PIGMENTS IN ALGAL-MATS OF A SMALL AND SHALLOW BAY IN GREECE

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Abstract

This paper describes the identification and measurement of pigments in coastal organosedimentary forms, using HPLC. Various types of pigments were determined but Chlorophyll α was the dominant one. An increasing trend was observed during spring and autumn and a decreasing one during summer and winter. Chlorophyll-b, Pheophytyn-a and Carotenoids were also detected in considerable amounts. Traces of Foucoxanthine and Luteine were identified in some cases. Microscopic study of the system revealed that Cyanobacteria was the dominant group; Chlorophytes and diatoms were also present

Keywords : Pigment, chlorophyll, HPLC, algal-mat

Introduction

Photosynthetic pigments are of great importance for several biochemical procedures in the marine environment. Chlorophylls are the most important group of such compounds and probably the most frequently measured biochemical parameter in oceanographic studies. The concentration of chlorophylls reflects the primary production and eutrophication level in marine systems. Photosynthetic pigments also appear in marine sediments coming from benthic ecosystems that include many algal species. An interesting case is that of recent stromatolites developed in some shallow Mediterranean coasts. They are defined as organosedimentary structures produced by sediment trapping, binding, and/or precipitation due to the growth and metabolic activity of benthic microorganisms principally cyano-bacteria (1). These structures consist of various colored layers. Most of the organisms can be found in the surface layer (algal-mat).

The concentrations of various pigments and their seasonal fluctuation were studied in such organosedimentary structures from a small enclosed, shallow bay near Athens, where environmental conditions are favorable for them (Mesotrophic level, low tides, shallow and warm waters, sunlight)(2).

Methodology

Sediment cores of about 10 cm long, were collected on monthly basis from July 2000 to June 2001 from three different points of the bay. Samples were fractionated in three layers: the upper one, 0.5-1.2 mm thick that includes the algal-mat; the middle one, up to 5 cm thick, of dark color, anoxic; the third one 5 to 10 cm represents the background sediment of the bay.

After freeze-drying, the separated layers were sieved through 0.24mm sieves and stored under inert atmosphere, in darkness at –18º C.

The HPLC technique was selected for the detection and measurement of the pigments as the most accurate and reliable one. The measurement of pigments by a Waters HPLC instrument (600/60F) with a 996 Diode Array Detector and a C18 column, followed their extraction procedure (3). The separation and measurement of pigments was achieved using a system of three eluants in a gradient elution procedure (4). Identification of cyanobacteria was carried out by light microscope on live field and cultured material.

Results and discussion

The microscopic analysis of natural and cultured material taken from the surface layer or the samples revealed that cyanobacteria was the dominant group of the system phototrophs. Chlorophytes and diatoms were also present but in a lesser degree. The composition of the cyanobacteria communities of the surface layer does not differ significantly among the samples. Six taxa of cyanobacteria were identified. Among them the filamentous Lyngbya *aestuarii* and *Microcoleus chthonoplastes* were the most abundant. Evidently, there is a reduction of phototrophs occurring in the second black layer. However specimens from its upper part (aprox. 1 cm deep) when put in culture, shown growth of cyanobacteria.

A representative chromatograph of the pigments is shown in Fig. 1. The seasonal mean values of Chlorophyll α, Chlorophyll-b, Pheophytin-a and Carotenoids are presented in Table 1. Foucoxanthine and Luteine were detected only in traces. Increase of all pigment concentrations was observed during springtime and autumn and decrease during summer and winter. The relevant concentrations in the second dark colored layer were found to be about one order of magnitude lower.

The distribution and fluctuations of pigments in this organosedimentary system indicate its complexity and ecological significance. This rarely observed in Greek coasts system, is probably affected by changes in environmental conditions and marine pollution. These influences are under research in our laboratory.

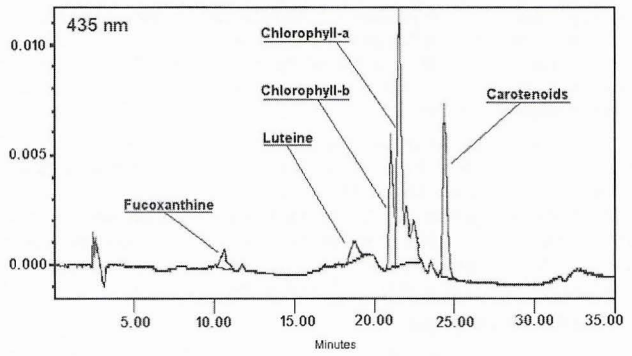

Table 1. Seasonal concentration of pigments in the upper layer of the sediment core (in μg / g)

Pigment	Summer 2000	Autumn 2000	Winter 2001	SpringTime 2001
Chlorophyll α	116,8	175,3	186,2	211,3
Chlorophyll-b	44,6	72,4	36,6	59,2
Pheophytin-a	17,7	20,4	14,8	29,3
Carotenoids	9,8	12,4	8,0	16,2

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