Estimation of Organic Pollution By Palmer's Algal Index of Deothan Reservoir, Akole Taluka, Ahmednagar.

Wagh.B.D. and Jondhale.A.S [1]

Department of Botany, SMBT Arts Commerce and Science College, Sangamner, Tal-Sangamner, Dist-Ahmednagar.

[1]Department of Botany, MJM Arts Commerce and Science College, Karanjali,Tal-Peth,Dist-Nashik

Abstract:-

In the present investigations to study the organic pollution of Deothan reservoir, Taluka Akole, District Ahmednagar, Maharashtra during the period of 2004 and 2005. Present study three different locations (D1, D2 and D3) 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 Deothan reservoir. It showed that the sampling locations D2 are high organic pollution as compared to the other two locations. The locations D1 and D3 have moderate polluted water as per Palmer index. The genera with tolerance to pollution were Oscillatoria, Euglena, Chlorella, Phormidium, Synedra and Navicula.

Keywords: Algae, Bio-indicators, Pollution Index and Deothan Reservoir.

Introduction:-

Deothan reservoir (Adhala Project) is one of the important dams near Deothan village of Akole taluka of Ahmednagar district. The main purposes of this reservoir are drinking and irrigation purposes of farming. The main source of water in Deothan reservoir for surrounding the area of Deothan village. The reservoir was constructed in 1993 and the catchment area is 67.50 sq miles. The reservoir capacity is 1060 mcft. and command area is 230.67ha. Reservoir is situated in the northern part of Akole tahsil. It is a hilly area with high rainfall. Deothan reservoir was constructed on Adhala river, the tributary of Pravara. This river originates near village Ekdara, 18 km upstream of the reservoir. There is extreme annual variation of inflow of the reservoir. The excess use of chemical fertilizers, cattle washing, washing of cloths and sewage discharge on upstream are the main reasons for water degradation. The reservoir's water contamination depends on population of algae and inorganic chemicals are responsible for the growth of algale bodies. Manoj and Pooja, (2012), reported that the natural water maintains a wide variety of aquatic life which is balanced with the environmental behaviors.

Therefore, the 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 (Sushma and Ramesh,2018). 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). Palmer (1969) first reported that they identify and prepare a list of genera and species of algae with reference to the tolerance of organic pollution. Therefore, evaluation of algal bodies is necessary for quality of water and it is easy to understand or identify bio-indicators of algae. But, there is not any information about algal indicators of the Deothan reservoir for assessment of pollution status in the study area. Hence, the present study was aimed to analyze the organic pollution intensity and tolerance of algae in Deothan reservoir by using Palmer's pollution scale. The pollution status of sampling stations of Deothan reservoir was determined based on their index. This water pollution index is used for evaluation of water pollution.

Material and Methods:-

Deothan fresh water reservoir is in the geographic region of the taluka Akole in the district Ahmednagar, Maharashtra (Figure 1). It is situated on Adhala river, near Deothan villages. The water samples for pollution analysis were collected from the Deothan freshwater reservoirs. The sampling method was used for the present investigation. Water samples during the experimental study period were collected from January 2004 to December 2005 in Deothan water reservoirs. The algal samples were collected from three different sampling locations such as D1(towards the Savargaon pat village),D2 (near the canal alignment) and D3 (southern region near pump house) of the Deothan 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) 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.

Result and Discussions:-

In the present investigation the water samples collected from selected three different locations of Deothan water reservoir, have been identified (Fig-1). The algal genus and species pollution index was shown in Table-1, 2, 3 and 4 numbers. The Palmer (1969) reported that, the algal studied in genus 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), along with indication of occurrence. However, the sampling location on D2 shows highest species diversity (31) and location D1 shows lowest species composition (12). In present investigations, 33 pollution tolerant genus and 25 pollution tolerant species from Deothan reservoir have been recorded.

Palmer (1980) 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 index, at each sampling location of Deothan water reservoirs were analyzed, (Table - 2 and 4).

In water reservoirs, pollution index at locations D1 shows moderate organic pollution, While at D2, pollution index is 33 and 31, genus and species, respectively. It shows probable evidence of high organic pollution. At locations D2 and D3, there is high organic pollution. In the present investigations, it was noticed that pollution tolerant species composition is found higher during the summer season. Human activities are more at D2, and D3 locations; which causes eutrophication. These results are compiled with Kashi Prasad and Chaudhari (1980), Mishra and Saksena (1993), Pingle and Mandhare (1995), Gore and Pingle (2003) and Deshmukh (2006). Finally, I concluded that, as per referred Palmer index the Deothan fresh water reservoir is highly polluted. So, it is urgent to avoid human interference in this natural reservoir. Therefore, sampling location D2 in the Deothan reservoir highest polluted water as compared, to other two locations.

References:-

[1] Deshmukh, B.S.2006. Ecological Studies of Pravara River Maharashtra,Ph.D. Thesis submitted to the University of Pune.

[2] Gore, A.B. and Pingle, S.D.2003. Ecological study of Ujani dam backwater at Siddhteka, Tal-Karjat, Dist- Ahmednagar. Indian Hydrobiology, 6 (1 and 2): 63-67.

[3] Kashi Prasad and Chaudhari, M.1980. Water quality indices application on the Ganga river.J. Instn. Publ. Helth. Eng. India. 2: 1- 8.

[4] Manoj, K. S. and Pooja, L.2012. Structural and Physico-chemical Correlation of Algal Community of a Wetland Affected by Pulp and Paper Mill Effluents. Global Journal Inc. (US). 256pp.

[5] Mishra S.R. and. Saksena, D.N.1993. Phytoplanktonic composition of sewage polluted Morar (Kalpi) river in Gwalior, M.P.Envn.Ecol.11(3): 625-629.

[6] Palmer, C.M. 1969. A composite rating of algae tolerating organic pollution. J. Phycol.5:78-82.

[7] Palmer, C.M.1980. Algae & water pollution. Castle House Publishers Ltd., England.

[8] Pearsall, W.H. 1932. Phytoplankton in English lakes-II. J Ecol. 22: 241-262.

[9] Pingle, S.D. and Mandhare, S.D. 1995. Occurrence and tolerance of algae in distillery waste water. J. of Aqua. Bio. 10 (1&2): 31-33.

[10] Sushma S. and Ramesh C. S.2018. Monitoring of algal taxa as bioindicator for assessing the health of the high altitude wetland, Dodi Tal, Garhwal Himalaya, India, International Journal of Fisheries and Aquatic, volume 6, no.3: p 128-133.

Table -1:- Pollutiion tolerent genera of algae from the sampling locations

Sr. No.	Genus	Group	Sampling locations		
			D1	D2	D3
1	*Euglena*	E	+	-	+
2	*Oscillatoria*	B	-	+	+
3	*Scenedesmus*	G	-	+	+
4	*Chlorella*	G	-	+	+
5	*Nitzschia*	D	-	+	-
6	*Navicula*	D	-	+	+
7	*Synendra*	D	+	+	+
8	*Ankistrodesmus*	G	+	+	+
9	*Phacus*	E	+	+	-
10	*Phormidium*	B	+	-	+
11	*Melosira*	D	-	+	+
12	*Cyclotella*	D	+	+	-
13	*Closterium*	G	+	+	+
14	*Pandorina*	G	+	+	+
15	*Spirogyra*	G	-	-	+
16	*Anabaena*	B	+	+	-
17	*Pediastrum*	G	+	+	+
18	*Fragillaria*	D	+	+	+
19	*Ulothrix*	G	-	-	+
20	*Eudoring*	G	+	-	-
21	*Lingbya*	B	+	+	+
22	*Oocystis*	G	+	+	-
23	*Cymbella*	D	+	+	+
24	*Actinastrum*	G	+	+	+
25	*Coelastrum*	G	+	+	+
26	*Cladophora*	G	-	+	+
27	*Hantzschia*	D	+	-	+
28	*Pinnularia*	D	+	+	+
29	*Cosmarium*	G	+	+	+
30	*Selenastrum*	G	+	+	+
31	*Dictyosphaerium*	G	-	-	+
32	*Crucigenia*	G	+	+	+
33	*Micractanium*	G	+	+	-

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

Table -2:- Pollution index of algal genera at the sampling locations

Sr.No	Group	Palmers Pollution index number		
		D1	D2	D3
1)	Chlorophyceae	2	2	2
1	*Ankistodesmus*	-	3	1
2	*Chlorella*	1	1	1
3	*Clostenrium*	1	1	1
4	*Pandorina*	-	4	4
5	*Scenedesmus*	2	2	2
2)	Cyanophyta			
1	*Oscillatoria*	-	5	4
2	*Phormidum*	1	1	1
3)	Bacillariophyta			
1	*Cyclotella*	1	1	-
2	*Melosira*	-	1	1
3	*Navicula*	-	3	3
4	*Nitzschia*	-	3	-
5	*Synendra*	2	2	2
4)	Euglenophyta			
1	*Euglena*	5	2	2
2	*Phacus*	2	2	-
Total		**15**	**33**	**25**

* 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 -3:- Pollution tolerant species of algae from the sampling locations

Sr. No	Algale Species	Group	Sampling locations		
			D1	D2	D3
1	*Euglena gracilis*	E	+	-	+
2	*Nitzschia palea*	D	-	+	-
3	*Oscillatoria limosa*	B	-	+	+
4	*Oscillatoria tenuis*	B	-	+	+
5	*Oscillatoria princeps*	B	-	+	+
6	*Scenedesmus quadricauda*	G	-	+	+
7	*Scendesmus dimorphus*	G	-	+	+
8	*Scendedesmus acuminatus*	G	-	+	+
9	*Synedra ulna*	D	+	+	+
10	*Ankistrodesmus falcatus*	G	+	+	+
11	*Pondorina morum*	G	+	+	+

12	*Chlorella vulgaris*	G	-	+	+
13	*Melosira granulata*	D	-	+	+
14	*Cyclotella meneghiniana*	D	+	+	-
15	*Navicula cuspidata*	D	-	+	+
16	*Hantzschia amphioxys*	D	+	+	+
17	*Eudorina elegans*	G	+	-	-
18	*Micractinium pusillum*	G	+	+	-
19	*Pediastrum boryanum*	G	+	+	+
20	*Pediastrum duplex*	G	-	+	+
21	*Anabaena constricta*	B	+	-	-
22	*Actinastrum hantzschii*	G	+	+	+
23	*Coelastrum microporum*	G	+	+	+
24	*Fragilaria capucina*	D	-	+	+
25	*Cladophora glomerata*	G	-	+	+

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

Table -4:- Pollution index of algal species at the sampling locations (Palmer 1969)

Sr.No	Algal Species	Palmers pollution index number		
		D1	D2	D3
1)	Chlorophyceae			
1	*Ankistrodesmus falcatus*	3	3	3
2	*Chlorella vulgaris*	-	2	2
3	*Pandorina morum*	3	3	3
4	*Scenedesmus quadricauda*	-	4	4
2)	Cyanophyceae			
1	*Oscillatoria limosa*	-	4	4
2	*Oscillatoria princeps*	-	1	1
3	*Oscillatoria tenuis*	-	4	4
3)	Bacillariophyceae			
1	*Cyclotella meneghiniana*	2	2	-
2	*Nitzschia palea*	-	5	-
3	*Synedra ulna*	3	3	3
4)	Euglenophyceae			
1	*Euglena gracilis*	1	-	1
Total		**12**	**31**	**25**

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

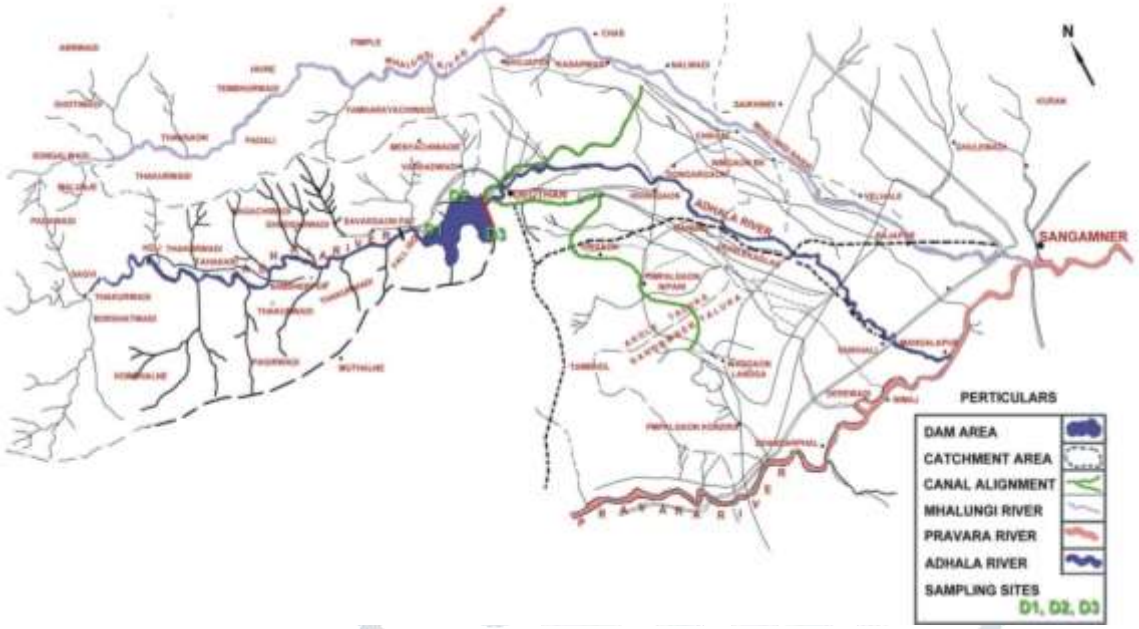

Fig.1.Map of the Deothan Reservoir, Akole Taluka