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Assessment of Groundwater Quality In Naupada, Ijjavaram, and Mulapeta: Coastal Villages of Srikakulam District of Andhra Pradesh

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ABSTRACT

The various water quality parameters, viz pH, electrical conductivity, total dissolved solids, total hardness, chloride, calcium, magnesium, sodium, potassium ions in bore well and well water of three coastal villages Naupuda, Ijjavaram and Mulapeta of Srikakulam district of Andhra Pradesh were analyzed by composite sampling methods. Different sampling stations were identified in each of these villages and water samples were collected and analyzed for the various parameters. The results were compared with the values stipulated by World Health and found that the overall quality of the three villages is poor and not recommended as potable.

Keywords: *Ground Water Quality, Srikakulam District, Statistical Approach.*

1. INTRODUCTION

Water is one of the most important resources and is the elixir of life. The most common standards used to assess water quality were related to health of ecosystem, safety of human contact and drinking purpose. Many health disorders in the villages were primarily due to consumption of contaminated water. Such more prone area considered for the case study was the most remote, tribal inhabitant area, Srikakulam district of Andhra Pradesh. The present study focused on the three coastal villages Naupuda, Ijjavaram and Mulapeta of Srikakulam district. The medical statistics reveal that the inhabitants of the villages under study were more prone to renal failure, for which the root cause was unidentified and the investigations were still under process. This drew our attention to assess the quality of water from various sources especially bore and well water. Thirteen different water quality parameters were analyzed for the water samples collected from these areas. The results were compared with ISO 10500 standards and it was found that TDS, total hardness, chloride and magnesium were beyond the prescribed standard permissible limits.

2. EXPERIMENTAL

Study Area

Srikakulam District is in the north coastal districts of Andhra Pradesh, India adjoining Bay of Bengal. It is situated within Geographical Coordinates of 18-20 and 19-10 of the northern latitudes and 83-50 and 84-50 of eastern longitude. The areas under investigation are situated in Santhabommali Mandal (18^0 31’38’’N 84^0 9’11’’E) with 34 revenue village panchayats. For the authors present study three coastal villages viz. Naupada, Mulapeta and Ijjivaram of Santhabommali Mandal were selected. The geographical details are incorporated in Fig.1, 2 & 3. Ijjavaram is 9.0 Km away from the shoreline of Bay of Bengal, 10 Km far from its mandal main town Santhabommali and is located 60 Km distance from district main city Srikakulam. Mulapeta is 1.0 Km away from the shoreline of Bay of Bengal and 58 Km far from the district main city Srikakulam. Naupada is 7.0 Km away from the shoreline of Bay of Bengal and 57.0 Km far from the District main city Srikakulam.

Fig.1 Srikakulam Map, Santhabommali

Fig.2 Mulapeta Village, Under Study

Fig.3 Ijjavaram and Naupada Villages, Under Study

Sampling

From each of the Village aforesaid, six sampling stations were identified and samples were collected from wells and bore wells, in totality 15 sampling stations were carried out (table-1). The samples were collected in clean high quality polyethylene bottles, EC, temperature, pH and DO of the collected samples were measured on spot the present work was carried out during June, 2013 to March, 2014.

Table.1 Sampling Station information

S.No.	Sample Station	Village
1	BORE-1	IJJAVARAM
2	BORE-2	IJJAVARAM
3	BORE-3	IJJAVARAM
4	BORE-4	IJJAVARAM
5	BORE-5	IJJAVARAM
6	BORE-1	MULAPETA
7	WELL-2	MULAPETA
8	BORE-3	MULAPETA
9	BORE-4	MULAPETA
10	WELL-5	MULAPETA
11	BORE-1	NAUPADA
12	WELL-2	NAUPADA
13	WELL-3	NAUPADA
14	BORE-4	NAUPADA
15	BORE-5	NAUPADA

3. METHODOLOGY

The concentration of chloride ion in water samples was determined by Mohr's Method using potassium chromate as indicator. DO of the samples was determined by a DO meter with gold electrode on the spot. An ELICO scanning visible spectrophotometer (SL-177) with 1Cm glass cell was used for the determination of Nitrite in the water samples. An ELICO flame photometer (CL-361) is used for determination of sodium and potassium ions. For the pH measurements ELICO digital pH-meter (11-127) and for conductance measurements ELICO Conductometer (CM-180) were used. Standard methods of APHA (Lenore SC Et.a1.1989) were used for the analysis of water samples. All the chemicals and reagent used were of Analytical grade and the aqueous solutions were freshly prepared by double distilled water.

4. RESULTS AND DISCUSSION

The analysis report of the water samples of the three villages presented in Table2 and Table 3. The results were compared with World Health Organization (WHO guide lines of Drinking water quality 3rd edition 2004) and150 10500 standards. It was found that the values of total hardness, magnesium and Calcium and EC were higher when compared to all other parameters. During post-monsoon 15 samples were analyzed and 53.3% samples were found to be higher than permissible limit (PL). 46.6% samples were found to be within desirable limit. Of 15 samples analyzed for THW, 40.0% Samples were found to be higher than PL while 60.0% samples were within the desirable limit. For Ca 46.6% samples were higher than PL, 53.3% samples were found to be within desirable limit. For Mg 40.0% were higher than PL, 60.0% samples were found to be within desirable limit.

The pH values of the samples analyzed were found to in the range 6.3 – 7.7 and 7.1 – 7.9 in post monsoon which is well within the prescribed standard value. Total Conductance was found to be in the range of 500-3100 in summer and 600-3300 in post monsoon which is beyond the permissible limit indicating the presence of higher levels of salty in the water analyzed. TDS was found to be 600-1400 mg/L in summer and 300-1720 mg/L in post monsoon. DO values of the surface water analyzed were found be in the 6.2 – 7.7 which is well within the limit value.

Total hardness of water in summer was 190-1500 mg/L, in post monsoon is 320-3610 mg/L; in summer calcium was 76-750 mg/L, in post monsoon 76-960 mg/L; Magnesium in summer was 47-290 mg/L, in post monsoon 23-1000 mg/L; Sodium in summer was 43-89 mg/L, in post monsoon 32-96 mg/L; potassium in summer was 1-9 mg/L, in post monsoon 1-9 mg/L; chloride in summer was 102-516 mg/L, in post monsoon 12-557 mg/L; phosphate in summer was 7.5 – 29 mg/L, in post monsoon 8-14 mg/L; nitrate in summer 0.1 – 0.7 mg/L, in post monsoon 0.1 – 0.7 mg/L; flouride in summer was 0.1 – 0.7 mg/L.

Tale 2: Physico – Chemical Characterization of water during post monsoon

S. No.	pH	EC	TDS	THW	Ca	Mg	Na	K	Cl-	Po_4^{3-}	No_2^-	f^-	Do
1	7.7	1200	790	620	200	70	82	9	220	14	0.7	0.3	6.7
2	7.4	900	300	320	157	23	50	9	12	9.2	0.2	0.2	6.2
3	7.6	600	1200	1232	196	220	92	6	14	9.0	0.1	0.4	
4	7.3	1700	630	497	90	99	76	8	17	7	0.4	0.3	6.9
5	7.1	2100	470	526	76	140	96	7	19	9.7	0.3	0.1	
6	7.9	2600	1720	326	87	76	78	5	20	9.1	0.5	0.2	
7	7.7	3300	1120	760	88	148	56	9	21	9.6	0.6	0.4	7.2

8	7.2	3000	1420	396	85	124	36	6	26	9.4	0.2	0.3	
9	7.1	2700	1115	225	96	72	32	3	20	10	0.1	0.7	6.2
10	7.8	2300	1050	3610	300	222	42	4	316	17	0.1	0.9	
11	7.2	2500	1200	1016	425	99	45	4	200	13	0.1	0.4	
12	7.3	1400	626	1067	960	1000	49	1	415	16	0.6	0.3	
13	7.7	600	790	1085	750	98	58	1	551	12	0.2	0.1	7.7
14	7.2	2000	780	1075	700	76	41	2	670	9	0.1	0.1	
15	7.1	2300	1110	1065	250	79	40	3	620	8	0.3	0.1	
STD	6.5 – 8.5	500	500	300	75	30	200	10	250	5	1.0	1.2	4.8
PL	9.2	2000	2000	600	200	100			1000			1.5	

Table-3 Physico – Chemical Characterization of water during summer

S. No.	pH	EC	TDS	THW	Ca	Mg	Na	K	Cl-	Po_4^{3-}	No_2^-	f^-	Do
1	7.4	500	720	600									
2	7.2	1200	600	190	164	170	70	5	201	29	0.1	0.2	
3	7.6	1700	1800	940	72	74	47	7	39	20	0.1	0.4	
4	7.3	2000	1900	852	140	190	56	6	342	19	0.1	0.2	6.9
5	7.1	1200	1400	570	220	286	78	3	516	17	0.2	0.3	
6	7.0	1800	1086	321	290	140	90	2	410	15	0.3	0.1	
7	6.5	2000	410	451	211	122	43	4	1072	15	0.4	1.0	7.1
8	7.7	3000	1550	392	130	110	59	4	50	9.2	0.7	0.6	
9	7.3	2100	1280	642	147	322	67	3	3002	7.5	0.3	0.2	7.4
10	7.2	2500	1370	1500	196	190	89	3	174	9.6	0.2	0.2	7.2
11	7.7	2700	1020	1340	280	74	70	1	132	9.7	0.1	0.1	
12	7.5	3000	1220	1101	188	47	76	1	1022	15	0.2	0.3	7.6
13	7.2	3100	1115	1320	290	290	79	9	152	17	0.1	0.1	7.8
14	6.3	3200	1000	986	286	173	55	6	367	10	0.1	0.2	
15	7.1	3100	1300	740	188	59	43	5	319	11	0.1	0.1	
STD	6.5 – 8.5	500	500	300	75	30	200	10	250			1.2	4-8
PL	9.2	2000	2000	600	200	100			1000			1.5	

During summer 3% samples were beyond permissible limit for chloride, 10% samples were found to be within permitted value. 33.3% were beyond desirable and 66.6% were with in permissible limit for total hardness. For Mg 66.6% samples were within permissible limit and 33.3% samples were beyond desired value. For Ca 40.0% samples were beyond permissible limit and 66.6% samples were within desirable value. From the results it was found that most of water samples of the three villages analyzed has higher concentration levels than the prescribed standard values, and not recommended as potable as it is well known that increased concentration of magnesium, chloride and sodium in drinking water leads to ill health to human.

5. CONCLUSIONS

Most of the water samples analyzed, collected from the three coastal villages of Srikakulam district are found to have higher concentration levels compared to the standard values prescribed. Hence the water is not recommended as potable.

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