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INTEGRATING SCIENCE AND SPIRITUALITY TO UNDERSTAND THE CULTURAL AND LIMNOLOGICAL IMPORTANCE OF SELECTED TEMPLE PONDS OF KARNATAKA

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ABSTRACT

Temple ponds are integrated water storage structure found inside and outside the temple. In the view of traditional and cultural aspect, temple ponds are the auspicious place of worship from the Puranas, Vedic era to till date. The temple ponds are not a simple construction, it has been the source of divinity, purity, beliefs, holiness and sacredness of our rich cultural heritage. Usually, temple ponds constructed for various purposes like rain water harvesting, control the surface runoff, water shed management, act as a Sanjeevini during drought etc., Some of the ponds are the birth place of many prominent rivers and became the life line for particular region. Certain ponds are having capability to cure the various kinds of skin diseases, inflammation etc., even can cure mental illness and depression. Karnataka hides such a mysterious places in its womb. In those such ponds, the present investigation carried out on physico-chemical parameters, biological parameters and Medicinal properties of the water in selected ponds. The five ponds which were selected for the study are having their history and own Mythology. Selected ponds like 'Ambu Tirta'- origin of River 'Sharavathi', 'Shankara Honda'- origin of River 'Aghanashini'. The 'Shreedhara Tirta', Miracle Pond- 'Guli Guli Shankara', 'Varada Moola' have evident to be having medicinal value in it. The study elucidated that the presence of trace amount of minerals like Ca, Mg, Si, Ag, Cu, Zn etc., along with the organisms like diatoms, cyanobacteria, algae etc., are providing more potential to the study of medicinal value of water. Scientific study proved that cyanobacteria contain phytochemicals and act as a bio remedial source for curing diseases. Above factors incorporates the medicinal properties into the water and has been curing the multi disorders.

INTRODUCTION

"Temple ponds are considered as sacred and which are believed to have purifying properties and also capable of washing away sins and impurities according to rig veda 10.9. 1-2"

The Water is precious and is the lifeline of all the living entities in the universe. The present domain of life existing on earth has evolved in water. About 70% of the earth's surface is covered with water contributing about 2.3% to total freshwater and the rest is salt water.

The materialistic view indicates the five elements to be the root of this materialistic creation. Every living and non-living body is made up of five basic gross elements of nature called "Panchabutha".[7]

Earth, sky, air, fire, and water are the five essential elements (Pancha Bootha) Considered sacred on the earth and as well as the universe. More importantly, water occupies two-thirds of the planets space [12]. Water occupies the highest place amongst the five basic elements of nature[7]. Because of the holy and divine nature of the water, they have been given the name of a 'Tirtha'.[9]

The Vedas are the oldest around 6500 BC monumental scriptures

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and represent the fountain of wisdom of knowledge [7]. Vedas are always been vast and boundless sea of information. Water has been regarded as the first and foremost element in Veda which is the original source that gave rise to the subsequent evolution of the universe. The importance of water and Temple ponds are mentioned in several hymns and verses in 4 Vedas and also in Matsyapurana, Skandapuran, Vishnupurana, samhitas, Shastras, Smritis and many more. According to Rigveda water sources such as well, springs, ponds, etc contain many nutrients. And one becomes energetic and powerful by using such nutritious water. (Rigveda 10.17.10)

In Rigveda, mentioned that one should consume water which is like honeydew and which has medicinal properties like them who consume it in the correct way.

"Apswadantarmritmapsu bheshjampaamut prashastayey deva bhakt waajinah" (Rigveda 1.23.19)

The successors of Aryans continue this natural worship. Worship of water is one among them. Water is very much essential for our religious purpose as well as daily life [9]

Most of the cultures of the world ascribe sanctity to water. Similarly most of the religions believe in the purifying power of water and healing power of water. It is the sustainer of life. The symbol of water in the Vedas is significant.

The Vedas identify water as the very essence of spiritual sacrifice or 'the first door to attain the divine order' (Atharva Veda).and AVS 6.24 is the only complete charm in the Atharvaveda which focuses on the healing properties of water.

(Apamahan divyanampaan srotsyanaam

Oopamah prarejnedshava bhavay waajina:)

Atharva veda 19.1.4

Water is the prime necessity of life, without it, there would be no life 10. Water has been used to maintain health since time immemorial. Water helps in treating diseases and hence is known as the most ancient remedial agent. Using water to gain and maintain health is a very old cure. The great bath found in Mohenjo-Daro shows that water was used as a therapeutic measure by the Harappans to restore health. Water has several remedial properties which are used in many forms externally as well as internally in the treatment of illnesses [2]. Acharya Charaka has mentioned the importance of groundwater in Charaka Samhita.

Water is the energy element in the creation. Water is not only worshipped in India but in many European and other Asian countries like Egypt, Iran, Greece, Rome, Israel, Syria, Jordan, Mangolia etc [9]

Water bodies play an important role in rituals in temples. The purpose of constructing pond as the water is used for holy dips by worshippers, offerings, cleaning purposes and other important religious activities like Sandya Vandane, Tirta Snana as they believe to be sacred and pure and removes our sins, some tanks are said to be cure various diseases when bathed in and plays a vital role in recharging underground water also serves as a fresh water source as well as they provide unique habitat for diverse range of aquatic species. Some of the ponds are the origins of great rivers. In contrasting point of view, one can experience the positive vibration around and fresh atmosphere.

Temple ponds are water storage structures, integral component of the hydrological system. Water bodies of temple are traditionally conserved unique heritage ecosystems over a long period and serve as potential sources of groundwater recharge [10]. Many of the ponds are the source of springs having water throughout the year is one of the mysterious things. Unlike other aquatic ecosystems, they have fairly less human interference, hence the water quality and aquatic biodiversity seem to be unique [10]. Temple pond Ecosystem serve as repositories of a variety of cyanobacteria of nutritional, medicinal, agricultural and industrial significance [10]. Temple water bodies are freshwater habitats traditionally linked with the temples in India as a part of temple structures and heritage [13]. Usually, almost all such lentic sources are fairly unpolluted due to restricted use. The major water source for these lentic habitats are rainwater and groundwater, thus in addition to its usefulness to temple activities, they enable rainwater harvesting as well as groundwater recharge [3]. These water bodies support a variety of flora, fauna and microbes as they receive organic and inorganic materials of routine rituals. Owing to the development of microhabitats and the availability of sunlight, temple water bodies serve as hotspots for various plankton including algae and bacteria. Phytoplankton being primary producers, balance the water quality of lentic habitats by enrichment of nutrients and energy to support other organisms [4].

Healthy pond ecosystem are critical for achieving several sustainable development goals through numerous ecosystem services e.g., flood control, nutrient retention and carbon sequestration. However, the socio-economic and ecological value of ponds is often underestimated compared to the larger water bodies [11].

Traditionally, temple ponds are important source of compounds with therapeutic potential and still represent a significant pool for curing various diseases. The medicinal property of a pond is may be due to the presence of active organic and inorganic compounds having the properties of anti- inflammatory, antiviral, anti-bacterial etc., It is said that when the holy sages, way back in the early 16th century, belief in the healing power of sacred springs with mineral rich waters of varying temperatures, which gushed out naturally from beneath the earth's surfaces and existed in the form of healing pools of temples located at the mountain foothills may have been mystical or superstitious.

METHODOLOGY

The five temple (lentic sources) ponds have been chosen for the study of physico-chemical characteristics, phytoplankton, medicinal, nutritional and economic value of water of temple pond. The samples were collected from each pond in the month of September 2024 using plankton net for phytoplankton and zooplankton study and the surface water were collected for the physico-chemical analysis of water. The temperature of water were noted down. Plankton Identification was done using compound microscope. Physico-chemical parameters were assessed based on APHA 24th edition.

Malenadu is the region, covered by dense evergreen forests, Western and Eastern slopes of Western ghats. The 5 temple

ponds selected for the studies are in the State of Karnataka and located at different taluks like Sirsi where located the pond 'Shankara Honda' at the distance of 7km. 'Ambu Tirta' located at the distance of 17.5km from Thirthahalli taluk , 'Shreedhara Tirta' located at the distance 10.4km and 'Varada Moola' 7.5km from Sagara taluk, 'Guli-Guli Shankara' located at the distance of 42.3km from Hosanagara taluk(Fig 1) surrounded by lofty and mighty Western ghats and lush paddy fields, Nilgiri plantation, Hills, Areca plantation, species and commercial crops.

Materials and Method

Study Area

- **Pond 1**- Shreedhara Tirta- Sagara Taluk, Shivamogga LAT 14.125893° LONG 74.987631°
- **Pond 2**- Shankara Honda - Sirsi Taluk, Uttara Kannada (origin of Aghanashini River) LAT 14.611738° LONG 74.833222°
- **Pond 3**- Ambu Tirta – Tirthahalli, Shivamogga (origin of Sharavati River) LAT 13.792263° LONG 75.176407°
- **Pond 4**- Guli-Guli Shankara- Hosnagara Taluk, Shivamogga LAT 13.943554° LONG 75.352058°
- **Pond 5**- Varada Moola – Sagara Taluk, Shivamogga (origin of Varada River) LAT 14.114119° LONG 75.037348°

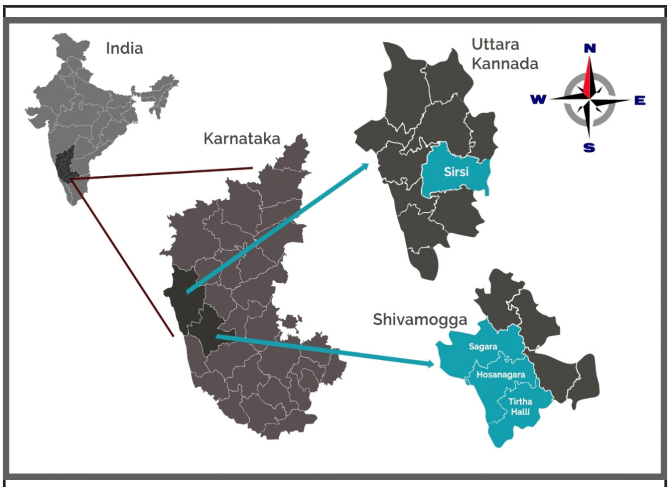


Fig-1 Study area of Temple Ponds of Karanataka

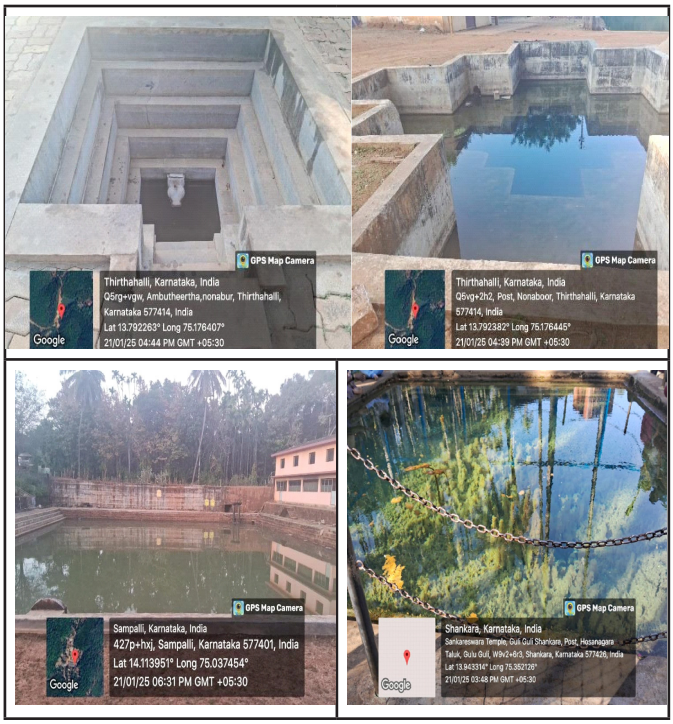


Table-1 Experiments for determination of Parameters

Sl.No	Parameter	Experiment for determination of Parameters
1.	pH	pH meter
2.	Electrical conductivity	Conductivity meter
3.	DO (mg/l)	Winklers
4.	BOD	3 days incubation
5.	COD	3 days incubation
6.	TDS	TDS meter
7.	Cl (mg/l)	Silver nitrate method
8.	TH	EDTA titrimetric method
9.	TS	Gravimetric method
10.	Ca	EDTA titrimetric method
11.	Mg	EDTA titrimetric method
12.	Iron	Atomic absorption spectrometer
13.	Copper	Atomic absorption spectrometer
14.	Zinc	Atomic absorption spectrometer
15.	Nitrite	APHA 24TH Edition 4500 NO2
16.	Silver	APHA 24TH Edition 3500 Ag-B
17.	Silicon	APHA 24TH Edition 4500

Counting and Calculation of plankton

Both phyto-plankton and zoo-plankton identification was done by following Fritsch (1975), Desikachary (1959) and Anand (1998) for phytoplankton; Edmondson (1959) Battish (1992) for Zooplankton.

RESULTS

Table 2. Statistical analysis of five ponds with respective to Physico-chemical parameters

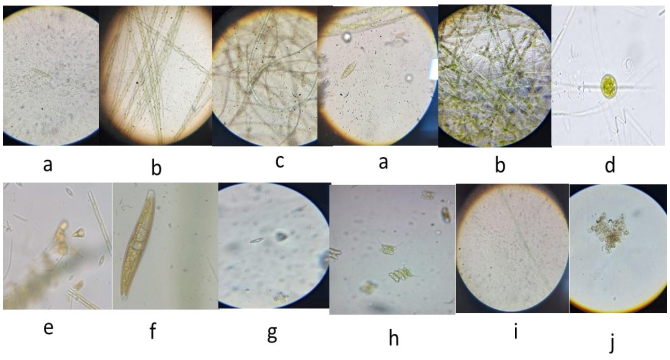
Sl. No ponds	pH	EC	Ca	Cl	Mg	TDS	TH	DO	BOD	COD	Suspended solids
1	6.75	43.41	2.0	5.49	2.0	23	10	8.1	3.0	10	2.0
2	5.65	180.90	9.6	19.9	4.8	96	44	7.5	7.0	30	5.0
3	6.10	93.62	5.6	17.9	2.4	47	24	8.5	5.5	30	5.0
4	6.50	344.50	52.9	69.9	24.0	183	260	8.90	5.0	20	15
5	5.32	219.16	12.0	26.9	5.83	116	54	8.0	5.0	20	7.0

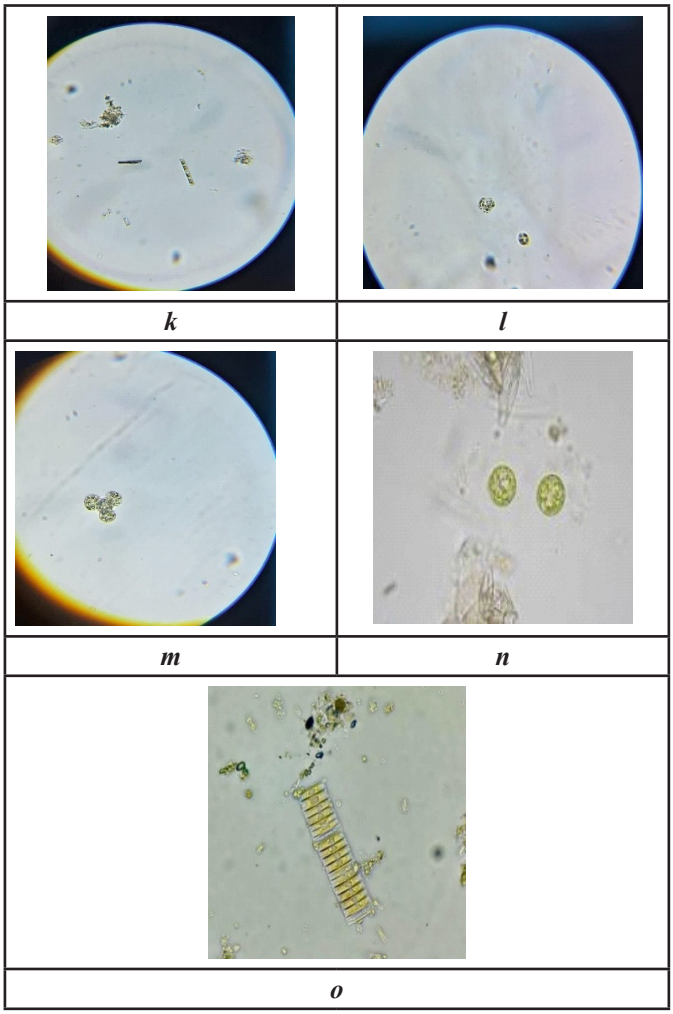
Table 3 Analysis of Trace minerals in selective ponds which is said to be having the medicinal value in water.

Sl. No	Iron	Zinc	Copper	Silver	Silicon
Pond 1	0.1	1.343	0.070	0.140	2.350
Pond 4	1.40	1.397	0.081	0.151	2.440
Pond 5	1.34	1.163	0.060	0.125	2.030

Table 4 Identification of species in selected Temple Ponds

Species	Pond 1	Pond 2	Pond 3	Pond 4	Pond 5
Spirogyra		✓			✓
Anabeana				✓	
Oscillatoria	✓			✓	
Navicula	✓		✓	✓	✓
Scenedesmus		✓			
Chlorococcum	✓				✓
Gomphonema			✓		
Ciliate			✓		✓
Cymbella			✓		
Gyrosigma		✓	✓		
Pediastrum		✓			
Ulothrix	✓	✓			
Cosmarium		✓			
Fragilaria		✓			
Golenkinia			✓		
Cyclotella	✓				





a – Navicula, b – Spyrogyra, c – Anabaena, d- Golenkinia, e- Gomphonema,

f - Gyrosigma ,g- Cymbella, h- Scenedesmus, i- Oscillatoria, j- Pediastrum,

k – Fragilaria, l- Chlorococcum, m- Ulothrix, n- Cyclotella, o- Cosmarium

DISCUSSION

Temperature

Temperature is important factor for growth and survival for aquatic species by regulating the dissolved oxygen concentration in water, lead to increased biological activity. The average temperature present in corresponding pong ranges between 24 to 26 ^{0}C and which is ideal temperature the pond ecosystem

EC

Electrical conductivity is another key factor that determines

the quality of water. It indicates the amount of dissolved salts in water. More dissolved salts in water, higher the electrical conductivity. Study of EC is crucial in water quality analysis because it provides a way to assess the overall level of dissolved minerals in water. The EC of different ponds ranges between 43 to 345 µS/cm. The EC of each pond satisfied the water quality standards and also indicate the presence of dissolved minerals in the water which may aids to nutritional and beneficial value of water. This study might provide potentiality for assuring the medicinal properties of water.

Chloride

Chloride anion is generally present in natural waters. Chloride was one of the major anion found in water and are generally combined with calcium, magnesium or sodium. High chloride content indicates the accumulation of polluting substances in the water bodies [8]. In this investigation the chloride values are within the permissible limit. Chloride is essential nutrient for proper functioning in human body and not harmful if ingested with adequate amount of fresh water. The good amount of chloride found in respective ponds which ensures the nutritional value of the water.

Ca and Mg

Ca and Mg are generally present in waters, Calcium is necessary for human nutrition and key ingredient in development of teeth and bones. The calcium found in water is readily absorbed by the body, making it good source of mineral. Consuming calcium through water can help prevent osteoporosis. Mg is vital nutrient. Magnesium in water is important because it provide a readily accessible source of the essential mineral for human body and making it beneficial for overall health when present in adequate amounts in drinking water. The present investigation shows the presence of calcium and magnesium with respect to the ponds are in normal range according to BIS and the presence of these minerals in water also supports the nutritional value in these temple pond.

TDS

TDS is the sum of portable charged ions, including salts, that dissolves in particular amount of water. It is directly associated with the purity of water. A higher TDS value is toxic to aquatic life through an increased amount of salinity in water. The measured TDS value ranges from 23 mg/l to 116mg/l and the study shows TDS value within the water standards. This investigation was compared with (Meenakshi *et al*, 2023) as reference.

Total hardness

The total hardness in the water is due to the presence of the ions calcium and magnesium. Total hardness is measured Titrimetrically by the EDTA method. The measurement of hardness in CaCO3 nature indicates a soft condition 0 to 100 mg/l, a medium: 100 to 200 mg/l, a hard condition: of 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 [5]. The measured value varies from 10 mg/l to 260 mg/l. The temple pond water is safe in total hardness for surface water standards.

DO

DO is the amount of oxygen gas that is dissolved oxygen in water. It is key indicator of water quality and essential for aquatic life to survive. DO relationship with water gives information about the bacterial action, photosynthetic process. 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.

BOD

Biological oxygen demand represents the oxygen requirement for the bacteria to perform biological decay of dissolved solids. 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. The study shows temple water has a nil BOD value except pond 2 and moderately in pond 3.

COD

Chemical oxygen demand which measure of the amount of oxygen needed to chemically oxidize all organic matter present in a water sample, essentially indicating the level of organic pollution in the water. It also gives the measure that the amount of oxygen required to break down organic compounds in water through a chemical reaction. The results obtained are safe and acceptable

TDS

Total suspended solids showed high significant positive relationship with turbidity, electrical conductivity, total solid and total dissolved solids. The total suspended solids are composed of carbonates, bicarbonates, chlorides, phosphates and nitrites of calcium, magnesium, sodium, potassium, manganese, salts and other particles. The presence of total suspended solids is the turbidity due to silt and organic matter.

Silicon

The mineral silica present in water in the form of silicon dioxide and believed to having several health benefits which aids in curing wounds, skin diseases, rashes and may help to excrete the aluminum and act as a anti-oxidant. The water exhibits the trace amount of silica which may aids medicinal value to the water and cure the various skin diseases.

Copper, Zinc, Iron, Silver

These elements which are present in water, they release hydration energy. This energy is associated with the formation of aqua complexes and the interaction between the metal ions and water molecules. Copper, Zinc, Iron, Silver are considered as D-block elements can participate in redox reactions with water, releasing energy in the form of heat or light. The presence of d-block elements in water can release energy through various mechanisms, including hydration energy, redox reactions, complexation reactions, and radiolysis. The factors influencing energy release include concentration, temperature, pH, and the presence of other ions.

By above general factors regarding to the D block elements and its properties which capable of forming complexes and exchange of energy through various factors that contributes to

the significant benefits in medicinal properties. On the basis of the characteristics of D block elements, it could be reveal that the ponds having significant role in having medicinal properties and cures the various kind of diseases as one believes about the ponds that having medicinal properties to cure curse, sins and diseases. As they exhibit the various properties like Anti-microbial properties, Antioxidant, Anti-inflammatory properties Wound healing, Neuroprotective properties and Immune system regulation etc.,

Table-5 Species present in ponds and its importance

Sl.No	Species	Importance
1.	Navicula, Cyclotella Cymbella, Gamphonema (diatoms)	Diatoms play an irreplaceable role in water quality regulation, oxygen generation. The wall of diatoms are made up of Silica and thus silica acts as a skin medicine. Navicula species indicates a potential multi mechanism antiviral agent that could be useful in managing chronic infection (Reynolds *et al*, 2021).
2.	Chlorococcum	Genus of green algae which having important health benefits as it is rich source of astaxanthin, that is a potent antioxidant.
3.	Cyanobacteria (Oscillatoria)	Have biochemical pathways that produce unique bioactive molecules which having the medicinal applications like antibiotic, antifungal, antimicrobial, immunosuppressant, anti-inflammatory, antiviral, anticancer, antibacterial properties. Oscillatoria- plays important role in fixing atmospheric nitrogen, contributing to primary production through photosynthesis and serving food source for aquatic organisms and present as dominant species it is being investigated as medicinal organism for cancer and other infectious diseases, some of the study also proved the presence of Phynolic acid, flavonoids, total proteins, total sugar, reducing sugar and free amino acids and phytochemicals like alkaloids, phytosteron, tannin, terpenoids, glycosides and saponin (Tunio *et al*, 2022)
4.	Pediastrum, Ulothrix, Cosmarium, Scenedesmous	Belongs to the desmids(algae) found usually in freshwaters. Scenedesmus (Green algae) present in the water incorporates the importance as environmental indicators and produce oxygen and removes pollutants and indicate water quality.
5.	Gyrosigma, Fragelleria (diatoms)	found in the pond are contributing as bioindicator to monitor the water quality.
6.	Golenkinia	Species belongs to green algae that is important for its potential in biofuel production, wastewater treatment and phyto remediation which has ecological importance for aquatic ecosystem
7.	Anabaena (cyanobacteria)	ability to fixing atmospheric nitrogen thus having significant role in agricultural applications.
8.	Spirogyra	Contain antibacterial properties, nutritional rich species, acts as a medicine and source of carbohydrate. The spirogyra which having the medicinal value to cure skin infections, the ciliates feeds on spirogyra which are the bioindicators of water quality. Spirogyra algae contributing significantly to oxygen production through photosynthesis, plays role in nutrient cycle also having the potential to bioremediation. It has been studied that it has potential to treat the inflammation. Spirogyra contains bioactive compounds that may be used as antibiotics and antivirals and also contains antioxidants.
9.	Anabaena	Capable of fixing atmospheric nitrogen. These filamentous algae has significance in producing oxygen, tolerate environmental stress, contain vitamins minerals and amino acids, also produce antibiotics that can be used to treat infections.

Due to these above concerned factors may evidence the presence of medicinal properties in the water conjointly the presence of these species along with the minerals present in the water substantiate the medicinal properties of water which is capable of curing the various kinds of internal and external disorder.

CONCLUSION

The Water are a resting place for all the Gods. These holy water is believed to have nutritional value and also water in some ponds having the medicinal value which cures the diseases, mental illness and skin related issues. The holy dip from these holy water is also believed to remove all our sins as mentioned from the Vedic era and many epic Rivers get its origin from these temple ponds. Thus the source of river/water is always considered as sacred and important.

The Physico-Chemical properties of water were analysed in the corresponding ponds of Shreedhara Tirtha, Shankara Honda, Ambu Tirtha, Guli-Guli Shankara and Varada Moola. The results correlated with the Physico-Chemical properties of water from each temple pond. The waters are found satisfied as it meets the BIS water quality standards except the Pond 2- Shankara Honda due to heavy load of BOD and pH of 5.6 thus it is not fit for drinking purpose and can be utilized for irrigation as of now practicing However the pond is under regular maintenance. The rest of four ponds are found clean and safe for drinking and other activities also it was found that presence of minerals in respective ponds like Shreedhara Tirtha, Guli-Guli Shankara and Varada Moola. The phytoplankton genera present in ponds also adds up the nutritional and beneficial value to the water and also enhance the quality of water. It ensures the sustainable ecosystem for the species which depend on phytoplankton. Though the ponds are also believed to be have the medicinal value to cure the diseases and removes sin. All the selected temple ponds were considered as sacred, as integral part of our culture and many of the ponds are the birth place of legendary rivers.

The five mentioned Temple ponds are having their own unique shrine which comprises of Mythological, Historical, Scientific and Medicinal aspects from the puranic age, these temple ponds are also the source of origin of Heritage Rivers, some of the ponds contains minerals, significantly important species which tends to impart the medicinal and nutritional value of the water. The selected Temple Ponds are under the regular maintenance and frequently monitoring by the administrations and locals. All the respective ponds are considered as sacred and worshipped as holy sanctum. However further research is necessitated to substantiate the findings and provide conclusive evidence.

Conservation and restoration of temple pond is crucial because of following reasons

Recommendations

The runoff of organic materials along with water into the pond increases the nutrient level of the water and the phytoplankton present in water helps in maintaining or balancing the ecosystem. Bioremediation helps keep the temple ponds clean and hygienic with sustainable cleaning methods. Regular maintenance, constant monitoring, sustainable cleaning methods and hygienic waste management methods are some of the best ways to keep temple ponds premises clean and hygienic. Bioremediation of temple ponds not only keeps it clean but also helps to keep the aquatic life healthy. The preservation of temple ponds helps to maintaining both the quality and quantity of water. This can be achieved by encouragement of local people by creating a proper awareness about the importance of temple pond and water for their active participation by involving local administrative bodies.

However, many temple ponds have faced neglect, pollution, and degradation, threatening their very existence. Efforts to rejuvenate and conserve these sacred water bodies are essential to preserve India's cultural heritage and ecological balance. it is crucial to recognize the significance of temple ponds and work towards their sustainable management, incorporating traditional knowledge and modern practices.

Let us join hands to protect, conserve, rejuvenate and uphold the wisdom of our culture of sacred temple ponds, ensuring their continued relevance and significance for generations to come.

Future prospects

Water resources are disappearing and degrading day by day at the faster rate. The importance of temple ponds often known by fewer. The temple ponds are immortal but yet they are at the risk of extinction. So it is our prior duty to protect and conserve before getting vanished. They contribute to the nature by incorporating the significant role in order to preserve and maintain the environment. These sacred water bodies encase the tradition and wisdom of our ancestors at water conservation. It is very important and responsibility to preserve, conserve and rejuvenate the temple ponds as they are the integral part of ecosystem as they maintain healthy balance of aquatic life and support our socio-economic needs. Thus more active participation of the community in conserving these temple ponds is required at greater level through various Sustainable Management Practices.

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"Temple ponds are often seen as a symbol of spiritual growth, representing the journey of soul towards liberation according to Upanishads, chandogya upanishad 7.10. 1-2"

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