International Journal of Botany Studies
www.botanyjournals.com
ISSN: 2455-541X
Received: 03-05-2022, Accepted: 18-05-2022, Published: 04-06-2022
Volume 7, Issue 6, 2022, Page No. 13-16

Evaluation of organic pollution by palmer's algal index of Kotmara Reservoir in Sangamner (Ahmednagar) Maharashtra, India

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Abstract

The present study was conducted to assess the problem of organic pollution of Kotmara reservoir, Sangamner Taluka, Ahmednagar District, Maharashtra. Present investigation three different locations (K1, K2 and K3) were selected for collection of water algal samples. During the research work Palmer index, algal genus and algal species pollution index were employed to study the water quality of Kotmara reservoir. Palmer's Algal Index showed that K3 and K2 sites in Kotmara reservoir have high organic pollution. The K1 site Palmer's algal genus index showed moderate pollution, but Palmer's algal species index was little organic pollution. The predominance of genera with tolerance to pollution were Oscillatoria, Euglena, Chlorella, Phormidium, *Ankistodesmus*, *Scenedesmus*, Synedra and Navicula.

Keywords: palmer's index, algae, bio-indicators, pollution index and kotmara reservoir

Introduction

Kotmara fresh water reservoir (Ambidumala Project) is one of the important reservoirs near Ambidumala village of TalukaSangamner of Ahmednagar district. It is situated on Kas River and is a tributary of Mula River.The sources of water in Kotmara reservoir for surrounding the area of Ambidumala and Kurkutwadi village. The important purposes of this reservoir are used for drinking and irrigation purposes of farming in the total command area of Kotmara reservoir. But, there is a water degradation, because of the huge use of chemical fertilizers, washing in domestic animals, washing of cloths and sewage discharge waste material flow in this Kotmara reservoir.

The water contamination mostly depends on the population of algae and inorganic chemicals are responsible for the growth of algale bodies. Wagh and Jondhale, (2018) [11] has been reported that human interference is directly effects on nature water reservoirs. Radhakrishnan *et al*., (2007) pointed out that almost 70% of water in India has become polluted due to the discharge of domestic sewage and industrial effluents into natural water sources such as rivers and streams as well as lakes. The natural water maintains a wide variety of aquatic life which is balanced with the environmental behaviors (Manoj and Pooja, 2012) [4]. Dokulil, (2003) [13], also reported that, water quality changes are caused by an environmental stress factors such as influx of organic nutrient into a low nutrient water body, there by altering the equilibrium state or dominance of particular bio-indicator species of algae community.

Therefore, algae are considered as very good bio-indicator of water quality due to their repaid response to pollutants. Alp, *et al*., (2012) [15] mentioned that algae are important biological organisms for purification of water bodies because they absorb organic and inorganic pollutants, heavy metals and radioactive substances. Similarly, Sushma and Ramesh, (2018) [10] observed that algae are one of the most rapid bio-indicator of water quality changes due to their short life spans, quick response to pollutants and easy to determine their numbers. So, individual species of algae are bio-indicators or tolerance of particular habitat and their ability to grow other algae under particular conditions of water quality. It was the first observed by the correlation between organic pollution with algal members (Pearsall, 1932) [8]. Palmer (1969) [6] first reported that they identify and prepare a list of genera and species of algae with reference to the tolerance of organic pollution. So, the study of algal bodies is essential for quality of water and it helps toverifying or understanding algae as a bio-indicators. Kotmara reservoir receives huge quantity chemical fertilizers, washing in domestic animals, washing of cloths and sewage results in organic pollution which encourages large number of disease spreading organisms. Based on above information and lack of organic and inorganic pollution assessment is essential for in Kotmara reservoir. Therefore, the present study was conducted to evaluate the organic pollution intensity and tolerance of algae in Kotmara reservoir by using Palmer's pollution scale.

Material and Methods

Kotmara reservoir is in the geographic region of the taluka Sangamner in the district Ahmednagar, Maharashtra (Figure 1). It is situated on Kas River near Ambidumala and Kurkutwadi villages. The water samples for pollution analysis were collected from the freshwater reservoirs. The sampling method was used for the present investigation. The algal samples were collected from three different sampling locations such as K1 (situated near the Kurkutwadi village), K2 (towards southwest near the end of the west weir) and K3 (near tower tank at the Southern extremity of the reservoir) of the Kotmara reservoirs. All selected sampling sites were selected after the survey and all samples were collected monthly in the morning between 6.00 a.m. to 10.00 a.m. The samples were observed on the spot in natural conditions. Palmer (1969) [6] proposed a pollution index based on algal genus and species used in the rating water sample for high or low organic pollution. The pollution tolerant genera and species of algae were recorded from selected sampling locations. A pollution index factor was assigned to each genus and species by determining the relative number of total points scored by each alga. A list of most pollution tolerant genera and species according to Palmers index were calculated for all sampling locations. As per the Palmer, (1969) experimental study, in the present study the algal genus pollution index and algal species pollution index as shown in Table.1,2,3 and 4.

Table 1: Pollution index of algal genera at the sampling locations

Sr.No	**Group**	**Palmers Pollution Index Number**		
		K1	**K2**	**K3**
1)	Chlorophyceae	2	3	3
1	*Ankistodesmus*	1	-	-
2	*Chlorella*	1	1	1
3	*Clostenrium*	-	-	1
4	*Pandorina*	2	2	4
5	*Scenedesmus*			
2)	Cyanophyta	2	2	5
1	*Oscillatoria*	-	1	2
2	*Phormidum*			
3)	Bacillariophyta	-	1	-
1	*Cyclotella*	-	1	1
2	*Melosira*	-	2	3
3	*Navicula*	-	1	3
4	*Nitzschia*	2	2	-
5	*Synendra*			
4)	Euglenophyta	1	-	1
1	*Euglena*	11	16	24
Total		2	3	3

* 0-10-Lack of Organic Pollution, 10-15- Moderate Pollution, 15-20-Probable evidence of high organic pollution, 20 or More-High organic pollution.

Table 2: Pollution tolerant species of algae from the sampling locations

Sr. No	**Algale Species**	**Group**	**Sampling Locations**		
			K1	**K2**	**K3**
1	*Euglena gracilis*	E	+	-	+
2	*Nitzschiapalea*	D	-	+	+
3	*Oscillatorialimosa*	B	+	+	+
4	*Oscillatoriatenuis*	B	-	+	+
5	*Oscillatoriaprinceps*	B	+	-	+
6	*Scenedesmusquadricauda*	G	+	+	+
7	*Scendesmusdimorphus*	G	-	-	+
8	*Scendedesmusacuminatus*	G	+	+	+
9	*Synedra ulna*	D	+	+	-
10	*Ankistrodesmusfalcatus*	G	+	+	+
11	*Pondorinamorum*	G	-	-	+
12	*Chlorella vulgaris*	G	+	-	-
13	*Melosiragranulata*	D	-	+	+
14	*Cyclotellameneghiniana*	D	-	+	-
15	*Naviculacuspidata*	D	-	+	+
16	*Hantzschiaamphioxys*	D	+	+	+
17	*Micractiniumpusillum*	G	-	+	+
18	*Pediastrumboryanum*	G	+	+	+

19	*Pediastrum duplex*	G	-	+	+
20	*Anabaena constricta*	B	+	-	-
21	*Actinastrumhantzschii*	G	+	+	+
22	*Coelastrummicroporum*	G	+	+	+
23	*Fragilariacapucina*	D	-	-	+
24	*Cladophoraglomerata*	G	-	-	+

* G-Green algae (Chlorophyceae), D-Diatoms (Bacillariophyceae),B-Blue Green (Cyanophyceae), E-Euglenophyceae

Table 3: Pollution index of algal species at the sampling locations (Palmer 1969) [6]

Sr. No	Algal Species	Palmers Pollution Index Number		
		K1	K2	K3
1)	Chlorophyceae			
1	*Ankistrodesmusfalcatus*	3	3	3
2	*Chlorella vulgaris*	1	-	-
3	*Pandorinamorum*	-	-	3
4	*Scenedesmusquadricauda*	1	1	4
2)	Cyanophyceae			
1	*Oscillatorialimosa*	1	-	4
2	*Oscillatoriaprincep*s	-	-	1
3	*Oscillatoriatenuis*	-	1	4
3)	Bacillariophyceae			
1	*Cyclotellameneghinian*a	-	2	-
2	*Nitzschiapalea*	-	1	1
3	*Synedra ulna*	3	3	-
4)	Euglenophyceae			
1	*Euglena gracili*s	-	-	1
Total		09	11	21

* 0-10-Lack of Organic Pollution, 10-15- Moderate Pollution, 15-20-Probable evidence of high organic pollution, 20 or More-High organic pollution.

Result and Discussions

As per mentioned experimental study the water samples were collected by selecting three different locations of Kotmara water reservoir (Fig-1). Present study to observe the tolerant algal genus and species in Kotmara reservoir and pollution index numbers was shown in Table-1, 2, 3 and 4. Palmer (1969) [6] reported that the algal studied ingenus and species, which can tolerate organic pollution. They prepared a list of 60 genera and 80 species, which can tolerate organic pollution. Algal species reported in present investigations were recorded with Palmer's index number (Palmer 1969) [6], along with indication of occurrence. Present observations K3 sampling sites had the highest species and genus diversity as compared to other sites. In present investigations, 31 pollution tolerant genus and 24 pollution tolerant species from Kotmara reservoir have been recorded. As per the reference of Palmer (1980) [7] used 20 algal genera and 20 algal species, most tolerant to organic pollution and for calculating algal indices. Highest number indicates the most organically polluted water. The lower values indicate, organic pollution is less or absent. By applying Palmer's Index values, for rates of pollution, water samples as 0–10 lack of organic pollution; 10-15 moderate pollution; 15-20 probable evidence of high organic pollution and 20 or more, high organic pollution (Table - 2 and 4). By applying these parameters, pollution indexes, at each sampling site of Kotmara water reservoirs were analyzed, (Table - 2 and 4). Present study in water reservoirs, pollution index at site K3 shows high organic pollution pollution index is 25 and 20, genus and species, respectively. It shows probable evidence of high organic pollution. The sites K2 and K3, there is high organic pollution. In the present investigations, it was noticed that pollution tolerant species composition is found higher during the summer season. In the Kotmara reservoir the number of human activities are more at K2, and K3 sites. These results are compiled with Kashi Prasad and Chaudhari (1980) [3], Mishra and Saksena (1993) [5], Pingle and Mandhare (1995) [9], Gore and Pingle (2003) [2] and Deshmukh (2006) [1]. Therefore, I concluded that, as per Palmer index, the Kotmara fresh water reservoir is highly polluted. However, it is urgent to avoid human interference in this natural reservoir. Overall observation, sampling site K3 in the Kotmara reservoir highest polluted water as compared to other two sites.

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