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Physio-Chemical Analysis of Pond Water in Berhampur Town Odisha

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Abstract

The study assessed the water quality of six pond water of Berhampur town of Ganjam district, Odisha. The results of this present comparative study of pond water were carried out by taking certain important parameters like Temperature, PH, Transparency, Total dissolved solid, Total suspended solid, Redox potential, Dissolved oxygen(DO) , Biological oxygen demand (BOD), Chemical oxygen demand (COD), Total hardness, Chloride and also macrophytes were analyzed. The Temperature, PH, were found normal range ,but other parameters like TDS, TSS, COD, alkalinity were found to be very high where as the DO and BOD were found to be very low. This is because of sewage, municipal waste and domestic effluents discharge in to the water body and excessive facial contamination and human unhygienic habits like washing. In the present study, among the six ponds the Golapalli Pond(Sample-E) and Gudikhai pond(Sample-F), were highly polluted ,because many parameters like BOD Total Alkalinity, TDS,TSS.COD were found to be very high than the other ponds. So these ponds are unsafe for human use like washing, bathing and other uses. Following control measures are required to protect the water bodies of these ponds.

Keywords: Water Quality, Pond, BOD, TDS.

Introduction

Water plays an important role in the development of healthy society. It is the most abundant and most useful compound in the world .Life is not possible without water . 70% surface of earth is covered by water, Majority of water available on the earth is saline in the nature only 3 % of exists as fresh water. Fresh water has become a scare commodity due to over exploitation and pollution (Ghosh and Basu 1968: Gupta and Shukla 2006). The water quality in ponds, rivers and streams may vary depending on the geological morphology, vegetation and land use (modification by human activities such as agriculture, industrialization and urbanization) in the catchment. Industries, agriculture and urban settlements produce nutrients (sewage effluent and fertilizers) and toxic substances, such as organic and inorganic pollutants, and other chemicals including heavy metals. Water pollution occurs when these substances, which degrade the water quality of river, enter the waterway and alter their natural function. Where ponds and lakes have been profoundly altered and have lost much of their value, the scientific understanding of these water bodies is being used in prescribing restoration methods (Lewis, 2000). The study on the physio-chemical analysis of water is of great significance in removing the constraints in the pond.

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Effluent quality evaluation is also based on Physio-chemical parameters. The physicochemical parameters of the pond have been shown to influence the rate of bio degradation in the pond. Temperature has a direct effect on important factors such as growth, oxygen demand, food requirements and food conservation efficiency. This refers to the amount of suspended matter dirt, organic particulates plankton etc, in the water. Turbidity determines visibility in the pond. Whether turbidity indicates a real problem or not depends on the type of particulate matter suspended in the water. Water turbidity in fresh water pond is caused by phytoplankton and zooplankton and suspended solid such as clay and soil particles in the water column. This work deals with physio-chemical and macrophytes analysis of water samples of six ponds located in Berhampur town, The research project was conducted with an objectives to check the quality of water whether it is safe for bathing, washing and other uses or not by the comparative physio-chemical and macrophytes analysis of water samples using standard methods.

Material and Methods

Description of study area

Water samples were collected from six different ponds located in Berhampur town in Ganjam district, Odisha India during July to December 2015. The place Berhampur is situated in Ganjam districts of Odisha, India. It is situated at 19.32 North latitude, 84.78 East longitude and 31 meters elevation above the sea level. It is one of the oldest and largest cities of odisha, Nick

named 'The silk city'. It is famous for its silk saries, temple and unique culture. All the ponds are the water source for use of bathing, washing for local human and sometime drinking water for cattle. Much information are not available on the water quality, pollution load and aquatic macrophytes. So, keeping all these facts in mind six ponds were chosen for detailed study.

Table I. Location of ponds/sampling points of water collection in Berhampur Town, Odisha

Sl.No.	Location of ponds/ Sampling points	Code no.
1	Bijipur pond at Bijipur.	Sample-A
2	Sunari pond at Santoshi maa mandira.	Sample-B
3	Beda pond at Sastrinagar.	Sample-C
4	Ramalingam pond at Anapurna market.	Sample-D
5	Golapalli pond at New bus stand Road.	Sample-E
6	Gudikhai pond at Mukti padar sahi.	Sample-F

Sampling

Samples were collected in 300ml glass bottle for DO and BOD also sample were collected in plastic bottle for other physio-chemical parameters, pre-cleaned by washing with detergent rinsed in tap water. Before sampling, the bottles were rinsed two times with sample water before being filled with the sample. The sampling were done in the morning 8 AM to 10 AM and the containers were dipped and filled at a depth of 25-30 cm below the surface of pond. The sample was mix together in a plastic container labeled and transported into laboratory and stored in a freeze for further analysis.

Physio Chemical Analysis

Analysis was carried out for various water quality parameters such as Temperature, PH transparency, TDS, TSS, Redox potential, DO, total hardness total alkalinity, chloride, BOD, COD following the standard methods(Gupta,2001). Besides, the macrophytes were also analyzed.PH, temp, transparency and macrophytes were determined on the site of collection while other parameters were analyzed in the laboratory using standard method. The reagents used for the analysis were of high quality and double distilled water was used for preparation of solutions.

Results

The variation in physio-chemical characteristics of six ponds have been summarized in the Table II and macrophytes analysis in Table III.

Table II. Physio-chemical parameters of water samples collected from ponds of Berhampur Town, Odisha

Sl.No.	**Pond's Name**	**Temp (˚C)**	**pH**	**Transparency (c.m.)**	**TDS (g/L)**	**TSS (g/L)**	**Redox pontential (mill V)**	**D.O. (mg/L)**	**Alkalinity(g/L)**	**Total Hardness (g/L)**	**Chloride (g/L)**	**BOD (mg/L)**	**COD (mg/L)**
1	Bijipur pond (sample-A)	27.6	6.3	35	0.40	0.16	90±2	2.22	0.48	0.19	0.17	1.61	480
2	Sunari pond (sample-B)	29.0	6.8	24	0.44	0.10	70±3	2.62	0.50	0.11	0.14	1.21	300
3	Beda pond (sample-C)	27.0	6.9	25	0.46	0.12	33±3	2.82	0.50	0.28	0.25	1.42	440

4	Ramalingam pond (sample-D)	28.0	6.4	30	0.54	0.14	74±2	2.01	0.67	0.14	0.22	1.22	400
5	Golapalli pond (sample-E)	27.5	6.7	21	0.48	0.20	70±2	3.02	0.51	0.13	0.18	1.82	520
6	Gudikhai pond (sample-F)	28.2	7.2	18	0.56	0.24	52±1	1.81	0.53	0.12	0.21	1.62	440

A macrophyte is an aquatic plant that grows in or near water and is emergent, submerged or floating in lentic and lotic habitat. Macrophytes provide cover for fish and substrate for aquatic invertebrates, produce oxygen and act as food for some fish and wild life. A +ve sign indicates the presence of the macrophytes and –ve sign indicates the absences of macrophytes were observed in the following sampling points.

Table III. List of Macrophytes found in ponds of Berhampur Town, Odisha

SL.NO	Scientific name	Sampling points					
		Sample A	Sample B	Sample C	Sample D	Sample E	Sample F
1	*Nymphea sp.*	+	_	+	+	_	_
2	*Nelumbo nucifera*	+	_	+	+	+	_
3	*Cynodon dactylon*	+	+	+	+	+	+
4	*Pistia stratiotes*	+	+	_	_	+	+
5	*Ipomea aquatica*	+	+	+	+	+	_
6	*Azolla pinnata*	+	+	_	_	+	_
7	*Typha sp.*	+	_	+	+	+	_
8	*Commelina sp.*	+	+	+	+	+	+
9	*Cyperus. Sp.*	+	+	+	+	_	_
10	*Eichornia crasslpes*	–	–	+	–	–	–
11	*Jussiaea repens*	_	+	_	+	+	_
12	*Polygonum glabrum*	–	+	–	+	+	–

Discussion

Temperature

Temperature is the measurement of hotness of any material .It affects the physical and chemical properties of water and also affects the aquatic vegetation, organisms and their biological activities .During this study, temperature of the samples ranged from 27°C to 29°C.Maximum temperature was observed in sample B and minimum was observed in sample C. Thripathaih et al (2012) and Shyamala et al,(2008) also reported the range of temperature in between 24.75 to28.5°C and 26.3 to 27.2°C respectively.

pH

The pH values were analyzed using digital pocket pH meter was found to be more or less similar in all samples, and, the pH values ranged from 6 to 8. Maximum pH was recorded in sample F where as minimum observed in sample A. The pH was within the permissible range 6 to 8 by WHO. According to Medera et al (1982) the pH of most natural water ranges from 6.5 to 8.5, while deviation from the neutral 7.0 is as a result of carbon dioxide or bicarbonate or carbonate equilibrium. Choudhary et al. (2014) reported a range of

pH in between 7.0 and8.3.According to Umavathi et al. (2007), pH ranged between 5.0 to 8.5 is best for planktonic growth.

Transparency

Transparency directly proportional to the amount to the amount of suspended organic and inorganic matter. Transparency of water relates to the depth that light will penetrate water. During this study transparency ranged from 18 c.m to 35 c.m .Maximum transparency was observed in sample A whereas minimum was observed in sample F.

Total dissolved solids (TDS)

Total dissolved solids are the solids of water in the dissolved state which contains carbonates, bicarbonates, chloride, calcium, phosphate etc (Esmaeili and Johal, 2005).In present investigation, the TDS ranged from 0.40g to 0.56g/l .Maximum TDS was observed in sample F where as minimum observed in sample A. The Present observation reported higher concentration TDS which is similar to the findings of Nagaraja *et al.,* (2011) and Shamal (2011). Excess amount of TDS increase due to increased amount of surface runoff (Pawar 2010).

Total suspended solid (TSS)

Suspended solid are particles that large enough and do not pass through the filter used to separated them from the water.TSS ranged from 0.10 to 0.24 g/l. Maximum TSS was observed in sample F where as minimum observed in sample B.

Redox potential:

In this study Redox potential ranged from 33 to 90.Maximum redox potential was observed in sample A whereas minimum observed in sample C.

Dissolved oxygen (DO)

Dissolved oxygen is a measure of the amount of gaseous oxygen dissolved in aqueous solution that plays a vital role in biology of culture organisms. The chemical and biochemical process undergoing in water body are largely dependent upon the presence of oxygen. In the present investigation dissolved oxygen ranged from 1.81 to 3.02mg/l. Maximum D.O was recorded in sample E where as minimum was recorded in sample F. Shrivastava and Kanungo (2013) reported a rage of DO 2.43 - 4.45 mg/l in their study. Thirupathaiah et al. (2012) reported a range of DO in between 5.18-9.72mg/l. Benerjee (1967), and Torzwall (1957) had reported that if the concentration of DO is about 5mg/l, throughout the year, the reservoir will be productive for fish culture.

Total hardness

Total hardness is the property of water which prevents lather formation with soap and increases the boiling point of water .Hardness of water mainly depends upon the amount of calcium or magnesium salts or both. In this present study total hardness ranged from 0.11 to 0.28 g/l. Maximum hardness was observed in sample C where as minimum was observed in sample B.

Total alkalinity

The alkalinity of water is caused mainly due to carbonate and bicarbonate ions. Alkalinity is an estimate of the ability of water to resist change in pH upon addition of acid During this study the total alkalinity of the samples ranged from 0.48 to 0.67 g/l. Maximum alkalinity was observed in sample D where as minimum observed in sample A. In the present study, the higher values of alkalinity was due to the decomposition of organic waste in the pond which might have increased the level of alkalinity, as evidenced from the studies of Rao et al., (1993).

Chloride

During the study the chloride ranged from 0.14 to 0.25g/l. Maximum chloride was observed in sample C where as minimum observed in sample B. The increase in chloride content may be due to the increased temperature and evaporation of water body as reported by Khabrade and Mule (2005).

Biochemical oxygen demand (BOD)

BOD is the measurement of total dissolved oxygen consumed by micro-organisms for biodegradation of organic matter such as food particles, sewage etc. In this study the BOD values ranged from 1.21 to 1.81mg/l. Highest BOD was found in sample E where as minimum BOD found in sample F .

Chemical oxygen demand (COD)

Chemical oxygen demand determines the oxygen required for chemical oxidation of organic matter.COD values convey the amount of dissolved oxidisable organic matter including the non-biodegradable matters present in it. In this study COD values ranged from 200 to 520 mg/l. Highest COD value found in sample E where as lowest COD found in sample B. High COD values of all samples indicates high pollution level. The sample E was observed to be more polluted than the other samples. COD of paper and rice mill effluent was previously analyzed and found to be between 92.36 and 630.00mg/l (Pradhan and Sahu, 2011).

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