

# EXTRACELLULAR LIBERATION OF DISSOLVED CARBOHYDRATES BY *CRICOSPHAERA CARTERAE* AND *COCCOLITHUS HUXLEYI*

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## ABSTRACT

Excretion of dissolved carbohydrates (DCHO) by *Cricosphaera carterae* and *Coccolithus huxleyi* was studied under laboratory conditions for fifteen days. Production of DCHO varied from 0.5 to 2.5  $\mu\text{g/ml}$  in *C. carterae* and 0.4 to 3.5  $\mu\text{g/ml}$  in *C. huxleyi*. Accumulation of DCHO was maximum towards the declining phase of the cultures. The importance of organic material excreted by algae have been indicated.

Pure cultures of algae are known to liberate organic material during growth (Ignatiades and Fogg, 1973; Fogg, 1975 a). The ecological implications of the extracellular substances liberated by the algae into the aquatic environment have been summarized by Fogg (1962). The present communication indicates the production of dissolved carbohydrates by two unialgal cultures, i. e., *Cricosphaera carterae* and *Coccolithus huxleyi* in the laboratory.

The unialgal cultures were maintained in 'f/2' medium (Guillard and Ryther, 1962) at 20°C and under 4000 to 5000 lux cool fluorescent illumination. Aliquots of cultures were drawn each day for fifteen days for the measurement of cell counts and DCHO. Cell counts were determined with a Neubauer haemocytometer while DCHO was estimated colorimetrically by the phenol-sulphuric acid method (Dubois *et al.*, 1956) using a Beckman DU spectrophotometer. 25 ml of the medium containing the algae was used for filtration through millipore filters. When the culture grew very dense the filtration volume was reduced to 10 ml.

In both the cultures, there was a progressive increase in the production of DCHO from the first day of inoculation to the last day. The cell numbers began to show an exponential growth phase between 3rd and 7th day in *C. carterae* and between 3rd and 8th day in *C. huxleyi* (Fig 1 a & b). Between 8 and 13 days and 9 and 13 days, the cell numbers began to show a stationary phase in *C. carterae* and *C. huxleyi* respectively. The DCHO seemed to accumu-

late when the cultures reached the stationary and declining phases. Maximum amount of DCHO was observed on the 15th day in both the cultures. In *C. carterae* the DCHO concentration varied from 0.5 to 2.5  $\mu\text{g/ml}$  and from 0.4 to 3.5  $\mu\text{g/ml}$  in *C. huxleyi*. In actively growing cultures, the DCHO did not exceed 1  $\mu\text{g/ml}$  in *C. carterae* and 2  $\mu\text{g/ml}$  in *C. huxleyi*.

Liberation of extracellular material is not species specific or confined to only a group of algae. Thus Samuel *et al.* (1971) found that the pure cultures of *Tetraselmis* and *Dicrateria* and natural population of phytoplankton dominated by diatoms and dinophyceae liberate extracellular products. Sumitra-Vijayaraghavan *et al.* (In press) have also reported on the production of extracellular product (DCHO) by cultures of *Tetraselmis gracilis*, *Chlorella salina* and *Synechocystis salina*. The present study also confirms that DCHO is liberated by *C. carterae* and *C. huxleyi*.

According to Watt (Fogg, 1975 a) there are two types of algal excretion during photosynthesis — one in which glycollate is the major product and in another polysaccharides are excreted predominantly. Glycollic acid is reported to be an important extracellular product of photosynthesis (Tolbert, 1974; Fogg, 1975 a) Hellebust (1965) reported on the occurrence of glycollate in the filtrates of about 22 species of marine algae. Pant and Fogg (1976) reported that the cultures of *Skeletonema costatum* excrete glycollate during photosynthesis. They also suggested that glycollate may act as an extracellular storage product under natural conditions.

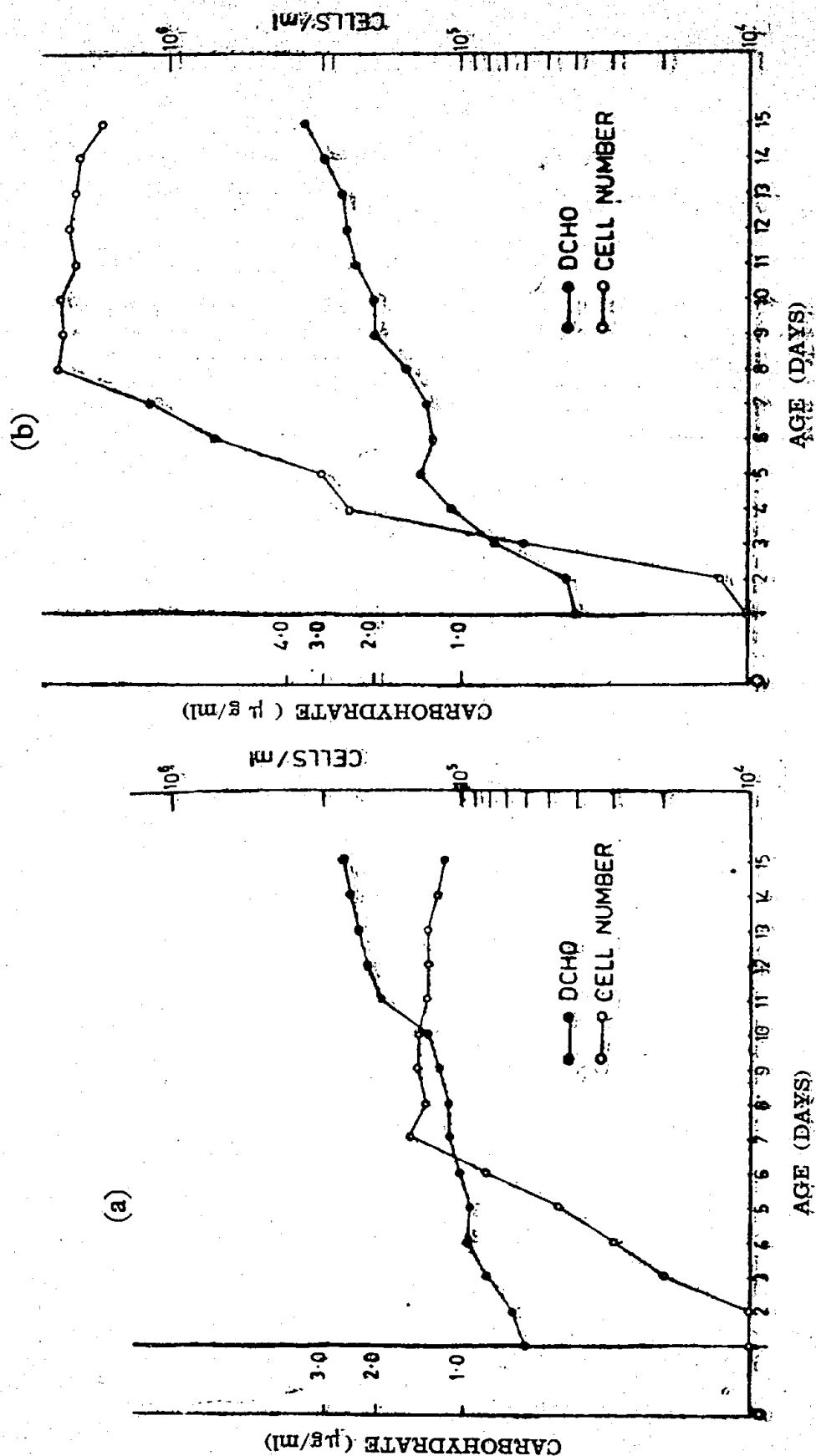


Fig. 1. Cell density and carbohydrate concentration during growth of a culture of  
(a) *Coccolithus huxleyi* and (b) *Cricosphaera carterae*

Guillard & Hellebust (Fogg, 1975 a) found that acrylic acid and polysaccharides are liberated in large amounts by *Phaeocystis puncteti*. Huntsman (1972), while working with the culture of *Dunaliella tertiolecta* detected large amount of glycerol as an extracellular product. The biochemistry of glycollate is well known (Tolbert, 1974; Fogg, 1975 b), but very little is known about the nature of polysaccharides.

The maximum amount of DCHO produced by *C. carterae* and *C. huxleyi* amounted to 2.5 and 3.5 µg/ml respectively in the present studies. This quantity compared with the values reported by Guillard and Wangersky (1958) for different marine algae, Huntsman (1972) for *D. tertiolecta* and Sumitra-Vijayaraghavan *et al.* (In press) for *T. gracilis*, *C. salina* and *S. salina* appears to be low.

Extensive information is available on the production of DCHO by the algal cultures

but its production in the natural environments of the tropical waters is little known (Srinivasagam, 1965; Samuel *et al.*, 1971; Sumitra-Vijayaraghavan *et al.*, 1972 and Sumitra-Vijayaraghavan, 1973). In view of the importance of DCHO to the total organic carbon in natural waters, further studies will be of interest.

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