

PHYSICO-CHEMICAL OBSERVATIONS ON FIVE MICROCYSTIS BLOOMS LOCATED AT DIFFERENT LOCALITIES IN PUNE (M.S.) AREA

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ABSTRACT : A dense growth of planktonic algae often involving just one or few species and usually imparting a distinct colour to the water body is referred to as “*Algal Blooms*”. Bloom generally seen to occur when the water is sufficiently rich in dissolved plant nutrients. In the temperate region bloom formation take place in the season of summer and autumn when the weather is calm.

Microcystis aeruginosa (Kutz) is one of the most cosmopolitan bloom forming alga. In the present study five ponds of Pune region located at different geographic locations and altitude levels were investigated for survey of blooms of *Microcystis aeruginosa* (Kutz). Studies were conducted to determine the relation between various physico-chemical parameters and occurrence of *Microcystis* bloom. The chemical parameters selected for analysis were dissolved oxygen, free CO₂, pH, total hardness , total suspended solids ,sulphates, ortho-phosphates,chlorides.The results showed that in Pune waters the *Microcystis* blooms are not confirmed to any narrow range of physico-chemical conditions. Alkaline pH, high bicarbonates, organic matters appeared to be most favourable for *Microcystis* bloom to occur.

Introduction:

Five major blooms of *Microcystis aeruginosa* Kutz were investigated during the survey of algal blooms made by author. In which three permanent blooms of *Microcystis* were discovered from Dehu Road area. One of the largest blooms of *Microcystis* was observed in Bhima River, Khed (Rajgurunagar), while another bloom of *Microcystis* was noted in a Sinhagad fort which lies on a hill having an altitude of about 1440 meters from sea level.

DEHU ROAD PONDS

From this region three ponds were investigated. These ponds are located along new Pune-Mumbai highway, about 17 km. North of Pune. These ponds have been formed at abandoned quarry sites.

POND-A: This is comparatively a smaller pond that lies about 50 meters East of new Pune-Mumbai Highway. The pond is roughly wedged shaped. Towards its narrow region, it is about 25 feet in breadth. The measured depth of the pond was 20 feet . This is a permanent water body with permanent bloom of *Microcystis*. During monsoon the water of the pond is used for washing of cloths and cleaning of vehicles. (Plate- I, II).



Plate I – Dehu Road Pond - A

Plate II - Microcystis colony

POND-B: Across the canal about 200 feet from the pond A, there lies another wedged shaped, slightly bigger pond . This pond is also with permanent bloom of *Microcystis aeruginosa* (Kutz.) Length of the pond is also about 300 feet. Width of the pond towards its widest region is 200 feet while towards its narrow region it is 15 feet only. Depth of the pond is about 25 feet. This pond also receives water from rain, ground and sewage water through the canal. The pond water is used for brick construction. (Plate- III,IV).



Plate III – Dehu Road Pond - B



Plate IV – Microcystis bloom

POND-C: This is a much bigger and deeper pond in contrast to the pond described earlier. This water body is oblong in shape and measure about 500 feet in length, 300 feet in breadth. A big crusher unit is located next to the pond whose dust blows intermittently over the pond. This pond water is also used for the washing of cloths, utensils, and bathing.

THE BHIMA RIVER, KHED (RAJGURUNAGAR): The study site lies about 35k.m.North of Pune in the river Bhima near the town Rajgurunagar (khed) on Pune- Nasik Highway. The river Bhima originates at Bhimashankar and reaches Rajgurunagar after its journey of 75 k.m. On the river, near Rajgurunagar there are two Kolhapur type of bunds for the storage of water. The river stretches of almost 3 k.m. length exhibited thick bloom of *Microcystis* in the month of February, April and May, 1994. The river water is used for irrigation, fisheries, washing of cloths and utensils, recreation, cleaning of cattles and vehicles. (Plate-V,VI).



Plate V – Khed (Rajgurunagar) : Bhima river



Plate VI – Bhima river (Khed)

SINHGAD: Sinhgad is one of the historic fort of Maharashtra and had strategic importance in the history of the Marathas. The fort lies on a hill having an altitude of about 1440 meters from sea level. The fort is about 1000 meters in length and 647 meters in width. There are no of ponds located on the fort. Large number of tourists visits the fort almost every day.

ENTRY GATE POND: This pond lies in the close vicinity of the main gate (Pune gate) of the fort. The pond is well constructed and rectangular in shape. The pond measure about 150 feet in length, 75 feet in breadth and 25 feet in depth. The pond is provided with steps. The pond water is used for washing of cloths and cleaning of utensils by residents of the fort. (Plate-VII,VIII).



Plate VII – Sinhgad entry gate pond

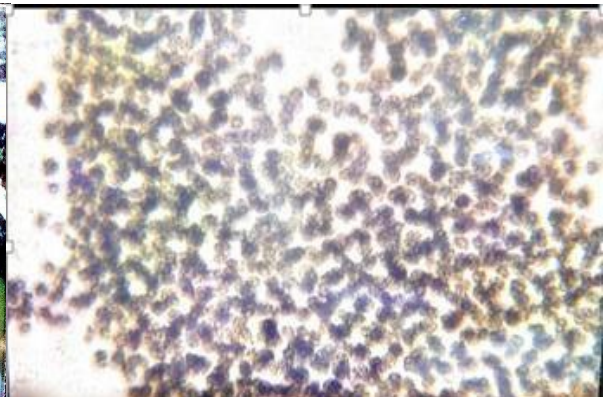


Plate VIII – Microcystis bloom

MATERIAL AND METHODS

Water samples from concerned localities were collected and analyzed for various Physico-chemical Parameters such as pH, Temperature , Color , Dissolved oxygen (DO), Biochemical Oxygen Demand (BOD) , Free CO₂, Total alkalinity (carbonate and bicarbonate), Hardness, Total suspended solids (TSS), Sulphates and Ortho-phosphates . The methods recommended by APHA (1980) have been followed in most cases. Quantitative analysis of the algae was done by simple drop method. Frequency of an algal form in a sediment sample was calculated by counting its individuals at 10 different fields in a single drop (0.05 ml.) under 10X or 45X magnification of microscope objectives. Algal forms from the samples were identified using standard monographs. Photographs of the study site, and the microscopic specimens were taken using ‘Minolta-X-700’ camera.

Table No.1: Methods used for analysis of Water Parameter:

Sr.No	Parameters	Methods
1.	Dissolved Oxygen	Modified Winkler method
2.	pH	pH Paper
3.	Chloride	Titrimetric method
4.	Total Hardness	Titrimetric method
5.	Ortho-phosphate	Ammonium molybdate stannous chloride method
6.	Sulphate	Colorimetric method
7.	Free CO ₂	Titrimetric method
8.	Total Alkalinity	Titrimetric method
9.	Bi- Carbonates	Titrimetric method
10.	Carbonates	Titrimetric method

DISCUSSION

Iyengar,(1938) reported common occurrence of *Microcystis aeruginosa* and *Microcystis floes aquae* in many temple pond in south India . Ganapati, (1946) was the first to study the ecology of a pond with a permanent bloom of blue green algae *Microcystis aeruginosa* (Kutz) Henry George,(1962) described the conditions in the pond with a permanent bloom of *Microcystis aeruginosa* in Delhi. According to Deshikachary ,(1959) the factors that promote blue algal blooms are shallowness, warm temperature, high nitrogenous and phosphorous contents and good supply of half bound CO₂. Venkatraman,(1956), Philipose, (1962), Shrinivasan,(1974);Venkateshwarlu,(1956);Trivedi (1983); Dakshini,(1984);Zutshi, (1984); Unni,(1985) and Goel,(1988) also contributed towards the knowledge of ecological features of *Microcystis* bloom occurring in India.

Temperature appeared to be one of the factor governing the *Microcystis* bloom , (Fritsch, 1907; West and West, 1912; Griffith,1912; Fritsch and Rich,1913; West & West,1912; Grifitchs,1912; Fritsch and Rich,1913; Pearsall,1923; Howland,1931;Rainherd 1921; Yoshimura,1932; Williams,1933; Godward,1934; Daily,1938;Prescott,1938,1948; Gonzalves and Joshi,1946 ; Chu and Tiffany,1931; Komarovosky,1953; Chakraborty,1959; Philipose,1960; and Sing ,1960). A laboratory studies by Konopka and Broock,(1978), kruger and kloff, (1978); Box,(1981) inform us that *Microcystis* grow very slowly at temperature below 13 to 15 °C. Its growth rate accelerates rapidly as the temperature rises to 20 °C and 37°C.

Temperature records by Indian workers indicate prevailing temperature range from 5 ° C to 35 ° C during the bloom of *Microcystis*. Temperature recorded during our study ranged between 18 ° C to 32° C indicating that the temperature by itself is not a primary factor.

Bloom forming blue green algae usually occur in the hard water than the soft water (Reynolds,1975). Cherunousova et al. (1968) demonstrated dependence of *Microcystis* On bicarbonates for their photosynthesis. Hydro -biological data by Indian workers on the water bodies with *Microcystis* bloom indicates presence of bicarbonates in Poona water bodies with *Microcystis* blooms are much higher ranging from 34.39 mg/lit. to 328.25 mg/lit. The estimated amount of bicarbonates in Poona water bodies with *Microcystis* blooms are much higher ranging from 165 mg/lit. to 625 mg/lit. The pH in this water ranged from 7.3 to 8.0. The hardness values were also much higher in studied Pune water bodies.

Nitrates and phosphates have been considered as key elements in the growth of phytoplankton. Based on experimental study Gerloff and Skogg (1954-57) concluded that excessive nutrient densities are not essential for the production of a population of *Microcystis*. The phosphate values determined by Indian worker during the bloom ranged from 0.1 to 115 mg/lit. Among the water bodies studied for *Microcystis* bloom, Sinhagad pond exhibited lack of phosphates. In the other water bodies, the concentration of phosphate ranged from 0.05 to 0.6 mg/lit. It should be mentioned here that, nutrient concentration in the water is not a true measure of availability since it ignores fluxes and contents of the algal cells. Many algae in fact absorb and store far many more than their immediate needs when nutrients are freely available (Reynolds, 1975).

Pearsall, (1932) was of the opinion that the growth of the blue green algae is favored by dissolved organic compounds. During our study the estimated values of bio-chemical oxygen demand were very high indicating heavy load of organic matter. However, precise role played by organic matter in promoting blue green algae is still a mystery (Reynolds, 1975).

Chacko, (1954) while studying fish pounds in Tamilnadu, reported several instances of O₂ depletion and large scale mortality of fishes and other Fauna causing considerable damage and loss to fish farms and fish farmers in Tamilnadu. However, such mortality of fish as well as direct toxic effect of *Microcystis* did not encounter during the study. (Plate- IX , Graph- I).



Plate IX - Bhima river: Fish catch

CONCLUSION:

In Pune waters the *Microcystis* blooms are not conformed to any narrow range of physico-chemical conditions. Shallow water condition, alkaline pH, high bicarbonate and organic matters appeared to be most favourable for *Microcystis* bloom to occur.

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Table No.2: Physico-Chemical Observations On *Microcystis* bloom:

Sr. No.	PARAMETERS	LOCALITIES				
		Dehu Road pond (DRP)			Bhima River Khed	Sinhagad Entry Gate Pond
		A	B	C		
01	Colour	Blue Green	Blue Green	Blue Green	Green	Green
02	Temperature(⁰ C)	18	23	26	32	22
03	Ph	7.5	7.3	7.5	8.0	7.5
04	Dissolved Oxygen (mg/l)	2.21	1.21	2.62	1.81	2.62
05	Biochemical Oxygen Demand (BOD) –(mg/l)	141	121	131	242	132
06	Free CO₂ (mg/l)	6.6	24.4	22.0	35.2	-
07	Total Alkalinity (mg/l)	430	405	405	625	245
08	Carbonates (mg/l)	00	00	00	00	80
09	Bicarbonates (mg/l)	430	405	405	625	245
10	Hardness (mg/l)	120	156	92	140	66
11	Total suspended solids (mg/l)	6.94	14.0	1.2	18.7	3.15
12	Sulphates (mg/l)	0.25	1.53	0.27	32.0	0.61
13	Ortho-phosphates (mg/l)	0.30	0.68	0.10	0.0 5	00
14	Chlorides (mg/l)	---	---	36.18	---	29.48

Graph 1- Physico-Chemical Observations on *Microcystis* bloom

