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RESEARCH ARTICLE

Study of Physico-Chemical Parameters of Ground Water from Selected Stations of Rajula Taluka of Amreli District-Gujarat

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ABSTRACT

Study of drinking water terms of Physico chemical parameters like pH, Total dissolve solid (TDS), Total hardness, Total alkalinity, Chloride, Sulphate, Calcium, Magnesium, Nitrate values, Chemical oxygen demand (COD), Biological oxygen demand (BOD), Fluoride and Turbidity. Measurement is done for six stations of **Rajula Taluka** of **Amreli** district. All the parameter are measured with respected to three different seasons such as WINTER, SUMMER and MONSOON. Results obtained are compared in terms of their highest value and lowest values among six stations in terms of 13 parameters.

KEYWORDS

COD, BOD, Fluoride, Calcium content, Ground water, Turbidity

INTRODUCTION

Water is the most valuable offerings of the mother nature to mankind; the terrestrial ecosystem cannot function without it. All life and peripheral activities are ceased without water[1]. More over to drinking and personal health, water is necessary for agricultural crop, industrial and manufacturing process, hydroelectric power generation, waste assimilation, recreation and wildlife etc.[2,3] when a resource is used for so many diverse purposes, it is important that it be developed and used rationally and efficiently. From the very beginning, man realized the efficacy and essentiality of water for his daily life for that reason, water is called as life and it has been known as nectar[4]. Water is extremely elementary to life. One cannot imagine a form of life that might exist without water.

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On the surface of the earth, water, in the form of oceans, seas, glaciers, freshwater bodies, rivers, wells, lakes, etc. occupies about 71.00 per cent of the area while, the landmass occupies about 29.00 per cent of the area[5, 6]. Considering that 71% as 100%, 97% is seawater which is salty, while only 3.00 per cent is fresh water. Polar ice contains about 2.00 per cent water and less than 1.00 per cent water is found in the form of lakes and groundwater. If we go through the data of water used 79% is used for irrigation, 23% water for industries and about 8% only is used for domestic purposes[7]. Groundwater is an important source but unfortunately prone to contamination by materials deleterious to human health[8]. In many areas of the world, infectivity is so high that the water is in poor condition even for agricultural use. Pollution levels of the ground water in densely populated are reached so high because of continuously withdrawn of ground water and formation of absorption pit. As this resource becomes more contaminated and scarcer, demand for high quality water will continue to grow making groundwater even more valuable and protection more important[9, 10]. Water sources are there for drinking and various journal use must have high degree clarity free from all types of pollution[11]. The source and quality of bore well water is a clip resource and easily available source of our life. Is getting polluted due to population increase and industrial use[12] Studies on bore well water hear, we report the physicochemical studies of bore wells water of Kathalal region, Kathalal is situated in kheda district of Gujarat state and its some interior Adivasi area[13]. Most of the isolated resenditial community i.e. community residing far away from the urban area i.e. Adivasi area mostly not getting safe drinking water. They don't have hygienic water supply so the people are complied to use water from any source that have near their village. In the most of remote tribal area the bore well water is used for drinking and other purpose. Bore well water is pure and it is not possible to spoil it but the main causes of bore well water's pollution is the use of chemicals, fertilizers, pesticides, lime, manures etc are[14-16]. Physico-chemical analysis of drinking water of Kheda district of Gujarat state has been investigated in restively[17]. Bore well water is commonly used for drinking and other uses in this area[18]. The use of chemicals, fertilizers, manure, lime, 10 refused dump etc. are the main source of bore well water's pollution. There is no fresh water supply for the people living in this region, so they use bore well water for their drinking and general purpose[19]. We have noted the physico-chemical analysis of bore well drinking water considering water at some amount. Fluoride is present in all natural water at some amount[20]. In spite to being low and high concentration of fluoride can occur depending upon the type of the rocks and the occurrence of the fluoride-bearing minerals in ground water. Endemic of tropical climates another name of Fluorosis has been described as an. The main sources of fluoride in take are water[21]. Many inherited problem like cancer and goiter have been related with attendance of high level of a chemical or its derisory resource of water. Opinya et al. have cited that high or low level of F^- ions level in water as the main reason for dental Fluorosis. Low concentration of iodine in Homo sapiens results in goiter[22,23]. Little children have been noted as a potential high risk group to the toxic effects a sodium for drinking water. Now a day's about 18% of the world population do not gate pure drinking water and more than 4.5 million people lose their lives every year from illness connected with pure drinking water and scarcity sanitation services[24,25]. If everybody acquires safe drinking water & good hygiene facilities there would be 198 million fewer problems of diarrhea and 2.0 million death occure by diarrheal deases on every year[26, 27]. Biofilms are including of Inorganic and organic substances in piping that can waterfront, defend and permit the explosion of various bacterial pathogens, covering legionella & mycobacterium avium compound (MAC)[28]. Sources infuriate bacterial progress on Biofilms have water temperature altered sterilizer and remaining concentration, ecofriendly animal C level, degree of pipe deterioration and kind of circulation system chloramines are meaningfully powerfully operative than chlorine for monitoring legionella in Biofilms distribution system deficiencies linked to a number of water born disease outbreaks[29, 30]. The advantage of an optimal neural channel model for prediction of water quality parameters based on few known parameters is implemented in this work. The empirical formula was taken from the Department of Natural Resources, New South Wales (NSW), and Australia[31]. The conclusion of the model was encouraging. The comparison of the NSW model, actual experimental results and regression models are also appended[32,33]. These replicas are working by the expert whichever since it is imperfection in terms of period and/or area to collect evidence to kind the estimates than to cover the material round the occurrence itself, or, additional prospective, since the incident to be prophesied will take place in some impending time[34]. Abundant of the western United States is semi-arid, requiring significant irrigation to grow common crops[35]. Improvements in pump technology during the 1960s made groundwater wells easy solution forsatis fying crop requirements. However, by

1989 significant groundwater level reductions of up to 30.5-m (100-ft) were observed in parts of the High Plains aquifer (also referred to as the Ogallala aquifer for its geologic formation) underlying the states from South Dakota to Texas[36]. Reductions in stream flow have had negative impacts on aquatic habitat resulting, in some cases, in the extirpation of fish species from western rivers[37].

In Colorado, his disappearance of habitat is threatening the Brass Minnow (Hybognathushankinsoni), throughout the Arikaree River which is a stronghold for this species[38, 39] particularly along The Nature Conservancy's Fox Ranch property along the Arikaree River[40].

Groundwater models often are used to investigate water rights or to estimate habitat recovery. The assumptions made during the modeling process are very different depending on which of these goals the modeler is trying to achieve[41]. Modeling for habitat recovery projections requires the modeler to assume conservative estimates of flow recovery (underestimation) because over estimation could mean habitat is actually not available where projected[42] If a given species were to require the area of habitat recovery projected in the model for survival and it were not available, there may not be enough time to remedy the situation. Conversely, underestimation of stream depletion causes legal problems when modeling to establish water rights because a user may be imposing on a senior right held by another user. The distinction is important and the purpose of a model must be established before it is used for any work[43].

From above introductory part we have planned to analysed ground water of 06 stations of Rajula taluka of Amreli district, Gujarat with respect to thirteen parameter such as pH, Total dissolve solid (TDS), Total hardness, Total alkalinity, Chloride, Sulphate, Calcium, Magnesium, Nitrate values, Chemical oxygen demand (COD), Biological oxygen demand (BOD), Fluoride and Turbidity in terms of WINTER, SUMMER and MONSOON seasons.

MATERIAL AND METHOD

Chemicals and Reagents

All the reagents used are of AR grade and used without further purifications. Physico-chemical characterization of river, ground, and surface water such as p^H, Total dissolve solid (TDS), Total hardness, Total alkalinity, Chloride, Sulphate, Calcium, Magnesium, Nitrate values, Chemical oxygen demand (COD), Biological oxygen demand (BOD), Fluoride and Turbidity were carried out by following methods[44].

Sr. No.	Parameters of water analysis	Methods
1	P^H	Digital P^HMeter
2	Mg^{+2} , Ca^{+2} Hardness	Titration (EDTA-Titrimetric)
3	TDS & Total hardness	Digital TDS Meter
4	Total Alkalinity	Titrimetric using Indicators
5	Chloride	Argenometric
6	Phosphate	Spectrophotometric
7	Sulphate	Spectrophotometric
8	Nitrate	Spectrophotometric
9	COD & BOD	Open reflux method
10	F^-	Spectrophotometer

Experimental

Sampling

Samples will be collect in pre cleaned 2 litre polyethylene bottles. The sampling preservations and analysis of parameters (APHA, 1998) **[9]**. The water samples will be collected nearly from 6 stations of **Rajula** Taluka. During the WINTER, SUMMER and MONSOON seasons. Physicochemical parameter such as pH, Temperature, Chloride, Sodium, Nitrate, Chloride content, Fluoride content, Sulphate content, Turbidity, COD and BOD etc will be planning to study (Table 1-3).

Table 1: Physico-chemical analysis of ground water of Rajula taluka of Amreli district, Gujarat (WINTER)

Sr. No.	**Name of Parameters**	**Name of Stations**					
		Amuli	**Balapar**	**Barbatana**	**Chanch**	**Chotra**	**Dungar**
1	TDS	456	516	**449**	598	**745**	668
2	pH	**6.91**	7.40	7.60	7.22	7.23	**7.95**
3	T. Hardness	**428**	331	322	295	**216**	262
4	Ca^{+2}	**65**	33	**28**	44	30	55
5	Mg^{+2}	45	**88**	42	35	30	**22**
6	Cl^{-1}	86	**30**	98	**160**	158	114
7	SO_4^{-2}	21	22	25	**08**	20	**40**
8	NO_3^{-1}	15.90	12.43	16.10	**21.42**	**7.10**	8.15
9	F^{-1}	0.4	0.2	0.3	0.9	**1.4**	**0.2**
10	Alkalinity	298	**293**	318	385	**460**	362
11	Turbidity	3.5	**1.4**	1.8	3.6	2.8	**4.5**
12	COD	14	11	**8**	7	14	**18**
13	BOD	7	12	**14**	5	**1**	5

Table 2: Physico-chemical analysis of ground water of Rajula taluka of Amreli district, Gujarat (SUMMER)

Sr. No.	**Name of Parameters**	**Name of Stations**					
		Amuli	**Balapar**	**Barbatana**	**Chanch**	**Chotra**	**Dungar**
1	TDS	**370**	512	425	**750**	745	370
2	pH	7.88	**6.85**	**7.80**	7.30	6.90	7.45
3	T. Hardness	422	**438**	318	**225**	228	258
4	Ca^{+2}	58	**62**	**28**	52	39	60
5	Mg^{+2}	38	**90**	42	45	**15**	25
6	Cl^{-1}	85	**30**	98	98	**162**	115
7	SO_4^{-2}	28	20	22	**10**	**35**	20
8	NO_3^{-1}	16.82	12.35	17.15	**20.25**	**7.10**	8.15
9	F^{-1}	0.4	0.8	**0.1**	0.8	**1.2**	0.5
10	Alkalinity	**225**	295	320	390	**465**	360
11	Turbidity	3.2	2.1	**1.8**	3.5	2.9	**3.6**
12	COD	12	**3**	9	15	**18**	8
13	BOD	4	12	**15**	8	**1**	4

Table 3: Physico-chemical analysis of ground water of Rajula taluka of Amreli district, Gujarat (MONSOON)

Sr. No.	Name of Parameters	Name of Stations					
		Amuli	Balapar	Barbatana	Chanch	Chotra	Dungar
1	TDS	565	635	642	615	**785**	**520**
2	pH	**7.18**	7.95	7.45	7.65	**8.95**	7.85
3	T. Hardness	260	310	**430**	315	245	**210**
4	Ca^{+2}	**89**	84	60	**34**	42	41
5	Mg^{+2}	50	**20**	38	66	**75**	40
6	Cl^{-1}	110	**145**	117	120	**20**	75
7	SO_4^{-2}	**22**	39	45	40	**48**	25
8	NO_3^{-1}	12.10	18.10	15.15	**25.30**	**10.35**	21.26
9	F^{-1}	1.20	1.25	**0.76**	1.10	**1.45**	0.98
10	Alkalinity	315	230	346	**210**	**370**	280
11	Turbidity	3.7	3.8	3.4	**4.1**	**1.3**	1.8
12	COD	178	**2.15**	**0.52**	0.70	1.13	1.18
13	BOD	5	9	**10**	3	**1**	8

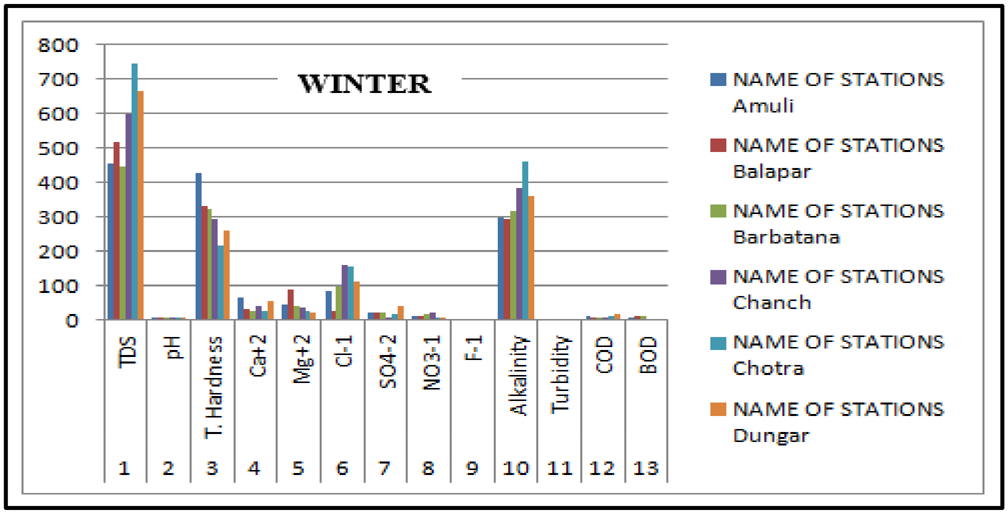

Figure 1: Physico-chemical parameter of ground water of Rajula taluka (WINTER)

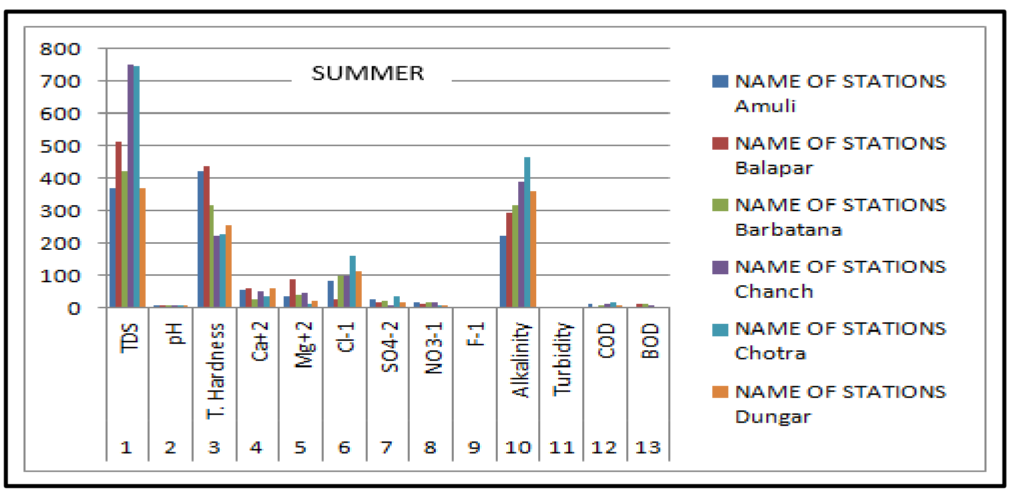

Figure 2: Physico-chemical parameter of ground water of Rajula taluka (SUMMER).

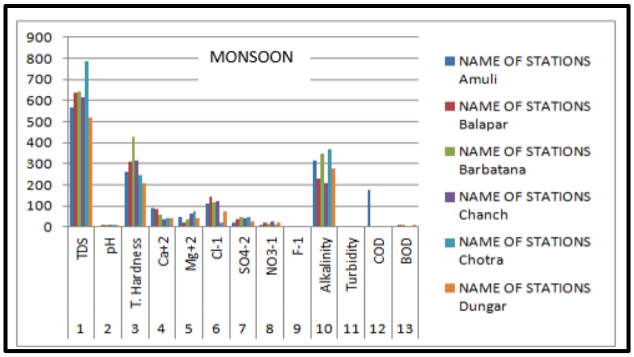

Figure 3: Physico-chemical parameter of ground water of Rajula taluka (MONSOON).

RESULT AND DISCUSSION

Maximum and minimum values of parameters of ground water quality of **Rajula** taluka of Amreli district, Gujarat. Standard values of parameters[18] are also given with each parameter.

TDS

All the minerals, salts and non volatile inorganic impurities are termed as Total dissolved Solid. WHO in 1993 has specified upper limit of TDS as 1000mg/l. higher level of TDS may cause kidney dysfunction like stone, calcium deposition in renal system. Here in the present study the TDS ranges from 200-6000 mg/l.

WINTER Season shows highest value at **Chotra** and lowest value at **Barbatana** .

SUMMER Season shows highest value at **Chanch** and lowest at **Amuli**.

MONSOON Season shows highest value at **Chotra** and lowest at **Dungar**.

pH

This parameter tells about the presence of acid or alkali in water. As per the WHO the acceptable limit for potable water is 6.5-8.5.

WINTER Season shows highest value at **Dungar** and lowest value at **Amuli**.

SUMMER Season shows highest value at **Barbatana** and lowest at **Balapar**.

MONSOON Season shows highest value at **Chotra** and lowest at **Amuli**.

Total Hardness

Its comprises the total hardness of water along with Ca^{+2} and Mg^{+2}. As per the WHO the acceptable limit for potable water is 300 mg/l. Its higher value causes dared consequences but depending in the values of Ca^{+2} and Mg^{+2} hardness.

WINTER Season shows highest value at **Amuli** and lowest value at **Chotra**.

SUMMER Season shows highest value at **Balapar** and lowest at **Chanch**.

MONSOON Season shows highest value at **Barbatana** and lowest value at **Dungar**.

Calcium content

Calcium is necessary in the body for healthier bone but under specified limit it is beneficiary or else excess of calcium can cause Kidney stone/bladder. As per the WHO the acceptable limit for potable water is 75-200 mg/l.

WINTER Season shows highest value at **Amuli** and lowest value at **Barbatana** .

SUMMER Season shows highest value at **Balapar** and lowest at **Barbatana** .

MONSOON Season shows highest value at **Amuli** and lowest at **Chanch**.

Mg^{+2} content

Magnesium is necessary in the body for healthier digestion Magnesium above specified limit cause Gastro intestinal irritation in presence of sulphate ion. WHO the acceptable limit for potable water is 50-100 mg/l.

WINTER Season shows highest value at **Balapar** and lowest value at **Dungar**.

SUMMER Season shows highest value at **Balapar** and lowest at **Chotra**.

MONSOON Season shows highest value at **Chotra** and lowest at **Balapar** .

Chloride content

Almost all water bodies contain chloride. Even common salt contain more than 50% of Chloride. Excess of Chloride cause the séance toward its taste, also the Laxative effect, Heart and Kidney diseases. According to WHO the acceptable limit for potable water is up to 250 mg/l.

WINTER Season shows highest value at **Chanch** and lowest value at **Balapar** .

SUMMER Season shows highest value at **Chotra** and lowest at **Balapar** .

MONSOON Season shows highest value at **Balapar** and lowest at **Chotra**.

SO_4^{-2} content

Sulphate has very less effect on the taste of water as compare to chloride. The desirable limit of drinking water prescribed by WHO is 200-400 mg/l. The content higher than specified limit causes diarrhoea and intestinal disorders.

WINTER Season shows highest value at **Dungar** and lowest value at **Chanch**.

SUMMER Season shows highest value at **Chotra** and lowest at **Chanch**.

MONSOON Season shows highest value at **Chotra** and lowest at **Amuli**.

NO_3^- content

Though the nitrate is combined form of nitrogen which is essential for healthy growth of plant Kingdom but its nitrate form may cause Diarrhea in child and adult where as when the water use to prepare baby food is having nitrate content more than specified limit it cause Blue baby syndrome. The desirable limit of drinking water prescribed by WHO is up to 45 mg/l.

WINTER Season shows highest value at **Chanch** and lowest value at **Chotra**.

SUMMER Season shows highest value at **Chanch** and lowest at **Chotra**.

MONSOON Season shows highest value at **Chanch** and lowest at **Chotra**.

Fluoride content

Numerous of minerals are found as fluoride salts which make it soluble. It is necessary in certain limit because beyond that it cause fluorosis, porous bone etc. Desirable limit of Fluoride content in potable drinking water as prescribed by WHO is 0.6-1.2 mg/l.

WINTER Season shows highest value at **Chotra** and lowest value at **Dungar**.

SUMMER Season shows highest value at **Chotra** and lowest at **Barbatana** .

MONSOON Season shows highest value at **Chotra** and lowest at **Barbatana** .

Alkalinity

It's a combined property of water that it content carbonate and hydroxide. In other terms it can be said that ability to neutralize acid. Maximum permissible limit as prescribed by WHO is 600 mg/l.

WINTER Season shows highest value at **Chotra** and lowest value at **Balapar** .

SUMMER Season shows highest value at **Chotra** and lowest at **Amuli**.

MONSOON Season shows highest value at **Chotra** and lowest at **Chanch**.

Turbidity

Desirable limit is Up to 10NTU.

WINTER Season shows highest value at **Dungar** and lowest value at **Balapar** .

SUMMER Season shows highest value at **Dungar** and lowest at **Barbatana** .

MONSOON Season shows highest value at **Chanch** and lowest at **Chotra**.

COD

It is a measure of the required oxygen for the oxidation of organic matter. It is the most essential property of the water. Generally the ground water have dissolve oxygen value 4.2 mg/l to 6.0 mg/l. WHO recommends the water having DO value greater than 3mg/l as potable water. Water saturated with oxygen gives a pleasant taste. Water with DO less than specified limit may prove to be fetal for aquatic Kingdom.

WINTER Season shows highest value at **Dungar** and lowest value at **Barbatana** .

SUMMER Season shows highest value at **Chotra** and lowest at **Balapar** .

MONSOON Season shows highest value at **Balapar** and lowest at **Barbatana** .

BOD

Biochemical Oxygen Demand (BOD) reflects the value of oxygen required to oxidize organic waste in water using bacteria and/or protozoa. In case of high BOD levels the value of DO decreases. Nitrates, phosphates salts in water increases the chances for plant Kingdom to survive as a result of which the BOD value increases and DO decreases. WHO recommends the water having BOD value up to 30mg/L as potable water.

WINTER Season shows highest value at **Barbatana** and lowest value at **Chotra**.

SUMMER Season shows highest value at **Barbatana** and lowest at **Chotra**.

MONSOON Season shows highest value at **Barbatana** and lowest at **Chotra**.

CONCLUSION

Physicochemical parameter such as, P^H, Total dissolve solid (TDS), Total hardness, Total alkalinity, Chloride, Sulphate, Calcium, Magnesium, Nitrate values, Chemical oxygen demand (COD), Biological oxygen demand (BOD), Fluoride and Turbidity are varied according to season so season play an important role in the quality of water. All the parameters were measure in terms of WINTER, SUMMER and MONSOON season.

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