ASSESSMENT OF BORE-WELL DRINKING WATER OF DIFFERENT LOCATIONS IN DHROL-JODIA REGION: A WATER QUALITY INDEX

B. M. Bheshdadia
Department of chemistry, M. M. Science College, Morbi-363642
Saurashtra University, Rajkot, Gujarat (India)

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 drinking water was carried out from twenty five sampling stations of Dhrol-Jodia region during May-2015 (before monsoon) and October-2015 (after monsoon) in order to assess water quality index. temperature, salinity, pH, electrical conductivity, T.D.S., turbidity, dissolved oxygen value were estimated by water analysis kit and alkalinity, total hardness, phosphate, sulphate, nitrate, fluoride, chloride were estimated by volumetrically. To study the quality of bore-well drinking water, each parameter was compared with the standard desirable limit prescribed by different agencies like ISI and WHO.

Key Words : Physico-chemical study, Bore-well drinking water, Dhrol-jodia, Gujarat.

INTRODUCTION

In continuation of earlier studies on bore-well water (Rana et al 2002 "a", Rana et al 2002 "b", Bheshdadia et al 2011), here we have investigated intensively the Physico-Chemical analysis of drinking water of Dhrol-Jodia territory, located in Jamnagar 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 (Hamilton et al 1995). 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

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EXPERIMENTAL

In the present study bore-well water samples from twenty five different areas located in and around Dhrol-Jodia territory were collected in brown glass bottle with necessary precautions (Broun et al 1974).

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 (Manivasagam 1984).

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 (Vogel 1978). Chloride content was determined volumetrically by silver nitrate titrimetric method (Mohr's 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 (Vogel 1978). Sulphate content was determined by volumetric method[7].

RESULTS AND DISCUSSION

Temperature : In the present study, temperature in May-2015 ranged from 29.8 to 32.9^0C and temperature in October-2015 ranged from 29.2 to 32.2^0C.

D.O. : In the present study, D.O. in May-2015 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. 3 and 24. In October-2015 D.O. ranged from 3.9 to 7.9 ppm. But the sample station No. 24 showed lower range.

pH : In the present study, pH in May-2015 ranged from 7.12 to 8.88. The tolerance pH limit (APHA 1985) is 6.5 to 8.5. The sample station No. 2, 3, 12, 14, 15, 16, 18, 19, 20, 22, 23 and 24 showed higher pH than prescribed range. In October-2015 pH ranged from 7.10 to 8.86. The sample station No. 2, 3, 12, 15, 16, 18, 19, 20, 22 and 24 showed higher pH than the prescribed range.

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Turbidity : In the present study, Turbidity in May-2015 ranged from 0.15 to 2.49 NTU and in October-2015 Turbidity ranged from 0.34 to 2.62.The tolerance range for Turbidity is 5 NTU (Gazette 1991). So all the sample station Nos. have shown lower NTU values than the prescribed range.

Electrical conductance : In present study, Electrical conductance in May-2015 ranged from 0.81×10^{-3} to 5.78×10^{-3} mho/cm, while in October-2015 Electrical conductance ranged from 0.72×10^{-3} to 5.39×10^{-3} mho/cm.

T.D.S. : In the present study, TDS in May-2015 ranged from 460 to 2920 ppm. According to WHO and Indian standards (Gazette 1991), TDS value should be less than 500 ppm for drinking water. The sample station Nos. 1 to 25 except 2 and 11 showed higher ranges compare to prescribed WHO and Indian standards. In October-2015 TDS ranged from 430 to 2700 ppm. But sample station Nos. 1 to 25 except 2 and 11 showed higher range than prescribed range.

Salinity : In the present study, Salinity in May-2015 ranged from 450 to 2910 ppm and in October-2015 Salinity ranged from 420 to 2690 ppm.

Alkalinity : In the present study, Alkalinity in May-2015 ranged from 110 to 610 ppm while in October-2015 Alkalinity ranged from 120 to 660 ppm.

Phosphate : In the present study, Phosphate in May-2015 ranged from 12 to 38 mg/l and in October-2015 Phosphate ranged from 10 to 32 mg/l. The evaluated value of phosphate in the present study is higher than the prescribed value (APSFSL 1988). 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-2015 ranged from 82 to 421 mg/l and in October-2015 Nitrate ranged from 78 to 401 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 (Miller 1981). If the nitrate reduces to nitrite then it causes methaemoglobinaemia in infants (NEERI 1972, White 1975) and also diarrhea.

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Sulphate : In the present study, Sulphate in May-2015 ranged from 120.12 to 348.68 mg/l and in October-2015 Sulphate ranged from 108.21 to 308.25 mg/l. The tolerance range of Sulphate is 200-400 mg/l (Mekee 1978).

Total hardness : In the presence study, Total hardness in May-2015 ranged from 108 to 924 ppm and in October-2015 Total hardness ranged from 101 to 810 ppm. The tolerance range for Total hardness (Dhembare 1978) is 300-600 ppm.

Chloride : In the present study, Chloride in May-2015 ranged from 115.5 to 1390.5 mg/l and in October-2015 Chloride ranged from 110.5 to 1220.5 mg/l. While the tolerance range for chloride is 200-1000 mg/l (Gazette 1991).

Fluoride : In the present study, Fluoride in May-2015 ranged from 0.8 to 1.1 mg/l and in October-2015 Fluoride ranged from 0.8 to 1.1 mg/l. While the tolerance range for Fluoride is 1.0 to 1.5 mg/l (Gazette 1991).

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TABLE - 1   ANALYSIS RESULT OF THE SAMPLES COLLACTED FROM MORBI-MALIA TERRITORY IN MAY - 2015

S.St. No:	Name of Sample Station	Temp (^{0}C)	D.O. (ppm)	P^H	Turb. (NTU)	Conduct. (mho/cm)	T.D.S. (ppm)	Salinity (ppm)	Alkalinity (ppm)	Phosphate (mg/l)	Sulphate (mg/I)	Nitrate (mg/I)	Flouride (mg/I)	Total Hardness (ppm)	Chloride (mg/I)
1	NANDANVAN SOCIETY	31.3	4.4	8.45	0.15	1.63×10^{-3}	820	810	240	20	249.32	409	0.8	590	296.2
2	UMIYA SOCIETY	32.1	6.2	8.72	0.40	0.99×10^{-3}	490	480	240	25	265.21	378	1.0	159	115.5
3	CHAMUNDA PLOT	30.4	3.9	8.84	0.27	1.89×10^{-3}	980	970	610	15	149.13	421	1.1	108	160.2
4	MEMAN CHOCK	30.1	5.3	7.12	0.21	2.41×10^{-3}	1210	1200	470	19	281.24	86	0.8	299	280.9
5	MOCHI BAJAR	31.2	5.3	8.20	0.20	2.12×10^{-3}	1100	1090	110	18	297.23	377	1.1	671	437.6
6	KHARVA	31.4	6.1	8.25	0.23	1.31×10^{-3}	700	690	220	21	120.12	379	1.1	268	146.3
7	VANKIYA	31.2	6.1	8.15	0.24	1.32×10^{-3}	710	700	220	20	125.27	371	1.0	269	147.4
8	SHOYAL	30.9	6.2	7.94	0.35	1.78×10^{-3}	890	880	200	12	257.12	312	0.9	521	375.1
9	MAVAPAR	31.5	5.5	8.42	0.23	1.29×10^{-3}	640	630	290	14	141.01	391	1.1	211	190.4
10	MOTA GARADIYA	31.0	5.2	8.17	1.69	1.68×10^{-3}	840	830	430	14	256.35	412	0.9	121	144.8
11	LATIPAR	30.3	7.3	8.02	0.37	0.81×10^{-3}	460	450	170	34	183.79	329	1.0	299	134.6
12	JAIYA	31.2	5.1	8.55	2.49	1.81×10^{-3}	960	950	430	19	348.68	388	0.8	175	287.6
13	ETALA	32.9	4.9	8.47	0.45	1.72×10^{-3}	920	910	110	21	156.35	421	0.9	700	375.7
14	LAKSHMIPARA	31.3	6.9	8.51	0.27	5.76×10^{-3}	2860	2850	340	20	222.15	189	1.1	904	1385.6

15	JALARAM SOCIETY	30.6	5.3	8.64	0.25	4.09×10^{-3}	2000	1990	570	32	212.86	271	0.9	189	648.4
16	NANOVAS	31.2	6.6	8.68	0.17	3.12×10^{-3}	1580	1570	560	37	138.52	382	1.1	426	422.8
17	MATOVAS	31.4	5.9	8.12	0.19	4.88×10^{-3}	2440	2430	120	15	254.25	123	0.8	327	1235.4
18	CHORASHERI	31.4	5.7	8.67	0.49	3.37×10^{-3}	1700	1690	320	21	277.31	82	1.0	235	636.5
19	HADIYANA	31.0	5.7	8.88	0.52	3.39×10^{-3}	1720	1710	300	20	275.68	84	1.1	231	632.0
20	BADANPAR	30.7	5.3	8.82	0.24	3.91×10^{-3}	2010	2000	570	32	212.12	271	0.9	188	647.3
21	LAKHTAR	29.8	4.5	8.37	0.42	2.13×10^{-3}	1040	1030	260	30	261.89	248	1.0	499	270.2
22	MORANA	31.2	6.5	8.72	0.17	3.08×10^{-3}	1580	1570	580	38	145.03	381	1.1	428	427.3
23	TARANA	31.3	6.6	8.52	0.19	5.78×10^{-3}	2920	2910	350	21	223.34	181	1.1	924	1390.2
24	DISMAL	30.7	3.7	8.60	0.21	2.21×10^{-3}	1120	1110	360	17	206.78	120	0.9	352	375.1
25	KESHIYA	31.5	5.7	8.15	0.18	4.81×10^{-3}	2440	2430	120	16	254.39	122	0.8	329	1250.5

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TABLE - 2   ANALYSIS RESULT OF THE SAMPLES COLLACTED FROM MORBI-MALIA TERRITORY IN OCT - 2015

S.St. No:	Name of Sample Station	Temp (^{0}C)	D.O. (ppm)	P^H	Turb. (NTU)	Conduct. (mho/cm)	T.D.S. (ppm)	Salinity (ppm)	Alkalinity (ppm)	Phosphate (mg/I)	Sulphate (mg/I)	Nitrate (mg/I)	Flouride (mg/I)	Total Hardness (ppm)	Chloride (mg/I)
1	NANDANVAN SOCIETY	30.8	4.9	8.43	0.34	1.25×10^{-3}	780	770	260	17	219.35	379	0.9	510	275.7
2	UMIYA SOCIETY	31.6	6.8	8.70	0.72	0.81×10^{-3}	460	450	260	21	225.26	353	1.1	144	110.5
3	CHAMUNDA PLOT	30.0	4.4	8.81	0.47	1.48×10^{-3}	940	930	660	12	121.18	401	1.0	101	151.8
4	MEMAN CHOCK	29.5	5.9	7.10	0.35	2.02×10^{-3}	1120	1110	490	16	221.24	78	0.8	277	261.1
5	MOCHI BAJAR	30.7	5.8	8.18	0.39	1.85×10^{-3}	1020	1010	120	15	247.25	348	1.1	577	406.4
6	KHARVA	30.9	6.8	8.24	0.45	1.02×10^{-3}	670	660	240	17	110.14	351	1.0	251	133.8
7	VANKIYA	30.8	6.9	8.13	0.47	1.12×10^{-3}	680	670	230	18	105.21	345	1.1	248	131.1
8	SHOYAL	30.2	6.8	7.91	0.57	1.39×10^{-3}	850	840	220	10	227.19	295	0.9	431	336.9
9	MAVAPAR	31.0	6.3	8.40	0.44	1.08×10^{-3}	600	590	320	11	111.14	360	1.1	191	175.6
10	MOTA GARADIYA	30.6	5.9	8.15	1.81	1.29×10^{-3}	790	780	460	12	226.19	390	0.9	190	132.3
11	LATIPAR	29.8	7.9	8.00	0.58	0.72×10^{-3}	430	420	180	30	153.70	300	1.1	270	122.4
12	JAIYA	30.6	5.6	8.51	2.62	1.42×10^{-3}	910	900	450	14	308.25	358	0.9	161	238.4
13	ETALA	32.2	5.4	8.45	0.75	1.35×10^{-3}	850	840	120	20	126.31	395	0.8	605	335.2
14	LAKSHMIPARA	30.9	7.3	8.50	0.55	5.38×10^{-3}	2660	2650	360	18	190.16	168	1.0	790	1210.4

15	**JALARAM SOCIETY**	30.1	5.8	8.62	0.48	3.69×10^{-3}	1880	1870	590	28	202.12	250	1.0	175	618.9
16	**NANOVAS**	30.6	7.1	8.65	0.36	2.85×10^{-3}	1440	1430	580	31	118.25	358	1.1	409	400.3
17	**MATOVAS**	31.0	6.2	8.11	0.42	4.49×10^{-3}	2290	2280	130	13	224.52	112	0.9	301	1115.6
18	**CHORASHERI**	30.9	6.1	8.65	0.62	3.05×10^{-3}	1580	1570	340	17	247.13	80	1.1	215	605.5
19	**HADIYANA**	30.6	6.4	8.86	0.85	3.11×10^{-3}	1600	1590	320	18	245.86	82	1.0	216	602.5
20	**BADANPAR**	30.2	5.9	8.81	0.84	3.55×10^{-3}	1870	1860	610	27	202.21	252	0.9	177	618.8
21	**LAKHTAR**	29.2	5.1	8.35	0.96	1.75×10^{-3}	950	940	280	26	231.93	225	1.1	410	242.7
22	**MORANA**	30.8	6.9	8.70	0.48	2.70×10^{-3}	1420	1410	610	32	145.30	345	1.0	390	404.8
23	**TARANA**	30.7	7.1	8.49	0.51	5.39×10^{-3}	2700	2690	380	17	220.43	169	1.1	810	1220.7
24	**DISMAL**	30.1	3.9	8.55	0.55	1.95×10^{-3}	1030	1020	390	15	201.87	112	0.8	325	336.9
25	**KESHIYA**	31.0	6.2	8.13	0.45	4.38×10^{-3}	2260	2250	130	14	254.93	115	0.9	310	1140.2

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REFERENCES

APHA: American Public Health Association, Standard Methods for Examinnation of water and Wastewater, 16th Edn., APHA-WPCF-AWWA, Washington (1985).

APSFSL, Andhra Pradesh State Forensic Science Laboratories, Annual Report (1988).

Bheshdadia, B.M., D.S. Kundariya, and P.K.Patel, Orientaj J.Chem., 27, 685 (2011).

Broun, E., M.W. Skovgstd and M.J. Fishman, Method for Collection and Analysis of water Samples for Dissplved Minerals andGases, Vol.**5** (1974)

Dhembare, A.J., G.M. Pondhe and C.R. Singh, poll. Res., 17, 87 (1998).

Gazette of India: Extraordinary, Part-II, 3, 11 (1991).

Hamilton, P.A. and D.K. Helsel, Ground Water, 33, 2 (1995).

Manivasagam, N., Physico-chemical Examination of water, Sewage And Industrial Effluents, Pragati Prakashan, Meerut (1984).

Mekee J.E. and H.W. Wolf, Water Quality Criteria. The Resources Agency of Californina State Water Quality Control Board (1978).

Miller, D.G. Nitrate in Drinking Water, Water Research Centre, Medmenham (1981).

NEERI: National Environment Engineering Research Institute, Disinfection of Small Community Water Supplies, Nagpur (1972).

Rana, A.K., J. Kharodawala, J. M. Patel, R.K. Rai, B.S. Patel and Dabhi, Asian J.Chem., 14, 1209 (2002).

Rana, A.K., M.J. Kharodawala, H.R. Dabhi, D.M. Suthar, D.N. Dave, B.S. Patel and R.K. Rai, Asian J. Chem., 14, 1178 (2002).

Vogel, A.I., Text Book of Quantitative Inorganic Analysis, 4th Edn., ELBC, London (1978).

White, J.W., J. Agri. Food Chem., 23, 886 (1975).

WHO, International Standard for Drinking Water, 3rd Edn., Geneva (1971).

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