Quality parameters of ground waters in Borsad and Anklav taluka (Dist: Anand, Gujarat)

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ABSTRACT

The present study deals with the Quality Parameters of Ground waters of Borsad and Anklav taluka village of Anand district of Gujarat state of India. The Ground water quality was assessed by examing various Physico-chemical parameters. Twenty-eight ground water (Borewell) samples were collected from different villages of Borsad and Anklav taluka during the month of May-2008, September-2008, April-2009 and August-2009. The Physico-chemical parameters like Temperature, PH, TDS, DO, Total-hardness, Ca-hardness, Mg-hardness, Total alkalinity, Chloride, Sulphate, Nitrate and Phosphate have been analyzed. In the light of above results the ground water of Borsad and Anklav taluka villages, some villages are not suitable for drinking purpose. The ground water must be subjected to proper disinfect ion to ensure health of population.

Key words: Ground water quality, physico-chemical parameters, Bore well samples.

INTRODUCTION

The portion of the water seeping into soil in excess of that held as film surrounding soil particles continues its downward passage until it reaches an impervious stratum at which point it tends to accumulate. The geological stratum super imposed upon the impervious layer then becomes saturated, and is known as the zone of saturation. The upper level of the saturated stratum is called the water table. The depth of the water table below the surface varies widely. A formation, which will yield, stored water to wells or springs is called an aquifer. Water thus accumulating constitutes the stored ground source that assumes an important role in providing for domestic water needs.

Groundwater is an important part of the water cycle. Ground water accounts for more than 80% of the rural domestic water supply in India data collected in 1998 for the 54th round of the National Sample survey showed that 50% of rural households were served by a tubewell/handpump, 26% by a well and 19% by tap. Most of Indian towns

and cities do not have access to safe drinking water. In most parts of the country, the water supplied through groundwater is beset with problems of quality.

In most of the villages borewells water is used for drinking purpose another domestic purpose. Borewells water is the under ground water that has come mainly from the seepage of surface water and is held subsoil and previous 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 pollution.

MATERIAL AND METHODS

Twenty-eight samples of Ground water (Bore well) were collected from different villages of Borsad and Anklav taluka of Anand district of Gujarat state with few interior places in the month of May-2008, September-2008, April-2009 and August-2009 have been tested. Samples for analysis with standard procedure in accordance with standard method of American Public Health Association (APHA-1998). The Instruments were used in the limit of precise accuracy and chemicals used were of GR grade. Temperature, PH and TDS were measured using appropriate instruments. The Total hardness, calcium and magnesium concentration in the ground water samples were measured by titrimetric methods. The total hardness was determined by titrating the buffered water sample with 0.01M EDTA. The calcium hardness was determined by adding calcium hardness indicator, 1ml of 8% NaOH into a sample of water, mixing thoroughly and titrating with EDTA to give a purple colour. The magnesium hardness was obtained from the difference between total hardness and calcium hardness. The chloride content was determined using silver nitrate titrant and potassium chromate as the indicator under neutral conditions. The dissolved oxygen was measured using Winkler method. The Total alkalinity was determined by titrimetric methods using phenolphthalein and methyl orange indicators. The Sulphate, Nitrate and phosphate were measured using the spectrophotometer.

RESULTS AND DISCUSSION

Temperature

It is one of the most essential parameters in water and waste water system. It has significant impact on growth and activity of ecological life and it greatly affects the solubility of such as oxygen in water. Oxygen levels have decreased, as the temperature tends to increase the molecular motion of the water and any dissolved oxygen. The temperature of the ground water samples of different villages of Borsad and Anklav taluka of Anand district were found to be in the range 28° c to 38° c the measured temperature were reported in table.

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pH value is the best indication of the presence of acid or alkali in water samples. PH of ground water of Borsad and Anklav taluka villages varies from 7.2 to 8.7. The acceptable limit prescribed by the drinking water standard is 6.5-8.5.

Dissolved Oxygen

D.O. is one of the most important parameters in assessing water quality and reflects the physical and biological processes prevailing in the water. Good water should have the solubility of oxygen 7.6 and 7.0 mg/l at 30°c and 35°c respectively. Oxygen saturated water have pleasant taste. In the present study of the D.O. values of Ground water samples ranged from 1.4 mg/l to 7.4 mg/I, According to the European Economic Community, the permissible standard for drinking water for DO is 5 mg/l. As per the ISI the minimum dissolved oxygen recommended is 3 mg/l. In the present study, DO Values of sample station Nos. 1,2,5,7,8,10,12,14,16,17,18,21,24,25,26 &27 show lower DO than prescribed by ISI. Hence remaining sample station (villages) is not polluted with respect to dissolved oxygen.

Total Dissolve Solids (TDS)

TDS is an important parameter for Drinking water and water to be used for other purposes. The upper limit of TDS recommended for Drinking water is 500 mg/l by USEPA (1996), 1000 mg/l by WHO (1993) and the permissible limit in the absence of alternate source is 2000 mg/l by IS: 10500(1991). In the present study TDS ranged from 390 mg/l to 1650 mg/l.

Total alkalinity

Alkalinity is the quantitative capacity of an aqueous media to react with hydrogen ions. Desirable limit is 200 mg/l and maximum permissible limit 600 mg/l. In the present study total alkalinity ranged from 350 mg/l to 828 mg/l. so, sample station Nos.1, 2,3,4,6,7,8,17,23,26 & 27 show higher than prescribed by IS: 10500.

Chloride

Chlorides are common constituents of all natural waters. Higher concentrations of chloride impart a salty taste to water, making it unacceptable for public consumption. As per the Bureau of Indian Standards the desirable limit of chloride for Drinking water is 250 mg/l and the permissible limit in the absence of alternate source is 1000 mg/l. The chloride values of Ground water vary from 63.8 mg/ I to 843.9mg/l. All the ground water samples showed chloride value within a permissible limit.

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s. No.	Sample Station	Hq	Temp. °C	TDS mg/L	DO mg/L	Total Hardness	Ca⁺² Hardness	Mg⁺² Hardness,	Total Alkalinity	Sulphate	Phosphate	Nitrate	Chloride
				,	,	Mg/L	Mg/L	Mg/L	Mg/L	mg/L	mg/L	mg/L	mg/L
~	BORSAD	7.9	30	810	3.0	394	98.7	72.1	550	×400	2.92	40	298
2	VALVOD	8.2	30	066	1.6	468	105	88.6	676	×400	20	48	333
с	GAJNA	8.3	32	840	5.4	86	35.7	12.3	592	92	2.4	39.2	212.7
4	KATHOL	8.5	32	650	5.3	166	39.9	30.8	538	>400	0.4	24	120.5
5	DAHEVAN	8.3	33	680	6.1	124	39.9	20.5	472	×400	0.8	39.2	198.5
9	BADALPUR	8.2	34	1200	5.9	190	56.7	32.5	458	×400	8	17.3	489.3
7	DIVEL	8.0	34	560	5.6	258	109.2	36.3	466	320	2.8	4.6	120.5
ω	RAS	7.7	34	1450	2.7	320	73.5	60.2	780	×400	0.8	27.2	475.1
6	DAVOL	8.1	29	740	4.9	396	123.9	66.39	520	×400	1.3	49.3	319
10	BODAL	8.1	30	580	5.6	424	132.3	71.17	430	×400	4	20.1	121
11	ASODAR	8.1	30	420	6.2	314	98.7	52.53	382	>400	1.2	23.7	106
12	ANKLAV	7.9	30	800	5.1	604	233	90.5	420	×400	1.2	34.6	220
13	AMBALI	8.1	32	390	4.4	298	130.2	40.9	370	206	5.6	28.3	106
14	RAMPURA	7.9	34	420	6.9	350	132.3	53.2	390	206	2.4	47.4	85
15	SANKHYAD	7.7	36	1080	7.4	606	233	90.9	420	×400	1.2	17.3	468
16	BAMANGAM	7.5	36	760	3.9	420	161.7	63	478	×400	1.2	25.5	206
17	GAMBHIRA	8.0	36	1340	4.7	264	94.5	41.35	562	×400	2.4	23.7	482
18	NAVAPURA	8.0	37	890	4.1	468	157.5	75.74	518	×400	7.2	41.9	234
19	KINKHLOD	7.9	38	460	3.8	404	151.2	61.68	350	>400	1.2	36.4	121
20	LALPURA	8.2	38	660	5.7	434	161.7	66.44	400	×400	2.8	33.7	135
21	ALARSA	7.9	38	710	5.5	548	147	97.8	476	×400	1.6	43.7	142
22	NISRAYA	8.3	38	570	6.1	280	84	47.8	452	×400	2.8	51.9	121
23	BHADRAN	8.3	32	670	3.9	122	44	19	582	200	2.6	44.4	127.6
24	BOCHASAN	8.1	30	590	5.0	258	107.1	36.8	446	×400	0.8	55.2	127.6
25	VIRSAD	8.1	30	1520	5.9	494	182.7	75.96	478	>400	12	68.4	787.1
26	DEDARDA	8.1	32	1080	5.1	348	117.6	56.22	630	>400	10.4	4.6	354.5
27	NAPAVANTA	7.9	32	870	4.7	272	105	40.75	560	>400	9.0	24	205.6
28	RUDEL	8.1	34	970	5.0	322	109.2	51.92	578	×400	0.4	9.2	368.75

Table 1: Analysis Results of the Sample collected During May-2008.

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s. No.	Sample Station	Hd	Temp. °C	TDS mg/L	DO mg/L	Total Hardness	Ca⁺² Hardness	Mg⁺² Hardness	Total Alkalinit	Sulphate	Phosphate	Nitrate	Chloride
				,	,	Mg/L	Mg/L	Mg/L	Mg/L	mg/L	mg/L	mg/L	mg/L
~	BORSAD	7.6	28	860	2.3	332	100.8	56.4	628	×400	0.8	11.7	248.2
2	VALVOD	7.7	30	1180	5.0	448	121.8	79.6	696	×400	0.4	43.2	305.0
ი	GAJNA	8.3	28	930	4.1	84	25.2	14.4	636	×400	1.2	15.1	206.0
4	KATHOL	8.2	30	670	5.3	182	31.5	36.7	596	×400	1.2	28.1	106.4
2	DAHEVAN	8.1	30	730	3.0	114	37.8	18.6	496	<u>,</u> 400	0.8	12.3	163.0
9	BADALPUR	8.2	31	1270	3.6	212	63.0	36.4	504	<u>→</u> 400	0.8	10.9	482.2
7	DIVEL	8.0	30	960	4.3	102	31.5	17.2	672	<u>→</u> 400	0.8	13.7	503.5
œ	RAS	8.0	30	1480	3.0	344	67.2	67.5	804	<u>→</u> 400	0.8	17.8	440.0
6	DAVOL	7.6	31	780	4.2	390	117.6	66.5	556	<u>→</u> 400	3.6	15.0	156.0
10	BODAL	7.7	30	610	3.9	404	130.2	66.8	456	×400	0.4	17.8	127.7
11	ASODAR	7.9	30	440	3.6	304	88.2	52.7	406	×400	0.4	10.3	78.0
12	ANKLAV	7.2	30	830	1.9	568	201.6	89.4	448	×400	0.2	18.5	212.7
13	AMBALI	7.7	31	410	3.5	280	134.4	35.5	396	<u>→</u> 400	0.4	14.4	63.8
14	RAMPURA	7.8	31	420	2.8	328	130.2	48.3	416	×400	0.4	11.7	70.9
15	SANKHYAD	7.3	31	1190	4.1	616	226.8	94.9	412	<u>→</u> 400	0.4	56.2	503.5
16	BAMANGAM	7.5	30	700	1.6	348	130.2	53.14	464	<u>→</u> 400	2.4	18.5	184.4
17	GAMBHIRA	7.8	29	1310	3.6	240	84.0	38.06	604	<u>→</u> 400	4.8	31.5	425.5
18	NAVAPURA	7.5	29	860	2.2	440	163.8	67.4	552	<u>→</u> 400	2.4	30.2	198.6
19	KINKHLOD	7.8	30	480	3.4	368	142.8	54.4	384	×400	3.6	15.0	106.4
20	LALPURA	7.5	28	860	3.5	524	184.8	82.8	488	<u>→</u> 400	2.4	32.0	219.8
21	ALARSA	7.7	30	710	4.5	540	142.8	96.9	508	×400	1.4	24.7	170.2
22	NISRAYA	7.9	32	620	4.3	296	79.8	52.8	468	×400	2.4	10.3	120.6
23	BHADRAN	7.8	32	790	6.1	242	88.2	37.5	528	×400	0.8	30.0	198.6
24	BOCHASAN	7.8	30	570	3.5	228	88.2	34.1	456	<u>→</u> 400	2.4	21.9	134.7
25	VIRSAD	7.7	30	1650	3.8	448	155.4	71.4	556	×400	4.8	37.7	843.9
26	DEDARDA	8.0	30	1100	4.3	320	109.2	51.4	716	×400	4.8	16.5	390.0
27	NAPAVANTA	7.8	31	850	3.98	260	105.0	37.8	508	×400	8.2	32	241
28	RUDEL	7.7	31	890	3.4	274	101.0	42.3	524	×400	4.4	21.3	290.7

Table : 2 Analysis Results of the Sample collected During September-2008.

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s. No.	Sample Station	Hq	Temp. °C	TDS mg/L	DO mg/L	Total Hardness	Ca⁺² Hardness	Mg⁺² Hardness/	Total Alkalinity	Sulphate	Phosphate	Nitrate	Chloride
						Mg/L	Mg/L	Mg/L	Mg/L	mg/L	mg/L	mg/L	mg/L
.	BORSAD	8.0	28	840	2.4	232	79.8	37.1	668	370	0.4	18.1	184.4
7	VALVOD	8.0	30	1190	4.2	456	121.8	81.5	720	×400	0.4	48	312.0
ი	GAJNA	8.3	28	066	4.5	84	37.6	11.3	660	×400	0.2	29.5	248.2
4	KATHOL	8.2	29	670	5.7	172	48.3	30.2	604	×400	0.4	24	99.3
5	DAHEVAN	8.0	29	740	2.8	116	58.8	13.9	528	×400	0.6	29.5	191.5
9	BADALPUR	8.1	30	1550	3.0	272	88.2	44.8	608	×400	0.4	13.0	624.0
7	DIVEL	7.9	31	1060	2.4	236	107.2	31.5	776	×400	0.4	3.4	283.7
8	RAS	7.9	31	1480	3.4	316	100.8	52.5	812	×400	0.4	20.6	460.9
6	DAVOL	8.1	32	760	3.3	404	130.2	66.8	588	×400	2.0	37.0	141.8
10	BODAL	7.9	29	580	1.9	432	149.1	69.0	460	×400	0.8	15.1	127.6
11	ASODAR	8.1	30	460	3.0	344	100.8	59.3	432	260	1.2	17.8	63.8
12	ANKLAV	7.6	30	860	2.1	668	264.6	98.4	472	×400	0.8	26.1	276.6
13	AMBALI	7.9	31	410	4.2	288	151.2	33.4	408	200	3.4	21.3	78.0
14	RAMPURA	7.6	32	580	2.6	522	218.4	74.1	476	220	2.4	35.7	134.7
15	SANKHYAD	7.6	32	1050	4.1	596	226.8	90.1	480	×400	1.8	13.1	468.0
16	BAMANGAM	7.7	31	660	2.9	204	94.5	26.7	596	180	1.6	19.2	127.6
17	GAMBHIRA	7.6	30	1470	1.8	368	128.1	58.5	636	×400	0.8	17.8	517.7
18	NAVAPURA	8.3	30	006	2.9	496	142.8	86.2	556	×400	1.2	31.5	234.0
19	KINKHLOD	7.7	31	500	3.0	424	157.5	65.0	404	270	2.4	27.4	106.4
20	LALPURA	7.4	31	930	3.2	632	231.0	97.8	532	×400	1.2	25.4	255.3
21	ALARSA	7.9	30	700	2.2	524	142.8	93.0	548	×400	1.2	32.9	163.1
22	NISRAYA	8.1	31	570	3.6	256	75.6	44.0	544	320	1.6	39.1	113.5
23	BHADRAN	8.1	31	730	4.6	264	155.4	26.5	350	110	0.4	31.5	106.4
24	BOCHASAN	8.0	30	590	3.4	258	109.2	36.3	468	230	0.2	35.0	92.2
25	VIRSAD	7.9	31	1310	3.7	444	163.8	68.4	596	260	0.4	40.5	609.9
26	DEDARDA	8.4	30	1190	2.8	304	113.4	46.5	740	×400	0.4	4.1	439.7
27	NAPAVANTA	8.0	31	890	3.9	296	121.8	42.5	556	×400	0.4	24	226.9
28	RUDEL	8.1	31	930	4.9	288	98.7	46.2	560	280	0.4	6.9	312.0

Table : 3 Analysis Results of the Sample collected During April-2009.

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			Ϋ́	able : 4 Aı	nalysis Re	sults of the	Sample col	lected Duri	ng Augu	st-2009.			
s. S.	Sample Station	Hq	°C °C	TDS mg/L	DO mg/L	Total Hardness	Ca⁺² Hardness	Mg⁺² Hardness,	Total Alkalinity	Sulphate	Phosphate	Nitrate	Chloride
				,	,	Mg/L	Mg/L	Mg/L	Mg/L	mg/L	mg/L	mg/L	mg/L
-	BORSAD	7.9	31	880	1.5	404	100.8	73.9	644	270	1.2	37	219.8
2	VALVOD	8.1	29	1180	3.3	472	109.2	88.5	736	×400	1.2	31.5	397.1
ი	GAJNA	8.7	29	066	3.8	72	33.6	9.36	664	>400	0.8	17.5	276.6
4	KATHOL	8.3	30	670	3.9	168	39.9	31.3	612	300	0.4	15.1	113.5
2	DAHEVAN	8.3	30	760	3.6	152	44.1	26.3	516	380	1.2	17.8	198.6
9	BADALPUR	8.4	31	1310	5.7	204	48.3	37.9	524	×400	0.8	15.0	510.6
7	DIVEL	8.2	31	1010	3.4	272	102.9	41.3	744	260	0.8	3.4	361.7
œ	RAS	8.2	31	1440	5.6	312	67.2	59.7	828	>400	0.2	9.5	453.8
6	DAVOL	7.9	31	780	4.2	432	113.4	7.77	578	×400	0.2	17.8	127.7
10	BODAL	8.2	30	610	3.9	448	121.8	79.6	492	×400	0.2	25.4	120.6
1	ASODAR	8.2	30	480	4.7	364	92.4	66.3	456	220	0.4	20.6	78.0
12	ANKLAV	7.8	30	880	4.5	660	239.4	102.6	488	280	0.2	21.5	262.4
13	AMBALI	8.0	31	430	5.1	284	128.1	38.0	424	200	0.8	26.2	70.9
14	RAMPURA	7.8	31	580	4.4	504	186.9	77.4	476	×400	0.8	39.1	127.7
15	SANKHYAD	7.8	31	1090	4.2	628	222.6	98.9	452	×400	0.4	31.5	546.1
16	BAMANGAM	7.9	31	770	1.8	392	142.8	60.8	496	230	0.4	29.5	170.2
17	GAMBHIRA	8.2	31	1250	3.7	156	60.9	23.2	608	×400	1.2	13.0	432.6
18	NAVAPURA	8.1	31	850	2.8	428	142.8	69.6	576	220	0.2	40.5	205.7
19	KINKHLOD	7.9	31	540	3.7	450	176.4	66.8	416	200	0.4	19.2	120.6
20	LALPURA	7.7	30	930	4.2	582	184.8	96.9	534	×400	0.4	17.5	262.4
21	ALARSA	7.8	30	730	5.5	564	151.2	100.7	528	×400	0.2	13.1	177.3
22	NISRAYA	8.2	31	620	4.2	324	71.4	61.6	516	×400	0.2	32.9	134.8
23	BHADRAN	8.3	29	710	4.1	164	81.9	20.0	620	160	0.4	35.7	156.0
24	BOCHASAN	8.1	31	590	2.2	244	88.2	38.0	468	180	0.2	48.0	120.6
25	VIRSAD	7.8	31	1270	2.6	444	149.1	71.9	496	220	0.4	37.0	631.1
26	DEDARDA	8.2	30	1310	1.9	132	48.3	20.4	812	×400	0.8	6.9	375.8
27	NAPAVANTA	8.0	30	810	1.4	136	50.4	20.8	636	260	0.4	29.5	148.9
28	RUDEL	7.8	30	1120	3.4	376	134.4	58.9	596	×400	0.2	24.0	453.9

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Total Hardness

Water hardness is caused by the presence of calcium and magnesium salts. Hardness of ground water samples varies from 72 mg/l to 668 mg/l. As per the IS: 10500 the desirable limit of total hardness for Drinking water is 300 mg/l and the permissible limit in the absence of alternate source is 600 mg/l.

In the present study Total Hardness values of sample station Nos. 1,2,8,9,10,11,12, 14,15,16, 17,18,19,20,21,22,25,26, & 28 were beyond desirable limit while sample station Nos. 12,14,15 and 20 are beyond permissible limit in the absence of alternate source. Water with hardness more than 150 mg/l is found to be objectionable for domestic purpose. In the present study Ca-Hardness values of sample station Nos. 12,14,15 & 20 were above permissible limit of 200 mg/l. Mg-Hardness values of sample station Nos.12 and 21 were above permissible limit of 100 mg/l.

Sulphate

Presence of Sulphate has less effect on the taste of water compared to the presence of chloride. The desirable limit of Sulphate in drinking water prescribed by ICMR is 200-400 mg/l. In the present study Sulphate ranged 92 mg/l to greater than 400mg/l. The high concentration of Sulphate may induce diarrhea and intestinal disorders.

Phosphate

It is an essential nutrient element for growth, propagation and activity of plants, animals, even aquatic species and microbes. Phosphate in water occurs in the form of orthophosphate, polyphosphate and organic phosphate. The values of phosphate concentration of different village samples vary from 0.2 mg/l to 20 mg/l.

Nitrate

The concentration of different forms of nitrogen give a useful indication of the level of micronutrients in the water and hence their ability to support plant growth. A high content of NO3- N in water may be toxic to babies when used for making up feeds from milk powders. The observed levels of nitrate concentration, 3.4 mg/l to 68.4 mg/ I. In the present study sample station Nos. 15, 22, 24 and 25 shows higher than prescribed by WHO upper limit of 50 mg/l for domestic water.

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