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**JOURNAL OF ULTRA CHEMISTRY**

An International Open Free Access Peer Reviewed Research Journal of Chemical Sciences and Chemical Engineering

website:- [www.journalofchemistry.org](http://www.journalofchemistry.org)**Pre-Monsoon Statistical Analysis of Physicochemical Parameters and Trace Metal in Ground Water of Takhatpur, Bilaspur District, Chhattisgarh, India**<sup>1</sup>RAKESH KUMAR YADAV and <sup>2</sup>M.R. AUGUR<sup>1</sup>Research Scholar Dr. C.V. Raman University, Kargi Road, Kota Bilaspur (C.G.) (India)<sup>2</sup>Govt. Agrassen PG College, Bilha Bilaspur (C.G.) (India)Corresponding Author Email:- [rakeshyadav96@gmail.com](mailto:rakeshyadav96@gmail.com), [drmmaugur@gmail.com](mailto:drmmaugur@gmail.com)<http://dx.doi.org/10.22147/juc/140203>

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**Abstract**

Natural water contaminants due to weathering of rocks and leaching of soil etc. it necessary that the quality of drinking of water should be checked of regular time interval, because due to use of contaminated drinking water. Human population suffers from varied of water borne disease. The availability of good quality water is an indispensable feature for preventing disease and improving quality of life. it is to know details about different physico-chemical and trace metals such as Temperature, pH, EC, Turbidity, TS, TSS, TDS, TH, Alkalinity, DO, BOD, COD, Chloride, Sulphate, Phosphate, Fluoride, Nitrate, Na, K, Ca, Mg, Fe, Zn, Mn, Pb used for testing of water quality. The experimental statistical value of mean, SD & %CV of Dissolved Oxygen (DO), was found in TG2 (5.57mg/L), TG2 (0.38mg/L) & TG4 (6.98mg/L) of pre-monsoon season which is above the maximum limit. And in all the sampling station the observed value of Phosphate ( $\text{PO}_4^{3-}$ ), Zinc(Zn), Manganese (Mn), Lead (Pb) are below detection limit (BDL) of pre-monsoon season.

**Key words :** Pre-Monsoon, Ground Water, Trace Metals, Statistical Analysis, Takhatpur Region.

**Introduction**

A hydrosphere word is derived from the two different word Greek- hydor "Water" and sphaira "sphere". In physical geography describes the collective mass at water found on under and over the

surface of an earth planet. The earth's hydrosphere consist of in all form's the ocean, other surface water including inland seas, lakes, and rivers, rain, underground water, ice and atmospheric water vapours. Water is a chemical substance which is made of hydrogen and oxygen in fixed ratio, having chemical formula  $\text{H}_2\text{O}$ . Its molecule contains  $\text{O}_2$  and  $\text{H}_2$  atoms

connected by covalent bonds. Water is a liquid at ambient conditions. Water is also one of the most manageable natural resources as it is capable of diversion, transport, storage, and recycling. The essential micronutrients for plants are B, Na, Cu, Fe, Mn, Zn, V, Mo, these elements are required at trace levels and, if present at higher amount exert a toxic effect. Most of these element act as components of essential enzymes. Elements such as Mn, Fe, Zn, V, and Cl are likely to take part in photosynthesis. Several other element like Cr, Ni, Fe, Mn have been found to stimulate plant growth and regarded as potential micronutrients. Out of 35 elements, 16 elements promote metabolic activity in plants [Kaur, 2015]. Takhatpur is town place and situated in the bank of Manihari River. The distance from Bilaspur headquarter is 28km. in west direction. The area of the town is around 14,420 square kilo meter. Population and density of the city is 1, 19, 325 and 135 people per square kilo meter respectively. Topographical it is located 28°8'59"N and 81°52'12"E with a height of 374.8 meter above mean sea level. The average rain fall and temperature is 1230 mm and 42°C. Around the Takhatpur town mostly paddy and wheat are cultivated. The main fruits of this area are guava and jack fruit. The water source of the Takhatpur city is open ponds Maniyari River and bore wells. Municipal wastes and sewage discharge in these water bodies, therefore water system are continually contaminated day to day. Peasant using in proportional ratio of fertilizer, pesticides and insecticide as a result water and soil both system of environment is highly polluted. Therefore we have taken to the assessment of water quality status of Takhatpur town.

## Material and Methods

### Experimental Technique

We had commenced physico – chemical analysis and monitoring of selected Heavy metals including Na, K, Fe, Mn, and Zn, in water on monthly, Pre – Monsoon basis in one consecutive season i.e. 2014, 2015 and 2016. The obtained experimental results were subjected to statistical investigation as mean, SD, %, CV.

### Sampling and Preservation Procedure:

For this purpose experiment was conducted

in the following steps:

### Choosing appropriate sampling spots:

Sampling spots had been selected as the background of the degree of pollution around the Takhatpur Urban and Rural area. The locations of sampling spots are given in Table no 1. named from **TG1 to TG8**. Takhatpur Town - TG1, Khamariya-TG2, Daukapa TG3, Belpur-TG4, Khapari-TG5, Nigarbandh -TG6, Daijabija-TG7, Rajakapa –TG8.

### Method for sample collection:

Ground water samples were collected at fixed time viz. 1st date of every month Between 9:00 am to 4:00 pm in stopper polyethylene bottles of 2L capacity, for physico – chemical analysis while glass bottles were used for heavy metals. Before sampling containers were washed in order of 6N HNO<sub>3</sub>, Tap water, Bore wells water and finally with water samples.

### Parameter and Analysis Method:

Temperature-Electrometric, pH- Electrometric, Electrical Conductivity(EC)- Electrometric, Turbidity-Turbidity metric, Total Dissolved Solid(TDS)-Gravimetric, Total Solids (TS)-Gravimetric, Total Suspended Solid(TSS)-Mathematical, Total Hardness(TH)-EDTA Titrimetric, Alkalinity-Titrimetric, Dissolved Oxygen(DO)-Electrometric, Biological Oxygen Demand(BOD)-Incubation method, Chemical Oxygen Demand(COD)-Digestion method, Chloride (Cl<sup>-</sup>)-Argentometric method, Sulphate(SO<sub>4</sub><sup>2-</sup>)-Spectrophotometric Method, Phosphate (PO<sub>4</sub><sup>3-</sup>)-SnCl<sub>2</sub> method, Fluoride(F<sup>-</sup>)-SPANDS method, Nitrate (NO<sub>3</sub><sup>-</sup>)Phenol Disulphonic Acid method, Sodium (Na)Flame emission Photometric method, Potassium(K)Flame photometric method, Calcium-EDTA Titrimetric method, Magnesium- EDTA Titrimetric method, Iron(Fe)-1,10 phenanthroline method, Zinc(Zn)-Zincon method, Manganese (Mn)-Per sulphate method, Lead (Pb)- Dithizone method.

## Result and Discussion

### Pre-Monsoon (April' 2014-March'2016) :

**Temperature:** The maximum value of Mean, SD & %CV was noted on TG8 (22.26°C), TG7 (0.94°C) & TG7

(4.29°C) respectively, the minimum value of Mean, SD & %CV was noted on TG6 (21.00°C), TG8 (0.17°C) & TG8 (0.76°C) respectively.

*pH*: The maximum value of Mean, SD & %CV was noted on TG2 (7.56), TG7 (0.41) & TG7 (5.76) respectively, the minimum value of Mean, SD & %CV was noted on TG6&TG7 (7.17), TG2 (0.15) & TG2 (2.09)

respectively.

*Electrical Conductivity*: The maximum value of Mean, SD & %CV was noted on TG4 (726.93 µmhos/cm), TG5 (8.96 µmhos/cm) & TG5 (1.23 µmhos/cm) respectively, the minimum value of Mean, SD & %CV was noted on TG1, TG7, TG8 (706.03 µmhos/cm), TG4 (3.03 µmhos/cm) & TG4 (0.41 µmhos/cm) respectively.

Table 1. Mean Value of Pre- Monsoon Season (TG1-TG8)

PARAMETERS	Mean							
	TG1	TG2	TG3	TG4	TG5	TG6	TG7	TG8
Temperature	22.101	22.256	20.936	21.856	22.909	21.004	21.72875	22.264
pH	7.219	7.568	7.519	7.555	7.416	7.179	7.175	7.396
EC	706.039	725.184	718.608	726.931	723.869	718.608	706.0388	706.039
Turbidity	4.475	4.475	4.400	4.638	4.585	4.978	4.40875	4.450
TS	456.060	456.568	449.024	448.925	454.158	452.800	450.01	451.091
TDS	444.015	444.101	438.521	438.254	443.068	441.133	438.7688	440.144
TSS	12.045	12.466	10.503	10.671	11.090	11.668	11.24125	10.948
TH	286.875	271.500	278.000	252.375	286.875	260.875	287.125	280.250
Alkalinity	281.500	268.125	259.250	263.250	281.500	344.500	278.25	252.250
DO	5.263	5.575	5.249	4.900	5.225	5.450	5.4125	4.913
BOD	1.050	1.050	0.975	1.088	0.975	1.025	1.025	1.088
COD	1.863	1.825	1.538	1.500	1.913	1.900	1.4625	1.500
Chloride(Cl <sup>-</sup> )	210.820	260.140	209.844	204.358	203.304	204.904	204.0338	204.358
Sulphate(SO <sub>4</sub> <sup>2-</sup> )	159.875	180.000	172.000	151.750	154.750	156.500	190.25	169.500
Phosphate(PO <sub>4</sub> <sup>3-</sup> )	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000
Fluoride(F <sup>-</sup> )	0.716	0.685	0.646	0.668	0.659	0.609	0.7875	0.639
Nitrate(NO <sub>3</sub> <sup>-</sup> )	37.775	42.333	39.716	42.605	38.265	40.746	41.92375	41.491
Sodium(Na)	69.125	66.875	65.375	63.500	67.500	65.375	69.125	65.375
Potassium(K)	8.676	8.668	8.769	9.171	8.921	8.070	9.5525	9.171
Calcium	67.875	68.250	67.500	67.875	70.625	67.875	68.625	67.500
Magnesium	21.250	23.750	23.625	26.875	25.875	21.875	22.5	25.625
Iron(Fe)	0.233	0.226	0.231	0.216	0.218	0.231	0.2175	0.216
Zinc(Zn)	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000
Manganese(Mn)	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000
Lead(Pb)	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000

*Turbidity*: The maximum value of Mean, SD & %CV was noted on TG6 (4.97 NTU), TG3 (0.43 NTU) & TG3 (9.79 NTU) respectively, the minimum value of Mean, SD & %CV was noted on TG3 & TG7 (4.40 NTU), TG2 & TG6 (0.11 NTU) & TG6 (2.23 NTU) respectively.

*Total Solids*: The maximum value of Mean, SD & %CV was noted on TG2 (456.56 mg/L), TG2 (9.07 mg/L) & TG2 (1.98 mg/L) respectively, the minimum value of Mean, SD & % CV was noted on TG4 (448.92 mg/L), TG7 (3.02 mg/L) & TG7(0.67 mg/L) respectively.

Table 2. SD value of Pre- Monsoon Season (TG1-TG8)

PARAMETERS	SD(Standard Deviation)							
	TG1	TG2	TG3	TG4	TG5	TG6	TG7	TG8
Temperature	0.940	0.427	0.637	0.534	0.738	0.857	0.933	0.170
pH	0.197	0.159	0.173	0.317	0.337	0.304	0.414	0.186
EC	5.942	7.857	4.359	3.036	8.962	4.359	5.942	5.942
Turbidity	0.128	0.116	0.431	0.213	0.428	0.111	0.300	0.262
TS	6.078	9.074	4.291	4.730	5.714	6.567	3.025	4.177
TDS	5.260	7.720	3.791	4.463	5.608	6.007	2.320	3.585
TSS	1.629	1.918	0.600	0.643	1.037	0.666	0.859	0.868
TH	6.958	16.639	11.364	8.280	6.958	14.865	5.489	13.328
Alkalinity	6.908	18.240	14.489	15.800	6.908	34.055	11.158	7.611
DO	0.316	0.388	0.220	0.342	0.328	0.053	0.253	0.323
BOD	0.298	0.193	0.158	0.230	0.149	0.116	0.231	0.230
COD	0.628	0.296	0.378	0.404	0.113	0.207	0.250	0.404
Chloride( $\text{Cl}^-$ )	3.962	17.506	6.139	2.307	1.731	3.173	2.804	2.307
Sulphate( $\text{SO}_4^{2-}$ )	8.576	13.877	15.982	7.960	6.018	14.560	13.477	16.501
Phosphate( $\text{PO}_4^{3-}$ )	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fluoride( $\text{F}^-$ )	0.200	0.196	0.232	0.188	0.226	0.260	0.164	0.153
Nitrate( $\text{NO}_3^-$ )	5.187	3.173	2.210	1.128	3.079	3.348	2.387	0.282
Sodium(Na)	3.758	2.900	2.825	4.440	3.295	2.825	3.758	2.825
Potassium(K)	0.808	0.466	0.851	0.424	0.404	0.461	0.460	0.424
Calcium	4.121	2.816	1.773	1.553	2.326	1.553	2.825	2.070
Magnesium	3.327	2.866	1.598	1.642	3.441	2.295	0.756	2.504
Iron(Fe)	0.038	0.049	0.050	0.052	0.054	0.050	0.054	0.052
Zinc(Zn)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Manganese (Mn)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lead(Pb)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

**Total Dissolved Solids:** The maximum value of Mean, SD & %CV was noted on TG2 (444.10 mg/L), TG2 (7.72 mg/L) & TG2 (1.73 mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG4 (438.25 mg/L), TG7(2.32 mg/L) & TG7(0.52 mg/L) respectively.

**Total Suspended Solids:** The maximum value of Mean, SD & %CV was noted on TG2 (12.46 mg/L), TG2 (1.91 mg/L) & TG2 (15.38 mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG3 (10.50 mg/L), TG3(0.60 mg/L) & TG6(5.70 mg/L) respectively.

**Total Hardness:** The maximum value of Mean, SD & %CV was noted on TG7 (287.12 mg/L), TG2 (16.63 mg/L) & TG2(6.12 mg/L) respectively, the minimum value

of Mean, SD & %CV was noted on TG4 (252.37 mg/L), TG7(5.48 mg/L) & TG7(1.91 mg/L) respectively.

**Alkalinity:** The maximum value of Mean, SD & %CV was noted on TG6 (344.50 mg/L), TG6 (34.05 mg/L) & TG6 (9.88 mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG8 (252.25 mg/L), TG1 & TG5(6.90 mg/L) & TG1 & TG5 (2.45 mg/L) respectively.

**Dissolved Oxygen:** The maximum value of Mean, SD & %CV was noted on TG2 (5.57 mg/L), TG2 (0.38 mg/L) & TG4 (6.98 mg/L) respectively, the minimum value

Table 3. %CV value of Pre- Monsoon Season (TG1-TG8)

PARAMETERS	%CV(Percentage Coefficient)							
	TG2	TG3	TG4	TG5	TG6	TG7	TG8	
Temperature	4.255	1.921	3.041	2.444	3.222	4.081	4.294	0.762
pH	2.735	2.095	2.301	4.198	4.542	4.230	5.767	2.513
EC	0.842	1.083	0.607	0.418	1.238	0.607	0.842	0.842
Turbidity	2.864	2.603	9.794	4.601	9.334	2.234	6.795	5.885
TS	1.333	1.987	0.956	1.054	1.258	1.450	0.672	0.926
TDS	1.185	1.738	0.864	1.018	1.266	1.362	0.529	0.814
TSS	13.526	15.389	5.714	6.023	9.355	5.705	7.642	7.925
TH	2.425	6.129	4.088	3.281	2.425	5.698	1.912	4.756
Alkalinity	2.454	6.803	5.589	6.002	2.454	9.885	4.010	3.017
DO	6.004	6.964	4.188	6.985	6.285	0.981	4.678	6.568
BOD	28.344	18.355	16.217	21.105	15.262	11.366	22.581	21.105
COD	33.706	16.241	24.568	26.904	5.888	10.896	17.118	26.904
Chloride(Cl <sup>-</sup> )	1.879	6.730	2.926	1.129	0.851	1.549	1.374	1.129
Sulphate(SO <sub>4</sub> <sup>2-</sup> )	5.364	7.709	9.292	5.245	3.889	9.304	7.084	9.735
Phosphate(PO <sub>4</sub> <sup>3-</sup> )	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fluoride(F <sup>-</sup> )	27.943	28.597	35.900	28.150	34.296	42.669	20.852	23.999
Nitrate(NO <sub>3</sub> <sup>2-</sup> )	13.731	7.495	5.564	2.647	8.048	8.217	5.693	0.679
Sodium(Na)	5.437	4.337	4.322	6.992	4.882	4.322	5.437	4.322
Potassium(K)	9.316	5.382	9.704	4.628	4.528	5.711	4.816	4.628
Calcium	6.071	4.126	2.626	2.288	3.294	2.288	4.117	3.067
Magnesium	15.658	12.068	6.764	6.110	13.298	10.492	3.360	9.770
Iron(Fe)	16.216	21.773	21.614	24.211	24.790	21.614	24.790	24.211
Zinc(Zn)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Manganese(Mn)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lead(Pb)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

of Mean, SD & %CV was noted on TG4 (4.90 mg/L), TG6(0.05 mg/L) & TG6 (0.98 mg/L) respectively.

*Biological Oxygen Demand:* The maximum value of Mean, SD & %CV was noted on TG4 &TG8 (1.08 mg/L), TG1 (0.29 mg/L) & TG1 (28.34 mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG3 & TG5(0.97 mg/L), TG6(0.11 mg/L) & TG6(11.36 mg/L) respectively.

*Chemical Oxygen Demand:* The maximum value of Mean, SD & %CV was noted on TG5 (1.91 mg/L), TG1 (0.62 mg/L) & TG1 (33.70 mg/L) respectively, the

minimum value of Mean, SD & %CV was noted on TG7 (1.46 mg/L), TG5 (0.11 mg/L) & TG5 (5.88 mg/L) respectively.

*Chloride:* The maximum value of Mean, SD & %CV was noted on TG2 (260.14 mg/L), TG2 (17.50 mg/L) & TG2 (6.73 mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG5 (203.30 mg/L), TG5 (1.73 mg/L) & TG5 (0.85 mg/L) respectively.

*Sulphate:* The maximum value of Mean, SD & %CV was noted on TG7 (190.25 mg/L), TG8 (16.50 mg/L) & TG8 (9.73 mg/L) respectively, the minimum value of

Mean, SD & %CV was noted on TG4 (151.75 mg/L), TG5(6.01 mg/L) & TG5(3.88 mg/L) respectively.

**Phosphate:** Below Detection Limit

**Fluoride:** The maximum value of Mean, SD & %CV was noted on TG7 (0.78 mg/L), TG6 (0.26 mg/L) & TG6 (42.66 mg/L) respectively, the minimum value of Mean, SD & % CV was noted on TG6 (0.60 mg/L), TG8(0.15 mg/L) & TG7(20.85 mg/L) respectively.

**Nitrate:** The maximum value of Mean, SD & %CV was noted on TG4 (42.60 mg/L), TG1 (5.18 mg/L) & TG1 (13.73 mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG1 (37.77 mg/L), TG8 (0.28 mg/L) & TG8 (0.67 mg/L) respectively.

**Sodium:** The maximum value of Mean, SD & %CV was noted on TG1 & TG7 (69.12 mg/L), TG4 (4.44 mg/L) & TG4 (6.99 mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG4(63.50 mg/L), TG3 & TG8(2.82 mg/L) & TG3, TG6 & TG8(4.32 mg/L) respectively.

**Potassium:** The maximum value of Mean, SD & %CV was noted on TG7 (9.55 mg/L), TG3 (0.85 mg/L) & TG3 (9.70 mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG6 (8.07 mg/L), TG5 (0.40 mg/L) & TG5 (4.52 mg/L) respectively.

**Calcium:** The maximum value of Mean, SD & %CV was noted on TG5 (70.62 mg/L), TG1 (4.12 mg/L) & TG1 (6.07 mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG8 (67.50 mg/L), TG4 & TG6 (1.55 mg/L) & TG4 & TG6 (2.28 mg/L) respectively.

**Magnesium:** The maximum value of Mean, SD & %CV was noted on TG4 (26.87 mg/L), TG5 (3.44 mg/L) & TG1 (15.65 mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG1 (21.25 mg/L), TG8(0.75 mg/L) & TG7(3.36 mg/L) respectively.

**Iron:** The maximum value of Mean, SD & %CV was noted on TG1, TG3 & TG6(0.23 mg/L), TG3, TG4, TG5, TG6, TG7 & TG8 (0.05 mg/L) & TG5 & TG7 (24.79mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG4, TG5, TG7 & TG8(0.21 mg/L),

TG1(0.03 mg/L) & TG1 (16.21 mg/L) respectively.

**Zinc:** Below Detection Limit

**Manganese:** Below Detection Limit

**Lead:** Below Detection Limit

## Conclusion

The systematic exploration has been taken in to consideration to assess the different water quality parameters of Takhatapur area. C.G. India. Physicochemical parameter with some heavy metals Iron, Zinc, Manganese and Lead, their obtained value is compared with the national and international water quality regulatory authority (BIS and WHO).

The experimental statistical value of mean, SD & % CV of Dissolved Oxygen (DO), was found in TG2 (5.57mg/L), TG2 (0.38mg/L) & TG4 (6.98mg/L) of pre-monsoon season which is above the maximum limit. And in all the sampling station the observed value of Temperature, pH, Electrical Conductivity (EC), Turbidity, Total Dissolved Solid(TDS), Total Dissolved Solid(TDS), Total Solids (TS), Total Suspended Solid (TSS), Total Hardness (TH), Alkalinity, Biological Oxygen Demand(BOD), Chemical Oxygen Demand (COD), Chloride( $\text{Cl}^-$ ), Sulphate( $\text{SO}_4^{2-}$ ), Fluoride( $\text{F}^-$ ), Nitrate( $\text{NO}_3^-$ ), Sodium(Na), Potassium(K), Calcium, Magnesium, Iron(Fe) are under the desirable limit of pre-monsoon season. And in all the sampling station the observed value of Phosphate ( $\text{PO}_4^{3-}$ ), Zinc(Zn), Manganese (Mn), Lead (Pb) are below detection limit (BDL) of pre-monsoon season.

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