आज़ादी का अमृत महोत्सव

International Conference on NATURAL SCIENCE AND GREEN TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT (NTSD-2022)

30th November, 1st and 2nd December, 2022

Goa University, Taleigao Plateau, Goa

Jointly Organized by

National Environmental Science Academy
New Delhi

School of Biological Sciences and Biotechnology
Goa University, Taleigao Plateau, Goa

Abstracts and Souvenir

Sponsored by

Goa State Innovation Council

ROYAL SOCIETY OF CHEMISTRY

CEFIPRA

IGSTC
INDO-GERMAN SCIENCE AND TECHNOLOGY CENTRE


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Professor Harilal B. Menon
Vice-Chancellor

Goa University

Message

I am pleased to learn that the School of Biological Sciences and Biotechnology, Goa University and National Environmental Science Academy (NESA), New Delhi is organising an international conference on "Natural Science and Green Technologies for Sustainable Development (NTSD-2022)" from 30th November to 2nd December 2022.

I am glad to note that this conference will create an ecosystem for eminent scholars to discuss, interact and give impetus to research and extension activities. Key issues will be discussed, which are directly associated with the current trend in green technology dealing with challenges and prospects of society, where living conditions and resources are used to continue to meet human needs without undermining the integrity and stability of the natural system.

The objective of this conference is to focus on technological advancement to curb the environmental pollution and propose solutions to adopt the green technologies for sustainable development.

I am sure, this conference will provide great opportunities to the participants and serve as an effective platform for exchanging ideas.

I congratulate the Organisers and wish the Conference a grand success. I wish the participants a very enriching and enlightening experience and my greetings to all the renowned speakers of this Conference.

Harilal B. Menon 15/11/2022
Vice-Chancellor and
Patron- NTSD 2022

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22.11.2022

Message

5I and the members of the organizing committee are very proud to present the International Conference on NATURAL SCIENCE AND GREEN TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT (NTSD-2022) welcoming all the participants to Goa University, Goa from 30th November to 2nd December 2022.

It gives me immense pleasure to welcome you all as President of NESA.

The present conference that is being jointly organized by NESA, New Delhi and Goa University, Goa.

I also heartly welcome and congratulate all the Awardees of NESA – 2022 who will receive their respective awards on 30th November and 2nd December, 2022.

The conference is aimed at expanding the programme by including all aspects related to safe agriculture, environment, forest, ecosystems, food, climate change, sustainability of resources, renewable and non-renewable energy, global warming, extinction of species, malnutrition, hunger, drought & famine, biotechnological tools, integrating components for production and protection as a multidisciplinary approach for essential sustainable management.

The various sub-themes of the conference will offer many opportunities to delegates to learn many things and apply the same in their respective workplace.

I am sure the young scientists will get benefit after listening the invited talks in this conference.

I would also like to put before you the related recommendations of the renowned COP27 Climate Summit - November 6 – 18, 2022 at SHARM EL-SHEIKH, Egypt. For the protection of environment 50 billion trees will be planted under the Green Initiative in Africa as per joint declaration in the above summit.

Protection of oceans, clean energy, food availability, reduction of greenhouse gasses, carbon and fossil fuel are the recommendations of COP27. Thus the global warming and the increase of temperature of 1.5 degrees Celsius may be checked upto 2030. As per U.N. last eight years remained hot in the history of the world. Protection of endangered species & ecosystems (Congo forest, Gorilla population, Mangroves forest and coral reefs) is declared in joint declaration of COP27. Judicious use of resources is the key in climate fight.

The world population has become 8 billion in November, 2022 as per annual report issued by United Nations. It will be a great platform to strengthen the friendship and collaboration among scientists, academics and industries.

The diversity of specializations and current themes and issues, will enable us to achieve our targeted mandate and vision. Thus India may be able to achieve key goals to fight against climate change, food shortage and less emissions of Methane and GHGs.

We will have awardees, guests, keynote speakers, from the different states including Goa from varied fields of environment, agriculture, ecosystem, food, energy and Biotechnology / Biosciences.

The hard work and dedication of all the members of organizing, scientific, technological, hospitality, transport, boarding, lodging and financial committees during the preparation of this conference is highly appreciated at may end.

I am grateful to Prof. Harilal B. Menon, Vice Chancellor, Goa University for giving permission to hold the conference here as well as his Patronage for the success of conference.

Prof. (Dr.) Savita Kerkar, Dean, School of Biological Sciences & Biotechnology, Goa University, Goa and Convener NTSD 2022 is highly thanked for her valuable support and supervision on all activities of the conference.

Dr. Mrutyunjay Suar is also thanked for his continued encouragement during organizing the present event.

Prof. (Dr.) Shakeel Ahmad Khan, Organizing Secretary is also highly appreciated for his keen interest and continued efforts for the success of the conference.

Financial assistance from the Govt. agencies and N.G.O.'s for the present conference is also highly acknowledged.

The staff of NESA Mr. Gian Chand and Mr. Rakesh Kumar Roy also deserve appreciation for their hard work and sincerity.

Without them, the event would not have been possible.

My personal respect goes out to all of you.

I look forward for the success of NTSD 2022.

(Prof. Javed Ahmd)

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(Accredited by NAAC with Grade 'A')

Message

Natural Sciences decipher the rules that govern the natural world through scientific methods. Since ancient times, natural sciences has been changing our lives and ways of thinking at a much greater pace than in the earlier period of human civilization. A natural science, viz Green Technology or clean technology, deals with applying environmental science, green chemistry, environmental monitoring and sensors to monitor, model and conserve the existing natural environment and its resources. The history of natural sciences is inseparable from the gradually increasing awareness and understanding of indirect effects. Indirect interactions are not apparent, and their studies often face challenges of system complexity. However, the knowledge of complex interactions involving ecosystem components is indispensable for the sustainable development of humankind. Systematic elucidation of the indirect effects is becoming a central focus for ecology and environmental sciences.

Thus, the International Conference on Natural Science and Green Technologies for Sustainable Development (NTSD-2022) is a timely endeavour to carve out a futuristic, economically viable, and environmentally friendly solution. Being the contributor to organizing this conference, I anticipate a declaration at the end of the meeting that could be prescribed to the environmental agency. The conference will provide a unique platform to learn about the advancement in green technology and initiatives that are being taken to maintain and improve the quality of the environment and give new resource-efficient and sustainable thinking to the society.

savitaherkar

(Savita Kerkar)

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21.11.2022

Message

Dear delegates and friends Warm greetings!!!

On behalf of NESA and the organizing committee, I would like to cordially welcome you to the International conference on “Natural Science and Green Technologies for Sustainable Development" to be held at Goa University, Goa from the 30th November to 2nd Dec., 2022.

We had been working for the natural resources management and sustainable development for the last 5 decades to create awareness and educate people to realise that sustainable development is the keys factor linking to the quality of life of people and their ecosystem. We could successfully associate ourselves with various technology institutions and academia in the last decades and successfully demonstrated that environmental management and sustainable development could be achievable by joining hands together. This conference with the theme “Natural Science and Green Technologies for Sustainable Development" is the right platform to bring various academician under one roof to discuss needs of current scenario to mitigate the global warming and pollution problem by interlink the sustainable development goals of UNEP.

We are planning to have best interaction with multi domain displays and poster presentation. The thematic talks and the plenary sessions will drive you through the multi sectoral emergence and mitigation options to achieve SDGs. This could be the first conference of its kind in the region where everyone could have opportunity to showcase and present their ideas, thoughts, developments that could lead to a meaningful life in the community. We are trying our best to ensure that your time and stay in Goa during the conference be one of the most memorable one and you go back with rich information.

I welcome you, your family and friends again to this wonderful gathering and make the maximum out of it. I thank each and every one of you who are contributing to the success of the conference and looking forward to seeing you all soon.

JAI HIND

Best wishes

(Dr. Shakeel Ahmad Khan)
General Secretary NESA
Principal Scientist, Division of Environmental Sciences, ICAR-IARI, New Delhi -110012
Organising Secretary – NTSD 2022

About the Organizers

The School of Biological Sciences and Biotechnology (SBSB), Goa University, Goa

The School of Biological Sciences and Bio-technology (SBSB) was established in May, 2022 merging four Disciplines to form the School of Biological Sciences and Biotechnology. Goa being a coastal state, in proximity to the Western Ghats, a biodiversity hot-spot, provides several unique ecosystems for research.

The focus of amalgamation of the four departments was to bring fundamental and biological science Departments under one umbrella to provide the students a platform for interdisciplinary research.

Individually in the past, the departments have evolved in a step wise manner. The Department of Microbiology established in 1974 was a part of the Centre of Post-graduate Instructions and Research (CPIR) of the University of Mumbai in 1985, it became a full-fledged Department of the then newly founded Goa University. The Department of Botany and the Department of Zoology, were both established in 1990, became full-fledged Departments of the Goa University providing students with an opening for the Master's programme in Botany and Zoology. The Department of Biotechnology, one of the pioneer in Marine Biotechnology (1998) teaching and research in the country, became full-fledged Department of the Goa University in the year 2003. Subsequently, a new M.Sc. and Ph.D. Programme in Biotechnology were established. The Marine Biotechnology programme has been continuously funded by the DBT, Government of India. The four departments in the School of SBSB have come together to multiply their strengths and carry out effective interdisciplinary teaching and research in biological sciences. Equally, an important aspect of biological sciences, namely Home Sciences and Wildlife studies have been integrated to further gain in-depth knowledge of biological sciences.

The focus of the school is to provide quality education and research in biological sciences through an integrated approach with a view to create well trained human resource to handle the upcoming challenges in a sustainable manner and to apply the knowledge to the welfare of the society.

National Environmental Science Academy (NESA), New Delhi

National Environmental Science Academy (NESA) was founded by Late Prof. TRC Sinha, the then Head of Zoology Department, MJK PG College, Bihar University to create awareness, promote and protect the environment. Conceptualised and initiated in 1984, it was registered as a Society in 1988 under the Societies Act XXI of 1860 at Patna.

This ACADEMY is of National level, presently having its Head Office at 206, Raj Tower-1, Alaknanda Community Centre, New Delhi. The main objective of the Academy is to bring awareness about the environmental issues among the masses and strive to find sustainable solutions by arranging lectures, demonstrations, training programmes, seminars, symposium, conferences, publishing journals and organizing any other activities supporting the cause.

Aims Objectives and Functions of the Academy

To implements the SDDGs in India by encouraging students, scientists, researchers, academicians and members of the academy for pursuing research on sustainable development.

- **To set up Regional/State Chapters for dissemination of information on environment.**
- **To motivate and prepare young minds on environmental management.**
- **To organize national/international level conferences, symposia, seminars, meetings and workshops on themes of environmental concerns.**
- **To publish policy papers, synthesis volumes, proceedings, journals, newsletter, transactions and other publications for the promotion of Environmental Sciences.**
- **To forward the recommendation of scientists /professors to govt. agencies.**

Various eminent personalities have graced the Academy as President. The first President of the Academy was Dr. K.C. Bose, Vice-Chancellor of Ranchi University; then Dr. B.S. Attri, Advisor, Ministry of Environment and Forest. Most recently Padma Bhushan Dr. S.Z. Qasim was the President of the Academy till June 2015, who is a renowned marine scientist known for his Antarctica mission in 1981-82, he also served as the Secretary at the Dept. Of Ocean Development (now Ministry of Earth Sciences); Member, Planning Commission and Vice-Chancellor, Jamia Millia Islamia, New Delhi. Currently Prof. Javed Ahmad, (Former Dean, Faculty of Science), Jamia Hamdard, New Delhi, is the President of the Academy.

Annual Awards

The Academy recognizes the merit and achievements of individuals who have contributed to the field of environmental science, education and societal values by conferring **(1) NESA FELLOWSHIP OF THE YEAR AWARD (2) NESA EMINENT SCIENTIST OF THE YEAR AWARD (3) NESA SCIENTIST OF THE YEAR AWARD (4) NESA ENVIRONMENTALIST OF THE YEAR AWARD (5) NESA GREEN TECHNOLOGY INNOVATIVE AWARD (6) NESA DISTINGUISHED SCIENTIST OF THE YEAR AWARD (7) WOMEN EXCELLENCE OF THE YEAR AWARD (8) NESA YOUNG SCIENTIST OF THE YEAR AWARD (9) NESA JUNIOR SCIENTIST OF THE YEAR AWARD (10) NESA BEST RESEARCHER AWARD (11) NESA BEST PHD THESIS AWARD.**

Any life member of the Academy can apply for the awards. For more information please, log on to our website: http://nesa-india.org/award-form-submission.

In addition, the Best Oral Presentation and Best Poster Awards are given away during the Annual Conference of the Academy.

Publications

The Academy is publishing the following Journals (Biannual):

1) **INTERNATIONAL JOURNAL ON AGRICULTURAL SCIENCES**
2) **INTERNATIONAL JOURNAL ON ENVIRONMENTAL SCIENCES**
3) **INTERNATIONAL JOURNAL ON BIOLOGICAL SCIENCES**
4) **INDIAN JOURNAL OF UNANI MEDICINE**
   http://nesa-india.org/nesa-journal/
5) **E-NESA Newsletter (Monthly)** http://nesa-india.org/newsletter/

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abstracts

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1

BIOMONITORING OF INDOOR AIR CONTAMINANTS USING SPIDER WEBS

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ABSTRACT

The neurotoxic, immunotoxic, and other health problems associated with indoor air contaminants are of great concern. Hence, in recent decades there has been a substantial rise in studies pertaining to indoor air quality. The majority of the existing sampling techniques concerning indoor air monitoring involve the use of samplers made of synthetic materials that are less biodegradable. Thus, there is an urgent requirement to develop ecofriendly indoor air samplers that are cost effective and allows trace level detection of contaminants. The ability of spider webs to adsorb air pollutants makes it useful for measuring atmospheric pollution levels (Yu et al., 2007). In this context, the present work assessed the suitability of spider webs as a passive air sampler to determine the air contaminants in indoor spaces. The webs of Pholcidae species (a widespread spider throughout all indoor environments) were collected from three indoor work spaces (). Heavy metal (As, Ba, Cd, Cr, Fe, Pb, Hg, Ni, Mn, and Zn) concentration in webs were monitored using inductively coupled plasma optical emission spectrometry (ICP-OES). Furthermore, the samples were subjected to ATR – FTIR spectroscopy. The results revealed the presence of various heavy metals, minerals and organic compounds in the web samples. The concentration of heavy metals in the samples followed the order Fe (14590 -24680 µg/g) > Zn (490-600 µg/g) > Hg (92-120 µg/g)> Cr (114.1-117.1 µg/g) > Cu (72-81.7 µg/g) > Pb (15.5- 36.9 µg/g)> Ba (7-8.7 µg/g) > As (BDL-1.2 µg/g) > Cd (0.4-1 µg/g). The IR spectra indicated the occurrence of quartz, calcite, and organic compounds having functional groups such as C-O, C-H and N-H (Figure.1) in the samples. This study demonstrated the use of spider webs as an excellent, eco-friendly and cost – effective passive sampler for monitoring indoor air contaminants at trace levels.

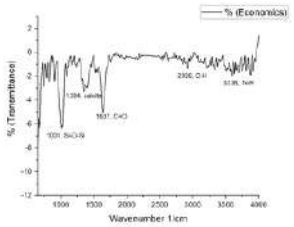

Figure 1: FTIR spectra of spider web

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Sreejith, M. V., Aradhana, K. S., Varsha, M., Cyrus, M. K., Aravindakumar, C. T., & Aravind, U. K. (2021). ATR-FTIR and LC-Q-ToF-MS analysis of indoor dust from different micro-environments located in a tropical metropolitan area.Science of The Total Environment,783, 147066.lution in Air. December 2005, 271277. https://doi.org/10.1007/s00128-006-0917-y

IMPACT OF ENVIRONMENT AND LIFE STYLE ON GYNAECOLOGICAL CANCER RISK

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ABSTRACT

The risk of gynaecological cancer (GC) is nonlinearly correlated with women's exposure to air pollutants (PM2.5, CO, O_3, and SO_2). Residents in municipalities with greater levels of PM2.5, a proxy measure of polycyclic aromatic hydrocarbons (PAH) and NO_2, had a higher risk of dying from ovarian cancer. The prevalence of pulp and paper manufacture was found to be highly linked with the incidence rates of ovarian cancer. Ovarian cancer risk factors include physical inactivity, obesity, talc-containing body powder used in the vaginal region, silica dust exposure, dry cleaning, telegraph and telephone work, and graphic and printing work. Women who had previously smoked cigarettes were more likely to develop cervical cancer as well as invasive and borderline mucinous ovarian tumors. Cervical dysplasia was more common in women in the highest residential benzene and diesel particulate matter (DPM) exposure categories and with high levels of home exposure to PAH. It was thought that exposure to PAHs influenced how cervical cancer developed and would strengthen the impact of high-risk human papillomavirus (HR-HPV) on cervical dysplasia. HPV infection and cervical, vaginal, and vulvar cancer have been linked in numerous studies. These comprised 62.5% of all cancer cases in the current analysis, and 76% of cervical cancer cases were found among low-income populations. Consumption of soybean milk, dietary additives, sweeteners, and preserved foods, exposure to plastics, cosmetics, and other pollutants like PM2.5, could all be risk factors for uterine leiomyoma. Endometrial cancer risk factors include obesity, diabetes, and hypertension. Due to civilization, industry, and urbanization, humans are continually exposed to endocrine-disrupting substances (EDS), which promote the growth of endometrial cancer.

ASSESSMENT OF GROUNDWATER CONTAMINATION IN COASTAL AQUIFERS IN NORTH GOA, GOA, INDIA

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ABSTRACT

Fresh water is increasingly becoming a scarce commodity. Monitoring of fresh water resources is an important aspect considering the constant stress it faces due to ever increasing anthropogenic activities.

In this study, a network of 69 wells was selected from two contiguous coastal aquifers in Pernem and Bardez Talukas, North Goa, Goa and the data obtained was used to generate a groundwater flow-net. 18 wells were selected to determine their pH, electrical conductivity, total heterotrophic bacteria and coliform count. The pH ranges from 5.9 to 9.1, 15 samples are within the BIS (2012) drinking water standards, 2 samples being below and 1 above the permissible limit. Electrical Conductivity showed a range from 72 to 897µs/cm, 16 wells are within and 2 are above the BIS (2012) drinking water standards. The presence of indicator organism Escherichia coli was detected in all the 18 samples in the presumptive and completed tests of most probable number (MPN) raising serious concerns about the potability of the water.

The wells when superimposed on a groundwater flownet, indicates the contaminated wells and the areas where these contaminants are likely to migrate. Comparative analysis of coliform count depicted higher prevalence of coliform in Pernem Taluka as compared to Bardez Taluka. The high values of total heterotrophic bacteria and presumptive coliform count in certain areas may be ascribed to the close proximity of septic tank system with groundwater as well as its flow direction in these localities, which does not filter the contaminants infiltrating through the lithology, thereby creating conditions for contaminant to percolate into the groundwater.

BASELINE PATTERN OF MICROPLASTICS, THE OMNIPRESENT POLLUTANT IN THE WATERS OF VEMBANAD KOL WETLAND OF KERALA, INDIA

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ABSTRACT

Multifunctional agrarian wetlands are contaminated with microplastics under the influence of intensive human activities and are considered to be a major sink and impacts the fragile systems. The degradation of larger plastic pieces to tiny pieces permits for extensive allocation and makes then persists in the aquatic food web. Attempts have been made to quantify the microplastic and the results showed that the fate and chemistry is directly linked and lethally affected the entire marine ecosystem. Hence the present investigation is initiated to evaluate the effect of these contaminants the identified hotspots. Here, the study is focused on the distribution microplastics in the waters of Kol wetland, a part of Vembanad Ramsar site and known the largest wetland in the south coast of India. To quantify the abundance of microplastics in the Kol wetland water, we samples were collected from monsoon season and subjected to microplastic extraction using density separation and filtration technique. The extracts were visually identified under a compound microscope and their chemical compositions were analysed using Fourier Transform Infrared (FTIR) spectroscopy. In all the examined water samples their presence were observed. Mean value of 30-70 numbers of microplastic particles in the experiment 2 liters of water were detected. Multiple types of microplastics representing fragments, films and fibers were detected. Polymers like polyethylene, polypropylene and polystyrene were conclusively identified with the analytical instrument. Filament shaped Polyethylene has been identified and is the most dominant types of polymer components in the analysed microplastics. The present investigation serve as the first baseline observation for evaluating the extent of microplastics in the water environmental matrices of Kol wetland and could extend for the effect of microplastics on aquatic biota.

CONSTITUENTS OF MAJOR XENOBIOTICS IN THE FISHERY HUB, VYPIN, KOCHI

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ABSTRACT

Estuarine contamination is a serious environmental threat which shows an increasing trend recently. Cochin estuary is one among them facing the same situation and Vypin zone is identified as one of the representative locales of the present investigation. The three surface sediment and surface water samples were taken from the Vypin area, which is an island region situated north side of the Cochin estuarine system and this fishing area is densely populated. Hence, the level of various xenobiotic constituents in the area needs to be studied and therefore analyzed. Influence of various anthropogenic activities leading to accumulation of both trace metal and various microplastic in the study site were assessed and evaluated. Analysis of trace metal in the sediment and water samples was done following the standard protocol and microplastic determination was done by density separation method. Grain size analysis was conducted by the pipette method. Total organic carbon, nutrients, chlorophyll, biochemical compositions of the sampled three surface sediment samples were analyzed in parallel following the conventional scientific method, along with microplastics and trace metals. The sediment texture in all three study samples was represented mostly by silt fraction, followed by sand and clay. A higher level of trace metals in this studied area along with various trans mended high amounts of microplastics were observed. These findings revealed to alter this vulnerable site and needs more research work to reduce the dangers of serious pollution in the whole aquatic ecosystem.

Keywords: Vypin fishing harbor, trace metals, Microplastics, Sediment and Water.

CONTINUOUS MAPPING OF RIVERINE SYSTEM IN KOCHI CITY USING MASS SPECTROMETRY

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ABSTRACT

The purity of river water is vital as it serves as a significant feeder to drinking water treatment plants for irrigation and other needs. However, one of today's most serious issues, particularly in developing nations, is river water pollution. It remains at the receiving ends of many effluent discharges, both point, and nonpoint sources. Though treated effluents are discharged, the screening studies indicate the presence of micropollutants. In the present study, the Periyar river, one of the significant rivers in Kerala that feed the entire Kochi city, is screened for the presence of micropollutants at selected sites. The study was carried out within a period of 2 years. The analysis of routine water quality parameters, ions, and organic contaminants was carried out from different sites continuously. The Total Organic Carbon (TOC) value at six sampling sites was observed to be higher than the allowed limit (< 4 mg/L). Site number 9 had the highest TOC reading (17.33 mg/L). The values of Chloride, Sodium, Potassium, Ammonia, and Magnesium ions were found to be above the allowed limits of the water quality standards. The values of basic water quality parameters were found to be within the allowed limit. The initial non-target analysis with LC-Q-ToF/MS showed the presence of 12 compounds, including mefenamic acid, metoprolol, lignocaine, and oxybenzone. To quantify their presence, target analysis was carried out. Prior to the analysis, SPE was used for the extraction, and eluents A and B were acetonitrile and water with 0.1% formic acid, respectively. Lignocaine and oxybenzone were below the quantification limit in 2018, but by 2020, their amount increased to 2.8 and 15.9 ng/L, respectively. Metoprolol concentration increased from 22.5 to 42.08 ng/L. While mefenamic acid concentration decreased from 680 to 0.78 ng/L. Currently, the number of study sites has increased, and the flow paths are identified to have more insights into the origin and occurrence of these micropollutants.

Keywords: Micro pollutants, Periyar River, (LC-Q-ToF/MS).

DISTRIBUTION PROFILE OF BIOCHEMICAL CONSTITUENTS IN THE CORE SEDIMENTS OF VYPIN, THE FISHING HARBOUR OF KOCHI

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ABSTRACT

To understand the vertical fate and characterization of sedimentary organic matter composition in the major fishing harbour of Kochi, core sediments were collected from three selected sampling stations of Vypin region (V1, V2 and V3). The Vypin area is a This zone has been experiencing extreme adverse impact mainly from the industrial hub area, the Eloor, one of the world's 'top toxic hot spots' resides along the bank of Periyar .Sediment grain size was analysed by standard pipette method, while bulk organic matter content was determined by spectrophotometric methods. The sediment texture in both study areas was represented mostly by silt fraction, followed by clay and sand content. The present study revealed higher abundance of biochemical components in the Vypin region. High PRT/CHO ratios recorded at the surface layers of both V1 and V2 indicated fresh organic matter deposition in the study area and also lower chlorophyll-a/phaeophytin ratios of both V1 and V2 unveil anoxic conditions favourable for organic matter preservation. Thus, the results suggest that core sediments in the ecosystems tended to accumulate higher proportions of sedimentary organic matter by long period. Hence the present study revealed the significance of conservation ecosystems so as to increase fishing abundance, thereby reducing the pollution status and their role in influencing sedimentation and sustainability of the fishing zones of Kerala.

ESSENTIAL MINERAL AND HEAVY METALS AVAILABILITY IN VARIOUS WATER RESOURCES OF COLD DESERT HIGH-ALTITUDE REGION OF LADAKH, INDIA

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ABSTRACT

Water is an essential for all basic physiological functions of the body. The ground and surface water availability is limited in high-altitude region, including Ladakh, India. The availability of essential mineral nutrients and heavy metals in water resources has enormous impact on the health of growing plant, human, and animals. Therefore, evaluation of water availability and quality are extremely important for sustaining agriculture and animal husbandry practices along with maintaining human health. Therefore, the present study was conducted to evaluate concentrations of various essential minerals and heavy metals in ground (hand-pump), irrigation, pond and river water of Ladakh, India using ICP-OES spectrometry methodology. The results revealed that most of the essential minerals and heavy metals level in hand pump water were within the drinkable limit, whereas hand-pump, pond, irrigation, and river water from some site/place were high in Ca, Mn, Zn, As, Cd, Fe, Pb than the permissible limit of drinking water. Therefore, these water resources, if used for more extended periods without water treatment, may pose health-related issues to humans and animals from these elements. So, this study finding will help develop specific mitigation strategies for water management for drinking and other purposes in high-altitude region of Ladakh.

PREVALENCE AND ASSESSMENT OF FLUORIDE LEVELS IN GROUNDWATER OF HINGOLI, MAHARASHTRA

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ABSTRACT

Water is vital component for life. As water is life, water parameters and quality of water is one of the challenges in today's scenario. Fluoride is one of the naturally occurring constituents of water. Fluoride is naturally occurring mineral which found in water. It often known as double edged weapon, as permissible limit is good for human's body but more than that are harmful for humans. Many health-related problems can be occurred due to high intake of fluoride dental fluorosis, skeletal fluorosis, osteoporosis, etc. Increasing concentration of fluoride levels in groundwater is one of major problem across the globe.

According to national drinking water mission's data, 20 states and 230 districts among them with 66 million peoples are endemic areas for fluoride related problems. Fluoride is often known as double aged weapon, as more than 1.5 mg/litre of fluoride is harmful for human body.

Groundwater is One of the important source of water in many parts of country. Especially in rural area, sometimes it is the only available source of water for primary use. Increasing concentration of fluoride in water due to anthropogenic and geogenic reasons is one of the international problems. Due to this, the present-day study conducted in District of Hingoli, Maharashtra. Analysis and assessment of groundwater samples for constituent of fluoride done as per the standard guidelines from world health organization (WHO) and American public health association (APHA). The results illustrate that some of water samples possess excess amount of fluoride. Present study reveals amount of fluoride from selected villages.

ADDRESSING EARLY BLOOMING IN ALMONDS UNDER NORTH-WESTERN HIMALAYAN REGION OF KASHMIR

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ABSTRACT

Almond is an important nut crop grown for its nutritious kernels. Almonds are rich source of protein, fibre, vitamin E, Omega-3 fatty acids and minerals like potassium, magnesium, phosphorus, calcium and iron. This nut crop blooms early in spring and blooming is often associated with early spring frosts. These frosts cause heavy damage to the flowers as well as discourage the activity of pollinators, leading to heavy reduction in fruit set, thereby posing serious economic loss to the growers. Late blooming almond cultivars escape early spring frosts and identification/development of late blooming almond cultivars has been an important breeding objective in this crop. To address the issue, we isolated *Flowering Locus C* (*FLC*) gene, a key gene associated with flowering, from almond cultivar Shalimar using degenerate primers. These primers amplified approximately 1 kb fragment revealing high sequence identity with *FLC* gene of *P. persica*. The coding region of the sequence (*PdFLC*) was submitted to Genbank under the accession number MG930898. This partial sequence of *FLC* gene from almond (*PdFLC*) was amplified later from several other cultivars and used for the construction of phenogram using Multalin software. The phenogram so created revealed three major groups viz. Group 1 including Primorskij, Makhdoom, Shalimar and California paper-shell; Group 2 including Pranyaj, Non-pareil and Merced; Group 3 including IXL, CITH4A, Waris and Drake. Moreover, transcriptome analysis of almond cultivars (Waris vs Ferralise) was done at flowering stage (pop corn stage of flowering) on an Illumina platform to identify the genes associated with blooming. Data processing employing pipeline: FASTQ, Trimmomatic, HISAT2, Stringtie, Stringtie merge and DESeq2 revealed prominent genes with significant up-regulation in local cultivar Waris as Ethylene Insensitive 3 while BADH acyltransferase and accelerated cell death were down-regulated.

ANTI-DIABETIC PROPERTIES OF MARINE OLIGOSACCHARIDES

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ABSTRACT

The percentage of the diabetic population is increasing worldwide and is of great concern among children, and young adults. As per the International Diabetes Atlas, on an average every single Indian adult out of 11 is diagnosed by type 2 Diabetes mellitus. The risks and medical complications arising from diabetes are some of the major factors contributing to morbidity and mortality. Decreasing the mortality rates from non- communicable diseases is one of the sustainable development goals, adopted by the United Nations member states. Cases where patients have developed resistance to the available anti- diabetic drugs have been reported. Hence, there is a need to explore more molecules and compounds with potential anti-diabetic properties. In our study, we have isolated a Gram positive bacterial strain KK1, capable of enzymatically hydrolysing complex seaweed polysaccharides viz., agar, carrageenan, pectin and xylan. This is done by the machinery of a specialized set of proteins called carbohydrate active enzymes (CAZymes). The oligosaccharide hydrolysate produced by enzymatic degradation of respective polysaccharides was used for studying the anti-diabetic potential. These oligosaccharides were partially purified by precipitating the unhydrolyzed polysaccharides using ethanol and were further concentrated. The therapeutic potential of the oligosaccharides is known to vary concerning their source (parent polysaccharide), the enzymes used for hydrolysis, the degree of polymerization, and the presence of functional groups. These oligosaccharides demonstrated higher anti alpha-glucosidase activity in comparison to that of acarbose, a standard anti-diabetic drug. Thus, further exploring and bioprospecting of the anti-diabetic seaweed based oligosaccharides will help us get a step closer towards attaining the sustainable development goals.

CHARACTERIZATION OF SEAWEED POLYSACCHARIDE DEGRADING BACTERIA AND THEIR EXPLOITATION FOR ANTI-DIABETIC ACTIVITY

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ABSTRACT

Anthropogenic activities are the foremost cause of coastal eutrophication. A global rise in temperatures has caused algal and seaweed blooms that can disrupt the marine ecosystem. The bacterial degradation of seaweed biomass and the subsequent use of degraded oligosaccharide products for applications in agriculture, food and medicine needs to be explored. Polysaccharide-degrading bacteria from marine ecosystems are one of the major sources of Carbohydrate-Active enzymes (CAZymes). These CAZymes can be further exploited for the production of bioactive oligosaccharides. Several culturable polysaccharide-degrading bacteria were isolated from the coastal water samples where seaweed growth was prominent. They were isolated on a seawater-based medium with either agar, alginate, or carrageenan as the sole carbon source. The polysaccharide degradative activity was detected by the dye-based plate assay method. The polysaccharide hydrolysis was visualized as clear zones around the colonies, on flooding the plates with Lugol's Iodine for agarolytic and carrageenolytic activity. Alginate degradation activity was detected by flooding the alginate plates with absolute ethanol. Most bacterial strains degraded more than one polysaccharide, with most of them showing agarolytic and carrageenolytic activity compared to alginolytic activity. Bacterial strain AN104 was used to hydrolyse the seaweed polysaccharide carrageenan to produce a mixture of carrageenan oligosaccharides. These oligosaccharides were partially purified by ethanol precipitation followed by concentration by rotary evaporator. The concentration of oligosaccharides was estimated by the Nelson-Somogyi method. To determine the anti-diabetic potential of the carrageenan oligosaccharides, the anti-α-glucosidase activity was determined in comparison to the standard anti-diabetic drug acarbose. Results based on the IC50 values obtained reveal that the partially purified carrageenan oligosaccharides demonstrated a potentially much higher anti-diabetic activity as compared to acarbose.

ECO-FRIENDLY APPROACH FOR DETOXIFICATION OF A HARMFUL TEXTILE DYE AND ITS PHYTOTOXIC EVALUATION

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ABSTRACT

The water is an essential resource for life on earth and for human development. The textile industry is one of the anthropogenic activity that most consume water and pollute water bodies also. The textile dyes significantly compromises the aesthetic quality of water bodies by increasing in BOD & COD, impair photosynthesis, inhibit plant growth, enter the food chain, provide recalcitrance and bioaccumulation, and may promote toxicity, mutagenicity, and carcinogenicity. Detoxification of Azo dye red 81 is selected for the present study because it is harmful if swallowed, May cause stomach discomfort, respiratory irritation, irritation to eyes, skin irritation in sensitive individuals, possible risks of irreversible effects. Particularly textile dye wastes are harmful to Agricultural and Aquatic habitat. Bioremediation is a pollution control technology that uses naturally capacity of microorganisms to break down toxic substances into non-toxic substances. The advantages of using microbes for bioremediation include; environmental friendly, their natural occurrence, ease of manipulation, high adaptive capacity, cheap production, fast growth rate, easy availability to treat large volumes of wastewater. In present study, in all total 05 dye decolorizing organisms were obtained. Out of these, DR-11 was efficient dye decolourizer and could decolorize the dye 98.00% in Nutrient broth having 10% NaCl. The potential strain was phylogenetically identified. The newly reported strain is most effective in decolourization, degradation and detoxification of Reactive Red 81 and having enormous potential of dye degradation under saline environmental conditions. The Microbial toxicity results proved that the degradation products of the dye were non-toxic to the agriculturally important microorganisms Viz. *Azotobacter spp*., *Rhizobium spp*. and *Pseudomonas spp*. The phytotoxicity study reveals that the degraded products of the dye were non-toxic to the agriculturally important plant like *Triticum sp.* (Wheat). The use of such bacterium would be Very Cost-Effective and Eco-friendly technologies to achieve Sustainable Cleaner Production.

ELEVATED CO_2 AFFECTS DNA METHYLATION PATTERN OF LOW AND HIGH ELEVATION POPULATIONS OF *ARABIDOPSIS THALIANA*

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ABSTRACT

Since the industrial revolution, atmospheric [CO_2] has risen from 280 ppm to over 410 ppm. It is expected to further rise to 550 –700 ppm by 2050 and 650 –1200 ppm by 2100, leading to global mean air temperature increase between 1.0°C to 3.7°C. Rise in atmospheric [CO_2] and temperature are imposing a great threat to the environment and in particular to plants because of their sessile nature. Understanding the molecular mechanisms of plant response to rising [CO_2] is critical for crop performance and the conservation of landscapes. However, plants responses towards rising atmospheric [CO_2] have largely been explored in genetical and morpho-physiological contexts. The epigenetic factors including DNA methylation which play critical roles in adaptation are largely unexplored. We have investigated the methylome, transcriptome and morpho-physiological responses of the two *Arabidopsis thaliana* populations evolved at high (3400 m amsl) and low elevation (700 m amsl) zones to elevated [CO_2] (e[CO_2]). We show that depending on the origin of the population, there is local level variations in DNA methylation when exposed to e[CO_2], but global methyl cytosine (mC) content remained unchanged. Further, there was loss of methylation and more protein coding genes were differentially methylated than other genomic contexts in both the populations but more so in the low elevation one. The differentially methylated genes of the two populations belong to distinct functional categories. More number of genes related to methylation machinery was down-regulated in the high elevation population than the low elevation one. Although there was no correlation between methylation and gene expression at global scale but a few genes exhibited methylation dependent expression level. Finally, we validated the gain or loss of methylation due to e[CO_2] treatment. Overall, our data suggested the two populations responded differently towards e[CO_2] with respect to methylome remodeling, phenotypic and molecular plasticity. However, methylome remodelling and molecular plasticity were more prominent in the low elevation population. Understanding the evolution of epigenetic response towards e[CO_2] may help in future crop improvement strategies.

ELUCIDATION OF MICROBIAL SIDEROPHORES IN SALT TOLERANT KORGUT RICE VARIETY OF GOA

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ABSTRACT

Siderophores have been long studied for their iron sequestration ability under iron starvation conditions. Siderophores (gk. sidero-iron, phores-carrier) are high-affinity ferric ion-specific chelators with a low molecular weight of less than 10 kda, produced by various micro-organisms like bacteria, fungi, and also by some plants. This study aims to check the gene expression responsible for siderophore production in the salt-tolerant Korgut rice plant indigenous to the state of Goa. Korgut is known for its growth in high-salinity conditions and its nutritional benefit. Various rhizospheric, as well as endophytic bacteria, have been studied to produce siderophores helping the plants in the uptake of iron for their metabolic processes. Bacterial siderophores have a higher affinity for Fe than phytosiderophores and can remove Fe from Fe^{3+}-phytosiderophore complexes. The other theory that has been suggested is that this occurs through ligand exchanges. The plant-produced siderophores (phyto-siderophores) interact with the bacterial siderophores-Fe complex, initiating the ligand exchange reaction. The plants absorb Fe via the iron-transferred Phyto-siderophores. The most common forms of siderophores are catecholates (produced by bacteria), hydroxamates (produced by both bacteria and fungi), and carboxylates (mainly produced by bacteria like *Rhizobium*, *Staphylococcus* and fungi like *Mucorales*). Some organisms produce mixed **siderophores** containing both catecholate and hydroxamate groups, such as heterobactin produced by *Rhodococcus erythropolis*. Many siderophores are small peptides synthesized by nonribosomal peptide synthetases, multimodular enzymes producing peptide products with a particular sequence without an RNA template. The expression of most proteins required for siderophore biosynthesis is regulated by a global iron-binding repressor protein called Fur (ferric uptake regulator).

ENZYMATIC HYDROLYSIS OF CASTOR OIL BY A NEWLY ISOLATED MICROBIAL STRAIN

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ABSTRACT

India is the leading producer of castor oil in the world with a market share of around 85-90%. In India approximately, 0.8 million hectares of land is devoted to the cultivation of the castor crop and around 0.7 % of the Indian farmers are engaged in castor cultivation. Castor oil consisting of 90% ricinoleic acid is a valuable industrial feedstock. Considering these facts, BASF, Arkema, Jayant Agro Organics Ltd., and Solidaridad came forward with the world's first sustainable castor bean program "PRAGATI". PRAGATI was launched in 2016 in Gujrat to ensure the uninterrupted supply of castor oil. Castor oil has diverse industrial applications due to its unique composition of fatty acids. The hydrolysis of the oil results in the production of ricinoleic acid, which can be converted into a number of valuable bio-based products. The hydrolysis of the oil could be achieved via a chemical route or biological route. The chemical route has disadvantages like the synthesis of by-products, energy squandering, and can also result in polymerization reactions. The biological route has advantages like product specificity and disposal of less harmful chemicals in the surrounding environment. The hydrolysis of castor oil via lipase from a newly isolated strain of *Aspergillus* has been presented in the study. The lipase activity obtained for 4% castor oil was around 6.68 µmol/ml/min. The concentration of ricinoleic acid and rate of hydrolysis were also determined.

EVALUATION OF METAL TOLERANCE OF HALOPHILIC EUBACTERIAL AND ARCHAEAL STRAINS ISOLATED FROM SOLAR SALTERNS OF GOA INDIA

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ABSTRACT

Marine econiche is continuously exposed to metal pollution thus enabling estuaries and solar salterns to serve as an effective sink for these metals, leading to their high accumulation through evaporation. Estuarine environments thus serve as a good source of metal tolerant microbes which also contribute towards the biogeochemical cycling of inorganic elements.In this study, the halophilic strains from solar salterns of Agarvado and Maina,Goa-India were obtained on NTYE and ZMA agar plates incorporated with 25 % crude salt. The halophilic isolates were characterized based on their Gram character; tolerance to salt, antibiotic sensitivity, response to sodium taurocholate, evaluation of the pigment extracted and also examined for the presence of glycerol diether moieties. The potential eubacterial and haloarchaeal strains were screened for their metal tolerance/resistance ability using metal salts of Cu, Ti and Ag at 0.5, 1, 1.5, 2 and 4 mM concentrations. Growth was observed by monitoring the absorbance for each of the culture for an incubation period of 5-7 days.Culture tolerating/resisting metal salt exhibited alteration in pigment intensity as well as appearance or disappearance of pigment peaks. This indicated the role of cell wall components of potential cultures in withstanding the metal ions. Further, the potential cultures can also be used in synthesis of metal nanoparticles of nanobiotechnological significance along with the bioremediation applicability in metal contaminated saline soils.

INTEGRATED FABRICATION OF A BIO-BASED COMPOSITE BY LACTIC ACID CONDENSATION WITH RICE STRAW/LIGNIN FOR MAKING SUSTAINABLE GOODS AND UTILITY ITEMS

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ABSTRACT

Rice stubble burning and its management issues are still faced every year. The advancement of polymer-based composite materials towards sustainability is exploring day by day. The chemically derived composites use precursors that are mostly derived from fossil fuel sources. Here, an approach was implemented for utilizing majorly renewable materials for making bio-based composite. A bio-composite material was fabricated by using rice straw/lignin as an intermediatory compound during the stage of catalytic condensation of lactic acid. The reaction was catalyzed by Sn/Zn (2-5%) based catalyst at a temperature range of 80-160 °C. The rice straw was mixed to interlink with the condensing structure. Biodiesel waste glycerol (5-10%) was used as an additive for increasing its flexibility toward molding into any form. Other strengthening additives such as silica, starch, and calcium were added at a certain ratio during solidification and molded in various frames to form stable and sustainable structures. This study shows the utilization of rice straw or lignin in bio-composite formation. It has potential applications for making furnishing items, automotive parts, household items, or other goods/utilities that can be an alternative for sustainably utilizing renewable resources.

METAL-ORGANICFRAMEWORK BASED ADSORBENTS FOR THE REMOVAL OF DICLOFENAC FROM SYNTHETIC WATER

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ABSTRACT

The presence of pharmaceutical and personal care products (PPCPs) in aquatic matrix highly demands newer innovations in water treatment protocol. Diclofenac (DCF), a very common non-steroidal ant- inflammatory drug with widespread occurrence is selected here as a model compound to evaluate the effectiveness of Metal Organic Frameworks (MOFs) as an adsorbent. MOFs are porous organic-inorganic materials having high specific surface area. The presence of functional groups and tunable poresize makes them an excellent material for water purification. In the present work, NH_2-MIL-101 (Al) is synthesised by a solvothermal method and characterised by SEM analysis and FTIR spectroscopy. DCF can be successfully adsorbed using NH_2-MIL-101 (Al). The effect of adsorptive conditions on DCF removal was also examined. The percentage removal of DCF was evaluated using high performance liquid chromatography (HPLC). NH_2-MOF showed above 90% adsorption capacity in all the studied pH. Adsorption at pH 4, 5 and 6 showed above 95% removal and the removal efficiency improved with increase in the weight of MOF from 42 to 98%. The adsorption efficiency in the presence of other coexisting compounds (Beta blockers) and ions (anions and cations) were also studied and they did not interfere the DCF adsorption except CO_3^{2-} and Al_3^+. From the adsorption isotherm study it is found that Langmuir model positively fit to the adsorption than Fraundlich model.

MICROPLASTIC TOXICITY: AN ANALYTICAL INSIGHT INTO DETECTION METHODS AND MYCO-DEGRADATION PATHWAYS

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ABSTRACT

Microplastics (MPs) have aroused a great deal of concern Due to their persistence in ecosystems and lack of degradability. Long-term exposure to microplastics can cause chronic toxicity, including impaired reproduction and malnutrition, threatening biota and humans. Aquatic populations that consume microplastics run the risk of choking, entanglement, and ingestion. Therefore, it is essential to develop highly efficient methods to remove MPs from the environment. In this regard, using fungi for microplastic degradation is beneficial owing to its diverse nature and effective enzymatic system. Extracellular and intracellular enzymes in fungi break down plastic polymers into monomers, producing water and carbon dioxide in aerobic environments and methane in anaerobic environments as bi-products. Further, fungi also secrete hydrophobins (surface proteins) which serve as a crucial aid in the bioremediation process by promoting substrate mobility and bioavailability. Therefore, the present review provides an insight into the mechanism and general pathway of fungal-mediated microplastic degradation. Additionally, analytical techniques for the monitoring of MPs degradation along with the roadblocks and future perspectives have been also discussed. To build an efficient and long-lasting technique for its management, more research is required to fully perceive the underlying process of microplastic biodegradation in the environment using fungus.

PHYSIOLOGICAL RESPONSE OF ECTOMYCORRHIZAL FUNGUS *PISOLITHUS* SP. ISOLATED FROM MINING SITE TO TEMPERATURE STRESS

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ABSTRACT

Ectomycorrhizal (ECM) fungi are mutualistic symbionts of majority of woody plants. They play key role in nutrient cycling, production of plant growth promoting substances and antimicrobials against plant pathogens and combating abiotic stresses. *Pisolithus,* traditionally used in textile dyeing, is a well-known ECM basidiomycete in forestry trees such as *Eucalyptus, Acacia* and *Pinus*. With stresses such as temperature, salinity and so on deciding the success of reforestation, ECM fungi have become important bioinoculants for forestry plants to thrive in harsh conditions. The aim of this study was to isolate *Pisolithus* from fruiting bodies and study the effect of temperature on axenic culture.

Young puffballs lacked distinction, having only unconsolidated peridioles while developing basidiocarps showed mosaic arrangement of unconsolidated, consolidated, young and mature peridioles exhibiting colors ranging from white, yellow to olive. Free basidiospores were contained in upper portion of mature puffball. Fully ripe basidiocarp was found to readily crumble due to discontinuous peridium. Isolate PtC1 was successfully purified from mature, intact basidiocarp and produced fuzzy, golden-yellow colony on Glucose Mineral Salt Media (GMSM) with golden-brown, extracellular, phenolic pigment.

When grown on solid and in liquid media, PtC1 was found to grow from 15 to 37 with maximum colony diameter and biomass at 25. However, at this temperature, it produced least amount of pigment. In contrast, at 15 and 37 where biomass reduced by 81% and 70% respectively, higher amounts of pigment were produced. Colonies formed at these temperatures were compact with dark hyphae in comparison with fuzzy, light golden colony at 25. Further, the slow-growing colonies of PtC1 exposed to temperature of 15 grew at normal rate upon incubation at room temperature. These observations indicate that pigmentation may be a stress response mechanism in *Pisolithus*.

UTILIZATION OF AGRO-RESIDUE IN HIGH-PERFORMANCE SUPERCAPACITORS: A BRIEF CRITICAL REVIEW

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ABSTRACT

Energy storage plays important role in achieving global energy security and sustainability. In today's world, electricity is an essential part of our lives. A variety of renewable energy sources are used to produce electricity, including wind, hydropower, solar power, biomass, and geothermal. The storage of electrical energy is very important and needed option to fulfil the requirement of energy security and sustainability. Now days, the storage of electricity is major challenge. This problem can be dealt by the use of energy storage system. There are various types of energy storage devices for electrochemical energy like batteries, fuel cell, capacitors and supercapacitor, etc. According to review of different researches based on energy density and power density, supercapacitors have highest energy density among all existing electrochemical energy storage systems. Supercapacitor is an electrochemical unit comprising of anode, cathode, electrolyte and a separator. The electrode of supercapacitor is made of activated carbon which can be made from different crop residue and waste after appropriate processing. Carbon suitable for supercapacitor should have high specific surface area as 2000-3000 m^2 /g and pore size nearly 2–5 nm. The researchers have also found that micropores (<2 nm) perform better than mesopores (2–50 nm) over the surface of electrode material in supercapacitor. Reviews state that the analyses of electrode have shown the specific energy as 1–10 Wh kg^{-1} and specific power as 500–10000 W kg^{-1}. This paper discusses about the use of agro biomass for making the base material for formation of effective electrode for use in supercapacitors.

CARABID BEETLES (COLEOPTERA: CARABIDAE) IN THE RICE AGRO-ECOSYSTEM OF KERALA

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ABSTRACT

Carabid beetles (Ground beetles) are abundant and normally live on the soil surface and inhabit almost all terrestrial habitats. They are active predators of insects and weed seeds hence they are considered as good biological control agents in agricultural ecosystems. Carabid beetles have bioindicator value, as they are sensitive to toxic substances (pesticides, herbicides and industrial fertilizers), agricultural practices (fragmentation and land management) and changes in the biotic factors of the environment. Studies in south-east Asian rice agro-ecosystems have established that Carabid beetles predate on many rice insect pests and maintain an equilibrium by regulating their number, acting as a keystone taxon in the rice agro-ecosystem. However, there is no comprehensive data about the Carabid beetles associated with the rice agro-ecosystem from Indian subcontinent and the major reason being the difficulty with the taxonomic verification of the family. The present study provides data about the species composition and abundance of Carabid community in a rice agro-ecosystem in Kerala. Fourty-four Carabid species belonging to eleven subfamilies were recorded and verified. The data will be useful to identify the Carabidae species in the rice agro-ecosystems and to understand their importance as a dominant predator in rice agro-ecosystems.

EDIBLE FILM PACKAGING-A NOVEL APPROACH IN FOOD PACKAGING

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ABSTRACT

India generated 3.3 million metric tons of plastic waste in 2018, according to a study made by the Central Pollution Control Board. Around 43% of manufactured plastics are used for packaging purpose. Huge amount of energy is required to degrade and recycle the food packaging.The main goal of food packaging is to provide a practical means of protecting and delivering food goods. Single-use food packaging takes a huge toll on our environment. The convenience of food packaging is outweighed by the waste and pollution that the packaging leaves behind. Most plastics do not biodegrade.Hence, there comes an urgent need to develop the edible packing and films. An edible film is defined as a thin layer, which can be consumed, coated on a food or placed as a barrier between the food and the surrounding environment.The main functions of this type of packaging are edibility and biodegradability. These natural films and coating are extracted from plants and animals in the form of polysaccharides, lipids, and proteins. The principle components for producing edible/biodegradable films are film forming biopolymers which includes the carbohydrates, proteins, solubilizing medium and plasticizers, etc.

On the other side, animals and humans are ingesting microplastic particles, via the food we eat and the water we drink.Thus edible film can both act as a barrier and protection, while enhancing quality and safety of food products. In the recent advances in edible film packaging bioactive peptides can play an important role, since they can fundamentally inhibit the growth of microorganisms by destroying their cell membrane. Edible films based on fruits and vegetables with novel health-promoting functionalities may also be developed, such as probiotic or prebiotic films, increasing their market appeal as healthy food components with desirable sensory properties.

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EFFECT OF NATURAL ANTI-BROWNING AGENTS IN AVOIDING BROWNING OF APPLE SLICES DURING INFRARED DRYING

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ABSTRACT

Apple is one of the most important fruit for a person's nutrition and vastly cultivated around the globe. The high moisture content makes them more susceptible to storage and transport. Hence, novel drying technology infrared drying is the energy efficient method and eco-friendly, adopted to avoid these losses. In apples polyphenol oxidase (PPO) causes enzymatic browning. It is well documented that the sample pre-treatment before drying can reduce various adverse phenotypic changes resulting from enzymatic reactions by inactivating the enzymes. Also, pre-treatment speeds up moisture evaporation and improves the color and texture of finished product to a large extent. Normally chemicals like KMS, ascorbic acid, cysteine, calcium salts used earlier but they affect the health of human beings. Hence, naturally available anti-browning agents like turmeric, honey and salt were used to prevent browning in apple slices before drying. The apple slices were soaked for 5, 10 and 15 min in naturally available anti-browning agents of three concentrations. The L, a and b values used to calculate browning index (BI) of pre-treated, infrared dried apple slices. The L value of turmeric water-soaked apple slices decreased as concentration increased and decreased with an increase in soaking time, a and b values increased as concentration and soaking time increased. In honey-treated apple slices, L value increased with concentration and decreased as soaking time increased, a and b values decreased as increased in concentrations and soaking time. Salt-treated apple slices shows increased L value and decreased a and b value with concentration and soaking time. The BI of control sample is 132.33 and turmeric, honey and salt treated slices ranged from 58.95 to 130, 50.60 to 34.39 and 28.53 to 46.53, respectively. The selected anti-browning agents were effective in controlling the enzymatic browning along with maintaining the quality properties of dehydrated apple chips.

HYDROGEN STORAGE CHARACTERISTICS OF HIERARCHICAL CARBON DERIVED FROM BIOMASS USING THERMOCHEMICAL TREATMENT

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ABSTRACT

An ever-increasing demand for hydrogen fuel has been a challenge for today's scientific workers. Production, transportation and hydrogen storage are the major challenges associated with H2 fuel. Hydrogen fuel can be stored using different storage methods which have merits and demerits. Among all the storage methods i.e. pressurized gas, liquid nitrogen at cryogenic temperature, chemical method storage in metal hydride, storage of H2 on carbon material is the safest and most reliable method. Many researchers utilize hierarchical carbon for electrical energy storage. Various literature reveal that carbon material for H2 storage is an emerging technology. Hierarchical carbon having modified 3-dimensional structure and multimodal pore is prepared from different chemically or catalytically activation process. The output may reach up to the surface area of 1250-4000 m^2/g and pore volume of 1.5 to 6 cm^3/g. This level of surface area and pore volume show high potential for H_2 storage on carbon material. The percentage of hydrogen storage linearly increases with an increase in surface area. The H_2 storage on carbon having cellulose, hemicellulose and lignin ranges from 2.3 to 7.58 %wt. at 77K temperature and pressure of 10 Mpa. However, the variation in H_2 storage capability was observed when biomass was varied. Hydrogen storage on carbon is one of the prominent technologies for overcoming the challenges associated with the storage and transportation of H_2.

MANAGEMENT OF JACKFRUIT STEM BORER, *BATOCERA RUFOMACULATA* DE GEER (CERAMBYCIDAE: COLEOPTERA)

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ABSTRACT

The jackfruit is native to the rain forests of the Western Ghats of India and is cultivated throughout South and Southeast Asia, central and eastern Africa and Brazil. The study was conducted on effectiveness of different management practices of the trunk borer infestation in jackfruit garden, Tamaka, Kolar, Karnataka, India. The chemical and non-chemical treatments were imposed against jack stem borer infestation during 2017-2018 and 2018-2019. Sixty-five infested jack trees were selected and each treatment was applied for three infested trees. The observations on treatment effect were recorded at 15 days intervals from the date of treatments imposition. The efficacy of different treatments were grouped into four classes (I, II, III and IV) to represent the state of larval activity, with corresponding values (v) of 3, 2, 1 and 0 to calculate the degree of control (Sheng-ying *et al*., 2009). Results from two years field experiment revealed that the jack stem borer can be effectively managed by placing the aluminium phosphide tablet (one tablet/ hole)+ sealed hole with Bordeaux paste ensured cent percent control of infestation. The next best management treatments are injection with DDVP @ 5ml/l+ sealed hole with Bordeaux paste (86.66%) and injection with Chlorantraniliprole @ 2ml/l+ sealed hole with Bordeaux paste (73.33%) followed by cent percent damage recovery and death of the tree noticed in untreated control.

EFFECT OF IRON AND ZINC OXIDE NANOPARTICLES SYNTHESIZED VIA GREEN ROUTE ON GRAPES: AN ECOFRIENDLY APPROACH

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ABSTRACT

For the past few decades, extensive research efforts have been made towards the preparation of cost-effective and eco-friendly nanostructured materials in the research fields of nanotechnology, a propitious branch of science that has received major success in the era of modern technology. Considering this, nanoparticles of iron and zinc were fabricated through novel green route. The obtained products (assumed as Fe-NPs and Zn-NPs) were subsequently characterized by Fourier Transform Infrared Spectroscopy, UV-vis spectra, Scanning Electron Microscopy and Particle Size Analysis techniques. The LCMS/MS was per-formed for the identification of biomolecules present in the grape pomace extract for formulating Fe-NPs and Zn-NPs. The morphology of Fe-NPs was monitored by SEM analysis and the particles were found in agglomerated form whereas the morphology of Zn-NPs was mostly spherical/agglomerated in shape.

To assess the impact of nanoparticles on grapes, field experiments were conducted. A significant increase in leaf Fe (+30.28% and +36.59%) and Zn content (+20.90% and +28.39%) was recorded after 14 and 28 days of application of Fe-NPs and Zn-NPs over conventional fertilizers in field studies. These findings suggested that Fe and Zn NPs have potential applications and could be used as a promising candidate for enhancing micronutrient content.

THERMAL DEGRADATION KINETICS OF PIGEON PEA STALK

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ABSTRACT

This study concentrates on pyrolytic kinetics and thermodynamics of intrinsic pseudo components of biomaterial. Thermogravimetric analyser was employed to investigate the thermal behaviour of pigeon pea stalk with four various heating rate (10, 20, 30 and 40 /min). Gaussian deconvolution function was used to resolve the individual spectrum of first derivative of conversion profile into three pseudo components (hemicellulose, cellulose and lignin). The Flynn-Wal-Ozawa (FWO), isoconversional method was used to estimate the pyrolytic kinetics of pseudo components. The activation energy for hemicellulose was computed high as 252-332 kJ/mol; whereas, for cellulose 128-145 kJ/mol and lignin 35-51 kJ/mol; for specific conversion level (0.1 - 0.9). The hemicellulosic conversion level α_H = 0.8 showed highest activation energy as 332 kJ/mol. Also, the thermodynamic parameters; change in enthalpy (ΔH), Gibb's free energy (ΔG) and entropy (ΔS) for pseudo hemicellulose (ΔH = 278 kJ/mol, ΔG = 178 kJ/mol, ΔS = 169 J/mol), pseudo cellulose (ΔH = 133 kJ/mol, ΔG = 179 kJ/mol, ΔS = -76 J/mol) and pseudo lignin (ΔH = 36 kJ/mol, ΔG = 232 kJ/mol, ΔS = -260 J/mol) were calculated. Presented article is an in-depth investigation to understand thermal degradation behaviour of pigeon pea stalk to obtain useful products.

ENVIRONMENTAL STRESS CONTRIBUTES TO AGE-RELATED HORMONAL DISFUNCTION: POLYAMINES CAN CURTAIL NEURODEGENERATION, MAINTAINING FUNCTIONAL INTEGRITY OF NEUROENDOCRINE SYSTEM

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ABSTRACT

INTRODUCTION- Aging pathologies are greatly influenced by environmental stressors. Exposure to pesticides and environmental toxins are reported to contribute to neurodegeneration associated with both normal brain ageing and neurodegenerative disease. One of the inherent pathological features of aging evident very early on is the decline in reproductive function. Gonadotropin-releasing hormone (GnRH) is the master regulator of reproductive function. Polyamines are essential biomolecules that act in concert with neuroendocrine system. Previous studies have described protective functions of polyamines against diverse stresses. Polyamines act as reactive oxygen species (ROS) ROS scavenger, acid tolerance factor and chemical chaperone, and positive regulators for expression of stress response genes as well as modulator of neurohormones.

AIM- In the present study we investigated the protein and mRNA levels of polyamine and their corresponding biosynthetic enzymes such as ornithine decarboxylase (ODC), spermidine synthase (SRM) and spermine synthase (SMS) in the hypothalamus of female mice during ageing. Further we looked at the effect of polyamine on GnRH-I in presence/ absence of two important metabolic markers of ageing (which increase in response to environmental stress), TNF-α and lactate, through in vitro approach using GT1-7 neuronal cells.

KEY FINDINGS- Immunofluorescence study revealed that the expression of ODC1, SPM and SPD were relatively low to moderate in young and young adult hypothalamus; with a rise in intensity of expression in mature adult hypothalamus and then sharply declining in old hypothalamus. This pattern was almost similar to the expression of hypothalamic GnRH-I. TNF-α and lactate decreased hypothalamic GnRH I mRNA expression in GT 1-7 cells when treated for 24 hours. Polyamines, putrescine and agmatine, contrarily increased GnRH I mRNA expression significantly when treated alone for 24 hours to GT 1-7 cells. Also, polyamines increased GnRH I mRNA expression when treated in presence of TNF-α and lactate for 24 hours.

VERMICOMPOST INFLUENCING THE AGRICULTURAL YIELD & QUALITY

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ABSTRACT

Vermicompost is a nutrient-rich, microbiological-active organic amendment that the interactions between earthworms and microorganisms during the breakdown of organic matter. It stabilized to divided peat-like material with a low C: N ratio, high porosity and high water holding capacity is the most nutrients are present in form to the plants. The agroforestry species produce huge amount of biomass and recycling of biomass by vermicomposting and other incorporation in soil by means of residue management practices for improvement of soil fertility. It prevents nutrient losses and increases the use efficiency of chemical fertilizers and it is free from pathogens, toxic elements, weed, seeds etc. it is necessary to monitor the temperatures of large-scale bin systems (high heat-retentive properties) as the raw materials or feedstocks used can compost and heating up the worm bins as they decay and killing the worms and the temperatures between 15-25^{O}C (59-77^{O}F). They can survive at 10^{O}C (50^{O}F) and above 30^{O}C may harm them. The important of the agricultural sustainability for the future of the national economy and the Vermicompost is very valuable resource as organic fertilizers because it provides macro and micronutrients for plants and is a low cost, environmentally- friendly, invaluable alternative to chemical fertilizers. Earthworms have the potential to reduce the retention of pollutant and plant essential metals in the organic horizons by decomposing organic matter.

EFFECT OF DOPANTS (CE AND N) ON PHOTOCATALYTIC EFFICIENCY OF TIO_2 FOR DEGRADATION OF DICHLORVOS

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ABSTRACT

Dichlorvos (DHV) is a Class Ib (highly hazardous) insecticide, commonly used in developing countries, which is very harmful to aquatic organisms especially fish as it causes damage to the metabolism of the organism, which leads to their death. Therefore, this work is focused on the DHV degradation with Ce and N co-doped TiO_2 photocatalysts. Ce and N co-doped TiO_2 photocatalysts were prepared through sol-gel route by varying concentration of both Ce and N. The presence of CeO_2 cubic structure and rutile phase along with anatase phase was observed in the XRD pattern of all the co-doped samples. A significant reduction in surface area and pore volume has resulted due to Ce and N co-doping. UV-Vis DRS spectra exhibited a red-shift in the absorption edge due to synergistic effect of Ce and N dopants. The band gap values of co-doped samples are closer to nitrogen doped samples with lowest value of 2.27 eV. The XPS study proved the co-existence of Ce^{4+}/Ce^{3+} *via* forming Ti-O-Ce type linkage. The formation of O-Ti-N bond linkage by N atom has been confirmed by FTIR and XPS results.

The photocatalytic performances of Ce and N doped and co-doped TiO_2 were investigated by conducting degradation experiments (under optimized conditions) of DHV in aqueous solutions. The results confirmed that photocatalytic activities of Ce-N-co-doped TiO_2 were higher for degradation of DHV as compared to pure and Ce or N singly doped TiO_2. This suggests that the presence of both the dopants (Ce and N) synergistically enhance the photocatalytic activity of co-doped TiO_2.

A STUDY ON CHEMICAL AND STRUCTURAL CHANGES OF MICROPLASTICS INDUCED BY ADVANCED OXIDATION PROCESSES

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ABSTRACT

Microplastics have gained global attention in recent years due to its increased prevalence in the body of living organisms including human beings and its possible ecological and toxicological impacts. Considering source reduction and clean up as the methods of MP pollution control, many physical, chemical and biological strategies have been progressively experimenting. Advanced oxidation process including photocatalysis, ozonation, electro-fenton and anodic oxidation is widely look over for its efficiency in degrading synthetic polymer particles leading to its mineralization. The present study investigated the efficiency of ozone in degrading virgin and processed polypropylene (PP) particles. Particles of size range 150 to 300 µm were dispersed in aquadest and subjected to ozonation under ambient temperature and pressure conditions with variable pH and reaction time. The experiment was conducted in a semi-batch reactor with varied pH conditions of 3, 5, 7, 9,11 and contact duration of 1, 2 and 3 hours. The extend of degradation was estimated by evaluating the gravimetric weight loss of the particles, COD analysis of solution, quantification of hydroxyl radicals and chemical structural changes of MP using Fourier Tranform Infrared (FTIR) spectroscopy. Further analysis using SEM and XRD will be carried out to observe the morphological and structural changes of microplastics up on degradation.

DEVELOPMENT OF AN ULTRASENSITIVE LUMINESCENT PAPER BIOSENSOR FOR QUANTIFICATION OF ARSENIC AND CADMIUM HEAVY METAL CONTAMINATION IN DRINKING WATER AND SEA FOOD

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ABSTRACT

Most of the Indian states are affected with heavy metal contamination mainly from mining, industrial effluents, improper industrial waste management and limited public awareness. In India, most of the rivers, estuaries and sea shores close to metropolitan cities are heavily contaminated. The effective way to reduce risks on common peoples is continuous monitoring of toxic metals in potable water or in the water body from where the sea food is regularly harvested or in the sea-food itself. Standard laboratory-based traditional analytical methods such as atomic absorption spectrometry (AAS) and atomic fluorescence spectrometry, inductively coupled plasma (ICP) are in practice for toxic metal quantification, but those traditional methods require expensive and bulky laboratory equipment, analytical expertise, sample transportation and pre-treatment.

Several research works have been reported for detection of heavy metal in drinking water and food utilizing chemically synthesized probe, engineered whole bacterial cell and genetically encoded probe. In most cases fluorescence probe was used which need light source, bleached easily, unstable, narrow detection limit and also require advanced instruments. Luminescence based sensor has capability to overcome with this problem. Here, I am developing low cost, ultra-sensitive, easy-to-implement and disposable heavy metal paper-based bioluminescence device using a brightest and smallest luminescent protein Nanoluc and the bacterial arsenic and cadmium metal regulatory trans protein and cis-factor. I am developing Nanoluc-trans factor recombinant proteins and immobilize oligomer cis-element on nitrocellulose paper. This sensor will be an intensiometric sensor, work with long pH range, independent to light excitation and capable to store at low temperature for long durability and cheaper.

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IMPACT ASSESSMENT OF KOTA STONE MINE SPOIL ON THE GROUNDWATER QUALITY IN THE REGIONS OF SOUTH-EASTERN, RAJASTHAN

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ABSTRACT

Mining leads to the land degradation by stacking of mine waste, loss of top fertile soil and vegetation covers, abstraction and deterioration of natural drainage system, cutting of forest, groundwater depletion, and loss of plant and aquatic biodiversity and public health. A study has been conducted for assessing the impact of Kota stone mine on the groundwater quality**.** The groundwater quality parameters of 34 hand pumps used for drinking were analysed. The Fluoride (F) content in the groundwater were found to be ranged from 0.37-9.05 mg l^{-1}, and nearly 86.84 and 92.10% of the groundwater samples had F content higher than that of maximum desirable limit (WHO, 2017) and acceptable limit (BIS, 2012), respectively for drinking water (1.5 mg l^{-1}). The consumption of water having F^- content higher than 1.5 mg l^{-1} usually causes dental fluorosis in both the children and adults. The TDS content in groundwater varies between 104 and 2240 mg l^{-1}, and 47.05% of the groundwater samples had TDS higher than 500 mg l^{-1}, which is not suitable for drinking purposes as per WHO and BIS. A similar trend as the TDS is recorded for the iron (Fe^{2+}) content, 41.17% of samples were higher than 0.3 mg l^{-1} as per WHO and BIS limit for drinking water (> 0.3 mg l^{-1}). Toxicity due to high concentration of the Fe in drinking water causes human health related hazards like hemochromatosis which results in organ damage, liver cirrhosis, hepatocellular carcinomas, fatigue, joint pain and hemosiderosis. The nitrate (NO_3^-) content in 20.58% groundwater samples was found to be higher than 50 mg l^{-1} as per WHO limit for drinking water. Consuming water having the NO_3^- content higher than 50 mg l^{-1} may cause methemoglobinemia in the infants. In addition, the pH and the potassium content of Kota stone slurry were recorded 9.08 and 42 mg l^{-1}, respectively, which indicated the Kota stone slurry, is alkaline in nature and rich in the potassium. Results of analysis suggest that the Kota stone slurry could be utilized for reclamation of the acidic soils and also a suitable substitute for potassium fertilizer for the crop production in the region.

ESSENTIAL MINERAL AND HEAVY METALS AVAILABILITY IN VARIOUS WATER RESOURCES OF COLD DESERT HIGH-ALTITUDE REGION OF LADAKH, INDIA

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ABSTRACT

Water is an essential for all basic physiological functions of the body. The ground and surface water availability is limited in high-altitude region, including Ladakh, India. The availability of essential mineral nutrients and heavy metals in water resources has enormous impact on the health of growing plant, human, and animals. Therefore, evaluation of water availability and quality are extremely important for sustaining agriculture and animal husbandry practices along with maintaining human health. Therefore, the present study was conducted to evaluate concentrations of various essential minerals and heavy metals in ground (hand-pump), irrigation, pond and river water of Ladakh, India using ICP-OES spectrometry methodology. The results revealed that most of the essential minerals and heavy metals level in hand pump water were within the drinkable limit, whereas hand-pump, pond, irrigation, and river water from some site/place were high in Ca, Mn, Zn, As, Cd, Fe, Pb than the permissible limit of drinking water. Therefore, these water resources, if used for more extended periods without water treatment, may pose health-related issues to humans and animals from these elements. So, this study finding will help develop specific mitigation strategies for water management for drinking and other purposes in high-altitude region of Ladakh.

IDENTIFICATION AND QUANTIFICATION OF COMPATIBLE SOLUTE FROM HYPERSALINE BACTERIA

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ABSTRACT

Bacterial cultures 24 were isolated from a crystal of salt from salterns of Goa. These bacterial cultures grew in a media with 20% of crude salt. The mechanism of survival in this physiochemical condition is attributed to the production of compatible solute by synthesizing de novo or by accumulating it. These bacteria produce "compatible solutes" are high salinity or/and above 220 psu. These cultures showed production of different kinds of compatible solutes in a different concentration under the same conditions. High performance liquid chromatography (HPLC) used for determination of individual 17 Amino acids shown the production of betaine hydrochloride, glutamic acid, glutamate, alanine, lysine, phenylalanine, arginine.

EVALUATION OF METAL TOLERANCE OF HALOPHILIC EUBACTERIAL AND ARCHAEAL STRAINS ISOLATED FROM SOLAR SALTERNS OF GOA INDIA

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ABSTRACT

Marine econiche is continuously exposed to metal pollution thus enabling estuaries and solar salterns to serve as an effective sink for these metals, leading to their high accumulation through evaporation. Estuarine environments thus serve as a good source of metal tolerant microbes which also contribute towards the biogeochemical cycling of inorganic elements.In this study, the halophilic strains from solar salterns of Agarvado and Maina,Goa-India were obtained on NTYE and ZMA agar plates incorporated with 25 % crude salt. The halophilic isolates were characterized based on their Gram character; tolerance to salt, antibiotic sensitivity, response to sodium taurocholate and evaluation of the pigment extracted. The potential eubacterial and haloarchaeal strains were screened for their metal tolerance/resistance ability using metal salts of Cu, Ni and Ag at 0.5, 1, 1.5, 2 and 4 mM concentrations. Tolerance of halophilic isolates to metal salts was observed by monitoring the growth for each of the culture on NTYE plates amended with the respective metal salts for an incubation period of 5-7 days. Growth and effect on pigment production of halophilic isolates in NTYE meduim in absence and presence of 1 mM concentration of different metal ions was also analyzed .Culture tolerating/resisting metal salt exhibited alteration in pigment production. This indicated the role of cell wall components of potential cultures in withstanding the metal ions showing metal tolerance in halophilic cultures isolated from solar salterns. Further, the potential cultures can also be used in synthesis of metal nanoparticles of nanobiotechnological significance along with the bioremediation applicability in metal contaminated saline soils.

ASSESSMENT OF MICROPLASTICS IN COASTAL AND ESTUARINE SITES OF GOA

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ABSTRACT

Around 275 million metric tons of plastic waste are produced annually, of which more than 4% leak into oceans. This causes devastating effects not only on human livelihood but the entire ecosystems. Around 80% of all plastic is either in landfills or the natural environment, 9% is recycled, and 12% is incinerated1. The secondary weathering of plastics releases lightweight microplastics (<5mm), which the winds can carry far-off distances. Goa is one of the most loved tourist destinations worldwide, has many water sports and beach activities, and is one of the important places for seafood. It has a 120 km coastline. Due to fishing and tourism activities, Goa's famous beaches have been littered a lot. Thus, a study was undertaken to check the presence and abundance of microplastics in surface waters and sediments collected from selected coastal and estuarine areas. Odxell and Baga were the coastal areas, whereas Mandovi and Chapora were the estuarine sites. The number of microplastic particles ranged from 0 to 562 in 1 kg of sediment or 1 L of water sample. The total weight of these microplastics particles isolated from the above sites varied from 3.1 mg to 83.9 mg. On the basis of colour, shape, thickness and transparency, the isolated microplastics were categorized into different categories and were assessed using Fourier Transform Infra-red (FTIR) and Raman spectroscopy. The particles were identified as polyethylene, polypropylene, polystyrene, nylon and polyethylene-polypropylene copolymers based on their similarity with the standard polymers in the online database. Sediment samples consisted of more microplastics than water, as the waves deposit microplastic particles at the tideline.

GREEN SYNTHESIS OF SILVER NANOPARTICLES AND THEIR ANTIBACTERIAL ACTIVITY

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ABSTRACT

Nanoparticles (NPs) have unique physico-chemical properties like high electrical and thermal conductivity, chemical stability, catalytic and biological activity, which make them potentially useful in industrial and biomedical applications. Physical, chemical, and biological methods are used to synthesize NPs. Due to its simplicity, low cost, and lack of organic solvents, biogenic production of NPs has drawn the most interest of all the techniques. In the biological synthesis of NPs, bacteria, fungi, algae and plant extract are generally used. In the present investigation, synthesis of silver nanoparticles (AgNPs) is examined using dried biomass of a green alga, Asterarcys sp. The bioactive molecules of alga, act as both reducing and stabilizing agents. Change in the colour from yellow to reddish brown is the first indicator of synthesized AgNPs. The synthesized NPs were then thoroughly characterised using UV-Vis spectroscopy, X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FT-IR), Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM).

Results: UV-Visible spectroscopic analysis based on a absorption pattern at 430 nm, confirm the synthesis of AgNPs. The crystalline character of AgNPs and the phyco-molecules involved in their synthesis were both confirmed by XRD and FTIR respectively. The synthesized AgNPs found to have antibacterial activity, which is measured using agar well diffusion techniques. Both gram-positive bacteria (Staphylococcus aureus, Bacillus subtills) and gram-negative bacteria (Klebsiella pneumoniae, Proteus vulgaris) shows considerable slowdown in their growth after treatment with AgNPs.

Conclusions: The green alga Asterarcys sp. found to be a good source for green-synthesis of AgNPs with later having antimicrobial properties.

Keywords: Green synthesis, Green algae, Reducing agent, Stabilizing agent, Silver nanoparticles, Antimicrobial activity

RHYTHMIC EXPRESSION OF LNCRNAS AND ITS FUNCTION IN FLORAL DEVELOPMENT AND THE CIRCADIAN CLOCK

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ABSTRACT

The circadian clock is regulated by signaling networks that enhance a plant's ability to coordinate internal events with the external environment. In this study, I examined the rhythmic expression of long non-coding RNAs (lncRNAs) using multiple transcriptomes of *Arabidopsis thaliana* in the diel light cycle and integrated this information to have a better understanding of the functions of lncRNAs in regulating the circadian clock. I identified lncRNA at the different light conditions and they showed rhythmic change in expression. In addition, we identified enriched motifs in lncRNA transcribing regions associated with light-responsive genes, flower development, and circadian clock under all three light conditions. We identified different lncRNAs targeting different miRNAs with perfect and interrupted complementarity (endogenous target mimic). These predicted lncRNA-interacting miRNAs govern the function of a set of genes involved in the developmental process, reproductive structure development, gene silencing and transcription regulation. The lncRNA transcribing regions were enriched for epigenetic marks such as H3.3, H3K4me2, H3K4me3, H4K16ac, H3K36ac, H3K56ac and depleted for heterochromatic (H3K9me2 and H3K27me1) and repressive (H3K27me3) histone modifications. My study showed that lncRNAs corresponding to the diel light cycle are implicated in regulating the circadian rhythm and governing the developmental stage-specific growth.

HYPTIS SUAVEOLENS INHIBITS GROWTH OF CO-OCCURRING PLANT SPECIES THROUGH ALLELOPATHIC INTERFERENCE

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ABSTRACT

Hyptis suaveolens (L.) Poit. is an annual plant of family Lamiaceae, which is native to tropical America, and is invasive in different tropical and sub-tropical regions of the world, including India. The plant negatively impacts the native plant communities by forming dense thickets/monocultures and replacing the native vegetation. The plant employs mechanism of allelopathic interference for inhibiting growth of co-occurring plant communities by release of allelochemicals in the environment. A study was therefore conducted where seeds of different co-occurring species with *H. suaveolens* were sown in the soil collected from the areas invaded by this weed. The seeds were also sown in pots with garden soil as a control treatment. The possible role of allelochemicals on the growth of plant seedlings was assessed through measurements of various morphological and physiological parameters, like root length (cm), shoot length (cm), root and shoot fresh weight (g), root and shoot dry weight (g), total chlorophyll and total carotenoid content (µg/mg dry weight), and photosynthetic efficiency, for 15 and 30 days after sowing. The results revealed significant effect of treatment and treatment days (15 and 30 days) on the co-occurring plant species. All the test plants sown in soil collected from *H. suaveolens* invaded areas showed significant decline in growth parameters compared to control. Further, the effect was also noticed to be species-specific. This study highlighted the negative impact of allelochemicals contributed by *H. suaveolens* on the co-occurring plant species. The study thus concludes that allelopathy is definitely a major driver of invasion success of *H. suaveolens* in the introduced regions.

METHANE ENHANCEMENT USING NANO-TECHNOLOGICAL INTERVENTIONS

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ABSTRACT

The biogas containing 55%-65% methane can be generated from wet biomass using bio-methanation process. This biogas also contains CO_2 (35%-45 %), water vapour, Sulphur, etc., which are detrimental for energy capability of biogas. There is need to remove impurities from biogas to the maximum extent possible to make the biomass based bio-methane for operating the engines to generate the shaft power. Thus, the high energy density can be obtained by removing the impurities and inert gaseous constituents from biogas. The high level pure methane is needed to have blue flame for thermal applications and also to operate electricity gen-sets.

The cleaning and enrichment of biogas is called biogas upgradation which is facing challenges in term of operating costs and energy consumption. The various studies are available in India & other countries related to use of nano technological interventions for enrichment of biogas. The uses of nano iron and Fe-based nano-materials as catalysis for biogas purification have been researched. Iron oxide nano-particle having size 7 nm at 70-80 ppm quantity added in bio digester of a portable food-waste digester improved the quantity as well as quality of biogas production. The production rate may also increase and as it will reduce CO_2 to form CH_4.The micro/nanoscale Fe_2O_3material powders have become the most promising as practical next-generation materials for methane enhancement. The carbon containing molecules can be removed using the nano catalysts. The mechanism may be the different with different catalytic materials. The mechanism of carbon species removal by trapping CO_2 over bimetallic Fe–Ni is different from that over a monometallic Ni catalyst. Nano-particles can play very effective role in methane enrichment for biogas producers to create better fuel. Nano interventions can manipulate the energy and fuel generation from wet biomass in effective manner.

NEXT GENERATION SEQUENCING: TYPES AND APPLICATIONS

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ABSTRACT

The world has entered a new genomics era with advancements in next-generation high-throughput sequencing technologies. NGS technologies have progressive advantages in terms of cost-effectiveness, unprecedented sequencing speed, high resolution, and accuracy in genomic analyses over other alternative techniques. In modern biological sciences, NGS sequencing has been extensively used for applications such as whole genome sequencing, target sequencing, gene expression profiling, chromatin immunoprecipitation sequencing, metagenomics variants/mutations detection and small RNA sequencing. This revolutionized modern science and accelerated biological and biomedical research. In my poster, I will compile the different types of available sequencing platform, their advantage and disadvantage, their application in various areas of science, including environmental, agriculture, forensic and, biomedical research, etc.

PHYSIOLOGICAL RESPONSE OF ECTOMYCORRHIZAL FUNGUS *PISOLITHUS* SP. ISOLATED FROM MINING SITE TO TEMPERATURE STRESS

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ABSTRACT

Ectomycorrhizal (ECM) fungi are mutualistic symbionts of majority of woody plants. They play key role in nutrient cycling, production of plant growth promoting substances and antimicrobials against plant pathogens and combating abiotic stresses. *Pisolithus*, traditionally used in textile dyeing, is a well-known ECM basidiomycete in forestry trees such as *Eucalyptus, Acacia* and *Pinus*. With stresses such as temperature, salinity and so on deciding the success of reforestation, ECM fungi have become important bioinoculants for forestry plants to thrive in harsh conditions. The aim of this study was to isolate *Pisolithus* from fruiting bodies and study the effect of temperature on axenic culture.

Young puffballs lacked distinction, having only unconsolidated peridioles while developing basidiocarps showed mosaic arrangement of unconsolidated, consolidated, young and mature peridioles exhibiting colors ranging from white, yellow to olive. Free basidiospores were contained in upper portion of mature puffball. Fully ripe basidiocarp was found to readily crumble due to discontinuous peridium. Isolate PtC1 was successfully purified from mature, intact basidiocarp and produced fuzzy, golden-yellow colony on Glucose Mineral Salt Media (GMSM) with golden-brown, extracellular, phenolic pigment.

When grown on solid and in liquid media, PtC1 was found to grow from 15^{O} to 37^{O} with maximum colony diameter and biomass at 25^{O}. However, at this temperature, it produced least amount of pigment. In contrast, at 15^{O} and 37^{O} where biomass reduced by 81% and 70% respectively, higher amounts of pigment were produced. Colonies formed at these temperatures were compact with dark hyphae in comparison with fuzzy, light golden colony at 25^{O}. Further, the slow-growing colonies of PtC1 exposed to temperature of 15^{O} grew at normal rate upon incubation at room temperature. These observations indicate that pigmentation may be a stress response mechanism in *Pisolithus*.

POTENTIAL OF YEASTS OBTAINED FROM MANGROVES IN GOA FOR L-ASPARAGINASE PRODUCTION

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ABSTRACT

Mangrove, an important tropical ecosystem rich in diversity needs to be scientifically explored before its resources deplete, as it is most susceptible to damage by the current climate changes and human activities. Mangroves have ample carbon resources that assist microbial growth supporting diverse microbial communities including Yeast, a eukaryotic unicellular fungus. Yeasts are prominent part of fermentation industry preferably due to their fast cell growth and ability to produce recombinant products. L-asparagine amidohydrolase a clinically significant enzyme catalyzes conversion of L-asparagine to aspartic acid and ammonia. It is a widely studied enzyme for its anti-cancer activity towards Acute Lymphoblastic Leukemia (ALL) and Hodgkin's Lymphoma. Commercially L-asparaginase is obtained from bacterial sources and it is observed to cause unfavorable effects. At present an enzyme of eukaryotic origin with less adverse effects is a necessity for anti-cancer treatments. Yeasts are equipped to generate proteins that resemble those of mammalian origin by performing post-translational modification with lesser adverse effects. In our current study fifty Yeast cultures were isolated from mangrove sediment samples collected from ten locations across state of Goa. Isolates were confirmed as Yeast on basis of microscopic studies. All the isolates were screened by a rapid plate assay technique based on principle that the change in pH leads to change in indicator colour. It included modified Czapek Dox Media containing L-asparagine as sole Nitrogen source and two different indicator dyes Phenol red and Bromothymol Blue, incorporated separately for the purpose of screening. Of total isolates, 9 isolates showed positive L-Asparaginase activity and will be further studied to obtain a potential Yeast isolate with therapeutic application.

SILVER BASED SILICA NANOCOMPOSITE IN MITIGATION OF CORROSION CAUSING GOAN SALTPAN SULPHATE REDUCING BACTERIA

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ABSTRACT

Corrosion of oil pipelines is a serious issue in the petroleum industry. Corrosion leads to spillage, flow problems and material deterioration of the hydrocarbon, which increases the maintenance cost of pipelines. Microbial-induced corrosion (MIC) contributes to 20% of the annual corrosion damage of the metals in the industry. Pipeline systems under marine environment are susceptible to external as well as internal MIC. Anaerobic Sulfate Reducing Bacteria (SRB) are one such group of microorganisms which initiate the MIC process. Biofilm formation by SRB on the metal surface generates localized corrosion in form of pitting, this impacts the cathodic and anodic reaction kinetics of the metal. In our study we are observing the corrosion induction by Goan saltpan SRB isolate on stainless steel sample. With surface analysis of the stainless steel sample, we are able to confirm that the SRB isolate are capable of corroding stainless steel. Silver at its nanoscale (Ag NPs) has proven to be a good antibacterial agent, However, its activity in mitigation of halotolerant Sulphur reducing bacteria is under question. In this report, we present a study on metal reducing SRB isolated from the marine environment, and their mitigation using Silver nanocomposite with a suitable Silica matrix (Ag-SiO2), which will be helpful in developing an antimicrobial coating for the prevention of metal corrosion.

Technical Session
2

AGRO – PASTORALISM IN LADAKH: CURRENT TRENDS AND CHALLENGES

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ABSTRACT

Agro – pastoral production system in Ladakh is mainstay of its economy and livelihood. However, due improved economic condition and infrastructure development such as roads, tourism and education it is undergoing changes. This study sought to understand current trend and challenges in sustaining agro – pastoralism in Kargil district. We used semi structured open – ended questionnaires per household to understand agriculture and livestock production system. Twenty village in five valleys comprising 519 households were covered. Overall, ten crops are cultivated in the region. Barley, alfalfa, wheat and peas are cultivated in all villages whereas oats is a new addition. Buckwheat, lentil, foxtail/proso millets and mustard cultivation is abandoned by most households in all the valleys. Likewise, five livestock types; sheep, goats, cow, yak, horse and donkey are reared. Overall livestock population is 5140 heads though it has decreased by 53 % (n=11054) in the aftermath of Kargil war in year 1999. In Chiktan Valley it has decreased by (71%; n=3216). In Drass and Suru Valley, it has decreased by 70%;2959 & 32%; 4879 respectively. Sheep and goats (shoats) from bulk of livestock population (n= 3766) whereas mule rearing is abandoned. Herd size of shoats per households has also decreased. Maximum decrease in herd size was observed in Chiktan Valley i.e., from 31.70 to 8.97 heads per households and least in Suru Valley i.e., from 14.88 to 10.23 heads. Similar declining trend is also observed for other livestock types. Overall lack of human resources due to off – farm income opportunities (53%) is a major challenge in sustaining agro – pastoral production systems, followed by fodder shortages (17%), climate (10%) and land division (8%). In order to sustain agro pastoral production system, it necessary to impart training in value addition of farm products in addition to opening market avenues for crops, handicraft and handloom products.

BAMBOO: CARBON SEQUESTRATION POTENTIAL

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ABSTRACT

A continuous increase in the human population has generated huge demand for wood and wood-based products in service sector. To meet the industrial demand, large numbers of trees are cut down, causing serious climate change problems worldwide. The global temperature is rising with increase in carbon dioxide level in the atmosphere which was reached 414.7 ppm in 2021. To prevent irreversible disastrous effects on human society, the global temperature should be limited to 2 C. At global level, the United Nations Framework Convention on Climate Change (UNFCC) passed the resolution of the Paris agreement in 2015 to limit the rise of atmospheric temperature. Hence, for achieving sustainable development, non-woody forest timber, i.e., bamboo, has been gaining attention. In south-east Asia, over 1200 bamboo species are distributed in China, India and Myanmar. Asia accounts for approximately 65 percent of all bamboo-growing areas, with India reportedly home to 125 indigenous and 11 exotic bamboo species from 23 genera. Bamboo, being the fast growing species, has the potential to capture and store the carbon and restore degraded lands, which ultimately depends on its rate of growth and life cycle. The extensive root system of bamboo has been reported to improve soil properties in a short period of time. The carbon sequestration potential of bamboo varies from species to species. Due to its excellent qualities in physical and mechanical properties, bamboo is also considered as an alternative to wood.

BIOTECHNOLOGY'S POTENTIAL CONTRIBUTION TO SUSTAINABILITY OF WOOD PRODUCTS

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ABSTRACT

Wood is a naturally occurring, biodegradable, and renewable raw material that is used in building, as a feedstock in the paper and wood products industries, as well as in the manufacture of fuel. With the exception of the paper industry, biotechnology has traditionally received little attention in the wood product industries. However, biotechnology in forestry is also creating applications specific to forestry, such as genes for fiber modification, lignin reduction and extraction, and for the encouragement of straight stems and reduced branching. Legal constraints on conventional procedures have changed the situation as a result of growing environmental concern and scientific advancement. The goal of biotechnological wood protection strategies is to make wood more treatable with preservatives and replace chemicals with biological control agents. Utilizing fungi cultures and isolated fungal enzymes allows for the replacement of traditional chemical glues in the production of board materials. The rehabilitation of waste wood treated with preservatives benefits greatly from the use of biotechnology. Biotechnology will have many environmental and societal benefits. Faster-growing trees, developed through biotechnology, will contribute significantly to sustainable wood products by diminishing the demand for wood harvested from old growth and natural forest stands. Biotechnology can reduce the amount of lignin in trees intended for paper manufacture. Lignin which gives wood its strength must be removed in the pulping process. Trees that have less lignin or more-extractable lignin are more readily pulped, allowing mills to reduce the chemicals and energy required to purify cellulose (the basis for paper, packaging and many absorbent products) from wood. Thus, pulp mills are expected to better achieve their ambitious environmental objectives while reducing inputs and costs.

RENEWABLE SOURCED MULCH MATERIALS FOR SUSTAINABLE AND IMPROVED PRODUCTION OF STRAWBERRY CROP

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ABSTRACT

Crop yields are generally limited by several factors like water, soil nutrients availability, proper managements etc. Strawberry is one of the most important soft fruits of the world after grapes and rich source of vitamin, iron and pectin content. It gives quickest return in shortest possible time. Besides antioxidant it contains phenols, flavonoids, dietary glutathionine which also exhibits a high level of antioxidant capacity against free radical species. Mulching manipulates the crop-growing environment to increase crop yield and improve product quality by controlling soil temperature, retaining soil moisture and reducing soil evaporation. A major limitation of polyethylene mulch involves disposal of mulch, if not properly disposed-off can fragment, and cause damage to environment i.e. land and water resources. The appropriate mulching materials, by controlling soil temperature and conserving soil moisture, can provide suitable soil microclimate for important crops (Chakraborty et al., 2008). Jute based renewable sourced non-woven mulch can be a sustainable alternative of synthetic mulch. The following study attempts to address the above issue.

FISH SILAGE AS A FEEDSTOCK FOR THE GROWTH AND SIMULTANEOUS LIPID PRODUCTION BY THE OLEAGINOUS YEAST

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ABSTRACT

Extensive utilization of non-renewable energy sources and the pitfalls associated with the vegetable oils have led to several environmental concerns and political debates. Considering this, single cell oil produced by the oleaginous microorganisms has turned into a competitive alternative for biodiesel production. Under stress conditions and excess of carbon sources, oleaginous microbes can accumulate neutral lipids, mainly in the form of triglycerides (TAG). The present study proposes a novel feedstock derived from by-product of the fish processing industry (fish silage) for the growth and simultaneous lipid production by yeast strain *Rhodotorula mucilaginos*a IIPL32. Under optimized culture conditions, maximum yeast biomass obtained was 6.5g/L. Lipid accumulated by the yeasts was in the range of 8-23% (w/w) and was initiated using in-situ transesterification process. Fatty acids from R. mucilaginosa IIPL32 consisted majorly of Oleic acid 38%, Stearic acid 35% and Palmitic acid 14%, suggesting that the fatty acids could be used as a feedstock for biodiesel production. Utilization of fish silage besides providing economic benefits would also have a positive role in environment sustainability.

GREEN SYNTHESIS OF AG/ZNO COATED ACTIVATED CARBON FOR THE REMOVAL OF PB FROM AQUEOUS MEDIUM

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ABSTRACT

In this work, green synthesis of Ag/ZnO nanocomposites on Acacia Auriculiformis (Akashmoni) Biochar to remove heavy metals from aqueous medium. SEM Analysis was done to verify the morphology and size of Ag/ZnO Nanocomposites whereas BET analysis for physical adsorption, XRD, and EDX techniques were used for crystallographic structure, chemical composition, and physical properties of the nanocomposites and FTIR for chemical properties respectively. The removal efficiency of the nanocomposites was determined by varying parameters like dosage of biochar (0.01g to 1g), initial concentration of heavy metal (1ppm to 100ppm), pH of the solution (2 to 8), and contact time between the adsorbent and the adsorbate (0.25min to 180min). Adsorption Kinetics study was used for investigating the mechanism of sorption using pseudo-first-order, pseudo-second-order, and Elovich kinetic models. The Adsorption Isotherm study was evaluated using Langmuir, Freundlich, Temkin, and Dubinin-Radushkevich isotherm models. This study also shows how Artificial Neural Network (ANN) was used for predicting performance of the adsorbent in the removal of heavy metals. Again, the parameters like dosage of biochar, initial concentration of heavy metal, pH of the solution, and contact time between the adsorbent and the adsorbate were used as input in the neural network. Working of the developed Artificial Neural Network model was determined using statistical measures like mean error, mean square error, root mean square error, and linear regression. The predicted ANN results and the experimental results were compared and a graph was plotted with experimented values on the X-Axis and ANN predicted values on the Y-axis. Ag/ZnO nanocomposite on biochar has been proved to be an effective and environmentally friendly adsorbent and can be utilized in various environmental applications.

IDENTIFICATION AND ANALYSIS OF MARINE LITTERS ON THE BEACHES OF GOA

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ABSTRACT

Globally, the problem of marine litter raises concerns about environmental imbalance and its effects on coastal human life. The origins of marine litter include a variety of land-based and maritime activities. New initiatives in the marine sector, with a particular emphasis on coastal regions and thrust on the blue economy, show the government of India's vision for the nation very clearly. The UN Decade of Oceans Science for Sustainable Development (2021–2030) is in line with this.

A significant environmental concern has been the exponential rise in marine litter as a result of expanding marine activities. In order to evaluate the effectiveness of the system and establish policy measures to address the issue of marine litter, it is necessary to identify the sources of marine litter. Data on the beaches in Goa with random selection of the sample site was collected and analysis was carried to identify the major sources and major component of the marine litter on the beaches in Goa.

The study's mainly focuses on identification of the sources of marine litter to make effective policy decisions and implementation plans to address the problem of marine litter. The paper also aims to outline the main awareness-raising techniques against marine litter pollution.

ROLE OF LAND USE CHANGES IN URBAN WARMING AND IDENTIFICATION OF RESILIENCE MEASURES IN PERI-URBAN AREAS

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ABSTRACT

Changes in land use have emerged as one of the leading causes of climate change, or at the very least, they have intensified the process, as seen by the phenomenon of urban warming. Cities that were once thought to be environmentally comfortable are now referred to as heat islands during certain times of the year. Urban land is subject to changes because of pressure from human activities. A city's heat index will be higher if it has more "grey infrastructure," as concretization quickly absorbs and holds heat, warming the environment. Urban heat is mainly attributed to two factors. First, transmission lines bring tonnes of megawatts of electricity into cities, where it is converted into different forms of energy including heat and contribute towards formation of heat island (HI). Second, direct sunlight shining on grey infrastructure causes the HI effect.

An effort was made in this research to link the UHI status over urban grey infrastructure and green area for peri-urban areas (Dehradun and Gurgaon). LST maps for the years 2001 and 2021, respectively, were created using the thermal band of Landsat 5 and 8, respectively. Both ENVI and ArcGIS Desktop were used to complete the task. The generated data were then transferred to an excel spreadsheet and used for additional analysis. Maps, charts, and graphs were used to understand the results at the end. The quantity of grey infrastructure that is directly exposed to the sun, as well as the temperature gradient, have a significant impact on the city's heat index, according to the study's findings. Therefore, it is urgent to implement resilience mechanisms including the deployment of novel techniques to lessen direct solar exposure.

RESPONSE OF SELECTED RANGE-RESTRICTED BIRD SPECIES OF WESTERN HIMALAYAN REGION TOWARDS CLIMATE CHANGE

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ABSTRACT

Climate change, an alarming global phenomenon is considered a major threat to biodiversity. It is expected to alter the structure, function and composition of the Himalayan ecosystem which is believed to have an enormously beautiful aggregation of avifaunal species. These species are believed to face habitat loss due to an increase in temperature conditions, making a shift in their habitat. Therefore, predicting their distribution and suitable future habitats for them is the need of the hour to develop management options and conservation policies for adapting to changes in these escalating changing climatic conditions. An early initiative would help to understand the effect of climate change on species distribution. The study aims to develop an understanding of the distribution of selected bird species in the Western Himalayas in the current environment and to predict suitable future habitats for them under projected climate change scenarios. It will be observed whether future climate change and land use would modify the distribution of these species or not. Therefore, the species distribution modelling (SDM) approach using different RCPs will be used to account for different emissions and concentration trajectories. Likewise, the potential distribution of the selected bird species will be found. The models will be developed under the current climatic conditions and then projected onto various future climate change scenarios for different time frames in the future to monitor the changes in the distribution of the species and how the bird species will interact with their existing environment in the coming future. Then accordingly, with the help of results, conservation and management practices will be implemented.

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TREND ANALYSIS OF METEOROLOGICAL VARIABLES OVER ALPINES IN CHAMBA DISTRICT OF HIMACHAL PRADESH, NW HIMALAYA, INDIA

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ABSTRACT

Different ecological studies conducted recently suggest that high altitude ecosystems are more vulnerable to fluctuations in meteorological variables than lower elevations. The floristic composition of high altitude is very rich and unique despite harsh environment conditions, which makes the flora sensitive to changes in external climatic variables. The increasing temperature trends reported in alpine regions have caused the species range shifts and increase in species richness, especially in deglaciated and permanent snow areas.

There is lack of sufficient ground-based data from these inaccessible areas. Thus, keeping this in view a study was conducted near Satrundi alpine area, located in district Chamba of Himachal Pradesh. Ambient temperature, relative humidity and dew point temperature data was recorded from the data logger installed at the study site using HOBOware. Data was analyzed and interesting results were obtained. The average ambient temperature recorded was 4.28°C, 4.51°C and 5.20°C with standard deviation of 6.67°C, 6.53°C and 5.74°C during 2019, 2020 and 2021 respectively. For relative humidity the average values recorded during study period were 67.29%, 64.49%, 62.76% with standard deviation 24.39%, 24.28% and 25.89% respectively. Data analysis of these meteorological parameters shows the significant variations over the years. The increasing trend of ambient temperature and decreasing trend of relative humidity (RH) is of great concern for climate induced environmental disasters.

As the unique and endangered biodiversity of alpine regions of Himalaya is under constant threat thus, anthropogenic activities responsible for degradation of these regions has also been discussed. This study also brought in focus the lack of sufficient ground-based data from these remote areas especially in Himachal Pradesh hence, more field studies are required to be carried out to know the actual effects and extend of climate change in order to suggest sustainable management strategies to save these sensitive regions.

BIOAUGMENTATION OF LOW-DENSITY POLYETHYLENE (LDPE)-CONTAMINATED SOIL WITH *ENTEROBACTER CLOACAE* AKS7: A NOVEL APPROACH TO PLASTIC WASTE MANAGEMENT

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ABSTRACT

An in-vitro study demonstrated that the soil bacterium *Enterobacter cloacae* AKS7, which breaks down low-density polyethylene (LDPE), accelerates the breakdown of UV-treated polymers. Its potential for contaminated LDPE habitat, however, has not yet been fully investigated. As a result, *in-situ* remediation was chosen for this investigation since it is more successful at getting rid of hazardous polymers. Four comparable soil-microcosm samples were similarly polluted with either UV-treated or untreated LDPE alone or in combination with AKS7 in order to study the same (T1 to T4). We detected considerable polymer degradation following the incubation in the bioaugmented soil contaminated with UV-untreated LDPE (T2). In addition, it was shown that UV-treated LDPE in AKS7 bioaugmented soil (T4) degraded polymers at a higher rate. Dehydrogenase and fluorescein di acetate (FDA) hydrolyzing activity were more active, which helped to explain why there were more microbes in the bioaugmented microcosm. The results of the carbon sources usage pattern of the BiOLOG Eco plate were used to assess the microbial functional diversity in order to comprehend the metabolic capability of the soil microcosms. Shannon-diversity index and Gini coefficient were shown to show the same, as functional-diversity include both microbial richness and evenness. According to the results, the microcosm that was exposed to UV-treated LDPE and challenged with AKS7 (T4) had the lowest Gini coefficient and highest Shannon-Weaver index when compared to the other microcosms. Overall, the findings showed that microcosm T4 had the greatest functional variety. When considered collectively, the findings showed that *Enterobacter cloacae* AKS7 might be employed as a bioaugmenting agent for the sustainable management of LDPE waste in contaminated sites without compromising the native soil microorganisms.

DETOXIFICATION OF PHENOLIC COMPOUND BY FUNGAL CRUDE ENZYMES

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ABSTRACT

Phenolic compounds persistent in nature are a global concern, given their recalcitrant nature to degradation and adverse effects on humans and the environment. Removal of chlorinated phenols (CPs) from the environment usually involves expensive physical and chemical methods that produce harmful by-products; in contrast, the biological method (bioremediation) is an effective environment-friendly method without producing toxic by-products and is relatively cheaper. In the present work, the potential of ligninolytic enzymes such as laccase (Lacc) and manganese peroxidase (MnP) produced from *Pycnoporus* sp. (white-rot fungus) in the detoxification of 2-chlorinated phenol (2-CP) was studied. Both the enzymes exhibited stability in the pH range of 4-5 and temperature range of 50-65 °C. The lacc showed V_{max} and K_m values of 9.88 µMmin^{-1} and 41.91 µM with ABTS and 10.47 µMmin^{-1} and 93.56 µM with 2,6-DMP as substrate, whereas the MnP showed V_{max} and K_m value of 10.41 µMmin^{-1} and 7859 µM with guaiacol as substrate respectively. The crude enzyme cocktail detoxified the 2-CP (12.8 mgml^{-1}) into a less toxic form, confirmed by UV visible absorption spectra, HPLC analysis and plate toxicity assay. This study demonstrated that a crude enzyme cocktail produced by *Pycnoporus* sp. could potentially remove toxic phenolic compounds in more environmentally friendly ways.

ISOLATION OF COPPER-MINING BACTERIA FROM THE MUNICIPAL SOLID WASTE DUMPSITES OF KOCHI: A GREEN APPROACH FOR REMEDIATION

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ABSTRACT

Municipal Solid Waste (MSW) dumpsites are the sinks of heterogenous refuses from different sectors of society. They also contain diverse indigenous microorganisms capable of withstanding these compounds, which can be exploited for various purposes. The leachate released from the MSW dumpsites presents potential risks to the surrounding environment. The dumpsite leachates constitute high concentrations of complex chemical pollutants such as ammonium, nitrates, pesticides, and trace metals. Among the trace metals, Cu (II) is one of the toxic metals serving as an essential micronutrient for plant growth. A reduced valence state of Cu (II) is Cu (0) having a wide application as heterogenous catalyst in the photoelectrochemical cells, sensors, inks, antimicrobial coatings and solar cells. As the conventional method for synthesizing the nanoparticles utilizes toxic chemicals and is costly, a sustainable method for reducing the toxicity of the Cu (II) and simultaneously extracting it for industrial application is the need of the hour. The exploitation of microorganisms for nanoparticle fabrication has garnered considerable global research interest. Among microbes, bacteria are an incredibly convenient target for green nanoparticle synthesis due to their variety and ability to adapt to different environmental conditions. It is known that individual bacteria are able to bind and concentrate dissolved metal ions and metalloids, thereby detoxifying their environment. Hereunder we report the green biosynthesis route for converting CuSO4 ions into single-atom Cu (Cu0) by an indigenous copper-resistant bacterium isolated from a major MSW dumpsite area of Kochi. The isolated bacteria were able to tolerate >1000 ppm of Cu. The bio transition of the Cu valence state was confirmed by various analytical methods (XPS, SEM-EDS and FT-IR). The results revealed that the bacterium was able to convert the Cu (II) (CuSO4=100 mg/L) into Cu (0) within 24 hours. This microbial conversion is carried out naturally under aerobic conditions eliminating toxic solvents. These observations suggest and reveal that the MSW dumpsite bacterial population could naturally and efficiently extract metal ions such as copper and transform it into a highly valuable commodity in this new era of science.

MICROCRYSTALLINE CELLULOSE DECORATED WITH FE_3O_4 NANOCATALYST FOR THE MICROWAVE-ASSISTED SYNTHESIS OF THIOGLYOXAMIDES UNDER GREEN AND SUSTAINABLE CONDITIONS

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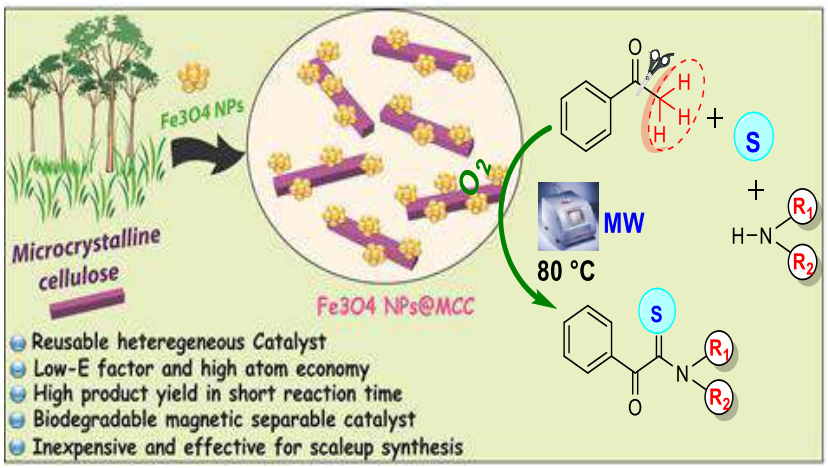
ABSTRACT

Ferrite nanoparticles (Fe_3O_4 NPs) supported on microcrystalline cellulose (MCC), is introduced as an active heterogeneous catalyst for the preparation of the α-keto thioglyoxamides by α-heterofunctionalization of acetophenones with sulfur and secondary amines via a microwave (MW)-assisted protocol. This prepared catalyst shows consistent particle size of Fe_3O_4 NPs as characterized by PXRD, XPS, SEM, EDS, EDX, TEM, HR-TEM and FT-IR analysis. A wide variety of thioglyoxamindes are synthesized under optimized reaction condition to afford good yield of products in short reaction time. Importantly, the presented catalyst can be recycled for five successive runs with no major loss in its activity and is equally relevant for gram scale synthesis of thioglyoxamides. This environmentally benign approach offers several advantages and displays good green chemistry metrics (GCM), namely process mass intensity (PMI), E-factor and atom economy (AE). reaction mass efficiency (RME).



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SELECTIVE REDUCTION OF ARYL CARBOXYLIC ACID USING AND SOLID ACID AND $NABH_4$

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ABSTRACT

Aryl alcohols and esters have immanent functionality in pharmaceuticals, agrochemicals, polymers, natural products, and food products. Also, these compounds can be employed as precursors for the preparation of various active pharmaceutical ingredients in pharma industries. The catalytic reduction of carboxylic acids into aryl alcohol is one of the most elementary and extensively employed transformations in synthetic organic chemistry. However, traditional methods (such as reduction using $LiAlH_4$) have their own drawbacks, such as the generation of inorganic waste, poor selectivity, lower yield. On the other hand, the catalytic hydrogenations of carboxylic acids were executed under high temperature and pressure largely to overcome their low reactivity and/or strong interactions with the metals catalysts. Thus, developing an alternative green protocol for chemoselective reduction of carboxylic acids to primary alcohols with wider functional group tolerance is still desirable. To this end, we have developed a new method for the reduction of aryl carboxylic acid by using recyclable solid acid CuPcS and $NaBH_4$. These CuPcS and $NaBH_4$ system exhibit excellent yields and good selectivity, therefore providing alternative synthetic approaches for the conversion of carboxylic acids to primary alcohols with a wide range of functional group tolerance. The main advantage of both these methods includes many things, such as short reaction time, safer conditions, and an easy way of isolation and recycling of CuPcS.

XENOBIOTIC BIODEGRADATION POTENTIAL OF BREVIBACTERIUM SP. ISOLATED FROM COASTAL DUNES OF GOA: A GENOMIC APPROACH

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ABSTRACT

Xenobiotic compounds include drugs, pesticides, cosmetics, industrial chemicals, and environmental pollutants. Bioremediation strategies employing microorganisms is a promising solution to tackle environmental pollution caused by these compounds. Denovo whole genome sequencing of the halotolerant *Brevibacterium* sp. K11IcPPYGO002 and the pathway annotation of the predicted genes using KAAS (KEGG Automatic Annotation Server) revealed the presence of seventy-one genes responsible for the biodegradation of xenobiotic compounds. Analysis of the pathways revealed the presence of bacterial genes involved in the biodegradation of benzoate, aminobenzoate, fluorobenzoate, chloroalkane, chloroalkene, chlorocyclohexane and chlorobenzene, toluene, xylene, ethylbenzene, styrene, caprolactam, naphthalene, polycyclic aromatic hydrocarbon, steroid, and drugs.Genome mining of the *Brevibacterium* sp. K11IcPPYGO002 isolated from Coastal Sandunes of Goa is an effective practical approach for employing the isolate for the bioremediation of xenobiotic compounds.

AN OVERVIEW OF ASSESSING THE PERFLUOROALKYL COMPOUNDS IN WATER BODIES AND THE REMEDIATION METHODS FOR A SUSTAINABLE ENVIRONMENT

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ABSTRACT

Chemicals in the per- and polyfluoroalkyl substances (PFAS) family exhibit strong fluorine and carbon linkages. They are more resistant to water and oil substances due to this quality. From their manufacturing through their consumption to their decomposition, these compounds are harmful to the environment. Furthermore, they endure extreme conditions and persist in the environment for a long time. More than 4500 PFAS and their precursors distributes in soil, water, and air after they released into the environment. It is in this specific context that environmental contamination due to PFAS should be addressed in the latest “Emerging Pollutants” category. Moreover, bioaccumulation of PFAS cause adverse health problems in plants, fishes and in mammals through food chain. Their uniqueness is that this new pollution can adversely affect the biotic and abiotic components, even in small quantities (one trillion parts). The scientific community has become profoundly aware of the adverse effects of these chemicals over the past couple of decades. Conventional wastewater treatment plants and methods followed by them are not an ideal solution for the removal of pfas from their sources. This study provides a critical analysis of the recent advancements in the detected amount of PFAS in waterbodies and the various economical and viable methods such as Advanced oxidation process (AOP) can be an effective technique for tackling the issues of PFAS.

EXPLORING THE LARVICIDAL EFFECT OF CHEMICALLY SYNTHESIZED PRISTINE A-MNO^2 NANOSTRUCTURES AND EVALUATING ITS TOXICITY USING OREOCHROMIS MOSSAMBICUS

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ABSTRACT

Mosquitoes are vectors of several diseases namely malaria, filariasis, chikungunya, yellow fever, lymphatic filariasis, Japanese encephalitis, Zika, West Nile and dengue. These diseases have been inflicting the lives of around millions of people annually. Indiscriminate usage of insecticides to curtail mosquito populations has resulted in devastating effects such as ecological imbalance, bioaccumulation, mammalian toxicity, and the dramatic emergence of resistant mosquito populations, to name a few. Hence there is a constant surge to find alternatives that are safe, target-specific, and equally effective or better. In the present study, we explore the larvicidal activity of α-MnO_2 nanostructures. X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), and Transmission Electron microscope (TEM) reveals that the MnO_2 nanocrystals have a hollandite (*α*-MnO_2) structure with a sea-urchin-like morphology and a high surface area. Larvicidal activity of MnO_2 nanoparticles was assessed against the larvae of *Culex quinquefasciatus* (*Cx. quinquefasciatus*), *Aedes aegypti* (*Ae. aegypti*), and *Anopheles stephensi* (*An. stephensi*), and revealed the toxicity in the order *Cx. quinquefasciatus*> *Ae. aegypti*> *An. stephensi* following the LC_{50} values. Overall, this study highlights the potential of α-MnO_2 nanostructures as an effective mosquito control agent. Additionally, we also propose the use of the cichlid fish Tilapia (*Oreochromis mossambicus*) as an experimental model to study the toxic effects of these as-synthesised nanocrystals.

MAHANEEM BASED AGRO-FORESTRY SYSTEM: SUITABLE FOR CLIMATE SMART AGRICULTURE

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ABSTRACT

A field study was carried out at research farm of CCS HAU, Regional Research Station, Bawal (Haryana) in rabi 2021-22 to study the effect of different densities of Mahaneem (*Ailanthus excelsa*) plantation on performance of wheat varieties grown as intercrop. The soil of experimental field was loamy sand in texture and alkaline in reaction (pH 8.22 to 8.30).The experiment was laid out in split plot design with three replications. *A. excelsa* was planted in September 2013 with four different tree densities viz. 200 (10 x 5m), 150 (10 x 6.5m), 100 (10 x 10m) and 50 (10 x 20m) trees/ha (spacing) and four varieties of Wheat (*Triticum aestivum*) i.e.WH-711, WH-1105, HD-2967 and HD-3086 were grown as intercrop. Recommended dose of fertilizers for the crop was applied as per packages practices of CCSHAU, Hisar. Irrigation and plant protection measures were applied as per recommended practices. Unusual high temperature was recorded in March, 2022. Results reveal that with decrease in tree spacing the yield of the wheat varieties increased significantly. All the wheat varieties recorded maximum yield under 10x5 m spacing. It has been recorded first time in Mahaneem based agroforestry system. It may be due to moderating effect of trees on high temperature in the month of March, 2022. The growth of trees in terms of height and girth at breast height (GBH) in sole plantation of Mahaneem as well as with intercropping did not differ significantly. However with close spacing / higher density of plantation tree height was slightly less and slight decrease in tree GBH was also recorded but statistically the difference was not significant. Maximum carbon sequestration was recorded under 10 x 5 m plantation of Mahaneem with wheat varieties followed by 10 x 6.5 m spacing. The soil organic carbon ranged from 0.19 to 0.22 percent, pH was recorded 8.19 to 8.21and available phosphorus was recorded maximum in 10 x 5 and 10 x 6.5 m plantation after harvesting of wheat crop. Similarly, available K ranged from 166.35 kg/ha in 10 x 5 m plantation to 165.3 kg/ha in 10 x 20 m plantation.

ROBUST ENVIRONMENTAL LAWS AND LEGAL INSTITUTIONS AND GREEN TECHNOLOGY FOR SUSTAINABLE DEVELOPMENT

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ABSTRACT

The fight for a clean environment continues in a climate of ever-increasing urgency. Constitution of India imposes a fundamental duty on every citizen (under Article 51A) to protect and improve the natural environment, including forests, lakes, 'rivers and wildlife', and to have compassion for living creatures. Although before India's independence in 1947, several environment legislations existed; the real impetus for bringing about a well-developed framework came only after the UN Conference on the Human Environment in Stockholm in 1972. Under the influence of this declaration, the National Council for Environmental Policy and Planning was set up within Department of Science and Technology. This Council later evolved into a full-fledged Ministry of Environment and Forests (MoEF) in 1985, the apex administrative body in the country for ensuring environmental protection. The Environment Protection Act (EPA), 1986, came into force soon after the infamous Bhopal Gas Tragedy. It is considered an umbrella legislation as it fills many gaps in the existing laws. It empowers Central Government to establish authorities equipped with the directive of preventing environmental pollution in all its forms and to tackle specific environmental problems, peculiar to different parts of the nation.

Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs and provides a framework for humans to live and prosper in harmony with mother nature rather than, as we have for centuries, at nature's expense. However, sustainability does not seem to have an adequate legal foundation besides green technology, despite many environmental and natural resources laws (discussed above) in force. Hence, if we are to make significant progress toward a sustainable society, we will need to develop robust laws and legal institutions, green technology and ensure their effective and firm reinforcement by creating a strong will among the concerned.

CLIMATE SMART AGRICULTURE

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ABSTRACT

Climate Smart Agriculture (CSA) is an approach to help the people who manage agricultural systems respond effectively to climate change. The Climate Smart agriculture approach pursues the triple objectives of sustainably increasing productivity and incomes, adapting to climate change and reducing greenhouse gas emission where possible. This does not imply that every practice applied in every location should produce “triple wins”. Rather the climate smart agriculture approach seeks to reduce trade-offs and promote synergies by taking these objectives into consideration to inform decisions from the local to the global scales and over short and long time horizons, to derive locally-acceptable solutions. The majority of world's poor live in rural areas and agriculture is their most important income source. Developing the potential to increase the productivity and incomes from smallholder crop, livestock, fish and forest production systems will be the key to achieving global food security over the next twenty years. Climate change is expected to hit developing countries the hardest. Its effects include higher temperatures, changes in precipitation patterns, rising sea levels and more frequent extreme weather events. All of these pose risk for agriculture, food and water supplies. Resilience is therefore a predominant concern. Agriculture is a major source of greenhouse gas emission. Mitigation can often be a significant co-benefit of actions to strengthen adaptation and enhance food security, and thus mitigation action compatible with national development priorities for agriculture is an important aspect of climate smart agriculture. Climate smart agriculture is an integrated approach to managing landscapes to help adapting agricultural methods, livestock and crops to the effects of climate change and, where possible, counteract it by reducing greenhouse gas emission from agriculture, at the same time taking into account the growing world population to ensure food security. Thus, the emphasis is not simply on carbon farming or sustainable agriculture, but also increasing agricultural productivity.

GROWTH PARAMETERS AND NICHE BREADTH ANALYSIS OF CARIDEAN SHRIMP PROVIDE NEW INSIGHTS FOR SUSTAINABLE DEEP-SEA SHRIMP FISHERIES AND ECOSYSTEM MANAGEMENT OF THE SOUTHWEST COAST OF INDIA

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ABSTRACT

Deep-sea ecosystems represent the largest biome of the global biosphere. Information on the biological parameters of deep-sea resources forms the basis for the development and implementation of resource management strategies for the sustainable harvest of the deep-sea fishery. The commercial deep-sea caridean shrimp Plesionika semilaevis Spence Bate, 1888 has long been recorded from India and constitutes an important part of catches of the deep-sea shrimp fisheries and thus forms a good candidate species for this study. Samples were obtained from the trawl nets operated at 200-350 m depth off the southwest coast of India. Length-weight relationships (LWR), food and feeding, and relative condition factor were analyzed for an annual cycle. Females outnumbered males in the catch (1.7:1) dominated by berried females (80.2%) and peak fishery was observed from October to January. The total length varied between 63-115 mm in males and 67-120 mm in females. Length at recruitment (Lr) was 63 mm. The parameters of the length-weight relationship were estimated as: a = 0.008, b = 2.54, r^2 = 0.61 for males and a = 0.009, b = 2.47, r^2 = 0.63 for females. The relative condition factor (K) in P. semilaevis males ranged from 0.42-1.66 and in females 0.57-1.95 indicating good growth condition(K>1 in most individuals) in Indian waters. The observed data provides information about the growth of the deep-sea shrimp, its general wellbeing, and fitness in a marine habitat. Such analyses are a keystone tool for sustainable fishery management. Diet studies revealed the predatory behaviour of this small deep-sea shrimp, feeding on energetic complex organisms like molluscs, crustaceans and fishes. This reveals the complexity of community level interaction in the deep-sea ecosystem and the pivotal role played by this species irrespective of its size in the ecosystem.

MICROBIAL DEGRADATION OF NAPHTHENIC ACID: A SUSTAINABLE APPROACH

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ABSTRACT

Naphthenic acids (NAs) are complex organic pollutants majorly consisting of saturated aliphatic and alicyclic carboxylic acids. NAs naturally occur in a variety of hydrocarbon resources, including bitumen, oil sands, and crude oils. They have gained scientific interest due to environmental implications as it has corrosive, recalcitrant, and toxic properties. In this direction, bioremediation emerged as an eco-friendly and sustainable approach compared to physico-chemical approaches. Therefore, it is important to develop efficient bioremediation strategies to remove NAs. This research aimed to investigate the robustness of native bacterial strain (C6) for higher concentrations of NAs degradation by exposure to varying concentrations. For this, benzoic acid was selected as a model compound from NAs group. The potential of the C6 strain for the degradation of benzoic acid was investigated at varying concentrations (25 mg L^{-1}, 50 mg L^{-1}, 100 mg L^{-1}. 250 mg L^{-1}, and 500 mgL^{-1}). The result showed 99.81%, 84.91%, 81.26%, 73.44%, and 60% of benzoic acid removal within 12 h using the C6 strain. The change in benzoic acid concentrations was determined through a UV-visible spectrophotometer. The results indicate a very promising potential of this strain for the removal of NAs.

Technical Session
3

ARSENIC IN AGRICULTURE AND ITS MITIGATION TO PROTECT THE FOOD CHAIN

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ABSTRACT

Arsenic (As) is a naturally occurring toxic metalloid at a mean content of 5 mg kg-1 in the earth's crust. The potential risks of arsenic to ecosystems and human health, particularly in the South Asian region (India and Bangladesh, etc.), have been thoroughly investigated. Human health toxicity resulting from the use of arsenic-contaminated groundwater for drinking and irrigation is a global concern, particularly in Asia and Southeast Asia. Groundwater from tube wells used to irrigate agricultural fields is adding large amounts of arsenic to the soil every year, resulting in increased levels of arsenic in crops grown on arsenic-contaminated arable soils. Arsenic accumulates in the edible parts of plants and subsequently contaminates the food chain. It is highly warranted to initiate monitoring and assessment programmes for arsenic contamination in irrigation groundwater sources, agricultural fields being irrigated using those sources and the crops grown in those fields. Because data from spiked soil and hydroponics experiments cannot be extrapolated as truly representative of the field condition of arsenic contamination of soil and crops. An understanding of soil arsenic content and other soil properties in relation to its uptake and toxicity to crops is therefore urgently needed under field conditions. It is revealed that soil total arsenic content is not likely a good predictor of arsenic uptake and toxicity under different soil types and micro-climatic conditions. It is the bioavailable fraction of total arsenic in specific soil conditions, which is potentially causing a threat to the crops/plants. Identification of geographic areas either presently contaminated with arsenic or susceptible to its contamination, is an important step for risk assessment and developing remediation strategies. The mapping of arsenic content which is being transported from soil or irrigation water to edible plant parts is important for protecting against human arsenic exposure through arsenic contamination of the food chain. Assessment of soil arsenic bioavailability may greatly support the scope of remediation required at contaminated sites. It is concluded that future R&D should be focused on speciation, transformation and bioavailability of arsenic in soil and associated soil properties to reveal tangible latent hazards of soil arsenic contamination to agriculture and related food chain links.

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CHARACTERIZATION AND CLASSIFICATION OF SOIL UNDER RAMIE GROWING AREAS OF FLOODED LOWER BRAHMAPUTRA VALLEY OF NORTH-EAST HIMALAYA FOR APPROPRIATE MANAGEMENT

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ABSTRACT

A study was conducted in the Ramie [*Boehmeria nivea* (L.) Gaud.], a growing area of Brahmaputra River derived soils in Barpeta district of Assam. The soils were studied to characterize and classify for appropriate crop management. The quality of crops is dependent on soil properties. Hence, the soil was studied and classified for crop suitability. For this purpose, eight representative profiles from different landform units of ramie growing area were characterized and classified. The Ramie growing soils are very deep, very dark grayish brown (10YR 4/2) to dark grayish brown in colour. The structure of the soil is granular to angular blocky in structure, loam to silty clay loam. The soils are strongly acidic to moderately alkaline in nature (pH 4.0 to 8.2), and the electrical conductivity varies from 0.001 to 0.003 dSm^{-1}. The OC is low to high in organic carbon (0.4 to 1.2 %). Anion (Al^{3+} and H^{+}) activity ranges from 0 -1.63 and 0.2-1.59 respectively. Low cation exchange capacity (1.8 to 6.6 cmol (P^{+}) kg^{-1}), calcium was the dominant cation, followed by magnesium, sodium and potassium. The base saturation percent was 27.64 to 96.36 percent. The fertility status of ramie growing soils was medium to high. Taxonomically, these soils were classified as *Typic Dystrudepts*, *Typic Fluvaquepts* and *Typic Udipsamments*. The soil-site suitability indicated that the *Typic Udipsamments* soils were marginally suitable, as *Typic Fluvaquepts* were moderately suitable and *Typic Dystrudepts* soils were highly suitable for ramie crop.

FAMILY NET VESSEL COMPOST TECHNOLOGY: BEST WAY TO MANAGE KITCHEN WASTE

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ABSTRACT

In India rapid urbanization, escalating population and food consumption rate led to increase in city waste (CW) generation in India. Per capita generation of CW ranges from approximately 0.17 kg to 0.62 kg per person per day in small towns and cities respectively with a mean of 0.4 kg per capita. About 40% of CW is considered to be organic and biodegradable, of which only 14% (9.1 Mt) being composted. Organic CW (OCW) mainly comprised of discharges from household and can be better designated as Kitchen Waste (KW). The KW contains high moisture content and is characterised by about 60% carbohydrates, 20% protein and 10% lipid. Thus, a strong technology is needed to segregate KW at source level and convert it into stable and nutrient enrich compost. ICAR-Indian Institute of Soil Science, Bhopal, has developed Family Net Vessel Compost (FNVC) technology using three epigeic earthworms (*Eisenia fetida, Eudrilus eugeniae and Perionyx excavatus*) for recycling of KW into valuable compost. In this technology, vessel is made of nylon net with 90cm length and 35cm diameter containing 10-15 kg capacity plastic basket placed inside the vessel. This vessel can be hanged with the help of nylon rope in the available space of the house or on the branches of the tree planted around the house. KW were cut into small pieces (3-5 cm length) and kept inside the vessel followed by well decomposed cattle dung spread over the wastes. About 100-150 nos. of adult epigeic earthworms of three species in equal numbers is kept in the basket. Whole material is covered with jute bag and kept moist by adding water regularly to maintain the moisture. After 30 days the vermicompost gets ready for field application. The compost had organic carbon to total nitrogen ratio of 10-12: 1; 1.2% total nitrogen, 2.0% total phosphorus and 0.8% total potassium. This FNVC is an efficient technology and can be easily adopted to convert KW into valuable compost.

A STUDY ON THE VARIATION OF THE PHYSICOCHEMICAL, HYDRO BIOLOGICAL AND LIMNOLOGICAL PARAMETERS WITH RESPECTS TO THE EUGLENA BLOOM AND ANTHROPOGENIC FACTORS IN A HIGH, MODERATE AND LESS PRODUCTIVE POND OF BANKURA DISTRICT OF WEST BENGAL, INDIA

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ABSTRACT

The Bankura town of district Bankura, West Bengal, India is full of lentic water bodies like pond, reservoir and water tank etc. Limnological characteristics of ponds in different seasons are related to the hydro biological condition of the Ponds. Physiochemical parameters of water and their influences on the occurrence of Euglena bloom and the distribution of other algal species. Sometimes water bodies are enriched with nutrients which lead to an excessive growth of plants that initially cause of Eutrophication and ultimately end up with algal bloom formation. Euglenophyte bloom is a common problem in most of the aquaculture ponds in Bankura. There is an intricate relationship between the metabolism of aquatic organisms and hydro-biological parameters is a fresh water body (Majumder and Dutta 2014). This study also focuses the impact of Euglena sp. on the growth and development of fish fauna. Algal bloom in the aquatic ecosystem is a natural process which triggered by different anthropogenic activity. Euglenophyte bloom is the common phenomenon in warmer shallow and eutrophic water bodies (Olaveson and Stokes, 1989; Xavier et al., 1991; Tripathi and Shukla, 1993) and it decreases the fish production and species diversity a lot. Our study is an attempt to study the dynamics of Euglena bloom in the various ponds of Bankura.

ASSESSMENT AND IDENTIFICATION OF EXOPHYTIC AND ENDOPHYTIC BIOFLOC FORMING ORGANISM FROM SELECTED MARINE ALGAE SOURCED ALONG THE COASTAL AREA OF PANDURANGAPURAM, VISAKHAPATNAM

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ABSTRACT

Nowadays, Biofloc technology is becoming both popular and successful in the field of aquaculture. Biofloc acts as a source of additional nutrients, improves immunity of the culture species and also maintains water quality by balancing the carbon and nitrogen ratio. In this context, there is urgent need to identify biofloc forming bacteria and therefore present study was undertaken. Initially marine algae belonging to Gracilaria sp., Ulva sp. and Cladophora sp. were selected to isolate exophytic and endophytic microbial population. For this, marine algal samples were collected from shallow waters of coastal area of Pandurangapuram, Visakhapatnam during the low tide period. Samples were sterilized and macerated and the solution obtained was subjected to serial dilution to isolate individual colonies. Isolated colonies were again subjected to quaternary streaking on Zobell Marine agar to get pure cultures. From these samples total 12 strains of exophytic and endophytic organisms were isolated aseptically, purified and preserved for further investigations. Preliminary identification of pure isolates was carried out by both culture and biochemical methods and was observed that majority of the organisms belong to genus Bacillus and Vibrio. Individual pure isolates were tested for their ability for floc formation under invitro conditions. In this experiment biofloc was formed with strain NPZ alone within two to three days of incubation. From harvested NPZ Biofloc, microbiological observation was carried out to know the purity of the floc formed. The whole experiment was repeated thrice and same results were obtained in every experimental setup. The NPZ strain was also able to form flocs in different salinity ranging from 1 ppt to 30 ppt. Preliminary Identification was carried out and strain NPZ was identified as Bacillus cereus based on culture and biochemical studies. By these findings, it was evident that bacterial strain NPZ belonging to the genus Bacillus had ability to form biofloc, which has potential application as inoculum in the field of Aquaculture and further studies are being carried out in both invitro and invivo conditions.

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BENTHIC FORAMINIFERA, SEDIMENT CHARACTERISTICS AND ECOLOGICAL STUDIES IN THE NEAR SHORE ENVIRONMENTS OF PALK STRAIT, TAMILNADU, EAST COAST OF INDIA

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ABSTRACT

A total of 72 offshore sediment samples in the depth range of 1-7m at Palk Strait, off Mandapam to Kodiyakarai were studied for Micropalaeontological investigations. This study highlights the presence of a composite cosmopolitan fauna of foraminifera of 112 benthic species belonging to 27 families and 57 genera from the 72 sediment samples. Among them *Rotalina* (49%) occupies a dominates followed by *Miliolina* (39%). The following genus *Ammonia, Asterorotalia, Quinqueloculina* dominates the living assemblages, followed by *Pararotalia* and *Elphidium*. From the total number of species, *Ammonia beccarii, A Asterorotalia trispinosa, Pararotalia nipponica, A.tepida, A.dendata, Elphidium crispum,* and *Quinqueloculina seminulum* record profile abundance. However, only thirteen species namely *P.nipponica, Neorotalia calcar, Q.lamarckiana, Q.seminulum, Q.tropicalis, Triloculina trigonula, E.macellum, A.beccarrii, E.crispum, A.dentata, A.tepida, Spirolloculina depressa,* and *S.communis* keep up a uniform distribution in more than six regions.

The influence of ecological parameters on the foraminifera taxa has been established in such a way that organic matter is contributed primarily by living species. The lack of relationship between the dead species and the organic matter sugessts that the organic matter recorded in these sediments may have originated either from living benthic species or from plant remains reported in this Strait. Lower concentration of organic matter in the channel zones of 5-7m depth leads to disturbances of the seabed bottom due to the turbidity current movement. Significant concentrations of nearshore carbonates are mainly attributed to the deposition of transported carbonates mainly of broken shells and carried by the drifting currents.

From the present study, it is inferred that sediments are normally sandy in the Palk Strait but siltysand in deeper depths. All these factors help to conclude the progressive deposition or dispersion of sediments in seaward direction. The sandy nature of the Palk Strait regions outlines the deposition of sediments primarily by northerly moving currents. The presence of negative skewness along with the poor sorting confirms the existence of high energic conditions in the depositional basins except for the northern and southern extremities. The alternate deteriorating sorting characters of the sediments in the different stations indicate the unevenness of the bottom topography. Geochemical analyses for Fe, Mn, Cr, Co, Ni, Pb, Zn and Cd were carried out. Based on the geochemistry, Fe concentration is very high compared to the all the trace elements. In general the concentrations of trace element are higher at shallower depths and lower at deeper depths.

The present study has illuminated the fast prograding nature of the shelf, as evidenced by the living/dead ratios indicative of higher rate of sedimentation in this Strait. However, the lowest value of 7.50% at Manalmelkudi is attributed to a zone of low sedimentation due to its location on the limb of the spit which acts as a barrier to divert the influencing littoral currents.

As a highlight of the present study, it is concluded that more sediment deposition takes place in the southern part of the region than in the northern part of the sand bar where the total number of living species is much low comparatively other localities. The morphological deformative species also observed both northern and southern part of the study area. The trace elements concentration was much higher in the northern part of Manalmelkudi than in the southern part of Manalmelkudi, and it was concluded that the trace elements concentration fully affected the living population in the northern part of Manalmelkudi, so present study also brings out the dire need of protecting the gradually shallowing nature of Palk Strait as confirmed by the foraminiferal and geochemical evidences.

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CONSEQUENCES OF CLIMATE CHANGE ON THE ENDANGERED BATS OF WESTERN GHATS, INDIA

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ABSTRACT

Western Ghats is home to 63 species of bats, including threatened and endemic species. Salim Ali's Fruit Bat (*Latidens salimalii*) is a cave-dwelling fruit bat restricted to the montane evergreen and adjoining coffee/cardamom plantations of the southern Ghats region. Due to various anthropogenic stress, there is a significant decline in the population of *L. salimalii* and now categorised under the endangered category by the IUCN. Climate change is an emerging threat to overall biodiversity, especially to the species with narrow or restricted distribution. Hence a study was conducted to identify suitable habitats for *L. salimalii* and the impact of climate change on the distributional ranges using MaxEnt. We followed the standard bat sampling protocol for collecting primary occurrence data. We also used secondary data to improve the accuracy and reliability of the models. Eco-geographic variables were identified based on the ecology of the species, and we used only the non-correlated variables for running final model. The habitat suitability model for *L. salimalii* was developed for current climatic conditions and projected their distribution for three Representation Concentration Pathway (RCP 4.5, 6.0, and 8.5) climate scenarios of the 2070 period. The results show that an overall 9,531 sq.km is suitable for *L. salimalii* under current climatic conditions. Variables like precipitation of the driest month, tree density, canopy height, and altitude have contributed much to the models. Future scenarios show a drastic decline in the highly suitable habitats across its distributional ranges. Our results thus inform managers to make a fitting move by looking at the appropriate example of this species to climatic change.

CONSERVATION STRATEGIES OF RARE ETHNOMEDICINALLY IMPORTANT ISODON NILGHERRICUS BENTH H. HARA PLANT

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ABSTRACT

The present study focussed on ethnomedicinally important *Isodon nilgherricus* (Benth) H. Hara Basionym - *Plectranthus nilgherricus* Benth. Plectranthus species is well known for its medicinal and economic value. Studies revealed that it is a rich source of essential oil and diterpenoids. *Isodon nilgherricus* is an aromatic plant native to Africa and India. In India it is mainly found in southern ghats, Nilgiri hills, Ooty in Tamil Nadu District. Plants are grown with the help of seeds and saplings were successfully grown in Ahmednagar area as well in table land Wai in Maharashtra. In Tamil Nadu, Kurumba tribes especially in Nilgiri region the leaf paste of this plant is used against gum disorder and toothache. This study provides an initial information of conservation practices of Plectranthus species in Maharashtra.

DEATH BY NETS: MONITORING BIRD KILLS IN POMOGRANATE ORCHARDS

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ABSTRACT

Fruit producers have identified bird damage as a critical issue as it incurs high costs. They try to limit this damage by deploying measures through traditional means or by using bird scaring techniques, reflecting devices, pesticides, and nets. Limited research has been carried out in monitoring the numbers and fate of the birds that get trapped in nets placed around fruit orchards. The present study was carried out with the objective of monitoring birds being caught in fishing nets used as a barrier to control the fruit damage by birds in pomegranate orchards in Chitradurga district of Karnataka, India. We assessed mortality rate of birds caught, noted their feeding guilds, and monitored them for six months from April to August 2021. A total of 36 species belonging to 11 orders and 20 families were recorded dead in the ten pomegranate plots studied. Some individuals were unidentified as they were decomposed with only few bones left in the nets. Among the 11 orders, Passeriformes were the most affected. A total of 1043 individual birds were observed entangled in the nets. Six individuals were found alive and were released after close observation of any injuries. Rose ringed parakeets were the most caught and found dead in the nets, followed by common myna and baya weavers. Feeding guilds of the birds entangled in nets comprised of majorly omnivores (44.4%) birds followed by insectivores (25%), granivores(16.6%), carnivores (11.11%) and frugivores (2.77%). Our study shows that monitoring mortality is essential in understanding populations of not only vulnerable and migratory species but also the common ones, which might not be common in the near future if such lethal bird control practices are not kept in check.

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ECOSYSTEM SERVICES VALUATION OF A RAMSAR COASTAL LAKE IN KERALA WITH SPECIAL EMPHASIS ON WATER QUALITY AND LAND USE LAND COVER PATTERN

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ABSTRACT

Coastal lakes and wetlands are dynamic ecosystems and provide many valuable ecosystem services (ESs) to human beings. The rapid increase in anthropogenic activities, socioeconomic development, and land use land cover (LULC) changes from the past two decades significantly affect the aquatic ecosystems and its ecosystem services. Unfortunately, these are not economically valued, especially in tropical and subtropical regions, which lead to under-investment and degradation of these ecosystems. This paper presents key results of a three-year international cooperation project focusing on ESs provided by Ashtamudi lake, a Ramsar site (Area= 56 km^2), located in the coastal zone of Kerala, SW India. We present the results of water quality monitoring program in the lake and results of economic valuation of key ESs provided by the lake, including fisheries, tourism, transportation, mangrove vegetation. The economic valuation relies both on primary data collected on-site as well as data from secondary sources, like stakeholders workshops involving key representatives from the population, administration and academy and questionnaire based survey. The ESs based on fisheries, tourism, and transportation was estimated and is discussed here. The revenue generated from clam fishery (mainly *Paphia Malabarica*) and aquaculture activities are 6.099 million and 7.799 million USD respectively in 2017. The calculated value for carbon sequestration for mangroves (Area= 0.64 km^2) is 144.64 Tonne C/year and revenue from this is 73314 USD in 2017, excluding flood management. The southern bank of the lake is densely populated and urbanized. The spatio-temporal variation of water quality attributes during non-monsoon and monsoon seasons show that DO, BOD and salinity exhibit spatio-temporal variations with adverse conditions on the seaward part of the lake. The southern zone shows hypoxic condition and Carlson Trophic State Index (CTSI) reveals that lake fell under eutrophic condition. The LULC around the lake basin were prepared and were classified into buildup area, agricultural land, wetlands, water bodies, and mangrove vegetation's and marsh lands. We found that all measured Land use classes and water quality characteristic correlations were statistically significant with the Ecosystem services; therefore, we concluded that Land use pattern and lake water quality affects the ecosystem services provided by the lake. These results could facilitate decision-making and development of related policies and might support finding strategies for sustainable management of the lake.

INTERACTIONS BETWEEN INDIAN WILDLIFE AND HUMANS IN TIGER STATE (MADHYA PRADESH)

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ABSTRACT

Humans and wildlife interact "when animals offer a direct and repeated threat to the livelihood or safety of people, resulting in the persecution of that species," according to the World Wildlife Fund. In India, there is growing concern over such interactions. Today, there is a growing emphasis on human connection with wild animal both domestically and internationally. Both humans and wildlife are badly impacted, but many of the latter are endangered or threatened. With its ongoing research into not just the ecology of the wildlife but also how people respond to the presence of the animals in human-use settings, human interaction with wildlife has been at the forefront of this field of knowledge. India's scenario is, nevertheless, evolving. Wildlife habitats have been degraded and fragmented as a result of the growing human population and its need for natural resources. As a result, competition for the same few resources exists between people and wildlife. In addition to potentially undermining current and future conservation efforts, this change from coexistence to conflict could also make it more difficult to accomplish the Sustainable Development Goals (SDGs) and the Aichi Biodiversity Targets. The main challenges that are emerging in urban wildlife near protected areas are presented in the current study.

NATURE-BASED SYSTEM FOR WASTEWATER TREATMENT AND REUSE

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ABSTRACT

The water crisis is an alarming issue in the recent era. The population explosion, climate change, industrialization, and changing lifestyles of humans have created this global issue. Water stress varies significantly from place to place and can have a profound negative impact on public health, economic growth, and international trade. To meet the global demand for accessing pure water, it is necessary to follow sustainable approaches that manage the wastewater problem and help reuse the water. Traditional wastewater treatment systems' energy-intensive and mechanical components need significant upfront investment and high ongoing operational expenses. High maintenance costs and poor expertise in conventional treatment technologies have been unsuccessful in treating the wastewater adequately in developing countries like India. Compared with traditional approaches, nature-based technologies are pocket and user-friendly. Nature-based treatment system uses plants, soil, microbes, and other natural components to eliminate pollutants from wastewater. Thus, no chemicals and energy are used in the nature-based approaches, which makes it affordable, eco-friendly, and sustainable. Natural wetlands, constructed wetlands, and lagoons are nature-based systems used for various wastewater treatments. Water treatment and socio-economic benefits like increasing biodiversity, improving urban microclimates, control of flood and storm, biomass production, and water reuse could be achieved while treating water through nature-based systems. This paper will discuss the role of various nature-based systems in wastewater treatment and recent advancements developed in nature-based systems to enhance treatment efficiency.

SPECTROPHOTOMETRIC MONITORING OF EXPLOSIVES WASTEWATER TREATED USING INTEGRATED TREATMENT METHODS

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ABSTRACT

Explosives are classified as potential human carcinogens as per USEPA. Activities such as manufacturing, transportation, destruction, loading assembly and packing of ammunition releases explosive chemicals into the environment. TNT red water majorly contributes to the mutagenic, carcinogenic and toxic properties of the effluent generated during TNT manufacturing. It contains high organic matter that interferes with its treatment methods. The main components of TNT red water are Dinitrotoluene sulfonate (DNTs), sodium nitrite, sodium sulfate, sodium sulfite and other nitro compounds contributing to its toxicity. Thus, there is a need to treat this wastewater for ensuring environmental safety. This study provides an integrated approach for the remediation of TNT red water which is divided into two steps; step 1 decolorization using sodium hypochlorite treatment followed by step 2 comparison of treatment methods viz. Zero valent ion, Fenton's oxidation integrated with advanced oxidation process. Monitoring of TNT wastewater treatment has been carried out by UV-Vis spectroscopy in terms of pH and its ionic concentration (nitrate and nitrite). Ionic concentration denotes the efficiency of the treatment process. Higher the ionic concentration better the degradation. Decolorizing TNT wastewater using liquid bleach followed by advanced oxidation process was found to be the most promising method with comparatively high nitrite ion concentration and complete treatment without the formation of precipitate or leaving any residue.

WASTEWATER REUSE IN AGRICULTURE

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ABSTRACT

Water is an important natural resource all over the world. The environment, economic growth and development are all highly influenced by water. Scientists around the globe are working on new ways of conserving water. Rapidly depleting and elevating the level of freshwater demand, though wastewater reclamation or reuse is one of the most important necessities of the current scenario. Total water consumption worldwide for agriculture accounts 92% out of which about 70% of freshwater is used for irrigation which comes from the rivers and underground water sources. The statistics shows serious concern for the countries facing water crisis reported that 40% of the global population is situated in heavy water–stressed basins, which represents the water crisis for irrigation. It is an opportune time, to refocus on one of the ways to recycle water—through the reuse of wastewater, for irrigation in agriculture and other purposes.

Wastewater comprises of liquid wastes generated by households, industries, commercial sources, as a result of daily usage, production, and consumption activities. By giving primary and secondary treatments we can use this water for irrigation purpose in agriculture. There are various systems of wastewater treatments available. Wastewater and its nutrient content can be used extensively for irrigation and other ecosystem services. It's reuse can deliver positive benefits to the farming community. Therefore, wastewater reuse in agriculture is an ideal resource to replace freshwater use in agriculture. Treated wastewater irrigation supports agricultural yield and the livelihoods of millions of smallholder farmers. The rich availability of nutrients in reclaimed wastewater reduces the use of fertilizers, increases crop productivity, improves soil fertility.

DEVELOPMENT OF REVERSE TRANSCRIPTION LOOP MEDIATED ISOTHERMAL AMPLIFICATION (RT-LAMP) ASSAY AS A POINT-OF-CARE DIAGNOSTICS FOR SARS-COV-2

Shweta Kelkar[1] and Rashmi H.M.[2]

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ABSTRACT

The present study aimed to develop a reverse-transcription Loop-Mediated Isothermal Amplification (RT-LAMP) assay as a "Point-of-care" (PoC) diagnostic solution which can be useful for the detection of SARS CoV-2. To develop this assay**,** the complete genome sequences of SARS CoV-2 reported from different States and Union Territories of India were downloaded from GISAID (**g**lobal **i**nitiative on **s**haring **a**vian **i**nfluenza **d**ata) database. The sequences were aligned to identify conserved regions for designing RT-LAMP primers. After the literature search, three conserved regions with no previously reported primers for detection of SARS CoV-2 were selected and the primers were designed uniquely using Primer Explorer V5. A total of six sets (A, B, C, D, E, and F) of primers, two each from the single conserved region were designed. The specificity of these primers was again checked *in silico* with BLAST tool in the NCBI server. The designed primers did not yield any similarity matches with the other human coronavirus except MERS-CoV and Bat SARS-CoV. On the other hand for the development of LAMP assay with these designed primers, the target conserved regions were got synthesized and analyzed for quality parameters before their use in the LAMP assay. Later, the primers (type, concentration, and ratio) and LAMP reaction temperature were optimized in the development of LAMP assay using synthetic gene constructs. Further, the performance of the developed assay was evaluated at KCGMC, Karnal, Haryana, using cDNA synthesized from RNA of SARS-CoV-2, and the developed LAMP technique was found effective in the detection of SARS-CoV-2. The developed LAMP technique was further explored for the development of colorimetric/fluorometric LAMP assay for rapid visual detection of SARS-CoV-2. The performance evaluation of developed colorimetric and fluorometric LAMP assays yielded satisfactory results in the detection of SARS-CoV-2 RNA. Hence, the developed Colorimetric and fluorometric LAMP assays can be used as PoC diagnostic tests for the detection of SARS-CoV-2. However, its performance directly with RNA or samples needs to be evaluated to make it an RT-LAMP assay and further validation is required with a larger sample size as per ICMR, India guidelines**.**

LARGE SCALE SOIL MAPPING (1:10000) USING GEOSPATIAL TECHNIQUES – A CASE STUDY OF DAHOD DISTRICT, GUJARAT

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ABSTRACT

The present study aimed to develop a reverse-transcription Loop-Mediated Isothermal Amplification (RT-LAMP) assay as a "Point-of-care" (PoC) diagnostic solution which can be useful for the detection of SARS CoV-2. To develop this assay**,** the complete genome sequences of SARS CoV-2 reported from different States and Union Territories of India were downloaded from GISAID (**g**lobal **i**nitiative on **s**haring **a**vian **i**nfluenza **d**ata) database. The sequences were aligned to identify conserved regions for designing RT-LAMP primers. After the literature search, three conserved regions with no previously reported primers for detection of SARS CoV-2 were selected and the primers were designed uniquely using Primer Explorer V5. A total of six sets (A, B, C, D, E, and F) of primers, two each from the single conserved region were designed. The specificity of these primers was again checked *in silico* with BLAST tool in the NCBI server. The designed primers did not yield any similarity matches with the other human coronavirus except MERS-CoV and Bat SARS-CoV. On the other hand for the development of LAMP assay with these designed primers, the target conserved regions were got synthesized and analyzed for quality parameters before their use in the LAMP assay. Later, the primers (type, concentration, and ratio) and LAMP reaction temperature were optimized in the development of LAMP assay using synthetic gene constructs. Further, the performance of the developed assay was evaluated at KCGMC, Karnal, Haryana, using cDNA synthesized from RNA of SARS-CoV-2, and the developed LAMP technique was found effective in the detection of SARS-CoV-2. The developed LAMP technique was further explored for the development of colorimetric/fluorometric LAMP assay for rapid visual detection of SARS-CoV-2. The performance evaluation of developed colorimetric and fluorometric LAMP assays yielded satisfactory results in the detection of SARS-CoV-2 RNA. Hence, the developed Colorimetric and fluorometric LAMP assays can be used as PoC diagnostic tests for the detection of SARS-CoV-2. However, its performance directly with RNA or samples needs to be evaluated to make it an RT-LAMP assay and further validation is required with a larger sample size as per ICMR, India guidelines**.**

BIODIVERSITY STUDIES OF PIGMENTED BACTERIA AND FUNGI ISOLATED FROM PANJIM NALLAH WATER AND CHARACTERISATION OF SELECTED ISOLATES

Marielou Ferrao

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ABSTRACT

The St. Inez nallah is an aquatic freshwater ecosystem that originates from the Altinho hill at Taleigao , branching along the way through agricultural lands and the city market, opening up in the river Mandovi. The water is contaminated by a huge amount of sewage which enters the nallah from the illegal community residences along the nallah. In this scenario, a biodiversity study has crucial value. Previous studies have shown that pigmented microorganisms have been isolated from polluted aquatic environments; hence a biodiversity study of pigmented bacteria and fungi in this ecosystem becomes extremely relevant. Isolation of pigmented bacteria and fungi was achieved by membrane filtration of collected water samples on Kings Medium and Potato Dextrose agar with glycerol. Pigmented isolates were screened for biosurfactant production by cetyltrimethylammonium bromide plate methylene blue assay. Isolates showing potential for accumulation of biosurfactant were chosen for determination of taxonomic status by 16SrRNA sequencing. Optimisation of growth in mineral medium was achieved with glycerol as a carbon source. Out of the 14 pure cultures of pigmented bacteria and fungi obtained two isolates SXC3 and SXC31 showed potential for production of biosurfactant. The culture SXC31 gave maximum growth at glycerol concentration of 0.02% and culture SXC3 gave maximum growth at glycerol concentration of 0.5% when glycerol was the sole carbon source in mineral medium. Cultures SXC3 and SXC31 did not display pigmentation when glycerol was the sole carbon source in mineral medium. SXC3 was identified as *Klebsiella michiganensis* strain BAE24 and SXC31 was identified as *Pseudomonas entomophila* strain W-S-1-1-2 by 16SrRNA sequencing.

CONSERVATION OF TERMINALIA CORONATA (STAPF) GERE & BOATWR. - A RARE, ENDANGERED AND THREATENED SPECIES OF RAJASTHAN

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Arid forest Research Institute, Jodhpur

ABSTRACT

Indradhok or *T. coronata* is a medium to large sized, semi-deciduous, multipurpose hardwood tree growing in the Aravalli region of Rajasthan. The wood of this plant is sufficiently tough to be employed in the construction of carts and other agricultural equipment. It is also an important source of fuel and feed. It may be used as an avenue tree since it's a huge, gorgeous tree. The study area's biodiversity is currently primarily threatened, which is depleting the area's floral resources and ecology as a whole. Demographic pressures and settlement patterns, overgrazing, drought conditions and invasive species introduction are some of the major threats faced by the species from the past until now. In this species, natural regeneration occurs through the production of seeds; however, seed viability is very low (0.1–0.2%) and therefore is the main constraint for its population decline in the wild. For both species, micropropagation techniques have been developed, but they are time-consuming, expensive, and require a lot of upkeep. In order to prevent these species from going extinct, conservation through macropropagation and restoration in their natural environment is unquestionably required in the near future.

DALBERGIA SISSOO: A POTENTIAL LEGUMINOUS PHYTOAMELIORATION TREE TO REHABILITATE THE DEGRADED SODIC LANDS OF ARID REGION

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ABSTRACT

Raising tree cover on sodic areas aids in transforming barren ground into a self-sustaining ecosystem, halting further degradation. In India, the sodic lands, one of the primary categories of salt-affected fields, cover roughly 36 million ha. These lands are unproductive and infertile for a variety of reasons, including poor nutritional status, excessive pH, and sodium dominance. Sodic soils, which are white and barren and come in patches of different sizes, have been disregarded for decades. Stopping this soil deterioration process and restoring the health of previously degraded fields are essential needs. The most acceptable land use for such areas is the establishment of a permanent tree cover made up of suitable salt-tolerant species since trees not only supply fuel, fodder, and lumber but are also of vital biological and environmental importance. The trees enhance the soil's physical and chemical properties and make it appropriate for the establishment and growth of other plants by, among other things, introducing organic matter, enhancing porosity, supplying shade, starting the cycle of nutrient availability, and enhancing microbial activity. The nitrogen-fixing tree species *Dalbergia sissoo* holds great potential for revegetation, fuel production, soil fertility enhancement through N fixation, and the production of pods for use as cattle feed in arid and salt-affected areas. So, for resource-poor farmers and community-based reclamation management of moderately saline-sodic and sodic soils, phytoamelioration is one of the more effective methods. It is currently a viable technique in several countries, including India.

GEOGRAPHICAL DISTRIBUTION OF *CALLIGONUM POLYGONOIDES* LINN.: AN IMPORTANT SPECIES OF THAR DESERT

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ABSTRACT

Calligonum polygonoides Linn. is a xeric endemic and threatened perennial shrub that is highly resistant to all types of abiotic stress. It belongs to the family Polygonaceae with a natural distribution in the Thar desert. *C. polygonoides* locally known as Phog, Phogra, Phogala or Phogaro, Berwaja. It grows on longitudinal transverse and parabolic dunes and it is a major component of plant communities of the psammophytic scrub desert. This plant is an important indigenous, dominant biomass producer under extremes of concurrent abiotic stresses in sandy areas. Phog plant has great potential to provide different ecological and economic services such as food, fodder, fuel and traditional medicines. Roots provide energy-rich fuel. This plant also shows ethnomedicinal importance. Flower buds locally called 'Phugusi' are effectively used in the treatment of sunstroke and also used in fresh, dried form for making heat relieving raiyta. Green long branches are used as a gargle for sore gums. Tonic and digestive properties of Phog are used against Typhoid, Asthma, Cough and Cold. The aqueous paste of this plant acts as an antidote against the poisonous effect of *Calotropis procera*. Recently, Phog is included in 10 medicinal herbs to be used in the 'Charak Programme'. *C. polygonoides* bestowed the status of keystone species of the Indian desert. Due to its significant multipurpose properties; Phog has been over-exploited which in turn has led to its inclusion in the list of vulnerable and endangered plant species of Red Data Book of India. Therefore there is a need to conserve it. Genetic diversity plays an important role in conservation. We have examined the plant distribution through field survey. After which we found that it is distributed in Barmer, Bikaner, Churu, Hanumangarh, Jaipur, Jaisalmer, Jodhpur, Nagaur, Sikar, and Sri Ganganagar.

PREDICTED IMPACT OF CLIMATE CHANGE ON ELUSIVE SMALL CARNIVORES OF WESTERN GHATS

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ABSTRACT

Western Ghats act as home to many small carnivores. These carnivores are the less studied group of animals. Only a few reports are there regarding their status and distribution, especially carnivores like herpestidae. Many of the small carnivores are (CE) critically endangered, (EN) endangered or (VU) vulnerable as per the IUCN status. Western Ghats (WG) is famous for its high level of endemism and constitutes many endemic and endangered species. The WG landscape is facing severe threats as a result of deforestation, agricultural extensions, and development. Species occurrence records were collected by direct sightings, camera trap surveys and literature records. Using species distribution modelling, we predicted the consequences of climate change of three herpestidate such as ruddy mongoose (*Urva smithii*), stripe-necked mongoose (*Urva vitticollis*), and brown mongoose (*Urva fusca*) in WG mountain range. We used Maxent algorithms to model the current and future distribution of these species in the three Representation Concentration Pathway (RCP 4.5, 6.0, and 8.5) climate scenarios of the 2070 period. Our predicted models indicated a decline in suitable habitats for these species in future climate scenarios. Hence implementing smart and effective policies that would help reduce carbon footprint and other greenhouse gases, and help lessen the pollution-driven climate change which endangers the health of communities and wildlife, is necessary for the conservation of these elusive, endemic species and their habitat in the WG landscape.

BIODIVERSITY STUDIES OF PIGMENTED BACTERIA AND FUNGI ISOLATED FROM PANJIM NALLAH WATER AND CHARACTERISATION OF SELECTED ISOLATES

Marielou Ferrao

Assistant Professor Department of Microbiology
St. Xavier's College of Arts Science & Commerce Mapusa Goa

ABSTRACT

The St. Inez nallah is an aquatic freshwater ecosystem that originates from the Altinho hill at Taleigao , branching along the way through agricultural lands and the city market, opening up in the river Mandovi. The water is contaminated by a huge amount of sewage which enters the nallah from the illegal community residences along the nallah. In this scenario, a biodiversity study has crucial value. Previous studies have shown that pigmented microorganisms have been isolated from polluted aquatic environments; hence a biodiversity study of pigmented bacteria and fungi in this ecosystem becomes extremely relevant. Isolation of pigmented bacteria and fungi was achieved by membrane filtration of collected water samples on Kings Medium and Potato Dextrose agar with glycerol. Pigmented isolates were screened for biosurfactant production by cetyltrimethylammonium bromide plate methylene blue assay. Isolates showing potential for accumulation of biosurfactant were chosen for determination of taxonomic status by 16SrRNA sequencing. Optimisation of growth in mineral medium was achieved with glycerol as a carbon source. Out of the 14 pure cultures of pigmented bacteria and fungi obtained two isolates SXC3 and SXC31 showed potential for production of biosurfactant. The culture SXC31 gave maximum growth at glycerol concentration of 0.02% and culture SXC3 gave maximum growth at glycerol concentration of 0.5% when glycerol was the sole carbon source in mineral medium. Cultures SXC3 and SXC31 did not display pigmentation when glycerol was the sole carbon source in mineral medium. SXC3 was identified as *Klebsiella michiganensis* strain BAE24 and SXC31 was identified as *Pseudomonas entomophila* strain W-S-1-1-2 by 16SrRNA sequencing.

Technical Session
4

ASSOCIATION OF ABO BLOOD GROUP PHENOTYPES WITH COVID-19: A CROSS-SECTIONAL STUDY IN GOA

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ABSTRACT

COVID-19 pandemic has caused massive havoc across millions of people worldwide. At present, extensive research is being emphasized on vaccine trials, treatment, and risk factors for the disease. Recent studies suggest one such inheritable trait, ABO blood group phenotype, may be associated with SARS-CoV-2 infection. The present study is aimed at determining the susceptibility and symptomatic variation of COVID-19 among ABO blood group phenotypes in a sample population of Goa, India. An online questionnaire-based survey was conducted among 228 Goan subjects by administering a google form. Subjects who were tested positive for COVID-19 and had information about their blood groups were recruited for this study. The data collected was subjected to statistical analyses using Fisher's exact test. Present study showed subjects with Blood group O were at a higher risk for COVID-19 (OR= 1.4 ,95% CI, 0.93-2.22, p-value=0.114), followed by B (OR= 1.4 ,95% CI, 0.93-2.22, p-value=0.896), A (OR= 1.4 ,95% CI, 0.93-2.22, p-value=0.488), while AB was at lower risk (OR= 0.43 , 95% CI, 0.17-1.13, p-value=0.090). Additionally, Rh+ subjects were at a lower risk for COVID-19 (OR= 0.77, 95% CI, 0.37-1.68) as compared to Rh- subjects (OR= 1.29, 95% CI, 0.59-2.64). However, the difference observed was statistically insignificant (p=0.460). Our findings suggest that ABO blood group phenotypes may influence the susceptibility of people towards COVID-19.

ENDOPHYTIC FUNGI INOCULATION: A SUSTAINABLE WAY FOR INCREASING THE PHYTOCHEMICAL CONTENT IN STEVIA REBAUDIANA (BERTONI) BERTONI

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ABSTRACT

The demand for *Stevia rebaudiana* has increased due to its low calorie and medicinal values. *S. rebaudiana* a perennial herb belonging to family asteraceae is important for its leaves which are used as non-calorie sweetener and in many therapeutic applications including diabetes. Endophytes have the influence on biological properties of medicinal plants, so the research is focused on twenty fungal isolates classified as ascomycota (R1-R14), zygomycota (R15-R17), or oomycota (R18-R20) which were isolated from the medicinal plant *Ocimum tenuiflorum* L. Among all fungal isolates R2 (*Fusarium fujikuroi*) strain showed maximum antagonistic activity towards plant pathogenic fungi *Rosellinia necatrix* and *Fusarium oxysporum*. Fungal endophyte *Fusarium fujikuroi* (ON652311) was inoculated on *Stevia rebaudiana* seeds to determine the effect of an endophytic fungus on the phytochemical properties of *Stevia rebaudiana*. During the study, it was observed that the highest amount of total phenolic, flavonoids, tannin, carbohydrate, protein alkaloid, saponin compounds, were recorded from the methanolic extract of endophyte inoculated plant. The lowest amount of total phenolic flavonoids, protein, tannin, carbohydrate, alkaloid, saponin, compounds were recorded in chloroform extract. GC-MS analysis of methanol plant extract of *S. rebaudiana* plant showed eleven prominent peaks. The major compound observed in methanol plant extract were Styrene (C_8H_8) with peak area 13.62%, 1,3-Benzodioxole-2-carboxylic acid, ethyl ester ($C_{10}H_{10}O_4$) with peak area 13.25. In chloroform plant extract, the major compound observed were 1H-Imidazole-1-ethanol, à,á-diphenyl-, (R*,R*)- ($C_{17}H_{16}N_2O$) with peak area 8.20%, N-(3-Phenylbutyl)-pentadeacafluor o-octanamide ($C_{18}H_{14}F_{15}NO$) with peak area 6.82%.. Thus, present research proved that methanol acts as best solvent to extract maximum quantity of phytochemicals from the plant and as well proved endophytic fungi inoculation as a sustainable way for increasing the phytochemicals in plants.

SENSITIVITY OF *ANDROGRAPHIS PANICULATA* (BURM. F.) MORPHOTYPES TO SOIL MOISTURE STRESS: STATUS OF ANTIOXIDANT ENZYME ACTIVITIES AND ANDROGRAPHOLIDE YIELD

Kuldeep Singh A. Kalariya, Deep Shahia, Parmeshwar Lal Sarana, Ram Prasnna Meena[1], Narendra Gajbhiyea, Rohan Sarkar[1], and Geetha K.A.[1]

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ABSTRACT

Well known across the world for its use in treatment of several diseases and alignments, the *Andrographis paniculata* (Burm. f.) Wall is popular for its bitterness. Steroidal lactones; andrographolide, neoandrographolide and dehydroandrographolide are major bioactive compounds from the entire herbage of this plants. As per reports, it is sensitive to water deficit stress and hence, with a view to test stress mitigating effects of foliar exogenous application of regulatory phytohormones; methyl jasmonate (MeJ) and salicylic acid (SA), five different morphotypes were evaluated under soil moisture stress conditions imposed during 90-140 days after transplanting in two consecutive crop seasons. The leaf water content (RWC) content and leaf water potential (LWP) were not affected by MeJ and SA however, soil moisture stress had severely affected the soil water plant relations in all morphotypes. Stress had significantly upregulated the activities of activity of superoxide dismutase (SOD), guaiacol peroxidase (GPOX), catalase (CAT) and ascorbate peroxidase (APX). Stressed plants had compromised dry herbage yield but, increase in andrographolide concentration by 6% however, the net loss in terms of andrographolide yield was nearly 8% in stressed plants. Foliar exogenous application of MeJ and SA mitigated stress effects through enhanced antioxidant enzymes activity, however, with no significant effects dry herbage yield in any morphotypes.

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A NEW CALIX[4]PYRROLE FUNCTIONALIZED FLUORESCEIN BASED SUPRAMOLECULAR COMPOUNDS FOR LIQUID CRYSTALLINE AND WINDOW LAYER SOLAR CELL APPLICATIONS

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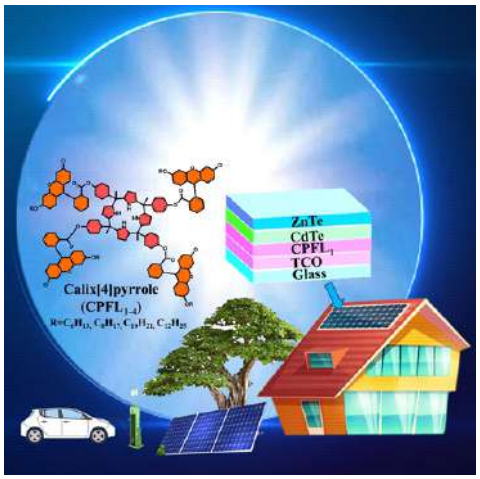
ABSTRACT

A newly symmetrical liquid crystals ($CPFL_1$-$CPFL_4$) based on calix[4]pyrrole as a central rigid core were synthesized *via* esterification reaction. All four functionalized compounds exhibits columnar hexagonal phase over a higher mesophase range and further stabilized upto room temperature. The thermal behaviours and optical textures were identified by using DSC, POM and the molecular organization of the compound in the mesogenic state is confirmed by XRD technique. Calix[4]pyrrole core with symmetrical nature exhibited columnar type self-assembly at room temperature. All four supramolecules with different side spacer showed higher thermal stability. Compound $CPFL_1$ is further tested for the absorbing layer in solar cell applications specially replace toxic CdS layer in solar cell devices. Herein, we used calix[4]pyrrole functionalized supramolecular liquid crystalline compounds as an optical window layer to achieve higher transmittance behavior towards the incident irradiance to the absorber layer. The current-voltage relation shows Ohmic-type behaviour. The photophysical behavior display high transmittance in visible and nearly IR regions. The derivative showed lower band gap values at different thin film state and variable temperature which are more suitable for ecofriendly absorbing window layer in solar cell applications. The morphology clearly indicates the uniform deposition of the sample with grain-growth type arrangement pattern.



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EFFECT OF FENUGREEK SEED EXTRACT ON FLUORIDE INDUCED TESTICULAR DISORDERS IN ALBINO RATS

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ABSTRACT

Fluoride is one of the most abundant trace elements present in nature especially in rocks, soil, coal and drinking water. Fluoride contamination in drinking water have been documented as one of the greatest human health issues globally. According to WHO and BIS fluoride concentration up to 1-1.5 mg/L is recommended as a permissible limit for drinking. Prolonged intake of fluoride through drinking water above this limit is associated with dental and skeletal Fluorosis. Fluoride contamination through drinking water can disrupt male gametogenesis and steroidogenesis and also induce testicular oxidative stress. The aim of this study was to investigate the efficacy of fenugreek seeds as a potential natural source of antioxidants. A fenugreek seed (*Trigonella foenum-graecum L.)* is a member of the leguminous family and its seeds are used as herbal medicine. This study was carried out to evaluate the effect of aqueous extract of fenugreek seeds at the dose of 80mg/100g body weight/day for 28 days on fluoride-induced testicular toxicity in albino rats. Treatment of rats with sodium fluoride at the dose of 2 mg/100g/day for 28 days resulted in a significant reduction of testicular ^{5}, 3-hydroxysteroid dehydrogenase and 17-hydroxysteroid dehydrogenase activities along with low plasma levels of testosterone, follicular stimulating hormone and luteinizing hormone. On contrary, fluoride treatment was associated with diminished activities of testicular catalase, superoxide dismutase and peroxidase along with elevation of thiobarbituric acid reactive substances and conjugated dienes. Co-administration of fenugreek seed to the fluoride treated animals resulted in a significant recovery from testicular disorders. In addition, fenugreek seed treatment led to a remarkable decrease in the level of lipid peroxidation and increase in the activities of antioxidant enzymes. Thus, it can be concluded that fenugreek seed extract can protect the sodium fluoride-induced testicular toxicity and this effect may be attributed to its antioxidant properties.

SEMECARPUS ANACARDIUM LINN. LEAF EXTRACT EXHIBITS ANTI-BREAST CANCER PROPERTIES AND PROLONG THE LIFE-SPAN OF TUMOR-BEARING MICE

Rajesh Kumar Singh[1]*, Bhagaban Mallik[2], Amit Ranjan[1] and Anil Kumar Singh[1]

[1]Department of Dravyaguna, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India
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ABSTRACT

Semecarpus anacardium Linn. nuts are used in preparation of drugs of several traditional medicine system to treat clinical ailments since ancient times that adversely affect the population of this plant, and finally the biodiversity. The alternative source for the nuts is demand of the time to preserve the biodiversity without affecting the clinical demands.

The phytochemical components of nuts can be difficult to isolate and have lethal effects on other cells. We used standardised techniques in this study to isolate the phytochemicals from the leaf extract and assessed their anti-cancer properties for potential drug development. The ethyl acetate leaf extract selectively affects cancer cells in a dose-dependent manner (IC50: 0.57 µg/ml in MCF-7 cells) in various cancer cell lines. However, the non-malignant cells were relatively insensitive to the extract. Further study with acridine orange, ethidium bromide and 4′,6-diamidino-2-phenylindole (DAPI) revealed that the extract induced apoptosis in cancer cells.

Next, we examined if the extract incubation could induce cell cycle arrest and suppress cell migration in the cell culture model. Consistent with this idea, the leaf extract could potentially affect the aggressive nature of migration in cancer cells. Moreover, oral administration of extract significantly restored the tumor growth of Ehrlich ascites carcinoma cells in mice. Besides, the ethyl acetate extract could potentially prolong the survival of tumor-bearing mice.

Together, these observations suggest the anti-cancer activities of *S. anacardium* leaf potential for both *in vitro* and *in vivo* models. Hence, this study opens a new paradigm to examine the phytochemical constituents of the leaf for anti-cancer activities.

EVALUATION OF NEUROPHARMACOLOGICAL ACTIVITIES OF PERSIMMON (*DIOSPYROS KAKI* LINN.) FRUITS IN RATS

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ABSTRACT

The *Diospyros kaki* L. , also known as oriental persimmon, is a tropical, deciduous fruit with a fleshy, fibrous texture that is a member of the Ebenaceae family. The fruit is rich in polyphenols, terpenoids, steroids, flavonoids, carotenoids, minerals, dietary fiber and other bioactive compounds.

The objective of the study is to conduct pharmacological screening of the persimmon (*Diospyros kaki* L.) aqueous and ethanolic extract in order to assess the extract's impact on the rat CNS utilizing various animal models.

The AEDK and EEDK were screened for antianxiety activity , spontaneous behavior and effects on learning and memory using different animal models. Two doses each of AEDK (200mg/kg and 400g/kg) and EEDK (200mg/kg and 400mg/kg) were selected for the study.

From the data, it can be inferred that the test groups have antianxiety activity because all four test groups increased in metrics such %OAE and %TSOE at some point in time. AEDK had more antianxiety effect than the fruit's ethanolic extract. In conclusion, pharmacological testing revealed that the aqueous and ethanolic extract of *Diospyros kaki* L. significantly reduced anxiety and had CNS depressive effects.

HYPERTENSION: A MAJOR THREAT TO HUMAN BEINGS

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ABSTRACT

Nowadays especially after Covid-19 pandemic, stress full lifestyle has led to the high blood pressure conditions which in turn resulted in hypertension. Almost half of all adults in the United States have high blood pressure, but many are not aware of this fact. Hypertension is a primary risk factor for cardiovascular disease, including stroke, heart attack and heart failure. Keeping blood pressure under control is vital for preserving health and reducing the risk of these dangerous conditions. The U.S. National Heart, Lung, and Blood Institute (NHLBI) recommend the DASH diet for people with high blood pressure. DASH stands for "Dietary Approaches to Stop Hypertension." Angiotensin-I-converting enzyme (ACE; peptidyl dipeptide hydrolase, EC 3.4.15.1) has a key role in the control of blood pressure through the renin angiotensin-aldosterone system. The key role of ACE is to convert angiotensin-I (the inactive decapeptide) to angiotensin-II (the potent vasoconstrictor octapeptide). ACE-inhibitory activities of peptides can be affected by their chain length, composition and sequence like conformational characteristics. ACE-inhibitory peptides have their potential of stability in gastrointestinal tract and reach the digestive, endocrine and cardiovascular system to show their bioactivity. Administration of antihypertensive medicines such as captopril and enalapril, which are potent ACE inhibitors, are among the synthetic medicines have shown to have undesirable side effects such as insomnia, angioedema, cough, allergic reactions, fever and headache. Antihypertensive peptides/ protein hydrolysates have been reported as natural ACE inhibitors that are also equally capable of reducing blood pressure with no side effects. Natural antihypertensive peptides have been reported from several medicinal plants such as *Benincasa hispida* and *Glycine max*. With that view many of plant bioactive peptides will become potent sources of such natural antihypertensive protein hydrolysates and help us to disease risk reduction.

HYPO-TESTICULAR ACTIVITY ASSESSMENT OF HYDRO-METHANOL (60:40) SEED EXTRACT OF *LUFFA ACUTANGULA* IN HUMAN AND ALBINO RAT: AN *IN-VITRO* INVESTIGATION

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ABSTRACT

Unprecedented population growth is one of world's major issues and it is most important priority area of research to control population growth. This *in-vitro* experiment was designed to explore the male contraceptive efficacy in different dose (10mg, 20mg and 40mg) of hydro-methanolic (60:40) extract (HME) of seed of *Luffa acutangula* in rat and human reproductive parameters. Spermiological sensors i.e., sperm motility, viability, HOS, acrosomal cap status were assessed in rat and human spermatozoa and also nuclear chromatin decondensation (NCD) were assessed in rat spermatozoa. Activities of oxidative stress biomarkers i.e., SOD, catalase and free radical end product i.e., TBARS also measure from testicular and epididymal tissue of rat and human sperm pellet. Activities of testicular androgenic key enzymes i.e., Δ5,3β-HSD and 17β-HSD were assessed in rat. Toxicity profile i.e., GOT and GPT were assessed from various tissue samples in rat like liver, kidney, testis and prostate. All spermiological profile were reduced significantly ($p<0.05$) with different doses (10mg, 20mg, 40mg). EC*50* value determines that fifty percent immobilization in spermatozoa as it was noted in human at 10mg/0.5ml dose and in case of rat the EC*50* was 8mg/0.5ml dose of seed extract. The testicular androgenic key enzymes activity i.e., Δ5,3β-HSD, 17β-HSD were reduced significantly ($p<0.05$). The activities of SOD and catalase were significantly ($p<0.05$) reduced and also significantly ($p<0.05$) increased the level of TBARS in rat testicular and epididymal tissue and human sperm pellet. No metabolic toxicity was noted on different reproductive and metabolic organs of rat. *In-vitro* investigation concludes that hydro-methanol (60:40) seed extract of *L. acutangula* possess a significant anti-testicular cum contraceptive efficacies in human and rat.

INTERACTIVE EFFECT OF ELEVATED CO_2 AND VARYING NITROGEN REGIME ON THE PHYSIO-BIOCHEMICAL RESPONSE OF *NEOLAMARCKIA CADAMBA*

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ABSTRACT

Quantitative integration of the literature on the effect of increasing CO_2 and nitrogen regimes on woody plants is crucial to aid our understanding of forest health in the future decades and to better forecast terrestrial feedbacks on the global carbon cycle. *Neolamarckia cadamba* is one of the promising, multipurpose, prospective and fast growing tree which is being grown in field in form of agroforestry. *N. cadamba* is considered to be a highly valuable tree in agroforestry and Carbon Sequestration due to its quick decomposition rate. However, there is no information on how this plant will react to changing climatic circumstances, including higher atmospheric CO_2 concentrations. The aim of the study is to understand the physio-biochemical response of *Neolamarckia cadamba* under elevated carbon dioxide(~800µmol mol^{-1}) as compared to control (400µmol mol^{-1}) with three different nitrogen regimes. Protein were increased significantly in N_{300} Kg N ha-1 in elevated CO_2 concentration while chlorophyll and carbohydrate were significantly increase in N_{500} Kg N ha-1in elevated concentration. While plant respiration, were increased significantly in N_{200} Kg N ha-1 in elevated CO_2 concentration as compared to control. Plants maintain stronger stress tolerance mechanism via improvements in the synthesis of photosynthate and water retention capacity. Such behavior may facilitate plant adaptation to deal with climatic change and global warming. Tree productivity, vegetation, and ecosystem health may also be improved.

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NOVEL MECHANISTIC INSIGHTS ON MELATONIN MEDIATED PHYSIO-BIOCHEMICAL, MICROSCOPIC, AND HISTOCHEMICAL MODIFICATIONS IN TOMATO PLANTS TO PROMOTE SALT STRESS TOLERANCE

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ABSTRACT

Salt stress is a serious environmental constraint that is increasingly limiting seed germination, plant growth and development as well as both yield and quality of agricultural crop plants. Melatonin (Mel) is an indolamine multi-functional signaling molecule governing diverse range of environmental stresses responses in plants. Therefore, an experiment was designed to explore the defensive role of Mel under salt stress conditions. Root dip pretreatment of Mel (50 or 100 µM, 4h) was applied to tomato plants just before transplantation and NaCl (100 or 150 mM) stress was imposed at 20 days after transplantation. It was observed that salt stress adversely affected stomatal physiology, photosynthetic efficacy, plant growth, and disrupted ultra-structure of chloroplast, root morphology, and cell viability, however, salt stress triggered hyper-accumulation of reactive oxygen species (H_2O_2 and O_2^-), and negatively affected membrane integrity. Interestingly, pretreatment of Mel significantly reduced the MDA content and electrolyte leakage, mitigated oxidative stress and promoted photosynthesis, improved cell viability, stomatal behavior, and plant growth, and boosted the activity of catalase (CAT), peroxidase (POX), and superoxide dismutase (SOD) and elevated proline content which bestowed endurance and alleviated the salt-induced toxicities.

SEQUENCE ANALYSIS OF *siet* gene IN *STAPHYLOCOCCUS PSEUDINTERMEDIUS* ISOLATED FROM CANINE PYODERMA

Prashantha M K; Shambulingappa B E*; Sundareshan S; Kotresh A M; Rudresh B H; Madhavaprasad C B and Arun S J

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ABSTRACT

A study was conducted on isolation, identification and characterization of staphylococcal organisms associated with the canine pyoderma. The bacteriological processing of the samples resulted in the recovery of 95 staphylococcal isolates and 18 other bacterial isolates. On culture, staphylococci were the most predominantly (n=95, 75.39%) isolated organisms.Based on *nuc* gene-based PCR, out of 95 staphylococcal isolates obtained, 82 (86.1%) of the isolates were found belonging to S. pseudintermedius. And out of 82 *S. pseudintermedius* isolates, *siet* gene was detected in 69 (86.1%) isolates. *S. pseudintermedius* was found to be predominant bacterial pathogen responsible for pyoderma in dogs.

Two PCR products which were amplified for *nuc* gene and one each of *siet* and *mec*A gene were sent for commercial sequencing and the sequence alignment revealed 99.23 *per cent*, 99.14 *per cent*, 98.98 *per cent* and 100 *per cent*, similarities with the corresponding genes of *S. pseudintermedius* respectively.

SIMULTANEOUS ESTIMATION OF METHOCARBAMOL AND IBUPROFEN IN FIXED DOSE COMBINATION BY UV SPECTROPHOTOMETRIC METHOD

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ABSTRACT

The objective of present research work is to develop a simple, precise and accurate UV spectropohtometric method based on Isobestic point approach for quantitative estimation of methocarbamol (MET) and ibuprofen (IBU) in their fixed dose combinations. All solutions were prepared using methanol as solvent. The isobestic point wavelength for MET and IBU was found to be 226 nm. Concentration of IBU was determined at isobestic wavelength 226 nm while MET was determined directly at 277 nm as there was no interference of IBU. Validation of the method was carried out as per ICH guidelines (Q2R1). Linearity was established for MET at the concentration range of 28 – 56 µg/mL (r^2 = 0.996 at 277 nm) and for IBU it was between 16 – 32 µg/mL (r^2 = 0.990 at 226 nm). Percentage relative standard deviation (% RSD) value of less than 2 % for intra-day and inter-day precision confirmed the precision of the method. Accuracy of the method was in the range of 98 - 102 %. The developed method is suitable and can be applied for analysis of marketed formulation.

STUDIES ON CLINICAL SPECTRUM OF CANINE PYODERMA ASSOCIATED WITH *STAPHYLOCOCCUS PSEUDINTERMEDIUS* AND OTHER SECONDARY BACTERIAL INVADERS AND THEIR ANTIBIOGRAM PROFILE FOR EFFECTIVE THERAPY

Prashantha M K; Shambulingappa B E*; Sundareshan S; Kotresh A M; Rudresh B H; Madhavaprasad C B and Arun S J

Veterinary college Shimoga (KVAFSU, Bidar), Karnataka

ABSTRACT

A study on bacteriological investigation of canine pyoderma cases was conducted at the Veterinary College, Shivamogga. Exudate/pus/lesion swabs were collected from clinical cases of canine pyoderma (n=126) and subjected to isolation and identification of bacterial isolates by phenotypic methods. The bacteriological processing of the samples resulted in the recovery of 95 staphylococcal isolates and 18 other bacterial isolates. On culture, staphylococci were the most predominantly (n=95, 75.39%) isolated organisms. The isolates obtained other than staphylococcal species were *E. coli*, *Pseudomonas* species, *Klebsiella* species, *Proteus* species. Subsequently *in vitro* antimicrobial sensitivity testing was carried out for all the isolates. *S. pseudintermedius* showed highest susceptibility to clindamycin and the highest resistance to enrofloxacin, and the other bacterial agents were found sensitive to co-trimoxazole and ceftriaxone and resistant to amoxicillin/sulbactam and enrofloxacin. A study on the occurrence patterns of canine pyoderma revealed higher frequency of cases in male dogs, in the age group of 1-2 years and in Labrador breed. We report the *S. pseudintermedius* as the most predominant pathogen associated with the canine pyoderma in the study area.

DEVELOPMENT OF LOW COST PISTON PRESS BRIQUETTING MACHINE

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ABSTRACT

The two most-promising climate resilient species of camel thrive well in hot arid and semi-arid regions of the desert (e.g. Camelus dromedaries) and arid cold-climatic regions of the mountains (e.g. C. bactrianus) and continue to provide livelihood opportunity to co-habiting human population. They serve as multipurpose animals producing milk, fiber/hair, as a means of transport or draught, excreting urine and providing manure, often yielding meat as a part of culling process and supplying leather and bones after death. The unique ability to adapt to extreme desert ecosystem with peculiar physiological (thermoregulation, water metabolism, glucose and energy metabolism, salt tolerance, forbearance against choking dust, etc.) and anatomical (fore limb and hind limb, long neck, single and double hump, third eye-lid, forestomach, etc.) differences has a significant bearing on its productive lifespan. Methane emission from ruminants is a significant component of greenhouse gas (GHG) production that contributes to global warming, but camel seems to contribute less due to its unique fiber-utilizing capability and foraging on phytochemical-rich forages that controls methane emission. Thus, it is noteworthy to say that camel is an environmental-friendly livestock of the globe and its remarkable adaptive characteristic projects it as the animal for future as the world is preparing itself to face the untoward challenges of climate change.

DEVELOPMENT OF BIODEGRADABLE NANOCOMPOSITE PACKAGING MATERIAL FOR CHICKEN MEAT

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ABSTRACT

Meat is a moisture-rich nutritious animal protein having great demand among consumers. The recent food packaging regulations amidst climate change recommend the usage of biodegradable packaging material for foods for preventing environmental pollution. Biopolymer-based films have a poor barrier and thermal properties compared to plastic films. This makes exclusive biopolymer films ineligible for use as primary packaging material for moisture-rich food products like meat. Hence research was undertaken to develop a biodegradable nanocomposite-biopolymer film for improved barrier and thermal properties for packaging meat. The eco-friendly nanocomposite packaging material was developed by incorporating polylactic acid, nano clay, and clove oil in chloroform. The film was prepared by casting method in a large glass tray. The nanocomposite film was characterized for quality parameters in comparison with the commercial low-density polyethylene (LDPE) films. The results indicated that film thickness, transparency, tensile strength, and lightness were significantly ($p<0.05$) higher for nanocomposite film when compared with the LDPE film. Whereas, traits like elongation at break were significant ($p<0.05$) in LDPE film compared to nanocomposite film. There was no significant difference in the parameters like moisture content, moisture absorption, water vapor permeability, and film solubility between the LDPE and nanocomposite films. Then the developed nanocomposite film was made into pouches to hold 250g of chicken meat. The pouches were sealed and the meat was stored in a refrigerator at 4±1°C to analyze the shelf-life attributes of the chicken meat. A control group was maintained with chicken meat packaged in LDPE pouches. The storage quality attributes revealed that there was no significant difference between the chicken meat packaged in LDPE and nanocomposite films for the parameters like pH, titratable acidity, and thiobarbituric acid reactive substances. While the parameters like extract release volume and tyrosine values differed significantly ($p<0.05$) between the chicken meat packaged in LDPE and nanocomposite films during the refrigerated storage period. The shelf-life attributes showed that chicken meat was acceptable upto day 6 in both LDPE and nanocomposite films. It is concluded from the above results of film characteristics and shelf-life attributes that the developed nanocomposite film is an ideal alternative for LDPE films for packaging fresh chicken meat and subsequent storage in refrigerated conditions.

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DEVELOPMENT OF ELECTROCHEMICAL BASED IMMUNOSENSOR FOR THE DETECTION OF COLISTIN-A BANNED ANTIBIOTIC IN CHICKEN MEAT

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ABSTRACT

An innovative amperometric immunosensor has been developed to detect antibiotic colistin from the chicken liver. Colistin is an antibacterial peptide that has been barred for human consumption, but it is being commonly used as a veterinary drug, and as a feed additive for livestock. In the present work, an immunosensor was developed by immobilizing an anti-colistin antibody onto the carbon nanofibers-gold nanoparticles surface of the screen-printed electrode. The sensor records electrochemical response in the chicken liver spiked with colistin with cyclic voltammetry (CV). Additionally, the characterization of electrode surface was done with Filed-emission scanning electron microscope, Fourier transform infrared spectroscopy, and Electrochemical impedance spectroscopy at each step of fabrication. The lower limit of detection was 0.89 μgKg^{-1}, with a R^2 of 0.901 using CV. Further validation of the immunosensor was conducted using commercial chicken liver samples, by comparing the results to those obtained using traditional methods. The fabricated immunosensor showed high specificity towards colistin, which remained stable for 6 months but with a 13% loss in the initial CV current.

DPP-IV INHIBITION (ANTI-DIABETIC) POTENTIAL OF KAPPA CASEIN HYDROLYSATES

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ABSTRACT

DPP-IV inhibitors work by blocking the action of DPP-IV, an enzyme which inactivates the incretin hormones. Incretin hormones help the body to produce insulin when it is needed. DPP-IV inhibition is one of the novel approach to treat the diabetes. In this study, focus is given to the milk proteins, as a natural source of DPP-IV inhibition to overcome the side effects of synthetic drugs. Kappa casein was isolated from *Gir* cow milk and analysed for DPP-IV inhibition potential. Enzymatic hydrolysis was done with different enzymes viz., Flavourzyme, pepsin, trypsin and proteinase K for 2-12 hours at different enzyme substrate ratio (1%, 2% and 4%). Trypsin treated kappa casein hydrolysate showed maximum DPP-IV inhibition 83.80 ± 0.68% after 12 h hydrolysis at 4% E:S ratio. Then hydrolysate with maximum DPP-IV inhibition was passed through ultrafilteration membranes 3 and 10 kDa. Less than 3 kDa fraction showed 73.69 ± 1.29 % DPP-IV inhibition. HPLC analysis was done to collect the fractions from less than 3kDa permeate. Fraction with maximum DPP-IV inhibition was selected for LC-MS/MS analysis to identify the peptides sequence. Two novel peptides with adequate DPP-IV inhibition activity were identified in kappa casein with IC_{50} value 1.79 mM and 1.56 mM. Hence, this hydrolysates rich DPP-IV inhibitors can be a consumed as a dietary supplement, to manage type-2 diabetes.

STABILITY ENHANCEMENT OF NATURAL FOOD COLOURS BY MODIFIED PROTEINS

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ABSTRACT

Synthetic food colours possess negative health impact due to which consumers are getting attracted towards the use of natural colorants. The four basic natural colours are- anthocyanins, betalains, carotenoids and chlorophylls. Anthocyanins and betalains are water soluble pigments whereas carotenoids and chlorophylls are lipid soluble pigments. Along with imparting colour to the food, these natural pigments show distinct bioactive and therapeutic activities. Lack of stability and less bioavailability of these colorants doesn't promote their utilization even if they are more beneficial. These natural colorants are sensitive towards intrinsic and extrinsic factors. This problem can be tackled by the modifying the proteins. Soya protein fibrillation enhanced the retainment of betalains up to 75% in the food, when processed at 90 ℃ for 15 minutes. Protein fibrils can be utilized as innovative food material for ameliorating the stability of natural colorants at various temperature, pH, enzymatic activity and level of oxygen. Self-assembled proteins at specific conditions, results in the formation of protein fibrils. These fibril proteins show augmented techno- functional properties. Therefore, they are able to conjugate with the natural colorants. Hence imparting stability to them. Not only the protein fibrils, but also the proteins- polyphenol interaction could stabilize these pigments. The protein interacts with polyphenols either by covalent or non- covalent bonding. Further, these interactions can stabilize the natural colour emulsions. Covalently modified different bovine milk proteins using epigallocatechin- 3- gallate improved the chemical stability of β- carotene in emulsions. Therefore, proteins can be considered as novel ingredient that can help in implementing the utilization of natural colorants.

METABOLOME PROFILING OF COLOSTRUM, TRANSITION AND MATURE MILK IN MURRAH BUFFALOES

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ABSTRACT

Bajaura Makka, H.P. a corn variety grown in Himachal Pradesh with low commercial value was used in this study for recovery of zein and xanthophyll and further application in food products for sustainable development of rural people of HP. The corn meal (CM) and corn gluten meal (CGM) prepared were first hydrolysed using microbial protease, amylase and lipase for extraction of zein at pH 6-10 and optimum pH was 9. The zein content was highest in amylase pre-treated CM (6.47%) and protease pre-treated CGM (4.81%) as detected with HPLC. Highest zein was recovered from both CM (7.14%) and CGM (6.2%) by using mixture of enzymes. Covalent binding was found best immobilization method for protease and lipase at contact time of 3h and 1h, respectively at 30 C and adsorption method for amylase for 1h at 25 C. On further treatment highest recovery of zein and xanthophylls was obtained using immobilized protease and amylase in two stage glass bioreactor and further on its filtration through cross flow ultrafiltration system, the relative recovery of zein and xanthophylls increased to 11.81% and 12.35% in CM and 0.10% and 24% in CGM respectively. Presence of different zein fractions was confirmed with SDS-PAGE. Edible zein films were prepared using zein (10% w/w), ethanol (90%), and plasticizers i.e. fructose (4%) and glycerol (5%). The prepared zein films were characterized for physiochemical properties and further used in coating of different model foods viz. Himalayan fig (*Ficus palmata*) leather, roasted nuts, chocolate and vanilla cookies. The extracted xanthophylls was also used as model colorant in yogurt at 0.01 % (w/w) with significant results.

REACTIVE OXYGEN SPECIES AND DIABETES MELLITUS: ENVIRONMENTAL IMPACT

Debidas Ghosh

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ABSTRACT

Environment has a great impact on health maintenance. Environmental factors those deviate the homeostasis of our physiological systems known as stressors and the physiological condition developed in such situation known as stress. Such factors are high temperature and severe cold exposure, different pollutants, food additives etc. Reactive oxygen species (ROS) like singlet O_2, hydrogen peroxide, superoxide anions are formed at high rate in such stressful conditions. As a results pro-oxidant status of our body is dominated over antioxidant status that results health disorder or disease. Diabetes mellitus (DM), a common metabolic cum non-communicable cum life style disease which is now consider as X-syndrome. Environmental stressors can generate free radicals at high level by oxidation-peroxidation chain reaction through ROS generation that results point mutation of gene which is related with production of mutant enzyme, lead to cellular metabolic disorders, especially carbohydrate metabolism, an important cause of diabetes. Moreover, free radicals through cellular signaling system down regulate gene expression of antioxidant enzymes like peroxidase, catalase, glutathione-s-transferase that results high levels of cellular free radicals in liver, kidney and skeletal muscles, most important metabolic organs. As output of this effect, glucose utilization is decreased that lead to DM. Pancreatic β cell degeneration, the source of insulin, is also elevated in such stress full conditions like –unhealthy food style and work style practices that increase the possibility for onset of DM.

For such management of raising level of DM incidence rate throughout the world, natural products having strong antioxidant activities, have major role. It has been noted that nutraceuticals presents in *E.jumbulana*, *Camellia sinensis*, *H. antidysenterica* have major contribution for such management by increasing gene expression of antioxidant enzymes in liver, kidney and skeletal muscles. This field of research unfold a new domain in 21st century about 'Environment and Health' known as 'Neutrogenomics'. Moreover, these nutraceuticals also elevate gene expression of hexokinase in liver and kidney that favours glucose utilization in cell. It has also established that such nutraceuticals have ability to generate β cells from hepatic stem cells and so, plasma insulin and c-peptide levels both are elevated. Insulin receptor gene expression is also corrected by such nutraceuticals in diabetic model animals and their efficiency has been comparable with anti-diabetic gold standard drugs. Such studies have been confirmed by genomics and proteomics studies using real time PCR followed by southern blotting and western blotting studies.

It may be concluded that environmental stress factors that results diabetes, a common disease globally and known as 4th killer disease at present, can be managed by natural products of environment, the parallel management process of modern medicine as per guideline of WHO.

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SIMULTANEOUS ENANTIOSEPARATION AND SIMULATION STUDIES OF ATENOLOL, METOPROLOL AND PROPRANOLOL ON CHIRALPAK IG COLUMN USING SUPERCRITICAL FLUID CHROMATOGRAPHY: A GREEN APPROACH IN SEPARATION SCIENCE

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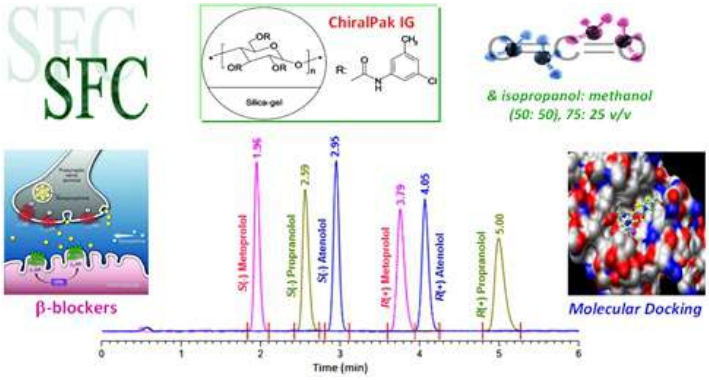
ABSTRACT



Enantioseparation of three β-blockers, atenolol, metoprolol and propranolol is studied on amylose tris(3-chloro-5-methylphenylcarbamate) immobilized chiral stationary phase using supercritical fluid chromatography (SFC). The effect of organic modifiers (methanol, isopropanol and their mixture), column temperature and back pressure on chiral separation of β-blockers was evaluated. Optimum chromatographic separation with respect to resolution, retention, and analysis time was achieved using CO_2 with 25 % methanol: isopropanol (50:50) containing 0.1 % isopropylamine in a single run. Under the optimized conditions, the resolution factors (R_s) and separation factors (α) were greater than 3.0 and 1.5, respectively for all the enantiomers. Further, with increase in temperature (25 to 45 C) and pressure (100 to 150 bars) there was corresponding decrease in retention factors (k), α and R_s. However, a reverse trend (α and R_s) was observed for atenolol with increase in temperature. The thermodynamic data from van't Hoff plots revealed that the enantioseparation was enthalpy driven for metoprolol and propranolol while entropy driven for atenolol. To understand the chiral recognition mechanism and the elution behaviour of the enantiomers, molecular docking studies was performed. The binding energies obtained from simulations studies were in good agreement with the elution order found experimentally and also with the free energy (ΔG) values. The method was validated in the concentration range of 0.5-10 µg/mL for all the enantiomers. The limit of detection and limit of quantitation ranged from 0.126-0.137 µg/mL and 0.376-0.414 µg/mL, respectively. The greenness assessment of the method was evaluated by using AGREE software covering all 12 principles of green analytical chemistry. The final score obtained was 0.78, suggesting excellent greenness of the method. Finally, the method was used successfully to analyze these drugs in pharmaceutical preparations.

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ABSTRACT

A study on bacteriological investigation of canine pyoderma cases was conducted at the Veterinary College, Shivamogga. Exudate/pus/lesion swabs were collected from clinical cases of canine pyoderma (n=126) and subjected to isolation and identification of bacterial isolates by phenotypic methods. The bacteriological processing of the samples resulted in the recovery of 95 staphylococcal isolates and 18 other bacterial isolates. On culture, staphylococci were the most predominantly (n=95, 75.39%) isolated organisms. The isolates obtained other than staphylococcal species were *E. coli*, *Pseudomonas* species, *Klebsiella* species, *Proteus* species. Subsequently *in vitro* antimicrobial sensitivity testing was carried out for all the isolates. *S. pseudintermedius* showed highest susceptibility to clindamycin and the highest resistance to enrofloxacin, and the other bacterial agents were found sensitive to co-trimoxazole and ceftriaxone and resistant to amoxicillin/sulbactam and enrofloxacin. A study on the occurrence patterns of canine pyoderma revealed higher frequency of cases in male dogs, in the age group of 1-2 years and in Labrador breed. We report the *S. pseudintermedius* as the most predominant pathogen associated with the canine pyoderma in the study area.

SIMULTANEOUS ESTIMATION OF METHOCARBAMOL AND IBUPROFEN IN FIXED DOSE COMBINATION BY UV SPECTROPHOTOMETRIC METHOD

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ABSTRACT

The objective of present research work is to develop a simple, precise and accurate UV spectropohtometric method based on Isobestic point approach for quantitative estimation of methocarbamol (MET) and ibuprofen (IBU) in their fixed dose combinations. All solutions were prepared using methanol as solvent. The isobestic point wavelength for MET and IBU was found to be 226 nm. Concentration of IBU was determined at isobestic wavelength 226 nm while MET was determined directly at 277 nm as there was no interference of IBU. Validation of the method was carried out as per ICH guidelines (Q2R1). Linearity was established for MET at the concentration range of 28 – 56 µg/mL (r^2 = 0.996 at 277 nm) and for IBU it was between 16 – 32 µg/mL (r^2 = 0.990 at 226 nm). Percentage relative standard deviation (% RSD) value of less than 2 % for intra-day and inter-day precision confirmed the precision of the method. Accuracy of the method was in the range of 98 - 102 %. The developed method is suitable and can be applied for analysis of marketed formulation.

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GREEN SYNTHESIS OF SILVER NANOPARTICLES MEDIATED BY GARCINIA INDICA (KOKUM) AND THEIR EFFECTIVENESS AGAINST ACNE-CAUSING BACTERIA

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ABSTRACT

Green synthesis of silver nanoparticles (AgNPs) is an emerging field in nanomedicine. *Garcinia indica* (Kokum) is a therapeutic plant indigenous to the Western Ghats of India. In this study, AgNPs were synthesized using aqueous *Garcinia indica* leaf extract as the reducing and capping agent. The AgNPs were characterized by UV-visible absorption spectroscopy, Fourier Transform Infrared (FTIR) spectroscopy, Field Emission Scanning Electron Microscope (FE-SEM) imaging, and Energy dispersive X-ray Diffraction (XRD) analyses. The AgNPs demonstrated both antioxidant and antibacterial properties attributed to the presence of flavonoids and saponins. The antibacterial activity of the AgNPs alone and in combination with ampicillin, chloramphenicol, and rifampicin against acne-causing bacteria revealed a synergistic effect of the AgNPs with all tested antibiotics. Thus, the AgNPs synthesized from *Garcinia indica* leaf extracts using a simple green approach demonstrated promising antioxidant and antibacterial properties which can be further developed for commercial biomedical applications.

AMELIORATION OF ENVIRONMENTAL TOXICANT BENZO(A) PYRENE INDUCED TESTICULAR GAMETOGENIC AND STEROIDOGENIC DYSFUNCTIONS BY A NATURAL ARYL HYDROCARBON RECEPTOR ANTAGONIST RESVERATROL: INVOLVEMENT OF P38MAPK/ATF2/INOS SIGNALING

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ABSTRACT

STUDY QUESTION
Does Resveratrol have any protective effect against common environmental toxicant benzo(a)pyrene (B(a)P) induced testicular germ cell apoptosis and dysfunctions of Leydig cell steroidogenesis?

STUDY ANSWER
Resveratrol ameliorates B(a)P induced testicular oxidative stress and germ cell apoptosis by modulating the transcriptional regulation of cytochrome P4501A1 (CYP1A1) and improving Leydig cell steroidogenesis.

BACKGROUND OF THE STUDY
Benzo(a)pyrene, an environmental toxicant mostly present in coal tar, wood burning and car exhaust and which leads to deleterious effects on male reproductive health. Our previous studies have suggested that B(a)P induced oxidative stress, DNA damage and apoptosis involving both mitochondria and death receptor dependent pathways. Natural aryl hydrocarbon receptor (AhR) antagonists may have potential defensive mechanism against B(a)P induced testicular toxicity. The polyphenolic compound resveratrol modulates anti- and pro-apoptotic mediators and document anti-tumoric activity. Recently, we have found that resveratrol prevented B(a)P-induced BPDE-DNA adduct formation and spermatogenic dysfunctions in testis. Clinically, resveratrol may be useful to protect against B(a)P induced testicular toxicity, although its effect on the same is not delineated.

STUDY DESIGN, SIZE, DURATION
Forty (40) male Wistar rats (8 weeks; 150–200 gm body weight (b.w.)) were divided into four (n=10); Control (C), Resveratrol (R), Benzo(a)pyrene (B), Benzo(a)pyrene + Resveratrol (B+R) groups those received 0.2 ml corn oil, 50 mg/kg b.w. Resveratrol, 5 mg/kg b.w. Benzo(a)pyrene and 5 mg/kg b.w. Benzo(a)pyrene + 50 mg/kg b.w. Resveratrol respectively by gavages for 60 days. This study was approved by Institutional Animal Ethical Committee (IAEC/BI/08/2016) of Bose Institute, Kolkata, India. (74)

PARTICIPANTS/MATERIALS, SETTING, METHODS

Testicular germ and Leydig cells were isolated by collagen digestion method. Various molecular biology techniques including immunostaining, Western blot, qRT-PCR, ChIP-assay, flow-cytometry, Terminal-deoxynucleotidyl-transferase-dUTP-nick-end-labeling (TUNEL) and radio-immuno-assay were employed to study the testicular spermatogenesis, stroidogenesis, oxidative stress, apoptosis and B(a)P signaling in order to delineate the ameliorative potential of resveratrol on Benzo(a)Pyrene induced testicular dysfunctions. $P < 0.05$ was considered to be significant as evaluated by One way ANOVA followed by Dunnett multiple comparison test.

MAIN RESULTS AND THE ROLE OF CHANCE

A significant decrease ($P < 0.01$) in epididymal sperm count and motility along with presence of sperm head abnormalities and altered testicular histology were documented following B(a)P treatment. In addition, TUNEL positive apoptotic germ cells were observed with increased ($P<0.01$) reactive oxygen species generation simultaneously decreasing the activity of antioxidant enzymes and increased mitochondrial damage compared to control. B(a)P disturbed cellular Bax/Bcl2 rheostat, released cytochrome-c, activated caspase 9 and 3 modulating Fas/FasL, Bid and caspase 8 expressions. Steroidogenic-acute-regulatory-protein (StAR) expression and its promoter activation was significantly compromised by B(a)P in Leydig cells. Resveratrol co-treatment with B(a)P maintained testicular redox potential, prevent germ cell apoptosis, increased testosterone level and ameliorated Leydig cell steroidogenic dysfunctions with enhanced expression of CYP1A1, StAR, 3βHSD and 17βHSD. Resveratrol also prevented B(a)P induced AhR protein level, its nuclear translocation and subsequent promoter activation of CYP1A1 in germ cells. Resveratrol modulated DAX1 and SF1 expression thus maintaining StAR gene homology and improved Leydig cell steroidogenesis. B(a)P-induced increased iNOS expression through activation of p38MAPK and ATF2, was also ameliorated by Resveratrol. Thus, Resveratrol inhibits conversion of B(a)P to BPDE by modulating the transcriptional regulation of CYP1A1 and acting as antioxidant which prevent germ cell apoptosis and Leydig cell steroidogenesis.

WIDER IMPLICATIONS OF THE FINDINGS

Resveratrol being an antioxidant and a natural AhR antagonist, works as a double-edged sword against environmental toxicant B(a)P induced male reproductive toxicity. Present day B(a)P induced toxicokinetics and its protection is not well elucidated in human. Resveratrol can come up with new hopes as potential protector of reproductive health against B(a)P.

STUDY FUNDING

This study was supported by the award of DST First Track Young Scientist Scheme of Govt. of India to Dr. Kuladip Jana.

A NOVEL CALEBIN A ANALOG INDUCES ROS AND INHIBITS CANCER PROGRESSION VIA DISRUPTING PI3K/AKT PATHWAY

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ABSTRACT

Chemotherapy, irradiation and immunotherapy emerges as the gold standard approaches for the treatment of cancer worldwide but due to their toxicity they have some limitations. Thus due to the toxicity of currently used therapeutics for the treatment of various types of tumors, use of natural products from plants and animals and marine organisms and their derivatives for proper targeting of both the cancer cell and cancer stem cell colonies have produced remarkable leads for the control of cancer due to their limited cytotoxicity to the normal cell as compared to cancer cells. Natural yields and their structural derivatives (small molecules) have contributed to nearly 50% of the drugs used for cancer chemoprevention. Calebin-A, a naturally occurring curcuminoidanalog derived from turmeric root (*Curcuma longa*) has gained attention due to its tremendous anti-cancer potential. Thus, keeping this in mind an array of Calebin-Aanalogswere designed and created and were evaluated for their cytotoxic potentials on various murine and human malignant cell lines. One such analog compound AS-18 awas effectively opted out as most potent with a high cytotoxic effect against cancer cells and less toxicity against normal cell lines. Our present study established ROS-induced mitochondrial dysfunction and finally apoptosis induction by the lead compound. The inhibition of cell propagation was linked to the data confirming G2/M phase arrest. The mitochondrial dysfunction was confirmed by JC1 and MitoSOX assay along with the change in Bax/Bcl-2 ratio. The compound also blocked the PI3K/Akt pathway. Molecular docking and western blot investigation established these pieces of information. The lead compound AS-18 suppressed the NRF-2 protein expression thus increasing the free radicals in the tumorcells. The compound AS-18 induced ROS-mediated caspase-dependent apoptosis as the western blot data confirmedcaspase activation. The 4T1 injected Balb/C syngeneic tumor model confirmed the augmentation in the inhibitory outcome of the lead compound. This study sums up the mechanistic pathway by which the compound AS-18 mediates its cytotoxic effect in cancer cells. A novel Calebin-A compound AS-18 acted as an antagonist against the IGF R1 receptor, blocked the PI3K/Akt and NRF-2 pathway, and encouraged apoptosis via ROS generation.

EVALUATION OF METAL TOLERANCE OF HALOPHILIC EUBACTERIAL AND ARCHAEAL STRAINS ISOLATED FROM SOLAR SALTERNS OF GOA INDIA

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ABSTRACT

Marine econiche is continuously exposed to metal pollution thus enabling estuaries and solar salterns to serve as an effective sink for these metals, leading to their high accumulation through evaporation. Estuarine environments thus serve as a good source of metal tolerant microbes which also contribute towards the biogeochemical cycling of inorganic elements.In this study, the halophilic strains from solar salterns of Agarvado and Maina,Goa-India were obtained on NTYE and ZMA agar plates incorporated with 25 % crude salt. The halophilic isolates were characterized based on their Gram character; tolerance to salt, antibiotic sensitivity, response to sodium taurocholate and evaluation of the pigment extracted. The potential eubacterial and haloarchaeal strains were screened for their metal tolerance/resistance ability using metal salts of Cu, Ni and Ag at 0.5, 1, 1.5, 2 and 4 mM concentrations. Tolerance of halophilic isolates to metal salts was observed by monitoring the growth for each of the culture on NTYE plates amended with the respective metal salts for an incubation period of 5-7 days. Growth and effect on pigment production of halophilic isolates in NTYE meduim in absence and presence of 1 mM concentration of different metal ions was also analyzed .Culture tolerating/resisting metal salt exhibited alteration in pigment production. This indicated the role of cell wall components of potential cultures in withstanding the metal ions. Thus, showing metal tolerance in halophilic isolates isolated from solar salterns. Further, the potential cultures can also be used in synthesis of metal nanoparticles of nanobiotechnological significance along with the bioremediation applicability in metal contaminated saline soils.

PERFORMANCE OF PLANT SPECIES ON THE TEXTILE EFFLUENT AFFECTED SOIL

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ABSTRACT

Pali district of Rajasthan is one of the textile (printing and dying) industrial hubs of India. Textile industries are high water requiring units and consume about 200 litres of water for processing of 1 kg of textile and thus this industry generate large amount of effluent. The treated and untreated effluent from textile industries in Pali, was directly or indirectly discharged into Bandi River. Agricultural land downstream of Bandi River from Pali city has been reported to be degraded due to irrigation from textile effluent contaminated Bandi River. These agricultural land were ones used for the cultivation of crops like wheat, mustard, vegetables etc. is presently not been cultivated from last 25-30 years. With this background, present study evaluated the growth of seven pant species on this contaminated soil at CAZRI-Regional Research Station, Pali, Marwar, with aim to re-cultivate the land. *Parkinsonia aculeate (*Parkinsonia*), Ailenthus excelsa (*Ardu*), Lawsonia enermis* (Henna), *Suaeda fruticose (*Suaeda*), Cymbopogon martini. (*Palmarosa*), Vetiveria zizanioides (*Vetiver*)* and *Diplachne fusca (*Karnal grass*)* were planted in pots filled with affected soil and amended with various amendments. After three month of planting, the plant growth parameters were recorded. The result showed significant difference in growth parameters among plant species. Out of seven plant species evaluated on textile effluent affected soil, *Diplachne fusca* (Karnal grass), *Vetiveria zizanioides (*Vetiver aromatic plant), *Lawsonia inermis* (Henna) *and Cymbopogon martini (*Palmarosa) performed well on textile effluent affected soil in terms of plant growth and biomass yield in both the years (2018 and 2019) of experiment.

APPLICATION OF NANOTECHNOLOGY IN CROP BIOFORTIFICATION

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ABSTRACT

Plants are the self-sustaining system that translates solar energy into organic forms usable for consumers of the ecosystem. The various type of environmental factor decides the overall development of Plants. As the plant has a bottom-up effect that directly affects the growth of other living organisms in the ecosystem. Amongst all the major dietary, vitamins and microelements are the prime limiting factors. Plant depends on the soil to fulfill their micronutrient requirement. Naturally, the soil itself is deficient in microelements, and also plants cannot absorb the available concentration due to various physiological factors like pH, temperature, physical structure, chemical composition, microbiota, etc. The unavailability of soil micronutrients is a major reason for the malnutrition of crop plants. Biofortification is a reliable technique to fortify plants with nutritive compounds to resolve malnutritional impairments. There are several methods available for plant biofortification like plant breeding and genetic engineering where the plant genome is edited with the desired one. Recent advancements in the nanosciences field revolutionized the whole scenario of plant biofortification. Different types of nanomaterials have been developed as nano fertilizers for micronutrient supplementation to crops in agriculture systems. Nano fertilizer ensures soil fortification along with their absorption by the plant. Besides biofortification, Nanoparticles also enhance plant defense against biotic and abiotic stress as pesticides, as well as improves the nutritional quality of the crop without any genetic modifications. Here in this review, we focused on, the need for biofortification and the techniques developed for the use of nanomaterials as biofertilizers. Further, this report also highlights the different crops that developed through nanomaterial biofortification.

ASSESSMENT OF CELLULAR DNA DAMAGE VIA COMET ASSAY ON HUMAN BREAST CANCER (MCF-7) CELLS EXPOSED TO ANNONACIN AND *ANNONA MURICATA* L. EXTRACTS

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ABSTRACT

Annona muricata L. exhibits wide array of medicinal and ethno-pharmaceutical benefits, attributed to different plant parts popularly known for its anti-cancer efficacy. The study was undertaken to verify the plausible genotoxic effect of pulp and leaf hydro-methanolic extracts in comparison with potent acetogenin, Annonacin on DNA of breast cancer (MCF-7) cells using alkaline comet assay. The genotoxic properties were assessed using the single cell gel electrophoresis (SCGE) method, and the tail parameters of pooled comets were scored using the TriTek CometScore Pro ver. 1.01.44 software. Following statistical analysis, the average tail length (TL), percentage of tail DNA (TD), tail moment (TM), and Olive tail moment (OTM) were estimated to assess the extent of DNA damage in cells. Study indicated highest DNA damage toward MCF-7 cells in the form of comet streak or tails in 0.01 mg/mL Annonacin treatment. The study found that 0.01 mg/mL Annonacin treatment caused the most DNA damage to MCF-7 cells in the form of comet streaks or tails. In comparison to the untreated control, *A. muricata* leaf extracts showed considerably higher tail characteristics than the pulp extract. Our findings indicated that the leaf extract from *A. muricata* had higher genotoxic potential than the pulp extract. However, the plant extracts had lower efficacy when compared to the standard annonacin molecule. This study also urges for more rigorous safety evaluation and alternative genotoxicity endpoints other than DNA damage.

IN-VITRO STUDY OF ANTI-SPERMATOGENIC ACTIVITY OF HYDRO-METHANOL EXTRACT OF (60:40) *CAESALPINIA PULCHERRIMA* LEAVES ON HUMAN AND RAT MODEL

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ABSTRACT

Worldwide research is being done on herbal plants having antifertility efficacy that people used in ancient medicine for contraceptive purpose. This study was carried out to determine *in-vitro* contraceptive potentiality of hydro-methanol extract of *Ceasalpinia pulcherrima* leaves on human and rat spermatozoa in three different concentration (1mg, 2mg, 4 mg). Different spermiological sensors in human and rat spermatozoa, androgenic key enzyme activities in testicular tissues of rat, oxidative stress markers (SOD, catalase, TBARS) in reproductive tissues of rat and human sperm pellet as well as toxicity sensors (GOT, GPT) in liver, kidney, testis and prostate of experimental rats were estimated to fulfil the objectives. After direct exposure of above said extract in the testis and epididymis tissues as well as in rat and human sperm, result showed a significant ($p< 0.05$) reduction in spermiological sensors, androgenic enzyme and antioxidant enzyme activities and significant increment ($p<0.05$) in TBARS level. Maximum anti-spermatogenic potential was noted in terms of above-mentioned parameters with in the concentration of 2 mg extract exposure group in human sperm and 1mg in rat spermatozoa and reported a dose-dependent and time-dependent effect. In this *in-vitro* experiment it may be concluded that hydro-methanolic extract of *C. pulcherrima* leaves in three different concentration (1 mg, 2 mg, 4 mg) have direct maximum spermicidal activity and have an *in vitro* male contraceptive effect without toxicity production. More research is required in an animal model (in vivo) that can establish its true impact as a potent male contraceptive agent and to explore the nature of its exact mode of action in connection to the anti-spermatogenic potential.

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MOLECULAR CHARACTERIZATION OF WILD (*LINUM BIENNE* AND *LINUM GRANDIFLORUM*) AND CULTIVATED LINSEED (LINUM USITATISSIMUM L.) USING NON-GENIC RANDOM AMPLIFICATION OF POLYMORPHIC DNA (RAPD) AND INTER SIMPLE SEQUENCE REPEAT (ISSR) BASED SEQUENCE CHARACTERIZED AMPLIFIED REGION (SCAR) MARKERS

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ABSTRACT

Linseed (Linum usitatissimum L.), a member of family Linaceae, is an important source of omega-3 (linoleic) and alpha-6 (linolenic) acids and one of the richest sources of lignans, a special class of phytonutraceuticals. Identification and cataloguing of wild and cultivated germplasm of linseed assumes importance in assessing comparative diversity in terms of the ability to respond to abiotic and biotic stresses, distribution of special metabolites etc. Molecular marker-based authentication of germplasm of linseed strives to establish unmatched unique identity of the cultivated linseed against a backdrop of wild species such as Linum bienne and Linum grandiflorum.

The present investigation seeks to develop species-specific random amplified polymorphic DNA (RAPD) and inter simple sequence repeat (ISSR) based sequence characterised amplified region (SCAR) markers for the identification and authentication of true-to-type cultivated and wild species of linseed. Both RAPD and ISSR are non-genic, random, multi-locus, dominant, and sequence independent markers. Thus, the information generated through use of these markers is faithfully converted to single-locus, highly reproducible and sequence based SCAR markers in the present study.

In this study, genomic DNA extracted from cultivated linseed accessions (46 in all) and wild species (2 in all) were subjected to RAPD and ISSR PCRs. The polymorphic bands were identified, eluted, ligated (with pGEM-T Easy vector) and transformed into competent E.coli DH5 α strain by heat shock method. The transformed recombinant plasmid clones were confirmed by PCR, restriction analysis and DNA sequencing. A pair of SCAR primers were then designed and have been used to resolve the issue of true-to-type identity of wild vs. cultivated linseed species.

MOLECULAR CHARACTERIZATION OF SENNA (*CASSIA ANGUSTIFOLIA* VAHL.) USING GENIC START CODON TARGETED POLYMORPHISM (SCOT) AND CAAT BOX DERIVED POLYMORPHISM (CBDP) BASED SEQUENCE CHARACTERIZED AMPLIFIED REGION (SCAR) MARKERS

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ABSTRACT

The leaves and pods of senna (Cassia angustifolia Vahl.), an important species of family Fabaceae, yields sennosides and rhein based laxative. Adulteration of senna with related species such as C. fistula, C.occidentalis, C.sophera, C.tora etc. at gross morphology is a serious issue with true-to-type identification and authentication of senna accessions. Molecular marker based authentication of herbal drugs, as senna in this case, strives to establish unmatched unique identity of an individual against a score of such adulterants.

The present investigation seeks to develop species-specific Start Codon Targeted polymorphism (SCoT) and CAAT Box Derived Polymorphism (CBDP) based sequence characterised amplified region (SCAR) markers for the identification and authentication of true-to-type senna and adulterant Cassia species. Both SCoT and CBDP are genic, multiple-locus, dominant and sequence independent markers. Thus, the information generated through use of these markers is faithfully converted to single-locus, highly reproducible and sequence based SCAR markers.

In this investigation, genomic DNA extracted from the accessions (44 in all) of senna and its adulterants (4 in all) were subjected to SCoT and CBDP PCRs. The polymorphic bands were identified, eluted, ligated (with pGEM-T Easy vector) and transformed into competent E.coli DH5 α strain by heat shock method. The transformed recombinant plasmid clones were confirmed by PCR, restriction analysis and DNA sequencing. Post-sequencing, a pair of SCAR primers were designed to validate and address the issue of true-to-type identity of senna accessions against other adulterant Cassia species.

ALGAL BIOFUEL: A PROSPECTIVE ALTERNATE SOURCE OF ENERGY

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ABSTRACT

Coal, oil, and natural gas are the three basic types of fossil fuels that were produced hundreds of millions of years ago. However, the supply of fossil fuels is finite and society is facing a wide range of problems like growing level of air pollution and current energy demands force us to pursue the alternate energy sources to compete with limited fossil fuel reserves. To meet the world's energy needs without harming the environment, biofuel may be a promising option. In recent years, algae have gained favor as a third-generation biofuel. Many researchers are exploring algae-based biofuels because of their many advantages over first-generation (crop-based) and second-generation (petro crop-based) biofuels. Algae is an intriguing addition to the sustainable fuel portfolio because of its high lipid content, high growth rate, capacity to quickly improve strains, use of waste land, ease of large-scale cultivation and ability to produce by-products without competing with arable land. During various stress conditions like nutrient (N, P) deprivation, nanoparticle stress, heavy metal stress, light stress, CO_2 stress, temperature, salt stress and so on, algae stored their chemical energy in form of oils. However, there are still certain limitations, such as the difficulty of maintaining biomass growth while boosting lipid synthesis in the algae. In order to overcome this issue some metabolomic approaches have been used to target the genes involved in lipid biosynthesis pathway like CRISPR-Cas9, ribonucleic acid interference (RNAi), Homologues recombination, Nuclear transformation, zinc-finger nucleases (ZFNs), and transcription activator-like effector nuclease (TALENs) based gene editing, knockdown and knockout approaches etc. In this presentation these different approaches are discussed in detail.

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ANTI-DIABETIC AND ANTI-OXIDATIVE EFFICACY OF HYDRO-METHANOL (60:40) EXTRACT OF AERIAL PARTS OF *COMMELINA BENGHALENSIS* LINN. IN STREPTOZOTOCIN INDUCED DIABETIC MALE ALBINO RAT: AN IN-VITRO APPROACH

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ABSTRACT

Background: Diabetes is a non-communicable cum unhealthy life style metabolic syndrome, affects large number of people worldwide to all stages of life cycle. It is caused due to the lacked insulin from the degenerated beta cell of pancreas or desensitization of insulin receptor. Excessive amount of reactive oxygen species generation is one of the prime etiological factors for the development of diabetes. Though several pharmacological approaches have been established for the reduction of ill effects of diabetes and its secondary complications, despite of that, people are favoured herbal formulation of drug because of its fewer side effects, cheaper and cost effective.

Aim: The main goal of this study was to investigate the *in-vitro* anti-diabetic and anti-oxidative properties of hydro-methanol extract (60:40) of aerial parts of *Commelina benghalensis linn.* in streptozotocin induced male albino rat.

Method: Streptozotocin was used for the induction of diabetes at a dose of 4 mg/ 0.1M citrate buffer/100 g body weight. The activity of glycemic sensors, anti-oxidative status and free radicals end product parameters along with toxicity sensors were assessed in liver, skeletal muscle, cardiac muscle, kidney and intestine by using the standard protocols.

Result: The activity of catalase, superoxide dismutase, hexokinase were decreased and glucose 6-phosphatase, glutamate oxaloacetate transaminase, glutamate pyruvate transaminase and thiobarbituric acid level were increased in diabetic group. After the *in-vitro* exposure of hydro-methanol (60:40) extract on targeted tissue at the dose of 10 mg/0.5 ml, 20 mg /0.5 ml, 40 mg/0.5 ml of *Commelina benghalensis linn.* above mentioned parameters were significantly resettled ($p<0.05$) in diabetic treated group except hexokinase activity and thiobarbituric level ($p>0.05$). Alpha glucosidase inhibitory reaction on intestinal tissue was elevated progressively with increased concentration of drug.

Conclusion: From the above considering view points it is focused that hydro-methanol extract (60:40) of *Commelina benghalensis linn.* has direct blood glucose lowering, free-radical scavenging activity in positive way. Out of all doses, 20 mg/0.5 ml drug dose has showed most significant effect.

APPLYING DATA ENVELOPMENT ANALYSIS (DEA) APPROACH FOR ENERGY INPUT-OUTPUT FLOW IN WHEAT CULTIVATION

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ABSTRACT

An energy input scenario of wheat production in Bhopal district of Madhya Pradesh was analysed to establish optimum energy input levels and to know the sensitivity of a particular energy input level on productivity. In this study energy input-output relationships for wheat cultivation were estimated from data collected from 50 wheat producers by face-to-face interview. Wheat is produced using energy sources ranging from human and electrical power to power of heavy machinery. Data Envelopment Analysis (DEA) approach that gives the relation between input and output, was utilized using Banker-Charnes-Cooper (BCC) input oriented model to analyse the observe data of wheat energy. Energy used in various operations like seedbed preparation, sowing, fertilizer application, spraying, irrigation and harvesting were computed and taken as input for DEA. The grain energy and residue energy were taken as output of the model. The energy input in wheat cropping system was observed 16950 MJ/ha. Seedbed preparation, sowing, fertilizer application, spraying, irrigation and harvesting were having share of about 1287, 2958, 6597, 159, 5003 and 947 MJ/ha respectively. The grain energy and residue energies were computed 61417 and 35205 MJ/ha, respectively. It was analysed by DEA that the input energy in various operations viz. seedbed preparation, sowing, fertilizer application, spraying, irrigation and harvesting may be reduced by 6.72%, 3.82%, 4.34%, 5.18%, 2.48% and 5.87%, respectively. The predicted input energy from the data envelopment analysis not only save energy but it may also enhance the grain energy about 1.75% and residue energy about 3.77%. The above analysis inferred that the relation in energy input may lead to increase in grain and biomass yield.

BAMBOO: CARBON SEQUESTRATION POTENTIAL

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ABSTRACT

A continuous increase in the human population has generated huge demand for wood and wood-based products in service sector. To meet the industrial demand, large numbers of trees are cut down, causing serious climate change problems worldwide. The global temperature is rising with increase in carbon dioxide level in the atmosphere which was reached 414.7 ppm in 2021. To prevent irreversible disastrous effects on human society, the global temperature should be limited to 2^{O}C. At global level, the United Nations Framework Convention on Climate Change (UNFCC) passed the resolution of the Paris agreement in 2015 to limit the rise of atmospheric temperature. Hence, for achieving sustainable development, non-woody forest timber, i.e., bamboo, has been gaining attention. In south-east Asia, over 1200 bamboo species are distributed in China, India and Myanmar. Asia accounts for approximately 65 percent of all bamboo-growing areas, with India reportedly home to 125 indigenous and 11 exotic bamboo species from 23 genera. Bamboo, being the fast growing species, has the potential to capture and store the carbon and restore degraded lands, which ultimately depends on its rate of growth and life cycle. The extensive root system of bamboo has been reported to improve soil properties in a short period of time. The carbon sequestration potential of bamboo varies from species to species. Due to its excellent qualities in physical and mechanical properties, bamboo is also considered as an alternative to wood.

EFFECTS OF LAND USE DYNAMICS AND IDENTIFICATION OF RESILIENCE MEASURES

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ABSTRACT

Changes in land use have emerged as one of the leading causes of climate change, or at the very least, they have intensified the process, as seen by the phenomenon of urban warming. Cities that were once thought to be environmentally comfortable are now referred to as heat islands during certain times of the year. Urban land is subject to changes because of pressure from human activities. A city's heat index will be higher if it has more "grey infrastructure," as concretization quickly absorbs and holds heat, warming the environment. Urban heat is mainly attributed to two factors. First, transmission lines bring tonnes of megawatts of electricity into cities, where it is converted into different forms of energy including heat and contribute towards formation of heat island (HI). Second, direct sunlight shining on grey infrastructure causes the HI effect.

An effort was made in this research to link the UHI status over urban grey infrastructure and green area for peri-urban areas (Dehradun and Gurgaon). LST maps for the years 2001 and 2021, respectively, were created using the thermal band of Landsat 5 and 8, respectively. Both ENVI and ArcGIS Desktop were used to complete the task. The generated data were then transferred to an excel spreadsheet and used for additional analysis. Maps, charts, and graphs were used to understand the results at the end. The quantity of grey infrastructure that is directly exposed to the sun, as well as the temperature gradient, have a significant impact on the city's heat index, according to the study's findings. Therefore, it is urgent to implement resilience mechanisms including the deployment of novel techniques to lessen direct solar exposure.

EVALUATION OF METAL TOLERANCE OF HALOPHILIC EUBACTERIAL AND ARCHAEAL STRAINS ISOLATED FROM SOLAR SALTERNS OF GOA INDIA

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ABSTRACT

Marine econiche is continuously exposed to metal pollution thus enabling estuaries and solar salterns to serve as an effective sink for these metals, leading to their high accumulation through evaporation. Estuarine environments thus serve as a good source of metal tolerant microbes which also contribute towards the biogeochemical cycling of inorganic elements.In this study, the halophilic strains from solar salterns of Agarvado and Maina,Goa-India were obtained on NTYE and ZMA agar plates incorporated with 25 % crude salt. The halophilic isolates were characterized based on their Gram character; tolerance to salt, antibiotic sensitivity, response to sodium taurocholate and evaluation of the pigment extracted. The potential eubacterial and haloarchaeal strains were screened for their metal tolerance/resistance ability using metal salts of Cu, Ni and Ag at 0.5, 1, 1.5, 2 and 4 mM concentrations. Tolerance of halophilic isolates to metal salts was observed by monitoring the growth for each of the culture on NTYE plates amended with the respective metal salts for an incubation period of 5-7 days. Growth and effect on pigment production of halophilic isolates in NTYE meduim in absence and presence of 1 mM concentration of different metal ions was also analyzed .Culture tolerating/resisting metal salt exhibited alteration in pigment production. This indicated the role of cell wall components of potential cultures in withstanding the metal ions showing metal tolerance in halophilic cultures isolated from solar salterns. Further, the potential cultures can also be used in synthesis of metal nanoparticles of nanobiotechnological significance along with the bioremediation applicability in metal contaminated saline soils.

HYPO-TESTICULAR ACTIVITY OF THE SEED OF *ARECA CATECHU* (LINN) IN ALBINO RAT : EFFECTIVE FRACTION SELECTION STUDY

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ABSTRACT

Objective: This study focus on hypo-testicular activity of the most effective fraction out of n-hexane, ethyl acetate, n-butanol of hydro ethanolic (6:4) extract of *Areca catechu* in connection with herbal contraceptive development.

Methods: After the treatment with different fractions of n-hexane, ethyl acetate, and n-butanol orally at a dose of 20mg/100gm for 28 days, different parameters were adopted for this experimental study including spermatogenic profile, serum testosterone, gene expression study, testicular androgenic key enzymes such as Δ5, 3β-HSD and 17β-HSD activities, and toxicity study from the targeted tissue.

Result: All treated groups showed a significant diminution ($p<0.05$) of the spermatogenic profile. Significant upregulation ($p<0.05$) of Bax gene and down-regulation ($p<0.05$) of Bcl-2 gene in testicular tissue which indicated the hypo-testicular activity of these fractions. Serum testosterone level and androgenic key enzyme activities were significantly decreased ($p<0.05$) when compared to the control group. Hepatic and renal ALP and ACP activities showed non-significant changes ($p>0.05$) which also supported the non-toxic nature of *Areca catechu*. Among all treated groups, n-butanol fraction treated group showed maximum hypo-testicular activities by the reduction of spermatogenic and androgenic profiles.

Conclusion: It can be concluded that n -butanol fraction of seed of *Areca catechu* has the most promising effect to develop herbal contraceptives may be due to the presence of effective phytomolecules in this concern.

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MALE CONTRACEPTIVE EFFICACY ASSESSMENT OF THE CONSTITUENTS PRESENTS IN DIFFERENT SOLVENT FRACTION OF *TINOSPORA CORDIFOLIA* (WILLD.) STEM: A STUDY ON TESTICULAR GAMETOGENESIS AND ANDROGENESIS

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ABSTRACT

The world population is steadily growing, leading to unfavourable effects on the environment and economic progress in developing world. Due to the abundant natural resources in our environment, phytotherapy is currently a more demanding field of study among researches. In this connection several medicinal plants have been studied to find out the antifertility efficacy for the formulation of effective, non-toxic and low-cost male contraceptive drug. *Tinospora cordifolia* is a highly praised drug in Ayurveda and Unani, commonly known as Guduchi/Giloe having multitude of therapeutic actions and reported for antifertility effects of this plant stem in male albino rats. The goal of this investigation is to establish the most potent solvent fraction of the effective hydro-methanol (3:2) extract of *T. cordifolia* stem. Biochemical, genomic and histological studies were performed after 28 days oral administration of n-hexane, chloroform, ethyl-acetate and n-butanol solvent fractions of hydro-methanol extract of the dose of 5 mg/ 100 gm of body weight/day to the experimental male rats. For the purpose, screening the phytochemicals present in fractions were performed by thin layer chromatography (TLC). After comparison with vehicle treated control group, significant diminution ($p<0.05$) in reproductive organo-somatic indices, spermiogram, serum testosterone level, seminiferous tubular diameter and germ cell populations at stage VII of spermatogenic cycle, genomic expression of androgenic key enzymes and antioxidant enzyme activities were noted in all fraction treated groups. Testicular TBARS and cholesterol levels showed a significant upward elevation ($p<0.05$) and non-significant change ($p>0.05$) in toxicity markers were observed after comparing the results of all the dose treated group with vehicle treated control group. So, it can be concluded that stem of this plant induces hypo-testicular activities, may be via modulating spermatogenesis and androgenesis.

METHANE ENHANCEMENT USING NANO-TECHNOLOGICAL INTERVENTIONS

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ABSTRACT

The biogas containing 55%-65% methane can be generated from wet biomass using bio-methanation process. This biogas also contains CO_2 (35%-45 %), water vapour, Sulphur, etc., which are detrimental for energy capability of biogas. There is need to remove impurities from biogas to the maximum extent possible to make the biomass based bio-methane for operating the engines to generate the shaft power. Thus, the high energy density can be obtained by removing the impurities and inert gaseous constituents from biogas. The high level pure methane is needed to have blue flame for thermal applications and also to operate electricity gen-sets.

The cleaning and enrichment of biogas is called biogas upgradation which is facing challenges in term of operating costs and energy consumption. The various studies are available in India & other countries related to use of nano technological interventions for enrichment of biogas. The uses of nano iron and Fe-based nano-materials as catalysis for biogas purification have been researched. Iron oxide nano-particle having size 7 nm at 70-80 ppm quantity added in bio digester of a portable food-waste digester improved the quantity as well as quality of biogas production. The production rate may also increase and as it will reduce CO_2 to form CH_4.The micro/nanoscale Fe_2O_3material powders have become the most promising as practical next-generation materials for methane enhancement. The carbon containing molecules can be removed using the nano catalysts. The mechanism may be the different with different catalytic materials. The mechanism of carbon species removal by trapping CO_2 over bimetallic Fe–Ni is different from that over a monometallic Ni catalyst. Nano-particles can play very effective role in methane enrichment for biogas producers to create better fuel. Nano interventions can manipulate the energy and fuel generation from wet biomass in effective manner.

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PRELIMINARY ANALYSIS OF THE ANTI-DIABETIC AND ANTI-OXIDATIVE EFFECTS OF HYDRO-ETHANOLIC (3:2) *BAUHINIA ACUMINATA* BARK EXTRACT: AN IN-VITRO INVESTIGATION

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ABSTRACT

Diabetes mellitus is a group of metabolic disorder characterized by hyperglycemia, hyperlipidemia and increased oxidative stress causing to the generation of reactive species involving macro and micro vascular complications in human body. The severity of diabetes can be managed with effective synthetic oral medications and insulin therapy, but due to the side effects of them, the acceptability of less toxic herbal medications are increasing in modern era.

This is an *in-vitro* experiment, conducted to search out the anti-diabetic and anti-oxidative effects of hydro-ethanolic (3:2) bark extract of *Bauhinia acuminata* (Kanchan, a herbal medicinal plant).

Wistar strain albino rats about 120 g body weight were selected for streptozotocin injection intramuscularly for diabetes induction except the control rat. After euthanasia, liver, kidney, skeletal muscle, cardiac muscle and small intestine were dissected and treated with extract (10 mg/0.5 ml, 20 mg/0.5 ml and 40 mg/0.5 ml distilled water) excepting control and diabetic control. Then the basic parameters (hexokinase, glucose-6-phosphatase, α-glucosidase, catalase, superoxide dismutase, thiobarbituric acid reactive substances, glutamate oxaloacetate transaminase and glutamate pyruvate transaminase) were checked using those organ tissues and assessed the effectiveness of the extract.

Different doses of hydro-methanol (3:2) bark extract of *Bauhinia acuminata* significantly ($P<0.05$) reduced glucose-6-phosphatase activity in liver, skeletal muscle and cardiac muscle in diabetic treated group compared to the diabetic control group, though having no direct effect on hexokinase activity ($P>0.05$). α-glucosidase activity in small intestine (after duodenum to ileum) was inhibited proportionately with increasing dose concentration. The recovery of anti-oxidant enzymes i.e superoxide dismutase and catalase were also observed ($P<0.05$) but no changes noted in the malondialdehyde level in hepatic and renal tissues. Glutamate oxaloacetate transaminase and glutamate pyruvate transaminase activities were also recovered ($P<0.05$) in the same tissues in diabetic treated group. In most of the cases, 20 mg/0.5 ml dose shows maximum recovery rate of these parameter.

It may be concluded that the hydro-methanolic (3:2) bark extract of *Bauhinia acuminata* exhibits promisable anti-diabetic and anti-oxidative activity and 20 mg is the threshold dose in this concern.

THE PREVALENCE OF ANTIBIOTIC RESISTANCE AMONG ENVIRONMENTAL ISOLATES OF BACTERIA FROM SELECTED HARBOURS IN KERALA, SOUTH INDIA

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ABSTRACT

The present study was carried out to determine the antibiotic resistance status of bacteria isolated from water and sediment samples from Ponnani and Chettuva harbours. Antibiotic sensitivity was determined by disc diffusion method. A total of 39 bacteria were isolated, of which 71.8% were gram negative and 28.2% were gram positive. 23 isolates were from Ponnani harbour and 16 from Chettuva harbour. Six of the bacterial isolates showed resistance to more than 7 of the 16 antibiotics tested, whereas 12 bacterial isolates showed resistance to 7 antibiotics used. Nitrofurantoin showed highest resistance among the bacterial isolates from Ponnani harbour which is 91.3%, followed by amoxicillin, ampicillin and chloramphenicol, which is 78.2%. In Chettuva harbour, amoxicillin showed 93.75% of incidence followed by ampicillin, showing 81.25%. Bacterial isolates from Ponnani harbour were sensitive to amikacin, streptomycin, and tetracycline whereas bacterial isolates from Chettuva harbour showed sensitivity to ciprofloxacin. Bacteria isolated from water sample showed resistance to more number of antibiotics than from the sediment sample source. In the current investigation we found an MAR index of 0 to 0.5 and 0.1 to 0.5 among gram negative bacteria and an index of 0 to 0.4 and 0.4 to 0.6 among gram positive bacteria from Ponnani and Chettuva harbour respectively. It owes that Chettuva harbour is more contaminated with antibiotics than Ponnani harbour.

THE PROTECTIVE ROLE OF SULFUR UNDER HEAT STRESS IN HIGH AND LOW SULFUR-RESPONSIVE RICE CULTIVAR

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ABSTRACT

Increasing temperature due to climate change severely threatens crop yield worldwide. The primary concerns associated with heat stress in plants are stunted growth, photosynthetic inhibition, reduction in crop yield, membrane fluidity, protein denaturation, and other related issues. Rice (*Oryza sativa* L.) is the staple food of an estimated 3.5 billion people worldwide. We conducted screening to investigate high and low sulfur-responsive rice cultivars (PS-2511; PB-1728; Birupa; PB-1509) exposed to different degrees of heat stress (mention heat stress treatments). The performances of the cultivars were evaluated based on growth, physiological and oxidative biomarkers. The temperature tolerant (PS-2511) and sensitive cultivars (PB-1509) were then treated with different sulfur concentrations (0 mM SO_4^{2-}; 1 mM SO_4^{2-}; 2mM SO_4^{2-}) to explore the role of this mineral nutrient and the best effective concentration in alleviating heat stress. It was observed that heat stress negatively affected photosynthetic efficiency, and chlorophyll content, induced hyper-accumulation of reactive oxygen species (H_2O_2 and O_2^-), and negatively affected membrane integrity. Interestingly, treatment of sulfur (best concentr) significantly improved the plant biomass, photosynthesis and maintained the steady-state equilibrium among ROS generation and antioxidant enzymes like catalase, peroxidase and superoxide dismutase in both PS-2511 and PB-1509 cultivar. Our outcomes suggests that treatment of sulfur promoted thermotolerance in rice cultivars by improving growth, photosynthetic attributes and regulating antioxidative enzymes. We further aim to reveal the coordinating role of sulfur with signaling molecules like ethylene and H_2S and utilize this mechanism as a crop improvement strategy.

UTILIZATION OF DIELECTRIC SPECTROSCOPY FOR CHARACTERIZING VARIANTS OF PANEER

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ABSTRACT

Paneer, one of the cheese variants named cottage cheese, is an indigenous milk-processed product prepared by the combined action of heat treatment and acid coagulation of milk and pressing of coagulum. It is a generous source of nutrition for fat, vitamins, good quality protein, and minerals like calcium and phosphorus (Chitranayak et al., 2021; Dey et al., 2020). Various types of cottage cheese are famous worldwide due to their nutritional features such as standard paneer, low fat paneer, fatless paneer, filled paneer etc. For characterizing these paneer variants, dielectric spectroscopy could be a powerful tool. It is an emerging technology that is used for quality analysis of various agricultural products, but the data on quality analysis of coagulated dairy products by dielectric spectroscopy is very scarce in literature. Therefore, in the present study a dielectric sensor based setup has been utilised to distinguish various types of paneer. Textural, Functional group and micrographs analysis has been also carried out to correlate it with the data of dielectric spectroscopy. Results depict a strong correlation between variants and proximate composition of *paneer* with dielectric property (R2> 0.95). Other functional characteristics such as texture and micro-structure also emboldens the possibility of evaluating paneer characteristics by dielectric spectroscopy.

CHLORELLA SOROKINIANA FOR BIODIESEL PRODUCTION

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ABSTRACT

The algae are one among the biomass energy source which can be promising. The microalgae are the diverse organisms which can inhabit in different climatic conditions and adapt themselves and perpetuate forming their own niche. Exploitation of microalgal strains with high biomass and cellular lipid productivity is essential for sustainable biodiesel production.

In this study, the green microalgae, was isolated from a fresh water lake of Bengaluru city grow on BG-11 agar media, characterized through microscopic studies and further identified as *Chlorella sorokiniana* by molecular studies using 18s DNA sequencing then the growth and lipid accumulation of microalgae were done in BG-11 broth.

The algae was harvested by centrifugation and the cells are washed with distilled water and re-centrifuged, the pellet was dried in hot air oven and dry weight of algal biomass was determined, it was found to be 2.33±0.20g/L.

Total lipid content was obtained by treating dried algal biomass with chloroform – methanol and estimated as 41%. After sonication, the chloroform layer was collected and evaporated in oven at 60°C then are cooled. The obtained lipid was subjected to alkaline transesterification for the production of biodiesel. The obtained content have the biodiesel and glycerol. The upper biodiesel layer was separated and quantified by FTIR analysis. The most characteristic peaks on a biodiesel spectrum is observed at 1000-1300 cm^{-1} which is related to O-CH_3 vibrations. Which confirms the produced biodiesel meets the biodiesel standards.

EFFECT OF MICROPLASTICS AND NANOPLASTICS TO AGRICULTURAL CROPS: A REVIEW

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ABSTRACT

Microplastics (MPs) and nano-plastics (NPs) are becoming emerging contaminants. MPs/NPs are estimated to accumulate in agricultural soils, and there needs to be more information on terrestrial plants' effect and uptake of MPs/ NPs. Plastics go through a prolonged degradation process in the natural environment. The physical and chemical composition of these particles poses known and unknown risks. The comprehensive knowledge about the toxic effects of MPs/ NPs on plants is yet to be fully discovered. This review focuses on the impact of MPs/NPs on plants by reviewing the literature on studies conducted in vitro and in vivo experiments on different plant species. The current literature review has highlighted sources, effects, possible uptake, and mode of the route of MPs/NPs in plants. The use of synthetic plastic granules (diameter size in nm) in published experimental research is also questionable, as the plastic in the natural environment would not be in the same spherical form after degradation. The entry of MPs/NPs from the natural environment into the plant system is questionable. Also, this review emphasizes the available detection techniques and challenges faced during these studies. More studies on biodegradable plastics and bioplastics are required to confirm the risks of human exposure to MP's/NP's due to ingestion of agricultural produce. Plastic waste management must be the priority and need of the hour to safeguard our environment and sustain healthy agricultural soils.

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APPLYING DATA ENVELOPMENT ANALYSIS (DEA) APPROACH FOR ENERGY INPUT-OUTPUT FLOW IN WHEAT CULTIVATION

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ABSTRACT

An energy input scenario of wheat production in Bhopal district of Madhya Pradesh was analysed to establish optimum energy input levels and to know the sensitivity of a particular energy input level on productivity. In this study energy input-output relationships for wheat cultivation were estimated from data collected from 50 wheat producers by face-to-face interview. Wheat is produced using energy sources ranging from human and electrical power to power of heavy machinery. Data Envelopment Analysis (DEA) approach that gives the relation between input and output, was utilized using Banker-Charnes-Cooper (BCC) input oriented model to analyse the observe data of wheat energy. Energy used in various operations like seedbed preparation, sowing, fertilizer application, spraying, irrigation and harvesting were computed and taken as input for DEA. The grain energy and residue energy were taken as output of the model. The energy input in wheat cropping system was observed 16950 MJ/ha. Seedbed preparation, sowing, fertilizer application, spraying, irrigation and harvesting were having share of about 1287, 2958, 6597, 159, 5003 and 947 MJ/ha respectively. The grain energy and residue energies were computed 61417 and 35205 MJ/ha, respectively. It was analysed by DEA that the input energy in various operations viz. seedbed preparation, sowing, fertilizer application, spraying, irrigation and harvesting may be reduced by 6.72%, 3.82%, 4.34%, 5.18%, 2.48% and 5.87%, respectively. The predicted input energy from the data envelopment analysis not only save energy but it may also enhance the grain energy about 1.75% and residue energy about 3.77%. The above analysis inferred that the relation in energy input may lead to increase in grain and biomass yield.

OPTIMIZATION OF ENERGY CONSUMPTION USING DATA ENVELOPMENT ANALYSIS (DEA) IN SOYBEAN CROPPING SYSTEM OF BHOPAL (M.P.)

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ABSTRACT

Energy-efficient agricultural systems are required to reduce energy inputs without reducing crop output. Effective utilization of available resources would be good for sustainable agriculture as well as more profitable that helpful to sustain rural economy. A survey was conducted by personal interview with the fifty soybean cultivator to know the energy use pattern of soybean cropping system in Bhopal district of Madhya Pradesh. Data envelopment analysis (DEA) approach that gives the relation between input and output, was utilized using Banker-Charnes-Cooper (BCC) input oriented model to analyse the observe data of soybean energy. Energy used in various operations viz. seedbed preparation, sowing, fertilizer application, spraying and harvesting were taken as input, where the grain energy and residue energy taken as output of the model. The energy input in soybean cropping was observed 11713 MJ/ha, in which various operation *viz*. seedbed preparation, sowing, fertilizer application, spraying and harvesting were shares about 1267, 2924, 6234, 232 and 1055 MJ/ha, respectively. The grain energy and residue energy was computed 13631 and 14181 MJ/ha, respectively. It was analysed by DEA that the input energy in various operations viz. seedbed preparation, sowing, fertilizer application, spraying and harvesting may be reduced about 1064, 2652, 5462, 147 and 843 MJ/ha, respectively. The predicted input energy from the Data Envelopment Analysis not only save energy but it may also enhance the grain energy about 15580 MJ/ha and residue energy about 14982 MJ/ha.

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ADVANCED HARVESTING TECHNIQUES FOR SUSTAINABLE BIOFUEL PRODUCTION

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ABSTRACT

Rapid industrialization and population growth are vital factors responsible for the world's energy crisis. 80% of energy demands have been fulfilled by conventional sources such as petroleum, coal and natural gases, however, they are the sole reasons for an increase in greenhouse gas emissions. In the last few decades, the concern regarding depleting conventional sources, and the urgent need for biofuel production has increased manifold. Microalgae have received the utmost attention to be used as biofuel producers, as it requires less land and resources. Biofuel production comprises 4 major steps- microalgae cultivation, cell harvesting, lipid extraction and conversion of lipid into biodiesel. Selecting a harvesting technique for microalgae biomass which is both economically and environmentally sustainable, is a great challenge.

Microalgae harvesting includes conventional as well as advanced methods. Centrifugation, sedimentation, filtration and electricity-driven methods fall under the conventional category, while flocculation, nanomaterial binding, magnetic nanoparticle, electrophoresis and flotation are advanced techniques. Biomass recovery using centrifugation ranges between 95-100 %, but high gravitational force can alter the cell structure. Sedimentation is one of the most useful methods in wastewater microalgae harvesting, though it is applicable to large cell microalgae (>70 µm). Filtration is a low-cost method and easy to process however, fouling and clogging can result in low yield. Among several techniques, flocculation is one of the most effective and economical approaches for biomass harvesting. Chemical flocculants including inorganic, organic, bio flocculants and nanomaterial-based techniques etc. are used for biomass recovery. Nano material-based flocculants are considered due to their efficiency and reusability. Present work highlights the recent milestones achieved in different harvesting techniques.

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PAHS DEGRADATION BY MICROBIAL CONSORTIA PBR-21: *IN VITRO* STUDIES AND ASSESSMENT OF PAH DEGRADATION EFFICIENCY IN STIMULATED MICROCOSM

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ABSTRACT

Fossil fuel is the predominant energy source across all the major sectors, out of which industries and transportation collectively share approximately 75% of the total energy consumption by 2040. The anthropogenic activities toward meeting the energy requirements have resulted in an alarming rise in environmental pollution levels. Among pollutants, polycyclic aromatic hydrocarbons (PAHs) are the most predominant due to their persistent and toxic nature. Amidst to physico-chemical method, biodegradation is a viable alternative. This study investigated the biodegradation using developed microbial consortium PBR-21 for 2-4 ringed PAHs named naphthalene (NAP), anthracene (ANT), fluorene (FLU), and pyrene (PYR). Biodegradation was observed up to 100 ± 0.0%, 79.07 ± 1.6%, 75.32 ± 2.3%, 72.74 ± 0.2%, respectively, for initial concentrations of 100 mg L^{-1} for NAP, ANT, FLU, and PYR respectively. Degradation followed first-order kinetics with rate constants of 1.41 d^{-1}, 0.12 d^{-1}, 0.11 d^{-1} and 0.10 d^{-1} and half-life of 0.5 h, 5.6 h 6.3 h and 7.3 h, respectively. Toxicity examination indicated that the microbial treatment resulted in lesser toxic metabolites than the untreated PAH. Simulated microcosm studies confirmed the ability of PBR-21 for PAH degradation and to colonize soil in the presence and absence of indigenous microflora. The result showed that PBR-21 is highly potent in degrading PAHs under laboratory and stimulated microcosm.

MITIGATING EFFECTS OF DROUGHT BY FOLIAR APPLICATION OF SALICYLIC ACID ON RICE CULTIVARS: A COMPARATIVE STUDY

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ABSTRACT

Drought stress has been identified to threaten rice growth and productivity, which illustrates a complex abiotic stress process. Plant growth regulator salicylic acid plays a crucial role in mitigating the deleterious effects of environmental stresses on plants, including drought. In this comparative study, we sought to evaluate the alleviating effect of SA on two rice varieties differing in their tolerance to drought stress. A controlled pot experiment was conducted to evaluate the efficacy of salicylic acid foliar application on morphological and biochemical attributes such as growth, accumulation of reactive oxygen species, protein carbonyl contents, the activity of antioxidant enzymes, and antioxidant metabolites of rice on exposure to different water conditions. Both rice varieties significantly reduced morphological parameters due to drought stress compared to well-watered conditions. However, the exogenous application considerably improved the growth parameters, shoot height and root length under drought. PEG induced drought significantly, upsurged the accumulation of hydrogen peroxide and hydroxyl radicals and enhanced the levels of protein carbonyl content. However, salicylic acid foliar application markedly declined ROS and protein carbonyl content under drought-stress conditions. Antioxidant enzyme activity and antioxidant metabolite accumulation showed a substantial rise by salicylic acid foliar treatment under both well-watered and drought-stressed conditions. Overall, the foliar application of SA was effective in boosting the drought tolerance in selected rice varieties through declined levels of ROS and protein carbonyls, enhanced antioxidant activities and accumulation of antioxidant metabolites

HYPO-TESTICULAR ACTIVITY OF THE SEED OF *ARECA CATECHU* (LINN) IN ALBINO RAT : EFFECTIVE FRACTION SELECTION STUDY

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ABSTRACT

Objective: This study focus on hypo-testicular activity of the most effective fraction out of n-hexane, ethyl acetate, n-butanol of hydro ethanolic (6:4) extract of *Areca catechu* in connection with herbal contraceptive development.

Methods: After the treatment with different fractions of n-hexane, ethyl acetate, and n-butanol orally at a dose of 20mg/100gm for 28 days, different parameters were adopted for this experimental study including spermatogenic profile, serum testosterone, gene expression study, testicular androgenic key enzymes such as Δ5, 3β-HSD and 17β-HSD activities, and toxicity study from the targeted tissue.

Result: All treated groups showed a significant diminution ($p<0.05$) of the spermatogenic profile. Significant upregulation ($p<0.05$) of Bax gene and down-regulation ($p<0.05$) of Bcl-2 gene in testicular tissue which indicated the hypo-testicular activity of these fractions. Serum testosterone level and androgenic key enzyme activities were significantly decreased ($p<0.05$) when compared to the control group. Hepatic and renal ALP and ACP activities showed non-significant changes ($p>0.05$) which also supported the non-toxic nature of *Areca catechu*. Among all treated groups, n-butanol fraction treated group showed maximum hypo-testicular activities by the reduction of spermatogenic and androgenic profiles.

Conclusion: It can be concluded that n -butanol fraction of seed of *Areca catechu* has the most promising effect to develop herbal contraceptives may be due to the presence of effective phytomolecules in this concern.

EXTRACTION OF LIPID FROM MICROALGAE

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ABSTRACT

Microalgae are microscopic unicellular organisms capable to convert solar energy to chemical energy via photosynthesis. They contain numerous bioactive compounds that can be harnessed for commercial use. Microalgae are a renewable source of bio fuel. In this study, microalgae biomass was produced using crop residue and biogas slurry based growth media in the open race way pond. Microalgae biomass was harvested and dried. A lipid extraction unit was used for extraction of lipids from dried microalgae biomass through solvent extraction process. Solvent used for the process was n-hexane. Lipid extraction carried out at 70 °C temperature for duration of 2 h. The lipids from solvent were separated using rotary evaporator at operating temperature of 70 °C. Almost 65% of the solvent could recover during the process. The recovered solvent was re-used in the next extraction operations. Lipid recovery from dried microalgae was obtained in the range of 16 to 18%.


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