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## ON THE INTERRELATIONSHIPS OF BOD, CO-EFFICIENT OF HETEROTROPHIC ACTIVITY, DISSOLVED ORGANIC CARBON AND BACTERIAL POPULATION IN A SMALL FRESHWATER LAKE

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### ABSTRACT

The interrelationships among dissolved organic carbon, population of heterotrophic bacteria, BOD and co-efficient of heterotrophic activity has been studied in a small freshwater lake at Shillong for a period of one year. The data showed a positive correlation among most of the parameters.

### INTRODUCTION

Heterotrophic bacterial populations and their activity measurements have received sufficient attention of limnologists in recent past (Jones 1971, Strickland 1971, Goulder 1980, Tiwari & Mishra 1982). The estimation of these characters of natural waters provide a direct measure of trophic status of the system. (Godlewska-Lipowa, 1976) Various techniques are available to measure the activity of microbes in freshwaters (Sorokin & Kadota 1972, Strickland 1971). Of these, BOD (APHA 1971) and co-efficient of heterotrophic activity (Godlewska-Lipowa 1974) are most widely used methods for the estimation of bioactivity of heterotrophs responsible for the breakdown of dissolved organic matter. In the present communication an effort has been made to study the relationship of bioactivity parameters (BOD and co-efficient of heterotrophic activity) with the dissolved organic carbon and bacterial population.

### STUDY AREA AND METHODS

The study was conducted in a small freshwater lake (length 333m, max. breadth 75m, area 23800m<sup>2</sup>, shore length 1284m, max. depth 6m, and mean depth 3.4m) situated in Shillong (alt. 1460m, lat. 25° 34' N, long. 91° 52' E). The morphometry and bathymetric map of the lake is given by Tiwari & Mishra (1982). The lake water was sampled on monthly intervals for a period of one year using Van Dorn sampler (Van Dorn 1956) for the physicochemical analyses and bioactivity measurements. Zobell's bacteriological sampler was used for bacteriological studies (Zobell 1941). The population of bacteria was estimated by spread plate method using Casein Peptone Starch Agar medium (Collins & Willoughby 1962). The co-efficient of heterotrophic activity was measured as per methods given by Godlewska-Lipowa (1974). The estimation of organic carbon was done following the method of Gocke & Hoppe (1977).

Water temperature, pH, conductivity, dissolved oxygen, nitrate-N, phosphate-P and Secchi disc reading were measured as described in APHA (1971).

## RESULTS AND DISCUSSION

The physico-chemical characters of the lake are given in Table 1. The values demonstrate that the lakewater contains moderate concentration of nutrients. The pH was slightly acidic. Minimum temperature of 11°C and maximum temperature of 24°C were recorded during the study period. The BOD, co-efficient of heterotrophic activity, bacterial population and dissolved organic carbon showed a clear seasonality pattern (Table 2) attaining peak values during spring (April-May) and lowest values during winter (November-January). The seasonality pattern of

these parameters was comparable to other temperate water bodies (Rheinheimer 1977). The values of correlation co-efficient ( $r$ ) are given in Table 3. The  $r$  values demonstrate that most of the parameters have statistically significant positive correlation among themselves. The only exception was the population of bacteria, which though exhibited a positive relationship with the BOD, co-efficient of heterotrophic activity and dissolved organic carbon, the  $r$  values were not statistically significant. It could be concluded from the results that the bioactivity estimates were more closely related to the substrate concentration, that is dissolved organic carbon, than to the population of heterotrophic bacteria. The bioactivity characters appeared to be a dissolved organic carbon concentration dependent character.

Table 1. Range of various physico-chemical characters of the lake water during the study period (March 1978-February 1979).

Character	Range
Temperature	11-24°C
pH	6.0-6.7
Conductivity	47.7-129.4 $\mu$ mho/cm
Dissolved O <sub>2</sub>	5.2-9.2 mg/l
NO <sub>3</sub> -N	0.3-1.2 mg/l
PO <sub>4</sub> -P	0.36-0.90 mg/l
Secchi disc reading	0.85-1.20 m

Table 2. Bacterial population, BOD, co-efficient of heterotrophic activity and dissolved organic carbon concentration in the lake water during the study period (March 1978-February 1979).

	March 1978	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb. 1979
Bacteria (X1600/ml)	48	397	680	81	67	184	22	35	68	4.7	20	112
BCD	3.6	3.85	3.25	3.4	2.3	1.8	1.6	1.4	0.7	0.7	0.7	2.1
Co-efficient of Heterotroph- ic activity	4.1	5.4	4.6	4.8	2.8	2.0	3.7	2.8	2.1	2.3	2.3	3.6
Organic carbon mg/l	0.70	0.76	0.6	0.7	0.47	0.37	0.34	0.33	0.24	0.24	0.22	0.42

Table 3. Correlation co-efficient (r) values among various characters of the lake water.

	BOD	Co-efficient of hetero- trophic activity	Organic carbon
Boacteria	0.550	0.517	0.549
BOD	—	0.993*	0.883*
Co-efficient of Heterotrophic activity	—	—	0.895*

\* Significant at 0.01 P level.

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