

Chemical, biological assessment and water quality index of Lower Manair Dam

¹L. Srinivas, ²Y.Seeta, ³P.Manikya Reddy

^{1,2} Research Scholars, Department of Botany, Osmania University, Hyderabad, India.

³ Professor, Department of Botany, Osmania University, Hyderabad, India.

Abstract

The present study was carried out to assess the quality of water in the Lower Manair Dam, Karimnagar district. To study the quality of water by evaluating physico-chemical parameters, biological parameters and water quality index for a period of two years. It is the main source of drinking water for Karimnagar, surrounding villages, Warangal, agriculture and supports fish culture. The surface water samples were collected and analysed various physico-chemical parameters. All the physico-chemical parameters were well below the permissible limits. Mainly four groups of planktonic algae were recorded in Lower Manair Dam. They were Bacillariophyceae, Chlorophyceae, Cyanophyceae and Euglenophyceae. Bacillariophyceae dominating during the entire study period. The water quality index (WQI) values of the study area were calculated. pH, total alkalinity, chlorides, total hardness, calcium, magnesium, nitrates, sulphates, total dissolved solids and dissolved oxygen were the parameters considered for the calculation of Water quality index. The water quality index levels of the lake and all the three stations were clearly shows that, the status of the water body is oligotrophic and it is suitable for the human consumption.

Keywords: Physico-Chemical Parameters, Phytoplankton, Water Quality Index, Manair Dam

1. Introduction

All life on this planet totally depends on the 'Water' which exist in nature in various forms such as ocean, river, lakes, clouds, rain and snow etc. As far as lakes are concerned, they are the most fertile, diverse, productive and interactive ecosystem in the world. The term water quality comprises the water column and the physical channel required to maintain and sustain aquatic life (Jha and Barat, 2003; Sharma *et al.*, 2015) [8, 16]. The physico-chemical characteristics of any water body or any aquatic ecosystem and the nature and distribution of its biota are directly related to and influenced by each other and controlled by a multiplicity of natural regulatory mechanisms (Chandrashekar, 2006; Ramalingam and Ramarani, 2004) [5, 19]. Surface water is generally using for drinking and irrigation purposes in India (Chaudari, 2009) [6]. The surface water bodies are the abundant and important sources of biological life (Tiwari and Chauhan, 2006) [21]. The phytoplankton in a reservoir is an important biological indicator of the water quality (Bhat and Pandit, 2003) [3]. They are among the primary producers in the aquatic ecosystems. They are vital parts of food chain in the aquatic ecosystems (Senthilkumar and Sivakumar, 2008) [17]. Phytoplankton has long been used to assess environmental conditions in aquatic habitats throughout the world (Sharma, 2010) [14, 15].

WQI of water can tell us whether the overall quality of water bodies possess a potential threat to various uses of water, such as habitat for aquatic life, irrigation water for agriculture and livestock, recreation and aesthetics, and drinking water supplies. Water quality index (WQI) is a single value indicator to the water quality (Kankal *et al.*, 2012) [9]. It integrates the data pool generated after collecting due weights to the different parameters. (Siddiqui and Ziauddin, 2006, Narayana *et al.*, 2008, and Ravikumar *et al.*, 2013) [18, 12, 20]

The present study is based on the analyses of physiochemical characteristics of lake water as samples of water collected from various locations of Manair Dam.

2. Materials and Methods

Karimnagar District is a district in northern Telangana, India. Karimnagar district occupies an area of 11,823 square kilometers (4,565 sq mi). It coordinates 18.43694 °N latitude and 79.124167 °E longitude. It borders Adilabad District in the north, Maharashtra and Chhattisgarh in the northeast, Warangal District in the south, Medak District in the southwest and Nizamabad District in the west. Lower Manair Dam Situated at Karimnagar District, Telangana State. The Lower Manair Dam is located on the Manair River at 18 °24' N latitude and 79° 20' E longitude in Karimnagar District at Km.146 of Kakatiya Canal. It is important to explore diversity of algae in Manair Dam.

The water samples were collected at monthly interval, for a period of two years at three sampling stations in the lake. Physico-chemical parameters were analysed by following the standards methods (APHA, 2005) [2]. One litre of surface water samples were collected from three different stations of the dam and samples were kept in the sedimentation column after adding 2-3 ml of 4% formaldehyde solution.

3. Results and Discussion

3.1 Physico-chemical parameters

The average values of various physico-chemical factors are given in Table-1. From the table, it is evident that all the parameters are well below the permissible limits.

PH of the water remained alkaline throughout the study period. The recommended pH for drinking purposes is between 6.5 to 8.5 (BIS, 2003) [4]. pH in all the samples analyzed are well within the desirable and suitable range. The higher value of pH in winter season is attributed to decreased

temperature and high values of DO and carbonate (Kumar and Sinha, 2010) [10].

The most important parameter is DO to assess the water quality. Dissolved oxygen showed higher value in winter season and moderate in summer season. Similar findings were made by Tiwari and Chauhan (2006) [21] and Altaf H. Ganai and Saltanat Parveen (2014) [1]. According to standards the values of BOD should not be more than 6mg/L (Pawar and Pulle, 2005 and Gayathri *et al.*, 2013) [13, 7]. In the present observation the BOD levels remain below the standard which indicates clean water without any organic content.

Chlorides, bicarbonates, total hardness and organic matter were recorded in low concentration throughout the period of investigation. The average values of the important physico-chemical variables of the lake studied along with the standards stipulated by BIS (2003) [4] is given in the Table - 1. From comparison it is clear that the water in Manair Dam can be termed 'less contaminated' because all the factors are within the permissible limits.

3.2 Biological Parameters

During the present investigation the phytoplanktonic population in Manair Dam was found to be the class Bacillariophyceae was dominant among all other classes having maximum diversity followed by Chlorophyceae, Cyanophyceae and Euglenophyceae having least diversity (Table-2). Similar pattern of dominance of different classes among phytoplankton has been observed by Rajeev Sharma and Ajay Kapoor (2010) [14].

Diatoms are best indicators of pollution which are placed first position. This group of phytoplankton representing the species of *Cymbella affinis*, *Nitzschia denticula*, *Navicula rhynchocephala*, *Synedra ulna*, *Achnanthes microcephala*, *Mastogloia smithii*, *Rhopalodia gibba* and *Diploneis ovalis*.

Chlorophyceae occupies the second position. This group is represented by *Pediastrum boryanum*, *P. simplex*, *Scenedesmus bijuga*, *S. armatus*, *Ankistrodesmus falcatus*, *Oocystis crassa*, *Tetraedron regulare*, *Cosmarium granatum* and *Cosmarium variolatum* are in good number indicates the lake water is free from pollution because of the above phytoplankton existence in well aerated fresh waters.

Cyanophycean group consist of fresh water forms such as *Merismopedia punctata*, *M. glauca*, *Oscillatoria formosa*, *Gomphosphaeria aponina*, *Coelosphaerium kuetzingianum*, and *Chroococcus turgidus* indicates that the lake water is well aerated with low organic matter, hardness and well balanced nutrients. This is in concurrence with the findings of Manikya Reddy and Venkateswarlu (1987) [11].

In the present investigation at all the stations *Euglena*, *Phacus* and *Trachelomonas* species were present in very low numbers.

3.3 Water Quality Index (WQI)

During the present investigation, the standards for the drinking water, recommended by BIS are considered for the computation of surface water quality rating (qi) and unit weights (Wi), for the purpose of calculate WQI. Ten parameters have been selected; they are pH, total alkalinity, chlorides, total hardness, calcium, magnesium, nitrates, sulphates, total dissolved solids and dissolved oxygen.

In the present study, considering ten selected physico-chemical parameters the water quality index was calculated for three stations. The results of water quality index employing ten parameters showed 65.74, 70.76 and 70.42 at station -I, station-II and station-III respectively. (Table-3)

The status of water corresponding to the WQI is categorized into five types which are given in Table: 4. From the table, different sampling stations are calculated as per the procedure described earlier. The water quality index values are given in Table: 3. Basing on the results obtained, all the physico-chemical parameters are well below the permissible limits as prescribed by Indian standards.

However, the WQI values (65.74 - 70.76) calculated for the different samples indicate that the water is safe for human consumption. It can safely be considered that the values of WQI in the present investigation were reported to be less than 75, indicating that the water is suitable for human consumption. It is evident that the surface water samples of the lake are falling under good category and it is suitable for domestic, irrigation and industrial purpose.

4. Tables

Table 1: Comparison of Physico-Chemical Parameters with BIS Standards

S.No	Physico - Chemical Parameters	Station - I	Station-II	Station-III	BIS(2003)	
					P	E
1	p ^H	8.43	8.26	8.42	5	25
2	CO ₃ ²⁻	31.38	25.31	33.74		
3	HCO ₃ ⁻	255.80	259.72	246.31		
4	Cl ⁻	135.57	133.70	136.87	250	1000
5	DO	8.78	9.41	9.93	6	
6	BOD	4.90	5.70	2.57	3	
7	TH	158.70	208.13	172.44	300	
8	Ca ²⁺	54.86	44.48	42.86	75	200
9	Mg ²⁺	25.32	39.86	31.41	30	100
10	TDS	261.70	307.50	340.73	500	
11	SO ₄ ²⁻	36.47	34.69	34.30	200	400
12	NO ₃ ⁻	2.30	0.78	1.79	45	45

Table 2: Common and Dominant Species of Phytoplankton in Lower Manair Dam

Group	Dominant Species
Bacillariophyceae	<i>Synedra tabulata</i> <i>Cocconeis placentula</i> <i>Mastogloia smithii</i> <i>Gyrosigma accuminatum</i> <i>Amphora ovalies</i> <i>Navicula rhynchocephala</i> <i>Cymbella affinis</i> <i>C. cymbiformis</i> <i>C. tumida</i> <i>Rhopalodia gibba</i> and <i>Nitzschia denticula.</i>
Chlorophyceae	<i>Scenedesmus acutiformis</i> <i>S.armatus</i> <i>S.perforatus</i> <i>Coelastrum cambricum</i> <i>Pediastrum boryanum</i> <i>P.simplex</i> <i>P.duplex</i> <i>P. tetras</i> <i>Cosmarium granatum</i> and <i>C.laeve</i>
Cyanophyceae	<i>Chroococcus turgidus,</i> <i>Gomphosphaeria aponina</i> <i>Merismopedia glauca,</i> <i>Oscillatoria formosa</i> and <i>Osc.princeps</i>

Table 3: Water Quality Status of Lower Manair Dam

S.No	Station	Wqi	Status
1	Station-I	65.74	Good
2	Station-II	70.76	Good
3	Station-III	70.42	Good

Table 4: WQI and Corresponding Water Quality Status

S. No	Wqi	Status	Possible Usages
1	0-50	Excellent	Drinking, irrigation and industrial
2	50-100	Good	Domestic, irrigation and industrial
3	100-200	Poor	Irrigation
4	200-300	Very poor	Restricted use for irrigation
5	>300	Unfit for drinking	Proper treatment required before use.

5. Conclusion

In the lake both physico-chemical and biological parameters have been taken into account for assessing the quality of water. Among the biological parameters the algal data has been used as an important tool in lake study. All the species observed at all the stations belongs to unpolluted water organisms. WQI analysis showed that the water of lake is in good condition for drinking purpose. Both physico-chemical and biological data analyzed in the Manair Dam indicates that the lake is at present free from pollution and the quality of water is good. Hence, it can be safely used for different purpose such as drinking, domestic and agriculture purposes.

6. Acknowledgements

The authors wish to thank Head Department of Botany for providing research facilities and one of the author is thankful to Department of Science and Technology, Government of India for providing the research fellowship.

7. References

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