Int. J. Chem. Sci.: 13(3), 2015, 1479-1484
ISSN 0972-768X
www.sadgurupublications.com

QUALITATIVE ANALYSIS OF GROUND WATER OF SAHARSA AREA (BIHAR)

AMAR NATH CHAUDHARY*

Department of Chemistry, R. M. College, SAHARSA (Bihar) INDIA

ABSTRACT

Collected fifteen water samples from different sources at different locality of Saharsa area during Feb. 2013. Studied the physico-chemical behaviour of water. Different physical-chemical parameter. pH, EC, alkalinity, TDS, turbidity, total hardness and content of fluorid, sulphate chloride were studied and compared with the standard values prescribed by WHO and APHA. In this analysis, it was observed that the water was not safe for drinking purpose and not suitable for domestic use. The people of this region suffer from severe water pollution, which is a threat to human health and survival of aquatic life. The present investigation revealed that the some of the water sample of Kosi Project are not suitable for domestic use and they need proper treatment before use.

Key words: Ground water, Water quality, Phyiso-chemical parameters, Saharsa.

INTRODUCTION

Safe drinking water is a fundamental human need and it is an important factor that determines the physical and social health of the people. Bullard[1] inferred that polluted surface water always results in an unhealthy socio-economic environment. Increase in living standard, growing population, rapid industrialization and wide spread human activities have increased the demand of water[2]. According to World Health Organization (WHO) about 80% of diseases of human being are caused by drinking water. Therefore, the present investigation aimed to calculate the quality of ground water in Saharsa area.

Talabs, wells, tube-wells and many open wells are the water resources of Saharsa area. Capacity of these sources is determined by rain. Saharsa is situated in semi-urban area with average rain fall of 575 mm and suffering critically from shortage of safe water. In past few decades, the authorities were trying to solve the safe water crisis. But still, Saharsa area

*Author for correspondence; E-mail: amarnath.chaudhary05@gmail.com

is facing water quality problem and large number of people are suffering from health problem due to consumption of contaminated locally available water.

Due to rapid growth of industrialization and urbanization much sewage water is disposed off that generates fair chance of ground water pollution[3] and Saharsa area is not an exception for this phenomena. Information on water quality of resources of Saharsa area are scanty. Hence, the present work draws the conclusion on the quality of water and provides information about suitability of water for drinking purpose. Comparison of water test results with WHO guideline[4] values and Indian Standard Institute tolerance limit[5] helps to address the specific problem of water sources and to select the appropriate method of water treatment before use.

EXPERIMENTAL

Materials and methods

Water samples were collected from 15 spots of Saharsa area during the month of Feb.-2013 in plastic (PVC) containers of 1000 ml. The samples were collected and analysed are per the standard methods prescribed by APHA-AWWA-WEF[6], Goltman et al.[7] and Trivedi and Goel[8]. In case of tube-well the water was flushed out for 10 mts. to get the fresh water and then the samples were collected. The grab sampling method was followed in case of collection of samples from open wells. In both the cases, containers were rinsed several times and filled with samples. The containers were sealed, labeled and the samples were protected from direct sunlight during the transportation.

Turbidity (Turb), pH and electrical conductance (EC) of the samples were determined on the day of collection to minimize the alteration of original sample condition, using Systronics digital turbidity meter-132, Systronics digital pH meter MK-VI and Systronics digital conductivity meter-304, respectively. Total dissolve salt (TDS) of the samples were determined gravimetrically by evaporation at 103-105ºC. Total hardness (TH) of the samples were determined by complexometric titration with EDTA using erichrome Black-T as an indicator. Total alkalinity of water samples were determined by titrating against 0.02 N H_2SO_4 using phenolphthalein and methyl orange indicators. The chloride ion (Cl^-) concentration was determined by titrating against Standard $AgNO_3$ solution using K_2CrO_4 solution as indicator, at neutral pH adjusted with H_2SO_4. Sulphate ion content in the water samples was determined by titrating against EDTA as prescribed by Jackson. Fluoride (F^-) content of samples was determined by SPADNS method[9].

Table 1: Physico-chemical parameters of water of Saharsa area on Feb. 2013

S. No.	Site of water sample	pH	EC (ms/m)	TDS (mg/L)	Turbidity NTU	Alkalinity (mg/L)	Total hardness (mg/L)	F^- (mg/L)	C^- (mg/L)	Sulphate (SO_4^{2-}) (mg/L)
S_1	Hatiya Gachi	7.18	1.4	733	0.41	386	235.6	0.85	194.6	233
S_2	Gangjala	7.22	2.0	950	0.13	660	323.6	0.98	216.2	168
S_3	Naya Bazar	7.31	1.9	990	0.30	270	390.7	0.80	335	178
S_4	Batraha	7.37	1.7	830	6.90	275	405.7	1.0	297.8	188
S_5	Kayastha Tola	7.50	2.1	990	0.12	330	264.0	1.1	335	188
S_6	Simraha	7.35	2.4	1360	0.25	605	215.1	1.1	372.2	235
S_7	Kahara	7.07	3.9	2070	0.12	495	571.0	1.2	580.7	282
S_8	Patuaha	7.18	1.9	910	0.12	440	303.1	1.3	275.4	188
S_9	Sarahi	7.42	1.7	852	0.55	385	244.5	1.1	238.3	188
S_{10}	Saharsa Basti	7.16	1.9	915	0.22	440	327.4	1.2	245.7	92
S_{11}	Baijnathpur	7.39	1.4	670	1.20	385	264.1	0.8	186.2	235
S_{12}	Koshi Project	7.45	1.0	460	0.22	275	127.1	0.52	111.7	141
S_{13}	Bangaon	7.01	1.5	732	0.10	275	331.5	0.60	111.7	141
S_{14}	Jhapra Tola	7.24	2.4	2040	8.20	385	488.7	1.6	603.0	284
S_{15}	Vidyapati Nagar	7.46	2.3	1270	0.12	275	435.1	0.8	372.4	188

RESULTS AND DISCUSSION

The results of the analysis water samples are given in Table 1. Turbidity of the water samples were in the range from 0.1 to 8.2 NTU. Sample No. S_4 and S_{14} showed the turbidity above the permissible limit (5 NTU) while rest of the samples showed within the desirable limit. pH of the samples were in the range from 7.01 to 7.50. So that slightly alkaline but within the permissible ISI limt (6.50 to 8.50). Higher pH value impart bitter taste to the water[10]. Electrical conductance of the samples were in the range from 1.0 to 3.9 mS/cm. sample S_7 has highest EC of 3.9 mS/cm while sample S_{12} has lowest EC of 1.0 mS/cm. There are no prescribed standard suggested by WHO for parameters EC, no comparison can be made from the observed values. However, the EC indicates the content of soluble and high conducting salts.

Total dissolved solids in the water samples were in the range from 460 to 2070 mg/L. Sample S_{12} contains the TDS within the desirable limit and sample S_7 and S_{14} contains above the permissible limit while rest of the samples have the TDS within the highest permissible limit. The values of total alkalinity for water samples varies from 275 to 660 mg/L. Except the sample S_2 and S_6, alkalinity of all the samples were within the WHO permissible limit. Alkalinity in many surface water is due to carbonate, bi-carbonate and hydroxide content. The large quantity of alkalinity imparts bitter taste to water[10].

Total hardness is the indicator of hydrogeology and aesthetic values of water. TH of water samples were in range from 127.1 to 571.0 mg/L. Samples S_1, S_5, S_6, S_{11}, S_{12} contain TH, within the desirable limit while rest of the samples contain within the highest permissible limit of WHO. It shows the water samples were moderately hard. Total hardness is imparted mainly by calcium and magnesium ions, which apart from sulphate, chloride and nitrate are found in combination with carbonates.

Fluorides concentration of water sample are within the permissible limit of WHO. High fluorides concentration causes dental Fluorosis[11], while low concentration causes dental carries. Hence, it is essential to maintain moderated concentration of fluoride in drinking water.

The chloride content in water samples varied from 111.7 to 603 mg/L. Samples S_3, S_5, S_6, S_7, S_8, S_{15} contain chloride within the desirable limit, while rest of the sample contain moderataly high. The chloride content indicates pollution status of water body due to contamination of animal and human waste. Chloride is common constituent of all natural water and is generally not classified as harmful constituent[12].

Concentration of sulphate ion was in the range of minimum 92 mg/L and maximum 284 mg/L. Sulphate concentration in sample S_1, S_6, S_7, S_{11} and S_{14} is moderately high while in rest of the samples it was within desirable limit of WHO guidelines. Higher concentration of sulphate ion has laxative effect, which is enhanced when sulphate is consumed with magnesium.

CONCLUSION

The present study, the analysis of ground water samples from Saharsa area, shows conclusively that except sample S_{12} concentrations of one or other investigated parameters are not within the desirable limit and hence they are not suitable for drinking in the accessible state. The effective maintenance of water quality of local resources through appropriate control measures, continuous monitoring of their quality parameters and after suitable treatment, the use of local resources as supplement to river water will reduce crisis of safe water of the area.

ACKNOWLEDGEMENT

I am thankful to the Principal Dr. Smt. Renu Singh, Principal Dr. Rajive Sinha, M. L. T. College, Saharsa, HOD Chemistry R. M. College, Saharsa Prof. Suman Kumar Jha, wife Smt. Madhu Kumari, daughter Miss Shruti Somya and Miss Tusha Tanya for their kind co-operation.

REFERENCES

1. W. E. Bullard, Effect of Land Use on Water Resources in Ecology of Man, An Ecosystem Approach, Harper and Row Publisher, New York (1972).
2. R. Venkatasubramani, T. Meenambal and P. Livingston Peter Goldwyn A. Correlation Study on Ground Water in Coimbatore District, Poll. Res., **25(2)**, 313-374 (2006).
3. H. D. Navadiya and H. G. Vagasia, Quality Analysis of Ground Water of B-Ward in Municipal Area of Bhavanagar (Gujrat), Int. J. Chem. Sci., **7(3)**, 1775-1778 (2009).
4. World Health Organization (WHO) Guidelines for Drinking Water Quality, 3rd Ed., Geneva (2004).
5. R. K. Trivedi (Edition) Quality Criteria for Drinking Water Prescribed by Indian Standard Institute in Environment Directory of India (1990) pp. 279-281.
6. APHA-AWWA-WEF (American Public Health Association, Americana Water Work Association-Water Environment Federation, 20th Ed. (1998).

7. H. Z. Goltman, R. S. Clymo and M. A. M. Ohnstad, Methods for Physical and Chemical Analysis of Fresh Water, IBPH, 2nd Ed. Blackwell Sceientific, Oxford (1978).

8. R. K. Trivedi and P. K. Goel, Chemical and Biological Methods for Water Pollution Studies, Environ. Publication, Karad, India (1984).

9. P. K. Gupta, Soil, Plant, Water and Fertilizer Analysis: Agrobios (India), Jodhpur (2006) pp. 334-335.

10. S. Mitharwal, R. D. Yadav and R. C. Angasaria, Emerging Water Quality Issue at Bagar: The Education Hub of Shekhavati, Int. J. Chem. Sci., **7(3)**, 1725-1732 (2009).

11. Meenakshi, V. K. Garg, R. Kavita and A. Mallik, Ground Water Quality in Some Villages of Hariyana, India, Focus on Fluoride and Fluorosis, J. Hazard. Mater., **106**, 85-97 (2004).

12. J. Chutia and S. P. Sharma, Relative Content of Chloride and Sulphate in Drinking Water Samples in Different Localities of Dhakuakhana Sub-Division of Lakhimpur District of Assam, Int. J. Chem. Sci., **7(3)**, 2087-2095 (2009).

Accepted : 02.08.2015