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Assessment of Water Quality – A Case Study of Temple Ponds in Kanchipuram

P. Meenakshi*and K. Ambiga

Department of Civil and Structural Engineering, Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya, Enathur, Kanchipuram, India

*Email: meenathavamani82@gmail.com

Abstract

Kanchipuram is an ancient city dotted with legendary temples. Temple tanks are water storage structures, and a number of festivals were conducted in pond water. Industries generation and anthropogenic activities create pollution, and a low level of temple pond water, leaving people around the temples facing water scarcity. The research work focused on finding the quality, pollution level of temple pond water, and the nature of its usage. Samples were collected and analyzed in seventeen legendary temple ponds for four years, from January to March. The measured physical and chemical parameters are pH, color, biological oxygen demand, total dissolved solids, electrical conductivity, dissolved oxygen, chloride, sulphate, total hardness, calcium, magnesium, total silica, total nitrogen, ammonical nitrogen, total phosphate, iron, zinc, arsenic, cadmium, lead, and biological parameter total coliform count. The outcomes were associated with BIS Surface Water standards of class C. Heavy metals and other measured parameters are within Class C standard limits. Analyzing the results confirms that pond water is not fit for direct drinking usage. It can be uses for other purposes washing, bathing, holy dip, etc.

Keywords

Pond water, Temple Ponds, Water Quality

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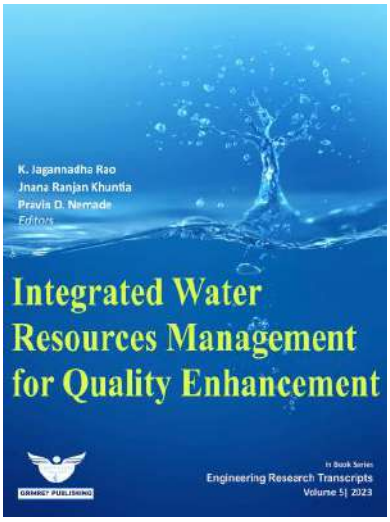

1. Introduction

Water in the earth occupies about seventy-one percent of the land's surface. Water is a single source and is needed for all city and rural facilities, and water is obligatory for human actions [1]. It is a very significant material that allows the continued existence of living organisms on earth. Water worth explains the radiological, physical, biological, and chemical properties of water [2]. Shell water value worsening has become a grave alarm worldwide due to improved contamination and weather change. This weakening threatens the usage of consumption of water and commercial growth [3]. Anthropogenic activities and usual processes disgrace shell waters and damage their use for water property consumption, engineering, farming, recreation, or other usages [4]. The heavy metals are sharp fundamentals that have a comparatively higher concentration and might be poisonous at small absorptions by the body. The bases of the trace elements in groundwater shall be a discharge from chemical surviving of raw materials and soil discharge procedures in addition to various anthropogenic actions [5]. The water quality index (WQI) is the most appropriate tool to determine the worth of water to decision makers [6]. The purpose of the WQI is to translate complicated superiority information into simple information that is useful for the community [7]. It explains the fitness of pond water for person utilization [8]. WQI is applied to recognize the quality of surface or groundwater, but it is limited in that microbial constraints are repeatedly not involved [9]. Several methods have been indicated for the assessment of the WQI [10, 11]. The main motive for water worth assessment was conventionally indicated by the need to find out the extent to which the water was appropriate for dissimilar usages [12]. This category of monitoring is normally known as verifying the force of anthropogenic activities on the atmosphere [13]. Kanchipuram is a temple city, with more people visiting, doing poojas in temples and ponds to relive their sorrows, and getting the blessings of god. This study was done to determine the quality of pond water in terms of physical, chemical, and biological properties.

2. Materials and methods

2.1 Study Area

The study zone consists of Kanchipuram temple ponds. It is seventy-five km from Chennai. The total area of the city is 11.35 km^2. The city once had over a thousand temples. Today, there are more than a hundred presents, and all are worth a visit. It is one of the seven most sacred pilgrim centers for the Hindus. Kanchipuram city is 83.2 m above sea level. Name and location of temple ponds represented in Table 1. The study area of temple ponds is represented in Fig. 1.

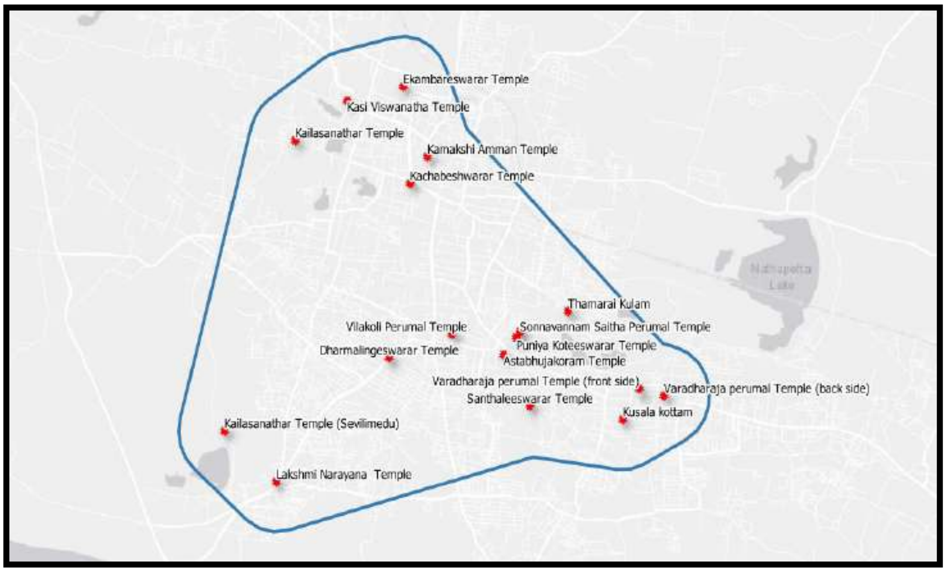

Fig.1. Study Area of Temple Ponds

Table 1. Name and Location of Temple Ponds

Sl. No	Sample Pond No	Temple Name	Latitude value	Longitude value
1.	P1	Lakshmi Narayana Temple	$12^0$48'41.49"N	$79^0$41'16.84"E
2.	P2	Kamakshi Amman Temple	$12^0$50'27.21"N	$79^0$42'11.00"E
3.	P3	Kailasanathar Temple Sevilimedu	$12^0$50'32.20"N	$79^0$41'23.16"E
4.	P4	Kasi Viswanatha Temple	$12^0$50'45.09"N	$79^0$41'41.92"E
5.	P5	Astabhujakoram Temple	$12^0$49'22.97"N	$79^0$42'38.90"E
6.	P6	Puniya Koteeswarar Temple	$12^0$49'28.67"N	$79^0$42'43.49"E
7.	P7	Kusala kottam	$12^0$49'02.28"N	$79^0$43'22.15"E
8.	P8	Kachabeshwarar Temple	$12^0$50'18.43"N	$79^0$42'04.80"E
9.	P9	Varadharaja perumal Temple (front side)	$12^0$49'12.36"N	$79^0$43'27.98"E
10.	P10	Varadharaja perumal Temple (back side)	$12^0$49'10.05"N	$79^0$43'36.98"E
11.	P11	Sonnavannam Saitha Perumal Temple	$12^0$49'30.39"N	$79^0$42'44.74"E
12.	P12	Dharmalingeswar Temple	$12^0$49'21.91"N	$79^0$41'57.44"E
13.	P13	Ekambareswarar Temple	$12^0$50'49.88"N	$79^0$42'02.16"E
14.	P14	Santhaleeswarar Temple	$12^0$49'06.54"N	$79^0$42'48.52"E
15.	P15	Vilakoli Perumal Temple	$12^0$49'29.64"N	$79^0$42'20.13"E
16.	P16	Kailasanathar Temple	$12^0$48'57.82"N	$79^0$40'58.01"E
17.	P17	Thamarai Kulam	$12^0$49'37.33"N	$79^0$43'02.15"E

2.2 Surface source and Sample Collection

The surface source for the temple tank is rainwater and temple usage water. Anthropogenic activities include cloth washing, bathing, deep dipping, and dipping their hands and legs. In the temple tanks, water was at different levels compared with the adjacent land levels in the temple area. A clean one-liter polythene container utilised for sample gathering. In each temple pond, sample water was collected, and a total of seventeen samples were tested according to the experiment for the determination of parameters mentioned in Table 2. The pond water samples were indicated as P1 to P17, and tested in the laboratory. The parameters pH, color, biological oxygen demand (BOD), electrical conductivity (EC), dissolved oxygen (DO), total dissolved solids (TDS), chloride (Cl), sulphate (SO_4), total hardness (TH), calcium (Ca), magnesium (Mg), total silica, total nitrogen (TN), ammonical nitrogen (AN), total phosphate (TP), iron, arsenic, lead, copper, zinc, total coliform count (TCC) were measured. The measured parameters are compared with BIS surface water standards, the standard values are represented in Table 3. Class of water indicates A for drinking without conventional treatment with disinfection, B for bathing, C for drinking with conventional and disinfection, D for fish culture, E for irrigation.

Table 2. Experiment for the determination of Parameters

Parameter	Experiment for the determination of Parameters
pH	pH meter
EC Micro ohms/cm	Conductivity meter
Colour (Hazen)	Colorimetry
DO (mg/l)	Winklers method
BOD (mg/l)	3 days incubation test at 28^0 C
TDS (mg/l)	TDS meter
Cl (mg/l)	Silver nitrate method
SO_4 (mg/l)	UV spectrometer

TH (mg/l)	EDTA titrimetric method
Ca (mg/l)	EDTA titrimetric method
Mg (mg/l)	EDTA titrimetric method
F (mg/l)	SPADNS colorimetric method
AN (mg/l)	Spectrophotometer
TN (mg/l)	Spectrophotometer
TP (mg/l)	Spectrophotometer
TS (mg/l)	Gravimetric method
Iron (mg/l)	Atomic absorption spectrophotometer
Arsenic (mg/l)	Atomic absorption spectrophotometer
Lead (mg/l)	Atomic absorption spectrophotometer
Copper (mg/l)	Atomic absorption spectrophotometer
Zinc (mg/l)	Atomic absorption spectrophotometer
TCC MPN	Multiple tube fermentation test

Table 3. BIS Surface Standards of Water

Parameter	**Class of Water**				
	A	**B**	**C**	**D**	**E**
pH	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
EC Micro ohms/cm	-	-	-	1000	2250
Colour (Hazen)	10	300	300	-	-
DO (mg/l)	6.0 Min	5.0 Min	4.0 Min	4.0 Min	-
BOD (mg/l)	2.0	3.0	3.0	-	-
TDS (mg/l)	500	-	1500	-	2100
Cl (mg/l)	250	-	600	-	600
SO_4 (mg/l)	400	-	400	-	1000
TH (mg/l)	300	-	-	-	-
Ca (mg/l)	200	-	-	-	-
Mg (mg/l)	100	-	-	-	-
F (mg/l)	1.5	1.5	1.5	-	1.5
AN (mg/l)	-	-	-	-	-
TN (mg/l)	-	-	-	-	-
TP (mg/l)	-	-	-	-	-
TS (mg/l)	-	-	-	-	-
Iron (mg/l)	0.3	-	50	-	-
Arsenic (mg/l)	0.05	0.2	0.2	-	-
Lead (mg/l)	0.1	-	0.1	-	-
Copper (mg/l)	1.5	-	1.5	-	-
Zinc (mg/l)	15	-	15	-	-
TCC MPN	50	500	5000	-	-

3. Results

The quality of water shows the relationship between the physical, chemical, and biological properties of the surface water. The statistical analysis for water quality parameters of different Pond water samples is given in 2017 Table 4, 2018 Table 5, 2019 Table 6, and 2020 Table 7.

Table 4. Statistical analysis for water quality parameters – 2017

Parameters	pH	EC	DO	TDS	Cl	SO_4	TH	Ca	Mg	A N	T N	TP	Fe	TCC
Unit		µmho/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	MPN
Min	7.25	203	6.2	132	23	10	116	22	12	1.3	2.4	2.6	0.37	500
Max	9.07	2040	7.9	1326	403	187	387	77	67	3.8	13.7	11.8	0.82	2300
Mean	7.25	744.12	7.03	483.71	121.8	56.76	222.5	43.35	27.82	2.38	6.45	7.81	0.61	1038
Median	7.48	653	6.9	424	96	39	204	45	22	2.4	5.6	7.8	0.65	820
SD	0.46	499.25	0.50	324.52	97.9	46.76	84.9	17.10	14.31	0.74	3.71	2.23	0.13	591

Table 5. Statistical analysis for water quality parameters - 2018

Parameters	pH	EC	DO	TDS	Cl	SO_4	TH	Ca	Mg	A N	T N	TP	Fe	TCC
Unit		µmho/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	MPN
Min	6.86	135	6.2	114	28	13	83	13	6	2.7	8.7	4.7	0.02	700
Max	9.31	1853	7.8	1204	349	184	316	69	53	4.8	13.8	8.6	0.09	2300
Mean	7.75	866.8	6.84	564.9	124.6	63.5	169.3	34.24	20.1	3.7	11.3	6.9	0.05	1558
Median	7.62	842	6.80	547	84	53	139	32	16	3.6	11.6	7.2	0.05	1600
SD	0.61	636.2	0.56	411.6	111.2	55.7	79.12	16.09	12.2	0.6	1.81	1.3	0.02	501

Table 6. Statistical analysis for water quality parameters - 2019

Parameters	pH	EC	DO	TDS	Cl	SO_4	TH	Ca	Mg	A N	T N	TP	Fe	TCC	T S
Unit		µmho/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	MPN	mg/l
Min	7.3	360	6.6	212	52	27	81	16	10	2.7	6.9	3.5	0.58	400	6.8
Max	8.9	2320	7.6	1380	486	369	342	72	42	9.2	22.3	17.3	1.14	2100	36.4
Mean	7.9	932.2	7.06	554.3	154.8	90.4	201.3	38	25.8	6.20	14.2	10.1	0.76	1217	21.4
Median	7.8	860	7	512	130	72	196	38	25	6.50	13.7	10.2	0.74	1100	20.9
SD	0.4	524.6	0.30	312.4	112.4	79.6	78.49	16.3	9.77	1.62	4.34	3.74	0.14	511.5	9.52

Table 7. Statistical analysis for water quality parameters - 2020

Parameters	pH	EC	DO	TDS	Cl	SO_4	TH	Ca	Mg	A N	T N	TP	Fe	TCC	Colour	F	T S
Unit		µmho/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	MPN	Hz	mg/l	mg/l
Min	7.2	403	6.5	242	63	33	97	19	12	1.9	5.3	3.8	0.72	450	5	0.32	7.6
Max	8.7	3012	7.2	1782	526	342	428	87	53	10.6	26.5	14.3	2.53	2800	100	0.87	32.7
Mean	7.8	1077	6.7	636.3	181	101	243	46.1	31.1	6.1	11.8	8.56	1.2	1550.6	33	0.6	17.5
Median	7.9	912	6.7	542	154	93	230	44	30	6.5	11.0	9.40	1.1	1640	30	0.63	17.5
SD	0.4	664	0.2	393.4	119	73.8	99.90	19.8	12.7	2.5	4.93	2.73	0.5	702.06	25	0.21	7.20

4. Discussion

4.1 Water Class Parameters

Water class parameters include the physical, chemical, and biological characteristics of water. The quality of a healthy aquatic ecosystem depends on these parameters of water. A change in water quality affects the biological community of an aquatic ecosystem, reducing primary productivity. Freshwater is essential for agriculture, industry, and human existence. It is important to evaluate the physico – chemical and biological parameters of water.

4.1.1 pH

pH is a significant sign for water worth parameters. The measurement value of pH indicated the acidic or basic nature of the water at the given temperature [14]. It gives an idea about the negative log of the hydrogen molecule’s attention. The pH level varies from 0 (most acidic) to 14 (most alkaline). The series of accepted pH values in water extended up to 4.5 in acid nature, muddy high ground waters, up to 10 in water due to powerful photosynthetic action by algae. The most commonly useful range is 6.5 to 8.5. The applicable range of pH for fish culture is 5 -9, though 6.5-8.5 is preferable. The change in pH alters the amount of supplementary ingredients in the water to greater toxic levels. The presence of ammonia, and chlorine disinfection creates a modification in pH value. The study of pH value in the sample points varies from 7.2 to 9.31; it indicates the temple pond water was of alkaline nature. Water class parameters include the physical, chemical, and biological characteristics of water. The quality of a healthy aquatic ecosystem depends on these parameters of water. A change in water quality affects the biological community of an aquatic ecosystem, reducing primary productivity. Freshwater is essential for agriculture, industry, and human existence. It is important to evaluate the physico – chemical and biological parameters of water.

4.1.2 Colour

Colour is an imperative parameter for aquatic water as it specifies the cleanliness of the water, and also explains the impurity of the water in the form of the presence of organic substances, like algae compounds. It helps in the quantitative assessment of presence of toxic organic materials in water. Domestic or industrial usage prefers colourless water. The national agricultural extension and research indicate that pale colours and light greenish or greenish water useful for fish culture. The green, bluish green or brown greenish colour of the water shows good plankton inhabitants, and is good for fish health [15]. The colour is primarily an apprehension of water value for an aesthetic basis. The presence of colour in water is controlled by coagulation, settling, and filtration process. This study indicates that pond water does not have the presence of colour in 2017 to 2019 and 2020 the colour ranges from 5 Hazen to 100 Hazen.

4.1.3 BOD

BOD means biological oxygen demand; it represents the oxygen necessary for the bacteria to perform biological decay of dissolved solids [49]. BOD is a factor to consider the organic load in the water. It is the quantity of total dissolved oxygen inspired by microorganisms for bio degradation of natural matter. It mainly depends on temperature, the level of biological action, the attention of organic matter, and microbial organisms like bacteria and fungi. A BOD level greater than 5 mg/l is an identification of water pollution [15]. The study shows temple water has a nil BOD value.

4.1.4 Electrical Conductivity

The EC value is a count of mobile ions and salt present in water [16]. The presence of EC is generally due to saline water and, through leaching, industrial discharges. The greater value of EC and total dissolved solids is normally present in the dry period than in the raining period due to elevated evaporation in the dry period and the dilution consequence experienced in the raining period [17]. The elimination of plants and renovation into monoculture may cause run-off to pour out instantly, thus reducing recharge during the drier stage [18]. Electrical Conductivity very much disturbs the taste of water; hence EC has a greater influence on the consumer's authorization of the water as drinkable [19]. A higher EC value may happen through ordinary weathering of any anthropogenic source [20]. The study explains the measured electrical conductivity value varies from 135 µmho/cm to 3012 µmho/cm for the temple pond water.

4.1.5 Dissolved Oxygen

The DO relationship with water gives information about the bacterial action, photosynthesis process, etc [21,22]. During the summer, DO values decreased due to a rise of the temperature and increased microbial activity [23]. The greater value of DO in summer is the maximum duration of clear sunlight manipulated on the percentage of soluble gases O_2 and CO_2. Greater sunlight increases photosynthesis by phytoplankton, utilizing CO_2 and giving off oxygen. This probably accounts for the superior qualities of oxygen during summer [24]. The variation in starting and ending DO give the quantity of oxygen taken by the bacteria during this stage. The measured DO value varies from 6.2 mg/l to 7.9mg/l. The study of temple pond water shows a medium value of dissolved oxygen; this value is useful for the growth of aquatics in the pond.

4.1.6 Total Dissolved Solids

TDS is the sum of portable charged ions, including salt, that dissolve in a particular amount of water in mg/l. It is directly associated with the purity of the water. A higher TDS value is toxic to aquatic life through an increased amount of salinity in the water. Principal sources of greater TDS in surface water include agricultural overflow, ejection of inland waste, and other anthropological actions like the cleaning of a vehicle at and around the surface [25]. In surface waters, anions as carbonates (Cl, $SO_{4)}$ and cations like Mg, Ca are present. In the natural environment, these compounds are present in magnitudes that generate a reasonable solution. If there are supplementary intakes of dissolved salts into the structure, the balance is changed and harmful effects will occur. Inputs comprise both normal and anthropogenic resources. The measured TDS value ranges from 114 mg/l to 1782 mg/l. The study shows TDS value within the surface water standards.

4.1.7 Chloride and Sulphate

It is the ionized shape of chlorine; chloride is the most plentiful non-living ion in normal water and un clean water. Seawater chloride concentrations averaged 35000 ppm. In usual fresh water, chloride attention is typically less than 10 ppm, but fairly less than 1 ppm. The greater limits of chloride cause stomach distress and eye and nose nuisance [26]. Sulphur is one of the essential plant nutrients. Algal growth will not take place when sulphate levels are less than 0.5mg/l. Sulphate salts can be the main impurity in normal waters. It is physically happening, the outcome of the breakup of several leaves that fall into a watercourse, of water fleeting through rock or soil containing gypsum and other general minerals, or of atmospheric declaration. Overflow from inseminated agricultural land also participate sulphate to the water. Sulphate is not poisonous to plants and animals at normal concentrations. Normally, in humans, quantities of 500 - 750 mg/l produce a short-term laxative effect. The allowed limits for water used as inland water are under 250 mg/l. The measured chloride value varies from 23mg/l to 526mg/l, and sulphate value varies from 10mg/l to 369mg/l. The current study shows the temple pond water chloride and sulphate values are within the surface water standards.

4.1.8 Total Hardness

In water, the total hardness is a composite mixture of cations and anions. Hardness consists of the ion's calcium and magnesium [27]. The hardness property avoids the lather creation with detergent and increases the steaming value of liquid [28]. It is a normal attribute of water that can improve its suitability for drinking. The general symbols of tough water delivery are reduced soaping and scum. Hardness consists of two parts: temporary hardness and permanent hardness. The impermanent hardness can easily be detached by steaming the water. The measurement of hardness in $CaCO_3$ nature indicates a soft condition 0 to 100 mg/l, medium: 100 to 200 mg/l, hard condition: 200 to 300 mg/l a greater hardness of 300 to 500 mg/l, and an exceedingly hard condition of 500 to 1,000 mg/l. The measured value varies from 83 mg/l to 428 mg/l. The temple pond water is safe in total hardness for surface water standards, it can be used for other purposes not directly for drinking purposes.

4.1.9 Calcium and Magnesium

The parameters Ca and Mg are normally found in normal waters, and they create the hardness of water Calcium is the most plentiful ion in new water and is significant in shell creation, bone construction and plant rainfall of lime. Calcium is necessary for human nutrition and a key ingredient in the development of teeth and bones. It is limestone, it produces water hardness. Magnesium application is lower than calcium in water. Magnesium is necessary for chlorophyll development and performs as a restrictive feature for the development of phytoplankton. It is a common element in the earth’s shell. It gives an unlikable taste at greater concentration. The measured calcium concentration ranges from 13 mg/l to 87 mg/l, and the magnesium concentration ranges from 10 mg/l to 67 mg/l. The temple pond water is safe in calcium and magnesium for surface water standards, and it can be used for other purposes not directly for drinking purposes.

4.1.10 Fluoride

Fluorine is a necessary element for human health. The fluoride (WHO, 2006) maximum acceptable concentration is 1.5 mg/l for drinking. The greater amount of fluoride is due to the existence of natural and non-living compounds that have fluoride in water in the form of Hydrofluoric acid, sodium fluoride, and uranium hexafluoride. Fluoride helps to avoid initial stage tooth decay; its greater concentration in drinking water and food creates health effects. The lower concentration in drinking water will avoid dental problems, but a greater dose will build up in human health the lead to fluorosis [29] (WHO, 2011). The measured fluoride in 2020 ranges from 0.32 mg/l to 0.87 mg/l. The pond water is safe in fluoride for surface water standards; it can be used for other purposes not directly for drinking purposes.

4.1.11 Total Silica

Silicon is the second most plentiful constituent on earth, next to oxygen. Silicon dioxide sand and complex quartz are the indications of silica. Silicate salts are normally present in water, and silicate minerals present in several forms, including gemstones, asbestos, talc, and mica. The concentration value varies in the range from surface water to greater than 100 ppm in groundwater. Some silicates are in colloid form it is difficult to manage. Silicates can create scale and build up on polluted membrane surfaces, which create corrosion in the metal. Silicon ions are there in all existing organisms. They survive as hydrated, amorphous silicates and are necessary for structural fundamentals in single-celled organisms, superior plants, and animals. Silica plays a positive role in silicate’s bone power, hair, and skin value. In the natural ecosystem, the silicon with phosphorus and silicon with nitrogen ratios are a reflection to donate to the verity of microorganisms that will lead, for example, diatoms versus cyanobacteria. Algal populations move after springtime as the silicate is inspired. The measured silica total ranges 6.8 mg/l to 36.4 mg/l. The temple pond water is safe in total silica, it can be used for other purposes other than drinking.

4.1.12 Total Nitrogen and Ammonical Nitrogen

Nitrates are mixed into freshwater through the disposal of manure, and manufacturing wastes, and runoff from the agricultural areas. The greater volume of nitrate creates blooms [30]. Nitrate is naturally present in the environment; organic material in the soil will decompose and produce ammonia, the oxidization of this ammonia forms nitrate. Naturally drinking water and eating food containing nitrates. Through urine and blood tests, the presence of nitrate in the body can be dictated. Nitrates are, however, not harmful to fish.

The vital attack of water and resultant land disposal cause an extreme rise in nitrate exists in pond water [31]. Ammonia particles are a nutrient necessary for life. The highest levels of ammonia may build up in the organism and alter metabolism and pH. It is a pointer of contamination from the extreme consumption of ammonia rich fertilizers. The total nitrogen varies from 2.4 mg/l to 26.4 mg/l and ammonical nitrogen ranges from 1.3 mg/l to 10.6 mg/l. The temple pond water is safe in nitrogen; it can be used for other purposes not directly for drinking purposes.

4.1.13 Total Phosphate

The concentration of colour is strictly relative to the amount of total phosphate and silicates present in the sample water. The phosphate compounds were decreased by weak dropping contents like ascorbic acid. The colour of the decreased complex is sky blue [32]. Phosphates are nontoxic to human or creature's health unless they are there at greater levels. The greater levels of phosphate will create digestive problems. Phosphate alone does not cause adverse health problems. A phosphate stage higher than 1.0mg/l may obstruct coagulation in water distillation plants [33]. Total phosphate ranges from 2.6 mg/l to 17.3 mg/l. The temple pond water has a greater total phosphate value, so it can be used for other purposes other than drinking purposes.

4.1.14 Heavy Metals

Heavy metals are metal chemical components that have a comparatively greater density and are poisonous at a small concentration [34]. The important examples of grave metals are chromium (Cr), mercury (Hg), cadmium (Cd), copper (Cu), cobalt (Co), arsenic (As), and lead (Pb), etc. Heavy metals are the normal materials of our ecological surroundings. They enter the human body through nutrition, water and, airborne particles in a small amount. The particular heavy metals, for example, copper, selenium, and zinc are essential to maintain the metabolism of personal fitness as trace fundamentals. Higher concentrations are poisonous and cause serious diseases. The bioaccumulation of heavy metal elements mixed in the water bodies affects the liver, muscle, kidney, and other tissues of fish. The release of heavy metals from industries affects certain aquatic species, aquatic fauna. So, it should be avoided [35]. The climatic variation of heavy metals causes changes in the properties of water like pH, dissolved oxygen, salinity, temperature [36]. Heavy metals may not be chemically despoiled by microorganisms [37], so the heavy metal substances are prolonged in soils and present in all creatures, including humans [38]. The trace elements at low attention may be present in water to a greater level in a fish hankie and become hazardous to marine life [39,40]. Ni accumulates in marine life, but its enlargement along in the food chain is not established. Cobalt is helpful for humans because it is an element of vitamin B12, which is necessary for to human fitness. It is useful in treating anaemia in prenatal ladies as it stimulates the manufacture of red plasma cells. A greater concentration of cobalt may injure human fitness [41].

4.1.15 Iron

The heavy metal iron is the most significant ingredient in blood in humans and other breathing organisms. Iron is a necessary constituent for human nourishment and metabolism, but in overload, quantities result in poisonous effects like hemochromatosis in tissues. The permissible limit of Fe in drinking water is 0.3 mg/l. The first representation of iron poisoning is stomach hurting, and caustic to the inside layer of the gastro intestinal region, including the stomach. Iron poison causes the blood vessels to expand, if it is not preserved properly it will cause to the expiry of the human [42]. The iron value varies from 0.02 mg/l to 2.53 mg/l. The maximum value for the class C standard of iron is 50mg/l. According to class C the water safe.

4.1.16 Arsenic

Arsenic is a necessary compound for the animal genus; it acts as the main function in protein production. It is a dietetic inorganic material for human life, and it receives from nutrition partial attention from 15-25µ. It mixed in with the surroundings by the way of mining, burning of fossil fuels. The arsenic attracted by humans in the way of water, nutriment, air, and skin relation with soil, water. Greater arsenic produces a health problem, less manufacture of red, white cells, abdomen and lung frustration, skin modification, growth of cancer cells and destroy of DNA [43]. The temple pond water has < 0.01 mg/l of arsenic value in four years.

4.1.17 Lead

Lead is not an essential component. Lead is deposited in soil from the following; painting, cutting, welding, destruction of large buildings, manufacturing mineral actions, and removal. Drinking water is mixed with lead pipes, fixtures. The excess lead in drinking water causes hip breakage, damages the kidneys and makes humans hypertensive. The suitable boundary for lead is 0.01 ppm (BIS 2012). Lead is an increasing pollutant, and its other sources include automobile exhaust smokes, old dry-cell batteries sewage effluent, and atmospheric settlement [44]. The concentration of lead in impure waters that draw off the old mine works and mine dump, creates lead filling of the rocks, leads to stagnation on the mine and soils [45]. The temple pond water has a lead value < 0.01 mg/l in four years.

4.1.18 Copper

In different enzymes, copper plays an important role, it is essential for the grouping of haemoglobin. The organic spices in the inactive industrial waste water combine with copper ions capability to precipitate a composite system, deposit it at the bottom of river basin, and infiltrate into the water table. The highest concentration of copper in the water is toxic. Copper has the greatest suitable amount of 0.l mg/l (WHO-2008). A small amount of copper is necessary for good health; a greater amount cause death in the nervous system, liver and kidney. The maximum amount of copper in drinking water may produce vomiting, nausea, diarrhea, and copper may be mixed into drinking water from pipes as well as from added materials planned to manage algal growth [46]. The supply of copper in the water may be a result of farming actions and waste sludge [47]. The use of copper and its minerals in water flow pipes and plumbing, fittings increase the danger of copper in the water [48]. The temple pond water has a copper value of < 0.01 mg/l for four years.

4.1.19 Zinc

Zinc is a necessary nutrient for human health, in numerous organisms, zinc plays an important role in physiological and metabolic development. The disintegration of zinc ores, municipal waste, pesticides used in agriculture, automobile waste, and zinc sulphate produces environmental contamination. The hazardous effects of heavy metals like nickel have carcinogenic stroke on rats. Similarly, excess zinc is harmful and produces zinc toxicity [49]. The temple pond water has a zinc value < 0.01 mg/l for in four years.

4.1.20 Total Coliform Count

The microbiological examination is to discover the stage of pollution created by breathing things particularly humans that survive or have employment in the region. The examinations are founded on coliform microorganisms as the pointer. The existence of these analytical organisms is proof that the water has been contaminated with the faces of creatures or any warm-blooded animals. The measurements of total coliform count, E. coli are all measured pointers of water polluted with fecal matter. Polluted water may have other pathogens that are more problematic to determine. These pointer bacteria help us quantify of the contamination stage. TCC is a complete collection of bacterial classes that are normally parallel to and comprise the class E. coli. The TCC value indicates coliform bacteria that do exist in fecal substances. The TCC is mostly present in raw sewage in poorly monitored septic tanks. The value varies from 400MPN to 2300MPN and is safe according Class C.

4.2 Water Quality Index

The term water class indicates the water feature and the physical canal necessary to maintain an aquatic life. The objective of the federal clean water act is "To safe guard and maintain the chemical, physical and biological reliability of the nation's waters," establishing the significance of assessing both water worth and the habitation required for maintaining other marine organisms [50]. WQI is the most efficient tool to exchange details on the worth of water, it is a numerical equation utilized to convert the great numeral of water worth data into a solo numeral. It is helpful for policy makers to understand the superiority of water [51]. The WQI is also defined in the following ways (i) Complex water value data into easily comprehensible and usable by the public [52,53]. (ii) Very significant parameters offer a single pointer of water class, an arithmetical equation that charges the health of a water scheme with figure [53]. (iii) Appropriateness of superficial water for humanoid utilization [54]. (iv) To understand the impression of the free waste release on the worth of the water as well as the fitness for human utilization based on calculated WQI values.

Types of water quality index calculation Methods used in calculation.

- National Sanitation Foundation (NSF) [55,56],
- Canadian Council of Ministers of the Environment (CCME) [57,58]
- Oregon Water Quality Index (OWQI) [59],
- Weight Arithmetic Water Quality Index (WQI) [60].

5. Conclusion

Normal water is never totally pure. Water eminence depends on the category of contaminants mixed and the existence of self-cleaning water. Water foundations get their water supply from rainfall. In precipitation, water permits, through the surface and ground, a wide variability of dissolved or suspended pollutants mixed into the source. The standards for the approved release of pollutants into the water body are planned based on water class personality. The properties of water contamination are not only destroying people; they also affect animals, fish, and birds. Contaminated water is inappropriate for consumption, irrigation, and industries. It affects the visual class of ponds, lakes, and rivers. After the investigation and review of twenty-two parameters, we concluded that dissolved oxygen, total phosphate, and coliform count values were slightly greater than prescribed limits. Heavy metals are present at very low values. The presence of TCC in pond water makes it unfit for drinking purposes. The temple pond water is not strictly used for consumption purposes; it can be used for swimming, fish civilization, improving the water table level, etc. Anthropogenic activities create more pollution. The current chapter is undertaken to describe the sharp awareness among the public about the value of water. Humans and society can assist in reducing water contamination by performing easy housework and providing supervision. The quantity of contaminants created may be reduced.

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