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EFFECT OF WATER TEMPERATURE ON PHYSICO-CHEMICAL PARAMETERS, IN SOME SURFACE WATER BODIES OF BHANDARA DISTRICT, A PERSPECTIVE TO SAVE WATER QUALITY

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ABSTRACT:

Present study deals with the water quality of rural lakes. The rural lakes are deteriorating with the human activities Conductivity of lakes ranges from 399 to 527 u mohs Dissolved oxygen 5.17 to 6.13 Mg/L., Temperature 29.68 to 31.52 ^{o}C, BOD 12.84 to 22.4 Mg/L.,Total Dissolved solids 399 to 412 Mg/L. During rainy season and summer the parameter showed higher ranges due incorporation of organic, human domestic and agricultural wastes.
Key words: -*Water quality, Conductivity, TDS, DO, BOD, Temperature, Lakes*

INTRODUCTION:

Bhandara district is located in the eastern region of Maharashtra state, India. This district is blessed with the variety of lakes, reservoirs and dams in terms of area occupied and irrigation capacity. Bhndara District has an area of 3716.65 Sq.Km with 878 villages covering population 11,36,146. It is surrounded by Gadchiroli, Gondia Nagpur district of Maharashtra state and Balaghat of Madhy Pradesh State (Bhandara District 2016). There are 52 reservoirs having water-spread area of 40 hectares and above. Waingnaga, Kanhan, Bawamthadi, Garhvi, Chulband, Bag, and Sur rivers are the major sources for agricultural and aquaculture practices. There are three major dams constructed on these rivers namely Chulband Dam on Chulband river near Dharmapuri, Indira Sagar Project on Wainganga river near Gose Khurd and Bawanthadi Project on Wainganga river near Tumsar Tahsil.

Previous records show that most of the lakes are relatively pollution free. Thereafter, increased population, discharge of wastes in water, use of water for agricultural practices and indiscriminate use of water by localities went on expanding rapidly. The pollutants mainly includes domestic wastes, temple wastes, insecticides, pesticides, detergents. The massive influx of these pollutants in the river must have altered water chemistry degrading the river massively not only as a source of potable water but destroying the biodiversity and Lotic and Lentic ecosystem as well. The pollution of water does not remain restricted to rivers or water bodies. The problem becomes more serious as the pollutants settle in the soil affect diversity icthyofauna. When such polluted water is used for agricultural and irrigation purposes, the contamination of soil are an inevitable side effect of water pollution.

MATERIAL AND METHODS:

Water sampling:

Water samples were collected from selected 78 water bodies including 60 lakes and ponds and 13 river sites. Sampling of water is done for physico chemical analysis of water from selected river sites and,

selected lake and ponds situated in rural areas of the study area, the samples were collected at morning time befor 9.00 am every time, in 2 litre plastic cans and travelled to laboratory of the college by using ice boxes for estimation of physico chemical parameters. Collection of water is tried for 4 times in each season during first two years, (Two samples of every water body or river sites for each season). The water samples were collected in every selected water body from the site of local activities and one sample from middle region of water body. Estimatin of Biochemical Oxygen Demand and Total Dissolved Solides was done in the laboratory. Estimation of remaining paramaters such as Temperature, pH, Conductivity and Dissolved oxygen was done at the field by using standerdized methods given by NEERI (1986) and APHA, AWWA, WPCF (1989).

OBSERVATION AND RESULTS:

Table.1.Seasonal Variations of the physicochemical parameter of Tiri lake

Sr No	Parameter	Rainy Season	Winter Season	Summer Season
1	Biological Oxygen Demand	12.00±2.11	9.19±1.18	22.4±3.77
2	Dissolved Oxygen	7.11±0.65	7.19±0.26	6.13±0.45
3	Electrical Conductivity	358±35	311±21	399±11
4	pH	7.83±0.32	7.97±0.12	8.1±0.32
5	Temperature	26.13±0.25	21.56±0.07	29.69±0.28
6	Total Dissolved Solids	471.9±23.14	186.7±13.44	399.4±12.33

Table.2. Seasonal Variations of the physicochemical parameter of Bhivkhidki lake

Sr No	Parameter	Rainy Season	Winter Season	Summer Season
1	Biological Oxygen Demand	10.8±1.11	9.01±1.53	20.6±3.71
2	Dissolved Oxygen	8.49±0.41	8.93±0.17	5.97±0.38
3	Electrical Conductivity	356±26	340±19	408±77
4	pH	7.52±0.28	7.44±0.10	7.63±0.34
5	Temperature	25.97±0.39	21.22±0.09	29.68±0.27
6	Total Dissolved Solids	503.1±18.32	200.8±12.14	399.7±15.11

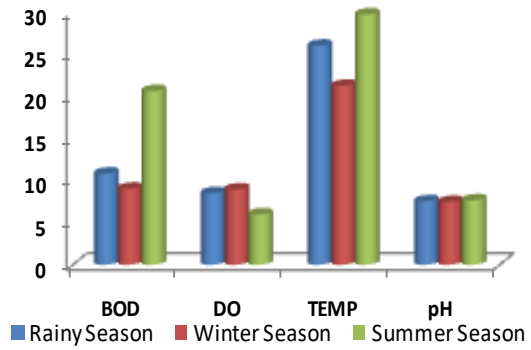
Table.3. Seasonal Variations of the physicochemical parameter of Salewada lake

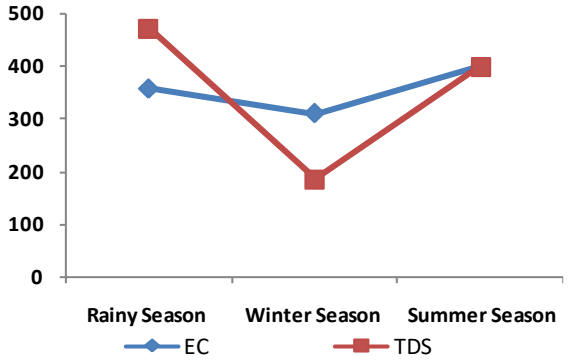
Sr No	Parameter	Rainy Season	Winter Season	Summer Season
1	Biological Oxygen Demand	11.2±2.13	7.95±0.14	21.5±3.76
2	Dissolved Oxygen	7.19±0.38	8.13±0.21	5.19±0.64
3	Electrical Conductivity	398±25	359±19	413±42
4	pH	8.06±0.29	8.10±0.16	8.2±0.41
5	Temperature	26.51±0.32	20.66±0.11	30.52±0.27
	Total Dissolved Solids	452.7±23.44	189.9±12.42	389.1±12.22

Table.4. Seasonal Variations of the physicochemical parameter of Adyal lake

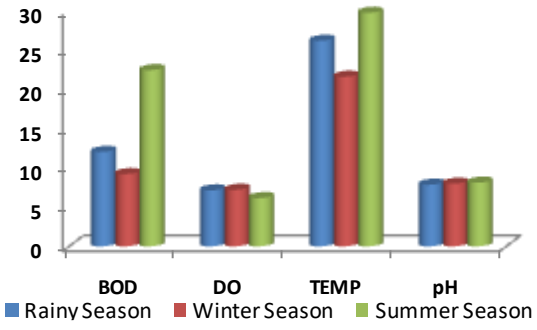
Sr No	Parameter	Rainy Season	Winter Season	Summer Season
1	Biological Oxygen Demand	10.8±1.15	6.92±0.18	12.84±2.54
2	Dissolved Oxygen	8.27±0.37	9.2±0.29	5.17±0.43
3	Electrical Conductivity	421±44	411±42	527±72
4	pH	8.00±0.13	7.5±0.06	8.6±0.28

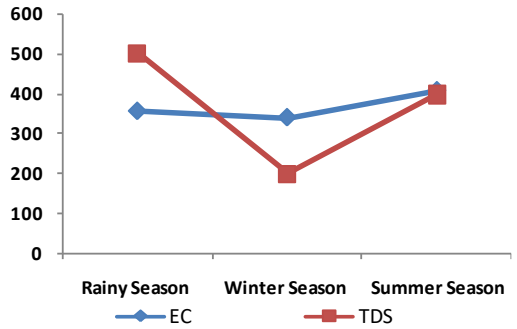
5	Temperature	26.6±0.22	22.03±0.09	31.52±0.42
6	Total Dissolved Solids	509.1±15.45	167.7±13.25	412.6±12.45



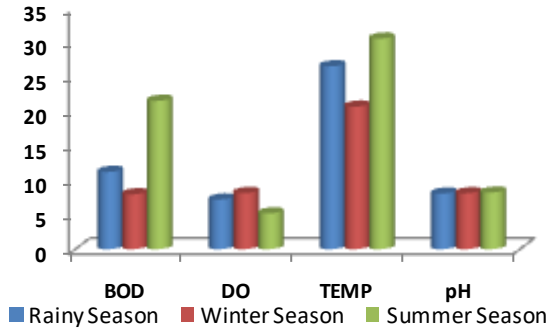


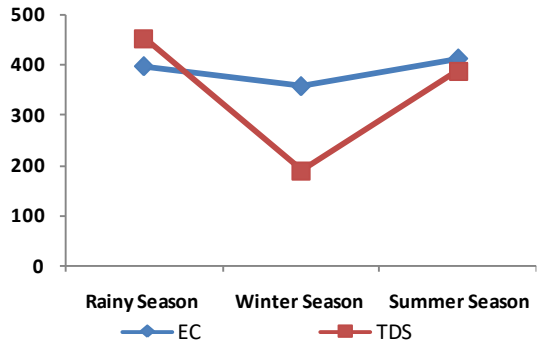
physicochemical parameter of Tiri lake



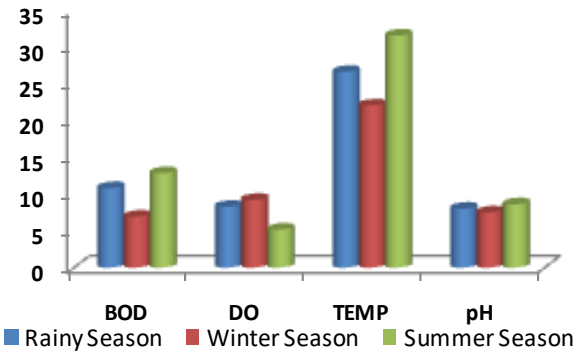


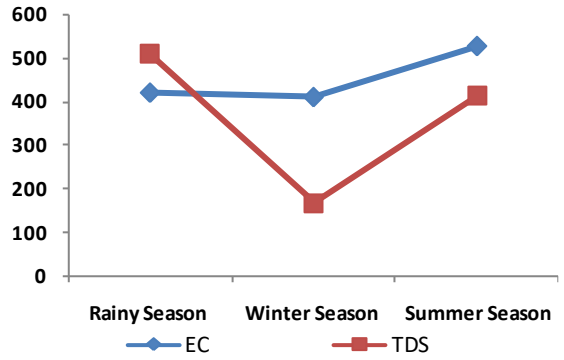
Figures- Seasonal Variations of the physicochemical parameter of Bhivkhindi lake





Figures- Seasonal Variations of the physicochemical parameter of Salewada lake





Figures- Seasonal Variations of the physicochemical parameter of Adyal lake

Tiri Lake:

In Tiri lake water dissolved oxygen ranges from 6.13 mg/l during summer season and 7.19 mg/l during winter season. The values of biochemical oxygen demand ranges from 9.19 mg/l to 22.4 mg/l during winter and summer respectively. Temperature of water ranges from 21.56 ^{0}C during winter and 29.69 ^{0}C during the months of summer. pH of lake water varies from 7.83 during the month of rainy season and 8.1 during summer months. Conductivity of water ranges from 311 µ mhos in winter months and 399 µ mhos during the month of summer. Total dissolved solids ranges from 186.7 mg/l during winter months and 471.9 mg/l during the months of rainy season, (Table-75).

Bhivkhidki Lake:

In Bhivkhidki lake water dissolved oxygen ranges from 5.97 mg/l during summer season and 8.93 mg/l during winter season. The values of biochemical oxygen demand ranges from 9.01 mg/l to 20.6 mg/l during winter and summer respectively. Temperature of water ranges from 21.22 ^{0}C during winter and 29.68 ^{0}C during the months of summer. pH of lake water varies from 7.44 during the month of winter season and 7.63 during summer months. Conductivity of water ranges from 340 µ mhos in winter months and 408 µ mhos during the month of summer. Total dissolved solids ranges from 200.8 mg/l during winter months and 503.1 mg/l during the months of rainy season, (Table-76).

Salewada Lake:

In Salewada lake water dissolved oxygen ranges from 5.19 mg/l during summer season and 8.13 mg/l during winter season. The values of biochemical oxygen demand ranges from 7.95 mg/l to 21.5 mg/l during winter and summer respectively. Temperature of water ranges from 20.66 ^{0}C during winter and 30.5 ^{0}C during the months of summer. pH of lake water varies from 8.06 during the month of rainy season and 8.2 during summer months. Conductivity of water ranges from 359 µ mhos in winter months and 413 µ mhos during the month of summer. Total dissolved solids ranges from 189.9 mg/l during winter months and 452.7 mg/l during the months of rainy season, (Table-77).

Adyal Lake:

In Adyal lake water dissolved oxygen ranges from 5.17 mg/l during summer season and 9.2 mg/l during winter season. The values of biochemical oxygen demand ranges from 6.92 mg/l to 12.84 mg/l during winter and summer respectively. Temperature of water ranges from 22.0 ^{0}C during winter and 31.52 ^{0}C during the months of summer. pH of lake water varies from 7.5 during the month of winter season and 8.6 during summer months. Conductivity of water ranges from 411 µ mhos in winter months and 527 µ mhos during the month of summer. Total dissolved solids ranges from 167.7 mg/l during winter months and 509.1 mg/l during the months of rainy season, (Table-78).

DISCUSSION:

Biochemical Oxygen Demand:

Biochemical oxygen demand affects more in the stagnant water bodies. In case of river and streams of running water offers the dilution and stabilization of organic matter in the course of its flow. Directly or indirectly deposited organic wastes when enters in the lakes and ponds it resides at the bottom sediments and undergo in collective process microbial degradation.

Amount of decomposing organic matter or biodegradable wastes present in the water lake water offers the extent of biochemical oxygen demand to the water.

During the study period all the lakes showed enhanced values during the summer months, (fig. 1 to 8). Comparatively less water in lakes and ponds during summer months offers the more concentration of organic wastes to the water. Moreover, the anthropological activities concerned with these water bodies contribute the pollutants. During the months of mid-June to August rain water with surface runoff contribute the enhancement of biodegradable wastes of the catchment area in the water bodies and resulted in to high biochemical oxygen demands. No doubt the increased BOD values lower the dissolved oxygen content of water, which proves to reduce the biodiversity of lakes. The bottom sediments and comparatively reduced rate of microbial activities maintains the values BOD in lakes and ponds.

Most of the water bodies in the district are indiscriminately overused for agricultural purposes. The fisherman community in the study area now appears as agricultural farmers and farming the Water Chestnut (*Trapa natans* or commonly called as Singhada) crops in water bodies. Most of the basins of small lakes and ponds are found with full of Trapa crops. Detail observations of these activities conclude the facts such as 1. They use organic manure occasionally, which mixes directly in to the water, 2. At some places, the use of insecticide dusting powder directly on the surface of lakes and ponds. 3. Due to over vegetation all the surface area of water bodies covers with the leaves of trapa plants, which cut the more than 60% of solar radiations penetrating inside the water. Such practices in the rural lakes going on hurting the diversity of fishes since decades, in the study area and only the species that tolerate the extreme pollution like Catla catla are increasing in population. (Bobdey 2010)

Dissolved Oxygen:

Dissolved oxygen in water is a prime requirement for the life of biotic components of lakes and ponds. Alteration of dissolved oxygen may be due to production of oxygen due to photosynthetic activities of aquatic vegetation and its level of water decrease due to its consumption during chemical oxidation and respiration of aquatic fauna. The extent of microbial activities in water decides the amount of dissolved oxygen in lakes. During the study period most of stagnant water bodies are having very much reduced levels of DO during the summer and rainy seasons, (Fig. 1 to 4).

Increased rate of microbial degradation due to increased temperature of water and intense solar radiations lowers the DO levels during summer months. Less water in lakes and ponds offers more concentration and sources of organic discharge in water bodies are mainly the cause of reduced values. During the periods of June to August months, rain water carry more organic wastes to the water bodies all the bottom deposited organic matter and its decomposition reduce the oxygen in water. In comparison of river and streams, lake and pond water showed lower values of DO. This may be due to turbulence in flowing water in rivers and streams add the atmospheric oxygen in water continuously at some extent.

Winter studies reveals that, the presence of ample vegetation in comparatively more water in the water bodies maintain the high ranges of dissolved oxygen, photosynthetic activities of vegetation contributes the dissolved oxygen to some extent.

Anthropological activities on the bank of water bodies, overuse of water for rice fields and agricultural practices in the lakes and ponds lowers the dissolved oxygen of water.

Temperature:

Air water and temperature are influenced by meteorological conditions and geographical locations. The temperature intern poorly influences the physiology of biotic components in water, but provided, it

is on tolerable ranges. In case of shallow ponds and lakes the environmental temperature and intensity of solar radiation during summer months create the condition more miserable, due to rise of water temperature during the afternoon hours.

In present investigation the temperature of dam and reservoirs are in optimum range, but in shallow ponds and lakes located in small areas showed some increased levels of heat in water. It may be due to natural discharge of organic materials in ponds such as dead leaves of nearby vegetation's, more quantity of plant remnants in less quantity of water contributes more concentration of biodegradable wastes in ponds and lakes. However, the anthropological activities generally and regularly performed on the bank of ponds and lakes such as bathing, washing of clothes, utensils, are responsible to discharge organic matter in to the water. Microbial degradation of the organic materials contributes the hike of temperature in lake waters.

During the rainy season and summer water temperature showed increased levels. Surface runoff from catchment areas, deposit maximum decaying organic matter, in the most of rural ponds and small lakes. However, the evaporation of water during summer and it overuse for domestic purposes resulted in to enhancement of lower the quantity of water in lake and enhancement of concentration of available organic matter.

During the study period in winter days, relatively more quantity of water in lakes and ponds offer dilution to the organic matter, so the microbial degradation of present bottom sediments maintain the low ranges of temperature, (fig. 1 to8).

Hydrogen Ion Concentration:

Present investigation reveals that Ph values of lakes and ponds are in the well alkaline levels. Increase of Ph in lake and pond water is recorded during the months of rainy season and summer, (Fig. 1 to 4). Runnign water from surface runoff carries most of the alkaline soil contents from catchment areas. In addition to it microbial degradation of organic wastes and formation of carbonates and bicarbonates in lake water impart the enhanced Ph values to the water.

During summer months the comparatively less water in lakes and ponds imparts more concentration of alkaline salts to the water. On the other hand comparatively more quantity of water in lakes and ponds during winter months with ample vegetation and their photosynthetic activities enhance the ph at alkaline ranges. Overnight respiration of vegetation and release of CO2 in water resulted in the formation of alkaline salts and its dissociation by microbial activities imparts alkaline Ph to lake and pond waters.

Conductivity:

Electrical conductivity depends up on the ionic status of water. In present investigation the lake water showed maximum conductance during summer days followed by rainy season. Enhanced microbial activities and fast rate of stabilization or organic matter present in bottom sediments resulted in to increase of ionic content of lake water. During rainy season the relatively more organic matter entering in the lakes and ponds with surface runoff water imparts ionic concentration to the water. However seepage of fertilizer contents in to the lakes from nearby rice fields contributes the ionic contents to the water. Activities of microbes and conversion of substances in to carbonates to bicarbonates, nitrites, nitrates and vice versa, such biochemical conversions mediated by microbial enzymes enhance the ionic status and intern conductivity of water, (Fig. 1 to 4).

During winter months presence of ample vegetation and less rate of microbial activities helps to keep constant values of conductivity. The anthropological activities on the bank of lakes and addition of fertilizers for the growth of Trapa agriculture in lakes and ponds also increase the values of conductivity in lake and pond waters during study period.

Total Dissolved Solids:

Comparative study lakes and pond waters in study area showed that, pick values of Total dissolved solids during summer months and month of rainy season. During the month of rainy season (July to mid-September) all the lakes became full of water running from catchment areas. Surface run off water during its course carries most of the alkaline soil contents and organic matter. Carbonates and bicarbonates of calcium, sodium, potassium and chlorides and routine anthropological activities of cloth washing, cattle washing contribute the TDS content of water in lakes and ponds, (fig. 1 of 8).

In summer months, increased temperature of water also enhances the microbial degradation of biodegradable wastes in water. However, comparatively less water in water bodies during summer imparts more concentration of organic matter to the available water, which is responsible to hike the TDS values in lake and pond waters. Moreover cattle activities are also observed in the study area, cattles resting and swimming in the water bodies and shedding their wastes in lake water enhance the organic matter and intern of dissolved solids in the lakes and ponds. In rural areas the lakes and ponds are only the sources of drinking water to the cattles. Due to alteration of ground water tables and scarcity of underground water in the study area since last decade turns the localities to the lakes, ponds and dams for their activities.

At most of the places in study area covered by rice fields in the vicinity of water bodies. Seepage of traces of chemical fertilizers containing N, P & K from nearby rice fields in to the water bodies also helps to contribute total dissolved solids in the form of carbonates and bicarbonates in the lake waters. More turbid water of lakes due to cattle activities and anthropological actions makes the condition difficult for the survival of aquatic life

The constant monitoring and water quality by concerning authorities and making of certain laws with strict enforcement, to protect the lakes in the region may help to maintain the quality of surface waters.

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