The Temporal Variations of Sedimentary Pigments in the Tidal Flat (the Seto Inland Sea); The Influence of Physical Parameters on Growth Rates of Microphytobenthos

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Introduction

The temporal dynamic of benthic chlorophyll *a* (Chl*a*) in the tidal flat (the Seto Inland Sea) was studied during 1993 to 2001. The mean annual concentrations of Chl*a* ranged from 6.1 to 12.2 μg g^{-1} in the top 0.5 cm of sediment. The highest Chl*a* concentration in each year during the monitoring period was found when the solar radiation ranged between 5 and 25 MJ m^{-2}. As a result, Chl*a* concentrations were significantly correlated with solar radiation ($p<0.001$, $n=208$) and grain size ($p<0.05$, $n=55$). However, non-significantly correlated between Chl*a* concentrations and physical parameter variables (temperature and salinity) were found. These results suggested that, in this environment, the relative importance of microphytobenthos is not regulated by single factor, but rather is highly variable as result of physical mixing. This is of great interest for the influence of physical parameters on growth rates of microphytobenthos.

Experimental design

The experimental development was carried out with dominant species of microphytobenthos (*Nitzschia sp*. and *Amphora sp.*) on tidal flat. In addition, growth rates of microphytobenthos on tidal flat was compared to the shallow coastal environment (mean depth = 8 m), estimated by same species in Shido Bay, the Seto Inland Sea. An experiment was performed on June 2001, the different levels of physical parameters were established up in the experiment with a 14:10 Light:Dark cycle; light intensity levels (0, 100, 200, 300 and 400 μE m^{-2} d^{-1}), temperature levels (21, 28 and 35 ºC) and salinity levels (20, 30 and 40 psu). Time-trend measurements of fluorescence (TURNER DESIGNS TD-700) in the incubation tubes were made at 12 hr intervals. Growth rates of microphytobenthos were estimated by the growth equation: $\mu = [\ln (N_t/N_0)/t_t\text{-}t_0]$

Results and Discussion

Growth rates increased with (incubation) light intensity, which ranged from 0 to 300 μE m^{-2} d^{-1}, which ranged from 0.56 to 1.90 per day. The maximum growth rate of tidal flat was obtained 1.90 per day for *Nitzschia sp.* and 0.98 per day for *Amphora sp.*, when the treatment light intensity at 300 and 400 μE m^{-2} d^{-1}, respectively. While, The maximum growth rate of the shallow coastal environment (Shido Bay) was obtained 1.83 per day for *Nitzschia sp.* at 30-50 μE m^{-2} d^{-1}. A significant difference between the growth rate under temperature and salinity conditions was found. The highest growth rate was obtained 1.90 and 0.85 per day for *Nitzschia sp.* and *Amphora sp.*, respectively, when treatment temperature of 21ºC is used. While, the growth rate at 30 psu of treatment salinity was highest value, which obtained 1.90 and 0.85 per day for *Nitzschia sp.* and *Amphora sp.*, respectively. This study suggested that physical parameters were influenced the growth rate of microphytobenthos. The optimum of light, temperature and salinity for growth of the tidal flat strain

microphytobenthos, in the culture conditions is 300 to 400 μE m^{-2} d^{-1} for light, 21°C for temperature and 30 psu for salinity.