

Physico-Chemical Studies on Bore Wells Water of Dahod [Gujarat]

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Physico-chemical analysis such as temperature, pH, dissolved oxygen, total dissolved solids, chloride, total alkalinity, calcium and magnesium hardness, sulphate, phosphate and nitrate of borewells water was carried out from twenty sampling stations of Dahod city, Gujarat and its some interior adivasi area during the year 1999-2000.

Key Words: Physico-chemical study, Bore-well water, Water quality, Dahod.

INTRODUCTION

In continuation of our earlier studies on bore wells water¹, here, we report the physico-chemical studies of bore wells water of Dahod city, Gujarat and its some interior adivasi area. Because of the geographical isolation and remoteness, people residing in the interior adivasi area, mostly do not have access to safe drinking water. In the absence of fresh water supply, the people are forced to take water from any source that lies near their village. In most of the interior adivasi area, the borewells water is used for drinking purpose and other domestic purposes. Borewells water is the underground water that has come mainly from the seepage of surface water and is held in subsoil and pervious rocks. Borewells water is generally good quality and it is difficult to pollute borewells water. The use of fertilizers, pesticides and insecticides in rural area, manure, lime, septic tank, refuse dumps, etc. are the main source of borewells water pollution². In order to access water quality index we have carried out title studies.

EXPERIMENTAL

In the present study bore wells water samples from twenty different areas located in and around Dahod city, Gujarat were collected in brown-glass bottles with necessary precautions³.

All the chemicals used were of AR grade. Double distilled water was used for the preparation of reagents and solutions. The major water quality parameters considered for the examination in this study are temperature, pH, dissolved oxygen (D.O.), total dissolved solid (T.D.S.), total alkalinity, calcium and magnesium hardness, sulphate, phosphate and nitrate contents⁴.

Temperature pH, T.D.S., D.O., phosphate, nitrate values were measured by water analysis kit and manual methods. Calcium and magnesium hardness of water was estimated by complexometric titration methods⁵. Chloride contents were determined volumetrically by silver nitrate titrimetric method using potassium chromate as indicator. The chloride contents⁵ in the samples was calculated and expressed in mg/L. Sulphate contents were determined by volumetric method⁵.

RESULTS AND DISCUSSION

The physico-chemical data of the bore wells water samples collected in April 1999, October 1999, March 2000 and July 2000 are presented in Tables 1-4. The results of the samples vary with different collecting places because of the different nature of soil contamination⁵. All metabolic and physiological activities and life process of aquatic organism are generally influenced by water temperature. In the present study temperature ranged from 19-31°C.

The pH value of drinking water is an important index of acidity, alkalinity and resulting value of the acidic-basic interaction of a number of its mineral and organic components. pH below 6.5 starts corrosion in pipes, resulting in release of toxic metals. In the present study pH ranged from 5.90 to 8.80. In the present study sample stations Nos. 11, 15 and 19 show lower pH than that prescribed by APHA⁶. The present study showed dissolved oxygen ranged from 0.08 to 4.24 mg/L. According to WHO and Indian standards, T.D.S. values should be less than 500 mg/L for drinking water. In the present study T.D.S. ranged from 150 mg/L to 2400 mg/L.

The chloride content in the samples is in between 28.40 to 376.30 mg/L. Natural water contains low chloride ions. The findings indicate that all are below the permissible limits of chloride in drinking water prescribed⁷ by Indian Standard Index. In the present study total alkalinity ranged from 24.0 to 880.0 mg/L.

The limits of calcium and magnesium have been prescribed in the range, 75-200 mg/L and 50-100 mg/L respectively⁸. Calcium and magnesium contents in all samples collected fall within the limits prescribed. Calcium is needed for the body in small quantities, though water provides only a part of total requirements⁸.

In the present study sulphate ranged from 26.88 to 610.56 mg/L. The high concentrations of sulphate may induce diarrhoea⁹.

In the present sample of water, phosphate ranged from 1.32 mg/L to 36.00 mg/L. The evaluated value of phosphate in the present study is much higher than the prescribed value¹⁰. The higher value of phosphate is mainly due to excess 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 juice. This could even lead to the death of consumer¹⁰. Nitrate nitrogen is one of the major constituents of organisms along with carbon and Hydrogen as amino acids, protein and organic compounds, present in the bore wells water¹¹. In the present study nitrate nitrogen level showed higher values than the prescribed values¹¹. This may be due to the excess use of fertilizers and pesticides in this remote adivasi area.

TABLE-1
ANALYSIS RESULTS OF THE SAMPLES COLLECTED IN APRIL 1999

Sampling station	Temp. (°C)	pH	D.O. (mg/L)	T.D.S. (mg/L)	Chloride (mg/L)	Total alkalinity (mg/L)	Ca-Hardness (mg/L)	Mg-Hardness (mg/L)	Sulphate (mg/L)	Phosphate (mg/L)	Nitrate (mg/L)
1. Ashirvad Society	25	7.43	0.09	400	72.42	275	40.08	27.22	72.40	1.84	68
2. Adivasi Society	27	7.05	0.87	600	63.90	400	62.53	19.44	192.00	2.88	296
3. Darji Society	27	7.27	1.03	150	66.74	270	33.67	15.55	240.00	10.80	184
4. Desaiwada	25	7.53	0.91	300	59.64	320	48.10	11.66	140.00	30.80	72
5. Godi Road	26	7.27	0.91	1600	123.44	370	129.86	23.33	180.00	4.20	332
6. Godhra Road	25	7.57	1.47	600.	258.44	315	105.81	46.66	40.00	2.12	364
7. G.I.D.C.	27	7.11	0.46	1600	181.76	420	110.62	20.41	170.00	2.12	220
8. Kasha	26	7.47	0.88	200	103.66	380	59.32	20.41	127.52	22.80	296
9. Padav	23	7.49	1.83	200	302.46	350	35.27	45.68	190.00	2.12	344
10. Pankaj Society	26	7.35	0.41	1200	88.04	360	97.80	14.58	240.00	3.96	372
11. Bawka	24	6.88	0.85	200	28.40	240	43.29	25.27	150.47	5.80	36
12. Chandawada	27	7.88	1.38	200	153.36	480	88.18	48.60	190.48	5.00	392
13. Gadoi	25	7.97	0.96	400	106.50	450	65.73	15.55	210.10	4.20	296
14. Gulmahor	27	7.30	0.84	400	45.44	360	67.32	21.38	160.10	2.88	124
15. Jekot	28	7.46	0.34	300	38.34	382	40.30	31.48	140.00	6.32	68
16. Lakheshwari	25	8.07	1.10	710	59.64	360	52.91	24.30	180.12	5.56	104
17. Nagrala	26	7.51	0.55	560	248.50	410	64.13	48.60	172.16	4.20	324
18. Punsari	27	7.92	0.71	400-	49.70	420	56.11	25.27	112.07	2.40	192
19. Rosam	25	7.85	0.80	200	41.18	405	58.06	48.50	180.15	5.56	204
20. Urban Bank Hosp.	26	8.34	0.62	200	157.62	450	41.68	44.71	198.12	1.68	184

TABLE-2
ANALYSIS RESULTS OF THE SAMPLES COLLECTED IN OCTOBER 1999

Sampling station	Temp. (°C)	pH	D.O. (mg/L)	T.D.S. (mg/L)	Chloride (mg/L)	Total alkalinity (mg/L)	Ca-Hardness (mg/L)	Mg-Hardness (mg/L)	Sulphate (mg/L)	Phosphate (mg/L)	Nitrate (mg/L)
1. Ashirvad Society	20	7.20	1.32	400	134.90	260	83.37	33.05	53.60	5.52	96
2. Advasi Society	20	7.10	1.58	200	72.42	204	67.33	19.44	180.48	10.80	4
3. Darji Society	21	7.10	1.50	600	143.42	176	89.78	28.19	268.80	8.80	288
4. Desaiwada	20	7.80	2.04	400	110.76	260	78.56	34.02	152.12	36.00	240
5. Godi Road	22	6.90	2.10	600	140.58	325	110.62	61.24	142.08	6.40	280
6. Godhra Road	20	7.00	1.82	1200	376.30	300	195.59	85.55	26.88	2.36	288
7. G.I.D.C.	24	7.10	1.20	200	176.08	360	99.40	45.68	153.60	3.16	176
8. Kasta	22	7.40	1.38	600	220.10	244	64.13	29.16	107.52	23.20	248
9. Padav	21	7.40	1.62	400	369.20	292	96.19	19.44	211.20	1.32	280
10. Pankaj Society	23	6.60	1.00	1400	157.62	444	202.00	52.49	203.52	8.00	324
11. Bawka	22	5.90	1.16	200	88.04	24	51.30	21.38	130.56	5.28	6
12. Chandawada	20	7.10	4.12	600	150.52	328	86.57	73.87	180.48	8.40	244
13. Gadoi	19	7.00	3.64	600	168.98	336	72.14	36.94	211.20	5.28	184
14. Gulmahor	23	6.90	2.64	200	116.44	252	48.10	50.54	172.80	7.20	20
15. Jekot	23	6.40	1.48	400	163.30	148	38.48	27.22	96.00	4.76	96
16. Lakheshwari	22	7.10	4.24	600	106.45	330	67.32	32.08	218.88	12.00	104
17. Nagrala	21	7.10	2.04	800	147.68	284	128.60	50.54	142.08	9.60	220
18. Punsari	20	7.00	3.16	200	92.30	288	70.54	31.10	92.05	11.60	240
19. Rosam	20	6.40	1.66	600	120.70	268	60.92	31.10	27.64	4.48	2
20. Urban Bank Hosp.	21	7.50	1.36	400	144.84	324	57.72	33.05	234.42	1.60	184

TABLE-3
ANALYSIS RESULTS OF THE SAMPLES COLLECTED IN MARCH 2000

Sampling station	Temp. (°C)	pH	D.O. (mg/L)	T.D.S. (mg/L)	Chloride (mg/L)	Total alkalinity (mg/L)	Ca-Hardness (mg/L)	Mg-Hardness (mg/L)	Sulphate (mg/L)	Phosphate (mg/L)	Nitrate (mg/L)
1. Ashirvad Society	30	7.60	0.28	1400	49.70	236	47.68	17.50	345.06	5.3	10.0
2. Adivasi Society	29	7.60	0.34	800	63.90	288	57.30	23.33	245.76	6.6	6.0
3. Darji Society	30	7.20	0.33	700	44.30	144	54.60	33.10	177.20	1.2	22.6
4. Desaiwada	30	7.35	0.42	800	85.20	365	78.56	20.41	226.56	3.24	66.0
5. Godi Road	29	7.40	0.56	1600	96.56	394	112.23	54.43	168.96	6.4	176.0
6. Godhra Road	29	7.00	0.60	2200	309.56	476	165.13	96.23	264.96	5.5	204.0
7. G.I.D.C.	30	7.35	0.32	800	92.30	440	89.78	31.10	311.04	4.2	204.0
8. Kasba	29	7.40	0.42	1800	134.90	402	78.56	35.96	314.88	2.12	30.4
9. Padav	31	7.10	0.46	1000	100.82	416	67.33	29.16	307.20	2.76	216.0
10. Pankaj Society	29	7.10	0.26	1400	134.90	532	112.23	47.63	168.96	7.4	18.6
11. Bawka	30	8.10	0.80	400	49.70	100	16.03	15.55	290.00	5.5	20.0
12. Chandawada	29	7.30	0.32	1200	210.16	480	112.22	39.85	26.88	7.1	176.0
13. Gadoi	31	7.60	0.48	2400	90.88	428	56.11	38.88	70.00	6.3	64.0
14. Gulmahor	30	7.40	0.58	1600	44.02	392	64.13	43.74	215.04	5.0	64.0
15. Jekot	30	6.60	0.08	800	35.50	248	54.40	42.70	53.76	6.3	11.2
16. Lakhshwari	29	7.50	0.20	1200	71.00	384	72.14	41.80	53.76	5.0	10.4
17. Nagrala	30	7.20	0.10	1400	127.80	420	133.07	21.38	38.40	4.7	124.0
18. Punsari	31	7.55	0.16	1000	42.60	408	81.76	34.99	99.84	5.5	24.0
19. Rosam	31	7.00	0.14	600	32.66	392	59.92	38.88	261.12	5.3	10.0
20. Urban Bank Hosp.	29	7.45	0.30	400	46.86	452	46.49	47.63	291.84	5.8	64.0

TABLE-4
ANALYSIS RESULTS OF THE SAMPLES COLLECTED IN JULY 2000

Sampling station	Temp. (°C)	pH	D.O. (mg/L)	T.D.S. (mg/L)	Chloride (mg/L)	Total alkalinity (mg/L)	Ca-Hardness (mg/L)	Mg-Hardness (mg/L)	Sulphate (mg/L)	Phosphate (mg/L)	Nitrate (mg/L)
1. Ashirvad Society	27	7.90	1.00	800	120.70	546	96.16	18.47	322.56	7.2	136.0
2. Adivasi Society	27	7.90	0.82	600	173.24	410	70.54	22.36	238.08	6.6	144.0
3. Darji Society	28	7.20	1.30	425	123.00	190	69.24	34.70	244.00	1.7	70.0
4. Desaiwada	28	8.80	1.04	1400	139.16	562	110.62	21.38	384.00	22.8	248.0
5. Godi Road	28	7.50	1.24	1200	171.82	550	142.69	48.60	257.28	10.0	272.0
6. Godhra Road	27	7.80	1.20	1000	363.52	638	180.13	44.20	314.88	8.8	252.0
7. G.I.D.C.	27	7.60	0.72	600	205.90	782	152.30	45.68	307.20	9.2	6.0
8. Kasba	28	8.10	1.44	1400	166.14	514	96.19	33.05	345.60	1.9	308.0
9. Padav	28	8.40	1.28	800	275.48	616	86.57	28.19	334.08	10.8	212.0
10. Pankaj Society	27	7.70	0.72	1400	150.52	650	136.97	34.02	311.04	6.4	144.0
11. Bawka	27	6.40	1.22	600	90.88	880	4.81	6.80	334.08	6.4	5.2
12. Chandiawada	27	7.50	2.20	1400	200.22	592	96.19	35.96	253.44	28.0	160.0
13. Gadoi	27	7.40	2.66	1000	150.52	660	65.73	31.10	353.28	5.8	152.0
14. Gulmahor	28	7.50	2.02	1000	199.28	498	73.20	47.25	372.48	7.6	100.0
15. Jekot	27	7.20	1.92	700	177.00	270	43.40	57.40	477.00	2.3	23.4
16. Lakheshwari	28	7.80	1.36	800	129.22	538	89.78	33.05	334.08	1.6	64.0
17. Nagrala	27	7.10	2.18	800	153.30	564	104.21	20.41	376.32	7.6	236.0
18. Punsari	28	7.90	1.02	600	124.96	554	49.70	29.16	445.44	6.8	172.0
19. Rosam	28	7.70	0.30	200	88.04	474	80.16	15.55	472.32	8.4	30.4
20. Urban Bank Hosp.	28	8.30	0.92	1200	119.28	532	46.49	41.80	610.56	5.3	136.0

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