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STUDY OF DRINKING WATER QUALITY OF SELECTED SAMPLES COLLECTED FROM AHMEDABAD CITY DURING JANUARY 2015

Biological Science

KEYWORDS: Drinking Water, Ground Water, Ahmedabad, EC, TDS, pH

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ABSTRACT

Clean drinking water is essential for the survival. Unfortunately the quality of water has deteriorated due to various means including anthropogenic pressures. The present study is carried out for evaluating drinking water quality from Ahmedabad city from 33 drinking water samples collected from borewell groundwater coming to houses in January 2015. Various physico-chemical parameters were analyzed by standard methods. All samples were without any unpleasant taste, appearance/colour and odour. The electrical conductivity (EC) and total dissolved solids (TDS by formula) and pH were analyzed. The study result reveals that all (100%) samples were between highest desirable limit and maximum permissible limit. The pH value of most of samples (87.88%) were between 6.5 to 8.5 i.e. permissible limits as compared to GPCB or BIS 10500 standards. The data indicates drinking water may be used after proper treatment before distribution or use.

INTRODUCTION:

Water is precious to living organisms including human beings and have various forms and sources with sacred value (Khandwala and Suthar, 2007; Suthar and Suthar, 2010; Suthar *et al.,* 2013). Surveillance of drinking water is essentially a health measure intended to product information to protect the public from water borne diseases (Lalwani *et al.,* 2004; Suthar *et al.,* 2008a-d ; Suthar and Suthar, 2010; Suthar and Suthar, 2013).

Suthar and Suthar (2010) have been extensively reviewed the status of groundwater quality of urban areas from different states of India. Singh *et al.* (2005) have found random concentration of various physico-chemical parameters below the recommended value in ground water (hand pumps, Submersible pumps, taps, tubewells and wells) in the drinking water samples from some areas of Amritsar district. Lavania *et al.* (2008) isolated and identified by latest techniques the non tuberculous mycobacteria in 20.69% of 62 drinking water samples from 48 villages of Ghatampur fields area of Uttar Pradesh which are related with leprosy. Senthilkumar *et al.* (2008) undertook to assess the bacteriological quality of drinking water samples in the rural areas around industrial zone in Erode district of Tamilnadu. The result reveals that the water quality in general was found to be unsatisfactory and unfit for consumption with relation to faecal coliforms as compared with WHO and BIS-10500 standards. Rao *et al.* (2005) found good correlation coefficient between EC and TDS, Mg and HCO_3, Na and SO_4 , and Na and Cl. The same study, the analysis of different drinking water sources from 100 ground water samples all along the Nellore coast of Tamilnadu state indicated that the quality of ground water in the study area was saline and consisted of high Sodium chloride, Magnesium bicarbonate and Sodium sulphate.

In Gujarat state, many investigators have noted groundwater quality parameters (Suthar and Suthar, 2010). Shah *et al.* (2008a) studied the water quality characteristics of water samples of 39 villages of Kalol Taluka in Ghandhinagar District of Gujarat during May-2006 and compared with WHO drinking water standards. Result showed excess amount of fluoride content in Aluva and Jethlaj villages. One fourth water samples were poor for irrigation purpose also. Out of 105 pairs, 67 pairs of water parameters had positive correlation and also linear relationship was found. In case of Ahmedabad city, it is one of the cities in India having a rapidly growing and densely populated and having industrial zones on Eastern side. Ground water abstraction has been increasing continuously to keep place with urban development (Suthar and Suthar, 2010; Seddique and Ahmed, 2004). Our previous studies showed altered physic-chemical parameters of drinking warer from various areas of Ahmedabad city (Suthar *et al.,* 2008a-d; Suthar et al., 2010; Suthar et al., 2011; Suthar and Mesariya, 2012; Suthar *et al.,* 2013). Hence, the present study was carried out as a part of continuous monitoring work for checking the drinking water quality of Ahmedabad city especially groundwater samples from borewell.

MATERIALS AND METHODS:

Ahmedabad is the largest city in Gujarat state and 6th largest city (metro city) in India with a population of almost 5 millions. It is located on the bank of the Sabarmati River at an elevation of 55 m (180 ft). It is located at 23.03^{0}N and 72.58^{0}E. It has a dry climate. The average rainfall is 932 mm. The present study is associated with drinking water quality evaluated of Ahmedabad city of Gujarat state of India in the year January 2015. The 33 ground water sample (borewell water) were collected in the morning by SYBSc (CB and CZ) students and labeled appropriately. Except 6 samples, there were all other samples from different areas of eastern side of Sabarmati river of Ahmedabad city. The drinking water samples were about to college laboratory and assessed by examining physico-chemical characteristics by standard metods (Sunilkumar and Ravindranath, 1998). The parameter analyzed were taste, appearance/colour, odour, electrical conductivity (EC), total dissolve solids (TDS) and pH. Taste, appearance/colour and odour were evaluated by direct observations. The EC was measured by Systronics digital EC meter model 335. TDS was calculated from the EC value by 442 conversion method (factor 0.7). The pH value was measured by Systronics digital pH meter 324 at 25^{0}C. The data were compared with Gujarat Pollution Control Board (GPCB) drinking water standards as per Kapila and Mehta (2006). These standards are same as IS:10500 of Bureau of Indian Standards for parameters studied (Shankar & Balasubramanya, 2008). Statistical analysis was carried out by MS-Excel™ like arithmetic mean, mode, median, standard deviation (SD), Range (minimum, maximum), standard error of mean (SEM),

percentage etc.

RESULTS:

In the presence study we have not found any unpleasant odour and taste along with colourless ground water sample. Electrical conductivity (EC) was having 1.1776 mean value between the range of 1.09 to 1.30 and standard deviation of 0.064. All 33 samples (100%) were between highest desirable limit and maximum permissible limits as compound with GPCB standards. This indicates that EC and TDS are higher than highest desirable limits but not exceeding maximum permissible limits. Value of pH having 6.8 mean, 6.14 to 8.46 range and 0.403 standard deviation. Most of the samples (29 out of 33) were within desirable standard limits. Only 4 samples were below 6.5 value. Total 26 out of 33 samples indicating acidic nature of water (pH <7) (Tables 1-5).

DISCUSSION:

Groundwater is generally free from contamination and is used over surface water, which is mostly contaminated by anthropological activities. However, in some cases, the quality of groundwater can deteriorate to such intolerable levels that interventions are needed prior to usage (Talabi, 2012). Health problems like fluorosis, cancer, goiter, low intelligence level, kidney stone (renal stone) etc. are resulted from consumption of improper composition or drinking water like excess floride, inadequate iodine concentration, water pollutants (such as heavy metals, inorganic and organic compounds). Excess amount of calcium and other salts in water affects public etc. (Karaiyanna et al, 2007; Suthar and Suthar, 2013).

Lokesh *et al.* (1999) carried out assessment of ground water quality from 46 public borewell both pre-monsoon and post-monsoon seasons in Udipi taluka of Karnataka state. Most of the chemical constituents were within maximum permissible limits of WHO and Indian drinking water standards. However, some of the samples showed pH less than 6.5. The fluoride concentration was less than the desirable limit. Hardness and iron concentration were in excess. During post-monsoon period, there were increased concentration of EC, Ca, HCO_3 and Fe levels observed. There was foul smell emitted by borewell water experienced by people.

Kamaraj *et al.* (2008) carried out appearance, odour, turbidity, TDS, EC, pH, alkalinity, total-Ca-Mg-hardness etc. from different water samples from Cuddalore district of Tamilnadu and the result reveals that most of the physico-chemicals parameters were reported with in permissible limits on the other hand.

Hussain and Hussain (2004) reported drinking water quality of 6 villages showing impact of textile industrial waste water outlated from Bhilwara, Rajasthan. The study area was high TDS (25 kmg/l) which is mainly contributed by Ca, Mg, Na, Cl and bicarbonate. No source in the study area is suitable for drinking purpose as per drinking water standards (IS:10500) 1993.

Shahnawaz *et al.* (2009) analyzed physico-chemical parameters of 66 ground water samples in Bhojpur district of Uttar Pradesh. The water sample were collected from hand pump and public water supply and compared with WHO drinking water standards. They found elevated levels of EC, turbidity, TDS, total hardness, calcium and Iron. Arsenic concentration ground water samples were found higher than that or WHO permissible limit.

Lark *et al.* (2002) had done analysis of drinking water samples from hand pumps in Amritsar city. They developed treatment method to chlorine demand and M.P.N. count zero. So, such innovations may lead to water quality management and distribution system may help the society at large.

CONCLUSION:

Eastern part of Ahmedabad city is mainly related with industrial activities. The result suggests further investigation by additional parameters in order to get the scenario of drinking water quality from ground water (bore-well) which can be helpful for preventing water borne diseases and other complication to laymen.

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Table-1 Some Physico-chemical parameters of various parts of Ahmedabad studied January 2015 (n=33)

No	EC (mS/ml)	TDS (PPM)	pH	Area	Source
1	1.14	798	6.16	Maninagar	Borewell
2	1.28	896	5.51	Bopal	Borewell
3	1.26	882	5.7	Vastral	Borewell
4	1.25	875	5.77	Odhav	Borewell
5	1.15	805	5.26	Sarkhej	Borewell
6	1.16	812	6.04	Vatva	Borewell
7	1.19	833	5.51	Vastral	Borewell
8	1.17	819	6.04	Sarbarmati	Borewell
9	1.12	784	5.67	C.T.M	Borewell
10	1.15	805	6.25	Vastral	Borewell
11	1.14	798	5.86	Ghodasar	Borewell
12	1.3	910	5.69	Naroda	Borewell
13	1.28	896	5.7	Ishanpur	Borewell
14	1.16	812	5.6	Ishanpur	Borewell
15	1.16	812	5.84	Naroda	Borewell
16	1.15	805	6.05	Vastral	Borewell
17	1.3	910	5.69	Vastral	Borewell
18	1.1	770	5.69	Naroda	Borewell
19	1.15	805	5.76	Naroda	Borewell
20	1.18	826	5.95	Maninagar	Borewell
21	1.18	826	5.74	Vastral	Borewell
22	1.14	798	5.76	Krishna Nagar	Borewell
23	1.22	854	5.69	Maninagar	Borewell
24	1.1	770	5.98	Ranip	Borewell
25	1.23	861	7.46	Jashoda Nagar	Borewell
26	1.1	770	5.95	Ranip	Borewell
27	1.09	763	5.14	Bapu Nagar	Borewell
28	1.09	763	5.65	Navarangpura	Borewell
29	1.26	882	5.34	Ramol	Borewell
30	1.24	868	5.81	Vastral	Borewell
31	1.14	798	5.35	Vastral	Borewell
32	1.1	770	6.35	Naranpura	Borewell
33	1.18	826	5.53	Sardar Nagar	Borewell

Abbreviations : EC= Electrical conductivity; TDS= Total Dissolved Solids

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Table 2 GPCB standards for water (as cited in Kapila and Mehta, 2006)

	Unit of Measurement	HDL	MPL
EC	mS/ml	0.7	2.86
TDS	PPM	500$	2000$
pH	-	6.5 to 8.5	-

Abbreviations : GPCB= Gujarat Pollution Control Board, EC= Electrical conductivity; TDS= Total Dissolved Solids, HDL= Highest Desirable Limits, MPL=Maximum Permissible limit

Note : $ Value Calculated using conversion 442 method

Table 3 Value of some physico-chemical parameters drinking groundwater samples of Ahmedabad City (n=33)

Ground water (Borewell)	EC	TDS $	pH
Unit of Measurement	mS/ml	PPM	-
Mean ± SEM	1.18 ± 0.00113	824.3 ± 7.7908	6.80 ± 0.0701
Minimum	1.09	763	6.14
Maximum	1.3	910	8.46
Mode	1.14	798	6.69
Median	1.16	812	6.74
SD	0.064	44.455	0.403

Abbreviations : GPCB= Gujarat Pollution Control Board, EC= Electrical conductivity; TDS= Total Dissolved Solids, SEM= Standard Error of Mean, SD= Standard Deviation

Note : $ Value Calculated using conversion 442 method

Table 4 Number of Samples having Value of EC and TDS compared with GPCB Standards

Measured Value	EC	TDS
Below HDL	0	0
Between HDL and MPL	33 (100%)	33 (100%)
Above MPL	0	0
Total	33	33

Abbreviations : GPCB= Gujarat Pollution Control Board, EC= Electrical conductivity; TDS= Total Dissolved Solids, HDL= Highest Desirable Limits, MPL=Maximum Permissible limit

Table 5 Value of pH compared with GPCB Standards

Value of pH	No of samples	%
Less than 6.5	4	12.12
between 6.5 to 8.5#	29	87.88
More than 8.5	0	0
Total	33	100

 # Desirable limit
Abbreviations : GPCB= Gujarat Pollution Control Board, %= Percentage

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