease along with population and urbanization growth especially in the developing countries [3] [4] [5]. Trace metals enter in river from variety of sources; it can be either natural or artificial [6] [7][4]. Heavy metal contamination in an aquatic environment. is of critical concern of globe, due to toxicity of metals and their accumulation in the aquatic habitats. Contaminated

sediments may be derived from inputs of suspended solids to which toxic substances are intensively adsorbed, such as soil particles in the surface water run-off from fields treated with pesticides. Heavy metals which are introduced into the aquatic environment are ultimately incorporated into the aquatic sediments, organisms living in these sediments accumulate these heavy metals to varying degrees [15] [14]. Trace metal contamination are important due to their potential toxicity for the ecology and human beings [17]. Release of heavy metals in river can occur in both particulate and dissolved state of which the particulate form gets deposited in the river sediment under favourable hydraulic conditions. Interaction between sediment and water can also be responsible for the deposition of metals in sediments [18] [19] [20]. Continuous discharge of toxic heavy metals and oxygen demanding substances along with solids and into river water altered the physio-chemical characteristics such as temperature, pH, total dissolved solid (TDS), biochemical oxygen demand (BOD), chemical oxygen demand (COD). Heavy metal contamination in the water is a significant environmental issue because of their toxicity, non-biodegradability and easy bio-accumulation potential in biota and food chain [21]. It is utmost importance to determine the quality of drinking water with respect to all constituents and take proper remedial measures, if needed, to ensure quality criteria as formulated by WHO and other regulating bodies.

II. METHODOLOGY

Rivers are the major natural source of the fresh water. The study was carried out in the Godavari River, Paithan from Aurangabad District. Aurangabad city is major city in Maharashtra and capital of Marathwada region. It spreads over 139 sq.km with more than 1 million population (2011). It is situated in latitude 19° 54' 59'' North and Longitude 75° 21' East. The average temperature recorded in summer month max 43°C and min. 28°C and in winter month temperature max 32°C to 5°C. The work includes estimation of different trace metals present in the river water in Paithan in Aurangabad district for which spectrophotometer was used.

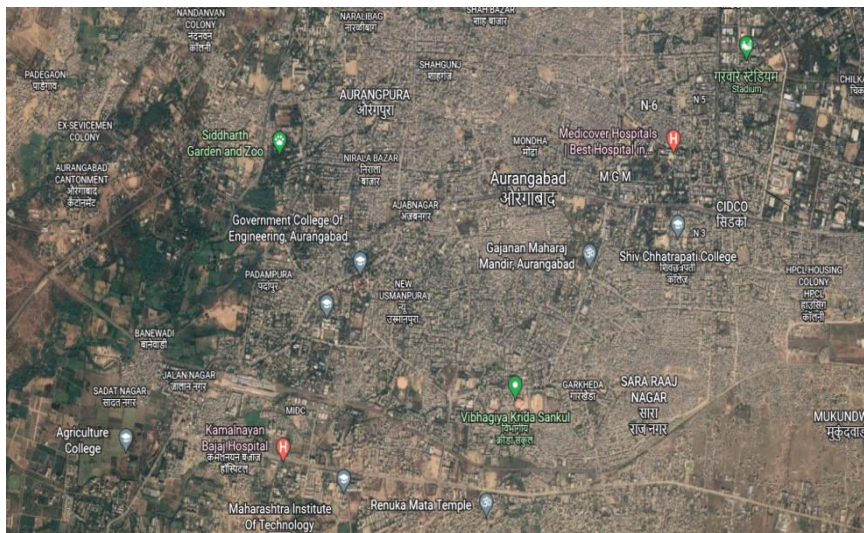


Fig 1. Map showing location of Aurangabad city

III. EXPERIMENTAL RESULTS

Trace metals are the inorganic materials. Humans need these trace metals in very low concentration. High metal concentrations in the river water may be because of excessive industrial discharge from industries like iron, steel, fertilizers, pesticides, heavy vehicles as well as discharge of domestic sewage coupled with natural geogenic processes [22]. The following table shows the concentration of metals like Iron (Fe), Copper (Cu), Manganese (Mg), Lead (Pb), Cadmium (Cd), Zinc (Zn), Fluoride (F) in the river water.

Station No.	Iron (Fe)	Copper (Cu)	Manganese (Mn)	Lead (Pb)	Cadmium (Cd)	Zinc (Zn)	Fluoride (F)
January	0.3131	0.4237	0.1163	0.3723	0.0221	0.1721	1.5212
February	0.324	0.3745	0.1252	0.3875	0.0146	0.1733	1.572
March	0.6526	0.4265	0.1422	0.3617	0.0142	0.1782	1.5402
April	0.2423	0.3633	0.2701	0.3875	0.0186	0.1651	1.592
May	0.2411	0.3231	0.2721	0.3965	0.0172	0.1621	1.422
June	0.3221	0.3419	0.115	0.3612	0.0274	0.1822	1.552
July	0.3102	0.4212	0.2973	0.3653	0.0122	0.1770	1.5312
August	0.426	0.3821	0.1123	0.4412	0.0121	0.1611	1.632
September	0.4233	0.4221	0.2237	0.4213	0.0275	0.1613	1.5783
October	0.5222	0.4142	0.2067	0.3925	0.0135	0.1675	1.5352
November	0.5102	0.3140	0.2144	0.4220	0.0240	0.1702	1.5213
December	0.4662	0.4113	0.1441	0.3652	0.0242	0.1631	1.5541
Average	0.39	0.38	0.18	0.38	0.019	0.16	1.54
Max.	0.6526	0.4265	0.2973	0.4412	0.0275	0.1822	1.6321
Min.	0.3102	0.3140	0.1123	0.3612	0.0121	0.1611	1.422

Table 1: Analysis of Water from the Godavari River, Paithan in Aurangabad District

All the values in above table are represented in $\mu\text{g/L}$.

The graphical representation of metals concentration in river water is shown in Fig 2 to Fig 8. The iron has the maximum value of 0.6526 in March and minimum value of 0.3102 in July and the average value of 0.39. The copper has the maximum value of 0.4265 in March and minimum value of 0.3140 in November and the average value of 0.38. The manganese has the maximum value of 0.2973 in July and minimum value of 0.1123 in August and the average value of 0.18. The Lead has the maximum value of 0.4412 in August and minimum value of 0.3612 in June and the average value of 0.38. The cadmium has the maximum value of 0.0275 in September and minimum value of 0.0121 in August and the average value of 0.019. The zinc has the maximum value of 0.1822 in June and minimum value of



0.1611 in August and the average value of 0.16. The fluoride has the maximum value of 1.6321 in August and minimum value of 1.422 in May and the average value of 1.54.

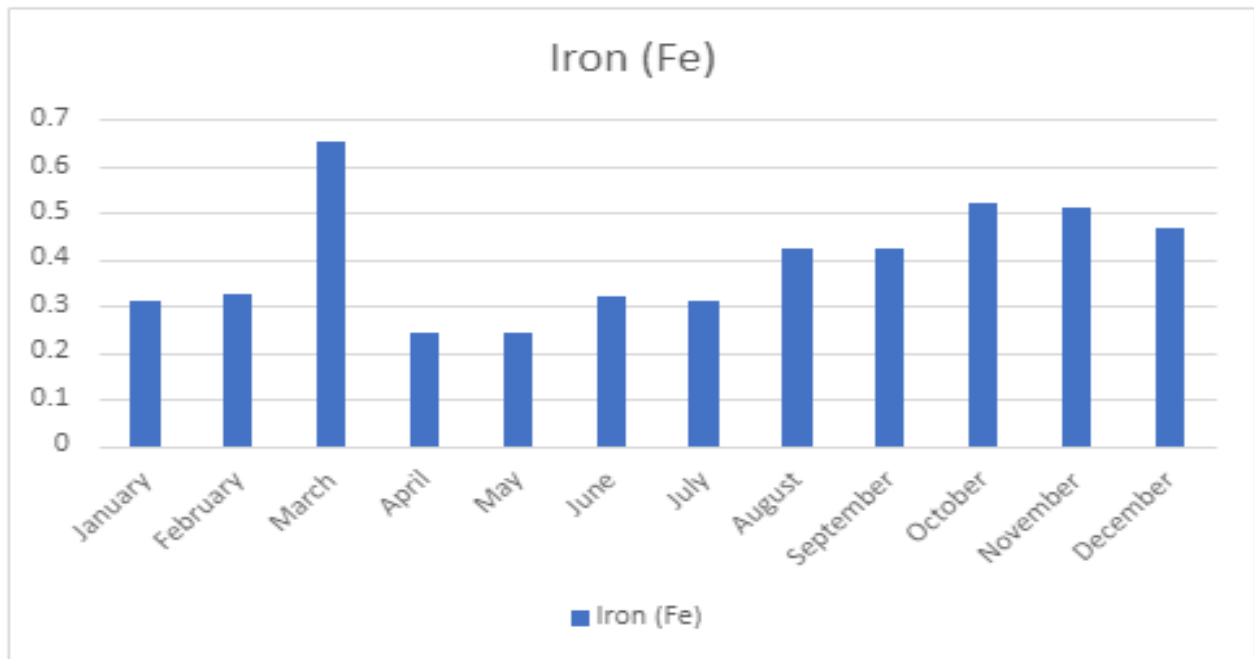


Fig 2: Graph showing Concentration of Iron metal in river water

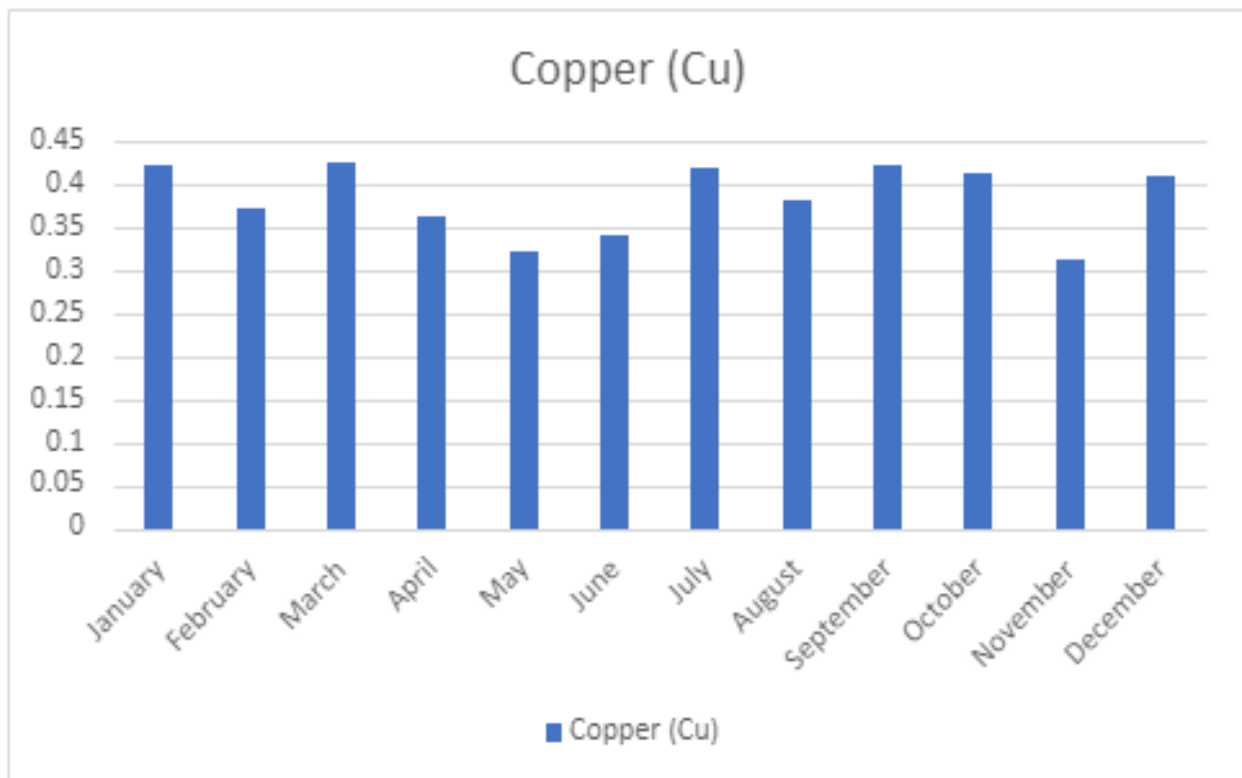


Fig 3: Graph showing Concentration of Copper metal in river water

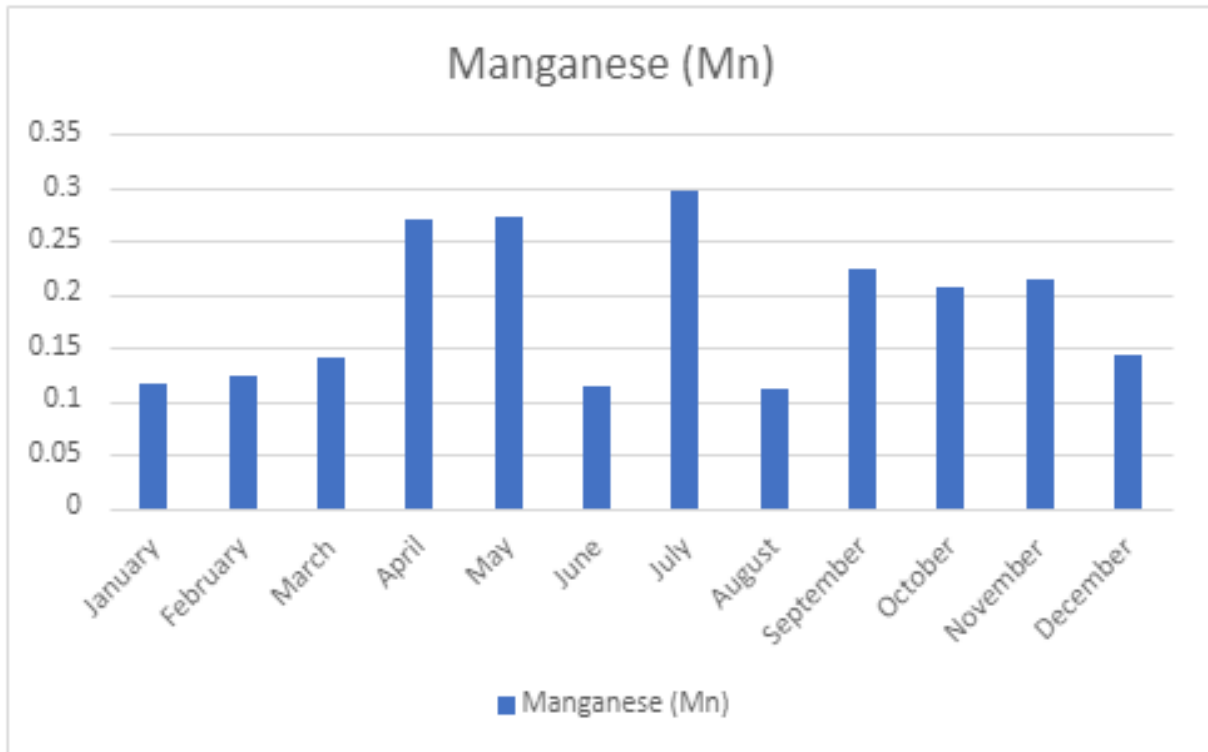


Fig 4: Graph showing Concentration of Manganese metal in river water

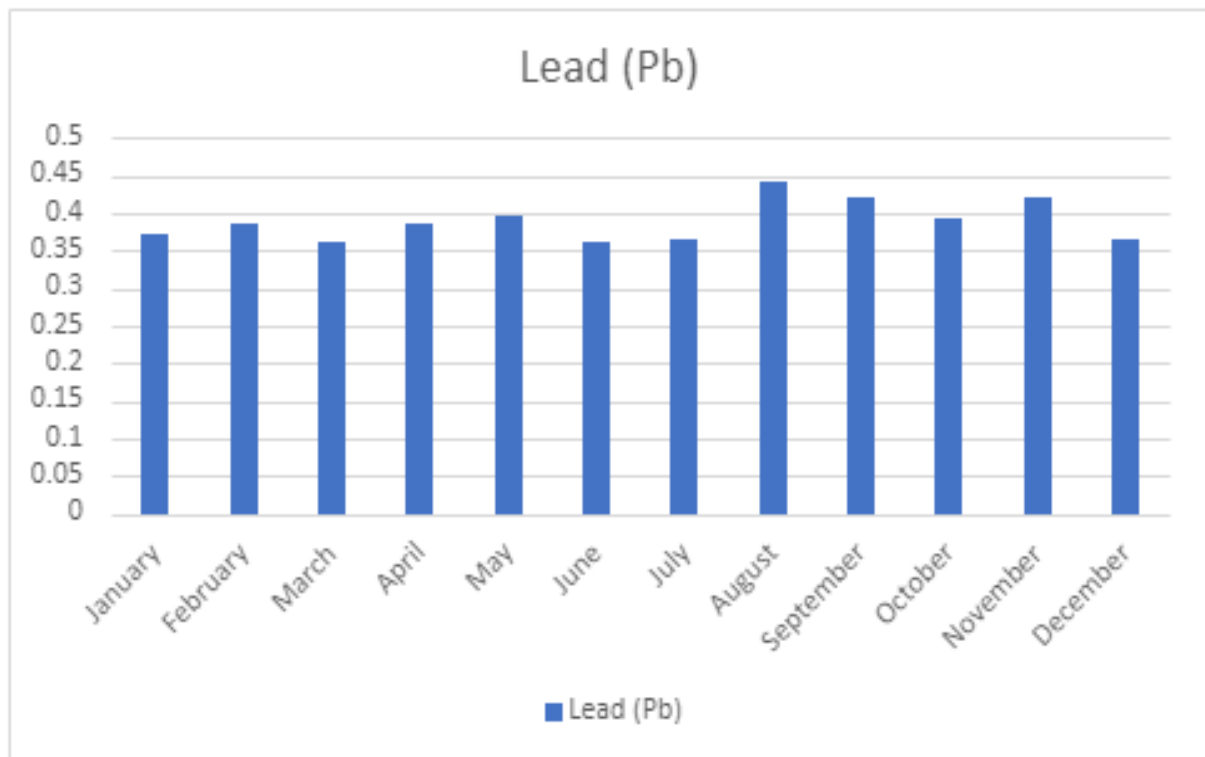


Fig 5: Graph showing Concentration of Lead metal in river

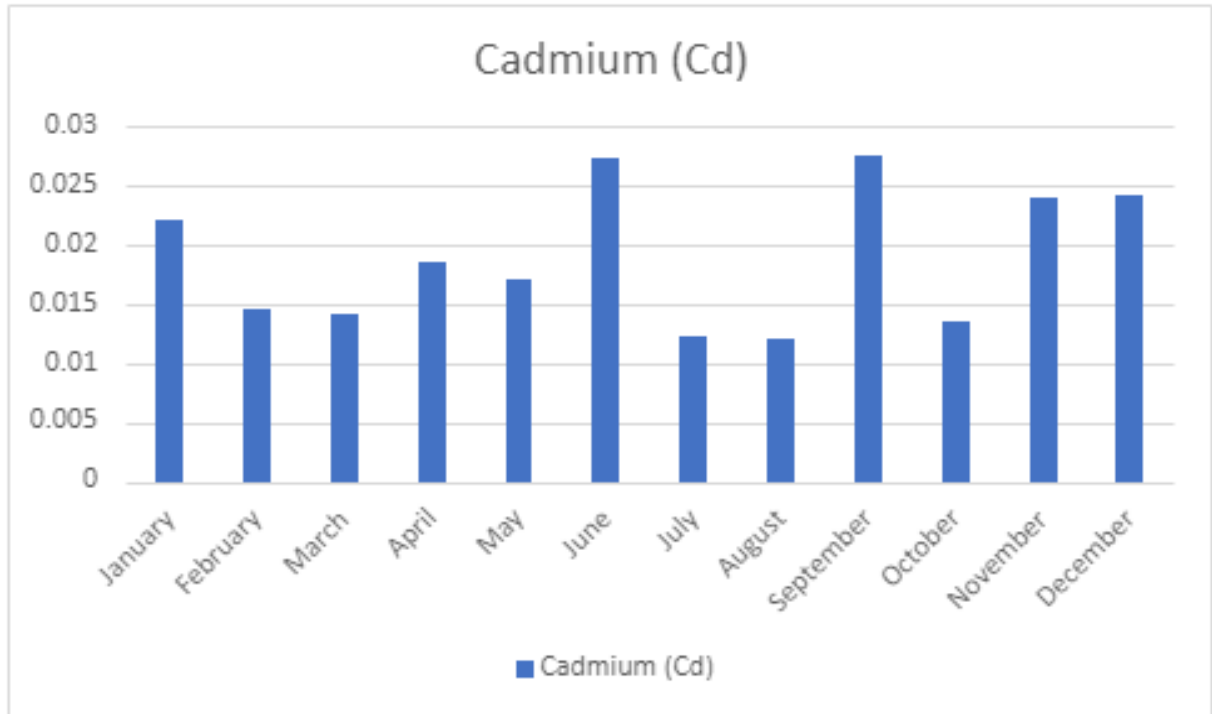


Fig 6: Graph showing Concentration of Cadmium metal in river water

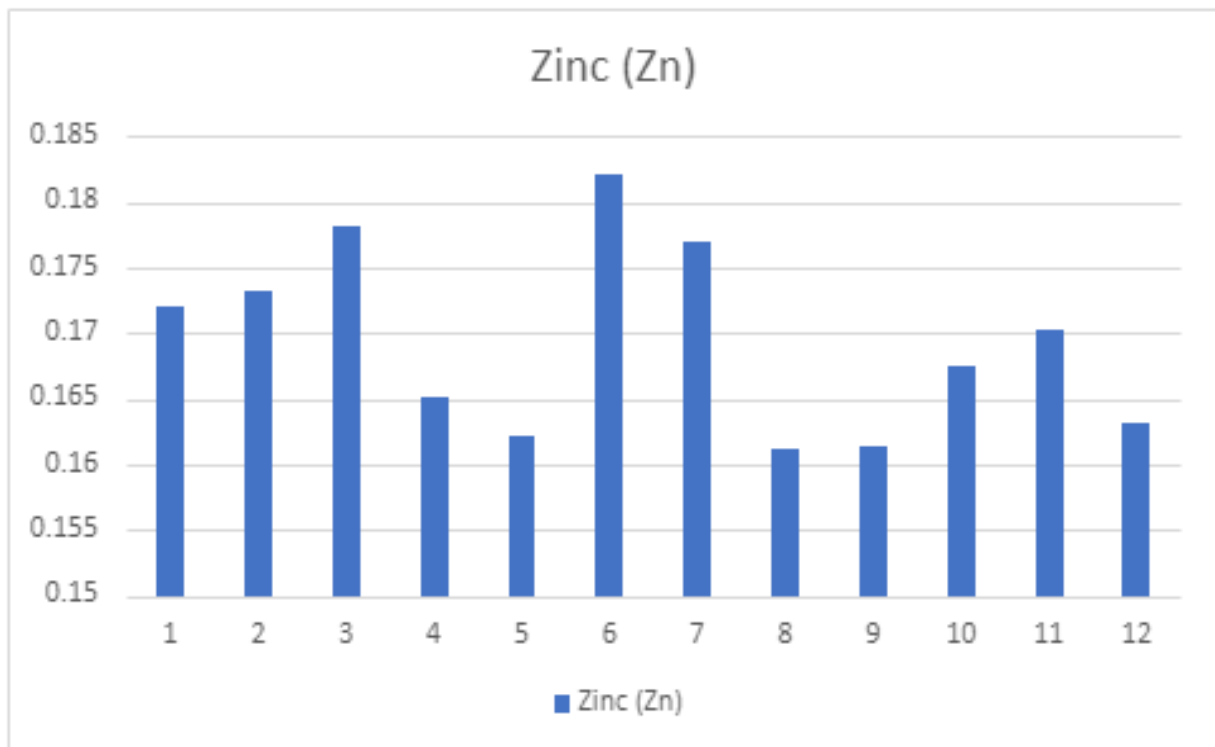


Fig 7: Graph showing Concentration of Zinc metal in river water

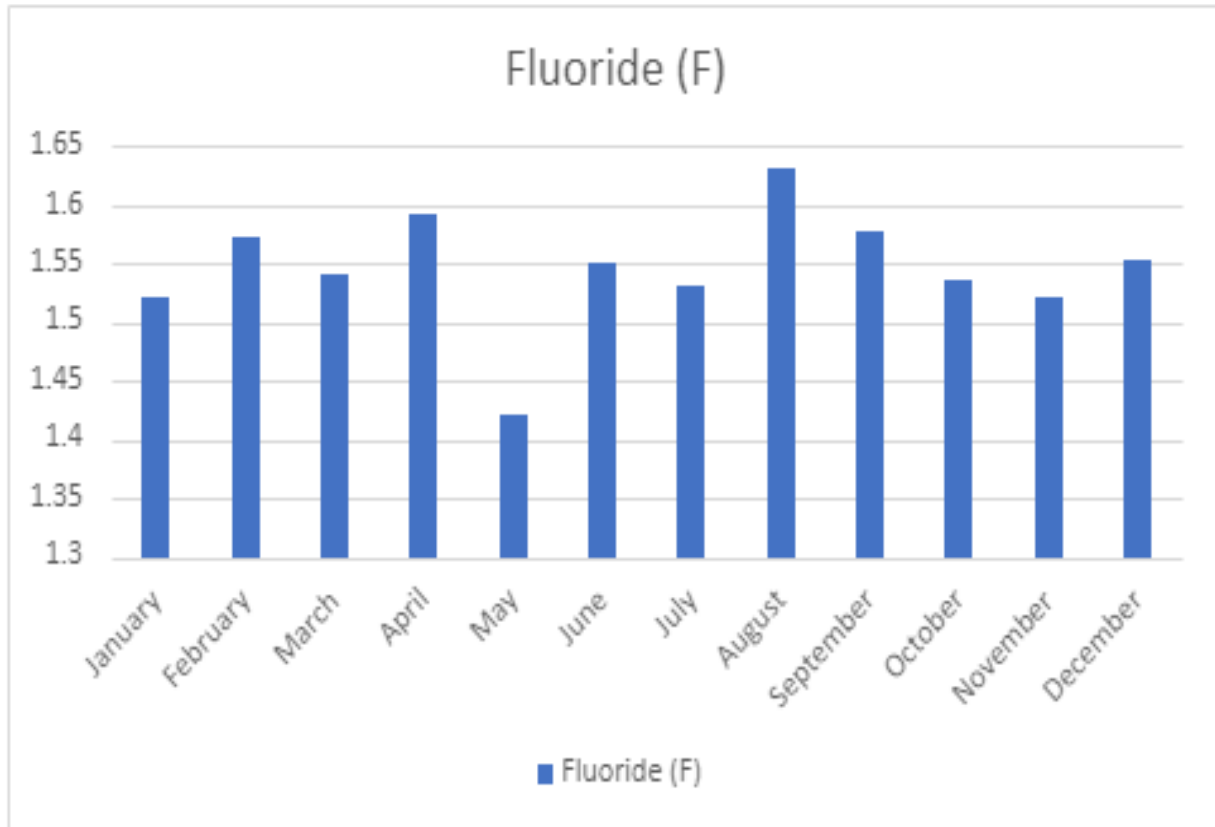


Fig 8: Graph showing Concentration of Fluoride metal in river water

Iron is the crucial element helpful for the haemoglobin in the blood, however the unwanted presence can lead to harmful effects on human beings. Copper, as an essential trace element, is needed by biological systems for the activation of some enzymes during photosynthesis but at higher concentrations it exhibits harmful effects on the human body. The sources for the exposure of copper are mining, metallurgy and the industries. Manganese is also useful in the formation of haemoglobin and healthy functioning of cells. Exposure of manganese affects the neurological systems of human beings. Lead is extremely toxic and shows toxicity to the nervous system, kidneys and to the reproductive system. Exposure to lead causes irreversible brain damage of human beings [23]. Cadmium is the most toxic element. Smoking of cigarettes is one of the major sources of cadmium poisoning in humans which causes lung cancer and severe negative effect on kidneys. Cadmium inhibits the formation of DNA, RNA and Proteins. Zinc is a very crucial element in our diet. Zinc exposure in large amounts results in nausea and vomiting in children. It may cause anaemia and cholesterol issues. Fluoride is used for good dental health. While excessive amount results in health issues like bone cancer.

IV. CONCLUSION

The presence of some metals in potable water is desirable to certain extents for proper maintenance. Above these limits, they behave as pollutants and toxicants causing serious health hazards. The research was carried out in Godavari river, Paithan in the Aurangabad district of Maharashtra state in India. The research was carried out by using the spectrophotometer. The average value of concentration of iron, copper, manganese, lead, cadmium, zinc and fluoride are 0.39, 0.38, 0.18, 0.38, 0.019, 0.16 and 1.54 respectively. The present research work shows that fluoride has the highest concentration of trace in river water. Trace metals, in contrast to most pollutants, are not easily degraded and they undergo a global ecological cycle in which natural sources of water are their main pathways.

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