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Original Article

Water Quality Index of Religious tanks in the temples of Kumbakonam, Thanjavur District

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Abstract *- The present investigation was carried out to assess the water quality in a selected temple and its tanks in Kumbakonam city, Thanjavur district, based on the highest number of tourist visits, which falls under the Tamilnadu Hindu Religious and Charitable Endowments [HR&CE] Department, Ministry of Government of Tamilnadu. According to a number of physicochemical studies, the principal sources of elevated levels of TDS, turbidity, electrical conductivity, and free ammonia include surface runoff, devotees' washing and bathing activities, and the outflow of sewage and rubbish from temples. The findings revealed that anthropogenic activities had a detrimental impact on the tanks at Porthamarai Temple and Aadhi Kumbeshwar Temple and that there was a trend towards growing eutrophication, with the Abhi Mukeshwara Mahamagam Temple tank trailing behind. The present study proposed that awareness campaigns be established in the adjacent metropolis to educate people about the negative effects of water contamination in temple ponds. It is advised that all tanks be replenished with freshwater on a regular basis using appropriate inlet and output channels.*

Keywords *- Temple tank water, Water Quality Index, Electrical conductivity, Total Dissolved Solids, Free Ammonia, Environmental pollution.*

1. Introduction

Water is fundamental for life, and freshwater ecosystems are often regarded as one of the most important natural resources for every living thing [1]. Humans use less than one percent of total water for the home, industrial, and agricultural purposes, which includes tanks, lakes, rivers, and dams. Tanks are an essential source of water in India's cities and villages. Tamil Nadu has approximately more than ten thousand temple tanks. [2]. The tank is an inexpensive and environmentally beneficial method of collecting rainwater to monitor groundwater levels. Hindu temples are places of worship. Temple visitors bathe in holy water tanks, and some even take a religious dip in the water. People think it can atone for all of their transgressions. Nonetheless, people bathe and wash their clothing in temple ponds that are situated outside of temples. [3].

Because they believe in the spiritual purifying properties of temple tanks, devotees bathe in them before entering. Temple tanks are used for important celebrations like Theppotsavam (float festival) and ritual activities. These tanks frequently serve as the focal points of social gatherings and cultural events. Temple tanks in pilgrimage towns serve as water sources for significant crowds of tourists, were a component of rainfall collection systems, and assisted in replenishing groundwater. [4].

Anthropogenic Activities Leading to Water Contamination due to the growth of urbanization have led to untreated domestic sewage being diverted into temple tanks. Immersion of idols made from non-biodegradable materials and ritual offerings like flowers, food, and cloth pollute the water. Encroachment reduces tank area and increases the load of solid waste and greywater discharge; in some urban areas, runoff containing chemicals enters tanks, degrading water quality.

It is well known that tanks and tanks serve as environmental markers of a city's strength. Both challenging human activities and natural processes control. The quality of surface water. Because surface and groundwater are in direct contact. [5].

Surface water Biochemical Oxygen Demand impacts nearby aquifers' groundwater board and subsurface water values. The surface water value is established using both systematic methods and human-caused special effects. [6]. The relationship between the surface water's chemical, physical, and biological characteristics is also demonstrated by the water's quality. The investigation of physical, chemical, and biological elements that replicate the biotic and abiotic environmental grade is included in the water quality design. [7].

Hindu temples are places of worship. Many temple tanks hold holy water that devotees use to wash their limbs. They occasionally dip holy in the water, believing it to be able to wash away all of their sins. On the other hand, people bathe and wash their clothing in the temple tanks that are situated outside the temples [8-10].

The physical-chemical properties of freshwater resources are being impacted by the addition of anthropogenic activities such as effluent and municipal wastewater, rendering them unfit for home use, animal feed, and other uses. Significant physical and chemical characteristics of water are impacted by salinity, pH, temperature, dissolved oxygen content, and redox potential. Among the others are ammonia, nutrients, heavy metal pollutants, and total suspended and dissolved solids. [11].

Water contamination in the temple tanks leads to environmental degradation, such as high levels of biological and chemical contaminants; algal blooms lead to the eutrophication from organic waste, causing oxygen depletion and loss of Aquatic Biodiversity: Toxic conditions kill fish and aquatic plants. Polluted tanks contaminate the local soil and water table, and the aesthetic and cultural loss damages the sacredness and beauty of the tank's decline. [12].

The contamination of temple tanks even leads to human health impacts such as waterborne diseases like cholera, typhoid, dysentery, and diarrhoea due to contaminated water; infecting skin while bathing in polluted tanks causes rashes and fungal infections. Producing vector breeding due to stagnant water promotes mosquito breeding, leading to malaria, dengue, exposure to toxic materials like heavy metals from idols and chemical runoff, causing long-term health issues and creating mental health issues like loss of clean public spaces affecting community well-being and spiritual practices.

The government and other non-government organizational need to take steps to reduce water contamination in temple tanks due to the high footfall of pilgrims in the temple towns. [13].

1.1. Chemical and Physical Characteristics Influencing Water - Water Quality Index

In a religious place like Tamilnadu, accompanied by temple tanks where we come across a lot of footfall, it becomes necessary to address the waste in these temple tanks as it affects human health and the local environment. Certain parameters like total dissolved solids, electrical conductivity, presence of phosphate, ammonia, nitrates and other organic compounds result in an increase in the temperature of water, which in turn raises the surrounding air temperature, affecting the place's microclimate.

An increase in temperature between the urban and non-urban areas is a symptom of the Urban Heat Island phenomenon. One of the popular methods for identifying and analyzing water contamination is the water quality index. It is defined as "a rating reflecting the composite influence of different quality parameters" on the overall quality of water."

The weighted arithmetic index method was used to calculate the water quality index. Bureau of Indian Standards of IS 10500: 2012 recommends parameters namely pH, TDS, turbidity, hardness, total alkalinity, Free Ammonia as NH3, Electrical Conductivity Ph.

Alkalinity as CaCO3, Ca, Mg, Na, K, Fe, Mn all are measured in Milligrams /litre for quality check of water as indicated in Table 4. It also suggests different classifications of water for drinking, bathing, washing and other purposes, as shown in Tables 1 and 2.

Table 1. Primary water quality criteria for outdoor bathing water

Standards	Validation
1. Fecal Coliform [Most Probable Number /100 milli litre] – 500 to 2500 [Maximum Limit] 2. Fecal Streptococci [Most Probable Number /100millilitre], Coliform - 500 to 2500 [Maximum Limit]	To ensure low sewage contamination. Faecal coliform and faecal streptococci are considered as they reflect bacterial pathogenicity. The desirable and permissible limits are suggested to allow for fluctuation in seasonal change, changes in inflow conditions, etc.
3. pH. between 6.5 -8.5	The range protects the skin and vital organs, such as the eyes, nose, and ears, which are directly exposed while swimming outside.
4. Oxygen Biochemical 3 Milligram/litre or less demand 3 day, 27 deg.C	The biochemical oxygen demand of 3Milligram/litre or less water ensures reasonable freedom from oxygen-demanding pollutants and prevents obnoxious gas production.

Table 2. Parameters for analysis of surface water samples

Parameter Group	Initially	Baseline	Trend
All-purpose	EC, pH, TDS, Do, Temperature.	TDS, pH, Temperature, EC & Do	Do, EC, pH, Temp.
Nutrients	Total P, No2+No3 , NH3+N,	No2+No3 , NH3+N, Total P	NH3+N,TotalP, No2+No3
Organic matters	Biochemical Oxygen Demand, Chemical Oxygen Demand	Nil	Chemical Oxygen Demand, Biochemical Oxygen Demand,
ions	Na, So4,Mg, HCO3, K,Ca,Co3,Cl,	Cl,So4,Ca,K,Na, Co3Ca,Mg,HCO3	Calcium
Inorganics etc	Nil	Nil	Nil
Metals	Nil	Nil	Nil
Organics	Nil	Nil	Nil
Microbiological	Total coliforms	Nil	Total and faecal coliforms
Biological	Nil	Nil	Nil

1.2. Effects & Causes of Polluted Water in the Temple Tank

Water contamination in the temple tanks leads to environmental degradation, such as high levels of physico-chemical qualities of water, which leads to environmental degradation. Temple tank contamination can even negatively affect human health, including cholera, typhoid, dysentery, and diarrhoea. When bathed in, the contaminated water can cause skin illnesses, rashes, and fungal infections. In addition to causing long-term health problems, exposure to toxic materials like heavy metals from idols and chemical runoff causes mental health problems like the loss of clean public spaces, which impacts community well-being and spiritual practices. Static water also encourages mosquito breeding, leading to malaria and dengue. [14].

High concentrations of biological and chemical pollutants, algal blooms that generate eutrophication from organic waste, oxygen depletion, and a loss of aquatic biodiversity are all consequences of water contamination in temple tanks. Fish and aquatic vegetation are killed by toxic circumstances, local soil and water tables are contaminated by polluted tanks, and the tanks' spiritual significance and beauty are diminished due to aesthetic and cultural loss. [15].

The effect of water contamination also leads to an increase of microclimate in and around the temple tanks due to contaminants from the commercial activities and by the surface runoff water carrying solid and other wastages into the temple tank that leads to emissions of polluted water heat algae absorb sunlight and warm the water and surrounding air, while stagnant, unclean water absorbs and holds on to more heat. Heat and chemicals are carried by surface runoff. Warm contaminants are carried by runoff from concrete and roadways, warming the water body-pollution and encroachment limit flora, which lowers natural cooling. Contaminated water evaporates more quickly, increasing air humidity. [16].

Microclimate effects raise local temperatures (Urban Heat Island Effect), particularly in cities with less green space and more contaminated tanks. Additionally, evaporation from contaminated water adds moisture to the air, causing unpleasant odours and poor air quality. Gases from decaying garbage have an impact on daily activities, temple visits, and cultural events, as well as the air quality surrounding the tank. [17].

The study aims to identify the temple water tanks as more highly contaminated in their physical-chemical properties than the prescribed level given by the Tamilnadu Water Supply and Drainage Board, Chennai.

The goal of this study was to ascertain the true state of the water quality in several temple ponds located in Kumbakonam, Thanjavur district. About 188 Hindu temples may be found inside Kumbakonam municipal boundaries. Together with them, the town is known as the "City of Temples" due to the thousands of temples surrounding it. People go from around the nation to attend its Mahamaham festival, which is its most famous event. It is the Cauvery Delta region's second-biggest city. Central Tamil Nadu's economic centre is located there. [18].

2. Limitations

The present study was limited to the selected temple and its tanks in the Kumbakonam city, Thanjavur district, based on the greater number of tourists fall which come under the Tamilnadu Hindu Religious and Charitable Endowments [HR&CE] Department, Ministry Government of Tamilnadu.

3. Materials and Methods

3.1. Area of Study - Kumbakonam

As depicted in Figures 1 and 2, Kumbakonam is one of the temple cities in Tamil Nadu, occupying a land area of 12.58 square kilometers and representing our cultural legacy against all invaders since the beginning. It is one of the Chola kingdom's political Centre's, still struggling to preserve its rich cultural past, located along the Cauvery River and in the delta formed by the Cauvery and its tributary, Arasalar. [18]. It is a large temple town with 14 major temples and five temple tanks under the Tamilnadu HR&CE Department.

Fig. 1 Tamilnadu state map

Fig. 2 Kumbakonam city map

Fig. 3 Selected temple tanks in kumbakonam city

These five temple tanks have been identified for the study based on the highest tourist footfall owing to a lot of religious activities. The water samples were gathered in two-litre plastic canes devoid of air bubbles for the purpose of physico-chemical analyses. During the sample, the grab sampling method was used. In water quality testing, a "grab sample" is a single sample collected utilizing the container at a certain time and location.

In order to manually collect a grab sample, a bucket or bottle is usually dipped into the body of water. It is used to assess the water's purity. Temperature, pH, turbidity, dissolved oxygen, and chemical concentrations are some of the variables that are assessed during grab sampling. Using accepted techniques, 21 physio-chemical parameters were examined in the water samples by Tamilnadu Water Supply and Drainage Board, Tamilnadu, Chennai, in January 2024.

3.2. Activities around the Five Temple Tanks in Kumbakonam

The temples listed are located in the city of Kumbakonam. Local residents and devotees commonly use these five temple tanks for activities like bathing, washing, drinking, and carrying out rituals all year, various festivals and celebrations in Hindu temples which will happen daily, weekly, fortnightly and monthly.

The physico-chemical quality of water in water reservoirs is being impacted by industrial sewage and municipal wastes, rendering it unsuitable for use by livestock and other organisms. The water in the tank has a slightly yellow tint. The colour could be a result of dissolved solids found in the water that was polluted by detergents, soaps, ritual waste, and Styrofoam pieces. The temple tanks of Kumbakonam city have been continuously affected and contaminated due to anthropogenic activities, and some of

the festivals and rituals happening in the temple cause water contamination, like the Immersion of Idols, which is made of Plaster of Paris, painted with chemicals are immersed in tanks, and the paints contain harmful substances like lead, mercury, and synthetic dyes. An offering of ritual materials where devotees throw flowers, coconuts, food, incense, ritual ashes, turmeric water, and other items are dumped into the tank after use; these materials decay and pollute the water. Due to high footfall during festivals, thousands of people bathe or wash in the tank water so that dirt, soap, oil, and sweat enter the water, increasing the organic load.

3.2.1. Banapurishwar Tank [Sample. No: 5879]

It is located. Behind the Chakrapani temple in Kumbakonam is an ancient Shaivaite temple dating back to the Shiva avatar. It has a larger tank than the others. During rainy seasons, the rainwater from the roads flows directly into the temple tank due to the lack of stormwater gutters. Additionally, devotees wash their clothes and themselves with detergents and soap, and they conduct other rituals in and around the temple tank, which leads to water pollution.

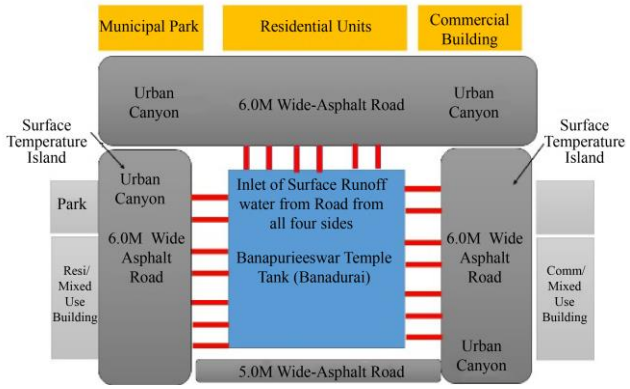

Fig. 4 Plan showing the commercial activities around the banupurishwartemple tank

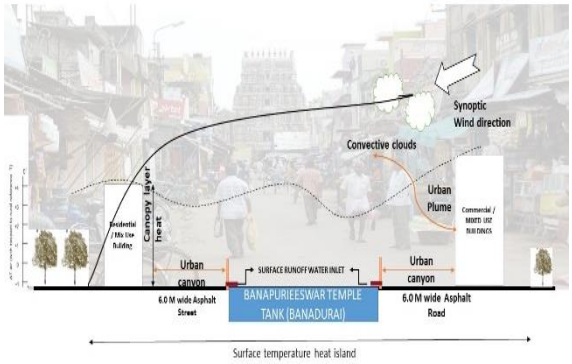

Fig. 5 Waste accumulation around the Banupurishwar temple tank

3.2.2. Chakrapani Temple Tank [Sample. No: 5880]

The Hindu temple at Kumbakonam is devoted to Vishnu. The temple is located two kilometres from the Kumbakonam Railway Station. The temple is a prominent tourist spot in Kumbakonam.

Water contamination is mostly due to waste dumping by the flower sellers adjoining the temple tank.

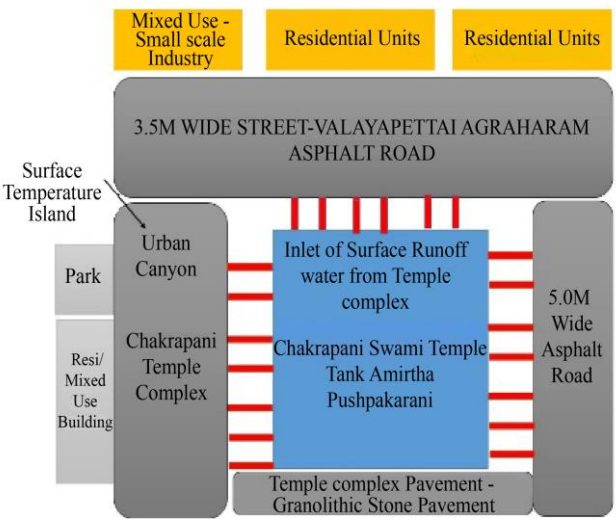

Fig. 6 Plan showing the commercial activities around the chakrapani temple tank

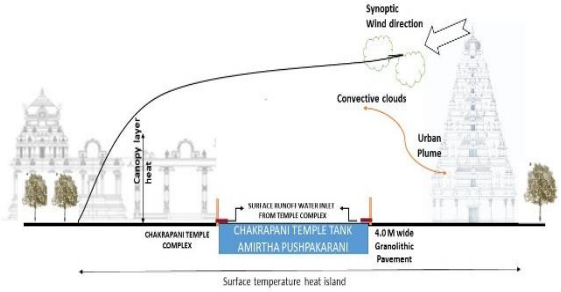

Fig. 7 Waste accumulation around the chakrapani temple tank

3.2.3. Aadhi Kumbeshwar Temple Tank [Sample. No: 5881]

The temple is also known as Mottai Gopuram Temple [Incomplete entrance tower], and the temple tank can be found within the temple grounds. Water contamination is mostly due to anthropogenic activities and liquid and oil waste from the temple deities.

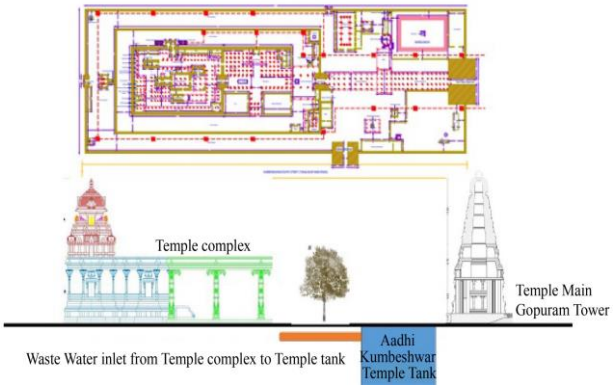

Fig. 8 Waste accumulation around the aadhi kumbeshwar temple tank

3.2.4. Porthamarai Tank [Sample. No: 5882]

It is located on the Thanjavur route, approximately 2 kilometres from the new bus terminal, between Sarangapani and the Kumbeshwara temple in Kumbakonam. The shopkeepers adjoining the western wall of the Porthamarai tank throw their every day remains into the tank, thereby polluting the water.

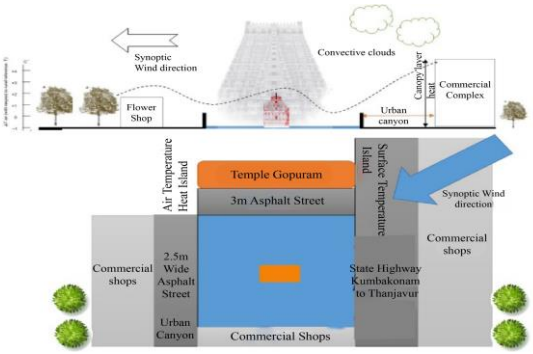

Fig. 9 Waste accumulation around the porthamarai temple tank

3.2.5. Abhi Mukeshwara (Mahamaham) Temple Tank. Sample. No: 5883]

It is one of the town's most prominent landmarks. It's one of the largest tanks in the city. Every twelve years, people use it for a ritual cleaning dip; its otherwise called as Kumbhamela of south India.

The general practice of Lord Shiva's devotees of having a holy dip in the temple tank after the application of oil on their bodies is also found in Abhi Mukeshwara temple, which leads to polluting the tank water.

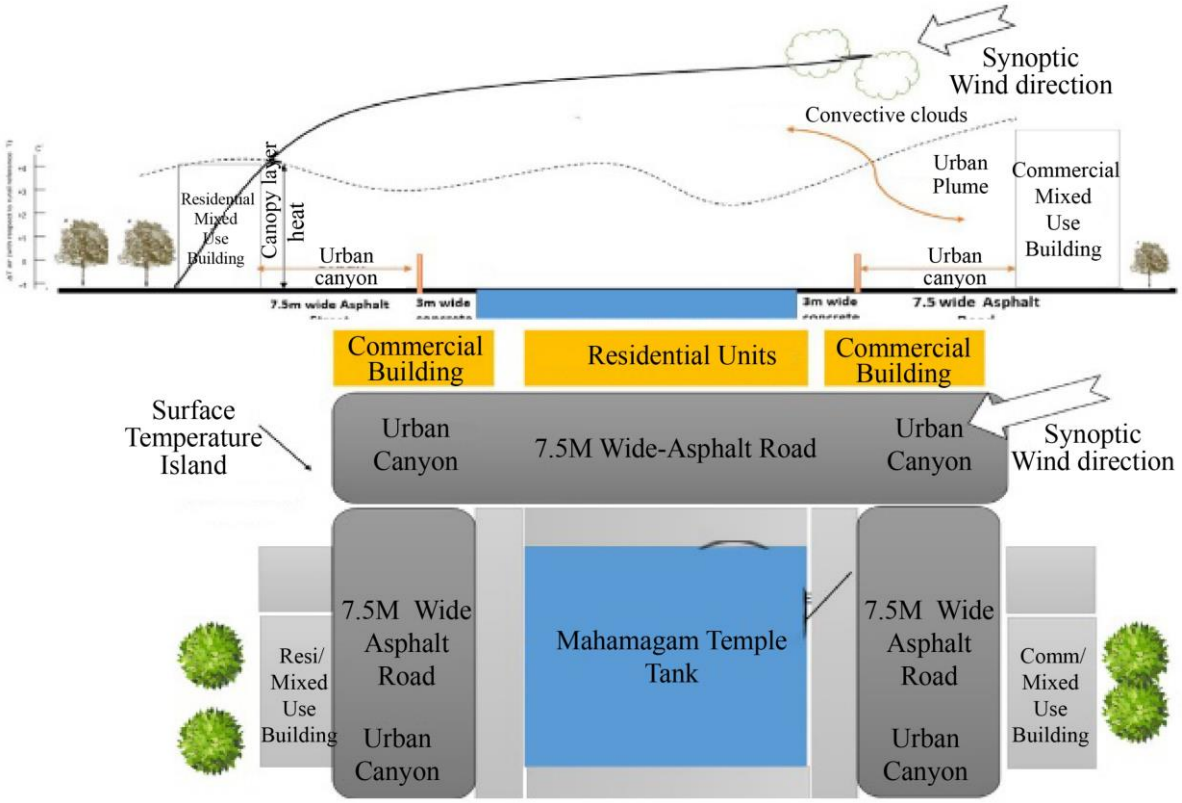

Fig. 10 Waste accumulation around the abhi mukeshwara temple tank

Table 3. Population of the five selected temples in kumbakonam city

S.no	Name of the temple	Population during Weekdays [Monday-Friday]	Population during Weekends : [Saturday and Sunday]	During Festivals
1.	Banapurishwar Temple	1000 peoples	2000 - 3000 people	More than 5000 peoples
2.	Chakrapani Temple	2000 peoples	2000 - 3000 people	More than 4000 peoples
3.	Aadhi Kumbeshwar Temple	3000 peoples	4000 peoples	More than 20000-50000 peoples
4.	Porthamarai temple tank	4000 peoples	5000 peoples	More than 50,000 during Theerthavari festivals etc.
5.	Mahamaham temple tank	3000 peoples	5000 peoples	More than 1lakh people during Masimagam and more than 12lakhs during Mahamagam

The population of the above five temples during weekdays and weekends has been given below in Table 3.

3.3. Calculation of Water Quality Index

The water quality index was calculated using the following 21 parameters: pH, TDS, turbidity, hardness, total alkalinity, Free Ammonia [NH3] Milligram/Litre, Electrical Conductivity Alkalinity is expressed as CaCO3, Ca, Mg, Na, K, Fe, and Mn all are measured in Milligram per litre. The total water quality of all parameters are measured by the relative weight method and calculated using the drinking water standards and its Permissible Limit set by the BIS - IS 10500: 2012, Tamilnadu Water Supply and Drainage Board, Tamilnadu, Chennai.

The comparable weight of each criterion in the whole water quality was determined using the drinking water standards set by the BIS.

Wi = K/Sn Where Constant of proportionality is K

I th parameter of standard value is Vs.

WQI = $[Wi\Sigma Qi\ \Sigma\ ]$

Where, Σ[Qi Wi] = Wi [pH] X Qi [pH] +.....+ Qi

Wi [Fe]. X [Fe]
ΣWi – Total relative weight of all parameters.

The water quality index values were classified into five categories based on their suitability: C- 25, Good 26 to 50], Slightly contaminated 51 to 75, Highly Polluted 76 to 100, and Unhealthy for consumption [100 and High].
I [th] parameter of the standard value is Si.

Grading Measurement for Quality: Each chemical factor was determined by dividing the concentration of each measured value by the matching standard value and multiplying by 100.

$$K: \frac{1}{S_{n1} + S_{n2+\cdots\ldots\ldots\ldots\ldots+K}}$$

$$Q_i = \left[\frac{V_a - V_i}{V}\right] * 100$$

Were Qi the quality rating based on the concentration of a chemical parameter in a water sample and Wi stands for Water Index Average value of the ith parameter is the Va extracted from the water sample.

The suitable value for good drinking pure water is Vi ranges [0 in all parameters except pH [7.0] and DO. [19].

4. Results & Discussion

4.1. Water Quality Characteristics

Table 4 shows the physical and chemical properties of temple tanks in Kumbakonam City. Anthropogenic contaminants occasionally contaminated the temple tanks.

4.1.1. pH

Water samples from the Kumbakonam temple tanks ranged in pH from 6.7 to 7.6. The pH level of the Sarangapani temple tank was high. Chakrapani's temple tank has the lowest level.

The elevated summer temperatures may have led the water to become more alkaline, lowering the quantity of carbon dioxide that can dissolve and promoting photosynthesis. Surface runoff, human activity, and the release of urban waste all contribute to pH changes. [20].

4.1.2. Turbidity

In January, the Adhi Kumbeshwar Temple tanks recorded a high turbidity level of 66.3 nephelometric turbidity unit, while the Banapurieswar Temple tank had a low reading of 3.1 nephelometric turbidity unit that month. Authors A. Kumar and Y. Bahadur, in their paper, proposed that elevated turbidity in the summer could be due to a high amount of suspended particles and dangerous organisms. [21].

4.1.3. Total Dissolved Solids

The TDS levels in the five temple tanks range from 1095 Milligram/Litre to 2507 Milligram per litre. Three tanks had TDS within the allowed limit, while the other two exceeded it. The highest TDS value of 2507 Milligram/Litre was seen in January. The elevated TDS levels could be a result of domestic wastewater, man-made pollutants, and waste such as garbage and sewage. [22].

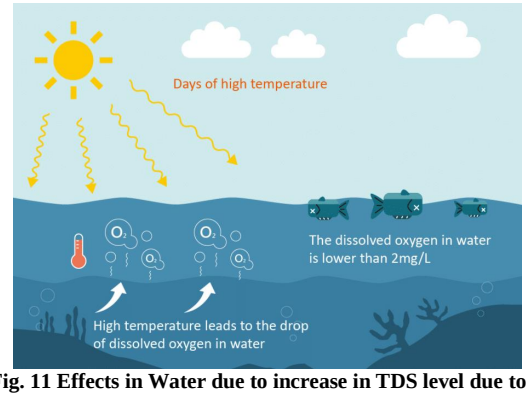

Fig. 11 Effects in Water due to increase in TDS level due to Anthropogenic activities in the temple tank at Kumbakonam

4.1.4. Total Alkalinity

The latest study found that the highest alkalinity level [324 Milligram/litre at Chakrapani temple tank] and lowest level [196 Milligram per litre] at Banapuriswar temple tank] were both observed in January. The elevated alkalinity levels in January may be due to an excess of free CO2 from decomposition and the mixing of sewage and household waste. Dilution could be a reason for the low alkalinity seen in the rainy season.

4.1.5. Total Hardness

The lowest [152 Milligram per litre] and highest [300 Milligram per litre] levels were discovered in January; rising hardness over the summer could be attributed to

decreasing water levels, higher evaporation, and the count of magnesium and calcium salts.

4.1.6. Electrical Conductivity

In January, the EC value ranged from 1560 mho/cm in the Banapuriswarar temple tank to 3582 mho/cm in the Chakrapani temple tank. Increased electrical conductivity in water is a clear indication of contamination, which is frequently produced by sewage leaks or agricultural runoff containing a high organic content and standing water [23]. Summertime EC levels may be lower due to high temperatures and increased microbial growth and activity.

4.1.7. Chloride

In January, chloride levels ranged from 335 milligrams/Litre to 840 milligrams per litre, indicating a likely increase in pollution caused by greater organic waste from plants and animals. [24].

4.1.8. Nitrate

In January, Nitrate levels were determined to be 13 milligrams/litre in the Banapurieswar temple tank and 32 milligrams/litre in the Chakrapani temple. The nitrate levels in the water tests are over the acceptable limit for drinking water.

4.1.9. Free Ammonia

The current study discovered that the concentrations of free ammonia in the five temple tanks ranged from 6.45 to 27.96 Milligram per litre, which exceeded the regulatory limit of 0.5 Milligram per litre. The presence of free ammonia can cause fish diseases, and the levels measured in each of the five temple tanks surpassed the permitted limit. Thus, the tank water samples are not fit for drinking.

4.1.10. Sulphate

The sulphate levels varied from 95.0 to 139 milligrams per litre. Sulphate levels in all tanks are below the established requirements. In January, a high sulphate concentration was observed in the Chakrapani temple tank.

4.1.11. Phosphate

An increase in phosphate levels indicates pollution, increasing eutrophication risk. In January, the lowest phosphate level at the Sarangapani temple tank was 0.08 milligrams per litre, while the highest was 1.91 milligrams/litre in the Aadhi Kumbeshwar temple tank.

4.1.12. Calcium

During the most recent investigation, the Sarangapani temple tank in January had a low calcium level of 16.0 Milligram/Litre and a maximum level of 64.0 milligram/litre. While calcium naturally occurs in water, the increase in quantity could be due to sewage waste. Drinking calcium-rich water can cause mineral accumulation in the Biochemical Oxygen Demand, resulting in digestive difficulties and the production of stones [25].

Table 4. Physical and chemical properties of Kumbakonam Selected Temple Tanks WHO- World Health Organization, EPA – Environmental Protection Agency

S.No	I.PHYSICAL EXAMINATION	IS 10500 : 2012 PERMISSIBLE LIMIT – TWAD BOARD, CHENNAI	BANUPURISWAR TEMPLE, KUMBAKONAM. Sample no: 5879	CHAKRAPANI TEMPLE, KUMBAKONAM Sample no : 5880	AADHI KUMBESHWAR TEMPLE, KUMBAKONAM. Sample no: 5881	SARANGAPANI TEMPLE, KUMBAKONAM. Sample no: 5882	ABHI MUKESHWARAR TEMPLE, KUMBAKONAM. Sample no: 5883
1	Turbidity NT Units	5	3.1	**6.8**	**66.3**	**6.9**	**5.9**
2	Total Dissolved Solids Milligram per litre [WHO]	500	**1095**	**2507**	**2001**	**1448**	**1341**
3	Electrical Conductivity micromhos/cm [EPA]	Less than 1000	**1564**	**3582**	**2858**	**2068**	**1916**
	II.CHEMICAL EXAMINATION						
4	pH AT 25 deg Celsius	6.5-8.5	7.64	6.74	6.62	7.77	7.41
5	Ph. Alkalinity as CaCO3, Milligram/Litre	Nil	0	0	0	0	0
6	Total Alkalinity as CaCO3, Mg/litre	600	196	324	276	224	244

7	Total Hardness as CaCO3, Mg/ litre	600	152	300	260	180	170
8	Calcium as Ca Milligram per litre	200	27	64	56	16	32
9	Magnesium as Mg Milligram per litre	100	20	34	29	34	22
10	Sodium as Na Milligram per litre	200	252	632	524	382	346
11	Potassium as K Milligram per litre	Nil	18	44	32	26	22
12	Iron as Fe Milligram per litre	1.0	0.10	0.85	0.80	0.04	0.10
13	Manganese as Mn Milligram per litre	0.3	0	0	0	0	0
14	Free Ammonia as NH3 Milligram per litre	0.5	6.45	10.38	27.96	7.73	10.01
15	Nitrite as NO2 Milligram per litre	Nil	0.18	0.15	0.13	0.09	0.06
16	Nitrate as NO3 Milligram per litre	45	13	32	29	18	15
17	Chloride as Cl Milligram/Litre	1000	335	840	710	460	420
18	Fluoride as F Milligram per litre	1.5	0.10	0.70	0.80	0.50	0.60
19	Sulphate as SO4 Milligram per litre	400	78	139	123	95	102
20	Phosphate as PO4 Milligram per litre	Nil	0.69	0.50	1.91	0.08	0.10
21	Tidy's Test 4hrs as O2 Milligram per litre	Nil	5.26	37.89	38.95	7.37	7.37
	III. Water Quality Index Values Of Temple tanks		94.6 – Severely	69.6 – Moderate	105.7 - Unfit	106.2 - Unfit	102.4 - Unfit

4.1.13. Magnesium

Throughout the investigation, all five temple tanks were found to be high in nutrients, with the lowest magnesium level reported in January at 20.0 Milligram/Litre and the highest at 34.0 Milligram per litre. The Banupuriswarar temple tank had the lowest level of magnesium found, and reduced magnesium levels were associated with reduced light, temperature, and phytoplankton counts, demonstrating that magnesium substantially impacts water quality [26].

Water quality values of selected temple tanks in Kumbakonam city limits taken in the month of January in Chakrapani, Aadhi Kumbeshwar, and Abhi Mukeshwarar Temple [Mahamaham tank] were found to be highly contaminated and unfit for human domestic use, while all other samples were moderately polluted. In summer, all tanks were deemed unsuitable for consumption; only the Chakrapani temple tank was exempted. Tanks in Kumbakonam city were found to be unsafe for human consumption. [27].

From all five tanks, the pollution levels in the Porthamarai tank are much greater than in other tanks. The temple tank waters have an alarmingly high WQI due to higher Total Dissolved Solids, Electrical Conductivity, and Free Ammonia levels. The increase in WQI of all water samples in January can be attributable to a combination of contaminants from surface runoff and worshippers' cleaning actions. The discrepancies in water quality index records could be attributed to deviations in water levels and waste disposal in specific water Biochemical Oxygen Demand.

The water quality index analysis revealed that human pollution harms the Porthamarai tank, the Aadhi Kumbeshwar temple tank, and the Abhi Mukeshwar temple tank, resulting in eutrophication. This is due to excessive amounts of TDS, turbidity, alkalinity, and hardness from washing, bathing, temple waste discharge, sewage, and local runoff.

According to the water quality index, the majority of water samples were found to be unsuitable for human use. None of the water in tanks is fit for human consumption. As a result, this investigation determined that the designated temple tanks at temples are not acceptable for domestic use but are all suitable for people's cleansing requirements. [28].

5. Conclusion

The current study explores the various functions that temple tanks fulfil, including ritual purification, religious rites, and the purification of water, which is revered and regarded sacred in Hinduism. Temple tanks are an essential component of temple construction. In addition to serving as a symbol of the holy rivers and being said to have holy water that cleanses the soul, temple tanks help boost the local economy by promoting tourism and fishing.

It also makes a significant contribution to ecological and environmental issues like water conservation and microclimate control, since the presence of sizable Biochemical Oxygen Demand of water in temple complexes has a cooling impact on the surrounding air and improves biodiversity. By providing crucial locations for ecological and environmental study, these tanks aid in understanding ecosystem dynamics and biodiversity in urban environments. Water Biochemical Oxygen Demand in urban areas has a positive impact on the microclimate of their surroundings by cooling the evaporation process. As a result, evaporative cooling could be one of the most effective passive cooling methods for urban areas and structures by studying tanks with crucial humidity values. The Urban Heat Island effect refers to temperature differences between the urban and non-urban spaces surrounding it. Water Biochemical Oxygen Demand has also been demonstrated to be an influential technique of decreasing urban temperatures subjective to the level of humidity; however, in this study, it was observed that tainted water owing to anthropogenic activities and the spread of contamination is considerably damaging the microclimate of the temple tanks and its surrounding places. It's not decreasing the temperature; rather, it's increasing the water and surface temperature, and it causes the environment to be in the form of an Urban Heat island.

In conclusion, temple tanks serve important functions in environmental preservation, communal welfare, and cultural preservation, in addition to being hallowed places for religious and spiritual activity. Their diverse significance emphasizes how important it is for modern civilization to preserve and protect them.

The present study recommends that awareness programs be undertaken around the city to teach people about the deleterious consequences of water pollution in temple tanks. All tanks must be filled with fresh water regularly using sufficient inlet and output lines; the proposal of Filtration tanks, also known as septic tanks or Onsite Wastewater Treatment Systems (OWTS), are used to treat liquid waste generated within a temple complex and tanks. They are designed to remove pollutants and pathogens before the treated wastewater is discharged or reused. These tanks typically involve a series of steps, including sedimentation, filtration, and sometimes biological treatment, to purify the water and manage and treat liquid waste generated from temple activities, including rituals, ablutions, and other operations, in an environmentally responsible manner.

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