



PHYSICO-CHEMICAL ANALYSIS OF NANDGAON AND ARWAT LAKES OF CHANDRAPUR DISTRICT WITH RESPECT TO SEASONAL VARIATION

Botany

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ABSTRACT

The present study deals with the comparative assessment of the water quality of two lakes, Nandgaon and Arwat lake of Chandrapur District, [M.S.] India. The physico-chemical characteristics were studied and analyzed during February 2016 – January 2017. Seasonal variations at three different sampling sites of both the lakes were observed. The result revealed that the condition of lakes in different seasons showed fluctuations in physico-chemical parameters. Nandgaon Lake has more organic pollution as compared to Arwat lake.

KEYWORDS

1. Introduction:

Water is one of the most important and precious natural resource available on our planet earth. Fresh water systems are commonly divided into two major categories – the lentic (standing) water systems and the lotic (running) water systems. Both systems share certain chemical, physical and biological characteristics. Lakes have numerous features, such as drainage basin, inflow and outflow, nutrient content, dissolved oxygen (Wiley and Sons, 2000). During their flow they cover land area of varying physical, chemical and geological features and with their great capacity for work to remove material from the substratum and carry load to the elevation as particulates as well as dissolved fractions of both organic and inorganic nature (Welling and Webb, 1994).

Hydrobiological studies on lake water are must because this valued resource is increasingly being threatened due to industrialization in urban as well as in rural area. Organic enrichment by various anthropogenic activities leading to lowering the dissolved oxygen and higher the BOD (Banerjee, 2013). At the same time, consumption of water for domestic, agriculture and economic activities is increased due to overpopulation as a result water bodies are changing the quality of the water.

Chandrapur district has about 6000 small, medium and large scale industries. It has large deposits of coal and lime stone. It is located between Latitude 19°27'1N and Longitude 78°10'9E occupying an area of 11,443 km² which constitutes 3.72 percent of the total area of the state. Physiographically, the district is situated on the Wainganga and Wardha river basin. The eastern and western boundaries of the district are well defined by these rivers which are the tributaries of Godavari. The climate of the district can be classified as a tropical hot climate with a high range of temperature throughout the year. In severe heat conditions, the temperature is among the highest temperatures in the South Asian region. The highest temperature was recorded in Chandrapur was 49°C on 2 June 2007. The southwest monsoons bring a lot of rainfall during rainy season. The average annual rainfall is about 1420 mm. The relative humidity is very high during monsoon season, which exceeds 70%, but after monsoon season, it goes down rapidly in summer.

2. Study Area:

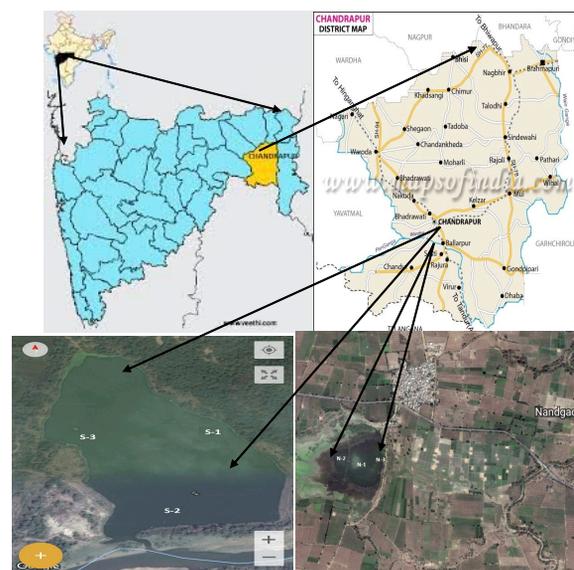
Chandrapur district is located between Latitude 19°27'1N and Longitude 78°10'9E occupies an area of 11,443 km² which constitutes 3.72 percent of the total area of the state.

Arwat lake is a perennial water body which has been formed due to the inflow of Irai river in mines pit, which spreads over 9.95 hectares area. The main source of water is Irai river and surface drainage. Arwat lake is 5 km away from Chandrapur and is situated South–West part of the Chandrapur district, Maharashtra.

Nandgaon lake is a perennial water body since British time. The main source of water is rain and surface drainage. This is spread over 29.4 hectares area. Nandgaon Lake is 19 km away from Chandrapur and is situated South–West part of the Chandrapur district, Maharashtra, India. Villagers are using water from both the lakes for domestic,

irrigation as well as for fishery purpose. Both the lakes have different entity from each other with respect to inflow source, depth, vegetation and surroundings.

Location Map of Nandgaon and Arwat Lakes:



ARWAT LAKE

NANDGAON LAKE

3. Materials and Methods:

The water samples for physico-chemical analysis was collected from both the lakes, at three different sites viz zone 1 (Silent zone), zone 2 (Inflow Zone) and zone 3 (Human Activity) in morning between 8 to 11 am of every month at regular interval from February 2016 to January 2017. The water samples were collected from the marginal area at 5 to 20 cm depth at each zone in dried plastic cans. Separate samples were collected for dissolved oxygen and biological oxygen demand in 250 ml BOD bottles and were fixed in the field by adding wrinkler –A and wrinkler –B solution immediately after collection. The samples were analysed immediately in the laboratory. The Physico-chemical parameter of lakes water studied like-Physical Parameters-Temperature, Transparency, Conductivity, Total Solids (T.S.), Total Dissolve Solids (T.D.S.) and Total Suspended Solids (T.S.S.), Chemical Parameters- P^H, Dissolved oxygen, Biological oxygen Demand, Chemical oxygen demand, Calcium, Magnesium, Chloride, Nitrate, Sulphate and Phosphate were determined monthly as per standard methods APHA (2012) and Maiti (2011).

4. Result & Discussion:

The result obtained from analysis of water samples of the two lakes Nandgaon & Arwat lakes are shown in table 1 & 2.

Table No.1: Seasonal variation of physico-chemical parameter of Nandgaon lake during 2016-17

Sr. No.	Parameters	Summer			Monsoon			Winter			WHO	ICMR	BIS
		N-1	N-2	N-3	N-1	N-2	N-3	N-1	N-2	N-3			
PHYSICAL PARAMETER													
1	Atm. Temp.	35.75	35.75	35.75	32.50	32.50	32.50	21.50	21.50	21.50	-	-	-
2	Wat. Temp.	33.25	32.25	32.25	30.00	29.25	30.00	18.25	19.25	19.00	-	-	-
3	Transparency	44.50	44.25	37.75	16.00	19.25	14.50	38.25	34.50	33.00	-	-	-
4	Conductivity	346.25	452.50	464.00	204.25	262.00	247.25	195.00	206.75	234.00	600	-	-
5	T.D.S.	203.00	209.75	220.50	368.00	419.25	435.00	138.00	149.00	225.50	500	500	500
6	T.S.S.	0.98	1.43	1.52	1.99	2.34	2.42	1.20	1.39	1.63	-	-	-
7	T.S.	224.25	245.25	274.75	401.50	471.00	444.00	202.50	221.25	249.75	-	-	-
CHEMICAL PARAMETER													
8	P ^h	8.05	8.15	8.23	7.31	7.45	7.575	8.15	8.53	8.48	6.5-8.5	6.5-8.5	6.5-8.5
9	D.O.	2.63	2.78	2.95	3.1	3.25	3.275	5.05	5.28	4.88	5	5	5
10	B.O.D.	4.55	4.68	4.23	4.13	3.85	4.05	2.75	2.7	2.88	6	5	30
11	C.O.D.	14.93	14.55	14.68	11.48	12.33	12.65	6.15	6.45	7.38	10	-	-
12	CO ₂	4.25	4.33	4.05	2.95	3.15	3.3	2.38	2.78	3.15	-	-	-
13	Alk. Total	169	150.25	162	104.25	100	96.5	88.25	105	121		120	200
14	Hard. Total	171.25	157	175.75	153	188.25	182.75	95	92.5	120	500	300	300
15	Calcium	67.54	62.75	81.75	66.55	82.5	70.5	47.5	26.75	45		75	75
16	Magnesium	25.30	22.99	22.93	21.09	25.8	28.68	11.59	15.92	18.30		30	30
17	Chlorides	10.79	11.07	10.42	3.70	4.51	4.44	3.16	3.98	4.31	250	200	250
18	Phosphate	3.18	3.18	3.42	2.34	2.5	2.82	1.57	1.93	2.22	-	-	-
19	Sulphate	5.03	5.44	6.72	5.47	6.29	5.35	2.29	2.91	3.10	400	200	200
20	Nitrate	3.28	3.45	3.9	6.23	6.85	6.88	2.6	2.98	3.5	45	20	45

(All Parameters are in mg/l, except Atm. Temp, Water Temp. = °C, Transparency =cm, Conductivity = μmhos/cm, P^h)

Table No.2: Monthly variation of physico-chemical parameter of Arwat lake during 2016-17

Sr. No.	Parameters	Summer			Monsoon			Winter			WHO	ICMR	BIS
		A-1	A-2	A-3	A-1	A-2	A-3	A-1	A-2	A-3			
PHYSICAL PARAMETER													
1	Atm. Temp.	34.5	34.5	34.5	32	32	32	23.25	23.5	23.5	-	-	-
2	Wat. Temp.	31.25	31.5	32.25	28.75	28.5	29.25	20.25	21	21.25	-	-	-
3	Transparency	49	47.5	45.3	16.5	15.25	13.75	38.75	35.25	32.75	-	-	-
4	Conductivity	504.75	492.25	522.25	278.5	288	298.5	270.75	281.75	276.75	600	-	-
5	T.D.S.	266	289.25	285.5	231.5	287	251.25	167.5	173.5	163.5	500	500	500
6	T.S.S.	1.186	3.609	1.288	1.367	1.847	1.479	0.997	1.141	1.078	-	-	-
7	T.S.	236.5	239.75	234.25	281.25	318.75	299.75	213	226.75	237	-	-	-
CHEMICAL PARAMETER													
8	P ^h	7.83	7.925	8	7.23	7.25	7.3	7.4	7.45	7.53	6.5-8.5	6.5-8.5	6.5-8.5
9	D.O.	3.08	3.275	3.03	3.1	3.28	3.03	4.35	5.2	4.88	5	5	5
10	B.O.D.	4.1	4.025	4.3	4.15	3.98	4.25	3.18	2.43	2.9	6	5	30
11	C.O.D.	11.28	11.95	11.13	9.33	9.9	9.45	5.85	6.28	6.4	10	-	-
12	CO ₂	4.45	4.33	4.43	2.33	2.53	2.63	2.28	2.55	2.83	-	-	-
13	Alk. Total	161.25	106.5	158.75	92	299.25	95.5	92.5	98	112.25		120	200
14	Hard. Total	125.5	139	137	174.25	169	172	100.75	104.25	123.25	500	300	300
15	Calcium	57.75	45.25	59	80.75	74.25	66.75	40	37	49.75		75	75
16	Magnesium	16.53	22.87	19.05	21.67	24.53	29.95	14.82	16.40	17.93		30	30
17	Chlorides	6.13	7.09	6.70	2.99	3.56	3.12	2.22	2.52	2.37	250	200	250
18	Phosphate	2.17	2.28	2.29	1.52	2.38	1.71	1.24	1.34	1.37	-	-	-
19	Sulphate	10.30	11.48	10.78	10.83	12.08	11.24	6.02	6.57	6.24	400	200	200
20	Nitrate	1.30	1.63	1.55	2.88	3.45	2.95	1.8	2.1	1.825	45	20	45

(All Parameters are in mg/l, except Atm. Temp, Water Temp. = °C, Transparency =cm, Conductivity = μmhos/cm, P^h)

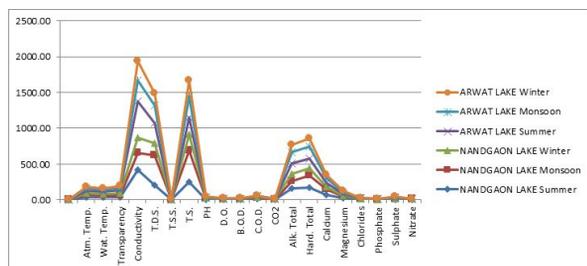


Fig.1- Comparison of various physico-chemical parameters of Nandgaon & Arwat lake

The results indicate that the quality of water shows variation. A summary of the findings is cited below.

Temperature variation is found in both the lakes. Water temperature is

lower than atmospheric temperature. Highest temperature is found in the month of May in both the lakes. The water temperature was recorded between 18.25 °C to 33.25 °C, while atmospheric temperature ranges from 21.5 °C to 35.75 °C.

The conductivity of water is affected by the suspended impurities and also depends upon the amount of ions in the water. The highest conductivity is found in Arwat lake (522.25 μmhos/cm). Total dissolve solids also affect the water quality which was found between the ranges of 138 mg/l to 435 mg/l highest value was found in Nandgaon Lake. Total suspended solids were recorded maximum 3.609 mg/l from Arwat lake during summer season.

P^h of Arwat lake ranges between 7.23 to 8.0, while Nandgaon lake P^h 7.31 to 8.53 shows Nandgaon lake is more alkaline in nature. Significant changes in P^h occur due to runoff, discharge of agricultural and domestic waste. The P^h value is slightly higher than standard value of ICMR, BIS & WHO.

The Dissolved oxygen ranged from 2.63 mg/l to 5.28 mg/l. The minimum DO was recorded in summer season & maximum in winter season. The DO value was high in Arwat lake; it is due to continue inflow of water from Irai river. The COD ranges from 5.85 mg/l to 14.93mg/l highest value was found in summer season from Nandgaon Lake. The value of COD is greater than standard value given by WHO. The BOD was maximum 4.68 mg/l in summer season while minimum 2.43 mg/l in winter season.

Free carbon dioxide was found throughout the year. It fluctuated from 2.38 mg/l to 4.45 mg/l in summer season. Total alkalinity ranges from 92 mg/l to 299 mg/l. Total hardness was higher in the monsoon season 188.25 mg/l and lower in the winter season 92.5 mg/l. The phosphate was highest in summer season 3.42 mg/l and minimum 1.24 mg/l in winter season. Sulphate maximum 12.08 mg/l in monsoon season while minimum 2.29 mg/l in winter season. Nitrate was found maximum 6.88 mg/l in monsoon season and minimum 1.30 mg/l found in summer season.

5. Conclusion:

The result revealed that there was significant seasonal variation in physicochemical parameters and some of the parameters were in the normal range but P^{H} & alkalinity of Nandgaon lake, COD & calcium level of both the lakes was slightly higher than standard value ICMR, BIS & WHO. Hence, the water analysis shows Nandgaon lake has more organic pollution than Arwat lake. The reason behind it has more anthropogenic activities, continuous discharge of domestic sewage, agricultural runoff, washing clothes and cleaning cattle are more in Nandgaon lake.

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