Research Paper

Volume : 2 | Issue : 11 | November 2013 • ISSN No 2277 - 8179

Seasonal Variation of Ground-Water Analysis from Bapatla Mandal, Guntur District, Andhra Pradesh

Biology

KEYWORDS : Seasonal variation, Ground water, Physico-chemical parameters, Permissible limits

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ABSTRACT

The seasonal variations of ground water parameters were studied in 2010 by collecting the samples from six villages of Bapatla mandal, Guntur district and were analysed for various parameters like pH, Electrical conductivity, Turbidity, Total dissolved solids, Carbonates, Chlorides, Nitrates, Sulphates, Fluorides, Potassium, Sodium, Magnesium, Iron and Total hardness. The methods employed for the analysis were as per standard methods recommended by WHO. The values obtained were compared with the standard limits. The results of this study revealed that the physico-chemical parameters of water in monsoon season were within the maximum permissible limits with some slight variations in few parameters and hence the water is safe and suitable for domestic, irrigation and drinking purposes.

INTRODUCTION:

The ground water is important for the existence of human society. It is a liberal part of environment. Hence it cannot be looked in isolation especially where high degree of dependence is upon ground water for drinking purpose in selected area.

Ground water is believed to be comparatively much clear than the surface water. Over usage of ground water for drinking, irrigation and domestic purpose has resulted in rapid depletion of water. Pollution of ground water aquifers has made many of the wells unfit for consumption (Chutia, J. and S. Sarma, 2009).

The rapid growing population and improved living standards, has put a pressure on the present water resources is increasing day by day (Narsimhan T.N 2005 and Patel S and Quadri S.H, 2011). Use of polluted water itself takes about 25000 peoples all over the world every day (Kumar D.A and De A.K, 2001).

Since ground water mainly contains no bacteria, the use of ground water for domestic purpose has been based on chemical composition of dissolved solids (Joshi A and Seth G, 2008). The quality of water can be checked by the determination of physico-chemical parameters such as colour, odour, p^H, TDS, Total Hardness, Electrical Conductivity, F^-, NO_3^-, SO_4^{2-}, Cl^-, Ca^{2+}, Mg^{2+}, etc. (Jain S and Mittal P, 2008].

Ground water is one of the sources of drinking water for local population of the Bapatla mandal because there is no perennial and seasonal stream in the study area. High salt in ground water provide the historical background of existence of sea in this area. In this study an attempt has been made to determine ground water quality . The selected 6 villages lie in Bapatla mandal, Guntur district which present in the coastal zone of Eastern Andhra Pradesh. The main objective of the present hydrochemical study is to know the distribution of solute in ground water and the suitability of the ground water for domestic and agriculture purpose.

MATERIAL AND METHODS:

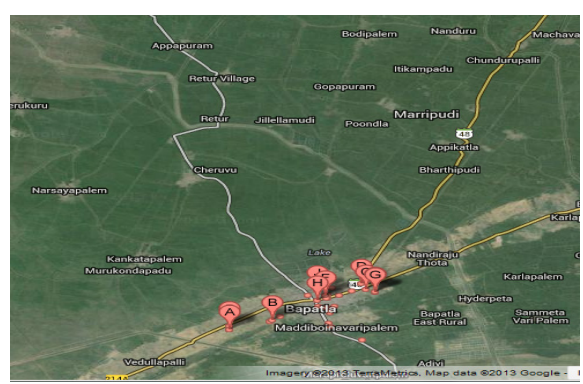
Study area:

Throughout the world, the quality of ground water is getting degraded by human activities, over exploitation, over pumping and percolation of effluents, residues from Agricultural regions and hence it has become very important to assess the groundwater quality of Bapatla mandal. The study area, Bapatla mandal is one of the major region in Guntur district, Andhra Pradesh situated in the south east and coastal of Andhra Pradesh, lies within the latitude - 15^0.48'North and the longitude- 80^0.17'East. The locations of samples were near the residential and agricultural area. About six sampling stations were selected for collection of ground water for this study during pre-monsoon and post monsoon seasons in the year 2010.

Method of analysis:

The ground water samples were collected from different villages of Bapatla in 2010, such as (S-1)-Marripudi, (S-2)-Appikatla, (S-3)-Poondla, (S-4)-Kondubotlavaripalem, (S-5)-Devinuthala, (S-6)- Pandurangapuram. Samples were collected in polythene bottles from various wells. To avoid any kind of contamination during sampling extra care was taken and the bottles were rinsed several times with the water. Double distilled water was used for the preparation of reagent and solution. Immediately p^H, TDS, EC were measured by universal water analysis kit and manual method. Total hardness was determined by complex metric titrations with EDTA using EBT as an indicator. Turbidity was measured by turbidity meter (Elizabeth K M and Naik L K, 2005]. Chlorides content was determined volumetrically by $AgNO_3$ titrimetric method. SO_4^{2-} was measured by gravimetric method. Other parameters like F and NO_3^- were estimated by spectrophotometric method (APHA, 1981).

Figure 1: Map of the study area showing the different sampling stations.



RESULTS AND DISCUSSION:

The results of the analysis of water sample were reported in Table-1 &2.

p^H –The low p^H values may cause corrosion in containers and pipelines, while the high may produce sediment, deposit and difficulties in chlorination for disinfection of water (Kumaraswamy 1991). In the collected samples the values of p^H were in the permissible limits. Table-1& 2 show that the p^H range of sample water is from 7.3 to 7.9 in pre-monsoon season and 7.0 to 7.8 in the post-monsoon season. These values are acceptable as per guidelines suggested by WHO.

EC –Electrical conductivity is used to indicate the total ionized constituent of water. It is directly related to sum of the cati-

ons and anions (Maruthi A and Rao S R K, 2004). The sample no.1 shows exceeding levels in both seasons as 3260, 3582 (mmhos/cm) and sample 3 shows slightly exceeding level as 3515(mmhos/cm) in post monsoon.

Turbidity- generally water turbidity is due to colloidal and extremely fine dispersions. Here the turbidity values varied between 1.4 to 2.8 NTU, and the values were in permissible range in both the seasons.

TDS-This is the important parameter for the use of water. The water with high TDS value indicates that water is highly mineralized. Desirable limit for TDS is 500 mg/L and maximum limit is 2000 mg/L prescribed for drinking purpose . Kumar M and Kumar R, 2012 reported that high levels of TDS may aesthetically be unsatisfactory for bathing and washing. The concentration of TDS in present study is observed in the range of 549 mg/L to 2088 mg/L. It was observed that sample no. 1has slightly high TDS in pre monsoon and the range of TDS was in between 890 and 3000 mg/L in the pre monsoon season. Sample no 1,2,3,6 were with high TDS in post monsoon and these values were above 2000 mg/L, indicating that this water was unsuitable for drinking purpose and also for irrigation.

Alkalinity (Carbonates)-Alkalinity of water is the measure of its capacity to neutralize acids. This is due to the salts of weak acids or strong bases. Carbonates and Bicarbonates represent the measure of alkalinity. Bicarbonates are formed in considerable amount from the action of carbon dioxide upon basic materials in soil and other salts of weak acids (APHA,1998 and Ansa-Asare O.D and Asante K A, 2000). The values observed in both seasons were in the permissible limits as mentioned in Table 1&2.

Chloride-Chloride content in fresh water is generally influenced by evaporation and precipitation (Dhuley D.G and Ubale M B 2000). Chloride in the form of Cl^- is one of major inorganic anions in water. High concentration of Cl^- produce hypertension, effect on metabolism of body, and increase the electrical conductivity of water. High chloride ion concentration indicates organic pollution in the water (Tripathi B.D et al., 1989. and Paliwal K.V, 1971).

Indian standards for drinking water have recommended 250 mg/L as desirable limit and 1000 mg/L as permissible limit for chloride concentration. The values obtained in the present case were in the range of 139 to 447 mg/L in pre-monsoon and 215- to 495 mg/L in post-monsoon. In the study area the water was suitable since chloride concentration was with in the permissible range in both the seasons.

Nitrates-Nitrates are the highest oxidisable form of the nitrogen. In water over 100 mg/L nitrates may causes blue baby disease, particularly in infants of 1 to 6 months of age. But in both seasons in selected areas the values were in permissible limits. The low nitrate content may be due to the less usage of nitrogen fertilizers and less disposal of wastes around study areas (Narain, S. and Rajeev 2000).

Sulphates-The sulphate ion is one of the major anion occurring in natural water. Sulphate has less effect on the taste of water as compared to the presence of chloride. Higher values of sulphate may cause intestinal disorder. Excess amount of sulphate in water has cathartic effect of human health. (Kataria H.C, 2011). Here, the sulphate values were within the permissible limits.

Fluoride- According to BIS and WHO standards the limit of fluoride is 1.0 to 1.5 mg/L. The Table-1 showed that the concentration of F- lies between 0.2 to 1.12 mg/L. and Table -2 showed that the concentration of F-lies between 0.3 to 2.2 mg/L. If the F concentration is between 0.9 to 1.2 mg/L then dental fluorosis is started and F - exceeds the level of 3 mg/L then skeletal fluorosis is started in living beings. (Kalwale A M and Savale P A, 2012)

Iron-The main sources of iron in ground water are naturally as a mineral from sediment and rocks or from mining, industrial waste, and corroding metal (Arain M.B et al., 2009). The high concentration of iron causes a bitter astringent taste to water and a brownish colour to laundered clothing and plumbing fixtures. Table 1&2 showed that in all the study sites the concentration was within the permissible limit of WHO guidelines (1.0 ppm).

Potassium-The main reason for the increase in the potassium concentration in groundwater is due to agricultural activities. Potassium in the present groundwater samples was found in the range between 2.5-6.9 mg/L and 3.5 to 7.0 mg/L in pre and post monsoons. The excess amount of potassium present in the water sample may leads to nervous and digestive disorder (Tiwari T.R, 2001). In the present samples minimum concentrations of potassium was 0.1 mg/L and maximum concentration was 1.5 mg/L.

Sodium-Sodium concentration is important in water and several studies have highlighted agricultural products as a predominant source of this compound (Bouchard et al. 1992). Excess of Na in water is unsuitable for patients suffering from hypertension or congenital heart diseases and also from kidney problems (Rao G.T et al., 2012]. It is dangerous for human health, particularly for infants causing Methaemoglobinemia. As per WHO (1993) guidelines 200 mg/L sodium is the permissible limit. In this study the concentration of Na in pre-monsoon (161-564 mg/L) and post-monsoon (189.45 to 498.98 mg/L) periods showed high values in groundwater.

Magnessium-The presence of major ions such as Ca, Mg and HCO_3 in water causes hardness and makes it unsuitable for drinking purposes (Jain et al.2005). According to the Indian standards the permissible limit of Mg is 30 mg/L, but in the present study, in both seasons all ground water samples showed exceeding levels.

Total Hardness- The chemical quality of water is a factor which is of paramount importance. Suitability of ground water for irrigation purpose depends upon the conductivity and hardness of water (Prasad, B.G, 2003).The hardness of water is produced by the Ca^{2+} and Mg^{2+} salt as the bicarbonates, sulphates and chlorides. The guideline value of total hardness is 500 mg/L. Here, in this study in both seasons except stations 1 &4, all others showed permissible values.

CONCLUSION

On the basis of above discussion, it may be concluded that quality of ground water in pre and post monsoon varies from place to place. The ground water of Bapatla mandal villages in the study region possessed higher values of Na, Mg and slightly higher levels in TDS, TH, and EC. Remaining all parameters were in the permissible limits, but the higher level parameters can cause the some diseases therefore required to be treated.

Table-1: Analysis of Groundwater samples from 06 villages during pre-monsoon (May-2010) season. (All constituents except p^H , EC and Turbidity are in mg/L).

Parameter	S-1	S-2	S-3	S-4	S-5	S-6
P^H at 29^0C	7.59	7.32	7.38	7.5	7.3	7.9
EC (mmhos/cm)	3260	2410	2310	2150	2205	3050

Turbidity (NTU)	2.3	1.4	1.7	2.5	2.4	2.1
TDS	2088	1560	1488	549	1600	1270
CO_3	480	305	265	250	195	420
Cl^-	446.49	176.19	240.26	447.39	159.75	205.85
NO^{3-}	0.2	0.1	1.1	1.5	0.2	0.1
SO_4^{2-}	181.12	169.24	160	143.4	140.27	160.72
F	0.2	1.12	0.92	12.2	0.5	1.1
K	6.5	4.2	3.9	2.5	4.5	6.9
Na	564.2	199.8	161.4	252.4	220.9	179.4
Mg	215	155	130	120	150	145
Fe	0.001	0.01	0.004	0.001	0.002	0.004
T H	695	460	395	549	450	400

S-1:Marripudi, S-2:Appikatla, S-3:Poondla, S-4:Kondubotlavaripalem, S-5:Devinuthala, S-6: Pandurangapuram

Table .2: Analysis of Groundwater samples from 06 villages during Post- monsoon (May-2010) season. (All constituents except p^H, EC and Turbidity are in mg/L).

Parameter	S-1	S-2	S-3	S-4	S-5	S-6
P^H at 29^0C	7.65	7.09	7.15	7.0	7.55	7.80
EC (mmhos/cm)	3582	3050	3515	2705	2892	3059
Turbidity (NTU)	2.5	2.4	2.5	2.8	2.7	2.0
TDS	2089	3000	2485	890	1950	2541
CO_3	385	460	495	351	259	495
Cl^-	480.12	250.12	215.29	495.57	350.19	376.46
NO^{3-}	1.2	0.5	1.8	1.4	1.0	1.2
SO_4^{2-}	171.50	211.23	189	115.31	135.68	189.89
F	0.3	1.13	1.2	2.2	1.5	1.9
K	6.9	4.0	4.8	3.5	4.8	7.0
Na	498.98	210.56	189.45	289.6	250.9	197.5
Mg	280	189	139	132	170	153
Fe	0.01	0.002	0.01	0.01	0.001	0.05
T H	702	512	410	525	480	413

S-1:Marripudi, S-2:Appikatla, S-3:Poondla, S-4:Kondubotlavaripalem, S-5:Devinuthala, S-6: Pandurangapuram

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