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RESEARCH ARTICLE

Assessment of Water Pollution of Hasdeo River and its Surrounding Areas at Janjgir-Champa District (C.G.) India.

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Abstract

A systematic study was carried out at the period of July 2012 to Sept 2012 to explore the physico-chemical qualities and selected toxic elements in SW; especially different sampling locations of Hasdeo river and GW around the Madhyabharat Paper mills in Janjgir-champa (C.G.) India. 24 water samples were collected from eight different locations of the study area and analyzed for physical, mineral, nutrients, demand, anion, alkali and alkaline earth metals and some selected metallic elements like Fe, Zn, Mn, Cu and phenol. The obtained results were compared with standard value presented by ISI and concentration of these parameters were obtained upto alarming level. On the basis of chosen parameters for different water samples, WQI was calculated, the results were just beyond from the standard ranges: 0-50; 113.067(MS_4) to 114.267(MS_1), which showed, the investigated water sources are not fit for human development. The analytical study also indicates the needs for periodic monitoring of water sources of study areas is mandatory.

Introduction

The paper industry is one of the largest industries in India (Trivedi and Raj, 1992) and currently expanding day by day to meet the increasing demand of industrial, writing, printing, news paper and book purpose. The raw materials are jute, straw, grass, bamboo, wood, waste papers, imported pulp, inorganic chemicals and water (Pokhrel and Viraragharan, 2004). Owing to consuming of large amount of water, the paper factory is situated on the bank of river. Nearly >5 to 95% of the water is discharging as effluents, which is characterized by undesired features such as high BOD, colour, high suspended solids and presence of chemicals and toxic components such as acids, bases, dioxins and furans (Biermann, 1996; ILO, 1992; Liss, 1997). In one side, every year, this sector produces several million tons of effluents, that contaminates receiving water bodies as a resulting disrupt the ecological system, biologically dead and creating severe water pollution, but other side treated water is consider as a potential water source because it contains considerable amount of nutrients, which may be beneficial for plant growth and increasing crop yield (Kumar and Chopra, 2011; Medhi et al, 2011).

Features of the Investigation field: Madhyabharat Paper Mills is located on the right bank of river Hasdeo in Janjgir-Champa district with geographical location 22.05^{o}N to 82.65^{o}E longitude with 253 meters mean sea level. Geologically the study area is occurring in the plane area belongs to the period from archian to the recent ones. Climatically the average temperature and rainfall of the investigation area are 49^{o}C and 1152.1 mm respectively. The annual outcomes of this factory is 60 tons per day. The partially treated effluents are continuously discharged into Hasdeo river, subsequent this water source is used mainly for agricultural purpose. Therefore we have taken broadly and systematic analysis of Hasdeo river (SW) and near GW sources. This article deals with the

environmental issues associated with the physico-chemical, metallic and phenolic compound analysis of Hasdeo river and nearly situated GW and results were interpreted by the statistical quality.

Materials and Methods:

Water samples were collected on 15th date of month July' 2012 to Sept-2012 in precleanned glass and polyethylene bottle of 1L capacity separately. The collected water samples were stored in refrigerator at $4^{o}C$, while for metallic elements and phenolic compounds were preserved by adding of 2 ml conc. HNO_3 and orthophosphoric acid orderly.

Nine Parameter analyzer kit was applied for the measurement of Temperature, P^H, EC, TDS, DO and Turbidity. Mineral parameters: Total Hardness and Total alkalinity was analyzed by titration method. COD and BOD were monitored by closed reflux and incubation method at $27^{o}C$. Chloride and Fluoride was determined by SPADNS method. Nutrient parameters were fixed by spectrophotometrically. Metallic elements were found in mgL^{-1} by instrumentation method as per given in (APHA, 2005), NEERI manuals (NEERI, 1988) and (Manivaskam, 2008).

Results and Discussion:

The observed monthly results for physico-chemical and metallic elements are given in Table-I, Statistical quality are depicted in Table-II, Correlation Matrix and WQI are displayed in Table-III and Table-IV.

Physical Parameters: The high values of P^H was looked at the sampling site MS_3 (Aug'12); 7.8 but the min. P^H was found at the site MS_3(Aug'12) and MS_4(July'12); 7.19. These ranges values were under desirable and slightly alkaline in nature. The EC of an aqueous solution is measure of the ability to carry out an electric current (Parashuram and Singh, 2007). The EC was found in the ranges of 927 μScm^{-1} on the site MG_4 (Sept'12) to 1280 μScm^{-1} on the site MS_1 (July'12). These ranges are not exceed the permissible level as per prescribed by (BIS, 2012). The high suspended, colloidal and less dissolved materials are refluxed by Turbidity. The min. value of Turbidity was found at the sampling site MG_4 (Sept & July'12), 8 NTU, while max. values was found at the site MS_1(Aug'12), 82 NTU. The high value is far beyond from max permissible level; 25 NTU. The prescribed limit for TDS is 500 mgL^{-1} to 2000 mgL^{-1} as per (BIS, 2012),

Fig. I: Location of study area

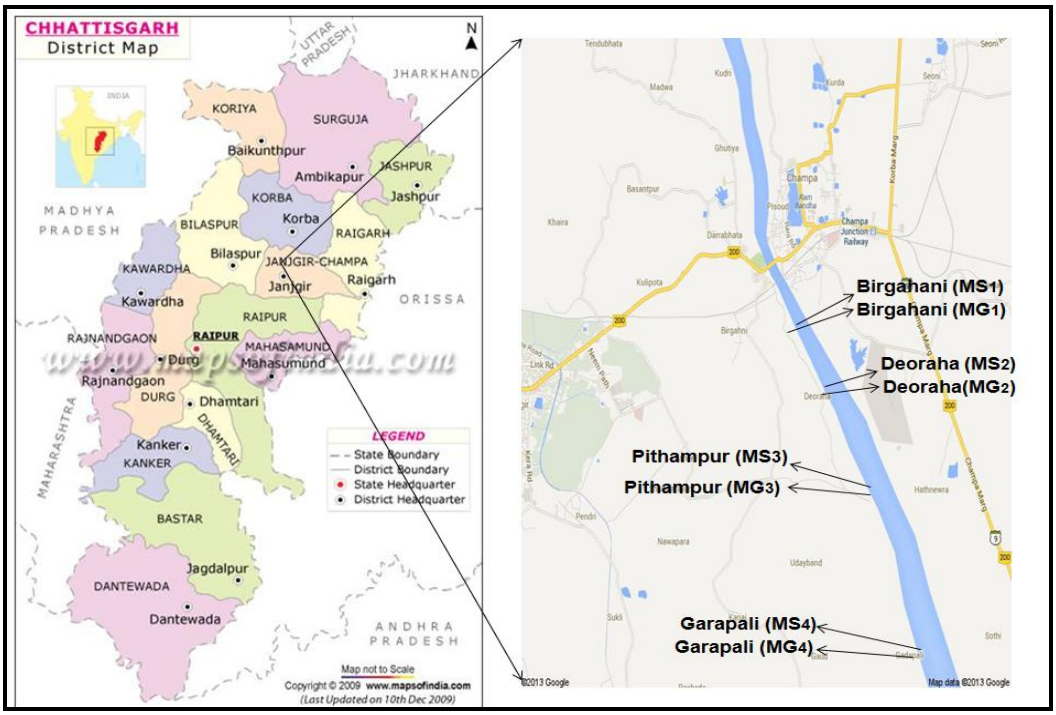

Table I: Average value of Physico-chemical and metallic element analysis.

Parameters / Sampling Spot	MS1	MG1	MS2	MG2	MS3	MG3	MS4	MG4
Temperature	28.567	28.400	28.467	28.300	28.500	28.300	28.533	28.267
P^H	7.630	7.313	7.420	7.493	7.667	7.320	7.590	7.273
Conductivity	1226.333	1170.667	1217.333	1112	1035.667	1051	1090.333	1033
Turbidity	75.667	18	62	25.667	24.333	22.667	55.667	8.667
TS	588.667	504.333	822	463.333	457	518.667	625	560.667
TDS	372.667	300	668	315.333	264	278.667	403.333	360.667
TSS	216	204.333	154	148	193	240	221.667	200
Alkalinity	523.333	623.333	552.667	628.667	353.667	426.333	198.333	361
Total Hardness	365.333	290.667	341.667	337	375.333	328.333	340.333	342
Chloride	155.557	159.150	605.100	484.967	246.883	196.1	104.547	323.513
Fluoride	0.730	0.743	0.910	0.933	0.977	0.927	1.030	0.927
Sulphate	404	273.333	446	298.333	265	220.667	359.333	280
D.O	6.513	4.617	6.450	4.620	6.240	4.153	6.560	3.733
BOD	4.090	4.343	4.863	4.590	4.373	4.470	4.057	4.420
COD	135.333	117	109.333	68	110.333	83.333	81.333	79
Nitrate	32.7	25.017	45.967	33.643	39.330	25.260	46.660	26.4
Phosphate	0.230	0.397	0.383	0.120	0.140	0.420	0.160	0.313
Sodium	349.667	415.667	357.333	544	250	519.667	260.667	424.667
Potassium	12	7.333	13.333	7	9.333	10.333	15.667	7.333
Calcium	126.133	146.587	123.060	136.967	119.8	95.960	111	131.567
Magnesium	23.753	21.647	17.413	12.913	20.937	26.573	14.620	14.673
Iron	1.717	0.730	0.857	0.763	0.750	0.757	1.213	0.553
Copper	0.014	0.008	0.006	0.079	0.011	0.011	0.264	0.020
Zinc	0.167	0.347	0.243	0.147	0.173	0.307	0.420	0.240
Manganese	0.257	0.083	0.050	0.213	0.113	0.120	0.867	0.067
Phenol	0.008	0.004	0.014	0.013	0.041	0.010	0.008	0.006

* All parameters in mg/L. except Conductivity (µ mhos/cm), Turbidity (NTU) and P^H

MS_1– Birgahani (River Water), MG_1– Birgahani (Borewell Water), MS_2– Deoraha(River Water), MG_2– Deoraha(Borewell Water), MS_3– Pithampur (River Water), MG_3– Pithampur(Borewell Water), MS_4– Garapali (River Water) MS_4– Garapali (Borewell Water).

Table II: Statistical Parameter of water Quality

Parameters	N	MEAN	S.D	S.E	%CV	MIN	MAX	RANGE	Indian Drinking water Std. IS 10500: 2012	WHO Rec.2011
Temperature	8	28.417	0.117	0.041	0.411	28.267	28.567	28.266 - 28.567	***	27-28
PH	8	7.463	0.154	0.055	2.070	7.273	7.667	7.273 -7.667	6.5-8.5	6.5-8.5
Conductivity	8	1117.042	78.979	27.923	7.070	1033	1226.333	1033 - 1226.333	***	1000
Turbidity	8	36.583	24.276	8.583	66.358	8.667	75.667	8.667 - 75.666	5-8 NTU	5 NTU
TS	8	567.458	118.326	41.834	20.852	457	822	457 - 822	520-2050	***
TDS	8	370.333	129.546	45.801	34.981	264	668	264 - 668	500-2000	1000
TSS	8	197.125	31.953	11.297	16.210	148	240	148 - 240	20-50	***

Alkalinity	8	458.417	150.435	53.187	32.816	198.333	628.667	198.333 - 628.667	300-600	***
Total Hardness	8	340.083	25.287	8.940	7.435	290.667	375.333	290.667 - 375.333	300-600	500
Chloride	8	284.477	176.653	62.456	62.098	104.547	605.1	104.547 - 605.1	200-1000	200-1000
Fluoride	8	0.897	0.106	0.038	11.826	0.730	1.030	0.73 - 1.03	1-1.2	1.5
Sulphate	8	318.333	77.086	27.254	24.216	220.667	446	220.667 - 446	200-400	250
D.O	8	5.361	1.191	0.421	22.223	3.733	6.560	3.733 - 6.56	5	***
BOD	8	4.401	0.260	0.092	5.913	4.057	4.863	4.057 - 4.863	5	***
COD	8	97.958	23.266	8.226	23.751	68	135.333	68 - 135.333	10	***
Nitrate	8	34.372	8.843	3.127	25.729	25.017	46.660	25.017 - 46.66	45	50
Phosphate	8	0.270	0.123	0.044	45.585	0.120	0.420	0.12 - 0.42	***	***
Sodium	8	390.208	107.843	38.128	27.637	250	544	250 -544	***	200
Potassium	8	10.292	3.169	1.121	30.797	7	15.667	7 - 15.667	***	***
Calcium	8	123.884	15.647	5.532	12.630	95.960	146.587	95.96 - 146.587	75-200	200
Magnesium	8	19.066	4.901	1.733	25.705	12.913	26.573	12.913 - 26.573	<30	***
Iron	8	0.918	0.373	0.132	40.684	0.553	1.717	0.553 - 1.717	0.1-1.0	0.3
Copper	8	0.052	0.089	0.031	172.844	0.006	0.264	0.006 - 0.264	0.05	2
Zinc	8	0.255	0.096	0.034	37.688	0.147	0.420	0.147 - 0.42	5	3
Manganese	8	0.221	0.270	0.096	122.239	0.050	0.867	0.05 - 0.867	0.1	0.5
Phenol	8	0.013	0.012	0.004	92.200	0.004	0.041	0.004 - 0.041	0.001	***

beyond the limit of 500 mgL^{-1} the palatability of water decreased (Chanakya and Rao, 2010). In study hour the ranges values were found from 204 mgL^{-1} (MS_3, Sept'12) to 692 mgL^{-1} (MS_2, July'12). Mineral Parameters: The main sources of alkalinity components are rocks which contain carbonate, bicarbonate, hydroxide, borates, silicates and phosphate (Patel and Patel, 2011) compounds may contribute to total alkalinity. The desirable values for total alkalinity for drinking water is 200 mgL^{-1}, where as the excess limit is 600 mgL^{-1}. Total alkalinity were observed ranging from 147 mgL^{-1} to 628.667 mgL^{-1} at the investigation site MS_4, July'12 and MG_2, Sept'12 respectively. The maximum value is crossed the excessive limit 600 mgL^{-1} due to influx of high concentration of paper mills effluent with high basic components. ISI has specified the total hardness as desirable 300 mgL^{-1} while excess permissible limit 600 mgL^{-1}. Regarding total hardness observation has been found as 275 mgL^{-1} (MG_1, July'12) to 388 mgL^{-1} (MS_2, Sept'12). The high concn. is more than desirable limit. But below the upper limit as set by ISI 600 mgL^{-1}.

Anions: The main sources of Fluoride and their concentrations in water in geological and industrial sources (De, 2008; Kannon et al, 2004). The maximum permissible limit of colourless and odourless natural pollutants Fluorides is 1.5 mgL^{-1}. The reported values were flactuated 0.3 mgL^{-1} (MS_1, July'12) to 1.05 mgL^{-1} (MS_4, July'12) which is not exceeding the upper limit; 1.5 mgL^{-1}. The natural and anthropogenic sources of Chloride in water sources is discharging of domestic sewage and weathering of rocks. The higher chlorides in water are subjected to laxative effects (Dahiya and Kaur, 1999). The obtained results were covered from 57 mgL^{-1}(MS_4, July'12) to 610 mgL^{-1} (MS_2, July'12) which is above the desirable limit; 250 mgL^{-1} but quite below the upper limit; 1000 mgL^{-1}. In excess amount of nitrate may cause methenoglobimemia in infants a disease characterized by blood changes (Olowu, 2010) . The desirable and upper limit of nitrate concentrations in drinking water is 45 mgL^{-1} and 100 mgL^{-1} respectively as per (BIS, 2012). The nitrate content in study area varied in the range 23 mgL^{-1} (MG_3, July'12) to 48.4 mgL^{-1} (MS_4, Aug'12), which is slightly cross the excessive permissible limit. Discharging of industrial water, domestic sewage and agricultural run off increase sulphate concentration in water sources. In the present analysis sulphate concentrations varied from 200 mgL^{-1} (MG_3, July'12) to 455 mgL^{-1} (MS_2, July'12) which is slightly above the upper limit; 400 mgL^{-1} as set by (BIS, 2012). The source of Phosphate is domestic sewage, detergent, agricultural effluents and industrial waste water. The phosphate content in the study was found in the ranges of 0.1 mgL^{-1} (MG_2, Aug'12 & MS_4, Sept'12) to 0.9 mgL^{-1} (MG_1 & MG_3, July'12). The ranges values are just beyond the permissible level; 0.10 mgL^{-1} as per (WHO, 2011) and (BIS, 2012) suggestion.

Demand Parameters: DO reflects the biological activity in water sources. In the Present analysis the observed DO noted from 3.52 mgL^{-1}(MG_4, July'12) to 6.84 mgL^{-1} (MS_1, Sept'12) at the period of analysis. The minimum concentration beyond the standard limit; 5 mgL^{-1} as per (BIS, 2012) suggestion, which is harmful for aquatic environment. The dissolve oxygen used by microorganisms in the biological oxidation of organic matter is measured by BOD. During the monitoring period the minm. and maxm. conc. was verified from 3.85 mgL^{-1} (MS_4, July'12) to

5 mgL^{-1} (MS_2, Aug'12), which is within the permissible limit. These values are indicated; the water sources under investigation are free from organic pollutions (Boarh and Mishra, 2010). COD of the collected water were analyzed, in the ranging from 59 mgL^{-1} (MG_4, July'12) to 146 mgL^{-1}(MS_1, Sept'12). The highest value of COD was observed at point MS_1 which could link with the more inflow of paper mills effluents in the water sources.

Alkali and Alkaline earth metallic elements: Na is the chief constituents of table salt; which is main part of human diet through it enter in body. Na is harmful to person suffering from cardiac, renal and circular diseases. In present analysis, the conc. of Na was obtained min 250 mgL^{-1} to 544 mgL^{-1} which is far beyond from the acceptable limit; 200 mgL^{-1} as set by (WHO, 2011). Potassium is an essential nutrient element, which excess amount is act as cathartic. Potassium concn. was dected in ranges from 3 mgL^{-1} (MG_1 & MG_4, July'12) to 18 mgL^{-1}(MS_1, Aug'12) . The reported high conc is above the upper limit, 10 mgL^{-1}. Calcium concentrations were found to vary from 98 mgL^{-1} (MG_3 & MG_4, July'12) to 184 mgL^{-1} (MG_1, sept'12). These values are quite above the desirable limit and just below from excessive permissible level. Mg is present in water as soluble from such as $MgSO_4$, $MgCl_2$, $MgCO_3$ etc and causing of Laxative effect. Mg content in the investigation water sample was varied from 11.12 mgL^{-1} (MG_2 & MS_4, Sept'12) to 28.42 mgL^{-1} (MS_3, July'12) in wide ranges. The high conc. of Mg compound due to influx of paper mills effluents in water sources.

Heavy Metals: copper is essential micronutrients but in high conc causes physiological effect in human beings such as gastrointestinal disturbance in adults. The observed values were ranging from 0.001 mgL^{-1} (MG_4, Sept'12) to 0.72 mgL^{-1} (MS_4, Aug'12). The high conc is cross the upper limit; 0.05 mgL^{-1} as per prescribed by ISI[9]. Mn conc was found from min conc 0.04 mgL^{-1} (MS_2, July'12 & MG_1, Sept'12) to 2.46 mgL^{-1} (MS_4, July'12). The high conc is above the max permissible level, 0.1 mgL^{-1}. Mn occurs in nature as various salts and minerals mainly it is associated with the Iron compounds. Mn is vital micronutrients (Boarh and Mishra, 2010) for both plant and animals. Zn is a nutritionally essential element which is necessary for growth and is involved in several physiological functions. In investigated samples contains, the conc. of Zn is varied from 0.04 mgL^{-1} (MS_3, Sept'12 & MG_3, Aug'12) to 0.35 mgL^{-1}(MS_3, July'12) which is within permissible limit. Iron is an essential metal and it is required for living body. It ranges connection were noted from 0.29 mgL^{-1} (MS_3, Sept'12 & MG_4, Aug'12) to 3.12 mgL^{-1} (MS_1, July'12). The high concentration is not maintained the excessive permissible level, 1.00 mgL^{-1} as per (BIS, 2012).

Phenol: phenol is aromatic organic compound and also chief chemical constituent of paper mill effluents. In collected water samples the connection were varied from 0.001 mgL^{-1} (MG_4, July'12) to 0.018 mgL^{-1} (MG_3, Aug'12). These ranges values are quite excess from permissible level 0.001 mgL^{-1}, as per (BIS, 2012).

Statistical Analysis:
% CV : The percentage of Coefficient of varience was calculated from minimum 0.411 for temperature to maximum 234.941 for Mg. The low value of % CV for temperature is indicated the variability of temperature for collected water samples are not high but the high value of % CV for Mg is clearly indicate the conc of Mg found during the investigation period is greatly vary from sample to sample.

Correlation Coefficient: In 325 relations, 178 relations were +ve and 147 relations were –ve calculated out. The max r value for + ve correlations was found 0.971 at 0.1 level for TDS vs TS which showed the chemical constituents of TDS and TS are same and min r value 0.005 at 5% level was obtained for Ca and TH. The –ve relations as max -0.985 at 0.1% level for Cl^- and TSS was obtained and min -0.004 recorded for Ca vs TDS at 5% level obtained, indicated the chloride compounds are absolutely soluble in water and not imparting in TSS as partial soluble. Other high degree +ve relations were found between DO and Temperature (r = 0.949), DO vs P^H (r = 0.813), SO_4^{2-} and Turbidity (r = 0.879), DO vs Tub (r = 0.835) BOD vs Cl^- (r = 0.905), K vs Tub (r = 0.801), SO_4^{2-} vs TDS (r = 0.841). Among selected metallic elements Mn is positively related with Fe with r value (r = 0.965). These relation show the Mn and Fe compound are associated together and found in same region.

WQI: water quality index was calculated of selected water sources as the basis of chosen water quality parameters. The results were ranging from 113.067 as the sampling side MS_4 to 114.267 as the site No MS_1. These ranges value are clearly showed that the water sources of study are in highly loading of various kinds of pollutants owing to intrusion of paper mills effluents. The orders of quality of water of selected spots are $MS_1 > MS_4 > MS_3 > MS_2 > MG_1 > MG_2 \sim MG_3 > MG_4$.

Table III: Correlation Matrix of water Quality

	Temp.	PH	Cond.	Turb.	TS	TDS	TSS	Alk.	T.H	Cl–	F–	SO42-	D.O	BOD	COD	NO3–	PO43–	Na	K	Ca	Mg	Fe	Cu	Zn	Mn	Ph
Temp.																										
PH	0.782																									
Cond.	0.488	0.131									Significant at 5% level, r > 0.649															
Turb.	0.792	0.575	0.718																							
TS	0.344	-0.063	0.554	0.643																						
TDS	0.283	-0.043	0.576	0.592	0.971																					
TSS	0.129	-0.057	-0.284	-0.021	-0.233	-0.459																				
Alk.	-0.235	-0.271	0.605	-0.020	-0.032	0.100	-0.524																			
T.H	0.440	0.731	-0.141	0.387	0.051	0.065	-0.077	-0.393																		
Cl–	-0.306	-0.187	0.213	0.014	0.436	0.616	-0.885	0.457	0.082																	
F–	-0.136	0.165	-0.680	-0.190	0.033	0.054	-0.097	-0.676	0.311	0.182																
SO42-	0.631	0.366	0.769	0.879	0.822	0.841	-0.365	0.105	0.283	0.349	-0.162															
D.O	0.949	0.813	0.474	0.835	0.474	0.456	-0.093	-0.222	0.532	-0.041	0.062	0.729														
BOD	-0.460	-0.427	0.095	-0.206	0.347	0.490	-0.702	0.491	-0.145	0.905	0.146	0.079	-0.232													
COD	0.683	0.322	0.653	0.503	0.214	0.163	0.131	0.281	0.165	-0.225	-0.714	0.415	0.531	-0.215												
NO3–	0.646	0.626	0.209	0.622	0.579	0.616	-0.352	-0.357	0.454	0.279	0.512	0.672	0.831	0.070	0.038											
PO43–	-0.323	-0.789	0.213	-0.153	0.353	0.260	0.255	0.282	-0.592	0.057	-0.393	-0.083	-0.393	0.364	0.194	-0.446										
Na	-0.829	-0.639	-0.062	-0.441	-0.284	-0.222	-0.152	0.577	-0.484	0.306	-0.194	-0.407	-0.785	0.423	-0.463	-0.660	0.338									
K	0.705	0.449	0.302	0.801	0.675	0.558	0.241	-0.498	0.295	-0.149	0.272	0.652	0.768	-0.252	0.184	0.749	-0.071	-0.589								
Ca	-0.105	-0.149	0.369	-0.195	-0.149	-0.004	-0.536	0.605	-0.329	0.231	-0.520	0.110	-0.174	0.100	0.212	-0.228	-0.087	0.120	-0.571							
Mg	-0.054	-0.391	0.276	-0.306	-0.218	-0.224	0.102	0.444	-0.787	-0.294	-0.592	-0.240	-0.251	-0.092	0.340	-0.433	0.421	0.096	-0.375	0.577						
Fe	0.760	0.632	0.576	0.866	0.243	0.151	0.287	-0.076	0.381	-0.383	-0.363	0.610	0.676	-0.603	0.534	0.303	-0.280	-0.380	0.611	-0.143	-0.198					
Cu	0.281	0.348	-0.167	0.256	0.087	0.040	0.159	-0.596	0.005	-0.302	0.549	0.174	0.321	-0.475	-0.442	0.535	-0.504	-0.328	0.561	-0.243	-0.206	0.276				
Zn	0.076	-0.302	-0.099	-0.026	0.210	0.062	0.528	-0.441	-0.582	-0.482	0.183	-0.084	-0.018	-0.313	-0.170	0.085	0.357	-0.194	0.426	-0.273	0.382	-0.043	0.562			
Mn	0.458	0.470	-0.063	0.414	0.097	0.011	0.313	-0.619	0.098	-0.457	0.410	0.244	0.450	-0.635	-0.242	0.526	-0.497	-0.428	0.667	-0.312	-0.211	0.492	0.965	0.546		
Ph	0.275	0.568	-0.340	-0.097	-0.242	-0.164	-0.229	-0.201	0.636	0.139	0.390	-0.152	0.367	0.152	0.148	0.364	-0.450	-0.452	-0.045	-0.175	-0.300	-0.179	-0.190	-0.450	-0.188	1

Table IV: Water Quality Index

Sampling Spot	∑QiWi	∑Wi	WQI = ∑QiWi / ∑Wi
MS1	22.396	0.196	114.267
MG1	22.266	0.196	113.6
MS2	22.318	0.196	113.867
MG2	22.187	0.196	113.2
MS3	22.344	0.196	114
MG3	22.187	0.196	113.2
MS4	22.370	0.196	114.133
MG4	22.161	0.196	113.067

4.Conclusion:

The observed values of study fields indicate that the quality of water fluctuated from sampling station to station. Higher values of certain parameters such as turb (82 NTU) , T. Alkalinity (698 mg/L), Total Hardness (388 mg/L), SO_4^{2-} (455 mg/L), COD (146 mg/L), Na (550 mg/L), K (18 mg/L), Mg (28.42 mg/L), Fe (3.12 mg/L), Mn (2.46 mg/L) and Phenol (0.018 mg/L) were obtained which is made not fit the water sources for drinking purpose. Hence proper care must be taken to avoid any contamination of water sources and quality be monitored periodically.

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