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Assessment Of Toxicological Effects of Heavy Metals in Aquatic Ecosystem of Shivnath River From: Dagauri Village Zone Bilaspur C.G.

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ABSTRACT

Quality of water is one of the major concerns for whole world. Toxicological effects of aquatic ecosystem by heavy metals have assumed serious proportion due to their toxicity and accumulative behavior. Unlike organic pollutants, natural processes of decomposition do not remove heavy metals. Metals are introduced into the aquatic system as a result of weathering of soil and rocks, from volcanic eruptions and from a variety of human activities involving mining, processing use metals or substances containing metal contaminants.

The impact of rapid Industrialization and fertilizers, Insecticide are uses around, the globe an unsafe water, Toxic element have become increasingly significant within Assessment of Toxicological effects of Aquatic Ecosystem in river. Shivnath river water is one of the major sources for domestic and agriculture uses may part of dagauri village area. The present investigation deals with a study of chemical parameters studies have in this river on different sites by a specially prepared. Aquatic Toxicological effects assessment questionnaire Heavy metals, organic & inorganic meters. Water quality Index and various physio-chemical parameters Analysis of surface river water of Different 8 sites of Dagauri village zone Bilaspur, have studies in Over a period of three months (Oct.-Dec. 2023) reading have observed to analysis different physio-chemical parameters Turbidity, Total Hardness (Mg & Ca), COD, BOD & pH the results are found in the range of 3.6–4.4 NTU, 170-210 mg/l, 13.5-19.1 mg/l, 1.8-3.1 mg/l, & 7.2-7.8 pH value.

Respectively while F, Cl, No₃, So₄, are in the range of 0.79-1.4 mg/l, 250-340 mg/l, 0.6-7.4 mg/l, 14-19 mg/l. Iron, zinc, Lead & Manganese heavy metal are present range of 0.16-0.31 mg/l, 1.21-1.56 mg/l, 0.14-0.28 mg/l & 0.042-0.074 mg/l.

The present study has it's almost importance for hygienic point of view in the Public Interest and its consequence with respect to health hazard. Bilaspur district Dagauri village zone was selected for the purpose of Investigation many illiterate villagers and use of surface river water for their drinking purpose & domestic activity.

Keyword:- Public health, Aquatic environment, River water physio-chemical parameters etc.

Introduction:-

The world's ground water reservoirs are probably the planet's most important fresh water resource. There is nearly 96% salt water in the world's and 4% fresh water. Many people depend

on fresh water supplies from river water. It provides water for domestic use for a large part of the Indian population is it one of the major [4].

sources of drinking and domestic uses water in the village and rural areas of the country. The present investigation deals with a study of Surface water used for various domestic uses[6].

Our studies recent year there has been Increasing awareness of and concern about water absorption & using for every activity all over the world. And new approaches toward achieving sustainable exploitation of Surface River water have been developed National & Internationally.

An Indication of various concentration of certain physio-chemical parameter and heavy metals the effluent and their subsequent effect on aquatic eco-system have critically examined.

Studies of physio-chemical Characteristic of surfaceriver water. From 8 sites of rural areas Dagauri village zone Bilaspur District (C.G.). Exhaustive use of pesticides, Manure Line, fertilizer, insecticide and solid waste (Garbage, onetime use polyethene) through surrounding river in a village sites. are main sources of river water contamination and pollution.

River water is usually safe to drinking (Growth & Health) purpose. But it is not 100% pure because of its hardness and contamination level.[15] Surface water might certain bacteria, geogenic chemical, inorganic, organic substance as like heavy metal and other like Fe, Zn, Mn, Pb, Ca, Mg, F, NO_3 , SO_4 . Typically, river water is naturally clean & safe to uses living being. But many uses and flows of Agriculture Insecticide, Waste water



Table No. 1

S.No.	Name of Sampling Sites
1.	Udantal – I
2.	Udantal – II
3.	Chudadih -I
4.	Chudadih -II
5.	Gudaghat - I
6.	Gudaghat -II
7.	Edge of Railway bridge in one side
8.	Upper side Dagauri Out let side

effluent. Industrial waste water Chemical owing to increasing Industrialization on hole hand and exploding population and irregular activities such as no clearness atmosphere, surface, circles of River .

STUDY AREA & SITES:

Bilaspur is located in eastern part of Chhattisgarh and fall within latitude $21^{\circ}47'$ to $23^{\circ}8'$ and longitude $81^{\circ}14'$ to $83^{\circ}15'$. State Chhattisgarh is situated in center of India, Bilaspur district Dagauri village zone is the rural & agriculture less literate area. literate most population located in south eastern central railway rout area (C.G.). Shivnath River is the longest tributary of the Mahanadi River which joint's Changori-Puridham in the Janjgir-Champa district in Chhattisgarh India[18]. The river Shivnath is a one of the major interstates east flowing river in Chhattisgarh.

Picture 1 Map Shivnath River (located sampling sits)





Picture No. 2: Location Sites of River Dagauri Village



Pict. No. 3: Sam. Sites of River Dagauri Village Zone

Material & method

Shivnath river water samples were collected from eight different location sites of Dagaori village zone district Bilaspur during Summer season Oct. - Dec. 2023. sample were collected in sterilized screw-capped polyethylene bottle of 1-liter capacity and analyzed in laboratory for their physio-chemical parameter sample collected from study sites were properly labeled and a record was prepared. Borosilicate glassware, standard quality A.R. reagent and instruments were through-out the testing. The water parameter has been determined by APHA 22th edition (2012) Prescribed standard method.

Parameter	Applied Method
pH	pH Meter (Systronic)
Turbidity	Nephelo Turbidity Meter (Systronic)
Total hardness	Complexo-metric titration
BOD, COD	Open reflux method
Ca & Mg	Volumetric analysis
Zn, Fe, Pb, Mn	A.A. Spectrophotometer
SO ₄ , NO ₃	Gravimetric, di sulphonic Acid method
Cl	Silver nitrate method
F	Spectrophotometer

Result & Discussion:

The observed range of concentration of all the parameter studies are given **table no.-3**. it is apparent from the data for :-

Water quality Parameters During month Oct-Dec 2023								
DAGAURI VILLAGE ZONE BILASUR DISTRICT SHIVNATH RIVER WATER QUALITY PARAMETER OF SAMPLING SITES								
No. of Sites	1	2	3	4	5	6	7	8
PH	7.5	7.3	7.2	7.8	7.34	7.6	7.4	7.3
Turbidity NTU	3.8	3.41	4.4	4.1	4.3	4	3.9	3.6
Total Hardness mg/l	200	180	190	195	170	175	155	210
TDS mg/l	230	240	239	259	240	230	245	310

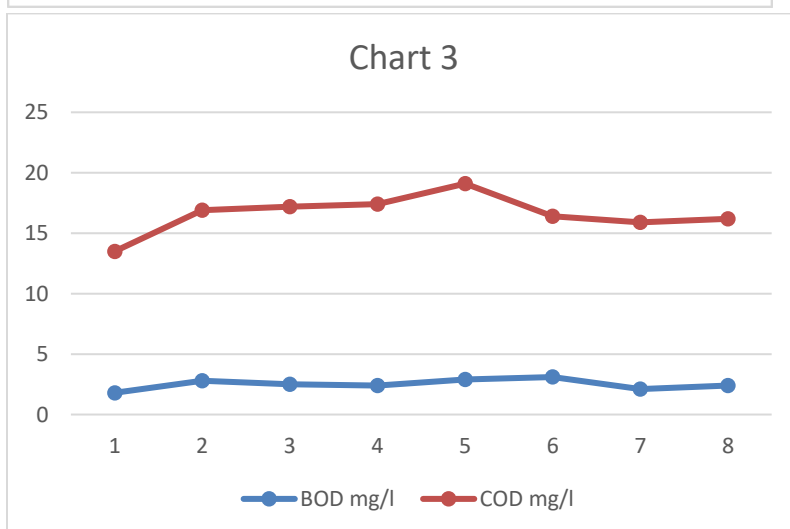
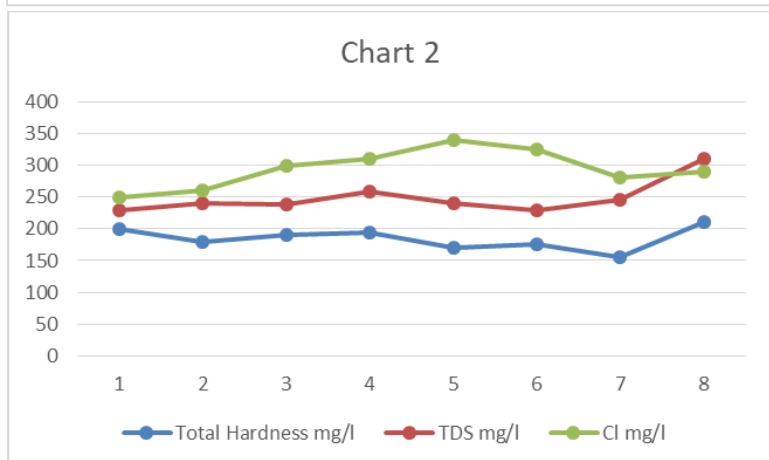
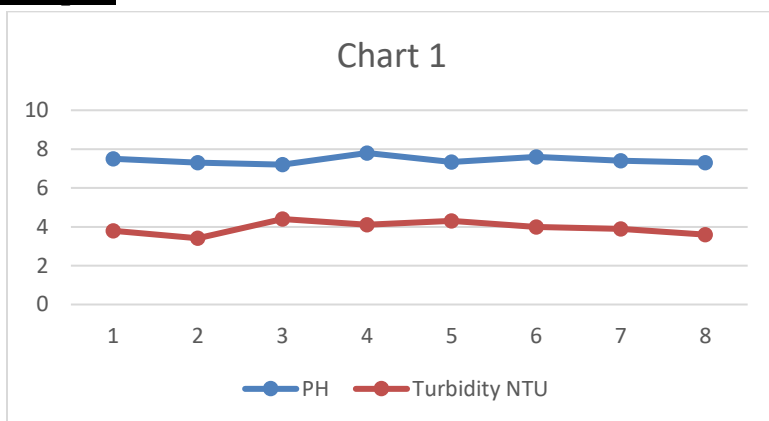
BOD mg/l	1.8	2.8	2.5	2.4	2.9	3.1	2.1	2.4
COD mg/l	13.5	16.9	17.2	17.4	19.1	16.4	15.9	16.2
Ca mg/l	55	53	59	62	65	63	64	60
Mg mg/l	15.5	14.8	18.1	17.4	18.2	17.8	18.2	16.1
Zn mg/l	1.21	1.3	1.56	1.35	1.25	1.32	1.3	1.27
Fe mg/l	0.28	0.19	0.16	0.31	0.23	0.24	0.18	0.17
Pb mg/l	0.16	0.25	0.16	0.14	0.19	0.24	0.27	0.28
Mn mg/l	0.066	0.074	0.068	0.054	0.042	0.063	0.056	0.071
F mg/l	1.4	0.96	0.78	1.3	1.1	0.9	0.86	0.79
Cl mg/l	250	260	300	310	340	325	280	290
No3 mg/l	6.5	6.3	4.9	4.6	5.2	5.4	6.8	7.4
So4 mg/l	16	15	18	17	19	14	15	17

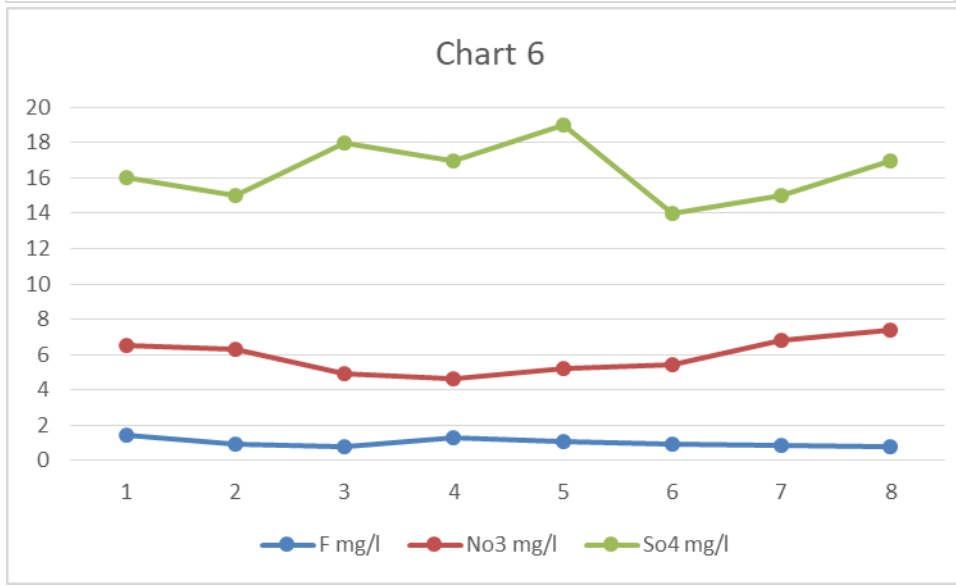
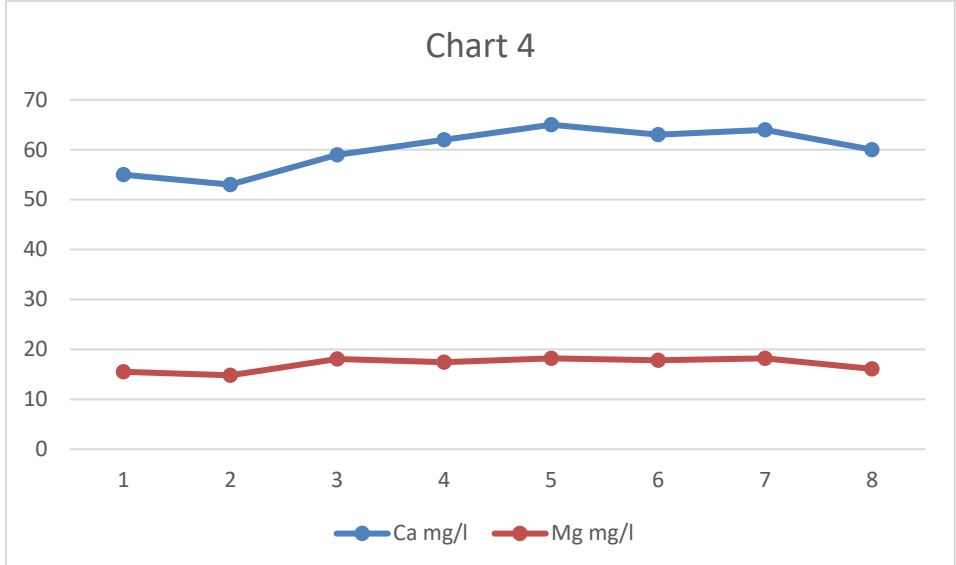
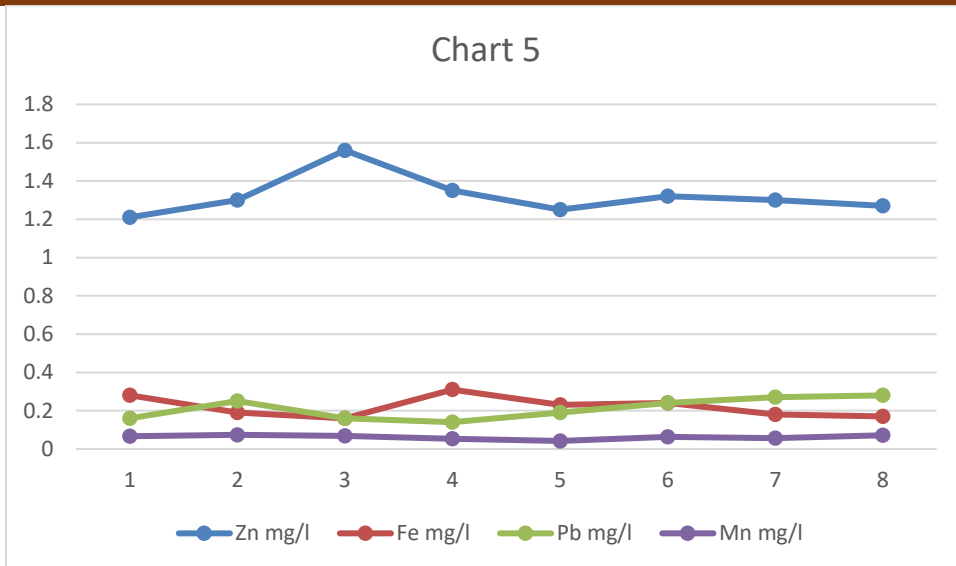
Table 4: STANDARDS OF PHYSICAL & CHEMICAL QUALITY OF DRINKING WATER SPECIFICATION.

S. No.	Parameter or Characteristics	Permissible Limit		
		WHO Rec. 2012	ISI 10500: 2012	ICMR 2011
i	PH	6.5-8.5	6.0-8.5	6.0-8.5
ii.	Turbidity	5(NTU)	5-8(NTU)	5(NTU)
iii.	Hardness (as caco ₃)	500	300-600	300
iv.	BOD mg/l	2.0	5.0	3.0
v.	COD mg/l	10	50	50
vi.	Teste mg/l	Normal	-	-
vii.	TDS mg/l	500	500-800	400
viii.	Ca mg/l	200	150	150
ix.	Mg mg/l	50	30	30
x.	Zn mg/l	5.0	5.0	0.10
xi.	Fe mg/l	0.3	0.1-1.0	1.0
xii.	Mn mg/l	0.1	0.2	0.1

xii.	Pb mg/l	0.05	0.10	0.05
xiv.	F mg/l	1.5	1.0-1.2	1.0
xv.	Cl mg/l	250	250	250
xvi.	No ₃ mg/l	50	45	45
xvii.	So ₄ mg/l	250	200-400	200

Result Graph :





pH: that the water is always associated with the kind of Alkalinity High pH is normality associated with high photosynthetic & aquatic life (biotic & abiotic) activity of water i.e. sampling site 8 pH value are range of pH 7.2-7.8 value.

Turbidity: range are observed 3.6-4.4 NTU. The physically pollution of water show the change in water with regard turbidity, change in color of water by turbidity noted that presented of suspended matter in water i.e., divided organic waste soluble compound, micro scoping organism and water plants. Change of taste of water effluent of metal Ion. High turbidity in sampling site 3 Value 4.4 NTU range in observed.

Total Hardness: As (Ca & Mg) Carbonate are observed range of 170-210 mg/liter respectively of different sampling sites (Villages) High value of Hardness are due to. Hardness of water reflected the nature of the geological formation with which the water is in contact (According WHO 2012 above 300 mg/liter CaCO_3 very hard water). Mostly hard water of 6 different sites.

TDS : TDS are observed range of 230-310 mg/liter respectively of different sampling sites (Villages) High value of TDS are due to. TDS The high content of total dissolved solids increases the density of water and influences osmoregulation of fresh water organisms. They reduce solubility of gases (like oxygen) and utility of water for drinking, irrigation and human activities.

BOD: BOD is the measure of the degradable organic material present in water sample and can be defined as the amount of O_2 required by the microorganisms in stabilizing the biological degradable organic matter under aerobic conditions. BOD is measured by incubating sample at 27°C for three days. BOD value noted on 1.8-3.1 mg/l. On different sampling sites comparatively BOD value is in large sample no. 4. Another sample were showed below the permissible limit prescribed ISI 2012.

COD: The ranking were obtained from sample no. 1 - 8 in order to 13.5-19.1 mg/l. According to WHO 2011 standard drinking water agencies as per the higher value is greater than given permissible value. Indicate high value may be cause presence of content carbonaceous particle and suspended particles.

Chloride Cl : are observed range of 250-340 mg/liter respectively of different sampling station (Villages) range Chloride occurs naturally in groundwater but is found in greater concentrations where sewage water and run-off from road salts can make their way into water sources. Chloride is one of the most common anions found in tap water. It generally combines with calcium, magnesium, or sodium to form various salts: for example, sodium chloride (NaCl) is formed when chloride and sodium combine. Although chlorides are harmless at low levels, well water high in sodium chloride can damage plants if used for gardening or irrigation, and give drinking water an unpleasant taste. Over time, sodium chloride's high corrosivity will also damage plumbing, appliances, and water heaters, causing toxic metals to leach into your water. Interestingly, there is no federally enforceable standard for chlorides in drinking water, though the WHO (2012) recommends levels no higher than 250 mg/l to avoid salty tastes and undesirable odors. At levels greater than this, sodium chloride can complicate existing heart problems and contribute to high blood pressure when ingested in excess. Sample site No. 3,4,5 & 6., Investigated 300-340 mg/liter in excess value. Important for health issue.

Nitrate NO_3 : are observed range of 4.6 – 7.4 mg/liter respectively of different sampling station (Villages). Nitrate is one such widespread surface flow water pollutant, mainly emanating from

agricultural activities and improper waste disposal, posing global health concerns like blue baby syndrome, thyroid disorders, and cancers due to prolonged exposure to high concentrations. Observed value is 7.4 mg/liter Nitrate value of villages sites 8. Slightly risk for living beings & aquatic ecosystems.

Sulphate SO_4 : are observed range of 14-19 mg/liter respectively of different sampling station (Villages) Excess amount of sulphate in water has cathartic effect of human health. In areas with high Sulphate levels, plumbing materials more resistant to corrosion, such as plastic pipe, are commonly used. How can Sulphate be removed from water. Three types of treatment systems will remove sulphate from drinking water: reverse osmosis, distillation, or ion exchange. Water softeners, carbon filters, and sediment filters do not remove Sulphate. All studies sites obtain sulphate value is permissible limit.

Fluoride: range from 0.78-1.4 mg/liter. Fluoride is a geochemical containment & Natural sources account for much of the Fluoride formed in ground water. Mazar part of Fluoride is Dissolve Alkaline Element and clay minerals, dental & skeleton Fluorosis $2.5 > 1.5$ mg/liter. (1 mg/liter W.H.O. 1985) Fluorosis and the severity of the symptoms are governed by various factor Nutrition deficiencies High Ambient Temp., High Alkalinity and low Ca & Mg content in drinking water. Sampling site 1 observe value 1.4 mg/liter Fluoride contain slightly large value important for measurement and monitoring every time of River water for drinking and domestic uses.

Iron: - 0.16-0.31 mg/liter Except Iron Fe whereas the permissible limit of Fe in the potable is only 0.3 mg/liter as per W.H.O. standard 2012. Water quality stations were collected and analyzed for Iron content from Oct. to Dec. 2023. 8 water quality station were found to contain Iron concentration 0.16-0.31 mg/liter BIS has recommended 0.3 mg/liter as acceptable concentration of Iron in ground water for drinking and domestic uses. Iron is essential to almost all living things, from micro-organisms to human. Iron is the fourth most abundant elements in the earth's crust and the most abundant heavy metal. Iron, an essential element in human nutrition, is an integral component of cytochromes, porphyrins and metalloenzymes.

It can be observation that 8 village water samples collected from river water shown a concentration of Iron that is much in excess of the safe permissible limit due to High Concentration water is rendered taste less and odorous and finely not fit for human consumption. The water also Import a brownish color on the laundered clothe due to this high concentration of Iron the high concentration. Also supported growth of Iro Bactria resulting in clogging of pipes Iron (Fe) concentration therefore needs to be Reduced to render the water safe for human consumption.

Zinc (Zn): It is an essential and beneficial element for human health and aquatic ecosystem (A.k.de. 2019). In surface river water values of zinc in obtained 1.21-1.56 mg/l. This value located permissible limit.

Manganese (Mn): Mn impart objectionable and tenacious stains to laundry plumbing fixtures. It occurs in domestic waste water industrial influence and receiving strums and there by enters water bodies. The value is located and, in our research, work the ranging were absorbed range 0.042-0.074 mg/l.

Lead (Pb): range from 0.14-0.28 mg/liter. It is a serious cumulative body poisons lead entries water bodies from industrial mines and smelter discharge.

Conclusions: - Analysis of different physio-chemical parameter of Shivnath River water of Bilaspur Dist. Dagaury Village zone. They very common problem of whole purpose of human activity water is because of the Total Hardness salinity hazard (i.e., Soluble potential of Carbonate Bi-Carbonate) and Alkalinity hazard & Toxicity, Fluorosis Skelton Hazard by Chloride Nitrate sulphate Iron, Zinc, Lead, Manganese & Fluoride. Show that concentrated turbidity, Total Hardness Sulphate Fluorotic and toxic heavy metals Iron, zinc, Lead, Manganese in view of preventing these health problems.

So that the most important physio-chemical assessment at a time interval(periods) some were carried out parameter for illiterate villagers' socio economics aware for health issues leaving beings.

I. BOD : Sample site 5&6 (2.9, 3.1 mg/l).

II. COD : Sample site 1 &5 (13.5, 19.1 mg/l).

III. Iron : Sample site 3 &4 (0.16, 0.31 mg/l).

IV. Zinc : Sample site 1&3 (1.21, 1.56 mg/l).

V. Lead : Sample site 4&8 (0.14, 0.28 mg/l).

VI. Mn : Sample site 5 &2 (0.042, 0.074 mg/l).

it is suggested that the uses of multipurpose human beings river water and domestic purpose of the toxic heavy metals and Fluorotic[4]. Hard water before uses villagers may be boiled with magnesium oxides, cooled down and them filtered or treated HCL acid and Iron, zinc Isolated from suitable effluent treatment plant. A strict aquatic environment protection policy. For waste water, solid waste, domestic refused a just moment dumping, one tie used polyethnic bags, domestic effluent water and uses of pesticides agriculture industrial runoff waste water treatment in industries regulatory and need treatment plants. A measure human health and economic and aquatic ecosystem settlement.

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