ORIGINAL RESEARCH PAPER

Engineering

KEY WORDS: pH, Contamination, Groundwater Quality, and Palnadu.

ASSESSMENT OF GROUNDWATER QUALITY – A CASE STUDY

K. Mariadas Research Scholar, Department of Chemistry, Andhra University, Visakhapatnam, Andhra Pradesh, India.

T. Siva Rao* Professor, Department of Chemistry, Andhra University, Visakhapatnam, Andhra Pradesh, India. *Corresponding Author

M.V. Raju Assistant Professor, Department of CE, Vignan's Foundation for Science Technology and Research, Andhra Pradesh, India.

ABSTRACT

The shortage and contamination of sources of surface water, as well as the increasing demand for agricultural practices, groundwater is important for many domestic, commercial, and industrial purposes. Human health and agricultural yields were significantly affected either by quality and concentration levels of groundwater. 25 groundwater samples were used in this study, which has been conducted in five different mandals of the Palnadu region. The samples were obtained from a variety of bore wells using the random sampling method, and the physical and chemical characteristics of water quality parameters were evaluated. The study covered the maximum amount of groundwater in the five mandals of Nuzendla, Vinukonda, Savalyapuram, Romicharla and Ipur as well as the suitable treatment methods for trying to turn the water in to the potable form.

1. INTRODUCTION

In naturalistic environments, water is seldom chemically clear due to the abundance of chemicals involved. Pure waters were chemically depleted in the environment, and its function in supporting life also was disturbed.

When precipitation occurs from the atmosphere to the earth's crust in any manner, such as rain, snow, fog, or another kind of precipitation, it is either highly clean or free of pollutants. None the less, as water draws in from the atmosphere, it absorbs the gases that are already present in the environment. The kind and quantity of the constituents that make up water define its quality.

Based on the negative impacts of various water quality constituents on human/animal and irrigation environments, various boards or agencies of pollution control boards (PCB), Bureau of Ind. St. (BIS), have established water quality standards and guidelines. The quality of groundwater is greatly affected by agricultural runoff and chemicals as well as industrial effluents and waste streams. The main factors affecting groundwater resources are improper solid waste disposal, excessive/uncontrolled aquifer withdrawal, poor solid waste decommissioning, and excessive fertilizer and pesticide use in agricultural activities.

2. Study Area

The northernmost area of the Indian state of Andhra Pradesh is named Palnadu. The regional capital of Palnadu is Gurazala. And it occupies an important place in Telugu history. The word Palnadu still refers to this region in memory of a Pallava dynasty. The Palnadu-Guntur district receives an average annual precipitation of 864 mille metres. The Figure 1 the Palnadu area.

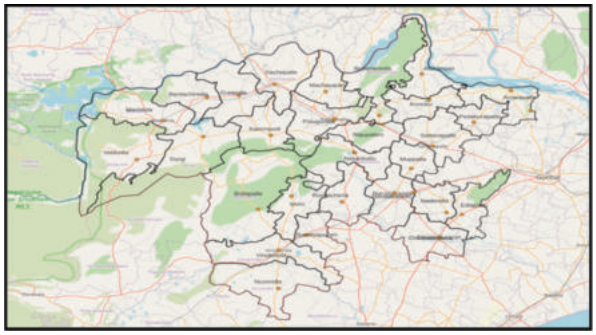

Fig.1: Study Area Map

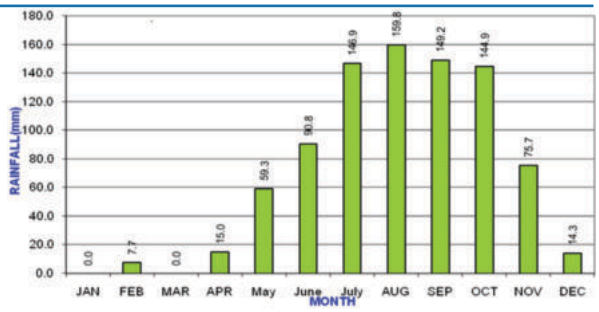

Fig.2. Mean Monthly Rainfall Distribution- Palnadu – Guntur area

The season-wise % position of precipitation is 63% in SW monsoon, 27 % in NE monsoon, one percentage in winter and nine percentages in summer. The mean monthly precipitation position has shown in Fig-2. The annual and seasonal rainfall distribution with its departure from mean along with % position by year-wise has furnished in Table 1.

Table 1: Rainfall distribution in the region of Palnadu – Guntur area

Sl No	Year	Annual	SWM	NEM	Winter	Summer	SWM %	NEM %	Winter %	Summer %	Departure from LPA
1	1999	722.0	544.0	131.0	3.0	44.0	75.35	18.14	0.42	6.09	-16%
2	2000	991.0	804.0	77.0	42.0	68.0	81.13	7.77	4.24	6.86	15%
3	2001	885.8	601.0	228.8	0.0	56.0	67.85	25.83	0.00	6.32	3%
4	2002	565.4	350.4	146.0	37.0	32.0	61.97	25.82	6.54	5.66	-35%
5	2003	914.1	631.8	258.3	1.0	23.0	69.1	28.26	0.11	2.52	6%
6	2004	759.5	526.3	151.5	3.9	77.8	69.30	19.95	0.51	10.24	-12%
7	2005	952.7	612.3	259.3	5.5	75.6	64.27	27.22	0.58	7.94	10%
8	2006	852.6	366.0	304.2	0.0	182.4	42.93	35.68	0.00	21.39	-1%
9	2007	1008.6	791.1	157.2	12.1	48.2	78.44	15.59	1.20	4.78	17%
10	2008	964.5	650.0	176.9	45.7	91.9	67.39	18.34	4.74	9.53	12%
11	2009	643.6	429.8	153.8	0.0	60.0	66.78	23.9	0.00	9.32	-26%
12	2010	1485.1	936.6	365.4	8.6	174.5	63.07	24.6	0.58	11.75	72%
13	2011	665.3	500.8	79.2	22.4	62.9	75.27	11.90	3.37	9.45	-23%
Long Period Average		863.7	546.8	234.9	7.7	74.3	63.31	27.20	0.89	8.60	

Source: Indian Meteorological Department and Directorate Of Economics And Statistics

3. OBJECTIVE OF STUDY

Analysing the physico-chemical characteristics of groundwater samples at five different mandals in Palnadu, which covers the largest study area, and by comparing the permissible limits to Indian standards, as well as by finding the suitable treatment methods to make water usable

4. METHODOLOGY

For chemical analysis, which will be done in the Chemistry Laboratory, Department of S & H, VFSTR, A.P., India, groundwater samples from the mandalas of Nuzendla,

Vinukonda, Savalyapuram, Romicharla and Ipur have been obtained from hand pumps.

Chemical parameters like pH, electrical conductivity, turbidity, chlorides, sulphates, nitrates, fluorides, and iron were evaluated by standard test procedures. The aim of the study is to assess groundwater quality in the study region and its portability during the pre-monsoon season.

Water samples were collected in line with UNESCO document procedures. The collected specimens were meticulously marked with exact point of samples taken at the study area. Safety protocols are used to analyse samples that are brought to the lab in bottles (APHA 1998). Table 3 presents the methods used for water analysis.

5. RESULTS AND DISCUSSIONS

Physico-Chemical Parameters, the relevant values of each parameter of the groundwater samples' observed water quality during the post-monsoon are shown in Tables 2. Figure 3 to 10 show graphs of pH, EC, Turbidity, Chlorides, Fluorides, Sulphates, Nitrates, and Iron in various mandals of the study area.

Table 2. Results of Groundwater samples at study area

S. No.	Sample Code	pH	EC (dS /m)	Turbidity (NTU)	Cl- (mg /l)	F- (mg /l)	So42-(m g/l)	No3- (mg /l)	Iron (mg /l)
1	S1 : Nuzendla	8.06	2.55	4	490	0.09	62	6.90	0.09
2	S2: Nuzendla	8.10	5.52	5	440	0.08	58	6.95	0.39
3	S3: Nuzendla	8.05	2.92	4	350	0.12	60	8.55	0.08
4	S4: Nuzendla	8.50	3.52	4	410	0.10	54	10.30	0.08
5	S5: Nuzendla	8.55	1.25	5	480	0.39	52	6.58	0.07
6	S6: Vinukonda	7.45	1.20	5	455	0.10	42	9.30	0.08
7	S7: Vinukonda	7.50	2.89	5	440	0.18	48	4.50	0.09
8	S8: Vinukonda	7.68	6.45	4	405	0.12	45	6.55	0.08
9	S9: Vinukonda	7.42	2.20	4	390	0.38	48	3.90	0.38
10	S10: Vinukonda	7.95	1.80	5	485	0.10	50	4.05	0.14
11	S11: Savalyapuram	7.25	1.88	4	650	0.35	65	6.88	0.08
12	S12: Savalyapuram	7.30	0.80	5	450	0.10	70	7.12	0.10
13	S13: Savalyapuram	7.50	4.40	4	550	0.20	62	6.45	0.35
14	S14: Savalyapuram	7.80	1.28	5	580	0.12	68	4.50	0.08
15	S15: Savalyapuram	7.95	2.45	4	520	0.06	62	8.85	0.10
16	S16: Romicharla	7.55	1.30	4	410	1.12	64	9.10	0.08
17	S17: Romicharla	7.70	1.99	4	540	1.15	75	6.88	0.08
18	S18: Romicharla	7.85	2.30	5	410	1.20	72	6.22	1.49
19	S19: Romicharla	7.45	2.10	4	450	1.49	70	6.10	0.09
20	S20: Romicharla	7.30	1.90	4	430	1.15	68	6.24	0.10
21	S21: Ipur	7.15	0.57	4	360	0.25	45	4.50	0.25
22	S22: Ipur	6.86	1.20	5	350	0.08	46	8.10	0.08
23	S23: Ipur	7.55	5.55	5	410	0.09	44	6.80	0.04
24	S24: Ipur	7.85	1.80	4	405	0.10	42	9.55	0.05
25	S25: Ipur	7.60	1.92	4	415	0.08	40	7.10	0.08

Table 3. Methods used for water analysis

Test Conducted	Units	Principle of the method
Temperature	0C	Precision thermometer, measured in situ
Electrical conductivity	Millimhos	Digital conductivity meter
Turbidity	NTU	Turbidimeter
Total Solids	mgl-1	Evaporation
PH		Digital pH meter
Sulphates	mgl-1	Spectrophotometry
Nitrates	mgl-1	Spectrophotometry
Iron	mgl-1	Flame photometry
Chlorides	mgl-1	Titration with stand. AgNO3 using K2Cr2O7 as indicator
Fluorides	mgl-1	Electrode method

Source: American Public Health Association (APHA) 1998

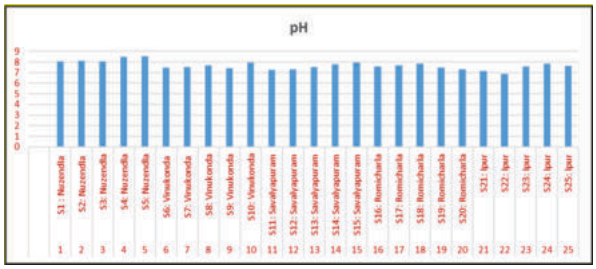

Fig 3. Graphical representation of pH

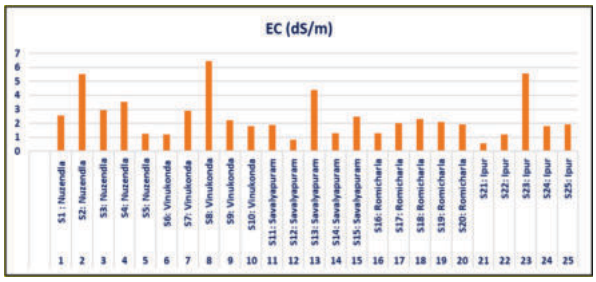

Fig 4. Graphical representation of EC

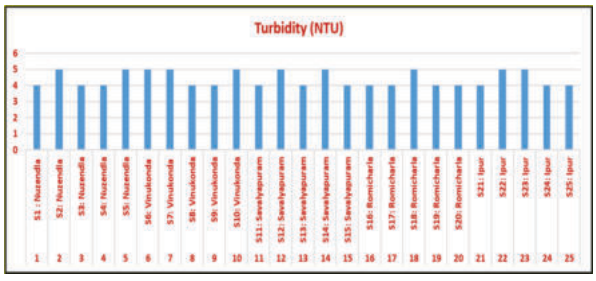

Fig 5. Graphical representation of Turbidity

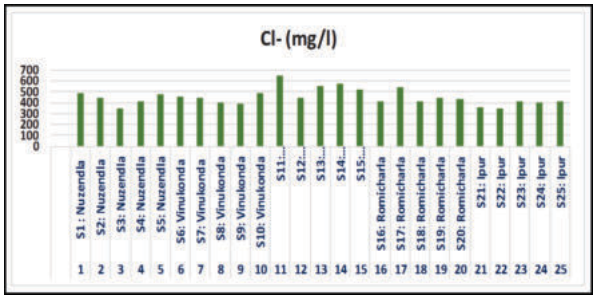

Fig 6. Graphical representation of Chlorides

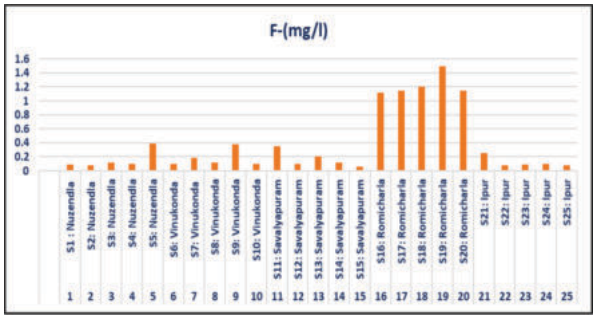

Fig 7. Graphical representation of Fluorides

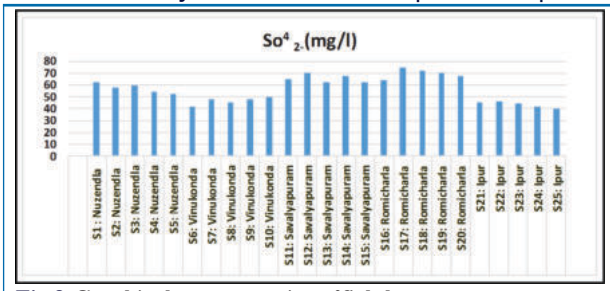

Fig 8. Graphical representation of Sulphates

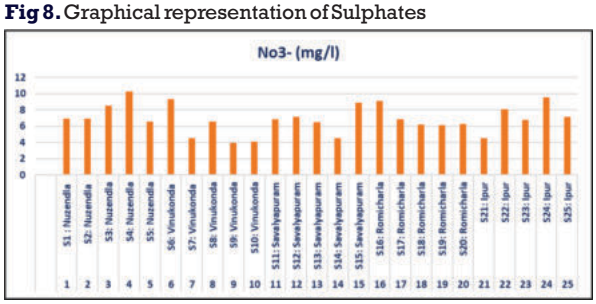

Fig 9. Graphical representation of Nitrates

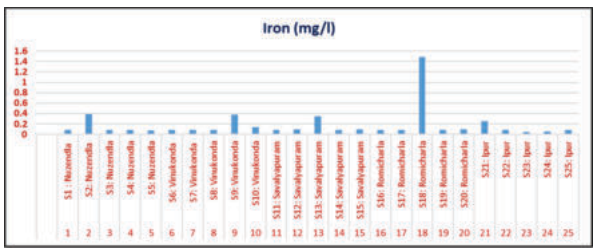

Fig 10. Graphical representation of Iron

6. CONCLUSIONS

When assessed against by the WHO-permitted limits, the water in the study Mandal areas of Nuzendla, Vinukonda, Savalyapuram, Romicharla, and Ipur in Palnadu is turned towards the lower life forms. Numerous samples were found to be have fluorides concentrations that are moderately safe within permissible limits, to be marginally and moderately saline in nature, to have nitrate concentrations that are moderately safe within permissible limits, to have sulphates concentrations that are moderately safe within permissible limits, and to have chlorophyll concentrations that are moderately unsafe within permissible limits. In order to raise public awareness, necessary steps must be taken to ensure proper sanitation, judicious water usage, and the adoption of pollution control technologies.

7. REFERENCES

[1] APHA, AWWA, WPCF, (1998), Standard Methods for the Examination of Water and Wastewater. (20th Edition). APHA, Washington DC, New York.
[2] Raju, M.V., et. al. (2018), An investigative study on water quality distribution in the zones of municipal corporation using remote sensing and gis applications, IJCET, 9(6), 1182-1190.
[3] Kumar, M.S., Raju, M.V., Palivela, H., Venu Ratna Kumari, G. (2017)., Water quality scenario of urban polluted lakes - A model study, IJCET , 8(5), 297-302.
[4] Madhuri, T.U. 2015, A study on assessment of groundwater quality and its suitability for drinking in Madhurawada, Visakhapatnam, Indian Journal of Environmental Protection, 35(2), 138-143.
[5] GVR Kumari SK Moparthi, MV Raju (2016), Field kits for water quality monitoring–A novel approach, IJSR - International journal of scientific research, Volume-5, Issue-12, Pages: 835-836.
[6] GVRK Satish Kumar Moparthi, M.V.Raju, Hepsibah Palivela (2016), Urban management planning using geospatial technology for part of Hyderabad city, Telangana, IJSR - International journal of scientific research, 5 (12), 653-655.
[7] https://des.ap.gov.in/.