Utilization of microalgae to address pollution problems

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ABSTRACT

Abatement of pollution is a challenge to the scientists. Use of oxygen evolving cyanobacteria holds great promise for dealing with intractable environmental problems, as it is not only cost effective but also ecofriendly. Cyanobacteria can remove solid, liquid and gaseous pollutants. Being photosynthetic, they act as CO₂ sink and considerably reduce the green house gases and their adverse effects. One of the major lignin containing solid wastes is the coir pith, generated in fairly huge amounts in all rope making coconut fiber based cottage industries all over rural south India. Cyanobacteria get immobilized into coir pith and start degrading lignin resulting in release of certain chemicals that induce profuse sporulation of cyanobacteria. This would be quite beneficial to biofertilizer industry as it increases inoculum potential several fold. Harmful chemicals of varied industries containing azo & acid dyes, phenols, detergents, pesticides and antibiotics have been found to be used as N, P, S and C sources by different cyanobacteria, thus detoxifying wastes. Heavy metals and melanoidin pigment of molasses based distillery effluent have also been found to be effectively removed by both live and dead cyanobacterial biomass. Disinfection of sewage was also brought about by cyanobacteria through the combined effects of oxygen, hydroxyl radicals and extra cellular polysaccharides. In spite of the immense potential of cyanobacteria, only few laboratory scale attempts have been made so far. Bioremediation is a unique interdisciplinary area involving microbiology, chemistry, biochemistry, biotechnology and hydrology. There is a need to study more about cyanobacterial interactions with different types of effluents and use them for abatement of pollution.
Biodiversity in Desmids

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ABSTRACT

Everyone agrees that we are on the brink of a collapse of life on earth. Extinction, the process by which we lose a plant or animal or microorganisms species forever, is currently at its highest since humanity came on earth. Everyone also agrees that this is mainly due to human activities. We all agree that biodiversity loss is making us more vulnerable to unnatural disasters, climatic changes and food insecurity. The need to support effective conservation and utilization of biodiversity requires development of skills in biosystematics and related disciplines. All the human activities and developmental processes, are closely associated with biological diversity. Its preservation and well management are the basic concerns in recent times. Since more than four decades algal collections were frequently surveyed mainly in Hyderabad, Warangal and various other places of Andhra Pradesh. Desmids (Placoderm desmids) were mainly collected. These unicellular species belong to the order Conjugales of class Chlorophyceae. Algologists were attracted to study these placoderm desmids because of their considerable morphological variability and ornamentation. This desmid variability is quite interesting to note when the conditions such as temperature and illumination were altered. Slight changes in the laboratory or environmental conditions prove instrumental in bringing out diversity in desmids. Frequently, the cells departed so widely from the specific characteristics that one could mistake them as belonging to different taxa. Taxonomically, desmids are a difficult group, as one has to study them in front, lateral and side-views along with mucilage pores and strands which constitute surface ornamentation and make the study much complicated. These diverse forms of various placoderm desmids were studied under light microscope (LM) and also scanning electron microscope (SEM). However, cell types are capable of maintaining their narrow specificity, which seems to be genetically controlled under favourable conditions only. In the present paper an account of diversity in desmids is enumerated.
Reclamation of salt affected wastelands through cyanobacteria

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ABSTRACT

The term wastelands include soils, which cannot be put under plough like mangroves, marshy lands, and acidic or saline-alkaline barren lands. Salinity is widespread around the world and is a serious problem in nearly half of the world. In India, about 7-12 million hectares of arable land are adversely affected by salt, leading to an appreciable loss of land area for effective crop production. The problem is getting worse due to excessive irrigation and lack of drainage system. Salt spray and seawater intrusion along the coast may also increase salinity and decrease productivity. Thus, bringing salt affected lands under more productive farming could open up an entirely new dimension to agricultural productivity. In order to keep the marginal saline alkali lands in production and to reclaim previously non-arable areas, application of chemicals such as gypsum and pyrite is recommended. However in spite of this, area under salinity is fast increasing. Blue green algae, also known as cyanobacteria, as a group evolved nearly 3 billion years ago and are known to be primary colonizers of inhospitable ecosystem. Therefore, reclamation of salt affected soils through organic inputs including cyanobacteria may prove a better alternative. This paper gives an account of cyanobacteria of saline soils and explains the mechanism of bioremediation of saline - alkaline soils by these organism.
Methods for estimating the seaweed quantitative resources of India

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ABSTRACT

Seaweeds are amongst the most productive of any crop. Their significant uses are for human consumption, industrial gels, etc. providing much economic return. Their role in fishery ecosystem deserves special mention. Seaweed distribution and abundance depend upon the physiological and demographic attributes and on biotic interactions. Four basic shore types can be distinguished on the Indian coast, viz. sandy shores, rocky shores, coral formations and estuarine regions. For numerical classification of vegetation, estimates are obtained from samples. The methods in use for assessing the quantities are given. A systematic method of sampling developed for the vegetation at Pamban is described. This method in a simplified form has been widely used in the later surveys. A scenario of the Indian seaweed resources, and a rational usage plan are indicated.
Present status of marine algal biodiversity in Gulf of Mannar region, Tamilnadu

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ABSTRACT

Many species of green, brown and red algae with luxuriant growth occur in the Gulf of Mannar region covering 21 islands. A total number of 147 species comprising 42 species of green algae, 31 species of brown algae, 69 species of red algae and 5 species of blue-green algae were reported. This reveals the richness and varied species composition in Gulf of Mannar Biosphere. The total standing crop of seaweeds from Gulf of Mannar was estimated as 11653 tons (wet wt) consisting of 1475 tons agarophytes, 7141 tons of alginophytes and 3037 tons of other seaweeds. The total biomass of seaweeds in Gulf of Mannar constitutes 53% of seaweed biomass of Tamilnadu coast. The diversity and density of seaweeds in Gulf of Mannar have come down gradually over a period of years. This region was having more than 200 species of seaweeds. The reasons for decrease in the species composition and measures to conserve and increase the marine algal biodiversity in Gulf of Mannar region are given in the paper.
Fungicides effect on *Cladophora crispata* (Roth) Kuetz.

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ABSTRACT

In India control of diseases has been practiced even from the ancient times. In earlier days they have been using certain cultural practices and some natural compounds for the control of diseases. It is assumed that of the total quantity of pesticides used in India at the moment the fungicides perhaps constitute about 20% or less. Number of synthetic fungicides were developed and have been widely used in India. These fungicides are among the agrochemicals which were extensively used for protecting crops and plants from destruction and damage that may be caused by various factors particularly, to control fungal growth. Today, copper fungicides are used widely in many countries including India. The effect of fungicides on eukaryotic algae from cytological view point are quite a few. During the present researches, *Cladophora crispata* a branched filamentous alga, belonging to the order Cladophorales of the class Chlorophyceae was selected and the effect of fungicides (Bavistin and Fytolican) was studied. This species was selected as it is being extensively studied in various other aspects by many workers. The chemicals were used in various concentrations and at different durations. Observations were recorded every week for a duration of 3 weeks. These studies were conducted for estimating survival percentage, dry weight of the alga and chlorophyll content. Simultaneously, morphological and cytological abnormalities were also observed after the treatment of fungicides, under study, employing various concentrations and durations. All the parameters employed during the present investigation showed the damage caused to the filaments of *Cladophora crispata* due to the effect of fungicides.
Use of photosynthetic micro-algae in phycoremediation

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ABSTRACT

The concentration of carbon dioxide, one of the ‘green house gases’ increases in the atmosphere by burning coal and petroleum. The United States is considered the largest emitter of the ‘green house gases’ blamed for global warming. Global warming is a more dangerous threat to life than terrorism. Photosynthesis can play an important role in reducing the atmoapheric carbon dioxide by phycoremediation. Phycoremediation is the use of algae to remove pollutants. In this case the pollutant is increasing concentration of carbon dioxide which can be reduced by growing photosynthetic micro-algae in high carbon dioxide concentration such as Chlorella, Dunaliella, Chlorococcum litorale, etc.
Investigation in the algal flora of Thodupuzha Thaluk, Kerala

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ABSTRACT

The algal biodiversity of Kerala is an unexplored area to a great extent. Although monographing the algal flora of India was started as early as 1959, so far no systematic study has been conducted on the fresh water algal flora of Kerala. Idukki, the largest district of Kerala is unique with respect to geographical, topographical and climatic conditions. A systematic study on the algal flora of Thodupuzha thaluk of Idukki district revealed the rich algal biodiversity of that region. Through extensive field visit to various parts of the thaluk during various seasons, algal specimens are collected, preserved and identified. The specimens are located with the help of a G.P.S. Special emphasis is given to demarcate endemic species. Digital images of various taxa are taken with the help of a digital camera attached to the microscope and are transferred to the computer for further analysis. A total of 67 algal taxa identified from the thaluk belong to Chaetophorales (4 genera), Chlorococcales (6 genera), Ulotricales (1 genus), Zygnematales (15 genera), Nemalionales (2 genera), Heterococcales (1 genus), Dinoflagellata (1 genus), Chrysomonadales (1 genus), and Euglenophyceae (3 genera). A good number of them are new reports from Kerala.
Algal biodiversity in a man made water body

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ABSTRACT

A pond was constructed about 18 months back within the premises of the university campus (SSSIHL, Prashanthi Nilayam, AP) with cement plaster lining and layer of black soil on the floor. Hydrilla, water lily and lotus have been introduced in the pond, and also fish and snails. A preliminary investigation was carried out to assess the status of algal biodiversity of the pond. The algal groups identified in this aquatic system belong to Cyanophyceae, Chlophyceae, Bacillariophyceae and Euglenophyceae. The physical parameter such as humidity, atmospheric pressure, air temperature, Water temperature, pH, TDS (total dissolved solids) B.O.D, C.O.D. and routine chemical analysis for various essential nutrients such as potassium, ammonia, phosphate, iron and fluoride. Total cell counts of algae were made using haemocytometer. Nygaard index was worked out which indicated that the pond is under going eutrophication.
Growth and composition of *Oryza sativa, L.* influenced by *Aulosira fertilissma* as biofertilizer

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**ABSTRACT**

Paddy (*Oryza sativa, L. Var. NDR-359*) plants raised in soil-pot culture conditions with different doses nil (control), 50, 100, 150, 200 and 250 g *Aulosira fertilissma* (Cyanobacteria)/Kg soil level. As compared to control, each level of *Aulosira fertilissma* (bga) supply showed highly significant (P=0.01) increase in dry matter yield and catalase activity of both 30 and 90 days old tops and dry matter yield of grains of 100 days old paddy plants. However increase in peroxidase activity at each level of bga supply, as compared to control, was found to be highly significant (P=0.01) in tops of 30 and 90 days old paddy plants. 250 g bga/kg soil level over control showed significant (P=0.05) increase in peroxidase activity in tops of 30 days old paddy plants. Chlorophyll content in leaves of both 30 and 90 days old plants showed maximum values at 250 g *Aulosira fertilissma/kg* soil level. 200 g *Aulosira fertilissma/kg* soil levels in leaves of 30 days and 250 g *Aulosira fertilissma/kg* soil level in stem of 30 days and in both stem and leaves of 90 days and grains of 100 days old plants showed maximum iron content. For manganese content 150 g *Aulosira fertilissma/kg* soil in stem of 90 days, 200 g *Aulosira fertilissma/kg* soil in stem of 30 days and 250 g *Aulosira fertilissma/kg* soil in leaves of both 30 and 90 days old and grains of 100 days old plants were found to be best levels of supply. Maximum value for nitrogen in both stem and leaves of both 30 and 90 days old and grains of 100 days old plants were observed at 250 g *Aulosira fertilissma/kg* soil level supply. Overall increase in growth and composition of paddy plants was observed between 150 to 250 g *Aulosira fertilissma/kg* soil supply levels.
Phycoremediation of petrochemical effluent by cyanobacterium

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ABSTRACT

Increasing levels of environmental pollution and the continuous monitoring of water quality both require specific and sensitive methods for the detection of detrimental water contents. Studies on pollution abatement of petrochemical wastewater by bioprocess using cyanobacteria have been carried out for optimization of parameters. It is known that the majority of the components in most petrochemical effluents are biodegradable. Biodegradation using cyanobacterium Oscillatoria sp. is an effective treatment solution for petrochemical wastewater. The maximum bioreduction potential of Oscillatoria sp of certain parameters like turbidity, TDS, TSS, total hardness, calcium, magnesium, sodium, potassium, iron, chloride, fluoride, BOD, COD and oil and grease).
Biomanagement of Dairy effluent by using cyanobacterium

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ABSTRACT

Dairy effluents are usually a strong pollution load due to their excellent nutritional properties, and they are readily oxidized by various cyanobacteria. They have low COD, BOD ratios, because of this the wastewater can be treated efficiently by biological processes. Biodegradation of effluents by using cyanobacterium in the environment plays an important role in cycling and recycling of wastewater in biotechnological applications. In the present study the effect of *Spirulina platensis* in the degradation of dairy effluent, has been studied and the results are discussed. The results revealed the potential of *Spirulina platensis* to degrade certain parameters like TSS, conductivity, total hardness, nitrate, phosphate, fluoride, BOD and COD. The possible impact of cyanobacterium on wastewater treatment efficiency deserves further study due to their large biomass and diverse metabolic characteristics.
Phytoplankton (BGA) Diversity in relation to Physico-chemical properties of River Water

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ABSTRACT

Noon river is highly deteriorated by the Industrial wastes and sewage water of city Orai of Distt. Jalaun (U.P.). In this investigation two sampling sites were made. The physico-chemical and biological variation found during study period (July 2005-March 2006) were studied. In physico-chemical parameters pH, total alkalinity, total hardness, total solids, dissolved oxygen, BOD & chloride are highly variable. Total alkalinity ranged between upto 277-338 (m eq/l), while total hardness ranged between 610-776 (m. eq./l). Chloride also ranged near to total hardness (617-771 m.eq/l). Water quality of river indicated high level of pollution when compared with standards and may be hazardous for near villagers if they consume it. In biological parameters the phytoplankton are of utmost occurrence. The growth of algal flora specially B.G.A. is enhanced due to polluted water. The common cyanobacterial species recorded from the aquatic system of Noon river, Ragauli were Microcystis flos-aquae, Gleocapsa quaternata, Aphanocapsa littoralis, Merismopedia tenuissima, Spirulina major, Lyngbya contorta, Calothrix marchica, Gloeotrichia pisum, Cylindrospermum musicola, Oscillatoria formosa, Nostoc commune, Nostoc hatei, Chroococcus minutus; Phormidium ambiguum, Anabaena oscillatorioides and Aphanothece microscopica.
Diversity of blue green algae in Allen Forest Lake, Zoological Park, Kanpur, mixing with campus sewage

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ABSTRACT

The physico-chemical characteristics of aquatic system were found to be highly variable in different seasons. Following members of blue green algae (thirty one species) recorded from the aquatic system of Allen Forest Lake, Zoological Park, Kanpur, during the season were Microcystis flos-aquae, Microcystis robusta, Chroococcus minor, Gloeocapsa magma, Aphanocapsa montana, Aphanothece castagnei, Synechococcus aeruginosus, Coelosphaerium kuetzingianum, Merismopedia glauca, Arthrospira spirulinoides, Spirulina gigantean, Spirulina major, Oscillatoria curviceps, Oscillatoria formosa, Oscillatoria subuliformis, Phormidium ambiguum, Phormidium fragile, Lyngbya contorta, Lyngbya porphyrospironis, Lyngbya majuscula, Cylindrospermum muscicola, Nostoc hatei, Nostoc commune, Nostoc punctiforme, Nostoc muscorum, Anabaena oscillarioides, Anabaena oryzae, Anabaena fertilissima, Calothrix gloeocola, Rivularia manginii and Gloeotrichia pismum.
Algal Biodiversity and Succession in Periyar River at Aluva, Kerala

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ABSTRACT

Periyar is the largest freshwater river in Kerala. Algal biodiversity study was conducted in one kilometer stretch in the river at Aluva for one year during 2005–06. Phytoplankton and periphytic algae were collected and identified. Seasonal variation and succession of algae were noticed in the various sampling sites of the study area. Blue green and green algae were dominant groups during pre-monsoon. Diatoms and green algae were dominant during monsoon and post monsoon seasons respectively. Periphytic algae such as Cladophora sp., Oedogonium sp., Ulothrix sp., were abundant throughout the year. Fluctuation of water level, speed of the discharge and variation in different environmental factors due to seasonal changes may be the reasons for the succession of the freshwater algae in the river.
Genotoxic effects of aqueous extracts of the alga *Enteromorpha prolifera* on *Allium cepa* root tips

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ABSTRACT

*Enteromorpha prolifera* was collected from Covelong, Chennai and tested for cytotoxic effects on root tips of *Allium cepa*. The rate of mitotic cell division and mitotic anomalies in onion root meristems were determined for 24 hours and 48 hours after treatment. There was no significant variation in the mitotic index of root meristems among the five different concentrations compared with the control after 24 hours and 48 hours. Mitotic anomalies have been observed only at a higher concentration after 24 hours and 48 hours.
Diversity of phycocolloids in selected members of Rhodomelaceae

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ABSTRACT

Phycocolloids of five species of Rhodomelaceae belonging to \textit{Polysiphonia}, \textit{Chondria}, \textit{Acanthophora} and \textit{Laurencia} (two species) collected from south east coast of Tamil Nadu during summer and winter, were extracted and their yield and physico-chemical properties were determined. Seasonal variations were compared. \textit{Polysiphonia tuticorinensis} and \textit{Chondria transversalis} yielded agar type of phycocolloid while lambda carrageenan was obtained from \textit{Acanthophora dendroides}, \textit{Laurencia flagellifera} and \textit{L. papillosa}.
On the occurrence of *Cloniophora* Tiffany in Indian waters

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ABSTRACT

A new alga collected near Kanyakumari, Tamil Nadu proved to be a species of *Cloniophora* so far not recorded from Indian waters. The morphology of the alga indicates that the alga is *Cloniophora spicata* (Schmidle) Islam. The distribution and the habitat diversity of the species is discussed.
A study on the algal diversity of Vamanapuram River of south Kerala, in relation to certain water quality parameters

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ABSTRACT

Vamanapuram River, one of the major rivers of southern Kerala has a total length of 88 km and a basin area of 787 km²; it originates at an altitude of 1717m in the Western Ghats. The river is found to be highly polluted by a number of rubber factories fringing its banks as well as by the paper mill located at its upper reaches. The present work was undertaken to discern the algal diversity of the river in relation to the varying physico-chemical parameters of water brought about by the influx of the effluents. The algal flora of the river system are found to fall under 6 major groups, 24 families, 58 genera and 107 species.
Distribution and abundance of the swarming crab *Charybdis (Goniohellenus) smithii* Macleay in the deep scattering layer of the eastern Arabian Sea

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ABSTRACT

The distribution and abundance of the swarming crab *Charybdis (Goniohellenus) smithii* Macleay in the deep scattering layer of the eastern Arabian Sea are presented here based on the 35 IKMT samples collected by the FORV Sagar Sampada during 1998-2001. Samples were collected from the surface down to depths of 750m in the area between 06-21°N, 67-77°E. The maximum concentration of swarming crab was found in the southern parts of the Arabian Sea.
Physio-chemical study of Ujani Dam backwater

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ABSTRACT

An attempt has been made to assess the water quality of Ujani Dam backwater at Siddhateka and nearby stations. The study was carried out by collecting water samples from five different sampling stations. The samples were collected monthly from June 2001 to March 2002. The samples were analysed for parameters such as temperature, pH, dissolved oxygen, electrical conductivity, TDS, BOD, free CO₂, total alkalinity, chlorides, hardness, calcium, magnesium, phosphate.
Influence of environmental factors on growth and N-related enzymes of cultured cyanobionts of *Azolla*

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**ABSTRACT**

An investigation was undertaken to evaluate the role of aerobic / air-tight environment and continuous light / continuous darkness, light-dark (16:8) regimes on growth attributes, ammonia excretion and activity of glutamine synthetase and nitrogenase enzymes in the cultured cyanobionts of six species of *Azolla* - *A. microphylla, A. filiculoides, A. rubra, A. caroliniana, A. mexicana* and *A. pinnata*. Growth attribute (chlorophyll) and nitrogenase activity were higher under aerobic conditions while continuous darkness drastically suppressed nitrogenase activity, but stimulated ammonia excretion. This investigation clearly indicates that the changes in the growth environment such as, light / dark or aerobic / air tight conditions could not stimulate the environment of “Azolla cavity” and induce the typical behaviour of true symbionts of *Azolla*, i.e. high heterocyst frequency and nitrogenase activity. Host signals / factors may have a much more critical role to play in true symbiotic properties, than hitherto understood.

Abberivations : ARA - Acetylene Reduction Assay; ACD - Aerobic continuous dark; ACL - Aerobic continuous light; ALD - Aerobic light-dark; ATCL - Air-tight continuous light; ATCD - Air-tight continuous dark; ATLD - Air tight light-dark; DMRT - Duncan’s Multiple Range Test; GS - Glutamine Synthetase; MSX - Methionine sulfoximine, N₂ ase, nitrogenase.