



Assessment of Groundwater Quality from Hand-Pumps: A Physico-Chemical Investigation

M.V. Raju¹, Ranjit Singh², D. Satyanarayana³, K. Maria Das⁴, M. Satish Kumar⁵

¹Assistant Professor, Centre for Environmental Pollution and Control, Vignan's Foundation for Science, Technology and Research, Deemed to be University, Guntur, Andhra Pradesh, India.

²Associate Professor, Department of Technical & Vocational Education and Research, National Institute of Technical Teachers' Training and Research (NITTTR), Bhopal, India.

³Professor, Department of Mechanical Engineering, Vignan's Foundation for Science, Technology and Research, Deemed to be University, Guntur, Andhra Pradesh, India

⁴Assistant Professor, Department of Chemistry, School of ASH, Vignan's Foundation for Science, Technology and Research, Deemed to be University, Guntur, Andhra Pradesh, India.

⁵Professor and HOD, Department of Civil Engineering, Kallam Haranadha Reddy Institute of Technology, Chowdavaram, Guntur, Andhra Pradesh, India.

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ABSTRACT:

Water in its natural state is inherently impure, containing dissolved substances that alter its chemical composition. While chemically pure water is nonexistent in nature, it is not essential for sustaining life. Rainwater, initially pure when it falls, interacts with atmospheric gases and particles, absorbing and capturing substances that affect its quality. This study investigates the physical and chemical characteristics of groundwater, including: Color, Turbidity, pH, Conductivity, Chlorides, Acidity, Alkalinity & Total Hardness. By analyzing these parameters, this research aims to provide a comprehensive understanding of groundwater quality and its sustainability implications.

1. Introduction

More than two-thirds of the Earth's surface is covered in water, with less than a third comprised of land. When toxic substances enter our waterways, including lakes, streams, rivers, and oceans, they can dissolve, suspend, or settle on the bottom. This contamination leads to water pollution, degrading the quality of the water and harming aquatic ecosystems

The primary sources of water pollution in India are untreated city sewage and industrial waste, which are discharged directly into rivers. Unfortunately, wastewater treatment facilities in Indian cities are inadequate, resulting in only about 10% of generated wastewater being treated. The remaining 90% is released into water bodies without treatment, contaminating groundwater, rivers, and other water sources. This polluted water, which eventually

reaches our households, often carries disease-causing microbes, posing serious health risks. Agricultural runoff, which carries fertilizers and pesticides from fields into waterways, is a significant source of water pollution. Furthermore, the improper disposal of household waste has become a major concern, as many individuals discard their trash, including cans, bottles, plastics, and other non-biodegradable items, directly into streams, lakes, rivers, and oceans, turning these water bodies into dumping grounds.

2. Objectives of the Work:

- To know physical and chemical characteristics of water and Analyze whether the results are according to the standards.

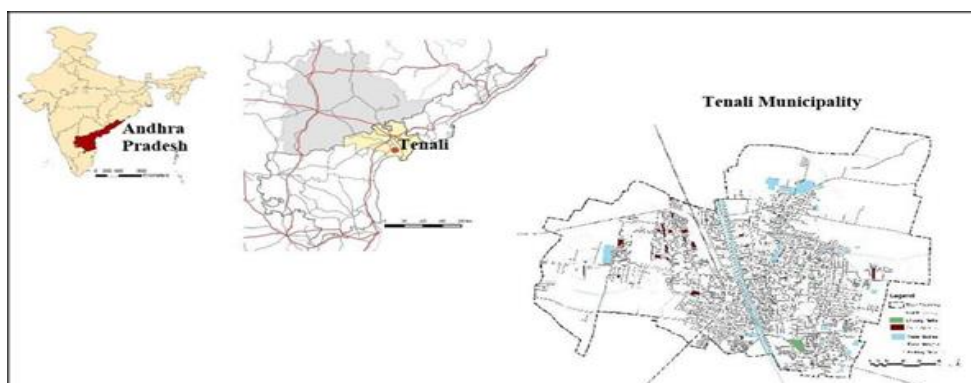


Fig. 1. Location map of study area.

3. Study Area

Tenali is a charming town situated in the southern deltaic region of the Krishna River. Geographically, it lies 28 kilometers east of Guntur, the district headquarters, and 37 kilometers south of Vijayawada city, accessible by road. Tenali is positioned on the eastern coastal plain, with coordinates 16.239°N 80.645°S, and an average elevation of 43 feet above mean sea level (MSL). The town spans an area of 29.56 square kilometres. The word Teravali is derived from Tenali. The land surrounding this town is covered in alluvium, as well as the primary soil variations of red and black. Three canals of the river Krishna, the Nizampatnam canal, the East canal, and the West canal,

run through Tenali town, resembling the rice bowl of Andhra Pradesh; another comparison is that it looks like Paris, where three canals pass through the city. Fig. 1 has been shown the Location map of study area.

4. Materials and Methods

Water samples were taken according to the rules stated in the UNESCO paper. The obtained samples were clearly marked, finding the specific location where they were taken in the research region. The samples are then sent to the laboratory in bottles and studied for rules set using standard methods (APHA 1998). The methods utilized for water analysis are presented in Table 1. And Table 2 shows the standards for drinking water.

Table 1 Methods used for water analysis

Test Conducted	Units	Principle of the method
Temperature	°C	Precision thermometer, measured in situ
Electrical conductivity	Mhoms	Digital conductivity meter
Turbidity	NTU	Turbidimeter
Total Solids	mg ^l - ¹	Evaporation
Total Dissolved and suspended solids	mg ^l - ¹	Filtration and evaporation
pH		Digital pH meter
Total Alkalinity as CaCO ₃	mg ^l - ¹	Titration with std. H ₂ SO ₄ P-alkalinity + MO – Alkalinity ----- x 100 ml of sample taken
P-Alkalinity as CaCO ₃	mg ^l - ¹	Vol. Of H ₂ SO ₄ required in presence of phenolphthalein x 1000 ----- ml of sample taken
MO-Alkalinity as CaCO ₃	mg ^l - ¹	Vol. Of H ₂ SO ₄ required in presence of methyl orange x 1000 ----- ml of sample taken
Chlorides	mg ^l - ¹	Titration with stand. AgNO ₃ using K ₂ Cr ₂ O ₇ as indicator
Total Hardness	mg ^l - ¹	EDTA titrimetric method
BOD	mg ^l - ¹	Sample measured for 5 days at 20°C

Source: American Public Health Association (APHA) 1998



Table 2. Indian Standards and WHO Guidelines for Drinking Water.

S.No.	Parameter	BIS, Indian Standards (IS 10500:1991)		World Health Organisation (WHO Guidelines)
		Desirable limits	Permissible limits	Maximum allowable limits
1	Colour	5Hazen units	25 Hazen units	15 True colour units
2	Turbidity	5 NTU	10 NTU	5NTU
3	pHh	6.5-8.5	No Relaxation	6.5-8.5
4	Total hardness	300 mg/L	600 mg/L	500 mg/L
5	Chlorides	250 mg/L	1000 mg/L	250 mg/L
6	Nitrates	45 mg/L	100 mg/L	10 mg/L
7	Iron	0.3 mg/L	1.0 mg/L	0.3 mg/L
8	D.O.	500 mg/L	2000 mg/L	1000 mg/L
9	Alkalinity	200 mg/L	600 mg/L	-
10	Calcium	75 mg/L	200 mg/L	-
11	Zinc	5.0 mg/L	15 mg/L	5.0 mg/L

5. **Results** The study included Physio- chemical parameters for water. The samples were analysed and the results are shown in Table 3.

Table 3. Results of the Samples at the Study area

S.No.	Colour (Hazen units)	Turbidity (NTU)	pH	Conductivity (Mhoms)	Chlorides (mg/L)	Acidity (mg/L)	Alkalinity (mg/L)	Total Hardness (mg/L)
1	4	4	7.24	1.7	394.8	255	10	257.5
2	4	4	7.25	2	394.8	255	10	252.2
3	3	4	7.25	1.4	399.8	255	10	252.2
4	4	4	7.27	1.6	399.8	255	10	252.2
5	4	4	7.28	1.8	399.8	255	10	252.2
6	4	4	7.29	1.9	399.8	255	10	257.5
7	4	4	7.30	1.8	399.8	255	15	255.0
8	4	4	7.32	2	394.8	255	10	252.5
9	4	4	7.34	1.8	399.8	255	10	252.5
10	3	3	7.38	1.7	399.8	255	10	252.5
11	3	3	7.40	1.4	399.8	255	10	252.2
12	2	3	7.52	1.6	399.8	255	15	252.2
13	1	2	8.1	1.	399.8	255	15	252.2
14	1	2	8.2	1.9	399.8	255	15	252.2
15	1	2	8.2	1.7	399.8	255	15	252.2

6. Conclusion

Results, when compared with the desirable and permissible limits by BIS, Indian Standards (IS 10500:1991) the water is turned towards base but still lies in permissible limits of drinking water. The water contains

low alkalinity. Presence of chlorides exceeds desirable limits but lies below permissible limits. Parameters which are tested are nearer to desirable limits and can be used for domestic purposes.

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