ASSESSMENT OF GROUNDWATER QUALITY – A CASE STUDY OF FEW MANDALS OF GURAZALA DIVISION OF PALNADU

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Article History: Received: 11.02.2023 **Revised:** 01.04.2023 **Accepted:** 17.05.2023

Abstract

Because of the shortage and contamination of surface water resources, as well as the increasing demand for agricultural practices, groundwater is of the utmost importance for various domestic, commercial, and industrial purposes. Both the quality and concentration levels of groundwater have significant effects both on human health and agricultural production. This study, which was carried out in five distinct mandals of the Gurazala division of the Palnadu district, employed twenty groundwater samples. Using a random sampling technique, samples were taken from a variety of bore wells/wells, and the chemical properties of water quality parameters were determined. The study examined the maximum amount of groundwater in the five mandals of Dachepalli, Machavaram, Piduguralla, Karempudi, and Bollapalle in the Gurazala division as well as the appropriate treatment procedures for attempting to put the water into potable form.

Key Words: Groundwater, pH, Chloride, Nitrates, Ca and Mg.

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DOI: 10.31838/ecb/2023.12.s3.352

1. Introduction

Due to the huge quantity of chemicals present, naturalistic ecosystems rarely contain chemically pure water. Chemical degradation of pure waters took place in the environment, which also damaged their ability to support life. Rain, snow, fog, or any other type of precipitation that falls from the atmosphere to the crust of the earth is either very clean or pollutant-free. The gases already present in the environment are nonetheless collected by water when it takes in from the atmosphere. Water's quality is determined by the kind and quantity of its elements. Water quality standards and guidelines have been set by several boards or agencies of pollution control boards (PCB), Bureau of Ind. St. (BIS), based on the detrimental effects that various water quality constituents have on human/animal and irrigation ecosystems. Industrial effluents, waste streams, and agricultural runoff all have a significant impact on the quality of groundwater. Groundwater resources are mostly impacted by improper solid waste disposal, excessive or unrestricted aquifer drawing, poor solid waste decommissioning, and excessive fertiliser 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 is study mandals of Gurazala division

Fig.1: Study Mandal Area Map

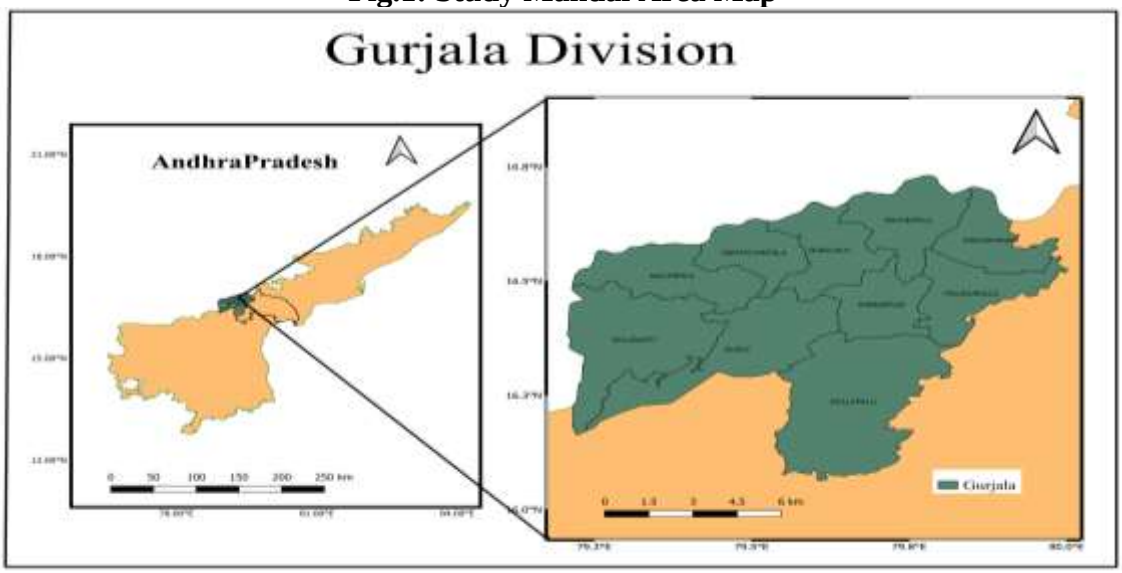
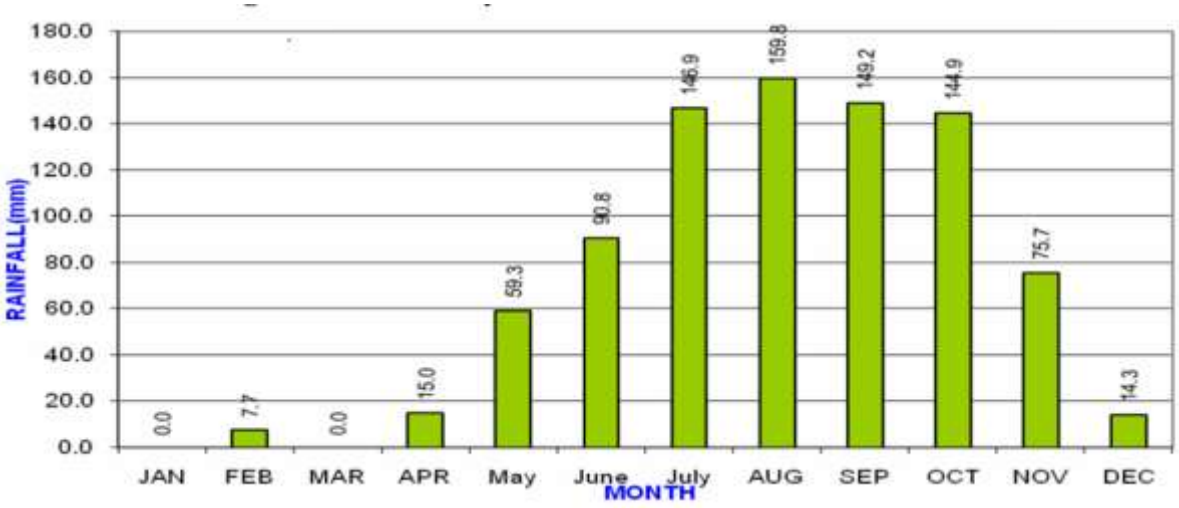


Fig.2. Mean Monthly Rainfall Distribution- Palnadu – Guntur



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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 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

The hand pumps have been used to collect groundwater samples from the mandalas of Dachepalli, Machavaram, Piduguralla, Karempudi, and Bollapalle for chemical

analysis, which will be conducted in the Chemistry Laboratory, Department of S & H, VFSTR, A.P., India. Standard test protocols were used to analyse chemical characteristics such as pH, electrical conductivity, chlorides, nitrates, calcium, and magnesium. The study's objective is to assess the mobility of groundwater in the study area during the pre-monsoon season.In accordance with the recommendations contained in the UNESCO document, water samples were taken. The exact location of the samples taken at the research area had been accurately recorded on the collected specimens. When samples are presented to the lab in bottles, safety measures are followed (APHA 1998). The methods that are used for water analysis are shown in Table 3.

5. Results and Discussions

Chemical Parameters, the pertinent values for each parameter of the water quality of the groundwater samples obtained during the post-monsoon are shown in Tables 2. In the research area's numerous mandals, graphs of the pH, EC, turbidity, chlorides, fluorides, sulphates, nitrates, and iron are shown in Figures 3 to 8.

S. No.	Sample Details	pH	EC (dS/m)	Ca (mg/l)	Mg (mg/l)	F (mg/L)	$No3^-$ (mg/l)
1	S1 : Dachepalli	7.16	1.99	72	47	0.98	7.88
2	S2:Dachepalli	7.22	0.62	57	50	0.62	6.45
3	S3: Dachepalli	7.59	3.10	64	50	1.15	8.95
4	S4: Dachepalli	7.78	3.24	68	53	1.20	10.05
5	S5: Machavaram	7.89	3.45	80	68	2.12	5.50
6	S6: Machavaram	7.58	2.98	89	61	1.98	4.34
7	S7: Machavaram	7.09	0.78	94	70	0.20	3.10
8	S8: Machavaram	8.62	2.88	105	75	0.78	4.10
9	S9: Piduguralla	7.50	1.89	95	66	0.63	8.15
10	S10: Piduguralla	8.42	3.88	89	74	0.98	9.05
11	S11: Piduguralla	7.07	3.95	76	80	1.22	9.10
12	S12: Piduguralla	7.89	3.78	90	84	0.89	8.98
13	S13: Karempudi	8.35	3.99	95	68	2.14	5.70

14	S14: Karempudi	7.25	3.93	86	64	1.45	4.99
15	S15: Karempudi	8.20	1.88	78	59	0.21	3.45
16	S16: Karempudi	8.34	3.45	92	62	1.99	4.34
17	S17: Bollapalle	7.60	3.98	78	64	1.98	6.79
18	S18: Bollapalle	7.02	0.98	64	58	0.33	1.16
19	S19: Bollapalle	7.89	3.45	58	69	1.78	6.89
20	S20: Bollapalle	7.45	3.22	85	78	1.45	6.56

Table 2. Results of Groundwater samples at study area

Table 3. Methods for Groundwater analysis

Test Conducted	Units	Principle of the method
P^H	levels	pH meter
Electrical conductivity	Millimhos	Digital conductivity meter
Ca and Mg	mgl^{-1}	Titration Method
Chlorides	mgl-1	Titration Method
Nitrates	mgl^{-1}	Spectrophotometry

Source: American Public Health Association (APHA) 1998

Fig 3. Graphical representation of pH

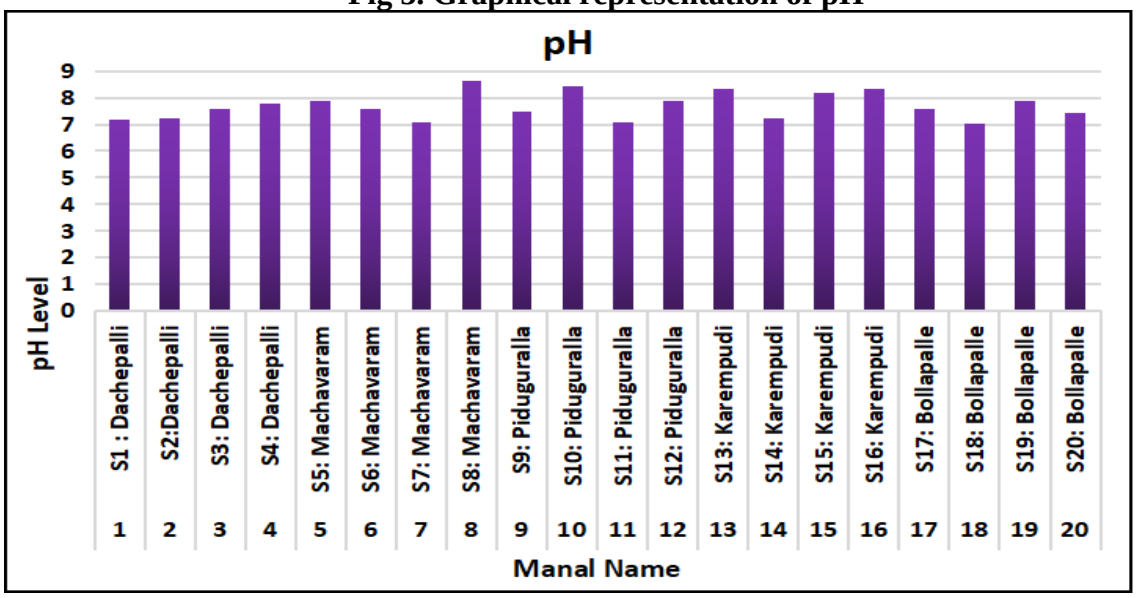


Fig 4. Graphical representation of EC

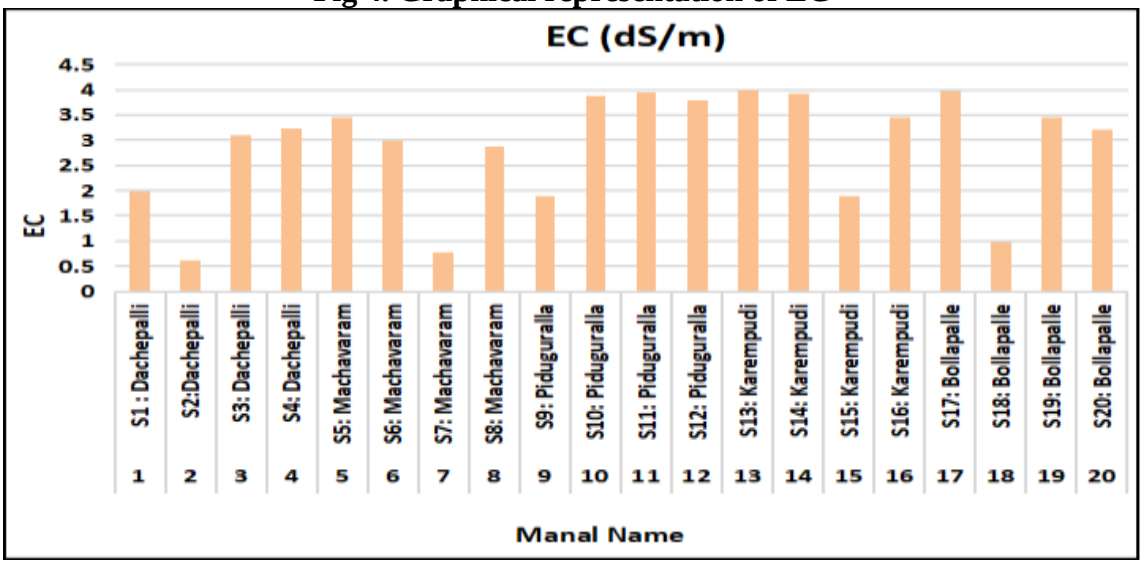


Fig 5. Graphical representation of Calcium

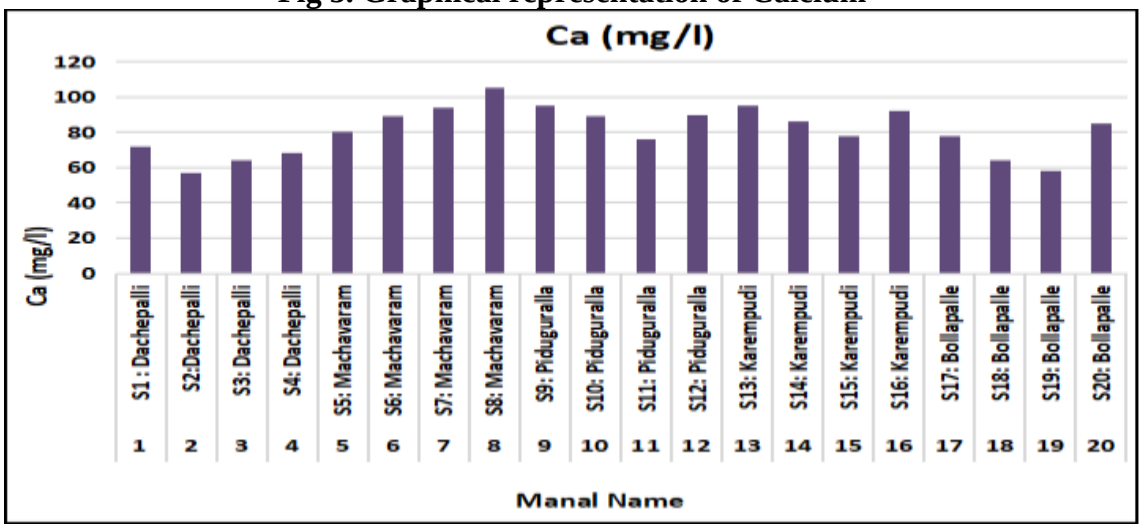


Fig 6. Graphical representation of Magnesium

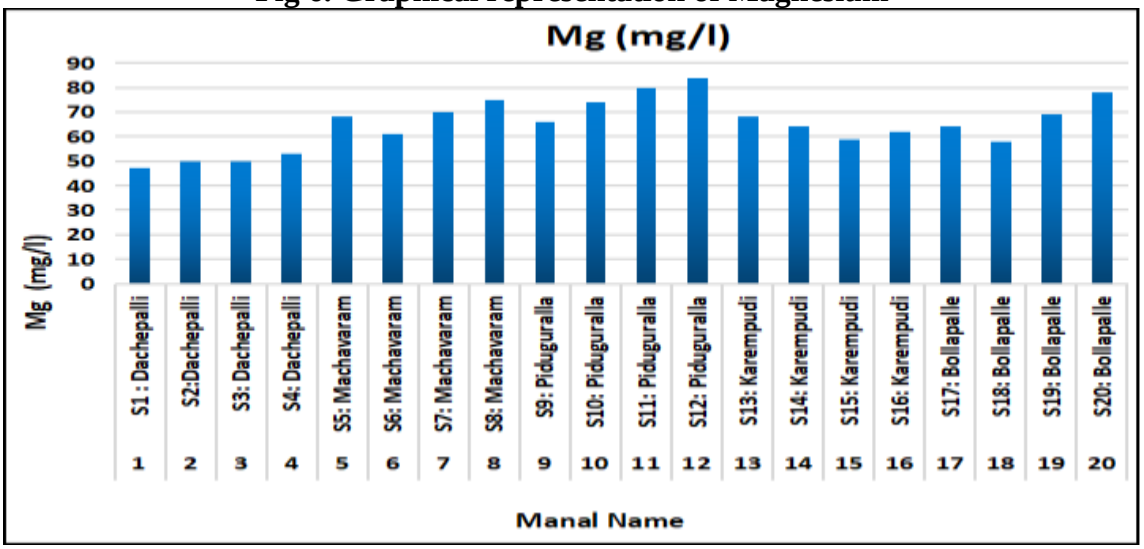


Fig 7. Graphical representation of Fluorides

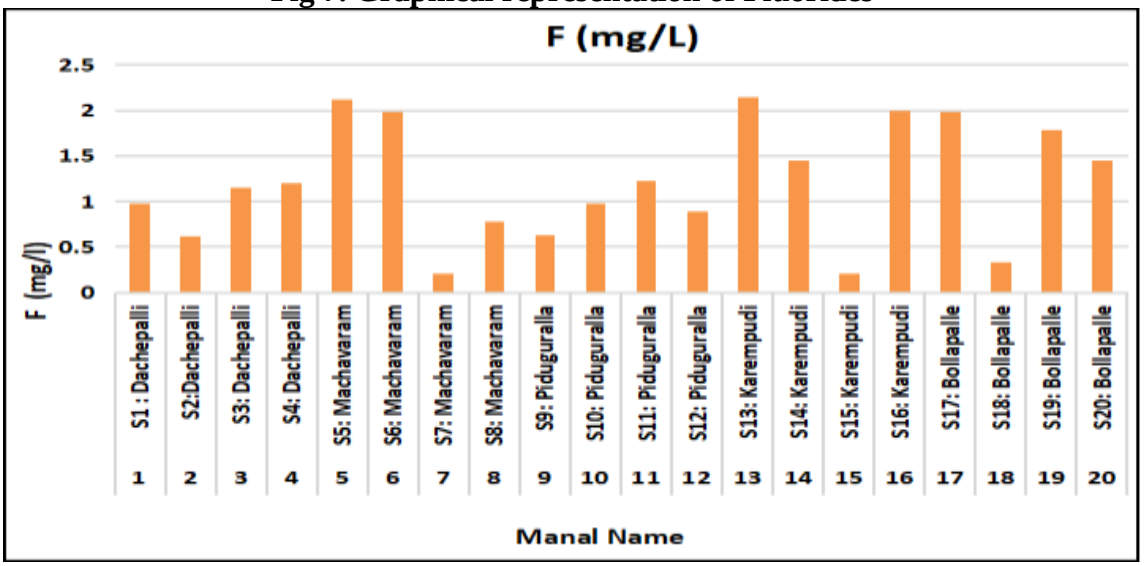
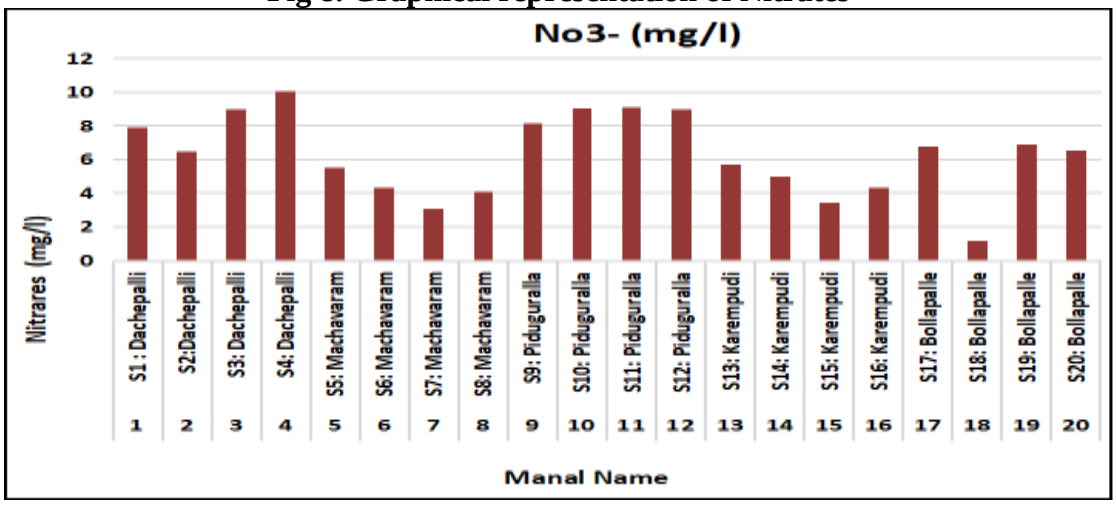


Fig 8. Graphical representation of Nitrates



6. Conclusions

The groundwater in the study Mandal areas of Dachepalli, Machavaram, Piduguralla, Karempudi, and Bollapalle in Gurazala division of Palnadu district is biassed in favour of lesser life forms when compared to the WHO-permitted limits. It has been found that many samples had fluoride concentrations that were moderately safe within permissible limits, that they were marginally and moderately saline in nature, that they had nitrate concentrations that were moderately safe within permissible limits, and that they had chloride concentrations that were moderately unsafe within permissible limits. The implementation of pollution control technologies, judicious water use, and good sanitation must all be ensured in order to increase public awareness.

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