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AT LAKE GEORGE

SYNTHESIS PROCESS REPORT
DECOMPOSITION

By

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Eastern Deciduous Forest Biome
IBP Memo Report 72-160

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ABSTRACT

Organic decomposition by heterotrophic microflora is being estimated indirectly at Lake George and Lake Wingra by means of measuring methane production and by measurements of growth rates via radioisotope incorporation (heterotrophic potential) and the chemostat (in situ growth rate).

KEYWORDS: Microorganisms, aquatic, growth rate, methane, radioisotopes, chemostat, decomposition.

Microbial decomposition of organic matter found in lakes is being studied at Lake George, New York and Lake Wingra, Wisconsin. This is being measured indirectly at both sites in order to circumvent the problems of heterogeneity of the decomposing organic material. Measurement of microbial growth rates and rate of production of key metabolic end-products allow an estimation of the rate at which complex organics are degrading.

At Lake Wingra, methane evolution represents a key vehicle whereby carbon leaves the lake. Methane evolution was measured during June to October 1972 both at the sediment-water interface and at the surface of the lake. In the center of the lake at the sediment-water interface (3-3.5 meters depth), 10-12 nanomoles of CH_4 per cm^2 were produced per day whereas an average of 100 nanomoles was produced at the surface. In a marsh area, at the sediment-water interface (0.5 meter), an average of 210 nanomoles were collected per cm^2 per day. At the surface, approximately 1,000 nanomoles were collected.

Since the amount of methane produced is dependent upon the organic content of the sediments, it is not expected that CH_4 evolution is very significant at Lake George since the organic composition of the sediments is very low.

Both sites have estimated the heterotrophic potential of the microflora in the water column by measuring the rate at which radioactively labelled substrates are assimilated into microbial biomass.

The uptake of ^{14}C - glucose has been measured systematically at Lake George from May to November 1972 in approximately three week intervals with two concentrated periods of sampling for 48 hours (every 4 hours) and at 72 hours (every 6 hours). These data can be correlated with chemical and physical data taken concurrently. Plate counts for viable heterotrophic microflora were made simultaneously, but showed little correlation with the radioactivity data. This same observation was made at Lake Wingra where radioactivity assimilation

studies were made with glucose, acetate, cellulose and keratin. The cellulose and keratin data proved to be inconclusive since assimilation was so slow.

The Lake George study has reported assay conditions, based upon a concentration step that permits incubations of one hour during which time linear uptake has consistently been observed. This uptake rate falls off at about 1-1/2 hours under the various conditions studied.

These studies provide data that indicate the maximum rate of growth of the heterotrophic microflora. At Lake George, studies were also made via the use of a chemostat to determine the "in situ" growth rate.

A comparison of the chemostat data with the heterotrophic potential data shows many orders of magnitude higher productivity with the heterotrophic potential method as expected. Chemostat data have indicated a productivity rate of 110 cells per ml per hour at Station 5A at 5 meters on 5/31/72. This dropped to 60 cells per ml per hour on 6/21/72 and rose to 220 cells per ml per hour on 7/18/72.

A twenty-two compartment mathematical model for aquatic decomposition was developed at Lake George. This is described in Memo Report 72-40.