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Physico-chemical analysis of drinking water of Nadiad region (North Gujarat)

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Abstract

Physico-chemical analysis such as temperature, pH, dissolved Oxygen, TDS, Chloride, Total alkalinity, Calcium and Magnesium hardness, Sulphate, Phosphate, Nitrate and fluoride of bore wells, wells and lacks drinking water has been carried out from twenty sampling stations of Nadiad territory area during February 2009 to July 2009 in order to assess water quality index.
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INTRODUCTION

Physico-chemical analysis of drinking water of Nadiad, located in Kheda district of Gujarat state has been investigated intensively[1-3]. 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. Are the main sources of bore wells water pollution[4]. In the absence of fresh water supply people residing in this area use bore wells water for their domestic and drinking consumption. In order to assess water quality index, we have reported the physico-chemical analysis of bore wells drinking water.

Fluoride is found in all natural water at some concentration. In ground water however low and high concentration of fluoride can occur depending upon the nature of the rocks and the occurrence of the fluoride – bearing minerals. Fluorosis has been described as an endemic of tropical climate[5].The main sources of fluoride intake is water[6].

In low concentration of fluoride prevent dental caries. However it has been observed that when fluoride intake through water, food and air increases to a specific level (1.0-1.5 mg / l.) the beneficial effect is lost and in fact harmful effect being to show with increasing concentration (above 1.5 mg / l.). Excess intake of fluoride beyond permissible limit bring out dental and skeleton fluorosis along with some neurological disorder. Higher concentration of fluoride also causes respiratory failure, fall of blood pressure and genera paralysis. Continuous investigation

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nonfatal dose of fluoride causes permanent inhibition of growth. Fluoride ions inhibit a variety of enzymes often by forming complexes with magnesium ion and other metal ions[7].

According to Water and River Commission Western Australia ground water occupies the pores and crevices in sand, sand stone and other rocks[8]. The crucial role which ground water plays as decentralized sources of drinking water for millions of rural and urban families cannot be overstated[9]. Rao et al. reported that about 80 percentage of the diseases in the world are created because of poor quality of drinking water[10]. The quality of the ground water cannot be restored by stopping the pollution if it is contaminated once. Water quality index is very important tool for the information on water quality[7-10]. Some important ratings are given below:

Parameter	Desirable Limit	Permissible Limit	Moderately safe	Unsafe
Fluoride (ppm)	1.0	1.5	1.5-2.0	> 2.0
RSC (Meq./L)	1.0	< 1.25	-	> 2.50
SAR	5.0	< 10	10-18	> 26
EC m moh/cm	0.0-0.5	0.0-0.75	0.25-0.75	> 2.25

RESULTS AND DISCUSSION

The physico-chemical data of the bore wells water sample collected in Feb. 2009 and July- 2009 are recorded in table 1 and 2 respectively. The results of the samples vary with different collecting places because of the different nature of the soil contamination[11-15].

Temperature : In the present study Temp. ranged from 27.3 to 33.0^0 C.

pH : In the present study pH ranged from 7.5 to 8.71. The tolerance pH limit is 6.5 – 8.5.

TDS : In the present study TDS ranged from 250 to 1470 mg/L. Accordin to WHO and Indian standards, TDS value should be less than 500 mg/L for drinking water.

D.O. : The D.O. range from 4.4 to 8.4 mg/L in present samples. The minimum tolerance range is 4.0 mg/L for drinking water.

Chlorides : In the present study chloride ranged from 26.98 to 569.42 mg/L. While the tolerance range for choride is 200 – 1000 mg/L.

Total Alkalinity : The total alkalinity content in the samples is in between 160 to 748 mg/L.

Calcium Hardness : The calcium hardness ranged from 8.02 to 88.70 mg/L. The tolerance range for Ca hardness is 75 – 200 mg/L.

Magnesium Hardness : The Magnesium hardness ranged from 7.88 to 155.42 mg/L. The tolerance range for Mg hardness is 50 – 100 mg/L.

Sulphate : The Sulphate ranged from 46.12 to 443.26 mg/L. The tolerance range for Sulphate is 200 – 400 mg/L.

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Table:1 Chemical propety of bore wells water samples of Nadiad territory area (Collected in July-2009)

No	Sample Station	Temp. 0C	pH	TDS mg./L	DO mg./L	Chloride mg./L	Total Alkalinity mg/L	Ca Hardness mg./L	Mg Hardness mg./L	Suphate mg./L	Phosphate mg./L	Nitrate mg./L
1	Sandhana Borewell	33.0	7.66	250	6.2	26.98	172	14.43	18.47	269.00	55	320
2	Lake	27.6	8.20	696	6.6	66.74	552	14.43	18.47	307.44	12	380
3	Sandhana Kenal	27.4	8.15	442	4.6	34.08	400	12.82	15.55	288.23	10	210
4	Vanasar well	27.4	8.00	488	5.8	166.44	388	32.06	68.04	384.30	18	430
5	Vanasar lake	27.4	8.00	412	7.6	63.90	368	59.31	58.32	238.27	11	325
6	Matar School	27.4	8.23	558	6.6	113.60	428	40.10	64.15	176.79	18	400
7	Matar lake	27.5	8.32	633	6.8	120.70	388	20.84	73.87	122.98	11	300
8	Matar well	27.7	8.66	737	6.6	92.30	592	11.22	36.94	226.74	21	90
9	Matar kenal	27.3	8.56	1108	5.0	213.00	748	9.62	36.94	434.26	21	100
10	Matar borewell	27.4	8.33	396	8.2	42.60	352	16.06	35.96	92.23	14	320
11	Motipura well	27.4	8.50	869	4.2	191.70	520	35.27	20.41	219.05	22	330
12	Motipura borewell	27.4	8.44	1454	6.4	468.60	600	62.52	7.88	199.84	22	130
13	Traj Kenal	27.4	8.30	358	8.0	36.92	300	30.46	62.21	188.31	20	400
14	Traj lake	27.4	8.35	1420	6.6	431.68	628	9.62	15.55	365.10	20	120
15	Traj borewell	27.4	8.18	747	4.4	177.50	432	56.11	51.52	199.84	19	120
16	Paliege lake	27.7	7.60	442	5.4	92.30	360	32.06	114.7	180.62	11	310
17	Paliege borewell	27.7	8.19	373	6.8	59.64	300	38.47	56.38	46.12	14	320
18	Alindra borewell	27.5	8.43	626	4.2	117.86	392	20.84	45.68	1344.51	7	75
19	Libathi borewell	27.7	8.52	376	5.6	42.60	328	14.43	49.57	211.37	35	400
20	Tethupura borewell	27.7	8.46	524	7.0	56.80	440	12.82	17.50	192.15	36	410

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Table:2 Chemical propety of bore wells water samples of Nadiad territory area (Collected in July-2009)

No.	Sample Station	Temp.^{0} C	pH	TDS mg./L	DO mg./L	Chloride mg./L	Total Alkalinity mg/L	Ca Hardness mg./L	Mg Hardness mg./L	Suphate mg./L	Phosphate mg./L	Nitrate mg./L
1	Sandhana Borewell	32.1	7.70	280	7.0	28.40	160	9.62	19.44	226.74	23.0	280
2	Sandhana Lake	32.0	8.18	700	6.8	72.42	524	14.43	18.47	315.13	11.0	395
3	Sandhana Kenal	30.3	8.10	490	4.8	36.92	392	33.66	61.24	303.60	12.0	250
4	Vanasar well	32.0	8.01	500	5.2	102.24	264	24.05	60.26	349.71	15.0	405
5	Vanasar lake	32.2	8.10	502	6.8	68.16	372	27.25	56.38	222.89	18.0	390
6	Matar School	32.2	8.25	580	6.2	102.24	372	9.62	70.96	172.94	21.5	450
7	Matar lake	32.1	8.40	620	6.8	129.22	348	16.03	34.02	119.13	11.0	310
8	Matar well	32.0	8.50	725	6.8	82.36	516	8.02	50.54	207.52	15.0	105
9	Matar kenal	32.2	8.71	1050	5.4	156.20	744	11.22	28.19	318.97	28.0	95
10	Matar borewell	32.2	8.35	380	8.4	42.60	296	32.06	9.72	111.45	13.0	250
11	Motipura well	32.2	8.10	852	4.4	213.00	484	41.68	31.10	238.27	35.5	270
12	Motipura borewell	32.3	8.22	1470	6.2	427.42	584	30.46	62.21	276.70	16.0	105
13	Traj Kenal	32.3	8.28	380	8.4	44.02	344	12.82	20.41	207.52	17.0	235
14	Traj lake	32.4	8.20	1052	7.0	579.42	588	56.11	74.84	388.14	15.0	95
15	Traj borewell	32.1	8.18	740	4.6	171.82	420	49.69	155.42	199.84	20.0	105
16	Paliege lake	32.1	7.50	422	5.6	71.00	292	52.90	52.49	188.31	18.0	280
17	Paliege borewell	32.3	8.10	356	7.0	73.84	292	8.02	43.44	111.45	10.0	270
18	Alindra borewell	32.2	8.22	615	4.4	71.00	376	19.24	70.96	149.88	19.0	130
19	Libathi borewell	32.2	8.30	350	5.8	41.00	316	14.43	40.82	188.31	20.0	300
20	Tethupura borewell	32.0	8.25	510	7.2	56.00	424	30.46	22.36	199.84	13.00	250

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Phosphate :   Phosphate ranged from 7.0 to 55 mg/L. The evaluated values of phosphate in the present study are higher than the prescribed values. The higher values of the phosphate are mainly due to the use of fertilisers 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.

Nitrate :   The Nitrate ranged from 75 to 450 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 wells water. If the nitrate reduces nitrite, then it causes methaemoglobinaemia in infants and also diarrhea.

Fluoride : The Fluoride ranged from 0.20 to 0.50 mg/L. The tolerance range for Fluoride   is 1.0 – 1.5 mg/L.

MATERIALS AND METHODS

Water samples from twenty different areas located in and around Nadiad territory were collected in brown glass bottles with necessary precautions. All the chemicals used were of AR grade. Double distilled water was used for the preparation of reagents and solutions. The water quality parameters considered for the examination in this study are Temperature, pH, Dissolved Oxygen, TDS, Total alkalinity, Calcium and Magnesium hardness, Sulphate, Phosphate and Nitrate contents.
Temperature, pH, Dissolved Oxygen, TDS, Total alkalinity, Phosphate and Nitrate were measured by water analysis kit and manual methods. Calcium and Magnesium hardness of water was estimated by complexometric titration methods. Chloride contents were determined volumetrically by $AgNO_3$ titrimetric method using K_2CrO_4 as an indicator and was calculated in terms of mg/L. Sulphate contents were determined by volumetric method.

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