

PHYSICO-CHEMICAL ANALYSIS OF WATER SAMPLES COLLECTED FROM CHOWDHURY CHERUVU, SURYAPET DISTRICT, TELANGANA

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Abstract: The aquatic water bodies like rivers, streams and ponds are not only important as water sources but also play a significant role in inhabiting the biodiversity and also responsible for maintaining the ground water level by rain water harvesting. As a result of increase in population and urban growth, these water bodies get polluted due to the discharge of the anthropogenic wastes resulting in poor water quality and leading to loss of flora and fauna and also make water non-potable. The water body may be converted to congenial breeding grounds for the mosquitoes and also for other insect species that thrive in such waters acting as vectors carrying the disease-causing organisms like viruses and bacteria. Therefore, an understanding of basic water chemistry and other physical parameters is necessary for proper management of the water body. In the present study Chowdhury Cheruvu in Suryapet town known familiarly as Saddula Cheruvu with 111.10 acres of catchment area was selected, as there is hardly any data available on the water quality parameters of the pond. Moreover, dengue fever was endemic in some parts of Suryapet district as per the data available from the health department records due to mosquitoes especially *Aedes* species dwelling in the catchment area of the pond. Therefore, the present study was undertaken for the physical and chemical analysis of water like pH, temperature, total alkalinity, nitrates, phosphates, sulfates, biological oxygen demand (BOD) and chemical oxygen demand (COD) etc using standard methods as described by American Public Health Association (APHA, 2017). The water samples were collected in bottles randomly from the water body on weekly basis during the months of January to March 2022 and analyzed for various water quality parameters as mentioned above. The values obtained are compared with that of the normal ranges as prescribed by Bureau of Indian Standards (BIS,1992). The results of the present study showed that some of the physical and chemical parameters are within the permissible limits, but others need to be corrected. The water body can be used for irrigation, as drinking water and also for recreational purposes if maintained well without mosquito menace and the water body can also be developed as mini tank bund and a tourist spot as well if maintained properly. During the present study it was observed that the mosquitoes when reared in normal water and rain water showed differences in the growth rates. Therefore, it is concluded that rain water is the suitable medium for the increased population growth of mosquitoes.

Keywords: Physico-chemical analysis, pH, Turbidity, Alkalinity, Conductivity, Biological Oxygen Demand, Chemical Oxygen Demand

INTRODUCTION:

The aquatic ecosystem as the basic water source is very important to the living organisms to meet different needs in a particular locality. The successful pond management requires an understanding of the water quality. If water quality is overlooked in pond management, it leads to excessive algal blooms, overgrowth of plants, noxious odor, dead and decaying of organisms especially, fish. In order to prevent these problems, an understanding of basic water chemistry and other physical parameters is necessary. In the present study Chowdhury Cheruvu in Suryapet town known familiarly as Saddula Cheruvu with 111. 10 acres of catchment area was selected as there is hardly any data available on the water quality parameters of the pond. Moreover, dengue fever was endemic in some parts of Suryapet district as per the data available from the health department records can be attributed to mosquitoes dwelling in the catchment area of the pond especially *Aedes* species. The present study discusses the physical and chemical characteristics of water samples collected from Saddula Cheruvu and there is no literature available on the water characteristics of this pond. And developing the pond as a mini tank bund in the present context of biodiversity conservation as well as water conservation without any harmful substances is a dire need as the water body has a sprawling habitat for the proper maintenance and growth of aquatic food chain and its associated benefits for the organisms and also human Welfare. Therefore, the present study was undertaken to assess the quality of the water and analyze the physical and chemical parameters like pH, odor, turbidity, color, total dissolved solids, hardness of water (alkalinity), dissolved Oxygen, Nitrates, Phosphates, Sulfates, Biological Oxygen Demand (BOD), and Chemical Oxygen Demand (COD) etc by following the standard methods as described by APHA 2017(1).

DESCRIPTION OF THE WATER BODY:

The present study was conducted on Chowdhury Cheruvu familiarly known as Saddula Cheruvu with 111.10 acres of catchment area located in Suryapet town and district of Telangana state with Geo ID 179149171498, in between the longitude

79.6149 and latitude 17.1498 with an area of 188.35 acres. Total capacity of the pond is 31.392 tmcft. Present available water quantity is 20.405 tmcft. under Musi project and feeding by MLFC channel.

(Source: records and list of tanks collected from office of Mandal Revenue Officer, Suryapet district)

MATERIAL AND METHODS:

The water samples were collected in bottles randomly from the water body Saddula Cheruvu on weekly basis in the months of January to March 2022 and also normal potable water and analyzed for various water quality parameters (2,3) such as physical and Chemical characteristics using standard methods as described by APHA 2017.

The pH of the water sample was estimated by using colorimetric method, the Turbidity-by-Turbidity meter (nephelometer) the total dissolved solids measured by the weight of dried filtrate and comparing it with constant weight at 180°C. The total alkalinity was determined by using phenolphthalein and titration with N/20 Sulphuric acid method. Dissolved oxygen analysis was done by the modified Winkler's method While Nitrates are estimated using the Phenol Di sulphonic Acid method. Phosphates in the water sample were estimated using Stannous Chloride method and Chloride estimation done by Argentometry method. The determination of Sulfates in water samples was by turbidimetry Technique. Chemical Oxygen Demand is by using a dichromate reflux method. Biochemical oxygen demand of the water sample was estimated using the Winkler method.

RESULTS:

The values obtained for various physical and chemical parameters of the samples of pond water are presented in the tables 1, 2 respectively along with the normal ranges as prescribed by IS (BIS) for comparison. The values obtained are mean \pm standard error. The normal potable water was used for comparison of the parameters (Table-3).

Table-I Physical properties of water sample collected from Choudhury Cheruvu, Suryapet

Sl.No.	Water quality parameter	Estimated values (in mg/l)	Optimum range(BIS) (in mg/l)
1.	pH	7.65	6.5-8.5
2	Turbidity	>100	5-10
3	TDS	515	500-2000
4	conductivity	792	U mhos/cm
5	Color	Brown	-
6	Odor	Earthy odour	-
7	Temperature	21-24°C	-

TABLE- 2 Chemical characteristics of water sample collected from Choudhury Cheruvu, Suryapet

Sl.No.	Water quality parameter	Estimated values (in mg/l)	Optimum range(BIS) (in mg/l)
1	Total Alkalinity	184	200-600
2	Dissolved Oxygen	2.4	5
3	Nitrates	6.0	45
4	Nitrites	1.1	0.005-0.5
5	Phosphorus	0.04	0.005-0.05
6	Chlorides as Cl	120	250-1000
7	Sulfates as SO ₄	68	200-400
8	Chemical Oxygen Demand	10	20-200
9	Biochemical Oxygen Demand	1.4	1-2 very good 3-5 fair

Table 3: Comparison of the different parameters of both normal potable water and pond water

Sl.No	Water quality parameter	Normal potable water Estimated values (in mg/l)	Pond water Estimated values (in mg/l)
1	pH	8.18	7.65
2	Turbidity	>100	>100
3	TDS	373	515
4	Total Alkalinity	108	184
5	conductivity	574	792
6	Dissolved Oxygen	1.90	2.4
7	Nitrates	4.0	6.0
8	Nitrites	0.6	1.1
9	Phosphorus	<0.01	0.04
10	Chlorides as Cl	60	120
11	Sulfates as SO ₄	85	68
12	Chemical Oxygen Demand	20	10
13	Biochemical Oxygen Demand	2.8	1.4

DISCUSSION:

PHYSICAL PARAMETERS:

pH is a measure of hydrogen ion concentration in solution and is also referred to as the degree of acidity or alkalinity (4). pH is also an important parameter in the monitoring and control of anaerobic bacteria, as low pH shows the inhibitor effect on them(5). The optimal pH is required for the growth of different aquatic organisms in the water body. The range as per BIS is 6.5 to 8.5 mg/l (6) is permissible for human consumption. As the pH of the present water sample was measured as 7.65 mg/l. which is the favorable condition of the pond for aquatic life.

Turbidity is one of the important physical parameters of a water body. The turbidity can be caused by silt, sand, mud, bacteria, other germs and chemical precipitates. In the present study the water sample showed the turbidity as more than 100 NTU(Nephelometric Turbidity Units). By the increased turbidity, temperature of the water body increases and water holds less dissolved oxygen resulting in low light reaching aquatic flora and fauna. Also the sediment particles can clog fish gills and bury fish eggs (7,8). As per the analysis of different physical parameters turbidity is estimated as high than the optimum range (BIS) as the silt, sand and mud is noticed in the water sample.

Total dissolved solids refer to the total concentration of dissolved substances as inorganic salts and a small amount of organic matter anions like carbonates (CO₃⁻), bicarbonates(HCO₃⁻), nitrates(NO₂⁻), chlorides(Cl⁻), sulfates(SO₄⁻) and cations like Calcium, Magnesium, Potassium and Sodium . High concentration of TDS caused by the excessive dissolved solids due to waste water discharge into the water body resulting in the hardness of the water. The taste of water also varies with the TDS Concentrations . As per the BIS the concentration of TDS will be in the range of 300 -600 mg/l is optimum and the present water sample was estimated for TDS and noted as 515 mg/l in permissible limits (9).

Conductivity is the ability of the liquid to conduct electric current. It is useful to evaluate the water purity, as it was estimated 792 mg/ml shows the increased dissolved slats percentage. The water samples collected from Choudhury Cheruvu were observed as brown in color by the natural debris like leaves and some algae also found. Pond containing stagnant water, and rid of rain water and algae led to the unpleasant smell.

The samples collected from Choudhury Cheruvu during the months of January and February, the temperature range was found to be between 21-24°C was recorded.

CHEMICAL CHARACTERISTICS:

Total alkalinity is a measure of the ability to neutralize acidic pollution by alkaline compounds in the water body such as carbonates, bicarbonates, hydroxides, remove H⁺ ions and lower the acidity of the water (10). Total Alkalinity helps in maintaining the PH levels in a water body by either releasing or attracting a Hydrogen ion(H⁺) as needed. Total alkalinity of the present water sample was measured as 184 mg/l whose optimum range in a pond is 200-600 mg/l (11). The alkalinity in the water body is influenced by rocks and solids, salts, certain plant activities and certain industrial wastewater discharges (10).

Dissolved oxygen is the amount of oxygen in the water body which is essential for growth and reproduction of aerobic aquatic life. During the decomposition of organic matter by microorganisms in the water body the dissolved Oxygen in water is consumed, resulting in a decreased oxygen levels in water, hypoxia or anoxia. And DO levels also vary with the temperature and elevation of the water in the pond. While each organism has its own DO tolerance range, as DO levels drop, some sensitive animals may move away, decline in health or even die (12). The introduction of organic waste, especially domestic and animal sewage, industrial wastes of paper mills, leather manufacturers, crop wastewater dramatically reduce the DO in water . as the low or extremely high levels of dissolved oxygen can impair or even kill fishes and other organisms like invertebrates (13). A healthy waterbody should generally have the Dissolved Oxygen concentration about 6.5-8mg/l (14). Dissolved oxygen of the present water sample is estimated as 2.4ppm as the DO levels below 3ppm are stressful to most aquatic organisms like fishes (15).

Nitrates and nitrites are the forms of nitrogenous waste products in a pond. Nitrogen is essential as plant nutrient but in excess amounts together with phosphorus can accelerate eutrophication (16), which affects the dissolved oxygen levels in the waterbody and leads to the stress or massive deaths of fish and shrimps (17,18) Nowadays high density and intensive farming models, sewage and mineral deposits are resulting in nitrogen accumulation in the water body and stimulate the growth of bacteria (19). In the present water sample nitrates are estimated as 6.0 mg/l in the acceptable range up to 45 mg/l and nitrites are estimated as 1.1 mg/l as the acceptable range is up to 0.5 mg/l

Phosphorus is a crucial nutrient for all living and its common source is decaying organic matter, fertilizer runoff. Sometimes these may result in the accumulation of phosphorus in the water body causing eutrophication (20). The household sewage and industrial effluents are the main source of increased phosphorus levels in a water body initiating the growth of algae (algal bloom), bacterial growth and finally resulting in the low dissolved oxygen levels in the water affecting aquatic life (21). Estimated phosphorus levels in the present water sample are 0.04 mg/l which is in the optimum range 0.005- 0.05 mg/l as per BIS.

Estimated value of chlorides in the present sample is 120 mg/l below the optimum level 250-1000mg/l (22,23,24). If the chloride levels are raised in freshwater bodies, the fish and other aquatic life is affected and they can't survive in such waters with high chloride content.

The optimum sulfate levels in pond water will be below 400 mg/l. In the samples tested in our study the sulfates are estimated as 68 mg/l. Increase in sulfate level may lead to severe health problems in aquatic flora and fauna (25,26,27).

Chemical oxygen demand is the amount of oxygen required for chemical oxidation of organic matter, i.e., the estimation of COD is a measure of oxygen used for the breakdown of organic substances in the water body (28). Chemical oxygen demand is the amount of oxygen required to oxidize all soluble and insoluble organic compounds present in a volume of water (29) High COD in water indicates greater levels of oxidizable organic matter and consequently a lower amount of Dissolved Oxygen. Critical DO depletion due to organic contamination can kill off aquatic life forms (30). As per BIS the optimum range of COD in a water body is up to 200 mg/l as in our present sample COD was calculated as 10 mg/l and this lower level of COD is indicating that not much of organic matter is getting breakdown in this water body (31).

Biological oxygen demand is represented as the amount of oxygen consumed by the microorganisms for the decomposition of the organic matter produced by human activities in the form of sewage that is introduced into a water body. The BOD decreases the percentage of dissolved oxygen and causes deprivation of oxygen to aquatic life due to increase in the decomposing bacteria. As per BIS the amount of BOD 1-2 mg/l is in very good range and 3-5 mg/l is fair. The BOD of our present water sample was estimated as 1.4 mg/l which shows a very good control of organic matter and decomposing bacteria in such a water body (32)

CONCLUSION:

In the present study all the parameters are conformed to the permissible limits except the higher levels of turbidity and total nitrogen percentage are indicating that the water body is getting contaminated. By the increased turbidity levels, temperature increases and the warmer water holds less dissolved oxygen and also results in less light penetration into the water body affects the aquatic flora and fauna. Even though nitrogen is essential for life, high density and intensive accumulation of nitrogen together with phosphorus can accelerate eutrophication and stimulate the growth of bacteria and aquatic plant growth leads to the stress or massive deaths of fish and shrimps.

From the table 3 comparison of the different parameters of both normal potable water and pond water it is concluded that the pond water is the suitable medium for the increased population growth of mosquitoes. By the vast catchment area, this pond also facilitates the outburst of mosquito population as a natural breeding site for mosquito larvae resulting in outbreak of mosquito borne diseases.

The results of the present study showed that some of the physical and chemical parameters are within the permissible limits, but others need to be corrected. The water body can be used for irrigation, as drinking water and also for recreational purposes if maintained well without mosquito menace and the necessary action to be taken for the increased pond quality by preventing the entry of sewage water to the pond and proper pond management and better water quality should be maintained for biodiversity conservation the water body can also be developed as mini tank bund and a tourist spot.

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CONFLICT OF INTEREST:

We are declaring no conflict of interests exist.

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