



## PHYSICO-CHEMICAL ANALYSIS OF UNDERGROUND WATER OF TALAJA TALUKA OF BHAVNAGAR DISTRICT, GUJARAT, INDIA

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### ABSTRACT

*Underground water samples were collected from different villages of Talaja taluka (Bhavnagar district). These samples were analyzed for their physicochemical characteristics. Laboratory tests were performed for the analysis of sampling for pH, Hardness, chloride, Alkalinity, TDS etc. This study is the aim for this research works to highlight the situation of current effect of Talaja Taluka. The usefulness of these parameters in predicting ground water quality characteristic were in and around Talaja Taluka, suitable for drinking purpose or not.*

**KEYWORDS:** Water quality, Physico-chemical parameters, TDS, EC, Talaja taluka.

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### INTRODUCTION

Chemically, water is a compound consisting of two atoms of hydrogen and one atoms of oxygen (H<sub>2</sub>O). Though it can exists in all the three forms – solids (ice at 0<sup>0</sup>C), liquid (Water at normal temperatures) and gas (Water vapours at 100<sup>0</sup>C), most water on earth is found in the liquid form. The water, odorless, tasteless, transparent liquid that is colorless in small amounts

but exhibits a bluish tinge in large quantities. It is the most familiar and abundant liquid on earth.[1-3] In solid form (ice) and liquid form it covers about 70% of the earth's surface. It is present in varying amounts in the atmosphere.[4-6] Most of the living tissue of a human being is made up of water; it constitutes about 92% of blood plasma, about 80% of muscle tissue, about 60% of red blood cells, and over half of most other tissues.[7] It is also an important component of the tissues of most other living things.

## **MATERIALS AND METHOD**

Ten different water samples were collected from different locations of rural areas from Talaja taluka and Kept in polythene bottles. Analysis of water samples was done as per standard process. All the chemicals used of AR grade .Double distilled water was used for the preparation of reagent and solutions. The water samples were immediately brought in to Laboratory for the estimation of Physico-chemicals parameters, like water temperature were recorded at the time of sample collection by using Thermometer , While other parameters such as pH, Chlorides, TDS, alkalinity, calcium, magnesium hardness, sulphate, sodium and potassium contents. Temperature, pH and TDS measured by water analysis kit and methods. Calcium and Magnesium hardness of water was estimated by complex metrics titration method. Chloride contents were determined volumetrically by silver nitrate titration method using potassium chromate as indicator. [8-9]

## **RESULTS AND DISCUSSION**

The Physico-chemical data of the ground water samples collected in May-2015 and Jun.2015 are presented in Table -2 and Table -3 respectively. The results of the samples vary with different collecting places because of the different nature of soil contamination.

### **Temperature**

The water temperature can increase due to natural and human factors. Direct sun light is the major cause for the rise in water temperature. The temperature of a water body varies with climate, season and time of the day, is one of the most essential parameter in water. It has significant impact on growth and activity of ecological life and is greatly affects the solubility of oxygen in water. In the study temperature ranges from 28.0 °C to 31.5 °C.

### **pH**

Waters which has a pH value of more than 9.6 or less than 4.5 becomes unsuitable for most life forms and also for most others uses. pH plays an important role in the estimation of hardness, alkalinity and coliforms in water. It may be used as an indicator of pollution. Most of water samples are slightly alkaline due to presence of bicarbonates and carbonates. The pH value observe ,in this study, of water samples varied between 7.02 to 8.06

### **Electrical Conductivity (EC)**

The conductivity of polluted waters is high. This measure, therefore, is often used as an index of pollution. Conductivity varies with temperature. Generally conductivity is reported at around at 30<sup>0</sup>C. Electrical Conductivity is a measure of water capacity to convey electric current. It signifies the amount of total dissolved salts. EC values were in the range of 0.39 micro mhos/cm to 2.94 milimhos/cm.

### **Total Dissolved Solids (TDS)**

In humans, drinking water containing a high concentration of total solids can cause laxative effects.[10] Total solids in irrigation waters can induce the formation of saline and alkaline wastelands. On evaporation, the salts are left behinds on the soil surface in the form of a thin crust or a fine powder. Total dissolved solids indicate the salinity behavior of ground water. A large number of solids are found dissolved in natural water the common ones are carbonates, bicarbonates, chloride, sulphate, phosphate, iron ,etc. There for TDS is sum of the cations and anions concentration. According to WHO and Indian Standards TDS values should be 500 mg/L for drinking water. In the present Study TDS ranged from 490 mg/L to 1440 mg /L and Sample No. 9 shows 1440 mg/L TDS which is highest value in all samples.

### **Alkalinity**

In drinking water, alkalinity up to 200 mg/l as CaCO<sub>3</sub>, is required to neutralize acids such as lactic acid and citric acid produced in human body .Alkalinity of water is its capacity to neutralize a strong acid and it is normally due to the presence of bicarbonate, carbonate and hydroxide compound of calcium , sodium and potassium. Total alkalinity values for all the investigated samples were found to be greater than the value prescribed by WHO. In the present study total alkalinity range from 70.8 to 97.6 mg/L.

## **Chloride**

In soft waters, a concentration of chlorides more than 250 parts per million gives a salty taste to water.[11] Higher concentration can make waters unfit for human and livestock consumption. A high chloride content also has a damaging effect on metallic pipes and structures as well as on agricultural crops. The chloride was found between 89.9 to 145.9 mg/L. Natural water contains low chloride ions. The tolerance range for chloride is 250 to 1000 mg/L

## **Calcium Hardness**

Hardness caused by bicarbonates and carbonates of calcium and magnesium cations is called temporary hardness. This can be removed by boiling water. Sulphates and chloride of calcium and magnesium cause permanent hardness which cannot be removed by simple boiling. The calcium hardness is ranging from 29.6 mg/L to 46.4 mg/L. The tolerance range for calcium hardness is 75 to 200 mg/L.

## **Magnesium Hardness**

Magnesium is a necessary constituent of chlorophyll. Its high content reduces the utility of water for domestic use. From results shows Magnesium hardness was ranging from 17.3 to 37.9 mg/L . The tolerance range for magnesium is 50 to 100 mg/L. Two samples are Devali and Habukvad both are same value of magnesium i.e. 17.3 mg/L.

## **Sodium (Na<sup>+</sup>)**

Sodium concentrations were found in between 260.0 mg/L to 304.0 mg/L.

## **Potassium (K<sup>+</sup>)**

The major source of potassium in natural fresh water is weathering of rocks but the quantities increase in the polluted water due to disposal of waste water. Potassium content in water, in the present study ,varied from 0.98 mg/L to 1.97 mg/L.

## Sulphate

Sulphates are found in natural water. Their concentration is high in arid and semi arid region where natural waters have a high salt content in general. They contribute to permanent hardness. Sources of sulphates are mainly sulphates rocks such as gypsum (calcium Sulphate) and sulphur minerals such as pyrites. Sulphate ranged from 181.1 to 341.6 mg/L. The tolerance range for sulphate is 200 to 400 mg/L. The high concentration of sulphate may induce diarrhea and intestinal disorders.[12-13]

**Table No. 1 Ground Water Quality Standards (Indian Standards 10500 (1991))**

Parameter ( milligrams per liter)	Values
<b>Physical Parameters</b>	
Colour ( Hazen Unit)	5.0
Turbidity (NTU)	5.0
Total Solids	500.0
<b>Chemical Parameters</b>	
pH	6.5- 8.5
Total Hardness	300.0
Calcium as calcium carbonate	75.0
Magnesium as calcium carbonate	30.0
Alkalinity as calcium carbonate	200.0
Chlorides as chlorine	250.0
Sulphates	200.0

**Table No. 2 Physical Properties of Ground Water of Talaja Taluka Region**

No.	Name of Village	Well/ Bore well	Depth in foot	Temp. °C	TDS mg/L	EC milimhos/cm
1	Devali	Well	80	28.7	1370	2.94
2	Habukvad	Well	50	28.0	490	0.39
3	Piparala	Well	60	29.2	650	1.90
4	Bhalar	Well	70	30.5	1200	2.90
5	Timana	Bore Well	140	29.6	1150	3.27
6	Talaja	Bore Well	70	30.2	870	1.80
7	Dihor	Well	85	31.5	950	1.90
8	Moti Babariyat	Well	50	30.8	770	1.60
9	Bhadra vad	Bore Well	120	29.8	1440	1.91
10	Royal	Well	55	29.5	1190	1.90

**Table No. 3 Chemical Properties of Ground Water of Talaja Taluka Region**

No.	Name of Village	pH	CO <sub>3</sub> <sup>-2</sup>	HCO <sub>3</sub> <sup>-2</sup>	Cl <sup>-</sup>	Ca <sup>+2</sup>	Mg <sup>+2</sup>	Na <sup>+</sup>	K <sup>+</sup>	SO <sub>4</sub> <sup>-2</sup>
1	Devali	7.73	0	75.6	89.9	44.8	17.3	268	1.80	238.7
2	Habukvad	8.02	16.8	70.8	121.9	33.6	17.3	272	1.62	181.1
3	Piparala	7.98	12.0	78.1	145.9	45.6	37.9	274	1.59	259.3
4	Bhalar	7.76	0	80.5	103.9	31.2	17.8	262	0.98	242.8
5	Timana	7.70	0	63.4	133.9	29.6	34.1	280	1.68	263.4
6	Talaja	8.06	28.8	97.6	113.9	32.8	20.2	304	1.97	300.4
7	Dihor	7.98	7.2	73.2	101.9	39.2	24.0	295	1.69	226.4
8	Babarpar	7.84	0	90.3	95.9	46.4	31.2	284	1.74	337.5
9	Bhadravad	7.02	0	70.8	119.9	44.8	22.1	260	1.84	321.0
10	Royal	7.14	0	78.1	129.9	38.4	21.6	269	1.79	341.6

Note: All parameters are in mg/L ,except pH ,EC and EC in milimhos/L.

## CONCLUSION

The important physico-chemical parameters of well/bore well water samples collected from 10 locations of rural areas of Talaja Taluka in May/June 2015. This sample was taken in May-2015& Jun-2015. It was observed that the pH ,EC, TDS, Total Alkalinity, Chloride, Total hardness and sulphate are normal for the water samples. Only very few samples showed values above the desirable limits India Standard Index.

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