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Water Quality monitoring on Tirumala and Tirupati, Andhra Pradesh, India

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ABSTRACT

An attempt has been made to evaluate the water quality of supplemented and ground water in Tirumala and Tirupati, Chittoor District, Andhra Pradesh, India. The Tirumala and Tirupati are the most popular pilligramage and education areas in Andhra Pradesh. Twelve areas of Tirumala and Tirupati have been selected, where the peoples are used supplemented and groundwater for drinking purpose, and the water samples were subjected to systematic analysis with a view to understand the potability of drinking water sources. The values obtained for different parameters have been compared with the standard values given by ISI/ICMR/ WHO and the variations were notable for the parameters like electrical conductivity, total dissolved solids, total hardness and nitrates for few samples. Medical survey has been carried out to study the harmful effects on the society due to these four parameters at the areas - Tiruchanur, Renigunta and Karakambadi.

Key words: Physico-chemical parameters; Total dissolved solids; Total hardness; Electrical conductivity.

INTRODUCTION

Water is one of the most essential components for the existence of life on earth. Although water pollution is an age-old problem, in this modern age, the problems like growing population, sewage disposal, industrial waste, radioactive waste, etc. have polluted our water resources so much that about 75 % rivers and streams, not only of India but also of all the countries, contain polluted waters [1]. According to WHO, about 600 million cases of diarrhea and 46,00,000 childhood deaths are reported per year because of contaminated water and lack of sanitation [2]. Although India has substantial freshwater resources there is an acute shortage of safe drinking water of acceptable quality [3]. Most of the Indian rivers and freshwater streams are seriously polluted by textile dyeing and printing industry effluents, which include wastes like metals, detergents, acids, alkalis, sulfates, chlorides, nitrates, dissolved and suspended solids, organic and microbial impurities [4].Hence these is a need to alter in physical, chemical and biological properties of environment of water. Since water quality index (WQI) is one of the most effective expressions, which reflect a composite influence of contributing factors on the quality of water for any water system. Therefore, present work deals with water quality index of drinking water used in various areas of Tirumala and Tirupati.

MATERIALS AND METHODS

The drinking water samples were collected from twelve different areas of Tirumala and Tirupati in Chittoor district, Andhra Pradesh, India. These samples were selected and the details of samples are given in **(Fig. 1 and Table 1).** The sample sites are major sources drinking sources for the various devote in Tirumala and Tirupati. The samples

were collected in polythene bottles, which were previously cleaned. The analysis was carried out systematically both volumetrically and by instrumental techniques [5]. The procedures were followed from standard books and manual [5, 6]. The analysis has been carried out immediately for P^H, electrical conductivity, and odour and for all the other parameters within three hours of sampling time. Analysis was carried out during August and October 2011.

Fig. 1 Location of sampling points in the study area.

A-INDIA

B-ANDHRA PRADESH

C-TIRUPATI

D-TIRUMALA

Table. 1 Details of the samples with various areas of Tirumala and Tirupati

S. No	Area in Tirumala and Tirupati	Sample No.
1	Pushka rini	S1
2	Papa vinashanam	S2
3	Vaikuntam complex I	S3
4	S.V.Museum	S4
5	S.V.Zoo park	S5
6	Alipiri	S6
7	Tiruchanur	S7
8	Renigunta	S8
9	Karakambadi	S9
10	SVIMS	S10
11	S.V. University	S11
12	Kapila theertham	S12

RESULTS AND DISCUSSION

Different physical parameters which include colour, odour, appearance, taste, electrical conductivity, turbidity, and total dissolved solids are studied in the present investigation. Different chemical parameters such as P^H, alkalinity, total hardness, sodium, nitrate, chloride, sulphate, calcium, iron and manganese are studied. The values obtained after the analytical study are given in **Table 2**. The values were compared with the standard values given by ISI and ICMR shown in **Table 3.** Of the physical parameters studied, variations were observed for the parameters such as electrical conductivity, total hardness and total dissolved solids. The standard value for EC is 1,500 µS cm^{-1} according to ISI. The electrical conductivity value is an index to represent the total concentration of soluble salts in water [7]. The electrical conductivity value of samples S7, S8 and S9 which are samples from the Tiruchanur, Renigunta and Karakambadi of Tirupati, was found to exceed the standard value given by WHO [8]. It is observed that waters with high electrical conductivity values are predominant in sodium, copper and chloride ions. While concentrations of these ions are considered together for all 12 samples, sample S7, S8 and S9 were found to have both the ions at higher concentration **[Fig. 2]**. The reason behind this may be continuous usage of synthetic fertilizers and minerals. A medical survey has been carried out in three areas i.e., Tiruchanur, Renigunta and Karakambad. Where values of nitrate were observed high.

Table 2. The values obtained for physico-chemical parameters in study area

S. No	Parameters	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	S_{11}	S_{12}
1	colour	Colour less	Colour less	Colour less	Colour less	Colour less	Colour less	Colour less	Colour less	Colour less	Colour less	Colour less	Colour less
2	odour,	Odour less	Odour less	Odour less	Odour less	Odour less	Odour less	Odour less	Odour less	Odour less	Odour less	Odour less	Odour less
3	appearance	Clear & Colour less	Clear & Colour less	Clear & Colour less	Clear & Colour less	Clear & Colour less	Clear & Colour less	Clear & Colour less	Clear & Colour less	Clear & Colour less	Clear & Colour less	Clear & Colour less	Clear & Colour less
4	taste,	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
5	electrical conductivity	321	247	413	502	659	611	1509	1869	1425	684	451	495
6	turbidity	1	1	1	1.3	1	1	1.2	2.1	1.1	1	1	1
7	Total dissolved solids	297	439	266	892	663	723	1436	1754	1995	964	447	369
8	pH	7.3	7.0	7.2	7.2	7.5	7.6	7.8	7.6	7.8	7.1	7.1	7.2
9	alkalinity	141	92	112	114	256	259	264	260	264	112	106	112
10	total hardness	69	91	76	98	209	116	477	598	662	232	119	404
11	sodium	111	128	101	307	322	147	159	264	300	211	99	154
12	nitrate	61	12	11	19	22	54	112	99	111	58	16	51
13	chloride	130	38	38	306	76	47	196	254	541	129	61	125
14	sulphate	21	36	19	103	66	10	63	112	147	99	14	32
15	calcium	19	61	48	46	74	29	60	57	59	24	48	22
16	Iron	0	0	0	0	0.2	0	0.3	0.3	0.1	0	0	0.1
17	manganese	0	0	0	0	0	0	0.1	0	0	0	0	0

The Renigunta and Karakambadi are best industrial areas in Tirupati. The increased levels of (EC) i.e., the long-term exposure to the copper can cause irritation of nose, mouth and eyes, and it causes headaches, stomachaches, dizziness, vomiting and diarrhea. The intentionally high uptakes of copper may cause liver and kidney damage. The chronic copper poisoning results in Wilson's disease, characterized by hepatic cirrhosis, brain damage, demyelization, renal disease and copper deposition in the cornea.

A medical survey has been done in three areas i.e., Tiruchanur, Renigunta and Karakambadi, where the values of nitrate were observed high. The nitrate toxicity results from the body's natural breakdown of nitrate to nitrite. The doctors of these areas contacted and enquired about occurrence of methaemoglobinaemia, the disease otherwise called as blue baby syndrome. In infants below the age of six months who drink water containing nitrite (nitrate) in excess could become seriously ill and, if untreated may die. The symptoms include shortness of breath and blue baby syndrome. People staying at various locations in these areas were enquired of early death of infants after the body becoming blue. From the survey, it was revealed that no medical report on such disease was observed. The drinking water source of Tiruchanur(S_7), Renigunta (S_8) and Karakambadi(S_9), having highest value of total

hardness among all the samples, was expected to have harmful effects, like kidney stone formation and other related diseases. The Karakambadi(S_9) people were surveyed for these diseases, and rare occurrence was reported.

Table. 3 Standard values for potability

S.NO.	Parameters	ISI Standard
1	Colour	Colourless
2	Odour	Odourless
3	Appearance	Clear & colour less
4	Taste	Tasteless
5	Electrical Conductivity	1500 US/CM
6	Turbidity	10 NTU
7	TDS	1500 - 3000 (ICMR)
8	P^H	6.5 to 8.5*
9	Alkalinity	600
10	Total Hardness	600
11	Sodium	-----
12	Nitrate	100
13	Chloride	1000
14	Sulphate	400
15	Calcium	200
16	Iron	1
17	Manganese	0.3

Fig. 2 Electrical Conductivity in the study areas.

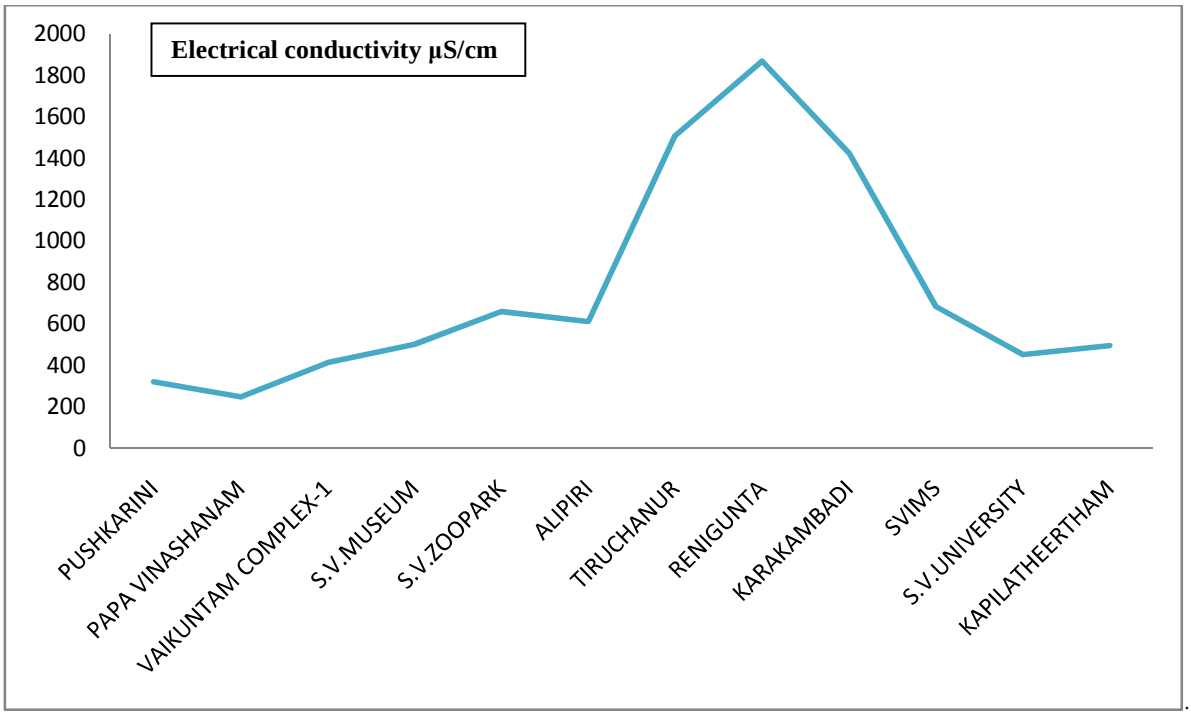


Fig .3 Total dissolved Solids in the study areas.

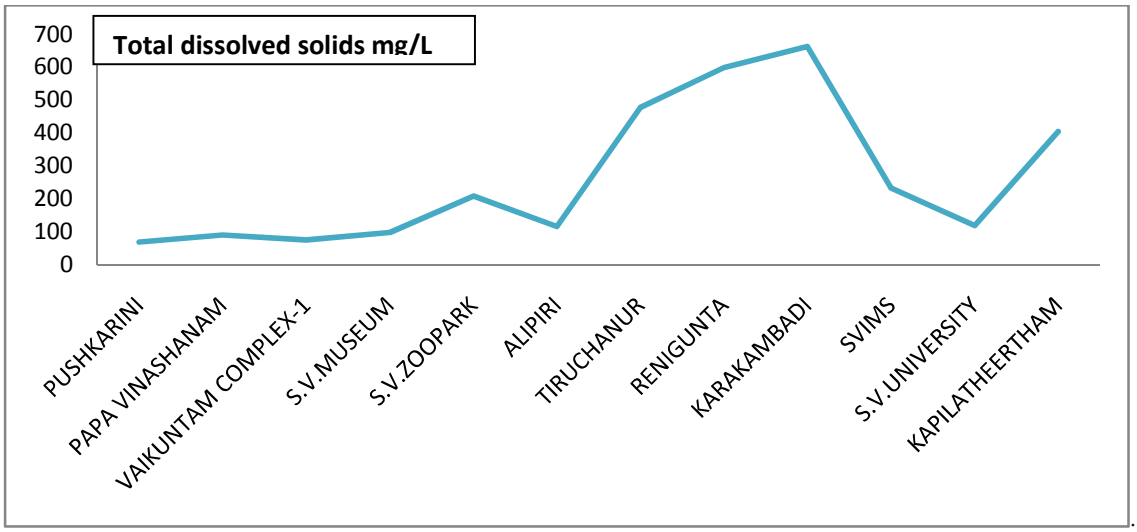
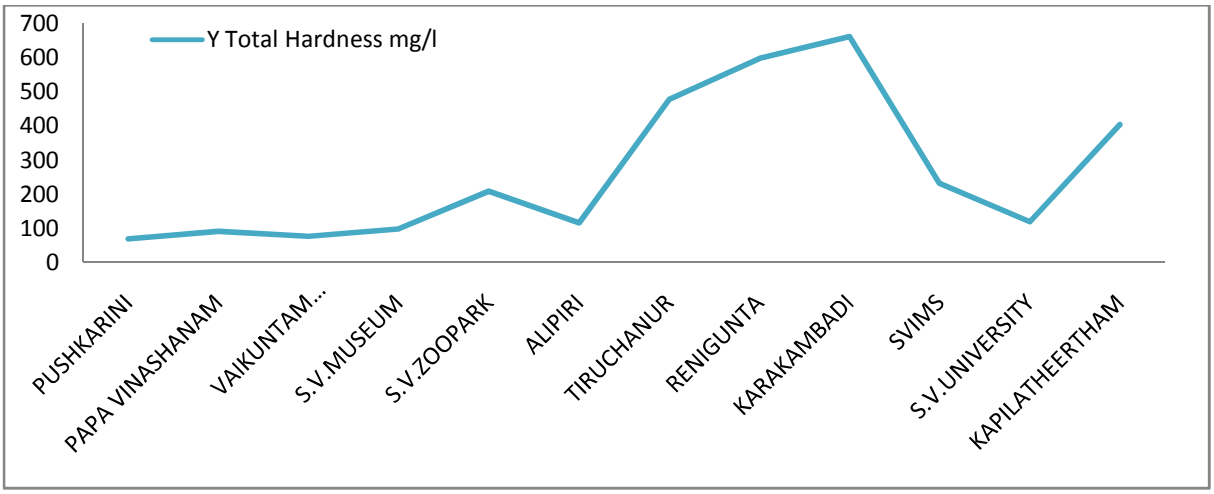


Fig. 4 Total Hardness in the study areas.



The samples S_8 and S_9 were drinking water sources of Renigunta and Karakambadi was found to have the highest value of total dissolved solids (TDS) as 1754 and 1995 mg/L compared with other ten samples **(Fig. 3)**. The highest value of TDS could be due to low water levels within the aquifers and sediment effect [9]. Dissolved material results from the solvent action of water on solids, liquids and gases. Like suspended material, dissolved substances may be organic or inorganic in nature. Inorganic substances may be dissolved in water. Water may come in contact with these substances in the atmosphere, on surfaces and within the soil. Decay products of vegetation, organic chemicals and gases are common organic dissolved constituents of water [10].

Among the different chemical parameters analysed, variations were observed comparing with the standard values for the parameters which include electrical conductivity, total hardness (TH) and nitrate. Sample S9, the drinking water source of the Karakambadi was found to have the total hardness value as 662 mg/L. So the greatest value of total hardness was found due to dissolution of limestone, natural accumulation of salts in contact with soil and geological formation. The values of sodium and potassium ions were found comparable with the values reported by Sudarshan [8]. The desirable nitrate value for drinking water prescribed by ISI is 100 mg/L. The values of nitrate for all water samples, except S7, S8 and S9 were found within the permissible limit **(Fig. 4)**. The samples S7, S8 and S9 were

taken from the drinking water sources at Tirupati region of Tiruchanurr (S_7), Renigunta (S_8) and Karakambadi (S_9) respectively. The main source of nitrate pollution was found to be the heavy use of nitrate fertilizers in these regions especially at karkambadi.

CONCLUSION

Among 12 water samples analysed, except three samples, all the samples were found to have the values according to the standard values prescribed by ISI/ICMR for all the parameters. The samples S7, S8 and S9 after analysis revealed that the water needs denitrification and ion excharge process in addition. General filtration methods should be adopted for all the samples and especially for S7, S8 and S9. The medical survey reports revealed that there were no adverse effects observed on the people.

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