PHYSCO CHEMICAL ANALYSIS OF WATER BODY OF CHHINDWARA DISTRICT (M.P.) INDIA

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Abstract: The objective of the present study to analyses the physicochemical environment. of the waterbody of the city chhindwara (M. P.). water samples were collected at all selected sites of lake atmonthly intervals and an analysis of samples was performed withrespect to temperature, pH, chloride, alkalinity, total hardness, silicate,free CO_2, phosphate, nitrate, DO and BOD.

Introduction: The lakes and reservoirs all over the world under different degrees of environmental degradation. The degradation is due to eutrophication. There has been a quantum jump in population during the last few centuries, the lakes and reservoirs especially the urban ones become seriously contaminated.

Natural changes in environmental conditions, such as flow rate, water temperature, dissolved oxygen, and food resources exert direct control on the population dynamics of aquatic organisms, which gives rise to characteristic biological communities within different ecosystems. Diatom shows a broad range of tolerance along a gradient of aquatic productivity, individual species have specific water chemistry requirement (Round, 1966).

In the investigations cited above, a few of the water bodies have been examined. Waterbodies like rivers, lakes, ponds are of great economic importance to man for the water organisms that around in them.Man has been using them with little or no consideration for their ecology. The demand for growing human population for the food and space is ever increasing. Frash water bodies are being used for these purposes. Management of the water bodies should aim at maintaing them in a useful form at high productive level with the provisions for a high rate of removal of plant and animal for human consumptions.

Review: Shastri and Bhatia (1970) have done year long survey on Upper Lake of Bhopal and Judge the intensity of pollution. Prasad and Quyyum (1980) have studied on pollution aspects on Upper Lake of Bhopal. (M.P.)
Sarkar and Krishnamoorthy (1977) have emphasized on biological monitoring as a method to evaluate the degree of pollution based mostly on the ecology and physiology of the flora and has recommended the use of species diversity index as an indication of water pollution.

Biological monitoring is valuable method used in conservation studies to protect and preserve the biological integrity of natural ecosystem, which includes preventive measures. Bioindicators of pollutants are useful in producting the level and degree of the pollutants before the effects of the pollutants starts, which caused large proportions group of biota used for detecting organic pollution (e.g. the Saprobian system by Kolkwitz and Mersson in 1908) (Ramachandra T.V., 2009).

Study Area: ***Location and Area:*** Chhindwara is situated a few kilometers in south of the tropic of cancer between 22º23'N latitudes and 78º58'E longitude at 685 meter above sea level.
It is situated in the state of Madhya Pradesh, India. Chhindwara district occupies an extreme southern part of the middle of the Satpura range. Chhindwara haspleasant climate and sufficient rainfall.

Selection of Study Sites: Chhindwara city has main water body namely **Badi Lake lake**. lake is situated at middle of the city.
Following three sites of the lakes which were quite different in characters were selected for sampling and detailed investigation. These are as follows:

Badi Lake:
1. Main road site – B-I
2. Dhobighat site – B-II
3. Trapa field site – B-III

Badi Lake: Badi Lake is situated 615 meter above the sea level and surrounded by Ghats on eastern, western and northern side except the southern side. Regarding the origin of this lake late Kuber Singh Raghuwanshi constructed this lake in 19^{th} century. The probable depth of this lake is more than 17 meters.
Lake is protected by fencing wall mainly one eastern and western side. The record of lake indicates that the area of lake is 150 hectares. At present lake occupies an area of 62 hectares only.
Following three sites of lake which were quite different in characteristics of water were selected for detail investigation.

Site-I (Road Site B-I): Water is apparently clean in this site. This site consists of big boulders and stones. It is a least disturbed site by the human activities except for fishing.

Site-II (Dhobi Ghat Site B-II): In this site bathing and laundry work have been done through out the year. This part of lake is used for bathing and cloth washing purpose which is consequently considered polluted. This site also contains big and small boulders.

Site-III (Trapa Field Site B-III): In this site water is comparatively transparent and covered by macrophytic vegetation. This vegetation seems to be responsible for silting of lake and raising bed level at all sites.

Material and Method: For the examination of the physic chemical complex standerd methods for the examination of water published by American Public Health Association (1980) have been consulted. Surface samples at different places at an interval of 30 days inlarge plastic bottes of 1 litre capacity between 8- 10 AM.care was taken to prevent undue shaking of the sample and also against sunlight while transporting them to the laboratory.

Discussion: Carbon dioxide is a product of respiration by both plants and animals, provides the major carbon source for photosynthesis, and in most ways shows an inverse relationship to oxygen. Although only a minor component of air, carbon dioxide is quite abundant in water because its solubility is about 200 times that of oxygen.
Carbon dioxide dissolves in water to produce carbonic acid (H_2CO_2), which dissociates into various fractions (HCO_3^-, CO_3^{2-}) depending upon hydrogen ion concentration (pH). When the demand for carbon dioxide for photosynthesis is high, precipitation of calcium carbonate occurs especially in warmwater lake.

Nitrogen is always present in aquatic ecosystem and most abundantly as a gas. Relatively small quantities exist in the combined forms of ammonia (NH_4^+), Nitrate (NO_3^-), Nitrite (NO_2^-), urea [$Co(NH_2)_2$] and dissolved organic compounds.

The most important source of the nitrate is biological oxidation of organic nitrogenous substance which comes in sewage and industrial wastes. Domestic sewage contains very high amount of nitrogenous compounds. Run off from agricultural field is also high in nitrate. Atmospheric nitrogen fixed into nitrates by the nitrogen fixing organism is also a significant contribution to nitrates in the water. Ground water can also be contaminated by sewage and other wastes, rich in nitrates. Nitrate denotes the aerobic conditions and high stability of the wastes.

In the present investigation nitrates remain high throughout the year in both lakes. The higher value of nitrates during rainfall is due to addition of nitrates in the form of runoff. Nitrate depletion in winter and summer may be due to the photosynthetic activity of the phytoplankton or may be due to oxidation of organic compounds (Butcher, 1946). There exists a close relationship between the rise in the concentrations of nitrates and chlorides. The rise of nitrates seems to influence the rapid sprouting in the summer forms of floating aquatic flora.

Observation and Result:

Table 3.4: Physicochemical Characteristics of Water Body

Month	Site	pH	Temperature	Chloride	Alkalinity	Total Hardness	Free CO_2	Phosphate	Nitrate	DO
January	B-I	8.5	18.00	89.12	25.20	165.00	1.1	0.25	5.41	2.90
	B-II	8.8	19.00	120.00	31.00	167.32	1.0	0.16	12.23	3.99
	B-III	9.0	17.00	90.00	40.00	160.31	1.3	0.10	10.01	2.92
February	B-I	8.7	20.00	71.29	23.35	155.35	Absent	0.25	9.27	3.01
	B-II	8.5	21.00	110.00	32.38	165.22	1.2	0.32	12.28	3.08
	B-III	8.2	21.00	99.00	31.00	150.11	Absent	0.30	10.28	3.09
March	B-I	7.5	25.2	89.0	27.00	16.00	1.2	0.25	6.24	3.02
	B-II	8.6	26.01	100.0	34.22	170.00	1.3	0.28	13.23	3.98
	B-III	7.0	25.09	99.0	30.00	168.00	1.2	0.18	11.08	2.99
April	B-I	7.9	30.02	90.0	30.00	161.00	1.2	0.22	8.41	4.02
	B-II	8.2	30.1	92.8	32.02	165.00	1.0	0.28	10.28	3.99
	B-III	8.0	30.0	91.2	30.00	163.00	1.0	0.25	11.22	3.28
May	B-I	7.5	35.00	90.09	20.00	160.00	1.1	0.07	7.50	1.60
	B-II	7.9	34.09	99.02	30.00	162.00	1.0	0.08	7.80	1.30
	B-III	7.8	34.00	98.03	30.01	161.00	1.1	0.07	7.00	1.29
June	B-I	8.2	40.00	101.00	30.28	160.00	Absent	0.08	9.02	1.50
	B-II	8.4	40.01	99.09	32.33	161.00	2.2	0.06	9.07	1.40
	B-III	8.0	40.02	100.00	33.01	161.00	2.8	0.06	9.06	1.39
July	B-I	7.5	23.00	190.2	99.3	171.2	2.3	0.22	22.3	5.23
	B-II	8.2	25.00	198.2	89.3	175.2	1.9	0.12	21.3	16.3
	B-III	8.0	27.00	200.0	69.5	98.0	2.1	0.17	25.3	7.2
August	B-I	7.6	25.00	60.29	17.20	140.60	1.6	0.29	3.20	2.90
	B-II	8.5	25.00	88.29	16.60	150.30	1.1	0.18	5.30	1.30
	B-III	7.7	26.00	110.29	31.20	143.20	1.3	0.16	4.80	1.90
September	B-I	8.5	24.00	76.99	17.20	129.30	2.4	0.06	7.40	1.60
	B-II	8.7	25.00	141.99	22.00	142.60	1.5	0.06	7.90	1.20
	B-III	8.6	24.00	180.29	41.20	140.60	1.6	0.09	6.90	1.80
October	B-I	8.6	26.00	96.29	20.60	154.00	Absent	0.04	10.10	1.70
	B-II	7.1	26.00	71.29	48.60	120.00	1.0	0.05	4.80	1.80
	B-III	7.6	26.00	94.79	63.20	137.00	Absent	0.06	8.30	1.60
November	B-I	7.1	23.00	78.00	14.22	143.20	Absent	0.03	6.30	2.80
	B-II	7.2	24.00	110.00	30.00	170.20	1.3	0.04	8.23	2.82
	B-III	9.0	23.00	109.00	29.00	162.00	Absent	0.04	7.29	2.20
December	B-I	8.9	19.00	85.08	25.00	161.00	Absent	0.21	4.90	2.50
	B-II	8.5	18.00	120.8	31.00	165.00	Absent	0.22	6.08	2.70
	B-III	7.7	19.00	130.0	30.0	167.00	Absent	0.08	5.09	2.60

Badi lake - B-I = Road, B-II = Dhobi ghat site, B-III= Trapa field site.

The minimum value of nitrates recorded may be due to dilution in the accumulated rain water or their consumption in the production of post monsoon bloom.

Nitrates and phosphate which are commonly referred to as nutrient chemicals are required in moderate quantities in aquatic and terrestrial ecosystems, but both may become limiting for plant growth in lakes and streams.

Phosphorus in lakes occurs in both organic and inorganic forms. The majority of inorganic phosphate present is in the form of orthophosphate (PO_4^{-3}) with lesser amounts in the form of monophosphate (HPO_4^{-2}) and dihydrogen ($H_2PO_4^{-2}$) phosphate.

Phosphorus being an important constituent of biological system may also be present in organic forms. The major sources of phosphorus are domestic sewage, detergent, agricultural effluents and industrial waste water. The higher concentration of phosphorus therefore, is indicative of pollution.

The net tendency of phosphorus in water is to get precipitate and lost to the sediments, resulting in the overall decrease of phosphorus in water.

The quality criteria for phosphorus in waters are only to check the process of eutrophication. The high values of phosphate during the rains may be due to the addition of phosphate through drainage. The high values of phosphate during the rains may be attributed to the formation or accumulation of inorganic phosphates and also to the substantial addition of phosphate from agricultural drainage and sewage from the neighbouring areas (Blum, 1957). During the later part of the winter and the early part of the rainy season, the phosphate content remain low. This might be due to photosynthesis of the phytoplanktons and also delayed rains and flood carrying phosphate matter (Pearsall, 1922).

Oxygen participates in much important chemical biological reaction and has become most widely studied chemical in the aquatic environment. It is continually consumed in respiration by both plants and animals and is produced by plant photosynthesis only when sufficient light and nutrients are available. Very cold water contains less than five percent of the oxygen contained in a similar volume of air. The oxygen amount rapidly decreases as the water temperature increases. Water contains little oxygen due to the relatively low partial pressure of oxygen in the atmosphere and its quite low solubility. The lack of oxygen in water relatively to air means that it is easily depleted by respiration and decomposition unless continually replenished form the air. The variations in dissolved oxygen of lakes and rivers give a good measure of their trophic state. Oligotrophic waters show little variation from saturation, while eutrophic ones may show the various ranges of saturation. Organic matter from natural sources or domestic and industrial sewage may result in serious depletion of dissolved oxygen. When this occurs for a long time, most aquatic organisms perish or are replaced by a few specialized organisms tolerance of oxygen.

Dissolved oxygen is one of the most important parameter in water quality assessment and reflects the physical and biological processes revealing in the waters. Its presence is essential to maintain the higher forms of biological life in water and the effects of a water discharge in a water body are largely determined by the oxygen balance of the system. Non polluted surface waters are normally saturated with dissolved oxygen. Oxygen can be rapidly removed from the waters by discharge of the oxygen demanding wastes. Other inorganic reductants such as hydrogen sulphide, ammonia, nitrates, ferrous iron, and other oxidizable substances also tend to decrease DO in water.

Low oxygen in water can kill fish and other organisms present in water. The concentration of oxygen also reflects whether the processes undergoing are aerobic or anaerobic. Low oxygen concentrations are generally associated with heavy contamination by organic matter. In such conditions oxygen, sometimes totally disappears from the water.

Dissolved oxygen is high during rains and minimum during winter. Periods of high temperature with low oxygen contain a feature noted by Gonzalves and Joshi (1946). The present study reveals a reduction in dissolved oxygen content in both lakes. Bulm (1960) stated that low value of dissolved oxygen is usually associated with high organic matter. Seenaya (1972) reported that oxygen content have an almost inverse correlation with free CO_2 content, a features noted by Lakshminarayana (1965).

Calcium, magnesium, sodium, and potassium (alkaline ion) are the main alkaline ions commonly found in surface waters. The calcium and magnesium contribute to the hardness of the water, whereas sodium and potassium, which are much more soluble, contribute more to the

Conclusion: Waterbodies like rivers, lakes, ponds are of great economic importance to man for the water organisms that around in them.Man has been using them with little or no consideration for their ecology. The demand for growing human population for the food and space is ever increasing. Frash water bodies are being used for these purposes. Management of the water bodies should aim at maintaing them in a useful form at high productive level with the provisions for a high rate of removal of plant and animal for human consumptions.

References:

1. A.P.H.A. 1981. Standard methods for the examination of water and west water American Public Health Assoc., New York.
2. Abdul-Majeed, M. 1935. The fresh-water Algae of The Punjab. Pt.-1. Bascillariophyta (Diatomeae), Publ. Panjab University, Lahore, 1935:1-45.
3. Ackman R.G., Jangaard P.M., Hoyle R.J. and Brocherhoff H. 1964 Origin of marine fatty acids. I. Analysis of the fatty acids produced by the diatom Skeletonema costatum. J. Fish. Res. Bd. Can. 21, 747-56.
4. Adoni, A.D., Joshi, G., Ghose, K., Choudhari, G.S.K., Vaishya, A.K., Yadav, M. and Verma, H.G., 1985. Work book on limnology, Pratibha Publication, Sagar (M.P.).
5. Association, American water works Association and Water Pollution Control Federation.
6. Ehrenberg, C.G. 1851. On the extensive rock formation of Silliceous-Polycystinia from the Nicobar Islands. Berlin Montatsbericht, 476-478.
7. Eloranto, P. 1976. Species diversity in the phytoplankton of some Finnish Lakes. Ann. Bot. Fenn., 13(1): 42-48.
8. Fjerdingstadt E. 1964. Pollution of streams estimated by benthal phycomicroorganisms I. A saprobic system based on communities of organisms and ecological factors. Int. Revue ges. Hydrobiol. 49, 63-131.
9. Fjerdingstad E. 1965. Some remarks on a new saprobic system. In Biological problems in Water Pollution, 3rd Seminar, USPHS Publ. 999-WP-25, pp. 232-5.
10. 10 - Fjerdingstad, E. 1960. Forurening of Vandlok biologisk bedomt. Nordisk Hyg. Tidskr. 41: 149-196.
11. Fjerdingstadt E. 1962. Some remarks on a new saprobic system. In Biological Problems in Water Pollution, 3rd seminar. Public Health Service Publication 999-WP-25, 1965, pp.232-5.
12. Fjerdingstadt E. 1964. Pollution of streams estimated by benthal phycomicroorganisms I. A saprobic system based on communities of organisms and ecological factors. Int. Revue ges. Hydrobiol. 49, 63-131.

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