International Journal of ChemTech Research
CODEN (USA): IJCRGG ISSN: 0974-4290
Vol.9, No.01 pp 302-307, 2016

Assessment of Ground water quality of Semariya Area District Rewa, Madhya Pradesh, India

Shankar Prasad Mishra[1]* and Arun kumar Shukla[2]

[1]Departmentof Chemistry, Y.P.S.P.G. College Semariya, Rewa, Madhya Pradesh, India.
[2]Department of Botany, Y.P.S.P.G. College Semariya, Rewa, Madhya Pradesh, India.

Abstract: The paper deals an assessment of ground water quality of Semariya area, District Rewa, Madhya Pradesh, India. Geologically, the area is occupied by shale and sandstone of Rewa group, Vindhyan Super group. A total number of twenty five ground water samples were collected from different locations of the study area. And analyzed for various water quality parameters such as pH, electrical conductivity, total dissolved solid, total hardness, chloride, fluoride, sulphate, nitrate, sodium, potassium, calcium and magnesium. Oncomparing the results against water quality standards laid by World Health Organization and BIS, it is observed that some parameters exceed the standard limits.The overall study reveals that water of this region is partially fit for drinking purpose.
Key words: Ground water, Semariya, Rewa, Madhya Pradesh,India.

Introduction

Water is one of the most essential requirements of life. Without fresh water of adequate quality and quantity sustainable development will not be possible[1]. The quality of ground water depends on a large number of hydrological, physical, chemical and biological factors. Generally higher proportions of dissolved constituents are found in ground water than in surface water because of greater interaction of ground water with various materials in geologic strata. Ground water has been used as major sources of drinking water in both rural and urban areas in the world. In India alone, nearly 80% of the rural population depends on untreated ground water[2]. Quality of ground water is under constant threat due to natural process as well as anthropogenic activities. The hydrogeological conditions are also responsible for significant variations in ground water quality[3]. The quality of ground water in the various parts of our country have been studied by various workers[4,5,6,7,8,9,10]. Polluted water is responsible for spread of various water borne diseases. Therefore in present study an attempt has been made to evaluate the physicochemical characteristics of ground water of Semariya area, Rewa district,Madhya Pradesh, India.

Study area

Semariya is a tehsil place of district Rewa, Madhya Pradesh and lies between $24^0 41'$ to $24^0 55'$N latitude and $81^0 05'$ to $81^0 20'$E longitude covering an area of about 960km^2(fig.1) The area is rich in natural resources like laterite, bauxite, sandstone, flagstone, geru and ramraj (a type of clay used in paint). Geographically climate of this area is semiarid to humid type and receives average annual rainfall 1178mm during the months of June to October through southwest monsoon. The average maximum temperature 45^0C was recorded during the month of May and minimum temperature 4^0C during the month of January. The area comprises black and red soil.

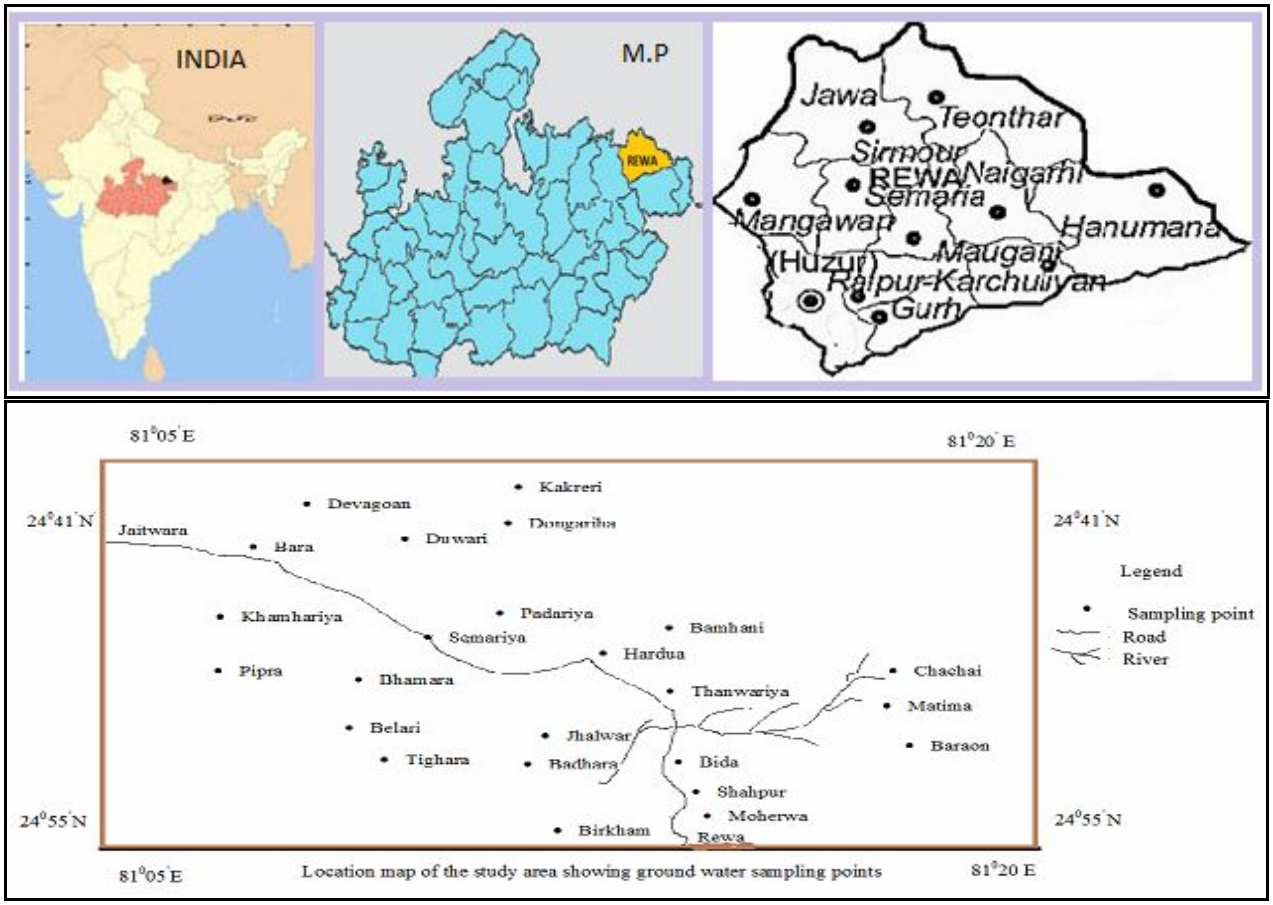

Fig.1

Materials and method

The total numbers of 25 ground water samples were collected from hand pumps of the different locations of the study area during pre & post monsoon seasons of year 2014. The samples were collected in polythene bottles of 1 liter capacity. The sampling bottles were thoroughly washed with 1: 1 HNO_3 and then cleaned and rinsed with distilled water. At the sampling site bottles were rinsed three to four time with water samples to be examined before finally filling with it. During sampling from a hand pump the water was pumped to waste for about five minutes and then sample was collected directly from a hand pump. All samples were labeled, brought to the laboratory and refrigerated at 4^0C. The physicochemical analysis was done using procedure of standard methods[11,12]. The methods used for determination of various physicochemical parameters are given below.

Table1. Methods used for analysis of water quality parameters

S. No	Parameters	Methods
1	pH	pH meter
2	Electrical Conductivity	Conductivity meter
3	Total Hardness	EDTA titration method
4	Total Dissolved Solid	Gravimetric method
5	Chloride	Argentometric titration method
6	Fluoride	Spands method
7	Sulphate	Turbidimetric method
8	Nitrate	Phenol disulphonic acid method
9	Calcium and Magnesium	Titration method
10	Sodium and Potassium	Flame photometer

Results and Discussion

During present study pH value ranges between7.0 to 8.1 in pre-monsoon and 6.9 to 7.7 during post-monsoon seasons indicating that ground water of the study area is acidic to alkaline in nature. As evident from table 2 and 3 the lower value of pH in post-monsoon season than pre-monsoon season is due to easily mixing of rain water to ground water. Electrical conductivity (EC) of water is a good indicator of pollution as most of the soluble pollutants exist as ions in water. The value of electrical conductivity varies between 416 to 1912µS/cm in pre-monsoon and 534 to 1783 µS/cm in post- monsoon seasons. Total hardness of ground water samples varies between 68 to 689 mg/l in pre-monsoon and 90 to 770 mg/l in post-monsoon seasons. Nearly 50% water samples show hardness above desirable limit 300 mg/l recommended by BIS (1991)[13] for drinking water. As per Sawer and Mc Carty (1967)[14] and Fetter(1990)[15] scheme, water having hardness up to 75 mg/l is classified as soft, 76-150mg/l is moderately soft, 151-300 mg/l as hard and >300 mg/l is very hard. On this basis, it is observed that most of water samples are hard in nature. The possible reason for the hardness of water in study area may be due to the presence of calcium and magnesium in aquifer. Total dissolved solid is a measure of the combined content of all organic and inorganic substances contained in a liquid in molecular, ionized or micro granular suspended form. The concentration of total dissolved solids ranges between 272 to 1220 mg/l in pre-monsoon and 290 to 1121 mg/l in post-monsoon seasons.Nearly 50% water samples show TDS value above desirable limits 500 mg/l recommended by WHO (1993)[16]. The intake of water having higher TDS may cause gastrointestinal problem in human body (Jasortia and Singh, 2007)[17]. Chloride concentration varies between 21.7 to 94.6 mg/l and 18.2 to 76.4 mg/l during pre and post-monsoon seasons respectively. All water samples show chloride within permissible limit (600 mg/l, BIS, 1991). The main sources of chloride in the water are the salts of sodium, potassium and calcium. Chloride generally enter into the water by solvent action of water on salts present in soil and from domestic sewage. The concentration of fluoride ranges from 0.52 to1.94 mg/l in pre-monsoon and 0.47 to 1.70 mg/l in post-monsoon seasons. Nearly 20% water samples exceed the standard limit 1.5 mg/l (BIS, 1991). Micaceous shale as well as chemical fertilizers used by formers are the main sources of fluoride in the water of study area. The concentration of fluoride upto 1 ppm in water is beneficial but higher concentration may cause dental and skeletal fluorosis[18].Sulphate concentration varies between 18.1to 74.2 mg/l in pre-monsoon and 15.4 to 61.5 mg/l in post-monsoon seasons. All water samples show sulphate within desirable limit. The possible sources of sulphate in water of study area may be due to gypsum bands associated with shale formation. Elevated concentration of sulphate may cause laxative effect. The concentration of nitrate varies between 5.6 to 55.2 mg/l and 4.8 to 58.1 mg/l in pre and post-monsoon seasons respectively. Only six water samples out of 24 exceed the standard limits 45mg/l, recommended by BIS(1991) and WHO (1996) for drinking water. The consumption of water having higher concentration of nitrate may cause a disease called methemoglobinaemia or blue baby syndrome in infants. The possible sources of nitrate in water of the study area are human and animal wastes and application of nitrogen rich fertilizer in agriculture. The concentration of sodium varies between 6.5 to 50.0 mg/l in pre-monsoon and 4.1 to 40.4 mg/l during post-monsoon seasons. The concentration of potassium lies between 0.9 to 12.8 mg/l and 0.8 to 7.4 mg/l during pre and post-monsoon seasons respectively. The values of both constituents(Na and K) are well within permissible limits. The occurrence of clay minerals in sand stone and shale may be possible sources of sodium and potassium in ground water. Calcium concentration varies between 10.6 to 127.4 mg/l in pre-monsoon and 15.2 to 180.5 mg/l during post-monsoon seasons. Magnesium concentration lies between 4.6 to 68.1 mg/l and 7.9 to 89.0mg/l during pre and post-monsoon seasons respectively. The values of both constituents(Ca and Mg) are within permissible limits. The higher concentration of magnesium makes water unplatable and consumption of such type of water cause laxative effect in human beings.

Table-2 Physicochemical characteristics of ground water samples of the study Area (Pre- monsoon 2014).

Sampling points	pH	EC	TH	TDS	Cl	F	SO_4	NO_3	Na	K	Ca	Mg
Semariya	7.6	1912	518	1220	78.5	1.26	69.2	21.4	12.5	5.5	88.8	38.9
Bhamara	7.8	978	340	546	72.3	1.10	68.5	23.5	21.2	8.6	78.3	35.0
Pipara	7.8	416	110	272	61.4	1.67	57.2	46.5	6.8	3.9	14.5	18.4
Khamhariya	7.9	722	304	318	53.1	1.69	74.2	24.0	7.2	12.8	52.2	24.0
Bara	7.2	659	190	466	69.5	0.82	45.1	17.8	19.1	2.3	18.4	38.4
Devagaon	7.5	816	180	545	74.5	1.0	30.5	13.5	16.1	3.2	29.5	26.7
Duwari	7.2	916	145	656	35.6	0.68	50.8	11.4	6.5	3.8	10.6	19.5

Dongariha	8.1	765	314	388	42.0	1.94	21.7	10.6	32.5	6.5	118.3	42.7
Kakreri	7.8	894	268	570	21.7	1.60	27.6	10.5	8.2	2.5	110.7	68.1
Bamhani	7.5	1120	525	780	35.1	1.09	19.8	9.7	22.6	4.5	106.2	45.3
Padariya	7.4	594	251	424	39.1	0.90	30.7	13.5	30.2	2.8	31.3	22.7
Hardua	7.0	769	289	477	76.8	0.72	58.7	32.5	15.8	4.0	56.0	21.5
Thanwariya	7.6	1750	689	1140	94.6	1.73	18.1	55.2	50.0	6.4	98.1	49.1
Belari	7.4	698	178	410	45.3	0.68	48.3	5.6	16.2	5.0	40.0	23.2
Tighara	7.3	744	208	472	71.6	0.79	49.1	19.0	40.9	3.8	43.2	25.8
Jhalwar	7.2	480	78	607	86.4	0.86	60.3	47.5	25.2	2.0	30.3	12.5
Badhara	7.3	656	361	376	90.5	1.41	54.0	40.0	45.8	4.2	13.4	4.6
Bida	7.2	866	320	510	66.4	0.95	40.4	22.6	14.3	2.9	62.1	30.0
Shahpur	7.1	1021	210	640	32.6	0.52	28.5	16.4	11.9	0.9	48.4	19.2
Birkham	7.3	595	68	312	40.3	0.70	71.9	39.4	9.10	10.1	90.7	25.8
Moharwa	7.2	680	118	412	47.9	1.29	52.1	47.3	29.8	1.6	59.5	22.4
Chachai	7.3	1015	288	624	29.6	1.09	34.0	46.1	28.4	3.5	102.5	18.4
Matima	7.3	778	275	506	50.7	1.37	50.6	23.8	21.6	2.9	127.4	30.9
Baraon	7.4	682	200	366	62.2	1.06	40.7	16.6	26.0	4.0	65.1	40.7

(Except pH and ECµs/cm, all values are in mg /l).

Table-3 Physicochemical characteristics of ground water samples of the study Area (Post- monsoon 2014)

Sampling points	**pH**	**EC**	**TH**	**TDS**	**Cl**	**F**	**SO_4**	**NO_3**	**Na**	**K**	**Ca**	**Mg**
Semariya	7.4	1783	620	1121	62.2	1.02	48.1	27.4	9.2	3.2	105.1	45.0
Bhamara	7.4	762	386	416	59.1	0.85	50.0	25.2	16.7	4.1	111.0	37.1
Pipara	7.6	587	167	312	60.3	1.48	42.4	52.1	4.1	1.5	31.6	24.4
Khamhariya	7.5	660	393	290	45.4	1.57	61.5	25.0	6.0	7.4	79.2	20.5
Bara	7.1	534	166	402	51.5	0.60	32.6	20.1	11.4	2.0	32.4	28.6
Devagaon	7.3	694	240	425	60.2	0.77	19.2	10.2	12.4	1.9	70.7	31.2
Duwari	6.9	930	212	560	30.0	0.54	26.7	17.6	5.4	2.7	15.2	19.0
Dongariha	7.7	848	290	415	38.6	1.70	29.3	12.0	18.3	4.0	160.4	52.4
Kakreri	7.6	710	292	490	18.2	1.52	25.1	9.2	11.5	1.0	146.5	89.0
Bamhani	7.4	1080	690	618	30.0	0.90	15.4	16.7	16.4	3.1	180.5	57.4
Padariya	7.2	618	342	344	28.4	0.72	27.0	15.6	28.1	1.0	35.4	20.2
Hardua	7.0	820	190	311	58.7	0.89	42.2	40.1	10.2	2.5	86.0	16.4
Thanwariya	7.3	1577	770	990	76.4	1.56	23.4	58.1	40.4	4.2	120.7	57.5
Belari	7.2	585	268	402	42.2	0.81	41.5	4.8	12.1	2.0	58.4	19.0
Tighara	7.1	624	310	356	59.1	0.59	37.6	23.2	22.4	1.0	70.1	27.0
Jhalwar	7.0	587	90	540	62.4	0.65	54.2	52.4	40.7	0.9	37.4	11.6
Badhara	7.1	720	384	660	71.3	1.20	39.0	48.2	10.5	3.5	16.2	7.9
Bida	7.0	840	267	406	50.2	0.90	22.8	21.5	8.1	2.1	78.4	23.5
Shahpur	6.9	943	283	475	28.1	0.47	36.1	17.1	11.6	0.8	69.6	21.6
Birkham	7.1	678	140	426	30.5	0.52	60.5	30.2	22.0	4.3	114.7	32.2
Moharwa	7.1	754	170	370	29.8	1.06	51.4	48.0	20.0	1.1	102.3	34.4
Chachai	7.0	920	414	478	21.0	0.87	34.2	30.5	19.1	3.0	148.6	11.6
Matima	7.2	716	380	490	42.4	1.11	43.3	25.1	20.0	1.5	174.0	20.0
Baraon	7.1	658	110	370	51.8	1.0	31.6	15.3	18.4	2.8	107.5	28.5

(Except pH and ECµs/cm,all values are in mg /l).

Table No-4 .Comparison of the water quality parameter of the study area with BIS and WHO for drinking purpose

S. No.	Water quality parameters	WHO(2006)		BIS(1993)		Concentration in study area.
		Max.desirable	Max.permissible	Max.desirable	Max.permissible	
1	pH	7.0-8.5	6.5-9.2	6.5	8.5	6.9 – 8.1
2	TH	100	500	500	1000	68 - 770
3	TDS	500	1000	500	1000	290 - 1220
4	Cl	200	600	250	1000	18.2 – 94.6
5	F	1	1.5	1	1.5	0.47 – 1.94
6	SO_4	200	400	150	400	15.4 – 74.2
7	NO_3	-	45	-	45	5.6 – 58.1
8	Na	20	175	-	200	4.1 – 50.0
9	K	10	12	-	-	0.8 – 12.8
10	Ca	75	200	75	200	10.6 – 180.5
11	Mg	30	150	30	100	4.6 – 89.0

Conclusion

Ground water samples of the study area are slightly alkaline in nature. The value of hardness exceed the standard limits at few locations indicate that water is hard which may be due to the presence of calcium and magnesium in aquifer. The concentrations of chloride and sulphate are within the permissible limits. Nearly 20% water samples exceed the standard limits of fluoride which may be due to the fluorine rich mica and phosphatic fertilizer. Except few locations the concentration of nitrate is within permissible limits. Comparatively high concentration of nitrate in water of study area may be due to indiscriminate use of nitrogenous fertilizer in agriculture and accumulation of animal manure near water bodies. Concentration of sodium, potassium, calcium and magnesium are found within standard limits. Thus the overall study reveals that water of the study area is not absolutely fit for directly drinking purpose need proper treatments to minimize the contamination.

References

1. Kumar, N. (1997). A view on fresh water environment, Ecol. Env. & Cons.Vol.3, pp. 3-4.
2. Kumar, A. (2004). Water Pollution. Nisha Enterprises New Delhi. pp. 1-331.
3. Mahanta, B.N., Sarkar, B.C., Singh, G., Saikia, K.and Paul, P.R. (2004). Multivariate statistical modeling and indexing of ground water quality in and around coalfields, Jharkhand, NSEEME.
4. Tiwari, R.N. (2011). Assessment of ground water quality and pollution potential of Jawa Block Rewa district, M.P., India. International Academy of Ecology and Environmental Sciences, Vol.19 (3-4), pp.202-212.
5. Bharati, Dattatraya, Sayyad, Isub Ali, Gaikwad, G.G., Taikar, D.R. and Dhore, J. (2011). Physicochemical characteristics of Borewell water quality in Nagpur region, Maharashtra, India. Journal of Chemical and Pharmaceutical Research, Vol. 3 (2), pp. 922-927.
6. Kalara, Neerja, Kumar, Rajesh, Yadav, S.S. and Singh R.T. (2012). Physicochemical analysis of ground water taken from five blocks of Southern Bhojpur, Bihar, India. Journal of Chemical and Pharmaceutical Research,Vol. 4 (3), pp.1827- 1832.
7. Pathak, Hemantand Limaye, S.N. (2012). Assessment of physicochemical quality of ground water in rural area nearby Sagar city, M.P,India .Advances in Applied Science Research, Vol. 3, pp. 555-562.
8. Ravichandran, K. and Jayaprakash, M. (2011). Seasional variation on physio- chemical parameters and trace metals in ground water of an industrial area of north Chennai, India. Indian Journal of Science and Technology,Vol. 4, pp. 646- 649.
9. Prakash, K., Hanuman Reddy, V., Prasad, P.M.N. and Rami Reddy, Y.V. (2012). Determination of quality in surface water and open well water around industrial park special economic zone of Mambattu, A.P., Indian. Journal of Chemical and Pharmaceutical Research, Vol. 4 (2), pp. 1239- 1245.

10. Tiwari, R.N., Mishra, Shankar and Pandey, Prabhat (2013). Study of major and traceelements in ground water of Birsinghpur Area, satna district M.P., India. International Journal of water resources and Environmental Engineering.
11. APHA, AWWA, (2005). Standard method for the examination of the Water and Wastewater, 21st Edn.
12. Trivedy, R.K. and Goel, P.K. (1984). Chemical and Biological method for water pollution studies Environmental Publication Karod, India.
13. BIS (1991). Bureau of Indian Standard Specification for Drinking Water IS: 10500.
14. Sawer, C.N.and McCarty, P.L. (1967). Chemistry for salinity engineers.
15. Fetter,C.W. (1990). Applied hydrogeology. New Delhi, India, CSB Publishers and Distributors.
16. WHO (2006). Guideline for drinking water quality (3rd edn.) Vol.1, recommendations, World Health Organization, Geneva.
17. Jasortia, A.S. and Singh, R. (2007). Hydrochemistry and ground water quality around Devak and Rui water shed of Jammu Region, Jammu and Kashmir, Jour. Geol. Soc. India, Vol. 69, pp. 1042-1054.
18. Brindha, K., Rajesh, R., Murugan, R. and Elango, L. (2010). Natural and anthropogenic influence on the fluoride and nitrate concentration of ground water in parts of Nalgonda district, Andhra Pradesh, India. Journal.of Applied Geochemistry, Vol. 12, No. 2, pp. 231-241.

*****