



## A Pilot Study on Water Quality of 22 Divine Wells of Ramanathaswamy Temple, Rameshwaram Island, Ramanathapuram, Tamil Nadu, India

Rajan S.\* and M. Manikandan\*\*

Associate Professor, PG and Research Department of Zoology,  
Pachaiyappa's College, Chennai-600 030, Tamil Nadu, India

\*\*M.Sc., Zoology Student, PG and Research Department of Zoology,  
Pachaiyappa's College, Chennai-600 030, Tamil Nadu, India

Received: 22 August 2014; Revision: 23 October 2014; Accepted: 05 December 2014

### ABSTRACT

Rameshwaram is an island situated at the south eastern end of the Indian Peninsula at the Latitude of 9.2800°N and Longitude of 79.3000°E in Ramanathapuram District of Tamil Nadu. Sri Ramanathaswamy Temple is situated close to the sea (200 meter) on the Eastern side of the island. Twenty two divine wells are located within the Ramanathaswamy temple, Rameshwaram Island. The present investigation was carried out in the month of January 2014 as a pilot study. The water samples were analyzed for physico-chemical quality and bacteriological water quality of divine water and the results are compared with WHO standard. The present study revealed that there was increase in TDS, Electrical conductivity, Total hardness, Calcium, Magnesium, Sodium and Chloride in divine water and their level exceeded the WHO standard. This may be attributed to over extraction of ground water for the pilgrims who visit usually 5000 to 10,000 persons per day at weekends as well as lakhs of people visit during the festival day. Further, people who are living in the nearby area of temple are extracting water for their life and innumerable of lodges which are used for accommodation of devotees. The bacteriological results of holy water revealed that there was no bacterial contamination of water. Therefore, the divine well water is considered to be as holy water. A future work is planned for the holy water management and prevention of contamination.

**Key words :** Temple water quality - Water conservation - Holy water - Microbial quality - Temple tank water management - Sea water intrusion.

### INTRODUCTION

Almost 70% of the water in India has become polluted due to the discharge of domestic sewage and industrial effluents into natural water source, such as rivers, streams as well as lakes

(Sangu and Sharma, 1987). About 95% of rural population living in India depends on ground water for domestic use. In our country 70% of the water is seriously polluted and 75% of illness and 80% of the child mortality is attributed to water pollution. The healthy nature of



In India, traditionally settlements are located in and around either shore areas or rivers or temples. The temple complex includes a tank which is as an important site for cultural actions, the temples and tanks are inseparable. Temple tanks occupy a prime in the day living of the people. It may be stated that a very few have attempted to characterise the water quality of divine wells of Ramanathaswamy temple

(Shivashankar and Ramachandramoorthy, 2009 and Singanan and Rao, 1996) however, the detailed study was not investigated so far. Based on the importance of Temple tank and wells, it was proposed to study the water quality of divine wells (22 numbers), which are located within the campus of Ramanathaswamy Temple, Rameshwaram Island, Ramanathapuram District, Tamil Nadu, India (Fig. 1).

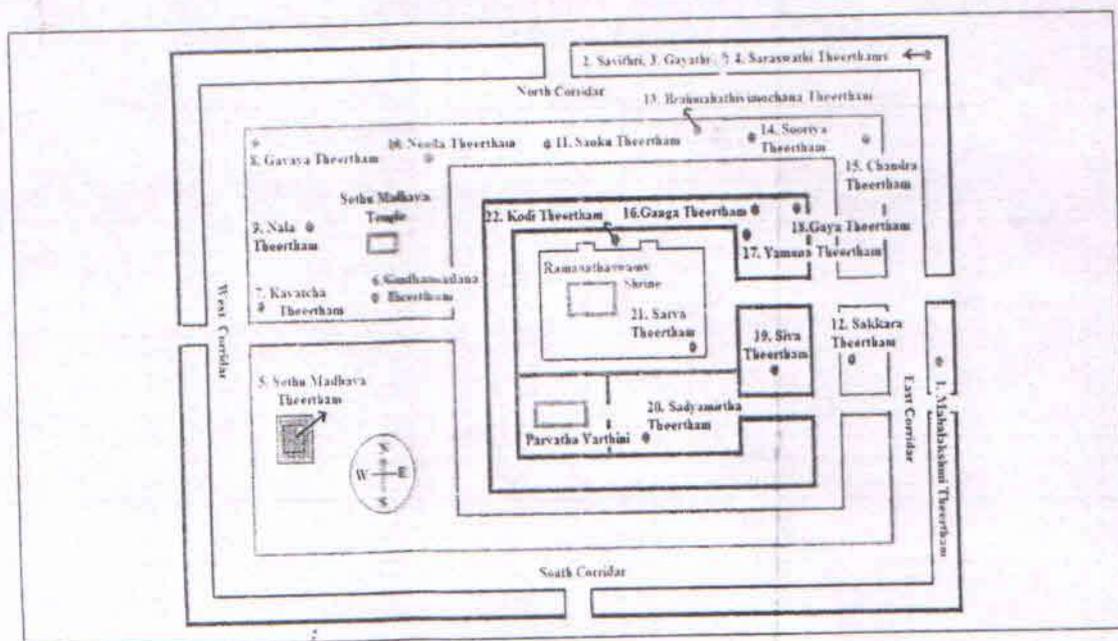


Fig. 2 : Location of sampling stations in Ramanathaswamy Temple in Rameshwaram Island

### MATERIALS

Ramanathaswamy Temple has twenty two divine wells located within the temple premises. The temple has stretched over a vast area of 15 acres. The each well has distinct properties. All of these wells water have different taste, salinity and curative properties. The location of wells are shown in Fig. 2. Rameswaram is located at the south eastern end of the Indian Peninsula at Latitude 9.2800°N and Longitude of 79.300°E in Ramanathapuram District (Fig. 1). There is a Lord Siva temple called Ramanathaswamy

Temple which is one of the major Lord Siva temples in India. This temple is in the center of town, located adjacent to the sea, Bay of Bengal. There are 22 theerthams (divine wells) present inside the temple in which pilgrims traditionally bathe in before seeing the deities (Fig. 2). The holy water in the well is found to wash away one's sins and bring salvation.

### METHODS

#### WATER QUALITY ASSESSMENT

Water samples were collected from 22 divine

wells (Theerthams) which are located within the Ramanathaswamy Temple. They are 1) Mahalakshmi theertham, 2) Savithri theertham, 3) Gayathri theertham, 4) Saraswathi theertham, 5) SethuMadhava theertham, 6) Gandhamadana theertham, 7) Kavatcha theertham, 8) Gavaya theertham, 9) Nala theertham, 10) Neela theertham, 11) Sanku theertham, 12) Sakkara theertham, 13) Brahmahathivimochana theertham, 14) Sooriya theertham, 15) Chandra theertham, 16) Ganga theertham, 17) Yamuna theertham, 18) Gaya theertham, 19) Siva theertham, 20) Sadyamirtha theertham, 21) Sarva theertham and 22) Kodi theertham. Holy water was analyzed for Physico-Chemical water quality parameters which includes: Appearance, Colour, Odour, Turbidity, Total

Dissolved Solids (TDS), Electrical Conductivity (EC), pH, Total Alkalinity (TA), Total Hardness (TH), Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Iron (Fe), Manganese (Mg), Free Ammonia (FA), Nitrate (NO<sub>3</sub>), Chloride (Cl), Fluoride (F), Sulphate (SO<sub>4</sub>) and Phosphate (PO<sub>4</sub>) and microbiological water quality parameters includes standard plate count (SPC), Total coliform (TC), Fecal coliform (FC) and Fecal streptococci (FS) as outlined in APHA (1998). The period of pilot study was in the month of January 2014.

### RESULTS AND DISCUSSION

Ramanathaswamy Temple is an important pilgrimage site for the followers of Hinduism. All

Table 1: Physico-chemical water quality of holy water of 22 divine wells of Ramanathaswamy Temple, Rameshwaram island, (January 2014).

Stations	Physical examination			Chemical examination (mg/L)											
	Tur.	TDS	EC	pH	TA	TH	Ca	Mg	Na	K	Fe	No3	Cl	F	SO'
1	1	2870	4100	7.7	440	720	160	77	520	40	0	3	1030	0.8	55
2	2	3780	5400	7.5	330	490	100	58	900	45	0.2	4	1430	0.8	230
3	2	3920	5600	7.4	365	500	100	60	920	50	0.2	4	1500	0.8	215
4	2	4060	5800	7.9	350	520	108	60	940	60	0.2	4	1520	0.8	228
5	1	3780	5400	7.8	330	490	100	58	400	40	0	4	1420	0.6	228
6	1	560	800	8.1	165	180	40	19	110	12	0	2	125	0.4	20
7	1	3640	5200	7.7	325	430	96	48	880	36	0	4	1390	0.6	210
8	1	2450	3500	7.6	325	560	144	72	480	30	0	3	1050	0.6	65
9	2	2870	4100	7.6	435	760	160	86	520	36	0.2	4	1020	0.8	115
10	1	2030	2900	7.6	340	390	80	46	420	24	0	2	630	0.6	90
11	2	3570	5100	7.4	325	500	216	101	640	40	0.2	5	1410	0.8	180
12	2	3710	5300	7.5	330	10000	224	106	680	45	0.2	5	1450	0.8	235
13	1	2520	3600	7.6	325	6280	160	67	440	35	0	5	930	0.6	90
14	2	3920	5600	7.6	365	700	80	120	820	60	0.2	5	1510	0.8	230
15	4	5810	8300	7.7	325	20440	280	418	680	84	0.4	6	2520	1.2	160
16	4	5600	8000	7.7	325	20420	280	413	660	80	0.4	7	2350	1.2	160
17	4	6650	9500	7.7	420	20020	256	523	880	86	0.4	9	2810	1.4	115
18	2	5740	8200	7.6	320	20060	264	432	640	84	0.2	10	2500	1.2	135
19	4	7000	10000	7.6	420	20060	352	475	1100	120	0.4	10	3850	1.2	115
20	2	6650	9500	7.7	420	20040	320	490	940	120	0.2	11	2580	1.2	240
21	2	3780	5400	7.5	325	10020	160	149	720	60	0	6	1490	0.8	120
22	2	7140	10200	7.6	420	20000	320	460	1100	130	0	11	2800	1.2	575
WHO standard	5	500	1300	6.5-8.5	300	2000	75	30	-	-	0.3	45	250	1	200

the divine wells are located with the premises of temple. Each well is distinct and located geographically different sites and the quality of water is found to be different. The overall depth of each well never exceeds 10 to 15 feet only. However, the holy water from each well is taken by bucket and sprayed over the people. The quantity of visitors varies from 5 to 10000 during week end and one lakh to several lakhs during festival days. There are several such festivals occurs during the calendar year. During the summer holidays, each day will exceed 20,000 people. This human pressure may be one of the factors which change the variation in chemical quality of holy water. The physico-chemical water quality of the 22 theerthams or divine wells of Ramanathaswamy Temple, Rameswaram have been presented in Table 1.

#### Physico-chemical water quality of divine water

The appearance of water was clear and colourless in all the stations. Further, the odours of water in all the stations were within the agreeable limit only. According to WHO (2012) the maximum permissible limit for drinking water is 10 NTU. The maximum turbidity value 4 NTU was observed in station 15, 16, 17 and 19. The lowest value, 1 NTU was noted in station No 1, 5, 6, 7, 8, 10, and 13. The present study reveals that the turbidity of the 22 samples does not exceed the maximum limits of WHO (2012). There was not much variation in temperature of water also.

According to WHO (2012) maximum permissible limit of TDS for drinking water is 2000mg/L. The TDS level varied from 560mg/L to 7140mg/L in 22 station of Ramanathaswamy Temple theertham. The lowest TDS was found in station 6. However, remaining all the stations, the TDS level exceeded the maximum limit of WHO standard. The electrical conductivity level in divine water varied from 800 to 10200  $\mu$ mho/cm. among the 22 stations. This result is similar to TDS of water obtained in both the stations, indicating that higher electrical conductivity in water showed higher TDS of water.

The present study reveals that the pH of the twenty two stations lies in the range between pH 7.4 to pH 8.1, showing alkaline in nature. Therefore the samples are suitable for drinking as well as for ritualistic purpose. The Kodi theertham water (Station 22) kept in house for many months which never deteriorated in quality. Total alkalinity level ranged from 325 to 440 mg/l among the 22 divine wells of Ramanathaswamy temple and exceeding the standard limit of 200 mg/l WHO (1984). The maximum value was 440 mg/L was recorded at station 1 which is located adjacent to sea (about 200 meter distance).

The total hardness level varied from 180 mg/L to 2860 mg/L among the 22 divine wells of Ramanathaswamy temple. According to WHO, the maximum permissible limits for total hardness in drinking water is 300mg/L. The present study revealed that in all the stations, the hardness of water exceeding WHO standard except station No. 6. The maximum value observed was 2860 mg/L, at station 19 which is located adjacent to the sea. Higher amount of total hardness was noted between the stations 15 to 22 and the remaining stations showed lower range of total hardness. The higher level of total hardness found in certain stations also showed higher range of TDS and electrical conductivity.

The calcium level varied between 40 to 352 mg/L among the divine wells of the Ramanathaswamy temple. According to WHO (1999) maximum permissible limits for calcium in drinking water was 75mg/L. The present study revealed that in all the stations of theertham water, the calcium level was exceeding the WHO standard except station 6. The maximum calcium value was 352 mg/L at station no 19, and the minimum calcium value was 40 mg/L at station 6.

The magnesium level varied between 19 mg/L to 523 mg/L among the divine wells of Ramanathaswamy temple. The acceptable limit of magnesium is 30 mg/L and the permissible limit of magnesium is 100 mg/L. The maximum amount of magnesium (523mg/L) was noted at

station 17 and minimum value was noted 19mg/L, at station 6. It may be stated that higher range of magnesium was noted between station 15 to 22 and lower amount magnesium was noted in remaining stations. The similar pattern of variation was noted in calcium, hardness conductivity and TDS of Theertham water. It may be inferred that the stations 15 to 22 are located Eastern side of the temple which is closer to the sea. The over extraction of water may leads to changes in chemical quality of water due to sea water intrusion.

The sodium level in holy water ranged from 110 to 1100 mg/l in all the 22 stations. The present study revealed that in all the stations the sodium level exceeds WHO standard except at station 6. The higher amount of sodium was found at station 19 (1100mg/L) and lower amount of (110mg/L) sodium was found at station 6. The increase in sodium in divine water indicate that sea water intrusion takes place in the coastal groundwater aquifer.

Seawater contains about 400 ppm potassium. It tends to settle, and consequently ends up in sediment only. Rivers generally contains about 2-3 ppm potassium. This difference is mainly caused by a large potassium concentration in oceanic basalts. Calcium rich granite contains up to 2.5% potassium. This element is mainly present as  $k^+$  (aq) ions in water. The maximum value (130 mg/L) potassium was noted at station 22, and minimum value of potassium (12mg/L) was noted at station 6 and in remaining stations, higher level of potassium was noted.

The acceptable limit of iron in water is 0.3 mg/L, and the maximum value of iron 0.41 mg/L was noted in station no 15, 16, 17 and 19. A low amount of iron was noted at station 1, 5, 6, 7, 8, 10, 13, 21 and 22. It is of interest to state that Manganese, Free ammonia and Nitrite chemicals were not found in all the stations of Theertham water. Therefore microorganisms cannot grow in this divine water, ultimately this water is used as holy water to get rid of sin of person.

The nitrate level was ranged from 2 to 11 mg/l in all the stations and it is found to be within the limit of WHO standard. The acceptable limit of nitrate is 45 mg/L. However, the nitrate values in all the stations were found to be within the limits of WHO. Hence the divine water is not having any microorganism and considered to be as holy water.

The chloride level varied from 125 mg/L to 3850 mg/L and it exceeded the WHO standard in all stations except station 6. The higher level of chloride was noted from station 15 to 22 and remaining station showed lower range of chloride. It may be stated that over extraction of water for holy bathing must be responsible for such increase in TDS, hardness, conductivity, calcium and chloride in all the waters of divine well. However, according to Singanan and Rao, (1996) the holy water was contaminated with inorganic pollutant. The fluoride level varied from 0.6 to 1.4 mg/l among all the 22 stations. The acceptable limit of fluoride in water is 1.0 mg/L and permissible limit is 1.5 mg/L. The fluoride level in the water of all the station never exceeded the permissible limit of WHO.

The range of sulphate varied from 20 to 575 mg/l. The acceptable limit is 200 mg/L and permissible limit is 400 mg/L. Higher amount of sulphate was noted at station 1 to 5 and lower amount of sulphate was noted between 16 to 21. The maximum value is sulphate 575 mg/L in station no 22, and minimum value of sulphate was 20mg/L in station no 6. The phosphate, Ammonia and Nitrite were absent in all the stations of Ramanathaswamy Temple. This is also another important factor for the absence of microorganism in holy water. The earlier studies on the status of holy water of Ramanathaswamy Temple, (Sivashankar and Ramachandramoorthy, 2009) concluded that there was relationship between Calcium, Chloride and TDS. Further, the water was very hard nature. In the present study also obtained similar type of relationship among Calcium, Chloride and TDS.

Four water samples were selected randomly from the stations (No. 1, 5, 10 and 15) and analyzed for bacterial contamination of water.

The Standard plate count, Total coli form, Fecal coli form and Fecal streptococci were totally absent in all the stations. The result revealed that there was no bacterial contamination of water. Hence, the water is found to be holy water.

### CONCLUSION

The holy water available in 22 divine wells are located within the premises of Ramanathaswamy Temple were free from bacterial contamination, hence it is scientifically holy water. The increase in TDS, Electrical conductivity, Calcium, Magnesium, Sodium, Chloride in holy is due to over extraction of water for the catering the need of lakhs of pilgrim who takes holy bath and carry kodi theertham water to their house to perform pooja in their houses which may be the causative factor for increasing the concentration of various ions in water. In this context, it may be stated that everyone who visits the temple purchase the Kodi theertham water (1 litre water) from the Temple premises. Therefore, an integrated Temple water management and careful use of water for holy spray on their head is suggested without affecting the values of Hindu people.

### ACKNOWLEDGEMENT

The authors are thankful to The Principal, and HoD of Zoology, Pachaiyappa's College, Chennai for their cooperation and the TWAD Board, Ramanathapuram for performing water analysis.

### REFERENCES

1. Jacklin Jemi, R and G.S. Regini Balasingh, 2011. Studies on physicochemical characteristics of freshwater Temple ponds in Kanyakumari District and South Tamil Nadu. *Int. Natl. J. Geo Earth and Env. Sciences*.
2. Patil V.T and Patil, P.R., 2010. Physicochemical analysis of selected ground water samples of amalnal town in Jalgpn District, Maharashtra, India. Received 19 June: *E-journal of chemistry* 2010, 7(1), 111-116.
3. Sangu, R.P.S and Sharma, S.K., 1987. An assessment of water quality of river Ganga at Garmukeshwar. *Ind. J. Eco.* 14 (20):278-287.
4. Sankara Gomathy, S., Pavaraj, M., Karuppasamy, K. 2013. Physio-chemical characteristics of the water selected theerthams of Ramanathaswamy Temple in Rameswaram, Tamil Nadu., *Int. Sci. Environ. Tech.* 2(2):168-175.
5. Singanan, M.R. and Rao K.S. 1996. Chemical quality of Rameshwaram Temple complex wells water. *Eco. Environ. Conser.* 2(1,2): 79-81.
7. Sivasankar, V. and Ramachandramoorthy, T. 2009. An investigation on the pollution status of holy aquifers of Rameswaram, Tamil Nadu, India. *Environ. Monitor. Assess.* 156 (1-4): 307-315.
8. Sulabha, V and V.R. Prakasm, 2006. Limnological features of Thirumullavaram Temple pond of Kollam Municipality, Kerala. *J. Environ. Biol.* 27(2): 449-451.
9. World Health Organization, 2004 Drinking water guidelines and Geneva Switzerland.
10. Umamaheshwari, S. 2010 Water quality index of temple pond at Talakadu, Karnataka, India. *Biodiv. Climate Change.* 1-5.