

PHYTOPLANKTONIC STUDIES IN RIVER HOOGHLY

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ABSTRACT

The river Hooghly flowing through Calcutta and Howrah has a high degree of pollutants. Present study revealed the sources of pollution with phytoplanktonic abundance in the stream. Samples were collected from 5 sites near Howrah and Calcutta from June 1985 to May 1986. Members of Bluegreen algae, Bacillariophyceae and Chlorophyceae were found during the study. Changes in physicochemical parameters due to pollution were observed. Several parameters were responsible directly and indirectly which occurred in Phytoplankton population. A correlation between biological examination and chemical examination of river water has been made.

INTRODUCTION

River Hooghly, flows through the twin city Calcutta and Howrah which choked by the industrial wastes from more than 150 factories including 87 jute mills, 12 textile mills, five paper pulp factories, distilleries and thermals. Near Calcutta it attains the critical level. Calcutta's drainage system carries 120 million and 50 million gallons respectively of domestic sewage and industrial wastewater (Dutta 1984). Nearly about 346 outfalls dumping waste water from domestic and industrial sources. The Tolly's nullah discharge, including human excreta and carcass, adding the volume of domestic waste flowing into the Hooghly.

The discharge of domestic sewage, industrial effluents into natural water resources, changes the physical, chemical and biological nature. This may effect the aquatic life in various ways (Tarzwell & Gaufin, 1953). The aquatic organism like plankton when present in abundance effect taste, odour, death of aquatic fauna and normal quality of water (Lackey & Haupp, 1953), Assessment of river water has been done by Palmer

(1969), Weilgolaski (1955), Prasad & Saxena (1980). Present investigation deals with the study of river Hooghly in relation to Phytoplankton population and physico-chemical parameters of the water.

MATERIALS AND METHODS

The Hooghly river has been surveyed throughout the year (from June 1985 to May 1986) within the stretch from Vivekananda Bridge (Dakshineswar) to Indian Botanic Garden (Garden Reach). Water samples and algal samples were collected from 5 stations at monthly intervals.

COLLECTION OF WATER SAMPLE

Samples were collected at monthly intervals regularly from each sampling station about 10 meters away from the bank from the surface water. Phytoplanktons were collected by Plankton net (14 mesh) and preserved by adding 4% formalin.

Chemical analysis of water samples done by Standard methods (A.P.H.A. 1975). Population of phytoplankton was estimated. 3 groups of phytoplanktons viz. Bacillariophyceae, Cyanophyceae, Chlorophyceae were studied.

Identification of algal blooms was made

following Fritch (1956), Smith (1950), Desikachary (1959), Round (1965).

OBSERVATIONS

Survey of river water includes the identification and characterization of various pollutional sources. Calcutta's drainage system carries 120 million and 50 million gallon respectively of domestic sewage and industrial water, where 13% of the total wastes are industrial waste, 87% of waters are of domestic sewage. Table 1 gives the details of the sources of pollution to the river.

Table 1 showing river survey of various sampling stations

Sampling points	Station	Sources of pollution
1	2	3
S ₁	Dakshineswar, Bally	Bathing Ghat, Match factory, Municipal sewage, Dumping of garbage, Burning ghat, Effluent from Cotton mills, Steamer service.
S ₂	Belure, Baranagar, Cossipore	Gun Shell Factory, Municipal sewage, Baranagar Paper mill, Cotton mill, Thermal plant, Bathing Ghat, Shipping.

Table 1 (contd.)

1	2	3
S ₃	Jagannath Ghat, Howrah Bridge	Garbage dumps, Bathing ghat, Sewage nullahs, Steamer service. Hooghly Docking & Engineering Co. etc.
S ₄	Princep Ghat, Shalimar, Shibpur	Municipal & domestic sewage, Paint factory effluent, Flour mill, Jute mill effluent, Burning ghat, Bathing ghat.
S ₅	Garden Reach, Kidderpore, Botanic Garden	Dock centre, Ship building factory, Livestock, Bathing ghat, Steamer service etc.

The results of the physico-chemical examination of river water are summarised in Table 2. PH ranged from 7.0-8.5. The dissolved oxygen (DO) found low in the study area.

The above observation clearly revealed the organic pollution load in the river. Large amount of suspended solids and turbidity is also noted. The range of hard water varies from 210 to 815.00 mg/l which is higher than the minimum indicative value (Cox, 1964). The average population of 3 groups of Phytoplanktons is shown in Table 3. Total population of algae was found maximum in summer. Diatoms studied maximum in winter season as compared to summer and rainy season. Blue greens were dominant throughout the study.

Table 2 : Physico-chemical parameters of water (mean of 3 samples)

Parameter	S ₁	S ₂	S ₃	S ₄	S ₅
Temperature	30.5	31.2	30.0	29.5	30.0
Colour	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish
PH	8.1	7.1	7.5	7.5	7.1
Odour	Fishy	Fishy	Fishy	Fishy	Fishy
Turbidity				4.5	5.5
Suspended solids	325	243.6	421.5	265	422
Dissolved Oxygen (DO)	8.6	8.5	6.7	6.5	7.2
Biological Oxygen demand (BOD)	2.2	2.4	1.6	1.4	1.8

All values in Mg/l except Colour, Odour, Turbidity, PH.

Table 3 : Average population of Phytoplankton

Phytoplankton	S ₁	S ₂	S ₃	S ₄	S ₅
Bacillariophyceae	18.5	19.29	19.1	16.5	18.5
Cyanophyceae	25.2	22.3	21.2	20.2	24.32
Chlorophyceae	14.3	16.38	14.3	13.2	15.23
Miscellaneous (Zooplankton, etc.)	42.1	41.03	45.4	50.1	42.0

DISCUSSION

Phytoplankton population throughout the stream was maximum during summer season. Temperature plays an important role in increasing the plankton population as studied by Nazneen (1980). The blooms of algae usually dominated during summer which indicates the pollution level of the river (Rawson, 1956).

Temperature varies with seasonal variations and it plays a key role for controlling plankton population. Concentration of dissolved oxygen (DO) denotes the pollution status of the river. Dissolved oxygen varies with the adding of pollutants and it has a direct link with algal population.

Microcystis bloom found during summer indicates higher concentration of Phosphates which directly leads to less fish production. According to Central Inland Fisheries Research Institute (CIFRI), Barrackpore (1984) the rate of fish production has become less in the Hooghly estuary. Fish caught in the river between Baranagar and Diamond Harbour yielded the smallest catch, while the lowest part of the river from Diamond harbour to Sundarbans produced highest, about 30 times more than that of the Calcutta-Howrah component.

Relations with diatoms and physico-chemical parameters of water were studied by earlier scientific workers (Venkateswarlu, 1969). According to data, nitrogen and organic matter as individual ecological factors with pH and other physical factors in the distribution of diatoms in natural water.

On the basis of present study it was clear

that the river gets polluted throughout the study area.

REFERENCES

- A. P. H. A. Standard Methods for the examination of water & waste water (14th ed.). Amer. Public. Hlth. Assoc., N. Y. 1975.
- Cox, C. R. Operation and control of Water Treatment Process. WHO Publ., 1964.
- Desikachary, T. V. Cyanophyta, I.C.A.R., New Delhi 1959.
- DUTTA, S. C. Perils of pollution in the metropolis. *Sci. & Cult.* 50(6) : 177-181. 1984.
- FRITCSH, F. E. The structure and reproduction of the Algae Vol. 1. Univ. Press, Cambridge. 1956.
- LACKEY, J. B. AND E. R. HUPP. Plankton populations in Indian White river. Engineering Progress at the Univ. of Florida x-11. 1953.
- NANDAN, S. N. AND R. J. PATEL. Study of Phytoplankton and Physicochemical parameters in Viswamitra River, as indicators of eutrophication. *Res. Journ. Pl. Environ.* 2(1) : 23-27. 1985.
- NA ZNEEN, S. Influence of hydrobiological factors on seasonal abundance of phytoplankton in Kinshar lake, Pakistan. *Int. Revu. Ges. Hydrobiol.* 65 : 269-282. 1980.
- PALMER, C. M. Algae in water supplies. USPHS, No. 657. Washington. 1959.
- PRASAD, B. N. & M. SAXENA. Ecological study of blue-green algac in river Gomati. *Indian J. Env. Hlth.* 22: 151-168. 1980.
- RAWSON, D. S. Algal indicators of tropic lake types. *Oceangr.* 1 : 18-25. 1965.
- Round, F. E. The Biology of Algae. Edmar Arnold Ltd., London. 1965.
- SENGAR, R. M. S., K. D. SHARMA, AND P. D. PATHAK. Studies on distribution of Algal flora in polluted and nonpolluted regions in Yamuna river at Agra (U. P.). *Journ. Indian Bot. Soc.* 64 : 365-376. 1985.
- SMITH, G. M. Fresh water algae of United States, New York. 1950.
- TARZWELL, C. M. AND A. R. GAUFIN. Some important biological effects of pollution disregarded in stream surveys. *Purdue Univ. Engg. Bull. Proc. of the 8th Industrial Waste Conference* (May 4-6) : 37. 1953.
- VENKATESWARLU, V. Factors influencing the distribution of algae-II. *Hydrobiologia* 32 : 352-363. 1969.
- WIELGOLASKI, F. E. Biological indicators on Pollution. *Urban Ecol.* 1 : 63-79. 1975.