ORGANIC NUTRIENT FACTORS EFFECTING ALGAL GROWTH

PHASE II

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Gerald C. McDonald [1] and Nicholas L. Clesceri

Bio-Environmental Engineering Department

Rensselaer Polytechnic Institute

Troy, New York 12181

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1. Present Address:
Director
Albany County Sewer District
Ferry and Green Street
Albany, New York 12201

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INTRODUCTION

Secondary waste effluent was concentrated and was fractionated by gel permeation chromatography. There were six factors found in this particular secondary waste effluent with molecular weights in the range of less than 100 greater than 30,000. Of these fractions, three gave an algal stimulation response. The experimentation is being elaborated to detect any synergistic effort.

Cultures of test microorganisms as specified in PAAP (1969) were maintained in Basic ASM medium for experimentation. Algal growth was followed using spectrophotometric techniques.

PROGRESS

In Phase II, culture of the test microorganisms as specified in PAAP were maintained in the culture room for experimentation. Basic ASM medium for culturing was adapted as per PAAP (1969).

Concentration and fractionation of the secondary waste effluent was done. Calculations were made to determine the percentage of original effluent organic carbon that each of the fractions represented, Tables I and IA. It was decided that, initially, the organic carbon fraction concentration in the culture flask would, as close as possible, approximate that existing in the original effluent. This represents a situation with a zero dilution receiving water, that is, the stream would be essentially all waste water effluent. This format was chosen so one could obtain a clear idea of the maximum effect, if any, that would be forthcoming from the addition of the fraction to the culture flask.

The experimental investigations were carried on with Selenestrium capricornutum and Anabaena flos-aquae initially, with work using Microcystis aeruginosa coming later. PAAP specifications were adopted for preparing inoculum and transferring it to test flasks.

The growth of the algae was followed using spectrophotometric techniques, the chosen instrument being the Beckman DU2 Spectrophotometer. To perform the absorbance measurements, an aliquot of the culture was removed and deposited in a 5cm cell which had been acid washed and set aside specifically for use with the chosen algal form.

Table II represents the effects of the fractions on the growth rate (k) and mean generation time of Selenestrium capricornutum. From Table II, those fractions having an effect on Selenestrium capricornutum were:

1)	G	10	IIIb	Apparent M.W.	<100	increase in k	13.95%
2)	G	25	II	Apparent M.W.	1,000	increase in k	16.28%
3)	G	50	Front	Apparent M.W.	>30,000	increase in k	67.44%

As a corollary the effect of unfractionated effluent was also investigated. The increase in "k" value was 123.25%. Possibility of synergistic effect is being investigated in Phase III.

Table III represents the effect of waste water fractions and the unfractionated effluent on the growth rate of Anabaena flos-aquae. It can be seen from Table III that those fractions having an effect on the growth rate of this organism were:

1)	G	10	IIIa	Apparent M.W.	<100	increase in k rate	11.76%
2)	G	25	II	Apparent M.W.	1,000	increase in k rate	8.82%
3)	G	50	Front	Apparent M.W.	>30,000	increase in k rate	20.6%

The unfractionated effluent as was the case with Selenestrium capricornutum exhibited the most dramatic effect. The increase in "k", i.e., growth rate was 58.8%.

TABLE I

PERCENT OF ORIGINAL EFFLUENT ORGANIC CARBON CONTENT IN FRACTIONS

Gel	Fraction	Percent of Organic Carbon Applied	Percent of Original Effluent Organic Carbon Content
G10	Front	31	31
	II	35	35
	IIIa	11	11
	IIIb	5	5
	IV	2	2
G25	Front	72	22
	II	24	7
G50	Front	80	18

TABLE IA

ORGANIC CARBON CONCENTRATION OF FRACTION IN ORIGINAL EFFLUENT

Fraction	Organic Carbon Concentration in Original Effluent (mg/l)
G10 II	2.4
IIIa	0.8
IIIb	0.4
IV	0.2
G25 II	0.5
G50 Front	1.3

TABLE II

EFFECT OF FRACTIONS ON THE GROWTH RATE OF SELENESTRIUM CAPRICORNUTUM

Fraction	Organic Carbon Concentration in Culture Flask (mg/l)	Growth Rate K_{10} (day^{-1})	Apparent M.W.	Mean Generation Time (hrs.)
Control	---	0.43		16.8
G10 II	2.0	0.43	350	16.8
IIIa	0.6	0.42	<100	16.8
IIIb	0.3	0.49	<100	14.7
IV	0.2	0.43	Indeterminate	16.8
G25 II	0.4	0.50	1,000	14.5
G50 Front	1.3	0.72	>30,000	10.0
Concentrated Effluent	7.0	0.96		7.5

TABLE III

EFFECT OF FRACTIONS ON THE
GROWTH RATE OF ANABAENA FLOS-AQUAE

Fraction	Organic Carbon Concentration in Culture Flask (mg/l)	Growth Rate K_{10} (day^{-1})	Apparent M.W.	Mean Generation Time (hrs.)
Control	---	0.34		21.2
G10 II	2.0	0.34	350	21.2
IIIa	0.6	0.38	100	19.0
IIIb	0.3	0.33	100	21.2
IV	0.2	0.34	Indeterminate	21.2
G25 II	0.4	0.37	1,000	19.5
G50 Front	1.3	0.41	30,000	17.6
Concentrated Effluent	7.0	0.54		13.4