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PROCEEDINGS OF THE NATIONAL CONFERENCE ON PROSPECTS OF ALGAE IN FOOD, HEALTH, ENVIRONMENT AND ENERGY

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Karunya Nagar, Coimbatore, Tamil Nadu, India - 641114

APHEE 19'

Proceedings of

National Conference on

Prospects of Algae in Food, Health, Environment and Energy

PAFHEE'19

March 7 & 8 2019

Organized by

Department of Biotechnology

School of Agriculture and Biosciences

Karunya Institute of Technology and Sciences

Preface

"The study of algae has changed a lot, but it has always been a research problem," Strangest of all, algal research is one of the older careers in biology, but still remains attractive. We are extremely honored to welcome you to the National Level Conference on Prospects of Algae in Food, Health, Environment and Energy (PAFHEE'19) – an algal hunt in various streams organized by the Algae Biomass Research Laboratory, Department of Biotechnology, Karunya Institute of Technology and Sciences.

Karunya Institute of Technology and Sciences always stress upon the R&D activities in the frontier of food, health, water energy and energy. We firmly believe that the Conference - PAFHEE'19 help to achieve the mission. This volume of proceedings from the conference provides an opportunity for readers to engage with a selection of refereed works that are presented during PAFHEE'19. The reader will sample the reports of research on emerging technologies in algae research in our country. The reader will discover the common challenges and create solutions emerge from very diverse settings.

PAFHEE'19 has many highlights, The Themes for the sections will be of interest on multiple meanings of algal research and designed to offer a unique fortuitous for exchange of knowledge and interaction within algologists, academician, Industrial experts to deliberate the focus of algal teachings, research and technology developed world wide. Eminent experts from algae research deliver their plenary and lead lectures. Around 166 delegates within India participate and deliberate their research work during the conference.

We hope that this proceeding will be a wisdom that enlightens algae research and be a memorabilia of the conference. Get benefited from interactions with peers as well as pioneers

With best regards

Dr. Jibu Thomas
Organizing Secretary
Prospects of Algae in Food, Health, Environment and Energy (PAFHEE'19)

Foreword

I am extremely delighted to be a part of the National Level Conference on "Prospects of Algae in Food, Health, Environment and Energy" (PAFHEE'19) as the Convener of conference organized by Department of Biotechnology, Karunya Institute of Technology and Sciences.

Algae – a buzz word, world over for multiple research problems. The National Level Conference on Prospects of Algae in Food, Health, Environment and Energy aims to bring together leading academic scientists, researchers and Students to exchange and share their experiences and researches on various aspects of Algal Biotechnology. This unique opportunity provides the participants a platform to network, deliberate and collaborate. It also provides a premier interdisciplinary platform for researchers, practitioners and educators to present and discuss the most recent innovations, trends, and concerns as well as practical challenges encountered and solutions adopted in the fields of Algal research.

I congratulate the untiring efforts of team organizing this technical event and in publishing this proceeding. I wish the organizers a grand success!

All the very best to all participants and delegates!

Dr. S. Jacob K Annamalai
Convenor – PAFHEE'19
(Dean, School of Agriculture and Biosciences)

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National Level Conference on Prospects of Algae in Food, Health, Environment and Energy (PAFHEE'19) during March 7 and 8, 2019

Schedule of Events

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	Presidential Address Inaugural Address by Vice Chancellor	
	Felicitations Registrar/ Pro Vice – Chancellor	
	Guest of Honour – Prof. Ruey Yi Chang, Director Department of Life Science, National Dong Hwa University, Taiwan	
	Release of Proceedings Honouring the Guest Speakers National Anthem	
10.30 – 10.45	Tea Break	
Technical Sessions		
10.45 – 11.45	Keynote Lecture Prof. Ruey Yi Chang, Director Department of Life Science, National Dong Hwa University, Taiwan	Elohim Auditorium
11.45 – 12.55	Invited Talk - Dr. Krishna Mohan Poluri Associate Professor, Department of Biotechnology, Indian Institute of Technology Roorkee	Elohim Auditorium

	"Integrated Algal-omics studies to delineate the molecular Mechanisms of bioremediation and lipid production"	
1.00 – 1.45	Lunch Break	Restaurant
1.45 – 2.25 – 3.00	Parallel Oral/Poster Presentations	Department Corridor/Lecture halls
2.30 – 3.00	Higher Education options by M/s. Global Reach (Sponsor's Session)	Elohim Auditorium
3.00 – 3.55	Invited Talk Dr. Muthu Arumugam Scientist, CSIR, Trivandrum "Sustainable production of nutraceuticals from edible microalgae"	Elohim Auditorium
3.55 – 4.30	Invited Talk Prof. Siva Subramanian Director, Phycospectrum Environmental Research Centre **"Micro algae technology for industrial effluent treatment and restoration of polluted water bodies"**	Elohim Auditorium
4.30 – 5.15	Technical session by Prof. Rengaswamy, CTO, M/s. Shibin Neutrceuticals (Sponsors Session)	Elohim Auditorium
5.15 – 5.45	Cultural Evening	Elohim Auditorium
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9.15 – 10.30	Special Theme Lead Lecture - N Thajuddin Professor and Dean, Faculty of Science, Engineering & Technology Bharathidasan University, Tiruchirapally "Microalgae and Cyanobacteria – an imminent bioresource for energy, environment and health"	KCDC Gallery Hall

10.30 – 10.45	Tea Break	
10.50 – 11.50	Prof. Subburamu Karthikeyan Professor, BioChemCon Lab, Department of Bioenergy, Tamil Nadu Agricultural University "Enhancing algal biomass productivity for sustainable fuels"	KCDC Gallery Hall
11.55 – 12.55	Dr. Krishna Mohan Poluri Associate Professor, Department of Biotechnology, Indian Institute of Technology Roorkee "Metabolomic studies on Microalgae using NMR Spectroscopy"	KCDC Gallery Hall
1.00 – 1.30	Feed Back Session Certificate Distribution - Prof. Ruey Yi Chang, Taiwan Vote of Thanks – Organizing Secretary	KCDC Gallery Hall
1.30 to 2.30 -	Lunch	Restaurant
2.30 to 4.00	Networking and Lab visits	

INVITED TALKS

PAFHEE'19

INVITED TALK

Sustainable production of nutraceuticals from edible microalgae

Muthu Arumugam M[1,2]

Microbial Processes and Technology Division

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Abstract

Microalgae are rich in variety of nutritionally important compounds like proteins, pigments, carbohydrates, poly unsaturated fatty acids, dietary fibres and bioactive compounds with wide range of health benefits. Microalgae have been studied for decades, but in recent years a new wave of research has started as part of the search for renewable and sustainable energy sources. Fish meal is the protein source primarily constituted by products from processed fish traditionally used in aquaculture diets but its increasing demand makes it limited and expensive. So in order to overcome this problem nutritional contents of algae are rapidly gaining importance as a renewable source to substitute the conventional ingredients in the human diet or animal feed. In our lab, work progressed in substantial extent on two important nutraceuticals namely Selenoproteins and Omega-3 fatty acids from both marine and freshwater microalgae. Selenoprtoeins are a group of proteins which are essential for our body to perform various biological functions. Its deficiency may lead to several disorders like cancer, thyroid, cardiac disorders, muscle disorders, immune disorders etc. In all these selenoproteins, the trace element selenium is present in the form of an proteinogenic amino acid called selenocysteine. The current study uses two edible microalgal candidates from both fresh water as well as marine source for selenoprotein identification and biochemical characterization. Fatty acids play a vital role in metabolism, as an essential component of all the organelle membranes and as a regulatory molecule. Poly unsaturated fatty acids are essential dietary lipids that are the major precursor molecules for active metabolism. Marine microalgae are potential sources of Long Chain Poly Unsaturated Fatty Acids (LC- PUFA). Polyunsaturated fatty acids (PUFAs) are fatty acids that contain more than one double bond in their backbone. Omega 3 fatty acids are the major PUFAs which serve as components cell

membranes and important in anti- inflammatory processes and viscosity of cell membranes. Mainly three types of omega 3 fatty acids involved in human health and physiology are α-linolenic acid (ALA) (found in plant oils), Eicosapentaenoic acid (EPA), and Docosahexaenoic acid (DHA) (both are commonly found in marine oils). The overall aim of our study is to enrich the omega 3 fatty acid content in marine microalgae *Nannochloropsis oceanica CASA CC201* using Plant Growth Regulators (PGRs). Different kind of PGRs such as Kinetin, Gibberellic acid, Indole-3 Acetic acid, Salicylic acid and Methyl Jasmonate were used to enhance EPA production in *N.oceanica CASA CC201*[a]. Treatment with kinetin resulted 4 fold increases in EPA content while treatment with IAA created 5 fold increases in EPA content[b]. Further, we have also developed a comprehensive method, employing both mechanical and enzymatic treatment for selective degradation of the cell wall of *S. quadricauda*to enable the easy bioavailable and uptake of nutrients by animals and human beings[c] .The recent developments in terms of enrichment of organic selenium and omega-3 fatty acids on health benefits will be discussed in detail with appropriate experimental evidences.

Keywords: Microalgae, PUFAs, Omega 3 Fatty acids, Plant Growth Regulators

Key reference from our work:

a. Aswathy, U., Kathiresan, S., **Arumugam, M** (2018) Kinetin and Gibberellic acid (GA3) act synergistically to produce high value polyunsaturated fatty acids in *Nannochloropsis oceanica CASA CC201*. Algal Research. 32: 182-192 **[IF-3.994].**

b. Udayan, A. and **Arumugam, M.**, (2017). Selective Enrichment of Eicosapentaenoic acid (20: 5n-3) in N. oceanica CASA CC201 by Natural Auxin Supplementation. Bioresource Technology. 242: 329-333. [**IF-5.651**]

c. Reshma, R. and **Arumugam, M** (2017). Selective degradation of the recalcitrant cell wall of *Scenedesmus quadricauda* CASA CC202. Planta 246 (4) 779-790. [**IF-3.361**].

INVITED TALK

Micro algae technology for industrial effluent treatment and restoration of polluted water bodies

V Sivasubramanian

Phycospectrum Environmental Research Centre (PERC), 132 A K Block, 7th Main Road, Anna Nagar, Chennai 600040, India

Abstract

Phycoremediation is defined as the use of either macro-algae or micro-algae for the removal or biotransformation of pollutants, including nutrients and xeno-biotics from wastewater. Wastewater Treatment using Micro-Algae has a variety of advantages over conventional systems. Phycospectrum Environmental Research Centre (PERC), Chennai, India, has been developing and implementing this technology in various industries in India and abroad for the past two decades. World's First large scale Phycoremediation plant was installed in 2006 by PERC at SNAP Industry, Tamil Nadu, India, which is handling high TDS effluent with a zero discharge. Right from correcting pH, colour removal, odour removal, removal of nutrients, reduction of BOD and COD and sludge reduction algae technology can help avoiding chemicals and improve the existing ETPs saving energy, chemicals and cost of operation and finally saving the environment. PERC. Chennai, has implemented this technology in a variety of industrial ETPs in India and abroad. PERC has successfully completed three major projects in Colombia and recently demonstrated the efficiency of algae based technology in restoration of a polluted drain in Barranquilla, Colombia and in restoration of polluted lakes in UP and Rajasthan, India. PERC is also taking up one of the projects in cleaning a drain in UP as part of National Mission for Clean Ganga programme in collaboration with a Delhi based organization. Valuable biomass generated through phycoremediation can be an excellent feedstock for bio-gas, bio-fuels, bio-fertilizers etc. based on the quality of biomass generated.

INVITED TALK

Microalgae and Cyanobacteria – an imminent bioresource for energy, environment and health

N. Thajuddin

National Repository for Microalgae & Cyanobacteria – Freshwater (Sponsored by DBT, Govt. of India) Department of Microbiology, School of Life Sciences, Bharathidasan University, Tiruchirappalli – 620 024

Abstract

Microalgae including cyanobacteria (=Blue-green algae) are the most primitive and simply organized members of the plant kingdom exist as single cells in aqueous habitats, but some are in aggregated colonies, simple filamentous, false branched, heterocystous and well organized true branched structures. They exhibit superior photosynthetic efficiency, using light approximately three times more efficiently than higher plants, hence considered as most productive organisms on the planet. They can grow well in all aquatic habitats (freshwater & marine), all types of soils, agricultural fields, extreme environments (hot springs, polar regions sewage and effluents). Though they have a long history of existence, and were till recently in the oblivion uncared and unrecognized, have shot into fame and popularity owing to a host of their innate properties that make them ideal organisms for use in a variety of ways to meet our needs and to promise us a bright future. They constitute a vast potential resource in varied areas such as mariculture, food, feed, fuel, fertilizer, medicine, industry and combating pollution. Pioneering work of the last decades has raised the status of these microbes to a level where they are being viewed with favor in biotechnologically relevant spheres.

Among several cyanobacteria, *Spirulina* in particular is used as food supplement, due to its rich content of protein, polysaccharide, lipid, essential amino and fatty acids, dietary minerals and vitamins and better digestibility due to delicate cell wall. Generally microalgae and cyanobacteria has several pharmacological activities such as antimicrobial, anticancer, metalloprotective, immunostimulant and antioxidant properties. In addition to their applications as biofertilizer and pollution abatement, several enzymes (protease, lipase, cellulose, urease, superoxide dismutase etc.) amino acids, lipids, fatty acids and an unique sequence specific endonucleases are known from these organisms which can be made available in the market at a lesser cost since relative biomass production is much less expensive than bacteria or fungi. A novel compound

monogalactosyl-diacyl-glycerol containing a palmitoyl (MGDG-palmitoyl), being reported from marine cyanobacterium *O. acuminata* NTAPC05 for the first time, as the active fraction, and its bactericidal property against ESBL producers. Some of the marine cyanobacteria are a potential source of long chain polyunsaturated fatty acids, especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), found useful in the prevention of cardiovascular disease. The carotenoids and phycobiliproteins (Phycocyanin & Phycoerythrin) an important constituent of cyanobacteria have high commercial value. Medically important gamma linolenic acid (GLA) is relatively rich in cyanobacteria, which is easily converted into arachidionic acid in the human body and arachidionic acid into prostaglandin E2 which has lowering action of blood pressure and the contracting function of smooth muscle and plays a very important role in lipid metabolism. Microalgae can provide several different types of renewable bio-fuels. There is a strong view among industry professionals that algae represent the most optimal feedstock for biofuel production and present multiple possibilities for fuel end-products – biodiesel, ethanol, methane, jet fuel, biocrude and more – via a wide range of process routes. Technologies such as blue colourant, β-lactamase enzyme and an aqua feed were developed from marine cyanobacterium *Phormidium valderianum* BDU 30501. Several marine and hypersaline cyanobacterial and microalgal isolates are proved to be very effective in bioremediation of various industrial effluents, production of antimicrobial compounds, antioxidants, siderophores, biosynthesis of several types of nanoparticles and other novel substances.

For long been India is celebrated for its richness in algal diversity and extraordinary contribution to the field of phycology. Although the biodiversity of the algal resources of India is critically recorded at times by renowned algologist of our country, often the actual algal populations have been greatly under-represented in the culture collections maintaining our native species. The growth of the algal biotechnology greatly relies on the culture collections for authenticated, reliable biological material and associated information. Therefore, reliable culture collections are needed as the repository and for further study and utilization of the cultures for our benefit. Extensive and exhaustive taxonomic and diversity surveys of both marine cyanobacteria and freshwater microalgae and cyanobacteria had resulted in the establishment of a publicly accessible germplasm collection of National Facility for Marine Cyanobacteria (NFMC), and National Repository for Microalgae and Cyanobacteria – Freshwater (NRMC-F) respectively funded by the Department of Biotechnology, Govt. of India. Major tasks of culture collections are

the collection, isolation, purification, identification and maintenance of important and useful microalgal cultures, supply of the cultures in a healthy live condition on demand and preparation of their informative catalogs and DNA Barcodes. So far as many as 20 strains of microalgae including cyanobacteria have been cultivated and exploited at the industrial scale. To make use of these organisms for our benefit, it is essential not only to understand and preserve the biodiversity of microalgae and cyanobacteria, but also to gainfully exploit them for different biotechnological applications.

INVITED TALK

Perspectives and commercial aspects of *Haematococcus pluvialis* Flotow

R. Rengasamy

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Abstract

The AlgaeTech International is one of the leading companies globally known for the production of Astaxanthin from green alga, *Haematococcus pluvialis* Flotow. Astaxanthin is known as the King of Antioxidant, since it ever and never becomes pro-oxidants unlike beta carotene etc. *H. pluvialis* shows different stages in the life history viz., microzoids, macrozoids, palmella, aplanospore and cysts. The cysts accumulate high amount of astaxanthin in cytosol under stressed conditions like high light intensity, temperature and salinity and nitrogen deprivation. It also enhanced at increased Ferrous ion concentration. Plastic bag photobioreactor under controlled condition was used to cultivate the green alga. This alga is easily contaminated by microbes, therefore continuous monitoring is required. An endophytic fungus, Chytrid is known to affect growth and development of *H. pluvialis*. A technique was developed to control the growth of fungus. Increased cell density was achieved at different dosage and concentrations of media used. Harvested biomass was processed and obtained Asta-oleoresin. It was used and manufactured as capsules and also included in skin creams. The spent biomass contained left over Astaxanthin was fed into Chicken. The yolk of eggs contained Astaxanthin for mankind.

Keywords *Haematococcus pluvialis*, astaxanthin, antioxidant, photobioreactor

INVITED TALK

Enhancing Algal Biomass Productivity For Sustainable Fuels

S Karthikeyan

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Abstract

The transition towards renewable energy is creating a fundamental, long-term shift in the global economy. A systematic diversification of the energy mix towards alternative renewable sources, presents ample opportunities, to free up domestic energy production for export. Additionally, a transition towards a more sustainable energy future would reduce CO_2 emissions and bring a wide array of other socio-economic benefits. The global photosynthetic rate of approximately 130 TW secures environmental homeostasis by maintaining the carbon balance between land and atmosphere. The depletion of the finite chemical energy resources is another reason to pursue such alternatives, especially because of the necessity of carbon-based liquid fuels for transportation (4 TW) at least for the near future. Biofuels are generally viewed as a solution: they are produced in a continuous manner and reduce CO_2 in the process. However, this potentially green solution, particularly to become effectively commercialized, has many issues that must be overcome. The most important issue is the requirement for large amounts of arable land. One promising alternative to terrestrial biomass feedstock is microalgal biomass. Microalga is a promising biomass feedstock to restore the global carbon balance and produce sustainable bioenergy. However, the present biomass productivity of microalgae is not high enough to be marketable mainly because of the inefficient utilization of solar energy. These phototrophic microorganisms achieve a 10- to 50-fold higher photosynthesis rate than terrestrial plants; therefore, they need a far smaller land area for biomass production than their terrestrial counterparts. Nevertheless, there exist plenty of challenges for production of microalgal biomass with monoculture, such as avoiding contamination, enhancing lipid contents, and reducing production cost. In recent years, microalgae have gained much attention due to their high-value chemicals, high nutritional value, high growth rate as compared to higher plants, and the ability to utilize light energy. Sustainable, economic and energetic production is in question. One of these technical challenges is related to the dilution of

microalgae biomass, typically around 0.5–1 kg/m^3 in open ponds and 5–10 kg/m^3 in photobioreactors. Extremely high volumes of water need to be processed during cultivation, harvesting and especially drying that need a high energy investment. Indeed, microalgae biodiesel production should be associated with low-carbon energy sources in order to limit its environmental impact. The innovative pathway is by limiting the environmental impact of microalgae biodiesel production and by optimizing its energy efficiency. However, cost is essential for the development of the microalgae biodiesel industry. Low cost designs, higher biomass and lipid productivity as well as incentive policies are the possible ways of improving biodiesel production cost. Analyzing the resource potential in India for algae biofuels production will assist policymakers, investors, and industry developers in their future strategic decisions. India has very favorable conditions to support algae farming for biofuels production: considerable sunshine, generally warm climate, sources of CO_2 and other nutrients, low-quality water, and marginal lands. Sustainable algae biofuels production implies that this technology would not put additional demand on freshwater supplies and use low-quality water such as brackish/saline groundwater, co-produced water associated with oil and natural gas extraction, agricultural drainage waters, and other waste waters. Sustained yields in algae mass culture is the key to cost effective algal biofuel production.

BIODIVERSITY AND CONSERVATION OF ALGAE

PAFHEE'19

BDC 01

An investigation of fresh water algae and physico-chemical analysis of selected wetlands in Coimbatore District, Tamil Nadu

J. Anuja

Assistant Professor, Department of Botany, PSG College of Arts & Science, Coimbatore.

Natural wetlands play an important role in receiving run off, storm water and domestic waste waters. Later these wetlands were adopted in various additional functions namely effluents from mining, dairy, petroleum industry, agro industries etc. Water quality of Coimbatore wetlands has shown deterioration in the past few decades. In Coimbatore, there are 31 wetlands in the River Noyyal Basin fed by the river. Out of 31 wetlands, 10 wetlands were selected and investigated in this project. The studies on wetlands gain momentum in maintaining the bio-geocycles, the aquatic ecosystem, and equilibrium between abiotic and biotic components and in predicting the future of the wetlands. These wetlands are also highly important for the migratory and roosting birds. Physical and chemical investigation reveals that these wetlands are rich in nutrition and they are on the state of eutrophication. High concentrations of nutrients supported heavy growth of green and blue-green algae. Appreciable amount of silica is also seen and it reflects in the cell count of Bacillariophyceae members. A total of 84 species of algae belonging to 15 species of Cyanophyceae, 42 species of Chlorophyceae, 21 species of Bacillariophyceae and 6 species of Euglenophyceae was found. Part the collected algal samples was cultured by standard methods. Other communities like bacteria, fungi (soil), avian and tree species of the lakes were also noted.

BDC 02

The first new record of two diatoms (*Navicula phyllepta* Kützing, 1844 and *Navicula zostereti* Grunow, 1874) from the South West Coast of India (Cochin backwaters, Kerala.)

Geo Joseph, Mannancheril Sebastian Francis

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Diatoms are microscopic unicellular microalgae. They are important biomass and oxygen producers that can be found in all aquatic ecosystems. The main objective of the present study is to report two diatoms (*Navicula phyllepta* Kützing, 1844 and *Navicula zostereti* Grunow, 1874)

from Cochin backwaters, which prove to be a new finding from Kerala waters. Surface water samples were collected monthly from twelve stations covering the ecosystem from May 2015 to April 2016. The analysis of physicochemical parameters and preparation of permanent slides of diatoms were performed based on standard procedures. Descriptions, spatial and temporal variation of diatoms density and photographs of the two diatoms are included in this study. These two new species further enrich the diatom floristic diversity of Cochin backwaters in Kerala.

BDC 03

An Assessment of Algal Diversity in Periyar River Before and After the Recent Massive Flood In Kerala

Jayalakshmi P.S[1]* and Jose John[2]

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[2]*Assistant Professor, Centre for Post Graduate and Advanced Research, Department of Botany, Sacred Heart College, Thevara, Kochi-13, Kerala, India*

Environmental disasters always challenge the biodiversity of micro and macro habitats. The present study attempts to assess the impact of the massive flood in Kerala occurred in August 2018, on the algal diversity in Periyar River, the longest river of Kerala. Algal samples representing different habitats of the ecosystem were collected on a monthly basis during May-July 2018 (pre-flood) and Aug-Oct 2018 (post-flood). Algal taxa belonging to Bacillariophyceae, Chlorophyceae, Cyanophyceae and Euglenophyceae dominated the study area. A total of 76 species of phytoplankton were identified before the flood period which comes under 49 genera (Bacillariophyceae-30%, Chlorophyceae-52%, Cyanophyceae-14%, Euglenophyceae-4%) while only 37 species of phytoplankton representing 22 genera (Bacillariophyceae-1%, Chlorophyceae-35.1%, Cyanophyceae-5.4%, Euglenophyceae-5.4%) were recorded after the flood event. Twenty (20) phytoplankton species were found to be present in both periods. There is a significant difference in the algal flora before and after flooding. The flood event has profoundly impacted on the algal diversity of the river.

BDC 04

Algae as Sunscreen

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Sunscreen is a key to protect the skin from carcinogenic UV radiation. Some synthetic sunscreen components can accumulate in aquatic environments and potentially cause harm by acting as hormone disruptors. An estimated 6,000-14,000 tons of sunscreen are deposited into coral reef areas of the sea every year. In order to avoid such incidents algae is used as sunscreen. Shinorine, an alga has the property to overcome this problem. Algae have specific amino acids that naturally protect their DNA from UV exposure. We can harness this power to protect our skin from damaging sun rays. By selecting a strain of freshwater cyanobacteria, Synechocystis, as a host cell for shinorine expression because it grows quickly, and it is easy to change its genes. The cluster of genes responsible for the synthesis of shinorine is inserted into Synethcocystis, as a result no growth differences were observed with UV-A light. But control cells experienced an obvious decline in population from UV-B exposure. Shinorine acted as sunscreen against UV-B light, which helped the cells live and grow better. By using shinorine as a sunscreen we can protect and conserve our environment.

Keywords: Shinorine, Synethcocystis, sunscreen, UV radiation, coral reef.

BDC 05

Effects of Algal Diversity on the Production of Biomass in Homogeneous and Heterogeneous Nutrient Environments: A Microcosm Experiment

Liya Thasnim L, G. Sharmila, P. Rhema Angelin

Karunya Institute of Technology and Science, Coimbatore

Recent experiments have shown that species richness tends to enhance the production of biomass across a wide range of trophic groups and ecosystems; however, the biomass of diverse polycultures only rarely exceeds that of the single most productive species in a community (a phenomenon called 'transgressive over yielding'). Some have hypothesized that the lack of

transgressive over yielding is because experiments have generally been performed in overly-simplified, homogeneous environments where species have little opportunity to express the niche differences that lead to 'complementary' use of resources that can enhance biomass production.

Keywords Algal Diversity, Biomass, Homogeneous, Heterogeneous, Ecology

BDC 06

Marine Algae an Ecofriendly Tool

E.Shanmugapriya, V.Vanessavictor, Dr. JohnKingsly

Karunya Institute of Technology and Science, Coimbatore

Marine macro algae are plant-like life forms with clear internal structures that is generally found in seashore area. They mainly include different groups of red, brown and green algae. Marine macro algae usually found in rocks and other hard surface. They are viewed as an amazing common bio - source in various parts of farming fields. . They have remarkable capacity in improving soil physical and substance properties. Marine macro algae are also characterized by producing a large number of biologically active substances against plant-infecting pathogens.

Unfortunately, most open articles on marine macroalgae and their subordinates mainly focused on pharmaceutical applications. They also play a potential role in agriculture. This topic discusses an alternative use of macro algal applications in agriculture. Bioactive compounds like unsaturated fats (in particularly polyunsaturated unsaturated fats (PUFAs), proteins (amino acids), bioflavonoids, sulfated polysaccharides, carotenoids, polyphenols and starches present in macro algae are considered to have several bactericidal, antiviral and fungicidal effects against some plant infecting pathogens. These bio-control agents gives a various advantages for improving profitable advancement practices in natural environment. Marine macroalgae can be normally considered as promising multifunctional and ecofriendly biological device in future trends of organic farming.

Keywords Marine macroalgae, bioactive compound, biocontrol agents, environmental tool, organic farming.

BDC 07

Treatment of Dairy Manure Using Benthic Algae

Joanna Rai

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An alternative to land spreading of manures is to grow crops of algae on the nitrogen and phosphorus present in the manure. Compared to terrestrial plants, filamentous algae have exceedingly high growth and nutrient uptake rates. Moreover, they are capable of year-round growth in temperate climates, can be harvested on adapted farm-scale equipment, and yield a valuable biomass. The primary objective of this research was to evaluate and develop one method of growing filamentous algae (an algal turf scrubber (ATS)) to remove nitrogen, phosphorus and soluble carbon from dairy manure. Laboratory scale experiments were conducted using natural mixtures of algae that were fed diluted dairy manure. Results from nutrient balance results show that most of the manure nitrogen, and nearly all of the manure phosphorus, was taken up by the algae. Results from these experiments are important because they show for the first time that dairy manure contains all of the necessary nutrients needed for algae growth in this type of system. In addition, the nutrient balance results show that manure nitrogen and phosphorus are effectively captured in this system. The resulting algal biomass may find use as a protein supplement to animal feed, a feedstock for biodiesel, or as a source of biocontrol agents for plant pathogens. The primary objective of this research was to evaluate and develop algal turf scrubber (ATS) technology to remove N, P and soluble carbon from dairy manure. Laboratory-scale ATS units were seeded with algal consortia from nearby streams. The algal turfs were established at 25 C using a 16 hour photoperiod with two 400 watt metal halide lights, a flow rate of 111 Lpm, and grown using dairy manure from two different dairy y farms. The pH of the systems was maintained at pH 7-7.5 to minimize Laboratory scale experiments were conducted using natural mixtures of algae that were fed diluted dairy manure. Results from nutrient balance results show that most of the manure nitrogen, and nearly all of the manure phosphorus, was taken up by the algae. Results from these experiments are important because they show for the first time that dairy manure contains all of the necessary nutrients needed for algae growth in this type of system. In addition, the nutrient balance results show that manure nitrogen and phosphorus are effectively captured in this system.

The resulting algal biomass may find use as a protein supplement to animal feed, a feedstock for biodiesel, or as a source of biocontrol agents for plant pathogens.

Keywords Filamentous algae, dairy manure, biomass, nutrient balance, feed stock, animal feed.

BDC 08

Review on marine algae and future food source

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Microalgae are a nearly untapped resource, and are found in both freshwater and marine aquatic systems. Although they are only few micrometers in size, they produce amino acids, fatty acids, vitamins, minerals, antioxidants, polymers and carbohydrates. For example, the omega-3 rich microalgae *Nannochloropsis oculata*, or simply Nanno, is a promising potential source of high-nutrient food and feed. It is 40 percent protein by dry weight, of which one-third contains essential amino acids, and 6 percent EPA omega-3 essential fatty acid in a highly bioavailable form. specialists are looking at marine microalgae, an abundant and quality food that's waiting to be harvested. Scientists have suggested that commercial production of marine microalgae, rich in protein and Omega-3, could help us face global hunger. pea- and soy-based alternative meat products with similar nutritional amino acid value to Nanno could be produced using 6.4 times less freshwater than beef, but would require 2.2 times more fertile land. In contrast, using marine microalgae reduces land usage by over 75-fold, since no fertile land is required, and lowers freshwater usage by a factor of 7,400.

PHYCOREMEDIATION AND ENVIRONMENTAL MANAGEMENT

PAFHEE'19

PEM 01

Microalgae based phosphorous fixation in crop cultivation from waste water

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Next generation farming has several modernized practices in fixing fertilizers to soil. IoT based agricultural practices are emerging in a big way, still there is a considerable socio-economic impact caused by usage of high amount of fertilizers in plant growth and its development. Phosphorous (P) is a non-renewable resource, a major plant nutrient that is essential for modern agriculture. The use of algal biomass grown on P-rich waste streams for biofertilizers production occurs on a scale where supply and demand can be balanced. Some rice growers are currently using cyanobacteria rather than eukaryotic algae as a biofertilizer. Cyanobacteria ability to fix nitrogen from the atmosphere comprises a significant added value. Cyanobacteria applied as living cells and pre-treatment of the plant seeds with cyanobacteria linocula led to enhanced germination rates of numerous species. This effect is likely due to phytohormonal and enzymatic activities that together with nutrients promoted plant performance. Application of living algal suspensions may, however, is hampered by difficult biomass conservation, implying that more manageable forms of algal biomass processing, logistics, and application must be found. An alternative to using or selecting native organisms is to engineer strains with higher P uptake and storage capacities. However, according to current legislation, the use of engineered algal strains is permitted only in closed cultivation systems such as PBRs Whereas P uptake and regulation systems are relatively well studied in prokaryotes and in higher plants, our knowledge about the genes responsible for P uptake and their expression, regulation, and conservation in algae is scarce, limiting genetic manipulation towards this goal. A better understanding is required about the interaction of algal biomass with the soil microbial community, particularly with bacteria and mycorrhiza, including detailed mapping of the phosphorus flux from algal biomass to soil and plant roots. Further we will facilitate comprehensive studies of the effects of algae-based bio-fertilizers on various crops and arable soils remain essential.

PEM 02

Sorption of mercury, cadmium and lead by *Tolypothrix tenuis, Scenesdesmus acutus* and *Chlorella vulgaris*

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Release of heavy metals like mercury, cadmium and lead from industries into environment has resulted in severe pollution causing a great danger to human health and ecosystems. Microalgae are known to sequester heavy metal ions by adsorption and absorption as done by other micro-organisms hence three strains of microalgae: a blue green algae (*Tolypothrix tenuis* TISRT 8063) and two green algae (*Scenesdesmus acutus* IFRPD 1020 and *Chlorella vulgaris* BCC 15) were studied. These are the commonly found algae in nature. In this study these microalgae strains suitable for mercury (Hg), cadmium (Cd) and lead (Pb) removal in aqueous solution were selected and their efficiency of removal, maximum adsorption capacity (q_{max}) and binding constant (k_b) were also determined. The % removal and concentration factor were also determined and tabulated. *Tolypothrix tenuis* had the highest maximum adsorption capacity of 27 mg Hg/g dry wt. at a minimum concentration of 1.04 mg/l, *Scenedesmus acutus* had the highest maximum adsorption capacity of 110 mg Cd/g dry wt. at a minimum concentration of 48 mg/l and *Chlorella vulgaris* had the highest maximum adsorption capacity of 127 mg Pb/g dry wt. at a minimum concentration of 130 mg/l.

Keywords Microalgae, concentration factor, heavy metal removal, mercury, cadmium and lead.

PEM 03

Blue green algae promises to boost food crop yields

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Algae are called has "Green Gold", They are the most valuable treasure of future. Blue green algae which is known as Cyanobacteria have the characteristics of both algae and bacteria. Cyanobacteria occur in worldwide, especially in calm, nutrient rich waterways. Cyanobacteria

(BGA) are one of the major components of nitrogen fixing biomass in paddy fields. Due to important characteristic of nitrogen fixing cyanobacteria have a unique potential to contribute to enhance productivity in variety of paddy. For the first time we have inserted blue green algae (BGA) into pulse crop Vignaradiata (green gram), that form part of a system that could lead to 60% increase in crop growth. We have conducted pot experiments in Rabi season to study the influence of algal biofertilizer on growth of Vignaradiata (green gram). We observed a notable difference in the growth of inoculated one with that of the control crop. The study revealed that the cyanobacteria significantly improved growth and could effectively reduce the use of inorganic fertilizers

Keywords Blue green algae (cyanobacteria), Vignaradiata (green gram), growth increase.

PEM 04

Use of Micro algae as a sustainable alternative for waste water treatment

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A decrease in natural water bodies in past decades have caused to take drastic steps towards the wise management of water. Let it be for domestic or industrial purpose. One of the steps being waste water treatment. But, why is the use of algae a thriving technology; is that they have potential to remove organic matter, nutrients including nitrogen and phosphorus from wastewater and also provide biomass energy source. Additionally when combined with the conventional activated sludge system, algae-bacteria symbiosis can reduce 50% or more of total energy usage for waste water treatment due to less aeration demand. The positive interactions are very clear as through photosynthesis algae provide oxygen to bacteria to biodegrade organic pollutants, consuming in turn carbon dioxide released from bacterial activity. Also the biomass produced can be used for several purposes, including biogas substrate, bio fuels, bio-fertilizers and biopolymers, which can be converted into packaging materials and have advantage of being renewable. Given global population growth, increasing consumption and scarce natural resource, we need to promote sustainable progress. Algae based technology is great option for treating waste water and generating useful products with low cost and high efficiency.

Keywords Biomass Energy, algae-bacteria symbiosis, biogas substrate, renewable biopolymers.

PEM 05

Monoraphidium contortum as a potential organism for waste water treatment and for biofuel production

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Microalgae culturing has been applied in many field as a potential option for CO 2 mitigation, biofuel production and in the field of waste water remediation. *Monoraphidium contortum* is proposed for environment friendly waste water renovation and for the synthesis of several compounds to be used in the production of nutraceuticals and in the field of biofuel production. In this study the efficiency of *Monoraphidium contortum*, a chlorophycean member in waste water treatment and biofuel production was assessed. This abstract reports the use of *Monoraphidium* species for the renovation of waste water from a domestic setting. Waste water from a cafeteria in the Calicut University campus after 24 hours of settling was used. The supernatant was filtered to remove solid particles and then aerated. Algal species isolated from the Kole wetland from Thrissur district is used for the study. The species showed average biomass 23.3mg per litre/day. The quality of the waste water was very much improved by 21 days of treatment with *Monoraphidium*. This algal strain having high nutrient removal capacity with 92 %of nitrogen and 89% of phosphate removed from the waste water. The algae were found to have a lipid content of 27.3 % of dry biomass which is far greater than the control species. Micro photographs of algae stained with Nile red correlates with high lipid content of algae. Increased biomass production, high lipid content and efficient nutrient uptake from waste water suggests that the *Monoraphidium contortum* could be developed into a bio-tool for domestic waste water treatment and as a sustainable green energy source.

PEM 06

Role of Algae in Bioremediation of Organic Pollutants

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The multiplication of organic pollutants in the environment can cause serious problems. These organic pollutants are affecting the lives and stability of the aquatic ecosystems in a negative way and can also cause fatal effects on human health and the environment. Surveys throughout the world indicate that the water bodies all over have been converted into dumping sites for all kinds of pollutants and waste particles. It becomes worser when these polluted waters are put to uses, like irrigation. This leads to a chain of reactions, and ends up in biomagnifications. Here Phycoremediation is a sustainable and environmentally eco-friendly approach for cleaning up the polluted areas. The algae play an important role in controlling and bio monitoring of organic pollutants in aquatic ecosystems. Algal degradation of organic pollutants is a natural process which ensures a lower threat to environment compared to other ways such as mechanical, physical, and chemical removal approaches to organic pollutants. The advantages of algal-based bioremediation are greater production of biomass and high ability to accumulate, detoxify, or degrade xenobiotics and pollutants. In addition, the biomass produced in bioremediation could be economically valorized in the form of bioenergy. The ease with which various algae can be cultured and the variety of biomasses rendered by them as living, dead, or immobilized have made algae one of the most potent bioremediators. This poster mentions the ability of algae in removal of organic pollutants and potential of microalgae species for phycoremediation of organic pollutants in aquatic ecosystems.

Keywords Algae, Phycoremediation, Organic pollutants

PEM 07

Comparative Study of *Arachis hypogeae* and Sesame Oil cake on Soil Health Management

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Soil health is a term which is widely used to describe the general conditions or quality of the soil resource. The dynamic living matrix soil is a vital area in the terrestrial ecosystem. It is an important source in agriculture production and food security for a living. The important function of the soil is the crop production. Increasing use of these chemical inputs led to several negative effects, hence, the organic techniques were considered more ecofriendly than farming methods which relied on chemicals since they reduced the risk of water and soil contamination. Hence at present the world is turning its attention towards organic fertilizers. Oil cakes are by-products obtained after oil extraction from the seeds. Oilseed cakes are rich in fibre and have high concentration of nutrition. They contains 40–50 % of crude protein. In our research project we have used these oil cakes for biofertilizer production and analyzing its efficacy in Green gram plant (Co(Gg)7).

Keywords Oil cakes, Organic techniques, soil health, Biofertilizer.

PEM 08

Role of Aquatic Algae in Reduction of Green House Effect

Umayaval Shanmugam

SVCE

One of the major issues pertaining to the environment is GLOBAL WARMING. Its major cause is the excess amount of CO2 present in the atmosphere. To reduce this, algae do play an important role. Here in our poster presentation, we come to you with the ideology of TOTAL CARBON BURIAL in lakes actually influence the amount of carbon present in the atmosphere. The algal bloom caused by eutrophication has proven it and we will present with analysis and applications.

PEM 09

Eradication of Plastics by Algae

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The usage of plastics have become more prevalent among the people all around the world. Plastics becoming an integral part of the human life for daily needs is alarming as plastic have a destructive as well as a catastrophic effect. These plastics accumulate in the environment for a longer period of time. They also are harmful for the animals especially living in the marine ecosystem. The novel way to eradicate plastic is by degrading them at a wider rate using cheap techniques. One of the best ways to degrade them is by algae. Algae has proven effective in the degradation of plastic to about 8%. These marine organisms are friendly to the environment and they are easy to grow on a large scale in open pond systems. Some of the important algal species which is useful for this process is *Scenedesmus dimorphus , Anabaena spiroides* and *Navicula pupula*. These algae are found in the dumps feeding off at plastics. Another way of reducing plastics is to replace them with an organic material. This is possible by the production of algal plastics that are safe and pollution free to the ecosystem. The degradation of plastic and production of plastics by algae would solve the major environmental crisis the world is facing.

Keywords Algae, plastic, environment, degradation

BIOINFORMATICS AND MOLECULAR BIOLOGY OF ALGAE

PAFHEE'19

BMB 01

DNA barcode resolves taxonomic disputes in *Cosmarium subcostatum* Nordstedt and *Cosmarium leave* Rabenhorst collected from Tamil Nadu, India

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Desmids, the most taxonomically diverse group of green algae occurring in fresh water, are unicellular or simple filamentous forms having conjugation mode of sexual reproduction and show high diversity in their morphology. These are often used as organisms of pollution indicator. DNA barcode is gaining much attention in recent times due to its rapid and accurate identification of unknown organisms and also in aiding resolving species disputes that exist among closely related taxa. Use of short genes from specific portion of DNA for identification helps taxonomists to identify the taxa with much clarity. In the present study, molecular identification of two taxa of *Cosmarium* Corda *ex* Ralfs viz., *C. subcostatum* Nordstedt and *C. leave* Rabenhorst were studied using the rbcL, the most important chloroplast DNA marker. Pure cultures of these two species were used for DNA extraction, PCR amplification and sequencing. The resulted sequences were deposited in GenBank with the following accession nos., viz., MG517005 and MG517006. Phylogenetic tree was constructed using MrBayes 3.2 (Ronquist *et al.*, 2012) and Monte Carlo Markov Chain (MCMC). Analysis was performed in 2M generations by retrieving rbcl sequences from GenBank database (https://www.ncbi.nlm. nih.gov/) to find the evolutionary relationship within *Cosmarium* spp. The tree with 50% majority rule consensus tree, and it was viewed in Fig tree along with branch support of posterior probabilities (PP) from the analysis. The pairwise analysis was done for these taxa along with their complex group. (i.e., Complex I- *C. laeve* Rabenhorst and *C. subgranatum* (Nordstedt) Lütkemüller and Complex II- *C. subcostatum*

Nordstedt and *C. subcrenatum* Hantzsch). This analysis helped in resolving systematic disputes due to morphological similarity that exist in *C. subcostatum* and *C. leave* to that of *C. subcrenatum* and *C .subgranatum* respectively.

Keywords Desmid, DNA barcode, Bayesian analysis, Molecular identification, *Cosmarium* Corda*ex* Ralfs.

BMB 02

Algae Could Cure Blindness

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Nowadays the level of blindness is constantly increasing due to genetic defect and malnutrition. The estimated number of people visually impaired in the world is 285 million, 39 million blind and 246 million having low vision. To reduce this blindness level, scientists have found that green algae could hold a cure for blindness. The algae known as *Chlamydomonas reinhardtii*, are simple, single-cell green algae that live in water and in dirt. It has a light-sensitive protein called channel rhodopsin-2 which is found in its eyespot. It helps to locate sunlight to help with photosynthesis. Researchers have managed to restore light perception to mice through gene therapy by inserting algae genes into the retina. The treatment has succeeded in restoring the ability to sense light and dark to blind mice. The Food and Drug Administration approved human clinical trials. So human clinical trials could begin in as little as two years.

Keywords Blindness, *Chlamydomonas reinhardtii*, light sensitive protein, mice, and human clinical trials.

BMB 03

Genome-wide analysis and revelation of gene families from biostimulant algae reveals endophytic lifestyle and colonization in host plants

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Plant Growth Stimulants (PGS) is a naturally occurring plant-associated bacterial endophyte that effectively colonizes a wide range of plants and stimulates their growth and vitality. There are plenty of cyanobacterial based bio fertilizer which are used in wide range of crops, most of marine and non-marine algae are formulated as fertilizer based on their activity. To improve soil structure stability, nutrient availability and crop productivity, non- marine algae such as *Nostoc sp., Anabaena variabilis, Calothrix desertia, Chlorogloeopsis sp., and Synchocystis sp.*, genome sequences were retrieved from NCBI. Here we analyze a whole genome of five different PGS along with other endophytic bacteria. Retrieved sequences were further processed using CLC Genomics and gene annotation were carried out using AUGUSTUS, TMHMM and GENEMARKs. To decipher the lifestyle of PGS, we postulate the existence of typical PGS traits and gene cluster could be effectively linked to the endophytic lifestyle. Our study revealed a genetic diversity among PGS endophytes as reflected in their genotypic and phenotypic features. NGS data has helped us to reveal hidden metabolic potential of PGS algae. This genome characterization of five different non-marine algae reveals progression in development, phylogeny, mating type, Carbohydrate active enzymes (CAZy), transporters and peptides. GO and KEGG pathway analysis using BLAST2GO reveals the number of peptidase involved in the process of metabolism, algal development and revealed endophytic lifestyle. Revelation of gene families attributes to successful colonization in wide variety of plant species might be based on its large genome harbouring a broad range of physiological functions. This genome based study has brought new vista in finding metabolic potential of PGS and may encourage the cyanobacterial community to broaden their research to related organism with higher metabolic activity in desired pathway.

ALGAL NUTRACEUTICALS AND PHARMACEUTICALS

PAFHEE'19

ANP 01

Phytochemical Characterization of Red algae *Kappaphycus alvarezii* from coastal areas Pudukottai District, Tamil Nadu

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Marine seaweed is a rich source bioactive compounds and one of the most undermined source of valuable medicinal properties. *Kappaphycus alvarezii* is one of the red marine algae commercially cultivated for carrageenan, which is a major ingredient in food industries for its thickening property in improving the texture of ice cream, soy milk etc. This seaweed is cultivated by the fishermen in the region along the side of Bay of Bengal from Adirampattinam to Rameswaram. This article evaluate and characterize the phytochemical content of the *Kappaphycus alvarezii* collected from the Jagathapattinam a coastal village in Tamil Nadu. The *K. alvarezii* is extracted using various solvents like ethanol, ethyl acetate and chloroform. The phytochemical screening revealed the presence of phytochemicals like Alkaloids, flavonoids, diterpeniods, phenols, steroids, sterols, proteins and carbohydrates found to be better extracted with ethanol. The GCMS analysis of this Marine algae shows distribution of alkanes, phenols and fatty acids in large amount and also the other compounds like glycol, aldehydes, ketone, flavouring agents, alkene, alkyl, ester, pyridine, hydroxyl methyl and indol. The ethanol, ethyl acetate and chloroform extract of *Kappaphycus alvarezii* also showed antimicrobial activity.

Keywords *Kappaphycus alvarezii*, Phytochemical analysis, GCMS, antimicrobial activity

ANP 02

Health Benefits of Astaxanthin

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In Humans, Astaxanthin,an Algae was shown to protect cells from the types of neuron damage seen in diseases such as Parkinson's and Alzheimer's. It is showed that it lowered levels of the metabolite, PLOOH, which has been linked with dementia. This shows that supplementation with this one nutrient can help to prevent the onset of dementia in healthy patients also. The astaxanthin for brain function are still being explored. One thing that is certain is that this is a highly valuable nutrient for maintaining normal brain function into old age. It helps one to maintain the memory and protects the brain from damage associated with other conditions such as heart attacks or strokes. Astaxanthin is produced by the microalgae *Haematococcus pluvialis* when its water supply dries up, forcing it to protect itself from ultraviolet radiation. Researchers found that supplementing with Astaxanthin-rich *Haematococcus pluvialis* extract lead to improvements in cognitive function in older individuals who complained of age-related forgetfulness. It has even been found to reduce the accumulation of phospholipid hydroperoxidases (PLOOH) compounds known to accumulate in the red blood cells of people who suffer from dementia and scientists now believe astaxanthin could help prevent dementia, including Alzheimer's. As a fat-soluble nutrient, astaxanthin readily crosses our blood-brain barrier. One study found it may help prevent neurodegeneration associated with oxidative stress, as well as make a potent natural "brain food". This Astaxanthin for brain function are still being explored.

Keywords Astaxanthin, Neuron damage, *Haematococcus pluvialis*

ANP 03

Inspecting the possibility of genetically modified *Thalassiosira weissflogii* to replace *T.pseudonana* in targeted drug delivery for Chemotherapy

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Diatoms are single-celled microscopic algae with intricate cell walls made up of silica. They are a major group of unique species found in the oceans, waterways, soils, etc., which are an ecologically significant group of organisms on earth. One of the most challenging issues in anticancer research is that chemotherapeutic drugs are often toxic to healthy tissue. A research work published in the 'Natural communication' journal has claimed to achieve targeted drug delivery using genetically modified *T.pseudonana*, without harming the healthy cells. This method is found to be cheaper than using Nano-porous silica-based materials which involve highly toxic chemicals. The modification has been done in order to display an IgG-binding domain of protein G on the biosilica surface, enabling attachment of cell-targeting antibodies. A literature review was done in order to examine the probability of *T.weissflogii* in replacing *T.psedonana*, as they belong to the same genus and are found to be in the same hierarchy. The hypothesis could be taken for further consideration based on the results obtained from this review.

Keywords *Thalassiosira weissflogii*, *Thalassiosira pseudonana*, Genetic engineering, biosilica, IgG-binding domain, chemotherapy, targeted drug delivery

ANP 04

Spirulina platensis (blue-green algae) in cancer treatment

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Spirulina platensis is blue green algae which are used in dietary supplement, it has hypercholestrolemic properties. It is a potent antioxidant and anti-proliferating agent. The anti proliferative effects of *S.platensis* and its tetrapyrrolic compounds were tested upon pancreatic cancer cell lines and xeno transplanted mice. The experimental therapeutics significantly

decreased proliferation of human pancreatic cancer cell lines in vitro in a dose-dependent manner. The observation on the third day of treatment showed inhibition of pancreatic cancer growth. Bilirubin, also a major antioxidant in blood and negative associations between serum levels and numerous oxidative stress-mediated diseases including cardiovascular, certain cancer and autoimmune diseases. Among many potentially bioactive substances, PCB and chlorophyll shows structural resemblance to bilirubin, atheroprotective, and anti-proliferative agent. HMOX has been reported to affect tumor cell proliferation and tetrapyrrolic compound and HMOX is a potent effector of the antioxidant defense system. In fact, the anticancer action of bilirubin has been attributed to its effects on mitochondria as well as intracellular signalization. Co-localization study with a mitochondrial marker MitoTracker Green revealed that C-phycocyanin was absent in the mitochondria as shown by their typical elongated shape (mitochondrial network). In contrast, both dyes co-localized in aberrant-looking vesicles of mitochondrial origin (fragmented mitochondria) , disrupting the usual mitochondrial network. the algal tetrapyrroles-induced improvement in glutathione redox status known to be associated with inhibition of tumor promotion. These effects were at least partially due to their potent antioxidant activity, inhibition of mitochondrial production of ROS and subsequent changes in intracellular redox status. This assumption of more generalized use of *S. platensis* in cancer chemoprevention is supported by demonstrating anti-cancer potential of this algae on liver as well as breast carcinogenesis.

ANP 05

Use of algae ingredients in food and beverage industry

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Algae are primary producers which present a remarkable source of different nutrients. It is used as a Versatile Ingredient for Food Beverages and Supplements. It contains high-value functional compounds such as astaxanthin, beta-carotene, phycocyanin, and the omega-3 fatty acids EPA and DHA. The algae ingredients can transform the foods we eat in terms of nutrition, sustainability, taste, texture, and flavor. These ingredients are exclusively used in Bakery products confectionery, brewing industry, cooking oils, creamers and as protein and lipid powder. Its unique, open, porous physical structure provides numerous benefits when compared to the calcium salts used in certain

food and beverages. Organic, gluten-free, fair trade, eco-friendly, animal- or dairy-free, or vegan products are produced with the help of algae ingredients.

Keywords Algae ingredients, high-value compounds, structure, gluten-free

ANP 06

Potential of Algae as Nutritional Supplements - A Review

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Microalgae are microscopic algae, typically found in freshwater and marine systems, living in both the water column and sediment. They are unicellular species which exist individually, or in chains or groups. Microalgae, capable of performing photosynthesis, are important for life on earth; they produce approximately half of the atmospheric oxygen and use simultaneously the greenhouse gas carbon dioxide to grow photoautotrophically. Microalgae, together with bacteria, form the base of the food web and provide energy for all the trophic levels above them. Micro algae have been cultivated and used for many purposes. They are used as livestock feed in aquaculture for production of fish, crustaceans and other aquatic products that are consumable. Therapeutic Products like β-carotene, astaxanthin, polyunsaturated fatty acid (PUFA) such as DHA and EPA and polysaccharides such as β- glucan are obtained from microalgae. Products from microalgae are also used in many food and cosmetic industries. Though microalgae is mainly focused on biofuel production, this review gives way to all the nutritional applications of microalgae and how effective they are.

Keywords Microalgae, Nutrition, Health products.

ANP 07

Algae as Source of Functional Ingredients for Health Benefits

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Algae are one of the renewable sources for pharmaceuticals compounds and nutraceutical compounds. As proper nourishment is a growing concern with increasing world populations, sustainable sources of nutritional value are needed. Due to diverse nutritional components algae can produce and concentrate along with their simple and rapid growth characteristics, autotrophic organisms are exceedingly desired for using nutraceuticals and nutritional supplements. Algae produce a number of important functional ingredients for health benefits which are incorporated into foods consumed on daily basis such as energy bars, breads, cookies, cereals, desserts, ice creams, pastas and emulsions etc., to improve human health and reduce risk of chronic disease. Further algal powders and extracts are used in nutraceutical, pharmaceutical and food industry as tablets, capsules, crystals, gels and dietary supplements etc. This depends on the recent advancements in this field and projects the opportunities that exist in industrial production of the functional ingredients. Many types of algae have documented health benefits from strengthening the immune system to fight cancer and heart diseases. Many of these unique characteristics such as carotenoids, micronutrients accumulation, aminoacids etc., have led to an extensive base of compounds that are critical in human health. These are extremely good in terms of nutritional components and documented health benefits.

Keywords algae, bioactive compounds, nutraceuticals, functional ingredients, health Benefits

ANP 08

Antioxidant activity of *Kappaphycus alvarezii* -a Marine red algae

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Marine red algae is a rich source bioactive compounds and one of the most undermined source of valuable medicinal properties. *Kappaphycus alvarezii* is one of the red marine algae commercially cultivated for carrageenan, which is a major ingredient in food industries for its thickening property in improving the texture of ice cream, soy milk etc. This seaweed is cultivated by the fishermen in the region along the side of Bay of Bengal from Adirampattinam to Rameswaram. This article evaluate and characterize the antioxidant content of the *Kappaphycus alvarezii* collected from the Jagathapattinam a coastal village in Tamil Nadu. The *K. alvarezii* is extracted using various solvents like Methanol, ethanol, ethyl acetate and chloroform. DPPH (1-1-diphenyl 2-picryl hydrazyl), Hydroxyl radical scavenging activity, Superoxide anion scavenging activity, Hydrogen peroxide scavenging activity are the assays done to analyse the antioxidant acitivity of *K.alvarezii*. The Marine red algae showed excellent antioxidant activity.

Keywords *Kappaphycus alvarezii*, antioxidant activity, Marine red algae.

ANP 09

Algae in Animal Nutrition

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Algae are by far the most abundant primary producers, although some can be heterotrophic. In biological sense, the term algae implies more divisions of lower plants which contain chlorophyll in cells and are typical inhabitants of aquatic biotopes, although they are quite widespread outside the aquatic environment. They present a remarkable source of different nutrients. Since algae also represent an important source of vitamins, minerals, antioxidants and natural colorants, the incorporation of the whole biomass in food and feed could be used to provide the color, increment

nutritional value, and improve texture or resistance to oxidation. Even when used in small amounts in nutrition of different animals, algae have been credited with improving the immune system, the increasing of weight, the number of eggs, reproductive performance, or reducing cholesterol levels, indicating the possibility of new farming methods in order to improve the quality of meat and eggs. Research results indicate the possibility of new farming methods in order to improve the quality of meat and eggs, and it may also be considered in order to lower the cholesterol level in blood and egg yolks. Microalgae are a source of food and a dietary supplement in the commercial cultivation of aquatic organisms. Their importance in aquaculture is not surprising considering the fact that they are natural food for these organisms. Sturgeon fed with Spirulina-based feed even outperformed those receiving fish meal-based diets.

Keywords algae, chlorophyll, spirulina, dietary supplement, natural food.

ANP 10

The Blue Green Algae for HIV

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Now-a-days, most of the people are being affected by many dreadful diseases and one among them is HIV, the sexually transmitted disease which is also passed on during blood transfusion. Several medications were found but not a cure. In order to extend the survival time for the infected person to some years an anti -HIV protein from the blue green algae, has the ability to reduce the activity of Human Immunodeficiency Virus. This is done by the cyanobacterium, a blue green algae. The anti-viral protein also known as cyanovirin-N (CV-N) can extend the survival time of Ebola infected mice. CV-N effectively inhibits HIV infection of cells grown in laboratory and is effective against a broad range of HIV strains. CV-N inhibits the HIV infection by binding to the outside of the virus and physically blocking it from entering cells. When CV-N was injected to a mouse it survived for a longer period of time than with the non-injected CV-N mouse. CV-N itself is an effective treatment for Ebola. If taken as a research later, I would use this method to concentrate in the modification of reverse transcriptase method, where the RNA genome is converted into double stranded DNA. Understanding the specific molecules involved in CV-N's interaction with

the virus by the chemical isolations from algae like (sulphated molecules) will help to clarify the process necessary for the infection.

Keywords Algae, HIV, Anti-virus, Cyano-bacteria, Transcriptase methods.

ANP 11

Effect of Algae as a Source of Nutrition and its Economy-A Review

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Nutritional supplements from diversified sources are being formulated, quantified for different purposes. Algae are one of those, but under a less prone category. The limited usage of the Ecosystem has resulted in various strongholds that we recently overcome. Similarly, the minimal usage of Algae and its derived products in our routine has lead to a drawback for quantifying Algae's usage. This dimension of Algae to be used as a source of nutrition has been under discussion on their activity in the human metabolism, their reaction with the other gut microbiome. In these discussions Algae has evolved to have many required nutrients that play a vital role in the health benefits. In addition to the study of Algae as a component with health benefits, it would also require a market for bringing them to the consumers. This review is a comparative study of the Organism's Nutritional value, Health benefits, challenges faced in the production and marketing of the Algae derived products. The review concludes by getting an inference in transferring ideas about Nutritional value of Algae and its other products along with the study on the Algae's Economy.

Keywords Microbiome, Nutrition, Algae.

ANP 12

Spirulina: The solution to Malnutrition

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Spirulina, a type of blue-green algae, is an incredible superfood that provides a concentrated source of protein, vitamins, antioxidants, and other nutrients. As one of the oldest life forms on Earth, the use of spirulina as a food source dates all the way back to 9th century Chad, and it is believed spirulina was used by the Aztecs in 16th-century Mexico. In the U.S., spirulina is mostly known as a nutritional supplement or an ingredient to add nutrient power to smoothies and green drinks. However, in other parts of the world, spirulina is regarded as a valuable food source to prevent malnutrition. Spirulina is one of the oldest life forms on Earth, consisting of unicellular organisms that use light, warmth, water and minerals to produce protein, carbohydrates, vitamins and other vital nutrients. The resultant edible algae are one of the most concentrated foods on earth, noted for being excellent sources of all eight essential amino acids as well as ten of the twelve nonessential amino acids, beta carotene, minerals such as iron, and gamma-linoleic acid amongst others. Blue-green algae which is low in fat and sodium, resist contamination by heavy metals such as lead when properly cultivated, and are easy to digest, unlike most single-celled algae which have a tough cellulose cell wall.

ANP 13

Toxicity analysis of *Gymnema sylvestre* using *Artemia salina*

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Gymnema sylvestre is a perennial woody vine that grows in the tropical areas of India, Africa, and Australia. It has been used for centuries in traditional medicine for curing various ailments. It is also used in the treatment of diabetes. Despite the increasing demand for herbal drugs, there are very few studies on the toxicity screening and standardization of dosage for these drugs. This raises

concern on the safety of these herbal drugs. Toxicity screening using the brine shrimp, *Artemia salina*, is an effective method to determine the toxic dose of any natural or synthetic compound. In this study, the plant extract of *Gymnema sylvestre* was subjected to toxicity analysis using *Artemia salina*. The results are discussed.

Keywords: *Gymnema sylvestre*, toxicity screening, *Artemia salina*, brine shrimp.

ANP 14

Algae in Food – general review

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Algae have been used as human food for thousands of years in all parts of the world. Due to their rich chemical composition and content of bioactive substance they have been used in many fields of industry. Moreover, algae are used in the food industry as food supplements and an addition to functional food. Algae are also added to meat products such as pasty, steaks, frankfurters and sausages, as well as to fish, fish products, and oils, to improve their quality, Cereal based product such as Pasta, flour, and bread are another group of products enriched with algae. Due to their properties algae may also be used for construction of fermented functional foods. Fermented products containing algae are, most of all, diary products, such as cheese, cream, milk deserts, yoghurt, cottage cheese and processed cheese. Combination fermented products offering a high content of lactic acid bacteria with algae processing biologically active metabolites of natural origins allows not only to compose products with a high content of nutrient, but also to create a brand new segment of fermented food. Thus, this review aims at a better understanding of the recent uses of algae in food industry.

Keywords Algae in the food industry, fermented food, lactic acid bacteria, functional food

BIOTECHNOLOGY AND NANOTECHNOLOGY OF ALGAE

PAFHEE'19

BNA 01

Marine Microalgae With Anti-Cancer Properties

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Among marine organisms, marine algae are rich sources of structurally diverse bioactive compounds with various biological activities. In order to survive in a highly competitive environment, freshwater or marine algae have to develop defense strategies that result in a tremendous diversity of compounds from different metabolic pathways. Cancer is the leading cause of death globally and finding new therapeutic agents for cancer treatment remains a major challenge for a cure. This abstract presents an overview on microalgae with anti-cancer activities. Microalgae are eukaryotic unicellular plants that contribute up to 40% of global primary productivity. They are rich sources of pigments, lipids, carotenoids, omega-3 fatty acids, polysaccharides, vitamins and other fine chemicals, and there is an increasing demand for their use as nutraceuticals and food supplements. Some microalgae are also reported as having anti-cancer activity. The microalgal species have shown anti-cancer properties, which affected cell lines and induced arrest of cell growth. The mediums used for growing microalgae showed anti-cancer activity and thus microalgae can be promising sources of anti-cancer compounds for future development.

BNA 02

Metabolic engineering of cyanobacteria for photoautotrophic production of heparosan, a pharmaceutical precursor of heparin

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Heparosan is an unsulfated polysaccharide potentially important for its wide range of cosmetic and pharmaceutical applications, particularly as the precursor for the extensively used anticoagulant, heparin. Generally sourced from animals, commercially available heparin may encounter various immunological and contamination risks. Thus, safe and sustainable microbial platforms could

serve as an alternative heparin source. *Synechococcus* due to their fast photoautotrophic growth, strong sugar phosphate metabolisms and generally regarded as safe nature, may serve as photo-bio refineries for manufacturing heparosan. In this study, we have synthesized an integrative plasmid pUPm48 for cloning galU and PmHS2 genes in *Synechococcus elongatus* PCC 7942. The engineered recombinants (pgp7942) exhibited significant production of heparosan under different culture conditions, where the products were present in both supernatant and cell biomass. The maximum yield of 0.7 ± 0.2 μg/g-DCW (dry cell weight) and a titer of 2.8 ± 0.3 μg/L was achieved by pgp7942 under shake flask and continuous light conditions. Large scale plastic-bag cultures with natural diurnal light exhibited heparosan production of 0.5 μg/g-DCW with a titer of 0.44 μg/L. The analysis also found PCC 7942 encodes a promiscuous uridyltransferase for UDP-glucose synthesis and naturally produces multiple glycosaminoglycans including chondroitin sulfate (CS). This study demonstrates for the first-time cyanobacteria as a promising photoautotrophic refinery for producing a high-value polysaccharide commonly from animals.

Keywords Glycosaminoglycans; Cyanobacteria; Heparin; Photoautotrophic production; Polysaccharides; *Synechococcus*

BNA 03

Potential Health Benefits of Spirulina Microalgae

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Spirulina is a micro algae that has been consumed for centuries due to its high nutritional value and supposed health benefits. Today, popular personalities advertise Spirulina as a secret, potent super food, and a miracle from the sea. Spirulina, a type of blue-green algae that grows naturally in oceans and salty lakes in subtropical climates. The Aztecs harvested Spirulina from Lake Texcoco in central Mexico, and it is still harvested from Lake Chad in west- central Africa and turned into dry cakes. Spirulina was once classified as a plant because of its richness in plant pigments as well as its ability of photosynthesis. New understanding of its genetics, physiology and biochemical properties caused scientists to move it to the Bacteria kingdom and the Cyanobacteria phylum. At first it was classified in the genus Arthrospira, but later it was placed into the genus Spirulina. There are several species, but three *Spirulina platensis*, *Spirulina*

maxima and *Spirulina fusiformis* are studied extensively because of their high nutritional as well as potential therapeutic values, according to the study's authors.

BNA 04

Algae Architecture

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With rapid increase in energy consumption in the world and the subsequent depletion of non-renewable energy sources in the near future, we have to make sure that energy security is guaranteed. Such energy sources are the major dischargers of greenhouse gases and are transported over large distances. Therefore energy security can be established by generating it locally and from a sustainable source. In the past, solar cells and wind turbines have been considered to be the norm when it comes to zero energy buildings, but now algae is entering the arena and bringing with it a breath of fresh air. The review is on the use of algae as a building component that reduces the external energy demand in existing and new buildings. Especially the use of algae in façade design in closed photo bioreactors can be implemented as components in buildings. The necessities for the algae to survive and grow are sunlight, nutrients, pH, CO 2 and temperature. Thus bioreactors need to be designed with these conditions in mind. During the cultivation process the appearance of the building will change in color and becomes less transparent with increase in biomass concentration. The building will have a dynamic appearance with a liquid façade that also works as an adaptive sunshade. So designing a building with a main focus on micro algae as element is quite in the world of architecture and proves to be a good source of sustainable energy source.

Keywords Non-renewable energy, façade, zero energy buildings, bioreactor

BNA 05

Harmful Effect of Algal Bloom and their Potential Impacts on Desalination Operations

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To investigate the harmful effect of algal bloom and their potential impacts on desalination operations. Algal bloom is defined as a rapid increase or accumulation in the population of algae in freshwater or marine water. Algal bloom is mainly caused by eutrophication. Seawater desalination by reverse osmosis (RO) is a reliable method for augmenting drinking water supplies. In recent years, the number and size of these water projects have increased dramatically. As freshwater resources become limited due to global climate change, rising demand and exhausted local water supplies, seawater desalination will play an important role in the world's future water supply. Emerging contaminants have been widely discussed with respect to wastewater and fresh water sources, but also must be considered for seawater desalination facilities to ensure the long-term safety and suitability of this emerging water supply. Harmful algal bloom, frequently referred to 'red tides' are concerned for desalination plants due to the high biomass of microalgae present in ocean water and a variety of substance are produced by algae. The compound various from noxious substance to powerful "NEUROTOXIN" that constitute significant public health risks if they are not effectively and completely removed by RO membrane. Algal bloom can cause significant operational issues that result in increased chemical consumption. Early algal bloom detection by desalination facilities is essential so that operation adjustment can be made to ensure that production capacity remains unaffected.

Keywords Algal bloom, seawater desalination, reverse osmosis.

BNA 06

Algal Growth In Photosynthetic Algal Microbial Fuel Cell And Its Subsequent Utilization for Biofuels

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Electricity generation from biomass has captured a lot of attention these days. Many countries have inclined to start large-scale research projects so that the microbial fuel cells could be installed to fulfil the power requirements of domestic as well as industrial sectors. The chemical energy stored in the algal biomass can be harnessed for sustainable production of fuels and other value-added products. Bioelectricity production using algae seems to be a wise approach to extract energy from sunlight in an economic and sustainable manner. It is achieved through integration of photosynthesis with microbial fuel cell (MFC). Algae have been used commonly in MFCs to reduce oxygen at cathode or as a substrate for bacteria. However, sufficient electric current can also be generated at anode, where cytochromes help indirect shuttling of electrons generated in photosynthetic II of the algal cells and can be called as photosynthetic algal microbial fuel cell (PAMFC). Despite being environmental friendly, low efficiency makes these neoteric systems unviable. Hence, a good understanding is needed for the bio electrochemical mechanisms working behind the electron transfer from algae to electrode. Oxygen is also a limiting factor among different variables viz. pH, substrate loading rate etc., affecting the fuel cell performance. The present review addresses the mechanism of electron transfer in algae and algae to electrode and the factors affecting the performance of PAMFC.

Keywords Algal Biomass, Biofuel, Bioelectricity, fuel cells, Photosynthesis.

BIOENERGY AND BIOREFINERY

PAFHEE'19

BB 01

A review article on Biodiesel production from algae to overcome energy crisis

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The use of energy sources has reached at the level that whole world is relying on it. Being the major source of energy, fuels are considered the most vital. The fear of diminishing the available sources thirst towards biofuel production has increased during last decades. Considering the food problems, algae gain the most attention to be used as biofuel producers. The use of crop and food-producing plants will never be a best fit into the priorities for biofuel production as they will disturb the food needs. Different types of algae having the different production abilities. Normally algae have 20%–80% oil contents that could be converted into different types of fuels such as kerosene oil and biodiesel. The diesel production from algae is economical and easy. Different species such as tribonema, ulothrix and euglena have good potential for biodiesel production. Gene technology can be used to escalate the production of oil and biodiesel contents and stability of algae. By increasing the genetic expressions, we can find the ways to achieve the required biofuel amounts easily and continuously to overcome the fuels deficiency. The present review article focusses on the role of algae as a possible substitute for fossil fuel as an ideal biofuel reactant. We as biotechnologists should come up with solutions to overcome the limitations in using the algae for the production of biodiesel.

Keywords: algae, biofuel, fossil fuel, gene

BB 02

Algae as a Biofuel

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Algae fuel, algal biofuel, or algal oil is an alternative to liquid fossil fuels that uses algae as its source of energy-rich oils. Liquid biofuels are alternative fuels promoted with potential to reduce dependence on fossil fuel imports. Biofuels production costs can vary widely by feedstock, conversion process, scale of production and region. Algae will become the most important biofuel

source in the near future. Algae are simple organisms that are mainly aquatic and microscopic. Microalgae are unicellular photosynthetic micro-organisms, living in saline or freshwater environments that convert sunlight, water and carbon dioxide to algal biomass. Microalgae appear to be the only source of renewable biodiesel that is capable of meeting the global demand for transport fuels. Microalgae can be converted to bio-oil, bioethanol, bio-hydrogen and methane via thermochemical and biochemical methods. Microalgae are theoretically very promising source of biodiesel. This poster investigates the algae production technologies such as open, closed and hybrid systems and algal energy conversions.

BB 03

Hybrid Role of Algae in Biofuel Generation, Wastewater Treatment and Pollution Control: Present and Future Perspectives

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Sustainable production of renewable energy is the topic which is being hotly debated around the globe. The extensive usage of fossil fuels has led to rapid depletion of fossil fuel reserves, global climatic change, rising crude oil price and environmental degradation. Now, the scientific community is forced to look for other alternative energy resources where Algae have emerged as one of the most promising sources for biofuel production. Coupling Algae cultivation with wastewater treatment is considered as one of the most promising routes to produce bioenergy and bio based by products in economically viable and environmentally friendly way. The current progress of hybrid technologies (biomass production, wastewater treatment, GHG mitigation) for production of prime products as biofuels offer atmospheric pollution control such as reduction of Green House Gases. This paper reviews the algal biomass production using waste water streams, biomass harvesting methods, lipid extraction and mitigation of Greenhouse gas emissions, future direction for sustainable microalgal biofuel production.

BB 04

Elucidation of algal oil for the production of biofuel using *Oedogonium* sp.

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Fuel is the most significant need of the modern world but now the availability of fuel source has decreased alarmingly. Therefore, scientists are focusing on other alternative source for the production of fuel. Algae is considered as one of the best source for the fuel production because they are easily available, cheaper, easy to handle and as well, they are eco-friendly. In this study, I have isolated the *Oedogonium* sp., from Sulur Lake. It is a micro algae present in fresh water which contains 67% of lipid content and thus paved a way to focus on this algae. The isolated species were characterized by morphological identification. Then, the growth of algae was optimized by different pH, Temperature, light intensity and Nitrogen source. The result of optimization includes: pH- 8, Temperature- 20°C, light intensity- 2000 Lux, Nitrogen source- urea. It was then cultivated in a mass level for extraction of fatty acids. Fatty acids were extracted by a slight modification of Blight and Dryer method. Then, transesterification was done for the extracted fatty acids. Finally, biofuel was analyzed by GC-MS and found that there were totally 21 types of monoesters present in biofuel.

Keywords Fuel, Algae, *Oedogonium* Sp., Transesterification, GC-MS.

BB 05

Marine algae: Future sources of Biofuels

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The current scenario of world's energy crisis made us understand the fact that world's fossil fuel resources are in peril of exhaustion and prices are reaching historical heights. Fossil fuels contribute to negative effects in the environment. Therefore a green alternative liquid fuel technology that is a biofuel can be used as a non-toxic and bio-degradable fuel. They found out

that first generation biofuels was primarily produced from food crops and oilseeds. The second and third generation biofuels increased interest and so a keen focus was given on non- food and non-terrestrial sources. Marine algae have been taken into consideration recently as the third generation biofuel and as a promising biomass feedstock with great potential. Marine alga reproduce every few days, they yield oil that exceeds 10 times more than the yield of the best oil seed crops, reduces greenhouse gas with enhanced carbon dioxide fixation. The increasing interest in the use of algae for production of bio fuel is due to the accumulation of very high level of lipid that can be then easily Trans esterified into biodiesel. Following lipid extraction, the carbohydrate content of algae can also be fermented into bioethanol or butanol fuel. This technique of producing oil from marine algae and using it as a biofuel it has much potential globally and in market sectors with increasing feasibility and reducing the cost of production. Hence, requires technological development.

BB 06

Review on Extraction of Bio-Diesel from Algae

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Fossil fuels are used on a large scale in the world, this also contributes to increased production of greenhouse gases contributing toward global issues like global warming and the available resources are rapidly decreasing. The depletion of fossil fuel reserves has caused an increase in demand and price of diesel. To keep the environment clean and maintain sustainability, renewable and environment friendly fuels are needed to be produced. Among the various biomass candidates for biofuel production, microalgae are being considered as a more viable feedstock because microalgae are aquatic, non-edible, highly genetically modifiable and fast growing with productivity 3-35 times higher than terrestrial plants in term of energy content. Normally algae have 20%-80% oil content that could be converted into different types of fuels such as kerosene oil and biodiesel. The diesel production from algae is economical; it can be used in pure form and easy. Our aim is the production of biodiesel from algae sources and getting benefit in economically and saving natural sources.

BB 07

Third generation biofuels from micro algae

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Biofuels is formed of bioproducts. It has three generation 1st generation used starch or sugar by transesterification of oil crops but it caused shortage of food. 2nd gen used lignocelluloses material but this was costly. 3rd gen uses micro algae. It overcame the limitations this produce 50-300 times more oil as fuels. It have shorter harvesting cycle, high growth, osmotolerence solar energy conversion rate, metabolic diversity, high capacity to produce lipid. Biomass contain proteins carbohydrates and lipids. Cultivation is of two types – open air and photobioreactors (tubular, flat, column). Harvesting methods 1. Bulk harvest (flocculation, floating).2. Thickening (centrifugation, filtration and ultrasonic aggregation). 3. Extraction of micro algae lipid (drying process, self disruption). Methods of extraction of lipid – expeller/oil press, liquid liquid extraction, super critical fluid extraction and ultrasound techniques. Biodiesel production – transesterification converts micro algal oil into biodiesel. Bioethanol production – microalgae as a feed stock for formation process.

Keywords Biofuels, microalgae, transesterification, Biodiesel, Bioethanol

BB 08

Production of Fuels From Wastes

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Production of fuels obtained from algal degradation of wastes. Algal components are coated over the bins made to collect wastes from house hold, and those of biodegradable wastes are converted into biofuels using algae. This is economically made possible by providing biofuels to household. This will promote the usage of biodegradable wastes.

BB 09

Biodiesel from algae

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Algae are the fastest-growing plants in the world. Industrial reactors for algal culture are open ponds, photobioreactors and closed systems. Algae are very important as a biomass source. Algae will be competitive as a source for biofuel in future. Different species of algae may be better suited for different types of fuel. Algae can be grown almost anywhere, even on sewage or salt water, and does not require fertile land like any other biofuel crop, and processing requires less energy than the algae provides. Algae can be a replacement for oil based fuels, one that is more effective and has no disadvantages. According to recent studies, producing each gallon of oil from algae only consumes 13 to 14 kilograms of the carbon dioxide, and unlike 1st generation biofuels, it does not have any negative effect on global food supply and prices because it does not require taking away pieces of land that are being used for cultivating food crops. Algae are among the fastest-growing plants in the world, and about 50% of their weight is oil. This lipid oil can be used to make biodiesel for cars, trucks, and airplanes. Microalgae have much faster growth-rates than terrestrial crops. The per unit area yield of oil from algae is estimated to be from 20,000 to 80,000 per acre, per year; this is 7–31 times greater than the next best crop, palm oil. The lipid and fatty acid contents of microalgae vary in accordance with culture conditions. Most current research on oil extraction is focused on microalgae to produce biodiesel from algal oil. Algal-oil processes into biodiesel as easily oil derived from land-based crops.

Keywords: Algae, Algal oil, Biodiesel, Economy

BB 10

Production of Biodiesel from rapeseed oil

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In recent years, there has been an increase in the demand for a fuel which is a non- pollutant and sustainable. Sustainable development can be defined as the compatibility between progress and

protection of natural environment in order to meet the needs of our own future generation. Nowadays, there is a significant technological progress and consequently increase in demand for vegetable fats as a fuel. Two types of biofuels are produced on a world scale i.e. Bioethanol and Biodiesel. Bioethanol is used in car engines as a maximum of 15% additive to gasoline. Biodiesel is a natural fuel defined mainly as methyl esters of long- chain fatty acids derived from renewable biological sources. There are several methods of producing biodiesel from vegetable oils. The well-known and cheap one is transesterification. Transesterification process involves preparation of esters of lower alcohols and fatty acids of vegetable oils in the reaction of oil mixture with ethyl or methyl alcohol in the presence of catalyst. Apart from oilseeds, animal fats as well as waste and used oils find applications in this method. The basic oil for biodiesel production is rapeseed oil. Rape is one of the most cultivated oil plant which is a renewable raw material for the production of liquid biofuels. The work presents both process of obtaining rapeseed oil and describes stages of transesterification. Vegetable oils can be obtained by mechanical and/or chemical extraction. In biodiesel production processes, methanol is used, mainly due to the cost and its physical and chemical advantages. Legal regulations in force require the use of fuels containing biocomponents from renewable sources. Fuels derived from vegetable oils have widespread applications. However, its use is the most effective while adding to the fossil fuels. Rapeseed oil is the main source of quality biodiesel.

BB 11

Biofuel Production from Algae Using Waste Water

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The concern about the rapid depletion of fossil fuels, global climate change, rising crude oil price and environmental degradation have led to the research of alternative path of consuming energy sources. The potential of microalgae as a renewable energy source can be an impeccable solution to this rising problem. However, the overall current production and harvesting techniques of microalgal biomass to produce biofuels is too expensive to ensure a competitive production price. If microalgal biofuel production is to be economically viable and sustainable further research is

needed to find an alternate path for mass culture and harvesting conditions. However, the technologies required for large scale cultivation, processing and conversion of microalgal biomass to energy products have not yet turned to commercial reality. Wastewaters derived from municipal, domestic, agricultural and industrial activities can potentially provide cast-effective and sustainable means of algal growth for biofuels. However, currently there are no commercial algae-to-fuels technologies that can overcome techno-economic barriers and address serious sustainability concerns. Coupling microalgae cultivation with wastewater treatment is considered as one of the most promising routes to produce bio-energy and bio- based by-products in an economically viable and environmentally friendly way. This poster will contain major challenges to sustainable production and harvesting of algae, compare the benefits and limitations of different approaches to algae production.

Keywords: Biofuels, algae, waste water treatment

BB 12

An Investigation of Biodiesel Production from Microalgae Found in Mauritian Waters

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The aim of this is to study the lipid content and the subsequent potential of the different microbes that present in the Mauritian marine water to produce biodiesel. The micro-phytoplankton species that present in the water column was determined. The worldwide annual production of algal biomass in 2004 was estimated to be 5 Gg. Recently, microalgae were discussed to be used as a renewable feedstock for biodiesel production compared to traditional biofuel feedstocks. Cyanobacterial mats were identified as leptolyngbya sp. and *Nodularia harveyana* and the RFLP characterized the endosymbiotic dinoflagellates as the symbiodinium clade C. The selection of the most suitable species is based on several keys parameters such as lipid and fatty acid productivities. With predictions that crude oil prices will reach record breaking increases, algal based biofuels are gaining widespread attention.one of the renewable and carbon-neutral fuel applications exploiting algal components is transesterification of lipids to biodiesel. After algal growth, there are many methods for harvesting of microalgae such as centrifugation, filtration and gravity sedimentation which may be preceded by a flocculation step. The Infrared analysis yielded peaks at around

1738cm-1 and 1200cm-1 characteristic of the carbonyl and ether group respectively. Indicating the presence of biodiesel.

BB 13

Fatty acid profiling of fresh water microalgae Grasiella sp. And Chlorella sp. Under nitrogen and phosphate stress

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Microalgae lipid has been identified as a reliable resource for biodiesel production due to its high lipid productivity and potential cultivation in non-fertile locations. The present study investigates on comparison of the biomass and lipid production of microalgae *Grasiella* sp. And *Chlorella* sp. Under two different conditions of cultivation viz. normal and nutrient stress conditions. Stress was induced in the form of nitrogen and potassium deficiency in the cultivation media. The biomass was obtained using different harvesting techniques like centrifugation, flocculation (using alum) and vacuum filtration. Results found that biomass obtained from stress conditions was comparatively higher than normal conditions. The dry weight of biomass for *Grasiella* sp. Under normal and stress conditions was found to be 0.78g/L and 0.96g/L respectively and for *Chlorella* sp. 0.48g/L and 0.8g/L respectively. Total lipid content of *Grasiella* sp. and *Chlorella* sp. was extracted and the fatty acid profile was documented.

Keywords: Microalgae, *Grasiella, Chlorella,* biodiesel, nutrient stress

BB 14

Algae in biofuels

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Microalgae have long been recognized as potentially good sources for biofuel production because of their relatively high oil content and rapid biomass production. Microalgae grow very quickly compared to terrestrial crop. Thus, use of microalgae as an alternative biofuel feedstock is gaining

increasing interest. Algal biomass contains three main components: carbohydrates, proteins, and lipids/natural oils. The bulk of the natural oil made by microalgae is in the form of tricylglycerol which is the right kind of oil for producing biodiesel, microalgae are the exclusive focus in the algae-to-biodiesel arena. In addition, microalgae can also be used to generate energy in number of ways. Algae can convert solar energy into fuels at higher photosynthetic efficiencies, and can thrive in salt water systems. Some algal species can produce hydrogen gas under specialized growth conditions. The biomass from algae can also be burned similar to wood or anaerobically digested to produce methane biogas to generate heat and electricity. Algal biomass can also be treated by pyrolysis to generate crude bio-oil. These challenges include strain identification and improvement, both in terms of oil productivity and crop protection, nutrient and the production of co-products to improve the economics of the entire system.

BB 15

Algae oil – A Sustainable Renewable Fuel of Future

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Petroleum has been used from centuries as a fuel and its usage has kept on increasing day by day. This has resulted in an increased production of green house gases leading to issues like global warming. To meet environmental and economical needs, an alternative fuel which is sustainable and renewable is necessary. For this requirement, microalgae can be used for the production of biodiesel by the process called trans-esterification. These microalgae produce oil from sunlight similar to plants but in a much more efficient manner. Being a renewable resource, biodiesel has gained a lot of attraction. It also provides more environmental benefits. The algal biofuel technology includes selection of specific species for production and extraction of valuable co products. Apart from biodiesel, microalgae offer several different kinds of renewable biofuels. Earlier, the idea of using microalgae as a source of fuel was not novel; but it is now taken seriously because of the increasing price of petroleum and diesel. Global issues are associated with the incinerating fossil fuels. Moreover, some species of algae have the ability to produce up to 60% of their dry weight in the form of oil. Regional cultivation of microalgae and the production of biofuel will ensure economic benefits to rural communities. Microalgal biodiesel is technically

feasible. This provides a controlled environment that can be tailored to the specific demands of highly productive microalgae to attain a successful good annual yield of oil.

Keywords Microalgal Biodiesel, Renewable Resource

BB 16

Production of Biodiesel from Algae

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Biodiesel have been developed in recent years because of its eco-friendly nature, non-toxic characteristics, biodegradability and lower net carbon cycle compared to conventional diesel fuels. Two thirds of earth's surface is covered with water, thus algae would truly be renewable option of great potential for global energy needs. In the current study, potential algal specie Spirogyra were collected from different districts and employed as a feedstock for biodiesel production. In the first step, oil from algae specie was extracted using n-Hexane and Di-ethyl Ether as solvents, while in the second stage; extracted oil was converted into biodiesel via transesterification reaction. While in transesterification reaction, effects of molar ratio, temperature, reaction time and amount of catalyst (Sodium Hydroxide) were evaluated on the amount of biodiesel produced. Almost 95% conversion of extracted oil into biodiesel was achieved after 25 minutes of contact time at 60 degree C with catalyst amount of 0.5% weight of oil and oil to methanol ratio of 8.

OTHERS

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OTH 01

Ciguatera Fish Poisoning – an Emerging Biological Hazard among Reef Fishes of India

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Ciguatoxins are a class of toxic polycyclic polyether found in fishes that cause ciguatera. Ciguatera Fish Poisoning (CFP) is an emerging food safety hazard which has been reported in southern peninsular India in recent times. It is an illness caused by eating fish that contain toxins produced by a marine microalgae called *Gambierdiscus toxicus*. Ciguateric fishes mostly associated with coral reef ecosystem are implicated in food poisoning outbreaks. Ciguatera Fish Poisoning has been reported from tropical or subtropical areas around the world between latitudes 35° N and 35° S, particularly in the Caribbean, Pacific and Indian Ocean and in the Flower Garden Banks area in the northern Gulf of Mexico. CFP is considered as a natural toxin and USFDA has listed out 12 group of fishes under ciguatera hazard category. With recent EU import rejections of some of the seafood consignments originated from India, CFP has emerged as an important food safety concern. Although, no fatality has been reported so far, morbidity symptoms observed from cases of hospitalization is a definite concern to the export trade. This review deliberates on the significance of CFP, its distribution and hazard control measures.

Keywords: Ciguatoxin, CFP, reef fish, morbidity symptoms, food safety

OTH 02

Analysis of soil microbes for Antibiotic properties

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Antibiotics used today are isolated and extracted from microbial source. The emergence of antibiotic resistance and need for better antibiotics is always in high demand. In the study, antibiotic producing bacteria were isolated from a local soil sample. After primary screening, two bacterial strains (strain 1 and 2) were isolated, which showed antimicrobial activity against some common bacteria namely, *E. coli, K. pneumonia, S. aureus, P. aeruginosa* and *M. smegmatis*. The isolated strains showed significant zones of inhibition against *E. coli, K. pneumoniae, S. aureus*

and *P. aeruginosa* but not against *M. smegmatis*. To identify the isolated strains, biochemical tests were performed and it was found that both the strains were Bacillus. sp with some differences in characteristics. The strains were also found to be resistant to some antibiotics such as tetracycline. The screen for the presence of any plasmid which might be influencing antibiotic production by these strains, the cultures were used for extraction of plasmids wherein, both the strains were observed to have a plasmid of ~ 10 kb. Developed study of this lead to identifications of new antibiotic products.

OTH 03

Potential Antioxidant Analysis of Orange Peel and Beetroot Peel

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Consumption of fruits such as orange and beetroot prevents degenerative process caused by oxidative stress. Orange accounts for 70% of citrus production. It is an anticancer, reduces pressure and treats constipation. Beetroot is rich in vitamin c and folate. And they are great source of antioxidant lipoic acid. It also has anticancer properties, fights inflammation and provides detoxification support. The main objective of my work is to expose the antioxidant activity of orange peel and beetroot peel where the beetroot peel has more antioxidant than the orange peel through DPPH assay, phosphomolybdenum assay and Fe3+ reducing power assay.

Keywords: Beetroot, Orange, antioxidant