

Physical and chemical analysis of drinking water of Singheswar block of Madhepura District, Bihar (India)

Dilip Kumar ' Dil ' and Arvind Kumar

Post Graduate Department of Zoology, B. N. Mandal University , Madhepura

E-mail : dilip97099@gmail.com

Manuscript received online 24 August 2022, accepted on 16 September 2022

Abstract : Groundwater samples were collected from selected locations of Singheswar tehsil of Madhepura district during pre monsoon, post monsoon , spring and winter seasons from 2019 - 2021. Physicochemical parameters like TDS, pH, specific conductivity, hardness, total alkalinity, magnesium, nitrate, sulfate, phosphate, sodium, potassium, chloride and fluoride were determined. Evaluation of the parameters were done using standard methods in order to judge the suitability of groundwater for irrigation and drinking purposes. It was found that conductivity, hardness and alkalinity parameters have higher values during post monsoon season than in spring season. The lower and upper limits of different parameters were found as follows: pH (7.2 - 8.3), EC (910-1315 micro S/cm), TDS (658 - 912 mg/l), TA (207-405 mg/l), TH (122-310 mg/l), Ca (78-186mg/l), Mg(42-124mg/l), Na (110-182 mg/l) , K (6 -10 mg/l) , Cl (55-108 mg/l) , sulfate (63-126 mg/l), nitrate (18-40 mg/l) and phosphates (0.3-0.57 mg/l). The results were compared with the WHO standards. Both the lower and upper limits values in the present case were found to be higher than the WHO limits in most of the cases. It was found that the premonsoon water are better than the postmonsoon one.

(Keywords : Groundwater parameters, Singheswar tehsil Madhepura)

Introduction

During recent years , extensive studies have been done on evaluation of groundwater quality parameters in order to judge the suitability of water for drinking and irrigation purposes [1-9] in different parts of India . It was found that quality of water depends on climate change and seasonal variations . No such studies have been done in Madhepura in recent years . Consequently

the present programme of investigating the groundwater quality of Madhepura district have been undertaken and results of Singheswar tehsil is being communicated in the present paper .

Experimental The Study Area

The tehsil of Singheswar is in Madhepura District which is situated in the Eastern part of Bihar state, India having longitude of 25° 34' to 26° 07' and latitude of 86° 19' to 87° 07'. With an area of 1788 km², Madhepura is surrounded by Araria and Supaul in the north, Khagaria and Bhagalpur in the south, Purnia in the east and Saharsa in the west .

Results and Discussion

To illustrate the groundwater quality of Singheswar tehsil of Madhepura district , 15 different physicochemical parameters namely pH , conductivity , total dissolved solids (TDS) , total alkalinity (TA) , bicarbonate alkalinity , (bicarb. A) , total hardness (TA) , calcium hardness (Ca hard.) , magnesium hardness (Mg hard.) , sodium , potassium , chloride , sulfate , nitrate , fluoride and phosphate were evaluated using standard methods . The obtained parameters have been presented in Table -1 .

The samples were collected from five selected sites , one each in the five villages namely Saroopatti , Shaibala , Jajhat, Piprahi and Belari in four different seasons namely pre -monsoon , post - monsoon , winter and spring of the years 2019 ,

2020 and 2021 . All parameters were compared with drinking water standards prescribed by WHO and BIS. Classification of irrigation water on the basis

of Na % , SAR (sodium absorption ratio) , ESR (exchangeable sodium ratio) and RSC (residual sodium carbonate) is shown in Table-2 .

Table- 1
Physicochemical parameters obtained for Singheswar tehsil
(average values of different locations) (2019)

S.No.	Year 2019				
	Parameter Seasons	Pre	Post	Winter	Spring
1	pH	7.7	7.1	7.6	7.7
2	TDS(mg/l)	885	677.	744.	795
3	Conduct.	1299	926	1105	1213
4	TA.	400	212	303.	367
5	TH.	305	128.	131.	265
6	Ca hard.	180	80	131	158
7	Mg hard.	120.	53.	130	130
8	Na.	178.	108	138.	163
9	K.	8.	5.	6.	8
10	Chloride	98.	55.	73.	88
11	Sulfate	122.	69.	96.	108
12	Nitrate	32.	19.	27.	28.
13	Fluoride	1.2.	0.8	1.1.	1.2
14	Phosphate	0.5	0.3	0.4	0.5

Table - 1
Continued for year 2020

S.No.	Year 2019				
	Parameter Seasons	Pre	Post	Winter	Spring
1.	pH	8.0	7.5	7.7	7.9
2.	Conduct.	1303	932.	1132	1308
3.	TDS	911	703	770	828
4.	TA.	402	216	318	380
5.	Bicarb.A	403	217	318	380
6.	TH	302	125	212	280
7.	Ca hard	180	80	125	168
8.	Mg hard	120	50	86	111
9.	Na	178	110	147	170
10.	K	10.	6.	9.	10
11.	Chloride.	102	52.	75.	96
12.	Sulfate.	118.	62.	93.	113
13.	Nitrate.	38.	20.	28.	36
14.	Fluoride	1.3	0.8	1.2	0.5
15.	Phosphate	0.5.	0.3	0.3.	0.5

Table -2
Continued for the year 2021

S.No.	Year 2021				
	Parameter Seasons	Pre	Post	Winter	Spring
1	pH.	8.1.	7.6.	7.8.	8.0
2.	Conduct.	1313	910	1141.	1266
3.	TDS.	866.	659	729	787
4.	TA.	407.	205.	321.	383
5.	Bicarb A	407	205.	321.	383
6.	TH.	312.	120.	219.	289
7.	Ca hard.	185	79.	134.	172
8.	Mg hard.	125	43.	84.	115
9.	Na.	183.	116.	153	174
10.	K.	11.	6.	8	10
11.	Chloride.	107.	61.	78.	101
12.	Sulfate.	125	70.	99.	117
13.	Nitrate	41	22	30.	37
14.	Fluoride.	1.5.	1.0.	1.3.	1.5
15.	Phosphate	0.5.	0.3.	0.3.	0.6

**Table -3 Results of different indices calculated with average values of
physicochemical parameters obtained for different sampling locations (2019)**

Indices.	Pre.	Post.	Winter	Spring
% Na	56.4	63.5.	58.9.	57.6
SAR	4.6	4.2	4.4	4.5
ESP	5.2	4.7.	4.9.	5.1
RSC.	2.0	1.6.	1.7.	2.0

Table-2 Continued for the year 2020

Indices	Pre	Post	Winter.	Spring
% Na.	56.4.	54.0.	60.5	57.0
SAR	4.6.	4.4	4.6.	4.6
ESP.	5.2.	4.9	5.3.	5.2
RSC.	2.0.	1.7.	2.1.	2.0

Table 2 Continued for the year 2021

Indices.	Pre.	Post.	Winter.	Spring
Na %.	56.1.	67.1.	60.5.	57.0
SAR.	4.7.	4.7.	4.7.	4.6
ESP.	5.3.	5.4.	5.3.	5.3
RSC.	1.9.	1.7.	2.1	1.9

Critical analysis of the data related to different physicochemical parameters reveals trends in the parameters. Observations have been made for three consecutive years from 2019 to 2021 in four seasons pre - monsoon , post - monsoon , winter and spring . Some parameters have shown increasing trends wherein some exhibit decreasing trends.

Conclusion: Contamination of groundwater is

caused by irresponsible attitude of the people of the area and population growth. Presently groundwater quality of Madhepura district is of moderate quality. But if attitude of the people does not improve, it will take no time to bring the quality into unsafe zone .

Acknowledgments : Authors are grateful to professor H C Rai of B R A Bihar University for encouragement .

References

1. J. Aryal, B. Gautam and N. Gupta, Drinking water quality assessment, *J Nepal Health Res Counc* ; **10** (22):192 (2012)
2. A. Azrina, H. E. Khoo , M A Idris , I Amin and M R Axman ; Major inorganic elements in tap water samples in peninsular Malaysia, *Malayalan Journal of nutrition* ; **17**(2) : 271 (2011)
3. S. Basabraja, S. M. Hiremath, K. N. S. Murthy , K. N. Chandrasekharappa, A. N. Patel and E. T. Putting, Analysis of water quality using physico-chemical parameters of Hasanhalli turf in Shimoga district of Karnataka, India; *Global journal of science frontier research*, **1**(3):31 (2011)
4. G. E. Dissmeyer, Drinking water from forests and grasslands , South research station , USDS Forest Service ; Ashville , NC , USA (2000)
5. A Gore, Earth in Valence, Ecology and the the human spirit, New York , Rodale Press (2006) .
6. Y Meride and B Ayenew, Drinking water quality assessment and its effects on residents health in wonder Genet campus, *Ethiopia, Env Syst Res*, **5**(1):1 (2016) .
7. A. J. Yadav, N. Gupta, S. M. Nafees, K. K. Gupta and S. Kalpana, Assessment of seasonal trends in groundwater quality across the Itawa tehsil of Kota district of Rajasthan, India; *Int. J. Curr. Res.*; **7**(12):24138 (2015) .
8. Vasant Wagh, Srikant Mukate, Aniket Muley, Ajay Kumar Kadam, Deepak Panaskar and Abhay Varadey, Study of groundwater contamination and drinking suitability in basaltic terrain of Maharastra, India through PIG and multivariate statistical techniques ; *Journal of water supply, Research and Technology Aqua*, **69**(4) : 398 (2020)
9. B. Chakraborty, S. Roy, B. Bera and P. K. Shit; Evaluation of groundwater quality and its impact on human health : a case study from Chotanagpur plateau fringe region in India, *Applied Water Science*, **12**:25 (2022).