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RESEARCH ARTICLE

Assessment of Ground Water Quality Characteristics of Kathalal City and its Area, Gujarat State, India

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ABSTRACT

The aim of this research work is to highlight the condition of current situation of water of kathalal territory which can help in identification of status of the water used for drinking purpose, and to establish the base for further research by considering the analytical results and findings. Various samples of bore well water collected from different areas in and around the Kathalal taluka territory and analyzed for their Physico-chemical analysis characterizations. The results of this analysis were compared with the water quality standards of WHO and CPHEEO. This study consisted of the determination of the Physicochemical properties of different types of drinking water of kathalal territory. The aim was to ascertain the quality of drinking water. On an average, the water in this area was suitable for drinking purpose. All the being rapid, economical and quantitative can be in corporate in existing field kits. A very simple pre-treatment is enough to make the water potable.

KEYWORDS

Physico-chemical parameters, drinking water, kathalal territory, Gujarat.

INTRODUCTION

“Water is the driver of life”, said Leonardo da Vinci. Water is one of the most abundant substances on our planet. Our planet is a complex system of land, air and water. It is the only substances on the earth that exists in all the three states (solid, liquid and gas) of matter[1]. Nobel laureate A. Szent-Gyogri has called "The Matrix of life" Water which maintains biologically active structure and it is now universally agreed that all life will perish without water. Some years ago, an engineer Thomson King epitomized the Water problem in the following terms:

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"Of all the substances that are necessary to life as we know it on earth, water is by far the most important, the most familiar, and the most wonderful, yet most people know very little about it"[2,3].

In continuation of our earlier analysis on bore wells water, here we report the Physico-chemical analysis of bore wells drinking water of kathalal territory. Kathalal is located in kheda district of Gujarat[4]. Bore wells water is generally used for Drinking and other domestic purposes in this area[5]. 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 forced to use bore wells water for their domestic and drinking consumption[6]. In order to assess water quality

index, we have carried out the Physico-chemical analysis of bore wells drinking water[7].

Site Location & Geological Background

Figure 1: Gujarat State Map

Kheda: The most prominent district of the Gujarat state Kheda district was formed in 1961 by dividing of Gujarat and Maharashtra state. It is spread over 2951 sq. km. Kathalal is the most valuable taluka of Kheda. Kathalal town is located about 25 km away from Nadiad. About 269604 hectare land is available for agriculture. Tobacco, wheat, potato and Paddy are the main crops. Total ten (10) talukas are in Kheda.

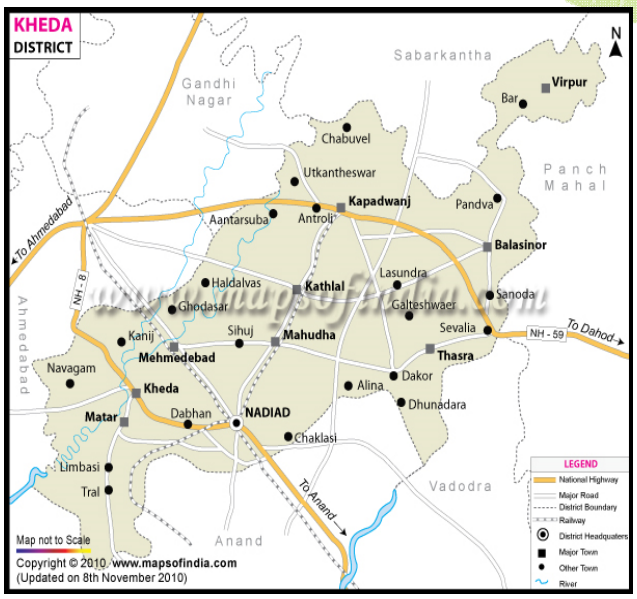

Figure 2: Kheda District Map

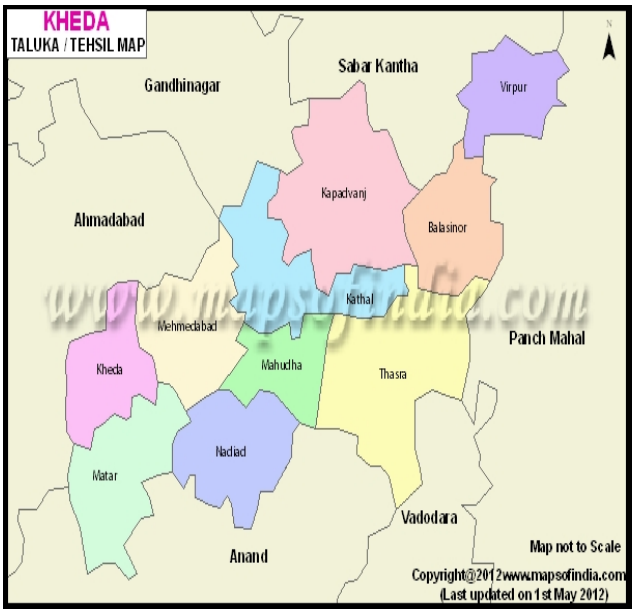

Figure 3: Kheda District with different colored tehsil Maps

Kathala taluka roughly lays between in north side Latitude and east side Longitude. In Kathalal taluka total 34337 hectare lands for farming purpose. Main crops in Kathalal taluka are like rice in 3100 hectare millet in 10459 hectare maize in 1160 hectare, wheat in 1840 hectare, castor in 3400 hectare. The Shedhi and Vatrak rivers are passing in Kathalal taluka. Total 58 villages in Kathalal taluka. Four industries are in Kathalal taluka. (In TDO Book Ref. 2007-2008)

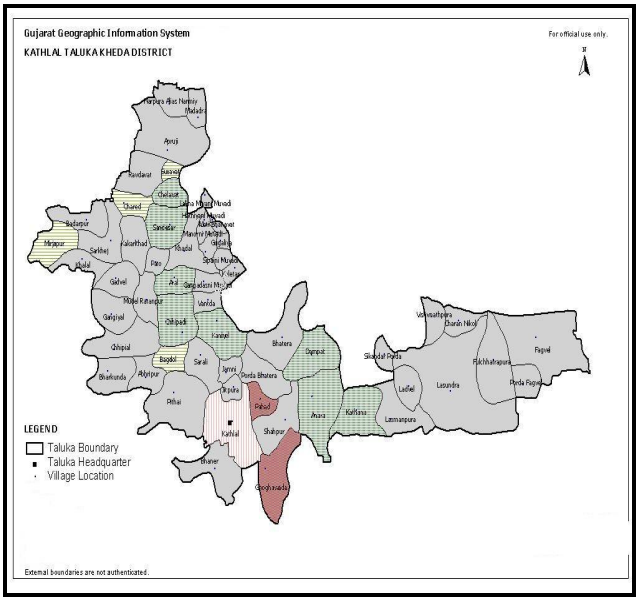

Figure 4: Kathalal Taluka Map

EXPERIMENTAL

In the present study bore wells water sample from twenty difference areas located in and around kathalal territory were collected in brown glass bottles with necessary precautions

Physico-Chemical analysis

All the chemicals used water of AR grade. Double distilled water was used for the preparation of reagents and solutions[8,9]. The major water quality parameters considered for the examination in this study are temperature PH ,dissolved oxygen (DO)total dissolved solid(T.D.S),total alkalinity, calcium and magnesium hardness, sulphate, phosphate and nitrate contents[10,11].

Temperature pH, dissolved oxygen (DO) total dissolved solid (T.D.S), phosphate, Nitrate values were measured by water analysis kit and manual methods. Calcium and magnesium hardness of water was estimated by complexometic titration method. Chloride contents were determined volumetrically by silver nitrate titration method using potassium chromate as an indicator. It was calculated in terms of mg/L. sulphate contents were determined by volumetric method[12].

RESULTS AND DISCUSSION

The Physico-chemical data of the bore wells water samples collected in February -2011 are present in table respectively. The results of the samples vary with different colleting places because of the different nature of soil contamination[6].All metabolic and physiological activities and life processes of aquatic organisms are generally influenced by water temperature.

Temperature

In the present study temperature ranged was kept from 29.4^{o}cto 34.3^{o}c.

pH

In the present study PH ranged from 6.9to 8.3 which lies in the range prescribed byAPHA[1]. 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. Toxic metals which are present in water increase the pH value of water. The tolerance pH limit is 6.5 to 8.5.

TDS

In the present study TDS ranged from 185 mg/l to 1380 mg/l. according to WHO and Indian standards. TDS value should be less than 500 mg/l for drinking water. All the sample station except sample station no 14 higher ranged as prescribed by WHO and Indian standards[7,8].

D.O

In the present study dissolved oxygen (D.O) ranged from 6.4 mg/l to 10mg/l. The minimum tolerance range is 4.0 mg/l for drinking water.

Chlorides

The chlorides contents in the samples between 28.48mg/l to 285.40 mg/l natural water contain low chloride ions. In the present study sample No.7 shows 315.75 mg/l chloride which is highest value in twenty different sampling stations. The tolerance range for chloride is 200 to 1000mg/l.

Total Alkalinity

In the present study total alkalinity range was from 148 mg/l to 856 mg/l.

Calcium Hardness

The calcium hardness range is from 8.02 mg/l to 144.3mg/l. The tolerance range for calcium hardness is 75 to 200 mg/l. Calcium contents in all samples collected fall within the limit prescribed. Calcium is needed for the body in small quantities, though water provides only a part of total requirements.

Magnesium Hardness

Magnesium hardness ranged from 19.44 to 182.74 mg/l. The tolerance range for magnesium is 50 to 100 mg/l.

Sulphate

Sulphate ranged from 19.41 mg/l to 384.30 mg/l. The tolerance range for sulphate is 200 to

Chemical analysis of underground water samples of Kathalal City DuringMarch-2011 to July-2012. That is given in table 1.

Table 1: Chemical analysis of underground water samples of Kathalal City

Sample No.	**Tem.^{o}C**	**P^{H}**	**Ca $^{+2}$ Hardness mg/L**	**Mg $^{+2}$ Hardness mg/L**	**TDS In ppm**	**Total Alkalinity mg/L**
1	27.5	7.36	145	85	435	557
2	29.1	7.47	125	**56**	446	345
3	30.2	7.6	126	59	380	**254**
4	27.4	7.39	123	67	332	552
5	27.5	**8.1**	147	66	305	478
6	27.8	7.12	254	78	1220	369
7	26.9	7.42	265	59	375	358
8	27.5	7.3	120	102	330	365
9	30.1	7.56	127	158	260	345
10	28.1	7.39	**104**	65	690	302
11	28.2	7.67	205	98	1022	301
12	29.1	6.63	200	90	595	358
13	27.7	7.45	148	67	220	678
14	28.7	6.4	156	69	525	544
15	**26.8**	7.46	178	65	470	358
16	27	7.64	189	79	990	447
17	28.4	**5.9**	185	76	**125**	458
18	**30.4**	7.62	182	72	765	401
19	28.1	7.27	135	70	540	402
20	27.5	6.34	229	86	235	465
21	27.6	7.44	269	95	235	498
22	27.4	7.5	285	93	260	521
23	28.3	7.33	247	73	**1390**	321
24	27.6	7.39	257	71	425	**845**
25	27.5	7.52	256	70	405	562
26	27.5	6.35	288	80	265	632
27	27.6	7.47	**294**	90	365	447
28	28.1	7.38	209	94	275	325
29	28.5	7.23	203	82	270	547
30	27.7	7.64	211	76	385	625

Chemical analysis of underground water samples of Kathalal City DuringMarch-2011 to July-2012. That is given in table.

Table 2: Chemical analysis of underground water samples of Kathalal City

Sample No.	**Chloride mg/L**	**PO_4^{-3} mg/L**	**SO_4^{-2} mg/L**	**NO_3^{-1} mg/L**	**D.O mg/l**	**COD mg/l**	**F^{-1}**
1	402	1.4	0.1	3.1	4.22	12	0.43
2	145	1.2	0.2	5.1	4.58	15	**0.27**
3	156	0.8	0.0	6.4	5.47	19	1.9
4	178	1.1	0.2	3.2	5.25	16	1.8
5	258	0.7	**0.0**	1.0	4.89	25	3.2
6	245	0.9	0.1	6.0	5.5	46	**5.3**
7	456	1.4	0.2	**10.2**	5.47	45	2.5
8	589	2.4	0.0	3.9	5.56	33	4.0
9	321	2.1	0.4	7.5	5.23	77	3.4
10	125	1.9	0.5	6.4	4.58	58	1.3
11	126	2.5	0.0	8.1	4.55	69	5.2
12	147	2.0	0.2	5.9	5.14	102	4.9
13	159	1.0	0.0	4.5	5.89	**120**	3.2
14	**123**	2.4	0.1	6.1	**6.01**	14	0.68
15	223	1.8	0.0	8.1	5.14	16	2.2
16	225	1.8	0.3	5.4	4.48	**09**	1.8
17	287	2.4	0.4	5.4	4.25	76	4.8
18	354	0.8	0.4	3.8	4.21	12	4.8
19	369	1.4	1.9	4.6	**4.20**	45	1.0
20	358	2.1	0.2	5.4	4.47	65	3.4
21	321	1.7	0.1	2.9	5.2	85	0.66
22	324	**2.6**	0.3	1.7	5.7	95	0.72
23	325	1.9	**2.8**	5.4	4.48	32	1.5
24	321	1.3	0.5	2.4	5.21	12	0.93
25	**665**	**0.7**	0.0	2.2	5.4	41	0.79
26	425	1.7	0.2	4.5	5.4	55	0.92
27	337	1.1	0.3	1.8	4.89	14	1.0
28	214	2.4	1.0	3.3	5.41	12	0.93
29	258	1.0	1.5	4.6	4.58	65	1.7
30	201	2.4	1.4	**1.2**	4.23	45	2.6

Table 3: Village: Bhatera Time Period: Aug.-2011-September-2011

Sr. No.	Parameters	Value		
		Minimum	Maximum	Average
1	Tem.^{o}C	26.7	29.1	27.9
2	P^{H}	6.55	7.4	6.98
3	Ca^{+2} Hardness mg/L	244	354	299
4	Mg^{+2} Hardness mg/L	50	90	70
5	TDS In ppm	877	1120	998.5
6	Total Alkalinity mg/L	224	556	390
7	Chloride mg/L	224	367	295.5
8	PO_4^{-3} mg/L	1.6	2.1	1.85
9	SO_4^{-2} mg/L	0.8	2.4	1.6
10	NO_3^{-1} mg/L	2.5	5.4	3.95
11	D.O mg/l	3.4	4.8	4.1
12	COD	33	68	50.5
13	F^{-1}	1.5	4.2	2.85

400 mg/l. The high concentration of sulphate may induce diarrhea.

Phosphate

In the present study phosphate ranged from 4.0 mg/l to 42 mg/l. The evaluated value of phosphate in the present study is much higher than the prescribed values.

The higher values of phosphate are mainly due to use of fertilizers and pesticides by the people residing in this area. If phosphate is consumed in excess, phosphine gas is produce in gastro-intestinal tract on reaction with gastric juice. This could eve lead to the death of consumer.

Nitrate

In the present study nitrate ranged from 60 mg/l to 450 mg/l. The tolerance range for nitrate 20 mg/l to 45 mg/l. Nitrate nitrogen is one of the major constituents of organisms along with carbon and hydrogen as amino acid, protein and organic compounds present in the bore wells water.

In the present study nitrate nitrogen levels show higher values than the prescribed values. This may be due the excess use of fertilizers and pesticides in this area.

Fluoride

Generally, fluoride is a naturally occurring toxic mineral present in ground water. Fluorine is a fairly common element, representing about 0.3 g/kg of the earth's crust. It exists in the form of fluoride in a number of minerals, of which fluorspar, crinoline and fluorapatite are the commonest and many rocks contain fluoride materials. From these natural sources fluoride finds its path to groundwater through infiltration.

Though, the role of fluoride in plant's nutrition is not yet well established. It is essential in small amounts (up to 1.0 ppm) for animals and human body. It may prove toxic to plant growth when present beyond certain limits. Fluorine content beyond 10 ppm. In irrigation water is harmful.

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