ISSN: 0970-020 X; CODEN: OJCHEG
Oriental Journal of Chemistry
2011, Vol. 27, No. (2): Pg. 685-689

http://www.orientjchem.org

Physicochemical Analysis of Bore-Wells Drinking Water in Morbi-Malia Territor

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(Received: March 13, 2011; Accepted: April 17, 2011)

ABSTRACT

Physico-chemical analysis such as temperature, salinity, alkalinity, total hardness, phosphate, sulphate, nitrate, pH, electrical conductivity, T.D.S., turbidity, dissolved oxygen, fluoride, chloride of bore-well water was carried out from twenty five sampling stations of Morbi-Malia territory during May-2009 (before monsoon) and October-2009 (after monsoon) in order to assess water quality index.

Key words: Physico-chemical analysis, Bore-well drinking water, Morbi-Malia, Gujarat.

INTRODUCTION

In continuation of earlier studies on bore-well water[1-3], here we have investigated intensively the Physico-chemical analysis of drinking water of Morbi-Malia territory, located in Rajkot district of Gujarat state. Bore-well water is generally used for drinking and other domestic purposes in this area. The use of fertilizers and pesticides, manure, lime, septic tank, refuse dump etc. is the major sources of bore-well water pollution[4]. In the absence of fresh water supply people residing in this area use bore-well water for their domestic and drinking purpose. In order to assess water quality index, we have conducted the physico-chemical analysis of bore-well drinking water.

EXPERIMENTAL

In the present study bore-well water samples from twenty five different areas located in and around Morbi-Malia territory were collected in brown glass bottle with necessary precautions[5].

All the chemicals were used of AR grade. Double distilled water was used for the preparation of reagents and solution. The major water quality parameters considered for the examination in this study are temperature, pH, D.O., turbidity, electrical conductivity, T.D.S., salinity, alkalinity, phosphate, sulphate, nitrate, fluoride, total hardness and chloride contents[6].

Temperature, pH, D.O., turbidity, electrical conductivity, T.D.S., salinity, phosphate, nitrate and fluoride value were measured by water analysis kit, portable D.O. meter and manual methods. Total hardness of water was estimated by complexometric titration methods[7]. Chloride content was determined volumetrically by silver nitrate titrimetric method using potassium chromate as an indicator and was calculated in terms of mg/l. Alkalinity of water samples were measured volumetrically by titrimetric method[7]. Sulphate content was determined by volumetric method[7].

RESULTS AND DISCUSSION

Temperature

In the present study, temperature in May-2009 ranged from 29.8 to32.8^{0}C and temperature in October-2009 ranged from 29.0 to 31.7^{0}C.

D.O.

In the present study, D.O. in May-2009 ranged from 3.7 to 7.3 ppm. The minimum tolerance range is 4.0 ppm for drinking water. But the D. O. was found lower in sample station Nos. 1 and 8. In October-2009 D.O. ranged from 3.9 to 8.1 ppm. But the sample station No. 1 showed lower range.

pH

In the present study, pH in May-2009 ranged from 7.09 to 8.89. The tolerance pH limit[8] is 6.5 to 8.5. The sample station No. 1, 3, 5, 6, 8, 11, 12, 13, 15, 16, 17, 21, 23, 24 and 25 showed higher pH than prescribed range. In October-2009 pH ranged from 7.58 to 9.06. The sample station No. 8, 12, 15, 16, 17, 20, 21 and 23 showed higher pH than the prescribed range.

Turbidity

In the present study, Turbidity in May-2009 ranged from 0.06 to 2.50 NTU and in October-2009 Turbidity ranged from 0.10 to 4.70.The tolerance range for Turbidity is 5 NTU[10]. So all the sample station Nos. have shown lower NTU values than the prescribed range.

Electrical conductance

In present study, Electrical conductance in May-2009 ranged from 0.78 x 10^{-3} to 6.10 x 10^{-3} mhos/cm, while in October-2009 Electrical conductance ranged from 0.47 x 10^{-3} to 4.94 x 10^{-3} mhos/cm.

T.D.S.

In the present study, TDS in May-2009 ranged from 397 to 3090 ppm. According to WHO[9] and Indian standards[10], TDS value should be less than 500 ppm for drinking water. The sample station Nos. 1 to 25 except 10 showed higher ranges compare to prescribed WHO and Indian standards. In October-2009 TDS ranged from 237 to 2490 ppm. But sample station Nos. 1 to 25 except 7, 10, 20 and 21 showed higher range than prescribed range.

Salinity

In the present study, Salinity in May-2009 ranged from 390 to 3080 ppm and in October-2009 Salinity ranged from 240 to 2470 ppm.

Alkalinity

In the present study, Alkalinity in May-2009 ranged from 100 to 660 ppm while in October-2009 Alkalinity ranged from 120 to 700 ppm.

Phosphate

In the present study, Phosphate in May-2009 ranged from 11 to 42 mg/L and in October-2009 Phosphate ranged from 10 to 31 mg/L. The evaluated value of phosphate in the present study is higher than the prescribed value[13]. The higher value of phosphate is mainly due to the use of fertilizers and pesticides by the people residing in this area. If phosphate is consumed in excess, phosphine gas is produced in gastro-intestinal tract on reaction with gastric.

Nitrate

In the present study, Nitrate in May-2009 ranged from 84 to 447 mg/L and in October-2009 Nitrate ranged from 90 to 415 mg/L. The tolerance range for Nitrate is 20-45 mg/l. Nitrate nitrogen is one of the major constituents of organism along with carbon and hydrogen as amino acids proteins and organic compounds in the bore-well water[14]. If the nitrate reduces to nitrite then it causes methaemoglobinaemia in infants[15,16] and also diarrhea.

Sulphate

In the present study, Sulphate in May-2009 ranged from 125.29 to 365.08 mg/L and in October-

Table 1: Analysis result of the samples collacted from morbi-malia territory in may - 2009

S. No	Name of Sample Station	Temp (^{0}C)	D.O. (ppm)	P^H	Turb. (NTU)	Conduct. (mho/cm)	T.D.S. (ppm)	Salinity (ppm)	Alka-lini ty (mg/L)	Phosh phate (mg/L)	Sulphate (mg/l)	Nitrate (mg/l)	Flou-ride (mg/L)	Total Hard- (ppm)	Chlo-ride (mg/L)
1	Shri ram society	30.6	3.9	8.69	0.17	2.00	1020	1000	660	15	155.15	445	1.1	110	166.1
2	Yadunandan society	30.3	5.3	7.09	0.12	2.55	1290	1270	500	20	298.23	88	1.0	310	293.9
3	Panchavaty society	31.5	4.3	8.52	0.06	1.69	850	840	260	22	262.31	426	0.9	630	309.2
4	Jain derasar	29.8	4.4	8.38	0.36	2.17	1100	1090	260	32	273.01	255	1.2	522	281.2
5	Gayatri nagar	31.3	6.6	8.69	0.13	6.10	3090	3080	380	21	233.58	196	1.2	980	1469.7
6	Bhagvati park	31.1	6.4	8.80	0.09	3.32	1680	1660	620	42	146.12	407	1.1	448	447.3
7	Science college	32.8	4.8	8.47	0.32	1.87	950	930	100	21	163.72	447	1.0	744	393.7
8	Relif nagar	30.9	3.7	8.73	0.15	2.41	1220	1210	360	17	216.37	125	0.9	362	391.1
9	Bhuvneshwer park	31.3	5.2	8.30	0.12	2.28	1160	1150	100	18	311.44	409	1.2	710	457.6
10	Kenal road	30.2	7.3	8.30	0.27	0.92	465	460	160	38	193.15	340	1.1	310	140.6
11	Matam chock	31.5	6.8	8.65	0.14	6.00	3050	3040	370	20	233.58	195	1.2	960	1460.7
12	Bhisti vad	30.8	5.2	8.80	0.19	4.25	2120	2110	620	36	223.21	293	0.9	195	678.4
13	Rail. Station road	31.2	6.5	8.75	0.09	3.30	1680	1670	610	40	145.12	406	1.1	445	442.8
14	Kharivadi	31.6	5.9	8.20	0.11	5.11	2600	2580	120	15	266.48	124	1.0	345	1314.5
15	Ramji mandir chock	31.3	5.7	8.88	0.44	3.56	1810	1800	320	21	291.23	84	1.1	245	666.5
16	Jetpar	30.9	5.1	8.83	0.18	4.21	2130	2120	620	37	221.21	291	0.9	192	677.3
17	Aniyari	31.2	5.6	8.89	0.45	3.57	1810	1800	320	22	293.23	85	1.2	240	662.0
18	Khakharechi	31.6	6.1	8.21	0.15	1.43	720	720	220	21	125.29	395	1.1	276	153.4
19	Sarvad	31.7	5.7	8.20	0.11	5.13	2600	2570	120	16	267.48	125	1.0	342	1316.3
20	Mota dahishara	31.2	5.2	8.48	1.70	1.72	870	860	440	14	269.01	420	0.9	122	150.8
21	Khakharada	32.0	5.7	8.53	0.46	0.78	397	390	160	11	134.51	360	1.2	196	130.3
22	Jodhapar nadi	30.9	6.1	7.95	0.27	1.82	920	910	200	12	269.01	317	0.9	554	391.1
23	Chachapar	31.1	5.3	8.60	2.50	1.98	1000	990	440	20	365.08	403	1.0	176	301.6
24	Nani vavadi	32.1	6.2	8.79	0.30	1.01	510	500	240	27	278.23	390	1.2	194	120.2
25	Nichi mandal	31.8	5.5	8.63	0.12	1.30	660	650	300	14	146.12	419	1.1	216	199.4

Table 2: Analysis result of the samples collacted from morbi-malia territory in oct - 2009

S. No	Name of Sample Station	Temp (^{0}C)	D.O. (ppm)	P^H	Turb. (NTU)	Conduct. (mho/cm)	T.D.S. (ppm)	Salinity (ppm)	Alka-lini ty (mg/L)	Phosh phate (mg/L)	Sulphate (mg/l)	Nitrate (mg/l)	Flou-ride (mg/L)	Total Hard- (ppm)	Chlo-ride (mg/L)
1	Shri ram society	29.4	3.9	8.10	0.25	1.97	1000	990	700	11	105.15	345	1.0	90	230.0
2	Yadunandan society	29.2	5.3	7.58	0.56	2.28	1160	1150	660	13	188.23	92	1.0	280	242.8
3	Panchavaty society	30.6	5.6	8.41	0.94	1.39	710	700	420	20	182.31	401	0.9	500	212.1
4	Jain derasar	29.0	5.3	8.38	0.42	1.78	900	890	360	29	223.01	235	1.1	400	240.2
5	Gayatri nagar	30.4	7.7	8.21	0.49	4.94	2490	2470	580	19	203.58	176	1.1	810	1180.9
6	Bhagvati park	30.3	7.4	8.45	0.15	2.30	1390	1380	680	36	136.12	377	1.0	350	347.6
7	Science college	31.7	5.9	8.25	0.55	1.21	500	490	580	17	143.72	402	0.9	624	303.7
8	Relif nagar	29.8	4.8	8.96	0.53	1.51	770	770	440	15	196.37	105	0.9	160	173.8
9	Bhuvneshwer park	30.5	6.1	8.30	0.50	1.16	590	580	220	16	281.44	369	1.1	320	168.7
10	Kenal road	29.4	8.1	8.44	0.30	0.89	450	450	320	34	173.15	305	1.0	310	120.2
11	Matam chock	30.5	7.8	8.20	0.48	4.90	2460	2450	580	18	205.58	175	1.0	810	1181.8
12	Bhisti vad	30.0	6.4	8.61	0.33	2.03	1030	1010	420	37	201.21	290	0.9	190	343.3
13	Rail. Station road	30.4	7.5	8.44	0.14	2.29	1380	1370	680	35	136.12	375	1.0	355	346.7
14	Kharivadi	30.8	6.7	8.26	1.22	4.30	2180	2170	120	14	236.48	127	1.1	300	1267.0
15	Ramji mandir chock	30.6	6.6	8.53	0.50	3.00	1550	1540	460	20	274.23	92	1.0	240	608.2
16	Jetpar	30.1	6.2	8.63	0.34	2.02	1030	1020	420	38	201.21	295	0.9	190	345.1
17	Aniyari	30.5	6.4	8.52	0.50	3.08	1560	1550	460	21	273.23	90	1.1	230	610.9
18	Khakharechi	30.5	7.0	8.20	0.10	1.44	730	720	280	22	118.29	397	1.1	260	143.1
19	Sarvad	30.9	6.5	8.27	1.20	4.32	2190	2170	120	15	237.48	127	1.1	300	1265.2
20	Mota dahishara	30.4	6.1	8.69	0.36	0.86	434	430	220	15	239.01	415	0.9	110	145.7
21	Khakharada	31.0	6.8	8.52	0.85	0.47	237	240	160	10	134.51	355	1.2	150	69.0
22	Jodhapar nadi	30.0	7.0	8.17	0.68	1.27	640	640	200	12	249.01	313	0.9	370	250.5
23	Chachapar	30.2	5.9	9.06	4.70	1.62	820	820	520	21	355.08	401	1.0	80	242.8
24	Nani vavadi	31.3	7.1	8.19	0.53	0.74	374	370	360	26	270.23	391	1.1	140	63.9
25	Nichi mandal	31.1	6.3	8.10	0.58	1.75	890	880	360	15	145.12	414	1.2	290	337.4

2009 Sulphate ranged from 105.15 to 355.08 mg/L. The tolerance range of Sulphate is 200-400 mg/L[12].

Total hardness

In the presence study, Total hardness in May-2009 ranged from 110 to 980 ppm and in October-2009 Total hardness ranged from 80 to 810 ppm. The tolerance range for Total hardness[11] is 300-600 ppm.

Chloride

In the present study, Chloride in May-2009 ranged from 120.2 to 1469.7 mg/l and in October-2009 Chloride ranged from 63.9 to 1180.9 mg/L. While the tolerance range for chloride is 200-1000 mg/L[10].

Fluoride

In the present study, Fluoride in May-2009 ranged from 0.9 to 1.2 mg/L and in October-2009 Fluoride ranged from 0.9 to 1.2 mg/L. While the tolerance range for Fluoride is 1.0 to 1.5 mg/L[10].

ACKNOWLEDGEMENTS

The Principle Investigator is thankful to UGC for financial assistance in the form of Minor Research Project [F No. 47-550/08 (WRO) Dated:-15/01/2009]. The Principle Investigator is also thankful to The Sarvodaya Education Society, Morbi and the Principal, M. M. Science College, Morbi, for providing necessary facilities.

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