E-ISSN: 2347-5129
P-ISSN: 2394-0506
(ICV-Poland) Impact Value: 5.62
(GIF) Impact Factor: 0.549
IJFAS 2017; 5(1): 223-227

www.fisheriesjournal.com
Received: 03-11-2016
Accepted: 04-12-2016

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Anthropogenic impact by phenol in relation to the physico-chemical parameters of Bhopal Lower Lake (M. P)

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Abstract
This study deals with the physico-chemical parameters undertaken during November 2014 to October 2015 in lower lake of Bhopal. The paper deals with the variety and abundance of pollutants along with phenol present in the lake among the various parameters recorded the overall surface water temperature range 7.4 °C to 30.4 °C., air temperature range 7.8 °C to 40.7 °C; Turbidity index 6.35 to 7.50 (Secchi-disc transparency) Dissolved oxygen 5.1 to 8.5 mg L-1; pH ranged between 7.25- 8.90; Electric Conductivity 360 to 395 µScm-1.; Total Alkalinity 130 to 150 mg L-1,Chloride values 18.3 to 20.30 mg L-1,Total Hardness 130 to 190 mg L-1; Ammonical Nitrogen 50.21to 72.84 µg L-1; Nitrate Nitrogen 130.31 to160.1 µg L-1; Nitrite Nitrogen 3.90 to 21.36 µg L-1.; and Phosphate Phosphorous 1.40 to 12.12 µg L-1.All the above parameters show that the pollution load including phenol are increasing due to anthropogenic pressure and climatic factors which results the eutrophic condition of the lake, so immediate remedial measures should be taken for its protection from further pollution. Use of phenolic compounds which directly enter in lake effects the fish diversity. The entry of these compounds not effects only the fish diversity but also effects on physio-chemical parameters of the lake.

Keywords: Physico-chemical parameters, phenol, pollution load, anthropogenic pressure, Bhopal lower lake.

1. Introduction
Phenols and phenolic substances are aromatic hydroxy compounds classified as monohydric (with one hydroxy groups e.g., phenol, cresols [methylphenols], xylenols [dimethylphenols]), dihydric (with two hydroxy groups e.g., catechols [o-dihydroxybenzenes], resorcinols [m-dihydroxybenzenes]) or polyhydric (with three or more hydroxy groups e.g. pyrogallol [1, 2, 3-trihydroxybenzene]), depending on the number of hydroxyl groups attached to the aromatic benzene ring. Phenols and particularly chlorophenols are toxic and particularly carcinogenic, and can affect the taste and odor of drinking water USEPA (1973) [1]. Phenol is produced naturally and synthesized as a manufactured chemical. Naturally, it is a constituent of coal tar and creosote, decomposing organic material, human and animal wastes, and as a compound found in many non-foods and foods. For example, salicylic acid is a natural phenolic compound found in willow bark.

Madhya Pradesh is rich with different aquatic ecosystem and has 3.0 lakh hectare water areas in the form of reservoir and ponds. All these aquatic ecosystems support diversified flora and fauna. In "Lake City Bhopal" large number of lakes and reservoirs are present, which are polluted due to multiple anthropogenic factors in catchment area of wetlands**.** The Lower Lake or Chhota Talaab is a lake in Bhopal, the capital of Madhya Pradesh state of India. Along with the Upper Lake, it forms the Bhoj Wetland. The lake was built by creating in 1794 to beautify the city. The construction was commissioned by Chhote Khan, a minister of Nawab Hayat Muhammad Khan Bahadur. A number of earlier wells were merged in this lake. The bridge that separates the Lower Lake and the Upper Lake is called "Pul Pukhta" or Lower Lake Bridge. The lower lake has also been mentioned as "Pukhta-Pul Talao" in literature**.**. This Lower Lake is located to the east of the Upper Lake. An earthen dam separates the two lakes. The two lakes are built in a terraced manner, the lowest level of the Upper Lake is just below the highest level of the Lower Lake. The Lake has an area (water spread) of 1.29, and its

catchment area is 9.6 km². The lake receives subsurface seepage from the Upper Lake. In the 1850s, the maximum and minimum depths of the lake were 11.7 m and 6.16 m respectively [2]. As of 2011, the maximum depth was 10.7m. The Lake does not have any fresh water source; it receives seepage water from the Upper Lake and drainage from 28 sewage-filled nallahs [3]. It drains into the Patra rivulet, which joins Halali River, a small tributary of the Betwa River. The Lower Lake suffers from pollution due to drainage from sewage-filled nallahs, lack of fresh water source and commercial washing of clothes. The entire lake is eutrophic, and its water is not suitable for drinking [3].

Since 90·s the water bodies have been marred by extensive pollution, siltation and encroachments, gradually affecting the fish biodiversity. As per current scenario of the said water body, the anthropogenic activities effects the biotic species of the lake especially fish fauna, which indirectly affects on the whole food chain of the said lake. To understand such impacts caused by anthropogenic activities on the fin fishes of both inlet and outlet sources of the upper lake the present study was carried out the affect of pollution on Physico-chemical parameters of Bhopal lower lake.

Solid wastes are unwanted materials thrown away in solid form, arising from the normal community activity. It includes garbage i.e. kitchen and food wastes, rubbish materials like paper, rag, glass bottles, metallic cans, plastics, fibers, residues from home fuels, street sweeping, building debris, rubbles and abandoned vehicles. Urban solid waste is also called as municipal waste or garbage or trash. Modernization in agricultural system results in extensive use of chemical fertilizers and pesticides. Agricultural practices are one reason for deterioration of the soil fertility. Excessive pollution results in change of soil environment and also decreases the fertility of soil. Industrial pollutants change the soil fertility, Sastry, *et al*. (2001) [4]. Industrial toxic effluent contaminating the soil. One of these contaminants is the introductions of heavy metals such as lead in adjacent soils of roads especially those with high vehicular traffic, Ubogu, 2006. Some of the industries dispose off solid waste and effluents in the open ground which ultimately affect the domestic animals and crops, Pria, *et al*., (1998) [5].

2. Study Area

The lake of occupies almost central position between, old and new Bhopal. It lays 230 14' -230 16' N latitude and 77025 E longitudes its surface area is about 1.297sq.km. Chhota Talab is very beneficial for the for the people of Bhopal as its water is used for various domestic purposes, fish culture and Boating.

2.1 Experiment Design and Setup

To evaluate the experimental results, four sampling stations were selected around lower lake namely (site A) Sultuna road, (site B) MLB Girls college, (site C) Hamidia school, (site D) Professors colony. Water samples were collected from the site at different intervals in the month November (2014).to October (2015) The water samples were collected from the surface layers of the Lower Lake and subjected to physicochemical parameters following the procedure prescribed by APHA 6 and Adoni, 7. The parameter water temperature range, Air temperature range; Turbidity index (Secchi-disc transparency) Dissolved oxygen; Electric Conductivity; Total Alkalinity, Chloride values, Total Hardness; Ammonical Nitrogen; Nitrate Nitrogen; Nitrite Nitrogen and Phosphate Phosphorous at different intervals.

3. Results and Discussion

The Values of water quality parameters of four different selected site of lower lake were mentioned in Table 1 respectively. In the water quality index calculation, pH is an important parameter which determines the stability of water for various purposes. Evaluation of physico-chemical parameters is basic to the understanding of the status of water body. The results of various physico-chemical parameters of the water samples of Bhopal lower Lake are presented in the given table 1.

S. No	Parameter	Site A	Site B	Site C	Site D
1	Air Temperature (oC)	7.9 ± 0.16	8.1 ± 0.12	7.8 ± 0.11	7.9 ± 0.06
		40.7 ± 0.26	40.4 ± 0.16	40.9 ± 0.20	40.3 ± 0.18
2	Water temperature (oC)	7.4 ± 0.27	7.4 ±0.16	7.6 ± 0.31	7.5 ± 0.33
		30.4 ± 0.22	30.2 ± 0.34	30.5 ± 0.25	30.1 ± 0.28
3	Turbidity Index (cm)	6.35 ± 0.05	6.47 ± 0.05	6.5 ± 0.14	6.30 ± 0.04
		7.50 ±0.04	7.57 ± 0.05	7.43 ± 0.28	7.39 ± 0.08
4	Dissolved Oxygen (mgL-1)	5.8 ± 0.27	5.9 ± 0.26	5.1 ±0.26	5.1 ± 0.11
		8.5 ± 0.21	8.6 ± 0.26	8.9 ± 0.27	8.8 ± 0.27
5	pH	7.20 ± 0.05	7.25 ± 0.03	7.29 ± 0.06	7.33 ± 0.04
		8.90 ± 0.03	8.93 ± 0.02	8.99 ± 0.06	8.95 ± 0.02
6	Electrical Conductivity (Scm-1)	360 ± 3.63	365 ± 5.71	355 ± 6.57	359 ± 3.63
		395 ± 3.63	390 ± 3.53	395 ± 4.39	389 ± 5.53
7	Total Alkalinity (mgL-1)	130 ± 2.12	130 ± 2.55	132 ± 2.12	135 ± 3.08
		155 ± 4.07	150 ± 2.67	153 ± 2.67	153 ± 2.58
8	Chloride (mgL-1)	18.3 ± 0.37	18.8 ± 0.28	17.3 ± 0.39	17.5 ± 0.37
		20.30 ± 0.28	20.0 ± 0.25	21.9 ± 0.32	21.7 ± 036
9	Total Hardness (mgL-1)	130 ± 3.14	128 ± 1.61	130 ± 2.73	134 ± 3.60
		188 ± 3.25	185 ± 2.68	190 ± 3.50	188 ± 2.68
10	Ammonical Nitrogen (µgL-1)	50.13 ± 0.05	50.47 ± 0.14	50.23 ± 0.14	50.21 ± 0.60
		72.84 ± 0.05	72.63 ± 0.32	72.3 ± 0.16	69.00 ± 0.43
11	Nitrate Nitrogen (µgL-1)	133.4 ± 3.79	130.31±2.11	130 ± 2.66	131.1 ± 2.22
		160 ± 2.56	160.1 ± 3.25	160 ± 5.01	159 ± 3.78
12	Nitrite Nitrogen (µgL-1)	3.90 ± 0.07	3.92 ± 0.11	3.97 ± 0.15	3.4 ± 0.16
		21.4 ± 0.51	22.2 ± 0.39	21.40 ± 0.12	21.36 ± 0.07
13	Phosphate Phosphorus (µgL-1)	1.50 ± 0.02	1.42 ± 0.03	1.40 ± 0.05	1.43 ± 0.05
		11.13 ± 0.06	11.11 ± 0.06	12.12 ± 0.32	12.16 ± 0.56

The various physico-chemical parameters of the water samples of Bhopal lower Lake which are discussed below. The change in the parameters is due to pollutants. The different pollutants directly enter in the lake. Mostly phenols enter in it through drainage system, washing of clothes, and many other purposes. These phenols effect the physico chemical analyses of the lake. which further become harmful for different diversities of the lake.'

3.1 Temperature

The surface temperature of Air and water of different study sites during the study period ranged from 7.8 °C to 40.7 °C and 7.4 °C to 30.4 °C. The maximum water temperature was recorded in august and minimum temperature was observed in December, while as for air temperature the maximum was recorded in June and minimum in January. The monthly variation was noticed during the present investigation in both air and water temperature, which is in accordance with Yousuf and Qadri [6]. A close relation relationship between the air and surface water has been reported by Wanganeo [8].

3.2 Turbidity index (Secchi-disc transparency)

In the present study water turbidity values ranged from 6.35 to 7.50 in all the study sites throughout the whole study period. The present study revealed low secchi values. The low values have been attributed to different factors, viz. plankton population [10], setting of materials in calm weather, suspension of phytoplankton in water [11], glacial silt [12]. The incoming sewage and high loading dissolved organic matter is also the factor for low secchi values [9]. During rainy season silt, clay and other suspended particles contribute to the turbidity values, while during winter and summer seasons settlement of silt, clay results low turbidity.

3.3 Dissolved oxygen (DO)

Dissolved oxygen is one the most important parameters in water quality assessment and important regulator of metabolic processes of organisms and also the community as a whole [13]. In the present study, the DO concentration in all the study sites varied from 5.1 to 8.5 mg L-1 through the study period, but it was absent in bottom waters for all the study sites throughout the study period. The maximum concentration of D.O. was observed in February in surface waters can be attributed to vigorous photosynthetic activity of the autotrophs. A marked decrease
of DO in July can be the result of increasing water temperature and rate of consumption. A prominent decrease in DO content from surface to its complete absence in the bottom water showed that the vertical profiles of DO would be a clinograde type. The present findings are in
broad agreement with Wanganeo [9] and Wanganeo and Wanganeo [14].

3.4 pH

During the present study the values of pH ranged between 7.25- 8.90. Variations of pH over a high range are often observed in the lakes due to several factors such as influence of fresh water inputs, pollution, photosynthesis interaction with suspended matter etc. High range of pH at surface (7.3 to 8.6) indicates the higher productivity of the water body. The present values recorded in all the study sites are in agreement with the findings of Qadri and Yousuf [15] in Lake Malpur Sar, Kashmir, Qadri and Yousuf [16] in Lake Manasbal, Kashmir, Devi [17] in Loktak Lake, Manipur (7.4 to 8.9), Vyas *et al*. [18] in Udaipur (7.1 to 9.1) and Billore and Vyas [19] in pichhola lake, Udaipur (7.46 to 8.64).

3.5 Electrical conductivity

The present values of electric conductivity varied from 360 to 395 µScm-1. The highest value was recorded in July where as the lower value was recorded in January in all the study sites. In the present study very high Electric conductivity values were observed throughout the study period. This enhancement of conductivity values is due to periodical sedimentation of decomposing organic material. The present values are in broad agreement with Sarwar and Irfan-ul-Majid [20] in Wallur Lake, Kashmir and Wanganeo [9] in the Manasbal Lake, Kashmir.

3.6 Total alkalinity
The Total alkalinity values in all the study sites during the study period ranged from 130 to 150 mg L-1. This was due to intense photosynthetic activity removing free as well as bound carbon dioxide from bicarbonates. As a result calcium carbonate got precipitated and pH value increased. In the present study the bottom water showed high total alkalinity in close relation with decomposition process. The present values are in broad agreement with Wanganeo [9] in Manasbal Lake, Kashmir, Hussainy [21], and Sreenivasan [22].

3.7 Chloride
The chloride contents of the water samples in all the study sites throughout the study period varied from 18.3 to 20.30 mg L-1. The present study found a narrow fluctuation for chloride both vertically as well as with time (i.e. throughout the study period). This may be due to the organic load and sewage in the water body. Similar findings were observed by Ali *et al*. [23] in regulated water bodies of Egypt in Aswan Reservoir.

3.8 Total hardness
The values of total hardness ranged from 130 to 190 mg L-1. Hardness is the concentration of multivalent metallic cations in solution and, due to carbonate and bicarbonate of calcium and magnesium salts from detergents and soap. Similar observations were noticed by Wanganeo [9], Trisal [24] and Pandith [25].

3.9 Ammonical nitrogen
In the present study, Ammonical nitrogen values ranged from 50.21to 72.84 µg L-1. A decreasing trend in ammonical nitrogen was observed throughout the study period (i.e. from January to November) this may be due to nitrification or direct absorption by many phytoplanktons' [25, 27]. In bottom waters it may be due to decomposition of organic matter present in the anoxic hypolimnetic sediment and near mid water interface.

3.10 Nitrate nitrogen
In the present investigation period Nitrate nitrogen ranged from 130.31 to160.1 µg L-1. In the present study period an increase in concentration of nitrate nitrogen was observed, can be related to oxidation of ammonical nitrogen to nitrate [28].

3.11 Nitrite nitrogen
The Nitrite nitrogen values during the study period ranged from 3.90 to 21.36 µg L-1. Nitrate nitrogen is an unstable product of either nitrification of free ammonia or denitrification of nitrates. The lowest value was observed in July and highest value in March.

3.12 Phosphate phosphorus
In the present study Phosphate phosphorus ranged from 1.40 to 12.12 µg L-1 in all the study sites. In vertical column, values were generally increasing from surface to bottom, Wanganeo [9]. This may be due to both allochthonous and autochthonous inputs, when the metabolic activity in the water starts to gear up.

4. Conclusion
In this study, the physico-chemical parameters at different sites varied considerably during the study period due to the impact of anthropogenic activities along with the phenol. The high values of the physico-chemical parameters obtained in the present study indicate the eutrophic status of the Lake is due to over pollution. Hence immediate remedial measures should be taken up for protection and conservation of this Monomictic Lake in order to save it from further pollution and deterioration.

5. References

1. USEPA (United States Environmental Protection Agency) Water Quality Criteria, 1972. Section IV Marine aquatic life and wildlife U.S Washington, D.C. 1973, 269.
2. Jump up to:$^{a\ b}$ Places of Interest in Bhopal. Collectorate, Bhopal. Retrieved 2011-10-28.
3. Jump up to:$^{a\ b}$ Prashant S. Khirwadkar Lake front planning for a sustainable lake". In Ugo Maione; Beatrice Majone Lehto; Rossella Monti. New trends in water and environmental engineering for safety and life (illustrated ed.). Taylor & Francis, 2000. ISBN 978-90-5809-138-3.
4. Sastry KV, Shukla V, Abusaria S, Gill P. Studies on the impact of bicycle manufacturing industry effluents on soils, Poll. Res. 2001; 20(2):187-192.
5. Pria, parivarthan. Vikasachya shodhat- Lote Industrial area. Publish-Pira, New Delhi and parivarthan, Chiplun, 1998.
6. American Public Health Association (APHA), Standard methods for examination of water and waste water, 16 edition, American Public Health Association, Washington DC, USA, 1995, 8
7. Adoni AD. Work Book on Limnology. Bandna Printing Service, New Delhi, 1985, 216.
8. Yousuf AR, Qadari MY. Seasonal distribution of family Chydoridae (Cladocera: Crustacea) in Lake Manasbal, Kashmir J Indian Inst Science. 1981a; 63(C):35-42.
9. Wanganeo A. Phytoplankton photosynthesis, Nutrient dynamic and tropic status of Mansabal Lake Kashmir, Ph.D. Thesis of Kashmir University, India, 1980.
10. Zutshi DP, Vass KK. High altitude lakes of Kashmir. Ichthylologica 1970; 10:12-15.
11. Khan MA, Zutshi DP. Contribution to high altitude limnology of the Himalayan system I. Limnology and primary productivity of the plankton community of Nilnag Lake, Kashmir. Hydrobiologia. 1980; 75:103-112.
12. Zutshi DP, Khan MA. On Lake Typology of Kashmir. Environ Physiol Ecol Plants 1978, 465-472.
13. Hutchison GE. A Treatise on Limnology, Introduction to Lake Biology and the Limnoplankton, John Wiley and Sons, New York, 1967, 2.
14. Wanganeo A, Wanganeo R. Hydraulic detention period carrying capacity of a system. J Hydrobiology. 1994; 1:1-6.
15. Qadri MY, Yousuf AR. Limnological studies on Lake Malpur Sar. The Biotope Geobiosciences. 1980; 7:117-119.
16. Qadri MY, Yousuf AR. Influence of physico-chemical factors on the seasonality of cladocera in lake Manasbal. Geobiosciences. 1980; 7:273-276.
17. Devi NB. Distribution, Primary Production and Nutrient status of themacrophytic University, Manipur, 1993.
18. Vyas LN, Sankhal, Paliwal PP. Hydrobiological studies of Udaipur Lakes. In J S Singh and B Gopal (edn). Perspectives in Ecology, Jagmander Book Agency, New Delhi, India, 1989.

19. Billore DK, Vyas LN. Distribution and Production of Macrophytes in macrophytes in Pichhola Lake, Udaipur (India). In B Gopal, RE Turner, RG Wetzel and DD Whigham (edn), Wetlands Ecology and Management, National Institute of Ecology and International Scientific Publications, India, 1982.
20. Sarwar SG, Irfan-Ul-Majid. ABIOTIC features and diatom population of Wular Lake, Kashmir. EEC. 1997; 3:121-127.
21. Hussainy SU. Studies on the Limnology and primary production of a tropical lake. Hydrobiologia. 1967; 30:335-352.
22. Sreenivasan A. Limnology of tropical impoundments: a comparative study of the major reservoirs in Madras State (India). Hydrobiologia. 1970; 36:443- 469.
23. Ali MM, Hamad AM, Springuel IV, Murphy KJ. Environmental factors affecting submerged macrophyte communities in regulated water bodies in Egypt. Arch Hydrobiologia. 1995; 133:107-128.
24. Trisal CL. Studies on primary production in some Kashmir lakes, Ph.D thesis, The University of Kashmir, India, 1977.
25. Pandit AK. Dal Lake ecosystem in Kashmir Himalaya: Ecology and management. In: Ecology and pollution of Indian lakes and reservoirs. (PC Mishra and RK Trivedy edns), Ashish Publication House, New Delhi, India, 1993.
26. Takahashi M, Saijo Y. Nitrogen metabolism in Lake Kizaki, Japan, Ammonium and Nitrate uptake by phytoplankton. Arch Hydrobiologia. 1981; 91:393- 407.
27. Toetz DQ. Effects of pH, phosphate and ammonia on the rate of uptake of nitrate and ammonia by freshwater phytoplankton. Hydrobiologia. 1981; 76:23-26.
28. Quastle JH, Scholefield PG. Biochemistry of nitrification in soil. Bacteriol Rev. 1951; 15:153.