

Analysis of Ground Water Quality

Neelu Singhai

Assistant Professor Chemistry

Govt. M.V.M. Bhopal

ABSTRACT

Quality of ground water of Kolar area, Bhopal, M.P, India. has been determined by analyzing its physico chemical Parameters such as Temperature, Turbidity, pH, Electrical conductivity (EC), Total Dissolved Solids (TDS), Total Alkalinity (TA), Total Hardness (TH), Calcium Hardness (CaH), Magnesium Hardness (MgH), Chloride (Cl), Sulphate (SO₄) and Nitrate (NO₃). Samples were analyzed for a periods of one year from November 2015 to October 2016. Statistical analysis of the data is presented to determine correlation among various parameters.

INTRODUCTION

The quality of potable drinking water has been a major issue in the developing nations for the last few decades ^[1]. The quality of water is a vital concern for mankind, since it is directly linked with human welfare. The natural aquatic resources are causing heavy and varied pollution in aquatic environment leading to water quality and depletion of aquatic biota due to increased human population, use of fertilizers in agriculture and man-made activity. Therefore it is necessary to check drinking water quality at regular time interval. Ground water is ultimate and most suitable fresh water resource. The problem in case of water quality monitoring is the complexity associated with analysis of the large number of measured variables. In recent years an easier and simpler approach based on statistical correlation, has been developed using mathematical relationship for comparison of physico chemical parameters ^[2]. In Present Study involves the Analysis of ground water quality in terms of physico chemical parameters of Kolar area, Bhopal, M.P, India.

Materials and methods

Sample Collection

Samples from tube well were collected from the outlet after flushing water for 10–15 minutes in order to remove the stagnant water. All the samples collected in tight capped high quality sterilized polyethylene bottles were immediately transported to the laboratory under low temperature conditions in ice boxes. The samples were stored in the laboratory at 4°C until processed/analyzed. The collected samples were kept in the refrigerator maintained at 4°C and analyzed for a few important parameters in order to have an idea on the quality of drinking water. Standard procedures involving AAS spectrophotometers, flame photometry and volumetric analysis and other related instruments were used for the determination of temperature, turbidity, pH, electrical conductivity, total dissolved solids, total alkalinity, total hardness, calcium hardness, magnesium hardness, sulphate, chloride and nitrate ^[2]. All the chemicals used were of AR grade. SPSS® statistical package was

used for correlation studies among various Parameters.

Results and discussion

The monthly variation in physico chemical Parameters are presented in Table 1. Physical and chemical properties of tube well water as per IS 10500-2012 are presented in Table 2.

Temperature

Water temperature plays an important role in deciding the chemical, Biochemical and Biological characteristics of water body^[3]. In the present study water temperature varies from 24.6°C to 27.2°C. The maximum (27.2°C) temperature was recorded in the month of May (summer) and minimum (22.5°C) in the month of December (winter).

Turbidity

Suspension of particles in water interfering with passage of light is called turbidity. As per IS: 10500-2012 the acceptable and permissible limits of turbidity are 1 and 5 NTU respectively. In the present study water turbidity varies from 0.2 to 2.6 NTU. The maximum (2.60) turbidity was recorded in the month of May (summer) and minimum (0.2) in the month of January (winter).

pH

As per IS: 10500-2012 desirable limit for pH is 6.5-8.5 and no relaxation in permissible limit. In the Present Study water pH varies from 7.20 to 8.52. The maximum pH value (8.52) was recorded in the month of March and minimum (7.20) in the month of July.

Electrical conductivity

Conductivity is the capacity of water to carry an electrical current and varies both with number and types of ions the solution contains. In the present study water EC varies from 482 to 542 μ Mho. The maximum EC (542) was recorded in the month of June (summer) and minimum (482) in the month of February (winter).

Total dissolved Solids

High values of TDS in ground water are generally not harmful to human beings but high concentration of these may affect persons who are suffering from kidney and heart diseases. TDS values in the studied area varied between 183-280 mg/L. As per IS: 10500-2012 desirable limit and permissible limit for TDS is 500 and 2000 mg/l respectively.

Total Alkalinity

Various ionic species that contribute to the alkalinity include hydroxide, carbonates, bicarbonates and organic acids. Alkalinity value in the studied domestic area varied between 140 -218 mg/l. As per IS: 10500-2012 desirable limit and permissible limit for total alkalinity is 200 and 600 mg/l respectively.

Hardness

The total hardness is relatively high in all samples due to the presence of calcium, magnesium, chloride and sulphate ions. Hardness value in the studied area varied between 280-396 mg/l. The maximum value of hardness (396) was recorded in the month of April (summer) and minimum (270) in the month of December. Hujare reported total hardness was high during summer than monsoon and winter^[4]. High value of hardness during summer can be attributed to decrease in water volume and increase of rate of

evaporation of water. As per IS: 10500-2012 desirable limit and permissible limit for hardness lies between 200 to 600 mg/l respectively.

Calcium Hardness

Calcium hardness value in the studied area varied between 116-186 mg/l. If calcium is present beyond the maximum acceptable limit, it causes incrustation of pipes, poor lathering and deterioration of the quality of clothes. As per IS: 10500-2012 desirable and permissible limit for calcium is 75 and 200 mg/l respectively.

Magnesium Hardness

Magnesium hardness value in the studied area varied between 112-216 mg/l. Too high magnesium will adversely affect crop yields as the soils become more alkaline. As per IS: 10500-2012 desirable and permissible limit for Magnesium is 30 and 100 mg/l respectively.

Chloride

Chloride value in the studied area varied between 175-238 mg/l. The maximum value (238mg/l) was recorded in the month of June (summer) and minimum value (175 mg/l) in the month of February. Similar results were also reported earlier ^[5]. As per IS: 10500-2012 desirable and permissible limit for chloride is 250 and 1000 mg/l respectively.

Sulphate

Sulphate occurs naturally in water as a result of leaching from gypsum and other common minerals. Sulphate value in the studied area varied between 54-95 mg/l. Ingestion of water with high sulphates causes laxative effect and

gastro-intestinal irritation. As per IS: 10500-2012 Desirable and permissible limit for Sulphate is 200 and 400 mg/l respectively.

Nitrate

Ground water contains nitrate due to leaching of nitrate with the percolating water and by sewage and other wastes rich in nitrates. Nitrate value in the studied area varied between 22-49 mg/l. As per IS: 10500-2012 desirable limit for nitrate is maximum 45 and no relaxation in permissible limit.

Correlation Studies

Interrelationship studies among different water quality parameters are very helpful in understanding geochemistry of the studied area. The regression equations for the parameters having significant correlation coefficients are useful to estimate the concentration of other constituents. Values of correlation coefficient among different parameters are presented in

Table3. A positive and significant correlation has been observed among various parameters. Temperature shows significant correlation with turbidity and TDS indicating that turbidity and TDS increases with rise in temperature. Alkalinity shows significant correlation with calcium indicating that the alkaline nature of ground water is mainly due to calcium salts. Calcium shows good correlation with chloride indicating that calcium is associated with chloride in water of the studied area. Conductivity shows significant correlation with calcium and chloride which reveals that conductance of water samples is mainly due to calcium and chloride in the ground water of the studied area. Magnesium shows good correlation with sulphate and nitrate indicating that magnesium is in the form of magnesium sulphate and magnesium nitrate in the ground water of the studied area.

Section 1.01 Conclusions

Section 1.02 Over exploitation of resources and improper waste disposal practices affected the drinking water quality. According to WHO, nearly 80% of all the diseases in human beings are caused by

Section 1.03 water [6]. Results of physicochemical parameters of the samples collected from November 2015 to October 2016 shown that some of the parameters are well in a compliance and agreement within water quality standards as per IS: 10500-2012. Interpretation of data through correlation studies shows that ground water of the area is slightly polluted and appropriate treatment will be needed for future use of water in the region to protect human beings from adverse health effects. It is, therefore, immediately required that the water source be properly protected from potential contaminants. The above analysis is also cost effective and time saving because statistical equations used for calculating the value of physicochemical parameters and to measure the extent of pollution in ground water of the study area.

Section 1.04

Section 1.05 References

[1] Tamminen S. and Helena Ramos & Didia C, (2008): *Water Resour Manage* (22:1579–1607DOI 10.1007/s11269-008-9244-x)

[1] Chakrabarty S. and Sarma H.P. (2011): A statistical approach to multivariate analysis of drinking water quality in Kamrup district, Assam, India, *Archives of Applied Sci. Research*, 3(5), 258-264.

[2] APHA (1996): Standard methods for the examination of water and waste water, Public Health Association, 19th ed., Washington DC.

[3] Salve, V. B. and Hiware C. J. (2008): Study on water quality of Wanparakalpa reservoir Nagpur, *J. Aqua. Biol.*, 21(2), 113-117.

[4] Hujare, M. S. (2008): Seasonal variation of physico-chemical parameters in the perennial tank of Talsande, Maharashtra. *Ecotoxicol. Environ. Monit.* 18(3): 233-242.

[5] Swaranlatha, S. and Narsingrao A. (1998): Ecological studies of Banjara lake with reference to water pollution. *J. Envi. Biol.*, 19(2), 179-186.

[6] Dilli Rani G., Suman M., Narasimha Rao C., Reddi Rani P., Prashanth V. G., Prathibha R. and Venkateswarlu P. (2011): *Current World Environment*, 6(1), 191-196.

Table-1
Physico Chemical Parameters

	Temp	Turb	pH	EC	TDS	TA	TH	CaH	MgH	Cl	SO ₄	NO ₃
Unit	^o C	NTU		μMho	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Nov-15	25.4	0.9	7.42	532	223	177	290	178	112	234	54	46
Dec-16	24.6	0.6	7.22	520	204	157	270	130	140	204	61	44
Jan-16	25	0.2	8.22	540	250	198	280	180	100	234	47	48
Feb-16	25.6	0.3	8.34	482	183	147	282	116	166	175	64	34
Mar-16	26.2	1.2	8.52	529	247	218	380	182	198	228	67	44
Apr-16	26.8	1.4	8.44	520	257	200	396	180	216	219	89	45
May-16	27.2	2.6	8.1	524	280	184	392	180	212	200	95	49
Jun-16	27.1	3	7.25	542	270	190	388	186	202	238	79	42
Jul-16	26.7	2.3	7.2	530	189	140	310	150	160	210	81	46
Aug-16	26.5	2.5	8.2	510	180	149	315	152	163	195	71	38
Sep-16	26.2	0.7	7.44	521	197	151	300	170	130	218	69	22
Oct-16	26.1	1.2	7.77	522	200	160	287	173	114	224	59	20

Table 2
Physical and chemical properties of tube well water as per IS 10500-2012

S No.	Parameter	Unit	Accept. Limit	Permi. Limit
1	Color	Hazen	5	15
2	pH		6.5-8.5	No relaxation
3	Turbidity	NTU	1	5
4	Total Dissolved Solid	mg/l	500	2000
5	Total Alkalinity	mg/l	200	600
6	Total Hardness	mg/l	200	600
7	Calcium	mg/l	75	200
8	Magnesium	mg/l	30	100
9	Sulphate	mg/l	200	400
10	Nltrate	mg/l	45	No relaxation
11	Chloride	mg/l	250	1000

Table 3
Correlation Coefficients

	Temp	Turb	pH	EC	TDS	TA	TH	CaH	MgH	Cl	SO ₄	NO ₃
Temp	1											
Turb	0.87	1										
pH	-0.02	-0.17	1									
EC	0.15	0.28	-0.37	1								
TDS	0.38	-0.29	0.21	0.57	1							
TA	0.09	0.01	0.31	0.51	0.84	1						
TH	0.8	0.63	0.31	0.27	0.74	0.63	1					
CaH	0.33	0.3	0.09	0.76	0.73	0.71	0.57	1				
MgH	0.78	0.6	0.33	-0.09	0.49	0.36	0.89	0.14	1			
Cl	-0.18	0.03	-0.24	0.88	0.5	0.6	0.2	0.81	-0.2	1		
SO ₄	-0.92	0.72	0.06	-0.02	0.37	0.06	0.77	0.16	0.85	-0.24	1	
NO ₃	0.09	0.23	0.1	0.36	0.53	0.46	0.35	0.14	0.35	0.1	0.22	1