



Jamal Mohamed College (Autonomous)

Accredited with A++ Grade by NAAC (4th Cycle) with CGPA 3.69 out of 4.0
(Affiliated to Bharathidasan University),
Tiruchirappalli – 620 020, Tamil Nadu, India



4th International Conference on **MICROBIAL INNOVATIONS FOR A SUSTAINABLE FUTURE (ICMISF-2025)** 11th September 2025

organized by

P.G. & RESEARCH DEPARTMENT OF MICROBIOLOGY

in association with

ICAR - NATIONAL RESEARCH CENTRE FOR BANANA

Tiruchirappalli - 620 102, Tamil Nadu, India

Souvenir



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Hajee Dr. A.K. KHAJA NAZEEMUDEEN
Secretary and Correspondent



MESSAGE

As we all know that Microbiology, an applied science, plays an important role in improving the quality of life on earth. Therefore, it is but natural, that research and innovations in microbiology are considered as necessary catalytic agents for better existence. Motivated by this the PG and Research Department of Microbiology is organizing the 4th INTERNATIONAL CONFERENCE ON MICROBIAL INNOVATIONS FOR A SUSTAINABLE FUTURE (ICMISF- 2025) on 11th September 2025.

I am sure that this conference, with focus on the interdisciplinary aspects and applications, will definitely help the budding researchers and students of life sciences. It will also help them to come in contact with the eminent personalities in the field, exchange views and learn from them the latest developments and future challenges.

I congratulate all the staff members for their earnest efforts and wish the conference a grand success.

28.08.2025

Hajee Dr. A.K. KHAJA NAZEEMUDEEN
Secretary and Correspondent



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Hajee M.J.JAMAL MOHAMED
Treasurer



MESSAGE

I am delighted to know that the PG and Research Department of Microbiology is organizing the 4th INTERNATIONAL CONFERENCE ON MICROBIAL INNOVATIONS FOR A SUSTAINABLE FUTURE (ICMISF- 2025) on 11th September 2025.

Our daily life is influenced to a very large extent, unknown to us by microbes. Every single material in the world is a Microbe. In fact, it wouldn't be an exaggeration to say that microbes rule the modern world.

The international conference aims to bring together experts, facilitating the interaction of our students, researchers and academicians with them. This, I am sure, will help young people in their pursuit of research in Microbiology.

I congratulate all the staff members, researchers and students of the Department of Microbiology for organizing this conference for the fourth year in succession and wish for its successful conduct.

Hajee M.J. JAMAL MOHAMED

Treasurer 28/8/2025



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Dr. K.ABDUS SAMAD
Assistant Secretary



MESSAGE

It is with immense pleasure that I convey my heartiest greetings and wishes to the PG and Research Department of Microbiology for organizing the 4th **INTERNATIONAL CONFERENCE ON MICROBIAL INNOVATIONS FOR A SUSTAINABLE FUTURE (ICMISF- 2025)** on 11th September 2025.

In this millennium, thanks to the technological innovations and improved communications, winds of changes are sweeping in every sphere of human endeavor. This calls for constant updating of the knowledge of students and research scholars. This conference is one such initiative by the department in realizing the same in the chosen field of microbiology.

I am sure that this conference will facilitate the meeting of minds resulting in the sharing of ideas and imparting of the knowledge of advances in microbiological research.

I congratulate and appreciate the staff members of this conference for their sincere efforts and team work. I wish this conference a grand success.

Dr. K.ABDUS SAMAD
Assistant Secretary



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Dr. K.N. ABDUL KADER NIHAL
Member & Honorary Director



MESSAGE

I am glad to know that the PG and Research Department of Microbiology is organizing the 4th **INTERNATIONAL CONFERENCE ON MICROBIAL INNOVATIONS FOR A SUSTAINABLE FUTURE (ICMISF- 2025)** on 11th September 2025.

An event of this nature offers an excellent opportunity to learn from and interact with the best minds in the field and stay up-to-date with the latest advances in microbial science and technology.

My best wishes to the convener, members of the organizing committee and participants of the conference.

Dr. K.N. Abdul Kader Nihal
28/08/2025

Dr. K.N. ABDUL KADER NIHAL
Member & Honorary Director



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Dr. D.I. GEORGE AMALARETHINAM
Principal



MESSAGE

It is a matter of pride and pleasure to learn that the PG and Research Department of Microbiology of our College is organizing the 4th INTERNATIONAL CONFERENCE ON MICROBIAL INNOVATIONS FOR A SUSTAINABLE FUTURE (ICMISF- 2025) on 11th September 2025 in this Platinum Jubilee year.

This conference, where in many researchers and scientists from India and abroad are participating, I am sure, will definitely pave the way for the betterment of the quality of research of our scholars and students, help them update their knowledge of recent innovations and identify new emerging directions in research in microbiology.

I congratulate the organizing team for their sincere efforts and wish the conference a resounding success.


Dr. D.I. GEORGE AMALARETHINAM
Principal

28.08.2025



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Dr. R. JAHIR HUSSAIN
Vice Principal



MESSAGE

It is with great pleasure that I convey this message on the occasion of the 4th INTERNATIONAL CONFERENCE ON MICROBIAL INNOVATIONS FOR A SUSTAINABLE FUTURE (ICMISF- 2025) on 11th September 2025, organized by the PG and Research Department of Microbiology.

It also gives me pleasure to learn that many great academicians, eminent scientists, researchers and industrial experts are to take part in the deliberations of this conference.

May this conference be a source of insight to every participant. My appreciations to the organizers for their laudable efforts and best wishes for the successful conduct.

Dr. R. JAHIR HUSSAIN
Vice Principal



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Dr. A.J.HAJAMOHIDEEN
Additional VicePrincipal



MESSAGE

I am extremely happy to note that the PG and Research Department of Microbiology is organizing the 4th INTERNATIONAL CONFERENCE ON MICROBIAL INNOVATIONS FOR A SUSTAINABLE FUTURE (ICMISF- 2025) on 11th September 2025.

The plenary sessions of the conference will cover a wide range of topics related to microbial innovations and technology providing the participants an opportunity to learn from experts in the field, build-up networks and collaborate with peers in the fields.

I congratulate the staff members of the Department of Microbiology for their efforts and convey my good wishes to all.

A.J. Hajamohideen
28/8/25

Dr. A.J.HAJA MOHIDEEN
Additional Vice Principal



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Dr. A. ISHAQ AHAMED
Additional Vice Principal



MESSAGE

It gives me immense pleasure to learn that, in this seventy fifth eventful year of our college's fruitful existence, the PG and Research Department of Microbiology is organizing the 4th INTERNATIONAL CONFERENCE ON MICROBIAL INNOVATIONS FOR A SUSTAINABLE FUTURE (ICMISF- 2025) on 11th September 2025.

The thematic focus of the conference is wonderfully aligned with the vision of the college of becoming a highly acclaimed, world class innovative and competitive center for academic and extra academic excellence. I am sure many eminent professors, research scholars and students from different universities and colleges will be sharing their research ideas in this conference.

I congratulate all the staff members of the department for their devoted service in organizing the conference. I also would like to extend my best wishes to the participants and prayers for the success.


28/8/25

Dr. A. ISHAQ AHAMED
Additional Vice Principal



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Ms. A. FAMITHA BANU
Additional Vice Principal



MESSAGE

It's my greatest pleasure to record my greetings to the PG and Research Department of Microbiology which is organizing the 4th INTERNATIONAL CONFERENCE ON MICROBIAL INNOVATIONS FOR A SUSTAINABLE FUTURE (ICMISF- 2025) on 11th September 2025.

There has been a marvelous amount of discussion over the past few years concerning the importance of research in microbial innovations. Therefore, the contemplations of this conference are designed to cover a full spectrum of research, development, application and current status of microbiology and its applications in various fields.

I hope that the conference will offer excellent opportunities to the students and scholars of microbiology.

I appreciate all the staff of the Department of Microbiology for their wonderful service in organizing the conference and wish it a grand success.

A Famitha Banu
28/8/2025

Ms. A. FAMITHA BANU
Additional Vice Principal



Tel. No. : 0431 - 2331135
P.B.No. : 808

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Hajee Dr.K.N.MOHAMED FAZIL
Director - Hostel Administration



MESSAGE

I am happy to know that the PG and Research Department of Microbiology is organizing the 4th INTERNATIONAL CONFERENCE ON MICROBIAL INNOVATIONS FOR A SUSTAINABLE FUTURE (ICMISF- 2025) on 11th September 2025.

I hope that the conference will definitely help the researchers to update their knowledge by interacting with eminent scholars in their discipline and also develop a fundamental understanding of the nature of the microbiological processes.

I take this opportunity to congratulate all the staff members of the Department of Microbiology for their excellent team efforts in conducting this conference and wish every participant a grand success.

Hajee Dr. K. N. MOHAMED FAZIL
Director - Hostel Administration



भाकूअनुप – राष्ट्रीय केला अनुसंधान केंद्र
(भारतीय कृषि अनुसंधान परिषद)
तोगमलै रोड, थायनूर पोस्ट,
तिरुच्चिरापळि. – ६२० १०२, तमिलनाडु, भारत.

ICAR - National Research Centre for Banana
(Indian Council of Agricultural Research)
Thogamalai Road, Thayanur P.O.
Tiruchirappalli - 620 102, Tamil Nadu, India



Recipient of "Sardar Patel Outstanding ICAR Institution Award 2020"

Dr. R. Selvarajan
Director



MESSAGE

I am pleased to learn that the International Conference on "Microbial Innovations for a Sustainable Future" is being organized by Jamal Mohamed College in association with ICAR-NRCB on 11th September, 2025 in Tiruchirappalli, TamilNadu. This timely event brings together brilliant minds to explore the transformative potential of microbes in addressing global challenges such as food security, environmental sustainability, health, and climate resilience.

Microorganisms, though invisible to the naked eye, hold immense power to reshape our world. From innovative applications in agriculture and industry to groundbreaking advances in medicine and environmental remediation, the microbes offers sustainable solutions to many of our most pressing problems. It is quite common for people to associate the term 'microbes' with pathogens. However, many of the microbes that surround us are non-pathogenic and incredibly essential for life. From nitrogen fixation to plastic degradation, the role of microbes for a sustainable future is undeniable. Microbes have a direct link to several of the UN's Sustainable Development Goals (SDGs) such as clean water and sanitation, good health and hygiene, and affordable and clean energy, just to name a few.

This conference serves as a vital platform for sharing cutting-edge research, fostering interdisciplinary collaborations, and inspiring innovations that bridge science and society. I commend the scientific community for its unwavering commitment to unlocking the potential of microbial resources and translating knowledge into impactful action. Let this conference ignite new ideas, strengthen networks, and pave the way toward a healthier, more sustainable future.

I extend my heartfelt congratulations to the organizers, participants, and contributors of this conference and wish it grand success

[R. Selvarajan]

Date: 08.08.2025
Place: Trichy

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ABOUT THE COLLEGE

Jamal Mohamed College, situated in the heart of Tiruchirappalli, was founded in the year 1951 as a government aided institution by Hajee. M.J. Jamal Mohamed Sahib and Janab N.M. Khajamian Rowther of revered memory. It is housed in a sprawling campus of 60 acres and is administered by the Society of Jamal Mohamed College. It was first affiliated to the University of Madras and then consequently to the Bharathidasan University upon its formation in 1982. From a humble beginning 75 years ago with 250 students and 12 staff members, the college has now grown as a multi-faculty institution offering 29 UG, 20 PG and 17 research programmes in various disciplines as well as other diploma and certificate programmes. Currently it has on its rolls about 11,000 students and 483 faculty members. The college celebrated its Silver Jubilee in 1976, the Golden Jubilee and Diamond Jubilee in 2001 and 2011 respectively and is right in the midst of celebrating its Platinum Jubilee during this academic year 2025-2026.

Presently the college is led admirably by the present Management Committee, and in its march towards realizing the vision of its noble founders has crossed successfully, many a milestone. The college was provided with financial assistance under the DST-FIST scheme in 2019-2020 and also had five of its science departments selected for financial assistance by the Department of Biotechnology (DBT) under the DBT Star College Scheme during the academic year 2020-2021.

The services of the college in the field of higher education have earned it encomiums from the central and state governmental agencies. It was accredited at 'A' Grade with Five Star status by NAAC in 2001, was conferred with the Autonomous Status by the UGC and Bharathidasan University in 2004-2005 and was bestowed with "College with Potential for Excellence" status twice in 2011-2012 and 2016-2017 respectively. The college has been consistently ranked within the top 100 institutions since 2018 in the National Institutional Ranking Framework (NIRF) conducted by the Ministry of HRD, Government of India. Its premiere

position among academic institutions is evident by the fact that it secured the much-coveted A++ grade with CGPA 3.69 out of 4.0 by NAAC (4th Cycle).

ABOUT THE DEPARTMENT

The Post Graduate Department of Microbiology was started in the year 1998 offering the M. Sc. Microbiology Programme for Men under the Self-financing Scheme. However, to cater to the educational aspirations of the women community and to empower them, the department started admitting women students also under Shift - II in 2008-09. In 2015, the department started offering UG programme for women and then research programme leading to M. Phil. and doctoral degrees. It boasts of well qualified and dedicated staff who are actively involved in research in the field of Microbiology and their applications. It has a full-fledged laboratory housing such advanced equipment as Advanced Nikon Photo Microscopes, Two-Dimensional Gel Electrophoresis, ELISA Reader, Thermal Cycler and Gel Document system. The dedicated services of the faculty and the excellent infrastructural facilities have resulted in its students excelling in the Combined Rankings conducted by the Bharathidasan University every year.

ABOUT ICAR - NATIONAL RESEARCH CENTRE FOR BANANA

The ICAR-NRCB was established on 21st August 1993 at Tiruchirappalli, Tamil Nadu under the aegis of Indian Council of Agricultural Research, New Delhi with the aim to augment the production and productivity of banana and plantain through mission mode basic and strategic approaches. The major thrust areas of research include viz., banana improvement, production, postharvest management and protection. ICAR-NRCB has well-equipped research laboratories for genetic resources management, crop improvement, molecular biology and biotechnology, tissue culture, nutrition, water management, soil and leaf nutrients, physiology and biochemistry, postharvest technology, crop protection disciplines like entomology, nematology, plant pathology and virology and ABI and ITMU for business incubation, IPR, consultancy processing and technology commercialization and

transfer. It also houses a field gene bank consisting of 470 banana germplasm. The centre has international and national collaboration with institutes like Diversity, France; Queensland University of Technology (Brisbane), Australia; CIRAD, Montpellier; France; KUL, Belgium; IITA, Nigeria, Cornell University, Ithaca, USA and TNAU, Coimbatore, BARC, Mumbai, NIT, Trichy besides carrying out consultancy services to all the stakeholders of banana. The centre has been implementing e-governance and E-Office systems for ensuring speedy and responsive administration.

ABOUT THE CONFERENCE

In an era defined by unprecedented environmental challenges from climate change and resource depletion to widespread pollution humanity is in urgent need of innovative and sustainable solutions. Hidden from the naked eye, a powerful and ancient ally has emerged from the world of microbiology. Microbes, the most abundant life forms on earth, possess an extraordinary metabolic diversity that we are only beginning to harness. These microscopic organisms are at the forefront of a green revolution, offering novel approaches to build a more sustainable and circular global economy.

These innovations represent a paradigm shift away from the fossil fuel-dependent, linear models of production and consumption. Instead of "take, make, dispose," this field leverages the natural processes of microorganisms to create regenerative systems. This International Conference on "Microbial Innovation for a Sustainable Future" mainly focuses on areas such as Bioremediation, Bioenergy, Sustainable Agriculture, Green Chemistry and Biomaterials, Waste Valorization and human health etc.

This conference aims to promote sustainable practices by highlighting recent advances in microbial technology. It intends to offer a platform for leading academicians, scientists, researchers and students to exchange their research experiences and as well as to share the practical challenges that they have

encountered and solutions they adopted in the fields of microbiology. This conference thereby encourages interdisciplinary collaboration and aims to promote sustainable practices. The topics of the conference include, but are not limited to the following:

- ❖ Agriculture and Environmental Technology
- ❖ Biodiversity and Conservation
- ❖ Biofuels and Bioenergy
- ❖ Drug Design and Delivery
- ❖ Marine Microbiology
- ❖ Medical Microbiology
- ❖ Microbial Nanotechnology
- ❖ Microbial Production of Bioactive compounds
- ❖ Molecular Pathogenesis and Diagnosis
- ❖ Pharmacological Microbiology
- ❖ Plant Pathology
- ❖ Plant and Animal Biotechnology

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Invited Talks

FIELD-DEPLOYABLE BIOSENSING PLATFORMS FOR BIOTHREAT AGENTS: HYBRID MATERIAL ARCHITECTURES AND SUSTAINABLE DESIGNS

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Modern warfare and national security challenges necessitate the development of field-deployable, smart, and multifunctional biosensing platforms for rapid and reliable detection of bioterror agents in extreme environments. The article discusses sustainable sensing techniques that make utilisation of hybrid nanomaterial architectures, including Quantum Dots (QDs), Metal-Organic Frameworks (MOFs), and Bacterial Cellulose (BC), which collectively offer high sensitivity, strength, and eco-compatibility. QDs provide size-tuneable fluorescence and exceptional optoelectronic properties for fluorometric detection of indicators of pathogenicity, enabling real-time and high-resolution sensing. MOFs, with their ultra-high surface area and tunable porosity, demonstrate superior performance in adsorbing toxins, chemical warfare agents, and stabilizing recognition elements for bioterror identification. Bacterial Cellulose, as a sustainable biopolymer, offers mechanical stability and biocompatibility for portable sensing platforms that are lightweight and cost-effective. Recent advances highlight the integration of these materials to create synergistic hybrid biosensors for improved selectivity, sensitivity, and resilience under operational stress. Minimalistic sensing modules and scalable fabrication protocols enable rapid on-site deployment, addressing the challenges of low-resource and battlefield conditions. This also emphasizes future directions in AI-assisted design of sensing architectures, data-driven optimization, and real-time threat analytics, paving the way for next-generation intelligent biosensing systems that align with the strategic goals of national defence. This convergence of nano-architectonics, sustainable materials, and advanced detection technologies marks a transformative leap toward autonomous bioterror surveillance and protection in defence operations.

NANOPARTICLE BASED STRATEGIES TO COMBAT BIOFILM ASSOCIATED INFECTIONS IN HEALTHCARE

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Biofilm associated infections represent a significant clinical challenge due to their persistent nature and resistance to conventional antimicrobial therapies. In healthcare settings, microbial biofilms are commonly implicated in chronic wounds, indwelling medical devices, and hospital acquired infections, contributing to increased morbidity, mortality, and healthcare costs. Traditional antibiotics often fail to penetrate the protective biofilm matrix, necessitating the development of innovative therapeutic approaches. Nanotechnology offers promising solutions through the development of nanoparticles based antimicrobials with enhanced biofilm penetration, targeted delivery, and multi-modal mechanisms of action. This talk will highlight recent advances in the synthesis and application of metal and polymer-based nanoparticles, including silver, gold, zinc oxide, and chitosan nanoparticles, in disrupting biofilm structure, inhibiting quorum sensing, and enhancing antimicrobial efficacy. Emphasis will be placed on their physicochemical properties, biocompatibility, and functionalization strategies for site-specific delivery. Furthermore, the presentation will discuss *in vitro* and *in vivo* studies demonstrating the efficacy of these nanomaterials against clinically relevant biofilm forming pathogens, as well as current challenges in clinical translation, such as toxicity, stability, and regulatory concerns. By integrating nanotechnology with microbiological insights, nanoparticle based therapies hold transformative potential in preventing and treating biofilm-associated infections in modern medicine.

Keywords: Biofilms; Nanoparticles; Antimicrobial resistance; Healthcare associated infections; Metal based nanoparticles; Quorum sensing inhibition; Medical devices.

THE POWER OF MICROBES: GREEN SOLUTIONS FOR A GREENER TOMORROW

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The current energy crisis and the escalating impacts of global warming, primarily driven by greenhouse gas emissions from fossil fuels, necessitate a paradigm shift toward sustainable and renewable energy sources. It is imperative that we explore diverse renewable energy alternatives to meet future energy demands while preserving ecological integrity. Among various renewable options—including wind, solar, and hydropower—biomass emerges as a particularly promising candidate due to its abundance and potential for sustainability. Historically, the potential of biomass energy has been underutilized due to insufficient technological advancements. The conventional methods for converting biomass into energy carriers tend to be energy-intensive, toxic, and require significant time investments. Additionally, leveraging biomass derived from waste streams presents an opportunity to mitigate waste while serving as a feedstock for energy production. Traditional biomass conversion typically involves the use of chemical additives and microbial agents, which can be hazardous and environmentally unfriendly. A more sustainable approach would be to utilize natural microbial processes for energy extraction from biomass. The cultivation of specific microbial strains offers a promising avenue for applications in the energy, food, agriculture, and pharmaceutical industries. To unlock the full potential of microbial communities in the conversion of biomass into energy substrates, it is crucial to conduct targeted studies on novel microbial strains. This research should focus on selecting effective microbes capable of facilitating sustainable energy production and contributing to broader sustainable development goals.

Keywords: Biomass, Microbial Technology, Sustainable solution, GHG, Biofuels.

TRENDS IN MARINE MICROBIAL BIOPROSPECTING

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The world marine biotechnology marketing is expected about 7.69 billion USD in 2027. Bio-prospecting of marine natural products from marine ecosystems including sediments, marine water, deep sea, Arctic and Antarctic regions, mangroves, higher saline regions and other extremophilic sources through conventional and genomic tools, we can get novel molecules which will have many pharmaceutical, cosmetic, food, industrial and environmental applications. Recently, the discovery rate of new compounds from terrestrial origin has decreased, whereas the rate of re-isolation of known compounds and their derivatives has increased. Marine is the untapped reservoir of biologically active compounds, which leads to the development of new medicines, industrial products and nutraceuticals with diverse novel chemicals. Marine organisms have special adaptations to synthesize diverse of novel molecules, because they surviving under stressful conditions like higher saline environments, pressure, low temperature, high temperature etc. Marine microbes including bacteria, fungi, actinomycetes and micro algae and their association with marine flora and fauna help to synthesis novel biomolecules with different bioactivities including antibacterial, antifungal, antiviral, antioxidant, immunostimulant, anti-inflammatory, anti-cancer and other bioactivities. Marine natural products such as cyclic peptides, small molecules, phenolics, alkaloids, carotenoids, pycocyanin, biosurfactants, enzymes, thermostable enzymes, halophilic enzymes, anti-freeze proteins, siderophores, polysaccharides and polyketides etc have various applications. Microalgae from different marine ecosystems also derived valuable biomolecules including fatty acids including HUFA, PUFA, very long chain fatty acids, carotenoids, biopolymers, bioplastics, algal oil, biofuel production and toxins have diverse applications. The genomics technology including bio-prospecting of biosynthetic gene clusters, transcriptomes, metabolomics and metagenomic tools is highly useful in identifying functional genes and their novel molecules related to health care, cosmetic, industrial, food and environmental applications.

Keywords: Bio-prospecting; Healthcare applications; Marine Microbial Bio Products; Micro Algal Bio Products; Secondary metabolites

*Oral
Presentation*

DIE-BACK" DISEASE ASSOCIATED WITH CASHEW (ANACARDIUM OCCIDENTALE L.) ORCHARDS IN PANRUTI (THE CASHEW CAPITAL OF TAMIL NADU)

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ABSTRACT

Tamil Nadu is one of the important cashew growing states in East Coast region of the country. Panruti taluk, Cuddalore district of the state has second largest area under cashew and second highest number of cashew processing industries which contributes a major share in the cashew economy. This study was conducted to observe the die-back disease in cashew trees grown in seven hot spot areas of Panruti taluk of Cuddalore district; it was found that cashew cultivation was severely affected by die-back disease based on the symptomatological studies in all the study areas. The Department of Horticulture, Government of Tamil Nadu needs to take up intensive efforts to advise the farmers to take appropriate management strategies.

Key words: Cashew trees, Die-back, *Lasiodiplodia theobromae* (Pat.) Griffiths & Maubl.

1. Introduction:

Cashew (*Anacardium occidentale* L.), which belongs to the family Anacardiaceae is a perennial tree and a native of Eastern Brazil introduced to Goa, India at first time by the Portuguese travellers in 16th Century (Nair, 2010). It is one of the most important plantation crops of the country and ranks high among the Agri-Horticultural commodities getting exported from India (Shares 15% of the global trade) and which are widely grown along the coastal regions of Maharashtra, Goa, Karnataka and Kerala in the West Coast and Tamil Nadu, Andhra Pradesh, Odisha and West Bengal in the East Coast (<https://dccd.gov.in/crOP-history-cashew>). The cultivation of cashews in India covers a total of 0.7 million hectares of land, and produces over 0.8 million tonnes (MT) annually. Recently, In terms of volume, India's cashew exports

declined from 80,366 MT in 2021-22 to 76,824 MT in 2022-23 due to various biotic and abiotic constraints (<https://www.ibef.org/exports/cashew-industry-india>).

It is known to be damaged by more than 300 insect pests and diseases worldwide limiting its productivity. Nearly 50 % of annual crop loss results due of pests and disease problems in different cashew growing regions of the country. The cashew tree is known to be infected by different pathogens leading to numerous diseases that includes inflorescence blight (*Lasiodiplodia theobromae*), powdery mildew (*Oidium anacardii*), anthracnose (*Colletotrichum gloeosporioides*), Pestalotia leaf spot (*Pestalotia* spp), damping-off (*Fusarium* sp., *Sclerotium rolfsii*), black mold (*Pilgeriella anacardii*), Angular leaf spot (*Septoria anacardii*), leaf and nut blight (*Cryptosporiopsis* spp), seedling dieback (*Pythium* sp., *Fusarium* sp.) and dieback (*L. theobromae*). (Muntala *et al.*,2020). Among all, *Lasiodiplodia theobromae* is a fungus common in many countries, widely distributed in tropics and subtropics, and also has a wide host range. This pathogen causes dieback of cashew parts, which is considered as an economically important disease. This disease caused significant crop losses to yield reduction in cashew.

2. Survey in Cashew capital of Tamil Nadu:

Owing to the complaints from cashew farmers in and around Cuddalore District, about the problems of pests and diseases in their orchards, during May-June, 2024, a detailed survey has been conducted based on random method to cover larger area for the disease incidence of Die-back in major Cashew tree growing orchards of Panruti taluk in cuddalore district of Tamil Nadu. Seven localities were selected in Panruti and these areas included Visur, Tiruvamur, Palappattu, Kadampuliyur, Anguchettipalayam, Elandampattu, and Karukkai. The diseased cashew trees associated with die-back symptoms such as leaves, trunk bark, inflorescence and twigs showing varying degrees of suspected symptoms were observed for critical evaluation.

3. Result & Discussion

A number of diseases were observed and recorded during the survey in selected cashew orchards in the study area. Diseases such as anthracnose, gummosis, dieback, *Pestalotia* leaf spot, algal leaf and stem spots (red rust), powdery mildew and lichens growth were all observed on the cashew trees in the study area. Among these "Dieback" constituted the major constrain of cashew trees in the hot spot areas.

Die-back the observed symptoms of caused by *Lasiodiplodia theobromae* (Pat.) Griffiths & Maubl. were observed in all the hot spot areas. Etiology of the pathogen is under Kingdom: fungi; Phylum: Ascomycota; Class: Dothideomycetes; Order: Botryosphaeriales; Family: Botryosphaeriaceae; Genus: *Lasiodiplodia*; Species: *L. theobromae* (Pat.). All the infected trees were identified on the basis of symptoms, initially the progressive death of twigs and branches which generally starts at the tips (Figure 1). Later, the shoots and branches wilt and dry up from the tip downward (Figure.2), in advanced stages, the barks splits and peel off, while, the leaves turn yellow and fall off (Figure.3)

This finding is completely agreed with Adeniyi *et al* 2011, that *Lasiodiplodia theobromae* has been established to cause twig dieback and inflorescence blight of cashew and considered as the most limiting factor to cashew nut yield.



Figure.1 "Dieback" – the progressive death of twigs and branches which generally starts at the tips



Figure.2. *Infected trees may die within a year or two after symptoms first appear*



Figure.3. *Diseased trees the barks splits and peel off*



Figure.4. Overview of Cashew Orchard in Kadampuliyur village (panruti)

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IN SILICO EXPLORATION OF ENZYMATIC PATHWAYS IN MICROBES FOR INDUSTRIAL APPLICATIONS

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Microbial enzymes drive innovation across industrial sectors, from sustainable biofuels to pharmaceutical synthesis. This study applies a bioinformatics pipeline integrating genome mining, comparative genomics, and machine learning to identify novel enzyme pathways in industrially relevant microorganisms. Genomic datasets from *Bacillus subtilis*, *Pseudomonas putida*, and *Thermomyces lanuginosus* were analyzed to detect gene clusters associated with secondary metabolite and biocatalyst production. Hidden Markov Models (HMM) were applied to annotate catalytic domains, while network analysis mapped co-occurring biosynthetic pathways. A deep learning model trained on known enzyme sequences predicted catalytic novelty scores, prioritizing candidates for experimental validation. Three novel enzyme clusters (glycoside hydrolases, oxidoreductases, and esterases) were identified with >90% novelty scores and favorable physicochemical stability predictions. These enzymes demonstrate potential for lignocellulose degradation, green chemistry catalysis, and biodegradable polymer synthesis. The study underscores the role of computational pipelines in accelerating microbial innovation for industrial Biotechnology.

Keywords — Bioinformatics, Genome mining, Enzyme Discovery, Microbial biotechnology, Industrial enzymes, Machine learning

ASSESSMENT OF BIOGENIC PALLADIUM NANOPARTICLES SYNTHESIZED BY *FALSIBACILLUS PALLIDUS* AGAINST LUNG CANCER CELLS

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Marine organisms are a vital resource for their vast genetic ability to manufacture different secondary metabolites for developing new physiologically active compounds. In the present study, new antibiotic producing bacterial strain *Falsibacillus pallidus* isolated from marine soil sample for synthesis of palladium nanoparticles extracellularly using their secondary metabolites and to evaluate the anticancer effects on lung cancer cells. Results indicates that the biosynthesized palladium nanoparticles have effective anti-oxidant activity. The synthesized nanoparticles effectively induced apoptosis in lung cancer A549 cells as evidenced by the increased lipid peroxidation and reduced antioxidant activity in A549 cells. It revealed that the synthesized nanoparticles induced apoptosis in cells by inducing reactive oxygen species (ROS), reduce mitochondrial membrane potential and inducing apoptotic morphological changes. The isolated *Falsibacillus pallidus* bacteria could be used for preparation of biocompatible nanomaterials for treatment of Lung cancer after pharmacological studies.

Keywords: Palladium nanoparticles, Marine bacteria, *Falsibacillus pallidus*, lung cancer cells

EXPLORATION OF NOVEL BIOACTIVE COMPOUNDS AND ITS ANTIMICROBIAL RESISTANCE AGAINST PATHOGENS

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The rising threat of antimicrobial resistance necessitates the exploration of novel bioactive compounds. In this study, three isolated compounds (1–3) were evaluated for their antimicrobial activity against a panel of microbial strains using the Resazurin-based 96-well microtitre plate assay. The test organisms included two Gram-positive bacteria (*Micrococcus luteus* NCTC 7508 and *Staphylococcus aureus* NCTC 12981), two Gram-negative bacteria (*Escherichia coli* NCTC 12241 and *Pseudomonas aeruginosa* NCTC 12903), and a fungal strain (*Candida albicans* ATCC 90028). The minimum inhibitory concentration (MIC) for each compound was determined through visual inspection of colorimetric changes from blue to pink in the presence of resazurin, an oxidation-reduction indicator. Ciprofloxacin and nystatin served as positive controls for bacterial and fungal strains, respectively. The MIC values were obtained by serial dilution and expressed as the lowest concentration showing color change inhibition. To further distinguish bacteriostatic from bactericidal properties, culture from MIC wells was sub cultured onto nutrient agar plates and observed for microbial regrowth after 24 hours of incubation. Absence of regrowth confirmed bactericidal activity, while visible colonies indicated bacteriostatic effects. All assays were conducted in triplicate under aseptic conditions. The findings demonstrate differential antimicrobial potential among the tested compounds, with selected samples exhibiting potent bactericidal effects against specific strains. These results suggest the therapeutic promise of these compounds as potential antimicrobial agents.

Keywords: Antimicrobial assay, Resazurin, MIC, Bactericidal, Bacteriostatic, *Ruta chalepensis*, Bacterial resistance

THE DIVERSITY OF INSECTS IN SUGARCANE FIELDS IN THENI DISTRICT, TAMIL NADU, INDIA

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A study in sugarcane fields of Theni District (Tamil Nadu, India) assessed insect diversity by measuring ecological parameters such as diversity indices, abundance, dominance, species richness, functional roles, and seasonal incidence. Using various collection methods and taxonomic dichotomous keys, researchers identified 410 insect specimens belonging to 25 species across eight orders: *Coleoptera*, *Lepidoptera*, *Diptera*, *Blattaria*, *Hymenoptera*, *Orthoptera*, *Odonata*, and *Hemiptera*. Among these, *Hemiptera* was most abundant (250 individuals), whereas *Lepidoptera* was least abundant (15 individuals). Ecologically, 70% of species were pests, 20% predators, and 10% pollinators—highlighting the dominance of pest species. Although this study provides essential baseline biodiversity data, long-term seasonal investigations are necessary to gain a deeper understanding of species occurrence and environmental interactions.

Keywords: Sugarcane fields, Insect diversity, *Hemiptera*, *Lepidoptera*, Pest species

DIETARY INFLUENCE BY THE SPIRULINA FISH FEED AND FREEZE-DRIED BLOODWORMS IN ZEBRA FISH, *DANIO RERIO*

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Ornamental fish farming is a growing area in aquaculture that offers substantial income and job opportunities worldwide. This sector plays a pivotal role in boosting economic growth, particularly in underdeveloped tropical areas. The zebrafish, *Danio rerio* is currently emerging as an increasingly popular model of vertebrate embryonic development, gene function analysis, and mutagenesis. There has been extensive research addressing the positive effects of commercial feed using ornamental fish as animal models. The present research was an attempt to assess the efficacy of dietary influence of the Spirulina fish feed and freeze-dried bloodworms in commercially important ornamental fish viz *Danio rerio* (Zebra fish) as an animal model study. We have found freeze-dried bloodworms feed in powder form to be remarkably effective on fish growth and the fish reproductive system and sustainable fishery management of ornamental fish culture. It enhanced the production of matured eggs in zebra fish within short period by using simple method of breeding. If this technique is employed to increase the production rate, it is possible to meet the domestic demand as well as to enter the international market in turn will fetch foreign exchange to our country.

Keywords: Zebra fish, Spirulina feed, freeze-dried blood worms and growth, mosquito larvae control.

BIOGAS PRODUCTION FROM AGRICULTURAL WASTE USING MICROBES

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Agricultural residues are generated in large quantities and often disposed of in ways that cause environmental pollution. An eco-friendly alternative is the conversion of these wastes into biogas through microbial fermentation. The present study focuses on the production of biogas from selected agricultural wastes (such as rice husk, sugarcane bagasse, and vegetable residues) using mixed microbial consortia under anaerobic conditions. The wastes were pretreated and subjected to anaerobic digestion in small-scale digesters, and parameters such as gas yield, methane content, pH, and temperature were monitored. The results demonstrated that microbial activity effectively converted complex organic matter into biogas, with significant differences in yield depending on the substrate used. This study highlights the potential of agricultural waste valorisation for sustainable energy production and reduction of environmental pollution. Agricultural wastes can be efficiently converted into renewable energy through microbial biogas production. In this study, selected crop residues were subjected to anaerobic digestion using microbial consortia, and gas yield was monitored. The results highlight the potential of microbes in sustainable energy generation and agricultural waste management.

Keywords: Biogas, Agricultural waste, Anaerobic digestion, Microbial consortia, Renewable energy, Methane production, Bioenergy.

MICROBIAL AND PLANT-BASED STRATEGIES FOR THE DETOXIFICATION OF HEAVY METAL-CONTAMINATED WASTEWATER

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Heavy metal pollution is one of the major environmental concerns worldwide. The use of microorganisms to reduce pollutant concentrations is known as *bioremediation*, a natural process that emphasizes the role of biodiversity in cleaning up contaminated ecosystems. While all metals are toxic at higher concentrations, some are essential in trace amounts. However, metal toxicity can lead to serious morbidity and mortality. Bioremediation can be carried out under both aerobic and anaerobic conditions, with microorganisms playing a crucial role in the treatment of heavy-metal-contaminated soil and wastewater. Conventional treatment methods often face challenges such as low efficiency at minimal heavy metal concentrations, high operational costs, and the safe disposal of toxic sludge. In this study, heavy metal-resistant bacteria were isolated from electroplating industry effluents. The isolates—*Bacillus thuringiensis*, *Enterobacter cloacae*, and *Bacillus cereus*—were characterized for their ability to biodegrade Cr(VI), assessing their potential for industrial wastewater treatment. Optimization studies were conducted to determine the effect of various parameters such as metal concentration, pH, carbon sources, and nitrogen sources on degradation efficiency. The physicochemical properties of both untreated and treated effluents were analyzed, including biological oxygen demand (BOD), chemical oxygen demand (COD), turbidity, total dissolved solids (TDS), total suspended solids (TSS), odour, colour, pH, and electrical conductivity. Furthermore, the optimized biodegradation process was coupled with *phytoremediation* using *Zea mays* (maize) plants. Plant growth was measured in terms of leaf and shoot length, along with biochemical estimations of chlorophyll, protein, and carbohydrate content.

Keywords: Bioremediation, Heavy Metals, Optimization, Physicochemical Analysis, Phytoremediation (*Zea mays*).

IMMOBILIZED MICROBIAL CONSORTIA FOR INDUSTRIAL WASTEWATER TREATMENT: A SCALABLE BIOREMEDIATION STRATEGY

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The discharge of untreated industrial effluents poses a major threat to environmental and public health, necessitating sustainable and effective remediation strategies. Traditional physicochemical treatment methods often fall short in handling complex pollutant loads and can be cost-intensive. In this context, microbial bioremediation offers a promising eco-friendly alternative for efficient pollutant degradation. This study evaluates the bioremediation potential of a laboratory-assembled microbial consortium comprising *Bacillus subtilis*, *Stenotrophomonas maltophilia*, *Klebsiella quasipneumoniae*, *Pseudomonas panipatensis*, and *Bacillus tequilensis*—strains capable of degrading dyes, heavy metals, and pesticides—for the treatment of industrial effluents. Batch experiments using a 1:50 inoculum-to-effluent ratio demonstrated significant reductions in COD, BOD, TDS, and TSS. However, at a higher inoculum concentration (1:25), increases in COD and BOD were observed, likely due to microbial stress and metabolic imbalance. Immobilization of the consortium in alginate beads enhanced treatment efficiency. In static systems, COD and BOD were reduced by 21–68% and 94–96%, respectively, although increases in TDS and TSS occurred due to biomass detachment. Remarkably, continuous-flow reactor trials using the same immobilized beads achieved industrial-grade remediation, with reductions of 80% in COD and 99% in BOD, demonstrating improved microbial stability, substrate contact, and operational resilience.

Keywords: Industrial effluents, Microbial consortium, Immobilized bioremediation, COD and BOD

MANAGEMENT OF *PYTHIUM APHANIDERMATUM* CAUSING DAMPING-OFF DISEASE IN TOMATO THROUGH *BACILLUS SUBTILLIS* (MMBS) AND EXPLORING ITS ANTIFUNGAL COMPOUNDS BY GC-MS ANALYSIS

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Pythium aphanidermatum is one of the most important pathogens to cause damping off disease in nurseries and a major constraint in the production of tomato. The bacterial strains of *Bacillus subtilis* (MMBs) are known to enhance plant growth promotion and reduce the severity of tomato damping off. The maximum inhibition zone with minimum mycelia growth was documented for the native isolate of MMBs recorded a minimum 87.77 per cent reduction over control, the same isolate (MMBs) complete mycelia growth inhibition (100%) of the pathogen at the 15 per cent concentration. The maximum plant growth parameters were observed by the isolate of MMBs (14.56 and 8.24 cm; 2183.78, respectively). Five effective bacterial isolates of MMBs produced crude antibiotics were evaluated for their antifungal action against *P. aphanidermatum*. MMBs strains were confirmed by performing of biochemical characterization gave positive result to the following test viz., Casein hydrolysis, Growth in NaCl, Gram staining, KOH test and Starch hydrolysis anaerobic growth and carbon utilization. The active compounds of MMBs (23) which were analyzed by running GC-MS by using chemical profile of ethyl acetate extract and the results were compared with library search results and presented. Details of active compounds, retention time, structure of compounds, molecular formula.

Keywords: *Pythium aphanidermatum*, Inhibition zone, *Bacillus subtilis*, Biochemical characterization

MICROALGAE: A TREASURE TROVE OF ANTICANCER NUTRACEUTICALS AND PROMISING THERAPEUTIC MECHANISMS

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Microalgae, the microscopic photosynthetic organisms found in diverse aquatic and terrestrial environments, are increasingly recognized as a potent source of anticancer nutraceuticals and therapeutic agents. Carotenoids: Microalgae are rich in various carotenoids like astaxanthin, fucoxanthin, β -carotene, and violaxanthin. These compounds have demonstrated the ability to inhibit tumor growth and induce apoptosis (programmed cell death) in various cancer cell lines. Polyunsaturated Fatty Acids. Research has shown phycocyanin's potential in inhibiting pancreatic cancer cell proliferation and tumor growth in vivo by influencing the pathways. Polysaccharides: Microalgal polysaccharides like fucoidan have shown anti-angiogenic properties, inhibiting the formation of new blood vessels crucial for tumor growth. Some polysaccharides have also demonstrated the ability to induce apoptosis and hinder cell proliferation in various cancer cell lines, including human colon and uterine cancer cells. Anti-inflammatory and Immune-modulatory effects: Combination Therapies: Exploring the combination of microalgae compounds with conventional chemotherapy drugs or other therapies, such as photodynamic therapy, could enhance treatment efficacy and potentially reduce side effects. In conclusion, microalgae represent a promising and largely untapped resource in the fight against cancer. Continued research, including expanded preclinical studies, clinical trials, and the development of sustainable production methods, is essential to fully realize the potential of these fascinating organisms for novel cancer therapies.

Keywords: Algae, Apoptosis, Cancer, Mechanism of action, Microalgae, Nutraceutical

FORMULATION AND EVALUATION OF BIOFUNGICIDE AGAINST SELECTED DANDRUFF CAUSING PATHOGEN

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The present study was carried out to collect the dandruff samples from the adolescent girls from STET Women's College (A), Mannargudi, Thiruvarur Dt. Tamil nadu, India. Then, the samples were analyzed for the presence of the dandruff causing pathogen. The samples were placed on Potato Dextrose Agar medium and identified using Lactophenol Cotton Blue staining. The isolated fungi were confirmed as *Malassezia furfur* using the manual of soil fungi. Six different plant samples such as *Aloe barbadensis*, *Hibiscus rosa sinensis*, *Azadirachta indica*, *Allium cepa*, *Citrus limon* and *Embllica officinalis* from STET Herbal Garden, STET Women's College(A), Sundarakkottai, Mannargudi. Crude extracts of the plant materials were subjected to phytochemical analysis such as for the presence of alkaloids, flavonoids, saponins, steroids, tannins, phenols, glycosides and resins. Then the plant extracts were analyzed for their antifungal activity by well diffusion technique. The efficiency of *Aloe barbadensis*, *Hibiscus rosasinesis*, *Azadirachta indica*, *Allium cepa*, *Citrus limon* and *Embllica officibalis* was examined at different concentrations (25%, 50%, 75%, and 100%) to control the fungi using the well diffusion method. The strongest inhibition was observed at 100% concentration, with *Azadirachta indica* showing the highest effectiveness, followed by *Citrus limon*, *Aloe barbadensis*, *Hibiscus rosasinesis*, *Alium cepa*, *Embllica officinalis* at the same concentration.

Key words: Dandruff, *Citrus limon*, *Azadirachta indica*, *Allium cepa*, *Embllica officinalis*, *Hibiscus rosasinesis*.

ISOLATION OF OXALATE DEGRADING PROBIOTIC LACTIC ACID BACTERIA FROM GOAT MILK TO REDUCE THE RISK OF HYPEROXALURIA AND ITS ANTIBACTERIAL PROPERTIES AGAINST URINARY TRACT INFECTIONS (UTIS)

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Lactic acid bacteria (LAB) are key microbial communities in dairy products with notable health-promoting potential. This study focused on the isolation and characterization of oxalate-degrading probiotic LAB from goat milk and their antibacterial activity against Urinary Tract Infections (UTIs). Screening on sodium oxalate plates revealed isolate A1 with a 12 mm clear zone, indicating significant oxalate degradation. Molecular identification through 16S rRNA sequencing confirmed the isolate as *Lactobacillus plantarum* PP69527. Probiotic attributes of *L. plantarum* PP69527 were evaluated under gastrointestinal stress conditions. The strain showed strong survival at low pH and bile salts, alongside notable adhesion capability in yeast agglutination assays, highlighting its ability to colonize and persist in the gut. These features confirm its suitability as a probiotic candidate. Oxalate degradation by the isolate offers a promising strategy for managing hyperoxaluria, a condition linked to kidney stone formation and renal complications. Furthermore, the strain exhibited antibacterial activity against UTIs, mediated by antimicrobial peptide production, competitive exclusion, and modulation of the urinary microenvironment. Such dual functionality positions this isolate as a potential therapeutic agent for urinary health. In conclusion, *L. plantarum* PP69527 from goat milk demonstrates oxalate-degrading ability, probiotic resilience, and antibacterial effects against UTIs. Its multifaceted properties provide a natural, sustainable approach for managing hyperoxaluria and urinary infections, emphasizing the therapeutic promise of LAB in functional foods and microbial therapeutics.

Keywords: Lactic Acid Bacteria (LAB), *Lactobacillus plantarum*, Oxalate degradation, Probiotics, Hyperoxaluria, Urinary Tract Infections (UTIs)

MICROBIOME AND MALE INFERTILITY

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Male infertility is a multifactorial disorder as it results from a combination of genetic, environmental, hormonal and more recently, microbial factors. New research suggests the seminal microbiome may be an important underlying factor influencing sperm function, maintaining a balanced genital tract, and predicting reproductive success. Male infertility accounts for nearly 50% of infertility cases worldwide, and emerging evidence suggests that the microbiome particularly of the gut, seminal fluid, and urogenital tract—plays a crucial role in male reproductive health. Disruptions in microbial balance, known as dysbiosis, have been linked to reduced sperm quality, motility, and DNA integrity. The **gut microbiome** influences hormonal regulation, immunity, and oxidative stress levels. An imbalance can lead to systemic inflammation and oxidative stress, both of which negatively impact spermatogenesis. For instance, gut dysbiosis is often observed in men with obesity, diabetes, and other metabolic disorders—conditions also associated with infertility. The **seminal microbiome**—the community of microorganisms present in semen—has also garnered attention. Healthy semen contains beneficial bacteria like *Lactobacillus* and *Streptococcus*, which may protect sperm from pathogens. In contrast, an overgrowth of *Prevotella*, *Gardnerella*, or *Escherichia coli* has been correlated with reduced sperm count and motility. Infections in the **male urogenital tract** can alter the local microbiota, leading to inflammation and damage to sperm or the reproductive tract. Chronic prostatitis and sexually transmitted infections, both associated with microbial imbalance, are common in infertile men. Recent studies suggest potential therapeutic benefits of **probiotics and prebiotics** in restoring microbial balance and improving sperm parameters. However, standardized clinical guidelines are lacking. Overall, the microbiome represents a promising frontier in understanding and potentially treating male infertility. More targeted research is needed to explore how microbiome modulation could be integrated into fertility care.

Keywords: Infertility, seminal microbiome, ART, 16S rRNA, Diagnostics, microbial dynamics.

ANTIMICROBIAL ACTIVITY OF FERMENTED CITRUS FRUITS PEEL EXTRACT

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Citrus fruit peel waste represents a major portion of household organic residues and can be effectively converted into antimicrobial products through microbial fermentation. Fermented citrus peels are enriched with bioactive compounds such as flavonoids, phenolics, limonene, and organic acids, which exhibit strong inhibitory effects against pathogenic microorganisms. This study focuses on evaluating the antimicrobial activity of fermented citrus fruit peel extracts prepared from orange (*Citrus sinensis*), lemon (*Citrus limon*), and sweet lime (*Citrus aurantifolia*). The peels were collected, cleaned, and fermented for 21 days with jaggery and water under ambient conditions, after which the extracts were filtered and tested against selected bacterial and fungal pathogens using the agar well diffusion method. The bacterial organisms tested included *Escherichia coli*, *Staphylococcus aureus*, *Bacillus subtilis*, *Enterococcus spp.*, and *Klebsiella spp.*, while fungal organisms comprised *Candida albicans*, *Penicillium spp.*, *Mucor spp.*, *Rhizopus spp.*, and *Aspergillus niger*. The fermented extract demonstrated significant antimicrobial activity, producing inhibition zones of 18 mm for *E. coli*, 20 mm for *S. aureus*, 16 mm for *B. subtilis*, 15 mm for *Enterococcus spp.*, and 14 mm for *Klebsiella spp.*; among fungi, zones recorded were 13 mm for *Candida albicans*, 12 mm for *Penicillium spp.*, 11 mm for *Mucor spp.*, 10 mm for *Rhizopus spp.*, and 12 mm for *Aspergillus niger*. The highest antibacterial activity was observed against *S. aureus*, while *Candida albicans* showed maximum inhibition among fungi. These findings confirm the potential of fermented citrus peels as an eco-friendly, value-added product with promising applications in pharmaceuticals, food preservation, and environmental health.

Keywords: Citrus peel, Fermentation, Antimicrobial activity, Eco-enzyme, *S.aureus*, *C. albicans*Organic waste.

EFFECT OF NUTRITION EDUCATION PROGRAM ON HEALTHY LIFSETYLE PRACTICES AMONG INDUSTRIAL WORKERS

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Industrial workers are at a higher risk of nutrition-related health problems due to irregular work schedules, stress, and limited access to balanced diets. This study investigated the effectiveness of a structured nutrition education program in improving healthy lifestyle practices among industrial workers. The research design adopted is experimental research design. The intervention consisted of interactive sessions on balanced diets, low-cost meal planning, hydration, physical activity, stress reduction, and sleep hygiene, supported with visual aids, pamphlets, and group discussions. Data were collected using a validated questionnaire assessing nutrition knowledge, dietary intake, and lifestyle practices at baseline and after the intervention. Statistical analysis revealed a significant increase in mean knowledge scores ($p < 0.01$), improved frequency of fruit and vegetable consumption ($p < 0.05$), and reduced intake of high-fat and processed foods ($p < 0.05$). Participants also demonstrated positive behavioral shifts, including regular hydration, improved portion control, and adherence to consistent meal patterns. Awareness and practice of physical activity were notably enhanced, with a majority reporting integration of at least 30 minutes of moderate activity into daily routines. Findings highlight that workplace-based nutrition education is a feasible, cost-effective, and impactful strategy to enhance workers' health, reduce lifestyle-related risks, and contribute to better overall productivity and well-being.

Keywords: Nutrition education, Industrial workers, Lifestyle practices, Dietary behavior, Workplace intervention

UNLOCKING THE HEALTH SECRETS OF CASHEW APPLE JUICE: PHYSICOCHEMICAL AND ANTIOXIDANT PERSPECTIVES

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Cashew apples, a rich but underutilized source of nutrients, have been traditionally valued for their therapeutic properties. This study explored the physicochemical profile and antioxidant potential of juice from red and yellow cashew apple cultivars collected across the Cuddalore District of Tamil Nadu, India. Key parameters, including pH, juice yield, total dissolved and suspended solids, reducing sugars, phenolic content, and vitamin C concentration, were assessed alongside antioxidant capacity using the DPPH assay. Comparative analysis revealed that yellow cashew apple juice (CAJY), particularly the Panruti cultivar (CAJY-P), outperformed red varieties (CAJR) in most parameters, showing higher juice yield, phenolic content, vitamin C levels, and antioxidant activity. Antioxidant activity ranged from 60.31% to 79.92% at 1000 μ L concentration, underscoring the strong free-radical scavenging ability of these cultivars. The findings suggest that geographical origin and varietal differences strongly influence the nutritional and therapeutic value of cashew apple juice. Yellow cashew apples, with their superior biochemical properties, emerge as promising candidates for functional food development and nutraceutical applications.

Keywords: Cashew apples, Anthocyanins, DPPH, Flavonoids, Antioxidant activity, Vitamin C

MARINE ALGAE-DERIVED ENDOPHYTIC XYLARIA FOR GREEN SYNTHESIS OF BIMETAL OXIDE NANOPARTICLES WITH MULTIFUNCTIONAL BIOLOGICAL ACTIVITIES

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Fungal endophytes and their secondary metabolites are being researched for metal oxide-based nanoparticle synthesis due to their ability to reduce metal salts, offering an environmentally friendly alternative in medicine, pharmaceuticals, agriculture, and developing novel insecticides. The study intends to develop a sustainable, eco-friendly procedure for the green synthesis of bimetal oxide nanoparticles (Bi'MtO NPs) utilizing silver nitrate (AgNO_3) and Copper nitrate hexahydrate ($\text{Cu}(\text{NO}_3)_2$), together with endophytic *Xylaria* sp. from marine brown macroalga, *Turbinaria ornata* collected from Krusadai island in Rameshwaram. The synthesized nanoparticles were characterized using a series of advanced physicochemical techniques such as UV, SEM, EDX, XRD, FTIR & DLS each confirming key structural and functional attributes crucial to their biological activities. The synthesized nanoparticles were analyzed for their biological evaluation such as antioxidant assays, hemolytic assay, anti-biofilm, cell cytotoxicity assay against Human Cervical cells (HeLa) and Human embryonic Kidney cells (HEK293); insecticidal efficacy on *Culex quinquefasciatus* larvae, respectively. The results showed fungal metabolite synthesized bimetal oxide nanoparticles were biocompatible to human blood cells and showed an improved antioxidant activity at an IC_{50} value of (58 $\mu\text{g}/\text{mL}$), selective cytotoxicity against HeLa cells with an IC_{50} 66.18 $\mu\text{g}/\text{mL}$, while HEK293 cells exhibited a higher IC_{50} of 78.79 $\mu\text{g}/\text{mL}$ and were too toxic for *Culex quinquefasciatus* larvae, with LD_{50} (148 $\mu\text{g}/\text{mL}$) and LD_{90} (248 $\mu\text{g}/\text{mL}$). The Bi'MtO nanoparticles synthesized herein demonstrated exceptional multifunctionality, bridging the gap between sustainable nanotechnology and real-world biomedical and environmental applications.

Key Words: Endophytes, *Xylaria*, Bi'MtO, HeLa, HEK293, *Culex quinquefasciatus*

FORMULATION OF PHYLLOPLANE BACTERIA AS BIOFUNGICIDES FOR SUSTAINABLE RICE DISEASE MANAGEMENT

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Rice a staple food crop, is threatened by fungal diseases like brown spot, blast, and sheath blight. Chemical fungicides provide control but cause resistance, soil imbalance, and environmental hazards. Phylloplane bacteria, naturally inhabiting leaf surfaces, offer eco-friendly biocontrol alternatives. Healthy rice leaves were collected and subjected to leaf wash for bacterial isolation. Pure isolates were screened against *Bipolaris oryzae*, *Pyricularia oryzae*, and *Rhizoctonia solani*. Dual culture and agar well diffusion assays were used to assess antagonistic activity. Potential strains were further analyzed for enzyme production, siderophores, and metabolites. Isolates such as *Bacillus subtilis* and *Pseudomonas fluorescens* showed strong inhibition. Talc and liquid carriers were employed for biofungicides formulation and shelf-life studies. Greenhouse trials were performed to validate efficacy in reducing rice disease incidence. Formulated biofungicides significantly reduced disease severity compared to untreated controls. They also promoted plant growth and enhanced resistance under controlled conditions. Inhibition zones ranged between 15–22 mm against tested rice pathogens. The formulations proved stable and viable during storage and application. This approach reduces chemical fungicide dependence and promotes sustainability.

Keywords: Phylloplane bacteria, Rice diseases, Biofungicides, Antagonistic activity, Sustainable agriculture.

NATURAL FLAVONOID-BASED LIPOSOMAL DELIVERY OF QUERCETIN: A SUSTAINABLE STRATEGY FOR TARGETED LUNG CANCER THERAPY

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Quercetin, a naturally occurring polyphenolic flavonoid, exhibits potent antioxidant, anti-inflammatory, and anticancer properties, making it a promising candidate in sustainable therapeutic approaches. However, its poor solubility and bioavailability limit its therapeutic potential. To address these challenges, quercetin was encapsulated in liposomes to enhance stability, solubility, and targeted delivery. This study examines the cytotoxic and apoptotic effects of liposomes loaded with quercetin on Vero normal cells and A549 lung cancer cells. MTT assay was used to assess cytotoxicity, and AO/PI dual staining evaluated apoptosis induction. The results demonstrated dose-dependent cytotoxicity, with a significant reduction in A549 cell viability compared to Vero cells, highlighting selective anticancer activity. Apoptotic changes, including chromatin condensation and nuclear fragmentation, were observed in A549 cells, confirming apoptosis induction. These findings suggest that quercetin-loaded liposomes enhance therapeutic efficacy against lung cancer cells while minimizing toxicity to normal cells. The study supports liposomal quercetin as a natural, sustainable drug delivery strategy for cancer management, warranting further preclinical and in vivo investigations.

Keywords: Quercetin-loaded liposomes, Sustainable drug delivery, Cytotoxicity, Apoptosis, A549 lung cancer cells, Vero cells, Natural flavonoid

PHYTOCHEMICAL AND BIOLOGICAL EVALUATION OF BLACK PEPPER EXTRACT

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Piper nigrum L. (black pepper) is a widely used spice valued for both culinary and medicinal purposes. Its major bioactive constituent, piperine, is known for diverse pharmacological properties including antimicrobial, antioxidant, and anti-inflammatory effects. The present study evaluated the methanolic extract of black pepper for its antimicrobial activity against *Staphylococcus aureus* strains isolated nasal carriers, alongside its antioxidant potential through multiple in vitro assays. Phytochemical screening of the methanolic extract confirmed the presence of alkaloids, flavonoids, tannins, saponins, and phenolics, highlighting its richness in bioactive compounds. Antimicrobial activity was assessed through agar well diffusion and microdilution assays. The extract produced clear zones of inhibition and exhibited low MIC (minimum inhibitory concentration) and MBC (Minimum Bactericidal Concentration) values, demonstrating strong antibacterial efficacy. These results suggest that piperine may act by disrupting bacterial cell walls, interfering with metabolic processes, or modulating efflux mechanisms. Antioxidant capacity was assessed using DPPH (2,2-Diphenyl-1-picrylhydrazyl), ABTS [2,2'-azino-bis-(3-ethylbenzothiazoline-6-sulfonic acid)], FRAP (Ferric Reducing Antioxidant Power), hydroxyl radical scavenging, and superoxide anion scavenging assays. The extract consistently showed dose-dependent radical scavenging and reducing activity, confirming its potential to alleviate oxidative stress. Since oxidative stress contributes to infection-related tissue damage and inflammation, this property further strengthens its therapeutic significance. In conclusion, black pepper methanolic extract, rich in piperine and other phytochemicals, demonstrated notable antimicrobial and antioxidant properties. These findings support its traditional medicinal use and underscore its promise as a natural therapeutic agent for managing resistant pathogens and oxidative stress in healthcare settings. Further purification and in vivo studies are recommended to explore its clinical applications.

Keywords: Black Pepper, *Staphylococcus aureus*, Nasal carriers, Antimicrobial Activity, Antioxidant Activity, Therapeutic Properties

EXPLORING THE EFFICACY OF *TREMELLA FUCIFORMIS* AS PHARMACEUTICAL AND NUTRACEUTICAL AGENTS

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Tremella is a well-known mushroom in Chinese cuisine, valued for its wide range of health benefits. Polysaccharides from this mushroom are widely recognized for their therapeutic and pharmaceutical potential. In this study, polysaccharides from *Tremella fuciformis* were extracted using hot water extraction followed by ethanol precipitation, and further purified by the Sevag method for deproteinization. The purified extract was subjected to phytochemical screening, which confirmed the presence of bioactive compounds. Structural characterization of bioactive compounds was performed using Fourier Transform Infrared Spectroscopy (FTIR) to identify the functional groups and Gas Chromatography–Mass Spectrometry (GC–MS) for compositional analysis. The biological activities of the extract were evaluated through antioxidant, antidiabetic, and antimicrobial assays by DPPH radical scavenging, α -amylase inhibitory activity, and antimicrobial activity respectively. Antimicrobial potency of the purified extract was further confirmed by determining the minimum inhibitory concentration (MIC). In order to assess the binding efficacy of the extracted polysaccharides, molecular docking studies were conducted against xanthine oxidase (XO) (PDB ID: 3NVW), peroxisome proliferator-activated receptor γ (PPAR γ) (PDB ID: 6MS7), *Staphylococcus aureus* (PDB ID: 4QGG), *Escherichia coli* (PDB ID: 1XFF), and *Candida albicans* (PDB ID: 4LEB). Collectively, these findings highlighted the multifaceted therapeutic potential of *T. fuciformis* polysaccharides, substantiating their formulations as pharmaceutical and nutraceutical agents.

Keywords: Tremella, Polysaccharides, Bioactive compounds, Proliferator-activated receptor

LARVICIDAL AND ANTIMICROBIAL POTENTIALITY OF SOIL ACTINOBACTERIA FROM MARINE AND TERRESTRIAL ENVIRONMENT, TAMIL NADU - A COMPARATIVE STUDY

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This research investigates the isolation and screening of terrestrial and marine actinobacteria, with a focus on identifying the compound responsible for the larvicidal activity against *Culex quinquefasciatus* larvae and antimicrobial properties. Several deadly diseases were primarily transmitted by mosquitoes of the genus *Culex*, which cause diseases including West Nile Virus (WNV), St. Louis encephalitis virus, filariasis, etc. Thus, using actinobacterial compounds might be an appropriate approach for biologically controlling mosquito infestations. This study isolated 63 actinobacterial colonies from marine and terrestrial soil samples. Out of 63 isolates, 12 were morphologically different, comprising 8 from terrestrial sources and 4 from marine sources. From the primary screening, four isolates (T10 and T14 from terrestrial; M2 and M4 from marine) had larvicidal activity. Among the 4 isolates with larvicidal activity, the marine isolate *Nocardiopsis* sp. M2 was identified as superior larvicidal compound producer. The isolate also had antimicrobial activity against *Escherichia coli*, *Pseudomonas* sp., *Staphylococcus* sp., *Bacillus* sp. and *Fusarium* sp. Further, the active compound was identified as Dibutyl phthalate based on the FT-IR and GC-MS analysis. Furthermore, 16S rRNA gene sequencing of the isolate was categorized the isolate to species level as *Nocardiopsis dassonvillei* (Accession number PP825756). In accordance with the results of this work, the marine isolate *Nocardiopsis dassonvillei* M2 has shown the most significant potential for preventing vector-borne diseases, making it an excellent candidate for vector control applications.

Keywords: *Nocardiopsis dassonvillei*, *Culex quinquefasciatus*, larvicidal and antimicrobial activity.

FROM WASTE TO WELLNESS: SUSTAINABLE BIOVINEGAR FROM PAPAYA AS A NATURAL ALTERNATIVE TO CHEMICAL PRESERVATIVES

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Papaya (*Carica papaya L.*) is a highly valued tropical fruit enriched with natural sugars, essential vitamins, carotenoids, polyphenols, and the proteolytic enzyme papain, which together contribute to its nutritional, therapeutic, and functional importance. However, significant portions of the fruit particularly the peel and seeds are frequently discarded, resulting in substantial agro-residual waste. At the same time, the food industry relies extensively on synthetic preservatives, many of which raise safety concerns for long-term human consumption. Against this backdrop, biovinegar produced from whole papaya fruit (pulp, peel, and seeds) emerges as a natural, eco-conscious, and sustainable alternative to chemical preservatives. In this study, papaya fruit extract underwent a dual-stage microbial fermentation process. The primary alcoholic fermentation was carried out by *Saccharomyces cerevisiae* for 6 days, followed by secondary acetic acid fermentation using *Acetobacter aceti* under aerobic conditions for 90 hours. Analytical evaluation of the final vinegar revealed a pH of 3.2, titratable acidity of 6.8% (expressed as acetic acid), total soluble solids of 2.3 °Brix, and residual sugar of 0.42%, confirming efficient microbial transformation. Sensory assessment with 10 semi-trained panelists using a 9-point hedonic scale reported favorable attributes, including a bright orange appearance, pleasant fruity aroma, balanced acidity, and smooth aftertaste, which contributed to high overall acceptability. The findings affirm that whole papaya fruit can be effectively bioconverted into vinegar of high quality and consumer appeal, while simultaneously addressing agro-waste management and adding economic value. This explores papaya biovinegar as a promising and sustainable replacement for synthetic preservatives. Future research directions may include fine-tuning fermentation parameters, enriching the vinegar with probiotic strains or bioactive extracts, and developing scalable production systems for broader applications in food, beverage, and nutraceutical industries.

Keywords: Papaya fruit, Biovinegar production, Whole fruit fermentation Sustainable alternative, Natural preservative, Functional beverage, Sensory quality.

A BIO-HYBRID BIOSENSOR FOR REAL-TIME FOOD SPOILAGE DETECTION USING SPIRULINA-ENCAPSULATED ZEOLITIC IMIDAZOLATE FRAMEWORKS

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Food spoilage is a natural process caused by microorganisms that produce chemical by-products, leading to significant waste and health risks. This project introduces a novel bio-hybrid biosensor to address this challenge by leveraging a bio-doped Zeolitic Imidazolate Framework (ZIF-8) with living *Spirulina* algae. The ZIF-8 framework acts as a porous scaffold that protects the *Spirulina*, while allowing spoilage compounds to interact with the algae's pH-sensitive phycocyanin pigment. The sensor provides a clear, real-time, visual color change in response to different spoilage indicators. For example, it detects acidic spoilage in foods like packaged curd by changing from blue-green to a purplish hue and detects fungal spoilage in pickles by changing to a pale yellowish color. This work demonstrates a successful proof of concept for a low-cost, visually intuitive, and accessible solution for food quality monitoring.

Keywords: ZIF-8, *Spirulina*, Biosensor, Food Spoilage, Bio-Doped

BIO DEGRADATION OF LOW-DENSITY POLYETHYLENE (LDPE) BY INDIGENOUS DUMPYARD BACTERIAL ISOLATES

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Low-density polyethylene (LDPE) is one of the most widely used synthetic polymers and a major contributor to persistent plastic pollution. This study aimed to isolate and identify soil bacteria capable of degrading LDPE and to evaluate their biodegradation efficiency under controlled conditions. Soil samples collected from a municipal solid waste dump yard yielded seven distinct bacterial colonies, of which two showed clear degradation zones on minimal media supplemented with LDPE as the sole carbon source. Morphological, microscopic, and biochemical characterization identified the isolates as *Pseudomonas sp.* (Gram-negative, rod-shaped) and *Bacillus sp.* (Gram-positive, rod-shaped). Both isolates exhibited visible turbidity in minimal broth containing LDPE films after 20–25 days of incubation. Weight loss analysis revealed that LDPE films inoculated with *Pseudomonas sp.*, *Bacillus sp.*, and their consortium displayed measurable degradation, with the consortium achieving the highest weight reduction (24.6%). Fourier Transform Infrared Spectroscopy (FTIR) confirmed chemical alterations in the polymer structure, evidenced by changes in carbonyl and hydroxyl functional group peaks. The findings underscore the biodegradative potential of soil bacteria against recalcitrant plastics and highlight the enhanced efficiency of bacterial consortia over single isolates. The study not only uncovers indigenous bacterial allies against plastic pollution but also emphasizes the promise of microbial innovations in shaping a cleaner, more sustainable future.

Keywords: LDPE, Biodegradation, Plastic-degrading bacteria, Plastic waste management

ANTI-OBESITY AND HYPOLIPIDEMIC POTENTIAL OF DESMIDORCHIS INDICA STEM EXTRACT AGAINST HIGH FRUCTOSE INDUCED OBESE RATS

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Desmidorchis indica stem extract in vivo antiobesity, hypoglycemic, and antioxidant properties in Wistar rats that have been made fat by a high fructose diet. To compare the outcomes, orlistat, an anti-obesity medication, was utilized. Body weight of the animals was recorded and they were divided into 4 groups of 6 animals. Group I: Normal rats fed with the control diet. Group II: High fructose diet-fed animals received a fructose enriched diet for a period of 8 weeks. Group III: High fructose diet fed animals co-administrated with hydro-ethanolic extract of *D. indica* by oral gavage daily at a dose of 200 mg/kg body weight (Based on effective dosage fixation studies) for 8 weeks. Group IV: High fructose diet fed animals treated with standard drug Orlistat at a dose of 10 mg/kg body weight for 8 weeks. On completion of the experimental period, animals were anaesthetized with thiopentone sodium (50mg/kg). The blood was collected with and without EDTA as anticoagulant. Plasma and serum were separated for the estimation of various biochemical parameters. Adipose tissue used for histological analysis. Over the course of the trial, the animals' body weight gradually grew. When compared to rats fed a high-fat diet, it was shown that the administration of *D.indica* stem extract only slightly increased the animals' body weight. Photomicrographs of the control and treated rats' skin color and adipose tissue morphometric analysis were examined. *D.indica* supplementation decreased the size and yellowing of the abdomen region in rats fed a high-fat diet, and comparable effects were shown in rats given orlistat. *D.indica* in rats fed a high-fat diet and hydro-ethanolic extract restored the effects of the plant on serum liver and kidney indicators, plasma MDA and antioxidant enzymes, plasma lipids, and the activities of enzymes that break down glucose. Adipose tissue histological analysis reveals that groups treated with *D.indica* extract had good retention and results demonstrate the antiobesity, hypolipidemic, and antioxidant properties of *D.indica* extract, which warrant more research in clinical trials to support their therapeutic and pharmaceutical uses.

Keywords: *Desmidorchis indica*, Anti-obesity, Antioxidant, Hypoglycemic effects, Histological study

FORMULATION OF PHYLLOPLANE BACTERIA AS BIOFUNGICIDES FOR SUSTAINABLE RICE DISEASE MANAGEMENT

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Rice a staple food crop, is threatened by fungal diseases like brown spot, blast, and sheath blight. Chemical fungicides provide control but cause resistance, soil imbalance, and environmental hazards. Phylloplane bacteria, naturally inhabiting leaf surfaces, offer eco-friendly biocontrol alternatives. Healthy rice leaves were collected and subjected to leaf wash for bacterial isolation. Pure isolates were screened against *Bipolaris oryzae*, *Pyricularia oryzae*, and *Rhizoctonia solani*. Dual culture and agar well diffusion assays were used to assess antagonistic activity. Potential strains were further analyzed for enzyme production, siderophores, and metabolites. Isolates such as *Bacillus subtilis* and *Pseudomonas fluorescens* showed strong inhibition. Talc and liquid carriers were employed for biofungicides formulation and shelf-life studies. Greenhouse trials were performed to validate efficacy in reducing rice disease incidence. Formulated biofungicides significantly reduced disease severity compared to untreated controls. They also promoted plant growth and enhanced resistance under controlled conditions. Inhibition zones ranged between 15–22 mm against tested rice pathogens. The formulations proved stable and viable during storage and application. This approach reduces chemical fungicide dependence and promotes sustainability.

Keywords: Phylloplane bacteria, Rice diseases, Biofungicides, Antagonistic activity, Sustainable agriculture.

BIOPROSPECTING PIGMENT-PRODUCING BACTERIA FROM CONTAMINATED SOIL: CHARACTERIZATION, OPTIMIZATION, AND THEIR ENVIRONMENTAL APPLICATIONS

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Microbial pigments have emerged as promising eco-friendly alternatives to synthetic dyes due to their biodegradability, bioactivity, and environmental sustainability. Exploring pigment-producing bacteria from contaminated environments offers a valuable approach to discovering novel strains with industrial and therapeutic potential. This study focused on the isolation and characterization of pigment-producing bacteria from chemically and metal-contaminated soils. A pigmented bacterial isolate, designated WUA_4, was identified as *Serratia marcescens* through morphological, biochemical, and molecular techniques. Optimization of pigment production was achieved using a Box–Behnken statistical design to evaluate the effects of key variables, including carbon and nitrogen sources, temperature, and pH. The pigment was extracted and characterized using UV-Visible spectroscopy, Fourier-transform infrared (FTIR) spectroscopy, and gas chromatography–mass spectrometry (GC-MS), confirming its identity as prodigiosin. The pigment exhibited strong biological activity, as demonstrated by antimicrobial assays, antibiotic susceptibility profiling, and antibiofouling evaluations. Notably, it showed effective antibiofilm activity when coated on metallic surfaces. In addition to its antimicrobial potential, the pigment was successfully applied as a natural colorant for textiles and candle wax, showing good color stability and adherence. These findings underscore the potential of *Serratia marcescens*-derived prodigiosin as a multifunctional, sustainable bioproduct with applications in biomedicine, environmental protection, and green industries.

Keywords: Prodigiosin, *Serratia marcescens*, FTIR, GC-MS, Antibiofouling

TITANIUM DIOXIDE NANOPARTICLES: A MULTIFACETED MATERIAL IN MODERN BIOMEDICAL AND ENVIRONMENTAL APPLICATIONS

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Titanium dioxide (TiO₂) nanoparticles are highly versatile materials with a wide range of applications, primarily due to their photocatalytic properties when activated by UV light. This abstract summarizes the key uses and potential toxicological concerns discussed in the provided text. The primary environmental application of TiO₂NPs is in purifying water and air. When exposed to UV light, they act as a photocatalyst, breaking down organic pollutants and killing microbes. For example, TiO₂ nanosheets can be used for continuous water purification and desalination, offering a self-cleaning capability by degrading adsorbed organic substances. In the food industry, TiO₂ coatings can reduce surface contamination, and nanocomposite films can be used in active packaging to inhibit the growth of bacteria and fungi. TiO₂ NPs also show promise in agriculture as antimicrobial agents and pesticides. In medicine, TiO₂ NPs are being explored for targeted drug delivery and wound healing, with studies focused on developing biomaterial-based scaffolds and dressings. Research highlights their potential in cancer therapy, showing selective cytotoxicity cancer cells while sparing normal cells. In conclusion, while the innovative applications of TiO₂ NPs offer significant solutions in environmental, agricultural, and medical fields, a thorough investigation into their safety and long-term effects is crucial to ensure their safe and effective use.

Keywords: Titanium dioxide, Cancer therapy, Drug delivery, Photocatalyst, Wound healing.

BIO-SUBSTITUTE TO CHEMICAL INSECTICIDES FOR MOSQUITOES CONTROL IN RAINY SEASON

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Mosquito-borne diseases such as malaria, dengue, chikungunya, and filariasis pose a major public health challenge, especially during the rainy season when stagnant water provides ideal breeding sites. Conventional chemical insecticides, though widely used, lead to environmental pollution, insecticide resistance, and adverse effects on human health and non-target organisms. To address these limitations, the present study focuses on exploring bio-substitutes for mosquito control. Biocontrol agents such as *Pseudomonas fluorescens* in agricultural straw have shown promising eco-friendly potential. These alternatives act specifically on mosquito larvae or adults without disturbing the ecological balance. The integration of such bio-based approaches with community awareness and source reduction measures could provide sustainable and safe mosquito management strategies, particularly effective in the rainy season when chemical reliance is highest. This work highlights the need for large-scale adoption and further research on bio-substitutes as long-term solutions for vector control.

Keywords: *Pseudomonas fluorescens*; Mosquito control; Bio-substitutes; Rainy season; Biological control agents.

INNOVATIVE MICROBIAL TECHNOLOGIES FOR FUTURE AND SUSTAINABLE FOOD SCIENCE

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The rapid growth of the global population will demand innovative solutions in food production, processing, and preservation. Microbial technologies will play a central role in shaping future and sustainable food science by providing eco-friendly and efficient alternatives to conventional practices. Through microbial fermentation, novel protein sources and bioactive compounds will be developed to meet nutritional demands. Engineered probiotics and post biotics will be introduced to enhance gut health and disease resistance. Food waste will be valorized into high-value products using microbial enzymes, while biopolymers derived from microorganisms will be applied in biodegradable food packaging. Precision fermentation and CRISPR-based microbial engineering will create new possibilities for flavor, texture, and nutrient enhancement in functional foods. Furthermore, microbial bio preservation strategies will ensure food safety and shelf-life extension without harmful chemicals. This project will explore these futuristic microbial innovations that will contribute to sustainable food systems, environmental protection, and improved human health.

Keywords: Microbial technologies, Sustainable food science, Fermentation, Probiotics, Biopolymers.

PIONEERING BIOPIGMENTS FROM ACTINOMYCETES: ENVIRONMENTALLY SAFE ALTERNATIVES TO HAZARDOUS SYNTHETIC COLORANTS

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This research focuses on extracting pigments of actinomycetes sourced from various locations including Ulundurpet, Madurai, Karaikudi, Thanjavur (Manora Beach), Mathur and Thottiyam (Trichy district). A total of 50 actinobacterial colonies were obtained from the six distinct sampling sites through serial dilution methods. The isolates were differentiated based on their colony morphology, and pure cultures were established and selected for further pigment production assay. The isolates ACT-Y4 (melanin) and ACT-GMVO4 (blue pigment) with notable pigments production were allowed for fermentation in SCA broth for 7 days. The crude pigments were purified using thin-layer chromatography on silica gel plates. Isolated pigments were characterized using UV, FT-IR and GC-MS studies. The solvents utilized for separation were ethyl acetate, DMSO, hexane, methanol, chloroform and water. The isolated pigments were evaluated for their capability to dyeing of textiles and as food colorants on agar-agar jelly. Carcinogenicity of the pigment was tested using Ames test with *Escherichia coli* mutant strain MTCC No.1561. Additionally, the pigments were also assessed for antibacterial properties against *Staphylococcus aureus*, *Escherichia coli*, *Bacillus* sp. and *Pseudomonas* sp. The results of the present study providing a natural pigment from actinomycetes, alternative to synthetic pigments, which pose health risks due to toxicity and contribute to environmental pollution by increasing the turbidity of natural water bodies.

Keywords: Actinomycetes, Pigments, Antibacterial properties, Textile dyeing and Food colourant.

TRICHODERMA SECONDARY METABOLITES: NATURAL TOOLS FOR PLANT DISEASE MANAGEMENT AND GROWTH STIMULATION

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Trichoderma species are widely recognized as promising biological agents in sustainable agriculture due to their ability to produce diverse secondary metabolites with multifunctional roles. These metabolites, including peptaibols, polyketides, terpenes, and volatile organic compounds, contribute significantly to plant disease management and growth stimulation. They act as natural biocontrol tools by inhibiting phytopathogenic fungi and bacteria through mechanisms such as antibiosis, mycoparasitism, and induction of systemic resistance in plants. Simultaneously, certain metabolites function as biostimulants by enhancing nutrient uptake, promoting root and shoot development, and improving plant tolerance against abiotic stresses. Recent advances in metabolomics and molecular characterization have provided deeper insights into the chemical diversity and mode of action of these bioactive compounds, highlighting their potential for integration into eco-friendly crop protection strategies. Harnessing *Trichoderma* secondary metabolites offers a sustainable alternative to synthetic agrochemicals, contributing to improved crop productivity, soil health, and environmental safety.

Keywords: *Trichoderma*, Biostimulant, Plant Growth Promotion, Sustainable Agriculture, Induced Systemic Resistance

COLEUS AMBOINICUS: A PROMISING MEDICINAL PLANT WITH DIVERSE THERAPEUTIC APPLICATIONS

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Coleus amboinicus, commonly known as Indian Borage, is a herb rich in pharmacological properties, with a long history of traditional and medicinal use. Its leaves serve as a flavoring agent and are incorporated into various culinary preparations. However, the plant's true value lies in its medicinal potential. Every part of the plant, from roots to leaves, possesses therapeutic properties. It exhibits a wide range of pharmacological activities, including antimicrobial, anti-inflammatory, antidiabetic, antineoplastic, analgesic, antimalarial, and antifungal effects. These activities are attributed to the presence of bioactive compounds such as flavonoids, glycosides, phenols, tannins, and steroids. Historically, *Coleus amboinicus* has been used in traditional medicine to treat a variety of ailments, including colds, asthma, constipation, headaches, coughs, fevers, and skin diseases. Recent scientific research has further validated these traditional uses and explored its potential for treating typhoid fever. While the plant offers significant promise, further research is needed to fully understand its therapeutic potential and optimize its use. Combining *C. amboinicus* with other medicinal plants may enhance its efficacy.

Keywords: Pharmacological evaluation, Bioactive compounds, *Coleus amboinicus*, Traditional medicine

CLIMATE CHANGE & ITS IMPACT ON PLANT DISEASE DYNAMICS

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Climate change has significantly altered the epidemiology of plant diseases by influencing pathogen survival, host susceptibility, and vector populations. Rising temperatures, altered rainfall patterns, and increased CO₂ levels have contributed to the emergence and spread of new plant diseases in previously unaffected regions. Pathogens such as *Puccinia* (rusts) and *Phytophthora* are predicted to thrive under future climatic conditions, leading to severe outbreaks. This study reviews the effects of climate variables on plant-pathogen interactions and discusses predictive models for forecasting disease outbreaks. Adaptation strategies, including the development of climate-resilient crop varieties and integrated disease management, are essential to mitigate these impacts.

Keywords: Climate change, Plant disease, Epidemiology, Pathogen dynamics, Predictive models

INVESTIGATION OF BIOACTIVE COMPOUNDS FROM ELAEOCARPUS GANITRUS (RUDRAKSHA TREE): A GC-MS AND MOLECULAR DOCKING - BASED APPROACH

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Elaeocarpus ganitrus, commonly known as the Rudraksha tree, has long been revered in traditional medicine for its therapeutic properties. This study aims to explore the phytochemical constituents of *E. ganitrus* using Gas Chromatography-Mass Spectrometry (GC-MS) and evaluate their potential biological activities through molecular docking techniques. GC-MS analysis identified several bioactive compounds, including alkaloids, flavonoids, fatty acids, and phenolic derivatives. The identified compounds were subjected to molecular docking studies against selected target proteins associated with antimicrobial, anti-inflammatory, and anticancer activities. Docking results revealed strong binding affinities of specific compounds, indicating promising biological potential. The integrated GC-MS and in silico approach provides valuable insights into the pharmacological relevance of *E. ganitrus* and supports its traditional use as a source of natural therapeutic agents. Further in vitro and in vivo studies are recommended to validate these findings.

Keywords : Phytochemical analysis, Molecular docking, Bioactive compounds, Antimicrobial activity

ISOLATION AND FUNCTIONAL CHARACTERIZATION OF PHOSPHATE-SOLUBILIZING BACTERIA FROM DIFFERENT RHIZOSPHERES FOR SUSTAINABLE SOIL MANAGEMENT

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In terms of essential plant nutrients, Phosphorous is a major macronutrient that comes second to nitrogen. As a result of binding with soil minerals, phosphorous is easily immobilized in soil making them unavailable to plants. Plant Growth Promoting Bacteria (PGPR) like Phosphate solubilizers play a vital role in the conversion of insoluble forms of phosphorous into soluble forms. As a sustainable approach, we can develop Phosphate solubilizers as efficient biofertilizers which will be ecofriendly and also cost-effective. The aim of the current study is to isolate and characterize Phosphate Solubilizing Bacteria with plant growth promoting traits from different rhizosphere soil samples. Out of the sixteen phosphate solubilizing bacterial isolates obtained from the rhizosphere soil of banana, brinjal, gooseberry and ladies' finger, ten isolates with better solubilization zones were selected for further study. Based on the Phosphate Solubilization Index, three isolates PSB1, PSB3 and PSB 4 with solubilization indices 2.25, 2.23 and 2.44 respectively that were above average were selected and subjected to quantitative estimation of phosphate solubilization in both Pikovskaya (PVK) and National Botanical Research Institute's Phosphate (NBRIP) growth medium. The phosphate solubilization rate was observed higher in NBRIP medium for all the three isolates compared to that of PVK medium. The solubilization values ranged from $115.57 \pm 4.54 \mu\text{g/ml}$ to $124.56 \mu\text{g/ml}$ on 7th day of incubation in NBRIP medium and $35.44 \mu\text{g/ml}$ to $68.08 \mu\text{g/ml}$ in PVK medium. Based on the colony morphology, microscopic characters and biochemical properties, the isolates were identified as *Bacillus* sp, *Klebsiella* sp and *Pseudomonas* sp. The phosphate solubilization capacities of the above isolates have ensured that they could be used as potential biofertilizers. Further studies on the plant growth promoting traits and optimization of physical and nutritional parameters for the isolates could be done before developing these isolates into efficient bioformulations.

Keywords: Phosphate solubilizing Bacteria, Rhizosphere, Pikovskaya medium, Phosphate Solubilization Index, Biofertilizer

ISOLATION OF ELECTROGENIC BACTERIA FROM MARINE SEDIMENT FOR IMPROVED MICROBIAL FUEL CELL PERFORMANCE

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As the global demand for clean and sustainable energy intensifies, **Microbial Fuel Cell (MFC)** have emerged as a promising technology for converting organic waste into electricity through microbial metabolism. **Electrogenic bacteria** are unique bacteria may possess specialized metabolic pathways, bio-film forming capacity, and stress-tolerance. This study explores marine sediments as a novel source for isolating potent electrogenic strains to enhance MFC performances. While most of the research has focused on microorganisms from freshwater and wastewater environments, marine sediments represent a largely untapped reservoir of potentially superior exoelectrogens. These marine microorganisms are naturally availability and fluctuating oxygen levels, offering enhanced resilience and stability for long term MFC performance. Sediments samples were collected from coastal regions and subjected to the enrichment techniques. Multiple bacterial isolates were obtained and evaluated for their ability to generate electricity in dual-chamber MFC and their electrochemical performance assessed through parameters such as voltage generation, power density, power output, coulombic efficiency. This study aims to isolate and characterize electrogenic bacteria from marine sediments and evaluate their effectiveness in MFC systems. The isolated strains were identified based on morphological and biochemical characteristics, and further confirmed through phylogenetic analysis using 16S rRNA gene sequencing. Microbial diversity on biofilm was observed by Scanning Electron Microscope (SEM) image analysis. Additionally, the influence of anode surface area on electricity generation was investigated, revealing a positive correlation between increased surface area and power output. The findings of this research highlight the potential of marine electrogenic bacteria to improve power density, stability, and substrate versatility in MFC applications. These insights contribute to the development of decentralized, eco-friendly energy solutions, particularly suitable for remote coastal areas.

Key words: Microbial Fuel Cell (MFC), Electrogenic Bacteria, Bio-film, Marine sediments, 16s rRNA sequences, Electricity generation.

PRODUCTION OF AMYLASE ENZYME FROM SOIL BACTERIA

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Amylases are industrially important enzymes widely used in food, fermentation, textile, and pharmaceutical industries. Soil is a rich source of diverse microorganisms capable of producing extracellular enzymes, including amylase. The present study aims to isolate amylase-producing bacteria from soil samples and evaluate their enzyme activity under laboratory conditions. Soil bacteria were cultured on starch agar plates and screened by iodine test for amylase production. The most potent isolates were subjected to optimization of growth parameters such as pH, temperature, and substrate concentration for maximum enzyme yield. The results indicate that soil bacteria serve as efficient producers of amylase, highlighting their potential application in industrial processes and biotechnology. Amylases are commercially important enzymes with wide applications in food, textile, and pharmaceutical industries. Soil microorganisms are considered a rich source of extracellular amylase-producing bacteria. In this study, soil samples were collected and cultured on starch agar to screen for amylase producers using the iodine test. The most efficient isolates were optimized for enzyme production under varying growth conditions. The findings suggest that soil bacteria can serve as potential sources for large-scale amylase production.

Keywords: Amylase, Soil bacteria, Extracellular enzymes, Starch hydrolysis, Enzyme production, Industrial microbiology, Biotechnology.

ECO-FRIENDLY TREATMENT OF SYNTHETIC WASTEWATER USING ALKALI ACTIVATED *PSIDIUM GUAJAVA* AND MICROBIAL SYSTEMS FOR ZINC ION REMOVAL

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Heavy metals can be extremely toxic, causing damage to organs and inhibiting vital enzymatic functions. Among these, zinc is a significant heavy metal often found in effluents. It travels through ecosystems via bioaccumulation. This study focuses on screening bacterial strains resistant to or that can accumulate zinc, isolated from metal-contaminated sites. The goal is to determine the zinc (II) resistance and accumulation performance of selected strains as potential bio sorbents. The accumulation of heavy metals, such as zinc, in wastewater presents serious environmental and health risks. Conventional treatment methods are often costly and can generate secondary pollutants. This research investigates the efficient removal of zinc ions from synthetic wastewater using KOH-treated guava leaves as an adsorbent. To characterise the physicochemical properties of the treated guava leaves, the study employs advanced analytical techniques such as SEM (Scanning Electron Microscopy), FTIR (Fourier Transform Infrared Spectroscopy), XRD (X-ray Diffraction), and BET (Brunauer-Emmett-Teller) analysis. Additionally, the research extensively examines the effects of various experimental factors on the adsorption process, including agitation time, adsorbent dosage, pH levels, and desorption, to identify the optimal conditions for maximum Zn(II) ion removal. Industrial effluents from electroplating, textile containing heavy metals, particularly zinc, are of increasing environmental concern due to their toxicity, persistence, and potential for bioaccumulation in aquatic ecosystems. The Guava leaves, an abundant agricultural by product, were subjected to alkali activation to enhance their adsorption efficiency by increasing surface area, porosity, and functional group availability. In parallel, zinc-resistant bacteria consortia were isolated and employed for bio sorption and possible biotransformation of zinc ions, thus providing a biological dimension to the treatment process. The findings suggest that this integrated strategy not only provides a low-cost and environmentally sustainable alternative for heavy metal remediation but also adds value to agricultural waste by converting guava leaves into a functional bio sorbent. Conventional treatment methods such as chemical precipitation, ion exchange, and membrane filtration. Zinc contamination in aquatic environment. Microorganisms involved; *Pseudomonas*, *Bacillus*, *Staphylococcus*, etc,

Key words: Eco-friendly, Biosorbents, Heavy metals, *Psidium guajava*, Zinc, Microbes

MICROBIAL DEGRADATION OF MICROPLASTICS AND NANOPLASTICS

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Microplastics and nanoplastics have emerged as a critical global pollutant, threatening ecosystems, food chains, and human health. Conventional methods of plastic removal are energy-intensive and unsustainable, highlighting the need for eco-friendly solutions. Recent studies reveal that diverse microorganisms including bacteria, fungi, and algae possess the ability to degrade plastics through enzymatic action. Key enzymes such as PETase, laccases, and hydrolases break down polymer chains into smaller, less harmful compounds. Advances in metagenomics, synthetic biology, and protein engineering are accelerating the discovery and optimization of plastic-degrading microbes. Moreover, microbial consortia show higher efficiency compared to single strains, enhancing biodegradation rates. Future research focuses on improving enzyme stability, scaling up biodegradation under environmental conditions, and integrating microbial solutions with waste management systems. Harnessing microbial potential for plastic degradation represents a promising strategy toward a sustainable, circular economy and mitigating plastic pollution on a global scale.

Keywords: Microplastics, Nanoplastics, Enzymatic action, Sustainable, Biodegradation.

THE EFFECT OF HS-CRP IN MANAGING TYPE 2 DIABETES MELLITUS

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Diabetes mellitus (DM) is one of the leading and chronic progressive metabolic disorder threatening mankind. The most significant health concern of current era is diabetes mellitus and its complications. Inflammation plays a key role in the development of many systemic diseases such as DM, hypertension, cardiovascular disease and cerebrovascular accidents. Diabetes itself is risk factor for the inflammation, plays a crucial role in the development and progression of diabetes mellitus, which can be detected through the measurement of the levels of high-sensitivity C-reactive protein (hs-CRP). There are many inflammatory markers, one of the marker is CRP, which is an acute phase reactant produced by the liver and it is an extremely sensitive marker of systemic inflammation and also powerful indicator of cardiovascular disease. Among the various inflammatory biomarkers, hs-CRP has been extensively studied due to its sensitivity, cost effectiveness and prognostic value. CRP, the typical inflammatory biomarker produced in the liver, is regulated by adipocyte-derived proinflammatory cytokines, including interleukin-6 (IL 6) and tumor necrosis factor alpha (TNF- α). The hs-CRP is a useful inflammatory biomarker that can enhance cardiovascular risk stratification in type 2 diabetes. Incorporating hs-CRP into routine clinical assessment may help to identify high risk individuals early and guide timely preventive interventions.

Key words: Diabetes mellitus, hs-CRP, biomarker, type 2, inflammation.

SCREENING, EVALUATION AND VARIOUS POTENTIAL APPLICATIONS OF EXOPOLYSACCHARIDE (EPS) PRODUCING BACTERIA FROM SUGARCANE FIELD SOIL

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Soil is a highly dynamic ecosystem that harbors a wide diversity of microorganisms, many of which play a crucial role in maintaining soil fertility, plant growth, and environmental sustainability. Among the diverse microbial metabolites, exopolysaccharides (EPS) have gained considerable attention due to their multifunctional roles in microbial survival, soil aggregation, plant–microbe interactions, and potential industrial applications. Sugarcane cultivation is widely practiced in tropical and subtropical regions, and its rhizosphere is rich in microbial communities due to the abundance of root exudates and organic matter. The soil associated with sugarcane fields provides a favorable niche for EPS-producing bacteria, which may possess unique physiological and biochemical traits owing to their adaptation to this agroecosystem. Exploring these bacteria not only aids in understanding microbial ecology but also offers opportunities for identifying strains with potential applications in biotechnology, agriculture, medicine, and environmental remediation. Screening and characterization of EPS-producing bacteria are therefore essential to evaluate their biochemical potential and functional properties. Techniques such as morphological, biochemical, and molecular characterization provide valuable insights into their taxonomic identity and metabolic diversity. Additionally, studying EPS from these bacteria may reveal novel bioactive compounds with antimicrobial, antioxidant, and anti-stress properties, thereby highlighting their role as bio fertilizers, soil conditioners, and sources of industrial biomaterials. This study focuses on the isolation, screening, and characterization of EPS-producing bacteria from sugarcane field soil, with the aim of identifying promising strains that can be harnessed for agricultural and industrial applications.

Keywords: Exopolysaccharides (EPS), EPS-producing bacteria, microbiome, Industrial applications.

APPLICATION OF BIOLUMINESCENT BACTERIA IN EVALUATING THE IMPACT OF HEAVY METALS: ISOLATION AND CHARACTERIZATION STUDIES

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Bioluminescence is the property of emission of light by living organisms. Microorganisms, especially bacteria, make up the majority of luminescent organisms found in nature. The enzyme responsible for luminescence is known as luciferase. In nature, luminescent bacteria exist independently as well as in symbiosis with various marine animals. In the present study, a free living bioluminescent bacterial species was isolated from sea water. Spread plate method was followed for the isolation of bacteria and the medium used was sea water agar. The isolate was designated as S1. Based on its morphological and biochemical characteristics, isolate S1 was tentatively identified as *Photobacterium* sp. Studies were conducted to evaluate how salinity, pH, and glycerol concentrations influence the growth and luminescence of the isolate. The effect of various heavy metals such as mercury, copper, and zinc on the luminescence of bacterial isolate was also studied. In the presence of heavy metals, the bioluminescence was seen to either increase or decrease. This property can be used to build biosensors that assist in the detection of water contaminants such as heavy metal ions. Because the genes controlling bioluminescence (lux operon) respond to contaminants, they can be effectively utilized in designing biosensors.

Keywords: Bioluminescence, *Photobacterium* sp., Heavy metals, Biosensors

A REVIEW OF PHYTOCHEMICAL ANALYSIS, ANTIMICROBIAL ACALYPHA INDICA

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Medicinal plants have long served as important sources of therapeutic agents, particularly in the management of infectious diseases. *Acalypha indica* L., commonly known as Indian copperleaf, is a medicinal herb widely used in traditional medicine systems such as Ayurveda, Siddha, and folk practices for treating skin ailments, wounds, and inflammatory conditions. In recent decades, increasing attention has been directed toward its phytochemical composition and antimicrobial potential. The plant is rich in diverse secondary metabolites, including alkaloids (acalyphin, flindersin), flavonoids, tannins, saponins, terpenoids, and phenolic compounds, many of which are known for their antimicrobial and antioxidant properties. Several in vitro studies have demonstrated that leaf extracts of *A. indica*, particularly methanolic and ethanolic extracts, exhibit significant antimicrobial activity against clinically relevant human skin pathogens such as *Staphylococcus aureus*, *Streptococcus pyogenes*, *Pseudomonas aeruginosa*, and *Candida albicans*. These effects are often attributed to the synergistic actions of its phytochemicals, which may disrupt microbial cell membranes, inhibit enzymatic activity, or interfere with genetic material. Despite promising results, research remains largely limited to laboratory-based assays, with a lack of in vivo validation and clinical applications. This review synthesizes current knowledge on the phytochemical profile and antimicrobial potential of *A. indica* leaves, emphasizing their role against human skin pathogens. It also highlights research gaps and future directions for developing standardized, evidence-based phytomedicine and topical formulations from this plant.

Keywords: *Acalypha indica*, Traditional medicine, Antimicrobial, Antioxidant

NEXT-GENERATION BIOFERTILIZERS USING SYNTHETIC MICROBIAL CONSORTIA

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The overuse of chemical fertilizers has led to soil degradation, reduced biodiversity, and environmental pollution. To address these challenges, next-generation biofertilizers are being developed using synthetic microbial consortia engineered communities of beneficial microorganisms designed to work synergistically. Unlike traditional single-strain biofertilizers, synthetic consortia integrate multiple microbes with complementary functions, such as nitrogen fixation, phosphate solubilization, potassium mobilization, and plant growth promotion. These engineered consortia can be optimized for rhizosphere colonization, stress tolerance, and nutrient cycling, thereby improving crop productivity in a sustainable way. Advances in synthetic biology, systems biology, and metagenomics enable precise design and regulation of these microbial communities. Future research focuses on developing stable, field-adapted formulations, integrating them with precision agriculture, and ensuring biosafety. Thus, synthetic microbial consortia-based biofertilizers hold the potential to revolutionize agriculture by reducing dependence on chemical inputs while promoting climate-resilient and eco-friendly farming systems

Keywords: Microbial Consortia, Solubilization, Soil Degradation, Biofertilizers, Colonization.

BIOSYNTHESIS OF SILVER NANOPARTICLE FROM THE SEED EXTRACT OF PHYLLANTHUS EMBLICA AND ITS POTENTIAL ANTIDIABETIC ACTIVITY

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This study investigates the green synthesis of silver nanoparticles (AgNPs) using *Phyllanthus emblica* (Amla) seed extract and evaluates its potential antidiabetic properties through alpha-amylase inhibition. *Phyllanthus emblica* seeds, traditionally recognized for their medicinal properties, were utilized as a sustainable and eco-friendly reducing and capping agent for AgNPs synthesis. The biosynthesized AgNPs were characterized using UV-visible spectroscopy, FTIR, XRD, SEM, and EDX techniques, confirming the formation of stable, crystalline nanoparticles with an average size of approximately 25 nm and a spherical morphology. The phytochemical components of *P. emblica* seed extract, primarily polyphenols, flavonoids, and vitamin C, were found to play crucial roles in the reduction of silver ions and stabilization of the resulting nanoparticles. The biosynthesized AgNPs exhibited significant alpha-amylase inhibitory activity with an IC_{50} value of 46.13 $\mu\text{g/mL}$, comparable to the standard drug acarbose ($IC_{50} = 44.06 \mu\text{g/mL}$). Enzyme kinetic studies suggested a mixed-type inhibition mechanism. Cytotoxicity assessments demonstrated that the AgNPs were biocompatible at therapeutic concentrations. The findings of this study highlight the potential of *P. emblica* seed extract mediated AgNPs as promising candidates for the development of novel antidiabetic agents with alpha-amylase inhibitory properties. This research contributes to the growing field of green nanotechnology and offers a sustainable approach for the synthesis of bioactive nanoparticles with potential applications in diabetes management.

Keywords: Silver nanoparticles, *Phyllanthus emblica*, Antidiabetic activity, α -amylase inhibition

MOLECULAR IDENTIFICATION OF BACTERIAL ISOLATES FROM THE GUT OF EARTHWORM (*EUDRILUS EUGENIAE*) USING 16S RRNA GENE SEQUENCING

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Earthworms play a key role in soil health and nutrient cycling, largely through the activity of their gut microbiota. Understanding the bacterial diversity associated with earthworm gut systems provides insights into microbial ecology and potential applications in biotechnology and soil fertility. Gut-associated bacteria were isolated from *Eudrilus eugeniae* under laboratory conditions. Pure cultures were obtained and subjected to molecular characterization using 16S rRNA gene sequencing. The amplified sequences were analyzed and compared with available databases (NCBI BLAST) for taxonomic identification. The validated sequences were deposited in GenBank. A total of seven distinct bacterial species were successfully isolated and identified from the earthworm gut. These include *Klebsiella michiganensis*, *Kocuria rhizophila*, *Bacillus velezensis*, *Kocuria soli*, *Pseudochrobactrum saccharolyticum*, *Klebsiella aerogenes*, and *Staphylococcus aureus*. Sequence lengths ranged between 547–1447 bp. All sequences have been submitted to NCBI and assigned accession numbers. This study highlights the bacterial diversity present in the gut of *Eudrilus eugeniae*. The identified bacterial strains belong to functionally significant groups, including *Bacillus*, *Klebsiella*, and *Staphylococcus*, which are known for roles in nutrient cycling, plant growth promotion, and pathogenesis. The findings provide baseline data for further research into the functional roles of earthworm gut microbiota in soil ecosystems and potential biotechnological applications.

Keywords: Earthworm gut microbiota, 16S rRNA gene, Bacterial diversity, Molecular identification, NCBI GenBank.

SEAWEED-ASSOCIATED PROBIOTICS AS MODULATORS OF HUMAN GUT MICROBIOTA

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The human gut microbiota is central to maintaining health, influencing both metabolism and disease prevention. Probiotics, known as beneficial bacteria, help sustain microbial balance by suppressing harmful organisms and supporting useful ones. These microbes contribute to multiple physiological functions, including lactic acid production, fatty acid metabolism, immune modulation, enhanced antibody (IgA) secretion, phagocytosis, and cytokine stimulation. In addition, epibiotic and endobiotic microbes associated with seaweeds often mirror their algal hosts in producing bioactive compounds with antibacterial properties. This study focused on isolating and characterizing probiotic bacteria from seaweeds collected along the South Indian coast. The samples included green algae (*Caulerpa scalpelliformis*, *Ulva lactuca*, *Ulva fasciata*), red algae (*Gracilaria edulis*, *Gracilaria corticata*, *Hypnea valentiae*, *Grateloupia filicina*, *Kappaphycus alvarezii*), and brown algae (*Sargassum wightii*). From these, 127 bacterial isolates were recovered as both epibiotics and endobiotics. Morphological, Gram-staining, and biochemical analyses identified 57 probiotic isolates belonging to six species: *Bacillus coagulans*, *Lactobacillus delbrueckii*, *Lactobacillus fermentum*, *Bacillus subtilis*, *Bacillus licheniformis*, and *Escherichia coli*. The study revealed distinct patterns of association: probiotics were predominantly endobiotic in green seaweeds, epibiotic in red seaweeds, and occurred in both forms in brown seaweeds. These findings suggest that South Indian seaweeds represent a promising natural source of probiotic bacteria, with potential applications in functional foods, nutraceuticals, and gut health management.

Key words: Macro algae, Probiotic bacteria, Endobiotic, Epibiotic, Lactic acid.

QUALITATIVE AND QUANTITATIVE PHYTOCHEMICAL ESTIMATION OF *ZANTHOXYLUM SIMULANS* SEED EXTRACT

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Bioactive compounds such as alkaloids, flavonoids, and phenols found in medicinal plants are utilized to treat human illnesses and promote healing. These substances have been used for centuries in traditional medicine and are still being investigated for the creation of novel therapeutic agents and cures for a range of illnesses because of their diverse pharmacological qualities, which include anti-inflammatory, antioxidant, antibacterial, and anticancer action (Kumar et al., 2021). *Zanthoxylum simulans* (Sichuan pepper) from the family Rutaceae is a potent medical and edible plant due to its aroma, therapeutic and nutritional content (Liu et al., 2020). It is found in East Asia particularly China and has traditionally been used in the treatment of different kinds of malaise including digestive dysfunction, inflammatory conditions and pain-related disorders (Wang et al., 2015). The current study was carried out to investigate the key bioactive ingredients in the seed extracts of *Zanthoxylum simulans*. Qualitative and quantitative analyses using Methanol as the polar solvent, and Chloroform and hexane as Non polar solvents were performed. The qualitative analysis of *Zanthoxylum simulans* revealed the presence of Alkaloids, Terpenoids, Tannins, Phenols, Flavonoids, Carbohydrates, Saponins and Glycosides in all the three extracts. For quantitative analysis, the total phenol content was determined using Folin–Ciocalteu’s Reagent (FCR) method against Gallic acid as the standard. The maximum concentration of phenolic content was observed in Chloroform extract with the value of 420.0 ± 1.19 mg QE/g extract. 131.2 ± 1.03 mg QE/g was the result from Hexane extract, followed by 96.1 ± 1.01 mg QE/g in Methanol extract. The quantitative estimation of Flavanoids was executed using Aluminium chloride colorimetric method using Quercetin as the standard. The highest concentration of 142.9 ± 0.44 mg QE/g was recorded in the Chloroform seed extract followed by Hexane and Methanol with values of 114.4 ± 0.43 mg QE/g extract and 50.6 ± 0.43 mg QE/g extract respectively. Further assays like GC-MS and LC-MS need to be carried out to identify and quantify volatile and semi-volatile organic compounds of the seed extract with high precision and selectivity.

EXPLORING THE POTENTIAL OF YEAST FOR SUSTAINABLE BIOETHANOL PRODUCTION FROM MOLASSES

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Bioethanol is a renewable fuel that offers a cleaner and sustainable alternative to fossil fuels. Molasses, a cheap by-product of the sugar industry, provides an excellent raw material for large-scale ethanol production. Yeast, especially *Saccharomyces cerevisiae*, efficiently ferments the sugars present in molasses into ethanol. This work highlights the potential of yeast in enhancing ethanol yield through its tolerance to stress conditions like pH, temperature, and osmotic pressure. Strain improvement and metabolic engineering can further increase fermentation efficiency and ethanol productivity. Advanced fermentation techniques such as fed-batch and continuous processes also improve output and stability. The use of molasses not only lowers production cost but also supports waste management and promotes a circular bioeconomy. Large-scale adoption of yeast-based ethanol can reduce greenhouse gas emissions, decrease reliance on fossil fuels, and contribute to national energy security. Overall, yeast-driven fermentation of molasses is a cost-effective, eco-friendly, and scalable solution for future sustainable energy needs.

Keywords: Yeast, *Saccharomyces cerevisiae*, Molasses, Bioethanol, Fermentation, Renewable energy

COLONEX - A REINVENTION IN FORMULA MILK BY INCORPORATING NATURAL INGREDIENTS

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A reinvention in formula milk not only aims to meet the nutritional needs of infants who cannot be breastfed but also strives to address global challenges like malnutrition and food security. By bridging the gap between formula and natural breast milk, this innovation represents a significant leap forward in infant health and development. Incorporated natural ingredients into a formula milk to produce A Reinvention in formula milk that helps to enhance infants growth and also acts as an immune booster by reducing infants related problems such as Digestion, Dysentery and Gastrointestinal related problems by analysing the antioxidant, antimicrobial and phytochemical screening methods. It helps to provide a nutritious and safe alternative to traditional formula milk, made with natural ingredients. It Support the healthy growth and development of infants and also it reduce Morbidity and Mortality rate in infants. The research focuses on analysing the phytochemical composition, antioxidant capacity using the DPPH assay, and antimicrobial activity of the enhanced formula. Phytochemical screening identifies bioactive compounds such as flavonoids, phenolics, and alkaloids, which contribute to nutritional and therapeutic properties. The antioxidant potential, evaluated through the DPPH radical scavenging assay, determines the capacity of the formulated milk to combat oxidative stress. Additionally, antimicrobial screening assesses the inhibitory effects against common pathogenic microorganisms, ensuring improved safety and potential immune- supporting properties. The findings provide insight into the functional properties of the newly formulated milk, paving the way for a healthier alternative in infant nutrition. This research contributes to the growing field of functional foods, supporting advancements in infant health and well-being.

Keywords: Formula Milk, Infants, Immune booster, Using Natural Ingredients.

A GERMINATION-BASED SCREENING FOR METABOLIC FLEXIBILITY AND RESILIENCE IN CROP PLANTS

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Enhancing seed vigor and stress resilience is vital for securing crop productivity and sustainability in the face of climate variability and increasing environmental challenges. However, conventional germination assays—though widely used—are limited to measuring emergence efficiency and fail to reveal a genotype’s true capacity to withstand stress. In this study, we introduce a powerful and practical alternative: an alternative oxidase (AOX) inhibition assay using salicylhydroxamic acid (SHAM) applied during early germination. AOX is a key regulator of mitochondrial respiration, especially under stress conditions, and its temporary inhibition offers a unique window into a seed’s metabolic flexibility and adaptive potential. By applying SHAM at 10 hours after imbibition, we observed significant variation in how crop genotypes respond—some maintained strong germination and seedling vigor, indicating superior resilience and an enhanced ability to restore normal respiration following stress. This approach not only provides insights into early stress responses but also serves as a low-cost, scalable alternative to complex physiological techniques such as calorimetry. Importantly, it supports sustainable agriculture by identifying varieties that establish quickly, compete effectively with weeds, and reduce the need for herbicide application. The simplicity and dual predictive power of this screening make it a valuable tool for modern breeding programs and on-farm decision-making. However, due to the toxic nature of SHAM, the assay must be conducted under controlled conditions by trained personnel to ensure safety and environmental responsibility.

Keywords: Crop plants, Stress resilience, Alternative oxidase, Metabolic flexibility, Sustainable agriculture, Screening assay, Plant breeding.

INCIDENCE, IDENTITY, AND INTERVENTION: MANAGING CHILLI FUSARIUM WILT WITH TRICHODERMA ASPERELLUM.

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Fusarium wilt, caused by multiple *Fusarium* species, remains a major threat to chilli (*Capsicum annuum* L.) production in India, impacting yield and crop quality across leading chilli- growing regions. A comprehensive regional survey conducted in Andhra Pradesh and Tamil Nadu highlighted widespread disease prevalence, with notable differences in severity linked to local varieties, soil types, and virulence of *Fusarium* populations. Morphological characterization of isolates confirmed significant diversity in colony attributes and conidial structures, underscoring the need for tailored diagnostic and management strategies. Recognizing the limitations and environmental impact of synthetic chemicals, this study evaluated the biocontrol potential of *Trichoderma* species, particularly *Trichoderma asperellum*, against *Fusarium incarnatum*. Ten *Trichoderma* isolates sourced from chilli rhizosphere soils were characterized with morphologically. In vitro assays demonstrated strong antagonistic activity, with the T5 isolate showing up to 74.6% inhibition in dual culture and nearly 95% inhibition in poisoned food technique at higher concentrations. These results affirm the effectiveness of *Trichoderma asperellum* in suppressing *Fusarium* wilt and highlight the importance of integrating regional pathogen profiling with biocontrol interventions. Continued monitoring and development of bio- agent-based strategies offer promising avenues for sustainable chilli wilt management, fostering better crop health and productivity.

Keywords: Chilli (*Capsicum annuum* L.), *Fusarium* wilt, *Trichoderma asperellum*, Biological control, *Fusarium incarnatum*

BIOCONVERSION OF SEWAGE SLUDGE INTO ENVIRONMENTALLY SAFE BIOFERTILIZERS

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The rapid generation of sewage sludge poses a significant challenge to urban waste management, as its indiscriminate disposal leads to environmental pollution and public health risks. Converting this sludge into eco-friendly biofertilizers provides a sustainable solution that not only minimizes waste but also enriches soil fertility. In this study, sewage sludge was collected, dewatered, and pre-treated to reduce moisture content and initial pathogen load. The material was then blended with bulking agents such as rice husk and sawdust to optimize the carbon-to-nitrogen ratio, followed by aerobic composting under controlled temperature and moisture conditions. The thermophilic phase effectively reduced pathogenic microorganisms, while curing stabilized the material into mature compost. To enhance its biofertilizer potential, the compost was enriched with beneficial microbial inoculants including *Azotobacter*, phosphate-solubilizing bacteria, and *Trichoderma harzianum*. The final product was evaluated for physicochemical parameters (pH, EC, NPK content, C:N ratio) and biological safety (pathogen reduction, heavy metals, germination index). Results indicated that the enriched sludge compost was pathogen-free, nutrient-rich, and environmentally safe, demonstrating its potential as a low-cost, sustainable alternative to chemical fertilizers while contributing to effective waste valorization.

Keywords: Sewage sludge, Biofertilizer, Composting, Sustainable agriculture, Waste valorization

EVALUATION OF ANTIBACTERIAL POTENTIAL OF POLYHERBAL EXTRACTS AGAINST RESPIRATORY PATHOGENS

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The present study aimed to evaluate the antibacterial potential of a polyherbal extract prepared from the leaves of *Solanum trilobatum*, *Coleus aromaticus*, and *Acalypha indica*. The plants were collected from Sirkazhi, Mayiladuthurai District, Tamil Nadu, and authenticated using standard botanical references. Shade-dried leaves were powdered and subjected to extraction with three different solvents: acetone, chloroform, and ethanol. The polyherbal extracts were tested against respiratory bacterial pathogens (*Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*) using the agar well diffusion method. Results revealed that the ethanol extract exhibited the highest antibacterial activity compared to acetone and chloroform extracts. The maximum zone of inhibition (30 mm at 100 μ l) was observed against *Staphylococcus aureus*. These findings suggest that polyherbal formulations possess significant antibacterial potential and may serve as promising alternatives in the management of bacterial infections. The future aspects of this study have to develop novel drug delivery systems (E.g., Herbal Ointments, Capsules, Nanoparticles) for effective clinical application in treating respiratory infections.

Keywords: Polyherbal extract, *Solanum trilobatum*, *Coleus aromaticus*, *Acalypha indica*, Antibacterial activity, Respiratory pathogens, Ethanol extract.

ISOLATION, CHARACTERIZATION OF PROBIOTIC LACTIC ACID BACTERIA FROM FERMENTED WATERMELON (*CITRULLUS LANATUS*) SEEDS

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Probiotic bacteria are beneficial microorganisms that support gut health and enhance the immune system. They help maintain intestinal balance, widely used in functional foods and therapeutics. The present study focuses on the isolation and evaluation of Probiotic lactic acid bacteria (LAB) from fermented watermelon (*Citrullus lanatus*) seeds collected from Trichy, Chennai, and Thanjavur. Natural Fermentation was carried out in distilled water for 24 hours under controlled conditions, followed by isolation of pure cultures on selective media. Biochemical characterization included carbohydrate fermentation profiling and growth curve analysis. Morphological identification done by Gram staining and SEM analysis, while molecular characterization was confirmed by 16S rRNA sequencing. Probiotic properties of the isolates were assessed through tolerance to bile salts, acid, pH and temperature. Cell surface characteristics were analysed through hydrophobicity and auto aggregation assays to assess adhesion ability, which is essential for colonization. Biosafety evaluations included haemolysis activity and antibiotic susceptibility profiling. The results demonstrated that the isolated LAB strains exhibited promising probiotic characteristics and were non-haemolytic, indicating their potential safety for further application in food or therapeutic formulations. This study highlights the probiotic potential of indigenous LAB from natural source, supporting their safe and effective use in the development of functional food products, gut health-promoting and medical health applications.

Keywords: *Citrullus lanatus*, Fermentation, Lactic acid bacteria, Probiotic bacteria, Biosafety assay

PHARMACEUTICAL AND BIOMEDICAL POTENTIAL OF SEAWEED-DERIVED BIOACTIVE COMPOUNDS: A SUSTAINABLE SOURCE FOR NOVEL THERAPEUTICS

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Seaweed, are the diverse group of marine macro algae, which has increasing attention due to their sustainable bioresource and significant pharmaceutical and biomedical potential. Beyond its nutritional value, seaweed is considered to be rich in polysaccharides like alginate, carrageenan, agar, fucoidan, phenolic, peptides, and sulphated compounds that has lot of therapeutic properties. These bioactive molecules demonstrate antioxidant, anti-inflammatory, antimicrobial, antiviral, anticoagulant, antitumor activities, making seaweed a promising candidate for drug discovery and development. Collectively, the pharmacological diversity and bio functional properties of seaweed underscore its importance as a renewable marine resource for novel therapeutic agents, biomedical materials, and health-promoting products. Seaweed can be widely used in pharmaceutical applications. They offer significant therapeutic potential in maintaining blood and kidney health. Sulphated polysaccharides like fucoidan and carrageenan exhibit antithrombotic and anticoagulant properties like heparin, thereby supporting cardiovascular health and reducing risks of clot formation. Polyphenols from brown seaweeds demonstrate antihypertensive and vasoprotective effects through angiotensin-converting enzyme (ACE) inhibition, thereby helping in blood pressure regulation. Seaweed-derived peptides and fibers further contribute to improved glycemic control and lipid metabolism, and helps reducing risk factors for diabetic nephropathy. The alginates and other polysaccharides act as natural detoxifying agents supporting kidney function and reducing oxidative stress. Emerging studies highlight the nephroprotective effects of seaweed metabolites as a promising resource for the development of functional foods, nutraceuticals, and pharmaceuticals.

Keywords: Seaweed, Marine bio resources, Bioactive compounds, Drug delivery, Regenerative medicine, Anti diabetic, Cardiovascular health, , Nephroprotective, Kidney Detoxification.

FUNGAL ENDOPHYTIC COMMUNITIES IN TRIBULUS TERRESTRIS L.

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Tribulus terrestris L. is an annual, silky herb plant widely distributed around the world. The leaf, root and fruit of the plant have been utilized medicinally in traditionally Ayurvedic medicine, Siddha and Unani for their phytochemical and pharmacological activities. An assemblage of endophytic fungi was isolated from *T. terrestris* L. collected from the Delta Region of Tamil Nadu, India. Fungal endophytes were isolated using leaf surface sterilization standard methods. Totally 15 endophytic fungal species were isolated from the leaves, petioles and stems of *T. terrestris*. The identification of fungal organisms through morphological observation from standard manuals and showed that fungal endophytes were associated with host plants belonging to a few taxons of *Alternaria*, *Cladosporium*, *Aspergillus*, *Curvularia* and *Fusarium* sp. that were frequently isolated. The endophytic fungus *Fusarium oxysporum* was the dominant species in this study; it was isolated from host plant samples during wet and dry seasons.

Keywords: *Tribulus terrestris*, Endophytic fungi, Ayurvedic medicine, Phytochemical, Pharmacological activities.

PROBIOTICS AS SUSTAINABLE BIOTHERAPEUTICS: INSIGHTS FROM FERMENTED FOODS

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Probiotics are increasingly acknowledged as sustainable biotherapeutics with the potential to enhance human health, support nutrition and reduce reliance on conventional pharmaceutical interventions. Fermented foods, traditionally valued for their sensory attributes and preservation qualities, are rich sources of diverse probiotic strains that offer a wide array of multifunctional benefits. These microbes contribute to the balance of gut microbiota, modulation of immune responses and possess antimicrobial and anti-inflammatory properties, positioning them as eco-friendly alternatives in both preventive and therapeutic healthcare. Advancements in biotechnology and molecular tools have facilitated the identification, characterization and application of probiotics from fermented foods. The integration of these probiotics into functional food products not only enhances nutritional value but also fosters sustainable approaches to disease management. Additionally, probiotics are increasingly being explored beyond healthcare, with applications in agriculture, food safety and environmental sustainability, underscoring their diverse potential. By linking traditional fermentation methods with modern microbial innovations, this review explores how natural microbial diversity can be harnessed to tackle global health and environmental challenges. The role of probiotics as sustainable biotherapeutics reflects the growing potential of microbes in shaping a healthier, more sustainable future.

Keywords: Probiotics, Fermented foods, Microbial innovation, Functional foods, Sustainability and Bio therapeutics

ENDOPHYTIC FUNGAL COMMUNITIES IN THE LEAVES OF PTERIDOPHYTE PLANTS: DIVERSITY AND DISTRIBUTION PATTERNS

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Two species of pteridophytes, viz., *Adiantum capillus* and *Nephrolepis cordifolia* pteridophyte plant species of the tropical herb, studied for endophytic fungi were collected from Coonoor, a city in (Ooty) Nilgiris district in the south India state of Tamil Nadu. They were screened for the presence of fungal endophytes from the plant parts. A total of 17 species of fungal endophytes were recorded. *Colletotrichum gloeosporioides*, *Fusarium oxysporum*, *Curvularia lunata* and *Phomopsis* sp. occurred in all the pteridophyte species screened. The maximum number of endophytic fungal species was observed in *A.capillus*, while *N.cordifolia* ranked first in the number of fungal organisms. The species composition, endophyte assemblage and pattern of colonisation among these vascular cryptogams were similar to those of the most studied phanerogams.

Keywords: Pteridophytes, *Adiantum capillus*, *Nephrolepis cordifolia*, Endophytic fungi vascular cryptogams.

BIOCHEMICAL COMPOSITION OF THE MARINE ALGAE *SARGASSUM CRISTAEOFOLIUM*

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Seaweed or marine macroalgae are the potential renewal resources of the marine environment. They are rich in bioactive compounds and like carotenoids, protein, essential fatty acids, vitamins, minerals, calcium, iron, potassium, sodium. This article aims to give information about the chemical composition of *Sargassum cristaefolium*. The present study, the marine algae *Sargassum cristaefolium* collected from Rameswaram coast. The chemical study was conducted on this particular algae. The results of *Sargassum cristaefolium* obtained Protein 8.42 (% dw), Lipid 0.23 (% dw), Carbohydrate 7.21 (% dw) and content of varies minerals Sodium 1357 (mg/100g), Calcium 3152 (mg/100g), Iron 63.27 (mg/100g) and Potassium 8365 (mg/100g).

Keywords: *Sargassum cristaefolium*, seaweed, Chemical content

HARNESSING THE NATIVE RHIZOBIUM STRAINS FOR SUSTAINABLE MANAGEMENT OF COLLAR ROT IN GROUNDNUT AND BLACK GRAM

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Leguminous crops such as groundnut (*Arachis hypogaea*) and black gram (*Vigna mungo*) are highly susceptible to collar rot disease caused by *Aspergillus niger*, leading to severe yield losses. In the present study, native *Rhizobium* strains were isolated from healthy root nodules of groundnut and black gram cultivated in Chidambaram, Tamil Nadu, and evaluated for their plant growth-promoting and antifungal potential. The isolates were characterized through morphological, biochemical, and scanning electron microscopy (SEM) analyses. *A. niger* was isolated from collar rot-infected groundnut plants and identified based on cultural and microscopic characteristics. Antifungal activity was assessed using dual culture and agar well diffusion methods. Among the isolates tested, Rh1 (groundnut) and Rh2 (black gram) exhibited significant inhibition of *A. niger* mycelial growth, with inhibition zones up to 26 mm, indicating the secretion of bioactive antifungal metabolites. The findings highlight the dual role of *Rhizobium* as both a nitrogen-fixing biofertilizer and a biocontrol agent against soil-borne fungal pathogens. Application of indigenous *Rhizobium* strains offers an eco-friendly, cost-effective, and sustainable alternative to chemical fertilizers and fungicides for enhancing legume productivity.

Keywords: *Rhizobium*, *Aspergillus niger*, collar rot, biofertilizer, biocontrol, groundnut, black gram

BIODIVERSITY CONSERVATION AS A STRATEGY FOR SECURING ECOSYSTEM SERVICES AND CLIMATE RESILIENCE

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Biodiversity, encompassing genetic, species, and ecosystem levels, underpins the stability and functioning of natural systems and the ecosystem services they provide. These services—provisioning, regulating, supporting, and cultural—are vital for human well-being and sustainable development. However, human activities such as deforestation, pollution, and habitat fragmentation are driving biodiversity loss, threatening ecosystem resilience and service provision. Conserved and diverse ecosystems are better able to adapt to climate change, recover from disturbances, and sustain essential processes like food production, water purification, and climate regulation. This paper examines the ecological and economic value of biodiversity, the role of conservation in strengthening ecosystem resilience, and the integration of ecological, social, and economic objectives through successful conservation strategies. Recognizing biodiversity as a foundation for sustainability is crucial to building a resilient and equitable future.

Keywords: Biodiversity Conservation, Ecosystem Service, Climate Resilience, Ecosystem Stability

CIRCULAR BIOECONOMY THROUGH MICROBIAL ACTION – HARNESSING MICROBES TO RECYCLE RESOURCES, CONVERT WASTE INTO VALUABLE PRODUCTS, AND CLOSE INDUSTRIAL PRODUCTION LOOPS.

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Shifting from the linear paradigm of use and throw to a circular bioeconomy is crucial to making resources last longer and ecosystems stable. Microbes facilitate this transition through waste degradation, nutrient recycling, and enabling industries to run in closed, self-contained loops. This work emphasizes microbial processes such as fermentation, biodegradation, production of bioenergy, and biosynthesis of polymers that minimize waste and create environmentally friendly alternatives to traditional products. Examples range from utilizing farm residues for biofuel production to the use of microbes for the production of biodegradable plastics and for the removal of precious nutrients from wastewater. When industries embrace microbial technologies, they not only reduce their environmental impact but also create new opportunities for sustainable business expansion. This report emphasizes the requirement for sustained scientific advancement coupled with robust policy responses to accelerate the adoption of microbial approaches into circular bioeconomy schemes.

Keywords: Bioeconomy, microbes, biodegradation, bioenergy, fermentation.

STUDIES ON THE BIOCHEMICAL COMPOSITION OF THE MARINE ALGAE *ULVA FASCIATA*

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Algae are photosynthetic organisms that are unicellular or multicellular. Algae are photosynthetic organisms that are unicellular or multicellular. The world population which is increasing from year to year has caused an increase in the need for raw materials in the fields of pharmaceuticals, cosmetics, and aquaculture. Algae contain various nutrients such as protein, carbohydrates, lipids, fiber, and others. Bioactive compounds such as alkaloids, phenolics, terpenes are found in algae. The high nutritional content and bioactive compounds cause algae to be widely used in various fields, including in the fields of food, pharmacy, cosmetics, and also aquaculture. For the present study, the marine algae *Ulva fasciata* collected from Rameswaram coast. The chemical study was conducted on this these algae. The results of *Ulva fasciata* obtained Protein 14.2 (% dw), Lipid 0.17 (% dw), Carbohydrate 57.6 (%d w) and content of varies minerals Sodium 357 (mg/100g), Calcium 1793 (mg/100g), Iron 13.97 (mg/100g) and Potassium 458 (mg/100g).

Keywords: *Ulva fasciata*, seaweed, Chemical content

THE ROLE OF BIODIVERSITY IN SUPPORTING ECOSYSTEM STABILITY, HUMAN WELL BEING AND SUSTAINABLE DEVELOPMENT

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Biodiversity is a foundational element of life on Earth, encompassing the variety of genes, species, and ecosystems that interact to sustain ecological balance. Its role in maintaining ecosystem stability is vital, as diverse ecosystems are more resilient to environmental changes and disturbances such as climate change, disease outbreaks, and natural disasters. Biodiversity supports critical ecosystem services including food and water security, air and soil quality, pollination, and climate regulation all of which directly influence human well-being. Moreover, biodiversity contributes to cultural, spiritual, and recreational values that enrich human societies. In the context of sustainable development, conserving biodiversity is essential not only for ecological health but also for long-term economic and social progress. This paper explores how biodiversity underpins ecosystem stability, enhances quality of life, and acts as a cornerstone for achieving the United Nations Sustainable Development Goals (SDGs). Urgent and integrated conservation efforts are needed to protect biodiversity and ensure a sustainable future for both people and the planet. It also contributes to cultural, spiritual, and recreational values, enriching human life in multiple ways. Furthermore, biodiversity is central to achieving sustainable development, as it supports long-term ecological health, economic prosperity, and social equity. This paper examines the interconnectedness between biodiversity, ecosystem stability, human well-being, and sustainable development, and emphasizes the urgent need for its conservation in the face of global environmental challenges.

Keywords: Biodiversity, Ecosystem Stability, Ecosystem Services, Climate change

SCREENING OF MARINE BACTERIAL ISOLATES FROM TAMIL NADU FOR ROBUST ENZYME PRODUCTION AND ANTIMICROBIAL ACTIVITIES SUPPORTING SUSTAINABLE BIOTECHNOLOGY

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Marine bioprospecting offers a valuable approach for sourcing novel enzymes and bioactive compounds from microorganisms adapted to the unique and often extreme conditions of marine environments. Such microbes frequently produce halotolerant, thermostable, and broad-specificity enzymes with significant industrial relevance. In this study, we collected water and sediment samples from 5 different coastal areas across Chennai, Tamil Nadu. The coastal sampling site analyses revealed variations in pH (7.6–9.3), temperature (28.6–36.0 °C), salinity (28.6–31.4 ppt), and light intensity, influencing microbial diversity and metabolic potential. We isolated 55 marine bacteria whose growth at different temperatures was observed using the tolerant assay. All 55 isolates were checked for antimicrobial activity against test pathogens and enzyme production. Antimicrobial assay demonstrated inhibitory effects against the test pathogen, *Escherichia coli*, and enzyme screening indicated the production of protease, amylase, and both by several isolates. From 56 isolates, 12 isolates were selected based on an increased zone in the enzyme screening process. Quantitative analyses of the 12 selected isolates confirmed high protease (>4 AU) and amylase (>3 AU) activities, demonstrating proven stability and efficiency under detergent-supplemented conditions for proteinaceous and starchy stain removal. MALDI-TOF of the twelve selected isolates primarily linked these strains to *Bacillus*, *Brevibacillus*, *Paenarthrobacter*, and *Acinetobacter*, alongside possible novel taxa. Based on comprehensive functional and industrial assessments, 12 isolates were identified as commercially viable candidates for applications in detergent formulations, biocatalysis, and antimicrobial development, highlighting their potential as sustainable marine biotechnology resources.

Keywords: Marine bioprospecting, Marine bacteria, Protease, Detergent formulations

PHYSICO-CHEMICAL AND GC–MS CHARACTERIZATION OF CASHEW APPLE JUICE WITH NANOPARTICLE-ENHANCED FERMENTATION FOR BIOETHANOL YIELD IMPROVEMENT

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Cashew apple, a nutrient-rich by-product of cashew nut processing, is often discarded despite its abundance of fermentable sugars and organic acids. This study investigates its potential as a sustainable feedstock for biofuel production. The physicochemical properties of cashew apple juice, including pH, total soluble solids, and sugar composition, were characterized to determine its suitability for fermentation. Gas Chromatography–Mass Spectrometry (GC–MS) analysis was employed to profile key volatile and bioactive compounds, providing insight into components influencing fermentation efficiency. Fermentation trials were carried out using selected microbial strains, with optimization of parameters such as pH, temperature, and inoculum concentration. To enhance bioethanol yield, nanoparticles were incorporated as fermentation enhancers, facilitating improved microbial activity and substrate conversion. The combined approach resulted in higher ethanol recovery compared to conventional fermentation. This work demonstrates that cashew apple can be effectively valorized into biofuel while addressing agro-waste challenges. Integrating physico-chemical analysis, advanced metabolite profiling, and nanotechnology offers a novel pathway to improve renewable energy production from underutilized fruit resources.

Keywords: Cashew apple, Biofuel, Ethanol fermentation, Physico-chemical properties, GC–MS, Nanoparticles, Agro-waste utilization

MICROBIAL INTEGRATION IN DAY-TO-DAY LIFE.

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Innovative microbial technologies are creating sustainable solutions to everyday global challenges. This presentation looks at how we can integrate microbes in various fields, including materials design, energy generation, agriculture, waste management, and environmental restoration. Some key innovations include bioconcrete that significantly reduces carbon emissions, lab-grown fibers made from microbial fermentation, fungal-enhanced carbon capture in soils, microbial fuel cells that produce electricity from organic waste, and bacteria that break down plastic. Each example is supported by data showing its impact and relevant real-world uses. The presentation wraps up with thoughts on scalability, regulatory challenges, and future steps toward a regenerative, microbe-driven bioeconomy.

Keywords: Microbes, Organic waste, Microbial Fermentation, Bioeconomy.

SYNERGISTIC EFFECT OF GUAVA LEAVES AND CINNAMON EXTRACTS ON ORAL PATHOGENS ASSOCIATED WITH GUM DISEASES

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Gum infections, primarily caused by pathogenic bacteria such as *Streptococcus mutans*, *Porphyromonas gingivalis*, and *Fusobacterium nucleatum*, pose a significant oral health challenge. The increasing resistance of oral pathogens to conventional antibiotics necessitates alternative therapeutic approaches using natural bioactive compounds. In this study, the antibacterial activity of guava (*Psidium guajava*) leaves extract and cinnamon (*Cinnamomum verum*) extract was evaluated against bacterial isolates associated with gum infections. Aqueous and ethanolic extracts of guava leaves and cinnamon bark were prepared and tested using the agar well diffusion method and minimum inhibitory concentration (MIC) assays. The results demonstrated that both extracts exhibited significant antibacterial activity, with zones of inhibition ranging from 12–20 mm depending on the bacterial strain and extract type. Ethanolic extracts showed higher activity than aqueous extracts. Guava leaf extract displayed the strongest effect against *Streptococcus mutans* (20 mm zone), while cinnamon extract was highly effective against *Porphyromonas gingivalis* (18 mm zone). The MIC values ranged between 0.5–2.0 mg/mL. A synergistic effect was observed when guava and cinnamon extracts were combined, producing enhanced inhibition compared to individual extracts. These findings suggest that guava leaves and cinnamon extracts possess promising antibacterial properties and could serve as potential natural alternatives for the prevention and management of gum infections. Further *in vivo* studies and formulation trials are recommended to develop herbal-based oral care products.

Keywords: Guava leaves, Cinnamon, Antibacterial activity, Gum infections, *Streptococcus mutans*, *Porphyromonas gingivalis*, Natural therapeutics

SYNERGISTIC EFFECT OF VERMIWASH AND VERMICOMPOST ON THE GROWTH PERFORMANCE OF CHILLI (*CAPSICUM ANNUUM L.*)

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The rising need for sustainable agriculture has directed attention toward organic biofertilizers as alternatives to chemical inputs. Chilli (*Capsicum annum L.*), an economically important spice crop rich in vitamins, phenolics, and capsaicinoids, requires balanced nutrition for optimal growth and yield. The present experimental study evaluated the synergistic effect of vermiwash and vermicompost on the growth performance of chilli under controlled conditions. A pot culture experiment was established with four treatments: T1 (control), T2 (vermicompost alone), T3 (vermiwash foliar spray), and T4 (combined vermiwash + vermicompost). Growth and yield parameters such as germination percentage, plant height, number of leaves, chlorophyll content, flowering response, fruit set, and fresh and dry biomass were recorded at regular intervals. The results demonstrated that the combined application (T4) significantly outperformed individual treatments and control. Plant height increased by 29% over control, while leaf number and chlorophyll content rose by 34% and 26% respectively. Flowering occurred earlier in T4, with higher fruit set and an overall 38% yield increase compared to control. Preliminary phytochemical screening of chilli fruits indicated elevated capsaicin and total phenolic content under combined biofertilizer treatment, suggesting enhanced nutritional and medicinal quality. The synergistic effect is attributed to vermicompost enriching the soil with organic matter and macro-nutrients, while vermiwash supplied growth-promoting hormones, enzymes, and beneficial microbes through foliar absorption. This study concludes that integrating vermiwash and vermicompost offers a sustainable, eco-friendly strategy for boosting chilli growth, yield, and phytochemical richness, reducing dependence on chemical fertilizers.

Keywords: Chilli, Biofertilizers, Vermicompost, Vermiwash, Synergistic effect

GREEN ENERGY TRANSITION: SOLAR ASSISTED PLASTIC TO PETROL CONVERSION

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Plastic pollution is a growing environmental crisis, while global energy needs demand sustainable alternatives. This project presents a solar assisted plastic to petrol conversion system, integrating green energy principles with advanced pyrolysis, using solar thermal heating with hybrid backup and catalyst, plastic waste such as PP, PE and PS are converted at 350-400°C into high grade fuel petrol. This process achieves 700-900ml fuel per Kg of plastics with reduced external energy consumption, emission control and AI based sorting for efficiency. By combining renewable energy with waste-to-fuel technology, this approach supports the green energy transition and promote a circular economy, offering a scalable and eco-friendly solution.

Keywords: Pyrolysis, Hybrid backup, Solar thermal heating, Sustainable solution

ZOONOTIC DISEASES AND ITS TRANSMISSION

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Zoonotic diseases are infections that are naturally transmitted between animals and humans, caused by viruses, bacteria, parasites, and fungi. They represent a major public health concern worldwide due to their wide range of reservoirs and modes of spread. Transmission can occur through direct contact with infected animals, indirect contact with contaminated environments, consumption of unsafe animal products, insect vectors, and exposure to contaminated air or water. Common examples include rabies, influenza, leptospirosis, and brucellosis. The increasing interaction between humans, animals, and the environment has intensified the emergence and re-emergence of zoonosis, highlighting the need for effective. We also highlighted COVID-19, a newly emerging zoonotic disease of likely bat origin that has affected millions of humans along with devastating global consequences. The implementation of One Health measures is highly recommended for the effective prevention and control of possible zoonosis.

Keywords: Zoonosis, Pathogens, Viruses, Bacteria, Fungi, Animal, SARS-CoV-2, COVID-19

EFFECT OF FISH AMINO ACID AND LIQUID INOCULANTS OF *AZOSPIRILLUM* ON GROWTH AND YIELD OF MARIGOLD (*TAGETES ERECTA*)

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The use of organic biostimulants and microbial inoculants is gaining importance in sustainable floriculture to enhance plant growth and flower yield. This study aimed to investigate the effect of fish amino acid (FAA) in combination with liquid inoculants of *Azospirillum* on the growth and yield of marigold (*Tagetes erecta*). The experiment was carried out under field conditions using different treatments: control (no application), fish amino acid alone, *Azospirillum* inoculant alone, and the combined application of fish amino acid with *Azospirillum*. Growth parameters such as plant height, number of branches, and leaf area were recorded, along with yield parameters including the number of flowers per plant, flower diameter, and flower weight. Results revealed that the combined treatment of fish amino acid and *Azospirillum* significantly enhanced plant height (average 78 cm), increased the number of branches (14 per plant), and improved leaf area compared to individual treatments and control. Yield attributes showed maximum number of flowers (62 per plant), larger flower diameter (7.8 cm), and higher fresh flower weight (92 g per plant) under the combined treatment. The study concludes that the synergistic application of fish amino acid and *Azospirillum* inoculants promotes better vegetative growth and enhances yield in marigold, indicating their potential as eco-friendly inputs in floriculture.

Keywords: Fish amino acid, *Azospirillum*, Marigold, Growth, Yield, Organic biostimulants, Floriculture

ECO– PHARMA: MICROBIAL CONVERSION OF PLASTIC WASTE INTO PAIN RELIF

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Plastic pollution has emerged as one of the most pressing environmental challenges, with vast amounts of non-biodegradable plastic waste accumulating in ecosystems worldwide. Innovative biotechnological approaches now offer a sustainable solution by employing engineered microbes to degrade plastic and convert it into valuable pharmaceutical compounds such as paracetamol (acetaminophen). This process integrates microbial metabolism, synthetic biology, and green chemistry to transform plastic-derived monomers into bio active molecules. The approach not only addresses the urgent issue of plastic waste management but also reduces reliance on petrochemical-based drug synthesis, lowering carbon footprint and production costs. By coupling environmental remediation with pharmaceutical production, this strategy represents a breakthrough in circular bio economy, turning waste into medicine. Further research into optimizing microbial pathways, improving conversion efficiency, and ensuring large-scale applicability can pave the way for industrial adoption of this eco-friendly innovation

KEY WORDS: Acetaminophen, Polyethylene terephthalate , Terephthalic acid, Engineered microbes , P – aminobenzoic acid

COMBATING POST-HARVEST LOSS: AN INTEGRATED BIO-SYSTEM FOR EARLY PEST DETECTION (BIOSTRIP) AND BIOLOGICAL RECOVERY OF INFESTED GRAINS

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Post-harvest insect infestation threatens global food security, causing massive grain losses and economic damage, particularly in resource-limited rural communities. To combat this, we introduce an innovative dual-strategy framework integrating prevention with a novel early- detection tool and recovery through a novel biological treatment. Our primary innovation is the BioStrip Pest Alert: an eco-friendly, paper-based biosensor functionalized with red cabbage anthocyanins that provides a clear visual colorimetric response to pest-emitted alkaline gases within 4–6 days, offering farmers a critical early warning. While highly effective, challenges in color standardization across diverse storage environments remain a key focus for further development. Complementing this, we pioneer a remedial process using the endophytic bacterium *Bacillus clausii* to induce systemic resistance in infested rice. This promising approach aims to suppress pest advancement and mycotoxin production, potentially salvaging compromised grain stocks. The scalability of this treatment and its impact on grain quality present significant but addressable hurdles. Together, this holistic strategy—from precise monitoring to biological intervention—provides a sustainable and practical pathway to significantly reduce grain spoilage and enhance resilience in agricultural storage systems.

Keywords: Food security, post-harvest loss, biosensor, colorimetric detection, *Bacillus clausii*, induced systemic resistance, grain recovery, sustainable agriculture.

INFLUENCE OF LONG - TERM ORGANIC AND CONVENTIONAL FERTILIZATION ON BACTERIAL COMMUNITIES INVOLVED IN BIO-ELECTRICITY PRODUCTION FROM PADDY FIELD- MICROBIAL FUEL CELLS

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Soil organic matter derived from plant roots can function as a sustainable energy reservoir through microbial fuel cells (MFC). This investigation amalgamates MFC systems with living paddy roots to generate bio electricity while concurrently monitoring methane emissions under organic and conventional fertilization regimes. Graphite anodes and carbon cathodes were meticulously installed in both fertilization systems, and bacterial communities were scrutinized utilizing Illumina MiSeq sequencing. The results demonstrated that the conventionally fertilized paddy field MFC (CFPF - MFC) produced superior electricity and power density while exhibiting diminished methane emissions in comparison to the organically fertilized MFC (OFPF - MFC). Next-generation sequencing unveiled a higher prevalence of Geobacteraceae on the CFPF -MFC anodes, which correlated with enhanced bio electricity generation. These findings underscore the potential of plant -MFC technology for sustainable energy production and the mitigation of greenhouse gas emissions within agricultural ecosystems.

Keywords: Microbial Fuel Cells (MFCs), paddy fields, bio electricity, Geobacteraceae, methane emission, Illumina MiSeq

ISOLATION AND IDENTIFICATION OF FUNGI FROM COMPOST AND GARDEN SOIL FROM SUNDARAKKOTTAI, THIRUVARUR DISTRICT, TAMIL NADU, SOUTH INDIA.

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Microorganisms occur in natural environment like soil. This project was designed for the isolation and identification of some fungi found in the soil. These microorganisms may be either pathogenic or non-pathogenic to the plants and humans. Two soil samples one from garden soil and the other one from compost soil were put into serial bags and taken to the laboratory for analysis. One gram of each sample was put into 9ml of serial water. Using pipette one in ten folds dilutions was done on each sample. Exactly 0.1 ml of each dilution was poured into Sabroaud dextrose agar plates and was spread using spreader on each Sabroaud dextrose agar plates and left on the table for 24 to 48hrs. The representative growth on each plate was sub-cultured on Sabroaud dextrose agar slant to obtain pure culture for identification and left for at least 72hrs for spores to be formed. Slide culture technique was used for proper identification of the filamentous fungi. Lactophenol blue was used to stain the growth on the slide and cover slip and viewed under the microscopy. A total of three fungal isolates were obtained from the soil samples on the Sabroaud dextrose agar plates. Three fungi species, were identified and from the fungal isolates species belonging to the genera *Aspergillus* spp and *Mucor* sp. The identified soil fungi from the two soil sample were *Aspergillus niger*, *Aspergillus fumigatus* and *Mucor* sp. and the three were isolated from two soil samples. In this result fungi growth occur more in compost soil than in garden soil and the most common organism was *Aspergillus* spp. The two soil fungi obtained in this work were known to be pathogenic to human beings. Some *Aspergillus* spp are known to produce mycotoxic which can cause disease in man e.g. Aflatoxins. It is a cumulative toxins. Also *Mucor* sp are known to cause disease in man through inhalation of the spores in the air e.g. systematic mucormycosis in diabetic patients.

Keywords: Fungi, Compost soil, Garden soil, *Aspergillus* spp, *Mucor* spp, and Sabouraud dextrose agar.

AHL DEGRADATION BY *BACILLUS SUBTILIS* ISOLATED FROM POND ENVIRONMENT FOR QUORUM QUENCHING.

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Quorum sensing is a process by which bacteria communicate using signaling molecules like N-acyl homoserine lactones (AHLs) to coordinate activities such as biofilm formation and virulence. Quorum quenching refers to the disruption of this communication, which can help control bacterial infections. In this study, *Bacillus subtilis* was isolated from a pond environment and tested for its ability to degrade AHL molecules. The isolate was screened using bioassays and analytical methods to confirm its quorum quenching activity. Results showed that *Bacillus subtilis* effectively degraded AHL signals, indicating its potential to interfere with quorum sensing and reduce bacterial pathogenicity. This suggests that pond-derived *Bacillus subtilis* could be used as a biocontrol agent to manage harmful bacterial populations.

Keywords: Quorum quenching, *Bacillus subtilis*, AHL degradation, quorum sensing, antimicrobial strategy.

UNVEILING EPIGENETIC MODULATION OF PHENYLPROPANOID PATHWAYS CONFERS ENHANCED DEFENSE AGAINST SPODOPTERA FRUGIPERDA INFESTATION IN KARUPPU KAVUNI RICE

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Rice (*Oryza sativa* L.), a staple crop for nearly half the global population, faces increasing threats from insect pests such as the fall armyworm (*Spodoptera frugiperda*). This study explores the molecular defence mechanisms of the traditional black rice variety Karuppu Kavuni, focusing on epigenetic modulation of the phenylpropanoid pathway under pest stress and copper nanoparticle (CuNP) treatment. FTIR analysis confirmed the presence of key functional groups, while LC-MS profiling identified 86 bioactive compounds, including flavonoids and anthocyanins linked to insect resistance. Antioxidant enzyme assays revealed elevated activities of PAL (14.18 ± 1.13 UA/g FW), CAT (12.38 ± 1.19 mol UA/g FW), and SOD (4.40 ± 1.18 -unit $\text{min}^{-1} \text{g}^{-1}$ FW) in CuNP-treated plants. Transcriptomic analysis showed significant upregulation of PAL6 subgroup genes (e.g., LOC_Os04g43800, 9.27-fold) and transferase genes (T1, T2), with epigenetic marks such as enrichment, indicating transcriptional activation. These findings suggest that CuNPs synergize with epigenetic regulation to enhance rice defense responses, offering a sustainable strategy for integrated pest management.

Keywords: *Oryza sativa* (Karuppu Kavuni), *Spodoptera frugiperda*, phenylpropanoid pathway, epigenetic regulation, copper nanoparticles, PAL, antioxidant enzyme

BACTERIOPHAGE-BASED THERAPEUTIC STRATEGIES AGAINST MULTIDRUG RESISTANCE: MECHANISMS, APPLICATIONS, AND FUTURE PERSPECTIVES

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The alarming rise of multidrug-resistant (MDR) bacterial infections has created an urgent need for therapeutic alternatives as conventional antibiotics lose effectiveness. Bacteriophage (phage) therapy has re-emerged as a promising solution owing to its host specificity, ability to disrupt biofilms through polysaccharide depolymerases, and success in experimental and clinical cases against high-priority MDR pathogens. Phage–antibiotic synergy (PAS) further strengthens therapeutic potential by enhancing bacterial clearance and mitigating resistance. This review provides a comprehensive overview of phage-based strategies to combat MDR bacteria, structured in line with recent advances and challenges. It begins by outlining the global threat of antimicrobial resistance (AMR) and the limitations of antibiotics, followed by a discussion of key MDR mechanisms, including efflux pumps, horizontal gene transfer, and biofilm formation. The biology and mechanisms of bacteriophages are then examined, with emphasis on their life cycles, host specificity, and targeting strategies. Clinical applications, success stories, and case studies of phage therapy are highlighted alongside insights into PAS. Advances in genetic engineering, particularly CRISPR–Cas–mediated modifications and synthetic phages, are described for their role in tailoring phages against resistant pathogens. Challenges such as bacterial resistance to phages, regulatory barriers, and delivery/stability limitations are critically assessed. Future perspectives are explored with a focus on phage cocktails, personalized phage therapy, and integration into healthcare frameworks as part of antimicrobial stewardship. Environmental aspects, including effluent- and soil-based reservoirs of phages and resistant bacteria, are also discussed. Collectively, this review emphasizes both the promise and limitations of phages as sustainable interventions against MDR infections.

Keywords: Multidrug resistance, Bacteriophages, Biofilms, Phage–antibiotic synergy, Genetic engineering, Personalized phage therapy

FLAVONOIDS AS EMERGING ANTITUBERCULAR AGENTS: IN SILICO AND IN VITRO INSIGHTS INTO DNA GYRASE INHIBITION

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Mycobacterium tuberculosis complex bacteria are the cause of tuberculosis (TB), one of the oldest known human diseases and a major cause of death worldwide. In this investigation molecular docking studies were carried out on flavonoid compounds to investigate the binding properties of enzyme DNA gyrase (gyrase b subunit) involved in *Mycobacterium tuberculosis*. The result of docking showed predicted binding energy with docking scores (kcal/mol) between pure flavonoids compounds and target proteins are observed in the higher to lower energy. Swiss ADME has proven to be a straightforward, reliable, and precise technique for comprehending the ADME characteristics of the flavonoid compounds. Using Swiss ADME, all of the flavonoid compounds satisfied Lipinski's criteria for drug likeness. The antimycobacterial activity was measured by MIC (Minimum Inhibitory Concentration) values which ranges from 3.125 µg/mL to 50 µg/mL against *M. smegmatis*. Ultimately, the results of this study could serve as a foundation for creating novel treatments related to *M. tuberculosis*.

Keywords: Docking, flavonoids, DNA gyrase b, *Mycobacterium tuberculosis*, MIC, *Mycobacterium smegmatis*

MODERN FOOD PRESERVATION THE IMPACT OF TECHNOLOGY ON FOOD CONSUMPTION AND CONSERVATION

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Modern food preservation techniques have transformed the way food is processed, stored, consumed, and conserved worldwide. Advancements in technology such as refrigeration, freezing, vacuum packaging, irradiation, pasteurization, and intelligent packaging have not only extended shelf life but also enhanced food safety and reduced post-harvest losses. These methods ensure that seasonal and perishable foods are available year-round, promoting global food security and convenience in consumption. Moreover, emerging technologies like nanotechnology, biotechnology, and smart sensors are further revolutionizing food preservation by improving quality retention and minimizing waste. However, the growing reliance on technological interventions also raises concerns about energy use, environmental sustainability, and consumer acceptance. Overall, technology-driven food preservation plays a crucial role in shaping modern dietary habits, reducing food wastage, and supporting conservation efforts.

Keywords: Food preservation, Refrigeration, Packaging, Food security and Conservation.

TEXTILE DYE EFFLUENT TREATMENT USING MANURE - ISOLATED FUNGI FOR BIOADSORPTION

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The textile industry generates large volumes of dye-contaminated effluents that pose serious environmental threats due to their toxicity and resistance to degradation. This study investigates the bioadsorption potential of fungi isolated from manure, specifically *Trichoderma viride*, *Aspergillus niger*, and *Fusarium oxysporum*, for the treatment of textile dye effluents. The fungal strains were screened for their ability to adsorb synthetic dyes from aqueous solutions under varying pH, temperature, and concentration conditions. The results revealed that all three fungi demonstrated significant adsorption capacities, with *Aspergillus niger* showing the highest removal efficiency, followed by *Trichoderma viride* and *Fusarium oxysporum*. The adsorption process followed Freundlich and Langmuir isotherm models, suggesting multilayer and monolayer adsorption mechanisms, respectively. The study highlights the role of fungal cell wall components in dye binding and emphasizes the potential of using manure-derived fungi as a sustainable and low-cost solution for textile wastewater treatment, promoting environmental safety and waste valorization.

Keywords: Textile dye effluent, Bioadsorption, *Trichoderma viride*, *Aspergillus niger*, *Fusarium oxysporum*.

ECO-FRIENDLY MANAGEMENT OF POSTHARVEST DISEASES IN BANANA USING YEAST ISOLATES AND READILY AVAILABLE THYME OIL

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Postharvest diseases significantly reduce the quality and marketability of bananas (*Musa spp.*), particularly in tropical and subtropical regions. Crown rot and anthracnose, caused by *Lasiodiplodia theobromae* and *Colletotrichum musae*, are among the most destructive diseases leading to substantial losses during postharvest storage and transport. This study evaluates the *in vitro* efficacy of thyme oil (*Thymus vulgaris*) and various yeast strains (*Saccharomyces cerevisiae* - SCG, *Pichia bruneiensis* - NP3, *Meyerozyma caribbica* - PO4) against these pathogens. Thyme oil, at all tested concentrations (25%, 50%, 75%, and 100%), demonstrated significant mycelial inhibition against both *L. theobromae* and *C. musae*. Inhibition rates ranged from 52.5% to 95.0% for *L. theobromae* and from 57.14% to 92.0% for *C. musae*. Thyme oil was particularly effective in suppressing mycelial growth and inhibiting conidial development in the pathogens likely due to its key antifungal compounds, such as thymol, p-cymene, and γ -terpinene. These findings record the potential of thyme oil as a natural antifungal agent for postharvest disease management in bananas. Additionally, all tested yeast isolates (*Saccharomyces cerevisiae* - SCG, *Pichia bruneiensis* - NP3, *Meyerozyma caribbica* - PO4) showed significant inhibitory effects on the mycelial growth of both *L. theobromae* and *C. musae*. Among the isolates, SCG exhibited the highest level of inhibition, with 64.5% suppression of *L. theobromae* and 36.7% inhibition of *C. musae*. Both NP3 and PO4 also demonstrated considerable antifungal activity, with similar levels of inhibition against both pathogens. These results highlight the biocontrol potential of yeast isolates, particularly SCG, in suppressing the growth of key postharvest pathogens. The antagonistic properties of thyme oil and yeast isolates suggest that they could serve as effective, eco-friendly alternatives to conventional chemical fungicides for the management of postharvest diseases in bananas. Given their natural origin/safe microbes, they offer a promising approach to reducing reliance on synthetic chemicals, promoting safer and more sustainable agricultural practices.

Keywords: Postharvest diseases, Bananas, Antifungal activity, Biocontrol potential

DEVELOPMENT OF A SUSTAINABLE LIQUID LIPSTICK FORMULATION UTILIZING RED ALGAE - DERIVED PIGMENTS

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Phycoerythrin, a natural pigment derived from red algae, is gaining attention in cosmetics due to its vibrant red hue and potential skincare benefits. In spite of its great demand, the application of phycoerythrin, a red coloured pigment under the phycobilin family, is however very challenging in terms of its extraction and stability under normal conditions. This project explores the extraction, stability, and application of phycoerythrin in cosmetic formulations, emphasizing its eco-friendly and sustainable characteristics. The findings suggest that phycoerythrin could serve as a promising and innovative natural pigment in cosmetic products, aligning with the increasing demand for sustainable and plant-derived ingredients in the beauty industry. These brilliantly colored pigments have several industrial and biotechnological applications in food, cosmetic, diagnostic, and pharmaceutical industries due to their nontoxic, non carcinogenic nature. The findings suggest that incorporating algal pigments into lipstick formulations not only enhances color options but also aligns with the growing consumer preference for sustainable and natural ingredients in cosmetics.

Keywords: Phycoerythrin, Cosmetic formulation, Non carcinogenic, Phycobilin, Vibrant red, Sustainable.

MEDICINAL PLANTS AND TRADITIONAL USES IN THIRUVARUR DISTRICT, TAMIL NADU

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Medicinal plants are crucial for accessible healthcare in rural areas. This study documented plants used medicinally by rural communities in the Thiruvarur District. Ethnobotanical data were gathered through semi-structured interviews, literature review, and descriptive statistical analysis. identified 20 plant species and 14 families from six villages across Three talukas in Thiruvarur District (Mannargudi, Koothanallur, Needamangalam). Plants were collected with informants, and a herbarium was created. Data from 20 plant species from 14 families were used in traditional remedies. Commonly represented families included *Solanaceae*, *Euphorbiaceae*, *Caesalpiniaceae*, *Lamiaceae*, *Amaranthaceae*, *Fabaceae*, *Asteraceae*, *Apocynaceae*, *Acanthaceae*, *Capparaceae*, *Convolvulaceae*, *Asclepiadaceae*, *Piperaceae*, and *Zingiberaceae*. Stems, roots, and leaves were the most frequently used plant parts, primarily prepared as aqueous decoctions. These communities have a long history of using medicinal plants for various ailments, employing methods such as grinding, juice extraction, and herbal mixtures.

Keywords: Traditional, Medicinal plants, Ailment, Rural Communities, Thiruvarur.

HARNESSING NATIVE CURD MICROBIOTA FOR SUSTAINABLE CONTROL OF POSTHARVEST BANANA DISEASES

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Bananas (*Musa* spp.) are one of the most important and widely consumed fruits globally, serving as a staple food and a vital source of income for millions of people, particularly in tropical and subtropical regions. However, their post-harvest shelf life is severely limited due to susceptibility to fungal diseases, with crown rot being one of the most prevalent and economically damaging. Crown rot is primarily caused by the fungal pathogens *Lasiodiplodia theobromae* and *Colletotrichum musae*, which infect the crown tissue and spread rapidly during storage, ripening, and transportation. These infections result in significant post-harvest losses, reduced fruit quality, and decreased market value. To combat these issues, chemical fungicides have traditionally been employed but the use of synthetic fungicides raises serious concerns due to the development of pathogen resistance, potential residues on food products, and adverse impacts on human health and the environment. In this context, the present study explored the use of beneficial microorganisms, specifically bacteria isolated from homemade curd, as a potential biocontrol strategy against crown rot pathogens. A total of 31 bacterial strains were isolated from various homemade curd samples and screened for their antifungal activity using *in vitro* assays. Among the isolates, five strains designated as N-2, N-5-1, N-6-1, C-2-2, and C-4-1 exhibited strong inhibitory effects against the crown rot pathogens. Notably, isolate N-2 suppressed the mycelial growth of *L. theobromae* by 55.7%, while isolate C-4-1 inhibited *C. musae* by 63.57%. These findings indicate a significant antagonistic potential that could be harnessed for post-harvest disease management in bananas. Further biochemical characterization and 16S rRNA gene sequencing revealed that the most effective isolates belonged to the genus *Bacillus*, known for its broad-spectrum antimicrobial properties and environmental resilience. The identified species included *Bacillus subtilis*, *Bacillus velezensis*, *Bacillus siamensis*, and *Bacillus subtilis* subsp. *inaquosorum*. Therefore, the results of this study reveal the potential of curd-derived *Bacillus* spp. as natural and sustainable biocontrol agents for managing post-harvest fungal diseases in bananas.

Keywords: Bananas, Fungal diseases, Homemade curd, Beneficial microorganisms

ENZYME ACTIVITY IN MARINE SEDIMENTS: A VITAL COMPONENT OF COASTAL ECOSYSTEM HEALTH

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Marine sediments harbor diverse microbial communities that drive biogeochemical processes through enzyme-mediated reactions. Enzyme activity plays a crucial role in marine soil biodiversity, influencing carbon sequestration, nutrient cycling, and pollutant degradation. This review highlights the importance of enzyme activity in marine sediments, including its role in organic matter decomposition, nutrient regeneration, and benthic-pelagic coupling. We discuss the factors influencing enzyme activity in marine sediments, such as salinity, temperature, and redox conditions, and explore the potential applications of enzyme activity measurements in monitoring coastal ecosystem health and resilience. Understanding enzyme activity in marine sediments can inform strategies to mitigate the impacts of climate change, pollution, and coastal development on these critical ecosystems.

Keywords: Marine sediments, enzyme activity, coastal ecosystems, biogeochemical processes.

ALOE VERA GEL IN THE TREATMENT OF ACNE LESIONS

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Acne vulgaris is a chronic inflammatory skin condition common in adolescents and young adults, caused by excess sebum, follicle blockage, bacterial growth, and inflammation. Conventional treatments like antibiotics and retinoids are effective but often lead to side effects such as dryness, irritation, and resistance. Aloe vera, rich in polysaccharides, vitamins, and antioxidants, offers anti-inflammatory, antibacterial, and wound-healing benefits. In acne treatment, it reduces redness, swelling, and bacterial growth while keeping skin hydrated, making it a safe and cost-effective alternative or complementary therapy. Beyond its therapeutic role, Aloe vera is widely accessible, inexpensive, and culturally accepted in traditional medicine, which adds to its appeal as a natural skincare remedy. Its gentle action makes it suitable for long-term use and for individuals with sensitive skin, unlike harsher synthetic drugs. Still, clinical research is essential to standardize dosage, ensure consistent quality, and evaluate its effectiveness across different acne severities.

Keywords: Acne vulgaris, anti-inflammatory, sebum production, *Cutibacterium acnes*

ASSESSMENT OF ADSORPTION AND CORROSION INHIBITION EFFICIENCY OF *PHYLA NODIFLORA* LEAF EXTRACT ON MILD STEEL IN HYDROCHLORIC ACID MEDIUM

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Natural plant extracts are among the most effective inhibitors of metallic corrosion due to their availability, eco-friendliness, biodegradability, renewability, and non-toxicity. The present study investigates the corrosion inhibition performance of *Phyla nodiflora* leaf extract (PNLE) on mild steel in hydrochloric acid medium. Electrochemical impedance spectroscopy (EIS) revealed that the equivalent circuit with two time constants, representing charge transfer and film formation, provided the best fit to the data. At higher PNLE concentrations, a maximum inhibition efficiency (I.E.%) of 96.5% was achieved¹. Increasing PNLE concentration resulted in higher charge transfer resistance (R_{ct}) and lower double-layer capacitance (C_{dl}), indicating the development of a protective film on the steel surface. Polarization studies confirmed the mixed-type inhibition behaviour of PNLE. Adsorption of the phytochemical constituents was found to follow the Langmuir adsorption isotherm. Fourier-transform infrared (FT-IR) analysis identified electron-rich functional groups responsible for adsorption and inhibition, while scanning electron microscopy (SEM) images provided morphological evidence of surface protection². Overall, PNLE exhibits excellent anticorrosion potential for mild steel in acidic environments.

Keywords: Corrosion, *Phyla nodiflora*, Adsorption, Impedance, Polarization, SEM.

PREBIOTIC CYANOBACTERIAL EXOPOLYSACCHARIDES: A NUTRACEUTICAL APPROACH FOR AMELIORATING DSS-INDUCED ULCERATIVE COLITIS

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Inflammatory mediators are a key component in inflammatory bowel disease aetiology. To sustain both native and adaptive immunity in the gut, pro- and anti-inflammatory cytokines must express themselves in balance. In the present study, exopolysaccharide from *Leptolyngbya* sp. MKU-05 was evaluated as a treatment agent against DSS-induced colitis in a mouse model. This implies that EPS is a potential alternative to antibiotics for treating intestinal inflammation. Haematological parameters have been enhanced in the group treated with DSS+EPS. Myeloperoxidase activity was enhanced in the DSS induced EPS treated group and total immunoglobulin also increased in the DSS induced EPS treated group compared to the control group. In addition, the quantitative PCR (q-PCR) demonstrates that EPS treated group increased the expression of anti-inflammatory cytokine gene (*IL10*), and decreased the expression of a pro-inflammatory gene (*TNF α* , *IL1 β*) compared to control group. Furthermore, DSS induced EPS treated group altered gut microbiota composition and diversity. Histopathology results showed the highest number of intraepithelial cells observed in the proximal sections of intestinal tissue in the DSS induced EPS treated group showed significant differences in comparison with commercial drug (Mesalazine) and no treatment group. This study hints at the use of bacterial exopolysaccharide as a potential nutraceutical or treatment agent in healing ulcers of the mucosa.

Keywords: DSS, ulcerative colitis, Exopolysaccharide, Inflammation, Intestinal epithelial cell.

NUTRIENT AND MICROBIAL DYNAMICS OF VERMIWASH AND ITS ROLE IN THE CULTIVATION OF TOMATO (*LYCOPERSICON ESCULENTUM* L.)

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Organic waste recycling through vermicomposting provides an eco-biotechnological approach to generate value-added biofertilizers via the activity of earthworms, primarily *Eisenia fetida*. The present study focused on the preparation and evaluation of vermiwash, a liquid filtrate produced during vermicomposting, using domestic vegetable waste as the sole feedstock. Fresh vegetable residues were subjected to vermicomposting under controlled moisture and aeration for 45–60 days. Vermiwash was periodically collected through a bottom-drainage system and analyzed for its physico-chemical and biological properties. The vermiwash exhibited a slightly alkaline pH (7.2), moderate electrical conductivity (2.1 dS m⁻¹), and was enriched with available nitrogen (145 mg L⁻¹), phosphorus (78 mg L⁻¹), potassium (210 mg L⁻¹), and humic substances (3,200 mg L⁻¹). Microbial profiling revealed the presence of beneficial genera, including *Bacillus*, *Pseudomonas*, *Azotobacter*, and *Trichoderma*, indicating its bioactive potential for nutrient mineralization and plant growth promotion. Additionally, growth-regulating substances such as indole acetic acid (IAA) and gibberellins were detected in trace amounts, suggesting further plant stimulatory effects. Pot culture experiments with tomato (*Lycopersicon esculentum* L.) demonstrated that foliar application of vermiwash (5–10%) significantly enhanced seed germination, plant height, leaf chlorophyll index, and biomass accumulation compared to untreated controls. The findings confirm vermiwash as a low-cost, eco-friendly, and scalable biofertilizer derived from vegetable waste recycling. Its dual enrichment in nutrients and microbial biostimulants makes it a promising input for sustainable tomato cultivation and climate-smart agriculture, while simultaneously reducing domestic organic waste burdens.

Keywords: Vermiwash, *Eisenia fetida*, *Lycopersicon esculentum*, Biofertilizer, Vermicompost.

PHYTOCHEMICAL AND ETHNOBOTANICAL EXPLORATION OF LICHEN NATURAL PRODUCTS FROM KODAIKANAL

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The Kodaikanal Hills, part of the biodiverse-rich Western Ghats in Tamil Nadu, India, harbor a remarkable variety of lichen species with significant medicinal potential. These symbiotic organisms, formed by the association of fungi and algae or cyanobacteria, have long been utilized in traditional medicine for treating various ailments including wounds, respiratory infections, skin disorders, and inflammation. This study highlights the occurrence and ethnopharmacological relevance of several medicinally important lichens such as *Usnea*, *Parmotrema*, *Ramalina*, *Everniastrum*, and *Heterodermia* species in the Kodaikanal region. The therapeutic properties of these lichens are attributed to secondary metabolites like usnic acid, atranorin, and lecanoric acid, which exhibit potent antimicrobial, antioxidant, and anti-inflammatory activities. However, due to ecological sensitivity and overharvesting, sustainable management and conservation of these bioresources are essential. This research emphasizes the need for further pharmacological validation and bioprospecting to explore the potential of lichens as alternative sources of natural drugs.

Keywords: Biodiversity, Lichens, Secondary metabolites, Bioprospection and Pharmacology

QUANTUM DOT NANO CARRIERS FOR THERAPEUTIC APPLICATIONS

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Quantum dots (QDs) have emerged as multifunctional nanocarriers due to their optical properties, high surface area, and ease of functionalization. Conventional QDs, however, are often limited by toxicity and environmental concerns. These QD nanocarriers, synthesized using green methods such as plant extracts, microbial systems, or biopolymer stabilization, provide a sustainable and biocompatible alternative. Their eco-friendly design reduces toxicity while retaining the capacity for drug loading, targeted delivery, and theranostic applications. In medicine, these nanocarriers offer significant benefits: they enable site-specific delivery of anticancer drugs, minimizing systemic side effects; improve bioavailability of poorly soluble drugs. Additionally, their intrinsic fluorescence allows real-time imaging and monitoring of therapeutic response, supporting personalized treatment strategies. Eco-engineered QDs also hold potential in antimicrobial therapy, gene delivery, and regenerative medicine, where controlled release and low toxicity are critical. Thus, eco-engineered quantum dot nanocarriers represent a sustainable advancement in nanomedicine, merging therapeutic efficacy with environmental responsibility.

Keywords: Quantum dots, Eco-engineering, Nanocarriers, Green synthesis, Theranostics, Drug delivery, Anticancer therapy, Biomedical applications

BIOGENIC ZINC NANOPARTICLES FROM *ULVA COMPRESSA*: A NATURAL SHIELD AGAINST OXIDATIVE STRESS AND PATHOGENS

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The accelerating pace of medical innovation is increasingly shaped by sustainable nanotechnology. In this study, a green and efficient biosynthetic approach was employed to fabricate zinc oxide nanoparticles (ZnO NPs) using *Ulva compressa*, a marine green macroalga, serving as both a natural reducing and capping agent. This eco-friendly method enabled rapid and safe nanoparticle synthesis, harnessing marine bioresources for potential biomedical applications at the nanoscale. Structural and functional confirmation of ZnO NPs was achieved through UV-Vis and FTIR spectroscopy, while SEM coupled with EDAX revealed diverse morphologies ranging from 10 to 120 nm. The bio-synthesized nanoparticles demonstrated notable antioxidant and antibacterial activities, with enhanced efficacy against a broad spectrum of microbial strains. Their strong free radical scavenging ability underscores their antioxidant potential, suggesting a promising role in cellular defense mechanisms. Overall, this study highlights the therapeutic promise of marine algae-mediated ZnO nanoparticles and their relevance in future eco-conscious nanomedicine.

Keywords: *Ulva compressa*, Zinc oxide nanoparticles, Green synthesis, antioxidant activity and antibacterial potential.

ESTIMATION OF VARIOUS POLLUTANTS IN LIQUID AND SOLID MATRIX-A STUDY OF APPROACH

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This study focusses on integrated approaches in environmental engineering, combining both physio-chemical and biological techniques to address challenges in water treatment and organic waste management. A major part of the work involved determining the point of zero charge (PZC) of adsorbent materials using the salt drift method, which is crucial in understanding the surface charge behaviour of materials used in adsorption and ion exchange processes. Phosphate concentration in aqueous solutions was estimated using the stannous chloride colorimetric method, which enabled the quantification of phosphates through absorbance measurement. To study heavy metal removal, manganese concentration was analysed after treatment with both cation and hybrid ion exchangers. The hybrid resin was synthesized by combining inorganic and organic components to enhance ion-exchange efficiency and stability. In the biological segment of the study, protein extraction was performed on Black Soldier Fly (BSF) larvae using alkaline solubilization followed by acid precipitation. The extracted protein was quantified using Lowry's method, which is a widely accepted biochemical technique for protein estimation. Furthermore, the safety of BSF-derived frass was evaluated through pathogen detection using serial dilution and simple staining techniques to identify the presence of microorganisms. These experiments collectively provided hands-on experience in environmental monitoring, pollution control, and resource recovery. The interdisciplinary nature of the work bridged chemical and biological environmental methods, reinforcing the importance of sustainable practices in engineering applications.

Key words: Point of zero charge, Phosphate concentration, cation and hybrid ion exchangers, Black Soldier Fly, sustainability.

IN SILICO EVALUATION OF ANTIFUNGAL COMPOUNDS FROM NATURAL SOURCES AS PROMISING CANDIDATES FOR COLON CANCER-RELATED MOLECULAR TARGETS

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Colorectal cancer is one of the most common and leading causes of cancer-related mortality worldwide, highlighting the importance of effective therapies. Chemotherapy drugs are generally restricted due to several complications, as well as the development of resistance and relapse. This study evaluates the interaction between natural antifungal compounds and three key receptors implicated in colorectal cancer progression: Matrix Metalloproteinase-2 (MMP-2), Poly [ADP-ribose] polymerase-1 (PARP) and apoptosis regulator Bcl-2 using molecular docking analysis. The results reveal a stronger binding affinity between the chosen molecular targets and antifungal compounds through significant hydrogen and hydrophobic interactions. Pharmacokinetic evaluations, based on Lipinski's rule of five, demonstrate that compounds emodin, paclitaxel, hypericin and pravastatin adheres to essential drug-likeness parameters, suggesting favorable bioavailability. In spite of their low solubility, the binding stability and pharmacokinetic profile suggest their potential as an effective therapeutic agents for colorectal cancer, particularly when combined with drug delivery systems that enrich solubility. This work emphasizes the importance of receptor-specific ligand interactions in drug design and highlights the need for *in vitro* anticancer effects against colorectal cancer cells.

Keywords: Colorectal cancer, Molecular docking, PARP, BCl-2, Pharmacokinetics

ECO-FRIENDLY BIOREMEDIATION OF SEWAGE: ROLE OF BENEFICIAL MICROBES IN POLLUTANT REDUCTION AND FLOCCULATION

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Sewage pollution is a critical environmental concern, contributing to high organic loads, nutrient enrichment, and the release of foul odors and toxic byproducts. Bioremediation using beneficial microbes provides a sustainable and eco-friendly alternative to conventional treatment methods. In this study, a microbial consortium consisting of *Bacillus* sp, *Pseudomonas* sp, and lactic acid bacteria was applied to sewage samples to evaluate its remediation potential. After 15 days of treatment, substantial improvements in water quality were observed, with biochemical oxygen demand (BOD) reduced by 68% and chemical oxygen demand (COD) reduced by 72%. In addition, visible flocculation and sedimentation of suspended solids led to a 64% reduction in turbidity and total suspended solids (TSS). The treatment also eliminated the characteristic blackening and foul odor of untreated sewage, while dissolved oxygen (DO) levels increased by 55%, indicating enhanced microbial activity and improved water quality. These results demonstrate that beneficial microbial consortia can effectively degrade organic pollutants, reduce odor and blackening, and restore sewage water quality, offering a cost-effective and environmentally sustainable solution for wastewater management.

Keywords: Sewage pollution, Bioremediation, Microbial consortium, Water quality, Wastewater management

EXTRACTION AND PROFILING OF MICROORGANISM DERIVED METABOLITES FROM EARTHWORM

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Earthworm gut microbiota produces diverse metabolites that play crucial roles in soil fertility, ecological balance, and organism's health. The extraction and profiling of these metabolites through chromatographic and spectroscopic techniques reveal compounds such as short-chain fatty acids, organic acids, enzymes, and antimicrobial agents with strong diagnostic potential. Changes in metabolite profiles often reflect shifts in gut microbiota composition, which can be linked to physiological stress indicators and incorporated into a comprehensive toxicological profile. To achieve high-resolution insights into microbial diversity and functional potential, **Next-Generation Sequencing (NGS)** is employed alongside metabolite analysis. NGS enables precise identification of microbial taxa, functional genes, and their dynamic responses to environmental stressors, thereby connecting microbial shifts with metabolite disruptions. The integration of NGS-based microbial profiling with metabolomic data enhances the ability to use metabolites as biomarkers for health diagnosis. This combined approach contributes significantly to ecological research, sustainable agriculture, and vermin biotechnology applications.

Keywords: Earthworm, Gut microbiota, Metabolites, NGS, Biomarkers, Health diagnosis, Toxicological profile,

ASSESSMENT OF MICRONUTRIENTS IN CHILDREN WITH MALARIA INFECTION

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Malaria remains a major public health concern in endemic regions, particularly among children under five years of age, where it contributes significantly to morbidity and mortality. Beyond the direct impact of parasitemia, malaria infection is associated with alterations in nutritional status, especially in the metabolism and bioavailability of essential micronutrients. This study assessed the levels of key micronutrients including iron, zinc, vitamin A, and copper in children diagnosed with malaria infection compared with apparently healthy controls. A cross-sectional design was employed, and blood samples were analyzed using standard biochemical methods. Results indicated that children with malaria had significantly lower serum concentrations of iron, zinc, and vitamin A, while copper levels were elevated relative to controls. These alterations may be attributed to malaria-induced inflammation, oxidative stress, and impaired nutrient absorption, which can further compromise immune function and recovery. The findings highlight the bidirectional relationship between malaria and malnutrition, suggesting that micronutrient deficiencies may exacerbate disease severity while infection itself worsens nutritional imbalance. Integrating micronutrient assessment and supplementation into malaria control programs could play a vital role in improving clinical outcomes and reducing the disease burden among children in endemic areas.

Keywords: Malaria, Children, Micronutrients, Iron, Zinc, Vitamin A, Nutritional Status

SEQUENTIAL DEGRADATION OF CONGO RED USING SELENIUM-DOPED COPPER OXIDE NANOCOMPOSITES AND FUNGAL CONSORTIA

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The release of Congo Red (CR) by many sectors poses a threat to human health by compromising the availability of clean drinking water and undermining environmental safety. In recent decades, azo dyes have gained widespread use in the textile industry across various countries, owing to their chemical stability and diverse color range. Azo dyes have highly recalcitrance, toxic, mutagenic, and carcinogenic properties. Their release into the environment poses a significant threat to living organisms. This study aims to achieve the complete degradation of Congo red through a two-stage approach. Initially, Se-CuO nanocomposites will be employed for the sequential degradation of the dye. In the second phase, a fungal consortium will be applied to further break down any remaining traces of Congo red, ensuring complete degradation. The pure CuO NPs and Se-CuO NCs were synthesized with the help of a plant-mediated bottom-up fabrication approach using *Hibiscus rosa-sinensis* aqueous flower extracts. Ultraviolet-visible (UV) spectroscopy of pure CuO and Se-CuO NCs shows a peak in the range of 260-334nm. Fourier Transform Infrared spectroscopy (FT-IR) reveals the presence of CuO at the peak of 522 cm^{-1} and the zeta potential of 3% Se-CuO NCs reveals the stability of NPs at the charge of -19.2 mV. The amorphous crystalline structure of 3% Se-CuO NCs was characterized by X-ray diffraction (XRD). Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM) studies reveal the size of NCs in the range of 20-50 nm. Selected Area Diffraction (SEAD) reveals the electron diffraction pattern of 3% Se-CuO NCs. In the first phase, the photocatalytic degradation of Congo red (100 ppm) was performed using 3% Se-CuO nanocomposites, resulting in a degradation of up to 74% at 37°C. In the second phase, the fungal consortium-AM, consisting of *Aspergillus fumigatus* and *Mucor indicus*, was applied, leading to an impressive 99% degradation of Congo red. Further, FT-IR, GC-MS and HPLC analysis of degraded metabolites confirm the complete mineralization of Congo red when compared to the control.

Keywords: Congo red, Se-CuO NCs, *Aspergillus fumigatus*, *Mucor indicus*, Mineralization

DUAL FUNCTION OF RHIZOSPHERE-ASSOCIATED ACTINOBACTERIA: GROWTH PROMOTION AND DISEASE SUPPRESSION IN CHILLI

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Chilli (*Capsicum* spp.), a globally important high-value crop, suffers major yield losses due to fruit rot, mainly caused by *Colletotrichum capsici*, *C. gloeosporioides*, *C. truncatum*, and *C. acutatum*. The disease threatens production at field, transit, and storage stages, causing 10–80% yield reduction and severe post-harvest deterioration. Reliance on synthetic fungicides is increasingly unsustainable due to resistance, environmental risks, and food safety concerns, highlighting the need for eco-friendly alternatives. Actinobacteria, with their metabolic versatility, antimicrobial activity, and plant growth-promoting traits, offer a promising solution for sustainable crop production and disease management. This study focused on the isolation and characterization of actinobacteria from chilli (*Capsicum annuum* L.) plants, with special emphasis on their plant growth-promoting (PGP) and antifungal traits. In the present study, 52 actinobacterial isolates were evaluated for their PGP and antifungal properties. Among them, *Streptomyces tuius* AR26 exhibited superior PGP attributes, including phosphate and zinc solubilization, siderophore and ammonia, and hydrolytic enzyme (cellulase, chitinase) production. It also enhanced seed germination, vigour index, root–shoot growth and conferred significant tolerance under salt-stressed conditions. Antifungal assays revealed strong inhibition of *Colletotrichum truncatum*, marked by hyphal distortion and aggregation. GC–MS profiling of *S. tuius* AR26 during interaction with *C. truncatum* identified 24 antifungal biomolecules, including 13 unique compounds absent in axenic cultures. Molecular docking confirmed that metabolites such as octadecanamide, 17a-Methyl-3β-methoxy-17a-aza-d-homoandrost-5-ene-17-one, and benzeneethanamine interacted strongly with key protein targets (β-tubulin, histone H3, GAPDH, cellulase) of *C. truncatum*. SwissADME analyses validated their drug-likeness and favourable pharmacokinetic properties. These findings highlight the dual role of *S. tuius* AR26 as both a PGP bio-inoculant and a potent

biocontrol agent against anthracnose. Its multifaceted functionality underscores the potential of actinobacteria as sustainable alternatives to synthetic fungicides, aligning with Integrated Nutrient and Pest Management strategies for resilient chilli production systems.

Keywords: Chilli, *Streptomyces tuirus* AR26, Plant growth-promoting, Molecular docking

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CARBON FIXATION - EXPLORING THE SEQUESTRATION POTENTIAL OF MICROALGAE

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Rising atmospheric carbon dioxide (CO₂) levels are a major driver of climate change, there is a need for sustainable approaches in carbon capture and mitigation. Microalgae, with their rapid growth rates with a high photosynthetic efficiency, and their ability to fix inorganic carbon into biomass are biological solution for carbon sequestration. This study focuses on evaluating the carbon sequestration potential of locally isolated micro algal strains through cultivation under controlled conditions. Various Parameters such as growth rate, chlorophyll content, and CO₂ uptake efficiency are measured to determine carbon fixation capacity. The accumulated biomass is further analysed for its biochemical composition like lipids, proteins, and carbohydrates, which is a great source for biofuel, feed, and fertilizer applications. In addition to it, micro algal cultivation offers opportunities for wastewater treatment and nutrient recycling, aligning with circular bio economy principles. By exploring the dual benefits of carbon capture and biomass valorisation, this research underscores the role of microalgae as eco-friendly and cost-effective agents in sustainable climate mitigation strategies.

Keywords: Microalgae, Carbon sequestration, CO₂ fixation, Biomass, Climate change mitigation, Sustainable biotechnology

STUDY OF PLANT GROWTH HORMONES FROM *VIGNA MUNGO* (L.) RHIZOSPHERE SOIL IN TRICHY FOR SUSTAINABLE CROP MANAGEMENT

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Plant growth hormones present in the rhizospheric soil play a vital role in enhancing crop productivity and soil health. This study focuses on the isolation and identification of plant growth-promoting substances from the rhizosphere of blackgram (*Vigna mungo*) cultivated in the Trichy zone. Soil samples were collected from selected blackgram fields and subjected to extraction processes to isolate phytohormones such as indole-3-acetic acid (IAA), gibberellins, and cytokinins. Qualitative and quantitative analyses were performed using chromatographic and spectrophotometric techniques to confirm the presence and concentration of these hormones. The results indicated a significant presence of IAA and other growth regulators that contribute to root development, nutrient uptake, and stress tolerance in blackgram plants. The study highlights the potential of rhizospheric microbes and soil interactions in promoting sustainable agriculture and improving crop yields in the Trichy region.

Keywords: Rhizospheric soil, Blackgram (*Vigna mungo*), Indole-3-acetic acid (IAA), Gibberellins.

ISOLATION OF BACTERIA FROM SOIL CAPABLE OF DEGRADING PLASTICS OR HYDROCARBONS.

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The increasing accumulation of plastics and hydrocarbon pollutants in the environment poses a significant threat to ecosystems and human health. Bioremediation using microorganisms offer a promising, eco-friendly solution to mitigate this issue. This study focused on the isolation and Characterization of soil bacteria with the potential to degrade plastics (such as polyethylene) and Hydrocarbons (like diesel or motor oil). Soil samples were collected from polluted sites, including Landfill areas, petrol stations, and industrial zones. Enrichment cultures were prepared using Plastic films or hydrocarbons as the sole carbon source. Several bacterial strains showing growth on these substrates were isolated and further screened for degradation capability using weight Loss analysis, clear zone formation, and GC-MS where applicable. Morphological and Biochemical characterization was performed, followed by molecular identification through 16S rRNA gene sequencing. The most efficient isolates belonged to genera such as *Pseudomonas*, *Bacillus*, and *Rhodococcus*, known for their metabolic versatility. These findings suggest the Potential application of these indigenous bacteria in bioremediation strategies for plastic and Hydrocarbon-contaminated environments.

Keywords: Bioremediation, Plastic films, Microorganisms, Eco-friendly solution

FUNCTIONAL ASSESSMENT OF LACTIC ACID BACTERIA WITH PROBIOTIC PROPERTIES FROM COCONUT FLOWER SAP

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The isolation and characterization of LAB from different traditional fermented foods and products have gained research interest in recent years. Probiotic bacteria were isolated from different traditional fermented foods as there are several such foods that are not well explored for their probiotic activities. Hence, the present study was conducted to find the potential of lactic acid bacteria (LAB) as probiotics that were isolated from the sap extract of the coconut palm flower. The collected sample is transported in ice box and are kept at 4°C throughout the experiment period. The pH was analyzed and is found to be 6.5. Isolation of LAB strain from coconut flower sap was carried out and are identified by observing their colony morphology, physiological as well as biochemical characterization and the isolated strain was named as SHC1. The isolated strain is found to be gram positive, nonmotile and catalase negative. The effective growth of the isolates at pH 6.5 on MRS agar plates in anaerobic conditions further confirmed their identification as *Lactobacillus* spp. The results of acid tolerance test revealed that the isolated LAB Strain is tolerant to the range of pHs and grow well in acidic pH. *Lactobacillus* spp. isolated in this study was resistant to bile salt and the isolates survive and grow at different bile salt concentration. In the present study the antibiotic susceptibility test shows that the LAB isolates are resistant to some of the antibiotics tested. The isolate is resistant to Vancomycin, Streptomycin, Kanamycin. The potential isolate showing eminent probiotic activity was identified by 16s rDNA sequencing and from BLAST analysis.

Key Words: Probiotic, Lactic acid bacteria, Coconut flower sap.

FORMULATION AND EVALUATION OF ANTI-ACNE CREAM USING *MORINGA OLEIFERA* LEAF EXTRACT

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There are an increasing number of studies on the cosmeceutical properties of medicinal plants growing in various climatic zones. The formulation of phenolic rich plant extracts into cosmetic Cream products can maximize the commercial value of such products. Most of the herbs used In Nepal for cosmetic purposes are locally available Ayurvedic herbs. The antioxidant property of the ethanoic extracts of *Moringa oleifera* L. Leaves collected from Rupandehi and Makawanpur districts respectively were determined by 2, 2-diphenyl-1-picrylhydrazyl (DPPH) Scavenging activity. Total phenolic and total tannin content was determined by Foline Ciocalteu Reagent. Total phenolic content was found from 35.51 and 42.89 mg/100 g Gallic acid in the Makawanpur and Rupandehi districts. Overall, findings revealed that there were slight differences in antioxidant properties between the two samples. The cream formulated from the Makawanpur plant sample had considerable physiochemical parameters within the range of Acceptance. These findings provide strong evidence for further development of commercial creams with antioxidant properties

Keywords: Medicinal plants, Cream products, *Moringa oleifera*, Antioxidant properties

BIOREMEDIATION OF TEXTILE POLLUTANTS BY RHIZOBIUM: A STUDY ON NOYYAL RIVER

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The present study evaluates the biodegradation potential of *Rhizobium sp.* PS1 for industrial wastewater management and sustainable agriculture in the textile hub of Tirupur, Tamil Nadu, where the Noyyal River is severely impacted by dye effluents. Textile wastewater containing the synthetic azo dye Reactive Red 198 was treated under controlled laboratory conditions. Decolorization efficiency, assessed spectrophotometrically at 540 nm, revealed 78–85% dye removal within 72 hours at pH 7.0 and 30 ± 2 °C, indicating strong adaptability of *Rhizobium sp.* PS1 to effluent conditions. Gas chromatography–mass spectrometry (GC–MS) confirmed the breakdown of complex dye molecules into less toxic intermediates. Furthermore, pot culture experiments showed enhanced seed germination and a 22% increase in plant biomass in legumes inoculated with *Rhizobium sp.* PS1 compared to controls. These findings highlight the dual role of *Rhizobium sp.* PS1 in pollutant degradation and plant growth promotion, underscoring its potential as a sustainable bioagent for textile wastewater bioremediation and eco-friendly agricultural practices in the Noyyal River basin.

Keywords: *Rhizobium spp.* PS1, Reactive Red 198, Biodegradation, Decolorization, GC–MS, Plant growth promotion, Sustainable agriculture

SYNERGISTIC ANTIFUNGAL ACTIVITY OF TULSI (OCIMUM SANCTUM) WITH HERBAL EXTRACTS AGAINST MALASSEZIA SPP.

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Dandruff is a chronic scalp disorder characterized by itching, flaking, irritation, and hair loss, predominantly caused by the lipophilic yeast *Malassezia* spp. Conventional antifungal agents, such as ketoconazole, are widely used but may be associated with side effects and recurrence, leading to growing interest in herbal alternatives. Tulsi (*Ocimum sanctum*), a medicinal plant widely used in Ayurveda, has demonstrated notable antifungal and scalp-protective properties. Tulsi extract supports blood circulation, reduces scalp irritation, and nourishes hair roots, thereby alleviating dandruff symptoms and preventing fungal proliferation. Studies indicate that tulsi leaves exert mild antifungal activity against *Malassezia* when applied individually, but their efficacy is markedly enhanced in synergistic combinations with other herbs such as curry leaves, fenugreek, and aloe Vera. These combinations have shown significant inhibitory effects on *Malassezia* growth, validating the traditional use of tulsi in anti-dandruff formulations. Further bioassay-guided studies are recommended to isolate tulsi's active antifungal constituents and evaluate its pharmacological mechanisms, with the goal of developing optimized herbal shampoos or oils for effective dandruff management.

Keywords: Tulsi, *Ocimum sanctum*, Dandruff, *Malassezia*, Antifungal activity, Herbal remedy

PROFILING THE NUTRITIONAL PARAMETERS AND METAGENOME OF FERMENTED SOUR RICE (PAZHAYASADHAM) IN DIFFERENT RICE VARIETIES

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Fermentation of rice (well-known as Pazhaya sadham) is known to enrich functional macro and micronutrients, phytochemicals, prebiotics and diversified beneficial microflora, including wild probiotic strains. Thus, it is well known to possess therapeutic potential. It is also reported to improve gut health and overall wellness if consumed regularly which needs scientific authentication. As it is a natural fermentation, it involves numerous microflora predominated by lactic group of bacteria. Variation in rice varieties can be used for unravelling variation in microbial genetic diversity. Novel and native probiotics can further be explored from such naturally fermented rice. Thus, in this study, 4 rice varieties (Mapillai samba, White ponni, ADT 36 and CO 43) were used for preparing fermented sour rice with two different time intervals (12h and 16h). All the samples were analysed for physicochemical and nutritional parameters viz., pH, titratable acidity, carbohydrate, protein, fat, crude fibre, minerals like iron, zinc, magnesium, calcium, colour value and antioxidant activity (DPPH method). Among the selected 4 varieties for fermented sour rice (Pazhayasadham) Mapillai samba is found to be the best, followed by White ponni, ADT 36 and CO 43 based on sensory parameters, physicochemical (pH, TA, colour value), nutritional (CHO, protein, fat, fibre, minerals) and functional parameters (antioxidant activity). By metagenome analysis of 4 fermented sour rice samples, it was known that all the samples were highly predominated by *Firmicutes*, *Bacteroides*, *Proteobacteria*, and *Actinobacteria*. At genus level, a significant abundance of *Lactococcus*, *Bacillus*, *Leuconostoc*, *Weissella*, *Parabacterioidetes*, *Comamonas*, *Idiomarina* were found. Hence, it is confirmed that fermented sour rice is rich in diversified probiotic strains.

Keywords: Fermented sour rice, rice varieties, nutritional value, metagenome, probiotics

BIOACTIVE COMPOUND-PRODUCING MICROORGANISMS AND SCREENING TECHNIQUES: FUTURE TRENDS IN HEALTH AND AGRICULTURE

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Microorganisms are a rich and versatile source of bioactive compounds with vast applications in health and agriculture. These natural products include antibiotics, antifungals, immunosuppressant, bio pesticides, and plant growth promoters, which are crucial for developing sustainable and eco-friendly solutions. Bioactive compound-producing microorganisms can be isolated from diverse environments such as soil, rhizosphere, and compost, decaying organic matter, marine habitats, and plant tissues (endophytes). Key microbial producers include bacteria such as *Streptomyces spp.*, *Bacillus subtilis*, *B. amyloliquefaciens*, *Pseudomonas aeruginosa*, *P. fluorescens*, *Escherichia coli*, *Myxococcus xanthus*, *Nocardia sp.*, *Micromonospora sp.*, and *Actinomyces sp.*; fungi including *Penicillium chrysogenum*, *Aspergillus niger*, *A. flavus*, *Trichoderma harzianum*, *Fusarium oxysporum*, *Cladosporium spp.*, *Taxomyces andreanae*, *Beauveria bassiana*, and *Metarhizium anisopliae*; and cyanobacteria such as *Nostoc*, *Microcystis aeruginosa*, *Oscillatoria sp.*, and *Anabaena*. The identification and screening of these microorganisms using biochemical and molecular techniques are essential for discovering novel compounds with enhanced efficacy and reduced side effects. Screening techniques commonly involve primary antimicrobial assays, enzymatic activity tests, pigment production, and biochemical characterizations like catalase, oxidase, nitrate reduction, starch hydrolysis, and indole production. These tests provide insights into the metabolic pathways and potential of microorganisms to produce bioactive metabolites. Advanced methods such as genomic mining and metabolomics complement traditional screening to accelerate the discovery process. The future of bioactive compound research lies in integrating innovative screening methods with biotechnology and synthetic biology to optimize production and diversify compound libraries. In agriculture, microbial bioactives can replace synthetic pesticides and fertilizers, reducing environmental pollution and promoting plant health. In healthcare, they offer new avenues for combating antibiotic resistance and treating chronic diseases. Overall, bioactive compound-producing microorganisms are a

promising approach to address global health challenges and agricultural sustainability. Continued research and development in this field will lead to novel, effective, and environmentally friendly solutions, supporting the growing demand for natural bioproducts.

Keywords: Bioactive compounds, Microorganisms, Health applications, Agricultural sustainability, Biotechnology.

OP-115

SCREENING OF POLYETHYLENE DEGRADING MICROORGANISMS FROM GARBAGE SOIL

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Polythene waste accumulating in the environment are posing an ever-increasing ecological threat. Polythene (PE) is one of the most widely used synthetic polymers, contributing significantly to global plastic pollution due to its high resistance to degradation. The accumulation of polythene in the environment, particularly in garbage dumps and landfill sites, has raised concerns about its long-term ecological impact. Microbial degradation offers a promising eco-friendly approach for polyethylene waste management. In this study, garbage soil samples were collected from garbage soil and screened for polyethylene-degrading microorganisms. Enrichment cultures were established using polyethylene films as the sole carbon source, followed by isolation of bacterial and fungal strains capable of adhering to and colonizing the polymer Surface. The biodegradation potential of the isolates was assessed through weight reduction of polyethylene films, changes in surface morphology observed by Fourier-transform infrared spectroscopy (FTIR). Several bacterial isolates, including species of *Pseudomonas* and *Bacillus*, as well as fungal strains such as *Aspergillus* and *Penicillium*, degradation activity. The findings highlight the potential of garbage soil as reservoir of plastic-degrading microorganisms and suggest their application in bioremediation strategies for sustainable plastic. The present study focuses on the screening of polyethylene-degrading microorganisms from garbage soil, a niche environment continuously exposed to plastic waste.

Keywords: Biodegeneration, Garbage soil, Polythene,Plastics,Garbage

LIGAND BASED DRUG DESIGN FOR MULTIDRUG RESIDENT BACTERIAL PATHOGENS

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The rapid emergence of multi drug - resistant (MDR) bacterial pathogens poses a significant global health challenge, rendering conventional antibiotics increasingly ineffective. This project aims to utilize ligand - based drug design (LBDD) approaches to identify and develop novel small - molecule inhibitors that can effectively target essential bacterial enzymes and proteins involved in resistance mechanisms. In ligand - based drug design, existing active compounds against bacterial targets are analyzed to derive pharmacophore models and molecular descriptors that define the critical structural and chemical features necessary for activity. Computational techniques such as quantitative structure - activity relationship (QSAR) modeling, molecular similarity analysis, and virtual screening will be employed to predict and optimize potential drug candidates.

Keywords: MDR bacteria, Ligand-based design, Pharmacophore, QSAR, Virtual screening, Small-molecule inhibitors, Antimicrobial resistance.

PROBIOTIC FORTIFICATION WITH *LACTIPLANTIBACILLUS PLANTARUM* ENHANCES THE METABOLITE AND MINERAL PROFILE OF PEARL MILLET MICROGREENS: INSIGHTS FROM GC-MS AND ICP-MS

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Millet microgreens represent sustainable, nutrient-rich foods with growing relevance in climate-resilient diets. This study evaluated pearl millet microgreens in their normal and probioticated forms fortified with *Lactiplantibacillus plantarum* (10^9 CFU), with emphasis on metabolite and mineral composition. Gas Chromatography–Mass Spectrometry (GC-MS) of normal pearl millet microgreens identified essential amino acids (cysteine, serine, valine), organic acids (4-hydroxybutyric, 3-hydroxyvaleric), functional sugars (sorbofuranose, tagatopyranose, xylose, ribose), polyols (myo-inositol, glycerol), fatty acids (linoleic, arachidonic, stearic, myristic), vitamins (cholecalciferol), and sterols (cholesterol). Probioticated microgreens exhibited a broader and more enriched profile, including higher levels of amino acid derivatives (asparagine, threonine, glutamic acid, kynurenine), phenolic compounds (cinnamic acid derivatives, linocinnamarin), and fermentation-enhanced sugars, indicating metabolic diversification induced by probiotic interaction. Inductively Coupled Plasma–Mass Spectrometry (ICP-MS) confirmed the presence of nutritionally significant macro- and microelements such as potassium, calcium, magnesium, iron, and zinc in both forms, with improved mineral bioavailability in the probiotic-enriched samples. Comparative analysis highlighted that probiotic fortification not only increased amino acid and organic acid diversity but also enriched bioactive sugars and phenolic metabolites, thereby enhancing antioxidant and functional attributes. These findings demonstrate the synergistic potential of millet microgreens and probiotic innovation in developing next-generation functional foods. The integration of *L. plantarum* in microgreen production offers a sustainable approach to improving nutrition and supporting global health and food security.

Keywords: Pearl millet microgreens, *Lactiplantibacillus plantarum*, GC-MS, ICP-MS, functional foods, sustainability.

PROBIOTIC-FORTIFIED BEVERAGES FOR IMMUNE ENHANCEMENT

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The rising demand for functional foods has drawn significant attention to probiotic-fortified beverages as a natural strategy for enhancing immunity. Probiotics are live beneficial microorganisms that, when consumed in adequate amounts, regulate gut microbiota and stimulate host immune defences. Strains such as *Lactobacillus acidophilus*, *Lactobacillus casei*, and *Bifidobacterium bifidum* are widely recognized for their ability to promote intestinal health and improve immune responses. In this research, a functional beverage was formulated using suitable carrier media such as fruit juices, fermented cereal extracts, or dairy-based drinks, selected for their nutrient profile and consumer acceptance. The beverage was developed under controlled fermentation or direct inoculation conditions, with optimization of factors including pH adjustment, natural stabilizers, prebiotic supplementation, and cold storage to ensure probiotic viability during shelf life. The immune-enhancing potential of the formulation was evaluated through probiotic survival under simulated gastrointestinal conditions and literature-supported immune markers such as secretory IgA, cytokine modulation, and infection resistance. The ultimate goal of this research is to design a stable, palatable, and affordable probiotic-fortified beverage that can serve as an accessible preventive nutritional tool to strengthen immunity in the general population.

Keywords: Probiotics, Fortified Beverages, *Lactobacillus*, *Bifidobacterium*, Immunity, Gut Microbiota, Prebiotics

DEVELOPMENT OF A SELECTIVE MEDIUM FROM MALTED WHEAT ROOTLETS FOR MICROBIOLOGICAL SCREENING OF ENZYMATIC MICROFLORA.

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The present study reports the development of a selective culture medium formulated from sprouted, waste wheat malt rootlets, a by-product of the malting industry, to enable targeted isolation and screening of probiotic *Lactobacillus* spp. with amylase and protease enzymatic activities. The medium leverages plant-derived substrates to enhance microbial growth, selectively enriching beneficial strains while suppressing non-target species. Optimization of physicochemical parameters, including pH, carbon, and nitrogen sources, facilitated the selective enrichment process. Functional screening assays demonstrated that the medium effectively supports enzymatic activity critical to gastrointestinal health and industrial bioprocesses. Preliminary evaluations indicated a high selectivity index, underscoring the potential of this medium in probiotic strain discovery. By valorizing agro-industrial waste streams, this approach provides an eco-friendly, cost-efficient platform aligned with circular bioeconomy principles. The methodology offers scalable solutions for microbial bioprocessing, functional food development, and enzyme production, advancing sustainable biotechnology and waste-to-resource conversion strategies.

Key words: Waste Valorization, Probiotic LAB, Enzymatic Profiling, Selective Enrichment

PHYSICAL AND CHEMICAL ANALYSIS OF CRAB WASTE AND MICROBIAL PROFILING FOR BIOFERTILIZER PRODUCTION

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Crab waste from seafood processing was collected as a preliminary step for biofertilizer production. The waste was first subjected to physical analysis, which recorded color – off-white, texture – coarse, odor – mild fishy, moisture content – 65%, pH – 7.2, and electrical conductivity – 1.8 dS/m. Chemical analysis revealed nitrogen – 2.1%, phosphorus – 1.2%, potassium – 0.9%, calcium – 18%, chitin – 23%, and chitosan – 5%. Microbial profiling was conducted, identifying dominant bacterial genera including *Bacillus*, *Pseudomonas*, and *Streptomyces*, along with fungal species such as *Aspergillus* and *Trichoderma*. The microbial load was quantified, showing 3.2×10^6 CFU/g for bacteria and 1.5×10^5 CFU/g for fungi. Pretreatment of the crab waste, including size reduction, drying, and microbial inoculation, was carried out to enhance decomposition. The results provided a baseline for further biofertilizer formulation, indicating that crab waste is a promising source of nutrients and beneficial microbes for sustainable agricultural applications.

Keywords: Crab waste, biofertilizer, physical–chemical analysis, microbial load, chitin, chitosan, *Bacillus*, *Aspergillus*, sustainable agriculture

ECO-FRIENDLY DEGRADATION AND DECOLORATION OF REACTIVE DYE – A SUSTAINABLE SOLUTION FOR TEXTILE WASTEWATER TREATMENT

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The textile industry is a major global contributor to industrial effluents, with reactive dyes being one of the most widely used and environmentally persistent pollutants. These synthetic dyes are designed to resist fading, making them recalcitrant, highly stable, and difficult to degrade using conventional wastewater treatment methods. Their direct discharge into water bodies reduces light penetration, interferes with aquatic photosynthesis, alters dissolved oxygen levels, and introduces toxic, mutagenic, and carcinogenic compounds into the environment. Traditional treatment techniques such as coagulation, adsorption, and chemical oxidation are often expensive, energy-intensive, and generate large volumes of sludge or secondary contaminants. This study proposes an ecofriendly, sustainable alternative through the use of microbial systems for the degradation and decoloration of reactive dyes in textile wastewater. Selected bacterial and fungal strains were screened and optimized for dye-degrading ability under varying physicochemical parameters including pH, temperature, agitation, and dye concentration. The microbial degradation process was evaluated using UV-Vis spectrophotometry to monitor decoloration efficiency, while FTIR and HPLC analyses confirmed structural breakdown of complex dye molecules into less toxic metabolites. The research highlights the role of microbial enzymes such as laccases, azoreductases, and peroxidases in initiating dye cleavage and facilitating complete mineralization. The findings indicate that microbial bioremediation not only achieves significant decoloration but also reduces toxicity, thus enhancing the potential for safe water reuse. Compared to conventional methods, this biological approach is cost-effective, energy-efficient, and environmentally benign. By utilizing naturally occurring microorganisms, the process provides a scalable solution for the textile industry to address wastewater management challenges while aligning with principles of green technology and sustainable development. Microorganisms involved: *Bacillus subtilis*, *Pseudomonas* spp., *Kleb siella* spp., *Aspergillus* spp.

Keywords: Ecofriendly, reactive dyes, decoloration, biodegradation, textile wastewater, microbial enzymes, sustainability.

SCREENING OF SECONDARY METABOLITES AND GC-MS ANALYSIS OF SARGASSUM SPECIES

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India has a rich tradition of using plants and marine resources for treating diseases in humans and animals. However, many of these remedies lack scientific proof. This study aimed to identify important chemical compounds (secondary metabolites) in four types of seaweed called Sargassum collected from the Mandapam coast, Tamil Nadu. The seaweeds were tested using phytochemical screening and GC-MS analysis with solvents like methanol, acetone, chloroform, and water. The tests found many beneficial compounds such as tannins, steroids, alkaloids, flavonoids, and others in almost all extracts. Acetone and methanol extracts showed the highest amounts. GC-MS identified over 25 important compounds, with 8 appearing repeatedly. These results support the traditional use of these seaweeds in treating infectious diseases in the area.

Keywords: *Sargassum acinarium*, fusiforme, muticum, polycystem, GC-MS, Secondary Metabolites.

FROM OCEAN TO FEED: VALORIZATION OF PORTIERIA HORNEMANNII AS A SUSTAINABLE AQUACULTURE RESOURCE

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The global aquaculture sector faces increasing pressure to identify sustainable feed alternatives that can reduce reliance on conventional fishmeal and synthetic additives. Marine macroalgae have emerged as promising candidates due to their rich nutritional composition and bioactive properties, though many species remain underexplored. *Portieria hornemannii*, a halogenated red alga, represents one such untapped resource with significant potential for aqua feed development. In this study, dried biomass of *P. hornemannii* was evaluated for proximate composition following AOAC standard methods. The results revealed appreciable levels of protein, carbohydrates, crude fiber, lipids, and ash, highlighting its nutritional relevance. Soxhlet extraction was employed to obtain crude extracts, which were subsequently screened for phytochemicals and antioxidant activity. The presence of phenolics, flavonoids, and tannins was confirmed, while strong radical scavenging activity indicated notable functional potential. To assess biosafety and elemental composition, Inductively Coupled Plasma Mass Spectrometry (ICP–MS) was performed, confirming essential trace minerals within safe limits and the absence of harmful heavy metals. Collectively, these findings establish *P. hornemannii* as a dual-benefit resource, combining nutritional enrichment with functional bioactivity. The study contributes to the valorization of underutilized red algae as sustainable aquafeed ingredients. Future studies will focus on controlled feeding trials to validate its growth-promoting and immune-modulating effects in aquaculture species, as well as optimizing processing methods to enhance bioavailability and safety.

Keywords: *Portieria hornemannii*, Soxhlet extraction, proximate composition, phytochemicals, antioxidant activity, ICP–MS, sustainable aquaculture

CHARACTERISTICS AND DIVERSITY OF YEAST IN LOCALLY FERMENTED BATTER SOLD IN THIRUVARUR, TAMIL NADU

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Fermented batter is a cornerstone of South Indian cuisine, particularly in the preparation of staple foods such as idly and dosa. Yeast plays a crucial role in the natural fermentation process by contributing to leavening, texture development, flavor, and nutritional enhancement. In Thiruvarur district of Tamil Nadu, fermented batter is widely sold in local shops and roadside stalls, providing a unique source for studying indigenous microbial diversity. The present study investigates the characteristics and diversity of yeast in locally fermented batter collected from different sites in Thiruvarur district. Yeast isolates were obtained using selective media, and their morphology, biochemical traits, and molecular identity were examined. Results indicated the predominance of *Saccharomyces cerevisiae*, alongside non-*Saccharomyces* yeasts such as *Candida tropicalis*, *Pichia kudriavzevii*, and *Kluyveromyces marxianus*. These yeasts were found to play significant roles in aeration, acid production, and aroma formation during batter fermentation. The findings underline the microbial richness of traditional fermented foods and highlight the potential of native yeast strains for improving starter culture development, ensuring food safety, and enhancing the quality of fermented products while retaining their traditional authenticity.

Keywords: Fermented batter; *Saccharomyces cerevisiae*; *Candida tropicalis*; *Pichia* spp. *Kluyveromyces* spp.

FROM BIN TO BLOOM: A CIRCULAR ECONOMY MODEL FOR CLIMATE SMART AGRICULTURAL SUSTAINABILITY

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Modern agriculture heavily relies on chemical fertilizers to boost crop yield and meet the food demands of a growing population. While these fertilizers offer immediate benefits, their long-term impact on the environment is devastating. Continuous use of synthetic fertilizers depletes the natural fertility of the soil, reduces organic carbon content, and harms beneficial microorganisms. Furthermore, when these fertilizers are over applied, excess nutrients like nitrogen and phosphorus run off into nearby water bodies, leading to eutrophication—a process that causes harmful algal blooms, depletes oxygen in water, and kills aquatic life. To address this issue, we are going to develop an environmentally responsible alternative to synthetic fertilizers. This natural formulation, created using organic waste materials through a safe and simple backyard process, offers essential nutrients for plant growth while restoring soil health. This solution is entirely chemical-free, rich in organic compounds, and contains natural growth-promoting substances that improve plant vitality, increase root strength, and enhance soil microbial activity. It functions not only as a plant nutrient but also as a soil conditioner, enriching the soil structure and promoting long-term fertility. Unlike conventional fertilizers, our formulation is produced entirely from household organic waste, requiring no industrial processing or synthetic inputs. It offers a closed-loop solution—managing waste at the source while enriching the soil naturally. The process is low-cost, eco-friendly, and replicable in homes, schools, and small communities. This innovation not only reduces environmental harm but empowers individuals to participate in climate-positive practices. By turning everyday waste into a resource, our project promotes a circular economy model—a fresh, grassroots approach to sustainable agriculture. Our approach bridges traditional composting practices with modern scientific validation, empowering local farmers and gardeners with cost-effective, organic alternatives to chemical fertilizers. This project not only advances the scientific understanding of compost leachate but also aligns with the Indian Knowledge System (IKS) by revitalizing indigenous agricultural wisdom in a contemporary, impactful way. The innovative use of compost leachate represents a significant step toward environmentally responsible and self-reliant farming practices.

Keywords: Synthetic fertilizers, Eutrophication, Compost leachate

FORMULATION AND EVALUATION OF LIQUID INOCULANTS FOR ENHANCEMENT OF FLOWERING IN ROSE (ROSA SPP.) PLANTS

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Roses (*Rosa* spp.) are among the most commercially important ornamental plants, valued for their aesthetic and economic significance. However, conventional cultivation practices often rely heavily on chemical fertilizers, which may affect soil health and long-term productivity. This study aimed to develop and evaluate liquid bio-inoculants containing beneficial microorganisms for enhancing flowering performance in rose plants. The inoculants were formulated using strains of *Azospirillum*, *Pseudomonas fluorescens*, and *Bacillus subtilis*, known for their plant growth-promoting traits including nitrogen fixation, phytohormone production, and induction of systemic resistance. Standard carrier media were optimized to maintain high microbial viability and stability of the inoculants. Rose plants were treated with liquid inoculants through root drenching and foliar spray under controlled field conditions. Results showed a significant increase in the number of flower buds, flower size, and blooming duration in inoculant-treated plants compared to untreated controls. The treatment with a consortium inoculant (*Azospirillum* + *Pseudomonas* + *Bacillus*) resulted in the highest enhancement, with a 30–35% increase in flowering intensity and improved overall plant vigor. Additionally, treated plants exhibited higher chlorophyll content and better resistance to minor foliar diseases. The findings suggest that liquid inoculants offer an eco-friendly, cost-effective, and sustainable approach to improving rose flowering performance while reducing dependency on chemical fertilizers.

Keywords: Liquid inoculants, Plant growth-promoting Rhizobacteria (PGPR), *Azospirillum*, *Pseudomonas fluorescens*, *Bacillus subtilis*, Rose flowering, Biofertilizers, Sustainable floriculture.

ANTIMICROBIAL ACTIVITY OF HYDRANGEA MACROPHYLLA LEAF EXTRACTS AGAINST MULTIDRUG RESISTANT ORGANISMS

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The emergence of antibiotic-resistant pathogens has intensified the search for plant-derived phytomedicines with potent antimicrobial properties. Medicinal plants serve as promising sources of novel therapeutic agents due to their rich repertoire of bioactive secondary metabolites. In this context, the present study investigates the antimicrobial activity of leaf extracts of *Hydrangea macrophylla* against selected bacterial and fungal pathogens. Soxhlet extraction was performed using petroleum ether, ethyl acetate, chloroform, acetone, and distilled water. Quantitative evaluation revealed maximum yield with aqueous extract; however, antimicrobial screening by agar well diffusion showed that organic solvent extracts exhibited stronger inhibitory activity compared to aqueous extracts. Among the tested organisms, all extracts demonstrated activity against *Staphylococcus aureus*, while aqueous extract failed to inhibit *Pseudomonas aeruginosa*, *Escherichia coli*, *Bacillus* sp., *Klebsiella* sp., and *Candida albicans*. The minimum inhibitory concentration (MIC) ranged from 128–512 µg/ml for bacterial strains and 32–64 µg/ml for *Candida albicans*, indicating significant antifungal potential. Phytochemical screening confirmed the presence of phenolics, tannins, flavonoids, terpenoids, glycosides, and other metabolites, which likely contribute to the observed antimicrobial activities. These findings highlight *Hydrangea macrophylla* as a valuable source of phytomedicines and suggest its potential for the development of novel antimicrobial agents upon purification and dosage standardization.

Keywords: Phytomedicine, Antimicrobial Activity, *Hydrangea macrophylla*, Phytochemicals

HARNESSING MICROBIAL VOLATILES FOR THE SUSTAINABLE MANAGEMENT OF ROOT-KNOT NEMATODE IN TOMATO

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Root-knot nematodes (*Meloidogyne* spp.) cause significant global yield losses in vegetable crops, estimated at 5%. Due to the environmental and safety concerns associated with chemical nematicides, microbial volatile organic compounds (VOCs) offer a promising eco-friendly alternative for managing plant-parasitic nematodes. This study evaluates the nematicidal efficacy of VOCs, both in vitro and as biofumigants against *Meloidogyne incognita* in tomato plants. For the first time, a commercial microbial consortium containing *Rhizophagus irregularis*, *Purpureocillium lilacinum*, and *Bacillus subtilis* was applied individually and synergistically to tomato plants to combat root-knot nematodes. Volatile compounds from treated tomato plants were analyzed using gas chromatography-mass spectrometry (GC-MS) and exhibited the association of seven VOCs. Among that, four compounds such as dimethyl disulfide (DMDS), 1-octadecanol, alpha-phellandrene, and octadecane exhibited strong nematicidal activity by achieving mortality rates of 87%, 83%, 80%, and 78% respectively. Additionally, these VOCs promoted plant growth and significantly reduced *M. incognita* infection compared to untreated controls. These results underscore the potential of microbial VOCs as effective biocontrol agents for root knot nematode management. Their application at lower concentration makes them a sustainable alternative to agrochemicals across diverse agricultural systems.

Keywords: Microbial volatiles, root-knot nematodes, *Meloidogyne incognita*, tomato, sustainable agriculture.

PRODUCTION OF BIOPLASTIC FOR SUSTAINABLE ENVIRONMENT BY USING MICROORGANISM.

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Bioplastics are one of the answers that can point society toward a sustainable future. Under this premise, the synthesis of polymers with competitive properties using low-cost starting materials is a highly desired factor in the industry. Also, tackling environmental issues such as nonbiodegradable waste generation, high carbon footprint, and consumption of non-renewable resources are some of the current concerns worldwide. The scientific community has been placing efforts into the biosynthesis of polymers using bacteria and other microbes. These microorganisms can be convenient reactors to consume food and agricultural wastes and convert them into biopolymers with inherently attractive properties such as biodegradability, biocompatibility, and appreciable mechanical and chemical properties. Such biopolymers can be applied to several fields such as packing, cosmetics, pharmaceutical, medical, biomedical, and agricultural. This bioplastic also made by corn starch, potato starch and they are used in food packing but for mass production of bioplastics we extract Polyhydroxy alkanoate, a biologically produced biodegradable substance that has characteristic properties similar to that of conventional plastics. Polyhydroxyalkanoates are secondary metabolites of microorganisms which are produced under stressful conditions. The bacteria which produce PHA are *Pseudomonas putida* and *Azotobacter*. In this work, four different samples were collected. These strains were then morphologically and biochemically characterized. The strains producing polyhydroxyalkanoates from each sample were identified by Sudan Black staining. The method used for the production and isolation of polyhydroxyalkanoate was cost effective and eco-friendly. Work in this field is ongoing, with interest in improving biodegradation efficiency, designing new plastics or plastic blends and identifying new organisms capable of degrading more recalcitrant plastics, such as polyethylene. There is also increased interest in developing a circular economy, especially a biologically mediated circular economy, Thus, further research on bioplastics to make their properties more competitive against petrochemical-based polymers along with the decrease in cost can lead to a considerable shift in the market as they can potentially solve issues related to the waste generation and aggressive consumption of non-renewable resources.

Keywords: Biocompatibility, recalcitrant plastics, Polyhydroxyalkanoates

METABOLOMICS OF EXTREMOLYTES SYNTHESIZED BY *MARINOCOCCUS* SPP ISOLATED FROM THE SALT PAN MILIEU OF TUTICORIN

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Extremophiles are the sources of enzymes and other metabolites with massive prospective applications in Biotechnology and Industry. Metabolites isolated from Extremophiles snatch weird properties such as Salt tolerance, thermostability and cold adaptivity. Halophiles are a phylogenetically resourceful group of microbes requiring hypersaline environments with NaCl acting as the major salt component. Nature developed different strategies to adapt living organisms to life in highly saline environments. The parallel co-production of Poly- β -hydroxybutyrate (PHB) and ectoine boast immense significant for tumbling the manufacture cost and endorsing industrialization of PHB and ectoine. The pure aqueous extraction method based on osmotic down shock was used for the extraction of Ectoine from Halophiles. Metabolomics method was established to analyze changes of intracellular metabolites and study the mechanism for enhancing ectoine production by halotolerant bacteria. Understanding their metabolic pathways will afford insight into the future development of anticancer property against skin cancer. Determine the bacterial biomass at different NaCl concentration, pH, and Temperature. The quantification of ectoine was performed indirectly by analyzing its hydrolysis product, N-alpha- Acetyl- diamino butyric acid (DABA), through a colorimetric assay using ninhydrin. The arginine dihydrolase test is used to determine the ability of bacteria to decarboxylate arginine which raises the pH of the medium. This test is a reliable method for assessing the metabolic capabilities of bacterial isolates. The process of purifying ectoine from crude extracts underwent using cation exchange chromatography. The molecular structure of ectoine was analysed using NMR Spectra that suggests ectoine possess a heterocyclic nitrogen containing core. This article appraises the modern state of information on the production of ectoine under extreme environmental conditions. Conversely, further challenges have still to be surmounting in terms of strain improvement and process engineering aspects.

Keywords: Halophiles, Ectoine, *Marinococcus* spp., Osmotic down shock, N-alpha-Acetyl- diamino butyric acid (DABA).

SUSTAINABLE BIOPRESERVATION METHODS TO IMPROVE QUALITY AND NUTRACEUTICAL VALUE OF MUSHROOM

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Mushrooms are highly nutritious and functional foods but are prone to rapid spoilage due to their high moisture content and metabolic activity. Conventional preservation techniques such as refrigeration and chemical preservatives have limitations in extending shelf life and maintaining quality. This study aimed to evaluate the potential of bio preservation techniques, including the application of lactic acid bacteria (LAB), natural antimicrobial metabolites, and edible coatings enriched with probiotics, to enhance the shelf life and value of mushroom-based products. Fresh mushrooms were treated with biopreservatives and stored under controlled conditions. Physicochemical parameters (pH, moisture content, and texture), microbial load, antioxidant activity, and sensory attributes were periodically assessed. Results demonstrated that biopreservation using LAB and probiotic-coated films effectively inhibited microbial growth, delayed enzymatic browning, and maintained nutritional quality for up to 10–14 days longer compared to untreated controls. Furthermore, the incorporation of probiotic cultures enhanced the functional value of mushroom products, adding health-promoting properties. Sensory evaluation confirmed consumer acceptance of biopreserved mushrooms with minimal changes in texture and flavor. The study highlights the role of biopreservation as a sustainable, safe, and consumer-friendly method for value addition in mushroom products, supporting both extended shelf life and enhanced nutraceutical potential.

Keywords: Biopreservation, Mushroom products, Lactic acid bacteria, Edible coatings, Shelf life extension, Probiotic enrichment, Functional foods, Value addition

A MICROBIAL RECIPE FOR THE NEXT GENERATION

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The global food industry is at a critical juncture, facing challenges related to climate change, food insecurity, and the demand for healthier, more sustainable products. In this context, next-generation microorganisms including genetically engineered, synthetic, and newly isolated microbial strains are emerging as powerful tools to transform food production and processing. These microorganisms are being applied across diverse sectors of the food industry. Through precision fermentation, microbes can produce high-value ingredients such as animal-free dairy proteins, egg whites, and fats, significantly reducing the environmental footprint of conventional animal agriculture. Additionally, single-cell proteins derived from bacteria, fungi, and algae are being developed as sustainable and efficient protein sources for human nutrition. Advances in synthetic biology and CRISPR-based genome editing have enabled the development of functional microbes capable of enhancing food safety, improving sensory properties, synthesizing essential nutrients (e.g., B12), and acting as targeted probiotics for gut health. Furthermore, microbial systems are being utilized in food waste valorization, converting low-value agricultural by-products into bioactive compounds, enzymes, and food additives supporting circular and zero-waste food systems. The integration of next-generation microorganisms offers a pathway toward reducing greenhouse gas emissions, minimizing resource inputs, and enhancing nutritional outcomes. Leading companies and research initiatives are demonstrating the scalability and commercial viability of these microbial innovations. This highlights the scientific, technological, and practical implications of next-generation microbes in advancing a sustainable, nutritious, and resilient global food system. As regulatory frameworks evolve and consumer acceptance grows, microbial biotechnology is poised to play a central role in the future of food.

Keywords: Next-generation Microorganisms, Microbial proteins, Synthetic biology, Probiotics, Food innovation.

FORMULATION AND EVALUATION OF HERBAL INCENSE STICKS FROM LOCALLY AVAILABLE PLANTS FOR MOSQUITO REPELLENT ACTIVITY

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Mosquito-borne diseases such as malaria, dengue, and chikungunya remain major public health concerns. Synthetic mosquito repellents, though effective, are often associated with health hazards and environmental concerns. This study focuses on the utilization of locally available herbs with known insecticidal and repellent properties for the formulation of eco-friendly incense sticks. Medicinal plants such as Neem (*Azadirachta indica*), Tulsi (*Ocimum sanctum*), Lemongrass (*Cymbopogon citratus*), and Eucalyptus (*Eucalyptus globulus*) were collected, dried, and powdered. Herbal powders were blended with natural binders (such as jiggat powder and cow dung) and rolled into incense sticks. The formulated sticks were evaluated for mosquito repellency, burning time, smoke density, and user acceptability under controlled conditions. Results indicated that incense sticks prepared with a combination of neem and lemongrass exhibited the highest repellency, effectively reducing mosquito activity by 70–80% compared to control. Tulsi and eucalyptus also showed significant repellent activity, while the blends enhanced both fragrance and efficacy. The herbal incense sticks were safe, biodegradable, and well-accepted in sensory evaluation. This research highlights the potential of herbal-based mosquito repellent incense sticks as a low-cost, sustainable, and locally adaptable solution for vector control.

Keywords: Mosquito repellent, Herbal incense sticks, Neem, Tulsi, Lemongrass, Eucalyptus, Vector control, Eco-friendly alternatives.

AN OVERVIEW ON POLAR MICROBIOLOGY

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Polar microbiology explores the extraordinary microbial life thriving in the extreme environments of the Arctic and Antarctic regions. These ecosystems are characterized by subzero temperatures, high salinity, low nutrient availability, and seasonal fluctuations in light yet they host a remarkably diverse array of psychrophilic (cold-loving) and psychrotolerant microorganisms. From sea ice and glacial surfaces to permafrost and subglacial lakes, polar microbes have evolved unique biochemical and physiological adaptations, including antifreeze proteins, cold-active enzymes, and membrane fluidity adjustments that allow them to maintain metabolic activity in conditions lethal to most life forms. These microorganisms play a central role in polar biogeochemical cycles, contributing to carbon and nitrogen turnover, methane oxidation, and primary production. Marine polar microbes, especially cold-adapted phytoplankton and bacteria, influence global climate regulation by sequestering carbon dioxide and producing climate-relevant gases like dimethyl sulfide (DMS). As sentinels of environmental change, polar microbial communities are among the first to respond to warming temperatures, ice melt, and shifts in salinity and pH, making them crucial indicators of climate-driven ecosystem transformations. Recent advances in metagenomics, single-cell genomics, and remote sampling technologies have uncovered vast microbial diversity in polar habitats, much of which remains unexplored and uncultured. These findings not only challenge our understanding of the limits of life on Earth but also offer immense biotechnological potential, including novel enzymes for industrial processes and bioactive compounds with medical applications. As climate change rapidly transforms the polar regions, understanding the structure, function, and resilience of microbial life in these habitats has never been more urgent. Polar microbiology not only deepens our knowledge of life in extreme environments but also provides essential insight into Earth's climate system and the future of these fragile ecosystems.

Keywords: Psychrophilic microorganisms, Climate change, Metagenomics, Cold-active enzymes, Carbon sequestration, Microbial adaptation.

TRANSFORMING FLORAL WASTE INTO BIOACTIVE COMPOST: A PHYTOCHEMICAL AND MICROBIAL PERSPECTIVE

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The increasing accumulation of floral waste from temples and markets presents a pressing environmental concern while offering opportunities for sustainable resource valorisation. This study investigates the transformation of three selected flowers—*Nerium oleander*, *Chrysanthemum morifolium*, and *Tagetes erecta*—into nutrient-rich vermicompost using *Eisenia fetida* and *Eudrilus eugeniae*. Phytochemical screening, Fourier Transform Infrared Spectroscopy (FTIR), and Gas Chromatography–Mass Spectrometry (GC–MS) analyses confirmed the presence of alkaloids, phenols, flavonoids, tannins and carbohydrates in the floral extracts. Vermicomposting trials demonstrated efficient biodegradation of flower biomass, yielding stable compost enriched with bioactive compounds. Microbial analysis of the matured compost revealed diverse bacterial taxa, including *Bacillus*, *Pseudomonas*, *Escherichia coli*, *Staphylococcus*, and *Enterobacter* species, alongside other gram-positive and gram-negative strains. These microorganisms normally contribute to nutrient cycling, organic matter stabilization, and secondary metabolite production. Antioxidant assays (DPPH and ABTS) further validated the radical scavenging activity of both the floral extracts and compost, underscoring their bioactive potential. The study establishes a clear correlation between the phytochemical richness of the flower substrates and microbial ecology of the final compost. Overall, the findings highlight vermicomposting as an eco-friendly and value-added strategy for floral waste management, with promising applications in sustainable agriculture, soil fertility enhancement, and bioremediation, thereby contributing to circular bioeconomy and environmental sustainability.

Key words: Microbial analysis, Vermicomposting, *Nerium oleander*, *Chrysanthemum morifolium*, *Tagetes erecta*, *Eisenia fetida*, *Eudrilus eugeniae*

EXPLORING THE DIVERSITY OF FERMENTED MILK BEVERAGES OF LASSI IN THIRUVARUR DISTRICT, TAMIL NADU, INDIA

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Fermented milk beverages such as lassi and neer mor represent an integral part of the traditional dairy-based food culture of South India. The present study was undertaken to document and evaluate the diversity of lassi and related fermented milk beverages sold in Thiruvapur district, Tamil Nadu, India. A survey of local vendors, restaurants, and branded outlets revealed a wide range of product types including sweet lassi, salted lassi, spiced neer mor, fruit-based lassi, and dry-fruit enriched variants. These beverages exhibited considerable variation in preparation style, flavoring ingredients, serving temperature, and consumer appeal. Preliminary analyses indicated diversity in physicochemical parameters (pH, titratable acidity, total soluble solids, and viscosity) as well as microbial load, with notable differences between street-vended and commercially branded products. The findings highlight both the cultural richness of fermented milk beverage traditions in the region and the need for improved quality and safety monitoring, particularly for non-standardized street-vended preparations. This study provides baseline data that can support further nutritional, microbiological, and value-addition research on traditional fermented dairy drinks in Tamil Nadu

Keywords: Lassi, Neer mor, Fermented milk beverages, Diversity, Physicochemical properties, Microbial quality

BIOTECHNOLOGICAL STRATEGIES FOR ENHANCING SECONDARY METABOLITES IN PLANTS

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Secondary metabolites such as alkaloids, flavonoids, terpenoids, phenolics, and glycosides play crucial roles in plant defense and have immense applications in pharmaceuticals, nutraceuticals, cosmetics, and agriculture. However, their natural accumulation in plants is often limited, influenced by environmental conditions and developmental stages. Biotechnological interventions provide sustainable strategies to enhance the production of these valuable compounds. Techniques such as plant tissue culture, elicitor-mediated production, metabolic engineering, and genetic transformation have been employed to boost secondary metabolite yields. The use of hairy root cultures induced by *Agrobacterium rhizogenes* has proven particularly effective for large-scale metabolite production. Moreover, the application of CRISPR-Cas9 gene editing and omics-based approaches allows precise manipulation of metabolic pathways for targeted enhancement. This study highlights the importance of integrating classical plant biotechnology with modern molecular tools to achieve higher metabolite yields, ensuring a reliable supply for industrial and medicinal purposes. The findings emphasize the potential of biotechnological strategies as eco-friendly, scalable, and economically viable alternatives to conventional plant extraction methods.

Keywords: Secondary metabolites; Plant metabolics; Elicitors; CRISPR-Cas9; Biopharmaceuticals.

CHEMICAL MICROBIOLOGY AND SENSORY PROPERTIES OF NON FAT YOGURT

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Plain nonfat yogurt is a widely consumed fermented dairy product valued for its nutritional, functional, and sensory qualities. The chemical composition of non-fat yogurt is characterized by low fat content, high protein, carbohydrates [mainly lactose], organic acids, vitamins and minerals, which contribute to its health-promoting properties. During fermentation, lactic acid bacteria [Primarily *Lactobacillus delbrueckii subsp.bulgaricus* and *Streptococcus thermophilus*] convert lactose into lactic acid lowering the pH and enhancing product safety by inhibiting spoilage and pathogenic microorganisms. Microbiologically, plain non-fat yogurt provides a rich source of viable probiotic cultures, which can promote gut health and improve digestion. Sensory properties including appearance, texture, aroma, and taste, are strongly influenced by starter culture activity, fermentation conditions, and post processing storage. The absence of fat often leads to lower milk yogurt, but improvements in culture selection and processing techniques can enhance acceptability. Overall, plain non-fat represents a nutritious, safe, and sensory-appealing food product with significant health benefits, making it an important functional food.

Keywords: Plain yogurt, Chemical properties, Microbiological quality, Sensory Evaluation, Probiotics, Lactic acid bacteria, functional food

SYNERGISTIC BIOCONTROL EFFICACY OF MULTI-ANTAGONISTIC CONSORTIUMS WITH FORTIFIED LIGNITE FLY ASH FOR SUSTAINABLE MANAGEMENT OF GROUNDNUT STEM ROT DISEASE

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Groundnut stem rot caused by *Sclerotium rolfsii* Sacc. represents a critical agricultural challenge, causing yield losses of up to 80% under severe conditions. This comprehensive study introduces an innovative integrated disease management approach combining native biocontrol agents with fortified lignite fly ash for enhanced pathogen suppression. Field surveys across Cuddalore district revealed maximum disease incidence at Sivapuri (41.25%). Through systematic screening of rhizosphere-derived antagonists, superior isolates were identified: *Pseudomonas fluorescens* Pf4 (73.61% growth inhibition), *Bacillus subtilis* Bs3 (69.24% inhibition), and *Trichoderma viride* Tv7 (77.93% inhibition) demonstrated exceptional *in vitro* antagonistic potential against *S. rolfsii*. The novelty of this research lies in the development of fortified lignite fly ash as an innovative carrier matrix, which significantly enhanced antagonist viability and longevity compared to conventional carriers. The synergistic application of tri-antagonistic consortium (*T. viride* + *P. fluorescens* + *B. subtilis*) combined with fortified lignite fly ash achieved remarkable disease control efficiency (71.85% reduction) while simultaneously enhancing plant growth parameters. Biochemical analysis revealed substantial induction of defense-related enzymes including peroxidase (2.62 units), polyphenol oxidase (2.56 units), phenylalanine ammonia lyase (94.36 units), and β -1,3-glucanase (76.2 units), indicating robust systemic resistance activation. This eco-friendly formulation demonstrated performance comparable to chemical fungicides while offering sustainable pathogen management. The research establishes a paradigm shift from single bioagent applications to multi-antagonistic consortiums, providing farmers with an economically viable and environmentally sustainable alternative for groundnut stem rot management.

Keywords: *Sclerotium rolfsii*, Biocontrol consortium, integrated disease management, systemic resistance induction, sustainable agriculture, groundnut protection, multi-antagonistic approach

ANTIMICROBIAL AND PHYTOCHEMICAL PROPERTIES OF YOUNG COCOS *NUCIFERA* COCONUT

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Young coconut *Cocos nucifera* is widely utilized in traditional medicine, with young coconuts particularly valued for their nutritional and therapeutic properties. The phytochemical constituent and antimicrobial activity of extracts derived from young coconut tissues, including water, husk, and endosperm. Phytochemical screening revealed the presence of bioactive compounds such as alkaloids, flavonoids, tannins, phenols, glycosides, saponins, and terpenoids, which are known to contribute to antimicrobial efficacy. Antimicrobial assay against selected Gram-positive and Gram-Negative bacteria, as well as fungal strains, demonstrated significant inhibitory activity, particularly in ethanol and methanol extracts, suggesting the presence of potent secondary metabolites. The results support the ethnopharmacological use of young *Cocos nucifera* and highlight its potential as a source of natural antimicrobial agents. Further studies on compound isolation and mechanism of action are recommended to validate and expand its therapeutic applications.

Keywords: Young Coconut, Traditional Medicine, Phytochemicals, Antimicrobial activity.

UNVEILING THE BIOACTIVE PHYTOCHEMICALS OF *HIBISCUS SABDARIFFA* L. LEAVES FOR THERAPEUTIC USE

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Hibiscus sabdariffa L. leaves are a rich source of bioactive compounds with potential applications in medicine and nutraceuticals. In this study, dried leaf samples were subjected to Soxhlet extraction using hexane, chloroform, ethyl acetate, and methanol as solvents. Preliminary phytochemical screening revealed the presence of triterpenoids, steroids, reducing sugars, alkaloids, phenolic compounds, catechins, flavonoids, saponins, and tannins. Quantitative determination of bioactive constituents was carried out using spectrophotometric assays, which confirmed significant levels of total phenolic content (TPC) and total flavonoid content (TFC). Functional group analysis via FTIR demonstrated the presence of hydroxyl and carbonyl groups, indicating strong antioxidant-related moieties. Furthermore, GC-MS profiling identified a wide array of bioactive compounds, supporting the potential of *H. sabdariffa* leaves as a natural source of antioxidants. These findings highlight the pharmaceutical and nutraceutical relevance of *H. sabdariffa* L. leaf extracts and provide a scientific basis for their future application in therapeutic formulations.

Keywords: *Hibiscus sabdariffa*, Total phenolic compounds, Total flavonoid content, FTIR and GCMS.

KINETIC MODEL STUDIES ON GROWTH OF *SACCHAROMYCES CEREVISIAE* IN BANANA WINE PRODUCTION USING DIFFERENT NITROGEN SOURCES

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Banana (*Musa acuminata*), a highly cultivated tropical fruit from the Musaceae family, is not only a key source of carbohydrates, essential minerals, and bioactive compounds but also a potential raw material for value-added products due to its high sugar content and distinctive flavor. However, up to 20% of global banana production is lost post-harvest due to inadequate handling and storage, creating both economic and environmental challenges. Fermentation offers a sustainable solution for converting these perishable residues into shelf-stable products such as fruit wines. Despite its potential, banana wine production remains underexplored, particularly in relation to microbial dynamics, nitrogen metabolism, and sensory outcomes. This study investigates the production of banana wine through controlled fermentation using a yeast strain of *Saccharomyces cerevisiae*. Fermentation trials were conducted with varying inoculum levels and nitrogen supplementation, including inorganic and organic sources such as di-ammonium hydrogen phosphate (DAHP) and selected amino acids. The process was evaluated based on yeast growth dynamics, fermentation kinetics, chemical composition, and volatile compound development. Yeast populations exhibited distinct growth patterns influenced by nitrogen availability, with biomass accumulation continuing until the end of fermentation. Among the nitrogen treatments, DAHP and a tailored amino acid combination supported efficient sugar conversion and resulted in wines with improved sensory and physicochemical attributes. Kinetic modelling aligned well with observed fermentation behaviour, while GC-MS analysis identified a range of volatiles contributing to aroma complexity. Sensory assessment confirmed a strong preference for wines produced under optimized conditions. These findings support the potential of banana wine as a viable, value-added product and a sustainable approach to reducing post-harvest fruit waste.

Key Words: Over ripe banana, Fruit wine, Yeast growth kinetics, Nitrogen sources, Secondary agriculture, GC-MS, aroma, volatiles

BIOCONTROL POTENTIAL OF *TRICHODERMA VIRIDE* AGAINST ROOT ROT DISEASE IN MINT (*MENTHA* spp.)

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Root rot, caused by soil-borne fungal pathogens such as *Fusarium* spp., *Pythium* spp., and *Rhizoctonia solani*, poses a major threat to the growth and productivity of mint (*Mentha* spp.), an economically important medicinal and aromatic crop. The present study evaluated the biocontrol potential of *Trichoderma viride*, a well-known antagonistic fungus, against root rot pathogens. In vitro dual culture assays revealed that *T. viride* inhibited more than 70% of the mycelial growth of pathogenic fungi. Pot experiments further demonstrated that *T. viride* treatment reduced root rot incidence by 65% compared to untreated controls and enhanced plant vigor, including higher root biomass and chlorophyll content. Field application of *T. viride* as a soil amendment and seedling dip consistently suppressed disease incidence while significantly improving mint yield. These findings highlight *T. viride* as a sustainable and eco-friendly alternative to chemical fungicides for managing root rot in mint cultivation.

Keywords: *Trichoderma viride*, biocontrol, root rot, mint, *Mentha* spp., *Fusarium*, *Rhizoctonia*, *Pythium*.

BIOGENIC ZINC NANOPARTICLES FROM *ULVA COMPRESSA*: A NATURAL SHIELD AGAINST OXIDATIVE STRESS AND PATHOGENS

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The accelerating pace of medical innovation is increasingly shaped by sustainable nanotechnology. In this study, a green and efficient biosynthetic approach was employed to fabricate zinc oxide nanoparticles (ZnO NPs) using *Ulva compressa*, a marine green macroalga, serving as both a natural reducing and capping agent. This eco-friendly method enabled rapid and safe nanoparticle synthesis, harnessing marine bioresources for potential biomedical applications at the nanoscale. Structural and functional confirmation of ZnO NPs was achieved through UV-Vis and FTIR spectroscopy, while SEM coupled with EDAX revealed diverse morphologies ranging from 10 to 120 nm. The bio-synthesized nanoparticles demonstrated notable antioxidant and antibacterial activities, with enhanced efficacy against a broad spectrum of microbial strains. Their strong free radical scavenging ability underscores their antioxidant potential, suggesting a promising role in cellular defense mechanisms. Overall, this study highlights the therapeutic promise of marine algae-mediated ZnO nanoparticles and their relevance in future eco-conscious nanomedicine.

Keywords: *Ulva compressa*, Zinc oxide nanoparticles, Green synthesis, antioxidant activity and antibacterial potential.

MICROALGAE-BASED WASTEWATER TREATMENT WITH BIOMASS PRODUCTION FOR PIGMENT EXTRACTION

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The growing need for sustainable wastewater treatment methods has led to the search for eco-friendly and resource-recovery-based solutions. Microalgae-based systems are becoming a promising option because they can clean wastewater and produce useful biomass at the same time. This project looks into growing microalgae in nutrient-filled wastewater to reach two main goals: (i) removing important pollutants like nitrogen, phosphorus, and organic materials, which helps prevent water from becoming too rich in nutrients, and (ii) collecting algal biomass to extract high-value natural pigments such as chlorophylls, carotenoids, and phycobiliproteins. The process involves growing specific microalgal strains in secondary or tertiary wastewater treatments under controlled light and air conditions. The microalgae take in nutrients and carbon dioxide, improving water quality while producing a lot of biomass. Once harvested, the biomass is processed using environmentally friendly methods to recover the pigments. These pigments are used in many industries like pharmaceuticals, health products, cosmetics, and natural food coloring. The study shows the benefits of combining wastewater treatment with the production of valuable resources, supporting a circular bioeconomy. The expected results include a big decrease in pollutant levels (up to 80–90% removal of nitrogen and phosphorus), high biomass production, and the recovery of pigments that have commercial value. By combining environmental protection with making useful products, this project shows a sustainable way to use wastewater. Using algal technology together with wastewater management offers a low-cost, renewable, and scalable alternative to traditional treatment methods, making it a good solution for use in cities and industries in the future.

Keywords: Microalgae; Wastewater Treatment; Biomass Production; Pigment Extraction

MODERATING EFFECT OF SOCIAL MEDIA USE ON THE RELATIONSHIP BETWEEN BLOOD GROUP AND ACADEMIC ACHIEVEMENT AMONG FEMALE UNDERGRADUATES

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Blood groups have historically been linked with personality traits, stress tolerance, and cognitive abilities, raising questions about their possible influence on academic performance. At the same time, social media has emerged as a dominant factor shaping student behavior, study patterns, and learning outcomes. This study aimed to compare the academic performance of female undergraduate students with different blood groups and to examine the impact of social media usage. A cross-sectional study was conducted among students of a women's college, where academic performance was assessed through semester examination scores and internal assessments. Blood group data were collected, and social media usage patterns were recorded using a structured questionnaire. Result Indicated that blood group alone may not significantly predict academic performance, patterns of social media use—such as frequency, duration, and purpose—may influence this relationship. Specifically, certain blood groups (e.g., A or O) may be more sensitive to the cognitive and behavioral effects of excessive or non-academic social media use, potentially leading to lower academic outcomes. This suggests that social media use can either amplify or buffer the relationship between blood group and academic achievement, highlighting the complex interplay between biological and behavioral factors in educational outcomes. Excessive social media use of more than three hours per day for non-academic purposes was negatively associated with academic performance across all blood groups, whereas moderate and academic-oriented usage showed a positive correlation. The findings suggest that although blood group may have a modest association with academic achievement, social media appears to play a stronger role, with excessive use proving detrimental. Programs emphasizing balanced and purposeful social media use may therefore contribute to better learning outcomes among female students.

Keywords: Blood group, Academic performance, Female students, Social media

FUNGI ASSOCIATED WITH SPOILAGE OF DRY FISH

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Dried fish is a major source of protein in many parts of the world and serves as an important food commodity due to its long shelf life, affordability, and nutrition value. However, despite the preservation achieved through dehydration, dried fish remains highly susceptible to fungal contamination during processing, storage, and marketing, particularly under humid and unhygienic conditions. Several filamentous fungi have been identified as key agent of spoilage, including *Aspergillus spp.* (*A.flavus*, *A.niger*, *A. fumigatus*, *A. orchraceus*), *Penicillium spp.* (*P.citrinum*, *P.Chrysogenum*), *Rhizopus stolonifer*, *mucor spp.*, *cladosporium spp.*, and occasionally *Fusarium spp.* These fungi contribute to visible mold growth, discoloration, texture degradation, and the development of off-flavour and odour. More importantly, some species are capable of producing of producing hazardous mycotoxins such as aflatoxins, ochratoxin, and fumonisins, which pose serious health risks to consumer. The occurrence of these spoilage fungi is influenced by environment factor such as temperature, moisture content, relative humidity, and handling practices. Their presence not only reduces the quality and market value of dry fish but also represents a significant challenge to food safety. Effective prevention strategies, including proper drying, improved packaging, hygiene handling, controlled storage condition, and the application of natural antifungal agents, are therefore essential to minimizing contamination. The study of fungi associated with dried fish spoilage is critical for ensuring both consumer safety and the sustainable utilization of this vital protein resources.

Keywords: Dried fish, Shelf life, Spoilage, Hygienic.

SCREENING OF BIOACTIVE COMPOUNDS FROM *MURRAYA KOENIGII* LEAF AND THEIR ANTIMICROBIAL POTENTIAL

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The present study investigates the presence of bioactive compounds in *Murraya koenigii* (curry leaf) and evaluates their antimicrobial potential. Fresh leaves were collected, shade-dried, and extracted using appropriate solvents. Preliminary phytochemical screening revealed the presence of various bioactive constituents including alkaloids, flavonoids, phenols, tannins, and saponins. The antimicrobial activity of the extracts was tested against selected Gram-positive and Gram-negative bacteria using the disc diffusion method. The diameter of the zones of inhibition was measured to assess the effectiveness of the extracts. The findings suggest that *Murraya koenigii* leaves contain bioactive compounds with promising antimicrobial properties, supporting their use in traditional and alternative medicine.

Keywords: *Murraya koenigii*, bioactive compounds, phytochemical screening, antimicrobial activity, curry leaf, natural antibiotics, medicinal plant, disc diffusion method.

LARVICIDAL ACTIVITY OF AN IMPORTANT MEDICINAL PLANT IN *LUFFA ACUTANGULA* L. VAR. *AMARA*. ROXB. FRUIT EXTRACTS AGAINST *AEDES AEGYPTI* AND *CULEX QUINQUEFASCIATUS*

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Mosquito borne diseases are one of the most important health problems widespread in the developing and developed countries also. Larvicidal is a successful way of reducing mosquito densities in their breeding places before they emerge into adults. The present study was carried out on the Larvicidal activity of Cucurbitaceae family *Luffa acutangula* L. Var. *amara*. Roxb. against second and fourth instar larvae of *Aedes aegypti* and *Culex quinquefasciatus*. Larvicidal activities were conducted at different concentration (100-500 ppm) of chloroform, petroleum ether, water and methanol fruit extracts of *Luffa acutangula* L. Var. *amara*. Roxb. The present investigation revealed that the LD₅₀ and LD₉₀ value of chloroform, petroleum ether, water and methanol fruit extracts of *Luffa acutangula* against *Aedes aegypti* II – instar larvae in 24 hr were 275.57, 268.922, 237.79, and 1197.47, 74.96, 750.56, 916.06 and 755.18 ppm respectively. The LD₅₀ and LD₉₀ value of VI – instar larvae in 24 hr were 517.4, 507.73, 490.99 and 456.28, 935.77, 1,168.98, 943.46 and 1035.81 ppm for chloroform, petroleum ether, water and methanol fruit extracts respectively. The LD₅₀ and LD₉₀ value of *Culex quinquefasciatus* II – instar larvae in 24 hr were 593.06, 698.46, 658.28, 658.28 and 525.39, 963.26, 10311.1, 1064.13 and 997.87 ppm for chloroform, petroleum ether, water and methanol fruit extracts respectively. It is concluded that the highest larvicidal activity against *Aedes aegypti* and *Culex quinquefasciatus* was obtained with methanol extracts of *Luffa acutangula* Lin. Var. *amara*. Roxb.

Keywords: Cucurbitaceae, *Luffa acutangula*, *Aedes aegypti* and *Culex quinquefasciatus*

GREEN SYNTHESIS, CHARACTERIZATION AND BIOLOGICAL EVALUATION OF SILVER NANOPARTICLES USING *WATTAKAKA VOLUBILIS* LEAF EXTRACT

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This study reports the eco-friendly synthesis of silver nanoparticles (AgNPs) using *Wattakaka volubilis* leaf extract and evaluates their antibacterial and cytotoxic potential. Ethanolic extracts of the plant were used to reduce silver nitrate (AgNO₃) resulting in a visible color change, indicating nanoparticle formation. UV–Vis spectroscopy showed a strong absorption peak at 328 nm, confirming AgNPs synthesis. FT-IR study demonstrated the presence of bioactive molecules derived from the AgNPs, which acted as capping agents, while SEM revealed rod-shaped nanoparticles ranging from 10–20 µm. EDX confirmed a silver content of 62.95%, and XRD analysis showed a crystalline structure with an average particle size of 14.61 nm. Antibacterial testing using the disc diffusion method demonstrated significant activity against *E. coli*, *K. pneumoniae* and *S. aureus*, with inhibition zones up to 38 mm. Cytotoxicity assessment via the brine shrimp lethality assay revealed dose-dependent toxicity, with an LC₅₀ of 24.4 µg/ml. These results highlight the potential of *Wattakaka volubilis* derived AgNPs for biomedical and pharmaceutical applications.

Keywords: *Wattakaka volubilis*, Silver nanoparticles, Green synthesis, Antibacterial activity, Cytotoxicity

ISOLATION, SCREENING AND IDENTIFICATION OF KERATINOLYTIC BACTERIA FROM FEATHER DUMPING SOIL

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Keratinous wastes such as poultry feathers, human hair, horns, hooves, etc., are generated abundantly and are a serious environmental menace. Disposal of these wastes is causing a lot of environmental issues. Keratin, an insoluble fibrous protein, is the major component of these materials. It is a highly stable protein and is resistant to degradation by physical and chemical methods. Discovery of microorganisms capable of degrading this insoluble structural protein into value-added products through the action of keratinase enzymes, paved the way for their industrial utilization. In this study bacterial species are isolated from feather dumping soil by inoculating onto different basal media. From the 10 morphologically distinct bacterial colonies selected, isolate 1, isolate 2 and isolate 10 exhibited potential proteolytic and keratinolytic activity. Estimation of keratinase production by the potent isolates were carried out in submerged fermentation. The three promising isolates are further identified by microscopical observation and biochemical characterization. The isolates were morphologically and genotypically confirmed as *Pseudomonas oleovorans*K1, *Acinetobacter variabilis* K2 and *Bacillus tropicus*K10. Based on the optimization studies, maximum production of keratinase for three isolates were at 72h of incubation, pH 7, 35°C temperature and in the presence of keratin substrate.

Key words: Keratinase, isolate, characterization, temperature

BIOPROSPECTING THE CELLULOYTIC, PROBIOTIC AND ANTIOXIDANT ACTIVITY OF YEAST ISOLATED FROM TERMITE GUT *MICROTERMUS CRASSUS*

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The energy and environmental crises developed due to a huge number of cellulosic materials are disposed of as “waste.” Cellulose is the most abundant biopolymer on Earth. The hydrolysis of cellulose to glucose and soluble sugars has thus become a subject of intense research. Termites are one of the most important soil insects that efficiently decompose lignocelluloses with the aid of their associated microbial symbionts to a simpler form of sugars. The steps of this study consisted of isolation of yeast from termite gut and screen the cellulolytic activity. Cellulose degrading yeast from termite (*Microtermus crassus*.) gut flora was isolated, screened and their identification was studied which showed halo zones due to CMC agar. In addition, an attempt has been made to characterize the probiotic and anti-oxidant activity. In the present study, the yeast isolated from termite gut possess probiotic activity. Culture filtrate of *C. pseudorhagii* can be utilized as a source of natural antioxidant compounds as their crude extract exhibit antioxidant activity. The results show maximum radical scavenging activity (61.26%) was observed at 80 mg/ml of extract in *C. pseudorhagii*. In conclusion, there are isolated termite gut microbes can be used as probiotic candidate for human to digest cellulose of the new food source.

Keywords: *Microtermus crassus*, Probiotics, Cellulose degradation, Yeast, Anti-oxidant activity

PHYTOCHEMICAL PROFILING AND MOLECULAR DOCKING OF *EMBELIA RIBES* EXTRACT FOR NEMATICIDAL ACTIVITY AGAINST *MELOIDOGYNE ENTEROLOBII*

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Guava Root-knot nematode, *Meloidogyne enterolobii* is an extremely dangerous Phyto parasitic nematode that causes significant loss in guava orchard. The search for sustainable and eco-friendly alternatives to chemical nematicides has led to an exploration of natural resources of nematode control agents. In this study, we investigated the nematicidal efficacy of *Embelia ribes* leaf extract against egg mass and second-stage juvenile (J2) of *M. enterolobii* under *in vitro*. Egg mass and J2s of *M. enterolobii* were treated with different concentrations (1,3,5 and 7%) of leaf extracts and observations were taken 24, 48 and 72 h after exposure. These results indicate that all concentrations had highly toxic effects on egg mass and J2s mortality and EC50 value was 1.042 mg/ml. Using Gas chromatography-mass spectroscopy (GCMS), we identified three phytochemicals viz., Bis (2-ethylhexyl) phthalate, n- Hexadecanoic acid and octadecanoic acid. The molecular docking of GC-MS–identified phytochemicals against the selected effector proteins from *Meloidogyne* spp. revealed specific binding interactions, predominantly through hydrogen bonding, which are critical for ligand–protein stability. Molecular docking analysis affirmed the efficacy of *E. ribes* leaf extract on the binding interactions of its phytochemicals with the targeted protein, acetylcholine esterase (AChE) of *M. incognita*. Remarkably, the computed values of binding affinity revealed a hierarchy of potency with -5.56, -5.50 and -5.30 kcal/mol observed for calreticulin, venom allergen-like protein, endoglucanase. Among all of these ligands, calreticulin binds with the receptor AChE more efficiently than the other two ligands. Furthermore, molecular docking studies provide valuable insights into the mechanisms underlying their nematicidal activity, paving the way for the development and novel nematode management strategies that are both effective and ecofriendly.

Keywords: Phytochemical compounds; *Embelia ribes*; nematicidal property; Guava Root knot Nematode; Molecular Docking

BIOGENIC SYNTHESIS OF SILVER NANOPARTICLES USING LAWSONIA INERMIS LEAF EXTRACT AND THEIR ANTIMICROBIAL EFFECTIVENESS

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Medicinal plants have a high level of safety for treating a wide range of diseases caused by microorganisms, owing to their rich content of bioactive compounds. The biological synthesis of silver nanoparticles (Ag-NPs) using plant extracts provides an easy approach for developing alternative solutions to treating drug-resistant pathogens. In this study, we investigated the antimicrobial potential of Lawsonia inermis aqueous extract, which is known for its diverse range of phytochemicals. The extract was reacted with 2mM AgNO₃ to synthesize Ag-NPs. The formed nanoparticles were characterized using various techniques, including UV spectroscopy, SEM, EDAX, XRD and FTIR spectroscopy. The characterization confirmed the formation of silver nanoparticles with grain-sized morphology. The antimicrobial activity of the synthesized Ag-NPs was assessed using the disc diffusion method against both Gram-positive and Gram-negative bacterial strains responsible for infectious diseases. The results demonstrated significant antibacterial activity, indicating the great potential of these nanoparticles as antimicrobial agents against pathogenic microbes.

Keywords: Nanoparticles, UV-Visible spectroscopy, FTIR, Lawsons, Lawsonia Inermis, Antimicrobial activity.

SCREENING OF SECONDARY METABOLITES AND GC-MS ANALYSIS OF SARGASSUM SPECIES

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India is well known country for its traditional medicinal practices that uses medicinal plants and marine organisms to treat human and livestock ailments. However, the lack of empirical validation regarding the efficacy of the bioactive compounds against specific infectious diseases requires rigorous scientific investigations. The objective of this study was to identify the secondary metabolites from four *Sargassum* species through phytochemical screening, GC-MS analysis, anti-oxidant potential and molecular docking. The marine seaweeds *Sargassum acinarium*, *fusiforme*, *muticum* and *polycystem* was collected from the shoreline of Mandapam coastal regions, Gulf of Mannar, Tamil Nadu, India during November 2023. Preliminary phytochemical screening and GC-MS analysis was used to identify the presence of secondary metabolites by different solvent extracts such as methanol, acetone, aqueous and chloroform. The qualitative preliminary phytochemical screening indicated the presence of tannins, steroids, alkaloids, flavonoids, saponins, lignin, glycosides, coumarin, quinone, phenol and terpenoids almost all the extracts. Acetone and Methanol extracts shows the major presence followed by chloroform and aqueous extracts. The GC-MS results revealed the presence of more than 25 biologically important compounds based on their retention time and percentage of peak area. Among these 25 compounds 8 compounds are repeatedly present in majority of the solvents. The current findings supported for the long-standing claim of the traditional medical system of the study area for their continued use of these brown seaweeds in their treatment of infectious diseases.

Keywords: *Sargassum acinarium*, *fusiforme*, *muticum*, *polycystem*, GC-MS, Secondary Metabolites

ISOLATION AND CHARACTERIZATION OF *PSEUDOMONAS* FROM THE HYDROCARBON POLLUTANTS PETROL

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Pseudomonas are gram-negative, rod-shaped bacteria found in soil and water known for their adaptability and metabolic diversity. The genus *Pseudomonas* is recognized for its remarkable metabolic diversity, enabling it to thrive in a wide range of environments. According to this bioremediation means removal of pollutants by using microorganisms. Microbial degradation is the most useful and ultimate method to clean up the environment from hydrocarbon pollutants. Bacteria are the most active agents in petroleum degradation; they have the capacity to degrade the pollutants as primary degraders. In the present exploration, petrol was taken from the contaminated soil and collected from the mechanic shop. The samples were aseptically transported to the laboratory and subjected to plating technique on pseudomonas agar. The sample was spread and incubated at 37°C for one day. Whereas those colonies were taken for further study such as biochemical characterization. Then the sample is given a further research PCR test for identifying which specific species is contained within the soil environment. This research topic will be carried out with the objectives to study the characterization, identification, and its application of *Pseudomonas* isolated from the petrol.

Keywords: *Pseudomonas* agar, Bioremediation, Hydrocarbon pollutants, PCR Technique.

MAPPING RESISTANCE: ANTIBIOGRAM OF CLINICAL *PSEUDOMONAS AERUGINOSA* IN TAMIL NADU

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Pseudomonas aeruginosa drives severe nosocomial infections and shows complex multidrug resistance, demanding local susceptibility surveillance. Profile clinical isolates and define susceptibility across major antipseudomonal classes. Methods: Sixty-three isolates (pus 57%, sputum 22%, urine 21%) were confirmed by standard phenotypic methods; Kirby–Bauer per CLSI 2014 tested 12 agents on CA-MHA. Susceptibility remained highest for polymyxin-B 84%, amikacin 79%, tobramycin 78%, gentamicin 67%, and ofloxacin 54%. Resistance was universal to cefotaxime and ceftazidime (100%), and high to norfloxacin 83%, nitrofurantoin 79%, and piperacillin/tazobactam 52%. Marked cephalosporin and fluoroquinolone resistance with retained activity of polymyxins and aminoglycosides should shape empiric choices and stewardship in the study setting.

Keywords: *P. aeruginosa*; antibiogram; MDR; aminoglycoside; polymyxin

IONIC LIQUID PROMOTED GREEN SYNTHESIS OF NOVEL THIAZOLE DERIVATIVES & EXPLORING THE ANTI-INFLAMMATORY ACTIVITY

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This study reports ionic liquid supported synthesis of a series of novel thiazole derivatives. The use of ionic liquids provided a recyclable and environment friendly medium, enabling reactions to proceed under mild conditions with improved yields. Structural characterization of the synthesized compounds were performed through IR, NMR, and mass spectral analysis. The anti-inflammatory potential of the compounds were assessed using both in vitro assays and in silico techniques. Among the tested derivatives, compound 10 exhibited notably higher activity than the standard Diclofenac sodium. further understand the pharmacological relevance, ADMET and ProTox computational evaluations were carried out. These analysis indicate that these compounds possess favourable pharmacokinetic properties along with lower predicted toxicity. Density Functional Theory (DFT) calculations were employed to investigate the electronic characteristics and reactivity profiles of the active molecules. Additionally, it provides deeper insight into their potential mechanisms of action and stability.

Keywords: Novel thiazole derivatives, Diclofenac sodium, Pharmacological relevance

DEVELOPMENT OF A NUTRIMIX POWDER FOR ADDRESSING IRON DEFICIENCY ANEMIA IN MENSTRUATING ADOLESCENTS AND WOMEN

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Iron deficiency anemia (IDA) is a common nutritional concern among menstruating adolescents and women. To address this, the aim of this study was to develop a Nutrimix powder formulated with iron-rich and bioactive ingredients to improve iron status and overall health. Key ingredients included beetroot powder, foxtail millet, almonds, moringa leaf powder, flaxseeds, banana peel, ragi, and *Asparagus recemosus*. This study sought to determine the optimal ratio and concentration of *Asparagus recemosus*, alongside other vitamins and minerals essential for combating anemia. Two variants of the Nutrimix powder were prepared, with comprehensive assessments of their physical, chemical, and sensory properties. The results of the chemical analysis showed promising outcomes. Sample 1 and Sample 2 exhibited moisture contents of 6.57% and 5.55%, respectively. Total ash content was 11.71% and 14.85%, while protein content was 12.56% and 15.73%, and fat content was 14.30% and 14.90%. Crude fiber content was 3.26% and 3.34%, and carbohydrate content was 54.86% and 48.96%, respectively. Sensory evaluation revealed that Sample 2 displayed better palatability and overall acceptability, making it a more favorable option. Iron and vitamin C content were also assessed, with Sample 2 showing satisfactory levels. Specifically, Sample 2 contained 3.6 mg of iron, which meets the recommended daily allowance (RDA) for women of reproductive age. Notably, the iron content in both samples remained within the tolerable upper limit, indicating a safe and effective formulation. In the storage study, fluctuations in moisture content were observed, which points to a need for further investigation to enhance the product's stability. A comparative study with another Nutrimix powder demonstrated that the developed formulation was superior in terms of chemical composition, sensory attributes, and overall effectiveness. In conclusion, the study successfully developed a Nutrimix powder aimed at addressing iron deficiency anemia, incorporating the ideal concentration of *Asparagus recemosus* along with essential nutrients. While the formulation was found to be effective and acceptable, the observed moisture fluctuations during storage suggest opportunities for future research to further stabilize the product.

Key words: Iron Deficiency Anemia (IDA), Nutrimix Powder, *Asparagus recemosus*, Menstruating Women and Adolescents, Iron Supplementation

FABRICATION OF ACTINOBACTERIA-MEDIATED SILVER NANOPARTICLES FOR COMBATING ETHANOL RESISTANT MICROBES IN HEALTHCARE SETTINGS

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The study demonstrates the potential of Actinobacteria, particularly *Streptomyces roseofulvus*, in the biosynthesis of silver nanoparticles (AgNPs) with strong antimicrobial activity. From terrestrial soil samples, 32 Actinobacteria were isolated, and 10 morphologically distinct isolates were chosen for further analysis. Among them, isolate ARS5 (*S. roseofulvus*) was found to rapidly reduce silver ions, synthesizing AgNPs within just 2 minutes. The nanoparticles were characterized through different techniques: UV-Vis spectroscopy showed a peak at 484 nm confirming their formation, FTIR analysis indicated the presence of biomolecules responsible for reduction and stabilization, DLS revealed particle sizes ranging between 20–250 nm, and EDS confirmed silver as the major elemental component. Additionally, ethanol-resistant *Bacillus* species were isolated from a UV chamber and identified by cultural and microscopic methods. The AgNPs synthesized by *S. roseofulvus* ARS5 were tested against these resistant *Bacillus* strains, showing significant antibacterial activity, with inhibition zones ranging from 0 to 17.2 cm at different concentrations (25–400 mg/mL). The results highlight the efficiency of biologically synthesized AgNPs in combating resistant microorganisms, suggesting promising applications in several fields. These include the development of antimicrobial coatings for healthcare and food processing industries to minimize microbial contamination, their incorporation into disinfectants as active antimicrobial agents effective against a wide range of pathogens, and their use in medical devices such as wound dressings, implants, and catheters to prevent infections. Overall, the study establishes *S. roseofulvus* as a valuable biological source for AgNP synthesis and emphasizes its potential role in antimicrobial strategies.

Key words: *Streptomyces roseofulvus*, Ethanol-resistant *Bacillus*, Silver nanoparticles

ECO-FRIENDLY SYNTHESIS OF SILVER NANOPARTICLES USING MEDICINAL PLANTS: ANTIBACTERIAL AND ANTIBIOFILM POTENTIAL OF *A. PANICULATA* AND *C. PAPAYA*

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Nanotechnology has emerged as a promising field in biomedical sciences, with silver nanoparticles (AgNPs) gaining significant attention due to their unique physicochemical and antimicrobial properties. The present study focused on the green synthesis of AgNPs using methanolic leaf extracts of *Andrographis paniculata* and *Carica papaya*, both known for their rich phytochemical composition and medicinal value. The synthesis was confirmed by a visible color change of the reaction mixture from pale yellow to brown, attributed to surface plasmon resonance. The nanoparticles were characterized using UV–Visible spectroscopy, Fourier Transform Infrared (FTIR) spectroscopy, and Scanning Electron Microscopy (SEM). UV–Vis analysis revealed a sharp absorption peak at 402 nm, and FTIR spectra indicated the presence of functional groups such as alcohols, amines, carboxylic acids, and phenols involved in nanoparticle stabilization. SEM analysis ranging from 5–35 nm in size, predominantly spherical with some irregular forms, and clustered in aggregates. The biosynthesized AgNPs exhibited effective antibacterial activity against selected pathogens. At 100 µL concentration, inhibition zones were observed for *Klebsiella sp.* (14 mm), *Proteus sp.* (9 mm), and *Staphylococcus aureus* (8 mm). The minimum inhibitory concentration (MIC) was determined as 75 µL against *Klebsiella sp.* In addition, strong antibiofilm activity was recorded against *E. coli*, *S. aureus*, and *Klebsiella sp.* These findings confirm that green-synthesized AgNPs from *A. paniculata* and *C. papaya* are potent antibacterial and antibiofilm agents, with promising applications in biomedical development.

Keywords: Biosynthesis, Silver nanoparticles, *Andrographis paniculata*, *Carica papaya*, Antimicrobial activity, Antibiofilm.

ANTIBIOGRAM OF BACTERIAL PATHOGENS ASSOCIATED WITH URINARY TRACT INFECTIONS

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Urinary tract infections (UTIs) are a common health issue among female patients, often caused by bacterial pathogens exhibiting variable antibiotic resistance. The present study aimed to isolate and identify bacterial species from urine samples of 30 female patients with UTIs and to analyze their antibiotic susceptibility patterns. A total of 29 isolates were obtained, comprising *Escherichia coli* (62%), *Klebsiella* spp. (28%), and *Staphylococcus aureus* (10%). Identification was performed through gram staining, motility, and biochemical characterization, confirmed by Bergey's manual of systematic bacteriology. Antibiotic susceptibility testing revealed that Gentamicin showed the highest activity against all isolates, followed by Cefuroxime, Nitrofurantoin, Amoxicillin, and Tetracycline. The findings highlight the increasing concern of drug resistance among uropathogens, emphasizing the need for regular surveillance and periodic reassessment of antimicrobial susceptibility patterns. This study underscores the importance of selecting appropriate antibiotics for empirical therapy in female UTI patients and recommends cautious use of antibiotics under medical supervision to prevent the emergence of resistant strains.

Keywords: Urinary tract infection (UTI); Female patients; *Escherichia coli*; *Klebsiella* spp.; *Staphylococcus aureus*; Antibiotic susceptibility; Drug resistance; Gentamicin; Empirical therapy; Antimicrobial surveillance.

FORMULATION AND EVALUATION OF HERBAL GEL AGAINST SKIN MICROBES

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The increasing prevalence of antimicrobial resistance and the limitations of synthetic drugs have created a demand for safe and effective alternatives in the management of microbial skin infections. In this study, a herbal gel was formulated using bioactive plant extracts incorporated into suitable gelling agents for topical application. The gel was evaluated for physicochemical parameters such as pH, viscosity, and spread ability, along with antimicrobial activity against common skin pathogens including *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Candida albicans*. The results demonstrated significant inhibitory activity, compared to standard formulations, providing additional benefits such as moisturizing and wound-healing properties. These findings suggest that herbal gel formulations can serve as a promising natural remedy for skin infections, with potential for further development and commercialization following clinical validation.

Keywords: Herbal gel, Skin infections, Antimicrobial activity, Plant extracts, *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Candida albicans*, Topical formulation.

PHYSICOCHEMICAL AND MICROBIAL CHARACTERISTICS OF SELECTED MINOR ESTUARIES OF THE WEST COAST OF KERALA, INDIA

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The physicochemical and microbial characterization of estuarine water samples from the Chaliyar and Kallai estuaries along the West Coast of Kerala, India, was carried out over a one-year period from January 2022 to December 2022. Water temperature ranged from 26°C to 30.8°C. The highest pH value of 8.5 was recorded in September, while the lowest pH of 6.2 was observed in June. Dissolved oxygen levels peaked in October and reached a minimum in July. Concentrations of nitrite, nitrate, calcium, and magnesium showed significant seasonal fluctuations. Heterotrophic bacterial populations were highest in the post-monsoon months of September and October and lowest during the pre-monsoon month of May. Variations in physicochemical parameters and microbial load were strongly influenced by the southwest monsoon rains. These fluctuations affected the metabolic activity and population dynamics of microorganisms, highlighting the complex interactions between environmental factors and estuarine microbial ecology.

Key words: Estuary, Physicochemical parameters, Microbial analysis

EVALUATION OF ANTIOXIDANT ACTIVITY AND CHARACTERIZATION OF POLYSACCHARIDES EXTRACTED FROM *NOSTOC SP.*

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Polysaccharides from cyanobacteria such as *Nostoc* sp. are gaining attention due to their bioactive properties, especially antioxidant activity, along with low toxicity and side effects. This study focused on extraction, characterization, and evaluation of antioxidant activity of *Nostoc* exopolysaccharides (EPS). Cultivation was carried out in ASN III medium under controlled conditions (25 °C, continuous light at 40 $\mu\text{mol m}^{-2} \text{s}^{-1}$) for one month. EPS were extracted from the culture supernatant by cold ethanol precipitation and purified through dialysis, yielding a powdered sample (*Nostoc* EPSC-1). SEM revealed spherical to cubic particles within 76–85 nm. EDX confirmed the dominance of carbon and oxygen, consistent with polysaccharide composition, and minor elements such as magnesium, sodium, silicon, chlorine, calcium, and phosphate indicated structural complexity. FT-IR spectra confirmed functional groups typical of polysaccharides, including hydroxyl, carbonyl, ether, and carboxyl. Antioxidant activity was determined by the DPPH assay, at 500 $\mu\text{g/ml}$ EPS showed strong radical scavenging (OD 0.397; inhibition 71.26%), close to the standard, while at 10 $\mu\text{g/ml}$ activity was minimal (62.01%). The IC_{50} value of 115.8 $\mu\text{g/ml}$ confirmed significant antioxidant capacity. A visible dose-dependent color change during the assay further supported the results. These findings indicate that exopolysaccharides from *Nostoc* sp. exhibit potent, dose-dependent antioxidant activity. Their natural origin, structural complexity, and bioactivity suggest promising applications in pharmaceutical, nutraceutical, and food industries. Further work on purification, structural elucidation, and evaluation of additional biological properties could expand their therapeutic potential.

Keywords: Polysaccharides, Cyanobacteria, Biological properties, Therapeutic potential.

*Poster
Presentation*

UNVEILING THE MICROBIOME OF DECAYING FRUITS, IDENTIFICATION, FUNCTIONAL ROLES AND INDUSTRIAL POTENTIAL

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Decaying fruits harbor a diverse microbiome consisting of bacteria, fungi, and yeasts that drive spoilage and nutrient recycling. Identification of these microbes involves both culture-based methods and advanced molecular tools such as 16S rRNA and ITS sequencing, which reveal dominant genera like *Pseudomonas*, *Bacillus*, *Penicillium*, *Botrytis*, and *Saccharomyces*. Functionally, these organisms produce enzymes including pectinases, cellulases, and amylases that degrade fruit tissues, leading to softening, off-flavors, and mycotoxin production. Yet, not all roles are detrimental-some microbes act as natural biocontrol agents, suppressing pathogens through competition, volatile production, or antagonism. Industrially. Fruit-associated microbes hold great potential: their enzymes are applied in juice clarification, biofuel production, and pharmaceuticals; yeasts contribute to wine, ethanol, and organic acid fermentations; while certain bacteria produce biosurfactants and probiotics. Thus, the fruit microbiome, though linked to spoilage, represents a valuable reservoir of biotechnological applications that can transform waste into wealth and promote sustainable industries.

THE HUMAN MICROBIOME AND ITS IMPACT ON HEALTH

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The human microbiome comprises Bacteria, Archae, Viruses and Eukaryotes which reside within and outside our bodies. These organisms impact human physiology, both in health and in disease, contributing to the enhancement or impairment of metabolic and immune functions. Microorganisms colonize various sites on and in the human body, where they adapt to specific features of each niche. Facultative anaerobes are more dominant in the gastrointestinal tract, whereas strict aerobes inhabit the respiratory tract, nasal cavity, and skin surface. The indigenous organisms in the human body are well adapted to the immune system, due to the biological interaction of the organisms with the immune system over time. An alteration in the intestinal microbial community plays a major role in human health and disease pathogenesis. These alterations result from lifestyle and the presence of an underlying disease. Dysbiosis increases host susceptibility to infection, and the nature of which depends on the anatomical site involved. The unique diversity of the human microbiota accounts for the specific metabolic activities and functions of these microorganisms within each body site. It is therefore important to understand the microbial composition and activities of the human microbiome as they contribute to health and disease.

Keywords: Microbiome, Immune System, Diversity, Metabolism, Disease.

IN VITRO ANTIMICROBIAL EVALUATION OF BIOACTIVE COMPOUND FROM STAR FISH, *PROTOREASTER LINCKII*

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The present investigation highlights the antimicrobial properties of solvent extracts derived from the tissues and coelomic fluid of the starfish *Protoreaster linckii*. The Extracts were evaluated against a panel of microorganisms, including five human pathogen, two fungal stains, and five fish pathogenic bacteria. Among test solvents, chloroform extracts exhibited comparatively stronger inhibitory action against the test organisms. In general, the tissue extracts of starfish showed little or no suppression of human bacterial pathogen, except the chloroform fraction, which displayed mild activity against *K.pneumoniae* (from digestive gland extract) and *proteus vulgaris* (with gonad and tube extracts).against fish pathogenic bacteria, all tested extracts produced only marginal inhibition zones. However, chloroform extracts demonstrated superior antifungal effect, particularly against *aspergillus niger* and *aspergillus flavus* with the coelomic fluid extract producing the maximum inhibition zone of 11(mm)

Keywords: *Protoreaster linckii*, Coelomic fluid, Bacteria.

BIOINOCULANT-DRIVEN GROWTH ENHANCEMENT IN FLAX (*LINUM USITATISSIMUM* L.)

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Flax (*Linum usitatissimum* L.) is a remarkably versatile crop, valued worldwide for its dual purpose is fiber and oilseed production. Its ability to thrive in diverse environments makes it a prime candidate for sustainable agriculture. As global concerns around environmental impact and chemical dependency grow, researchers and farmers alike are turning to bioinoculants—microbial allies that offer a greener path to productivity. These bioinoculants, made from beneficial microorganisms such as *Pseudomonas fluorescens*, *Trichoderma viride*, Vesicular Arbuscular Mycorrhizae (VAM), *Azotobacter*, and nutrient-solubilizing agents for phosphorus and potassium, are proving to be powerful tools in boosting plant growth while preserving ecological balance. In recent trials, seed germination rates varied significantly across treatments. *P. fluorescens* led the pack with an impressive 92% germination, while potassium-solubilizing microbes showed the lowest at 52%. Notably, the combination of *P. fluorescens* and *T. viride* delivered the most promising results—achieving a plant height of 24.74 ± 0.7 cm and a germination ratio of 23.05 ± 1.35 . These findings highlight the potential of bioinoculants not just as growth enhancers, but as key players in building a more resilient and eco-friendly future for flax cultivation. Embracing these microbial solutions could be a game-changer in reducing synthetic inputs and promoting long-term agricultural sustainability.

Key words: *L. usitatissimum*, *Pseudomonas fluorescens*, nutrient-solubilizing agents, Vesicular Arbuscular Mycorrhizae.

BIOACTIVE COMPOUND OF SEAWEED-DERIVED POTASSIUM AND THEIR USAGE AS BIO FERTILIZERS

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Seaweed-derived bio fertilizers are rich in bioactive compounds that enhance plant growth and soil fertility in a sustainable manner. Polysaccharides such as alginate and laminarin improve soil structure and water retention, while phytohormones including auxins and cytokinins stimulate germination, root growth, and yield. Proteins, amino acids, vitamins, and minerals further contribute to improved nutrient uptake and plant resilience. The application of seaweed extracts as foliar sprays or soil amendments reduces reliance on chemical fertilizers, promotes microbial activity, and strengthens plant tolerance to environmental stresses. Thus, seaweed-based bio fertilizers represent an eco-friendly and efficient approach improving agricultural productivity. Seaweed-derived biofertilizers serve as an effective and eco-friendly source of plant nutrients, particularly potassium, which is essential for crop growth and productivity. Potassium-rich seaweeds enhance enzyme activation, photosynthesis, and osmotic regulation, thereby improving plant stress tolerance. Potassium, seaweed extracts promote root development, nutrient uptake, and microbial activity in soil. The combined effect strengthens plant resistance against salinity, drought, and disease, while improving yield and quality. When applied as foliar sprays or soil amendments, seaweed-based biofertilizers reduce dependence on chemical fertilizers and maintain soil fertility in a sustainable manner. Thus, potassium-enriched seaweed formulations represent a promising strategy for advancing climate-resilient and resource-efficient agriculture.

Keywords: Seaweed, Biofertilizers, Polysaccharides, Phytohormones, Sustainable agriculture, Soil fertility, Potassium based fertilizers

FORMULATION AND HEALTH BENEFITS OF DRAGON FRUIT-ENRICHED SOY YOGURT

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Yogurt is a widely consumed cultured dairy product valued for its nutritional content, therapeutic benefits, and functional properties. In recent years, consumer demand for plant-based and dairy-free alternatives has risen, prompting the innovation of non-dairy yogurt options. One such development is dragon fruit-flavoured soy yogurt, which merges the health advantages of soy-based fermentation with the exotic appeal of dragon fruit. Soy milk, derived from soybeans—a leguminous plant—is fermented using live probiotic cultures to create soy yogurt, making it a suitable alternative for individuals who are lactose intolerant or follow a vegan lifestyle. The addition of dragon fruit not only enhances the sensory appeal of the yogurt through its vibrant pink hue and tropical flavour but also contributes additional nutrients and antioxidants. This combination results in a product that mimics the creamy texture of traditional yogurt while offering enhanced nutritional benefits. Dragon fruit-flavoured soy yogurt is rich in plant-based protein, calcium, and beneficial probiotics that support gut health. It caters to health-conscious consumers seeking variety in their diets and meets the growing demand for functional foods that address specific dietary restrictions. This yogurt can be consumed as a standalone snack, paired with cereals or granola, or blended into smoothies, providing a versatile and appealing dietary option. Finally concluded that the dragon fruit-flavoured soy yogurt represents a nutritious, functional, and attractive alternative to traditional dairy yogurts, combining taste, health benefits, and dietary inclusivity in one innovative product.

Keywords: Soy yogurt, Dragon fruit, Dairy-free alternative, Probiotics, Fermented soy milk.

NOVEL HBD-3@FE/GMP HYBRID NANOZYME INDUCES REDOX-MEDIATED APOPTOSIS AND TUMOR SUPPRESSION IN COLORECTAL CANCER

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Colorectal cancer is among the leading causes of cancer-related mortality, necessitating novel therapeutic strategies. Antimicrobial peptides such as human β -defensin 3 (hBD-3) possess anticancer potential but are limited by instability and low bioavailability. A hybrid nanozyme was engineered by immobilizing hBD-3 onto a guanosine monophosphate-coordinated iron framework (Fe/GMP). The hBD-3@Fe/GMP formulation was synthesized, characterized, and tested for anticancer activity in HT-29 colon cancer cells using cytotoxicity, apoptosis, migration inhibition, reactive oxygen species (ROS), and redox biomarker assays. *in vivo* efficacy was further validated in a colon carcinoma xenograft mice model. hBD-3@Fe/GMP significantly enhanced ROS generation and induced apoptosis in HT-29 cells via upregulation of p53 and Bax and downregulation of Bcl-2. The nanozyme suppressed antioxidant enzyme activity, inhibited cell migration, and demonstrated strong antitumor efficacy *in vivo* by reducing tumor volume and weight in xenograft-bearing mice. hBD-3@Fe/GMP exerts potent anti-colon cancer activity through redox-mediated apoptosis and tumor suppression, highlighting its potential as a next-generation nanozyme therapeutic for colorectal cancer treatment.

Keywords: Nanozyme; Human β -defensin 3; Colon cancer; ROS generation; Apoptosis; Antitumor efficacy

BIOREMEDIATION OF HEAVY METALS FROM AQUATIC ENVIRONMENT THROUGH MICROBIAL PROCESSES: A POTENTIAL OF PROBIOTICS

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Over the years, researchers have proven that heavy metal concentration creates a disastrous effect on aquatic creatures and also it creates a very bad impact on humans who consume it because sea foods contribute essential part of protein sources required in human diet. The most commonly found heavy metals in aquatic environment are mercury (Hg), cadmium (Cd), and chromium (Cr). These heavy metals that are found in higher concentration in water increases the toxicity and the water becomes unsuitable for both aquatic as well as human race. In order to remove the toxins, present in the water bodies bioremediation process is one of the most effective mechanisms which helps in process of eliminating the toxins from the water bodies using microorganisms such as bacteria fungi and green plants. This is found to be a very effective method for the removal of toxic heavy metal concentration. In this project they have are used enterococci (BT1, BT2, MC1AND MC2) and *Bacillus acidiproducens* (SM1, SM2) this particular microbe which is as many advantages over the other microbes.

Keywords: Bioremediation, Heavy metals, *Enterococci*, *Bacillus acidiproducens*

STARCH-BASED BIOPLASTICS FROM TAPIOCA AND SWEET POTATO: A SUSTAINABLE ALTERNATIVE FOR FOOD PACKAGING AND INDUSTRIAL APPLICATIONS

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The extensive use of petroleum-derived plastics has led to severe environmental and health concerns due to their non-biodegradability and reliance on fossil resources. Over 9 million tons of plastic waste entering oceans each year and only about 9% being recycled. Starch-based bio plastics are gaining attention as sustainable alternatives because of their abundance, renewability, and compatibility with food applications. However, native starch has critical drawbacks, including low mechanical strength, poor water resistance, and high sensitivity to environmental factors. This study focuses on the development of starch-derived bioplastics from tapioca and sweet potato, employing glycerol as a plasticizer in varying formulations. The resulting materials were evaluated for biodegradability, mechanical strength, and physical performance. Improvements were achieved through strategies such as chemical modification, polymer blending, and the incorporation of natural fillers, essential oils, and nanoparticles. Recent innovations, including cross-linking of starch derivatives and the designing recyclable composites, further enhance their functional properties and expand potential applications. Life cycle assessments indicate that starch-based bio plastics reduce plastic pollution and support a circular economy. Beyond food packaging, their versatility extends to agriculture, biomedical, textile, and consumer product industries. Overall, the findings highlight the promise of starch-based bio plastics as environmentally friendly and sustainable alternatives to conventional plastics, while underscoring the need for continued research to overcome performance limitations and enable large-scale industrial adoption.

Keywords: Starch-based bio plastics; Tapioca; Sweet potato; Glycerol plasticizer; Biodegradability; Polymer blending; Sustainable packaging; Circular economy

HYBRID HBD-3@FE/GMP NANOZYME WITH ENHANCED PEROXIDASE-MIMETIC ACTIVITY EXHIBITS POTENT ANTI-*HELICOBACTER PYLORI* EFFECTS

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Helicobacter pylori infection remains a major global health concern, contributing to gastric disorders and antibiotic resistance challenges. Antimicrobial peptides (AMPs) such as human β -defensin 3 (hBD-3) show potent antibacterial effects but suffer from poor stability and bioavailability. To overcome these limitations, we developed a hybrid nanozyme by immobilizing hBD-3 onto a guanosine monophosphate-coordinated iron framework (Fe/GMP). The hBD-3@Fe/GMP nanozyme was synthesized, characterized, and evaluated for antibacterial efficacy against *H. pylori* through agar diffusion, biofilm inhibition, and virulence gene expression. [assays.hBD-3@Fe/GMP](#) exhibited enhanced peroxidase-like catalytic activity, generating higher levels of reactive oxygen species (ROS) compared to Fe/GMP alone. The nanozyme significantly inhibited *H. pylori* growth, disrupted biofilm formation, and downregulated virulence-associated genes (babA, alpA, alpB, flaA, flaB). hBD-3@Fe/GMP demonstrates potent anti-*H. pylori* activity by combining the antimicrobial properties of hBD-3 with the redox functionality of Fe/GMP. This hybrid nanozyme represents a promising therapeutic candidate for combating *H. pylori* infection and associated gastric complications.

Keywords: Nanozyme; Human β -defensin 3; *Helicobacter pylori*; Antibacterial activity; Peroxidase mimic.

FROM WASTE TO WATTS: MICROBIAL INNOVATIONS IN BIOENERGY

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The need for clean and renewable energy is increasing every day, and microbes can play an important role in meeting this demand. Microorganisms like bacteria, fungi, and algae can turn waste materials such as leftover food, plant residues, and industrial by-products into useful energy sources like bioethanol, biodiesel, biogas, hydrogen, and even electricity through microbial fuel cells. This process, known as “waste to watts,” not only produces eco-friendly energy but also helps reduce waste and protect the environment. New techniques have made microbes more efficient at producing energy, which makes it possible to use them on a larger scale. This poster will show how simple microbes can make a big difference in creating sustainable energy and a cleaner planet. By using microbes to generate energy, we can take an important step toward a greener and more sustainable future.

Keywords: Biofuels, Bioenergy, Microbes, Waste to Energy, Sustainability

A REVIEW ON ACTINOMYCETES AND ITS BIOACTIVE COMPOUNDS PRODUCTION FOR BIOLOGICAL APPLICATION

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Actinomycetes are soil-dwelling microorganisms, with *Streptomyces* being a major group known for antibiotic and bioactive compound production. They contribute to organic matter degradation and plant health. Actinomycetes were studied for their morphology, metabolic potential, and enzyme production using specialized isolation and cultivation techniques to address their slow growth and nutritional requirements. *Streptomyces* secondary metabolites are produced mainly during the stationary growth phase using fermentation in specially optimized solid or liquid culture media. Extraction and analysis of metabolites are typically done by solvent extraction followed by chromatographic and mass spectrometric methods for identification and characterization. *Streptomyces* produces two-thirds of all antibiotics used in medicine, such as streptomycin, tetracycline, and erythromycin. Actinomycetes also produce enzymes like proteases and lipases that aid in biomass degradation. Actinomycetes produce enzymes like amylase, cellulase, protease, lipase, and chitinase that have wide industrial and environmental uses. These enzymes are applied in food processing, fermentation, and detergent industries to improve efficiency and product quality. They also aid in textile and paper manufacturing by helping degrade fibers and remove stains. With diverse metabolic capabilities, Actinomycetes are vital for pharmaceutical and industrial applications. Their role in producing antibiotics and enzymes makes them indispensable, despite cultivation challenges.

Keywords: Actinomycetes, *Streptomyces*, secondary Metabolites, antibiotic resistance, natural products.

MICROBIAL APPROACHES FOR SUSTAINABLE BIOENERGY AND BIOFUEL PRODUCTION

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Microorganisms play a vital role in sustainable bioenergy and biofuel production, offering a promising solution to the global energy crisis. Microbial approaches, such as fermentation and anaerobic digestion, can convert biomass into biofuels like ethanol, butanol, and biodiesel, as well as bioenergy in the form of biogas and bioelectricity. This review highlights the potential of microbial technology in bioenergy production, including the use of genetically engineered microbes, microbial consortia, and innovative bioprocesses. By harnessing the power of microorganisms, we can create a more sustainable, efficient, and environmentally friendly energy future.

Keywords: Microorganisms, Biogas and Bioelectricity, Global energy, Anaerobic digestion

ROLE OF MICROBES IN THE PHARMACEUTICAL INDUSTRY

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Microorganisms are indispensable in modern medicine, with vast applications in the pharmaceutical sector extending from drug discovery to large scale manufacturing. The presentation explores the multifarious roles of microbes, highlighting their contributions to human health and well-being. Fungi and bacteria are the primary source for a multitude of life-saving antibiotics, such as penicillin and amoxicillin. Microbes are utilized to create vaccines and antibodies, stimulating the body's immune response to combat infectious diseases. Microbial fermentation is crucial for the commercial production of essential vitamins, like vitamin B12 and B2 (riboflavin), as well as probiotic strains to enhance health. Many enzymes and hormones used therapeutically are produced using engineered microbial processes. Microorganisms are a rich source of novel bioactive compounds, leading to the discovery of new antimicrobial, antifungal, and antiviral agents. Studying microbial cellular mechanisms helps in the development of targeted therapies that effectively combat opportunistic infections without harming the human host. Pharmaceutical microbiology plays a vital role in maintaining sterile manufacturing environments and developing testing methods to prevent microbial contamination of drugs. Regular microbiological testing ensures the safety and efficacy of raw materials, intermediates, and final pharmaceutical products. Microbial biotechnology has revolutionized the pharmaceutical industry, offering sustainable and efficient methods for producing diverse medicinal products. Continued exploration of microbial diversity promises further advancements in discovering new drugs, improving manufacturing processes, and enhancing public health.

Keywords: Microbial Products and Bioprocessing, Antibiotics, Vitamins and Nutraceuticals

MICROBIAL PAINTED WALLS

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“Microbial Painted Walls” is an out-of-box innovation that reimagines wall painting through living microorganisms rather than chemical paints. Conventional paints are resource-intensive, toxic, and environmentally damaging. In contrast, microbes such as bacteria, fungi, and algae naturally produce pigments like carotenoids, melanin, and violacein. Harnessing these pigments allows walls to be “painted” in a way that is renewable, biodegradable, and eco-friendly. The approach is cost-effective, as microbial growth requires only inexpensive culture media and basic maintenance compared to the high production costs and environmental toll of synthetic paints. Once applied, these living paints can persist and even self-repair, reducing the need for frequent repainting. Certain microbial strains can also provide added benefits, such as air purification, carbon dioxide absorption, or mild antimicrobial action, making the walls both decorative and functional. This concept is not only scientifically sound but also practically implementable in controlled environments like schools, public buildings, or eco-parks, where sustainability and education intersect. By uniting microbiology, design, and sustainability, microbial painted walls transform an ordinary surface into a living system. They demonstrate how microbes, often overlooked, can serve as partners in building greener, healthier, and more resource-efficient futures.

Keywords: Conventional paints, Microbes, Resource-efficient futures

BIODEGRADATION OF DI-(2-ETHYLHEXYL) PHTHALATE BY NOVEL *RHODOCOCCUS* SP. PFS1 STRAIN ISOLATED FROM PADDY FIELD SOIL

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Di-(2-ethylhexyl)-phthalate (DEHP) is a widely used phthalate ester plasticizer, commonly present in cosmetics, packaging materials, and other consumer products. However, DEHP exhibits carcinogenic and mutagenic effects on humans, raising environmental and health concerns. Biodegradation by microorganisms offers an eco-friendly strategy to eliminate DEHP contamination from different environments. In the present study, a soil bacterium *Rhodococcus* sp. PFS1 was isolated from paddy field soil and identified through 16S rRNA sequencing. The DEHP degradation ability of strain PFS1 was evaluated under varying environmental conditions, including different pH, temperature, salinity, glucose concentration, and varying concentrations of DEHP. Biodegradation potential in contaminated soil was also tested. Furthermore, the DEHP metabolic pathway in strain PFS1 was investigated using HPLC-MS analysis. Strain PFS1 demonstrated efficient DEHP degradation, with optimal activity observed at neutral pH and 30 °C. The strain exhibited strong tolerance to salinity, effectively degrading DEHP even at high salt concentrations (up to 50 g/L). PFS1 degraded a range of phthalate esters (PAEs) with efficiency up to 90%. In soil experiments, DEHP removal reached 94.66% when combined with native soil microorganisms and 87.67% in sterilized soil with PFS1 alone. HPLC-MS confirmed the metabolic pathway of DEHP degradation via mono(2-ethylhexyl) phthalate (MEHP) to phthalate (PA), which was subsequently utilized for cell growth. These findings indicate that *Rhodococcus* sp. PFS1 possesses strong biodegradation potential for DEHP and other PAEs under diverse environmental conditions. Its efficiency in contaminated paddy field soil highlights its suitability for bioremediation applications.

Keywords: Di-(2-ethylhexyl)-phthalate (DEHP), Biodegradation, *Rhodococcus* sp., Mono(2-ethylhexyl) phthalate, Paddy field soil

ASSESSMENT OF PHYTOCHEMICALS FROM THE ROOTS OF ACHYRANTHES ASPERA AS QUORUM SENSING INHIBITORS AGAINST CARIOGENIC DENTAL BIOFILM

B.Sangeetha

Dental caries is a prevalent oral disease caused by cariogenic bacteria that form biofilms on tooth surfaces. Quorum sensing (QS) is a bacterial communication system that regulates biofilm formation. Inhibiting QS can be a promising strategy to prevent dental caries. This study investigates the potential of phytochemicals from *Achyranthes aspera* roots as QS inhibitors against cariogenic dental biofilm. The roots of *A. aspera* were extracted and phytochemicals were identified. The extracts were tested for their ability to inhibit QS-regulated biofilm formation in cariogenic bacteria. The results showed that the extracts significantly reduced biofilm formation and QS-regulated genes expression. The phytochemicals responsible for QS inhibition were identified and their mechanism of action was elucidated. This study highlights the potential of *A. aspera* roots as a natural source of QS inhibitors for the prevention of dental caries.

Keywords: *Achyranthes aspera*, phytochemicals, quorum sensing inhibitors, dental biofilm, cariogenic bacteria.

INNOVATIONS IN BIOTECHNOLOGY IN HEALTH SCIENCE

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With innovative breakthroughs that have the potential to completely change illness diagnosis, treatment, and prevention, biotechnology is revolutionizing the healthcare industry. The progress and influence biotechnology has had on contemporary health science are examined in this project. The development of recombinant DNA technology is among the most famous instances of biotechnology's revolutionary potential. New treatments, the creation of life-saving medications, and a better knowledge of hereditary illnesses have all been made possible by this discovery. In the quickly changing healthcare technology sector, biotechnology is at the forefront of innovation and advancement. Its ongoing advancement has enormous potential to enhance patient outcomes and influence medical practice in the future. Notwithstanding these developments, issues including moral dilemmas, legal restrictions, and fair access to biotech advancements continue to be significant.

Keywords: Digital health, immunotherapy, gene editing, personalized medicine, biotechnology, healthcare, CRISPR-Cas system.

**POPULATION FLUCTUATION AND SEASONAL VARIATIONS
OF BLACK-HEADED IBIS (*THRESKIORNIS
MELANOCEPHALUS*), IN HIREKOLALE LAKE
CHIKMANGALUR DISTRICT, KARNATAKA, SOUTHERN INDIA**

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The present study was undertaken to document the seasonal variations and population status of the Black-headed Ibis (*Threskiornis melanocephalus*) in the Hirekolale Lake ecosystem, located in Chikmagalur District, Karnataka, Southern India. Observations were conducted from January 2023 to December 2023, covering four distinct seasons: post-monsoon, summer, pre-monsoon, and monsoon. Hirekolale Lake is a large perennial water body, divided into two regions to facilitate systematic data collection. The lake serves as a vital habitat, offering food, shelter, nesting, and breeding grounds for both resident and migratory bird species, particularly the Black-headed Ibis. The study revealed that Region I supported 10% of the Black-headed Ibis population during the post-monsoon season, 46% in summer, 33% in pre-monsoon, and 11% during the monsoon. Region II supported 18% of the population in post-monsoon, 45% in summer, 28% in pre-monsoon, and 10% during the monsoon season. Overall analysis indicated that Region I recorded the highest number of Black-headed Ibises throughout the study period, while Region II had the lowest. Several anthropogenic factors appear to influence these population fluctuations, including sewage discharge, solid waste dumping, and open defecation—activities more prevalent in Region II than in Region I.

Keywords: Black-headed Ibis, Seasonal Variation, Hirekolale Lake, Chikmagalur District, Karnataka.