

Growth of fouling diatoms from the Zuari estuary, Goa (West coast of India) under different salinities in the laboratory

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ABSTRACT

Diatoms take part in the initial process of fouling i.e. primary film formation. In order to understand the growth of the diatoms under different salinity conditions in the laboratory, this work was undertaken. Fouling diatoms on glass slides were incubated under three different salinities i.e. 15‰, 25‰ and 35‰. Totally 21 species of diatoms were incubated, and the following 12 species were found to show better growth : *Amphora turgida*, *Biddulphia obtusa*, *Bacillaria paradoxa*, *Cocconeis littoris*, *Cymbella gastroides*, *Gramatophora marina*, *Licmophora gracilis*, *Navicula inflexa*, *N. oblonga*, *Nitzschia longissima*, *N. longissima var. closterium* and *N. sigma var. regidula*. A maximum growth rate of 6105 cells / day was recorded in *Navicula inflexa* in 15‰ salinity. The species such as *Navicula*, *Amphora* and *Biddulphia* grew well in all the above salinities while *Cymbella* and *Bacillaria* preferred 15‰. Generally the diatoms on the glass slide, which were not healthy, did not grow after incubation. The growth of the diatoms was also found to be satisfactory at higher salinities of 25‰ and 35‰. Interestingly, diatoms which were not incubated also developed on the glass slide and this would possibly be due to the spores of such diatoms.

Introduction

Fouling is an integral process in any coastal ecosystem wherein, there is a colonisation of organisms on man made structures. Initially, there is a development of primary

film followed by settlement and growth of macrofoulers. The diatoms take part in the initial process of primary film formation. Fouling is a complex process involving both biotic and abiotic factors. Of these parameters, salinity plays an important role

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in a fluctuating environment like estuary. Studies on incubation of diatoms have not been reported in literature from Indian waters. An attempt was therefore made to study the growth response of fouling diatoms from Zuari estuary, Goa to varying salinities.

Material and Methods

A study of fouling diatoms on glass slide panels was carried out for a period of 14 months from August 1993 to September, 1994 at 1 m depth in Zuari estuary. For the present study the methods of Redekar and Wagh (1999) were followed. Three slides were removed on the 3rd day from the frame for subjecting to incubation study.

Three different experimental salinities viz. 15‰, 25‰ and 35‰ were used to simulate estuarine salinity levels. Although, Subrahmanyam (1958) has suggested the optimum temperature for phytoplankton as 25°C for west coast of India, 20°C was observed to give better results in the present study. Keeping this in view, all the experiments were conducted at 20°C.

Three sets of 250 ml beakers were used for the experiment and 200 ml of the F/2 medium (Guillard and Ryther, 1962) of respective salinity was added to each beaker. After enumeration of the total diatoms settled on the slides, irrespective of species or genus, the slides were placed in the respective beakers. These beakers were covered and placed in an incubator for 12:12 (light: dark) cycle. The source of light was three tubes of 20 watts each. After completion of 7 days experimental period, the slides were used for counting diatoms. The sediment portion of each beaker was taken for counting the diatoms. Growth rate in terms of average cell number / day was calculated by dividing the final cell number by initial number of cell and number of days.

Results

In total 21 species of diatoms were incubated under three different salinities viz. 15‰, 25‰ and 35‰. They are: *Achnanthes longipes*, *Amphora turgida*, *Biddulphia obtusa*, *Bacillaria paradoxa*, *Coscinosira polychorda*, *C. conscinnus*, *Cocconeis littoris*, *Cymbella gasteroides*, *Fragillaria oceanica*, *Gramatophora marina*, *Licmophora gracilis*, *Melosira borreri*, *Navicula inflexa*, *N. oblonga*, *Nitzschia longissima*, *N. longissima var. closterum*, *N sigma var. regidula*, *Pleurosigma angulatum*, *Raphoneis amphiceros*, *Synedra ulna var. longissima* and *Thalassiothrix nitzscheoides*. Out of these, only 12 species of diatoms could develop viz. *Amphora turgida*, *Biddulphia obtusa*, *Bacillaria paradoxa*, *Cocconeis littoris*, *Cymbella gasteroides*, *Gramatophora marina*, *Licmophora gracilis*, *Navicula inflexa*, *N. oblonga*, *Nitzschia longissima*, *N. longissima var. closterium*, *N sigma var. regidula* were found to develop. The maximum growth rate (in terms of number of cells / dm²) was recorded in *Navicula inflexa* (6105 cells / dm²) in 15‰ salinity during September, 94. On the other hand, *Navicula*, *Amphora*, *Biddulphia* grew well in all the salinities (15‰, 25‰ and 35‰). *Cymbella* and *Bacillaria* however preferred lower salinity (15‰). The growth of diatoms in general was found satisfactory at higher salinities i.e. 25‰ and 35‰. Generally, the diatoms on the glass slide which were not healthy, could not develop after incubation. An interesting observation is the appearance of forms which were not incubated. The spores of these diatoms might have been present on the glass slides which might have developed after incubation. The present results however can not be compared with others, since no information on similar work is available.

Table 1. Growth of fouling diatoms under different salinities

Month	<i>Navicula inflexa</i>			<i>Navicula oblonga</i>			<i>Nitzschia longissima</i>			<i>Nitzschia longissima var. closterium</i>			<i>Nitzschia sigma var. regidula</i>			<i>Licmophora gracilis</i>		
	15‰	25‰	35‰	15‰	25‰	35‰	15‰	25‰	35‰	15‰	25‰	35‰	15‰	25‰	35‰	15‰	25‰	35‰
Aug., 1993	1587	2785	2216												NG			NG
Sept	361	446	404	-	NG	826	NG	NG	NG	-	-	-	NG	-	425	-	-	-
Oct	26	37	35	-	NG	-	-	NG	-	NG	-	-	-	-	-	-	NG	NG
Nov.	142	44	43	-	NG	548	NG	-	-	NG	-	NG	-	-	-	-	-	-
Dec.	NG	702	754	NG	NG	NG	NG	NG	NG	1374	1248	1393	NG	NG	199	-	NG	39
Jan., 1994	569	618	888	NG	NG	-	NG	NG	NG	-	922	2590	1224	-	78	NG	-	NG
Feb.	550	633	1078	NG	NG	-	NG	64	31	-	-	-	NG	-	94	NG	NG	NG
Mar.	434	422	1269	-	-	NG	-	-	-	-	409	-	-	19	31	-	-	NG
April.	341	788	3613	NG	72	114	-	-	NG	-	2265	-	NG	NG	2340	NG	-	-
May	520	475	710								NG	216	NG	125	31	-	-	-
June	70	103																
July	1	1	1															
Aug.	4713	9022	4081															
Sept	6105	2651	1205											NG	-	105	74	54

Month	<i>Gramatophora marina</i>			<i>Cymbella gastroides</i>			<i>Cocconeis littoris</i>			<i>Bacillaria paradoxa</i>			<i>Biddulphia obtusa</i>			<i>Amphora turgida</i>		
	15‰	25‰	35‰	15‰	25‰	35‰	15‰	25‰	35‰	15‰	25‰	35‰	15‰	25‰	35‰	15‰	25‰	35‰
Aug., 1993													142	134	223	-	-	-
Sept																		
Oct	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	169	-	-
Nov.	-	-	-	216	52	NG	NG	NG	NG							24	34	-
Dec.	-	-	-	-	430	366	NG	NG	5	-	-	666	-	-	-	452	40	23
Jan., 1994	-	-	-	NG	NG	319	-	NG	NG	70	-	NG	-	NG	-	NG	946	885
Feb.	12	33	14	670	489	395	NG	NG	NG	-	NG	-	-	-	-	117	385	54
Mar.	NG	NG	6	515	94	78	NG	-	NG	-	NG	-	-	NG	-	297	38	179
April.	-	-	-	64	-	655	NG	NG								24	37	144
May	-	-	-	NG	NG	587	NG	NG	NG							NG	NG	216
June													NG	NG	54	-	-	-
July													NG	NG	1	-	-	-
Aug.	-	-	-	-	-	-	-	-	-	-	-	-	117	15	116	-	-	-
Sept	-	-	-	-	-	-	-	-	-	-	-	-	3	5	302	-	-	-

NG - No growth; - Diatoms absent on the slide incubated

Discussion

Regarding the response of fouling in the present study to incubation, it can be observed that growth of *Navicula* was maximum and consistent throughout the study period of 14 months followed by *Amphora* though for less period. Incidentally, *Navicula* was most dominant in fouling. Although *Nitzschia* was next in dominance to *Navicula* its response to incubation was comparatively much less.

Generally, the diatoms on the glass slide, which were not healthy, could not develop after incubation. Apparently, growth was satisfactory in higher salinities i.e. 25‰ and 35‰. An interesting observation is the appearance of forms which were not incubated and this could be due to the presence of the spores of such diatoms on the glass slides which might have developed after incubation.

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