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Impact of Pollution on Diversity of *Cyanobacteria* in Nearby Areas of Pulp, Oil and Fertilizer Factories of Assam (India)

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Abstract

Diversity study of Algal community particularly *Cyanobacteria* in terms of influential effluents released by pulp and paper, oil and fertilizer factory of Assam was conducted with a view to find out its impact on distributional pattern of *Cyanobacteria* according to increasing and decreasing trend of pollution load from the source. Palmer applied for rating the genus and species of *Cyanobacteria*. The results revealed that palmer's pollution tolerant index for algal genera and species was highest in paper mill area followed by oil and fertilizer. Similarly the number of pollution tolerant genera and species of *Cyanobacteria* was recorded highest in S1 and lowest in S3 which signify the higher pollution load in nearby area and lowest in the areas situated at long distance from the sources.

Keywords: *Cyanobacteria*; Palmer (1969); Pollution indicator; Genus; Species

Introduction

Every process on the earth needs water; industries consume a lot too. Industries, during the processing or manufacturing of products, generate waste materials and useless by products. Most of these waste materials ultimately goes to water without treatment or partially treated [1]. One of the major environmental problems in our water bodies is the disposal of untreated or partially treated effluent and sewage, as these discharges may result in deterioration of water quality. The pulp and paper industry, oil industry and fertilizer industries are among the major source of water pollution. Of the variety of organisms inhabiting water bodies, algae are one of the most suitable organisms for water quality assessment owing to their small size and quick reaction to pollutants [2]. Widespread distribution of algal flora all over the world as compared to others is an important feature for their adaptation in water quality assessment [3]. Many workers had studied the diversity of *Cyanobacteria* in polluted habitats to name a few are Subramaniyam et al. Srivastava and Singh, Sudhakar et al. [4-6].

A large number of water pollution indices have been developed in recent times which can provide the numerical information about the physical and chemical nature of environment. Among these the algal indices are easiest and provide quickest response to situations as biological indicator of pollution. Palmer [1] developed and designed two indices based on algal data found in organically polluted water. He prepare a list of 60 most tolerant genera and 80 species in order of decreasing order which popularly known as Palmer's Algal Genus Index (PPI-G) (Table 1) and Palmer's Algal Species Index (PPI-S) (Table 2). In the present study these two indexes was applied. The algae found and identified in the sample sites of three different factories were given and assigned mark separately for genus and species depending on relative tolerance from the list table noted below. The total score obtained from assigned species from each genus and species from each station. Palmer [1] developed a pollution index scale which is given in the Table 3.

Genera	Pollution Index	Genera	Pollution Index
Anacystis(Microcystis)	1	*Micractinium*	1
Ankistrodesmus	2	*Navicula*	3
Chlamydomonas	4	*Nitzschia*	3
Chlorella	3	*Oscillatoria*	4
Cyclotella	1	*Pandorina*	1
Chlosterium	1	*Phacus*	2
Euglena	5	*Phormidium*	1
Gomphonema	1	*Scenedeomus*	4
Lepocinclis	1	*Stigeoclonium*	2
Melosira	1	*Synedra*	2

Table 1: Pollution index of algal genera [1].

Algal Species	Pollution Index	Genera	Pollution Index
Ankistrodesmus falcutus	3	*Stigeoclonium tenue*	3
Arthospria jenneri	2	*Synedra ulna*	3
Cyclotella meneghiniana	2	*Nitzschia palea*	5
Chlorella vulgaris	2	*Oscillatoria chlorina*	2
Euglena viridis	6	*Oscillatoria limosa*	4
Nevicula cryptocephala	1	*Oscillatoria princeps*	1
Euglena gracilis	1	*Oscillatoria putrida*	1
Gomphonema pervulum	1	*Oscillatoria tunuis*	4
Nitzschia acicularis	1	*Pandorina morum*	3
Melosira varians	2	*Scenedesmus quadricauda*	4

Table 2: Pollution index of algal species [1].

Results and Discussions

In the present study the algae particularly the *Cyanobacteria* (Blue Green algae) as per list of Palmer [1] are shown in Table 4. According to decreasing trend of pollution at different sample sites (S1, S2 and S3) nearby the area of pulp and paper, oil and fertilizer industry. Out of 60 most pollution tolerant genera of *Cyanobacteria* 22, 20 and 17 are found in sample station S1, S2 and S3 of pulp and paper industry; 20, 21 and 17 are found in oil industry and 21, 19 and 16 are found in the sampling

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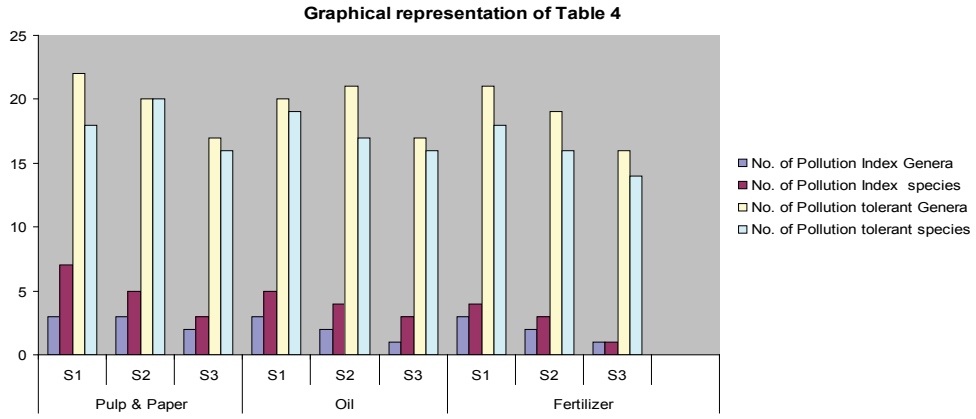

Figure 1: Graphical representation of different genera and species of *Cyanobacteria* at different Industrial sites.

Pollution Index	Pollution Load
<15	Very light organic pollution
15-20	Organic pollution
>20	High organic pollution

Table 3: Pollution index scale.

	Pulp & Paper			Oil			Fertilizer		
	S1	S2	S3	S1	S2	S3	S1	S2	S3
No. of Pollution Index Genera	3	3	2	3	2	1	3	2	1
No. of Pollution Tolerant Genera	22	20	17	20	21	17	21	19	16
No. of Pollution Index Species	7	5	3	5	4	3	4	3	1
No. of Pollution Tolerant Species	18	20	16	19	17	16	18	16	14

Table 4: PPI (in average) of different genera and species of *Cyanobacteria* at different industrial sites.

sites of fertilizer industry. Similarly out of 80 most pollution tolerant species 18, 20 and 16 are found in sample station S1, S2 and S3 of pulp and paper industry; 19, 17 and 16 are found near oil industry and in case of fertilizer industry these numbers are 18, 16 and 14 [7,8].

The *Cyanobacteria*n flora of all three sampling stations was subjected to Palmer Pollution Index (1969) for rating pollution status. Out of 20 pollution index genera of algae 03, 03 and 02 and out of 20 pollution index species 07, 05 and 03 were recorded at station S1, S2 and S3 of Paper and Pulp industry. 03, 02 and 01 genera and 05, 04 and 03 species were found in the sampling station S1, S2 and S3 of oil industry whereas these values for fertilizer industry were 03, 02 and 01 genera and 04, 03 and 01 species. The results and the total score of each sample stations according to industry wise are given in Table 4 and Figure 1.

Conclusion

The results reveal that the pollution load of each sample site gradually decreases in downstream. The high organic pollution was recorded in nearby areas of each industry and low organic pollution was recorded which are away from the source. The total score of these stations were more than 20 indicate high organic pollution. The study also reveals that the value of pollution index genera is always higher than the species [9]. In Palmer pollution index of cyanophycian genera *Occillatoria* was considered more tolerant than other genera of *Cyanobacteria*. Thus the application of PPI indices shows a relationship to the status of pollution as well as evaluating the pollution load by using pollution tolerant genera and species [10]. The study also reveals that among algae cyanophycian algae are most suitable for bioremediation purposes since they are abundantly found in polluted sites [11].

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References

1. Palmer CM (1969) A composite rating of algae tolerating organic pollution. J Phycol 5: 78-82.
2. Gaur JP (1981) Phycology of certain oil refinery effluents, Thesis. Banaras Hindu University, Varanasi, India.
3. Rai LC, Kumar HD (1980) Algal and the problems of water pollution. In: Bilgrami KS, Vyas KM (eds) Recent advances in the biology of microorganisms, Deradun, India, pp: 127-140.
4. Vijayakumar S, Noorudin T, Chokkaiya M (2007) Biodiversity of Cyanobacteria in industrial effluents. Acta Botanica malacitana 32: 27-34.
5. Srivastava GK, Singh BB (1995) Observation of algal flora in relation to industrial pollution of Rafti river at Gorakhpur. Eco Environ Conservat 1: 53-55.
6. Sudhakar G, Jyothi B, Venkateswarlu V (1991) Impact of paper mill effluents on the distribution of Cyanobacteria in the River Godavari, India. water manage 11: 263-269.
7. APHA (1989) Standard methods for examination of water and waste water. American Public Health Association. (17th edn.), Washington D.C.
8. Shekhar TRS, Kiran BR, Puttaiah EP, Shivaraj Y, Mahadevan (2008) Phytoplankton as index of water quality with reference to industrial pollution. J Environ Biol 29: 233-236.
9. Shaji C, Patel RJ (1991) Chemical, biological evaluation of pollution in the river Sabarmati at Ahmedabad, Gujrat. Phykos 30: 91-100.
10. Vijaykummar S, Thajuddin N, Manoharan C (2007) Diversity of Cyanobacteria in industrial effluents. Acta Botanica Malacitana 32: 27-34.
11. Saikia MK, Baruah R, Kataki M (2017) Screening growth response of Cyanobacteria to certain industrial effluents and for bioremediation. Asian Academ Res J Multidisciplin 6: 4.