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A NOTE ON THE MEASUREMENT OF EXTRACELLULAR PRODUCTS (ECP) IN SOME NANNOPLANKTERS

ABSTRACT

The rate of excretion of dissolved organic carbon in two nannoplanktonic flagellates isolated locally and developed in axenic cultures has been measured using the C^{14} technique. Variations occur according to species, their density and the stage of growth. The ecological implication of phytoplankton excretory products is also discussed.

RELEASE of organic metabolites into the surrounding medium is an integral part of phytoplankton photosynthesis. However, the rate of excretion varies and is attributable to a variety of factors - physical, chemical and biological (Hellebust, 1974). In the present investigation, the rate of excretion of four nannoplankton species isolated locally and cultured in the laboratory has been determined.

Material and methods

The organisms used are two golden-yellow flagellates *Chromulina freiburgensis* Doflein, *Isochrysis galbana* Parke, a green flagellate *Tetraselmis gracilis* Kylin and the blue-green alga *Synechocystis salina* Wislouch. These plankters were grown in sterile culture media (modified Miquel's medium) at 10:14 light-dark cycle from five 40 watts fluorescent lamps (about 34×10^{15} quanta cm^{-2} sec^{-1}) at ambient temperature.

Aliquots were withdrawn on the fourth, eighth and sixteenth day following inoculation. These samples were incubated in triplicate with C^{14} for two hours in identical conditions as the culture. After the incubation the samples were filtered through Millipore HA filters. The activity of the filters and the filtrate (Extra Cellular Products, ECP) were counted in a Liquid Scintillation Counter (Steemann Nielsen, 1952; Krishnamoorthy and Viswanathan, 1968; Vollenweider, 1974).

Results and discussion

The rate of excretion of the plankters was low during the early days of growth and increased subsequently from 3.0% to 12.6% in *C. freiburgensis* from 3.9% to 45.2% in *I. galbana*, and from 2.5% to 22.4% in *T. gracilis* (Table 1). In *S. salina* the release was 38.9% on the fourth day, followed by a decrease to 36.9% on the eighth day and subsequent increase to 64.5% on the sixteenth day. In terms of absolute activity, 0.01 to 0.273 μC (micro curie) of C^{14} was excreted out of the 5 μC added to each (Table 2).

It has been found that phytoplankters excrete about 4% of the carbon assimilated (Hellebust,

TABLE 1. *Percentage of Extracellular Products (ECP) by nannoplankters during phases of growth in culture. (The % soluble represents the ECP as fraction of the total carbon fixed)*

Days of growth	Cells ml^{-1}	mgC L^{-1} hr^{-1}		% soluble
		Particulate	Soluble	
Chromulina freiburgensis				
4	90 x 10^3	19.53	0.60	3.00
8	160 x 10^3	7.03	0.55	7.80
16	330 x 10^3	9.71	1.22	12.57
Isochrysis galbana				
4	70 x 10^3	31.32	1.22	3.90
8	250 x 10^3	12.01	1.63	13.57
16	200 x 10^3	4.42	2.00	45.20
Tetraselmis gracilis				
4	24 x 10^3	2.35	0.06	2.50
8	70 x 10^3	2.18	0.30	13.76
16	150 x 10^3	3.22	0.72	22.36
Synechocystis salina				
4	160 x 10^3	24.62	9.58	38.91
8	3600 x 10^3	18.95	7.00	36.94
16	11000 x 10^3	14.24	9.19	64.50

TABLE 2. *The absolute activity in micro curies (μC) retained by filtrates of C^{14} labelled nannoplankton cultures (added activity = 5μC)*

Culture	Sampling interval		
	4 days	8 days	16 days
Chromulina freiburgensis	0.020	0.027	0.033
Isochrysis galbana	0.036	0.043	0.150
Synechocystis salina	0.129	0.141	0.273
Tetraselmis gracilis	0.010	0.018	0.028

1965; Samuel *et al.*, 1971) in the logarithmic phase of growth though a few species excrete upto 25%. Higher rate of excretion, as exhibited by that of *S. salina* could be due to excessive culture density (Nalewajko, 1966). In ageing cultures, however, the passive release of metabolites from dead and moribund cells also contribute to the ECP (Fogg, 1975).

The ecological significance of ECP is that it is an important link between photosynthetic and heterotrophic micro organisms (Bell, 1983). There is a rapid flow of dissolved organic carbon from the phytoplankton to the bacterial assemblages of the "phycosphere". This is an important step in mineralization and nutrient cycling in aquatic environment.

The authors are grateful to Dr. E. G. Silas, Director, Central Marine Fisheries Research Institute for the laboratory facilities and to the University of Cochin for permission to publish the same.

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PROTEIN PATTERN OF THE OVARY, DEVELOPING EMBRYO AND FREE VELIGER IN THE SNAIL *CERITHIUM CORALIUM* (KIENER)

ABSTRACT

Protein pattern and number of fractions were observed to change from the intra-ovarian eggs to developing embryo and to free veliger stage of *Cerithium coralium*. Protein fractions decreased from 12 to 5 and 4 in the above respective stages. While the slow-moving fractions present only in the ovary, the fast-moving fractions were found in all stages.

STUDIES of protein constituents and their variations during molluscan development have been few. Goldberg and Cather (1965) found molecular heterogeneity in Lactate Dehydrogenase during development of the snail *Argobuccinum*. No information on other molluscan species is available. In the present study, an attempt has been made to study the protein constituents of the egg masses, containing developing embryos and of free veliger stages of *Cerithium coralium* (Kiener) (Cerithiidae: