CHEMICAL AND MICROBIAL ANALYSIS OF POTABLE WATER IN PUBLIC – WATER SUPPLYWITHIN FIVE MANDALS IN THE UPLAND AREA OF WEST GODAVARI DISTRICT,ANDHRA PRADESH, INDIA

DR.CA JYOTHIRMAYEE

Abstract: Water plays an essential role in human life. West Godavari District, one among the nine coastal districts of Andhra Pradesh, is located between North longitude $16^{o}51'$ and $17^{o}30'$ and East latitude $80^{o}50'$ and $81^{o}55'$ covering an area of 7795sqkm.Physiographically and geomorphologically the district can be divided into 2 major regions viz., alluvial deltaic region and upland areas. The deltaic region mostly constitutes black cotton soils and the upland areas are dominated by the red soils. A systematic study is proposed to assess the water quality of ground water as well as surface water resources and based on the water quality and it's dynamics in time, proper and simple treatment technologies will be suggested. In this perception, water samples were collected from sources in different villages of some Mandals like Eluru, Denduluru, Bhimadole, Nallajerla and Devarapalli in the upland region of W.G.Dt. and are analyzed for pH, Turbidity, Electrical Conductivity (EC), Total Dissolved Solid (TDS), Total Hardness (TH), Total Alkanity (TA), DO, COD, BOD, MPN, Fluoride (F^-), Chloride (Cl^-), Nitrite (NO_2^-), Nitrate (NO_3^-), Sulphate (SO_4^{-2}), Phosphate (PO_4^{-3}), Sodium (Na^+), Potassium (K^+), Calcium (Ca^{+2}), Magnesium (Mg^{+2}), Iron(Fe^{+2}) using standard techniques. The results revealed that most of the water samples are within the permissible limits, according to the WHO standards (1996). In very few places the samples are observed to contain qualities that do not comply with the standards. In this paper, the results fromfive mandals are presented.

Keywords: Water borne diseases, ground water, contamination, DO, COD, BOD, MPN.

Introduction: Ground water is the main source for Agriculture and Drinking purpose in the upland area of West Godavari Dt.. During last decade this is observed that ground water get polluted drastically because of increased human activities. Consequently number of cases of water borne diseases has been seen which is a cause of health hazards. Water should be free from the various contaminations viz. Organic and Inorganic pollutants, Heavy metals, as well as all its parameter like pH, Electrical Conductivity, Calcium, Magnesium, Total Hardness, Carbonate, Bicarbonate, Chloride, Fluoride, Total Dissolved Solid, Alkalinity, Sodium, Potassium, Nitrate, DO, BOD, COD should be within a permissible limit .

Objectives:

The principal objective of the present study is

- To identify and map drinking water sources in up-land areas of west Godavari district
- To assess the drinking water sources for their quality.
- To identify and assess the source(s) and degree of contamination and suggest suitable treatment technologies
- To create awareness among public on water resources, efficiency measures and involve the local population in the adoption of self-management strategies towards sustained practices and resources.

Experimental Section:

Water Sampling: The water samples were collected in polythene bottles which were cleaned with acid water, followed by rinsing twice with distilled water. Water was collected in the morning and the containers were immediately covered tightly and transported to the laboratory for physico-chemical and microbiological analysis.
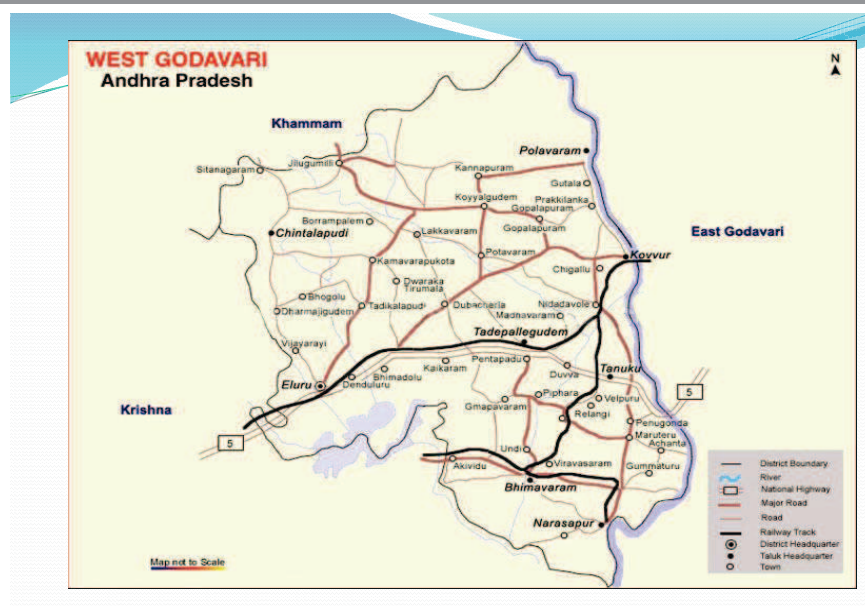
Figure – 1 West Godavari District

Methodology: The Physico- chemical analysis was carried out according to standard methods. The pH was was measured by PH meter. EC was measured by Digital Conductivity meter. TDS was measured by Digital TDS meter and Turbidity was observed with the help of Nephloturbiditymeter. Total alkalinity was determined by volumetrically by silver nitrate titrimetric methods using Potassium chromate as indicator. Total hardness Calcium and Magnesium were measured by EDTA titration methods. Sodium and Potassium were measured by using Flame photometer. Iron content was measured by using UV - Visible Spectrophotometer. Chloride and Fluoride were measured with the help of Ion- Selectivitymeter. Nitrate, Sulphate and Phosphate were measured titrimetrically. DO, BOD, COD and MPN were observed by standard methods.

A faecal coli form test is used to determine whether water has been contaminated with faecal matter. The presence of faecal coli form indicates the possible presence of organisms that can cause illness.

Two general types of analyses are possible to enumerate faecal coli forms:

1. MPN - Most Probable Number
2. Membrane Filter - MF

Results And Discussion: The water from the study area has no colour and odour. Taste of the water in most of the locations was pleasant. The results of the analysis of water in the present study in five different mandals were presented in Tables 1,2,3,4,5 as it is necessary to make comparison of water given by WHO standards.

The pH and EC of water shows variation in it's ranges. It indicates that they are in the range of water quality parameter permissible limits. TA within the limits. TDS and Total Hardness were comparatively high in few samples.The Ca^{2+} was showed wide variation in all the accepted limits. Mg^{2+} values were within the limits. Iron content is very low. Na^+ and K^+ content in water is generally low. Chloride content in water is low (except few due to soil texture). Fluoride content in water is also very low. Nitrite content lies within the permissible limit. Sulphate and phosphate are also low. The value of DO, BOD, COD were in limits.

Water samples of uplands were examined microbiologically for faecal coli forms using MPN method. As per Indian standards water of good quality should have< 10 coliforms/100ml of water sample.

Most probable number (MPN) values /100ml of sample for three sets of tests each of five tubes seeded with a 10ml,1ml,and 0.1ml volume of the sample.

The MPN greater than 1800 is unfit for drinking purpose. Few of these samples were tested for E.coli - which is considered as indicator of water pollution. EMB agar plate showing growth of E.coli. Proper treatment methods must be adopted for these samples .

S.NO	NAME OF THE VILLAGE	Total Hardness(ppm)	Chloride ppm	Alkalinity ppm	pH	E.C mS	T.D.S ppm	Turbidity NTU	Sulphate ppm	Phosphate ppm	Iron ppm
				ELURU MANDAL Table – 1 (a)							
1.	Chodimella	210	270	260	7.7	1.70	1090	1	19.09	0	0
2.	Gudivakalanka	76	6	182	8.1	0.41	260	0	5.68	0	0
3.	Jalipudi	104	105	260	7.6	0.93	590	6	9.09	0	0
4.	Kalakurru	160	38	260	7.8	2.15	1370	1	63.84	0	0
5.	Madepalli	320	770	388	7.5	4.16	2660	18	44.54	0	0
6.	Ponangi	280	850	466	7.2	4.14	2650	0	82.22	0	0
7.	Prathikollanka	67	6	141	7.9	0.41	262.4	1	5.95	0	0
8.	Sanivarapupeta	308	394	275	7.5	2.36	1510	1	18.18	0	0
9.	Satrampadu	160	203	272	7.6	1.41	900	32	11.81	0	0
10.	Sreeparru	128	172	240	7.7	1.49	950	1	33.87	0	0
11.	Tangellamudi	104	92	236	7.7	0.91	580	0	13.63	0	0

S.NO	NAME OF THE VILLAGE	Nitrite ppm	Fluoride Ppm	Calcium ppm	Magnesium ppm	D.O ppm	B.O.D ppm	C.O.D ppm
			ELURU MANDAL Table – 1 (b)					
1.	Chodimella	0.153	0.55	124	86	11	8.1	0
2.	Gudivakalanka	0.043	0.39	34	41	8.8	7.2	3.2
3.	Jalipudi	0.276	0.53	50	54	7	5	0
4.	Kalakurru	0.075	0.55	45	114	5.2	4.4	12.8
5.	Madepalli	0.18	0.53	150	170	7.5	4.7	0
6.	Ponangi	0	2.0	60	220	8.4	6	19.2
7.	Prathikollanka	0.031	0.41	28	38	8.8	7.6	24
8.	Sanivarapupeta	0.21	0.5	156	152	4.5	3.7	0
9.	Satrampadu	0.2	0.54	70	90	5.5	0.5	0
10.	Sreeparru	1.09	1	56	72	9	7.5	0
11.	Tangellamudi	0.26	0.52	80	106	6.5	5	0

BHIMADOLE MANDAL – Table – 2 (a)

S. N O	NAME OF THE VILLAGE	Total Hardness(ppm)	Chlori de ppm	Alkalin ity ppm	p H	E.C mS	T.D. S pp m	Turb idity NTU	Sul pha te pp m	Pho sph ate pp m	Iron pp m
1.	Agadallanka	64	55	130	7.7	0.42	270	5	7	0	0.056
2.	Bhimdole	60	18	141	8.0	0.27	172	1	4	0	0.05
3.	Chettunnapadu	70	100	119	7.7	0.60	384	9	19	0	0.066
4.	Gundugolanu	50	34	173	8.4	0.34	217	2	4	0	0.056
5.	Mallavaram	160	298	271	7.9	1.69	1081	1	32	0	0.044
6.	Polasanipalle	102	88	184	7.3	0.70	448	2	7	0	0.063
7.	Pulla	230	217.0	440	7.1	1.82	1164	0	32	0	0.063
8.	Surappagudem	40	20	87	9.3	0.15	96	0	3	0	0.061

Table – 2 (b)

SN	NAME OF THE VILLAGE	Nitrite ppm	Fluori de Ppm	Calci um ppm	Magnesium ppm	D.O ppm	B.O.D ppm	C.O.D ppm
1.	Agadallanka	0.081	0.5	20	44	9	7	16
2.	Bhimdole	0.3	0.45	30	30	9	7	40
3.	Chettunnapadu	0.075	0.45	16	54	9	7	24
4.	Gundugolanu	0.087	0.46	30	20	8	6.4	32
5.	Mallavaram	0.093	0.43	68	92	9.4	7.6	12.8
6.	Polasanipalle	0.081	0.48	68	34	8	6	48
7.	Pulla	0.1	0.46	126	104	8.2	6.8	52.8
8.	Surappagudem	0.075	0.49	14	26	8	5.4	48

DENDULURU MANDAL – Table - 3 (a)

SN	NAME OF THE VILLAGE	Total Hard ness(ppm)	Chlor ide ppm	Alkali nity ppm	pH	E.C mS	T.D. S pp m	Turb idity NTU	Sulp hate ppm	Pho sph ate pp m	Iro n pp m
1.	Challachinatalapu di	172	81	282	6.7	0.97	620	0	22.77	0	0
2.	Challapalle	240	502	483	7.4	2.78	1780	0	27.31	0	0
3.	Denduluru	68	60	148	8.2	0.44	280	1	6.36	0	0

4.	Galayagudem	148	156	542	7.5	1.66	1060	0	28.70	0	0
5.	Gopannapalem	226	292	412	7.7	2.08	1330	2	24.44	0	0
6.	Kothapalle	260	318	447	7.6	2.21	1410	0	26.3	0	0
7.	Malakacherla	200	122	412	7.3	1.36	870	0	19	0	0
8.	Medinaraopalem	166	135	217	7.5	1.06	680	0	31.98	0	0
9.	Naguladevunipadu	260	192	447	7.29	1.64	1050	2	25.9	0	0
10.	Ramaraogudem	190	102	217	7.43	1.06	680	0	32.18	0	0
11.	Saanigudem	300	542	373	7.54	3.04	1950	1	44.48	0	0
12.	Somavarappadu	296	352	423	7.28	2.17	1390	0	24.43	0	0
13.	Sriramavaram	140	95	308	6.69	0.92	590	1	10.34	0	0
14.	Uppugudem	246	447	391	7.07	2.36	1510	1	27.21	0	0
15.	Vegavaram	294	223	534	7.30	1.94	1241	0	24.6	0	0

Table - 3 (b)

SN	NAME OF THE VILLAGE	Nitrite ppm	Fluoride Ppm	Calcium ppm	Magnesium ppm	D.O ppm	B.O.D ppm	C.O.D ppm
1.	Challachinatalapudi	0.081	0.4	98	74	8	7.2	56
2.	Challapalle	0.056	0.54	154	86	10	7.6	0
3.	Denduluru	0.1	0.56	28	40	9	6	8
4.	Galayagudem	0.093	1.01	80	68	8.4	6.2	22
5.	Gopannapalem	0.081	0.56	124	102	8	5	6
6.	Kothapalle	0.043	0.52	140	120	8	6.2	25
7.	Malakacherla	0.093	0.9	120	80	9	6.4	40
8.	Medinaraopalem	0.075	0.54	94	72	8	6	22
9.	Naguladevunipadu	0.087	0.49	190	70	9	5	11.2
10.	Ramaraogudem	0.285	0.51	108	82	9.2	7.4	24
11.	Saanigudem	0.081	0.37	184	116	7.8	5.4	16
12.	Somavarappadu	0.031	0.38	160	136	8.6	6	19
13.	Sriramavaram	0.04	0.54	80	60	9	6.4	25
14.	Uppugudem	0.056	0.55	196	50	9	7.8	19
15.	Vegavaram	0.043	0.56	180	114	9	6	16

NALLAJARLA MANDAL – Table – 4 (a)

S.NO	NAME OF THE VILLAGE	Total Hardness(ppm)	Chloride ppm	Alkalinity ppm	pH	E.C mS	T.D.S ppm	Turbidity NTU	Sulphate ppm	Phosphate ppm	Iron ppm
1.	Ananthapalle	202	142	264	7.2	1.16	740	0	18.57	0	0
2.	Anumunilanka	162	10	169	6.8	0.90	580	0	26.02	0	0
3.	Avapadu	236	128	340	7.3	1.34	860	0	20.23	0	0
4.	Cheepurugudem	143	12	276	7.1	0.90	580	1	8.15	0	0
5.	Chodavaram(west)	300	170	320	7.1	1.33	850	0	24.82	0	0
6.	Dubacharla	230	7.5	456	7.4	1.05	670	0	2.73	0	0
7.	Gundepalli	140	67	272	7.2	0.88	560	0	25.52	0	0
8.	Nallajerla	171	10	247	6.6	0.80	510	0	6.30	0	0
9.	Pothavaram	190	15	247	6.7	1.18	750	0	61.7	0	0
10.	Prakasaraopalem	300	221	490	7.2	1.79	1150	0	31.64	0	0
11.	Telikacharla	120	106	200	6.9	0.79	510	0	12.82	0	0

Table – 4 (b)

S.NO	NAME OF THE VILLAGE	Nitrite ppm	Fluoride Ppm	Calcium ppm	Magnesium ppm	D.O ppm	B.O.D ppm	C.O.D ppm
1.	Ananthapalle	0.2	0.491	72	130	8	7.2	56
2.	Anumunilanka	0.05	0.56	76	86	10	7.6	0
3.	Avapadu	0.2	0.494	70	166	9	6	8
4.	Cheepurugudem	0.05	0.39	92	93.3	8.4	6.2	22
5.	Chodavaram(west)	0.2	0	64	236	8	5	6
6.	Dubacharla	0.04	0.57	228	105	8	6.2	25
7.	Gundepalli	0	0	80	60	9	6.4	40
8.	Nallajerla	0.03	0.36	72	99	8	6	22
9.	Pothavaram	0.03	0.19	97	93	9	5	11.2
10.	Prakasaraopalem	0.1	0.497	90	210	9.2	7.4	24
11.	Telikacharla	0	0	60	60	7.8	5.4	16

DEVARAPALLI MANDAL – Table - 5 (a)

S.NO	NAME OF THE VILLAGE	Total Hardness(ppm)	Chloride ppm	Alkalinity ppm	pH	E.C mS	T.D.S ppm	Turbidity NTU	Sulphate ppm	Phosphate ppm	Iron ppm
1.	Chinnayigudem	140	85.08	190	6.8	0.78	500	0	12.02	0	0
2.	Devarapalli	138	106.35	240	7.3	0.92	590	0	10.06	0	0
3.	Kurukuru	250	209.86	370	7.0	1.64	1050	0	18.34	0	0
4.	Lakshmipuram	186	77.99	490	7.5	1.27	810	0	5.75	0	0
5.	Pallantla	160	69.48	440	7.7	1.20	770	0	8.18	0	0

6.	Tyajampudi	260	205.61	370	7.1	1.44	920	0	17.04	0	0
7.	Yernagudem	230	113.44	170	7.0	1.25	800	0	10.40	0	0
8.	Krishnampalem	150	134.71	130	6.5	0.82	520	0	4.84	0	0
9.	Ramannapalem	100	85.08	90	6.9	0.59	380	0	5.05	0	0

Table - 5 (a)

S.NO	NAME OF THE VILLAGE	Nitrite ppm	Fluoride Ppm	Calcium ppm	Magnesium ppm	D.O ppm	B.O.D ppm	C.O.D ppm
1.	Chinnayigudem	0.1	0.523	100	40	10.4	7.2	4
2.	Devarapalli	0	0	72	66	9.6	7.2	14
3.	Kurukuru	0	0	116	134	12	8.8	16
4.	Lakshmipuram	0.1	0.512	80	106	11.6	9.2	0
5.	Pallantla	0	0	60	100	9.6	6.4	6
6.	Tyajampudi	0.5	0.414	110	150	10.4	7.6	3
7.	Yernagudem	0.5	0.477	100	130	10	6.8	1
8.	Krishnampalem	0.2	0	70	80	10.4	8	8
9.	Ramannapalem	0.5	0.520	40	60	10	7.2	24

Conclusion: This study shows that ground water is the only source for people in the study area and the results indicate not much considerable variation. In few areas TDS is comparatively high, thus if people drink water then health problems like stomach diseases and gastric troubles may arise. Also the contamination is found to be due to both anthropogenic as well as from geological sources. It must be noted that a regular analysis must be done to ensure that the quality of water in this area is not contaminated.

Faecal coli form bacteria are the most common microbiological contaminants of natural waters. Although most of these bacteria are not harmful and are part of the normal digestive system, some are pathogenic to humans. Those that are pathogenic can cause diseases such as gastroenteritis, ear infections, typhoid, dysentery, hepatitis A, and cholera.

Observed results shows that the technology to be applied for the treatment of ground water is source dependent and in most cases, effective and simple treatment solutions are sufficient without blindly implementing RO Technologies.

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Dr.CA Jyothirmayee/ Reader in Chemistry/Ch.SD St.Theresa's autonomous college for women/Eluru