

Assessment of Ground Water Quality in the City of Mahesana City, Gujarat, India

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ABSTRACT

Groundwater is one of an important source of water for the people in the city. The chemical parameters of groundwater play a significant role in classifying and assessing water quality. Groundwater samples were collected from 5 stations representing the whole city during summer of year 2014 and were analyzed for different physico-chemical parameters i.e. pH, Electrical Conductivity (EC), Total Dissolved Solid (TDS), Total Hardness, Total Alkalinity, Turbidity, Phosphate, Sulphate. The results were compared with the limits set by WHO and BIS.

Keywords: Groundwater, Water Quality WHO, BIS

I. INTRODUCTION

The earth has substantial water resources, in various forms and only a small fraction is readily accessible in river flows, surface lakes and ground water for human consumption. This has put constraints on water resources and is raising questions about limits to water availability. Serious water challenges face humanity, including the failure to meet basic human needs for safe water and sanitation. (Gleck and Palaniappan, 2010). The domestic water consumption is dwarfed by the demands of agriculture and ecosystems (Hunter et al, 2010; Data 360 2010). Locally rural people depend on groundwater as a source for drinking water and also for other domestic chores.

Groundwater is water located beneath the ground surface in the soil pore spaces and in the fractures of lithologic formation (Anonymous, 2009a) Groundwater is not as susceptible to pollution as surface water, but once polluted, restoration is difficult and long term (Henry and Heinke, 2005). Municipal waste, industrial wastes, chemical fertilizers, and landfill leachates have entered the soil, infiltrated to some aquifers, and degraded groundwater quality (Vasanthy et al, 2009; Anonymous, 2009b; Sirkar et al 1995).

The quality of groundwater may also vary with depth of water table and seasonal changes and is governed by the extent and composition of the dissolved salts depending

upon the source of the salt and subsurface environment (Maruthi and Madhuri, 2011; Burstson et al, 1993; Rajmohan 2003). In some coastal areas, intensive pumping of groundwater has caused salt water to intrude into freshwater aquifers. The physical and chemical parameters of groundwater play a significant role in classifying and assessing water quality. Hence a continuous periodical monitoring of groundwater bodies is necessary.

II. MATERIALS AND METHODS

The water samples extensively used for drinking purpose were collected from 5 different locations during summer 2012. High-grade Porcelain bottles were used to collect water samples. These bottles were sealed and capped till chemical analysis was done. The tests were carried out as per the standard methods (APHA 1995). 9 parameters, which are important for water quality, were selected for the analysis. The physico-chemical parameters included for analysis were pH, Electrical Conductivity (EC), Alkalinity, TDS, Total Hardness (TH), Phosphate (PO_4^{3-}), Sulphate (SO_4^{2-}), Turbidity. The results were compared with BIS and WHO standard.

III. RESULT AND DISCUSSION

The physico-chemical characteristics of groundwater are given along with the standard values in Table 1.

3.1 Colour, Odour and Taste:

In the present study colour, taste and odour of the water samples were noted at the sampling site. All the drinking water samples were clear, colourless and odourless.

3.2 pH:

The pH has no direct adverse effect on health, but alters the taste of water. The pH of ground water samples at all the sites varied from 7.11 to 8.6. According to WHO the permissible limit of pH for drinking water is 6.5-8.5 and according to BIS is 6.5-8.5. Hence, the pH values at all the stations are within the limit.

3.3 Electrical Conductivity (EC):

Conductance of water is due to the presence of soluble salts and other ionic species, which act as conducting agents. It is used to measure the ability of water to carry electric current. (Abdul Jameel, 2002). Electrical conductivity of water samples ranged from 1.28 mmho/cm to 7.7mmho/cm. EC is high at site 3. The high value of conductivity may be due to ionized substances present (Aramini et al 2009)

3.4 Total Dissolved Solids (TDS):

TDS indicates the general nature of water quality of salinity and is an important parameter for drinking water and other uses (Bruvold and Pangborn 1966). The Total dissolved solids ranged from 322-1430mg/L. The presence of high values of Total Dissolved Solids in certain locations of the study area may be due to the influence of anthropogenic sources such as domestic sewage, solid waste dumping leachates of various pollutants into the groundwater (Chandra et al, 2000; Chatterjee and AlokKumar, 2008). Water having high TDS can be used after removing the excess by reverse osmosis and electrodialysis (Clarke et al 1977).

3.5 Turbidity:

Turbidity is caused by particulate matter in Most of the natural waters contain substantial suspension. According to BIS (1998), the desirable limit of turbidity of water is 5NTU and a maximum permissible limit is 10 NTU. The study showed that the turbidity value ranged from 0-1 NTU. Therefore, all the water sample were well within the desirable limit.

3.6 Total Hardness:

The total hardness of water samples ranged from 133-966 mg/L. The maximum allowable limit for drinking purpose is 600 mg/L and the most desirable limit is 300 mg/L as per BIS standards and WHO up to 500 mg/L. The total hardness is relatively high in some samples may be due to the presence of calcium and magnesium ions as water. Acute toxicity of sulphates in humans and bicarbonates, carbonates, chloride and sulphate ions. Hardness in water could also be from solution of carbon dioxide released from bacterial action in soil in percolating water (Sawyer and McCarty 1967). Groundwater in the area exceeding the limit may be due to the discharge of untreated effluents from the dyeing units and solid waste leachate.

3.7 Alkalinity:

Amounts of dissolved carbon dioxide, which is the principle source of alkalinity and this can be conveniently evaluated by acid titration. In the present study the alkalinity of water samples ranges from 140-493 mg/L. According to BIS the maximum desirable limit of alkalinity in drinking water is 200 mg/L and maximum permissible limit is 600mg/L. Hence, all the groundwater samples collected in the study area are well within the permissible limit.

3.8 Sulphate (SO₄²⁻):

Sulphate is naturally occurring anion in all kinds of natural waters and does not affect the taste of animal data suggests that sulphate salts are not very toxic (Lorraine 2000). The maximum desirable limit of sulphate in drinking water is 200mg/L and maximum permissible limit is 400mg/L. In the present study, sulphates range from 18-98 mg/L. the values are within the standard limits given by BIS and WHO.

3.9 Phosphate (PO₄³⁻):

Phosphate may occur in ground water as a result of domestic sewage, detergents, agricultural effluents with fertilizers and industrial waste water. content in present investigation ranges from 0.1-0.35mg/L. in the present study area phosphate traced may be due to the use of detergents and discharge of domestic waste, untreated industrial water (Golterman 1975).

IV. CONCLUSION

The present study of the physico-chemical quality of water samples showed that most of the parameters were within the permissible limits of BIS and WHO. Analysis showed higher value of hardness and electrical conductivity at site number 3. The high value of Hardness and Conductivity may be due to the release of

untreated waste from the industries and the poor disposal system. Therefore, it is recommended that technologies like reverse osmosis, electro dialysis, filtering and boiling can be used for treatment consumption

Table 1. Analytical data of the physico-chemical analyses of groundwater in the Study area

Station	S1	S2	S3	S4	S5	WHO	BIS
pH	7.1	7.3	7.2	8.1	7.1	6.5-8.5	6.5-8.5
EC	3.85	1.28	7.70	2.56	3.85	--	--
TDS	1430	633	1200	322	1233	500-1500	500-1000
Turbidity	1	00	0.33	0.33	1	5	5
Hardness	454.2	149.6	966.2	133.7	422.2	500	300
Alkalinity	493.3	340	140	273.3	386.7	--	200
Phosphate	0.10	0.30	0.10	0.25	0.35	--	--
Sulphate	98	22	84	50	86	400	200

The values are in mg/L except pH, EC (mmho/cm), Turbidity (NTU). WHO-World Health Organization standard, BIS- Bureau of Indian Standards.

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