

ORIGINAL ARTICLE

Physicochemical Analysis of Pond Water in Berhampur Town, Odisha

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ABSTRACT

The present investigation focused on the characteristic phenomena of the quality of pond water samples from Berhampur Town by measuring their physical and chemical properties. Water is the valuable natural resources i.e. facing depletion and pollution due to increase in consumption by ever growing population & industries. This calls for active need for water management which requires water quality analysis as the initial step. Water quality standards vary due to different environmental conditions. The study accessed the water quality of TEN pond water of Berhampur town of Ganjam, Odisha. The results of this present comparative study of pond water were carried out by taking certain important parameters. The certain important parameters like temperature, pH, Transparency, Total dissolved solid, Total suspended solid, Redox potential, Dissolved oxygen, Total hardness, chloride, and also analyzed. The temperature, pH were found normal range but other parameters like TDS, TSS, alkalinity were found to very high, whereas DO was found to be very low. This is because of sewage, municipal waste and domestic effluents discharge into the water body and excessive facial contamination & human unhygienic habits like washing. In the present study among the TEN ponds the Dhoba Pond and Ganesh pond were highly polluted because many parameters like total alkalinity, TDS, TSS, were found to be very high than the other ponds. So, these ponds are unsafe for human use like washing, bathing, and other uses.

Keywords: pond water, water quality, physio-chemical, pollution

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INTRODUCTION

The study on physicochemical analysis of water has a great significance during this age where pollution is on its high range. Water quality evaluation for wetland leads to information about their misuse by indicating the pollution states [5].

The physicochemical parameters of the pond have been shown to influence rate of biodegradation in the pond. Temperature has a direct effect on important factors such as growth, oxygen demand, food requirements and food conservation efficiency. The total suspended solid and total dissolved solid plays important role in determining the solid particle present in water. Determination of pH value is very important as it gives idea about certain treatment. Another quality parameter of significance is chloride concentration, which show the pollution from household thrashes, human fecal matter and urinary discharges. Estimation of dissolved oxygen is a key to test in water pollution and waste treatment process control. Dissolved oxygen is required for respiration of aerobic microorganism as well as other multi cellular organisms.

Lime leaching out of concrete pond is mainly responsible for increasing alkalinity while respiration, nitrification decrease or consume alkalinity. Increase in phosphate of village pond may be attributed to high organic load of the ponds causing higher level of BOD. COD is used to measure the content of organic matter of the pond water. The increased demand for water as a consequence of population growth, agriculture and industrial development has made the environmentalist to determine the physical, chemical and biological features of all water resources [9, 29].

Water quality parameter furnish the basis for judging the suitability of water for its designated uses and for improving the existing conditions [20].The ecological behaviour of ponds changed by a number of physical, chemical, factors, such as climate, geological differences etc. [22]. Physicochemical parameters play a vital role in determining the distribution pattern and quantitative abundance of organisms

inhabiting a particular aquatic ecosystem. The causative factors for the pollution of water are industries, agriculture and domestic activities [16].

In Odisha there are some studies about physico-chemical analysis of surface and ground water and waste water by some workers. The physico-chemical analysis of surface and ground water of Baragarh town [12]. Their study about dug well and bore well water of Baragarh town indicates that both type of ground is not polluted and satisfy the requirement for the use various purposes. But the study of pond water indicates that ponds are highly polluted and unsafe for human use. Similarly the physico-chemical parameters of waste water of BMC, Berhampur [14]. Their study indicates that the waste water of two Nalas namely Bahana Nala and Sapua Nala are highly polluted.

pH of the water is an essential factor the gives a precious indications of its quality and index of pollution [28, 17]. Dissolved oxygen finds a place of importance in the aquatic environment and its concentration depends on factors such as temperature decomposition process, photosynthesis and the level of aeration [12].

Total dissolved solids are the solids of the water in the dissolved state which contains carbonates, bicarbonates, chloride, calcium, phosphate etc. [4] excess amount of TDS in waters disturbed the ecological balance and cause suffocation to the aquatic flora [10]. Calcium forms the most abundant elements ion fresh water imparting hardness and serves as one of the micro nutrients that influences the flora of ecosystem in metabolism and growth [17, 6].

BOD is a measure of degradable organic matter in the water [8] and it provides valuable information of pollution status [10] chloride concentration is used as an important parameter for the detection of contamination by sewage. Alkalinity value provides an idea of natural salts present in water and it is a measure of buffering capacity [7]. It may be caused due to evolution of CO₂ during decomposition of organic matters [27].

The high amount of chloride was recorded during summer and low values were observed during monsoon decreasing chloride may be due to increased temperature and evaporation of water bodies as reported [11]. Rajkumar *et al* [17] has suggested that higher concentration of chloride were an index of pollution of animal origin and it is supported by Cole [3].

MATERIAL AND METHODS

Description of study area

Water samples were collected from TEN different ponds located in Berhampur town in Ganjam district, Odisha, India during February to April 2017. The place Berhampur otherwise known as "The silk city" because it is famous for its silk saries, temple and unique culture. It is situated at 19.32 North latitude, 84.78 East longitude and 31 meters elevation above the sea level. All the ponds are the source for use of bathing, washing, fishing for local peoples and sometimes drinking purpose and bathing water for cattle. The water quality pollution load and aquatic macrophytes so keeping all these facts in mind TEN ponds were selected for detailed study.

Table- 1: Location of sampling points of water collection in Berhampur Town, Odisha

SI. NO.	LOCATION OF PONDS/ SAMPLING POINTS	CODE NO.
1	khodasinghi Pond at Khodasingi	Sample-A
2	Bhairavi pond at Indira Nagar	Sample-B
3	Ganesh Pond at Indira Nagar	Sample-C
4	Singi pond at keshav Nagar	Sample-D
5	Uttareswara Pond at Gosani Nuagam	Sample-E
6	Nua Pond at Gosani Nuagam	Sample-F
7	Nilakantheswar Pond at Gandhi Nagar	Sample-G
8	Jagabandhu Pond at Ganesh Nagar	Sample-H
9	Dhoba pond at Haridakhandi	Sample-I
10	Haridakhandi Pond at Haridakhandi	Sample-J

SAMPLING

Samples were collected in 500ml glass bottle for DO and BOD also sample were collected in plastic bottle for other physiochemical 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 labelled and transported into laboratory and stored in a freeze for further analysis.

PHYSICO 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 analysed. PH, Temperature, and Transparency were determined on the site of collection while other parameters were analysed 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. All physio-chemical analysis of water was carried out following the procedures outlined in USEPA [26].

RESULTS AND DISCUSSIONS

Table No-2: The variation in Physico-chemical characteristics of 10 different Pond of Berhampur Town.

Sl. NO.	Ponds name	Temp (°C)	pH	Transp arency (cm)	TDS (g/L)	TSS (g/L)	Redox Potential (m V)	D.O (mg/L)	Alkalinity (g/L)	Total Hardness (g/L)	Chloride (g/L)
1	khodasinghi Pond (S-A)	28	8.8	42	0.81	0.69	122	2.4	0.72	0.29	0.29
2	Bhairavi pond(S-B)	30	8.4	39	0.92	0.39	100	3.2	0.70	0.22	0.31
3	Ganesh Pond(S-C)	27	8.2	34	0.89	0.11	91	4.1	0.67	0.17	0.28
4	Singi Pond (S-D)	28	8.2	22	0.32	0.23	91	2.1	0.67	0.23	0.29
5	Uttareswar Pond (S-E)	28	7.4	39.6	0.76	0.61	19	1.9	0.56	0.24	0.30
6	Nua Pond (S-F)	29	8.1	40	0.65	0.27	60	3.2	0.71	0.15	0.29
7	Nilakantheswar Pond (S-G)	28	7.4	32	0.41	0.18	31	4.4	0.57	0.27	0.31
8	Jagabandhu Pond(S-H)	26	7.6	26	0.54	0.12	42	1.8	0.57	0.30	0.27
9	Dhoba Pond(S-I)	27	8.9	27	0.32	0.11	124	2.7	0.75	0.22	0.28
10	Haridakhandi Pond (S-J)	28	8.1	19	0.36	0.12	67	1.8	0.74	0.25	0.30

TEMPERATURE

It is the measurement of hotness of any material. It affects physical and chemical properties of water and aquatic vegetation as well. During the study temperature ranged from 26^o C to 30^o C. Maximum temperature was in sample B and minimum in sample H. Shamal *et al* [19] reported the range of temperature in between 24.75 to 28.5^o C and 26.3-27.2^o C respectively.

pH

pH value ranges from 7.4 to 8.9. Maximum was recorded in Sample-I and minimum in sample E and G. pH was in the permissible range 6-8 by WHO. Choudhary *et al* [2] reported a range of pH in between 7 and 8.3. According to Umavathi *et al* [25], pH between 5.0 to 8.5 is best for planktonic growth.

TRANSPARENCY

It is directly proportional to the amount of suspended organic and inorganic matter. Transparency of water relates to the depth that light will penetrate. During this study transparency ranged from 22 to 42 cm. Maximum transparency was in Sample A and minimum was in sample D.

TOTAL DISSOLVED SOLIDS

These are the solids of water present in dissolved state including carbonates, bicarbonates, chlorides, calcium, phosphate etc. [4]. In this investigation the TDS ranged from 0.32.gm to 0.92.gm per liter. Maximum TDS was in sample B and minimum was in sample A. The investigation reported higher concentration of TDS [13, 19]. Amount of TDS increased due to increased amount of surface run off [15].

TOTAL SUSPENDED SOLID

Suspended solids are particles that large enough and do not pass through the filter used to separate them from water. TSS ranges from 0.11 to 0.69m/lit. Maximum TSS was in sample C and minimum was in sample I.

REDOX POTENTIAL

In this study redox potential ranges from 19 to 124. Maximum redox potential was in sample I and minimum was in sample E.

DISSOLVED OXYGEN

It is a measure of amount of gaseous oxygen dissolved in aqueous solution that plays vital role in biology of culture organisms. Biochemical processes in water bodies are dependent upon presence of Oxygen. In this investigation dissolved oxygen ranged from 1.8 To 4.4mg/lit. Maximum DO was recorded in Sample G and minimum was in sample H and J. Shrivastav and Kanungo, [21] reported a range of DO 2.43 to 4.45 mg/lit in their study. Thirupathaiah *et al* [24] reported a range of DO in between 5.18 to 9.72mg/l. Banerjee, [1] and Terzewll, [23] had reported that if concentration of DO is about 5mg/lit through the year the reservoir will be productive for fish culture.

TOTAL HARDNESS

It prevent lather formation with soap and increase boiling point of water. Hardness of water mainly depends upon amount of calcium or magnesium salt or both. In this study total hardness ranged from 0.15 to 0.30 mg/l. Maximum hardness was observed in sample H where as minimum was observed in sample F.

TOTAL ALKALINITY

The alkalinity of water is caused mainly due to carbonate and bicarbonate ions. It is an estimate of the ability of water to resist change in pH upon addition of acid. During this study the total alkalinity ranged from 0.56 to 0.75 gm/lit. Maximum alkalinity was observed in sample I whereas minimum observed in sample E. In the present study, the higher values of alkalinity is due to decomposition of organic waste in the pond may increase the level of alkalinity, as evidenced from the study of Rao *et al*, [18].

CHLORIDE

During this study chloride ranged from 0.27 to 0.31 gm/lit. Maximum chloride was in sample B and minimum was in sample G Increase in chloride content may be due to increased temperature and water evaporation [11].

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