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Original Research Paper

Drinking Water Quality from Various Sources in Dhaligaon Area of Chirang District of Assam

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ABSTRACT

Water samples from 20 different sources from Dhaligaon area were studied to access their potability for drinking purpose. A total of 13 physico-chemical parameters have been investigated. In 50% of water samples pH was found below the permissible limit, while in 65% of water samples turbidity exceeded the permissible limit. The concentration of iron (Fe) was found within the permissible limit only in 20% of water samples. Other parameters like electrical conductivity, total suspended solids, calcium hardness, magnesium hardness, and total hardness were found within the permissible limit.

INTRODUCTION

Due to pollutional load, the availability of good quality fresh-water is becoming scarce day by day. As the quality of drinking water plays an important role in maintaining sound health, so regular monitoring of drinking water from different sources has become essential. Safe water is one which is free from faecal contamination and conforms to the limits on chemical contamination (Murugesan et al. 2004).

In Dhaligaon (26°28'N' and 89°96'E') of Chirang district, Assam, being a rapidly developing area, the demand for water supply has increased. However, till date drinking water supply has not been facilitated by civic authority in all parts of that area. In most parts of Dhaligaon, people use ring well, tube well and deep tube well as source of drinking water.

MATERIALS AND METHODS

Drinking water samples were collected randomly from 20 sources, 9 from ring wells (S_1-S_9), five from deep tube wells (S_{10}-S_{14}) and seven from tube wells (S_{15}-S_{20}) from Dhaligaon area of Chirang District, Assam. Four samples per station were collected in clean polythene bottles and stored at 4°C for analysis. Thus, all together 80 water samples were collected for a period of one year from September 2006 to August 2007 covering all the seasons (post monsoon, winter, pre-monsoon and monsoon) and carried to the laboratory of North East Regional Institution of Water and Land Management and Defence Research Lab, Tezpur. The water samples were analysed for various physico-chemical parameters such as pH, turbidity, electrical conductivity, total suspended solids, Ca-hardness, Mg-hardness, total hardness, sulphate, phosphate, chloride and iron by standard analytical methods (APHA 1995, NEERI 1986, 1988).

RESULTS AND DISCUSSION

The results of the study are presented in Tables 1, 2 and 3. The mean temperature of the water samples ranged from 26.15°C to 26.98°C in ring wells, 26.00°C to 26.60°C in deep tube wells and 25.18°C to 26.83°C in tube wells. A rise in temperature of the water leads to the speeding up of the chemical reactions in water, reduces the solubility of gases and amplifies the taste and odour (Murugesan et al. 2004).

The pH of water samples ranged from 6.05 to 6.58 in ring wells, 6.42 to 6.80 in deep tube wells and 6.22 to 6.71 in tube wells. The minimum value was recorded at the sampling point S_3, and maximum at the sampling point S_{17}. In 50% water samples the pH values were found below the permissible limit (6.5 to 8.5) of WHO (1998).

Electrical conductivity of water samples ranged from 0.087 mS to 0.785 mS in ring wells, 0.010 mS to 0.197 mS in deep tube wells, and 0.070 mS to 0.173 mS in tube wells. The electrical conductivity indicates presence of ionic salts in drinking water sources.

The turbidity of water samples ranged from 2.66 to 12.00 NTU in ring wells, 1.00 to 0.197 NTU in deep tube wells and 4.00 to 11.50 NTU in tube wells. In 65 % of water samples turbidity was above the permissible limit (5 NTU, WHO 1998). Turbidity is due to colloidal and extremely fine dispersions. Suspended matter such as clay also contributes to turbidity.

Table 1: Physico-chemical properties of drinking water collected from ring well in Dhaligaon area during the period of September 2006 to August 2007.

Sample No	Temp.	pH	EC	Turbidity	TSS	Ca	Mg hardness	TH hardness	PO_4	SO_4	Cl	Fe
S_1	26.98	6.38	0.248	06.66	06.01	42.43	054.51	096.94	0.092	8.086	0.41	0.26
S_2	26.15	6.43	0.350	02.66	02.81	48.65	021.99	070.64	0.265	3.332	1.00	0.03
S_3	26.23	6.05	0.337	12.00	09.04	94.70	105.32	200.02	0.181	5.485	1.40	1.72
S_4	26.58	6.44	0.087	05.00	09.72	09.90	002.71	012.61	0.120	0.885	0.52	0.01
S_5	26.55	6.57	0.785	06.00	04.69	49.94	086.07	136.01	0.136	4.790	0.60	0.45
S_6	26.25	6.30	0.355	11.68	19.22	19.85	019.75	039.60	0.812	2.499	1.83	3.33
S_7	26.25	6.60	0.190	11.00	13.90	44.63	037.14	081.77	0.156	2.187	0.29	0.14
S_8	26.73	6.56	0.143	09.67	09.23	40.70	049.35	090.05	0.223	4.778	0.29	0.13
S_9	26.67	6.58	0.223	04.33	22.90	23.78	022.71	046.49	0.218	3.610	1.50	0.01

Table 2. Physico-chemical properties of drinking water collected from deep tube well in Dhaligaon area during the period of September 2006 to August 2007.

Sample No	Temp.	pH	EC	Turbidity	TSS	Ca	Mg hardness	TH hardness	PO_4	SO_4	Cl	Fe
S_{10}	26.25	6.48	0.070	03.33	02.81	04.62	07.82	12.44	0.108	0.312	11.25	0.16
S_{11}	26.00	6.80	0.010	01.00	05.00	44.40	21.99	66.39	0.136	0.000	00.00	0.12
S_{12}	26.60	6.69	0.067	08.00	09.37	06.09	08.68	14.77	0.082	1.195	00.37	0.70
S_{13}	26.60	6.42	0.197	12.66	10.31	15.84	15.11	30.95	0.144	4.322	00.37	9.16
S_{14}	26.53	6.68	0.087	09.33	03.42	04.77	11.85	16.62	0.092	0.677	00.40	0.05

Table 3. Physico-chemical properties of drinking water collected from Tube well in Dhaligaon area during the period of September 2006 to August 2007.

Sample No	Temp.	pH	EC	Turbidity	TSS	Ca	Mg hardness	TH hardness	PO_4	SO_4	Cl	Fe
S_{15}	26.17	6.22	0.125	11.50	25.85	03.92	01.55	05.47	0.048	1.874	0.37	13.47
S_{16}	25.18	6.44	0.070	04.33	00.20	05.15	03.90	09.05	0.065	2.499	0.50	00.24
S_{17}	26.55	6.71	0.080	5.67	04.86	08.75	09.33	18.08	0.197	0.781	0.99	00.09
S_{18}	26.36	6.67	0.120	04.00	06.18	03.52	09.26	12.78	0.149	1.041	0.40	00.00
S_{19}	26.75	6.45	0.120	07.76	23.8	32.23	44.79	77.02	0.177	1.950	1.53	11.34
S_{20}	26.83	6.58	0.173	05.33	00.11	51.53	13.09	64.62	0.204	2.222	0.47	00.05

Temp. = Temperature; EC = Electrical Conductivity; TSS =Total Suspended Solids
All the parameters are in ppm except EC (in mS) and Turbidity (in NTU)
S_1 = Ring well of Bhowlaguri; S_2= Ring well of Mohammad Mandal Dhaligaon; S_3= Ring well of Hanuman Mandir; S_4 = Ring well of Ganesh Mandir
S_5 = Ring well of Kukurmari; S_6 = Ring well of Mahakali Mandir, Dhaligaon; S_7 = Ring well of Golden Industry; S_8 = Ring well of Assam Government construction; S_9 = Ring well of Golden industry Harpic; S_{10} =Deep tube well of Bhowlaguri; S_{11} = Deep tube well of Mohammad Mandal
S_{12} = Deep tube well of Ganesh Mandir; S_{13} = Deep tube well of Kukurmari; S_{14} = Deep tube well of Carbon Industry; S_{15} = Tube well of Bhowlaguri
S_{16} = Tube well of Hotel link line; S_{17} = Tube well of Ganesh Mandir; S_{18} = Tube well of Shib Mandir; S_{19} = Tube well of Assam Government construction
S_{20} = Tube well of Golden Industry Bucket.

Total suspended solids of water samples ranged from 2.81 to 22.90 ppm in ring wells, 2.81 to 10.31 ppm in deep tube wells and 0.11 to 25.88 ppm in tube wells.

Total hardness of water is characterized by contents of Ca and Mg salts. The total hardness of water in study area ranged from 12.61 to 200.02 ppm in ring wells, 12.44 to 66.39 ppm in deep tube wells and 5.47 to 77.02 ppm in tube wells which is within the permissible limit (300 ppm, WHO 1998).

The Ca-hardness of water samples ranged from 9.90 to 94.70 ppm in ring wells, 4.62 to 44.40 ppm in deep tube wells and 3.52 to 51.53 ppm in tube wells. The Mg-hardness of water samples ranged from 2.71 to 105.32 ppm in ring wells, 7.82 to 21.99 ppm in deep tube wells and 1.55 to 44.79 ppm in tube wells.

Sulphate is another important constituent of hardness. Excess sulphate has laxative effect and causes adverse effect on human health. Maximum desirable limit of sulphate in drinking water is 200 ppm (WHO 1998). Higher values of sulphate may cause gastro-intestinal disorders of human beings (Ramadevi et al. 2009). In the study area the concentration of sulphate ranged from 0.89 to 8.09 ppm in ring wells,

0.00 to 4.32 ppm in deep tube wells and 0.78 to 2.50 ppm in tube wells.

The concentration of phosphate ranged from 0.09 to 0.81 ppm in ring wells, 0.08 to 0.14 ppm in deep tube wells and 0.05 to 0.20 ppm in tube wells. The concentration of chloride ranged from 0.32 to 1.83 ppm in ring wells, 0.37 to 11.25 ppm in deep tube wells and 0.37 to 1.53 ppm in tube wells. Chlorides impart a salty taste and sometimes high concentration causes laxative effect in human beings (Veera Bhadram et al. 2004).

The concentration of iron ranged from 0.003 to 3.330 ppm in ring wells, 0.050 to 9.158 ppm in deep tube wells and 0.00 to 40.402 ppm in tube wells. Except S_2, S_4, S_9, S_{18} the concentration of iron was above the permissible limit (0.3 ppm, WHO 1998). Water samples from S_{19} (11.34 ppm), S_{15} (13.47 ppm) and S_{13} (40.40 ppm) were found to be highly objectionable with respect to iron content. Beyond the permissible concentration, iron alters the aesthetic quality of water (Sawant et al. 2000). Excess of iron may also cause haemosiderosis (Roy & Thakuria 2007).

CONCLUSION

On the basis of physico-chemical studies, it may be concluded that the quality of drinking water in the study area is not fully safe for human consumption. Though electrical conductivity, total suspended solids, calcium hardness, magnesium hardness and total hardness were found within the permissible limits, pH, turbidity and iron content in drinking water samples show anomalies. In fifty percent of water samples pH was below the permissible limit i.e., acidic in nature. Sixty five percent of water samples show higher turbidity. Therefore, for clean water and healthy environment proper disposal of industrial and other effluents as well as awareness creation among the people has become urgently needed.

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