



**POST-MONSOON SEASON SELECTED PHYSICOCHEMICAL  
PARAMETERS & TRACE METALS FOR TESTING OF GROUND  
WATER OF TAKHATPUR AREA, BILASPUR, CHHATTISGARH,  
INDIA**

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**ABSTRACT**

*Due to increased human population, use of fertilizers and man-made activity water is highly polluted with different harmful contaminants. 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 physicochemical parameters such as TS, TSS, TDS, TH, DO, BOD, COD, Chloride, Fluoride, Na, K, Ca, Mg, Fe, Zn, Mn, Pb & Statistical analysis (Mean, SD, %CV) used for testing of water quality.*

**Key Words:** Post-Monsoon Season (Nov'2014-Feb'2016), Ground Water, Physicochemical, Trace metals, Selected Parameters, Statistical Analysis, Takhatpur area.

## **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  $H_2O$ . Its molecule contains  $O_2$  and  $H_2$  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  $28^{\circ}8'59''N$  and  $81^{\circ}52'12''E$  with a height of 374.8 meter above mean tea level. The average rain fall and temperature is 1230 mm and  $42^{\circ}c$ . Around the Takhatpur town mostly paddy and wheat are cultivated. The main fruits of this area are gave 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 Method

### 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 Tableno1.named from **TG1 to TG8**. Takhatput Town - TG1, Khamariya-TG2, Daukapa TG3, Belpan-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 physic – 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:

Total Dissolved Solid(TDS)-Gravimetric, Total Solids (TS)-Gravimetric, Total Suspended Solid(TSS)-Mathematical, Total Hardness(TH)-EDTA Titrimetric, Dissolved Oxygen(DO)-Electrometric, Biological Oxygen Demand(BOD)-Incubation method, Chemical Oxygen Demand(COD)-Digestion method, Chloride(CL<sup>-</sup>)-Argentometric method, Fluoride(F<sup>-</sup>)-SPANDS 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

**Total Solids:** The maximum value of Mean, SD & %CV was noted on TG3 (440.36mg/L), TG8 (13.04mg/L)& TG8 (2.98mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG2 (413.99mg/L), TG2 (3.36mg/L)& TG2 (0.81mg/L) respectively.

**Total Dissolved Solids:** The maximum value of Mean, SD & %CV was noted on TG3 (425.05mg/L), TG8 (13.31mg/L)& TG8 (3.14mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG2 (401.63mg/L), TG2 (3.46mg/L)& TG2 (0.86mg/L) respectively.

**Total Suspended Solids:** The maximum value of Mean, SD & %CV was calculated on TG3 (15.30mg/L), TG6 (2.21mg/L) & TG4, TG6 (16.12mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG1 (12.16mg/L), TG5 (0.96mg/L) & TG4 (7.18mg/L) respectively.

**Total Hardness:** The maximum value of Mean, SD & %CV was noted on TG2 (234.37mg/L), TG2 (12.18mg/L) & TG2 (5.20mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG1 (217.37mg/L), TG5 (5.39mg/L) & TG5 (2.47mg/L) respectively.

**Dissolved Oxygen:** The maximum value of Mean, SD & %CV was noted on TG4 (6.45mg/L), TG3 & TG7 (0.65mg/L) & TG3 & TG7 (11.32mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG1 (5.12mg/L), TG2 (0.03mg/L) & TG2 (0.57mg/L) respectively.

**Table: 1 Mean value of Post-monsoon Season (Nov'2014-Feb'2016)**

PARAMETERS	Mean							
	TG1	TG2	TG3	TG4	TG5	TG6	TG7	TG8
TS	417.390	413.990	440.363	437.168	414.983	418.400	437.1975	437.568
TDS	405.226	401.635	425.056	422.535	402.639	404.665	422.3538	423.146
TSS	12.164	12.355	15.306	14.633	12.344	13.735	14.84375	14.546
TH	217.375	234.375	228.000	228.000	217.750	226.625	228	228.000
DO	5.128	5.454	5.763	6.450	5.388	5.488	5.7625	5.663
BOD	1.575	1.125	1.113	1.263	1.663	1.713	1.5	1.388
COD	1.788	1.613	1.650	1.750	1.863	1.713	1.6625	1.663
CHLORIDE(Cl <sup>-</sup> )	170.983	169.138	168.446	167.208	167.208	166.155	165.655	165.204
FLUORIDE(F <sup>-</sup> )	0.600	0.758	0.488	0.820	0.750	0.675	0.6375	0.758
SODIUM(Na)	67.250	67.750	68.125	65.625	65.500	62.500	67.5	70.125
POTASSIUM(K)	7.381	8.435	8.841	9.041	8.371	7.604	8.575	9.014
CALCIUM	58.000	57.125	57.375	56.375	58.750	58.125	58.25	57.500
MAGNESIUM	16.375	17.625	23.250	23.500	21.250	19.625	22.625	24.375
IRON(Fe)	0.200	0.238	0.218	0.191	0.213	0.313	0.19625	0.219
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

**Biological Oxygen Demand:** The maximum value of Mean, SD & %CV was examined on TG6 (1.71mg/L), TG6 (0.21mg/L) & TG2 (16.28mg/L) respectively, the minimum value of

Mean, SD & %CV was noted on TG3 (1.11mg/L), TG3 (0.13mg/L)& TG5 (9.05mg/L) respectively.

**Chemical Oxygen Demand:** The maximum value of Mean, SD & %CV was noted on TG5 (1.86mg/L), TG1 (0.25mg/L)& TG1 (14.47mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG2 (1.61mg/L), TG3 &TG6 (0.12mg/L)& TG3 (7.24mg/L) respectively.

**Chloride:** The maximum value of Mean, SD & %CV was calculated on TG1 (170.98mg/L), TG1 (3.83mg/L)& TG1 (2.24mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG8 (165.20mg/L), TG8 (1.98mg/L)& TG8 (1.20mg/L) respectively.

**Fluoride:** The maximum value of Mean, SD & %CV was examined on TG4 (0.82mg/L), TG3 (0.21mg/L)& TG3 (44.45mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG3 (0.48mg/L), TG2 (0.09mg/L)& TG2 (12.87mg/L) respectively.

**Table: 2 SD value of Post-monsoon Season(Nov'2014-Feb'2016)**

PARAMETERS	SD							
	TG1	TG2	TG3	TG4	TG5	TG6	TG7	TG8
TS	7.188	3.367	12.088	8.569	3.808	6.551	8.547	13.045
TDS	7.785	3.463	11.758	8.763	3.754	6.288	8.265	13.313
TSS	1.595	1.076	1.830	1.051	0.960	2.214	1.367	1.246
TH	5.805	12.188	10.309	10.309	5.392	8.501	10.309	10.309
DO	0.102	0.032	0.652	0.151	0.196	0.290	0.652	0.151
BOD	0.205	0.183	0.136	0.177	0.151	0.210	0.151	0.164
COD	0.259	0.173	0.120	0.141	0.160	0.125	0.160	0.192
CHLORIDE(CI <sup>-</sup> )	3.836	3.349	3.241	2.497	2.497	2.624	3.032	1.986
FLUORIDE(F <sup>-</sup> )	0.131	0.098	0.217	0.175	0.174	0.139	0.141	0.131
SODIUM(Na)	3.536	3.694	2.900	3.852	2.449	5.757	2.673	3.314
POTASSIUM(K)	0.532	0.070	0.241	0.695	0.165	0.270	0.192	0.675
CALCIUM	1.852	2.295	3.662	4.749	1.753	1.642	3.655	4.342
MAGNESIUM	1.768	1.506	2.493	2.449	1.669	2.504	2.560	1.685
IRON(Fe)	0.076	0.151	0.099	0.072	0.083	0.230	0.065	0.058
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

**Nitrate:** The maximum value of Mean, SD & %CV was noted on TG2 (37.04mg/L), TG2 (4.35mg/L)& TG2 (11.76mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG5 (30.78mg/L), TG8 (0.17mg/L)& TG8 (0.53mg/L) respectively.

**Sodium:** The maximum value of Mean, SD & %CV was calculated on TG8 (70.12mg/L), TG6 (5.57mg/L)& TG6 (9.21mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG6 (62.50mg/L), TG5 (2.44mg/L) &TG5 (3.74mg/L) respectively.

**Potassium:** The maximum value of Mean, SD & %CV was examined on TG4 (9.04mg/L), TG4 (0.69mg/L)& TG4 (7.68mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG1 (7.38mg/L), TG2 (0.07mg/L)& TG2 (0.82mg/L) respectively.

**Calcium:** The maximum value of Mean, SD & %CV was noted on TG7 (58.25mg/L), TG4 (4.74mg/L)& TG4 (8.42mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG4 (56.37mg/L), TG6 (1.64mg/L)& TG6 (2.82mg/L) respectively.

**Table: 1 %CV value of Post-monsoon Season(Nov'2014-Feb'2016)**

PARAMETERS	%CV							
	TG1	TG2	TG3	TG4	TG5	TG6	TG7	TG8
TS	1.722	0.813	2.745	1.960	0.918	1.566	1.955	2.981
TDS	1.921	0.862	2.766	2.074	0.932	1.554	1.957	3.146
TSS	13.110	8.709	11.955	7.182	7.774	16.121	9.209	8.567
TH	2.670	5.200	4.522	4.522	2.476	3.751	4.522	4.522
DO	1.983	0.579	11.320	2.344	3.637	5.285	11.320	2.659
BOD	13.034	16.287	12.191	14.002	9.058	12.264	10.079	11.835
COD	14.477	10.709	7.244	8.081	8.580	7.278	9.612	11.565
CHLORIDE(Cl <sup>-</sup> )	2.243	1.980	1.924	1.493	1.493	1.579	1.830	1.202
FLUORIDE(F <sup>-</sup> )	21.822	12.872	44.454	21.382	23.193	20.574	22.084	17.310
SODIUM(Na)	5.257	5.452	4.257	5.870	3.740	9.211	3.959	4.726
POTASSIUM(K)	7.203	0.826	2.731	7.683	1.976	3.546	2.243	7.490
CALCIUM	3.192	4.018	6.383	8.424	2.983	2.825	6.274	7.552
MAGNESIUM	10.796	8.544	10.722	10.423	7.854	12.757	11.315	6.913
IRON(Fe)	37.796	63.408	45.498	37.543	39.272	73.446	33.016	26.705
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

**Magnesium:** The maximum value of Mean, SD & %CV was calculated on TG8 (24.37mg/L), TG7 (2.56mg/L)& TG6 (12.75mg/L) respectively, the minimum value of

Mean, SD & %CV was noted on TG1 (16.37mg/L), TG2 (1.50mg/L)& TG8 (6.91mg/L) respectively.

**Iron:** The maximum value of Mean, SD & %CV was noted on TG2 (0.23mg/L), TG6 (0.23mg/L)& TG6 (73.44mg/L) respectively, the minimum value of Mean, SD & %CV was noted on TG4 & TG7 (0.19mg/L), TG8 (0.05mg/L)& TG8 (26.70mg/L) respectively.

**Zinc:**In all the sampling station the observed value of Zn was below detection limit (BDL).

**Manganese:**In all the sampling station the observed value of Mn was below detection limit (BDL).

**Lead:**In all the sampling station the observed value of Pb was below detection limit (BDL).

## 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 TG4 (6.45mg/L) of post-monsoon season which is above the maximum limit. And in all the sampling station the observed value of Total Dissolved Solid(TDS), Total Dissolved Solid(TDS), Total Solids (TS), Total Suspended Solid(TSS), Total Hardness(TH), Biological Oxygen Demand(BOD), Chemical Oxygen Demand(COD), Chloride( $Cl^-$ ), Fluoride( $F^-$ ), Sodium(Na), Potassium(K), Calcium, Magnesium, Iron(Fe) are under the desirable limit of post-monsoon season. And in all the sampling station the observed value of Zinc(Zn), Manganese (Mn), Lead (Pb) are below detection limit (BDL) of post-monsoon season.

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