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Studies on ground water quality in Narsinghgarh area of Madhya Pradesh, India

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ABSTRACT

In the present study, physicochemical analysis of ground water samples were carried out from 20 sampling stations of Narsinghgarh rural area. The analysis of different parameters viz., pH, conductivity, total alkalinity, total hardness, chloride, TDS were carried out as per standard methods given in APHA (1998). The objective of the present study was to calculate the water quality index (WQI) in order to assess the suitability of water for drinking purpose in the rural area of Narsinghgarh. The results showed that water quality at different stations come under 'good' to 'excellent' categories.

Keywords*:* WQI, Narsinghgarh area, ground water, water quality.

INTRODUCTION

Ground water is an invisible natural resource. It is present beneath our feet, in the dark pores and fissures of sands and rocks of the upper portion of the earth's crust. Due to its hidden dimension the general public is much less familiar with ground water than with the more visible components of the water cycle, such as rain and surface water [1].

Ground water is a source of drinking water and more than half of the world's population depends on ground water for its survival [2]. Also, it is the most important source of water supply for irrigation and industrial purpose but increasing population and its requirements have lead to the deterioration of surface and sub-surface water quality [3]. Hence, a continuous monitoring on ground water becomes mandatory to minimize its pollution and have control on the pollution causing agents [4].

The safe potable water is absolutely essential for healthy living. Ground water is most suitable for human consumption in both urban as well as rural areas. The importance of ground water for existence of human society cannot be overemphasized. There are several states in India where more than 90% populations are dependent on ground water for drinking and other purpose [5]. The present investigation was carried out in order to identify the quality of ground water in rural area by calculating water quality index for waters of Narsinghgarh area.

MATERIALS AND METHODS

Study area

The present study was conducted in rural area of Narsinghgarh area in Rajgarh district of Madhya Pradesh. The samples were collected from different locations and observations were made at 20 selected sampling stations. The villages selected for conducting present survey were Raghunathpura, Elahipura, Ramgarh, Ninor, Barkhedaveer, Shymapura, Khari, Ganiari, Dharmakhari, Berasia, Ambedkar nagar, Gandhi gram, Devgarh, Bihar, Kotra, Chainpurkala, Gadhia, Karhia, Achalpura, Adalhera.

Collection of ground water samples

The ground water samples were collected in different seasons from Narsinghgarh area. The samples were collected in sterile plastic bottles and were transported to laboratory for further analysis. The whole methodology for physicochemical analysis was followed from standard methods [6]. However, pH, TDS and conductivity, were measured on field with portable digital meters. All these parameters were compared with drinking water standards prescribed by BIS: 10500 [7] to calculate the water quality index**.**

Estimation of water quality index (WQI)

To determine the suitability of the water for various purposes, WQI [8] was calculated as follows:

$$WQI = \sum q_i W_i / \sum W_i$$

Where,

q_i = Quality rating for nth water quality parameter.

The quality rating q_i is determined as follows:

$$q_i = 100 \times (V_i - V_{10})/(S_i - V_{10})$$

Where,

V_i =Estimated value of the nth parameters at a given sampling station.

S_i =Standard permissible value of nth parameter.

V_{10} =Ideal value of the nth parameter in pure water.

All the ideal values (V_{10}) are taken as zero for the drinking water except for pH=7.0.

W_i, is a unit factor, given by the formula, $W_i = K/S_i$

S_i is the standard value of i^{th} parameter and K is proportionality constant.

The quality ratings and unit weights (W_i) for all the chosen parameters with standard values are given in Table: 1 and Table: 2 respectively.

Table 1: The quality ratings for drinking water quality

S.No.	WQI	Water quality
1	0-25	Excellent
2	26-50	Good
3	51-75	Poor
4	76-100	Very poor
5	>100	Unsafe for drinking

Table 2: Drinking water recommending agencies standards and Unit weight

Parameters	BIS :104500	Unit weight
pH	6.5-8.5	0.2181
Conductivity	300	0.00618
TDS	500	0.003708
Alkalinity	120	0.00927
Total hardness	300	0.00618
Chloride	250	0.02472

RESULTS AND DISCUSSION

During the present study, pH value of ground water samples varied from 6.2-8.2. Some workers reported pH value varied between 6-9 in Angul-talcher region of Orissa [9], and have recorded pH value ranged from 6.6-8.9 for groundwater in Tumkur Taluk, Karnataka [10] which supports the present findings. In the present study, the minimum value of TDS was observed 190 ppm at Adalhera during monsoon and maximum value 210 ppm at Devgarh during summer. In some studies, TDS values varied from 420-709 mgl^{-1} in some areas of Guntur district, Andhra Pradesh [11] while, it also ranged from 70-1500 mgl^{-1}[10]. The higher concentration of total dissolved solids in drinking water causes adverse health effects. In the present study, the minimum value for conductivity was recorded 160 mgl^{-1} at Gandhi gram and maximum value 210 mgl^{-1} at Devgarh during monsoon. Due to floods and heavy rains monsoon water level increases which contains more electrolytes that are responsible for high conductivity in water [12]. During the present investigation, minimum value for chloride was observed 64.99 mgl^{-1} at Achalpura in summer and maximum value 147.98 mgl^{-1} in monsoon. The excess value of chloride was found due to untreated effluents discharged into the water table through river course and ponds [13] it was also due to seepage from sewage in nearby localities [9]. The chloride value ranged from 74-134 mgl^{-1} in some areas of Guntur district,

Andhra Pradesh [11]. Hardness in water is caused by metallic ions dissolved in it. In the present study, the minimum value for total hardness was recorded 114 mgl^{-1} at Gandhi gram and maximum value 226 mgl^{-1} at Devgarh during monsoon. The range of total hardness of ground water samples varied in the range of 200-750 mgl^{-1} in Chidambaram taluk of Cuddalore district, Tamil nadu [14]. In the present survey, minimum value for alkalinity was observed 52 mgl^{-1} at Berasia and maximum value 116 mgl^{-1} at Barkhedaveer during monsoon. The total alkalinity of ground water varied from 62.2-106.4 mg l^{-1}[11] and 270-320 mg l^{-1} [12] in some studies.

During the present investigation the value for water quality index varied from 2.38 to 40.06 which comes under 'good' to 'excellent' water quality at all the stations. Similar findings with water quality index ranged between 14-67 in Angul-Talcher region of Orissa [9] and, 38.3-42 in some areas of Guntur district, Andhra Pradesh [11] were also reported earlier.

Table 3: Summary of basic statistics for different water quality parameters

Parameters	min. value	max. value	mean value
pH	6.2	8.2	7.2
Conductivity	160	210	185
TDS	190	310	250
Alkalinity	52	116	74
Total hardness	144	226	185
Chloride	64.99	147.98	106

Table: 4 Water quality index (WQI) at different stations in Narsinghgarh area

Stations	Summer	Premonsoon	Monsoon	WQI Legend	WQI Status
S_1	5.48	6.98	4.48	0-25	**Excellent**
S_2	18.09	17.96	15.24	0-25	**Excellent**
S_3	2.71	0.72	1.77	0-25	**Excellent**
S_4	8.08	7.86	7.44	0-25	**Excellent**
S_5	6.44	5.70	2.38	0-25	**Excellent**
S_6	3.52	4.97	5.51	0-25	**Excellent**
S_7	3.54	3.39	13.96	0-25	**Excellent**
S_8	8.58	8.12	8.44	0-25	**Excellent**
S_9	13	14.05	5.30	0-25	**Excellent**
S_{10}	28.99	25.61	1.41	26-50	**Good**
S_{11}	4.49	5.05	10.21	0-25	**Excellent**
S_{12}	39.97	40.06	33.53	26-50	**Good**
S_{13}	15.06	16.35	3.75	0-25	**Excellent**
S_{14}	23.69	23.08	4.07	0-25	**Excellent**
S_{15}	4.28	3.88	5.78	0-25	**Excellent**
S_{16}	10.79	11.26	6.69	0-25	**Excellent**
S_{17}	4.01	4.09	11.37	0-25	**Excellent**
S_{18}	17.02	9.85	11.28	0-25	**Excellent**
S_{19}	6.41	6.02	7.15	0-25	**Excellent**
S_{20}	4.24	5.9	6.52	0-25	**Excellent**

CONCLUSION

The physicochemical analysis of ground water samples indicated that water at most of the stations are normally suitable for drinking purpose in Narsinghgarh area, except at stations where certain parameters exceed the permissible limit. However, the WQI values in the present investigation were reported less than 50 (2.38-40.06) for all the twenty samples indicating that the water is safe for human consumption.

REFERENCES

[1] T Jeyavel Raja Kumar, A Balasubramanian, RS Kumar and K Manoharan, *Nat Env Poll Tech*, **2010**, 9,133-140.
[2] A Mohrir, DS Ramteke, CA Moghe, SR Wate and R Sarin, *IJEP*, **2002**, 22, 961-969.
[3] TS Dhiviyaa Pranavam, TV Rao, L Punithavathi, S Karunanithi and A Bhaskaran, *Indian J Sci Technol*, **2011**, 4, 19-21.
[4] RC Sheth and BM Kalshetty, *Int J Appl Biol Pharm*, **2011**, 2, 189-193.
[5] C Ramachandraiah, Right to drinking water in India, Centre for economic and social studies. **2004**, 56.
[6] APHA. *Standard methods for the examination of water and wastewater*. American Public Health Association, **1998**, 20th edn. Washington DC, New York.
[7] BIS (Bureau of Indian Standards) 10500, Indian standard drinking water specification, First revision, **1991**, 1-8.
[8] AK Srivastava, *Nat Env Poll Tech*, **2007**, 6, 315-319.
[9] R Rizwan and G Singh, *J Am Sci*, **2009**, 5, 53-58.
[10] CR Ramakrishnaiah, C Sadashivaiah and G Ranganna, *ECHEM*, **2009**, 6, 523-530.

[11] CS Rao, BS Rao, AVLNSH Hariharan and NM Bharathi, *Int J Appl Biol Pharm*, **2010**, 1, 79-86.
[12] K Saravanakumar and R Ranjith Kumar, *Indian J Sci Technol*, **2011**, 5, 660-662.
[13] K Arumugam and K Elangovan, *Environ Geol*, **2009**, 58, 1509-1520.
[14] A Murugappan, S Gnanakumar and G Senthilkumar, *Nat Env Poll Tech*, **2010**, 9, 167-172.