P: ISSN NO.: 2394-0344 RNI No.UPBIL/2016/67980 VOL-3* ISSUE-10 (Part-1)* January 2019
E: ISSN NO.: 2455-0817 *Remarking An Analisation*

Studies of Physico-chemical Status of the Ponds at Bishnupur, Temple City under Anthropogenic Influences

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Abstract

Scarcity of water, pollution load, political issues and rising population has drawn a great attention for proper management of water resources such as surface water in 21st century. India is one of the developing country having prosperous fresh water resources in the form of rivers, ponds and lakes etc. Bishnupur is a temple city and is popularly known for its ponds & Bandhs. The developments, urbanization and load of the various pollutant sources lead to deterioration of the ponds. In the present study physico-chemical quality parameters of two major Bandhs existing from historic period at the Bishnupur city is studied. The important water quality parameters studied were temperature, pH, dissolve oxygen (DO), and dissolve carbon di-oxide (DO2) in Pokabandh and Lalbandh site have objectionable.Water quality especially with respect to human health, biotic life and entire ecosystem. The catchment area study to find out the major contributor of the deterioration in water quality of these ponds reveal various ritual activities, municipal waste water, washing discharge of detergents and animals waste.

Keywords: Anthropogenic, Bandh, Urbanisation, Pollution.

Introduction

India is a country having various land forms and rivers. There are 14 major rivers in India. Water, the universal solvent because of high dielectric constant has the property of dissolving most of the substances but the access of these substances leads to water pollution (Gautam, 1990). The water bodies get polluted due to the discharge of effluents from the industries, domestic activities, and soil pollution from the nearby dumping sites and agricultural drainage. These factors results in the deterioration of water quality of the various water bodies (Chakra borty et al., 1959). Singh and Rai, 2003 studied that the impact of the industrial effluents and domestic sewage at and reported that all the pollution parameters are beyond the permissible limits and unfit for human consumption. Water resources are declining day by day at the faster rate due to rapid urbanization and population load. Deterioration of the water quality is now a global problem (Mahananda et al, 2010). From ancient times the rain water is being stored in small water body like ponds and Bandhs and in most of the area in India. This water body work as water reservoir for various purposes throughout the year (Arya et al, 2011). Bishnupur is known as the Temple city in West Bengal. Visitors come from different parts of India throughout the year in this heritage city. The important ponds and Bands are very often used for various activities. There are several well known Bands such as Pokabandh, Lalbandh, and Jamunabandh in Bishnupur. Recently,Dutta et al has reported that the several ponds in Bishnupur are in highly polluted situation due to various anthropogenic activities (Dutta et al, 2014).

Objective of the Study

The physico-chemical parameters have important significance in determining the trophic status of aquatic habitats (Sharma et al, 2009). The accumulation of various kinds of pollutants and nutrients through the domestic sewage, municipal effluents, and agricultural runoff in to the ponds leads changes in the physico-chemical characteristics of fresh water. Current study was under taken to investigate water quality of Bishnupur bandhs because of its importance in ground water recharging, irrigation and drinking purpose. Study of physico-chemical characteristic of any water body largely depends on its existing meteorological conditions and structural status of its catchment area (Arya et al, 2011a).

Review of Literature

In India, man-made ponds have been used as an alternate source of drinking water and employed for washing of clothes and bathing purposes by washer men and local people (Prakash et al, 2009).

Therefore two major sources of pollutants are bathing especially thenearby peoples and disposal of wastes originating from the houses of municipal areas. Rapid growth of urban areas directly or indirectly affected existence of the ponds such as over exploitation of resources and improper waste disposal practice (Murhekar 2011). Anthropogenic activity on pond ultimately, deteriorate the water quality, accumulation of toxic chemical and sediment, leads to loss of aesthetic value (Chaurasia and Pandey 2007).The pond water is mainly affected due to the various anthropogenic activities, by the people living in the nearby areas (Gupta et al, 2011a).

Concepts & Hypothesis

Water covers 71% of the Earth's surface (CIA The world fact book) and thus is vital for life (Annan 2005). It is estimated that 96.5% of the water is in seas and oceans, 1.7% is groundwater, and 1.7% is fixed in glaciers and ice caps in the Arctic and Antarctic circles. A large proportion of water exists in water bodies, and a much smaller fraction (0.001%) is suspended in the air as vapours, clouds, etc., which falls as precipitation. Thus, only 2.5% of the Earth's water is fresh water, and 98.8% of this is held as ice and groundwater. Less than 0.3% of fresh water is contained in rivers, lakes and the atmosphere, while an even lower amount (0.003%) is in biological bodies and in manufactured products. Safe drinking water is a necessity for humans as well as other organisms, although it does not contain any calories or organic nutrients. Globally, the availability of safe drinking water has improved in the last few decades. However, approximately one billion people still do not have access to safe drinking water, while another 2.5 billion do not have adequate sanitation. There is a clear correlation between access to safe water and GDP per capita expenditure incurred on goods and services including compensations of employees. However, it is estimated that by 2025 over half the world's population will be vulnerable .A report published in November 2009 (Mckinsey 2009) indicates that by 2030 water demand in certain developing countries is likely to exceed supply by over 50% (Mckinsey 2010). Water has a role in the global economy; it has uses as a solvent in a wide range of chemical preparations, in cooling towers, transportation and industry. It is estimated that around 70% of fresh water is used in agriculture (Baroni et al. 2007). Water is becoming scarcer as the human population continues to grow and demand high quality water for domestic purposes and economic activities.

Research Design

Location

Water samples were collected from the two different Bandhs at Bishnupur temple city for the analysis of physico-chemical parameters. Bankura district is a part of Burdwan Division. It is situated between 22° 38' and 23° 38' north latitude and between 86° 36' and 87° 46' east longitude. It has an area of 6,882 square kilometres (2,657 sq mi). Samples were collected in BOD bottle previously cleaned by distilled water. During sampling, containers were dipped in water for the *Studies of Physico-chemical Status of the Bands at Bishnupur Temple City* filled it at a depth of 30 centimeter below the surface of the pond from each of the two sampling sites.

The samples were labeled and transported to the laboratory, stored at 40C in the refrigerator for analysis of selected parameters. The city of Bishnupur is located in the district of Bankura inWest Bengal.

Material and Methods

The standard methods of APHA (1995) were followed for the analysis of physico-chemical parameters.

The samples were analyzed for four selective major parameters such as pH, temperature, dissolved O2 &CO2. Each of the Bands water samples were analyzed for pH and temperature by digital pH meter, Dissolved Oxygen and Biochemical Oxygen Demand were estimated by Winkler's Method and dissolved carbon di-oxide by Alkali titrimetric method. The experimental results were compared to the permissible limit of drinking and irrigation water quality standard (BIS, IS-10500, FAO).

Results and Discussion:

Observation on August-September-2018

Observation	pH	Temperature
1.(Pokabandh)	6.9	22 °C
2.(Lalbandh)	6.3	24°C

Observation (DO2) Pokabandh	Initial burette reading	Final burette reading	Difference of reading	Mean reading
1.	12.4	21.2	8.8	
2.	21.2	29.9	8.7	8.76
3.	29.9	38.7	8.8	

Observation (DO2) Lalbandh	Initial reading	Final burette reading	Difference of reading	Mean reading
1.	16.5	25.0	8.5	
2.	25.0	33.4	8.4	8.46
3.	33.4	41.9	8.5	

Observation (DCO2) Pokabandh	Initial reading	Final burette reading	Difference of reading	Mean reading
1.	15.5	16.9	1.4	
2.	16.9	18.4	1.5	1.43
3.	18.4	19.8	1.4	

Observation (DCO2) Lalbandh	Initial reading	Final burette reading	Difference of reading	Mean reading
1.	13.5	14.4	0.9	
2.	14.4	15.4	1.0	0.93
3.	15.4	16.3	0.9	

Observation on December-January-2019

Observation	pH	Temperature
1.(Pokabandh)	6.8	18 °C
2.(Lalbandh)	6.1	19°C

Observation (DO2) Pokabandh	Initial burette reading	Final burette reading	Difference of reading	Mean reading
1.	10.6	20.1	9.5	
2.	20.1	29.5	9.4	9.5
3.	29.5	39.1	9.6	

Observation (DO2) Lalbandh	Initial reading	Final burette reading	Difference of reading	Mean reading
1.	17.5	26.6	9.1	
2.	26.6	35.8	9.2	9.10
3.	35.8	44.8	9.0	

Observation (DCO2) Pokabandh	Initial reading	Final burette reading	Difference of reading	Mean reading
1.	13.4	14.8	1.4	
2.	14.8	16.3	1.5	1.50
3.	16.3	17.9	1.6	

Observation (DCO2) Lalbandh	Initial reading	Final burette reading	Difference of reading	Mean reading
1.	10.5	11.2	0.7	
2.	11.2	12.0	0.8	0.8
3.	12.0	12.9	0.9	

Observation on February-March -2019

Observation	pH	Temperature
1.(Pokabandh)	6.5	34 °C
2.(Lalbandh)	5.3	36°C

Observation (DO2) Pokabandh	Initial burette reading	Final burette reading	Difference of reading	Mean reading
1.	12.5	19.7	7.2	
2.	19.7	26.8	7.1	7.20
3.	26.8	34.1	7.3	

Observation (DO2) Lalbandh	Initial reading	Final burette reading	Difference of reading	Mean reading
1.	14.0	20.8	6.8	
2.	20.8	27.7	6.9	6.93
3.	27.7	34.8	7.1	

Observation (DCO2) Pokabandh	Initial reading	Final burette reading	Difference of reading	Mean reading
1.	10.4	10.9	0.5	
2.	10.9	11.5	0.6	0.60
3.	11.5	12.2	0.7	

Observation (DCO2) Lalbandh	Initial reading	Final burette reading	Difference of reading	Mean reading
1.	06.5	07.0	0.5	
2.	07.0	07.4	0.4	0.46
3.	07.4	07.9	0.5	

Findings

The results in the month of August & September show that in Pokabandh pH is 6.9, Temp.is 22°C, Dissolve O2 is 8.76 and CO2 is 1.43.In Lalbandh pH is 6.3, Temp. Is 24°C, Dissolve O2 is 8.46 and CO2 is 0.93.The result in the month of December & January show that in Pokabandh pH is 6.8, Temp.is 18°C, Dissolve O2 is 9.5 and CO2 is 1.5.In Lalbandh pH is 6.1, Temp. Is 19°C, Dissolve O2 is 9.1 and CO2 is 0.8.The result in the month of March & April show that in Pokabandh pH is 6.5, Temp.is 34°C, Dissolve O2 is 7.2 and CO2 is 0.60.In Lalbandh pH is 5.3, Temp. Is 36°C, Dissolve O2 is 6.93 and CO2 is 0.46.Thus the data of study indicate that the dissolved O2 level decrease with the increase of temperature. Also the dissolved CO2 level decreases with the increase of temperature. The pH level indicates that the water qualities in both the ponds are acidic in nature, which is not suitable for aquatic lives. Thus the data of study indicate that the both the ponds are highly polluted and unsafe for human use.

Dissolved oxygen (DO) is an important water quality parameter for various purposes. DO levels in surface water body indicate the ability to support aquatic life. In the present study, DO vary from 3.3-3.4 mg/l at site I, 3.2 -3.7mg/l at site II. The amount of DO in water has been reported not constant but fluctuates, depending on the local temperature and depth of the water bodies. The decrease in DO at site I may be attributed to absence of little turbulence in the Pond water and dumping of effluents along with urban garbage. As with other gases, the solubility of carbon dioxide in water decreases as the temperature increases.

A pH t pH: Effects on Aquatic Life:

11.0-11.5	Lethal to all fish species
10.5-11.0	Prolonged exposure is lethal to some species
9.0-10.5	Prolonged exposure is harmful to some species
8.2-9.0	Unlikely to be directly harmful to fish
6.5-8.2	Optimal for most organisms
6.0-6.5	Unlikely to be directly harmful to fish
5.5-6.0	Metals trapped in sediments are released in forms toxic to aquatic life
5.0-5.5	Bottom dwelling bacteria die, detritus accumulates, plankton begin to disappear, snails and clams absent
4.5-5.0	Many insects absent, most fish eggs will not hatch
4.0-4.5	All fish, most frogs, and insects absent
3.5-4.0	Lethal to some fish species
3.0-3.5	Unlikely that fish can survive for more than a few.

Conclusion

Fresh water is a precious resource as it constitutes only 0.3% of total water resources across the globe. Water is essential for life. Availability of water is subject to natural influences and anthropogenic activities. However, anthropogenic influences on water quality have the most impact on life. Natural influences on water quality include geological and hydrological processes and climatic changes, which may be gradual or rapid. Anthropogenic factors affecting water quality in rural areas differ from those in urban areas. In rural areas they include agriculture practices, e.g. use of fertilizers, herbicides and pesticides; river siltation due to erosion; nutrient loading in waters; run-off from degraded forest areas; and animal husbandry. Anthropogenic factors that affect water quality in urban areas include industrialization, sewage discharge and other domestic activities. Changes in land use pattern including changes in land cover also adversely affect water flow and quality. In rural environments, especially in developing countries, the anthropogenic influences are less profound; those due to industrialization and commercialization may not be present at all. Water pollution due to industrial wastewater is absent in rural areas while surface flow from commercial areas. The rural environment is thus a pristine one. The quality of surface water and groundwater is a sensitive issue as far as health is concerned. Contamination of these resources should be prevented, controlled and reduced. Heavy metal contamination and contamination due to potassium ions, nitrates, phosphate, chloride and organic solvents need to be removed. Faecal pollution also urgently needs to be addressed.

Suggestion

There is a need of awareness among the local people to maintain the ponds at least their optimum quality and purity levels. The onset of monsoon helps in diluting the pollutants but awareness and proper management practices such as planting trees around ponds, regularly recharging during summer period, removal of sediments from the bottom of pond, removal of floating debris from the pond surface, diversion of sewage discharge to proper disposal site and proper enforcement of law and policy might be very successful.

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