

Physico-chemical Analysis of Ground water Quality of Sidhi Madhya Pradesh with special reference to Nitrate

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Abstract: The present study deals with Physico-chemical analysis of ground water quality with special reference to nitrate, for whole of the municipal area of Sidhi District head quarter of Madhya Pradesh where we have undertaken 5 different areas of Sidhi town, the parameter such as temp. ph, turbidity, electrical conductivity, alkalinity, dissolved oxygen, B.O.D, total hardness, Ca, Mg, PO₄ SO₄ NO₃ Fe, Cl, and F, were estimated in the samples to evaluate their quality. The data obtained, compared with W.H.O. and IS : 10500 standards. The result revealed that concentration of D.O., B.O.D., total hardness, Ca, Mg, SO₄ turbidity, alkalinity, PO₄ Fe and Chloride are within permissible limits and Fe, PO₄ are negligible, whereas the concentration of Nitrate is higher at sampling area S₂, S₃ and S₅. The higher concentration of nitrate needs proper treatment before the use for drinking and irrigation purposes.

Key words: WHO, D.O., B.O.D. ISI, Nitrate, Ground water, Physico-chemical parameter and Water quality.

I. Introduction

Water is the prime requirement for life and used for drinking, bathing, irrigation, fisheries, navigation and power generation purpose etc. According to an estimate made by Indian Central Water Commission (CWC) for pollution Control the total utilizable water from surface water sources is 690 cubic kms and ground water sources is about 452 cubic kms (Sud. 1997).

India required 60 % water for irrigation and 85 % for drinking purpose, which depends upon ground water. India is the largest user of ground water in using over 25 % of the total global use of water (Gautam and Kumar 2010). India has more than 20 million bore wells in comparison to 0.2 million in USA. The increasing human population has tremendously increased the demanded of fresh water. The rapid growth of urban areas has affected the ground water quality due to over exploitation of resources and improper waste disposal practices.

National Environmental engineering Research Institute (NEERI) Nagpur has estimated that a staggering 70 % of the available water in India is polluted (Sharma et. al. 1996-97). Hence in the present study and investigation has been designed to understand the chemical characteristics of ground water of this region with special reference to nitrate.

II. Study Area :

Sidhi district is located in the north east border of Madhya Pradesh state between 23^o 47' to 24^o 42' Degree North Latitude and 81^o18' to 82^o 49' Degree East longitude, and at a height of about 609 meter above the mean sea level. The average rainfall is about 1085 mm. In the present investigation, we took five water samples form different areas of city during the month of November 2012 to estimate quality of ground water. The Sampling stations are Karondiya north tola (S1), Karondiya south tola (S2), Kotwali area (S3), Hiran nala area (S4) and Civil line (S5).

III. Material And Methods :

The analysis of phosphate, Iron, PH, total alkalinity, calcium hardness, nitrate nitrite, ammonium, fluoride, residual chlorine, chloride, arsenic etc. were carried out by water testing kits which are made available by PHE (Public Health Engineering) and Deptt. of Chemistry, Govt. P. G. College, Sidhi (M.P.) the temperature was measured by thermometer (in Celsius) and all data's obtained was compared with data available with WHO for drinking water.

Table 1 : Showing different Physico-chemical parameter of Ground water of Sidhi town

Sr. No.	Parameters	Study area locations				
		S1	S2	S3	S4	S5
1.	Temperature	27	27	28	28	27
2.	PH	8	8	9	9	9
3.	Alkalinity (mg/l)	300	250	300	300	170
4.	Phosphate (mg/l)	0.01	0.01	0.02	0.01	0.1
5.	Iron (mg/l)	0.2	0.3	3.0	0.03	0.03
6.	Calcium hardness (mg/l)	224	300	400	125	300
7.	Nitrate (mg/l)	22	53	62	31	52
8.	Nitrite (mg/l)	0.0	3.0	3.0	0.5	1.1
9.	Ammonium (mg/l)	0.6	1.1	1.1	3.2	0.7
10.	Fluoride (mg/l)	0.0	0.01	0.01	0.01	0.0
11.	Residual Chlorine (mg/l)	0.0	0.0	0.0	0.0	0.0
12.	Chloride (mg/l)	310	325	675	160	230
13.	Arsenic (mg/l)	0.0	0.0	0.0	0.0	0.0
14.	Total hardness (mg/l)	355	610	800	155	550
15.	Sulphate (mg/l)	156	125	135	142	180
16.	Sodium (mg/l)	60	62	50	40	65
17.	Potassium (mg/l)	7	9	10	8	10
18.	Dissolved oxygen (mg/l)	3.3	2.4	4.4	3.8	2.5
19.	Biological oxygen demand (mg/l)	2.3	1.7	2.5	2.9	2.4

IV. Result And Discussion :

The Physico-chemical characteristics of ground water are given in table 1 and data's compared with WHO (1992) and IS : 10500 Standards for drinking water.

Temperature : Temperature of water plays an important role for living being, quality of water is also maintained by temperature. The temperature of different sampling station ranges form 27 °C to 28 °C.

PH (Hydrogen ion concentration) : The PH of ground water ranges from 8 to 9 which is within the range of drinking water proposed by ISI 1991 is 6.5 to 8.5.

Alkalinity : Usually ground water associated with dissolved CO₂, bicarbonates and hydroxides which occurs due to dissolution of minerals in the soils. The value of alkalinity ranges form 170 to 300 mg/liter.

Iron : The concentration of iron varies from 0.2 to 3.00 mg/liter only the sample S3 have higher value of iron that is 3 mg/liter.

Calcium hardness : The value of calcium hardness varies from 125 to 400 mg/liter.

Nitrate : The biochemical oxidation of nitrogenous substances coming form domestic wastes are main source of Nitrate in ground water. The concentration of nitrate in present study varies form 22 to 62 mg/liter which is higher than the permissible limit of WHO health based guide line value. The concentration of Nitrate above 40 mg/liter caused blue diseases in infants (Sharma 1997).

Nitrite : It varies from 0.5 to 3.0 mg/liter in the samples.

Ammonium : It varies from 0.6 to 3.2 mg/liter in the samples.

Chloride : The chloride values ranges form 160 to 675 mg/liter. The permissible limit of chloride in drinking water is 250 mg/liter as suggested by WHO and ISI. The higher concentration of chloride may affect heart and kidney diseases affected person (Patil et. al 2002).

Total Hardness : The temporary hardness of water is only due to dissolved calcium and magnesium bicarbonate in water where as permanent hardness is due to presence of chloride of calcium and magnesium in water.

The value of total hardness ranges form 155 to 800 mg/liter, there is no firm evidence suggesting drinking of hard water causes any adverse effect on health (Doctor et. al. 1998). The observed value of sulphate, sodium, potassium, D. O., B.O.D., are within permissible limit as per WHO guideline for drinking water. The value of Phosphate, Fluoride, residual chlorine and Arsenic are observed negligible.

Table 2 : Drinking water specification as per IS : 10500-1993 revised

S. No.	Parameters	Desirable limit	Permissible limit in the absence of alternative
1.	PH (Hydrogen ion concentration)	6.5 to 8.5	No relaxation
2.	Total hardness as CaCO ₃ (mg/l)	300	600
3.	Iron (mg/l)	0.3	1.0
4.	Chloride (mg/l)	250	1000
5.	Fluoride (mg/l)	1.0	1.5
6.	T.D.S. (mg/l)	500	2000
7.	Calcium (mg/l)	75	200
8.	Magnesium (mg/l)	30	100

9.	Nitrate (mg/l)	45	100
10.	Sulphate (mg/l)	200	400
11.	Alkalinity (mg/l)	200	600
12.	Sodium (mg/l) as per WHO guideline	75	-
13.	Potassium (mg/l) as per WHO guideline	12	-

V. Conclusion :

In the present study it was observed that the concentration of Nitrate are much higher than the permissible limit that is 45 mg/l as suggested by WHO and IS :10500-1993 revised guideline for drinking water. The higher concentration of Nitrate needs proper treatment before the use of drinking purpose.

VI. Recommendation :

The detail investigation may be carried out on other living organism to avoid the hazardous/injurious impact of the nitrate contaminations.

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