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STUDIES OF PHYSICOCHEMICAL STATUS U NDER RELIGIOUS ACTIVITIES AT GALTA JI PONDS IN JAIPUR

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Abstract:

In this investigation, the degrees of physicochemical and microbiological pollution of water samples collected in Galta Ji, Jaipur, were to be determined. Physicochemical properties including as turbidity, pH, total hardness, dissolved solids, sulphate, nitrate, and total alkalinity were all investigated in this research. For waste water samples, other parameters including pH, dissolved oxygen, BOD, and COD are also calculated. In 2019, water samples from the pond were collected at periodic times, and using conventional techniques, the physicochemical and microbiological tests were examined. The physical and chemical properties of water varied widely, but some of the metrics for the water samples were within the maximum desired limit for drinking established by the WHO whereas the value of BOD and COD is greater as compare to limit.

Keywords: Physicochemical properties, chemical properties, BOD and COD

1. Introduction

Water is the most basic requirement for life on Earth, and it is a necessary component for all kinds of life, from microbes to humans. The dumping of residential sewage and industrial effluents into freshwater bodies pollutes around 70% of India's water supply. According to the World Health Organization, India loses 0.4 million lives per year owing to a shortage of safe and sanitary water (WHO, 2007). India is a country with a diverse cultural heritage and several festivals. Religious activities are an important part of India's cultural history. Apart from idol immersion, numerous religious offerings such as flowers, decorative materials, polish, painted material, polythene bags, and food offerings are dropped in water bodies during the festival, causing pollution.

In temperate climatic zones, lake ecosystems are subjected to considerable leisure activity (Hatvani *et al.,* 2018). Several studies have shown that anthropogenic activities are the primary cause of pollution in all ecosystems (Yunus *et al.,* 2020). In many nations throughout the world, water pollution is one of the most serious environmental issues (Xu *et al.,* 2020). Decades of industry and urbanisation have resulted in increased water pollution, mostly from agricultural runoff and toxic industrial effluents (Purohit *et al.,* 2020).

Reports by the World Health Organization (WHO), suggested that water-borne diseases are one of the leading causes of death in the world, resulting in a mortality rate of 3.4 million every year, most of which occur in children under the age of five years. Further, the waterborne disease caused by pathogenic microorganisms led to over 600,000 deaths per year in low and middle-income countries, amounting to 1.5 million deaths worldwide. In developing countries, there is an obvious lack of suitable sanitary framework and sewage water treatment capacities, provoking the contamination of the environment and drinking water sources (Farkas *et al.,* 2020). The quality of the lake or other surface water systems can be assessed by several physicochemical and biological parameters based on the Designated Best Use (DBU) of the lake water systems.

According to the WHO report, over fifty percent of the world population will be residing in water-stressed regions, by 2025 (WHO, 2019). Over 5% loss in the gross domestic product (GDP) in developing countries is due to pollution. Pollution not only impedes public health and the economy, but can also jeopardize food security, drinking water availability, and biodiversity (Akhtar and Mannan,2020).

Galtaji is a historic Hindu pilgrimage located around 10 kilometres from Jaipur, Rajasthan, India. A succession of temples have been erected into a tiny fissure in the ring of hills that encircle Jaipur. A natural spring springs from the top of the hill and runs down, filling a succession of holy kunds (water pools) where pilgrims wash. Natural springs gather water in tanks at the Monkey Temple, also known as the Sun Temple (kunds). Heavy metal-accumulating monkey faeces are used as markers of heavy metal pollution in the environment, and they can also be a source of heavy metal pollution in the soil and water in Galta Ji, Jaipur (Ha *et al.,* 2019).

2. Methodology

2.1. The description of the study area

Locating in a mountain pass at Aravalli Hill from the 18 th, Galta Ji temple complex encompasses water springs and holy 'kunds' or water tanks. Among these kunds, the 'Galta Kund' is the holiest one and believed to never get dry. A spring of water flows from the 'Gaumukh' - a rock shaped like a cow's head.

2.2. Sample collection

The Indian Standard Methods IS 3025 (Part 1) and the American Public Health Association, 23rd Edition were used to collect about 400 cc of water samples from the two lake sites (2017). The samples were collected in sterile 500 mL vials with dimensions of 43 mm 69 mm 208 mm. The water samples were taken from each site utilising the grab sampling approach using a bucket sampler at a depth of roughly 1 m below the water's surface. The bottles were sealed and secured to prevent air from getting into them, and they were delivered to the study lab within 8 hours of being collected. The samples were stored in a dark room for 4 h, before further processing. The laboratory analysis of samples was done using standard methods (APHA, 1998).

2.3. Physiochemical characterization

Analytical method used for determination of different physicochemical parameters for waters of Galta Ji is listed in Table-1. The water samples were collected from different sites in plastic bottles and transported to the laboratory in an icebox jars to avoid unpredictable changes in different physicochemical parameters. The selected parameters including Water pH, Turbidity, Total alkalinity (TA), Total dissolved solids (TDS), Total hardness (TH), NO_3, SO_4^{-2} were analyzed at regular intervals. The observed values of various physicochemical parameters of water samples were compared with standard values recommended by World Health Organization (WHO, 1993) for drinking purposes. Apart from these parameters Winkler's method (Zhang *et al.*, 2019) was employed to evaluate the Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD) for 5 days. COD is also a measure of pollution in aquatic ecosystems. It estimates carbonaceous factor of the organic matter

3. Results and Discussions

A.) Hydrogen Ion Concentration (pH):

The pH of water is important because many biological activities can occur only within a narrow range. Thus, any variation beyond an acceptable range could be fatal to a particular organism. Present study also shows pH is alkaline in most of samples and it ranges from 7.58-7.83. The pH value of different studied in different samples is within highest desirable limit (HDL) prescribed by WHO which is 6.5 to 8.

B.) Turbidity:

The turbidity is a major problem in the river water of all states. In our investigation, range of turbidity value of Galta Ji pond water is 7.8-16.8 NTU, whereas average turbidity of Galta Ji pond water is 11.724 NTU. During festival season immersion of idols in urban water bodies have grown in number and size over the years and therefore urban water bodies are facing an increasing nutrient load (Vyas *et al*, 2006)

C.) Colour

The colour of water of the Galta Ji pond is partially changed due to numerous religious offerings such as flowers, decorative materials, polish, painted material, polythene bags, and food offerings, domestic waste water and other waste materials from various sources. In our finding, range of colour value of Galta Ji pond water is 7-15 HZN, whereas average colour of Galta Ji pond water is 10.445 HZN.

D.) Chloride ion

In our investigation, range of Chloride ion value of Galta Ji pond water is 61.17-68.5 mg/l, whereas average Chloride ion of Galta Ji pond water is 64.739 mg/l., which was found within the permissible limit for drinking water (250 mg/L) prescribed by IS: 10500 and BIS, FAO.

E.) Total Alkalinity:

Alkalinity of water is important for aquatic life in a fresh water system as it equilibrate pH changes resulting from photosynthesis. In our finding, range of alkalinity value of Galta Ji pond water is 228.28-233.28 mg/l, whereas average alkalinity value of Galta Ji pond water is 230.544 mg/l. The variation of TA is in accordance with fluctuation in pollution load (Parashar *et al.*, 2006). Total alkalinity for all seasons for treated water and GW is within permissible limit of WHO which is 200 mg/l.

F.) Total Hardness:

Hardness is an important parameter in decreasing the toxic effect of poisonous element. In our investigation, range of hardness value of Galta Ji pond water is 264.4-273.55mg/l, whereas average hardness value of Galta Ji pond water is 269.112 mg/l. These high value may be due to the concentration of carbonate and bicarbonate salt of calcium and magnesium.

G.) Total Dissolved Solids:

TDS indicate the total amount of inorganic chemicals in solution. Total dissolved solids consists majorly all of the inorganic and organic substances in the water body that are generally found in the suspended form. In our investigation, range of TDS contents of Galta Ji pond water is 534-545 mg/l, whereas average TDS contents of Galta Ji pond water is 539.88 mg/l.

H.) Total Solids

The total solids in river water consist of total dissolved solid and total suspended solids. It is generally composed of floating matter; settle able matter, colloidal matter and matters in solution. In our finding, range of total solids contents of Galta Ji pond water is 534-550 mg/l, whereas average total solids contents of Galta Ji pond water is 543.013 mg/l.

I.) Sulphate:

Value of SO_4^{-2} contents for ground water and pond water is far below the maximum allowable concentration for sulphate ions in drinking water prescribed by WHO which is 250 mg/l. In our investigation, range of SO_4^{-2} contents of Galta Ji pond water is 39.48- 47.09 mg/l, whereas average SO_4^{-2} contents of Galta Ji pond water is 43.582 mg/l.

For the surface pond water samples show higher values of pH, turbidity, TA, TDS, TH, NO_3, SO_4^{-2} than values of respective parameters for ground water samples. This quality deterioration in pond water is due to various reasons like extent of pollution occurring due to urbanization and anthropogenic activities.

J.) Nitrate:

In present study NO_3 levels are below 45 mg/l according to WHO, range of NO_3 value of Galta Ji pond water is 29.03-38.07 mg/l, whereas average NO_3 value of Galta Ji pond water is 33.712 mg/l. Nitrate showed positive correlation with pH, alkalinity, total hardness, chloride, phosphate and negative relation with dissolved oxygen, TDS and conductivity (Sharma *et al.*, 2011).

K.) COD

Further chemical oxygen demand is the measure of oxygen equivalent of that portion of the organic matter in a sample that is susceptible to oxidation by strong chemical oxidant. It is important rapidly measured parameters for industrial waste water and control of waste treatments. COD test is used to measure the load of organic pollutants in industrial waste water. It was observed that in all the effluents are very much higher than 30.0 mg/l which have maximum permissible limit according references (Fig 1). According to our investigation, the COD value of the water at Galta Ji Pond ranges from 32 to 39.4 mg/l, with an average COD value of 35.360 mg/l.

L.) Dissolve Oxygen (DO)

The dissolved oxygen amount in waste water sample is very less, due to high amount of BOD and COD. In our investigation, range of DO value of Galta Ji pond water is 3.8-10.3 mg/l, whereas average DO value of Galta Ji pond water is 6.816 mg/l

M.) BOD

BOD may be defined as rate of removal of oxygen by microorganisms in aerobic degradation of the dissolved organic matter in water over a 5-day period. Increases in BOD can be due to mix of unwanted religious offerings in pond water. According to our research, the BOD range for the water in the Galta Ji pond is 2-8.1 mg/l, with an average BOD value of 5.015 mg/l.

Galta ji is a water fall and water flows from one side to another. Large type of *Synedra* and *Melosira* along with some other varieties of diatoms i.e. *Rhoicosphenia* and *Cyclotella* were also reported in previous study done by Pareek R and their colleague. Diatoms were found in abundance in this water body (Pareek *et al.,* 2011).

The results of the present investigation point out that the water is not good for human consumption and also struggling for their existence. All of the physicochemical characteristics had high values in the pond sample when compared to the standard. According to this study, devout, religious, and traditional activities at the location have caused the water quality to deteriorate.

However, workers are used to remove solid garbage that is afloat in the surface water. This activity's rotation needs to be enhanced by the Board. The moment has come to start taking the required steps to safeguard the water body. Thus, it is urgently necessary to implement improvements and advancements in waste water treatment techniques as well as a number of policies and goals that are both compatible with and beneficial to both the environment and people.

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Table1 Different physicochemical parameters and their permissible range used for waters samples analysis and compare with Galta ji pond water.

S.r. No.	Parameters	Unit	IS 10500 : 2012 Requirement Acceptable Limit	Water sample from Galta ji pond Mean ± SEM	Range of Various parameters of water collected from Galta Ji (Max-Min. value)	Protocol
1	pH	-	6.5-8.5	7.735± 0.004	7.58-7.83	IS: 3025 (pt-11)-1983, Reaff.2017
2	Turbidity (NTU)	NTU	5	11.724± 0.151	7.8-16.8	IS: 3025 (pt-10)-1984, Reaff.2017
3	Odor	-	-	Agreeable		IS: 3025 (pt-5)-1983, Reaff.2017
4	Color	HZN	5	10.445± 0.119	7-15	IS: 3025 (pt-10)-1984, Reaff.2017
5	Chloride (as Cl)	mg/l	250	64.739± 0.143	61.17-68.5	IS: 3025 (pt-32)-1988, Reaff.2019 (Argentometric Method)
6	Alkalinity	mg/l	200	230.544± 0.087	228.28-233.28	IS: 3025 (pt-23)-1986, Reaff.2019
7	Total Hardness (as $CaCO_3$)	mg/l	200	269.112± 0.147	264.4-273.55	IS: 3025 (pt-21) Reaff.2019 (EDTA Titrimetric Method)
8	Total Dissolved Solids	mg/l	500	539.88± 0.191	534-545	IS: 3025 (pt-16)-1984, Reaff.2017
9	Total Solids	mg/l	500	543.013± 0.219	534-550	IS-3025(Pt-15)1984,Reaff.2019
10	Sulphate (SO_4)	mg/l	200	43.582± 0.122	39.48- 47.09	IS: 3025 (pt-24)-1986, Reaff.2019 Turbidity Method
11	Nitrate (NO_3)	mg/l	45	33.712± 0.155	29.03-38.07	IS: 3025 (pt-34)-1988, Reaff.2019 (Chromotropic Acid Method)
12	COD	mg/l	30	35.360± 0.119	32-39.4	IS: 3025 (pt-58)-2006, Reaff. 2017
13	Dissolve Oxygen (DO)	mg/l	4.00-6.00	6.816± 0.066	3.8-10.3	IS: 3025 (pt-38)-1989, Reaff. 2019 (Titrimetric Method)
14	BOD	mg/l	5(ICMR)	5.015± 0.077	2-8.1	IS: 3025 (pt-44)-1993, Reaff.2019

(Mean ± SEM of 150 Samples)

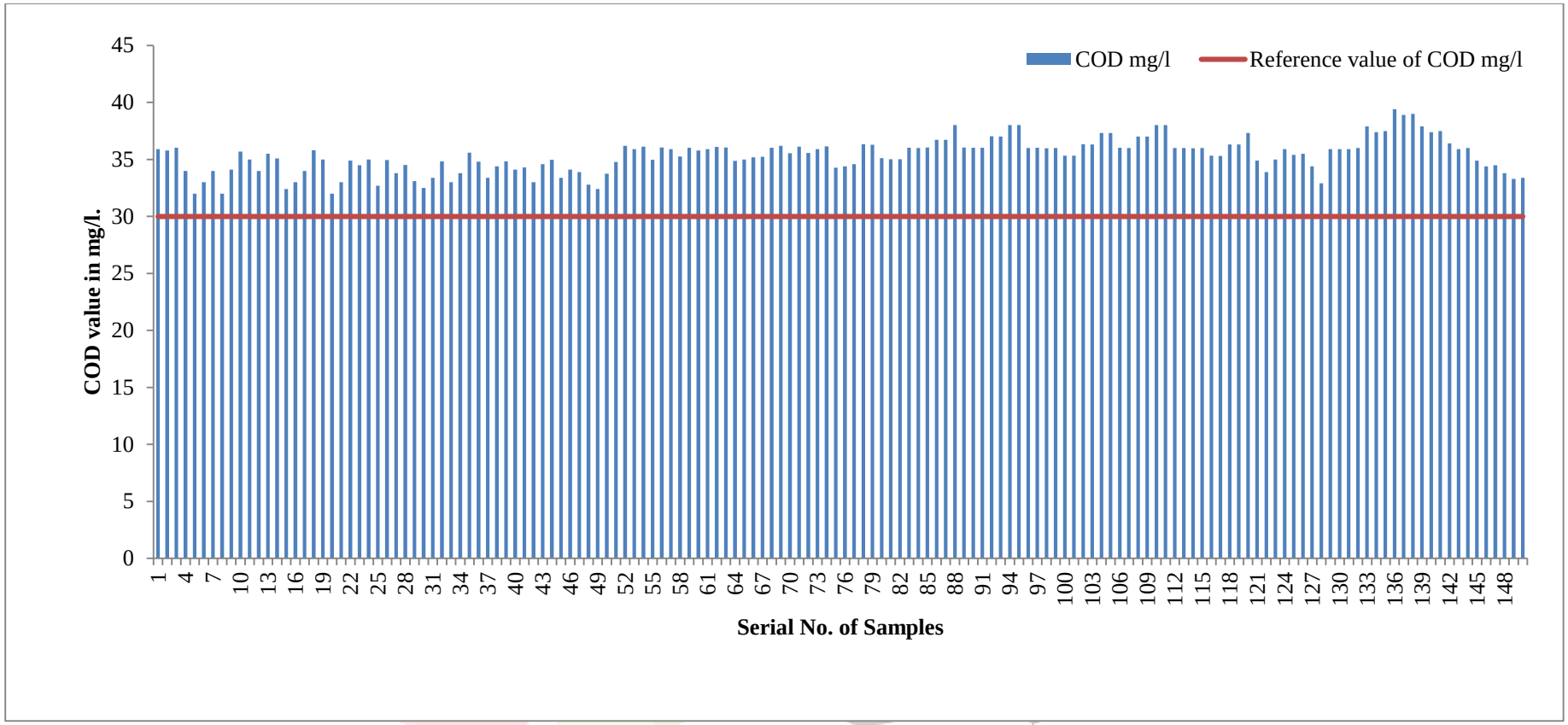

Fig 1 Showing COD value of Galta Ji pond water with reference value 30 mg/l.