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RESEARCH ARTICLE

PHYSICO-CHEMICAL ANALYSIS OF DRINKING WATER IN CHOWDUPALLI PANCHAYAT, CHINTHPALLI MANDAL, VISAKHAPATNAM DISTRICT, ANDHRA PRADESH, INDIA

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ABSTRACT

Drinking water quality is directly related to health. The worlds thirst for water is likely to become one 21st century. In order to evaluate the existing status and trends of different water quality parameters, Spring and Well water samples was collected in Chowdupalli Panchayat, Chinthpalli Mandal, Visakhapatnam district, Andhra Pradesh, India. The physic-chemical parameters include pH, Turbidity, Electric Conductivity (EC), Total Alkalinity, Total Dissolved Solids (TDS), Total Hardness (TH), Calcium, Magnesium, Chloride, Fluoride, Sulphates, Phosphate, Nitrite, Dissolved oxygen (DO), and Biological Oxygen Demand (BOD) tested. The results compared with the drinking water standards of BIS and WHO. It was found that some parameters were higher than the prescribed limits while other parameters were lower than the limits. The results showed that, the water in this area is not safe and needed treatment before it is consumed

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INTRODUCTION

Water is essential for survival in many parts of the world today ground water is the only source of fresh water where surface waters are either absent or polluted (Haniffa *et al.,* 1993). Peoples depends water on its availability (Lamikanara 1999, FAO 1997). The present days necessary to prevent portable water to prevent, health hazards (Leno 2002). Drinking water is defined as potable water that is free from diseases producing microorganisms and chemical substance detritus health. Before water can be described as potable, it has to comply with certain physical, chemical and microbiological standards, which are designed to ensure that the water is portable and safe for drinking. A supply of safe drinking water is needed for human development, health and well being. Chemical contamination of drinking water is often considered a low priority than microbial contamination by regulators, because adverse health effects from chemical contamination are generally associated with long turn exposure, where the effects from microbial contamination is usually immediate (WHO, 2007).

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The quality of life in many rural villages, because availability of safe drinking water has direct impact on the working conditions, health conditions, health of the people and their productive capacity (Rajpramukh *et al.,* 2004). Thus there is a need to monitor drinking water operation and performance look for some useful indicators, both chemical and microbiological. In present study water was collected from different sources such as springs, wells, bores. The area has no major industry in an around, yet household waste water and agricultural runoff are directly discharged into the area. The study aimed mainly on physical chemical analysis of drinking water samples from selected places of tribal area of Chinthapalli.

MATERIALS AND METHODS

Study area

The study was conducted in Chinthapalli mandal located on the North Easter part of Visakhapatnam dist, in Andhra Pradesh, India. It lies between 17°44'22" North Latitude to 18°04'29" East to 82°38'04" East. Very cool climate the minimum of 4°C and maximum of 34°C temperature present in the area. This tribal area which rain season account for 90% of rain fall an average Annual rain fall of 1178.

Sample Collection

Water samples were collected from Open wells and Springs at different villages from Chowdupalli Panchayat, Chinthpalli Mandal, Visakhapatnam district. Andhra Pradesh. India. The sites are represented in Table1. The water samples were collected in clean plastic cans and transferred the laboratory for further analysis. pH, Turbidity, Electric Conductivity, DO was determined within the felid. As per the standard method for the examination of water Physical and Chemical parameters were analyzed (APHA 1998).

Table 1: List of Villages & water samples Collected:

S. No	Name of Villages	Sample code	Water samples
1	Chowdupalli	S1	Spring
2	Chowdupalli	S2	Well
3	ChinaKothuru	S3	Spring
4	Bailukinchangi	S4	Well
5	Pinakoturu	S5	Spring
6	V.G.kothuru	S6	Spring

Analysis

A total of six samples were collected from Oct 2011 to Sept 2012 respectively. Electrical conductivity was measured by using digital conductometer was calibrated using 0.1 N KCL solution, (systronic make) Nephlo turbidometer was used for turbidity determination. The samples are also analyzed for TDS, Total Hardness, Nitrate (NO_3) Calcium, Magnesium, and Chloride by using Titrimetric methods. DO was determined by WINEUR'S Idodometric method. The Fluoride was determined by SPADAN'S Spectrophotometric Method. The estimation of Sulfate (SO_4), Nitrates amount was estimated by using the Phenol Disulphonic Acid method.

RESULTS

Table 2. Physical, Chemical analysis of drinking water and their comparisons with the BIS and WHO Standards

		S1	S2	S3	S4	S5	S6	ISO limit	WHO limit
1	pH	6.0	6.2	7.4	7.1	6.9	6.2	6.5-8.5	6.5-8.5
2	Turbidity	5.0	8.3	7.5	5.8	6.3	5.0	5NTU	-
3	Electrical Conductivity	132	180	252	573	136	401	300-400µs/cm	-
4	Total alkalinity	210	125	126	160	122	124	200mg/L	120mg/L
5	Total dissolved solids	274	224	156	112	105	193	500mg/L	500mg/L
6	Total hardness	84	52	52	92	144	54	300mg/L	300mg/L
7	Calcium	44	40	26	24	20	22	75mg/L	75mg/L
8	Magnesium	40	22	36	28	24	22	30mg/L	50mg/L
9	Chlorides	12.7	32.7	16.5	14.6	10.9	12.5	250mg/L	250mg/L
10	Fluorides	0.79	0.87	0.64	0.74	0.84	0.52	1mg/L	1.0-1.5mg/L
11	Sulphates	0.90	1.92	1.83	0.92	0.85	0.92	200mg/L	500mg/L
12	Nitrates	BDL	BDL	BDL	BDL	0.5	BDL	3.0mg/L	3.0mg/L
13	Phosphates	4	7.6	8.2	4.9	3	5.2	-	
14	Dissolved Oxygen	5.9	4.9	5.6	5.9	5.4	5.2	5.0mg/L	5.0mg/L
15	Biological Oxygen demand	3.2	2	3.2	4.2	4	4.8	-	-

pH

The pH of the water samples were found to range from 6.79 to 7.4 with a mean of 6.63. It indicating slight acidic to slight alkaline, this could favors the pathogenic microorganism's growth (Rajasekhar *et al.,* 2010). The pH value of S3 sample which is spring is maximum with the value as 7.4 and minimum with the value as 6.0 when compared with the other samples as show in table1. The maximum permission limit of WHO is 6.5- 8.5. The pH levels were in permissible limits in all the water samples. Though pH does not have direct effect on health, all biochemical reactions are sensitive to the variation of pH (Jeyakumar *et al.,* 2003).

Turbidity

The turbidity indicates clarity of water and is caused by living and nonliving suspended matter and color producing substances. The turbidity readings of the samples were found to range 5.0 to 8.3 NTU. Highest turbidity8.3 NTU was observed in S2 sample. WHO recommended turbidity value for drinking water is 5 NTU. In the present study suspended soil particles and other materials are usually responsible for high turbidity values, similarly higher turbidity values were reported by Garg *et al.,* (2006), Medudhula *et al.,* 2012.

Electrical conductivity

The amount and nature of many dissolved substances in water influences their ability to electric conductivity. The recommended permissible limit for electrical conductivity is 300 µs/cm. by analyzing the results, 90% of the samples showed electric conductivity ranged from 132-573µs/cm, except the sample of S4 and S6 which are spring and well water samples respectively water recorded 573 and 401 µs/cm.

DISCUSSION

The analysis carried out during period of 2001 – 2012. The results were comparing against the drinking water quality standards lead by BIS and WHO.

Kueheker *et al.* (2008**)** observed that the electrical conductivity of water samples was high in monsoon than post monsoon the reason may be during monsoon, the slit carried through runoff got mixed with the water and resulted in high electrical conductivity the similar observations were reported by Rao *et al.* (2004).

Total Alkalinity

WHO recommended alkalinity value for drinking water is 120 mg/l. present study results show that S1 and S4 water samples Alkalinity values cross the permissible limits of WHO standards. Alkalinity itself is not harmful to human health but still water with less 120mg/l are desirable for domestic use (Trivedi and Goel, 1984). Higher alkalinity values in the ground water of S1 and S4 that may be due to anthropogenic activities and the contamination of the resources with domestic wastes (Gupta and Sukla, 2004).

Total Dissolved Solids

All inorganic and organic substances contained in a liquid in molecular, ionized or micro granular suspended form measure in TDS (Balachandar *et al.* (2010)). In study area the minimum values were found to be 105 mg/ lit in S5 water sample which is well water, where as the maximum value of 274 mg/1 was noted in S1 which is spring water sample. The total dissolved solids which range from 105- 274mg/lit. The low level of TDS indicates that the recharging of underground water through either rain water or by the water from nearby canals and still indicated the pollution (Gupta 2009, Christopher 2011).

Total hardness

The hardness of water samples may be due to leaching of Ca and Mg ions into the ground water (Srinvasmoorthy *et al.,* 2009) Total hardness ($CaCO_3$) was low in all samples. The maximum prescribed a limit (WHO) is 300-600mg/l.

Calcium

The calcium of the sample ranged from 20- 44 mg/l. The minimum value was found to be 20mg/l in S5 which is a well and maximum concentration was found in spring water sample of S1 that is 44mg/l, the values were below permissible limit. Calcium may be added to water system as it passes through soil and rock containing large amounts of these elements in mineral deposits (Renn, 1970).

Magnesium

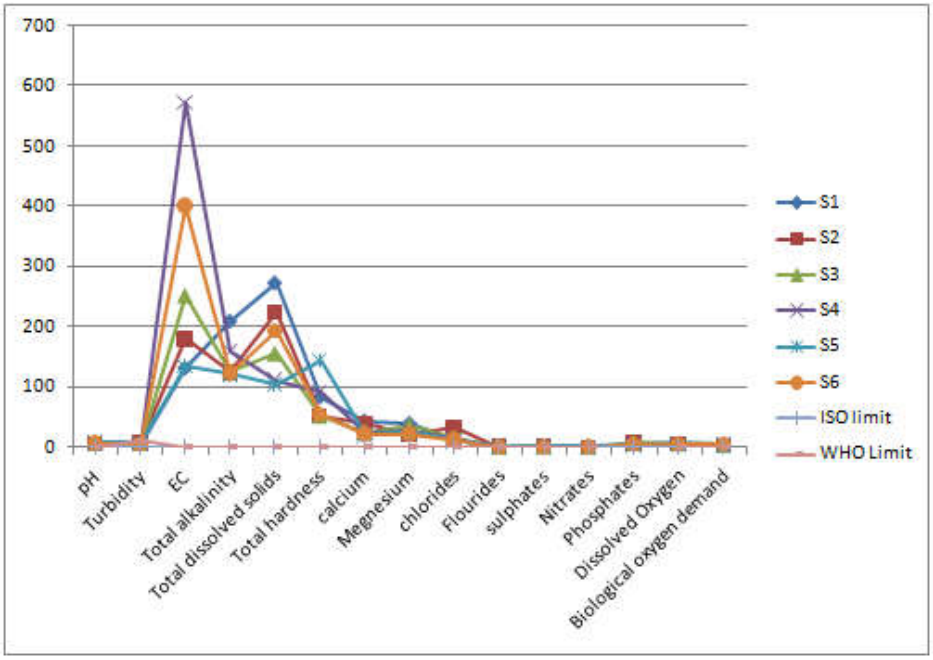
The magnesium concentration is in 22mg/lit to 40mg/lit. S1 well sample is maximum and it is 40 mg/L at S2 is well water sample with 22mg/L. When compared with other samples sources the values of magnesium in all water samples are below the permissible limit, according to the WHO the limit is 30mg/L. The possibilities of dissolution of minerals are very low in the study area (Gupta 2009**).**

Chlorides

In the study Chlorides ranged from 10.9- 32.7mg/L which are below the permissible limit of WHO & BSI levels. The chloride concentrations above 0.5ppm in natural water should be considered as evidence of pollution hence the drinking water requires treatment before use (Christopher *et al.,* 2011).

Fluorides

The presence of fluoride in drinking water is essential and WHO prescribe limits is 1.5mg/L fluoride as desirable limits in drinking water. The concentration of 1mg/L in drinking water has no biological side effects **(**Leone et al 1954). It enters human body through food, tooth paste, mouth rinses and other edible products. In the study area fluoride concentration observed to be within permissible limits.



Graphical representation of the comparison of the physic-chemical parameters with the ISO and WHO standards

Sulphates

The sulphates concentration ranged from 0.85mg/lit to1.92mg/lit, minimum values was 0.85mg/L in S5 sample, which is spring water. Whereas the maximum value was

1.92mg/L in S2 well sample. Sulphates are the common ion present in water. It can produce bitter taste at high concentration. One of the occurrences of Sulphates in natural waters may be break down the organic substances in the soil (Alexander 1961). in the study area sulphates content was quite below the permissible limits in all the samples.

Nitrates

Presences of nitrite in water lead to organic pollution. The water samples had nitrite level ranged from 0.5 mg/L present in spring water. Nitrite content in waters might be due to the activity of microorganism's sewage and contamination of ground water. In well water samples nitrate levels are very poor because the soil has poor nitrogen content.

Phosphate

The phosphate values range from 3 to 8.2 mg/L. in all the water samples are above the prescribed limit. There are number of ways by which phosphates contaminate to ground water. These include anthropogenic input like chemical fertilizers household detergents, human and animal wastes while the major geological source is appetite, a principal rock mineral in which phosphorous is a chief component (Stednick, 1991). The higher level of phosphate is indicative of eutrophication and pollution and water with high PO_4 contents causes health hazards' (Singana *et al.,* 1996). Less amount of PO_4 in some of the analyzed samples may be attributed to a rapid biological utilization (Devigadi *et al.,* 2003). As 0.1mg/L is the recommended standard of phosphate for the drinking water.

Dissolved Oxygen

The oxygen content in water samples depends on a number of physical, chemical and microbiological processes (Nurchihan *et al.,* 2009). In the study DO values found between 4.9 to 5.9 mg/L values, the DO concentration was higher than the prescribed standards laid by BIS.

Biological Oxygen Demand

BOD is the most important parameters used to assess the quality of water regarding organic matter present in both suspended and dissolved form. Usually drinking water has a BOD of less than 1ppm and water is considered to be fairly pure if BOD is of 3ppm and doubtful purity is at BOD value of 5ppm (Rao 1997) In the study BOD value range from 2.0mg/lit to 4.0mg/lit. Good water should have solubility of oxygen in 7.0mg/lit to7.6mg/lit at 36 c respectively (Kudesia *et al.,* 1995).

Conclusion

Ground water is a precious natural resources and it is an important component of the hydrological cycle. The present study indicates that that majority of the physic-chemical parameters analyzed are below the standards laid by BIS, and WHO. In order to evaluate the health conditions of the Tribal community, the study should be extended for continuous monitoring.

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Annexure

Sampling sources

Chowdupalli (well)

Bailukinchangi (well)

Spring sources in Chowdupalli and Chinakothuru

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