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WATER QUALITY ASSESSMENT OF UPPER LAKE BHOPAL WITH REFERENCE TO CONSERVATION AND MANAGEMENT

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ABSTRACT

Safety of drinking water is an important factor for health. The present study was aimed to access the health status of Upper Lake Bhopal in relation to water quality conservation and management. Water samples were collected from two different sites for various physiochemical, heavy metal and bacteriological analysis. The analyzed samples were compared with the standards given in BIS-10500 and WHO. The results showed high bacteriological contamination due to the sewage discharge from catchment areas. Regular monitoring and management of water quality is necessary to save the water from poor quality which becomes threat for human health and aquatic life especially for fish.

KEY WORDS: *Water quality, Upper Lake, Sewage discharge, etc.*

INTRODUCTION

Water is an essential compound for Mankind and millions of other species living on earth (Chidambaram *et al.,* 2010). It is important to all living organisms, ecological systems, human health, food production and economic development. Lakes have been defined as a body of standing water, occupying a basin or lacking continuity with sea (Forel, 1892). Lakes of all sizes provide us fisheries, drinking water, scenic splendour, power generation, increase in property values and act as excellent systems for ecological studies. Lakes are an important element of the natural environment that defines both landscape and its ecological functioning. Lakes and surface water reservoirs are the planet's most important freshwater resources and provide innumerable benefits. It is used for drinking, domestic, agricultural or industrial purpose and provide ecosystems for aquatic life especially fish, thereby functioning as a source of essential protein and for significant elements of the world's biological diversity (Arain *et al.,* 2008).

The quality of Portable drinking water is important for the health. The quality of drinking water is affected by various contaminants which included chemical and microbiological. The indiscriminate release of chemical fertilizers, pesticides, industrial effluents are causing heavy and varied pollution in the aquatic environment leading to the deterioration of water quality which in turn depletes the aquatic biota. The use of the contaminated water by human population results in water borne diseases, so that quality of water must be tested for both the chemical as well as for the microbial contaminants (Smitha and Shivashanker 2013). Hence it is important to check the water quality at a regularly. The present paper investigates physicochemical and bacteriological analysis of Upper Lake Bhopal and also to access the degree of pollution caused by input wastes from catchment areas which effects the aquatic life

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STUDY AREA

The study area selected was Upper Lake located in the city of lakes Bhopal, Madhya Pradesh, India. (lattitude 23o 12' to 23o 16' N and longitude 77o 18' to 77o 23' E). The total area covered is 31 Sq. Km and the depth varies from 4 to 8 metres. The lake is fed by Kolans river in rainy season The maximum length of the Upper Lake is 10.6 km while the width comes out to be 3.25Km Maximum elongation is in the east- west direction,

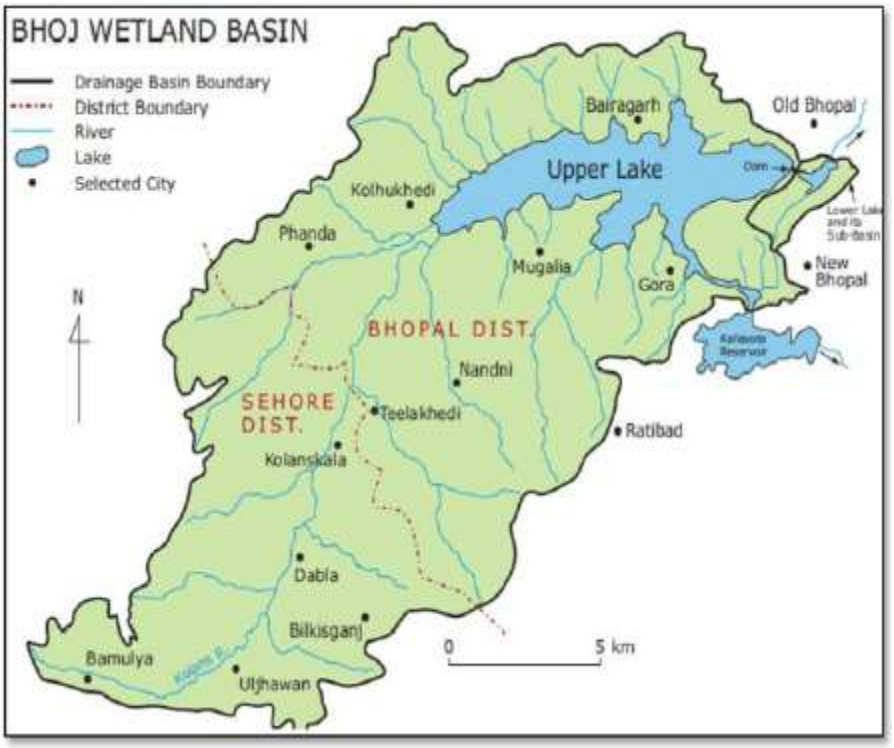

Fig. – Showing the map of the study area Upper Lake Bhopal.

Silent Features of Upper Lake Bhopal.

PERIOD OF CONSTRUCTION	**11TH Century A.D.**
TYPE OF DAM	Earthen
LOCATION: Latitude Longitude	23°12' - 23°16' N 77°18' - 77°23' E
CATCHMENT AREA (Sq.km.)	361
SUBMERGENCE AREA at FTL (Sq.km.)	36.54
FULL TANK LEVEL (MSL) (m)	508.65
DEAD STORAGE LEVEL (MSL) (m)	503.53
STORAGE CAPACITY (Million Chum.)	117.05
MAXIMUM DEPTH (m)	11.7

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DESIGNED FLOOD DISCHARGE (Sec./Sec)	2208
SOURCE OF WATER	Rain water
MAIN USE OF WATER	Potable water supply
INFLOW POINTS (Nos.)	31
SEWAGE WATER INFLOW (MLD)	50.47

MATERIAL AND METHODS

The water samples of Upper Lake Bhopal were collected in monsoon and post monsoon 2020 to assess the water quality The samples were collected in polyethylene bottle from selected sites and were analyzed for physicochemical and bacteriological parameters *viz.*, temperature, Total Alkalinity, TDS, free Co2, dissolved oxygen, total hardness, BOD, COD, MPN, lead, zinc cadmium and chromium by using standard procedure as mentioned in the Workbook of Limnology (Adoni *et al.*,1985) and (APHA, 2005).

RESULTS AND DISCUSSION

The temperature plays a crucial role in physical chemical and biological behavior of aquatic system (Dwivedi and Pandey, 2002). In the present study, air and water temperature is recorded with the help of mercury thermometer. The air temperature ranged between 28.5^0c (site 1) to 32.4^0c (site 2) during the monsoon and 33.5 (site 1) to31.6 (site 2) during the post monsoon and the water temperature ranged between 26.8^0c (site 1) to 27.7^0c (site 2) during the monsoon and 30.4^0c (site 1) to 30.1^0c (site 2) during the post monsoon. pH is the most important and commonly studied property of natural water and waste water. The main source of hydrogen ions within the ground water is carbonic acid in its various form. pH is a term to express the intensity of the acid and the alkaline condition of water body. Every coagulant used in the water purification process needs a specific pH range (for alum it is 4 to 7), in order to work effectively. The pH of Upper Lake ranged from 8 and 8.4 during monsoon to 8.5 and 8.2 during post monsoon. Total dissolved solids are mainly the inorganic mineral and sometimes some organic matter. In the natural water dissolved solids are composed of large variety of salt such as chloride, bicarbonate, sulphate, nitrate, phosphate, sodium, potassium, iron, manganese, calcium and magnesium which impart particular taste to water the density of water with high TDS adversely affects the human health. Higher concentration of TDS produce distress also in cattle and livestock. Water containing more than 500 mgl^{-1} of TDS is not considered suitable for drinking water supplies. In the present study, the TDS ranged between 223ppm to 240ppm. The minimum value was recorded 223ppm in post monsoon at station-2 and the maximum value was recorded 240ppm at station-2 in monsoon.The dissolved oxygen can be determined either by the Winkler method or by the use of dissolved oxygen electrodes. The concentration of oxygen in saturated water is dependent on temperature, pressure and salinity of the water. The dissolved oxygen during the investigation ranged between 7.2 to 8.8 mgl^{-1}. The minimum value was recorded 7.2 mgl^{-1} at station-I during monsoon and the maximum value was recorded 8.8 mgl^{-1} at station-II during post monsoon. The hardness in water is derived largely from contact with the soil and rock formation. It is mainly caused due to Ca^{++} and Mg^{++}Ions. The water containing excess hardness is not desirable for potable water. The term hard water and soft water may be defined within very specific concentration range as soft (0-50), moderately soft (50-100), slightly hard (100-150), moderately hard (150-200), hard (200-300) and very hard (>300). In the present study total hardness ranged from 82 to 98mgl^{-1}. The minimum value was recorded 82mgl^{-1} at station-II during monsoon and the maximum value was recorded 98 mgl^{-1} at station-II during the month of post monsoon. Total alkalinity is caused due to salt of weak acid and bi-carbonate. Highly alkaline water is not fit for potable use. The total alkalinity is largely governed by chemical composition of the aquatic ecosystem (Narain *et al*.,2009). In the present investigation, the total alkalinity was recorded between 85mgl^{-1} to 95mgl^{-1}. The minimum value of alkalinity was recorded 85 mgl^{-1} during post monsoon at station-I and maximum value was recorded 95 mgl^{-1} during post monsoon at station-II. In present observation Free CO_2 of lake was absent in both seasons at two different sites.

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Table - showing different readings of different physico-chemical, heavy metal and bacteriological parameters of different sampling sites						
Parameters	**Monsoon**		**Post Monsoon**		**BIS-10500**	
	SITE 1	**SITE 2**	**SITE 1**	**SITE 2**	**Desirable**	**Permissible**
Air Temperature (^{O}C)	28.5	32.4	33.5	31.6	-	-
Water Temperature	25.8	26.7	30.4	30.1	-	-
pH	8	8.4	8.5	8.2	6.5-8.5	No relaxation
Total Alkanity mgl^{-1}	76	94	85	95		
Total hardness mgl^{-1}	86	98	96	82		
Free CO_2 mgl^{-1}	ABS	ABS	ABS	ABS		
TDS	239	240	234	223	500	2000
BOD mgl^{-1}	2.4	1.6	2.6	2.2		
COD mgl^{-1}	22	40	24	20		
MPN Index	2800	2700	2100	2000		
Lead μgl^{-1}	0.001	0.002	0.003	0.002	0.01	No relaxation
Zinc μgl^{-1}	0.001	0.003	0.002	0.002	5	15
Chromium μgl^{-1})	0.001	0.011	0.04	0.001	0.05	No relaxation
Cadmium μgl^{-1}	0.002	0.003	BDL	0.001	0.003	No relaxation

BOD reflects the dissolved oxygen amount needed by aerobic organisms to breakdown organic matter occurring in water at a given temperature, for a specified time. BOD is an indicator of sewage and industrial pollution. The BOD content of various study ranged from 1.6 to 2.6 mgl^{-1}. The BOD values recorded from all sites were within the standards range of 3-20 mgl^{-1}recommended BIS-10500. The BOD of unpolluted water is less than 1 mgl^{-1}, moderately polluted water has the BOD range of 2-9 mgl^{-1}while heavily polluted water have BOD value more than 10 mgl^{-1} (Adakole, 2000). The present study revealed that water of Upper Lake falls under moderately polluted category. Chemical Oxygen Demand determines the oxygen amount needed for oxidizing the biodegradable and non-biodegradable organic matter in water by a strong chemical oxidant (Mahananda et al., 2010) under specific conditions of oxidizing agent, temperature and time. This is an indication of both sewage and industrial pollution. The COD value ranged from 20 $mgl^{-1}$to 40 mgl^{-1}.

Bacterilogical examinations of lake water has a significant in pollutions study, measures deleterious effect of pollution on human health. The pathogenic bacteria contaminated into water bodies by domestic sewage and other pollutants boating, bathing and immersion of idol and domestic sewage. Bacterial population are after considered as important indicator of pollution and eutrophication in the aquatic ecosystem. Faecal pollution of drinking water may introduce a variety of industrial pathogens i.e. bacteria viruses and other parasites. According to WHO (1978) water having MPN more than 10/100 ml is unfit for human use. During the present study the MPN value ranged from 2000/100ml to 2800/100ml.The minimum of 2000/100 ml was recorded on site-II in post monsoon while the maximum of 2800/100ml was observed on site-I in monsoon.

During investigation lead value ranged from 0.001 – 0.003 µg/l. minimum value was recorded in the monsoon and maximum value was recorded in the post monsoon. Higher value of lead concentration may be due to their surface runoff with rainwater. Zins value ranged from 0.001 to 0.003. Minimum value was observed in the monsoon and maximum value was observed in the post monsoon Chromium value ranged between 0.001 -0.004 µg/l. Minimum value was observed in the monsoon and maximum value was observed in the post monsoon. Similar results were also observed by Zafar (1997). Guideline value of chromium 0.05 mg/l is recommended by BIS. Cadmium value ranged between 0.001 – 0.003 µg/l.

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Minimum value was observed in the post monsoon and maximum in the monsoon. These findings could be supported by the studies made by Pani (2008) at Upper lake Bhopal. All the analyzed parameters of heavy metal were within the desirable limits given by BIS-10500.

CONCLUSION

The results obtained from the present study shall be useful in future conservation and management of the Upper Lake Bhopal. The results obtained were compared with standards given by BIS (IS:10500). All the physico-chemical and heavy metal parameters were within the desirable limits. Bacteriological parameters showed high contamination, this may be due to direct discharge of waste from catchment areas. Based on the values of the obtained through physico-chemical and heavy metal parameters, it can be concluded that the Upper Lake water quality was not much bad and did not show much significant pollution problem in the present study. Therefore, there is need to conserve lake, and aware the people for protection of natural lake water for human as well as aquatic life.

REFERENCES

1. *Adakole,J.A. "The effects of domestic, agriculture and industrial effluents on the water quality and biota of Bindare stream", Department of Biological Sciences, Ahmadu Bello University, Zaria, Nigeria, PhD Thesis, 2000, 256p*
2. *Adoni, A.D. Joshi, G., Ghosh, K., Chourasia, S.K., Vaishya, A.K. Yadav, M. and Verma, H.G. (1985). Workbook of limnology. Department of Botany. Dr. Harisingh Gour vishwavidyalaya Sagar. 1-212.*
3. *APHA (2005). Standard methods for the examination of water and waste water. 21st Edition, American Public Health Association/American Water Works Association/Water Environment Federation, Washington, DC.*
4. *Arain, M.B., T.G. Kazi, M.K. Jamali, H.I. Afridi, J.A. Baig, N. Jalbani and A.Q. Shah, 2008. Evaluation of physico-chemical parameters of manchar lake water and their comparison with other global published values. Pak. J. Anal. Environ. Chem., 9: 101-109.*
5. *Chidambaram, S., Ramanathan, AL., Shivanna, K., James, R.A. (Eds.) (2010) Recent trends in water research: Hydrogeological and hydrological perspectives. IK International Publishing House, Bangalore, India.*
6. *Forel F A. 1892.Le Léman - Monographie Limnologique. E. Rouge, Lausanne, Tome I:543p.*
7. *Mahananda, M.R., Mohanty, B.P., Behera, N.R. "Physico-chemical analysis of surface and ground water of Bargarh District,Orissa, India".in International of Research and Reviews in Applied Sciences, 2, 3, 2010, pp 284-295.*
8. *Pani, S., Bajpai, A.K., A., Dubey, A., Misra, S.M. (2000). Evaluation of water quality of Bhojland. In: Proceedings, National workshop on biodiversityPlanktonic Biodiversity of Bhoj Wetland, Bhopal, India.Wetland. Poll. Res. 20 (2), 147-153.*
9. *Smitha, D.A. and Shivashankar, P. (2013) Physico Chemical Analysis of the Freshwater at River Kapila, Nanjangudu Industrial Area, Mysore, India, International Research Journal of Environment Sciences, 2(8):59-65.*