Bioerosion of archaeologically important temples and monuments of India and their preservation strategies

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ABSTRACT

With the rich cultural heritage, comprising national and world heritage monuments, sculpture in great profusion and variety, India is known as a treasure trove of art and architecture. In recent years considerable corrosion of rocks and withering of fine architectural carvings have been observed in many of the temples and ancient monuments of India due to biological growth and more specifically by the excess colonization of cyanobacteria, algae and lichens. When a group of microorganisms colonise such gigantic structures forming a mat on the exposed rock surfaces, do they contribute to withering? The research work presented here provides answer to this question.
Algal diversity in Rushikulya river, Orissa from origin till confluence to the sea

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ABSTRACT

 Totally 42 taxa belonging to 29 genera were recorded from different collection sites in the course of Rushikulya river. Out of these 9 species belonged to 5 genera of Cyanophyceae, 3 species to 2 genera of Euglenophyceae, 19 species to 12 genera of Chlorophyceae and 11 species to 10 genera of Bacillariophyceae. At site 1 total 8 species, at site 2 total 6 species, at site 3 total 14 species, at site 4 total 6 species and at site 5 total 13 species were recorded. Changes in the occurrence pattern of the taxa during course of the river from its origin till confluence to the sea, and the reasons thereof is presented.
Applications of PCR based fingerprinting in the phylogeny of marine cyanobacteria

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Introduction

Cyanobacteria are one of the largest sub-groups of Gram-negative photosynthetic, especially oxygenic, autotrophic prokaryotes (Whitton and Potts, 2000). They contain an extensive number of different genera and species (Lu et al., 1997). Members of this group possess chlorophyll a and phycobiliproteins such as phycocyanin and phycoerythrin, which are responsible for the blue-green pigmentation often evident in this group. As a result of their pigmentation, cyanobacteria were traditionally referred to as blue-green algae. They are the ubiquitous organisms present in almost all environments includes aquatic and terrestrial areas (Honda et al., 1999). While emphasizing, cyanobacteria or their ancestors were the original oxygenic photosynthetic organisms; it is quite probable that they may be responsible for the change from a reducing to an oxygenated atmosphere in olden era (Willmott et al., 1992). The oxygenic photoautotrophic nature of cyanobacteria requires only light, CO₂, and H₂O as the sources of energy, carbon and electron donor, respectively. Cyanobacteria are known to occur in oxic as well as anoxic environments. Several species can switch to typical bacterial anoxygenic photosynthesis using sulphide as electron donor. Cyanobacteria have proven to be useful tool in examine endosymbiotic origin of eukaryotic chloroplasts (Castenholz, 2001).

In many environments cyanobacteria are the primary producer at the basis of the food web of ecosystem. They are also known as symbionts in a variety of other organisms (e.g. the marine diatom Rhizosolenia, roots of Cycas and leaves of Azolla) (Rai, 1990). Stromatolites, laminated biogenic rocks and even microfossil, are the evidence of the involvement of cyanobacteria in biological history of the earth from the Precambrian, 3.5 million years ago. It is also assumed that along with oxygenic eukaryotes, cyanobacteria was responsible for the oxygenation of the atmosphere. The most renewed features of cyanobacteria e.g. Nostoc and Anabena, is the ability to fix atmospheric nitrogen (Castenholz and Waterbury, 1989), a vital nutrient for their physiology. This made them to be used as biofertilizer. Additionally, cyanobacteria play a critical role in the stabilization of desert soils. A vast number of cyanobacteria secrete mucilage, which binds soil particles and preventing erosion.

Marine Cyanobacteria

Of the total estimated area of 150 million sq km of the earth, about 70.68% is occupied by oceans. India has a vast coastline of over 7500 km; in addition it has many lakes, ponds, puddles, backwater areas and a tropical climate that results in abundance of natural populations of varied organisms. Cyanobacteria are widespread and abundant in most marine habitats. Their ability to grow
Oedogonium (Chlorophyceae, Oedogoniales) from Jalgaon District

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ABSTRACT

During the study of algal flora of Hartala Lake (20° 20' North latitude and 76° East longitude) the authors collected 28 taxa of Oedogonium. The present communication describes 4 taxa of Oedogonium. They are O. mitratum var. mitratum, O. iowense f. iowense, O. pratense var. pratense and O. pratense var. scrobiculatum. All these taxa are macrandrous, heterothallic and operculate. Of these four taxa, two taxa namely O. iowense f. oiwense and O. pratense var. scrobiculatum are additions to Indian Oedogonia.
Some recipes with seaweeds of Kerala coast

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Introduction

Seaweeds are sources of commercially important chemical substances such as alginic acid, agar-agar, agaroids, carrageenan, iodine, bromine and mannitol (Subrahmanyan and Gopinathan, 1971; Chennubhotla et al., 1982). The nutritional value of algae depends mainly on the presence of minerals, trace elements, proteins and vitamins. Species of Ulva, Porphyra, Gracilaria, Suhria, Caulerpa, Laminaria, Sargassum and Codium are utilized in Japan, China and other countries (Chapman and Chapman, 1980; South, 1993). These algae are consumed by people as salads, puddings, jellies, soup etc.

The edible seaweeds present in Indian coastal waters are species belonging to Ulva, Enteromorpha, Chaetomorpha, Caulerpa, Codium, Hydroclathrus, Dictyota, Padina, Colpomenia, Rofenvingea, Chnnoospora, Sargassum, Turbinaria, Porphyra, Halymenia, Grateloupia, Centroceras, Gracilaria, Hymnea, Rodymenia, Acanthophora and Laurencia (Chennubhotla et al., 1981; Kathiresan, 1990). Five Indian seaweed species, viz., Enteromorpha linza, E. polifera, Ulva fasciata, Caulerpa taxifolia and Sargassum johnstonii, from natural and cultivated sources were evaluated for safety and nutritional quality and feeding test on rats did not produce any toxic effect on them (Naidu et al., 1993). A few recipes like tofy, squash, kiche, cutlet, bryiani and some practical uses of seaweeds are given in detail by Chennubhotla et al. (1981), Guiwa (1992). Using Gracilaria edulis, the coastal people of Tamil Nadu prepared gruel (porridge) during time of scarcity of food.

In the present communication, some recipes are given for preparation of dishes from algae from the coastal waters of Kerala, particularly from Kovalam (Trivandrum) and Thankasseri (Kollam). Six species of seaweeds were selected for the present study because they were available in plenty throughout the year in this area. They are potential raw materials for agar and algin industries and in the manufacture of cattle feed, fish feed and poultry feed. Present paper describes certain seaweed preparations, which could be served as table dishes, ulva toffy, ulva squash, mixed algae pickle, algae cutlet, algae biryani and algae thoran. They are detailed below.

Recipes

1. Ulva toffy

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dried Ulva powder</td>
<td>1 kg</td>
</tr>
<tr>
<td>Sugar</td>
<td>1 kg</td>
</tr>
<tr>
<td>Butter</td>
<td>150 gm</td>
</tr>
<tr>
<td>Salt</td>
<td>1/2 tsp.</td>
</tr>
<tr>
<td>Citric acid</td>
<td>1/2 tsp.</td>
</tr>
</tbody>
</table>

Fresh Ulva reticulata or Ulva fasciata were collected and all associated flora, fauna, sand and calcareous particles were removed from it. The material was then thoroughly washed in fresh water to remove the salt. The washed alga was spread in the hot sun for six or seven days until it was dry...
Temporal variation in the Specific Growth Rate of heterotrophic bacteria of the ground water from three different Agriculture, Domestic and Industrial areas, Mysore district, Karnataka state, India

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ABSTRACT

Temporal variation in the specific growth rate (SGR) of heterotrophic bacteria was studied from February 2005 to January 2007, in the ground waters from three different (agriculture, domestic and industrial) areas. In general, SGR of bacteria (k) in all the ground water samples fluctuated over a two year period and was largely not related to bacterial variables (parameters). Season wise grouped data of SGR showed variation with respect to season in some water samples during study period, especially in rainy and winter seasons which showed significantly less bacterial growth, when compared to summer season in domestic and industrial areas. The regression analysis revealed that 9.93% of variation in the SGR of bacteria was due to water temperature in the ground water of agricultural area, and 5.21 % due to $PO_4$ (+) in domestic area. However, the 25.09% variation in SGR of bacteria was due to TS (+) in industrial area, suggested that variation in SGR was controlled by environmental (physico-chemical) parameters.
Effect of salinity and temperature on photosynthesis and respiration of some estuarine algae of Godavari estuary, India

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ABSTRACT

Information was collected on combined effects of salinity and temperature on net photosynthesis and respiration of some estuarine macro algae such as Bostrychia tenella, Caloglossa leprieurii and Catenella impudica occurring at Gautami Godavari estuary. Highest rate of photosynthetic and respiratory responses were seen at 20 ppt salinity and lowest values were observed at 0 ppt salinity. These physiological responses were the highest at 25°C temperature in all estuarine algae tested.
Evaluation of Benthic Communities in the intertidal region of Tapi Estuary, Surat, Gujarat

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ABSTRACT

The present work is an attempt to study the occurrence of benthic communities and physico-chemical characteristics of water column in the intertidal region of Tapi estuary. The studies were carried out near a sewage outlet near Magdalla bridge, Surat from post monsoon season; (October 2005) to winter season; (February 2006). It is concluded that the sewage has an effective influence on the benthic communities and any alteration in the water quality directly affects the benthic communities residing in the interstices between the sediments in the intertidal region of Tapi estuary.
Blue-green algae of rice fields of South Telangana region, Andhra Pradesh

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ABSTRACT

A total 342 soil samples were collected from different rice fields of South Telangana region comprising of 6 districts. Altogether 89 blue–green algal forms belonging to 28 genera were identified. Amongst them Nostoc muscorum was found to be abundant followed by Anabaena variabilis, Phormidium ambiguum, Aphanocapsa littoralis, Oscillatoria acuta, Nostoc punctiforme, Anabaena muscorum, Scytonema simplex, and Tolypothrix tenuis respectively. The dominant species observed through out the period were Oscillatoria princeps, Merismopedia convoluta, Nostoc punctiforme, Scytonema javanicum and Phormidium tenue. About 50% of total recorded filamentous blue-green algae were found to be heterocystous. Non heterocystous filamentous forms showed limited distribution and diversity, with 18 species belonging to 4 genera, Lyngbya, Oscillatoria, Phormidium and Spirulina respectively.
Evaluation of water quality by using algal community of Godavari river at Nashik, M.S. India

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ABSTRACT

Water pollution indices are commonly used for detection and evaluation of water pollution. The river Godavari at Nashik (M.S.) was monitored for physico-chemical and phycological changes for two consecutive years (August -2004 to July 2005). From five sampling sites of Godavari river pollution tolerant genera and species of four groups of algae were recorded. Each station had characterized algal flora and physico-chemical properties. By using Palmer’s pollution index for rating the water samples, the total score of each station was noted to evaluate phycological status. Present study revealed that at station S2 and S3 moderate pollution was recorded, while at station S1, S4 and S5 lack of organic pollution was found.
Chlorophyceae from Godavari river at Nashik (M.S.), India

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ABSTRACT

Water quality of Godavari river was monitored for a period of one year (Feb-2004 to Jan-2005). The Chlorophycean flora inhabiting it was studied from five different sampling sites by collecting the samples at monthly intervals. In the present investigation, a total 50 genera and 84 species of Chlorophyceae were encountered with seasonal fluctuation at all five sampling stations. The flora was found to be abundant during summer, declined during monsoon and again increased during winter season. The most pollution tolerant genera according to Palmer (1969), encountered during present study were Ankistrodesmus, Chlorella, Scenedesmus, Closterium, Chlamydomonas, Pediastrum, Actinastrum, Golenkinia, Stigeoclonium, Coelastrum, Ulothrix, Cladophora and Crucigenia. At station 2 and 3 the dominance of this group might be due to higher values of alkalinity, nitrates, phosphates chlorides, hardness, free CO₂ and BOD. The pollution tolerant genera of Chlorophyceae and raised values of physico-chemical parameters showed the organic pollution of river water and indicate its unsuitability for potable purpose. Present study revealed that water flow, alkalinity, chlorides, free CO₂, BOD, nitrates and phosphates influenced the occurrence and abundance of Chlorophycean forms.
An Inventory of the Algal flora of Temple tanks at Kanchipuram

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ABSTRACT

Temple ponds are sacred grove freshwater ecosystem, rich in diverse phytoplankton. An attempt has been made to survey the algal diversity of Temple ponds at Kanchipuram during the year 2005. A total of 10 temple ponds were surveyed. Algae to Chlorophyta, Cyanophyta, Bacillariophyta and Euglenophyta comprising 31 genera were observed. The Chlorophyta was found to be dominant. During our study the temperature of the 10 ponds range from 28°C - 29°C, pH 7 and above, alkalinity ranged from 120 mg to 320 mg/l, dissolved oxygen from 0.4 to 1.4 mg/l, hardness 48-160 mg/l, magnesium 35-128 mg/l, calcium 1332 mg/l, chloride 4-46 mg/l and CO₂, 0-9 mg/l. Some toxin producing micro algae were also observed which might cause a biological hazards.
Observations on Haematochrome Pigment formation in two species of Trentepohlia

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ABSTRACT

Carotenoid pigments are essential components of photosynthetic membranes and assist in harvesting light energy, function as photoprotectants and antioxidants, serve as precursor for biosynthesis of plant growth regulator abscisic acid and protect the photosynthetic apparatus by quenching the harmful reactive oxygen species that are produced by over excitation of chlorophyll. Human diet supplemented with carotenoids, lycopene and β-carotene has been shown to be beneficial in reducing chronic conditions related to coronary heart disease (CHD), certain cancers and muscular degeneration. *Trentepohlia Martius* is an aerial green alga which is a good source of β-carotene. *T. umbrina* (Kütz) Bornet in Wille and *T. aurea* (Linn.) Martius var. *tenuior* Brühl and Biswas are two taxa represented widely in the hilly areas of Idukki district in Kerala. The difference in the haematochrome pigment formation invites further studies which may enable us to utilize this plant for the exploitation of β-carotene synthesis.
Impact of groundnut shell extract on growth of *Spirulina platensis*

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**ABSTRACT**

*Spirulina platensis* was grown in modified CFTRI medium to which groundnut shell extract was added as a source of trace elements. Optical density, number of *Spirulina* filaments and chlorophyll *a* content were observed from 3rd day upto 15th day at every three day interval. Maximum chlorophyll content, optical density and number of *Spirulina* filaments were obtained with 400 mg of groundnut shell extract in 150 ml culture medium.
Effect of seaweed extracts (SLF) on the growth and yield of *Phaseolus aureus, L.*

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**ABSTRACT**

In the recent times, seaweed extracts have been used as fertilizers. These extracts are commonly known as seaweed liquid fertilizer (SLF). The effect of seaweed extracts was studied on the growth parameters of *Phaseolus aureus, L.* upto 45 days of growth with an interval of 15 days. *Phaseolus aureus, L.* showed positive response. The application of seaweed extracts was found to promote overall growth. The use of seaweed extracts proved to be an efficient alternative to the conventional chemical fertilizers.
Some fresh water algae from Eastern Uttar Pradesh

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ABSTRACT

The present paper gives an account of consists of 41 taxa belonging to 22 genera of fresh water algae from two districts viz. Deoria and Mau of Eastern U.P.

Introduction


Fresh water algae of Eastern Uttar Pradesh have not been properly studied (Misra et al., 2004). In many water bodies the bacillariophycean algae are found in abundance. Some of them are good indicators of water pollution (Prasad and Singh, 1996).

Geographically, the district Deoria is situated on north-eastern corner of U.P. and it lies between 26° 52’ N latitude and 83° 792’ E longitude. It is bounded by the district Gorakhpur on the west, Maharajganj and Pardauna districts in North, Mau and Ballia districts in South and Bihar state in the East (Map 1). Total area of the district is above 2573.5 sq.kms. Average rainfall in the district is about 864.38 mm per year.

District Mau is situated on fertile plains of Ganga-Ghaghara doab covering the area of 1, 71, 459 Hectare. It lies between 83° 172’ to 84° 522’ E and 24° 472’ to 26° 172’ N. In its North Ghaghara river is on the border, Ghazipur district is on the South, Ballia district is in the East and Azamgarh district is in the West side (Map 2). The average annual rainfall recorded in the district is approximately 1017.05 mm. The maximum temperature is nearly 65.9°C while the minimum temperature recorded is 46°C.

Materials and methods

Sample collections were made during the month of October 2005 from lotic waters of Saryu and Gandak Rivers of district Deoria and Narja Tal, Pond near railway line and Banaura Pond of District Mau. Collections were made with the help of planktonic mesh net and by squeezing the submerged vegetation harboring algae. Diatoms were collected from scrapings of sand/soil. Algal samples were preserved in 4% formalin. For the detailed study cyanophycean algae were stained with 1% aqueous solution of methylene blue and chlorophycean algae were stained with Iodine. To study diatoms, frustules were digested with conc. Sulphuric
Freshwater green algae from Porur Lake, Chennai

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ABSTRACT

Porur lake is a perennial lake situated just 20 km from Chennai city. Periodic collections have been made from different selected sampling points of the lake on monthly basis from January 2003 to December 2004. In the present study, 42 genera and 65 species of Chlorophyceae members were recorded. The results of the study reveal that there exist differences in species composition and in relative abundance of algae.
Antimicrobial activity of semi purified fractions of marine brown alga *Padina tetrastromatica* Hauck.

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**ABSTRACT**

The crude chloroform: methanol (2: 1) extract of *Padina tetrastromatica* was fractionated by column chromatography. The fraction were evaluated using a number of human pathogenic bacteria (7 gram positive and 7 gram negative strains) and fungi (6 fungal species). The active fractions were identified and characterized by IR and GC-MS analysis. The MIC, MBC and MFC of the active fractions against susceptible organisms were determined. The active compounds were identified as long chain, even numbered saturated and unsaturated fatty acids ranging from C14 – C22 with preponderance of C18 – C20 mono and polyunsaturated fatty acids to be responsible for the antimicrobial activity of marine brown alga.
Freshwater diatoms from Porur Lake, Chennai

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ABSTRACT

Algae constitute a part of food chain of aquatic life in the water, they affect the population of zooplankton and other aquatic organisms. Diatoms are a major group of eukaryotic algae and are one of the most common types of phytoplankton. In the present study, an attempt has been made to assess the occurrence and distribution of diatoms of Porur lake with special reference to nutrients. The present study reports the occurrence of 42 species and 21 genera of diatoms in Porur lake.
Growth and composition of *Vicia faba*, L. influenced by Liquid Seaweed Fertilizers (LSF)

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ABSTRACT

Treatment of the seeds and the plant of *Vicia faba* with Liquid Seaweed Fertilizer of *Gracilaria verrucosa*, *Ulva lactuca* and *Enteromorpha intestinalis* showed a good response. However little work has been done on the different extraction methods of seaweeds. The present work is an attempt to find which method of aqueous seaweed extraction is more effective on the seed germination and growth of the plant. In all the experimental set up only the *Gracilaria* extract from oven method, boiled extract of *Ulva* and oven extract of *Enteromorpha* at 0.5% concentration gave good results. The effect of the different aqueous extracts of the different algae on the seed germination, root length and shoot length of the seedling, leaf area, chlorophyll content and protein content of *Vicia faba*, L. was estimated.
Protein profile and amylase activity of *Oreochromis mossambicus* Peters FED with *Enteromorpha intestinalis*

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ABSTRACT

In the present investigation *Oreochromis mossambicus* was fed with various marine algae such as *Chaetomorpha antennina*, *Enteromorpha intestinalis*, *Ulva lactuca* and *Gracilaria verrucosa* to observe which alga was more preferred by the fish. The biochemical analyses of the seaweeds showed highest amount of carbohydrate of 50.40% in *Enteromorpha intestinalis*. However the protein content was high in both *Ulva lactuca* (13.52%) and *Enteromorpha intestinalis* (13.95%) compared to *Chaetomorpha antennina* (9.51%). Among the different algae tried, *Enteromorpha intestinalis* was the most preferred and palatable food of *Oreochromis*. *O. mossambicus* provided with the algal feed showed considerably more amylase activity in the alimentary tracts than those fed on normal feed. Protein and energy contents of diet are primary nutritional considerations for dietary protein for growth. Hence Electrophoretic protein profile of gut samples of *Oreochromis mossambicus* fed with *Enteromorpha intestinalis*, *Ulva lactuca* and *Chaetomorpha antennina* was obtained by SDS-PAGE.
Freshwater algal diversity of Similipal Biosphere Reserve, Orissa

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ABSTRACT

The Similipal Biosphere Reserve, an unique ecosystem in the eastern part of India, occupy the central part of Mayurbhanj, a northern district of Orissa covering a vast area of 5578 sq. km. It is the richest watershed in the state of Orissa giving rise to many perennial rivers. An attempt was made by us to survey freshwater algal diversity of different water bodies of this undisturbed habitat. Our study revealed remarkable species diversity. A total of fifty-three taxa belonging to twenty-five species of Cyanophyceae, twenty species of Chlorophyceae, six species of Bacillariophyceae, one species each of Charophyceae and Rhodophyceae were recorded from ten different collection sites.
Algal treatment (Phycoremediation) to improve water quality

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ABSTRACT

Present investigation deals with the bioremediation potential of Chroococcus turgidus (Cyanophyta) in improving water quality. Water samples from lake, swimming pool, bore well, aqua guard and commercial water can were used for the investigation. Physico-chemical parameters were analyzed before and after algal treatment (Phycoremediation). Water quality parameters were compared with ISI standards for domestic water supplies. The results indicate phycoremediation can be effectively employed to improve the water quality. The technology to treat waters with algae at field level has to be evolved by further studies.
Dendrocystis raoi, a rare member of Chlorococcales from North Maharastra

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ABSTRACT

The present communication deals with the description of Dendrocystis raoi collected from Suki river under a bridge between village Mothe Waghode and Nimbhora, Tal. Raver, Dist. Jalgaon, Maharashtra. This alga is collected for the first time from Maharashtra.
Impact of UV Radiation on growth and pigments of *Spirulina platensis*

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**ABSTRACT**

To study the impact of UV rays on Cyanobacterium *Spirulina platensis*, we examine the growth, morphology and pigment changes. *Spirulina* was exposed to UV rays at a distance of 1 metre for 1-5 min. Cultures were analyzed quantitatively as well as qualitatively for different pigments. The percentage of Chlorophyll-a, Carotenoids, and Phycobiliprotein was increased up to 3 min exposures as compared to unexposed culture while one min. UV exposure has maximum growth and highest pigment quantity. But on subsequent exposure growth and pigment contents were reduced.
Preliminary studies on the Sunambu kulathour Lake and Pond waer quality in relation to algal flora

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ABSTRACT

Physico-chemical parameters with special reference to benthic forms, lithophytes, epiphytic and epizoic algae of Sunambu Kulathour Lake and Pond near Pallikaranai-601302 were investigated. The parameters such as pH, temperature, DO, turbidity, total dissolved solids, chloride, nitrite, nitrate, sulphate, calcium, total alkalinity and silica were estimated. Physico-chemical studies of both the water bodies showed poor amount of organic nutrients indicating that the water is less polluted. Present study reveals the occurrence of 55 species of algae belonging to Cyanophyceae, Bacillariophyceae and Chlorophyceae. The dominant groups were Cyanophyceae and Bacillariophyceae.
Algal Farming - A sustainable agriculture for food, feed and fertiliser

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ABSTRACT

Algal farming is a novel source of food, feed and fertiliser in contrast to conventional agriculture. Algal biomass rich in all the required nutrients for human body acts as food as well as medicine in the treatment of a number of therapeutic and chemopreventive diseases. It is the best food for both ruminants and nonruminants without any hazardous, toxic or antinutritional properties. Besides, algae being a natural food source for fish, when added increased body weight and imparted brilliant colour to the ornamental fishes and carps. Algae were equally beneficial to animals like pigs and frog being in use as food. One of the most common use of algae is for poultry birds, which enhanced body weight, quality egg production and hatchability, fertility and yolk colour. One of the oldest use of algae in India and abroad is that of algal biofertilisers. It enhanced the crop yield of all the cereals but was amply effective in case of rice crops. Even salt absorbed saline algae as biofertiliser has an edge over other sources of biofertilisers.