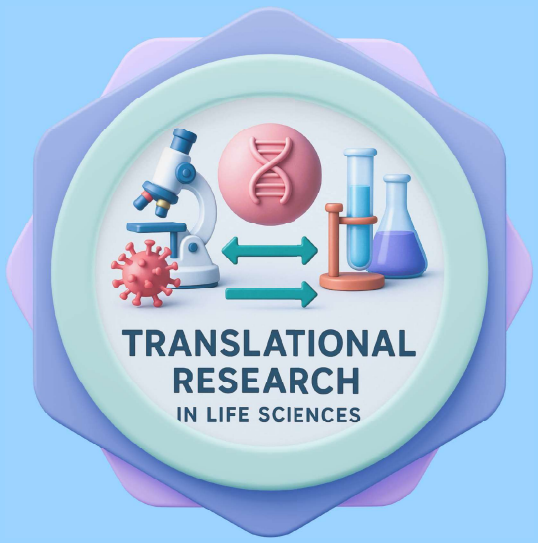
INTERNATIONAL CONFERENCE ON TRANSLATIONAL RESEARCH IN LIFE SCIENCES

(ICTRILS' 2026)

25 years DSEC 2001 - 2025 Silver Jubilee Celebration

CONFERENCE PROCEEDINGS



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INTERNATIONAL CONFERENCE ON TRANSLATIONAL RESEARCH IN LIFE SCIENCES ICTRILS-(2026)

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FOREWORD

It is with great pleasure that I welcome you to the proceedings of the International Conference on Translational Research in Life Sciences, a significant event organized by the Departments of Biotechnology, Biomedical Engineering, Food Technology, Pharmaceutical Technology, and Chemical Engineering. It is a multidisciplinary endeavor, involving the integration of fundamental research, clinical studies, technological advancements, and policy-making. The contributions collected in this proceedings book reflect the dynamic and forward-thinking nature of the scientific community's efforts in this area.

The topics presented here address both the challenges and the opportunities inherent in the application of scientific advancements to real-world problems. From novel drug delivery systems to sustainable food production techniques, from innovative biomedical devices to biotechnological solutions for environmental health. It is particularly inspiring to see how researchers from various fields are collaborating more than ever before, breaking down traditional silos to create new possibilities for the future. These collaborations are essential for tackling the complex health challenges we face today—from emerging infectious diseases to the growing burden of chronic conditions and the need for sustainable, health-promoting food systems. The conference and the publication of these proceedings are a testament to the vibrant, ever-evolving landscape of translational research.

On behalf of the organizing committees, I would like to express my heartfelt gratitude to all the authors, speakers, participants, and sponsors who have contributed to making this conference and its proceedings a success. It is my hope that the ideas shared here will inspire further collaborations, stimulate fresh thinking, and lead to meaningful breakthroughs in the life sciences.

Shri. A. SRINIVASAN

ESTEEMED CHANCELLOR

DHANALAKSHMI SRINIVASAN UNIVERSITY

Message

I am delighted to know that the Research & Development Cell of Dhanalakshmi Srinivasan Engineering College is hosting the "International Conference on Integrating Recent Innovations in Science and Technology: Shaping the Future" (ICIRIST-2026). The event is scheduled to take place from March 26th & 27th, at Dhanalakshmi Srinivasan Engineering College in Perambalur, Tamil Nadu. The constant emergence of innovative inventions in Science, Engineering, and Technology is a promising trend. The decision to organize an international conference on "Recent Innovations in Science and Technology" is commendable. The primary objective of these conferences is to provide a substantial platform for intellectual exchange. Researchers, industrialists, and students can come together to share their findings and insights in the realm of 'Innovative Researches', contributing to the enhancement of human life on both global and local scales. It is anticipated that the conference will serve as a catalyst for fostering a deeper understanding of various recent innovations from a broader perspective. I extend my best wishes to the organizing committee of ICIRIST-2026, hoping for the success of the event. May the academic deliberation sessions with esteemed scientists be fruitful and contribute significantly to the advancement of knowledge.

Prof. Dr. D. SHANMUGASUNDARAM, M.E., Ph.D.,

PRINCIPAL

Dhanalakshmi Srinivasan Engineering College

(Autonomous) Perambalur – 621212

Message

I am thrilled to learn that the Research and Development Cell of Dhanalakshmi Srinivasan Engineering College, Perambalur, is orchestrating the International Conference on Translational Research in Life Sciences (ICIRIST- 2026). This momentous event is scheduled to take place on March 26th & 27th, within the esteemed premises of the Dhanalakshmi Srinivasan Engineering College (Autonomous), Perambalur. Additionally, there will be the release of a souvenir and conference proceedings as well, marking this scientific gathering as a significant milestone. The conference proceedings are anticipated to offer valuable insights and perspectives, fostering suggestions for further research and applications in the dynamic fields of innovations in Science, Engineering, and Technology. This holds particular relevance to our region. In light of this auspicious occasion, I extend my warmest greetings to the dedicated Conveners and Organizing Secretaries of the ICIRIST-2026 and all the esteemed participants of the conference. May this gathering serve as a catalyst for intellectual exchange and collaboration, propelling advancements in research and applications. I convey my sincere wishes for the success of the conference and extend my hopes for a future filled with accomplishments for everyone involved. May the ICIRIST-2026 be an outstanding and grand success.

Prof. Dr. K. ANBARASAN, M.E.,Ph.D

VICE PRINCIPAL

Dhanalakshmi Srinivasan Engineering College

(Autonomous) Perambalur – 621212

Message

It gives me immense pleasure to extend my warm greetings on the occasion of the publication of the Conference Proceedings of the International Conference on Translational Research in Life Sciences (ICTRILS–2026). This conference, jointly organized by the Departments of Biomedical Engineering, Biotechnology, Chemical Engineering, Food Technology, and Pharmaceutical Technology, stands as a testament to the spirit of interdisciplinary collaboration and innovation. The convergence of diverse fields under a common platform reflects the growing importance of translational research in addressing real-world challenges in life sciences. The proceedings capture a rich collection of scholarly contributions, innovative ideas, and cutting-edge research presented by academicians, researchers, and industry experts from across the globe. I am confident that this compilation will serve as a valuable resource for advancing knowledge, fostering collaboration, and inspiring future research endeavors. I commend the organizing committee, editors, and contributors for their dedicated efforts in bringing out this publication successfully. I extend my best wishes for the continued success of such initiatives and hope that ICTRILS–2026 will pave the way for meaningful scientific advancements and collaborations.

PREFACE

It is with great enthusiasm that we present the proceedings of the International Conference on Translational Research in Life Sciences, an event that brought together scholars, researchers, and practitioners from multiple disciplines to explore the dynamic interface between fundamental science and practical application. This conference aimed to address some of the most pressing challenges in health, sustainability, and technology through innovative research and interdisciplinary collaboration.

Translational research represents a powerful bridge between the laboratory and real-world applications, with the ultimate goal of improving human health and addressing critical global challenges. It requires the collaboration of diverse scientific fields to convert promising discoveries into tangible solutions that can be used in clinical practice, industry, and society. This book captures the essence of the conference, which featured a rich variety of topics, ranging from biomedical innovations, biotechnological breakthroughs, drug development, and sustainable food production, to the design of new chemical processes and engineering solutions for global challenges.

We would like to extend our heartfelt gratitude to all the speakers, authors, and contributors who shared their expertise, and to the attendees who participated in making this conference a success. We also acknowledge the continued support of our respective institutions, whose commitment to fostering innovation and collaboration in research is fundamental to the success of events like this. As you explore the proceedings, we hope you will find the content not only intellectually enriching but also a call to action for greater interdisciplinary cooperation in the life sciences.

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DEPARTMENT OF BIOMEDICAL ENGINEERING

Vision:

Emergence of advanced learning, research and training to strengthen technologies in biomedical engineering for human welfare and Nation needs.

Mission:

The mission of the Biomedical Engineering Department is to construct a platform for bridging engineering principles, science and medicine.

M1: To engage with the specific to generic community for knowledge dissemination and career development.

M2: To update, analyze and impel the knowledge in the multi-disciplinary fields to strengthen technologies in biomedical engineering.

M3: To encourage the students to be aware of engineering principles in medicine for welfare of society.

M4: To expertise the students both in engineering and technical fields related to competitive medical technology in research and continuing education.

Program Educational Objectives (PEOs)

PEO 1: The graduates of the programme will have ability to improve the technologies by combining the design and problem solving skills for enhancing health care products.

PEO 2: Graduates of the programme will function as productive team member and leader who act as bridge between engineering and biology.

PEO 3: Graduates will be outstanding professionals by enhancing their advanced learning techniques in the field of biomedical engineering to face the global challenges.

PEO 4: Nurture responsible engineers with ethical values to serve the society and to learn and excel in higher education.

Program Specific Outcomes (PSOs):

PSO1: Bio- Analysis. Apply mathematical analysis for human paradigm, to problems, thereby to interface engineering and life science.

PSO2: Data Interpretation and Problem Solving**.** Make measurements on and interpret data from physiological systems and decipher the problems associated with the interaction between living and nonliving materials and systems.

DEPARTMENT OF FOOD TECHNOLOGY

Vision:

Prepare the food engineers to pursue their goals and to have successful career as competent technologist, scientist, researchers, entrepreneurs and personalities which benefits the public welfare through rigorous service in their challenging field.

Mission:

M1: Upgrade the scientific knowledge with a lifelong follow up in the areas of food science, food processing and safety for the development of food products through quality research.

M2: Extend to know how to identify and analyse the opportunities in Food Technology to adopt strategies that ensure socio-economic growth by collaborating with industries.

M3: Providing research and professional services to streamline and optimize operations which contribute to the enhancement of the quality of life.

M4: Develop socially responsible professionals and entrepreneurs who are capable of sustainable engineering practices for food industry.

Program Educational Objectives (PEOs)

PEO 1: Student will be able to pursue higher education in India or abroad in the field of Food Technology and it's related field and take up the competitive exams

PEO 2: Student will be able to come up with solutions for any technical and scientific problems related to Food Technology in institution, industry and society

PEO 3: Student will get familiarized in job related skills like communication, designing of experiments and entrepreneur skills in the field of food technology

Program Specific Outcomes (PSOs)

PEO 1: Apply basic skills and knowledge in Engineering to develop innovative food processing techniques and food products.

PSO 2: Adapt multidisciplinary approaches to solve food industry problems and ensure food quality and safety

PSO 3: Develop critical thinking and problem-solving skills in the domain of food technology with professional integrity and ethical values

MICROBIAL PROTEASES IN DETERGENT WASTE VALORIZATION

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ABSTRACT

Microbial proteases are gaining prominence in both detergent formulations and waste valorization due to their efficiency, specificity, and eco-friendly properties. In detergents, these enzymes effectively degrade proteinaceous stains like food, blood, and bodily fluids, enhancing cleaning performance. Microbial proteases, derived from bacteria, fungi, and actinomycetes, are advantageous in detergent products as they function at lower temperatures, reducing energy consumption and environmental impact. In waste valorization, microbial proteases contribute to recycling protein-rich organic waste, such as food scraps, agricultural residues, and animal by-products. They break down proteins into valuable products like amino acids and peptides, promoting the sustainable recovery of nutrients and bioactive compounds. This process reduces waste, supports a circular economy, and provides useful resources for industries like agriculture and pharmaceuticals. Advancements in genetic engineering and enzyme optimization have improved the stability, activity, and cost-effectiveness of microbial proteases. Despite challenges like enzyme stability and substrate specificity, continued research holds promise for enhancing their application in both detergent and waste valorization processes, driving sustainability and industrial efficiency. The review focuses on the overlooked aspects of microbial proteases in detergent and waste valorization, addressing gaps in the current literature.

Keywords: Eco-friendly, Pharmaceuticals, Reducing energy, Food scraps, Agricultural residues

SCREENING AND CHARACTERIZATION OF LOW-DENSITY POLYETHYLENE (LDPE)-DEGRADING BACTERIAL SUPERNATANT ENZYME

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ABSTRACT

Background: Plastic waste is a pressing global environmental concern, necessitating effective waste removal approaches such as biodegradation, offering a cost-efficient and eco-friendly solution. The accumulation of low-density polyethylene (LDPE) waste possesses significant environmental pollution risks, including degradation of natural beauty, entanglement and death of marine animals, blockage of urban sewage systems, foul odors, vector breeding. Due to its safety and ecological sustainability, biological remediation of LDPE has emerged as a prominent technique for plastic waste management. This study aims to screen and characterize Low-Density Polyethylene (LDPE)-Degrading Bacterial Supernatant Enzyme Methods: In this study, four bacterial isolates capable of degrading low-density polyethylene (LDPE) were selected from a previous investigation, and their supernatant enzymes were produced using MSM supplied with LDPE powder. Plate screening and weight loss methods confirmed significant LDPE degradation using the purified enzymes. The three prominent derivative enzymes were selected for further analysis and incubated with thermally treated LDPE sheets for four weeks. The degradation progress was evaluated using SEM (scanning electron microscopy) and FTIR (Fourier-transform infrared spectroscopy). SEM analysis revealed the presence of cracks, pits, and micro voids during biodegradation, while FTIR analysis showed shifts in the peaks of C and H bonds, as well as the formation of new peaks of C and O bonds, indicating changes in the LDPE film's chemical structure compared to the control. Based on 16S rRNA gene sequencing, the bacterial isolates were identified as (*Methylobacterium radiotolerans*), (*Lysinibacillus fusiformis*), and (*Plesiomanes shigelloides*).

Keywords: Biodegradation, Supernatant enzymes, LDPE, specific activity.

ALKALINE PROTEASE FROM *BACILLUS CEREUS* WAS CHARACTERIZED AND OPTIMIZED FOR ECO-FRIENDLY DEGRADATION OF FEATHERS

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ABSTRACT

To investigate the detailed analysis of alkaline protease production, media optimization, protease assay, mass production, and application in feather degradation by isolates of the *Bacillus cereus* strain isolated from leather industry effluent, Ethiopia. In this study, media optimization was subjected to nine different parameters like fermentation time, temperature, pH, substrate concentration, carbon sources, metal ions, and sodium chloride concentration to check the maximum alkaline protease production. Ammonium sulfate and dialysis were used to partially purify the enzyme from *Bacillus cereus*. At optimized temperature and enzyme concentration, partially purified enzyme demonstrated significant feather degradation of 76.5% on the fifth day. *Bacillus cereus* was found to cause considerable feather deterioration. It's also been discovered that enzyme activity gets enhanced at a specific optimized condition. When compared to the crude enzyme, partially purified and dialyzed enzymes demonstrated significant changes in enzyme activity, indicating that they have the potential to break down feathers.

Keywords: Crude protease, Feather degradation, Screening, Partially purified, Protease activities

EVOLUTIONARY CHANGES IN THE STEM-LOOP CONFORMATIONS OF CHIKUNGUNYA VIRUS (CHIKV) GENOMIC AND LINKER AND UNTRANSLATED REGIONS (UTRS): A 2006-2024 LONGITUDINAL STUDY

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ABSTRACT

Background & Methods: Chikungunya virus (CHIKV), a member of the Togaviridae family, remains a significant public health threat due to its recurrent outbreaks and association with severe morbidity. While coding regions are often the focus of evolutionary studies, the non-coding 5′ and 3′ untranslated regions (UTRs) contain critical RNA secondary structures, such as stemloops, that regulate viral replication and host immune modulation. This study investigates how evolutionary shifts in these RNA conformations from 2006 to 2024 impact the pathogenicity of the ECSA lineage. A longitudinal analysis was performed using CHIKV genomic sequences deposited between 2006 and 2024, retrieved from public databases. The study employed computational RNA-folding algorithms to predict secondary structure transformations in the 5′ and 3′ UTRs. Multiple sequence alignments (MAFFT) were used to identify nucleotide substitutions within conserved stem-loop motifs. These structural variations were then correlated with historical data on viral transmission and clinical severity to assess their potential impact on viral fitness and pathogenicity. The analysis revealed significant structural plasticity within the UTRs of isolates from the last 18 years (2006 – 2024). While certain core elements remained highly conserved, specific stem-loop conformations exhibited distinct evolutionary drifts, particularly in recent Indian ECSA isolates (post-2020). These conformational changes appear to alter RNA stability and protein-binding motifs. Our findings highlight the importance of RNA secondary structures as key determinants of CHIKV evolution. By demonstrating that changes in stem-loop conformations within the UTRs may directly influence viral pathogenicity, this research identifies new molecular markers for genomic surveillance.

Keywords: Untranslated regions (UTRs), Chikungunya virus (CHIKV), Pathogenicity, Multiple sequence alignments (MAFFT)

PATIENT METADATA-BASED EPIDEMIOLOGICAL ANALYSIS OF SARS-COV-2 CASES IN INDIA: DEMOGRAPHIC AND GEOGRAPHICAL TRENDS OVER TIME AND VARIANTS

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ABSTRACT

Demographic and geographic elucidation of SARS-CoV-2 infection patterns is a prerequisite for implementation of a measured public, health response as viral variants come into play. The fact that India was hit quite severely by COVID-19 notwithstanding, there are no extensive analyses that correlate patient-level metadata over several waves comprehensively. This investigation, a retrospective one, is set to delineate such patterns, point out the population groups with the highest risk, and also measure the dispersion across the regions of the different phases of the pandemic. The study is based on retrospective epidemiological analysis whereby patient, level data, de- identified and aggregated, from laboratory, confirmed cases of India are used. The major factors under consideration are age, gender, location and hospitalization. Trends over time are evaluated between the variant, dominant periods, i.e. Pre- Delta, Delta, and Omicron, through the use of descriptive statistics, incidence rates standardized by age, and regression models. Besides, geospatial mapping is leveraged for identifying spatial clusters at the state and district levels using population density and mobility as criteria. Several shifts in the age groups infected and the geographical distribution of the burden are expected to be manifested in correlation with variant periods. There will probably be a wider dissemination geographically of the later, more transmissible variants, along with a change in the cohort of younger population being affected. Additionally, the alignment of changes in case, fatality rates with variant severity and regional healthcare capacity is expected. Combining highly detailed patient, level data with spatio, temporal analyses is a significantly powerful evidence base for public health interventions tailored to age and region. Such results will help direct future surveillance, vaccination drives, and clinical resource distribution during the variant waves.

Keywords: COVID-19, SARS-CoV-2 infection, Omicron, geospatial mapping

DUAL MODULATION OF NONSENSE MEDITATED DECAY AND SCREENING OF DRUGS THAT ACTIVATE OR DEACTIVATE FOR THERAPEUTIC APPLICATIONS

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ABSTRACT

Nonsense-mediated decay (NMD) is a cellular quality control mechanism that degrades messenger RNAs (mRNAs) containing premature stop codons, thereby preventing the production of truncated proteins. In cancer, this pathway can limit the expression of mutation-associated neoantigens arising from truncating mutations, enabling tumor cells to evade immune surveillance. This study explores the therapeutic potential of NMD inhibition to enhance neoantigen expression and improve anti-tumor immune recognition. A cell-based experimental approach was employed to evaluate the effects of pharmacological NMD inhibition on mutant transcript and protein expression. Small molecule inhibitors targeting the SMG1 kinase, a key regulator of the NMD pathway, were utilized. Treatment of cancer cell lines with NMD inhibitors resulted in increased levels of truncated mutant transcripts and corresponding proteins. Furthermore, enhanced presentation of neoantigen-derived peptides on major histocompatibility complex (MHC) class I molecules was observed, indicating improved immune visibility of tumor cells. Functional assays demonstrated that NMD inhibition facilitated T-cell–mediated recognition and cytotoxicity against cancer cells. Additionally, preliminary in vivo studies suggested a reduction in tumor growth upon treatment, supporting the translational relevance of this approach. Overall, these findings highlight NMD as a promising therapeutic target in cancer immunotherapy. By unmasking hidden neoantigens, NMD inhibition may enhance immune-mediated tumor clearance and improve responses to existing immunotherapeutic strategies.

Keywords: NMD Pathway, T –Cell, Immunotherapy, Cancer

PHYTOCHEMICAL PROFILING, QUANTITATIVE ESTIMATION, AND ANTIOXIDANT EVALUATION OF MOMORDICA DIOICA ROOT EXTRACTS

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ABSTRACT

The study investigated the phytochemical composition, total phenolic content (TPC), total flavonoid content (TFC), and antioxidant activity of *Momordica dioica* root extracts using solvents of different polarity. Preliminary screening revealed the presence of alkaloids, flavonoids, phenols, glycosides, saponins, tannins, terpenoids, and steroids, with variation depending on the solvent. Methanolic and aqueous extracts were rich in phenolics and flavonoids, while hexane and ethyl acetate extracts mainly contained non-polar compounds like sterols. Quantitative analysis showed that the methanolic extract had the highest TPC and TFC, followed by the aqueous extract, with reliable results confirmed by strong calibration curves of gallic acid and quercetin. Antioxidant activity assessed by the DPPH assay showed a concentration-dependent increase, with methanolic extract exhibiting the highest activity, comparable to ascorbic acid at higher concentrations. Overall, the study demonstrates a strong correlation between phytochemical content and antioxidant potential, identifying *Momordica dioica* root as a promising natural antioxidant source with potential applications in pharmaceutical and nutraceutical fields.

Keywords: Phytochemical screening, Momordica dioica, Phenolic content, Flavonoids, DPPH antioxidant activity

SUSTAINABLE BIOBUTANOL PRODUCTION FROM WATER HYACINTH WITH CO_2-DRIVEN ALGAL WASTEWATER TREATMENT

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ABSTRACT

The growing demand for sustainable energy and environmental remediation has led to the development of integrated bioprocessing systems. This study focuses on the valorization of water hyacinth (Eichhornia crassipes), an invasive aquatic weed, for biobutanol production through a circular and eco-friendly approach. The biomass was collected, dried, pulverized, and subjected to particle size segregation, followed by acid and alkaline pretreatment to disrupt. The lignocellulosic structure and enhance cellulose accessibility. The effectiveness of pretreatment was confirmed through structural and compositional changes, enabling efficient down streaming processing. The pretreated biomass was hydrolyzed to release fermentable sugars, which were utilized in microbial fermentation for biofuel production. During fermentation, carbon dioxide was generated as a by-product; instead of being released into the atmosphere, it is proposed to be utilized for microalgal cultivation, enabling biological carbon sequestration. The cultivated microalgae are further applied for wastewater treatment, facilitating nutrient removal and pollutant reduction. This integrated approach addresses three major sustainability aspects, namely waste-to-wealth conversion, carbon emission reduction, and wastewater management. Overall, the study demonstrates a cost effective, scalable, and environmentally sustainable framework aligned with circular bioeconomy principles and global sustainable development goals.

Keywords: Water hyacinth, Biobutanol production, Lignocellulosic biomass Pretreatment.

MANGIFERIN WITH ALGINATE AS FOOD PACKAGING FILM FOR FISH PRESERVATION

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ABSTRACT

Fish and fishery products are extremely perishable because of their high moisture content, nutrient-rich composition, enzymatic activity, and vulnerability to microbial spoilage. Sustainable and natural solutions are required since conventional preservation techniques and artificial packaging materials pose health and environmental risks. Using sodium alginate combined with Mangiferin, a naturally occurring polyphenolic substance derived from Mangifera indica leaves that has potent antibacterial and antioxidant qualities, this study sought to create an environmentally friendly active food packaging film. Mangiferin was isolated from mango leaves through solvent extraction and subsequently characterized using Thin Layer Chromatography (TLC), Fourier Transform Infrared Spectroscopy (FTIR), and UV–Vis spectrophotometry. The solvent casting process was used to create composite films by incorporating the Mangiferin into a sodium alginate matrix.

Keywords: Nutrient-rich composition, Enzymatic activity, Mangiferin, Thin Layer Chromatography (TLC), Fourier Transform Infrared Spectroscopy (FTIR).

VALORIZATION OF FOOD WASTE FOR BIOETHANOL PRODUCTION USING MICROBIAL FERMENTATION

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ABSTRACT

The rising amount of food waste and the increasing demand for sustainable energy sources have become a world-wide challenge. Improper food waste management leads to pollution and emission of greenhouse gases into the environment, highlighting the importance of effective waste valorisation strategies. Food waste is a rich biomass resource that is abundant in carbohydrates like starches and reducing sugars. The conversion technology involves the use of pretreatment and enzymatic hydrolysis to break down complex polysaccharides into simple fermentable sugars. Such sugars are then fermented by Saccharomyces cerevisiae to generate ethanol and carbon dioxide in the bioreactor conditions. The produced ethanol is then recovered and purified through distillation. The application of this bioprocess offers a dual advantage by addressing waste disposal issues simultaneously producing renewable biofuel. Compared to the conventional fossil fuels, bioethanol is considered to be environmentally benign, biodegradable, and sustainable. The given methodology can be implemented in cities where the production of food waste is significant, and it is economically feasible and shows strong potential for large scale implementation. Additionally, the paper identifies future directions such as process optimization, use of genetically engineered microorganisms to enhance the production and productivity of ethanol. Overall, this strategy will enhance sustainable development and promote circular economy practices.

Keywords: Food waste valorisation, Bioethanol production, Enzymatic hydrolysis, Fermentation

DESIGN AND EVALUATION OF A NOVEL BIOACTIVE GLASS LOADED WITH CISSUS QUADRANGULARIS AND BOSWELLIA SERRATA PLANT EXTRACTS CONTAINING HYBRID HYDROGEL FOR ACCELERATED REGENERATION

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ABSTRACT

Accelerated Regeneration is a healing process in which cells restore damaged tissue through coordinated repair and regeneration. The regeneration and healing of soft tissue remain a challenge due to a lack of biomaterial studies and synergistic bioactivity. Conventional hydrogels provide biocompatibility but fail to achieve adequate physicochemical integration and minimal regenerative stimulation to repair and heal tissues. To address this challenge, this study presents a design hybrid hydrogel bioactive glass incorporated with Cissus quadrangularis and Boswellia serrata plant extracts to enhance biological response. Bioactive glass could be synthesized with Tetraethyl orthosilicate and other precursors through hydrolysis, condensation, gelation, and calcination, forming a stable nanopore network that enables therapeutic ion release, stimulating cellular response and tissue repair. The hybrid hydrogel integrates bioactivity and will be evaluated for its structural, chemical, and morphological characteristics. This hydrogel mediated bioactivity assays accelerate and enhance the tissue repair and healing process, which offers next-generation soft tissue healing. By adopting this synergistic system, bioactive glass and plant extract within a polymeric matrix to enhance the hybrid hydrogel demonstrates and promotes soft tissue repair and healing with sustained therapeutic ion release.

Keywords: Accelerated Regeneration, Bioactive glass, Boswellia serrata, Cissus quadrangularis, Hybrid hydrogel

AI-DRIVEN OPTIMIZATION OF BIOPROCESS PARAMETERS FOR SMART FERMENTATION CONTROL

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ABSTRACT

Artificial intelligence (AI) is quickly revolutionizing the bioprocess engineering field, but its application to real-time control in the fermentation process is not fully implemented in a variety of industrial and research environments. In this paper, a novel AI-based architecture is introduced, which predicts optimal bioprocess parameters and also learns and evolves throughout fermentation producing entirely smart and dynamic control design. The model proposed will combine machine learning models with the sensor-based measurements of pH, dissolved oxygen, temperature, substrate concentration, and biomass growth. This is in contrast to the conventional systems that are based on setpoints, but the method incorporates adaptive optimization that enables the fermentation procedure to automatically readjust circumstances in response to microorganism dynamics. One of the main inventions during this work is how Hybrid Predictive Control Model (HPCM) is created to integrate artificial neural networks and reinforcement learning. The neural network forecasts the trends of the performance of the processes, and the reinforcement learning agent constantly chooses the most suitable conditions of operations where the productivity can be at the highest. It was shown by experimental simulations that the yields of the products, nutrient consumption, and the fluctuations during the process were significantly enhanced when compared to the traditional manual or PID-controlled fermentations. The study presents an example of how smart fermentation can minimize human mistakes, improve reproducibility and provide a sustainable bioprocess set-up using less energy and fewer resources. The combination of AI-controlled decision-making gives a roadmap of what industrial bioreactors will be like in the future that autonomous bioprocessing will be the new normal.

Keywords: AI-Driven Bioprocessing, Smart fermentation control, Machine Learning Optimization, Autonomous Bioreactor Systems.

TO INVESTIGATE THE DMSP BIOSYNTHESIS AND DEGRADATION PATHWAY FROM VARIOUS ENVIRONMENTAL NICHES

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ABSTRACT

This study aims to investigate the diversity and molecular identification of rhizosphere-associated bacteria inhabiting saline environments, particularly those associated with halophytic plants such as Avicennia, Salicornia, and Suaeda. Halophytes thrive in high-salinity ecosystems and are known to host unique microbial communities that play a crucial role in plant growth promotion, nutrient cycling, and stress tolerance. Rhizosphere soil samples will be collected from the root zones of these plants under controlled and sterile conditions. The samples will be subjected to serial dilution techniques followed by culturing on nutrient agar medium to isolate distinct bacterial colonies. Morphologically different colonies will be carefully selected and purified through repeated subculturing to obtain axenic bacterial isolates. Genomic DNA will be extracted from the purified isolates using standard molecular protocols. The obtained sequences will be analyzed using bioinformatics tools and compared with existing databases to determine phylogenetic relationships and bacterial diversity. Overall, this research contributes to a deeper understanding of global sulphur cycle and highlights the potential application of halotolerant rhizobacteria in sustainable agriculture, particularly in improving crop productivity in saline soils.

Keywords: Rhizosphere bacteria, Halophytic plants, Avicennia, Salicornia, Suaeda, PCR, Sanger Sequencing.

NEXT-GENERATION MULTIFUNCTIONAL HYBRID OSTEOCHONDRAL SCAFFOLD

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ABSTRACT

Osteochondral defects are injuries that affect both the articular cartilage and the subchondral bone of joints. These injuries pose a significant clinical challenge due to mechanical differences among the tissues involved, which can lead to improper healing. Traditional treatments often fail to heal and restore the functions of both tissues simultaneously. However, more advanced innovations have made it much easier to mitigate these challenges; one such innovation is scaffolding. These are three-dimensional, biocompatible, and biodegradable surfaces that promote cell growth, adhesion, and proliferation. These function by mimicking the extracellular matrix of tissues, helping them heal and grow. The scaffold consists of three layers: a top layer comprising of 3D-printed polycaprolactone (PCL) with the integration of borate bioactive glass, aiding to support osteogenesis; a bottom layer consisting of electrospun chitosan and alginate nanofibers promoting chondrogenesis; a transitional layer in between consisting of 3D-printed thermoplastic polyurethane (TPU) incorporated with hydroxyapatite-magnetite (HAp-MAG) serving as a intermediate mechanical gradient between the hard bone and the soft cartilage.

Keywords: Osteochondral scaffold, Hybrid biomaterials, 4D magnetic scaffold, Polycaprolactone, Chitosan–alginate.

MOLECULAR CHARACTERIZATION AND FUNCTIONAL VALIDATION OF ANTIBIOTIC RESISTANCE GENE TRANSFER IN AVIAN FRESHWATER HABITATS THROUGH A ONE HEALTH FRAMEWORK

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ABSTRACT

Natural aquatic environments, especially bird sanctuaries and wetlands, are often left unmonitored but are essential hotspots for antibiotic resistance genes (ARGs). Although the global consequences of antimicrobial resistance (AMR) are extensively recorded, our comprehension of the environmental conditions that promote gene mobility within these ecosystems is still inadequate. This study combines genetic profiling, microbiological assays, and metabolomics analysis to investigate the environmental mechanisms of antibiotic resistance genes and horizontal gene transfer (HGT) inside water microbiomes in bird sanctuaries. The methodology focuses on the comprehensive analysis of water samples through molecular screening, functional characterization, and strain isolation to identify the primary drivers of resistance amplification. By focusing these sanctuaries as hotspots for resistance, the research aims at specific environmental codrivers that accelerate the propagation of genes across the ecosystem. This in depth analysis tries to bridge the gap between environmental monitoring and the biological processes that facilitate the rapid spread of resistance in natural habitats. The results offer a strong basis for an environmental surveillance system that combines genetic and phenotypic markers to monitor the ARGs effectively. Additionally, this study supports the development of risk assessment models which aims at identifying the transfer of resistance from natural ecosystems to human populations. In the end, the study gives an evidence based way to stop the spread of AMR by focusing on how to regulate environmental elements that make resistance grow in these vulnerable aquatic ecosystems.

Keywords: Antimicrobial resistance, Antibiotic resistance genes, Bird sanctuary, One Health, Environmental microbiology.

ULTRASOUND-ASSISTED ORGANIC SOLVENT EXTRACTION OF PECTIN FROM CASHEW APPLE POMACE, STRUCTURAL AND RHEOLOGICAL CHARACTERIZATION

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ABSTRACT

Cashew apple pomace is a significant agro-industrial byproduct, an underutilized and viable source for extracting pectin, which has value in various sectors, including the food, pharmaceutical, and cosmetic industries. This study undergoes a unique combination of organic solvent and ultrasound to extract and characterize pectin from cashew apple pomace. The study will measure extraction efficiency and maximize pectin yield under various process conditions. Several complementary analytical techniques will be used to characterize the extracted pectin: degree of esterification (DE) and galacturonic acid content will be determined using standardized protocols to classify pectin type and assess functionality; dynamic mechanical analysis will be used to evaluate rheological properties such as viscosity, flow behaviour, and viscoelasticity to determine suitability for applications; Fourier-transform infrared spectroscopy (FTIR) will be used to confirm structural features to identify characteristic pectic functional groups; and scanning electron microscopy (SEM) to visualize microstructural architecture. The ultrasound organic solvent integration is expected to outperform traditional techniques in terms of pectin extraction efficiency. The anticipated results will confirm cashew apple pomace powder as a feasible source of pectin and show how combining cutting-edge extraction techniques with thorough structural analysis can maximize the use of fruit processing wastes.

Keywords: Cashew apple pomace, Pectin extraction, Ultrasound-assisted extraction, Organic solvent extraction, Degree of esterification (DE), Galacturonic acid

PEPTIDE-NANO ARCHITECTONICS: PROGRAMMABLE PEPTIDE NANOSTRUCTURES FOR NEXT-GEN DRUG DELIVERY AND TISSUE ENGINEERING

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ABSTRACT

Peptide-based nanostructures are highly versatile biomaterials due to their biocompatibility, precise structure, and ability to self-assemble into nanoscale architectures. This study focuses on designing engineered peptide systems for drug delivery and tissue regeneration. Various nanostructures—such as nanofibers, nanotubes, nanogels, and hybrid composites—were developed with tunable mechanical properties, stability, and controlled degradation. These systems showed high drug-loading capacity and stimuli-responsive release (pH, enzymes, temperature), enabling targeted delivery with reduced side effects. They demonstrated effectiveness in applications like cancer therapy, anti-inflammatory treatment, antimicrobial activity, and gene delivery. In tissue engineering, peptide hydrogels and nanofibers mimic the extracellular matrix, promoting cell growth and regeneration. Functional motifs (e.g., RGD, IKVAV, BMP-like sequences) enhanced outcomes in bone, nerve, and skin repair. Although challenges such as large-scale production and stability remain, emerging approaches like stimuli-responsive systems, hybrid scaffolds, and AI-based peptide design show strong potential. Overall, peptide-based nanostructures are promising candidates for advanced therapeutic and regenerative applications.

Keywords: Peptide-based nanostructures, self-assembling peptides, drug delivery, tissue engineering, regenerative medicine

MARINE-BIOWASTE-DERIVED ZnO–CHITOSAN NANOPARTICLES: STRUCTURAL FEATURES AND ANTICANCER EVALUATION

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ABSTRACT

This study presents the green synthesis of zinc oxide–chitosan nanoparticles (Zin-Chi-NPs) using *Sepia pharaonis* cuttle bone as a marine biowaste source and chitosan as a natural stabilizing agent. X-ray diffraction (XRD) analysis confirmed a crystalline structure with 69.8% crystallinity, while Fourier-transform infrared spectroscopy (FTIR) revealed characteristic functional groups such as hydroxyl (3366 $cm^{-}1$), amine (1566 $cm^{-}1$), and carboxyl (1354 $cm^{-}1$), indicating effective biogenic stabilization. Field emission scanning electron microscopy (FESEM) reveals densely packed, irregularly shaped nanoparticles dispersed across the chitosan matrix. Zin-Chi-NPs exhibited notable antibacterial activity, with inhibition zones of 15 ± 0.12 mm (*E. coli*), 18 ± 0.12 mm (*Streptococcus mutans*), and 19 ± 0.14 mm (*Staphylococcus aureus*); no inhibition was observed against *Candida albicans*. Cytotoxicity was evaluated on KB1 oral cancer cells using the MTT assay. A dose-dependent response was observed, with 18% cell death at 10 µg/mL and a marked increase to 97% at 200 µg/mL The IC_{50} was calculated as 38.9 µg/mL, suggesting moderate cytotoxic efficiency and potential therapeutic relevance at higher concentrations. Overall, the synthesized Zin-Chi-NPs demonstrate promising structural stability, antimicrobial activity, and dose-dependent cytotoxicity, supporting their potential application in biomedical and pharmaceutical fields.

Keywords: Nanoparticles, Zinc oxide, Chitosan, *Sepia pharaonis*, Cuttlebone

DEVELOPMENT OF K-CARRAGEENAN-BASED EDIBLE COATING INFUSED WITH GREEN SYNTHESIZED ZNO NANOPARTICLES FOR SHELF-LIFE EXTENSION OF TOMATOES

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ABSTRACT

Fruits are often subject to post-harvest deterioration because of the loss of moisture, microbial contamination, and biochemical changes during storage. There are serious concerns about safety and environmental consequences when using traditional methods to preserve fruit - using synthetic coatings and plastic film. In this study a biodegradable and non-toxic edible coating of k-carrageenan incorporated with zinc oxide nanoparticles (ZnO-NPs) synthesized from aloe vera leaves. A plant-mediated synthesis technique was used to, prepare ZnO nanoparticles, and characterize them through multiple techniques (UV-Vis spectroscopy, FTIR, DLS, zeta potential, FESEM-EDAX, XRD, and cyclic voltammetry) and to identify various physical characteristics such as the formation of nanoparticles, particle size distribution, surface characteristics and stability. The outcomes of the characterization methods indicated that the size of the nanoparticles was about 216 nm and exhibited an intermediate degree of stability with common ZnO bonding. Different concentrations of znO nanoparticles were added to the k- carrageenan solution combined with glycerol as a plasticizer to form nanocomposite coating. The coating was applied to fresh tomatoes and evaluated at the storage level of physicochemical variables, including weight loss, pH, total soluble solids (TSS), titratable acidity (TA) and visual quality. Results showed that coated samples lost significantly less weight, exhibit slower pH, TSS changes and retain more titratable acidity than uncoated control. Optimal preservation was recorded with the higher concentration of ZnO among the treatments elongating the ripening and reducing the spoilage. Overall, the synthesized k-carrageenan-ZnO nanocomposite coating can potentially become a safe, greener and less expensive alternative to conventional preservation methods, and can avert a bright future of improving the shelf life of fresh fruits in the food industry.

Keywords: κ-Carrageenan, Zinc Oxide Nanoparticles (ZnO-NPs), Green Synthesis, Edible Coating, Tomato Preservation, Shelf-Life Extension

EXTRACTION AND DECOLORIZATION POTENTIAL OF REACTIVEBLACK 5 BY DEGRADING ENZYMES FROM ENTEROBACTER CLOACAE

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ABSTRACT

The present study investigates the decolorization potential and enzymatic capability of Reactive Black 5 (RB5) dye by Enterobacter cloacae. This metabolically versatile bacterium was cultivated in Nutrient Broth and Tryptic Soy Broth to enhance biomass production, while growth kinetics and enzyme activity were systematically monitored. At an initial dye concentration of 25 ppm, a maximum decolorization efficiency of 50.79% was achieved within 48 hours under optimized physicochemical conditions. Enzymatic analysis revealed the involvement of key dye-degrading enzymes, including laccase and azo reductase. Qualitative assays, performed through both plate and liquid culture techniques, confirmed enzyme activity based on characteristic color transformations—dark blue to greenish-brown in the case of laccase activity, and reddish-brown for azo reductase—indicating effective cleavage of azo bonds. Enzyme production was further optimized, and detailed activity studies were conducted to evaluate their efficiency. Overall, the findings demonstrate the promising potential of Enterobacter cloacae as a biological agent for the bioremediation of textile effluents contaminated with azo dyes.

Keywords: Reactive Black 5, Enterobacter cloacae, dye decolorization, UV–visible spectrophotometry

BIODIESEL PRODUCTION FROM NATIVE MICROALGAE ISOLATED FROM PETHAPPAMPATTI POND

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ABSTRACT

Microalgae-derived third-generation biofuels present a promising, sustainable alternative to fossil fuels. However, commercial scale-up is currently hindered by the techno-economic bottlenecks of high-cost closed photobioreactors and the environmental vulnerabilities of open raceway ponds. Additionally, the reliance on genetically engineered strains introduces significant regulatory and ecological risks when transitioned to outdoor cultivation. This review proposes a highly practical, localized biorefinery framework to overcome these commercialization barriers. We evaluate the integration of low-cost, open-source Internet of Things (IoT) microcontrollers to provide dynamic, real-time automation of environmental parameters, thereby significantly reducing operational expenditures. Concurrently, this paper highlights the critical advantage of bioprospecting wild-type macroalgae and microalgae directly from native ecosystems. Identifying these localized strains via targeted DNA sequencing leverages their inherent adaptability to regional climatic fluctuations and indigenous microbial communities, bypassing the need for hyper-controlled environments. Finally, we examine the streamlining of downstream processes utilizing low-energy harvesting methods, advanced thermochemical conversion such as Hydrothermal Liquefaction (HTL), and the rigorous characterization of the resulting biodiesel. Ultimately, synergizing accessible IoT technology with local ecological resilience establishes a commercially viable and scalable blueprint for renewable bioenergy production.

Keywords: Third-generation biofuels, Internet of Things (IoT), Bioprospecting, Microalgae Cultivation, Hydrothermal Liquefaction, Biorefinery.

DEVELOPMENT AND CHARACTERIZATION OF COUMARIN-ENHANCED XANTHAN GUM/ALGINATE BASED BIO ADHESIVE FILM FOR TOPICAL WOUND TREATMENT

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ABSTRACT

The Development of Advanced wound dressing materials with enhanced functionality and biocompatibility are one of the significant research areas in the field of biomedicine. In this present investigation, a bio adhesive hydrogel film was developed by using a combination of sodium alginate (SA) and xanthan gum (XG), wherein glycerol was incorporated in the formula as a plasticizer. Coumarin, a bioactive compound, was successfully incorporated in the formula. Fourier Transform Infrared Spectroscopy (FTIR), and Raman spectroscopy were the two methods used in making physicochemical characterization to indicate that the incorporation of the Coumarin was successful but did not alter the structure. The analyses performed by Thermogravimetric Analysis (TGA) displayed appropriate heating stability and porosity analysis showed a positive structure of fluid absorption and regulated drug liberation. Further functional evaluation and biological assessment are ongoing. The morphology on the surface is also being studied by Scanning Electron Microscopy (SEM) and in-vitro drug release tests are done to determine the behaviour of release. The antimicrobial is being compared to the Staphylococcus aureus, Bacillus subtilis, Escherichia coli and Klebsiella pneumoniae. Moreover, the biocompatibility is tested with the help of NIH3T3 fibroblast cells and wound healing can be estimated with the help of in-vitro scratch assay and CAM assay. It is anticipated that the developed hydrogel film will display sustained drug delivery, strong antimicrobial and increased wound healing opportunities, resulting in it being an excellent candidate in the advanced wound dressing domain.

Keywords: Hydrogel film, Sodium alginate, Xanthan gum, Coumarin, Controlled drug release, Antimicrobial activity.

GENETIC REGULATION OF SQUAMOUS EPITHELIAL DIFFERENTIATION STATES IN CHILDHOOD ASTHMA REVEALED BY SINGLE-CELL TRANSCRIPTOMIC INTEGRATION

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ABSTRACT

Childhood asthma is a chronic inflammatory airway disease marked by epithelial dysfunction, airway remodeling, and long-term respiratory morbidity. Although type-2 immune mechanisms are well studied, intrinsic epithelial differentiation and regulatory processes driving early disease susceptibility remain poorly understood. Single-cell RNA sequencing (scRNA-seq) has revealed marked epithelial heterogeneity in asthmatic airways, including rare hillock-like squamous epithelial cells expressing KRT13, KRT5 & DSG3. While these cells have been associated with epithelial stress and remodeling in adult asthma, their functional relevance, developmental regulation, and role in childhood asthma are largely unexplored. Existing studies predominantly emphasize cell-type identification or differential expression, with minimal integration of genetic susceptibility data, and the biological significance of squamous differentiation markers in pulmonary epithelium remains unclear. A critical gap lies in determining whether hillock-associated squamous signatures in childhood asthma represent stable epithelial states or transient stress-induced phenotypes, and how asthma-associated genetic variants regulate these features in a cell-specific manner. To address this, the proposed study will integrate pediatric airway scRNA-seq datasets with genome-wide association studies (GWAS), linking hillock-cell expression signatures to asthma GWAS and bulk transcriptomic data to uncover genetically regulated epithelial pathways contributing to early airway remodelling.

Keywords: Childhood asthma, pediatric asthma, scRNA-seq, Hillock cells, GWAS, Genetic regulation

PHARMACOGENOMIC NETWORK-BASED PRECISION MEDICINE APPROACHES IN GLAUCOMA

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ABSTRACT

Glaucoma is a progressive neurodegenerative disorder and one of the leading causes of irreversible blindness worldwide, characterized by optic nerve damage and gradual vision loss. Despite the availability of intraocular pressure–lowering therapies, variability in drug response and disease progression among patients remains a major clinical challenge. This highlights the need for translational and precision medicine approaches in glaucoma management. In this study, a pharmacogenomic network-based systems biology approach was used to investigate the molecular mechanisms and drug response variability in glaucoma. Gene–gene interaction networks, protein–protein interaction networks, and pathway enrichment analysis were constructed to identify key regulatory genes, molecular pathways, and potential therapeutic targets associated with glaucoma pathogenesis. Pharmacogenomic analysis was performed to evaluate genetic variations influencing the efficacy and adverse drug reactions of commonly used antiglaucoma medications. The integrated network analysis revealed important biomarkers related to neurodegeneration, intraocular pressure regulation, and neuroprotection pathways. This translational research approach bridges molecular biology, pharmacogenomics, and computational biology to support personalized treatment strategies and drug target identification. The study demonstrates that network-based precision medicine can improve early diagnosis, optimize drug therapy, and enhance clinical outcomes in glaucoma management, contributing to the advancement of personalized healthcare in life sciences.

Keywords: Glaucoma pathogenesis, Antiglaucoma medications, Biomarkers, Neuroprotection pathways.

BIOSYNTHESIS OF FLAVOUR COMPOUND γ -DECALACTONE USING SPORIDIOBOLUS SALMONICOLOR

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ABSTRACT

γ-Decalactone is a valuable flavor compound widely used in food, cosmetic, and fragrance industries due to its peach-like aroma. This study investigates the biosynthesis of γ-decalactone using Sporidiobolus Salmonicolor, a yeast known for its ability to produce lactones. Various parameters such as substrate concentration, pH, temperature, and incubation time were optimized to enhance γ-decalactone production. The biosynthesized compound was characterized using analytical techniques such as gas chromatography-mass spectrometry (GC-MS) to confirm its identity and purity. Additionally, the potential of Sporidiobolus Salmonicolor for large-scale production of γ-decalactone and its applications in various industries are discussed. This research provides valuable insights into the biotechnological production of γ-decalactone, offering sustainable alternatives to traditional chemical synthesis methods

Keywords: Sporidiobolus Salmonicolo, γ-decalactone, GC-MS

EXTRACTION AND SPECTROSCOPIC CHARACTERIZATION OF BIOACTIVE COMPOUNDS FROM THE MARINE GASTROPOD TURRITELLA ATTENUATE

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ABSTRACT

Marine invertebrates are increasingly recognized as a rich source of structurally diverse bioactive compounds with potential biomedical applications. The present study focuses on the extraction and spectroscopic characterization of bioactive constituents from the marine gastropod Turritella attenuata. Soft tissues of the organism were collected, cleaned, and processed for the extraction of bioactive compounds using both aqueous and organic solvents. The obtained extracts were subjected to Fourier Transform Infrared Spectroscopy (FTIR) to identify major functional groups, and Gas Chromatography–Mass Spectrometry (GC–MS) to profile the chemical constituents. FTIR analysis indicated the presence of characteristic functional groups such as hydroxyl, carbonyl, and sulfate groups, suggesting the occurrence of polysaccharides and other biomolecules. GC–MS analysis revealed a range of compounds including fatty acids, alcohols, and other low molecular weight metabolites that are commonly associated with biological activity. The study provides a preliminary understanding of the chemical composition of Turritella attenuata and highlights its potential as a source of marine-derived bioactive compounds. These findings may serve as a basis for further purification, structural elucidation, and exploration of their pharmacological properties.

Keywords: Turritella attenuate, Marine invertebrates, GC–MS analysis.

DEVELOPMENT AND EVALUATION OF A NOVEL FUNCTIONAL PROBIOTIC YOGURT INCORPORATING MAPILLAI SAMBA (RED RICE) MILK WITH NATURAL SHELF-LIFE ENHANCEMENT

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ABSTRACT

Functional foods have gained increasing attention due to their health benefits beyond basic nutrition. Yogurt is a widely consumed fermented dairy product known for its probiotic and nutritional properties; however, it has a limited shelf life and often requires synthetic preservatives. The present study focuses on the development of functional yogurt enriched with pomegranate peel extract and red rice as natural bioactive ingredients. Pomegranate peel is a rich source of phenolic compounds, flavonoids, and antioxidants, while red rice contains anthocyanins, dietary fiber, and essential nutrients that enhance nutritional value. In this study, pomegranate peel extract was prepared and incorporated into yogurt along with red rice components. Fresh milk was pasteurized at 85 °C and fermented using probiotic starter cultures containing Lactobacillus and Bifidobacterium species at 42 °C for 4–6 hours. The presence of bioactive compounds was analyzed using UV–Visible spectroscopy, which indicated characteristic absorbance peaks corresponding to phenolic compounds. The results suggest that the incorporation of pomegranate peel extract and red rice improves the antioxidant potential and functional properties of yogurt. Therefore, the developed functional yogurt may serve as a healthier dairy product and a natural alternative to synthetic preservatives in the food industry.

Keywords: Functional yogurt, Pomegranate peel extract, Red rice, Bioactive compounds, Antioxidant activity.

AUTOMATED SEIZURE PREDICTION FROM REAL TIME EEG SIGNALS USING ESRGAN

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ABSTRACT

Epileptic seizures are unpredictable neurological events that demand continuous monitoring and early warning mechanisms for effective intervention. This work proposes a patient-specific seizure prediction system integrating wearable biosensing hardware with machine learning and real-time analytics. EEG signals acquired through a BioAmp pill are transmitted wirelessly using an ESP8266 module to the ThingSpeak cloud platform for secure data storage and streaming. The recorded multichannel EEG data are processed in MATLAB, where signal preprocessing, feature extraction, and classification are performed. Both handcrafted EEG features and learned representations are used to classify brain states into inter-ictal, pre-ictal, and ictal phases using a machine learning-based Decision Tree model. A post- processing strategy converts window-level predictions into reliable early seizure alerts with low false prediction rates. The system includes a MATLAB-based GUI for real-time visualization and risk indication. Experimental results demonstrate effective seizure prediction, supporting timely clinical intervention and patient safety.

Keywords: BioAmp, Epileptic Seizures, ThingSpeak Cloud Platform, Clinical Intervention.

GREEN SYNTHESIS OF SILVER NANOPARTICLES FROM ALLIUM SATIVUM LEAVES FOR ADVANCED HYDROGELS IN WOUND HEALING TREATMENT

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ABSTRACT

This study explores the biosynthesis of silver nanoparticles (AgNPs) using leaf extract from Allium sativum as a sustainable reducing agent for incorporation into cutting-edge hydrogels for wound treatment. By utilizing the secondary metabolites of garlic leaves, this approach offers an environmentally friendly and cost-effective alternative to conventional chemical techniques. The transition of silver ions to a stable metallic state is monitored via colorimetric change and confirmed through a comprehensive characterization suite. UV-visible spectroscopy verifies surface plasmon resonance, while FTIR analysis identifies the phytochemical functional groups responsible for reduction and interfacial stabilization. DLS and particle size analysis evaluate the hydrodynamic diameter and colloidal stability within the hydrogel matrix. The biological efficacy of the AgNPs is assessed using RAW 264.7 (mouse macrophage) cells to measure the reduction of pro-inflammatory mediators, confirming anti-inflammatory potential. Furthermore, HaCaT (human keratinocyte) cells are subjected to an in vitro scratch assay to evaluate the regenerative capacity of the integrated hydrogels, specifically calculating accelerated cell migration and proliferation. Antimicrobial efficacy is evaluated against Staphylococcus aureus and Escherichia coli, where significant zones of inhibition are observed. Finally, a prototype wound-healing ointment is developed by embedding these nanoparticles into a specific hydrogel matrix to combine localized anti-inflammatory action with extended antimicrobial release. The results demonstrate that A. sativum-mediated nanoparticles serve as promising, high-performing options for the next generation of sustainable, bioactive wound treatments.

Keywords: Allium sativum, human keratinocyte, Staphylococcus aureus, mouse macrophage.

BRAIN TUMOR DETECTION SYSTEM USING DEEP LEARNING AND AI MEDICAL ASSISTANT

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ABSTRACT

Timely and accurate detection of brain tumours plays a vital role in improving patient survival and treatment planning; however, it remains a major challenge in rural and resource-constrained regions due to the shortage of skilled radiologists and limited diagnostic infrastructure. This project presents an advanced AI-driven brain tumour detection system that leverages deep learning techniques to automate the analysis of MRI scans and assist in efficient clinical diagnosis. The system is developed using the VGG16 transfer learning architecture, which enables robust feature extraction and high-accuracy classification of tumour presence and type, even with relatively limited datasets. The proposed solution follows a structured end-to-end pipeline, including image pre-processing, feature extraction, model inference, and result visualization through an intuitive dashboard that provides prediction outputs along with confidence scores for enhanced interpretability. To further improve accessibility and user interaction, an AI-powered medical chatbot is integrated, offering simplified, context-aware explanations of diagnostic results in multiple languages, thereby bridging communication gaps between medical technology and users. By significantly reducing manual effort, minimizing diagnostic delays, and ensuring consistent and reliable analysis, the system supports faster and more informed clinical decision-making. Its scalable, cost-effective, and deployment-ready architecture allows seamless integration into existing healthcare systems, making it particularly beneficial for underserved and remote areas. Overall, this work demonstrates the transformative potential of combining artificial intelligence with medical imaging to deliver accessible, efficient, and high-quality healthcare solutions on a broader scale.

Keywords: Artificial Intelligence, Deep Learning, Brain Tumour Detection, MRI Analysis, VGG16 Transfer Learning, Medical Imaging.

EFFECT OF MACRO NUTRIENTS, SALINITY AND PHOTOBIOREACTOR CULTIVATION ON BIOMASS, HYDROCARBON, LIPID PRODUCTION AND COMPOSITION OF POND MICROALGAE CHLORELLA SP., NEOCHLORIS SP., AND SCENEDESMUS SP.

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ABSTRACT

Microalgae are efficient and prominent producers of biofuel feedstock like lipid or hydrocarbons. Microalgae Chlorella, Neochloris and Scenedesmus were isolated from pond in Karamadai, Coimbatore. The influence of macronutrients such as nitrate (NaNO 3), phosphate (K 2 HPO 4) carbonate (Na 2 CO 3) and salinity (NaCl) on biomass, hydrocarbon and lipid content and composition were analysed. Highest biomass of all three isolates recorded in control (1.5 g L^{-1} nitrate, 0.22 mM phosphate, 0.18 mM carbonate and 0.0 mM NaCl) condition in all experiments. The hydrocarbon and lipid content of all three isolate significantly increased under nitrogen deprived and high NaCl condition. In addition, Chlorella and Scenedesmus also increased under carbonate and phosphate deprived conditions respectively. We also studied variation of growth, hydrocarbon, lipid content and their composition in large scale cultivation, algae grown under shaded and outdoor condition with or without air sparging in closed slope cylindrical type photobioreactors. All three isolates showed high biomass in control (without air-sparging) than air sparged. Hydrocarbon and lipid content of Chlorella increased in control than air-sparged condition under shaded and outdoor condition.

Keywords: Biomass, hydrocarbon, lipid, nitrate, phosphate, carbonate, NaCl, Chlorella, Neochloris, Scenedesmus, photobioreactor.

DEVELOPMENT OF CARBON-BASED NANOSENSING PLATFORMS FROM WASTE FOR SELECTIVE METAL ION DETECTION AND ANTIMICROBIAL EFFICACY

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ABSTRACT

Hazardous metal ions in the environment pose a severe threat to ecosystems and, as a result, human health due to their persistence and toxicity. Carbon-rich precursors such as plant pods and flowers were employed in the hydrothermal synthesis of carbon quantum dots. Various spectroscopic techniques were employed to assess the optical, surface, and structural features of the produced nanomaterial. The CQDs' ability to detect metal ions in aqueous solution was examined using an optical detection approach. Strong fluorescence and excitation-dependent emission characteristics were displayed. High selectivity for Fe3+ and Cu2+ ions was shown by quantitative sensing analysis. Antimicrobial activity was tested against Gram-positive and Gram-negative microorganisms. Antimicrobial activity was evaluated by the agar well diffusion method. The carbon nanomaterials exhibited zones of inhibition against the tested bacterial strains, indicating antimicrobial activity. The identification demonstrates that functional carbon dots can be effectively made from plant pods and flowers. These CQDs' potential as a sustainable nanomaterial for the identification of environmental pollutants is highlighted by their fluorescence property and sensitivity to metal ions.

Keywords: Carbon quantum dots (CQDs), hydrothermal synthesis, plant-based precursors, fluorescence, excitation-dependent emission, metal ion sensing.

THERMO-PROTECTIVE EFFECT OF GLUTATHIONE ON THE COLOR STABILITY OF PHYCOCYANIN AND ITS APPLICATION IN FOOD PRODUCTS

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ABSTRACT

C-phycocyanin, a natural phycobiliprotein derived from Spirulina, is extensively utilized as a natural blue colorant owing to its antioxidant and functional properties. However, its broader application in food systems is significantly constrained by its poor stability under thermal and photolytic stress conditions. The present study investigates the thermo-protective potential of glutathione in enhancing the color stability of C-phycocyanin. C-phycocyanin solutions, in the presence and absence of glutathione, were subjected to controlled thermal treatments over a temperature range of 25–80°C. The stability profile was assessed by monitoring the purity index (A620/A280), along with percentage retention and degradation analysis. A progressive decline in purity was observed with increasing temperature in control samples, whereas glutathione-treated samples exhibited comparatively higher retention and significantly reduced degradation, indicating improved thermal resistance. To further elucidate the underlying stabilization mechanism, molecular docking analysis was performed, which revealed favorable binding interactions between glutathione and C-phycocyanin. These interactions are likely to contribute to conformational stabilization and protection against thermal denaturation. Collectively, the findings demonstrate that glutathione effectively enhances the thermal and colour stability of C-phycocyanin, thereby improving its suitability as a natural colorant in thermally processed food products. This study provides a simple and effective strategy for stabilizing phycocyanin, facilitating its expanded application in food and related industries.

Keywords: C-phycocyanin, Spirulina, natural blue colorant, glutathione, thermal stability, photostability, antioxidant properties, purity index (A620/A280), thermal degradation, color retention, thermo-protection

FORMULATION AND CHARACTERIZATION OF BIO CELLULOSE SHEET MASK USING BANANA PEEL FOR COSMETIC APPLICATION

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ABSTRACT

Bio cellulose, a biopolymer of bacterial origin renowned for its high purity, mechanical strength, and excellent hydration properties, has emerged as a sustainable alternative for diverse applications, including cosmetic applications, including the treatment of dry and dehydrated skin. This study presents a sustainable method for bio cellulose production using agricultural waste materials, thereby addressing environmental concerns while advancing biopolymer research. Banana peel extract served as the carbon source in Hestrin-Schramm (HS) medium and naturally occurring cellulose-producing bacteria, was utilized as the bacterial inoculum. The production process involved preparing the HS medium supplemented with banana peel extract, followed by inoculation. The medium was incubated under static conditions at an optimal temperature of 37°C and a pH of 6 to facilitate bacterial growth and cellulose biosynthesis. The study utilized media containing varying concentrations of banana peel extract to assess its impact on bacterial growth and cellulose production. Further structural analysis using Fourier-transform infrared spectroscopy (FTIR), This innovative approach not only leverages agricultural waste materials like banana peels but also minimizes reliance on synthetic substrates, contributing to circular economy practices. The produced bio cellulose demonstrates promising potential in the cosmetic industry, particularly for developing bio cellulose sheet masks. These masks are highly valued for their ability to retain moisture, adhere closely to the skin, and deliver active ingredients effectively, making them ideal for skincare applications. Future work will focus on the formulation and characterization of bio cellulose sheet masks, incorporating SEM analysis to evaluate structural properties, as well as testing for hydration retention, mechanical strength, and compatibility with various cosmetic formulations. This research highlights the dual advantage of sustainable waste management and innovation in biopolymer applications, paving the way for environmentally conscious advancements in the cosmetic industry.

Keywords: Bio cellulose, Banana Peel Extract, Sustainable Production, Cosmetic Application

DEVELOPMENT OF CARBOXYMETHYL CELLULOSE BASED HYDROGEL FROM MUSA ACUMINATA LEAF AND VITIS VINIFERA SKIN

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ABSTRACT

The present study aimed to develop a CMC based hydrogel from Musa acuminata (banana) leaf and Vitis vinifera (grape) skin. The CMC hydrogel was formulated by incorporating the Musa acuminata leaf aqueous extract as natural biopolymer source and the Vitis vinifera skin ethanolic extract as functional additive in the carboxymethyl cellulose (CMC) suspension. Different antioxidant assays were carried out for both the Musa acuminata extract and Vitis vinifera extract to evaluate their potential antioxidant activity. The maximum DPPH radical scavenging activity of Musa acuminata aqueous extract and Vitis vinifera ethanolic extract were 58.71% and 90.71% at 120 µg/ml concentration. The maximum phosphomolybdenum reduction activity of Musa acuminata aqueous extract and Vitis vinifera ethanolic extract were 47.78% and 95.62% at 120 µg/ml concentration. The phytochemical analysis and estimation for both the samples have been performed to detect the major bioactive compounds. The antibacterial activity showed a maximum zone of inhibition of 15 mm against Escherichia coli for Musa acuminata leaf extract and Vitis vinifera extract showed a maximum zone of inhibition of 20 mm against staphylococcus aureus at 500 µg/ml concentration. The CMC hydrogel showed pH 6 which was compatible to skin. Further, the developed hydrogel will be evaluated for spreadability, swelling index, viscosity and toxicity. The polymer- extract interaction will be characterized using FTIR analysis which will indicate the successful hydrogel formation with potential anti-aging application.

Keywords: Musa acuminata, Vitis vinifera, CMC hydrogel, antioxidant and biopolymers.

ANALYTICAL AND COMPARATIVE ASSESSMENT OF QUALITY ASSURANCE TESTING METHODS FOR MILK AND SELECTED MILK PRODUCTS -A CASE STUDY AT MILMA

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ABSTRACT

Milk, a highly nutritious yet perishable foodstuff, is subject to quality alterations stemming from various influences, including its handling, storage, transportation, and processing. These factors contribute to considerable fluctuations in physicochemical and microbiological characteristics, which in turn directly impact product safety, shelf life, and its appropriateness for subsequent processing within the dairy sector. Consequently, achieving uniformity and consistency in milk quality poses a considerable challenge for industrial dairy operations. This investigation centers on assessing and mitigating variability in milk quality parameters throughout industrial processing. A total of fifty raw and processed milk samples were collected and subsequently analyzed for crucial quality parameters, such as fat content, solids-not-fat (SNF), titratable acidity, total solids, and microbial quality (MBRT), employing standard dairy analytical techniques in adherence to the Food Safety and Standards Authority of India guidelines. These parameters were chosen due to their critical role in determining the compositional integrity, freshness, and microbial stability of milk.Statistical analyses, including mean, standard deviation, and variability reduction percentage, were conducted to evaluate the consistency and efficiency of the processing system. A comparative examination of raw and processed milk revealed a significant decrease in variability across all measured parameters, thus suggesting improved consistency and process regulation. The microbial quality, in particular, showed considerable enhancement, thereby highlighting the efficacy of processing protocols in bolstering milk safety.This study illustrates that, in addition to routine industrial testing, the application of statistical tools offers a scientific foundation for evaluating process performance and quality stabilization.

Keywords: Milk Quality, Variability Reduction, Statistical Analysis, Fat, SNF, MBRT, Dairy Processing

EXTRACTION AND UTILIZATION OF TRICHOSANTHES CUCUMERINA (SNAKE GOURD) BIOPOLYMERS FOR BIODEGRADABLE PACKAGING FILM

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ABSTRACT

This study aimed to develop a biopolymer-based film using glycerol for food packaging applications. Biopolymers were extracted from Snake Gourd and utilized for the development of biodegradable packaging film. Different antioxidant assays were performed to determine the antioxidant activity of the Snake Gourd extract. The maximum DPPH radical scavenging activity was found to be 51.41% at a concentration of 120 µg/mL, while the maximum phosphomolybdenum activity reached 97.58% at 120 µg/mL concentration. Phytochemical analysis and estimation were performed to identify the presence of bioactive compounds in the extracts. The antibacterial activity showed a maximum zone of inhibition of 20 mm against Pseudomonas aeruginosa at 1000 µg/mL concentration. The antifungal activity showed a maximum zone of inhibition of 18 mm against Candida albicans at 1000 µg/Ml concentration. The extracted biopolymers were subsequently used for film preparation. The biopolymer solution was cast into films using glycerol as plasticizers to enhance their flexibility and processability. The structural and chemical properties of the fabricated films were characterized using Fourier-transform infrared (FTIR) spectroscopy. Thus, Snake gourd-based biopolymer films are a new material that could be used for sustainable food packaging.

Keywords: Trichosanthes cucumerina, Biopolymer, Antioxidant activity, glycerol and Plasticizers

SYNTHESIS AND CHARACTERIZATION OF SELENIUM NANOPARTICLES USING SEAWEED FOR DYE DEGRADATION

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ABSTRACT

The present investigation describes the green, eco-friendly synthesis of selenium nanoparticles (SeNPs) utilizing an aqueous extract of the marine algae Sodium selenite (Na2SeO3) served as the selenium precursor, while L- ascorbic acid functioned as an additional reductant alongside the algal phytochemicals. The formation of nanoparticles was primarily monitored by the characteristic colour transition from pale yellow to brick-red/dark brown, attributed to the surface plasmon resonance behaviour of selenium nanoparticles. Detailed synthesis protocols were established, involving controlled stirring speed (500–800 rpm), reaction temperature (40–60 °C), and defined mass ratios of the precursor and algal biomass. Comprehensive physicochemical characterization was performed using a battery of analytical techniques: particle size analysis via dynamic light scattering (DLS), UV–Visible spectroscopy, Fourier-transform infrared (FTIR) spectroscopy for functional group identification, X-ray diffraction (XRD) for crystallinity assessment, and scanning electron microscopy (SEM) for morphological and particle-size distribution studies. The catalytic efficiency of the biosynthesized SeNPs was evaluated by measuring the photodegradation of dye at its characteristic absorption maximum (λmax = 554 nm). A progressive decrease in dye absorbance with reaction time confirmed the high catalytic activity of the nanoparticles. The study conclusively demonstrates that seaweed- mediated SeNPs represent a cost effective, biologically safe, and environmentally benign nanomaterial for wastewater treatment.

Keywords: Selenium nanoparticles, Green synthesis, Marine algae, Dye degradation, Photocatalysis

BIOGAS PRODUCTION FROM CHICKEN MANURE

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ABSTRACT

The increase in number of chicken farms around the world has resulted in a large production of chicken manure. Adopting waste to wealth strategies and circular economy models can help reduce bio waste and add value. The chicken manure is an essential source of organics, ammonia - nitrogen, pathogens, and microorganisms degrading bacteria, and chicken manure can be converted into renewable energy through anaerobic digestion. The conversion of chicken manure into biomethane by Anaerobic digestion with focus on inhibiting factors, enhance digestion and valorization. The anaerobic digestion can be improved by various approaches include alkaline pretreatment of chicken manure and co-digestion of chicken manure with organic waste. The biogas production from chicken manure suggests that th technology as well as achievement and perspectives that provide an overview of the different approaches to remove ammonia from AD process to achieve high yield of biogas. Moreover, this provides zero emission for waste disposal and value addition of the waste for renewable green energy production.

Keywords: Ammonia, Nitrogen, Anaerobic Digestion, Chicken Manure

FORMULATION STRATEGIES TO IMPROVE STABILITY AND ORAL BIOAVAILABILITY OF GINGER EXTRACT IN SOLID ORAL DOSAGE FORMS

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ABSTRACT

Ginger (Zingiber officinale) extract possesses significant pharmacological activities, including anti-inflammatory, antioxidant, antiemetic, and gastroprotective effects, mainly attributed to bioactive compounds such as gingerols, shogaols, and related phenolics. Despite its therapeutic potential, the clinical efficacy of ginger extract in solid oral dosage forms is limited due to poor aqueous solubility, chemical instability under environmental stress, rapid first-pass metabolism, and variable gastrointestinal absorption. These factors contribute to low and inconsistent oral bioavailability. This review focuses on formulation strategies designed to enhance the stability and oral bioavailability of ginger extract in solid dosage forms such as tablets, capsules, and granules. Approaches including solid dispersions, lipid-based drug delivery systems, self-emulsifying drug delivery systems (SEDDS), nanoencapsulation, phytosome complexes, cyclodextrin inclusion complexes, and polymeric nanoparticles are critically discussed. The impact of excipient selection, microenvironmental pH control, incorporation of antioxidants, and advanced coating technologies on stability improvement is also evaluated. Furthermore, emerging manufacturing techniques such as spray drying, hot-melt extrusion, and nano crystallization are examined for their scalability and industrial feasibility. By integrating modern drug delivery systems with herbal formulations, enhanced stability, improved dissolution, and optimized systemic exposure of ginger bio actives can be achieved. This review provides a comprehensive scientific framework for the rational design of stable and bioavailable solid oral formulations of ginger extract.

Keywords: Ginger extract; Oral bioavailability; Solid oral dosage forms; Stability enhancement; Pharmacokinetics.

BIOTECHNOLOGICAL APPROACH FOR VALORIZATION OF LABORATORY GENERATED WASTE AGAR INTO VALUE ADDED PRODUCTS

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ABSTRACT

The increasing generation of agar-containing waste from microbiology and biotechnology laboratories has created a growing need for sustainable disposal and resource recovery strategies. Although agar is widely used as a solidifying agent in microbial culture media, discarded agar plates and residual media are often treated as laboratory waste despite their high polysaccharide content and potential for biotechnological reuse. This study explores a biotechnological approach for the valorization of laboratory generated agar waste by employing marine agarase producing bacteria capable of converting agar-based substrates into biologically valuable intermediates. Marine samples were used as the source for isolating agarolytic bacterial strains, which were screened for agar-degrading efficiency through selective plate-based assays and enzymatic evaluation. The most efficient isolate was characterized using morphological, biochemical, and molecular methods. Submerged fermentation conditions were subsequently optimized to improve agarase production by regulating key cultural and nutritional parameters. The produced agarase demonstrated effective hydrolytic potential toward agar substrate, indicating its suitability for the controlled breakdown of agar waste into smaller oligosaccharide fractions with prospective functional applications. By integrating marine microbial enzyme production with laboratory waste utilization, this study establishes a sustainable framework for agar waste valorization and supports circular bioresource management. This study highlights an eco-friendly strategy for converting laboratory agar waste into high-value biomolecules, contributing to sustainable waste management and circular bioeconomy applications in biotechnology, food, and pharmaceutical industries.

Keywords: Agar Waste Valorization, Agarase Production, Marine Bacteria, Submerged Fermentation

SYNTHESIS OF API INTERMEDIATES

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ABSTRACT

In our project focuses on the synthesis of API (Active Pharmaceutical Ingredient) intermediates, which are important compounds formed during the preparation of medicines. The aim of this work is to understand how these intermediates are produced and how they affect the quality and efficiency of drug manufacturing. In this study, a two-stage reaction process was carried out. In the first stage, a condensation reaction was performed using thiazole aldehyde and cyclopentanone in the presence of sodium hydroxide as a base catalyst. In the second stage, the intermediate formed was converted into a spiro compound using isatin and L-proline as an organocatalyst. Methanol was used as the solvent throughout the process. The reaction progress was monitored using Thin Layer Chromatography (TLC), and the final product was purified by filtration and drying. The synthesized compound was characterized using NMR and FTIR techniques to confirm its structure and functional groups. This project helps in understanding the importance of intermediates in pharmaceutical industries, improves practical laboratory skills, and provides knowledge about reaction mechanisms, analytical techniques, and drug development processes.

Keywords: API intermediates, Condensation reaction, Spiro compounds, Organocatalyst (L-Proline), Thin Layer Chromatography (TLC), NMR spectroscopy

EVALUATION OF ANTI-INFLAMMATORY POTENTIAL OF NERIUM OLEANDER & PONGAMIA PINNATA IN INVITRO & INSILICO MODELS

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ABSTRACT

The present study employs an integrated in vitro and in silico approach to investigate the anti-inflammatory potential of Nerium oleander and Pongamia pinnata. Inflammation is a major contributing factor in various chronic diseases, and the adverse effects associated with conventional anti-inflammatory drugs have led to increased interest in plant-based alternatives. Both plants are widely used in traditional medicine and are known to possess bioactive phytochemicals with promising therapeutic properties. The in vitro evaluation includes protein denaturation inhibition and human red blood cell (HRBC) membrane stabilization assays to assess anti- inflammatory activity. Plant extracts are prepared using appropriate extraction methods and subjected to preliminary phytochemical screening for compounds such as flavonoids, alkaloids, and phenolic compounds. The in-silico investigation involves molecular docking of selected phytochemicals against key inflammatory targets, including cyclooxygenase-2 (COX-2) and pro-inflammatory cytokines. Binding interactions are analysed to better understand the mechanism of action of these compounds. This integrated approach aims to evaluate the anti-inflammatory efficacy of Nerium oleander and Pongamia pinnata, thereby supporting the development of safe and effective plant-based therapeutic agents.

Keywords: Anti-inflammatory activity, molecular docking, COX-2, Phytochemicals, HRBC Membrane Stabilization, Protein Denaturation

FORMULATION AND DEVELOPMENT OF TANNIN-BASED ECO-FRIENDLY WOOD PRIMER FOR CIRCULAR BIO-ECONOMY

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ABSTRACT

Conventional wood primers rely heavily on toxic chemicals such as zinc chromate and synthetic resins with high volatile organic compound (VOC) emissions, posing considerable risks to human health and the environment. To overcome these limitations, a bio-based wood primer was developed by incorporating tannin derived from tamarind (Tamarindus indica L.) seed waste, an underutilized agricultural by-product, in alignment with circular bio-economy principles. Tannin was extracted from tamarind seed powder through an optimized Hot water extraction and concentration. Phytochemical screening confirmed the presence of tannins, while quantitative analysis using the Folin–Ciocalteu method revealed a total phenolic content of 522.3 µg/mL (gallic acid equivalent). The extracted tannin was subsequently incorporated into a water-based acrylic primer matrix, and the formulation was evaluated for physicochemical properties including viscosity, pH, density, drying time, and film-forming behavior. Surface hydrophobicity was assessed using static contact angle measurements. The tannin-based primer demonstrated adhesion strength, uniform film formation, and drying characteristics comparable to commercial primers. Contact angle analysis indicated increased hydrophobicity of the coated surface, suggesting enhanced resistance to moisture penetration. Furthermore, the developed formulation exhibited reduced VOC emissions and lower toxicity compared to conventional primers, indicating improved environmental and user safety. These findings demonstrate that tannin derived from tamarind seed waste can serve as an effective and sustainable functional additive in wood coating applications. This study promotes the efficient utilization of agricultural residues, reduces dependence on petrochemical-based materials, and supports the development of environmentally benign coating systems within a circular bio-economy framework.

Keywords: Tannin extraction, Tamarind seed waste, Wood primer, Eco-friendly coating, Circular bio-economy, Bio-based materials, Low VOC, Sustainable formulation, Phytochemical analysis

WASTEWATER-GROWN MICROALGAE FOR SUSTAINABLE BIOFUEL PRODUCTION

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ABSTRACT

The increasing global demand for renewable energy and the growing problem of wastewater pollution have encouraged the development of sustainable and integrated solutions. One promising approach is the cultivation of microalgae in wastewater for biofuel production. Microalgae are photosynthetic microorganisms capable of rapidly growing in nutrient-rich environments and accumulating significant amounts of lipids, carbohydrates, and proteins. Wastewater from domestic, agricultural, and industrial sources contains high levels of nutrients such as nitrogen and phosphorus, which can serve as an excellent growth medium for microalgae. By utilizing these nutrients, microalgae help in removing pollutants from wastewater while simultaneously producing valuable biomass. The biomass obtained from wastewater-grown microalgae can be converted into various types of biofuels, including biodiesel, bioethanol, and biogas. Lipids extracted from algal cells can be converted into biodiesel through transesterification, while carbohydrates can be fermented to produce bioethanol. In addition, the remaining biomass can undergo anaerobic digestion to generate biogas. This integrated approach provides dual benefits: efficient wastewater treatment and sustainable biofuel production. It also reduces the need for chemical fertilizers and freshwater, thereby lowering the overall production cost. Despite its potential, several challenges remain in large-scale implementation. These include efficient harvesting of microalgal biomass, optimization of cultivation systems, and improvement of lipid productivity. Advanced technologies and process optimization are required to enhance the economic feasibility of this approach. Overall, wastewater-grown microalgae represent an environmentally friendly and cost-effective strategy for renewable energy generation while contributing to improved wastewater management and environmental sustainability.

Keywords: Microalgae, Wastewater treatment, Biofuel production, Lipid extraction

PRODUCTION OF A PLANT-BASED FERMENTED SPREADABLE CHEESE ANALOGUE FROM CHICKPEA PROTEIN ISOLATE

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ABSTRACT

The rising global demand for sustainable, lactose-free, and plant-based food products has intensified research into alternative protein sources for dairy analogues. Among various plant proteins, chickpea (Cicer arietinum) protein has gained attention due to its high protein content, balanced amino acid profile, functional properties, and wide availability. This study aims to develop a fermented cheese analogue using chickpea protein isolate, with the incorporation of inulin as a functional ingredient, and to evaluate its feasibility as a nutritious and sustainable alternative to conventional dairy cheese. Chickpea protein isolate is obtained through systematic processing steps including dehulling, soaking, drying, milling, alkaline extraction, and isoelectric precipitation. The resulting protein curd is neutralized and utilized as the base matrix for cheese analogue formulation. Inulin is incorporated to improve texture, mouthfeel, and water-holding capacity, while also acting as a prebiotic component that can support beneficial microbial activity. Fermentation is proposed using the lactic acid bacterium Lactobacillus plantarum, selected for its strong acidification capacity, proteolytic activity, and adaptability to plant-based substrates. The fermentation process is expected to play a crucial role in enhancing texture, flavor development, and overall product stability. The study is designed to analyse the effects of fermentation and inulin incorporation on key physicochemical parameters such as pH, moisture content, protein composition, and textural properties, along with sensory evaluation. Additionally, the role of microbial activity in improving protein digestibility and the potential prebiotic effect of inulin will be explored. The expected outcome of this research is the development of a palatable, structurally stable, and nutritionally enhanced cheese analogue with improved functional properties. This work contributes to the growing field of plant-based functional foods and supports the development of environmentally sustainable dairy alternatives.

Keywords: Chickpea Protein Isolate, Plant-Based Cheese Analogue, Inulin, Fermentation, Lactobacillus Plantarum, Dairy Alternatives, Sustainable Foods

PRODUCTION OF NANOCELLULOSE FROM TEMPLE FLOWER WASTE

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ABSTRACT

Plastic waste is increasing and causing many environmental problems. So, there is a need to find better materials. Temple flowers are thrown away after use and become waste, which creates disposal problems. This study aims to use temple flower waste to produce nanocellulose. Temple flower waste was collected and cleaned to remove dust and impurities. The cleaned flowers were then dried and prepared for processing. After that, they were treated using different chemical steps to separate cellulose from the waste material. From this cellulose, nanocellulose was produced. The obtained material was then tested to check its structure and strength. Finally, films were made using the produced nanocellulose and were checked for their strength and flexibility. The produced nanocellulose showed good strength and useful properties. The films made from it were flexible and strong, similar to normal materials. The results show that temple flower waste can be converted into useful material. This study shows that temple flower waste can be used as a low-cost source to produce nanocellulose. It helps in reducing waste and making better use of available materials.

Keywords: Temple flower, Nanocellulose, Environmental problems

STRUCTURAL CONSEQUENCES OF DENGUE VIRUS(DENV) GENOME EVOLUTION IN THE 5' AND 3'UNTRANSLATED REGIONS(UTRs): IMPLICATIONS FOR INCREASING CASES IN INDIA

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ABSTRACT

The dengue virus (DENV) is a flavivirus that uses mosquitoes as its vector. The viral genome consists of a single-stranded positive-sense RNA molecule that has both a 5′ and a 3′ untranslated region (UTRs), where replication and translation of the virus is controlled in a highly complex manner by the addition of UTRs. Although there are many well-characterized proteins produced by DENV during the life cycle, the role of the UTRs in determining the fitness of DENV and its capacity to cause disease is less well-understood. In this study, we will be studying the evolution of the UTRs of DENV using RNA sequence data from GISAID over time (longitudinal analysis). Multiple sequence alignments of the sequences will be performed using MAFFT to obtain information on conserved and mutant regions, as well as the important functional elements of the UTR in determining the ability of DENV to adapt to its environment. The preliminary results indicate that key functional elements are conserved, while other regions exhibit a high degree of variability that may be functionally relevant (possibly due to alterations in the secondary structure of the RNA). Such changes in the structure of the RNA may have significant consequences for the ability of DENV to bind to its polymerase, the efficiency of translation of DENV-related RNA, and the capacity of DENV to synthesize RNA. Our findings will provide new information about the evolution of DENV and support our hypothesis that UTRs may provide new targets for antiviral therapy as well as to be valuable molecular markers for continuous genomic surveillance and evolutionary monitoring of DENV.

Keywords: Dengue virus, DENV, untranslated regions (UTRs), viral evolution, RNA secondary structure, genomic surveillance, GISAID, multiple sequence alignment, MAFFT, mutational hotspots, conserved motifs, viral replication, RNA synthesis, flavivirus

IDENTIFICATION OF CIRCULATING AUTOANTIBODIES AND THEIR ROLE IN CANCER DETECTION

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ABSTRACT

Cancer is a disease in which normal cells undergo abnormal changes, leading to uncontrolled growth and the ability to invade surrounding tissues. Cervical cancer, commonly associated with high-risk human papillomavirus (HPV) infection, remains a significant health burden and necessitates the identification of reliable biomarkers for early detection. Circulating autoantibodies directed against tumour-associated antigens (TAAs) have emerged as promising, minimally invasive indicators of tumour presence. The present study aims to culture the cervical cancer cell line SiHa (HPV16) as a source of tumour- associated antigens. Cell lysates were prepared and utilized to detect TAA- associated circulating autoantibodies in serum samples using Enzyme-Linked Immunosorbent Assay (ELISA). ELISA was employed specifically to identify the presence of autoantibodies in cancer patients. Further characterization and identification of antigen–autoantibody interactions were carried out using Matrix-Assisted Laser Desorption/Ionization (MALDI) mass spectrometry. Additionally, the study compares the presence of TAA-associated circulating autoantibodies between cervical cancer patients and healthy controls. This integrated immunological and proteomic approach may contribute to the development of sensitive diagnostic strategies for early cervical cancer detection and disease monitoring.

Keywords: Circulating Autoantibodies, Tumour-Associated Antigens (TAAs), ELISA, MALDI, Biomarkers; Early diagnosis, Cervical Cancer.

GENOME-SCALE METABOLIC MODELLING OF PATHOGENIC SPECIES

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ABSTRACT

Pathogenic species exhibit intrinsic metabolic adaptation to survive, cause virulence, and exhibit resistance within host environments. These system-level metabolic behaviours are difficult and laborious to capture using only the conventional experimental techniques. Genome-Scale Metabolic Modelling (GSMM) is a system biology approach for understanding the genotype-phenotype relationship by providing a computational framework to reconstruct and analyse the entire metabolic network of an organism based on its genome sequence. One such approach of GSMM is Constraint-Based Modelling (CBM). Initially, Constraint-BasedModelling (CBMs) was used to determine the theoretical pathway yield and metabolic overflow. With the advent of high-throughput omics technologies, CBM has evolved to incorporate transcriptomic, proteomic, and metabolomic data to constrain individual metabolic reactions, thereby enhancing model specificity and biological relevance. This model is used to construct a mathematical model that includes all known metabolic reactions, associated enzymes, corresponding genes, metabolites and their interaction. This approach serves as a robust systems biology framework for elucidating metabolic adaptations in pathogenic species.

Keywords: Genome-scale metabolic modelling, Constraint-based model, metabolic reaction, Pathogenesis

GENOME-BASED COMPARATIVE ANALYSIS OF PROBIOTIC STRAINS FOR SAFETY EVALUATION AND FUNCTIONAL CHARACTERIZATION

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ABSTRACT

Probiotic microorganisms play an important role in functional foods and nutraceutical formulations due to their ability to promote gut health and support host physiological functions. Despite their widespread application, systematic genomic evaluation is necessary to confirm their safety and functional potential before industrial or therapeutic use. In this study, a comparative genomic analysis was conducted on four widely studied probiotic species: Lactobacillus rhamnosus, Lactobacillus plantarum, Bifidobacterium longum, and Bifidobacterium bifidum. Complete genome sequences were retrieved from the NCBI database and analyzed using integrated bioinformatics approaches to explore their genetic architecture and probiotic attributes. Genome annotation was performed using the RAST platform to identify key genomic elements including coding sequences (CDS), transfer RNA (tRNA), ribosomal RNA (rRNA), and hypothetical proteins. The safety profile of these strains was evaluated by screening against the Virulence Factor Database (VFDB) to detect potential virulence-associated genes, while antibiotic resistance determinants were analyzed using the ResFinder tool. Toxin-related genes were also examined to confirm the absence of harmful genetic elements. Functional genomic analysis identified genes associated with essential probiotic traits such as acid and bile tolerance, intestinal adhesion, carbohydrate metabolism, vitamin biosynthesis, and antimicrobial activity. These genes were further mapped to metabolic pathways using the KEGG database to understand their biological roles. Comparative analysis revealed conserved genes involved in stress adaptation, metabolic flexibility, and host–microbe interactions. The absence of major virulence determinants indicates a favorable safety profile, supporting the potential application of these strains in functional foods and therapeutic products.

Keywords: Probiotics, Comparative Genomics, Nutraceuticals, Functional Foods, Bioinformatics

PRODUCTION OF POLYLACTIC ACID (PLA) FROM POTATO PEEL

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ABSTRACT

Petroleum-based plastics are widely used in daily life, but they cause serious environmental problems because they do not degrade easily and continue to accumulate in landfills and natural ecosystems. Every year, millions of tons of plastic waste are generated, increasing pollution and environmental risks. This situation creates an urgent need for biodegradable and eco-friendly alternatives such as Polylactic Acid (PLA). PLA is a biodegradable polymer produced from renewable resources and is considered a sustainable substitute for conventional plastics. In this study, potato peel, a common household and food processing waste rich in starch, was used as a raw material for PLA production. The process began with pretreatment of potato peel to extract fermentable sugars. These sugars were then subjected to microbial fermentation to produce lactic acid. The lactic acid obtained was further purified and converted into PLA through polymerization. This method not only helps in reducing plastic pollution but also promotes the effective utilization of agro-waste materials. The use of potato peel as a substrate makes the process cost-effective and sustainable. Overall, this study highlights a simple and eco-friendly approach for producing biodegradable plastic, contributing to waste valorization and sustainable development.

Keywords: Polylactic Acid (PLA), Potato Peel, Biodegradable Plastics, Lactic Acid Fermentation, Agricultural Waste, Sustainable Materials

WASTE DERIVED BIOSORBENT FOR DYE REMOVAL

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ABSTRACT

Synthetic dyes like Rhodamine B and Methyl Orange are toxic, stable, and resistant to degradation, their release from textile and industrial effluents poses a major risk to human health and aquatic environments. This study uses a composite adsorbent made from waste materials, specifically rice husk, banana peel, and neem powder, to remove these dyes in an economical and environmentally friendly manner. Before being mixed to create a biosorbent, the chosen waste materials were gathered, cleaned, dried, and ground into fine powders. Batch adsorption experiments were then used to remove dyes from contaminated water using the prepared adsorbent. The ability of the composite material to gradually lower dye concentration was used to assess its efficacy The findings showed that the biosorbent had strong adsorption potential and significant removal efficiency for both Methyl Orange and Rhodamine B. The presence of naturally occurring functional groups like hydroxyl and carboxyl groups as well as the composite adsorbent's porous structure, which makes it easier for dye molecules to bind to the surface, are responsible for its improved performance. The potential of using inexpensive agricultural and plant-based waste materials as sustainable adsorbents for wastewater treatment is highlighted in this study. Overall, the suggested approach contributes to pollution control and sustainable resource management by providing a straightforward, affordable, and ecologically friendly dye removal solution.

Keywords: Rhodamine B, Methyl Orange, Rice Husk, Banana Peel, Neem Powder, Dye Removal, Biosorbent, Wastewater Treatment

INTERGRATIVE GENE EXPRESSION ANALYSIS OF GLOBLASTOMA TO IDENTIFY POTENTIAL BIO MARKER

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ABSTRACT

Glioblastoma (GBM) is the most aggressive primary brain tumor, characterized by extensive molecular heterogeneity and poor patient prognosis. Identifying reliable biomarkers is critical for improving early diagnosis, prognostic assessment, and targeted therapy. In this study, we performed an integrative gene expression analysis using multiple publicly available transcriptomic datasets to uncover key genes and pathways associated with glioblastoma. Differential gene expression analysis was conducted to compare tumor and normal brain tissues, followed by functional enrichment analyses to identify significantly altered biological processes and signalling pathways. A protein–protein interaction (PPI) network was constructed to determine hub genes with high connectivity, and survival analysis was performed to evaluate their prognostic significance.

Keywords: Glioblastoma; Gene expression analysis; Biomarkers; Differentially expressed genes; Bioinformatics; Transcriptomics; Prognostic markers; Pathway analysis

SYNERGISTICALLY ENGINEERED BIOCHAR- MICROBIAL SYSTEM FOR TREATMENT OF TEXTILE DYE AND TANNERY EFFLUENTS

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ABSTRACT

Industrial effluents generated from tanneries and textile dyeing units processing pose serious environmental concerns due to their high organic load, intense color, toxic heavy metals, and recalcitrant compounds. Conventional treatment methods are often expensive, generate secondary pollution, and show limited efficiency for complex waste streams. This study develops and evaluates a plant derived biochar immobilized with microbe as a sustainable, low-cost, and effective treatment system for tannery effluents and dye wastewaters. It leads to reduction in color, BOD and overall toxicity of the effluents. The system also shows good operational stability and reusability over repeated treatment cycles, a sustainable waste-to-resource approach converting agricultural residues into value-added materials for eco-friendly and integrated industrial effluent.

Keywords: Industrial effluents, Biochar, Tannery effluents, Dye wastewaters, Waste-to-resource.

EXTRACTION OF HIGH-YIELD STARCH FROM MANGO SEED KERNEL

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ABSTRACT

The increasing demand for sustainable and value-added utilization of agro-waste has driven research toward the recovery of useful biomaterials from underutilized sources. This study focuses on the extraction of starch from mango seed kernel using an alkali-based chemical method and the evaluation of its physicochemical and structural properties. Mango seed kernels, a major by-product of the fruit processing industry, were processed into powder and subjected to alkali treatment to isolate starch efficiently. Proximate analysis was conducted to determine moisture and ash content, providing insight into the quality and stability of the raw material. The yield of the extracted starch was quantitatively estimated using UV–visible spectroscopy through an iodine assay, confirming efficient starch recovery. Additionally, Fourier Transform Infrared (FTIR) spectroscopy was employed to identify the functional groups present, verifying the structural integrity and characteristic features of starch. The extracted starch appeared white to off-white, smooth in texture, and odorless, indicating a high degree of purity. The extraction process resulted in a substantial starch yield ranging from 40–60% on a dry weight basis, highlighting mango seed kernel as a promising alternative source of starch. Moreover, the method required minimal chemical usage, making it cost-effective, environmentally friendly, and suitable for large-scale applications. Overall, the findings demonstrate the potential of mango seed kernel-derived starch for various industrial applications, including food, pharmaceutical, and biodegradable material production.

Keywords: Mango Seed Kernel, Starch Extraction, Alkali Treatment, Agro-Waste Valorization, FTIR Spectroscopy, UV–Visible Spectroscopy, Sustainable Materials.

INSILCO AND INVITRO EVALUATION OF THE ANTIDIABETIC POTENTIAL OF HYDROETHANOLIC LEAF EXTRACT OF TODDALIA ASIATICA

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ABSTRACT

Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder characterized by insulin resistance and persistent hyperglycemia, leading to severe complications if untreated. The growing demand for safer and cost-effective therapies has encouraged the exploration of plant-based bioactive compounds. This study investigates the antidiabetic potential of the hydroethanolic leaf extract of Todd Alia asiatica using integrated in silico and in vitro approaches targeting T2DM. In the in-silico analysis, major phytoconstituents were subjected to molecular docking against key enzymes such as α-amylase and α-glucosidase, which are responsible for carbohydrate digestion. The compounds exhibited strong binding affinities, indicating effective enzyme inhibition. In vitro evaluation was carried out using α-amylase and α-glucosidase inhibitory assays, along with antioxidant assays including DPPH and ABTS radical scavenging methods. The extract showed significant, dose-dependent inhibitory activity and potent antioxidant effects, comparable to standard drugs. Phytochemical screening revealed the presence of flavonoids, phenolics, tannins, and alkaloids, which are known to contribute to antidiabetic activity by reducing postprandial hyperglycemia and oxidative stress. In conclusion, the hydroethanolic leaf extract of Toddalia asiatica demonstrates promising antidiabetic potential against T2DM through enzyme inhibition and antioxidant mechanisms. Further in vivo studies are necessary to confirm its therapeutic efficacy and safety.

Keywords: Type 2 Diabetes Mellitus (T2DM), Toddalia asiatica, Antidiabetic activity, In silico, In vitro, Molecular docking; α-amylase inhibition; α-glucosidase inhibition; Antioxidant activity, Phytochemicals

PREPARATION AND BIOLOGICAL EVALUATION OF DICTYOTA BARTAYRESIANA LOADED CHITOSAN PVA COMPOSITE HYDROGEL FOR ANTICANCER DRUG DELIVERY IN NEUROBLASTOMA CELL LINE

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ABSTRACT

Cancer is a major global health problem and a leading cause of death worldwide. Chemotherapy, though widely used, produces severe side effects that affect patients significantly. Neuroblastoma is a common childhood cancer, mostly affecting children under five years of age and requires safer more targeted treatment approaches. Dictyota bartayresiana, a brown marine seaweed, contains rich bioactive compounds with antioxidant and anticancer properties. It acts as a natural reducing and stabilising agent, avoids toxic chemical reagents and is a cost-effective, biodegradable marine resource. Chitosan and Polyvinyl Alcohol (PVA) were selected to prepare a composite hydrogel due to their biocompatibility, biodegradability and controlled drug release capability. The hydrogel was prepared by dissolving Chitosan in 1% acetic acid and PVA in distilled water at 70-80°C. Both solutions were mixed, seaweed extract was incorporated and glutaraldehyde was added as a crosslinker to form the final composite hydrogel. Characterisation was carried out using FTIR, XRD and SEM analysis. FTIR confirmed successful polymer interactions and incorporation of algal bioactive compounds. SEM revealed a porous, interconnected 3D network with uniform dispersion of seaweed extract. In-vitro drug release showed an initial burst release followed by sustained release over 24 hours. DPPH assay demonstrated dose-dependent antioxidant activity at 20, 30 and 40 µg/mL concentrations. Antibacterial testing against MRSA by agar well diffusion showed a 20 mm inhibition zone at 75 µg, comparable to the positive control. Future studies will include anti-inflammatory activity, antidiabetic activity, swelling study, drug kinetics modelling and cytotoxicity evaluation against neuroblastoma cell line using MTT assay.

Keywords: Neuroblastoma, Dictyota bartayresiana, Chitosan, Polyvinyl Alcohol, Composite Hydrogel, Drug Delivery

IN SILICO ANALYSIS OF NONSYNONYMOUS MUTATIONS IN THE HUMAN HEMOPHILIA GENE USING BIOINFORMATICS TOOLS

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ABSTRACT

Hemophilia is a hereditary bleeding disorder mainly caused by mutations in clotting factor genes, leading to reduced or absent protein function. Nonsynonymous single nucleotide polymorphisms (nsSNPs) can alter amino acid sequences and potentially affect protein structure and activity. This study aims to perform in silico analysis of nonsynonymous variants in the human hemophilia gene using different bioinformatics tools to predict their pathogenicity and structural impact. Methods: Reported nonsynonymous variants in the human hemophilia gene will be collected from public mutation databases. These variants will be analysed using various sequence- and structure-based bioinformatics tools to predict their effect on protein stability, function, and conservation. Structural modelling and visualization tools will be used to assess the location of deleterious mutations within functional domains of the protein. Results: The in silico analysis is expected to identify a subset of nonsynonymous variants with high pathogenic potential based on multiple prediction tools. Variants predicted to be deleterious may cluster in conserved or functionally important regions of the hemophilia protein, suggesting a strong impact on its activity. These findings can help prioritize mutations for further experimental validation and clinical relevance. Conclusion: This study demonstrates that bioinformatics tools can be effectively used to screen and characterize nonsynonymous mutations in the human hemophilia gene. In silico prediction of variant impact provides a low-cost and rapid approach to support genetic diagnosis, guide future experimental studies, and improve understanding of the molecular basis of hemophilia.

Keywords: Nonsynonymous Single Nucleotide Polymorphisms, Hemophilia Prioritize Mutations

ISOLATION AND SCREENING OF INSULIN-STIMULATING ENDOPHYTIC BACTERIA FROM ALOE VERA GEL

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ABSTRACT

Endophytic bacteria residing within medicinal plants have gained increasing attention due to their potential therapeutic applications, particularly in metabolic disorders such as Diabetes Mellitus. This study focuses on the isolation and characterization of insulin-stimulating endophytic bacteria from the gel of Aloe vera, a plant well known for its antidiabetic properties. Fresh Aloe vera leaves were surface sterilized using hydrogen peroxide and sodium hypochlorite, followed by rinsing with sterile distilled water to eliminate epiphytic contaminants. The inner gel was aseptically extracted, homogenized, and subjected to serial dilution up to 10^{-6}. The diluted samples were cultured using the spread plate technique under sterile conditions to isolate distinct bacterial colonies. The obtained isolates were further screened for their ability to stimulate insulin secretion using in vitro assays involving pancreatic cell lines. Preliminary results indicate that certain bacterial isolates exhibit significant insulinotropic activity, suggesting their potential role in enhancing glucose metabolism. These findings highlight the importance of endophytic microorganisms as a promising source of bioactive compounds and potential candidates for developing novel antidiabetic therapies. Further molecular identification and characterization of these isolates will provide deeper insights into their mechanisms of action and applicability in pharmaceutical and probiotic formulations.

Keywords: Endophytic Bacteria; Aloe Vera; Insulin Stimulation; Diabetes Mellitus; Serial Dilution; Spread Plate Technique; Antidiabetic Activity; Medicinal Plants

EVALUATION OF ANTIOXIDANT, ANTIMICROBIAL AND ANTICANCER ACTIVITIES OF ACHYRANTHES ASPERA ROOT EXTRACT AND IN-SILICO APPROACH OF ACTIVE LIGANDS

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ABSTRACT

Medicinal plants are a rich source of bioactive compounds that play an important role in the development of novel therapeutic agents. Achyranthes aspera is a widely distributed medicinal plant traditionally used for the treatment of various ailments. The present study aims to evaluate the antioxidant, antimicrobial, and anticancer activities of Achyranthes aspera root extract and to identify potential bioactive compounds using an in-Silico approach of active ligands. The roots of Achyranthes aspera were collected, washed, shade-dried, and powdered. The powdered root material was subjected to methanol using standard extraction methods. Preliminary phytochemical screening of the root extract was carried out to identify the presence of phytochemical analysis such as alkaloids, flavonoids, phenolic compounds, saponins, tannins, steroids, Glucosides, Carbohydrates and proteins. The antioxidant activity of the root extract was evaluated using assays such as DPPH free radical scavenging method,Frap, Phospomolydenum, Superoxide Method. Antimicrobial activity was assessed against selected bacterial and fungal pathogens using agar well diffusion or disc diffusion techniques. The anti-cancer potential of the root extract will be assessed in vitro cytotoxicity assay on selected human cancer cell lines. An in-Silico molecular docking study will be performed. The phytochemicals analysis of Achyranthes aspera roots extract will be carried out using GC-MS. These active ligands were docked with target proteins involved in oxidative stress, microbial infection, and cancer-related pathways to analyze their binding affinity and molecular interactions. The results of this study suggest that the root extract of Achyranthes aspera exhibits significant antioxidant, antimicrobial, and anticancer activities.

Keywords: Achyranthes aspera; Root extract; Antioxidant activity; Antimicrobial activity; Anticancer activity; Phytochemicals; In-Silico analysis.

BIOTECH –DRIVEN NANOENCAPSULAION IN FUNCTIONAL FOOD ADDRESSING STABILITY, COST AND SCALABILITY CHALLENGES IN INDIAN FOOD INDUSTRIES

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ABSTRACT

Functional foods are increasingly promoted for their ability to enhance health and reduce the risk of lifestyle-related diseases. However, the effective incorporation of bioactive compounds such as vitamins, antioxidants, probiotics, and photochemical into food products remains a major industrial challenge due to poor stability, low bioavailability, and sensitivity to processing and storage conditions. These challenges are particularly significant in the Indian food industry, which is characterized by high processing temperatures, extended supply chains, and cost-sensitive markets.By encapsulating functional substances in nano-sized, food-grade carriers, biotech-driven nanoencapsulation has become a potential method for protecting them. This improves stability, hides unwanted tastes, and permits controlled release. In India, there is still no widespread use of nanoencapsulation in functional foods despite its benefits. Its industrial adoption is hampered by issues with thermal and oxidative stability under actual processing circumstances, high production costs, scalability of nanoencapsulation techniques, regulatory uncertainty, and consumer safety concerns. The main stability, affordability, and scalability issues related to the nanoencapsulation of functional food ingredients in the Indian context are thoroughly examined in this research. The limits of applying laboratory-scale nanoencapsulation technologies to industrial food processing are examined, as is the role of biotechnology in creating safer, more affordable, and scalable nano-carriers through the use of biopolymers and enzyme-assisted techniques. The study highlights that although nanoencapsulation offers a lot of promise for functional foods in the future, its success in the Indian food industry depends on striking a balance between technological innovation, practical viability, and regulatory approval.

Keywords: Functional Foods, Nanoencapsulation, Stability, Scalability, Indian Food Industries

SYNTHESIS OF ZINC OXIDE NANOPARTICLES AND EVALUATION OF THEIR ANTICANCER ACTIVITY

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ABSTRACT

Zinc oxide nanoparticles (ZnO NPs) have gained significant attention in biomedical research due to their unique physicochemical properties and potential therapeutic applications. The present study focuses on the green synthesis of ZnO nanoparticles using plant extract as a reducing and stabilizing agent, providing an eco-friendly and cost-effective alternative to conventional chemical methods. The anticancer activity of the prepared ZnO nanoparticles is evaluated using in vitro assays on selected cancer cell lines. Cytotoxic effects are assessed by cell viability assays, indicating the ability of ZnO nanoparticles to induce cell death selectively in cancer cells. The mechanism of action may involve the generation of reactive oxygen species (ROS), leading to oxidative stress and apoptosis in cancer cells.

Keywords: Zinc Oxide Nanoparticles, Reactive Oxygen Species, Anticancer Activity

PHYTOCHEMICAL PROFILING AND IN-SILICO SCREENING OF AMARANTHUS SPINOSUS FOR POTENTIAL ANTI-BREAST CANCER COMPOUNDS WITH SUBSEQUENT IN VITRO VALIDATION IN MCF-7 CELLS

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ABSTRACT

Phytochemical profiling, combined with computational and experimental approaches, offers an efficient strategy for identifying novel anticancer agents from medicinal plants. The present study explores Amaranthus spinosus for its potential anti-breast cancer activity through a sequential workflow involving phytochemical analysis, in silico screening, and in vitro validation. Phytochemical profiling of A. spinosus was carried out using gas chromatography–mass spectrometry (GC–MS), which identified diverse bioactive compounds, including flavonoids, phenolics, fatty acid derivatives, and terpenoid constituents. The identified compounds were subsequently filtered using in silico ADMET (absorption, distribution, metabolism, excretion, and toxicity) analysis to shortlist molecules with favourable drug-likeness and safety profiles. ADMET- filtered compounds were then subjected to molecular docking studies against key breast cancer–related molecular targets, including Estrogen receptor alpha and other proteins involved in tumour growth and survival, to evaluate binding affinity and interaction patterns. The ligand exhibiting the highest docking score and stable interaction profile was further analysed using molecular dynamics simulation to assess the stability, flexibility, and conformational behaviour of the protein–ligand complex under physiological conditions. Based on the computational findings, experimental validation was performed using the estrogen receptor–positive MCF-7 breast cancer cell line. The cytotoxic potential of the selected plant extract was assessed using cell viability assays, and morphological alterations indicative of apoptosis were examined through microscopic analysis. The in vitro results demonstrated a significant, dose-dependent reduction in MCF-7 cell viability, supporting the predicted anticancer activity observed in the in-silico studies.

Keywords: In Silico Screening, Phytochemical Analysis, Estrogen Receptor

DEVELOPMENT OF PLANT-BASED HYDROGEL FOR DIABETIC WOUND INFECTION AND HEALING

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ABSTRACT

A percentage of Cocculus hirsutus (Kattukodi) gel was employed as the polymeric scaffold to develop an herbal-mediated hydrogel for the treatment of diabetic wound infections and the acceleration of tissue repair Citric acid functioned simultaneously as a binder and stabilizer, providing structural cohesion and controlled release of bioactive constituents. These crude plant extracts Lagerstroemia speciosa (Banaba), Opuntia ficus-indica (Prickly Pear) and Cocculus hirsutus were incorporated in an equimolar ratio to modulate abscisic-acid (ABA) levels and stimulate cellular proliferation. Lagerstroemia speciosa and Cocculus hirsutus extracts were obtained by ethanol maceration, whereas Opuntia ficus-indica extracted with aqueous citric acid. The resulting hydrogel was characterized physico-chemically (FTIR, XRD, DLS, SEM) to conform matrix integrity, homogeneity, and appropriate porosity. Antibacterial efficacy against predominant diabetic-wound pathogens was evaluated through MIC, MBC, and biofilm inhibition assays, demonstrating potent antimicrobial activity. Cytocompatibility and wound-closure potential were assessed using L929 fibroblast scratch assays, revealing significant enhancement of cell migration and proliferation. Overall, the herbal- based hydrogel exhibits a synergistic combination of strong antimicrobial properties, favourable mechanical and morphological characteristics, and pronounced pro-regenerative effects, positioning it as a promising, biocompatible dressing for managing infected diabetic wounds. GCMS profiling of three medicinal plants followed by molecular docking highlights bioactive compounds with therapeutic potential.

Keywords: Cocculus Hirsutus, Lagerstroemia Speciosa, Opuntia Ficus-Indica, Herbal-Based Hydrogel, Diabetic-Wound, GC-MS, Molecular Docking

A STUDY ON SEQUENTIAL THERAPY OF PTH THERAPY IN ESTROGEN-DEFICIENT MICE MODEL AND ITS COMPARISON WITH IL-17 NEUTRALIZING ANTIBODY

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ABSTRACT

The global epidemic known as osteoporosis is characterized by the loss of systemic bone mass, poor bone strength brought on by low bone mineral density (BMD), and delayed bone mineralization, all of which raise the risk of non-traumatic fracture and bone fragility. Osteoporosis is the result of weakening or erosion of bone that causes the bone to become more porous. The word represents bone. Osteoporosis is mostly predicted by bone mineral density (BMD). Osteoporosis is defined as a BMD in young, healthy persons that is less than 2.5 standard deviations. According to recent research, inflammation is a major factor in the etiology of osteoporosis. T cell activation and bone loss are caused by low estrogen levels. According to a clinical study, pro-inflammatory cytokines are important factors that determine how quickly PMO women lose bone (Brincat, S. D., 2014). We can see from the literature that IL-17 cytokine is essential to the pathophysiology of osteoporosis. In this work, we have demonstrated that, in the bone defect/injury model, combination therapy (PTH (1-34) + IL-17 neutralizing antibody) increased bone regeneration potential relative to similar monotherapies. This suggested that a novel target for osteoporosis treatment drugs could be this combination therapy.

Keywords: Sequential Therapy, PTH Therapy, Estrogen-Deficient, Mice Model, Neutralizing Antibody

WEARABLE ACCELEROMETER AND GYROSCOPE SENSORS FOR ESTIMATING THE SEVERITY OF ESSENTIAL TREMOR

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ABSTRACT

Essential Tremor (ET) is a neurological disorder characterized by involuntary, rhythmic shaking, primarily affecting the hands and arms, and in severe cases, impacting daily tasks such as eating, writing, or holding objects. The severity of ET can vary significantly from mild, manageable tremors to intense shaking that disrupts quality of life. This project aims to provide continuous, real-time monitoring of ET severity through a wearable device equipped with an accelerometer, gyroscope, pulse oximeter, temperature, and pressure sensors. The accelerometer and gyroscope sensors measure tremor intensity and frequency, capturing subtle to severe movements associated with ET. The pulse oximeter monitors heart rate and blood oxygen levels, as tremor severity may increase with changes in heart rate. A temperature sensor helps detect fluctuations in body temperature, which can affect tremor intensity, while a pressure sensor assesses the force applied during actions like drawing, providing insights into fine motor control. When sensor data deviates from normal ranges, a buzzer is triggered, and alert messages are sent to a designated health protector, enabling timely intervention. All sensor data is continuously displayed on an LCD screen and the Blynk Android app through IoT, offering an accessible platform for caregivers and health professionals to track ET progression. This system aids in understanding the fluctuations in ET severity, helping patients and caregivers manage the disorder more effectively and potentially improving the quality of life for ET patients.

Keywords: Essential Tremor, Wearable Device, Real-Time Monitoring, Accelerometer, Gyroscope, Pulse Oximeter, Temperature Sensor, Pressure Sensor

BRAIN TUMOR DETECTION AND CLASSIFICATION USING DEEP LEARNING TECHNIQUES

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ABSTRACT

Brain tumor segmentation from MRI images is essential for accurate diagnosis and effective treatment planning. Manual segmentation is labor-intensive. time-consuming. and highly dependent on expert interpretation. This work presents an automatic brain tumor segmentation approach using deep Learning algorithms. Convolutional Neural Networks (CNNs). especially U-Net architecture. are used to learn discriminative features from MRI scans. Image preprocessing and pixel-wise classification enable precise identification of tumor regions. The proposed system improves segmentation accuracy, consistency, and efficiency supporting radiologists in clinical decision-making.

Keywords: Brain Tumor Segmentation, U-Net, CNN, MRI Imaging, Deep Learning

SMART BIOINSPIRED INCUBATOR MATTRESS SYSTEM FOR NEONATAL THERMAL REGULATION AND CONTROLLED NUTRIENT DELIVERY

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ABSTRACT

The present invention relates to a smart bio-inspired incubator mattress system designed to provide controlled thermal regulation, physiological comfort, and optional nutrient and moisture delivery for newborn infants, particularly premature and low-birth-weight neonates. The system comprises a multilayer flexible mattress integrated with temperature sensors, heating elements, a microcontroller-based control unit, and a safety alarm mechanism. The mattress architecture includes a bio-inspired synthetic layer engineered to mimic adaptive skin-like properties observed in natural neonatal nurturing systems, enabling efficient heat retention and distribution. Real-time temperature data sensed from the infant–mattress interface is continuously processed through a closed-loop feedback control mechanism to maintain a predefined optimal temperature range suitable for neonatal care.An optional diffusion layer having micro-porous channels connected to refillable reservoirs enables controlled delivery of moisture, nutrients, or therapeutic solutions at safe diffusion rates compatible with neonatal skin contact.

Keywords: Smart Incubator Mattress, Neonatal Care, Premature Infants, Low Birth Weight (LBW), Thermal Regulation, Bio-Inspired Design, Closed-Loop Control System

WEARABLE SPINAL POSTURE CORRECTION DEVICE

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ABSTRACT

Back pain has become a widespread health issue among corporate professionals, mainly due to prolonged sitting, poor posture, and sedentary work habits. This project presents the design and development of a smart spinal brace aimed at preventing back pain and promoting spinal health in desk-bound individuals. The proposed spinal brace integrates ergonomic design principles with smart sensor technology to monitor the user's posture in real time. When a deviationfrom correct posture is detected, the device provides gentle vibration alerts to encourage immediate correction. This real-time feedback helps users develop healthy posture habits over time. Key feature of the system is its mobile application, which syncs with the brace to log posture data, analyze user behavior, and provide personalized recommendations for improvement. The app offers insights into posture trends and alerts users about prolonged inactivity or repeated poor posture. By combining wearable technology, real-time monitoring, and preventive ergonomics, the smart spinal brace aims to reduce the risk of chronic musculoskeletal disorders, especially lower back pain. This innovation also contributes to overall workplace wellness and improves productivity for professionals working long hours at desks. The project includes stages of b to ensure the device is accurate, comfortable, and user-friendly. With further refinement, the solution has the potential to be applied across various work environments and age groups, making it a valuable tool in modern occupational health.

Keywords: Smart Spinal Braces, Posture Monitoring, Wearable Sensors, Real-Time Feedback, Mobile App, Back Pain Prevention.

BONE TRABECULAR ANALYSIS OF PROXIMAL FEMUR RADIOGRAPHS FOR THE DETECTION OF OSTEOPOROSIS USING ANISOTROPIC MORLET WAVELET TRANSFORM

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ABSTRACT

Osteoporosis is a thinning of the bone that leads to fracture with minimum force. It affects postmenopausal women and elderly of both genders. Bone Mineral Density (BMD) is one of the parameters related to bone strength. For measuring BMD, Dual Energy X-ray absorptiometry (DXA) is currently considered as the "gold standard". Osteoporosis is evaluated in postmenopausal women using low-cost digital hip radiograph in comparison with DXA as a gold standard. By using the anisotropic filter, proximal femur is enhanced then the feature is extracted using Morlet wavelet transform. A free medical screening camp for osteoporosis was conducted at SRM Medical College and Research Institute. Total number of 50 (n = 50) Indian women, 18 healthy premenopausal women (n = 18, 36.3 ± 8.7 years) and 32 postmenopausal women (n = 32, 58 ± 9.1 years) whose age ranged from 20 to 85 years were included.

Keywords: Osteoporosis, Indian Women, DXA, BMD, Proximal Femur, Radiographic Hip Geometry, Anisotropic Filter, Morlet Wavelet Transform.

VOLUMETRIC ESTIMATION FOR OSTEOPOROSIS CLASSIFICATION USING OPTIMIZATION-BASED DEEP BELIEF NETWORK IN X-RAY IMAGES

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ABSTRACT

The global epidemic known as osteoporosis is characterized by the loss of systemic bone mass, poor bone strength brought on by low bone mineral density (BMD), and delayed bone mineralization, all of which raise the risk of non-traumatic fracture and bone fragility. Osteoporosis is the result of weakening or erosion of bone that causes the bone to become more porous. The word represents bone. Osteoporosis is mostly predicted by bone mineral density (BMD). Osteoporosis is defined as a BMD in young, healthy persons that is less than 2.5 standard deviations. According to recent research, inflammation is a major factor in the etiology of osteoporosis. T cell activation and bone loss are caused by low estrogen levels. According to a clinical study, pro-inflammatory cytokines are important factors that determine how quickly PMO women lose bone (Brincat, S. D., 2014). We can see from the literature that IL-17 cytokine is essential to the pathophysiology of osteoporosis. In this work, we have demonstrated that, in the bone defect/injury model, combination therapy (PTH (1-34) + IL-17 neutralizing antibody) increased bone regeneration potential relative to similar monotherapies. This suggested that a novel target for osteoporosis treatment drugs could be this combination therapy.

Keywords: Sequential Therapy, PTH Therapy, Estrogen-Deficient, Mice Model.., Neutalizing Antibody.

WOUND HEALING MONITORING BANDAGE

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ABSTRACT

Chronic and acute wounds require continuous assessment to ensure proper healing and to prevent complications such as infection and delayed tissue regeneration. This study presents the design and development of a smart wound healing monitoring bandage integrated with miniaturized biosensors for real-time evaluation of wound conditions. The proposed bandage incorporates flexible sensing elements capable of measuring key physiological parameters such as pH, temperature, and moisture level, which are critical indicators of wound status. Changes in pH cansignal infection, while temperature variations may indicate inflammation, and optimal moisture levels support faster healing. The sensed data are processed through an embedded microcontroller and transmitted wirelessly to a mobile application for continuous monitoring by healthcare professionals. The system aims to reduce the need for frequent manual inspection, thereby minimizing patient discomfort and risk of contamination. Additionally, the bandage is designed using biocompatible and breathable materials to ensure patient safety and comfort. Experimental validation demonstrates that the proposed system can effectively track wound conditions and provide early warning signs of infection, enabling timely medical intervention.

Keywords: Wound Healing, Smart Bandage, Biosensors, pH Monitoring, Temperature Sensing, Wearable Healthcare, Infection Detection, Remote Monitoring

ALZHEIMER MRI CLASSIFICATION USING DEEP LEARNING METHOD

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ABSTRACT

Alzheimer's disease is a brain disorder that slowly affects memory and the thinking ability of the person. I think catching it early matters a lot. Doctors can then give better care and treatments that might help slow down or something. It seems like without that its harder for patients. In this project, we developed a deep learning model to classify the MRI Brain image, e focused on those four stages mainly: Non-Demanted,Very Mild Demented, Mild Demented, and Moderate Demented. We used transfer learning here, taking the MobileNetV2 model thats already trained on ImageNet, instead of starting a whole neural network from scratch. It seems like that saves a lot of time and effort. The dataset is split into training, validation, and testing sets in the ratio of 70%, 15%, and 15%. Here Data augmentation techniques are applied to improve the performance of the model. The final model achieved around 85% accuracy on the test dataset. From what we got in the results, it can be observed that transfer learning is useful for medical image classification tasks like Alzheimer detection.

Keywords: Alzheimer's Disease, MRI, Deep Learning, MobileNetV2, Transfer Learning

MORPHOMETRIC ANALYSIS OF X-RAY AND CT IMAGES FOR EVALUATING OSTEOPOROSIS

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ABSTRACT

Osteoporosis is a diminishing of the bone that prompts break with least compel. It influences postmenopausal ladies and elderly of both sexual orientations. Bone mineral density (BMD) is one of the parameters identified with bone quality. Double energy x-beam absorptiometry (DXA) is at present considered as the "highest quality level" for measuring BMD. Morphometric analysis of femur bone is done on both radiographic images and Computed tomography images. An aggregate number of 50 (n = 50) Indian ladies, 18 solids pre-menopausal ladies (n = 18, 36.3 ± 8.7 years) and 32 post-menopausal ladies (n = 32, 58 ± 9.1 years) whose age extended from 20 to 85 years were incorporated. The patients are subjected to take X-ray, CT and DXA. The outcomes gotten by DXA found that 20 and 34% of the Indian ladies were having osteoporosis and osteopenia separately. Using SPSS software, the morphometrics analysis like neck of the bone, width of the neck, thickness of shaft, width of acetabular bone is measured and in CT images using MIMICS software the Hounsfield is measured in neck of femur, trochanter head and shaft. Est vol|ume is calculated through measured Hounsfield unit.

Keywords: Index term-computed tomography. X-ray, Indian Postmenopausal Women

DEEP LEARNING-BASED EARLY DETECTION OF ALZHEIMER'S DISEASE USING MRI BRAIN IMAGE ANALYSIS

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ABSTRACT

Alzheimer's disease (AD) is a progressive neurodegenerative disorder and a major cause of dementia, characterized by memory loss, cognitive decline, and behavioural changes. With the rapidly growing aging population, the prevalence of AD is increasing significantly, making early diagnosis essential for effective treatment and improved patient care. Early detection can support better disease management and help slow its progression.Magnetic Resonance Imaging (MRI) plays a vital role in identifying structural brain changes associated with the early stages of Alzheimer's disease. It provides high-resolution images that enable detailed analysis of brain regions related to memory and cognition. However, manual interpretation of MRI scans is complex, time-consuming, and prone to variability, highlighting the need for automated diagnostic systems.Deep learning has recently gained attention in medical image analysis due to its ability to learn complex patterns from large datasets. It has shown promising potential in detecting subtle brain abnormalities that indicate early-stage Alzheimer's disease. By analysing MRI brain images, deep learning methods can enhance detection accuracy and efficiency. This study focuses on deep learning–based early detection of Alzheimer's disease using MRI brain image analysis.

Keywords: Alzheimer's Disease, MRI Brain Imaging, Deep Learning, Early Detection, Medical Image Analysis.

IOT AND AI-BASED INFANT HEALTH MONITORING SYSTEM

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ABSTRACT

Continuous monitoring of infant health is essential for the early detection of critical conditions such as fever, respiratory distress, and abnormal physiological behavior. This paper presents an IoT and Artificial Intelligence (AI)-Based Infant Health Monitoring System designed to provide real-time, accurate, and non-invasive monitoring of vital parameters. The system integrates sensors to measure temperature, breathing rate, and other physiological signals, which are collected and processed using a microcontroller and transmitted to a cloud platform through IoT communication technologies. The acquired data is analyzed using AI algorithms to identify patterns and detect anomalies that may indicate potential health risks. Unlike traditional threshold-based systems, the proposed solution leverages machine learning models to improve prediction accuracy and minimize false alarms. In case of abnormal conditions, the system generates instant alerts and notifications to caregivers through a mobile application, enabling timely intervention. The proposed system is cost-effective, portable, and user-friendly, making it suitable for both home and clinical environments. By combining IoT connectivity with intelligent data analysis, this approach enhances the reliability and efficiency of infant monitoring systems, contributing to improved neonatal care and reduced risk of severe health complications.

Keywords: Infant Monitoring, IoT, AI, Sensors, Anomaly Detection, Real-Time Alerts, Neonatal Care.

ESP32-ENABLED ADAPTIVE MULTI-FINGER EMG PROSTHETIC HAND FOR LOW-COST INTUITIVE MUSCLE-CONTROLLED OPERATION

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ABSTRACT

Developments on the prosthetic technology have greatly enhanced the functionality of artificial limbs but most systems are still expensive and cannot be flexible to accommodate various users. In this paper, the design and development of a multi-finger prosthetic hand based on EMG using a low-cost microcontroller, ESP32, is presented. The system picks up electromyography (EMG) data on the residual limb of the user with low cost surface electrodes, and performs adaptive signal processing, including self-learned thresholds, to support changes in muscle strength, fatigue and inter-user variation. In contrast to traditional prosthetics that use binary open/close control, the suggested device permits proportional multi-finger actuation, which allows the control of the grip force and complex hand gestures. The real time monitoring and system calibration are made easier through wireless connection. Speed of reaction (less than 130 ms), accuracy in grip force (less than 0.5 N), and consistency in functioning across users are experimentally tested on several patients. The prosthetic hand is entirely 3D-printable, open source, and created to be easy to make, which makes the overall costs significantly less and the prosthetic more accessible to rehabilitation, assistive technology, and education purposes. This work offers a flexible platform to the next-generation prosthetics by incorporating affordability flexibility, and easy control, which increases the usability and user-friendliness.

Keywords: EMG Prosthetic Hand, ESP32 Microcontroller, Adaptive Signal Processing, Multi-Finger Control, Low-Cost Rehabilitation, Wearable Assistive Technology, Proportional Grip.

LASER BASED NON INVASIVE GLUCOSE MONITORING SYSTEM WITH AUTOMATIC INSULATION INJECTOR

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ABSTRACT

Diabetes management requires continuous monitoring of blood glucose levels and timely insulin administration to prevent complications. This paper presents a non-invasive, laser-based glucose monitoring system integrated with an automated insulin injection mechanism for real-time diabetic care. The proposed system utilizes the MAX30100 optical sensor to estimate glucose concentration by analysing variations in infrared and red-light absorption through biological tissues. The acquired signals are processed using an ATmega328P microcontroller, which evaluates glucose levels against predefined thresholds. When abnormal glucose levels are detected, the system automatically activates a DC motor-based insulin delivery unit to administer controlled doses of insulin. To enhance usability and safety, the system is integrated with an IoT cloud platform that enables real-time monitoring, data logging, and remote alert notifications for patients and caregivers. The proposed solution aims to reduce the need for invasive blood sampling, improve patient compliance, and provide continuous, automated diabetic management. By combining non-invasive sensing, intelligent control, and IoT connectivity, this system offers a promising approach toward safer and more efficient healthcare solutions for diabetes management.

Keywords: Diabetes Management, Non-Invasive Glucose, MAX30100, Automated Insulin, Iot Monitoring, Real-Time Alerts.

AI PARKINSONS SCREENING SYSTEM

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ABSTRACT

Parkinson's Disease (PD) is traditionally diagnosed through clinical observation of motor symptoms, which often manifest only after substantial neurological damage; however, this project addresses the critical need for early-stage intervention by identifying subtle physiological biomarkers. The core of the system utilizes high-speed computer vision and the MediaPipe framework to execute a real-time Eye Aspect Ratio (EAR) analysis, which accurately quantifies the spontaneous blink rate of a subject via a standard laptop webcam. This ocular motor data is vital, as a reduced blink frequency is a primary clinical indicator of "masked face" syndrome or hypomimia, a common early-phase Parkinsonian trait. To achieve a holistic diagnostic profile, the software architecture—built using Python and Flask—integrates this motor data with a multimodal screening process that evaluates 20 key non-motor symptoms. These include specialized assessments for REM Sleep Behavior Disorder (RBD) and Olfactory Dysfunction (Hyposmia), both of which are statistically proven to precede motor tremors by several years. The system processes these combined inputs through a risk-stratification algorithm to generate a professional, color-coded diagnostic report featuring interactive graphical analytics powered by Chart.js.

Keywords: Parkinson's Detection, Blink Analysis, EAR, Media Pipe, Computer Vision, Early Screening

DESIGN OF A BEDSORE MONITORING SYSTEM AND SEVERITY ANALYZER

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ABSTRACT

Pressure ulcers, commonly known as bedsores, are a major concern for bedridden patients, often leading to severe complications such as infections, prolonged hospitalization, and increased healthcare costs. Continuous monitoring and timely interventions are essential to prevent their occurrence. This project presents the design and development of a smart bedsore monitoring system and severity analyzer that integrates sensor technology, microcontroller processing, and Internet of Things (IoT) communication for efficient patient care. The proposed system utilizes force sensors to continuously monitor pressure distribution on the bed surface. These sensors detect prolonged pressure at specific points, which may indicate a high risk of pressure ulcer formation. The collected data is processed using an ESP32 microcontroller, which analyzes the pressure levels and identifies abnormal conditions. When such conditions are detected, alerts are generated to notify caregivers, enabling timely repositioning of the patient. In addition to pressure monitoring, the system incorporates an ESP32 camera module for real-time visual observation and an LCD display for local monitoring of patient status. The integration of Wi-Fi connectivity allows remote monitoring through an IoT platform, ensuring continuous supervision even when caregivers are not physically present.

Keywords: Bedsore Monitoring, Pressure Sensors, ESP32, IoT, Severity Analysis, Real-Time Alerts

SMART CHATBOT FOR MEDICAL DEVICE RISK CLASSIFICATION

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ABSTRACT

The classification of medical devices and the identification of theircorresponding regulatory pathways are critical yet complex tasksthat often require extensive legal expertise. This project proposes aConversational AI interface designed to automate risk classification (Classes A through D) and accurately identify mandatory legalforms (MD-3 to MD-9) within the framework of the MedicaDevice Rules. By leveraging Natural Language Processing (NLP) and a structured regulatory knowledge base, the system transforms static compliance manuals into an interactive dialogue, analyzing user inputs regarding device intent, invasiveness, and duration of contact to assign a precise risk profile. High-risk devices (Classes C and D) are automatically mapped to stringent requirements like MD-7 or MD-9, while lower-risk categories (Classes A and B) are directed toward forms such as MD-3 or MD-5. This automation streamlines the pre-submission phase for manufacturers, significantly reducing human error and accelerating time-to-market. By bridging the gap between complex legal jargon and operational execution, the interface provides a scalable, user-centric tool that ensures regulatory compliance becomes a seamless, integrated component of the product development lifecycle rather than a bureaucratic hurdle.

Keywords: Medical Devices, AI Classification, NLP, Regulatory Compliance, Risk Classes, Legal Forms, Automation.

FACE RECOGNITION OF HUMAN ACTIVITYMONITORING USING AUTONOMOUS ROBOT

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ABSTRACT

Human activity monitoring using autonomous robots has become an important area in robotics and intelligent surveillance systems. This paper presents a face recognition-based human activity monitoring system implemented on an autonomous robotic platform. The proposed system integrates a camera module, image processing techniques, and machine learning algorithms to detect, recognize, and track human faces in real time. The robot navigates autonomously within its environment while continuously capturing video data, enabling it to monitor human presence and behavior effectively.

Keywords: Face Recognition, Human Activity Monitoring, Autonomous Robot, Computer Vision, Machine Learning.

PERFORMANCE ANALYSIS ON VAPOUR COMPRESSION CYCLE FROM RECOVERY OF WASTE HEAT

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ABSTRACT

Vapour compression refrigeration (VCR) systems are often employed inresidential, commercial, and agricultural settings; yet, traditional systems are constrained by fundamental thermodynamic limits that diminish their energy efficiency and coefficient of performance (COP). These limits are mostly due to the direct throttling of refrigerant through the expansion device, leading to expansion losses and the generation of flash vapor. The presence of flash vapor at the evaporator intake limits the effective mass flow rate of liquid refrigerant that may be used to absorb heat, which lowers the refrigeration effect. Also, typical condensers have to get rid of both sensible superheat and latent heat. This means they have to deal with more heat, be bigger, use more power for the fan, have higher discharge temperatures for the compressor, and be less efficient in the summer. The proposed project aims to improve the performance of a VCR system by integrating a flash chamber and a multi-diameter de-superheating heat exchanger. In the modified configuration, refrigerant exiting the expansion device enters a flash chamber where it is separated into liquid and vapour phases. The liquid refrigerant is directed to the evaporator to enhance cooling capacity, while the separated vapour is utilized for energy recovery instead of being wasted.

Keywords: VCR System, Flash Chamber, De-Superheating, COP Improvement, Energy Efficiency, Refrigeration Optimization

DESIGN OF AN IOT SMART TONOMETER FOR AI-BASED INTRA-OCULAR PRESSURE PREDICTION AND EARLY GLAUCOMA DETECTION

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ABSTRACT

Glaucoma is a major eye disease caused by increased intra-ocular pressure (IOP), which can lead to permanent vision loss if not detected early. This project proposes an IoT-based smart tonometer to measure eye pressure and monitor it in real time. The system uses a pressure sensor and microcontroller to collect IOP data and transmit it to a cloud platform through IoT technology. Artificial intelligence algorithms analyze the collected data to predict the risk of glaucoma. If abnormal pressure is detected, alerts are generated for early medical attention.The system allows doctors to remotely monitor patient data and track pressure variations. Continuous monitoring helps in identifying early signs of glaucoma. This approach improves healthcare accessibility and supports timely treatment.

Keywords: Glaucoma Detection, IoT Tonometer, IOP Monitoring, AI Analysis, Real-Time Alerts, Remote Healthcare.

AI TOOL FOR EARLY-STAGE DEMENTIA DETECTION

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ABSTRACT

Early-stage dementia often remains undetected because initial cognitive and behavioural changes are mild and easily overlooked. As a result, many individuals receive medical attention only after significant cognitive decline has occurred. This project proposes the development of a low-cost, AI-assisted screening tool designed to support early identification of dementia-related symptoms. The system is implemented as a mobile or web-based application that evaluates cognitive performance, speech characteristics, and behavioural response patterns through simple, non-invasive tasks. Users are guided through memory tests, attention-based exercises, and speech interactions that are suitable for elderly individuals. The collected data is analysed to identify deviations from expected cognitive baselines, enabling the system to generate a risk score that reflects the likelihood of early cognitive impairment. Special consideration is given to accessibility by incorporating vernacular language support, allowing users to interact in their native language. The tool does not provide a medical diagnosis but acts as a preliminary screening mechanism to assist healthcare professionals in identifying individuals who may require further clinical evaluation. By enabling early detection and continuous monitoring, the proposed system aims to improve timely intervention, enhance quality of life, and reduce the burden on healthcare systems through proactive cognitive health management.

Keywords: Early-stage dementia, Artificial Intelligence, Machine Learning, Cognitive Assessment.

SYNERGISTIC ANTI-UROLITHIATIC POTENTIAL OF ACHYRANTHES ASPERA AND TRIBULUS TERRESTRIS: A NOVEL POLYHERBAL APPROACH

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ABSTRACT

Urolithiasis, commonly known as kidney stone disease, is a major urinary disorder predominantly caused by the formation of calcium oxalate crystals. Although numerous medicinal plants are traditionally used in its treatment, the combined effects of such herbs remain insufficiently explored. In India, Achyranthes aspera and Tribulus terrestris are widely utilized due to their proven safety and therapeutic benefits in managing kidney stones. A. aspera is considered a promising source for developing novel anti-urolithiatic agents because of its protective properties and ability to reduce stone recurrence. Similarly, T. terrestris has been reported to inhibit calcium oxalate crystallization, prevent crystal adhesion to renal epithelial cells, and aid in both the prevention and treatment of urolithiasis. The present study evaluates the in vitro effects of extracts of A. aspera and T. terrestris on calcium oxalate crystallization. The polyherbal formulation contains key phytochemicals such as saponins, flavonoids, alkaloids, and phenolics, which enhance diuresis, reduce crystal formation, and improve antioxidant activity. In crystal-inhibition assays, the combined extract demonstrated superior activity compared to individual extracts, showing significant reduction in calcium oxalate crystal formation and deposition.

Keywords: Achyranthes Aspera, Tribulus Terrestris, Urolithiasis and In Vitro

ADAPTIVE OPTIMIZATION AND CONTROL OF INDOOR AIR QUALITY IN AIR-CONDITIONED VEHICLE CABINS USING OPTIMIZATION TECHNIQUES

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ABSTRACT

Due to rising air pollution and the cramped interior of cars, indoor air quality (IAQ) in air conditioned car cabins has grown in importance. Passengers may experience pain, diminished alertness, and possible health problems as a result of poor air quality, which is brought on by high levels of carbon dioxide (CO2), volatile organic compounds (VOCs), formaldehyde (HCHO), temperature, and humidity fluctuations. In this project, an integrated air quality sensor module and a microcontroller-based control unit are used to build and construct an intelligent system for monitoring and regulating indoor air quality in car cabins. The suggested system makes use of a small multi-parameter sensor module that can measure temperature, humidity, CO2, TVOC, and HCHO in real time. A microcontroller processes the gathered data and uses a rule- based management method to manage the HVAC (heating, ventilation, and air conditioning) system. To maintain ideal air quality and passenger comfort, the system automatically modifies ventilation rate, airflow, and cooling based on predetermined threshold levels. Easy monitoring is made possible by the integration of a display device that provides real-time depiction of air quality metrics.

Keywords: Indoor Air Quality (IAQ), Vehicle Cabin, CO_2 Monitoring, TVOC, HCHO, HVAC Control, Sensor Module, Microcontroller, Air Pollution, Smart Monitoring System

SMART BLIND STICK FOR VISUALLY IMPAIRED PERSON

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ABSTRACT

Visually impaired individuals face significant challenges in navigating their surroundings safely due to the presence of obstacles, uneven surfaces, and environmental hazards. Traditional white canes provide limited tactile feedback and are unable to detect hazards before physical contact. To address these limitations, this project presents the development of a Smart Blind Stick for Visually Impaired based on the principles of biosensors and bioinstrumentation. The proposed system integrates multiple sensing modules including Time-of-Flight (ToF) sensors for obstacle detection, an inertial measurement unit (IMU) for fall detection, and a capacitive water sensor for identifying wet or slippery surfaces. These sensors continuously monitor environmental conditions and transmit real- time data to an ESP32-S3 microcontroller, which processes the signals and generates immediate alert feedback through vibration and buzzer mechanisms. The system also establishes Bluetooth Low Energy (BLE) communication with a mobile application that provides emergency notifications, location tracking, and user assistance features. By combining advanced sensing technologies with embedded instrumentation, the proposed smart blind stick enhances mobility, improves situational awareness, and increases safety for visually impaired individuals. The system demonstrates how sensor-based assistive instrumentation can play an important role in human-centered healthcare and accessibility technologies.

Keywords: ESP32-S3 Microcontroller, Inertial Measurement Unit (IMU), Time-of-Flight (ToF) Sensors, Vibration, Buzzer Mechanisms.

PRIVACY-FIRST SMART CONTACT MANAGEMENT WITH EPHEMERAL MESSAGING AND SECURE LINK SHARING

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ABSTRACT

Traditional contact management systems are limited to storing and retrieving contact information, offering minimal support for secure interaction and privacy. This project presents a full-stack Smart Contact Management System that extends beyond basic functionality by integrating real-time communication and privacy-focused features. The system allows users to securely store and manage contacts while enabling direct chat between connected users. A key feature is the implementation of ephemeral link sharing, where users can share temporary, auto- expiring links that become inaccessible after a predefined duration. These links are designed to preserve user privacy by avoiding exposure of sensitive information such as phone numbers. The application is built using a full-stack architecture, combining a responsive frontend interface with a scalable backend and database for efficient data handling. Security mechanisms such as token-based authentication and time-bound access control are incorporated to ensure data protection and controlled communication. This solution addresses key limitations in existing contact management tools by prioritizing privacy, security, and seamless interaction, making it suitable for modern communication needs where data confidentiality and temporary access are critical.

Keywords: Smart Contacts, Secure Chat, Ephemeral Links, Privacy, Authentication, Access Control.

EXPLAINABLE MULTI-CLASS PCG CLASSIFICATION USING A HYBRID OPTIMIZED DEEP LEARNING FRAMEWORK

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ABSTRACT

Phonocardiogram (PCG) signal analysis plays a crucial role in the early detection and diagnosis of cardiovascular diseases. However, accurate classification of heart sounds remains challenging due to noise interference, signal variability, and overlapping characteristics between different cardiac conditions. This project proposes an advanced multi-class PCG signal classification framework using a hybrid optimized deep learning approach to improve diagnostic accuracy and robustness. The proposed system integrates signal preprocessing, feature extraction, and classification into a unified pipeline. Initially, raw PCG signals are denoised and segmented to isolate meaningful cardiac cycles. Both time-domain and frequency-domain features are extracted to capture essential characteristics of heart sounds. These features are then fed into a deep learning model, combining Convolutional Neural Networks (CNNs) for spatial feature extraction and Long Short-Term Memory (LSTM) networks for temporal pattern learning. To further enhance performance, hybrid optimization techniques such as meta-heuristic algorithms are employed for hyperparameter tuning and feature selection. This optimization improves model generalization, reduces overfitting, and ensures efficient learning. The system is designed to classify multiple cardiac conditions, including normal, murmur, and other abnormal heart sound patterns. Experimental results demonstrate that the proposed hybrid model achieves superior accuracy, precision, and recall compared to traditional machine learning approaches.

Keywords: Phonocardiogram, Deep Learning, CNN-LSTM, Signal Processing, Feature Extraction, Optimization, Classification, Cardiovascular Diagnosis

AN AI-DRIVEN PREDICTIVE HEALTHCARE FRAMEWORK FOR EARLY DISEASE DETECTION USING WEARABLE BIOSENSORS AND EDGE COMPUTING

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ABSTRACT

The growing need for proactive and preventive healthcare has led to the integration of Artificial Intelligence (AI) with wearable biosensor technologies. This paper presents a predictive healthcare system designed for early disease detection through continuous monitoring of physiological parameters. Wearable biosensors are used to collect real-time data such as heart rate variability, blood oxygen saturation (SpO2), body temperature, and physical activity patterns. The acquired data undergo preprocessing techniques including noise filtering and normalization to improve data quality. Relevant features are extracted from the processed signals and analyzed using supervised machine learning algorithms such as Decision Trees and Support Vector Machines to classify normal and abnormal health conditions. The system incorporates predictive modeling to identify early signs of potential diseases before the onset of visible symptoms. Additionally, the framework supports real-time monitoring and intelligent alert generation to notify users and healthcare providers in case of critical conditions. The proposed system aims to reduce healthcare costs, enable remote patient monitoring, and improve early diagnosis accuracy. This approach demonstrates a scalable and efficient solution for transitioning from reactive healthcare systems to predictive and personalized medical care.

Keywords: Artificial Intelligence, Wearable Biosensors, Predictive Healthcare, Machine Learning, Signal Processing, Feature Extraction, Disease Detection, Real-Time Monitoring

AYURTIME

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ABSTRACT

Ayur Time is an advanced patient management software designed specifically for Panchakarma clinics to streamline clinical operations and enhance treatment efficiency. The system integrates therapy scheduling, patient record management, and treatment tracking into a unified platform with secure role-based access control. Nurses play a vital role by registering patients, maintaining detailed medical histories, assigning customized therapy plans, and continuously updating treatment progress, which significantly reduces manual paperwork and improves workflow accuracy. Doctors can easily access comprehensive patient records, review ongoing therapy schedules, and approve or modify treatment plans to ensure personalized and effective care delivery. The platform also empowers patients by allowing them to book appointments, view prescribed medicines, track therapy schedules, and receive automated reminders, thereby improving treatment adherence and minimizing missed sessions. By digitizing and automating routine clinical processes, Ayur Time enhances coordination among healthcare providers, reduces administrative burden, and ensures data security and accuracy. Overall, the system improves operational efficiency, supports better clinical decision-making, and delivers a seamless experience for patients, doctors, and nursing staff, ultimately contributing to improved healthcare outcomes in Panchakarma therapy management.

Keywords: Ayur Time, Patient Management, Panchakarma, Therapy Scheduling, Electronic Records, Healthcare Automation, Role-Based Access, Clinical Efficiency

SINGING VOICE CLONING USING RETRIEVAL-BASED VOICE CONVERSION (RVC)

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ABSTRACT

This project focuses on developing an advanced singing voice cloning system using Retrieval-Based Voice Conversion (RVC) technology. The system aims to transform input vocals into a target singer's style while preserving key elements such as pitch, tone, and emotional expression. Unlike traditional text-to-speech or basic voice conversion methods, the proposed approach leverages retrieval mechanisms to improve timbre accuracy and ensure consistent voice quality even for unseen inputs. The workflow includes data preparation, feature extraction (MFCCs, pitch/f0, and phoneme encoding), model loading with trained RVC models, and real-time voice conversion. The system is designed to support multiple music genres and provide a user-friendly interface for both creators and performers. This project also emphasizes linguistic and cultural impact, particularly in improving Tamil pronunciation, prosody, and accessibility. Additionally, it addresses ethical concerns by incorporating consent-based data usage, watermarking, and security mechanisms to prevent misuse. Overall, the system has applications in music production, dubbing, education, audiobooks, and assistive technologies.

Keywords: Singing voice cloning, Retrieval-Based Voice Conversion (RVC), Timbre Transfer, Pitch Preservation, MFCC Feature Extraction, Phoneme Encoding, Tamil Pronunciation

DEVELOPMENT AND CHARACTERIZATION OF SUSTAINABLE BIOPLASTIC FILMS FROM COW DUNG AND NIRMALI SEEDS FOR BIODEGRADABLE FUNCTIONAL APPLICATIONS

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ABSTRACT

This project focuses on developing an advanced singing voice cloning system using Retrieval-Based Voice Conversion (RVC) technology. The system aims to transform input vocals into a target singer's style while preserving key elements such as pitch, tone, and emotional expression. Unlike traditional text-to-speech or basic voice conversion methods, the proposed approach leverages retrieval mechanisms to improve timbre accuracy and ensure consistent voice quality even for unseen inputs. The workflow includes data preparation, feature extraction (MFCCs, pitch/f0, and phoneme encoding), model loading with trained RVC models, and real-time voice conversion. The system is designed to support multiple music genres and provide a user-friendly interface for both creators and performers. This project also emphasizes linguistic and cultural impact, particularly in improving Tamil pronunciation, prosody, and accessibility. Additionally, it addresses ethical concerns by incorporating consent-based data usage, watermarking, and security mechanisms to prevent misuse. Overall, the system has applications in music production, dubbing, education, audiobooks, and assistive technologies.

Keywords: Singing Voice Cloning, Retrieval-Based Voice Conversion (Rvc), Mfcc Feature Extraction, Phoneme Encoding, Real-Time Audio Processing, Tamil Pronunciation, Ethical AI.

ECO WRAP & BOX - SUSTAINABLE PACKAGING FROM JACKFRUIT WASTE

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ABSTRACT

This project aims to develop a sustainable alternative to single-use plastic packaging by utilizing jackfruit processing waste. Plastic waste causes severe environmental damage, polluting land and water, while large quantities of jackfruit residues such as rags, seeds, and peels are discarded without proper utilization. To address both issues, a low-energy, chemical-free process was developed to convert jackfruit waste into 100% compostable, food-safe packaging materials. A unique formulation enables the production of both flexible wraps and molded rigid boxes, ensuring a zero-waste approach. Laboratory-scale prototypes (TRL 4–5) have demonstrated proof of concept with satisfactory strength, flexibility, and durability. The process is affordable, MSME-friendly, and scalable, making it suitable for both rural and urban production units. With the biodegradable packaging market expanding rapidly due to plastic bans and rising eco-consciousness, this innovation holds significant commercial potential. Moreover, it provides environmental benefits by reducing plastic pollution, economic benefits by adding value to agro-waste, and social benefits by supporting rural livelihoods and promoting sustainable consumption practices.

Keywords: Sustainable Packaging, Jackfruit Waste, Compostable Material, Plastic Alternative, Agro-Waste Utilization, Circular Economy

WASTE MANAGEMENT

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ABSTRACT

Integrated Waste Management Systems as global urbanization and industrialization accelerate, the management of solid, liquid, and hazardous waste has become one of the most pressing environmental challenges of the 21st century. This presentation explores the transition from traditional "linear" waste models (take-make-dispose) to circular economies that prioritize resource recovery**.**

Keywords: Integrated Waste Management Systems, Sustainable Waste Management, Urbanization, Environmental Sustainability

BIOHYDROGEN PRODUCTION FROM LIGNOCELLULOSIC FRUIT PEEL WASTE VIA DARK FERMENTATION

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ABSTRACT

The increasing demand for clean and renewable energy has intensified research into biohydrogen production as a sustainable alternative to fossil fuels. This study investigates the potential of lignocellulosic fruit peel waste such as banana, orange, mango, and pineapple peels—as a low-cost and abundant substrate for biohydrogen generation. Due to the complex structure of lignocellulosic biomass, an effective pretreatment strategy is essential to enhance the availability of fermentable sugars. In this work, acid pretreatment followed by enzymatic hydrolysis was employed to improve substrate digestibility. The pretreated fruit peel hydrolysate was subjected to dark fermentation using mixed microbial consortia under anaerobic conditions. Key operational parameters such as pH (5.5–6.0), temperature (35–37°C), and hydraulic retention time (24–48 hours) were optimized to maximize hydrogen production. The results demonstrated a significant increase in reducing sugar concentration from 18.5 g/L to 42.3 g/L after pretreatment. The maximum cumulative hydrogen yield achieved was 2.8 mol H_2/mol hexose, with a production rate of 1.6 L H_2/L/day under optimized conditions. The process also resulted in a reduction of chemical oxygen demand (COD) by approximately 65%, indicating effective waste stabilization. This study highlights the feasibility of integrating fruit waste valorization with clean energy production, paving the way for scalable and environmentally friendly biohydrogen systems.

Keywords: Biohydrogen, Lignocellulosic Waste, Fruit Peel Waste, Dark Fermentation, Renewable Energy, Pretreatment, COD Reduction, Sustainable Waste Management, Circular Economy.

DEVELOPMENT OF HYDROPHOBIC, TRANSPARENT BANANA-PSEUDO STEM CELLULOSE FILMS AS BIODEGRADABLE INNER LINERS FOR PAPER CUPS

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ABSTRACT

Around 500 billion disposable cups are used annually worldwide, and most of them are plastic-lined and non-recyclable because of a thin layer of polyethylene (PE) that takes hundreds of years to decompose. It has been revealed that the PE-lined paper cups can leach about 25,000 microplastic particles into 100 mL of hot liquid in 15 minutes, which emphasizes the role of disposable cups in plastic and microplastic pollution. This research aims to valorize banana pseudostem from agro-waste to produce a hydrophobic, transparent cellulose film as an alternative to the paper cup with Poly Ethylene liners. Banana pseudostem cellulose is converted into a thin film through nanofibrillation and solution casting. Food-grade plasticizers are also incorporated to enhance flexibility and compatibility with paper cup lamination. The films are being characterized using FTIR, XRD, and SEM to study structure and morphology, while tensile strength, water contact angle, and water vapor transmission rate (WVTR) measurements are being performed to analyze mechanical and barrier performance. Biodegradability studies are also in progress to assess environmental benignity. The developed films are expected to show enhanced hydrophobicity with a water contact angle of 90°, improved mechanical integrity, and low moisture permeability while maintaining transparency, demonstrating a strategy for converting agricultural waste into sustainable and biodegradable paper cup liners.

Keywords: Banana Pseudostem, Agro-Waste Valorization, Cellulose Nanofibrillation, Biodegradable Films, Hydrophobic Cellulose Film, Moisture Barrier Properties, Biodegradability.

ZIRCONIUM NANOPARTICLE - ENRICHED GELATIN COATING ENHANCES POSTHARVEST QUALITY OF FRUITS

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ABSTRACT:

Exhibited a tetragonal crystal structure (JCPDS 50-1089), confirmed by X-ray diffraction peaks at 2θ values of 30.3° (101), 35.1° (110), 50.5° (200), and 60.2° (211), with crystallite sizes of 25-45 nm calculated extract as a reducing and stabilizing agent from zirconium nitrate precursor. The nanoparticles by Scherrer equation. Particle size analysis showed a primary hydrodynamic diameter of ~202 nm with some aggregation, while SEM revealed irregular spherical morphology (500-650 nm aggregates). UV-Vis spectroscopy displayed characteristic absorption peaks at 255 nm and 303 nm, indicating Zr-O bond formation. The ZrNPs were incorporated (0.1-0.5% w/v) into gelatin coatings and applied to tomatoes by dip coating. The nanocomposite coating demonstrated concentration-dependent antimicrobial activity against food pathogens, with inhibition zones of 11-18 mm against Klebsiella pneumoniae, 13-14 mm against E. coli, and 6-16 mm against Candida albicans. Coated tomatoes maintained lower pH changes (4.05 to 6.05 over 15 days vs. 4.07 to 6.23 for uncoated), preserved color parameters (L*a*b*), and retained antioxidant activity (35.8-78.5% DPPH scavenging) compared to uncoated controls. The gelatin-ZrNP coating extended tomato shelf life by 20-30% under ambient (28°C) and refrigerated (2-4°C) storage through reduced microbial growth, moisture barrier properties, and protection of bioactive compounds. These findings demonstrate the potential of green-synthesized ZrO_2 NPs in gelatin matrices as effective edible coatings for postharvest preservation of tomatoes, reducing food waste while maintaining quality attributes.

Keywords: Green Synthesis, ZrO_2 Nanoparticles, Gelatin Coating, Anti-Microbial Activity, Edible Coating.

DEVELOPMENT OF EXTRUDED MILLET-BASED SNACK PRODUCTS USING TWIN-SCREW EXTRUSION TECHNOLOGY

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ABSTRACT

The growing demand for healthy, gluten-free, and sustainable snack products has increased interest in millet-based extruded foods. This study aimed to develop and optimize extruded millet-based snacks using twin-screw extrusion technology. A composite flour blend of finger millet (60–80%), chickpea flour (10–20%), and corn starch (10–20%) was processed under varying conditions of barrel temperature (120–160 °C), screw speed (200–400 rpm), and feed moisture content (14–20%). Response Surface Methodology (RSM) was employed to optimize processing parameters. Results showed that extrusion conditions significantly ($p < 0.05$) affected product characteristics. The optimized formulation (70% millet, 15% chickpea flour, 15% starch; 140 °C, 300 rpm, 16% moisture) exhibited a high expansion ratio (3.21 ± 0.08) and low bulk density (0.18 ± 0.01 g/cm³), indicating a light and crispy texture. The hardness value (12.6 ± 0.5 N) confirmed desirable crispness. Nutritional analysis revealed improved protein (13.4 ± 0.3%) and dietary fiber (8.7 ± 0.2%). Functional properties such as water absorption and solubility indices indicated enhanced digestibility. Sensory evaluation showed high overall acceptability (8.2 ± 0.3). Extrusion also reduced phytate content by 38%, improving mineral bioavailability.

Keywords: Millet-Based Snacks, Twin-Screw Extrusion, Functional Foods, Response Surface Methodology, Extrusion Optimization, Gluten-Free Products, Nutritional Enhancement

SEAWEED-BASED BIODEGRADABLE FILMS FOR FOOD PACKAGING: PROPERTIES, APPLICATIONS, AND FUTURE PERSPECTIVES

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ABSTRACT

Seaweed-based biodegradable films are emerging as an innovative solution to address the growing demand for sustainable food packaging. Derived from renewable marine biomass, these films combine biodegradability with favorable barrier and mechanical properties, making them suitable for a wide range of food applications. This review highlights the structural and functional characteristics of seaweed-based films, including their physicochemical attributes, safety considerations, and potential for incorporating natural additives such as essential oils to enhance antimicrobial and antioxidant activity. Current applications span fresh produce, bakery, and dairy packaging, offering an eco-friendly alternative to petroleum-based plastics. Key challenges—such as improving mechanical strength, extending shelf life, reducing production costs, and scaling up manufacturing—are critically examined. Future research directions emphasize material innovation, advanced formulation strategies, and industrial adoption pathways. Overall, seaweed-based biodegradable films represent a promising step toward reducing plastic waste and advancing environmentally responsible food packaging systems.

Keywords: Seaweed-Based Films, Biodegradable Packaging, Food Packaging, Sustainability, Essential Oils, Barrier Properties.

DEVELOPMENT AND CHARACTERIZATION OF BIODEGRADABLE STARCH BASED FILM USING MIXED FRUIT PEELS

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ABSTRACT

Global plastic consumption in 2025 is expected to reach approximately 516 million tonnes, with global plastic waste generation hitting 225 million tonnes. Environmental impacts are severe, as 19-23 million tonnes of plastic waste enter aquatic ecosystems annually. Despite recycling efforts, only 9% of plastic is recycled globally. This study aimed to develop an ecofriendly biodegradable packaging film using mixed fruit peel to promote a sustainable use of agricultural waste. The film 1 contain banana, orange and pineapple as well as, the film 2 contain pineapple, pomegranate and pineapple. The research was conducted using a fruit peels like banana, orange, pomegranate and pineapple peels then using a solvent casting technique, fruit-derived powders were integrated into a starch-based matrix to create natural bio composites. The addition of glycerol and gelatin improved the film's plasticization and structural integrity, offering sustainable, ecofriendly alternative to synthetic packaging materials. This film was characterized through testing, FTIR spectroscopy, Scanning Electron Microscope (SEM), Tensile strength, Elongation at break, Swelling, Thickness, Transparency, Antimicrobial activity, and biodegradability tests. The developed films showed a good antimicrobial activity like film-2 has better activity, swelling capacity of film 1 contains (75.97%) & film-2 (78.76%) and biodegradability of film-1 contains (94.03%) and film-2(91.97%) and the thickness of film-1 is (0.09mm) and film-2 is (0.01mm). The study concluded that film 2 has better antimicrobial activity, swelling test, biodegradability and thickness test results. Thus, the film 2 has adequate water absorption and strong biodegradability making them promising candidates for eco-friendly packaging applications.

Keywords: Biodegradable Packaging, Fruit Peel Waste, Starch Bio Composite, Antimicrobial Activity, Biodegradability.

DEVELOPMENT OF A MULTI- FUNCTIONAL RECOVERY GUMMY FOR POST FATIGUE AND DEHYDRATION USING NATURAL BIOACTIVE INGREDIENTS

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ABSTRACT

Gummy formulations are gaining popularity as an alternative to conventional dosage forms due to their chewable texture, palatability, and ease of consumption. Dehydration and post fatigue are common conditions caused by fluid loss, prolonged physical activity, and environmental stress, highlighting the need for convenient recovery solutions. Conventional recovery supplements such as powders and capsules may be less convenient and often show lower consumer compliance. There is a need for a portable and palatable product that can effectively support hydration and fatigue recovery. To develop a multi-functional recovery gummy enriched with electrolytes, vitamins, and natural bioactive ingredients for improved hydration and post-fatigue support. The process involved controlled heating and moulding, followed by optimization to achieve desirable texture, taste, and appearance. Physicochemical properties, sensory attributes, and stability were evaluated using standard methods. The developed gummy showed moisture content of 18.60%, ash content of 1.80, protein content of 6.7g/100g, vitamin C content was found to be 24.84mg/100g, sodium content was 80mg/100g indicating its potential for electrolyte replenishment. The developed gummies showed acceptable physicochemical characteristics, good sensory properties, and stability during storage. The presence of electrolytes supports fluid balance, while bioactive components aid in recovery. The recovery gummy offers a convenient, palatable, and effective functional product for managing dehydration and post-fatigue, with potential for regular consumption.

Keywords: Multi-Functional Recovery Gummy, Dehydration, Post-Fatigue, Electrolytes, Sensory Attributes.

AGRO- WASTE VOLARIZATION FOR THE DEVELOPMENT OF BIODEGRADABLE FILM FORM RICE HUSK CELLULOSE AND CASSAVA PEEL STARCH INCORPORATED WITH ALOE VERA GEL

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ABSTRACT

The plastic packaging causes serious environmental pollution due to non-biodegradable. Growing environmental concerns have increased the demand of biodegradable and sustainable food packaging material. The increasing environmental concerns associated with conventional plastic packaging have accelerated the search for sustainable and biodegradable alternatives. This study focuses on the development of biodegradable packaging films derived from agro-waste materials, specifically rice husk and cassava peel. Cellulose extracted from rice husk powder through alkali treatment followed by bleaching, while starch was obtained from cassava peels. The prepared films were characterized for their physicochemical, mechanical, and functional properties, including film thickness (0.08mm), swelling index (80.80%), better antimicrobial activity, biodegradability (71.42%), tensile strength, scanning electron microscopy (SEM), FTIR spectroscopy, transparency. The results indicate that the developed films exhibit promising performance suitable for food packaging applications. This study proves an effective strategy for the valorization of agricultural waste, contributing to sustainable material development and offering a practical solution to mitigate environmental pollution caused by non-biodegradable plastics. Observation of the result is concluded that, the film is good antimicrobial properties and get easily biodegradable and suitable for various applications.

Keywords: Biodegradable Packaging, Sustainable Alternative, Eco-Friendly Materials, Environmental Pollution Reduction.

IOT-BASED SMART MEDICINE ASSISTANT

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ABSTRACT

Medication non-adherence is a major challenge in healthcare, particularly among elderly individuals and patients with busy lifestyles, often leading to severe health complications. This paper presents an IoT-Based Smart Medicine Assistant, a reliable and intelligent system designed to ensure timely medication intake and improve patient safety. The proposed system utilizes an ESP32 microcontroller integrated with a Real-Time Clock (RTC), keypad interface, OLED display, buzzer, and servo motor to provide accurate and automated reminders through visual and auditory alerts. The system incorporates Internet of Things (IoT) technology to enable real-time data monitoring and remote access. Medication schedules and intake status are synchronized with cloud platforms, allowing caregivers or family members to track whether the patient has taken the prescribed medicine on time. Notifications and alerts are generated in case of missed doses, ensuring continuous supervision and improved adherence. Furthermore, the system can be extended with GPS and wearable device integration to track the location of both the patient and the medicine box. If the patient moves beyond a predefined range, alert notifications are triggered to prevent the user from forgetting the medicine. The proposed solution offers a cost-effective, user friendly, and scalable approach to modern healthcare assistance, enhancing medication management, patient independence, and caregiver support.

Keywords: IoT, Smart Medicine Assistant, Medication Adherence, ESP32, GPS Tracking, Remote Monitoring, Healthcare Systems.

INTEGRATIVE MULTI-GEO TRARSCRIPTOMIC META-ANALYSIS AND MACHINE- LEARNING DRIVEN DRUG SCREENING FOR INFLAMMATORY BONEL DISEASE

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ABSTRACT

Inflammatory Bowel Disease (IBD), encompassing ulcerative colitis and Crohn's disease, is a chronic, heterogeneous inflammatory disorder of the gastrointestinal tract with complex molecular underpinnings and limited therapeutic options. Leveraging the wealth of publicly available transcriptomic data, we conducted an integrative meta-analysis of ten independent Gene Expression Omnibus (GEO) datasets to identify a robust set of consistently upregulated genes defining the core IBD molecular signature. After harmonizing datasets, differential expression analysis revealed pathways that drive disease pathogenesis.We then prioritized druggable and biologically central targets and implemented machine-learning methods to screen the ChEMBL database for putative bioactive compounds with predicted efficacy againstthese targets. The screening incorporated model training, validation, and ranking based on predicted activity,and poly-pharmacological potential. Our integrative framework yielded a shortlist of therapeutic candidates suitable for downstream structural analysis and ADMET evaluation. This study demonstrates the power of combining multi-GEO transcriptomicmeta-analysis with machine-learning–driven drug screening to accelerate the discovery of re-purposable drugs for IBD treatment. Computational drug repositioning alleviates the time and cost burden of traditional drugdevelopment while focusing on clinically actionable targets.

Keywords: Inflammatory Bowel Disease (IBD), Transcriptomic Meta-Analysis, Gene Expression Omnibus (GEO), Differential Gene Expression, Machine Learning Drug Screening, Chembl Database, Drug Repurposing, Computational Drug Discovery.

A GLUCOSIDASE INHIBITORY POTENTIAL OF ANTHOCYANIN-RICH RED RICE (ORYZA SATIVA) EXTRACT: AN IN VITRO AND IN SILICO DOCKING STUDY

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ABSTRACT

The present study aims to prepare an anthocyanin-rich extract from red rice (Oryza sativa) using an appropriate extraction method and to evaluate its phytochemical composition and biological potential. Preliminary qualitative phytochemical analysis will be carried out to identify major classes of secondary metabolites, including phenolics, flavonoids, and anthocyanins. Quantitative estimation of total phenolic content, total flavonoid content, and total anthocyanin content will be performed using standard spectrophotometric methods. The antioxidant potential of the red rice extract will be evaluated through in vitro assays such as ABTS radical scavenging and ferric reducing antioxidant power (FRAP). In addition, the α-glucosidase inhibitory activity of the anthocyanin-rich extract will be assessed to determine its potential role in the management of postprandial hyperglycemia. To further support the experimental findings, in silico molecular docking analysis will be conducted to investigate the interaction between major anthocyanin constituents and the α-glucosidase enzyme. The study is expected to provide insights into the antioxidant and antidiabetic potential of anthocyanin-rich red rice and to establish a scientific basis for its application as a natural therapeutic agent.

Keywords: Red Rice (Oryza sativa); Anthocyanins; Antioxidant activity; α-Glucosidase inhibition

FORMULATION AND EVALUATION OF NANOGE USING MARINE ALGAE FOR ARTHIRITIS

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ABSTRACT

Arthritis is a chronic inflammatory disorder characterized by persistent joint pain, swelling, and restricted movement, which significantly reduces the quality of life of affected individuals. Conventional anti-inflammatory therapies, particularly oral non-steroidal anti-inflammatory drugs (NSAIDs), are widely used for arthritis management but are associated with serious side effects such as gastrointestinal irritation, renal toxicity, and cardiovascular risks during long-term use. Although topical formulations are considered safer alternatives, they often suffer from poor skin penetration and limited drug retention at the target site, leading to reduced therapeutic effectiveness. In recent years, increasing attention has been given to natural marine sources such as Turbinaria due to their potent anti-inflammatory and antioxidant properties. However, the effective delivery of bioactive compounds from marine algae to inflamed joints remains a major challenge because poor permeability and instability of phytoconstituents limit their clinical potential. Therefore, there is a clear need to develop an advanced drug delivery system such as a nano-gel that can enhance skin permeation, improve drug stability, and provide sustained anti-inflammatory action. The present study aims to formulate and evaluate a Turbinaria-based nano-gel for improved and safer management of arthritis.

Keywords: Arthritis, Anti-Inflammatory, Turbinaria, Nano-Gel, Drug Delivery System, Transdermal Delivery, Antioxidant Activity, Sustained Release.

GREEN SYNTHESIS OF PYRUS COMMUNIS -MEDIATED CU-ZN NANOPARTICLES AND EVALUATION OF THEIR ANTICANCER ACTIVITY

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ABSTRACT

The present study aims to develop an eco-friendly and sustainable approach for the synthesis of Cu–Zn bimetallic nanoparticles using Pyrus communis (pear) extract (PCZ) via green synthesis. Preliminary phytochemical screening confirmed the presence of bioactive secondary metabolites that function as natural reducing and stabilizing agents during nanoparticle formation. Quantitative analysis revealed a significant total phenolic content (TPC) and total flavonoid content (TFC), indicating the antioxidant-rich nature of the extract. The in vitro antioxidant activity of both the plant extract and the synthesized PCZ was evaluated using DPPH and ABTS radical scavenging assays, and IC_{50} values weredetermined, demonstrating enhanced free radical scavenging potential of the nanoparticles compared to the crude extract. The formation of PCZ was initially confirmed by UV–Visible spectroscopy through characteristic surface plasmon resonance peaks. FTIR analysis identified functional groups responsible for reduction and capping of nanoparticles. SEM analysis revealed nanosized, agglomerated particles with irregular to quasi-spherical morphology, while EDX confirmed the presence of copper and zinc along with carbon and oxygen, indicating phytochemical stabilization. XRD analysis demonstrated distinct crystalline diffraction peaks corresponding to Cu–Zn phases, confirming their crystalline nature and nanoscale crystallite size.

Keywords: Pear fruit (Pyrus communis); Phytochemical analysis; Cu-Zn nanoparticles.

DEVELOPMENT AND CHARACTERIZATION OF MICROCRYSTALLINE CELLULOSE (MCC) - BETALAIN COMPOSITES FOR ENHANCED ANTIOXIDANT AND ANTIMICROBIAL ACTIVITY

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ABSTRACT

Natural polymer-pigment composites for enhanced bioactivity microcrystalline cellulose (MCC), a Biocompatible and Biodegradable carrier, can enhance their stability and functionality. Betalain are natural pigments with notable anti-oxidants and anti-microbial properties but suffer from limited stability.This project aims to develop and characterize MCC-Betalain composites to improve their Biological activity.The prepared composites will be evaluated for Physiochemical properties, Anti-oxidants activity, and Anti- Smicrobial effectiveness using standard in-vitro methods, Highlighting their potential Pharmaceutical and Nutraceutical Applications.

Keywords: Microcrystalline Cellulose (MCC), Betalain, Biocomposite, Biocompatible Carrier, Antioxidant Activity, Antimicrobial Activity, Pharmaceutical Applications, Nutraceutical Applications.

EVALUATION OF ANTI-INFLAMMATORY OF POTENTIAL OF MUNTINGIA CALABURA LEAF EXTRACT USING INVITRO MODEL

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ABSTRACT

This study investigates the anti-inflammatory and antioxidant potential of Muntingia calabura leaf extract using in-vitro methods. The leaves were collected, extracted, and subjected to phytochemical screening to identify bioactive compounds such as phenols and flavonoids. Total phenolic and flavonoid contents were estimated antioxidant activity was evaluated using ABTS and FRAP assays, while anti-inflammatory activity was assessed through laboratory models. The findings suggest that Muntingia calabura leaves possess significant natural antioxidant and anti-inflammatory properties, indicating their potential use in herbal medicine development

Keywords: Muntingia Calabura, Leaf Extract, Antioxidant Activity, Anti-Inflammatory, Phenols, Flavonoids, ABTS assay, FRAP assay, Phytochemical Screening, Herbal Medicine

ISOLATION AND NEUROPROTECTIVE POTENTIAL OF PROBIOTIC STRAINS FROM SPATHODEA CAMPANULATA NECTAR

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ABSTRACT

Probiotics are gaining significant attention for their therapeutic potential beyond gut health, including neuroprotection. The present study aimed to isolate and evaluate probiotic strains from the nectar of Spathodea campanulata for their neuroprotective properties. Nectar samples were collected and subjected to microbial isolation, followed by preliminary screening for probiotic characteristics. The isolates were characterized based on tolerance to acidic pH, bile salts, NaCl concentration, and antibiotic susceptibility. Selected strains were further evaluated for antioxidant activity using assays such as reducing power and phosphomolybdenum methods, and anti-inflammatory potential through albumin denaturation and heat-induced hemolysis assays. Among the isolates, the most promising strain demonstrated strong tolerance to gastrointestinal conditions along with significant antioxidant and anti-inflammatory activities. This strain was selected for molecular identification through sequencing techniques. Furthermore, its neuroprotective potential was assessed using anti-neurodegenerative assays, indicating its ability to mitigate oxidative stress and cellular damage associated with neurodegenerative conditions. GC-MS analysis of the selected strain revealed the presence of bioactive compounds responsible for its functional properties.

Keywords: Probiotics, Spathodea campanulata, Nectar, Antioxidant activity, Anti-inflammatory, Neuroprotection, GC-MS, Lactobacillus, Functional foods.

SYNERGISTIC EFFECT OF REPURPOSED DRUG ADJUVANT WITH MEROPENEM AGAINST CARBAPENEM-RESISTANT PSEUDOMONAS AERUGINOSA: AN IN SILICO AND IN VITRO STUDY

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ABSTRACT

Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA) represents a critical threat to global healthcare due to its high level of antimicrobial resistance and limited treatment options. This study explores a synergistic approach to restore the efficacy of meropenem using a repurposed drug adjuvant. An integrated in silico and in vitro strategy was employed to identify FDA-approved drug molecules capable of targeting key resistance-associated proteins, including carbapenemase enzymes. In the initial phase, virtual screening techniques were utilized to evaluate docking affinity, binding stability, and molecular interaction profiles of selected compounds against resistance determinants. Based on these analyses, potential candidates with high inhibitory potential were identified and shortlisted for further validation. In vitro studies were conducted using carbapenem-resistant clinical isolates of *P. aeruginosa*. Antimicrobial activity was assessed through minimum inhibitory concentration (MIC) determination, checkerboard assays for synergy analysis, biofilm inhibition studies, membrane permeability assays, and stability testing under bacterial culture conditions. The combination of meropenem with the identified repurposed drug adjuvant demonstrated significantly enhanced antimicrobial activity, as evidenced by reduced MIC values and increased disruption of bacterial survival mechanisms compared to meropenem alone. These findings highlight the potential of drug repurposing as an effective strategy to combat CRPA infections.

Keywords: Carbapenem-resistant *Pseudomonas aeruginosa,* FDA-approved drug, Meropenem, Drug adjuvant, Drug repurposing

EXPLOITATION OF EFFECTIVE MICROORGANISM FOR BIOREMEDIATION OF HEAVY METAL CONTAMINATED SOIL

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ABSTRACT

Significant environmental contaminants called heavy metals accumulate in soil and disrupt its natural processes. They have long-term negative effects on plants, groundwater, animals, and people by altering soil and water chemical structure, inhibiting beneficial microorganisms, decreasing nutrient availability, and eventually lowering soil fertility. The bulk of heavy metal inputs into soil originate from anthropogenic activities like mining, metal plating, smelting, foundry operations, and other production processes that discharge dangerous metals into the environment. Moreover, smoke from vehicle emissions and the burning of fossil fuels both increases the deposition of metals onto nearby soils. Compared to typical agricultural fields, soils recovered from electroplating and foundry sites often have higher concentrations and a wider variety of heavy metals. Metal contamination spreads to nearby lakes, agricultural lands becomes contaminated through overflowing or improperly disposed of solid waste or industrial effluents. In order to restore soil health in areas affected by heavy metals, this study uses bioremediation with a commercially available Effective Microorganisms (EM) consortium. The main goal is to determine whether these microbes may improve soil biological activity and lower heavy metal concentrations, offering an environmentally beneficial way to manage contaminated areas. ICP-OES is used to examine soil samples after treatment in order to measure the kinds and concentrations of heavy metals along with the ICP-OES physicochemical parameters were done to support the study. The result displays that considerable decrease in metals over a 60-day period, Ni by 80.4%, Cr by 76.8%, and Cu by 60.1%. Additionally, the OM increased sharply from 1.35% to 2.45% and the pH changed from 8.9 to 7.18. The results show that EM reduced the concentration of heavy metals, restored soil fertility, and offered an economical method for bioremediation of soil contaminated with heavy metals.

Keywords: Heavy Metal Contaminated Soil, Effective Microorganism (EM), Physicochemical Parameters, ICP-OES.

SMART DRIP BUDDY (IRRIGATION SYSTEM)

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ABSTRACT

The Smart Drip Buddy is an automated irrigation system designed to improve water management in agriculture. It uses soil moisture sensors and environmental sensors to monitor the condition of the soil in real time. Based on the data received, a microcontroller automatically controls the water pump to supply the required amount of water to plants. This system helps to reduce water wastage, minimize human effort, and prevent overwatering or under watering of crops. It also integrates IoT technology, allowing users to monitor and control the system remotely through mobile or web applications. By ensuring efficient water usage and continuous monitoring, the Smart Drip Buddy promotes sustainable agriculture and enhances crop productivity. The system provides a reliable, cost-effective, and eco-friendly solution for modern farming practices.

Keywords: Smart Drip Irrigation, IoT Technology, Agriculture

IMPACT OF SUPERHEATED STEAM PRETREATMENT ON NUTRITIONAL, ANTINUTRITIONAL, GLYCEMIC, PASTING, AND STRUCTURAL CHARACTERISTICS OF MILLET-BASED RICE ANALOGUE

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ABSTRACT

The present study investigated the effect of superheated steam (SS) pretreatment on the nutritional, antinutritional, glycemic, pasting, and structural characteristics of millet-based rice analogue (MBRA). SS pretreatment was applied at temperatures of 120, 140, and 160 °C for 10, 20, and 30 min prior to extrusion processing. The treatment significantly influenced the overall quality attributes of MBRA ($p < 0.05$). Among the pretreatment conditions, SS at 140°C for 20 min was identified as the optimum, resulting in a balanced improvement in nutritional properties. SS pretreatment significantly improved mineral composition, pasting behavior, and thermal properties. Notably, iron content increased in treated samples compared to the control, indicating enhanced mineral availability. Pasting parameters, including peak viscosity, breakdown, and final viscosity, decreased, and suggesting partial starch degradation. Furthermore, SS pretreatment improved thermal stability while reducing the energy required for gelatinization. Structural analyses revealed reduced starch crystallinity, while FTIR spectra showed distinct shifts in the fingerprint region. Microstructural observations indicated the formation of a denser and more compact structure with fewer pores. Overall, superheated steam pretreatment demonstrates strong potential as a clean and efficient pre-processing strategy for enhancing the quality of millet-based rice analogue.

Keywords: Superheated Steam, Millet-based Rice analogue

A COMPREHENSIVE STUDY ON FERMENTATION-MEDIATED PRODUCTION OF NATURAL PIGMENTS BY Kocuria sp. AND THEIR SUITABILITY FOR ECO-FRIENDLY INDUSTRIAL DYEING APPLICATION

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ABSTRACT

The present study focuses on the fermentation-mediated production of natural pigments by Kocuria kristinae and their application in eco-friendly textile dyeing. Soil samples collected from selective environments were used to isolate pigment-producing bacteria on Mannitol Salt Agar, from which Kocuria kristinae was identified through morphological, biochemical, and molecular characterization. The isolate was cultivated under optimized fermentation conditions to maximize pigment synthesis, and the extracted pigments were obtained using methanol-based solvent extraction. The resulting pigment displayed a distinct yellow–orange coloration. Extracted pigments were applied to natural fabrics such as cotton using a simple aqueous dye bath and alum-based mordanting. Dye-fastness properties—including wash, light, and rubbing fastness—were evaluated, demonstrating encouraging color stability and minimal fading. The findings highlight Kocuria kristinae as a promising microbial source of bio-pigments with potential applicability in sustainable and non-toxic industrial dyeing processes. This work provides a rapid, cost-effective, and environmentally benign alternative to synthetic dyes, supporting the movement toward greener textile technologies.

Keywords: Kocuria kristinae, Fermentation-mediated, Dye-fastness, Mordanting, Textile

ASSESSMENT OF SOIL MICROBIAL ENZYMES IN THE BREAKDOWN OF SYNTHETIC POLYMERS FOR SUSTAINABLE WASTE MANAGEMENT

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ABSTRACT

Plastic pollution has become a serious environmental issue due to the long-lasting nature of synthetic polymers and their resistance to natural degradation. Conventional disposal methods such as landfilling and incineration often create additional ecological problems. In this context, microbial biodegradation emerges as a promising and eco-friendly alternative. This study focuses on the isolation and characterization of soil microorganisms capable of producing alkane hydroxylase, a key enzyme involved in the breakdown of hydrocarbon chains present in polyethylene and related plastics. Soil samples collected from plastic-contaminated environments were screened to identify efficient microbial strains. The presence and activity of alkane hydroxylase were confirmed through molecular identification techniques and enzyme assays. Furthermore, the enzyme's performance was evaluated under different environmental conditions, including variations in pH, temperature, and substrate concentration, to determine optimal activity. The results indicate that certain naturally occurring soil bacteria possess significant potential to degrade plastic polymers through enzymatic action. By improving our understanding of these microbial processes, this research contributes to the development of sustainable and biologically driven solutions for plastic waste management. Ultimately, it highlights the potential of harnessing native microorganisms for innovative biotechnological applications aimed at reducing environmental pollution.

Keywords: Plastic Biodegradation, Alkane Hydroxylase, Soil Microorganisms, Polyethylene, Enzyme Activity, Sustainable Waste Management

INNOVATIVE MURBURN CONCEPT FOR REVIVING DEGRADED SOIL HEALTH

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ABSTRACT

Investigating the oxidative transformation of soil contaminants via enzyme-mediated reactions based on the Murburn Concept was the aim of this work. The purpose of the study was to ascertain whether horseradish peroxidase (HRP) could produce reactive oxygen species that could change soil pollutants when hydrogen peroxide ($H2O_2$) was present. In order to comprehend the biochemical circumstances that facilitate oxidative degradation, the study also looked at pH variations during the reaction process. A soil suspension was made by suspending soil samples in distilled water. In order to prepare the control and experimental settings, buffer, HRP, and $H2O_2$ were added one after the other. To track the biochemical changes taking place during the reaction, the pH of each mixture was measured at various points. To guarantee the accuracy of the observations, the experiment was carried out several times. At first, the soil suspension had an alkaline pH of about 9.4. The pH dropped to almost neutral values (around 6.5–6.9) after the buffer was added. The pH was kept in a similar slightly acidic to neutral range by the subsequent addition of HRP and hydrogen peroxide. These circumstances favour the production of reactive oxygen species involved in the transformation of pollutants and suggest an environment conducive to enzyme-mediated oxidative reactions. The findings imply that soil contaminants may be transformed more easily by enzyme-driven oxidative processes that align with the Murburn Concept. This method provides a straightforward experimental framework for researching oxidative soil chemistry and emphasizes the possible involvement of enzyme-mediated processes in environmental remediation.

Keywords: Soil degradation, Murburn concept, Redox reaction, Enzymatic reaction

VALORIZATION OF DRAGON FRUIT PEEL WASTE: PIGMENTS AND POLYMERS EXTRACTION FOR ANTI-TAN HYDROGEL DEVELOPMENT

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ABSTRACT

The extraction of bioactive pigments and biopolymers from dragon fruit peel and their incorporation into an anti-tan hydrogel introduces a promising strategy for advancing natural, plant-derived skincare solutions. Dragon fruit peel is rich in betalains, potent antioxidant pigments known for their strong photoprotective activity, along with biopolymers such as pectin and cellulose that exhibit excellent gelling and moisture-retention properties. These compounds are obtained through eco-friendly extraction processes, purified, and characterized to ensure maximum functional integrity. When formulated into a hydrogel system, betalains demonstrate the ability to neutralize UV-induced oxidative stress, reduce skin tanning, and support skin recovery, while the natural polymers provide structural stability and controlled release of active ingredients. This research highlights the potential of fruit peel waste to serve as a multi-functional cosmetic ingredient, offering a safer, sustainable, and effective alternative to conventional synthetic anti-tan agents. By integrating phytochemical extraction with biomaterial-based formulation techniques, this approach supports the development of innovative, eco-conscious cosmeceuticals tailored for holistic skin protection

AQOUSTIC FREQUENCY BASED INDUSTRIAL FAULT DETECTOR

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ABSTRACT

An industrial fault detection system based on acoustic frequencies employs sound signal analysis to pinpoint and diagnose machinery issues at an early stage. This method involves capturing the acoustic emissions produced by equipment during its operation and processing these signals with sophisticated signal processing and pattern recognition techniques. By examining variations in frequency, amplitude, and harmonic content, the system can identify anomalies linked to mechanical problems, such as bearing wear, misalignment, or gear damage. Unlike traditional monitoring methods, this technique provides a noninvasive, cost-effective, and real-time solution for condition monitoring. The proposed system improves predictive maintenance by facilitating early fault detection, minimizing downtime, and enhancing operational efficiency and safety in industrial settings.

Keywords: Acoustic Frequency Analysis, Signal Processing, Frequency Spectrum Analysis, Non-Invasive Monitoring, Machine Learning

FUNGAL-DERIVED CHITOSAN MICROSPHERES AS A PROMISING BIOMATERIAL FOR SUSTAINED DRUG RELEASE IN BREAST CANCER TREATMENT

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ABSTRACT

Breast cancer remains one of the leading causes of cancer-related mortality worldwide, and conventional chemotherapy is often limited by systemic toxicity, poor targeting, and frequent dosing. This study aims to develop fungal-derived chitosan microspheres as an efficient biomaterial-based drug delivery system for sustained and controlled release of anticancer agents. Chitosan obtained from fungal sources offers advantages such as high biocompatibility, biodegradability, low immunogenicity, and consistent quality compared to crustacean-derived chitosan. Microspheres will be formulated using techniques such as ionic gelation or emulsion cross-linking and loaded with a suitable anticancer drug (e.g., doxorubicin). The prepared microspheres will be characterized for particle size, morphology, drug entrapment efficiency, and in vitro drug release behavior. The developed system is expected to provide prolonged drug release, enhance therapeutic efficacy, reduce dosing frequency, and minimize side effects. Therefore, fungal chitosan microspheres represent a promising approach for improving breast cancer treatment through advanced drug delivery strategies.

Keywords: Fungal chitosan, Microspheres, Breast cancer, Drug delivery, Sustained release

HIGH PERFORMANCE BIO-BASED CHITOSAN GRAPHENE OXIDE NANOCOMPOSITE COATINGS FOR ANTI-CORROSION PROTECTION OF ALUMINIUM SURFACES

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ABSTRACT

Corrosion of metals, especially aluminium, poses a major problem in industries such as aerospace, automotive, marine, and construction. It leads to shorter material lifespans, higher maintenance costs, and weaker structure. Traditional anti-corrosion coatings often use synthetic polymers and harmful chemicals, which harm the environment and are unsustainable. This project aims to develop bio-based chitosan-graphene oxide (GO) nanocomposite coatings as an eco-friendly and high-performing option for protecting aluminium surfaces. Chitosan, a natural polymer, offers a biodegradable film-forming matrix. Graphene oxide improves the coating's mechanical strength, barrier properties, and resistance to corrosion. The project includes making chitosan-GO coatings, applying them to aluminium material, and testing their adhesion, mechanical stability, and electrochemical stability, salt spray exposure, and immersion studies. We will also optimize the chitosan-to-GO coatings and coating parameters to enhance durability and protection. We expect to show the sustainable, durable coatings that reduce the use of synthetic materials while providing excellent corrosion protection. This work presents a potential green solution for metal surface protection in harsh environments and sets the stage for more research into bio-based nanocomposite coatings for industrial and structural use.

Keywords: Chitosan, Graphene Oxide, Nanocomposites, Aluminum Surface Protection

A COMPARATIVE ANALYSIS ON CHARACTERISTICS OF COAGULANTS IN THE PRODUCTION OF PUMPKIN SEED BASED CHEESE

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ABSTRACT

In this study, four different coagulants (lemon, vinegar, calcium chloride, and veg rennet liquid) were used to produce cheese from pumpkin seed milk. The effect of these coagulants on the physicochemical, sensory, and microbiological qualities of cheese was assessed. Pumpkin seed milk was prepared and divided into four samples, each treated with a different coagulant. sample1(cow milk, pumpkin seed milk, lemon), sample2(cow milk, pumpkin seed milk, vinegar), sample3(cow milk, pumpkin seed milk, calcium chloride), sample (c w milk, pumpkin seed milk veg rennet milk. The developmental cheese Values ranged from 30.12%–52.2% for Moisture content, 3.2–5.6 for pH, and 180.00–210.00 seconds for coagulation time. Cheese yield ranged from 20.3%–38.00%, with calcium chloride giving the highest yield. Proximate composition also significantly influenced by the coagulants. Microbiological analysis showed that all cheese samples were safe for human consumption.

Keywords: Cow milk, Pumpkin seed milk, Coagulants, Microbial safety.

SMART INTEGRATED BANDAGE SYSTEM FOR DIABETIC WOUND MONITORING

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ABSTRACT

Diabetic foot ulcers (DFUs) are one of the most serious complications of diabetes, often leading to infections and amputations if not detected early. Traditional wound dressings only provide passive protection without real-time health monitoring. This project proposes the development of a Smart Integrated Bandage System capable of monitoring wound parameters such as moisture level, pH, temperature, and infection markers. The system integrates biosensors, microcontrollers, and wireless data transmission to a mobile application for continuous monitoring. By providing real-time alerts and tracking wound healing progress, the proposed system will significantly improve wound management, reduce hospitalization, and enhance patient quality of life.

Keywords: Diabetic Foot Ulcers, Smart Integrated Bandage, Wound Healing

EEG HEADSET FOR BRAIN MONITORING

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ABSTRACT

Electroencephalography (EEG) headsets are wearable devices designed to measure the electrical activity of the brain without any surgical procedure. These headsets use small electrodes placed on the scalp to capture the electrical signals produced by brain cells. The collected signals are then converted into digital data so that they can be analyzed using computers. EEG headsets are widely used in areas such as medical diagnosis, neuroscience research, brain-computer interface (BCI) systems, and monitoring human mental states. By studying the patterns in brain signals, researchers and doctors can understand conditions like attention level, relaxation, stress, and emotional responses. Unlike the traditional EEG machines commonly found in hospitals, modern EEG headsets are smaller, portable, and easier to use. They are also more affordable, which makes them suitable for use in laboratories, universities, and technology-based projects. The brain signals recorded by these devices are usually processed with signal processing techniques and specialized algorithms to extract useful information about brain activity.EEG technology is also important in developing assistive technologies. For example, brain-computer interface systems allow users to control computers or electronic devices using only their brain signals, which can greatly help individuals with physical disabilities. With ongoing advancements in sensor technology, artificial intelligence, and data analysis, EEG headsets are expected to become more accurate, efficient, and widely used in the future for both healthcare and technological innovations.

Keywords: EEG Headsets, sensor technology, AI

OPTIMIZATION OF BIOETHANOL PRODUCTION FROM MIXED FRUIT USING RSM BOX-BEHNKEN DESIGN

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ABSTRACT

Global energy demand and environmental concerns are driving the search for sustainable energy. Bioethanol from waste biomass is a promising alternative. This study investigated mixed fruit waste (jackfruit, banana, grapes) for bioethanol production due to their rich fermentable sugars. The process involved pre-treatment, enzymatic hydrolysis (using a-amylase), and fermentation with Saccharomyces cerevisiae. Response Surface Methodology (RSM) with a Box-Behnken design optimized pH, yeast concentration, and jackfruit mass to maximize ethanol yield. Ethanol was recovered by distillation and confirmed through tests, FTIR, and HPLC. The highest yield (42.5%) was achieved with 300 g jackfruit, pH 4.75, and 2% yeast concentration. Statistical analysis confirmed the significance of these variables ($p < 0.05$), and the high R2 (0.9939) of the regression model indicated strong predictive accuracy. This research highlights the potential of fruit waste for bioethanol production, offering waste reduction and renewable energy, supporting a circular bioeconomy. The optimized model showed good agreement between predicted and actual ethanol yields. Utilizing fruit waste offers a scalable and sustainable approach to fuel production, particularly in regions with significant fruit processing. This research contributes to the circular bioeconomy by converting waste into a valuable renewable resource.

Keywords: Bioethanol production; Enzymatic Hydrolysis, Saccharomyces cerevisiae, Fermentation, Response Surface Methodology (RSM)

COMPARATIVE STUDY ON THE PHOTOPROTECTIVE EFFICIENCY AND ANTIOXIDANT POTENTIAL OF SEAWEED-BASED HYDROGELS

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ABSTRACT

Marine macroalgae are a promising source of bioactive polysaccharides with applications in antioxidant and photoprotective skincare formulations. In this study, polysaccharides extracted from *Sargassum tenerimum (ST), Turbinaria conoides (TC), Turbinaria ornata (TO), and Gracilaria salicornia (GS)* were evaluated for their biochemical composition and functional activities. G. salicornia showed the highest carbohydrate content, while T. ornata exhibited the highest sulfate and uronic acid content, contributing to its superior bioactivity. Antioxidant assays-DPPH, ABTS, hydrogen peroxide, and Fe2+ ion chelation-confirmed that TO had the strongest radical scavenging activity, followed by ST, with TC performing the least. Additionally, structural characterization of the extracted polysaccharides was performed using Nuclear Magnetic Resonance (NMR) spectroscopy and High-Performance Liquid Chromatography (HPLC), confirming the presence of characteristic monosaccharide units and functional groups relevant to their bioactivity. Photoprotective activity assessed via the in vitro Erythema and pigmentation inhibition assays corroborated these findings, showing ultra-protective effects at 500 ppm for TO and ST, and 600 ppm for TC. Agar from GS exhibited minimal UV- blocking efficacy. To improve the functional delivery of these bioactives, hydrogel formulations were developed using tannic acid as a crosslinker. Rheological characterization-including Adhesion test, self-healing, frequency sweep, and complex viscosity tests demonstrated superior mechanical and adhesive properties for TO-based hydrogels. Antioxidant assays of the hydrogels revealed significantly improved ICso values compared to crude extracts, indicating enhanced bio efficacy. Additionally, the hydrogels offered improved photoprotective properties over unformulated polysaccharides. These findings highlight Turbinaria ornata-derived hydrogels as potent candidates for natural, marine-based cosmeceutical applications with combined antioxidant and UV-protective benefits.

Keywords: Marine Polysaccharides, Photoprotection, Antioxidant Activity, Hydrogel

EVOLUTIONARY UNDERPINNINGS OF MOLECULAR CHANGES IN THE VIRAL PROTEIN OF ASIAN ZIKA VIRUS STRAINS

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ABSTRACT

Zika virus (ZIKV) is an arthropod-borne virus (arbovirus) belonging to the Flaviviridae family, genus Flavivirus. It is primarily transmitted to humans through the bite of infected *Aedes aegypti* and *Aedes albopictus* mosquitoes, though vertical (motherto-fetus), sexual, and transfusion-related transmissions. Clinically, ZIKV infection is often mild or asymptomatic; however, it has been linked to severe neurological complications, including Guillain-Barré syndrome in adults and congenital Zika syndrome in neonates, such as microcephaly and other neurological defects. This project offers significant scientific, public health, and translational benefits by focusing on the molecular characterization of Indian Zika virus (ZIKV) strains. Scientifically, it will elucidate unique mutations in structural (E) and non-structural proteins (NS1, NS5) as well as variations in the 5′ and 3′ untranslated regions (UTRs), providing insights into how these changes influence viral replication, stability, host adaptation, and pathogenicity. Phylogenetic and comparative analyses will clarify the evolutionary relationship of Indian strains to global lineages, improving understanding of outbreak patterns in the region. From a public health perspective, identifying molecular signatures associated with increased transmission or virulence can enhance surveillance, guide vector control strategies, and inform region-specific diagnostics, vaccines, and therapeutics. Translationally, the study may pinpoint key functional proteins and UTR elements as potential targets for antiviral interventions and improve the design of molecular diagnostics for Indian strains.

Keywords: Zika Virus, UTR, Antiviral Interventions, Molecular Diagnostics

VALUE ADDITION OF JACKFRUIT FOR SUSTAINABLE RURAL LIVELIHOOD

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ABSTRACT

Agricultural resources play a crucial role in supporting rural livelihoods; however, many locally available crops remain underutilized due to limited awareness and lack of processing knowledge. *Artocarpus heterophyllus* (jackfruit) is one of the largest tropical fruits cultivated in India and is rich in carbohydrates, dietary fiber, vitamins, and essential minerals. Despite its nutritional significance and abundance, a substantial portion of jackfruit and its seeds is discarded during harvesting, leading to post-harvest losses and reduced economic potential. The present study focuses on the development of value-added products from jackfruit to promote sustainable utilization and reduce agricultural waste. A field-based survey was conducted in a rural community to assess the availability, consumption patterns, and awareness regarding jackfruit utilization. Data were collected through structured questionnaires, personal interactions, and observational methods. The findings revealed that most respondents consumed jackfruit only as fresh fruit and discarded seeds due to lack of awareness regarding their applications. Based on these observations, several value-added products were developed using jackfruit pulp and seeds, including jackfruit seed flour, cosmetic scrub, and processed food products. The preparation methods involved simple and cost-effective techniques such as drying, roasting, grinding, and blending with locally available ingredients. The developed products were demonstrated to the community to highlight practical approaches for utilizing underexploited agricultural resources. The products were evaluated based on sensory parameters such as taste, texture, aroma, and overall acceptability. The results indicated a positive response from participants, confirming the feasibility and acceptability of jackfruit-based value-added products. The study highlights the potential of jackfruit in supporting small-scale entrepreneurship, reducing food waste, and contributing to sustainable rural development.

Keywords: Jackfruit, Value Addition, Rural Development, Food Processing, Waste Utilization

CANCER INTERCEPT: MACHINE LEARNING BASED PREDICTION MODEL FOR EARLY CHOLANGIOCARCINOMA DETECTION

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ABSTRACT

The prediction of early recurrent of intrahepatic cholangiocarcinoma (ICC) has been widely investigated; however, the predictive value is currently insufficient. To determine the effectiveness of machine learning (ML) for the diagnosis of early recurrent intrahepatic cholangiocarcinoma (ICC), particularly in comparison with clinical models, the present study aimed to determine which ML model had the best diagnostic performance for in patients with recurrent ICC. In order to search for studies which could be included, three electronic databases were screened from inception to November 2023. A network meta-analysis was performed to identify the most effective ML-based diagnostic model based on the surface under the cumulative ranking curve score. Following pairwise meta-analysis, it was found that the ML-based diagnostic accuracy was greater than that of clinical models (surface under the cumulative ranking curve score closer to 1, with significant differences), which initially proved that the ML-based diagnostic power was more optimal than that of clinical models. According to the network meta-analysis, the nomogram performed the best, indicating that this ML model achieved the best diagnostic accuracy for patients with recurrent ICC. In conclusion, the application of ML-based diagnostic models for patients with recurrent ICC was more optimal than the application of the clinical model.

Keywords: Intrahepatic, Cholangiocarcinoma, Machine Learning.

EARLY ARRYTHMIA DETECTION USING MULTIMODAL MACHINE LEARNING WITH PTB-XL ECG DATASET AND CLINICAL MEDICAL INFORMATION

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ABSTRACT

Early identification of cardiac arrhythmias is crucial for reducing the risk of serious cardiovascular complications and enhancing patient survival rates. Electrocardiogram (ECG) signals provide valuable insights into the electrical functioning of the heart; however, accurate diagnosis often requires the incorporation of additional clinical information. This study presents a multimodal machine learning framework for early arrhythmia detection by integrating ECG signals from the PTB-XL dataset with associated clinical medical data. The proposed framework applies advanced preprocessing and feature extraction methods to derive significant temporal and morphological characteristics from ECG recordings. In parallel, structured clinical variables such as patient demographics, medical history, and diagnostic indicators are included to strengthen the predictive performance of the model. These diverse data modalities are combined within a multimodal learning architecture, allowing the system to learn complementary patterns from both physiological signals and clinical attributes. By merging ECG-derived features with clinical data, the system aims to achieve improved diagnostic accuracy compared to traditional single-source approaches. Performance evaluation using the PTB-XL dataset highlights the capability of the proposed model to effectively detect early manifestations of cardiac rhythm disorders. The developed framework can assist healthcare professionals by offering an intelligent decision-support tool for early arrhythmia screening. Ultimately, this approach supports better cardiac disease diagnosis, enables timely medical intervention, and contributes to improved patient management in modern healthcare environments.

Keywords: PTB-XL, ECG

ENHANCED DIAGNOSTICS BASED ON DEEP LEARNING FOR VARICOSE VEIN DETECTION

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ABSTRACT

Varicose veins are a common vascular disorder affecting a large portion of the population and may lead to pain, swelling, and severe complications if not diagnosed at an early stage. Accurate and timely detection is essential for effective treatment and improved patient outcomes. This paper presents a deep learning-based diagnostic framework for automated detection of varicose veins using medical imaging data. The proposed system utilizes a convolutional neural network (CNN) to identify complex patterns and subtle visual features associated with varicose veins. A diverse dataset of vascular images is used to train the model, ensuring robustness across different patient conditions and imaging environments. Transfer learning is incorporated to enhance model performance and adaptability. Additionally, image preprocessing, segmentation, and feature extraction techniques are employed to improve diagnostic accuracy and provide detailed analysis of vein structures. The framework also supports multi-modal imaging inputs for comprehensive evaluation. Experimental results demonstrate high accuracy, sensitivity, and specificity, validating the effectiveness of the proposed approach. This system can assist healthcare professionals in early diagnosis, reduce manual effort, and support clinical decision-making, ultimately contributing to improved patient care and personalized treatment strategies.

Keywords: Convolutional Neural Network, Multi-Modal Imaging, Vascular Disorder

SMART INFUSION PUMP MONITORING SYSTEM

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ABSTRACT

The Smart Infusion Pump Monitoring System is designed to enhance patient safety and improve the efficiency of intravenous (IV) fluid administration in healthcare environments. Traditional infusion systems often lack real-time monitoring capabilities, which can lead to critical issues such as incorrect flow rates, fluid depletion, or blockage in the delivery line. This project presents an intelligent monitoring solution that continuously tracks key infusion parameters including flow rate, volume infused, and remaining fluid level. The system utilizes sensors such as a flow sensor, pressure sensor, and level detection mechanism interfaced with a microcontroller to acquire and process real-time data. The measured parameters are displayed on a digital interface and monitored against predefined safety thresholds. In case of abnormalities such as flow interruption, air blockage, or empty IV bottle, the system generates immediate alerts through visual and audible indicators. Additionally, the integration of IoT technology enables remote monitoring and data logging, allowing healthcare providers to supervise multiple patients simultaneously. This project aims to provide a cost-effective, reliable, and user-friendly solution that reduces human error and enhances patient care. The proposed system demonstrates the effective integration of biomedical instrumentation, embedded systems, and smart monitoring technologies, making it suitable for modern healthcare applications.

Keywords: IoT technology, Smart Infusion Pump, Monitoring System, Fluid Depletion Pressure Sensor

NEXT-GENERATION ORGAN-ON-CHIP SYSTEM WITH INTEGRATED BIOSENSORS FOR REAL-TIME DISEASE MODELING

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ABSTRACT

The development of physiologically relevant in vitro models is essential for advancing disease research and drug discovery. This paper presents a next-generation organ-on-chip system integrated with miniaturized biosensors for real-time disease modelling. The proposed platform combines microfluidic technology with living cell cultures to mimic the structural and functional behaviour of human organs under dynamic conditions. Embedded biosensors enable continuous monitoring of key physiological parameters such as pH, oxygen concentration, and metabolic activity. A data acquisition unit processes signals in real time, enabling accurate analysis and visualization. The system improves upon traditional static cell culture and animal models by providing a controlled and realistic microenvironment. Experimental validation demonstrates reliable performance in replicating disease- specific conditions and monitoring drug responses. This platform offers a scalable and efficient solution for personalized medicine, reducing animal testing and accelerating therapeutic development.

Keywords: Personalized Medicine, Reducing Animal Testing, Static cell culture

PREDICTING DIABETIC RETINOPATHY USING MACHINE LEARNING

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ABSTRACT

Diabetic retinopathy (DR) is an eye disease caused by the complication of diabetes and we should detect it early for effective treatment. As diabetes progresses, the vision of a patient may start to deteriorate and lead to diabetic retinopathy. As a result, two groups were identified, namely non-proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy (PDR). The amount of the disease spread in the retina can be identified by extracting the features of the retina..Here this paper proposed Multi Level SVM classifier for better results that's comparatively better than SVM. It provides a better result compared to the existing system using Multilevel support vector machine increase the quality of an image give higher accuracy of retinal damaged place it helps detecting the diabetic retinopathy affected range in retina.

Keywords: Diabetic Retinopathy, NPDR, PDR, Multilevel Support Vector Machine.

DESIGN AND DEVELOPMENT OF A MULTI-POSITION PATIENT LIFT AND TRANSFER SYSTEM FOR BEDRIDDEN PATIENTS

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ABSTRACT

The objective of this project is to design and develop a cost-effective, multi-position patient lift and transfer system that minimizes patient discomfort while eliminating musculoskeletal injuries among caregivers. Conventional patient handling methods—manual lifting, rolling, or the use of sling-based lifts—pose significant challenges, often leading to pressure points and instability for patients. For caregivers, repetitive lifting and awkward postures are leading causes of debilitating spine and shoulder injuries. We propose a standalone, electrically actuated transfer aid constructed from lightweight, high-tensile strength stainless steel. Unlike conventional lifts, the system eliminates slings and ropes by employing a sliding-tray mechanism integrated with rollers and inflatable cushions, ensuring a stable, low-friction interface. The device incorporates load cells for weight monitoring and limit switches for travel limitation, processed through a microcontroller based control unit. Safety is reinforced by an anti-tip chassis and mechanical lockingcasters. Experimental validation aims to demonstrate that manual controls enable a single caregiver to execute transfers without direct physical strain, providing a promising solution for hospitals and rehabilitation settings.

Keywords: Patient Lift, Transfer System, Mechatronics, Caregiver Safety, Sliding-Tray Mechanism, Biomedical Engineering, Assistive Technology.

AI-POWERD INTELLIGENT TRANSDERMAL JET DELIVERY INTERFACE FOR PRECISION AND SUSTAINABLE DRUG DELIVERY SYSTEMS

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ABSTRACT

Recent advancements in smart drug delivery technologies have accelerated the development of AI-integrated transdermal jet injection platforms as next-generation alternatives to conventional invasive administration methods. These systems utilize high-pressure micro fluidic jets combined with real-time sensing and adaptive control algorithms to deliver therapeutics across the skin barrier without the need for traditional needles. This study presents a comprehensive evaluation of intelligent jet-based delivery systems in comparison with legacy injection techniques, emphasizing emerging parameters such as adaptive dose modulation, tissue-response feedback, digital traceability, and environmental sustainability. The proposed systems demonstrate ultra-high dosing precision (<1% deviation) through closed-loop control mechanisms and machine learning–assisted penetration depth optimization. Advanced biosensing modules enable real-time monitoring of skin impedance and tissue resistance, ensuring personalized drug dispersion with minimal discomfort (VAS score ~0–1). Furthermore, the integration of Internet of Medical Things (IoMT) frameworks allows continuous patient monitoring, automated dose logging, and remote clinical supervision, significantly enhancing treatment adherence. Future directions include nano fluid-enhanced delivery, digital twin–based patient modeling, and autonomous self-administration systems guided by predictive analytics. The study highlights the transformative potential of AI-driven transdermal jet technologies in delivering vaccines, biologics, and chronic disease therapeutics with superior accuracy, patient compliance, and ecological responsibility, particularly in decentralized and resource-constrained healthcare environments.

Keywords: AI-Driven Drug Delivery, Transdermal Jet Injection, IoMT, Precision Therapeutics, Sustainable Healthcare, Smart Biomedical Systems

A SENSOR-BASED SMART CRUTCH FOR POSTURE MONITORING AND SAFE MOBILITY IN REHABILITATION

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ABSTRACT

Mobility assistance devices are essential for elderly individuals and patients undergoing rehabilitation due to injuries or musculoskeletal disorders. Traditional crutches provide structural support but lack intelligent monitoring systems that can assist users in maintaining proper posture and avoiding excessive load on the injured limb. This paper presents the design and development of a smart crutch system integrated with sensors, actuators, and Internet of Things (IoT) technology to improve mobility support and rehabilitation monitoring. The proposed system incorporates a load cell sensor for force measurement, MPU6050 accelerometer and gyroscope for posture detection, and LDR sensor for environmental lighting detection. An ESP8266 NodeMCU microcontroller processes sensor data and transmits it to a cloud platform (Adafruit IO) using Wi-Fi communication. The system provides haptic feedback, audible alerts, and automatic lighting to enhance user safety and mobility. The results demonstrate that the smart crutch system improves rehabilitation monitoring, reduces the risk of improper posture, and provides real-time feedback for safer mobility assistance.

Keywords: Smart Crutch, Rehabilitation Engineering, Iot Healthcare, Nodemcu, Load Cell Sensor, Assistive Devices

DRONE – AN ASSISTIVE DEVICE FOR AQUACAREMONITORING

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ABSTRACT

The main aim of this project is to design a drone which is helpful to monitor the water resource. Water in these days is polluted by several pollutions like industrial effluents and sewage water. To test the water quality, an unmanned aerial vehicle - assisted water quality measurement system (UAMS)will be developed for in situ surface water quality measurement[10]. A custom-built quadcopter or drone will be equipped with an open source electronic sensors platform to measure the pH, Turbidity, Temperature and Flow of water]6]. Electronic components of the system will be coated with a water resistant film, and the drone will be assembled with the equipment for checking the quality of water in various resources.

Keywords: Drone, Water-Resistant Film, Water Monitoring

CONVERSION OF ALKALINE BATTERIES INTO FERTILIZERS

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ABSTRACT

This project concentrates on how to convert the wasted alkaline batteries into Fertilizer. It is an initiative to the Circular economy and sustainable future development. The objective of this study is to investigate the growth and Zn accumulation and utilization by maize plants in Agricultural soils. The alkaline batteries are collected and it consists of Zn and MnO2 powder as fertilizers which will be applied in the soil to analyze the comparative analysis of corn growth. Literature studies revealed that, Zinc increases the chlorophyll content in leaves, improves photosynthesis and increases grain yield of summer maize. The grain yield and net field benefit will be studied with different ratios of Zinc Fertilizer. The soil type and pH range, macronutrients (NPK) and micronutrient (Ca) are to be known and studied. The Accumulation and uptake of Zn will be studied and growth differences will be determined.

Keywords: Alkaline Battery, Zinc, manganese Dioxide, Fertilizer, Maize, Agriculture, Soil, Grain yield, Accumulation, Uptake, Recycling, Circular Economy.

SEROTONIN-CONJUGATED MANGANESE OXIDE (MnO) NANOPARTICLES FOR BIOSENSING APPLICATIONS

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ABSTRACT

Neurotransmitters such as serotonin and dopamine play a critical role in regulating neurological functions, including mood, cognition, and motor control. Abnormal levels of these biomolecules are strongly associated with neurological and psychiatric disorders such as Parkinson's disease, depression, schizophrenia, and Alzheimer's disease. Therefore, the development of highly sensitive, selective, and rapid detection methods for neurotransmitters is essential for early diagnosis, clinical monitoring, and biomedical research. Conventional analytical techniques such as high-performance liquid chromatography (HPLC), fluorescence spectroscopy, and mass spectrometry provide accurate measurements but require sophisticated instrumentation, time-consuming sample preparation, and trained personnel. Electrochemical sensing has emerged as a promising alternative due to its simplicity, high sensitivity, rapid response, low cost, and potential for miniaturization. In this context, nanomaterials, particularly metal oxide nanoparticles, have gained significant attention due to their excellent electrical conductivity, high surface area, catalytic activity, and biocompatibility. The proposed research focuses on the synthesis and functionalization of manganese oxide (MnO) nanoparticles conjugated with serotonin to develop an efficient electrochemical sensor for neurotransmitter detection. The functionalized MnO nanoparticles will then be used to modify a suitable electrode substrate such as glassy carbon electrode (GCE) or screen-printed electrode (SPE). Electrochemical measurements including cyclic voltammetry (CV), differential pulse voltammetry (DPV), and electrochemical impedance spectroscopy (EIS) will be performed to evaluate sensitivity, selectivity, detection limit, and response time. The sensor performance will also be tested in the presence of interfering biomolecules to assess selectivity and reliability.

Keywords: Seratonin, MnO Nanoparticles, Neurotransmitters, Biosensors

DECIPHERING THE MOLECULAR MECHANISMS OF PESTICIDE-INDUCED GENOTOXICITY THROUGH AN INTEGRATED MULTI-OMICS AND SYSTEMS GENOMICS APPROACH

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ABSTRACT

The extensive use of use of pesticides, widespread in cultivation, has raised high promptness about the effect of pesticides on human health and environment. candidates among them is pesticide-mediated genotoxicity manifesting as DNA damage, chromosomal aberrations and genomic instability which can be considered significantly contributing risk factors of carcinogenesis and reproductive toxicity with long-term sequelae. Two possible explanations for this lack of understanding are the complexity of biological responses and the limitations imposed by single-endpoint analyses despite a number of toxicological studies on pesticides have been conducted. The current study aims to an integrated multi-omics and systems genomics approach, seeks to decode the molecular pathways of genotoxicity induced by pesticides. It has specific aims to determine genome-wide DNA damage and mutational signatures caused by selected widely used pesticides; characterize related transcriptomic, epigenomic, proteomic and metabolomic changes; and integrate these datasets to reconstruct key regulatory networks/pathways that are involved in the response to genotoxic stress. Established assays for genotoxicity (comet assay, micronucleus testing and γ-H2AX) will also be performed. Network-based analyses and machine-learning approaches will be employed to discover critical molecular drivers and markers of genotoxicity. Expected outcomes are the identification of relevant susceptibility networks, the discovery of predictive biomarkers, and a comprehensive molecular framework of pesticide-induced genotoxicity mechanisms. The findings from this project will lead to improved risk assessment techniques, evidence-based regulatory decisions and protection of public health through safer pesticide use.

Keywords: Multiomics, Genotoxicity, Micronucleus, Pestiside, DNA damage, Biomarker, Transcriptomic, Metabolomics, Proteomics

FABRICATION AND IN VITRO EVALUATION OF COLLAGEN NANOFIBERS FROM FISH SWIM BLADDER INFUSED WITH *TRIDAX PROCUMBENS*

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ABSTRACT

Collagen nanofibers are gaining attention in the field of tissue engineering due to their biocompatibility, biodegradability, and the ability to mimic the extracellular matrix (ECM) of native tissues. This study focuses on the development and characterization of collagen nanofibers derived from fish swim bladders using an enzymatic extraction method. Fish swim bladders, an underutilized marine by-product, offer a sustainable and cost-effective source of collagen. The process of collagen extraction involves the use of specific enzymes to isolate high-purity collagen, maintaining its native structure and functional properties. The resulting collagen is then processed into nanofibers through electrospinning, a technique that enables the formation of fibers with nanoscale diameters, suitable for tissue engineering applications. Comprehensive characterization of the collagen nanofibers includes morphological analysis using scanning electron microscopy (SEM), structural analysis via Fourier transform infrared spectroscopy (FTIR), thermal stability assessment through differential scanning calorimetry (DSC), and mechanical property evaluation using tensile testing. Biocompatibility and cytotoxicity assays are performed to assess the potential of these nanofibers for biomedical applications. The study aims to demonstrate that collagen nanofibers derived from fish swim bladders possess desirable properties for tissue engineering, including appropriate mechanical strength, thermal stability, and excellent biocompatibility. The findings of the study would be made useful in predictingthe fish swim bladder collagen nanofibers as a promising material for developing scaffolds in regenerative medicine, thereby contributing to the sustainable use of marine resources and advancing the field of tissue engineering.

Keywords: Collagen Nanofiber, Tissue Engineering, Regeneration, Fish Swim Bladder, Sustainable Natural Resource.

CARISSA CARANDAS PEEL EXTRACT MEDIATED SILVER NANOPARTICLES TO COMBAT FOOD BORNE PATHOGENS

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ABSTRACT

The peel extract of *carissa carandas*, which is naturally rich in bioactive components like flavonoids, phenolic compounds, and vitamins. The present study explores the eco-friendly synthesis of silver nanoparticles (AgNPs) using extract from the peel of Carissa carandas. By using UV-Visible spectroscopy the synthesis of KaAgNPs confirmed with SPR peak at 400 nm. Field emission scanning electron microscopy (FESEM) identifies the structure and size of the nanoparticles. Analysis of KaAgNPs shows spherical shapes with size ranging from 24.57 nm to 49.90 nm. Zeta potential analysis shows nanoparticles stability, by negative sufarce charge at -18.7 mv, while the dynamic light scattering (DLS) showed the particle size to be 180 nm. The nanoparticles were thoroughly characterized using advanced analytical tools, and their toxicity was evaluated in zebrafish (*Danio rerio*) embryos. The investigation also included the evaluation of antibacterial efficacy, biofilm inhibition, and potential mechanisms of action of the synthesized nanoparticles against foodborne pathogens. The synthesized AgNPs were spherical, with an average diameter of 41.34 nm. The minimum concentrations required to inhibit growth (MIC) of *Enterobacter bugandensis, Enterobacter chuandaensis* and *Enterobacter huaxiensis*were found to be 25 µg/ml. The minimum concentrations needed to kill the bacteria (MBC) were 12.5 µg/ml for *E.bugandensis* and 6.25 µg/ml for *E.huaxensis*. Based on exploring the mechanism of action of nanoparticles, it was observed that KaAgNPs were more effective than the antibiotics by including the leakage of proteins and sugars, measurement of malondialdehyde (MDA), measurement of glutathione (GSH) and estimation of catalase and superoxide dismutase (SOD). These nanoparticles distrupted bacterial integrity by causing leakage of intracellular contents and triggering oxidative stress.

Keywords: Silver nanoparticles (AgNPs); *Danio rerio*; *Carissa carandas*; Food-borne pathogens

THE IMPACT ON PULSED LIGHT (PL) AT THREE DIFFERENT FREQUENCY ON THE MICROBIAL INACTIVATION PHYSICOCHEMICAL AND NUTRITIONAL PROPERTIES OF RAISINS

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ABSTRACT

This study investigates the impact of pulsed light (PL) treatment at three different frequencies (2.5 Hz, 5 Hz, and 7.5 Hz) on microbial inactivation, as well as the physicochemical and nutritional properties of raisins. The main objective was to identify the optimal frequency for higher microbial reduction and better retention of color, texture, moisture content, and key nutrients in raisins. The results revealed that PL treatment effectively reduced microbial contamination at all tested frequencies. At 2.5 Hz, a 3.46 log reduction was achieved while 5 Hz resulted in a 3.68 log reduction, and 7.5 Hz led to the highest reduction of 3.73 log, indicating that higher frequencies are more efficient for microbial decontamination. Regarding physicochemical properties, the lightness (L*) values increased with higher frequencies, indicating a lightening effect on raisins. The yellow intensity (b*) remained stable, while DIFFERENT red/green intensity (a*) shifted slightly toward a redder hue with increasing frequency. In terms of moisture content, 7.5 Hz was the most effective in maintaining water activity, whereas 2.5 Hz caused significant moisture loss, suggesting that higher frequencies are gentler on raisins, preserving their texture and sensory qualities. Nutritionally, PL treatment at 7.5 Hz resulted in the highest phenolic content (15 mg/dl), followed by 5 Hz (14 mg/dl), with 2.5 Hz showing a slight decrease (12 mg/dl). Vitamin C content decreased slightly with higher frequencies, from 9.5 mg/100g at 2.5 Hz to 8.2 mg/100g at 7.5 Hz.k

Keywords: Pulsed light treatment, microbial inactivation, raisins, phenolic content & vitamin C

DEVELOPMENT OF NITROGEN CODOPED CARBON MODIFIED TIO_2 FOR SOLAR LIGHT ASSISTED PHOTOCATALYTIC APPLICATION

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ABSTRACT

The present work comprises of two steps. Firstly, we optimized the synthesis conditions of graphitized carbon by varying the carbonization temperature and obtained mesoporous graphitic carbon from immature coconut fruit (*Cocos nuciferus* L) through Chemical Vapour Deposition (CVD). The second part of the work was to use the synthesized mesoporous carbon as a substrate for the synthesis of anatase TiO_2 through CVD. To reduce the bandgap of the anatase TiO_2 nitrogen is used as a co-dopant to carbon modified Titania and finally the dye degradation properties of the nitrogen co-doped carbon modified TiO_2 was be carried out in the visible spectrum. The rate of degradation was found to be 94% at 50 ppm and the rate of degradation increase with increasing the irradiation period. The developed Nitrogen co-doped Carbon modified TiO_2 nanocomposites are expected to find applications in the dye degradation application in the presence of natural solar light.

Keywords: Titania, *Cocos Nuciferus* L, Co-doping, Photocatalysis, Dye degradation

AI-DRIVEN NATURAL FOOD COLOURANT IMPROVEMENT THROUGH WASTE TO WEALTH STRATEGIES IN THE FOOD INDUSTRY

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ABSTRACT

The food industry is increasingly shifting towards natural colourants as safer and healthier alternatives to synthetic dyes, driven by growing consumer demand for clean-label and minimally processed food products. This paper examines the improvement of natural food colourants through innovative waste-to-wealth strategies combined with Artificial Intelligence (AI) applications, in which agricultural and food-processing waste materials are converted into valuable natural colour compounds. Common food industry waste materials, including fruit peels, vegetable pomace, flower extracts, and plant-based byproducts, have been successfully utilised to obtain a wide range of natural colourants, including anthocyanins, carotenoids, betalains, and chlorophyll. AI-driven machine learning algorithms have been increasingly applied to predict colour stability, pigment concentration, and shelf life of natural colourants extracted from waste materials, significantly improving the efficiency and accuracy of colourant development. Evidence confirms that fruit peel extracts from pomegranate, beetroot, turmeric, and butterfly pea flower contain significantly high levels of natural pigments suitable for various food applications. AI-based predictive modelling has further enabled optimised extraction conditions and formulation parameters, reducing both time and cost in natural colourant production. Waste-derived natural colourants have demonstrated comparable or superior colouring performance, stability, and safety when compared to commonly used synthetic food dyes. This paper concludes that integrating AI technology with waste-to-wealth strategies offers a promising, sustainable, and cost-effective pathway for the development of natural food colourants and strongly supports circular economy principles in the food industry. Further research is recommended to enhance AI model accuracy and establish regulatory frameworks for waste-derived natural food colourants.

Keywords: Anthocyanins; Carotenoids; Butterfly pea flower; Circular economy, Sustainable food production

FORMULATION AND ANALYSIS OF FORTIFIED INFANT FOOD FROM MILLETS AND BY PRODUCTS OF RICE PROCESSING INDUSTRY

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ABSTRACT

NFHS-3, recent survey, indicates 37million of children aged 0- 35months are underweight or stunted, 49% of children aged 0-4 months and 58% of children aged 0-6 months are not exclusively breastfed and breast milk substitutes are required for nutritional requirements. Which are high in cost, not accessible for poor people (under poverty line). The objectives of this study were to formulate and evaluate the infant food using Pearlmillet (*Pennisetum glaucum*), Fingermillet (*Eleusine coracana*) broken rice (*Oryza sativa*) and Green gram (*Vigna radiate*). Two formula were developed, the first Sample1 (S1) with Broken rice-Pearlmillet-Green gram and the second Sample2(S2) with Broken rice-Pearlmillet-Green gram. Each of these cereals were processed and mixed in proportions in order to obtain enriched weaning food . The comparative analysis were performed to check moisture content(%), ash content(%) protein(g/100g), carbhohydrates(g/100g) and other macronutrients. When compared to the standards published by CODEX and Bureau of Indian Standards all the above mentioned analysis were ended in the optimum range. The moisture content for S1-6.593% & S2-7.038. The Protein content for both samples (S1&S2) ranged between 15-17 (g/100g). Further addition of flavors, probiotics and enhancing the taste of the formulation has to be done after the toxicity analysis.

Keywords: Infant Food Formula, Weaning Food, Millets, Nutrients, Nutrient Analysis

SYNTHESIS AND EVALUATION OF COPPER OXIDE NANOPARTICLES FROM FRUIT WASTE: PINEAPPLE, PAPAYA AND BANANA

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ABSTRACT

In India almost 16% of fruits and vegetables wasted annually, and once we consume the edible portions the peel is just considered as wastes. These peels are rich in valuable bioactive compounds such as carotenoids, polyphenols, vitamins and many other. The Ministry Of Food Processing Industries (MFPI) estimated that fruit and vegetables losses to be 12 and 21 million tons. Hence this study suggest fruit waste (pineapple, banana, papaya) mediated green synthesis of copper oxide nanoparticle (NPs) as an eco-friendly solution for efficient utilization of fruit wastes and study was also conducted to investigate the effects of different concentration of (10ppm, 20ppm, 40ppm and 80ppm) CuONPs on seed germination, growth performance, biochemical content in green gram too. Phyto-nano biotechnique method was used for synthesis of CuO NPs. The phytochemical screening of fruit peel waste was carried out by following standard procedures. Characterization of synthesized nanoparticles was done by using UV-Vis., FTIR, SEM and EDX, finally NPs was applied on crops and subsequently, conduct a detailed study to understand the impact of NPs on crop yield projection.The phytochemical screening of fruit peel waste showed that the presence of tannin, saponin, flavonoids, steroids, terpenoids, alkaloids, anthraquinone, polyphenol, glycosides and coumarins. Significant amount of total content of phenols and flavonoids were measured in the fruit peel waste powder. These environmentally benign CuO nanoparticles were further confirmed by UV visible and FTIR spectrum. The size of the nanoparticle ranges from 32 to 92nm with spherical and crystalline nature shape was confirmed by SEM studies. Green gram found to be maximum seed germination, growth performance and biochemical content with the treatment of 20ppm of CuONPs while in case of 10ppm, 40ppm and 80ppm were significantly decreased compare with 20ppm.

Keywords: Green Synthesis, CuONPs, Nanofertilizer, Fruit Waste, Phytochemicals, Plant Growth, Biochemical Analysis.

STRUCTURE -GUIDED DISCOVERY OF HDAC6 INHIBITORS FROM SIDDHA PLANTS FOR CARDIOVASCULAR DISEASE

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ABSTRACT

Cardiovascular diseases (CVDs) remain a leading cause of morbidity and mortality worldwide, necessitating the development of effective and targeted therapeutic strategies. Histone deacetylase 6 (HDAC6) has emerged as a promising therapeutic target due to its role in regulating cellular processes such as inflammation, protein degradation, and stress response. This study focuses on the structure-guided discovery of potential HDAC6 inhibitors derived from selected Siddha medicinal plants, namely shorea robusta Terminalia arjuna, and Phyllanthus emblica. A comprehensive library of phytochemicals from these plants was curated and subjected to in silico screening. Molecular docking using AutoDock was performed to evaluate the binding affinity and interaction patterns of selected ligands with the HDAC6 protein target. The docking results were analyzed based on binding energy scores and key amino acid interactions. Further validation of the top-ranked ligand–protein complexes was carried out using molecular dynamics (MD) simulations to assess the stability and behavior of the complexes over time. The results revealed that several plant-derived compounds exhibited strong binding affinity towards HDAC6 and formed stable interactions within the active site. MD simulation results confirmed the stability of the ligand–protein complexes, indicating consistent binding and minimal structural fluctuations. Notably, compounds from Terminalia arjuna and Phyllanthus emblica showed better stability and interaction profiles. In conclusion, this study highlights the potential of Siddha medicinal plants as a source of novel HDAC6 inhibitors for cardiovascular disease management. The integration of molecular docking and MD simulation provides a reliable computational approach for drug discovery. However, further experimental validation is required to confirm the biological activity of the identified compounds.

Keywords: HDAC6, Molecular Docking, Molecular Dynamics Simulation, Siddha Medicinal Plants, Cardiovascular Disease

DEVELOPMENT OF CATALASE ENZYME-LOADED HYDROGEL FROM SOLANUM TUBEROSUM FOR CHRONIC WOUND HEALING

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ABSTRACT

A major issue in healthcare is chronic wounds. This is caused by the delayed healing of these wounds resulting from oxidative stress, microbial infections, and cell regeneration, which have all failed to regenerate cells at a normal rate. This study aims to develop a hydrogel containing an enzyme (catalase) to regulate reactive oxygen species (ROS) and promote the healing of chronic wounds. Catalase was extracted from potato using a method that utilised homogenization, centrifugation, ammonium sulphate for the precipitation of proteins, and dialysis, along with measuring catalase activity using UV-Visible spectrophotometry, based on the breakdown of hydrogen peroxide. The purified catalase was placed in a Carbopol 940-based hydrophilic hydrogel, which would allow the enzyme to be stable and be delivered in a controlled manner to the chronic wound. The hydrogel was adjusted to physiological pH using triethanolamine to allow it to be compatible with biological tissue. The formulated hydrogel was analysed for physical, chemical, and biological characteristics, e.g. catalase activity, stability, and suitability for use in biomedical applications. The hydrogel's capability in treating chronic wounds was evaluated through the use of an in vitro scratch wound test on the L929 fibroblast cell line. The significance of using catalase within the hydrogel formulation was determined through the above data obtained through the scratch assay by calculating the percentage of closure of the scratch wound at 24 hours and 48 hours after treatment. From the 24-hour time point, the hydrogel exhibited a 58.90% closure, whereas the control exhibited a closure rate of 20.09%. At 48 hours, the hydrogel exhibited a 91.98% closure, whereas the control exhibited a closure rate of 49.98%. This illustrates that catalase within a hydrogel significantly enhances cell proliferation within the hydrogel and promotes the development of new tissue. All in all, the antioxidant properties of these hydrogels, having catalase as part of THEIR composition, are very high. It is also biocompatible, and it will aid in wound healing very efficiently.

Keywords: Chronic Wounds, Catalase, Hydrogel, Oxidative Stress, Wound Healing

GREEN SYNTHESIS OF TITANIUM DIOXIDE NANOPARTICLES BY USING OF VACCINIUM MACROCARPON AND APPLICATION FOR ANTICANCER ACTIVITY

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ABSTRACT

Titanium dioxide nanoparticles (TiO2 NPs) have garnered significant attention in recent years due to their potential applications in various fields, including medicine, energy, and environmental science. Conventional synthesis methods often involve toxic chemicals and harsh conditions, raising concerns about environmental sustainability and human health. This study focuses on the green synthesis of TiO2 NPs using Vaccinium macrocarpon (cranberry) extract, a natural and eco-friendly approach. The cranberry extract acts as a reducing and stabilizing agent, facilitating the formation of TiO2 NPs with enhanced biocompatibility and anticancer properties.The synthesized TiO2 NPs were characterized using various techniques, including UV-Vis spectroscopy, X-ray diffraction (XRD), Scanning electron microscopy (SEM),DLS, and Fourier transform infrared spectroscopy (FTIR). The results revealed the formation of spherical TiO2 NPs with an average size of 20-30 nm and a crystalline anatase structure. The anticancer activity of the synthesized TiO2 NPs was evaluated against human cancer cell lines (A375-melonama cell line) using MTT assay and fluorescence microscopy. The results demonstrated significant cytotoxicity and apoptosis-inducing effects, indicating the potential of cranberry-mediated TiO2 NPs as a promising anticancer therapeutic agent.The green synthesis approach using cranberry extract offers several advantages, including simplicity, cost-effectiveness, and environmental sustainability. This study highlights the potential of Vaccinium macrocarpon as a natural source for the synthesis of TiO2 NPs with enhanced anticancer properties, paving the way for future research in cancer therapy and nanomedicine.

Keywords: Titanium dioxide nanoparticles, green synthesis, Vaccinium macrocarpon, anticancer activity, nanomedicine.

NEURAL NETWORK MODELLING OF CRYSTAL VIOLET DYE REMOVAL USING ACID – ACTIVATED ULVA LACTUCA

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ABSTRACT

Industrialization, urbanization, and rapid population growth have significantly increased the contamination of freshwater resources, particularly by synthetic dyes. Among these, crystal violet (CV), a cationic triphenylmethane dye, is widely used in textile, pharmaceutical, and paper industries and is recognized as a hazardous pollutant due to its high toxicity, chemical stability, and resistance to biodegradation. The presence of CV in water bodies leads to serious environmental and health issues, including reduced light penetration, disruption of aquatic ecosystems, and genotoxic and carcinogenic effects in living organisms. Conventional treatment methods such as coagulation, membrane filtration, and chemical oxidation are often limited by high cost, operational complexity, and secondary pollution problems. In this context, adsorption has emerged as an efficient, economical, and eco-friendly technique for dye removal. The present study focuses on the use of *Ulva Lactuca*, a green marine macroalgae, as a low-cost biosorbent for the removal of crystal violet from aqueous solutions. To enhance its adsorption performance, acid activation using hydrochloric acid was carried out, which improves surface properties by increasing porosity and exposing functional groups. Additionally, microwave-assisted activation was employed to further enhance the adsorption capacity of the biomass. Batch adsorption experiments were conducted to evaluate the effect of key operational parameters such as pH, initial dye concentration, biosorbent dosage, contact time, and temperature. This study highlights the potential of acid-activated *Ulva Lactuca* as an efficient and sustainable biosorbent for CV removal and demonstrates the effectiveness of integrating experimental analysis with ANN Modelling for advanced wastewater treatment applications.

Keywords: Crystal Violet, Biosorption, Ulva Lactuca, Acid Activation, Adsorption Modelling, Artificial Neural Network (ANN)

INCREASE SOLUBILTY AND INHIBIT THE CRYSTAL GROWTH OF POORLY WATER-SOLUBLE ASPIRIN

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ABSTRACT

Poor aqueous solubility remains a critical challenge in improving the bioavailability of many pharmaceutical compounds, including aspirin (acetylsalicylic acids, ASA). The present study aims to enhance the solubility and dissolution characteristics of ASA through the development of polymer- assisted formulations employing hydrophilic carries such as PVP K-30 and peg 20000. The formulations were prepared using suitable solvent- based techniques to archive improved drug dispersion within the polymer matrix. Physicochemical characterization was caried out using differential scanning calorimetry(DSC) and powder X-ray diffraction (PXRD) to evaluate thermal behaviour and crystallinity changes, respectively. The DSC thermograms indicated a reduction in the characteristics melting peak of ASA, suggesting partial amorphization, while PXRD patterns demonstrated decreased intensity of crystalline peaks, confirming reduced crystallinity. Solubility studies revealed a significant enhancement in drug solubility compared to pure ASA, attribute to improved wettability and molecular dispersion within the polymer network. The combined analytical results indicate the polymer-assisted formulation is an effective strategy for improving the physicochemical properties of poorly soluble drugs. In conclusion, the developed formulations exh promising potential for enhancing the solubility and performance of ASA, which may contribute to improved therapeutic efficacy.

Keywords: Solubility Enhancement, Polymeric Carries, Amorphization

DEVELOPMENT OF HEMOSTATIC SPONGES USING FISH BONE-DERIVED HYDROXYAPATITE AND PLANT-BASED CELLULOSE

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ABSTRACT

In the present study, multifunctional curcumin-loaded hemostatic sponges were fabricated using a sustainable and biocompatible composite of cellulose nanofibers (CNF), polyvinyl alcohol (PVA), glycerol, citric acid, and hydroxyapatite (HAp). The CNF was extracted from *Crossandra* plant husk, while hydroxyapatite was synthesised from *Channa marulius* fish bone waste, promoting environmental sustainability and resource valorisation. The fabricated sponges were prepared via crosslinking using citric acid to enhance structural integrity, while glycerol acted as a plasticiser to improve flexibility. The developed sponges were characterised using FTIR, XRD, and SEM, confirming successful incorporation of all components and the formation of an interconnected porous structure. The porous morphology facilitated rapid fluid uptake, which was further supported by swelling studies, demonstrating high swelling capacity essential for effective blood absorption and clot formation. Drug release studies revealed a sustained release profile of curcumin under physiological conditions, with release behaviour influenced by pH variations. The release kinetics followed a controlled diffusion mechanism, sustained release is beneficial for reducing inflammation and preventing microbial infection during the healing process. Among the developed sponges (CNF/PVA, CNF/PVA/CU, CNF/PVA/HAp, CNF/PVA/HAp/CU), the developed CNF/PVA/HAp/curcumin composite sponge exhibited excellent swelling behaviour, controlled drug release kinetics, and promising structural and functional properties. These findings suggest that the fabricated sponge holds significant potential as a sustainable, multifunctional hemostatic dressing for managing post-extraction bleeding, particularly in anticoagulant patients, while also promoting wound healing and reducing the risk of infection.

Keywords: Hemostatic Sponge; Anticoagulant Intaking Patients; Oral Bleeding; Bio Waste-Derived Biomaterials; Cellulose Nanofibers; Hydroxyapatite; Curcumin; Drug Release.

MICROWAVE-ASSISTED EXTRACTION OF VIGNA MUNGO PODS DERIVED LIGNIN FOR HIGH PERFORMANCE SUNSCREENS

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ABSTRACT

This study offers a thorough examination of the extraction, bleaching, characterization, and sunscreen application of lignin sourced from *Vigna mungo* pod waste. Compositional analysis validated significant concentrations of cellulose, hemicellulose, and lignin in the raw biomass. Lignin was selectively isolated through acid-assisted (H_2SO_4) pretreatment combined with microwave irradiation. Extraction parameters were systematically optimized using (RSM) and (ANN) modelling, resulting in a maximum lignin yield of 83% while maintaining UV-absorbing functional groups. Subsequently, oxidative bleaching was done on the crude lignin to lower the number of chromophores. This made a light-colored lignin fraction that was better for sunscreen application. UV-Vis, FTIR, XRD, and SEM were used for structural and physicochemical characterization of extracted lignin. Lignin incorporated formulations for sunscreen were developed and evaluated for in vitro photoprotective performance. The control SPF recorded as a 2.6, whereas extracted lignin at 1%,5% and 10% concentrations SPF values obtained 5.0, 7.8, 10.3 respectively. Notably, bleached lignin demonstrated superior photoprotective efficacy, achieving SPF values of 6.4, 11.0, and 15.6 at the corresponding concentrations, reflecting the benefit of controlled modification of chromophores on UV-blocking performance. Antioxidant activity of the extracted lignin and bleached lignin was determined indicating meaningful radical-scavenging capacity. Additionally, both lignin samples displayed significantly enhanced antibacterial activities against both *Escherichia coli* and *Staphylococcus aureus*. This study establishes *V. mungo* pod waste-derived lignin as a multifunctional, renewable, and UV-protective ingredient, underscoring its promising potential for value-added application in cosmetics and functional materials.

Keywords: Agro-industrial waste valorization, Vigna mungo pod biomass, lignin, Microwave-assisted extraction, Anti-bacterial, Antioxidant, Protein denaturation inhibition, SPF enhancement.

SYNTHESIS OF TITANIUM OXIDE NANOPARTICLES WITH MALPIGHIA EMARGINATA LEAVES FOR ANTIOXIDANT AND ANTI-AGING ACTIVITY

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ABSTRACT:

Ageing is an inevitable process that every creature on earth must endure. It will appear on all parts of our skin, particularly our faces. This may be separated into two categories such as intrinsic ageing and extrinsic ageing. *Malpighia emarginata* leaves are acting as a powerful natural antioxidant that supports immune function, skin health (anti-aging, whitening) and reduces inflammation and supplements targeting free radical damage and related diseases like obesity. *Malpighia emarginata* leaves are used to strengthens the immune system, promotes collagen synthesis and acts as an antioxidant in the body. The research focuses on titanium oxide nanoparticle biogenesis and their potential use in environmentally friendly technological applications. Titanium oxide nanoparticles are commonly used in lotions, creams, skin ointments, and UV protection products because they shield the skin from UVA and UVB rays. Titanium oxide nanoparticles were synthesized from *Malpighia Emarginata* leaves under *invitro studies*. The qualitative analysis of phytochemical compounds using *Malpighia emarginata* contained terpenoids, flavonoids, saponins, tannins, alkaloids, steroids, glycosides, proteins, coumarin, emodin, anthraquinone, anthocyanin, carbohydrates, cardiac glycosides, xanthoproteins and phenols. The phytochemical study of *Malpighia emarginata* extract has the highest content of tannin, phenol, alkaloid, flavonoids, terpenoids and saponin. The nanoparticles were investigated with FTIR, UV-Visible spectroscopy, X-ray diffraction, SEM, and EDAX. *Malpighia Emarginata* leaf extract was analysed using TiO_2 nanoparticles, which demonstrated strong anti-aging potential by strongly inhibiting the enzymes collagenase (81.08), and elastase (80.35). This study has confirmed the traditional use of *Malpighia Emarginata* medicinal plant for longevity which will be beneficial for further development of anti-aging products.

Keywords: Titanium oxide, Malpighia Emarginata, Collagenase, Elastase, Antioxidant

PREPARATION OF BIOACTIVE PACKAGING FILM BY USING GUAR GUM EXTRACT AND ZINC OXIDE NANOPARTICLE

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ABSTRACT

This study reports the preparation and characterization of a bioactive packaging film prepared from galactomannan incorporated with zinc oxide nanoparticles (ZnO NPs) to enhance food preservation and safety. Biopolymer-based films were prepared using galactomannan synthesized from guar gum which blends with polyvinyl alcohol (PVA), into which green-synthesized zinc oxide nanoparticles were uniformly dispersed at varying concentrations (typically 0.5–5 wt%) via solution casting. The nanoparticles were first synthesized using eco-friendly methods (e.g., plant-based extracts) and then incorporated into the galactomannan and polymer solution under controlled stirring to ensure good dispersion and film stability. The resulting films were cast on glass plates, dried under mild conditions, and conditioned to obtain transparent, flexible bioactive sheets with improved mechanical strength, reduced water vapor permeability, and enhanced UV-blocking properties. Characterization studies revealed that the ZnO-incorporated films exhibited effective antimicrobial activity against common foodborne pathogens such as *Escherichia coli* and *Staphylococcus aureus*, with increasing nanoparticle loading leading to larger inhibition zones and improved microbial inhibition. The films also showed good antioxidant capacity and maintained structural integrity, chemical stability, and biodegradability, with no significant cytotoxicity observed in normal cell lines at recommended loadings. Overall, the prepared bioactive packaging film incorporated with zinc oxide nanoparticles demonstrates strong potential as a sustainable, active food-packaging material capable of extending shelf life and improving the safety of perishable food products.

Keywords: Zinc Oxide Nanoparticles, Bioactive Packaging Film, Antimicrobial Packaging, Biodegradable Packaging, Green Synthesis.

DEVELOPMENT OF ZINC OXIDE NANOPARTICLE-LOADED ALOE VERAGEL USING BANANA PEEL (*MUSA SAPIENTUM*) EXTRACT FOR SKIN REGENERATION

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ABSTRACT

This study reports the green synthesis of zinc oxide (ZnO) nanoparticles using banana peel (*Musa sapientum*) extract and their incorporation into Aloe vera gel to develop a bioactive formulation for skin regeneration. Control ZnO nanoparticles exhibited well-defined spherical morphology (20–40 nm), while banana peel-mediated ZnO showed quasi-spherical shapes with slight aggregation due to phytochemical capping. Aloe vera-loaded ZnO nanogel formed larger aggregated clusters (30–60 nm), indicating enhanced stability from polysaccharides and bioactive compounds. FTIR analysis confirmed hydroxyl, amide, and phenolic functional groups along with characteristic Zn–O bonds, demonstrating effective nanoparticle synthesis and strong interactions with biomolecules. XRD verified a hexagonal wurtzite crystalline structure, with crystallite sizes increasing from ~22 nm in control to ~35 nm in Aloe Vera nanogel and UV–Vis spectroscopy revealed absorption peaks at 365–375 nm with red shifts in green-synthesised samples, indicating surface modification and semiconducting behaviour. Biological evaluation demonstrated multifunctional bioactivity: HRBC membrane stabilisation assay showed anti-inflammatory potential with Aloe Vera–nanoparticle nanogel, achieving 58.33% stabilization compared to banana peel extract (50%), nanoparticles + banana peel (25%), and control (0%). Antimicrobial testing against *Staphylococcus aureus* demonstrated significant inhibitory activity, with the nanogel showing the strongest effect. Overall, the ZnO nanoparticle-loaded Aloe Vera gel exhibits favourable physicochemical properties and multifunctional bioactivities, highlighting its potential as a safe, effective, and eco-friendly therapeutic formulation for skin regeneration, wound healing, and antimicrobial applications, emphasising the value of combining green-synthesised nanoparticles with natural bioactive gels for biomedical use.

Keywords: Banana Peel, Zinc Oxide Nanoparticles, Aloe Vera Nano-Gel, Green Synthesis, Skin Regeneration.

ECO-FRIENDLY SYNTHESIS, OPTIMIZATION AND ANTI-CANCER EVALUATION OF ZINC OXIDE NANOPARTICLES DERIVED FROM *ENTEROMORPHA COMPRESSA*

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ABSTRACT

Green nanotechnology is increasingly being explored as a safer and more sustainable way to develop effective anticancer agents. In this study, zinc oxide nanoparticles (ZnO NPs) were synthesized using the marine green seaweed *Enteromorpha compressa*, which is naturally rich in bioactive compounds capable of supporting nanoparticle formation. These plant-derived compounds not only aid in stabilizing the nanoparticles but also enhance their biological activity. The synthesized ZnO nanoparticles demonstrated suitable physicochemical properties, indicating the successful formation of stable nanostructures with potential biomedical relevance. Their anticancer activity was evaluated against the human colon cancer (HT-29) cell line, where they showed a clear concentration-dependent reduction in cell viability. This suggests that the nanoparticles effectively interfere with cancer cell survival. The observed cytotoxic effect is likely linked to the generation of reactive oxygen species (ROS), which can induce oxidative stress, disrupt mitochondrial function, and trigger programmed cell death in cancer cells. What makes this approach particularly valuable is its eco-friendly nature, as it avoids the use of harmful chemicals typically involved in conventional nanoparticle synthesis. In addition, the use of marine resources like *Enteromorpha compressa* adds a novel dimension to nanomedicine by combining natural bioactivity with advanced nanotechnology. Overall, this study highlights the potential of seaweed-mediated ZnO nanoparticles as promising candidates for anticancer applications and supports the growing interest in green synthesis methods for developing safer and more effective therapeutic solutions.

Keywords: Enteromorpha compressa, Zinc oxide nanoparticles (ZnO NPs), Green nanotechnology,, Anticancer activity, HT-29 cell line, MTT assay.

PLANT-DERIVED COPPER NANOPARTICLE-INFUSED COTTON FOR ENHANCED WOUND HEALING APPLICATION

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ABSTRACT

The present study focuses on the biogenic synthesis of copper nanoparticles using Calotropis gigantea extracts and the evaluation of their antimicrobial, anti-inflammatory, blood clotting, and wound healing potential through nanoparticle-infused cotton. This plant-mediated approach offers an eco-friendly and cost-effective alternative to conventional chemical synthesis by utilizing natural biomolecules for reduction and stabilization. The formation of nanoparticles was initially indicated by a visible colour change during the reaction process. The synthesized nanoparticles were characterized using UV–Visible spectroscopy, FTIR, SEM, and XRD analyses. UV–Visible spectroscopy revealed characteristic surface plasmon resonance peaks at 420 nm, 430 nm, and 440 nm for leaf-, flower-, and milk-mediated nanoparticles, respectively, indicating differences in particle size and dispersion. FTIR analysis confirmed the presence of functional groups. SEM images showed well-defined spherical to quasi-spherical nanoparticles. XRD analysis confirmed the crystalline nature of the nanoparticles. The antimicrobial activity evaluated against Staph*ylococcus aureus* using the agar well diffusion method showed significant zones of inhibition, exhibiting strong antibacterial activity. Anti-inflammatory activity assessed by the HRBC membrane stabilization method revealed maximum inhibition for leaf and flower nanoparticles (100%), followed by leaf cotton (91%), indicating enhanced activity compared to crude extracts. Blood clotting assay results demonstrated that flower-mediated nanoparticles exhibited higher clotting activity (60%) compared to leaf nanoparticles (34%), showing concentration-dependent effects. Furthermore, nanoparticle-infused cotton demonstrated improved antimicrobial efficiency, confirming successful functionalization and sustained activity. Overall, the findings highlight that Calotropis gigantea-mediated copper nanoparticles and their cotton-based composites possess significant biomedical potential for wound healing applications.

Keywords: Biogenic Synthesis, Copper Nanoparticles, Calotropis Gigantea, Nanoparticle-Coated Cotton, Wound Healing

ECO-FRIENDLY BIOSYNTHESIS OF IRON OXIDE NANOPARTICLES VIA PROTEUS VULGARIS AND THEIR MULTIFUNCTIONAL BIOMEDICAL APPLICATIONS

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ABSTRACT

Nanotechnology has emerged as a rapidly advancing field in biomedical research due to its potential to engineer materials with unique physicochemical properties at the nanoscale. Among these, iron oxide nanoparticles have attracted significant attention because of their biocompatibility, magnetic behaviour, and wide-ranging therapeutic applications. However, conventional synthesis techniques often rely on toxic chemicals and energy-intensive processes, highlighting the need for sustainable alternatives. In this study, iron oxide nanoparticles were synthesized using an eco-friendly biological approach employing *Proteus vulgaris* cell-free supernatant as a reducing and stabilizing agent. The successful formation of nanoparticles was confirmed by UV-Visible spectroscopy, which showed a characteristic absorption peak between 200-300 nm, and FTIR analysis, which revealed functional groups such as -OH, -NH, and Fe-O bonds, indicating the involvement of microbial biomolecules in nanoparticle formation and stabilization. The synthesized nanoparticles exhibited notable biological activities. Antioxidant activity reached a maximum of 59.68% at 3.33 mg/mL, while anti-inflammatory studies demonstrated 55% inhibition of protein denaturation and up to 78% inhibition in the hemolysis assay. Antimicrobial activity showed concentration-dependent effects, with maximum zones of inhibition of 17 mm against *Staphylococcus aureus*, 15 mm against *Escherichia coli*, and 19 mm against *Aspergillus niger*. Importantly, the anti-ulcer activity displayed a peak inhibition of 81% at 2.27 mg/mL, indicating strong gastroprotective efficacy at lower concentrations. Overall, the findings highlight that biologically synthesized iron oxide nanoparticles possess significant multifunctional therapeutic potential and could serve as safe, effective, and sustainable alternatives for future biomedical applications.

Keywords: Iron oxide nanoparticles, *Proteus vulgaris*, Bacterial synthesis, Antioxidant activity, Antimicrobial activity, Anti-ulcer activity

ISOLATION AND MOLECULAR CHARACTERIZATION OF PATHOGEN CAUSING SIGATOKA LEAF SPOT DISEASE OF BANANA

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ABSTRACT

Banana is a major fruit crop cultivated widely in tropical and subtropical regions, playing a vital role in food security and economic development. However, its production is severely affected by several foliar diseases, among which Sigatoka leaf spot disease is one of the most destructive. This disease significantly reduces photosynthetic efficiency, leading to poor fruit development and yield losses. The Sigatoka disease complex is caused by closely related fungal pathogens, namely *Pseudocercospora musae, Pseudocercospora fijiensis, and Pseudocercospora eumusae,* making accurate identification essential for effective disease management.The present study was undertaken to isolate and molecularly characterize the pathogen responsible for Sigatoka leaf spot disease of banana. Infected leaf samples exhibiting typical symptoms were collected and processed under laboratory conditions. The pathogen was isolated using standard culture techniques, and pure cultures were obtained for further analysis. Morphological characterization was carried out based on colony appearance, growth pattern, and microscopic features such as conidia and conidiophores.For molecular characterization, genomic DNA was extracted using the CTAB method, ensuring good quality and purity of DNA. The extracted DNA was subjected to polymerase chain reaction (PCR) using specific primers targeting conserved regions of fungal DNA. The amplified products were analyzed through agarose gel electrophoresis to confirm the presence of the pathogen. The findings of this study provide valuable insights into the detection and characterization of Sigatoka pathogens and contribute to improved disease diagnosis and management strategies in banana cultivation. This work highlights the importance of molecular tools in distinguishing closely related fungal species.

Keywords: Banana, Sigatoka Leaf Spot, Pseudocercospora Musae, Pseudocercospora Fijiensis, Pseudocercospora Eumusae, Foliar Disease, Isolation, Morphological Characterization, Molecular Characterization, CTAB method, PCR,

FORMULATION AND EVALUATION OF HERBAL FACE MASK USING *CLITORIA TERNATEA* AND *CAMELLIA SINENSIS*

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ABSTRACT

This project aims to formulate and evaluate an herbal face mask as a cosmetic-grade product. Cosmetics can be used to clean or protect the body and skin. They are mixtures of chemical compounds from natural or artificial sources. It highlights the medicinal potential of these plants' antibacterial and antioxidant qualities, which help to preserve the skin's protective layer and delay the aging process. To provide specific cosmetic benefits, herbal cosmetics like face masks are made with ethanolic extract of *Clitoria ternatea* and *Camellia sinensis*. Natural extracts of this face mask have several functions, such as antioxidants, anti-aging, anti-inflammatory, and antibacterial. The herbal face mask helps to revitalise the skin, keep it supple, encourage blood circulation, and clear the pores of impurities. The formulated face mask was evaluated for parameters such as pH, organoleptic property, irritability, antioxidant test, and antimicrobial test. The goal of this work is to assess the study of the herbal extract finishing on the face sheet and its qualities. Face masks trap moisture in the skin, creating a film that helps hydrate, moisturise, dry, or exfoliate the skin.

Keywords: Cosmetics, Herbal, Ethanolic Extract, Anti-aging, Antioxidant

GREEN SYNTHESIS OF SILVER NANOPARTICLES FROM TRIDAX PROCUMBENS AS DRUG CARRIER FOR WOUND HEALING

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ABSTRACT

Wound healing is a natural yet complex process where the body works to repair damaged skin and tissues, but infections—especially those caused by antibiotic-resistant microbes—can slow this recovery and lead to complications. Because of this, researchers are increasingly looking for safer and more effective alternatives to traditional treatments. One promising approach is the green synthesis of silver nanoparticles (AgNPs) using medicinal plants, which is eco-friendly, cost-effective, and avoids harmful chemicals. In this study, *Tridax procumbens*, a well-known medicinal plant with antimicrobial and anti-inflammatory properties, is used to synthesize silver nanoparticles. The natural compounds present in the plant help in both forming and stabilizing the nanoparticles, making the process simple and sustainable. These AgNPs are highly effective due to their tiny size and large surface area, allowing them to easily interact with and destroy harmful microbes by damaging their cell membranes and preventing biofilm formation. In addition to their strong antimicrobial action, they also help reduce inflammation and support faster tissue regeneration. Moreover, using these plant-based nanoparticles as drug carriers provides the added benefit of targeted and controlled delivery of therapeutic agents directly to the wound site, improving healing outcomes while minimizing side effects. Overall, green-synthesized silver nanoparticles using *Tridax procumbens* offer a promising and biocompatible solution for advanced wound care and effective tissue repair. Keywords: Green synthesis, Silver nanoparticles (AgNPs), *Tridax procumbens*, Wound healing, Drug delivery, Antimicrobial activity, Nanotechnology, Biofilm inhibition.

Keywords: Green synthesis, Silver nanoparticles (AgNPs), *Tridax procumbens*, Wound healing , Nanotechnology, Biofilm inhibition.

IMPROVING THE DRUG EFFICACY OF SERRATIOPEPTIDASE BY COUPLING WITH TITANIUM NANOPARTICLES USING AMINOPROPYL SILANE

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ABSTRACT

Serratiopeptidase, an enzyme from Serratia marcescens, is known for its anti-inflammation, anti-swelling effects, and pain relief abilities by breaking down substances that cause inflammation. Due to its instability, short half-life, and degradation by enzymes, serratiopeptidase has limited clinical applications because it does not remain in the bloodstream long enough to be effective. Therefore, this research presents a way to modify the surfaces of biocompatible, stable titanium dioxide nanoparticles (TiO2 NP) that have a large surface area to be used as a nanoparticle drug delivery system (NDDS). To provide a surface for attaching serratiopeptidase, the surface of TiO2 NP was treated with aminopropyltriethoxysilane (APTES), which contains amine (–NH2) groups. Glutaraldehyde was then used to crosslink the TiO2 NP and covalently bond and encapsulate serratiopeptidase, thus creating stable nanoconjugates. Fourier Transform Infrared spectroscopy and zeta potential measurements were used to characterize the APTES-modified TiO2 nanoparticles. This helped confirm that the functionalization worked and that the enzyme and nanoparticles were successfully combined. Ultraviolet-visible spectrophotometry revealed that 60.56% of the serratiopeptidase was encapsulated in the TiO2 NP. Thiopeptidase enzyme assays demonstrated that the thiopeptidase retained enzymatic activity, while the dialysis-based release profiles of the nanoconjugates provided for sustained and controlled release when compared with free enzyme

Keywords: Serratiopeptidase, Serratiamarcescens, TiO2nanoparticles, Nanoparticle drug, delivery system (NDDS), APTES functionalization, Glutaraldehyde crosslinking, Enzyme, encapsulation, Anti-inflammatory enzyme,

ANTI-UROLITHIOTIC AND ANTI-MICROBIAL ACTIVITY OF ISOLATED FLAVONOID COMPOUND FROM THE AEGLE MARMELOS AGAINST UTI CAUSING STRUVITE CRYSTAL UNDER IN VITRO STUDY

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ABSTRACT

Medicinal Plants have been considered to possess bioactive compounds with a broad range of pharmacological activities. Amongst the medicinal plants, *Aegle marmelos* is used to treat different health-related issues. In the present study, an effort has been made to isolate and characterize a flavonoid-type compound from the fruit extract of *Aegle marmelos* and investigate its anti-urolithiatic and antimicrobial activities against urinary tract infection-causing microbes responsible for struvite kidney stone formation. Chromatography was used to separate and purify the isolated compound from the plant extract. The structure of the isolated compound was established by using different spectroscopic techniques. From the data, it was found that the isolated compound possesses a structure of 2-(3,4-dihydroxyphenyl)-3,5,7-trihydroxychromen-4-one. The anti-urolithiatic and antimicrobial activity of the isolated compound was evaluated by using the gel diffusion technique and the disc diffusion assay under an *in vitro* study. From the data, it was found that with an increase in the concentration of the isolated compound, the weight of the crystals was gradually reduced from the control 2.97g to the treated 5% of 0.40g. The antimicrobial activity of isolated compounds showed a maximum zone of inhibition of *Pseudomonas aeruginosa (5 mm)* and *Candida albicans* (5 mm) at a concentration of 100 µg/ml. Hence, it can be concluded that the isolated compound that is 2-(3,4-dihydroxyphenyl)-3,5,7-trihydroxychromen-4-one, from the fruit extract of *Aegle marmelos*, possesses significant anti-urolithiatic and antimicrobial activities and can be used as a potent drug to prevent urinary tract infection due to struvite kidney stone formation.

Keywords: *Aegle Marmelos*, Quercetin, Flavonoids, Anti-Urolithiatic, Antimicrobial, Struvite Crystals

QUICK DETECTION OF FUSARIUM OXYSPORUM F. SP. CUBENSE (FOC) INFECTED BANANA PLANT SAMPLES

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ABSTRACT

Banana (Musa spp.) is one of the most important fruit crops globally, serving as a staple food and a major source of income for millions of farmers. However, banana production is severely affected by Fusarium wilt, a destructive soil-borne disease caused by Fusarium oxysporum f. sp. cubense (Foc). This pathogen infects the plant through the roots and colonizes the vascular tissues, leading to blockage of water transport, yellowing of leaves, wilting, and eventual plant death. Due to its ability to survive in soil for extended periods and the absence of effective chemical control measures, the disease poses a significant challenge to sustainable banana cultivation. The present study focuses on the rapid detection of Fusarium oxysporum f. sp. cubense in infected banana plant samples collected from various regions of India. Two different approaches, namely direct and indirect methods, were employed to isolate and identify the pathogen. The indirect method involved sample collection, isolation of infected tissues, culturing on suitable media, observation of fungal growth, and morphological as well as microscopic identification. In contrast, the direct method included sample grinding, DNA extraction, protein separation, genomic DNA analysis, and polymerase chain reaction (PCR) confirmation for precise detection. The results demonstrated that both methods were effective in identifying the presence of the pathogen; however, the direct method proved to be faster and more efficient, enabling detection within a shorter time frame. The successful confirmation of the pathogen using molecular techniques highlights the reliability and accuracy of rapid diagnostic approaches. This study emphasizes the importance of early detection in managing Fusarium wilt and preventing its spread. Rapid and accurate identification of the pathogen can aid in implementing timely control strategies, selecting resistant varieties, and improving disease management practices. Ultimately, this approach contributes to sustainable banana production, enhanced crop protection, and improved food security.

Keywords: Banana (*Musa spp.*), Fusarium Wilt, *Fusarium oxysporum* f. sp. *cubense (Foc*), Soil-borne pathogen,

ISOLATION AND CHARACTERIZATION OF LDPE DEGRADING BACTERIA FROM ENVIRONMENTAL SAMPLES

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ABSTRACT

Low-density polyethylene (LDPE) is one of the most widely used plastics due to its flexibility, durability, and low cost. However, its resistance to natural degradation has led to severe environmental accumulation, posing significant ecological and health challenges. This study focuses on the isolation and characterization of LDPE-degrading bacteria from environmental samples such as soil, landfill sites, and wastewater. These habitats are considered potential reservoirs of microorganisms adapted to utilize synthetic polymers as carbon sources. Samples were collected and subjected to enrichment culture techniques using LDPE as the sole carbon source to selectively promote the growth of plastic-degrading microbes. Bacterial isolates were obtained through serial dilution and plating methods, followed by screening for degradation potential using weight loss analysis, clear zone formation, and changes in polymer surface morphology. Further characterization of efficient isolates was carried out using biochemical tests and molecular identification techniques such as 16S rRNA sequencing. The study also investigates factors influencing degradation, including temperature, pH, and incubation time. Advanced analytical methods such as scanning electron microscopy (SEM) and Fourier-transform infrared spectroscopy (FTIR) were employed to confirm structural and chemical changes in LDPE films after microbial treatment. Results indicated that certain bacterial strains exhibit significant LDPE degradation ability, suggesting their potential application in bioremediation. Overall, this research contributes to understanding the role of naturally occurring bacteria in plastic degradation and highlights an eco-friendly approach to managing polyethylene waste. The identification of efficient LDPE-degrading bacteria can pave the way for developing sustainable strategies to reduce plastic pollution and mitigate its environmental impact.

Keywords: LDPE degradation, Polyethylene waste, Plastic biodegradation, Environmental samples, Bacterial isolation.

ANTICANCER ACTIVITY OF BROCCOLI ON OXIDATIVE STRESS–INDUCED LIVER CANCER CELLS

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ABSTRACT

Liver cancer, particularly hepatocellular carcinoma (HCC), is one of the leading causes of cancer-related mortality worldwide. A major contributing factor in the development and progression of liver cancer is oxidative stress, which arises due to an imbalance between reactive oxygen species (ROS) and the body's antioxidant defense system. This imbalance leads to cellular damage, DNA mutations, and uncontrolled cell proliferation. The present study investigates the antioxidant and anticancer potential of broccoli (*Brassica oleracea*) leaf extracts against oxidative stress–induced liver cancer cells. Broccoli is known to be rich in bioactive compounds such as sulforaphane, glucosinolates, flavonoids, and phenolic compounds, which exhibit strong antioxidant and chemoprotective activities. Preliminary phytochemical screening and thin-layer chromatography (TLC) analysis were performed to identify the presence of bioactive constituents. Human liver cancer (HepG2) cells were cultured under controlled conditions and subjected to oxidative stress using hydrogen peroxide (H_2O_2). The cells were then treated with varying concentrations of broccoli leaf extract for a specified duration. The cytotoxic and anticancer effects were evaluated using the MTT assay, which measures cell viability based on mitochondrial activity. The results indicated that broccoli leaf extract exhibited significant antioxidant activity and effectively reduced oxidative stress–induced damage in liver cancer cells. A decrease in cell viability was observed with increasing concentrations of the extract, suggesting its potential role in inhibiting cancer cell growth. In conclusion, this study highlights that broccoli leaves, often considered agricultural waste, possess promising antioxidant and anticancer properties. These findings suggest that broccoli leaf extract could serve as a potential natural therapeutic agent for liver cancer. However, further in-depth studies and clinical validations are required to establish its efficacy and application in cancer treatment.

Keywords: Broccoli Anticancer, Anticancer activity, Oxidative stress, Reactive Oxygen Species (ROS), Hepatocellular carcinoma (HCC)

ANTIOBESITY AND ANTIMICROBIAL ACTIVITY OF SYNTHESIZED COPPER OXIDE NANOPARTICLE USING *COLEUS FORSKOHLII* TUBEROSA ROOOTS UNDER IN VITRO STUDY

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ABSTRACT

Obesity is a chronic Disease. It can be triggered by environmental factors such as a high-calorie diet and lack of physical activity. Obesity has mainly two types: Type I and Type II. Type I Obesity is due to the excessive intake of calories and lack of physical activity, and Type II Obesity is due to hypothyroidism (underactive thyroid), Cushing's syndrome (high cortisol levels). *Coleus forskohlii* is rich in bioactive compounds, such as terpenoids, Flavanoids, Sapponin, Tannins, Alkaloids, Steroids, Glycosides, Phlotatannins, Protein, coumarin, Emodin, Anthraquinone, anthranilic acid, Carbohydrate, leucoanthocyanine, Cardiac glycoside, Xantho protein, and phenol. The potential of green synthesis for the sustainable production of copper nanoparticles has been explored for applications in modern equipment. Typically, various chemical methods that are not environmentally friendly are used to synthesise nanoparticles. In the green synthesis approach, Coleus forskohlii root extract is utilised to produce copper nanoparticles by treating the extract of Coleus forskohlii, which should be produced after 60 minutes of treatment with a 3 mM cupric sulphate ethanol solution. FTIR, XRD, and UV-visible spectroscopy are some of the methods used to analyse copper nanoparticles. X-ray diffraction (XRD) confirmed the cubic crystal structure of the nanostructures. The produced copper nanoparticles showed a high percentage of inhibition in the anti-obesity test. The result of the synthesised copper nanoparticles by using the root extract of Coleus forskohlii showed the inhibition of pancreatic lipase assay, 80.95 and alpha-amylase 81.41 at a concentration of 100(µg/ml). The antibacterial activity showed the largest zones of inhibition against Pseudomonas aeruginosa and Staphylococcus aureus (6 mm), while Escherichia coli exhibited the smallest zone (3 mm). At the same concentration of 100µg/ml, the antifungal activity revealed that Aspergillus flavus had the largest zone of inhibition (5mm) and Candida albicans had the smallest (4mm).

Keywords: Copper oxide, *Coleus Forskohlii*, Antiobesity, Antimicrobial.

EXTRACTION AND IMMOBILIZATION OF AMYLASE ENZYME ON NANOPARTICLES FOR DEVELOPMENT OF STARCH DEGRADING DETERGENT ADDITIVES

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ABSTRACT

Enzymes are biological catalysts widely utilized in industrial applications, particularly in the detergent industry, where they enhance the removal of various stains. Among these, amylases play a crucial role in breaking down starch-based stains commonly found on fabrics. Conventional detergents often rely on high temperatures and harsh chemicals for effective stain removal, leading to increased energy consumption and potential fabric damage. The incorporation of amylase enzymes provides an eco-friendly and energy-efficient alternative by enabling effective starch degradation under milder conditions.Despite their advantages, free enzymes in detergent formulations are associated with limitations such as low stability, sensitivity to environmental conditions, reduced reusability, and loss of activity during storage. To address these challenges, enzyme immobilization has emerged as a promising strategy. Immobilization involves attaching or entrapping enzymes onto suitable support materials, thereby enhancing their stability, operational efficiency, and resistance to temperature and pH variations.Nanoparticles have gained significant attention as support materials for enzyme immobilization due to their high surface area, improved enzyme binding capacity, enhanced catalytic performance, and increased stability.. The integration of enzyme extraction, purification, and nanoparticle-based immobilization represents an advanced approach for developing efficient and durable detergent additives.Therefore, the present study focuses on the extraction and immobilization of amylase enzyme onto nanoparticles for the development of improved starch-degrading detergent formulations. This approach aims to enhance enzyme stability, activity, and reusability, contributing to sustainable, cost-effective, and high-performance detergent systems.

Keywords: Amylase, Enzyme Immobilization, Nanoparticles, Starch Degradation, Detergent Additives, *Bacillus* Species, Enzyme Stability, Eco-Friendly Detergents.

HIGH CELL DENSITY CULTIVATION OF PROBIOTIC BIOMASS USING FERMENTATION TECHNOLOGY AND ITS MAXIMIZATION

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ABSTRACT

Probiotics have a significant impact on the growth and well-being of aquatic species like shrimp and fish. The aim of the current study was to maximize probiotic biomass using fermentation technology and high cell density cultivation. Both batch and fed-batch fermentation techniques were used to grow the probiotic bacteria *Bacillus macerans*. Initially, the Plackett–Burman design was employed to optimize the culture medium by evaluating various parameters. In order to identify the ideal circumstances for maximum biomass production, significant variables were further adjusted using response surface methodology (RSM) based on the Box-Behnken design. Different carbon sources were screened to identify the most suitable carbon source for enhanced growth and biomass production. To increase biomass yield and lower production costs, a variety of nitrogen sources, including novel nitrogen sources were also examined. Additionally, pH and other process factors were improved, and the ideal pH for maximal growth was found. Moreover, amylase production was noted during fermentation, suggesting that it could be a value added product. Thus, this work shows how to cultivate *Bacillus macerans* at high cell density for probiotic uses in aquaculture in an effective and scalable manner.

Keywords: Probiotic Biomass Production, *Bacillus Macerans*, Plackett–Burman Design, High Cell Density Cultivation, Batch, Fed-Batch Fermentation.

FORMULATION, AND EVALUATION OF ENZYME-IMMOBILIZED SILVER NANOPARTICLES FOR ANTI-ACNE APPLICATION

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ABSTRACT

Acne is one of the most prevalent dermatological disorders affecting adolescents and young adults worldwide, primarily resulting from the blockage and inflammation of hair follicles and sebaceous glands. This condition is influenced by excessive sebum production, hormonal imbalance, and microbial colonization, particularly by *Cutibacterium acnes*. Conventional acne treatments such as topical antibiotics, benzoyl peroxide, and retinoids are widely used; however, their prolonged application may lead to adverse effects including skin irritation and the development of antibiotic resistance. This has created a need for alternative therapeutic strategies that are both effective and safe. In recent years, nanotechnology has gained significant attention in biomedical applications due to its ability to enhance drug delivery, improve antimicrobial activity, and increase therapeutic efficacy. Among various nanomaterials, silver nanoparticles have emerged as promising candidates owing to their potent antimicrobial, anti-inflammatory, and wound-healing properties. Their nanoscale size and high surface area facilitate enhanced interaction with microbial cells, thereby exhibiting strong antibacterial activity against acne-causing pathogens. Enzymes, as highly specific biological catalysts, offer additional advantages in therapeutic applications. Papain, a proteolytic enzyme derived from *Carica papaya*, is known for its ability to break down proteins and promote the removal of dead skin cells. In this study, papaya leaves were selected as a source of papain due to their availability, cost-effectiveness, and rich composition of bioactive compounds, including antioxidants and anti-inflammatory agents. This approach represents a promising alternative to conventional therapies by combining natural bioactive compounds with advanced nanotechnology for improved dermatological care.

Keywords: Acne, *Cutibacterium Acnes*, Silver Nanoparticles, Papain Enzyme, Papaya Leaves (*Carica Papaya*), Enzyme Immobilization, Sodium Alginate, Antimicrobial Activity, Nanotechnology, Anti-Acne Gel Formulation.

SMART FOOT STEP ELECTRICITY GENERATION

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ABSTRACT

The Smart Footstep Electricity Generation project is an innovative system that generates electrical energy from human footsteps using piezoelectric sensors. When a person walks or steps on the platform, mechanical pressure is applied to the sensors, which convert it into electrical energy through the piezoelectric effect. This generated energy is then rectified, regulated, and stored in a rechargeable battery for later use an LCD display shows the energy generated and the number of footsteps. This system can be effectively implemented in crowded areas like railway stations, malls, and pathways where continuous human movement is available. Overall, it is an eco-friendly, cost effective, and sustainable method to produce small-scale electricity and promote renewable energy awareness.

Keywords: Footstep Electricity Generation, Piezoelectric Sensors, Renewable Energy.

AI- ENABLE SMART EMERGENCY FIRST AID SYSTEM

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ABSTRACT

The AI-enabled smart emergency first aid system is an innovative healthcare solution designed to provide immediate and effective assistance during medical emergencies. This system integrates artificial intelligence, sensors, and communication technologies to assess a patient's condition in real time and deliver appropriate first aid guidance. It is equipped with vital sign monitoring sensors such as heart rate, temperature, and oxygen level detectors, which continuously analyze the patient's health status. Using AI algorithms, the system can quickly identify critical conditions like cardiac arrest, bleeding, or respiratory distress and suggest suitable first aid procedures through voice instructions or a digital display. In addition, it can automatically alert nearby hospitals, emergency services, and registered contacts by sharing the patient's location and condition. The system is especially useful in remote areas, accident sites, and situations where immediate medical help is not available. It reduces response time, minimizes human error, and improves survival rates by ensuring timely intervention. Overall, this smart first aid system represents a significant advancement in emergency healthcare, combining technology and medical knowledge to save lives efficiently and effectively.

Keywords: First aid system, AI algorithms, Sensors, Remote areas.

SMART ABDOMEN SUPPORTING BELT FOR MATERNAL AND FETAL HEALTH MONITORING

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ABSTRACT

Pregnancy is one of the most critical and delicate phases in a woman's life. During this period, continuous and accurate monitoring of maternal health and fetal well-being is of utmost importance to prevent adverse outcomes such as preterm birth, fetal distress, maternal hypertension, and other complications. Conventional monitoring methods typically require hospital visits and the use of dedicated clinical equipment, which may not always be accessible or affordable for pregnant women, especially in rural and semi urban areas. This necessitates the development of a portable, affordable, and non invasive solution that can be used for continuous monitoring during daily activities. This project presents the design and development of a Wearable Smart Pregnancy Monitoring Belt for Fetal Movement Detection and Maternal Health Tracking using Internet of Things (IoT) technology. The proposed system integrates multiple biomedical sensors into a comfortable and wearable belt that can be worn throughout the day without causing inconvenience to the pregnant woman. The belt incorporates the MAX30100 pulse oximeter and heart rate sensor to monitor maternal heart rate and blood oxygen saturation (SpO2) in real time. The LM35 precision temperature sensor is used for continuous measurement of maternal body temperature. The ADXL335 three-axis accelerometer is employed for detecting fetal movements by sensing subtle vibrations and movements on the abdominal surface. The proposed Wearable Smart Pregnancy Monitoring Belt offers a comprehensive, non-invasive, and cost-effective solution for remote maternal and fetal health monitoring, making it particularly suitable for home-based care and telemedicine applications.

Keywords: Wearable, Pregnancy, Monitoring, IoT, Fetal-Movement, Maternal-Health, Sensors, Non-invasive, Telemedicine, Smart-Belt

SMARTPHONE-ASSISTED DEEP LEARNING MODEL FOR ORAL CANCER SCREENING AT RURAL PRIMARY HEALTH CENTERS (PHCS)

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ABSTRACT

Oral cancer is a major public health concern, especially in developing countries like India, where late diagnosis leads to high mortality rates. This project presents a smartphone-assisted deep learning system for early detection of oral cancer, specifically designed for use in rural Primary Health Centers (PHCs). The proposed system utilizes oral cavity images captured using a mobile device and processes them through a Convolutional Neural Network (CNN) model to classify lesions as benign or malignant. The methodology involves image preprocessing techniques such as resizing, normalization, and noise reduction to enhance data quality. A lightweight deep learning model is employed to ensure efficient performance on low-resource devices. The trained model is integrated into a user-friendly web application that allows healthcare workers to upload images and receive instant diagnostic predictions along with confidence scores. Additionally, the system incorporates explainable AI techniques to highlight suspicious regions, improving transparency and trust among medical practitioners. This approach offers a cost-effective, non-invasive, and rapid screening solution, enabling early detection and timely medical intervention. The proposed system aims to bridge the gap in healthcare accessibility and improve oral cancer diagnosis in underserved rural areas.

Keywords: Oral-Cancer, Deep-Learning, CNN, Smartphone, Diagnosis, Rural-Healthcare, Screening, Non-invasive, AI, Telemedicine.

ADJUSTABLE IMPACT DAMPING WALKING AID

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ABSTRACT

This project focuses on the design and development of an Adjustable Impact Damping Walking Aid to improve comfort and safety for people who face difficulty while walking, especially elderly individuals and patients with mobility issues. In daily life, walking on hard or uneven surfaces can create high impact forces on joints like knees and hips, which may lead to pain or injury. To overcome this problem, our project introduces a simple and effective damping mechanism. The walking aid is designed using basic mechanical components such as springs and soft elastomer materials that help in absorbing shock during walking. The main feature of this device is its adjustability, where the user can control the level of damping based on their comfort, body weight, and walking condition. This makes the aid more flexible and suitable for different users. The structure of the walking aid is made to be lightweight, strong, and easy to handle. It does not require any electrical components, which makes it cost effective and easy to maintain. The design also improves balance and provides better support, helping users to walk with more confidence. From our observation and basic testing, the device shows a reduction in impact force compared to normal walking aids. Overall, this project provides a simple, affordable, and user-friendly solution to reduce joint stress and improve mobility, making it helpful for everyday use.

Keywords: Impact damping, adjustable walking aid, shock absorption Mobility support, joint protection, stability.

RENALVISION ENSEMBLE FOR MULTI-MODAL KIDNEY DIAGNOSTICS

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ABSTRACT

Renal Vision is an advanced automated framework designed to accurately classify kidney abnormalities from axial CT and MRI scans. The system focuses on identifying four major categories: Normal, Cyst, Stone, and Tumor, enabling early diagnosis and improved clinical decision-making. To achieve high precision and reduce model bias, RenalVision employs a Soft-Voting ensemble approach that integrates the predictive strengths of three powerful Convolutional Neural Network (CNN) architectures—InceptionV3, ResNet50, and EfficientNetB0. Each model independently analyzes the input medical images and generates classification probabilities, which are then combined using a soft-voting mechanism to produce a more reliable and robust final prediction. This ensemble strategy enhances overall accuracy, minimizes false classifications, and improves generalization across diverse datasets. Additionally, the framework includes preprocessing steps such as image normalization and resizing to ensure consistent input quality. By leveraging deep learning and ensemble techniques, Renal Vision provides a scalable, efficient, and intelligent solution for automated kidney disease detection. The system has significant potential in assisting radiologists, reducing diagnostic workload, and enabling faster and more consistent analysis in clinical environments, ultimately contributing to improved patient outcomes.

Keywords: Kidney Abnormality Classification, Renal Vision, CT scan, MRI, Deep Learning, CNN, InceptionV3, ResNet50, EfficientNetB0, Soft Voting Ensemble.

EMG BASED NERVE WEAKNESS DETECTION SYSTEM

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ABSTRACT

The Nerve Weakness Detection System using Electromyography (EMG) is designed to monitor muscle activity and evaluate neuromuscular function by measuring the bioelectric signals produced during muscle contraction. Surface EMG electrodes are used to capture these small electrical signals generated by muscle fibers. The signals are then amplified and filtered using an EMG sensor module and processed by the ESP32 microcontroller. The processed signal is analyzed to identify variations in muscle activity that may indicate possible nerve weakness. Based on the signal strength, the system provides visual indication using LED indicators and allows monitoring through a mobile interface. This system provides a simple, portable, and non-invasive solution for basic muscle activity monitoring and preliminary detection of nerve weakness.

Keywords: EMG, Electromyography, ESP32, Muscle Activity Monitoring, Nerve Weakness Detection.

DEVELOPMENT OF AN FSR BASED SINUS PRESSURE MONITORING AND THERAPEUTIC SYSTEM

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ABSTRACT

The Sinusitis is a common health condition characterized by inflammation of the sinus cavities, leading to symptoms such as facial pain, pressure, and nasal congestion. Conventional treatment methods, including medication and manual acupressure, often lack real-time monitoring and personalized therapy. This paper presents the design and development of a non-invasive sinus pressure monitoring and adaptive therapeutic system. The proposed system utilizes a Force Sensitive Resistor (FSR) sensor to measure pressure sensitivity in the sinus region, which serves as an indicator of sinus tenderness. The sensor output is processed using a microcontroller, which continuously monitors pressure variations in real time. Unlike traditional systems that rely on fixed classifications, the proposed approach implements a continuous monitoring mechanism. Based on the real-time sensor data, the system dynamically controls a vibration motor through a motor driver to provide acupressure-based therapy. The device operates as a closed-loop system, where the therapy is adjusted and maintained until the measured pressure returns to a normal range. This ensures adaptive and personalized treatment for effective sinus relief. The developed system is portable, cost-effective, and user-friendly, making it suitable for home and community healthcare applications. The results demonstrate the feasibility of integrating pressure sensing and adaptive control for non-invasive sinus pain management. This work provides a foundation for future development of wearable biomedical devices for personalized healthcare.

Keywords: Sinusitis, FSR Sensor, Pressure Monitoring, Adaptive Therapy, Acupressure, Microcontroller, Vibration Motor, Closed-Loop System, Non-Invasive Device, Personalized Healthcare.

HARDWARE BASED EARLY KIDNEY DISEASE DETECTOR

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ABSTRACT

Early detection of kidney disease is essential to prevent irreversible renal damage and reduce mortality. Conventional diagnostic methods depend on laboratory tests that are costly, time consuming, and often unavailable in resource presents a hardware-- limited areas. This paper based early kidney disease detection system that enables real time monitoring using physiological and biochemical parameters. The system integrates sensors to measure blood pressure, body temperature, and biochemical markers, connected to a microcontroller for data collection and processing. The data is analyzed using predefined threshold values to detect early signs of renal dysfunction. The system provides instant feedback through a display and can optionally transmit data wirelessly to healthcare providers for remote monitoring. This low cost, portable, and non-invasive system supports early diagnosis, improves patient outcomes, and promotes preventive healthcare especially in rural and underserved regions.

Keywords: Early Kidney Disease Detection, Real Time Monitoring, Biomedical Sensor, Microcontroller, Portable Medical Device.

BED OCCUPANCY MONITORING SYSTEM

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ABSTRACT

The Bed Occupancy Monitoring System using an LCD display is designed to provide an efficient and automated solution for monitoring the availability of hospital beds in real time. The system uses sensors such as pressure or IR sensors to detect the presence or absence of a patient on the bed, and this information is processed by a microcontroller to determine the occupancy status. Based on the sensor input, the system displays clear messages like “Bed Occupied” or “Bed Vacant” on an LCD screen, making it easy for hospital staff to understand the bed status without confusion. This system reduces the need for manual monitoring, minimizes human errors, and saves time, thereby improving overall hospital workflow and patient management. Unlike traditional systems that use alarms or LED indicators, this design maintains a quiet and disturbance-free environment, which is essential in healthcare settings. Additionally, the system is cost-effective, easy to install, and requires minimal maintenance, making it suitable for both small clinics and large hospitals. It can also be further expanded to monitor multiple beds and integrated with wireless communication technologies for centralized monitoring, enhancing its efficiency and practicality in modern healthcare systems.

Keywords: Bed Occupancy Monitoring, LCD Display, Microcontroller, Pressure Sensor, Real-Time Monitoring, Healthcare System, Patient Detection.

CHRONIC PODIATRIC FOOT ULCER DETECTION

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ABSTRACT

Chronic podiatric foot ulcers are a significant complication, especially among diabetic patients, often leading to severe infections, hospitalization, and even amputation if not detected early. This mini project focuses on the development of an intelligent system for the early detection and classification of chronic foot ulcers using modern computational techniques. The proposed system utilizes image processing and machine learning algorithms to analyze foot images and identify ulcer regions accurately. By applying preprocessing techniques such as noise reduction, contrast enhancement, and segmentation, the system isolates the affected area and extracts relevant features including texture, color, and shape. These features are then used to train a classification model that distinguishes between normal skin and ulcerated tissue. The system aims to provide a cost-effective, non-invasive, and user-friendly solution that can assist healthcare professionals and patients in monitoring foot conditions regularly. Early detection through this approach can help reduce complications, improve treatment outcomes, and minimize the risk of severe infections and amputations. Overall, this project contributes to the advancement of healthcare technology by integrating computer vision and artificial intelligence for better diagnosis and management of chronic foot ulcers, particularly in resource-limited settings.

Keywords: Chronic Foot Ulcer, Diabetic Foot Ulcer (DFU), Podiatric Ulcer, Wound Healing, Tissue Damage

DEVELOPMENT OF A COST-EFFECTIVE HUMAN MOVEMENT ANALYSIS SYSTEM FOR FUNCTIONAL BIOMECHANICS

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ABSTRACT

Sit-to-stand, walking, and running are fundamental human movements widely analyzed in biomechanics for clinical assessment, rehabilitation, and performance evaluation. This study presents the development of a cost-effective and accessible system for kinematic and basic dynamic analysis of these movements using video-based motion analysis techniques. The proposed framework utilizes Kinovea software to extract joint kinematics from recorded videos, while Microsoft Excel and Python are employed for data processing, analysis, and visualization. The methodology adopts a markerless tracking approach, eliminating the need for expensive sensors or markers and making the system highly suitable for low-resource and community-level healthcare settings. A structured workflow is implemented, including video acquisition, calibration, joint point tracking, data extraction, and post-processing. Comparative analysis is performed across sit-to-stand, walking, and running to identify variations in joint coordination, movement efficiency, and temporal patterns. Additionally, graphical representations such as angle-time and velocity-time plots are generated to enhance interpretation. Although direct force measurements are not incorporated, basic dynamic insights are inferred using kinematic data and established biomechanical principles, enabling approximate assessment of movement mechanics. The experimental results demonstrate that reliable and consistent motion analysis can be achieved with minimal hardware requirements, maintaining acceptable accuracy for clinical and educational purposes. The system shows potential in early detection of abnormal movement patterns, progress tracking in rehabilitation, and preliminary performance evaluation in sports biomechanics.

Keywords: Biomechanics, Kinematic Analysis, Sit-To-Stand, Gait Analysis, Running Analysis, Kinovea, Marker Less Motion Tracking, Joint Angle Measurement.

LOW COST NON INVASIVE HEMOGLOBIN AND GLUCOSE MONITORING SYSTEM FOR RURAL APPLICATION

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ABSTRACT

Access to reliable diagnostic tools in rural and resource-limited settings remains a significant challenge in global healthcare. This project presents the design and development of a low-cost, non-invasive hemoglobin and glucose monitoring system tailored for rural healthcare applications. The system employs photoplethysmography (PPG) and near-infrared (NIR) spectroscopy techniques to estimate blood hemoglobin and glucose levels without the need for painful finger-pricks or laboratory equipment. A low-power microcontroller processes the optical sensor data using calibrated algorithms to deliver real-time readings displayed on an LCD or mobile interface via Bluetooth. The device is designed with affordability, portability, and ease of use as core priorities, making it suitable for community health workers and rural clinics with limited technical infrastructure. By eliminating the recurring cost of test strips and lancets, the system significantly reduces the financial burden on patients and healthcare providers alike. Preliminary testing demonstrates promising correlation between the device's readings and standard laboratory reference values. This innovation has the potential to improve early detection of anemia and diabetes in underserved populations, enabling timely medical intervention and reducing complications associated with late diagnosis. Future work will focus on clinical validation and regulatory compliance for wider deployment.

Keywords: Non-Invasive Monitoring, Hemoglobin Detection, Glucose, Photoplethysmography (PPG), Near Infrared Spectroscopy (NIR), Rural Healthcare, Low-Cost Diagnostic Device, Biomedical Sensor System, Arduino/Microcontroller-Based System, Early Disease Detection

COMPACT AND WIRELESS WEARABLE SYSTEM FOR SLEEP APNEA DETECTION

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ABSTRACT

Sleep apnea is a common and potentially serious sleep disorder characterized by repeated interruptions in breathing during sleep, leading to reduced oxygen levels and poor sleep quality. Conventional diagnostic methods, such as polysomnography, are often expensive, complex, and require hospital-based monitoring, making them inconvenient for continuous use. This project proposes a compact and wireless wearable system for sleep apnea detection, designed to enable comfortable and continuous monitoring in a home environment. The system integrates multiple physiological sensors, including a respiration sensor and a pulse oximeter, to measure breathing patterns, heart rate, and blood oxygen saturation (SpO_2). A microcontroller processes the acquired signals in real time to identify abnormal breathing events, such as apnea episodes, based on predefined thresholds. The collected data is transmitted wirelessly via Bluetooth or Wi-Fi to a mobile device or computer for visualization and analysis. The proposed system offers a non-invasive, cost-effective, and user-friendly solution for early detection and monitoring of sleep apnea. It has the potential to improve patient compliance, reduce healthcare costs, and enable.

Keywords: Sleep Apnea, Microcontroller, Sensors, Wireless Device

DESIGN AND IMPLEMENTATION OF PORTABLE VENTILATION WITH VARIABLE PRESSURE PER MINUTE

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ABSTRACT

Portable ventilators play a crucial role in providing respiratory support during emergencies, transport, and home care settings. This project focuses on the design and implementation of a portable ventilation system with variable pressure and adjustable breaths per minute (BPM). The system is developed to deliver controlled airflow to patients who are unable to breathe adequately on their own. It incorporates pressure sensors, a microcontroller-based control unit, and a compact air delivery mechanism to regulate inspiratory and expiratory pressures accurately. The variable pressure feature ensures patient safety by preventing barotrauma, while the adjustable BPM allows customization according to patient requirements. The device is lightweight, energy-efficient, and powered by a rechargeable battery, making it suitable for use in ambulances and remote areas. Overall, the proposed system aims to provide an affordable, reliable, and user-friendly respiratory support solution for critical care situations In addition, the proposed portable ventilator is designed with real-time monitoring and safety features to enhance reliability and patient care. The system continuously monitors airway pressure, flow rate, and respiratory cycles, displaying essential parameters on a user-friendly interface. Alarm mechanisms are integrated to alert caregivers in case of abnormal pressure levels, power failure, or system malfunction. The compact structure and simple control settings make it easy to operate even in emergency situations with minimal training. By combining cost-effectiveness, portability, and adjustable ventilation parameters, this device aims to bridge the gap between advanced hospital ventilators and basic manual resuscitation systems, ensuring accessible respiratory support in both urban and rural healthcare environments.

Keywords: Portable Ventilator, Variable Pressure Control, Adjustable BPM (Breaths per Minute), Respiratory Support System, Microcontroller-Based Design, Pressure Flow Sensors.

NON-INVASIVE ANEMIA RISK DETECTION USING PPG MORPHOLOGY

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ABSTRACT

Anemia is one of the most common hematological disorders worldwide and is typically diagnosed using invasive blood tests to estimate hemoglobin concentration. These conventional methods are painful, time-consuming, and unsuitable for frequent or large scale screening. This project presents a non-invasive anemia risk detection system using Photoplethysmography (PPG) morphology analysis. PPG signals are acquired using an optical sensor placed on the fingertip, capturing variations in blood volume during cardiac cycles.The morpological characteristics of the PPG waveform, including pulse amplitude, rise time, fall time, pulse width, and area under the curve, are extracted and analyzed. These features are then processed using machine learning algorithms to classify individuals into normal or anemia-risk categories. The proposed system offers a low-cost, painless, and portable solution suitable for preliminary anemia screening and remote healthcare monitoring. Although it does not replace laboratory hemoglobin tests, the system demonstrates potential as an effective screening tool for early anemia risk detection.

Keywords: Photoplethysmography (PPG), Non-Invasive Detection, Anemia Risk Screening, PPG Morphology Bioledsignal processing

BIOFEEDBACK-BASED STRESS MONITORING AND RELAXATION GUIDANCE SYSTEM USING HRV ANALYSIS

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ABSTRACT

Stress is a major factor affecting physical and mental health in modern life. This project presents the design and implementation of an HRV-based biofeedback system for stress monitoring and relaxation guidance. A pulse sensor is used to acquire heart rate signals non invasively. The acquired signal is processed using a microcontroller to compute HRV parameters and estimate stress levels. Based on the stress condition, the system provides real-time biofeedback in the form of visual indicators and relaxation guidance. The proposed system does not directly reduce stress but assists the user in consciously regulating stress through guided breathing and awareness. The system is low-cost, portable, and suitable for mini-project applications.

Keywords: Stress Reduction, Heart Rate Variability (HRV), Heart Rate Sensor, Physiological Monitoring, Microcontroller, Real-Time Analysis, Wellness System.

COUGH MONITORING SYSTEM

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ABSTRACT

Cough is a common symptom associated with various respiratory diseases such as asthma, chronic obstructive pulmonary disease (COPD), tuberculosis, and COVID-19. Continuous monitoring of cough patterns can provide valuable insights for early diagnosis, disease progression tracking, and treatment effectiveness. This project presents a cough monitoring system that uses acoustic signal processing and machine learning techniques to detect, classify, and record cough events in real time. The system typically consists of a microphone sensor, a signal processing unit, and a classification algorithm that distinguishes cough sounds from other environmental noises. Data collected is analyzed to determine cough frequency, intensity, and duration, which can be stored or transmitted to healthcare providers via wireless communication. The proposed system is non-invasive, cost-effective, and suitable for both clinical and home environments. It aims to improve patient monitoring, enable remote healthcare support, and assist in early intervention for respiratory conditions .cough monitoring system is designed to detect and analyze cough events for effective respiratory health monitoring. This mini project mainly focuses on the integration of key hardware and software components required for accurate cough detection. The system consists of a microphone sensor to capture cough sounds, a signal conditioning unit to filter and amplify the audio signal, and a microcontroller (such as Arduino) to process the input data. A cough detection algorithm is implemented to differentiate cough sounds from other environmental noises. The system also includes a display module or mobile interface to show cough frequency and duration, along with a data storage unit or wireless communication module (Bluetooth/Wi-Fi) for recording and transmitting data.

Keywords: Cough Monitoring System, Acoustic Signal Processing, Machine Learning, Microphone Sensor, Signal Conditioning, Asthma, Chronic Obstructive Pulmonary Disease, Tuberculosis, COVID-19, Wireless Communication.

BIOMEDICAL WASTE SEGREGATION

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ABSTRACT

Biomedical waste segregation is an essential process in healthcare facilities to ensure safe handling, treatment, and disposal of medical waste. Improper disposal of biomedical waste can lead to serious health hazards, environmental pollution, and the spread of infectious diseases. The segregation process involves separating waste into different categories such as infectious waste, sharps, pathological waste, pharmaceutical waste, and general waste using color-coded containers as per biomedical waste management guidelines. Effective segregation at the point of generation helps reduce the volume of hazardous waste, lowers disposal costs, and improves recycling and treatment efficiency. This system also protects healthcare workers, patients, waste handlers, and the community from potential risks.

Keywords: Biomedical Waste, Waste Segregation, Health Waste.

REAL-TIME MUSCLE CRAMP DETECTION AND AUTOMATIC RELIEF SYSTEM

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ABSTRACT

Muscle cramps are sudden, involuntary muscle contractions that commonly occur due to dehydration, fatigue, nerve irritation, or prolonged physical activity. Severe or recurrent cramps can cause significant pain and temporary loss of muscle control, particularly in athletes, elderly individuals, and patients with neuromuscular conditions. This project proposes a Real-Time Muscle Cramp Detection and Automatic Relief System that continuously monitors muscle activity and provides immediate therapeutic intervention .The system utilizes a surface Electromyography (EMG) sensor to measure muscle electrical activity. Abnormal muscle contractions are identified by analyzing signal amplitude and duration using a predefined threshold-based algorithm .When a sustained high-intensity contraction indicative of a cramp is detected, the system automatically activates a relief mechanism such as controlled vibration or mild heat stimulation to relax the affected muscle .The proposed device integrates signal filtering, real-time processing, and a microcontroller-based control unit to ensure accurate detection while minimizing false positives. By combining monitoring and automated response in a wearable, low-cost design, the system aims to provide timely intervention, reduce pain duration, and improve patient comfort. This project demonstrates the application of biomedical signal processing and embedded systems in developing smart therapeutic assistive devices.

Keywords: Muscle Cramps, Electromyography (EMG), Real-Time Monitoring, Biomedical Signal Processing, Embedded System, Microcontroller, Automatic Relief System, Wearable Device, Vibration Therapy, Heat Stimulation.

SMART NON-INVASIVE BILIRUBIN MEASUREMENT AND PHOTOTHERAPY OPTIMIZATION SYSTEM FOR NEONATAL JAUNDICE MANAGEMENT

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ABSTRACT

Neonatal jaundice is a common clinical condition affecting a significant number of newborns during the first week of life. Early detection and proper management are essential to prevent severe complications such as bilirubin encephalopathy and kernicterus This paper proposes a Smart Non-Invasive Bilirubin Measurement and Phototherapy Optimization System designed to improve neonatal jaundice management through a safe, efficient, and technology-driven approach. The proposed system utilizes optical sensing techniques based on photoplethysmography (PPG) and multi-wavelength light analysis to estimate bilirubin levels non-invasively through the skin. A microcontroller-based processing unit analyzes the captured optical signals and computes bilirubin concentration using calibration algorithms. In addition, the system integrates a smart phototherapy module that dynamically adjusts light intensity and exposure duration based on the measured bilirubin levels, ensuring optimal treatment efficiency while minimizing unnecessary exposure. The device also includes a wireless communication interface for real-time monitoring and data logging through a mobile or clinical dashboard. By combining non-invasive diagnostics with intelligent phototherapy control, the proposed system aims to provide a cost-effective, portable, and user-friendly solution suitable for hospitals, neonatal care units, and resource-limited settings. This approach enhances early diagnosis, improves treatment outcomes, and reduces clinical workload in neonatal jaundice management.

Keywords: Neonatal Jaundice, Non-Invasive Bilirubin Measurement, Phototherapy Optimization, Optical Sensing, Photoplethysmography (PPG), Neonatal Care, Biomedical Monitoring System, Smart Healthcare Device.

AI- ENABLED MALNUTRITION SCANNER

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ABSTRACT

Malnutrition remains a critical public health issue worldwide, particularly in developing regions where early diagnosis is often limited. Conventional assessment methods rely on anthropometric measurements, which may fail to identify micronutrient deficiencies at an early stage. This project presents an AI-enabled malnutrition scanner that utilizes tongue and nail image analysis for rapid and non-invasive detection of nutritional deficiencies. The system captures images of the tongue and nails using a smartphone or digital camera and processes them using machine learning and image processing techniques. Key visual features such as color, texture, shape, and abnormalities are analyzed to identify signs of deficiencies like iron, vitamin B12, and protein. The trained AI model compares the extracted features with a predefined dataset to provide accurate predictions of possible malnutrition conditions. This approach offers a cost-effective, portable, and user-friendly solution, especially suitable for rural and resource-limited settings where access to laboratory testing is limited. The system enables early detection, continuous monitoring, and timely intervention, thereby improving health outcomes. In conclusion, the proposed AI-based scanner enhances traditional screening methods by providing a fast, reliable, and accessible tool for malnutrition detection using tongue and nail analysis.

Keywords: AI, ML, CNN, Vitamin B12, Pre Processing

DESIGN OF A SMART WEARABLE CERVICAL BAND FOR PAIN RELIFE AND POSTURE CORRECTION USING TENS STIMULATION AND HEAT MASSAGE THERAPY

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ABSTRACT

The widespread use of digital devices has significantly increased the incidence of neck pain and posture related disorders. Poor posture, particularly forward head posture, can lead to cervical strain and long term musculoskeletal problems. This paper presents the design and development of a Smart Therapeutic Cervical Neck Band for real-time posture monitoring and pain management. The proposed system utilizes an MPU6050 sensor to continuously track neck movement and detect improper posture based on predefined threshold values. When incorrect posture is identified, the system provides immediate feedback through vibration and buzzer alerts, encouraging users to correct their posture. In addition to monitoring, the device integrates therapeutic features such as Transcutaneous Electrical Nerve Stimulation (TENS), heat therapy, and vibration massage to relieve pain and improve muscle relaxation. Bluetooth connectivity enables users to control therapy modes and duration through a smartphone, enhancing usability and personalization. The system is compact, portable, and cost-effective, making it suitable for daily use. Experimental results indicate improved posture awareness and effective pain reduction, demonstrating the potential of the proposed system for healthcare and rehabilitation applications.

Keywords: Transcutaneous Electrical Nerve Stimulation, MPU6050 Sensor, Musculoskeletal Problems

IOT - ENABLED DESIGN AND IMPLEMENTATION OF AN ENDOTRACHEALTUBE CUFF PRESSURE CONTROLLERDEVICE

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ABSTRACT

The increasing need for precision in medical equipment and patient monitoring systems has led to the development of IoT-enabled devices. This paper presents the design and implementation of an IoT-enabled endotracheal pressure monitoring system.The system integrates an ESP32 microcontroller, DS18B20 temperature sensor, pressure sensor, SpO2 sensor, and various components such as relays, valves, an LCD display, and an alarm mechanism.The purpose of the system is to monitor the endotracheal tube (ETT) pressure and other vital parameters (temperature, SpO2) in real-time, ensuring patient safety and providing alerts for immediate action.The system uses IoT technology to remotely monitor patient data, allowing healthcare professionals to access real-time data through a mobile application.The proposed system offers an advanced solution compared to traditional methods, providing better accuracy, remote monitoring, and timely alarms.

Keywords: IoT-Enabled Healthcare System with ESP32, SpO2, DS18B20, Real-Time Patient Monitoring, Pressure Sensing, Remote Alerts, And Mobile App Integration.

MOISTURE CONTROL WOUND HEALING PATCH

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ABSTRACT

This project presents the design and development of a moisture-controlled wound healing patch aimed at improving the efficiency of wound management and accelerating the healing process. The patch is composed of multiple functional layers, each performing a specific role to maintain an optimal healing environment. The bottom absorbent layer, typically made using materials like Sterile Gauze Pads, helps in removing excess wound exudate and keeps the wound clean. Above this, a hydrogel layer such as Hydrogel Wound Dressing Sheet is used to maintain adequate moisture, which is essential for faster tissue regeneration and reduced scarring. A moisture sensing layer, implemented using a simple sensor like YL-69 Soil Moisture Sensor Module, is incorporated to monitor the moisture level within the patch, providing an indication of wound condition. The entire setup is covered with a protective and waterproof top layer like 3M Tegaderm Transparent Film Dressing, which prevents external contamination while allowing visibility. An adhesive layer using Micropore Surgical Tape ensures proper attachment of the patch to the skin. This multi-layered system creates a balanced moist environment, which is clinically proven to enhance wound healing compared to traditional dry dressing methods.

Keywords: Moisture-Controlled Wound Healing, Hydrogel Dressing, Smart Wound Patch, Yl-69 Moisture Sensor, IoT-Based Healthcare

DUAL UWB ANTENNA-BASED NON-INVASIVE BREAST CANCER DETECTION SYSTEM

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ABSTRACT

Breast cancer is one of the most common diseases an affecting woman worldwide, and early detection is important for effective treatment. Conventional techniques such as mammography have limitations including radiation exposure and patient discomfort. In this work, a Dual Ultra-Wideband (UWB) antenna is designed for microwave imaging-based breast cancer detection. The antenna operates in the 3.1–10.6 GHz frequency range and is simulated using ANSYS HFSS software. Important antenna parameters such as S-parameters (S11, S21), return loss, VSWR, and bandwidth are analysed to evaluate the antenna performance. A breast phantom model with and without tumour is also considered to study the variation in microwave signal propagation. The simulation results show good impedance matching and wide bandwidth performance of the dual antenna system. The proposed approach provides a non-invasive, safe, and low-power technique for early breast tumour detection.

Keywords: Dual Uwb Antenna, Breast Cancer Detection, Microwave Imaging, S-Parameters, Breast Phantom Model, Hfss Simulation

SMART HEAD MOVEMENT RECOGNITION SYSTEM FOR DISABLED PEOPLE

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ABSTRACT

Assistive technologies play a crucial role in improving the quality of life for individuals with physical disabilities, especially those with limited mobility. This project presents a Smart Head Movement Recognition System for Disabled People, designed to enable hands-free control of devices such as wheelchairs, computers, or communication systems using simple head gestures. The system aims to provide an affordable, user-friendly, and efficient solution to enhance independence and mobility for differently-abled individuals. The proposed system utilizes a camera-based vision approach integrated with image processing techniques to detect and interpret head movements in real time. Technologies such as OpenCV and machine learning algorithms are employed to capture facial landmarks and track head orientation. Specific movements such as left, right, up, and down are recognized and mapped to predefined control commands. The system incorporates preprocessing techniques like grayscale conversion, noise filtering, and thresholding to improve detection accuracy under varying lighting conditions. To ensure robustness, feature extraction methods such as Haar Cascade classifiers and Local Binary Pattern Histogram (LBPH) are used for reliable face detection and tracking. A smoothing algorithm, such as a moving average filter, is applied to reduce noise and avoid false triggering of commands. The recognized head movements are then converted into control signals, which can be interfaced with microcontrollers or assistive devices like smart wheelchairs. The system is designed with a focus on real-time performance, low latency, and ease of use, making it suitable for individuals with severe motor impairments.

Keywords: Assistive Technology, Head Movement Recognition, Opencv, Machine Learning, Gesture Control, Disabled Mobility

SMART WEARABLE DEVICES FOR ALZHEIMER'S PATIENTS USING IOT

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ABSTRACT

Alzheimer's disease is a progressive neurological disorder that affects memory, cognition, and daily functioning, posing significant challenges for patient safety and caregiving. This project proposes a smart wearable device integrated with Internet of Things (IoT) technology to assist Alzheimer's patients in real-time monitoring and support. The system utilizes sensors such as GPS, heart rate, and motion detectors to track the patient's location, vital signs, and activity patterns. In case of unusual behavior, wandering, or emergencies, alerts are instantly sent to caregivers through a mobile application. The device also includes features like geofencing and fall detection to enhance safety. Cloud-based data storage enables continuous monitoring and analysis, improving decision-making for caregivers and healthcare professionals. Overall, the proposed sysm provides a cost-effective, non-invasive, and efficient solution to enhance patient independence while ensuring safety and timely intervention.

Keywords: Alzheimer's, IoT, wearable device, GPS Tracking, Health Monitoring, Geofencing, Cloud Computing.

IOT BASED FALL DETECTION MONITOR

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ABSTRACT

Accidental falls are a major health risk for elderly individuals and patients with mobility impairments, often leading to serious injuries due to delayed assistance. This paper presents an IoT-based Fall Detection Monitor designed to provide real-time monitoring and immediate alerting. The system utilizes an ADXL345 accelerometer to continuously track body movements and detect sudden changes in acceleration that indicate a fall. An Arduino Uno microcontroller processes the sensor data and triggers alerts when abnormal patterns are detected. Upon fall detection, the system sends instant notifications to caregivers via a GSM module and activates a buzzer for local alerts. The proposed solution is cost-effective, portable, and reliable, making it suitable for continuous health monitoring. Experimental results demonstrate high accuracy in detecting falls under various conditions, ensuring improved patient safety and reduced response time.

Keywords: IoT, Fall Detection, ADXL345 Accelerometer, Arduino Uno, GSM Module, Sensor-based System.

ASSISTIVE WEARABLE VIBROTACTILE CUEING BAND FOR FREEZING OF GAIT IN PARKINSON'S DISEASE

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ABSTRACT

Freezing of gait (fog) is one of the most disabling motor symptoms experienced by patients with parkinson's disease, characterized by sudden and temporary inability to initiate or continue walking. These episodes significantly increase the risk of falls, reduce mobility, and negatively impact the quality of life. Conventional treatments such as medication and physiotherapy often provide limited or inconsistent relief for fog, highlighting the need for assistive technological solutions. This project presents a smart wearable vibrotactile cueing system designed for real-time detection and management of freezing of gait in parkinson's disease patients. The proposed system integrates emg sensors to monitor muscle activity and motion sensors to analyze gait patterns. An esp32 microcontroller processes the acquired data to accurately identify fog events. Upon detection, a vibration motor delivers adaptive vibrotactile cues to assist the patient in resuming normal walking. An lcd display provides real-time system status, while an rtc module records the time and occurrence of fog episodes. Additionally, the system incorporates iot connectivity for remote monitoring, data logging, and long-term analysis, enabling clinicians and caregivers to track patient progress and optimize rehabilitation strategies. The proposed wearable system is noninvasive, lightweight, cost-effective, and suitable for both clinical and home-based use. Overall, this project aims to enhance patient independence, reduce fall risk, and improve the quality of life for individuals suffering from Parkinson 's disease.

Keywords: Parkinson's Disease, Freezing of Gait (FoG), Wearable Devices, Vibrotactile Cueing, EMG Signal Processing, Internet of Things (IoT).

AI-POWERED COUGH SOUND ANALYZER

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ABSTRACT

Respiratory diseases are among the leading causes of illness worldwide, affecting millions of people and placing a significant burden on healthcare systems. Early detection of respiratory conditions such as asthma, bronchitis, pneumonia, and chronic obstructive pulmonary disease (COPD) is essential for effective treatment and prevention of severe complications. However, traditional diagnostic methods rely on clinical examination and medical imaging techniques, which can be expensive, time-consuming, and less accessible in rural and under-resourced areas. This study proposes an Artificial Intelligence (AI)-powered cough sound analyzer designed to detect and classify respiratory conditions using machine learning and acoustic signal processing techniques. The system captures cough sounds using a microphone or mobile device, followed by preprocessing steps such as noise reduction and filtering to improve signal quality. Important acoustic features, including Mel-Frequency Cepstral Coefficients (MFCC) and spectral features, are extracted and used to train machine learning models for accurate classification of cough patterns. The results demonstrate promising performance, indicating that the proposed system can serve as a low-cost, portable, and efficient tool for early detection and remote monitoring of respiratory diseases.

Keywords: Artificial Intelligence (AI), Machine Learning (ML), Cough Sound Analysis, Respiratory Disease Detection, Acoustic Signal Processing, Mel-Frequency Cepstral Coefficients (MFCC), Feature Extraction, Audio Classification, Early Disease Detection, Mobile Healthcare, Remote Monitoring.

DETECTION OF BLOOD GROUP USING IMAGE PROCESSING AND DEEP LEARNING

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ABSTRACT

Blood group identification is an essential prerequisite for safe blood transfusions, emergency treatments, and clinical procedures. Traditional blood grouping methods require invasive blood sampling, laboratory reagents, and trained personnel, often resulting in delays and potential human error. This project introduces an automated, contactless blood group detection system using fingerprint images, integrating advanced image processing and deep learning to achieve high accuracy. The system begins with fingerprint acquisition, followed by preprocessing techniques such as enhancement, segmentation, noise reduction, and normalization to improve image clarity and extract meaningful ridge features. To strengthen robustness, data augmentation is applied to simulate variations in real-world conditions. The InceptionV3 deep learning model is employed for feature extraction and classification, leveraging its deep convolutional layers to recognize subtle fingerprint patterns associated with specific blood groups. Model training, validation, and testing are performed on a labelled dataset to ensure reliable performance and generalization. Once trained, the system classifies the blood group into categories such as A, B, AB, or O, and provides rapid results suitable for real-time deployment. The proposed method offers numerous advantages including reduced processing time, minimized manual involvement, and improved diagnostic accessibility in remote or resource-limited environments. Potential applications include medical camps, emergency response units, military health services, and biometric healthcare systems.

Keywords: Blood Group Detection, Fingerprint Imaging, Deep Learning, InceptionV3, Image Processing, Classification, Biometrics, Medical Diagnostics.

SMART MEDICINE TRANSPORT SYSTEM FOR CRITICAL INJECTABLE MEDICINE

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ABSTRACT

Pharma secure is an IoT-based smart pharmaceutical cold chain monitoring and security system designed to ensure the integrity of temperature-sensitive medicines during transportation and storage. The system integrates an ESP32 microcontroller with a DHT11 temperature and humidity sensor, a fingerprint scanner module for authorized access control, a GPS module for real-time location tracking, a servo motor-driven electronic lock for physical security, and a Peltier thermoelectric cooling block for automated temperature regulation. When the DHT11 sensor detects that the internal temperature exceeds the predefined safety threshold, the ESP32 activates the Peltier cooling module and cooling fan to restore optimal conditions through a closed-loop control algorithm. The fingerprint scanner ensures that only authorized personnel can access the storage container, with the servo motor engaging or disengaging the lock upon successful biometric authentication. The GPS module continuously transmits the real-time location of the storage unit to a cloud dashboard, enabling end-to-end supply chain visibility. All sensor data — temperature, humidity, location, access logs, and system alerts — are transmitted over Wi-Fi to the Arduino IoT Cloud platform, where live dashboards and historical logs are maintained for regulatory compliance and quality assurance.

Keywords: Pharmaceutical Cold Chain, ESP32, DHT11, Fingerprint Authentication, GPS Tracking, Servo Lock, Peltier Cooling, IoT, Arduino Cloud, Healthcare Logistics

CARDIAC ARREST PREDICTION USING MACHINE LEARNING TECHNIQUES

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ABSTRACT

Cardiovascular diseases remain one of the leading causes of mortality worldwide, with cardiac arrest often occurring due to delayed diagnosis and lack of early risk identification. This project, titled "cardiac arrest prediction system using machine learning techniques," aims to develop an intelligent, data-driven solution for early detection of cardiac risk using patient health parameters. The system leverages the cleveland heart disease dataset, which includes key clinical attributes such as age, gender, chest pain type, blood pressure, cholesterol levels, heart rate, and electrocardiogram (ecg) results. The proposed methodology involves comprehensive data pre-processing, including handling missing values, encoding categorical variables, and feature scaling to ensure optimal model performance. The random forest model demonstrated superior performance in terms of accuracy, precision, recall, and f1-score, achieving an overall prediction accuracy of approximately 85–90%. The trained model is integrated into a user-friendly web-based application using gradio, enabling real-time prediction of cardiac arrest risk. Users can input medical parameters, and the system outputs a probability score indicating the level of risk (low, moderate, or high). This facilitates early diagnosis and timely medical intervention, thereby reducing the likelihood of severe cardiac events.

Keywords: Machine learning, cardiac arrest prediction, heart disease, risk stratification, random forest, healthcare analytics.

CANCERRECURRENCEPREDICTIONUSINGRNASEQUENCE

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ABSTRACT

Cancer recurrence remains a major challenge in oncology, often resulting in poor survival and limited treatment options. Accurate prediction of recurrence risk enables personalized treatment planning and early clinical intervention. This study presents a machine-learning-based model designed to predict cancer recurrence using RNA sequencing (RNA-Seq) gene expression data. The proposed workflow uinvolves data preprocessing, normalization, and feature selection using the LeastAbsolute Shrinkage and Selection Operator (LASSO) to identify key prognostic genes. A Logistic Regression classifier is then trained on the selected gene subset to distinguish recurrence vs. non-recurrence outcomes. Model performance is evaluated using accuracy, precision, recall, F1 score, and ROC-AUC. An interactive Streamlit dashboard is developed to visualize results through heatmaps, coefficient plots, and prediction outputs. Experimentalfindings demonstratethat the combinationofLASSO feature selectionand Logistic Regression provides a simple yet effective approach for cancer recurrence prediction, facilitating interpretability and clinical usability.

Keywords: Cancer Recurrence, RNA-Seq, LASSO Regression, Logistic Regression, Machine Learning, Gene Expression Analysis, Streamlit Visualization

IOT INTERGRATED CRAMP REDUCTION DEVICE

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ABSTRACT

Muscle cramps are a common problem affecting individuals due to fatigue, neurological disorders, dehydration, or poor blood circulation. This project proposes an IoT-integrated cramp reduction device designed to provide real-time monitoring and effective relief from muscle cramps. The system combines Transcutaneous Electrical Nerve Stimulation (TENS)/tDCS-based stimulation with intelligent sensing and connectivity. The device continuously monitors physiological parameters such as muscle activity, temperature, and movement using embedded sensors. When abnormal muscle contraction patterns are detected, the system automatically activates controlled electrical stimulation to relax the muscles and reduce pain. The integration of IoT enables remote monitoring, data logging, and analysis through a mobile or web application, allowing healthcare professionals to track patient conditions and adjust therapy accordingly.

Keywords: IoT, Muscle Cramps, TENS, Sensors, Machine Learning, Wearable Device, Health Monitoring, Pain relief.

DESIGN AND DEVELOPMENT OF A MULTIFUNCTIONAL NANOPARTICLE-BASED TRANSDERMAL PATCH FOR MIGRAINE AND MUSCLE PAIN MANAGEMENT

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ABSTRACT

Migraine is a common neurological disorder characterized by severe headaches, nausea, and sensitivity to light and sound, significantly affecting the quality of life. Conventional oral medications often show delayed action and cause gastrointestinal side effects due to first-pass metabolism. These limitations highlight the need for an effective and non-invasive drug delivery system. To overcome these issues, this study focuses on the development of a self-heating nanoparticle-based transdermal patch for migraine management. Transdermal drug delivery systems provide advantages such as bypassing the digestive system, controlled drug release, and improved patient compliance. However, skin permeability remains a major challenge In this work, herbal extracts such as peppermint and ginger are encapsulated into chitosan nanoparticles to enhance stability, bioavailability, and sustained drug release. These nanoparticles are incorporated into a polymer-based transdermal patch for effective drug delivery. A mild heating system using a PTC Heater is integrated to improve skin permeability and promote faster drug absorption. The developed patch demonstrates improved drug penetration, controlled release, and enhanced therapeutic efficiency compared to conventional methods. Overall, this system provides a safe, cost-effective, and patient-friendly alternative for migraine treatment with potential applications in advanced drug delivery technologies.

Keywords: Nanoparticle Drug Delivery, Transdermal Patch, Migraine Management.

A LOW-COST SEQUENTIAL ABI MEASUREMENT SYSTEM FOR EARLY DETECTION OF PERIPHERAL ARTERY DISEASE

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ABSTRACT

Peripheral Artery Disease (PAD) is a common vascular disorder caused by the narrowing of peripheral arteries, resulting in reduced blood flow to the limbs. Early detection is essential to prevent severe complications such as ischemia, tissue damage, and limb amputation. The Ankle-Brachial Index (ABI) is a widely used non-invasive diagnostic parameter for PAD; however, conventional measurement using Doppler ultrasound systems is expensive and requires skilled operation, limiting its accessibility in low-resource settings.This paper proposes a low-cost and portable sequential ABI measurement system utilizing a single pressure sensor integrated with an Arduino-based microcontroller. The system performs automated systolic blood pressure measurements at the brachial and ankle regions using a single cuff mechanism and computes the ABI value in real time. Based on the computed ABI, the system provides immediate classification of PAD risk levels.Preliminary testing on human subjects demonstrated that the system is capable of identifying normal and abnormal ABI ranges with consistent performance. The proposed approach reduces hardware complexity and cost while maintaining functional reliability, making it suitable for primary healthcare and rural screening applications.

Keywords: Peripheral Artery Disease (PAD), Ankle-Brachial Index (ABI), Arduino, Pressure Sensor, Non-invasive Monitoring.

GALLIXNET: DEEP LEARNING-BASED DETECTION OF GALLBLADDER DISEASES USING ULTRASOUND IMAGES

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ABSTRACT

Gallbladder diseases, particularly gallstones and cholecystitis, are among the most common causes of abdominal pain in clinical practice. Manual ultrasound interpretation is highly operator-dependent, prone to variation due to technician experience, probe angle, image noise, and patient body habitus, leading to frequent misdiagnosis. This paper presents GallixNet, a hybrid deep learning framework for automated, highly accurate classification of Normal, Gallstones, and Cholecystitis ultrasound images. The system integrates a robust multi-stage pipeline comprising speckle denoising (BM3D/NLM), Contrast Limited Adaptive Histogram Equalization (CLAHE), Retinex normalization, attention-guided U-Net segmentation for ROI extraction, dual-feature fusion of EfficientNet-B0 deep embeddings and handcrafted radiomics (GLCM, LBP, shape descriptors), and a dense-layer hybrid classification head. The model is trained using GPU accelerated Google Colab and deployed via a real-time web interface. Experimental results demonstrate 97.2% accuracy, 96.4% sensitivity, 97.8% specificity, an F1-score of 0.966, and AUC of 0.98, significantly outperforming existing CNN baselines while achieving a processing time of 0.42 seconds per image.

Keywords: Gall bladder Ultrasound; Deep Learning; GallixNet; U-Net Segmentation; EfficientNet-B0; CLAHE; Gallstones; Cholecystitis; Medical Image Classification; ROI Extraction; Feature Fusion.

MACHINE LEARNING-BASED PREDICTION MODEL FOR DEEP VEIN THROMBOSIS (DVT) AFTER GYNECOLOGICAL LAPAROSCOPY

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ABSTRACT

This project aims to design and develop a machine learning (ML)-based predictive model to estimate the risk of DVT after gynecological laparoscopy using clinical and demographic parameters obtained from electronic health records (EHRs).A total of 489 patient records were analysed, and 35 clinical indicators were initially collected. LASSO regression was applied to identify significant predictors, resulting in 13 key features, including age, BMI, operation time, intraoperative pneumoperitoneum pressure (IPP), diabetes, complications, and D-Dimer levels. Three machine learning models were developed and compared: Random Forest Model (RFM), Generalized Linear Regression Model (GLRM), and Artificial Neural Network Model (ANNM). Among them, the RFM achieved the highest predictive accuracy with an AUC of 0.862, indicating superior robustness and performance in identifying high-risk DVT cases. This model provides a valuable decision-support tool to help clinicians identify high-risk patients early and take preventive measures to reduce postoperative complications.

Keywords: Deep Vein Thrombosis, Gynecological Laparosscopy, Random Forest

MULTIMODAL HEART DISEASE CLASSIFICATION USING ECG AND CLINICAL DATA

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ABSTRACT

Heart disease is a major cause of global mortality, requiring accurate and early diagnosis for effective treatment. This paper presents a multimodal heart disease classification system that integrates electrocardiogram (ECG) signals with clinical data to improve predictive performance. ECG signals obtained from the PTB-XL dataset provide detailed information on cardiac electrical activity, while clinical parameters such as age, blood pressure, cholesterol, and blood sugar offer complementary risk factors. The proposed framework includes signal preprocessing, feature extraction of temporal and morphological ECG characteristics, and normalization of clinical data. A hybrid deep learning model combining convolutional neural networks and long short-term memory networks is used for ECG Feature fusion is performed to enable robust classification into multiple cardiac conditions. Experimental results demonstrate improved accuracy and reliability compared to single-modal approaches, supporting early detection and clinical decision- making.

Keywords: ECG, PTB XL Dataset, Multimodal Learning, CNN, LSTM, Heart Disease Classification, Clinical Data, Data Fusion

CONVERSION OF AGRICULTURAL WASTE INTO BIODEGRADABLE WOUND HEALING FILMS

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ABSTRACT

This project presents a sustainable and innovative approach to biomedical material development through the conversion of agricultural waste into biodegradable wound healing films. The study primarily utilizes banana pseudostem fibers, an abundant and underutilized agro-residue, to fabricate eco-friendly wound dressing materials. The main objective is to develop a cost-effective, biocompatible, and environmentally sustainable alternative to conventional synthetic wound dressings, which are often non-biodegradable and contribute to medical waste. In this work, banana fibers were extracted from pseudostem waste using mechanical and alkaline treatment methods to enhance purity and remove non-cellulosic components. These fibers were then incorporated into natural biopolymer matrices composed of chitosan and gelatin through a solvent casting technique. Chitosan was selected for its well-known antimicrobial and biocompatible properties, while gelatin contributed to film-forming ability, flexibility, and moisture retention. The resulting composite films were designed to combine mechanical strength, biological functionality, and biodegradability. The fabricated films were characterized for their mechanical, physical, and biological properties. Tensile strength and elongation tests confirmed that the inclusion of banana fibers significantly improved the structural integrity of the films.

Keywords: Agricultural Waste, Banana Fiber, Biodegradable Films, Wound Healing, Biopolymers, Sustainable Materials.

HOSPITAL-BASED SMART HEMATOLOGY ANALYZER WITH CANCER RISK ALERT

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ABSTRACT

The Hospital-Based Smart Haematology Analyzer with Cancer Risk Alert is an advanced system designed to automate blood analysis while providing early cancer risk detection for organs such as the brain, lung, and skin. The system integrates a deep learning algorithm, InceptionV3, to analyze blood smear images and identify abnormal cell patterns indicative of potential malignancies. High-resolution images captured through an optical sensor are pre-processed and fed into the algorithm for feature extraction and classification. The hardware architecture includes a microcontroller interfaced with sensors and a display unit, interconnected through UDP communication to ensure fast, reliable, and real-time data transfer within the hospital network. The analyser automatically computes haematology parameters such as RBC, WBC, haemoglobin levels, and platelet count, while the AI module evaluates potential cancer risk based on morphological anomalies. Alerts and reports are generated for medical staff if any abnormal patterns are detected, facilitating prompt medical intervention. The working flow begins with blood sample collection, followed by automated slide preparation, image acquisition, and pre-processing. The processed images are analysed by the InceptionV3 model, which classifies the results and calculates risk levels. Data is transmitted via UDP to a central monitoring system for visualization, record keeping, and further evaluation by doctors. This system emphasizes automation, real-time analysis, and predictive diagnostics, aiming to reduce manual errors, accelerate clinical decision-making, and improve early cancer detection. It provides a cost-effective, intelligent, and scalable solution for hospital-based patient care.

Keywords: Smart Haematology Analyzer, Cancer Risk Alert, InceptionV3, Blood Analysis, UDP Communication, Brain, Lung, Skin, Predictive Diagnostics

BREATH ANALYZER FOR MULTIPLE DISEASE DETECTION

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ABSTRACT

Breath analysis is a non-invasive diagnostic method used to detect diseases by identifying biomarkers present in exhaled air. This paper presents a portable breath analyzer designed to detect multiple diseases such as kidney failure, gastric ulcer, and lung disorders by analyzing gases like ammonia and volatile organic compounds (VOCs). The system uses MQ-series gas sensors interfaced with an ESP32 microcontroller to capture and process breath data in real time. The measured values are analyzed based on predefined thresholds and displayed on an OLED screen, providing immediate feedback to the user. The system is compact, low-cost, and easy to use, making it suitable for home-based and rural healthcare applications. Compared to traditional diagnostic methods, the proposed system offers a faster, non-invasive, and cost-effective solution for early disease screening. The results indicate that variations in breath gas concentrations can help identify abnormal health conditions, supporting the use of breath analysis in preventive healthcare.

Keywords: Portable Breath Analyzer, Non-Invasive Early Diagnosis, IoT- Enabled Health Monitoring, Gas Sensors, ESP32 Microcontroller, Cloud Connectivity.

A HYBRID AND IMPROVED LIGHTGBM MODEL FOR PREDICTING CORONARY HEART DISEASE

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ABSTRACT

Coronary Heart Disease (CHD) remains one of the leading causes of mortality worldwide, necessitating early and accurate prediction methods to improve patient outcomes. This paper proposes an efficient predictive framework using an improved Light Gradient Boosting Machine (LightGBM) algorithm for the early detection of CHD. The proposed model integrates advanced preprocessing techniques, including data cleaning, normalization, and feature selection, to enhance data quality and relevance. To address class imbalance, Synthetic Minority Oversampling Technique (SMOTE) is employed, improving model robustness. Hyperparameter tuning is performed to optimize model performance and reduce overfitting. The system is trained and evaluated using clinical datasets containing key attributes such as age, blood pressure, cholesterol levels, and lifestyle factors. Experimental results demonstrate that the improved LightGBM model achieves high accuracy, precision, and recall compared to traditional machine learning approaches. The model also identifies significant risk factors contributing to CHD, supporting clinical decision-making. The proposed approach provides a reliable, scalable, and efficient solution for early CHD prediction, with potential applications in healthcare systems for preventive diagnosis and risk assessment.The improved LightGBM model not only enhances predictive accuracy but also reduces computational complexity, making it suitable for large-scale medical datasets. The interpretability of the model, through feature importance analysis, allows healthcare professionals to better understand the contributing risk factors and take proactive preventive measures. This approach bridges the gap between data-driven insights and clinical practice, ultimately contributing to improved patient care, early intervention, and reduced mortality associated with coronary heart disease.

Keywords: Coronary Heart Disease (CHD), Light GBM (Light Gradient Boosting Machine), Machine Learning.

SMART HEADACHE ANALYZER

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ABSTRACT

This project presents a smart wearable system designed in the form of a neckband for identifying headache patterns using physiological signature mapping. The system continuously monitors key physiological signals such as heart rate variability (HRV), muscle activity (EMG), skin temperature, and electrodermal activity (EDA) in a non-invasive and user-friendly manner. These signals are acquired through integrated sensors strategically placed around the neck and ear region to ensure accurate data collection, stability, and enhanced user comfort during prolonged usage.The acquired multi-modal data is processed using an ESP32 microcontroller, where advanced signal processing techniques such as filtering, noise reduction, and feature extraction are applied. Multiple physiological parameters are then combined to generate unique signatures corresponding to different types of headaches, including migraine, tension-type, and stress-induced headaches. The system performs real-time analysis and classification using embedded algorithms, thereby significantly reducing dependence on subjective pain reporting and improving diagnostic reliability.Furthermore, wireless communication capabilities enable seamless data transmission to mobile or cloud platforms for continuous monitoring, visualization, and storage. The proposed neckband design ensures portability, energy efficiency, and suitability for long-term use. Overall, the system provides an effective solution for early detection, personalized healthcare, and improved management of headache conditions through objective physiological monitoring.

Keywords: Smart Wearable System, Headache Detection, EMG Signal Analysis, Physiological Signal Monitoring, ESP32, Real-Time Classification.

SMART VISION CARE SYSTEM USING AI BASED EYE ACTIVITY RECOGNITION AIR BLOWER CONTROL

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ABSTRACT

The widespread use of digital devices has significantly increased eye dryness and visual fatigue among students and professionals. Prolonged screen exposure reduces blinking rate and leads to incomplete blinking, causing tear evaporation and poor eye lubrication. This results in discomfort, irritation, and blurred vision. Conventional methods like manual reminders and eye drops fail to provide re l-time solutions. To address this, a Smart Vision Care System using AI-based eye activity recognition is proposed. The system uses a camera and a YOLO-based model to detect face and eye regions in real time. It analyses blinking rate, eye closure duration, and prolonged eye opening to identify signs of eye strain. When abnormal patterns are detected, an automated air blower is activated to provide gentle airflow.

Keywords: Eye Dryness, Visual Fatigue, AI-based Eye Tracking, YOLO, Blinking Detection, Smart Vision Care, Air Blower Control, Real-time Monitoring.

GREEN SYNTHESIS OF IRON OXIDE NANOPARTICLES USING PUNICA GRANATUM PEELS AND DEVELOPMENT OF NANOBEADS FOR TARGETED DRUG DELIVERY

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ABSTRACT

Nanotechnology has emerged as a transformative tool in biomedical engineering, particularly in drug delivery systems where precision, biocompatibility, and controlled release are critical. Iron oxide nanoparticles are of special interest due to their magnetic properties, low toxicity, and potential for site-specific targeting. In this work, we report the green synthesis of iron oxide nanoparticles using Punica granatum (pomegranate) peel extract, where phytochemicals act as natural reducing and stabilizing agents. This eco-friendly approach eliminates harmful chemicals, making the process sustainable and cost-effective. The synthesized nanoparticles were further incorporated into biopolymer-based nanobeads, enhancing drug encapsulation efficiency, stability, and sustained release behavior. Characterization was performed using UV-Visible spectroscopy, XRD, and FTIR to confirm nanoparticle formation and structural integrity. The nanobeads demonstrated protective effects against premature drug degradation and enabled controlled release at the target site. Additionally, the magnetic nature of iron oxide nanoparticles offers opportunities for magnetically guided drug delivery, minimizing systemic side effects. Overall, this study highlights Punica granatum peel-mediated nanobeads as a promising biocompatible platform for advanced drug delivery applications, combining sustainability with therapeutic efficiency.

Keywords: Iron Oxide Nanoparticles, Punica Granatum, Green Synthesis, Nanobeads, Drug Delivery, Biomedical Engineering.

DEEP LEARNING BASED CLASSIFICATION OF LIVER DISEASES FROM HETEROGENEOUS ULTRASOUND IMAGE

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ABSTRACT

Liver diseases such as fatty liver, cirrhosis, cysts, and tumors are among the leading causes of morbidity worldwide. Ultrasound imaging is widely used for liver diagnosis due to its non-invasive nature, low cost, and real-time capability. However, ultrasound images are heterogeneous in nature because of variations in imaging devices, operator dependency, and speckle noise, which makes manual diagnosis challenging. This project proposes a deep learning-based classification system using a ConvNeXt convolutional neural network to automatically classify liver diseases from heterogeneous ultrasound images. The proposed methodology includes image preprocessing, data augmentation, feature extraction using ConvNeXt, and multi-class classification using a softmax layer. Experimental results demonstrate that the proposed model effectively learns discriminative texture and structural features, achieving high accuracy and robustness across different liver disease categories. The system can assist radiologists by providing reliable and automated decision support.

Keywords: Deep Learning, Liver Disease Classification, Heterogeneous Ultrasound Imaging.

NON-INVASIVE DETECTION OF BLOOD CLOT BIOMARKERS FOR EARLY STROKE DIAGNOSIS

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ABSTRACT

Stroke remains a leading cause of global mortality, often due to delayed detection. This project proposes a non-invasive, real-time monitoring system that identifies physiological precursors of stroke by integrating an ESP32 microcontroller with high- precision sensors. By continuously tracking heart rate, SpO2, and body temperature, the system detects hemodynamic irregularities—such as atrial fibrillation-induced pulse variations or inflammatory spikes—indicative of early-stage thrombotic activity.The hardware architecture utilizes the MAX30102 pulse oximeter and MLX90614 infrared thermopile to capture vital signals, which are processed on-chip to filter motion artifacts. Data is transmitted via Bluetooth Low Energy (BLE) to a dedicated mobile application for remote medical review. Unlike expensive imaging like CT or MRI scans, this solution offers a low-cost, portable alternative optimized for home-care and resource-limited settings.Serving as a sophisticated early-warning triage tool, the system bridges the gap between sub-clinical symptoms and emergency intervention. By providing longitudinal data, it empowers healthcare providers to make informed decisions within the "golden hour," significantly improving clinical outcomes and global stroke prevention strategies.

Keywords: Non-Invasive Stroke Prediction, ESP32 Vital Signs Monitor, Wearable Thrombosis Detection.

MYOELECTRIC CONTROLLED PROSTHETIC FINGER SYSTEM

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ABSTRACT

Myoelectric prosthetic systems utilize muscle-generated electrical signals to control artificial limbs and assist individuals with amputations. This project focuses on the design and development of a myoelectric controlled prosthetic finger using a 3D printed mechanical structure and an embedded control system. EMG signals are acquired from forearm muscles using an EMG sensor and processed by a microcontroller such as Arduino Nano or ESP32. A threshold-based control algorithm is implemented to drive a servo motor, which pulls a tendon-like thread inside the prosthetic finger to produce flexion, while releasing the thread allows the finger to return to its extended position. The proposed system aims to provide a low-cost, simple, and intuitive prosthetic solution to restore basic finger movements and improve the functional ability and quality of life of amputees.

Keywords: Myoelectric Control, EMG Signal, Prosthetic Finger, 3D Printing, Servo Motor, Arduino, ESP32, Assistive Technology, Embedded Systems.

GREEN SYNTHESIS & CHARACTERIZATION OF NANOPARTICLES

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ABSTRACT

Green synthesis of oil-based Nano fluids has emerged as an environmentally benign and sustainable approach for enhancing thermophysical properties without the use of toxic chemicals. In the present study, oil-based Nano fluids were synthesized using a green route, employing plant-derived extracts as reducing and stabilizing agents for the preparation of nanoparticles. The synthesized nanoparticles were dispersed in biodegradable base oils such as vegetable or bio-oils through a controlled sonication process to achieve stable Nano fluid formulations. Structural and morphological characteristics of the nanoparticles were analyzed using techniques such as XRD, FT-IR, SEM, and UV–Vis spectroscopy. The stability of the prepared Nano fluids was evaluated using sedimentation observation and zeta potential analysis. Thermophysical properties including thermal conductivity, viscosity, and surface tension were systematically investigated at different nanoparticle concentrations and temperatures. The results demonstrated a significant enhancement in thermal conductivity with acceptable viscosity variation, indicating improved heat transfer performance. The green-synthesized oil-based Nano fluids show strong potential for eco-friendly applications in heat transfer, lubrication, and energy systems while minimizing environmental impact.

Keywords: Green Synthesis, Oil-Based Nano Fluids, Plant Extracts, Eco-Friendly Materials, Sustainable Engineering

PROSOPIS JULIFLORA LEAF- DERIVED ACTIVATED CARBON FOR ECO CO_2 CAPTURE

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ABSTRACT

Innovative and sustainable carbon capture techniques have been developed in response to the growing need to reduce rising atmospheric CO2 levels. For effective CO2 adsorption, this study examines a composite material composed of Potassium hydroxide (KOH), sodium hydroxide, and Prosopis juliflora Flora leaf ash. Prosopis juliflora Flora leaf ash, which is produced from agricultural waste and thermally activated at 700 °C, offers a porous support structure that is rich in potassium. While sodium hydroxide serves as a binder to increase pellet stability and structural strength, potassium is a highly reactive adsorbent that captures CO2 through carbonation. Excellent performance was shown by experimental results from two consecutive adsorption cycles, where the composite pellets achieved an average CO2 adsorption efficiency of 75% in both cycles. The development of a well-connected potassium network within the Prosopis juliflora Flora leaf ash, which increased surface area and improved CO2 interaction, was confirmed by structural analysis. In addition to strengthening the pellets, the addition of sodium hydroxide preserved their adsorption capacity over several cycles. Overall, the study emphasizes how Prosopis juliflora Flora leaf ash, potassium hydroxide, and sodium hydroxide work in concert to provide a scalable, affordable, and renewable solution for industrial carbon capture applications. Future research will concentrate on enhancing regeneration effectiveness and refining the composite for incorporation with actual emission sources.

Keywords: Activated carbon, Composite adsorbent, Carbon adsorption, Sustainable carbon capture

DEVELOPMENT OF REFRACTORY BRICK QUALITY THROUGH ADDITION OF BINDER

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ABSTRACT

This study investigates the development and evaluation of high-quality refractory bricks through the strategic addition of [insert specific binder, e.g., bentonite or silicate]. Refractory materials often face challenges such as low plasticity and insufficient green strength, which can be mitigated through binder optimization. In this work, various formulations were prepared by mixing raw aggregates with different binder percentages (5% to 15%), followed by drying and sintering at temperatures ranging from 1200°C to 1400°C. The fired samples were characterized for bulk density, apparent porosity, cold crushing strength (CCS), and thermal shock resistance. Results indicate that increasing the binder content significantly improves the CCS and densification of the bricks due to the formation of highly refractory phases like mullite and cristobalite. The findings suggest that the inclusion of [specific binder] effectively enhances the structural integrity and quality of the refractories, making them suitable for high-temperature industrial applications.

Keywords: Alumina Bricks, Bulk Density, Cold Crushing Strength, Apparent Poracity.

EDIBLE NUTRITIOUS GEL FORMULATION FROM SPIRULINA AND GUCCHI MUSHROOMS

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ABSTRACT

In order to provide a functional food with improved health advantages, the current study focuses on developing an edible, nutritious gel formulation combining spirulina and Gucchi mushrooms. To enhance nutritional quality and convenience of intake, Gucchi mushrooms—known for their beneficial micronutrients and bioactive compounds—and spirulina, a protein-rich microalga, were added to a gel matrix. Numerous analytical and biological procedures were used to assess the generated gel. The existence of significant bioactive substances such as flavonoids, phenols, and alkaloids was verified by phytochemical analysis. The formulation's antioxidant activity demonstrated its capacity to lessen oxidative stress. The gel demonstrated inhibitory effects against specific bacterial strains in antimicrobial experiments, indicating its potential to promote health and prevent infections. The Artemia assay was used to evaluate the formulation's toxicity, and the results showed that the gel is safe to eat at the measured quantities. The existence of many bioactive chemicals responsible for its therapeutic qualities was discovered through additional GC-MS research. Essential components that provide energy were found by the assessment of carbohydrates. Taste, texture, colour, and general acceptability were evaluated using sensory analysis, and the gel demonstrated good consumer approval. According to shelf life experiments, the formulation stayed stable for a considerable amount of time when stored properly. Overall, the created edible gel has encouraging antioxidant, antibacterial, and nutritional qualities, suggesting that it could be used as a functional food supplement to boost immunity and health.

Keywords: Gucchi Mushroom, Spirulina, Phytochemical, Bioactive, Antibacterial, GC MS

DEVELOPMENT OF IMMUNOBOOSTER NUTRACEUTICAL DRINK FOR ENHANCED RECOVERY IN CHEMOTHERAPY PATIENTS

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ABSTRACT

The purpose behind the formulation of IND is to help people who are undergoing chemotherapeutic treatments affected by cancer, especially like breast, head, and neck cancer. Also, the aim is to develop an innovative, functional, probiotic beverage to recover the health of people undergoing chemotherapy radiation to enhance their immunity and slow down after-effects of chemotherapy such as dehydration, nausea, exhaustion, dysgeusia, mucositis, diarrhea, etc. Key ingredients in the formulation included L-glutamine, hydrolyzed collagen peptides, tender coconut water, B-complex, zinc citrate, aloe vera, lemon, ginger, probiotics (L-acidophilus), and preservative (Sodium Benzoate). This combination of ingredients in accurate amounts as per FSSAI standards can create a powerful medicinal nutraceutical drink eclipsing vitamins, minerals, amino acids, fatty acids, and other nutrients. Laboratory tests such as total glucose, lipid, carbohydrate, protein, total energy value, pH, shelf life, and iron were estimated along with significant tests such as cytotoxicity by MTT assay, GCMS, ELISA, and molecular docking were estimated after formulation. The IND sample had high acceptability levels during sensorial analysis. Therefore, this new, non-dairy, probiotic nutraceutical drink can aid in the helping of cancer patients in the community and provide them comfort and solace.

Keywords: Nutraceutical beverage, Lactobacillus acidophilus, Oncology

EXTRACTION OF OIL FROM GINGER USING DIFFERENT EXTRACTIVE SOLVENT (ACETONE, ETHANOL AND AQUEOUS) AND ITS ANTIBACTERIAL ACTIVITY

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ABSTRACT

The extraction of oil from *Zingiber officinale* (ginger) was carried oaut using different solvents, namely acetone, ethanol, and aqueous (water)**,** to evaluate their efficiency in extracting bioactive compounds. Ginger is widely known for its medicinal and aromatic properties, primarily due to the presence of essential oils and oleoresins. Ginger (*Zingiber officinale*) is a widely used medicinal plant known for its bioactive compound gingerol**,** which exhibits strong antimicrobial properties. In this study, gingerol-rich extract was obtained from dried ginger using ethanol as the extraction solvent due to its efficiency in dissolving phenolic compounds. The antibacterial activity of the ethanolic extract was evaluated against common bacterial strains using the agar well diffusion method. The extract showed significant inhibition zones against both Gram-positive and Gram-negative bacteria, indicating effective antibacterial activity. The results suggest that ethanol is a suitable solvent for extracting gingerol and that the extract possesses promising antibacterial properties. This study highlights the potential use of ginger-derived compounds as natural antibacterial agents in pharmaceutical and food applications.

Keywords: Ginger *Zingiber officinale,* Gingerol**,** Bioactive Compound, Antibacterial Activity

NUTRI SCAN: COMPREHENSIVE ANALYSIS OF FOOD PRODUCT NUTRITIONAL VALUES

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ABSTRACT

The accurate assessment and analysis of nutritional values in food products are critical for fostering healthy dietary choices, addressing public health concerns, and meeting regulatory compliance. Nutri Scan is a proposed comprehensive analytical system designed to evaluate and present detailed nutritional information for a wide range of food products. Leveraging advanced technologies such as spectroscopy, machine learning algorithms, and big data analytics, Nutri Scan aims to deliver rapid, accurate, and user-friendly nutritional insights. This system integrates diverse datasets, including food composition databases, historical nutritional records, and real-time scanning outputs, to ensure high precision. Nutri Scan also incorporates artificial intelligence for ingredient recognition, caloric estimation, and macronutrient breakdown. Furthermore, it provides tailored recommendations and warnings for users with specific dietary restrictions or health conditions, enhancing its utility as a personal nutrition assistant. The proposed solution seeks to bridge gaps in current food analysis methods by offering scalability, portability, and compatibility with mobile and desktop platforms. It is designed to empower consumers, nutritionists, and food manufacturers with actionable data, promoting transparency in food labeling and fostering healthier consumption patterns. The paper outlines the system architecture, key features, technological innovations, and potential applications in diverse contexts, including public health initiatives, personalized nutrition, and food safety monitoring.

Keywords: Nutritional Analysis, Food Products, Spectroscopy, Machine Learning, Food Labeling, Personalized Nutrition, Public Health.

PESTICIDE RESIDUE MITIGATION AND QUALITY ASSESSMENT IN SMALL CARDAMOM (*Elettaria Cardamomum Maton*)

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ABSTRACT

A study on Pesticide residue mitigation in small cardamom *Elettaria cardamomum Maton* L. was undertaken at Indian Cardamom Research Institute, Myladumpara during January 2026 to March 2026. The objectives were to evaluate the effect of different decontamination methods for removal of pesticide residues from cured small cardamom and also to evaluate its quality parameters. Field survey was conducted among the farmers of Idukki, Kerala and revealed that Quinalphos, Profenofos, Lambda Cyhalothrin, Chlorpyrifos, Thiamethoxam and Acephate were the most commonly used pesticides by the farmers and these were selected for spraying in the concentration of Quinalphos 1.2 ml/L, Profenofos 1.5 ml/L, Lambda Cyhalothrin 0.4 ml/L, Chlorpyrifos 2 ml/L, Thiamethoxam 0.2 g/L and Acephate 1 g/L. The experiment was laid out in completely randomized design (CRD) with 10 treatments and 3 replications to study the efficacy of the different decontamination techniques in removing pesticide residues from cardamom capsules. Among various treatments, the mean percentage reduction of pesticide residue among various decontamination methods was in the range between 17.13 % to 58.85 % in which the fresh cardamom subjected to washing in water for three times followed by ultrasound treatment for 10 minutes (T7) and then cured is the most effective method in the removal of quinalphos residues (58.85 %) from the green cardamom when comparing to the untreated control (T1). The second-best decontaminating method was combination of 2 % synthetic vinegar with ozone (T10), which removed a mean percentage of (58.13%) pesticide residues from dry cardamom capsules. The study proved that subjecting fresh cardamom capsules to Ultrasound treatment followed by curing is an effective way for removing pesticide residues from the green cardamom also this treatment have shown better results among the quality parameters evaluation such as essential oil analysis, bulk density and chlorophyll.

Keywords: Pesticide, Quinalphos, Profenofos, Lambda Cyhalothrin, Chlorpyrifos, Thiamethoxam

FABRICATION OF ECO-FRIENDLY BIOFILM USING LEMON PEEL PECTIN AND MICROBIAL CELLULOSE

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ABSTRACT

The issue of environmental pollution from synthetic plastics is a growing concern which in turn is putting pressure on the use of sustainable and biodegradable materials which we see in food packaging. That is what this research sets out to do we are developing an eco friendly composite biofilm which we made from lemon peel waste pectin which we used as a base. Lemon peels which are a large scale agro industrial by product were chosen as a low cost source for the pectin which we extracted via an acid hydrolysis process we conducted in controlled conditions also which we then put through characterizing before we used it as our primary film forming material. For the bacterial cellulose we did a microbial fermentation which we incorporated into the pectin matrix to improve the film's mechanical and functional performance. Also to increase flexibility we added in glycerol. The we analyzed our composite films for their physiochemical properties which included thickness, tensile strength, water absorption and biodegradability. We found out that using bacterial cellulose to reinforce pectin greatly improved the film's strength, durability and overall stability. Also we noted that the developed biofilm did very well in terms of biodegradation in natural environment which in turn indicates its use as a better alternative to traditional plastic packaging. We see the use of lemon peel waste in this study as a way to reduce environmental pollution which at the same time supports the use of agricultural residues. In total this study reports on the success of using plant based pectin and microbial cellulose to put forth sustainable and biodegradable packaging solutions. Also the developed biofilm we present has very strong potential for use in food packaging which in turn supports eco friendly practices and better waste management.

Keywords: Biodegradable film, Sustainable packaging, Lemon peel pectin, Bacterial cellulose

SEAWEED ANTIOXIDANT SPRAY FOR REDUCING LIPID OXIDATION IN FISH

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ABSTRACT

One big problem in fishing business is Fish go bad fast when fats break down and microbes spread. This causes shorter storage times along with money lost. Now here comes a fresh idea – using sea plants like Sargassum wightii and Halymenia dilatata to make a protective mist that slows decay. Workers gathered these seaweeds, let them dry without sunlight, turned into fine dust, and then soaked that powder in 70% alcohol by leaving it steeped over time. From this soak came liquids tested against damaging molecules using both DPPH and phosphomolybdenum methods while also checking how much plant-based chemicals like phenols and flavonoids were inside. It turned out Sargassum wightii had stronger antioxidant effects than Halymenia dilatata. Instead of just measuring antioxidants, the team checked how well the seaweed spray fought bacteria like Pseudomonas aeruginosa and Staphylococcus aureus – higher doses worked better. When stored in the fridge, fish sprayed with the formula lasted longer, shown by slower spoilage signs over time. Peroxide levels stayed low in treated fish, meaning fats broke down much less when compared to ones left unsprayed. Microbes took their time growing on the coated samples, which quietly pointed toward extended freshness without saying it outright. From start to finish, findings point toward seaweed-based antioxidants as practical, green substitutes for lab-made preservatives. Using these naturally active substances in keeping seafood fresh improves both longevity and condition – while matching what people want: food that's safer, responsibly sourced, without complicated labels.

Keywords: Maceration Extraction, Seafood Shelf Life, Free Radical Scavenging, Oxidative Rancidity, Eco-friendly Preservatives

EXTRACTION AND PURIFICATION OF PHYCOERYTHRIN FROM RED SEAWEEDS – APPLICATION USED AS NATURAL FOOD COLORANT

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ABSTRACT

The increasing consumer preference for natural and safe food additives has led to the exploration of bioactive pigments from marine resources. Phycoerythrin, a red phycobiliprotein found in red algae, is known for its vibrant color and potential health benefits. In the present study, phycoerythrin was extracted, purified, and characterized, and its functional properties were evaluated to determine its suitability as a natural food colorant. The pigment was extracted under cold conditions and purified using ammonium sulfate precipitation followed by dialysis. Characterization using UV–Visible spectroscopy revealed a characteristic absorption peak at 565 nm, while SDS-PAGE and FTIR analysis confirmed its protein nature and structural integrity. The antioxidant activity of the pigment was evaluated using DPPH and ABTS assays, showing significant free radical scavenging activity. Antimicrobial activity demonstrated moderate inhibition against selected bacterial strains. Stability studies indicated that phycoerythrin remains stable under neutral pH and low-temperature conditions but degrades at higher temperatures. Cytotoxicity analysis confirmed its safety at moderate concentrations. The pigment was successfully incorporated into food products such as whipping cream, coconut milk yoghurt, and milkshakes, producing stable and visually appealing coloration. These findings suggest that phycoerythrin has strong potential as a natural alternative to synthetic food colorants in low-temperature food systems.

Keywords: Phycoerythrin, Natural food colorant, Red seaweed, UV–Visible spectroscopy, FTIR, SDS-PAGE, Antioxidant activity

DEVELOPMENT OF RTC LOW FAT DRIED GULAB JAMUN BALLS USING HEAT PUMP DRYING METHOD

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ABSTRACT

This study aims to develop a low-fat ready-to-cook (RTC) gulab jamun using Heat Pump Drying (HPD) technology as a modern alternative to conventional deep-fat frying. Traditional gulab jamun, though widely consumed and culturally significant, is associated with high fat content, limited shelf life, and susceptibility to microbial spoilage due to its high moisture content. To overcome these limitations, a standardized formulation was prepared using khoa, refined wheat flour, skim milk powder, baking powder, and water to produce a dough suitable for non-fried dehydration. The dough was shaped into uniform balls and subjected to control drying using a heat pump dryer to ensure uniform moisture removal while preserving structural and sensory attributes. The drying process demonstrated a gradual reduction in moisture, achieving a final moisture content of 32%, which is adequate to inhibit microbial growth and extend shelf life while maintaining product integrity. Physicochemical analysis revealed that the developed product had a bulk density of 0.77 g/cm³ and exhibited controlled shrinkage (12.8% diameter and 33.7% volume reduction), retaining its spherical shape without cracks. Texture profile analysis indicated a firm outer structure with moderate chewiness and low adhesiveness, making it suitable for handling and packaging. Colour analysis showed desirable light cream-brown tones with minimal browning due to the controlled drying conditions. The rehydration ratio of 1.78 confirmed good water absorption capacity, enabling the product to regain its soft and spongy texture upon soaking in sugar syrup. Overall, the results indicate that HPD is an effective method for producing a low-fat, shelf-stable RTC gulab jamun with desirable quality characteristics. The developed product offers advantages such as reduced fat content, improved storage stability, ease of preparation, and potential for commercialization in modern food markets.

Keywords: Ready-to-Cook (RTC), Gulab Jamun, Heat Pump Drying (HPD), Low-fat product, Dehydration, Shelf life, Rehydration ratio, Texture analysis

DEVELOPMENT OF NANO BASED MEMBRANE USING CHITOSAN NANOPARTICLE AND COPPER OXIDE NANOPARTICLE FOR FRUIT AND VEGETABLE PERSERVATION

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ABSTRACT

Nearly 20–30% of fruits and vegetables are lost after harvest, indicating the need for sustainable preservation techniques. In this study, a nano based membrane film was created by combining chitosan nanoparticle which is extracted from shrimp shell and copper oxide nanoparticle synthesized from shiitake mushroom. UV Spectroscopy and Fourier transform infrared (FTIR) Spectra indicated the interaction between chitosan nanoparticle and copper oxide nanoparticle in the nanocomposite film. Using the agar well diffusion method, the antimicrobial activity of the developed nanocomposite was assessed against specific foodborne pathogens, such as Staphylococcus aureus, Bacillus subtilis, Bacillus cereus, and Escherichia coli. When compared to the control, the nanocomposite showed improved antibacterial efficacy. The cytotoxicity of the nanocomposite on L929 cell lines was assessed using the MTT assay. The result shows that cell viability declined with concentration, remaining above 80% at lower concentrations (25–50 µg/mL) and dropping to about 54.76% at the highest concentration (100 µg/mL). This suggest that the nanocomposite exhibits moderate cytotoxic effects at higher concentrations while maintaining acceptable biocompatibility at lower doses. Fresh fruits and vegetables were treated with the nanocomposite to test its ability to preserve them in the presence of environmental factors. The nanocomposite film can be a potential choice for improving the shelf life and preservation of fruits and vegetables.

Keywords: Chitosan Nanoparticles, Copper Oxide Nanoparticles, Nanocomposite, Antimicrobial activity, Coating, Fruits and vegetable Preservation

EXTRACTION OF ANTHOCYANINS FROM STRAWBERRY AS A NATURAL FOOD COLORANT WITH ANTI CANCER PROPERTIES

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ABSTRACT

Anthocyanins are naturally occurring water-soluble pigments belonging to the flavonoid group, responsible for the red, purple, and blue colors in many fruits and vegetables. Among these, strawberries are a rich and widely consumed source of anthocyanins, particularly pelargonidin-3-glucoside, which contributes to their characteristic bright red color. Due to increasing consumer demand for natural alternatives to synthetic food colorants, anthocyanins extracted from strawberries have gained significant attention in the food, pharmaceutical, and nutraceutical industries. The extraction of anthocyanins from strawberries involves several techniques, with solvent extraction being the most commonly used method. Typically, acidified solvents such as methanol, ethanol, or water (acidified with hydrochloric acid or citric acid) are employed to enhance pigment stability and extraction efficiency. Parameters such as pH, temperature, solvent polarity, and extraction time significantly influence the efficiency and stability of anthocyanin recovery. Post-extraction processes like filtration, concentration, and purification using column chromatography or membrane filtration are often applied to obtain high-purity anthocyanin extracts. Anthocyanins (strawberry)are highly sensitive to environmental factors such as pH, light, oxygen, and temperature, which can lead to degradation and color loss. Therefore, stabilization techniques such as microencapsulation, co-pigmentation, and the use of stabilizing agents. As natural food colorants, strawberry-derived anthocyanins are increasingly used in beverages, dairy products, confectionery, and bakery items. Impared to synthetic dyes, anthocyanins offer the advantage of being non-toxic, biodegradable, and associated with various health benefits.

Keywords: Anthocyanins, Strawberry, Natural food colorant, Extraction techniques, Antioxidant activity, Anticancer properties, Pelargonidin-3-glucoside, Microencapsulation, Functional foods, Nutraceuticals

ISOLATION, PRODUCTION, AND APPLICATION OF PROTEASE ENZYME FROM BACTERIAL ISOLATED FROM DAIRY INDUSTRIAL SOIL

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ABSTRACT

Microorganisms are the best sources of extracellular protease and are used in various industrial processes for their potential application. Soil samples were collected from dairy processing sites, rich in proteinaceous waste, serve as a potent source for isolating diverse microbial strains with high proteolytic activity. Standard microbiological techniques, including serial dilution and plating on selective media such as skim milk agar, are employed to isolate and screen bacteria based on clear zone formation indicating casein hydrolysis. The isolate showing maximum protease activity was identified as bacillus sp. The potential isolate belonged to genus Bacillus. Culture medium parameters such as pH, temperature, incubation time, carbon and nitrogen sources were optimized for the high yield of protease production. The optimum conditions were pH - 7.0, temperature - 40°C, incubation time - 72 hours, carbon source - glucose/fructose, nitrogen source - yeast extract/peptone. Protease from bacterial strain was partially purified using (NH4) 2SO4 precipitation and characterized by SDS-PAGE analysis. The purified enzyme was tested for food industrial application. The application Such as rapidly find out the adultration in milk using protease enzyme and proteases are used in baking industry to modify the gluten structure in dough, resulting in improved dough handling, enhance softness, and better texture in baked goods such as bread.

Keywords: Extracellular protease, Skim milk agar, casein hydrolysis, optimization, purification

PREPARATION OF PROTEIN ENRICH ANTIOXIDENT AND ANTIDIABETIC RUSK BY USING FOXTAIL MILLET *(Setaria italica)*

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ABSTRACT

The increasing prevalence of lifestyle-related disorders such as diabetes and oxidative stress has led to a growing demand for functional foods with enhanced nutritional and therapeutic properties. Millets, particularly foxtail millet (Setaria italica), have gained attention due to their rich nutrient profile, including dietary fiber, proteins, minerals, and bioactive compounds. This study focuses on the development and evaluation of a protein-enriched, antioxidant-rich, and antidiabetic rusk using foxtail millet as a primary ingredient. In addition to protein-rich components like legumes and natural antioxidant sources, foxtail millet flour was used in the rusk's composition. Physicochemical examination, nutritional evaluation, antioxidant activity assessment, and sensory analysis were performed on the prepared rusk samples. According to the findings, the new rusk had a far higher protein content than traditional rusks made from wheat. Phenolic chemicals also contributed to increased antioxidant activity, which is essential for lowering oxidative stress. Through in vitro investigations, such as glycemic index analysis and enzyme inhibition tests like alpha-amylase inhibition, the rusk's antidiabetic potential was assessed. The findings showed that the rusk made from foxtail millet had a reduced glycemic response, making it appropriate for people with diabetes. The product's flavor, texture, color, and general palatability were all deemed satisfactory by the sensory review.In summary, adding foxtail millet to rusk preparation greatly enhances its functional qualities and nutritional value. In addition to being a healthier substitute for traditional bakery goods, the created product may help control oxidative stress and diabetes. The potential of millets as a useful and sustainable component in the creation of food items with added value is highlighted by this study.

Keywords: Foxtail Millet, Protein Enrichment, Antioxidant Activity, Antidiabetic, Functional Food, Rusk, Glycemic Index, Phenolic Compounds

CARRAGEENAN BASED FUNCTIONAL FILM INTEGRATED WITH ALGAE MEDICATED METAL NANO PARTICLES FOR ACTIVE FOOD PACKAGING APPLICATION

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ABSTRACT

The growing demand for sustainable and safe food packaging materials has encouraged the development of biodegradable films with active functionalities. In this study, a carrageenan-based functional film incorporated with algae-mediated metal nanoparticles was developed and evaluated for active food packaging applications. Carrageenan, a natural polysaccharide derived from red seaweed, was selected as the film-forming matrix due to its excellent biocompatibility and film-forming ability. Metal nanoparticles were synthesized using algal extracts as reducing and stabilizing agents, offering an eco-friendly and green synthesis approach. The prepared composite films were characterized for their physicochemical, mechanical, barrier, and antimicrobial properties. Results indicated that the incorporation of algae-mediated nanoparticles significantly enhanced tensile strength, reduced water vapor permeability, and improved thermal stability of the films. Moreover, the films exhibited notable antimicrobial activity against common foodborne pathogens, demonstrating their potential to extend the shelf life of perishable food products. Structural analysis confirmed uniform dispersion of nanoparticles within the polymer matrix, contributing to improved performance. The developed films also showed good biodegradability, making them an environmentally friendly alternative to conventional plastic packaging. Overall, this study highlights the potential of carrageenan-based nanocomposite films as promising candidates for active food packaging systems, combining sustainability with enhanced functional properties.

Keywords: Carrageenan, Algae-mediated synthesis, Metal nanoparticles, Biodegradable film, Active packaging, Antimicrobial activity, Food preservation, Nanocomposite film

DEVELOPMENT AND EVALUATION OF BIOACTIVE-RICH PUMPKIN SEED-PROBIOTIC BITES FOR GASTROINTESTINAL HEALTH

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ABSTRACT

Humans are well known for their spicy foods. However, their dietary patterns are often associated with gastrointestinal disorders such as peptic ulcer. Globally, peptic ulcer disease is one of most common gastric disorder. It is caused primarily by the imbalance between factors like gastric acid and gastric mucosal barrier, which helps to protect stomach lining during digestion. In recent years, natural plant based functional foods have sought attention to reduce the potential health effects caused by gastric disorders and improve overall human health. Among this, Cucurbita pepo (pumpkin) has emerged as a rich bioactive profile. Therefore, the present study aims to develop a functional food product enriched with anti-ulcer potential with improved digestion. Pumpkin seeds and peel are collected, processed, extracted and supplemented with bifidobacterium strains. Probiotic stability test was conducted and phytochemical screening including both quantitative and qualitative analyses was carried out to determine the presence of bioactive compounds. The Antioxidant and Anti-ulcer potential were evaluated through FRAP (Ferric reducing Antioxidant Power) method and using ELSIA (Enzyme-Linked Immunosorbent Assay). A Comparative analysis between pumpkin seeds and peel was conducted to examine their bio-active compounds and anti-ulcer potential. Notably, seeds exhibit more anti-ulcer potential than peel. Thus, it is an opportunity for value addition through resource recovery and sustainable waste management. Based on this finding, a probiotic-enriched pumpkin seed bite product infused with bifidobacterium strains was developed, and the formulated synbiotic product was further evaluated with quality, stability and shelf life. The results suggests that pumpkin seed-based bites have significant potential as plant based functional food products managing peptic ulcer and gastric disorders while also promoting overall digestive health.

Keywords: Peptic Ulcer Disease, Functional Foods, Cucurbita Pepo (Pumpkin), Probiotics (Bifidobacterium), Bioactive Compounds, Sustainable Waste Management

DEVELOPMENT OF BIODEGRADABLE PACKING MATERIAL BY COMBINING CORN HUSK AND GROUNDNUT SHELL

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ABSTRACT

Nowadays, plastic packaging materials are widely used in food and other industries, but it creates serious environmental problems because it is non-biodegradable. Due to this, there is a growing need to find eco-friendly and sustainable alternatives. In this project, an attempt has been made to develop biodegradable packaging material using agricultural waste such as corn husk and groundnut shell. These raw materials are easily available and usually discarded in large amount as waste. They were collected, cleaned, dried properly and ground into fine powder. The powdered materials were then mixed with natural binding agents such as corn starch and glycerol to form a uniform mixture, which was further processed into sheets, plates, cups or any other forms. The prepared materials were allowed to dry for 24hrs, and were later tested for basic properties like strength, flexibility, and water resistance. Major properties like SEM and FTIR. The results show that the developed material has good potential to be used as a biodegradable packaging alternative for light applications. It is eco-friendly, cost-effective, and helps in reducing agricultural waste as well as plastic pollution. Although it may not completely replace plastic in all applications, it can be a suitable alternative in certain areas like fruit and vegetables carrying trays. This project highlights the importance of sustainable materials and encourages the use of natural resources for developing environmentally friendly packaging solutions. Further improvements can be made to enhance its durability and expand its practical applications in the packaging industry.

Keywords: Biodegradable Packing Material, Utilisation Of Agriculture Waste, Corn Husk, Groundnut Shell

SMART FAST-FOOD RECOGNITION AND NUTRITIONAL RISK EVALUATION USING ARTIFICIAL INTELLIGENCE

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ABSTRACT

The fast growth in ultra-processed food consumption has become a major concern in this trend. The primary reason for the threat is its direct impact on public health and nutritional balance. Fast foods and ultra-processed foods are typically high in calories, saturated fats, sugars, and sodium. This contributes to lifestyle-related disorders such as obesity, diabetes, and cardiovascular diseases. There is a necessity to screen and analyze these foods before consuming. This paper introduces an intelligent food screening framework with the integration of Artificial Intelligence (AI) with food technology in nutritional analysis. This helps to detect fast-food items and its detailed health risks. we utilized deep learning based image recognition techniques to track fast-food items from images and estimates essential nutritional components, including caloric value, fat content, sugar levels, and sodium concentration. This novel approach uses a structured food composition database and nutritional parameters for accurate evaluation and prediction. The proposed approach eliminates the need for manual dietary classification and offers risk factors, making it feasible for everyday dietary monitoring and nutritional analysis. By combining food identification with nutritional risk assessment, this work contributes to the advancement of smart food systems and personalized nutrition. The proposed framework shows the impact of AI- in food informatics to spread awareness and support preventive healthcare within the domain of food technology.

Keywords: Fast-food detection, Food informatics, Nutritional analysis, Health risk assessment, Deep learning, Computer vision, Dietary monitoring, Smart food systems, *Nutritional Profiling*, AI in nutrition

INNOVATIVE STRATEGIES FOR FOOD PRESERVATION TO CONTROL MICROBIAL CONTAMINATIONS

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ABSTRACT

Innovative strategies for food preservation are becoming increasingly important to control microbial contamination and ensure food safety. Microorganisms such as bacteria, fungi, and viruses are major causes of food spoilage and foodborne diseases, leading to significant health risks and economic losses. While traditional preservation methods like refrigeration, drying, and chemical preservatives have been widely used, they often have limitations such as nutrient loss, altered taste, and potential health concerns. As a result, modern preservation techniques are being developed to overcome these drawbacks and provide safer, more effective solutions.Recent advancements focus on the use of natural antimicrobials, non-thermal processing technologies, biopreservation, nanotechnology, and smart packaging systems. Natural substances like plant extracts, essential oils, and bacteriocins offer antimicrobial properties without harmful chemical residues. Non-thermal methods such as high-pressure processing, pulsed electric fields, and cold plasma effectively inactivate microorganisms while preserving the nutritional and sensory quality of food. Biopreservation utilizes beneficial microorganisms to inhibit the growth of harmful microbes, especially in fermented products. In addition, nanotechnology enhances preservation through antimicrobial nanoparticles and improved packaging materials, while active and intelligent packaging systems help extend shelf life and monitor food quality.These innovative approaches not only improve food safety and quality but also reduce food wastage and meet the growing consumer demand for minimally processed and chemical-free foods.

Keywords: Food Preservation, Microbial contamination, Natural antimicrobials, Bio Preservation, Shelf life extension, Active packaging, Food safety

CHITOSAN–GELATIN–PVA SMART FILMS WITH ANTHOCYANINS FOR REAL-TIME COLORIMETRIC SEA FOOD SPOILAGE DETECTION

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ABSTRACT

The preservation of seafood freshness is a critical challenge in the food industry due to the rapid accumulation of volatile nitrogenous compounds that compromise consumer safety and economic value. Conventional assessment techniques often require expensive laboratory equipment or subjective sensory evaluation, which are impractical for real-time monitoring throughout the supply chain. This study addresses these limitations by developing a biodegradable, halochromic smart film composed of chitosan, polyvinyl alcohol (PVA), and gelatin, incorporated with natural anthocyanins as a pH-sensitive indicator. The integration of these biopolymers creates a robust matrix with enhanced mechanical properties and moisture resistance, while the anthocyanins serve as a functional pigment capable of detecting spoilage markers such as ammonia and amines. Characterization through FTIR and SEM confirms successful molecular interactions, such as hydrogen bonding and electrostatic connections, ensuring the uniform distribution of the pigment within the film. As seafood undergoes spoilage, the release of volatile basic nitrogen (TVB-N) increases the pH in the package headspace, triggering a distinct and visible color transition in the film from red/pink to green/blue. To enhance the utility of this technology for consumers and retailers, a dedicated smartphone application was utilized to analyze the colorimetric response. By correlating RGB values with critical freshness thresholds, the app provides a non-destructive, semi-quantitative evaluation of product quality in real-time. These results demonstrate that the chitosan-PVA-gelatin smart film is an eco-friendly, highly sensitive, and user-friendly solution for intelligent packaging, effectively reducing food waste and ensuring the safety of perishable seafood products

Keywords: Chitosan, PVA, Anthocyanin, FTIR, SEM, Halochromic Smart Film, Real Time Spoilage Monitoring.

GREEN ALGINATE-BASED ESSENTIAL OIL EMULSION COATINGS: A SCALABLE STRATEGY FOR DELAYING FRUIT RIPENING AND MICROBIAL SPOILAGE

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ABSTRACT

Postharvest spoilage and rapid quality deterioration greatly affect the shelf life and marketability of table grapes. This study explores a green and sustainable approach using sodium alginate-based edible coatings enriched with black cumin seed oil (BCSO) nano-emulsions to extend grape shelf life. Different formulations (SA, SA + 0.3% EO, SA + 0.5% EO, T20 + 0.5% EO, and SA + 0.6% EO) were applied and compared with uncoated control fruits. The samples were stored under refrigerated (4°C) and ambient (25°C) conditions to assess their effectiveness under practical storage environments. The nano-emulsions exhibited good physical stability, with no phase separation and favorable zeta potential values. Once applied, the coatings formed a thin, uniform layer on the grape surface, acting as a semi-permeable barrier. This significantly reduced physiological weight loss by limiting moisture loss and respiration, while also delaying browning in coated fruits compared to the control. Physicochemical analysis showed that the coatings helped maintain titratable acidity (TA) and total soluble solids (TSS), while slowing the increase in pH, indicating delayed ripening. Additionally, the incorporation of BCSO improved the retention of bioactive compounds, including total phenolic content (TPC), total flavonoid content (TFC), and total anthocyanin content (TAC) during storage. Sensory evaluation revealed that coated grapes retained better appearance, texture, and flavour without any negative impact. Overall, alginate-based BCSO nano-emulsion coatings offer an effective, eco-friendly strategy to reduce weight loss, delay spoilage, and enhance the postharvest quality of grapes.

Keywords: Sodium Alginate, Black Cumin Seed Oil, Nano-Emulsion, Edible Coating, Weight Loss, Shelf Life, Grapes, Postharvest Quality

SEAWEEDS – APPLICATION USED AS NATURAL FOOD COLORANT

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ABSTRACT

The proposed framework employed Artificial Intelligence (AI) in 3D food printing for traditional Tamil Nadu snacks, enhancing their shape, flavours, and preferred taste by the optimisation of the Stereolithography files (STL) format. The STL format is mostly used in 3D printing for better enhancement of the object's detail. The input is fed by the users, such as the ingredients, flavour, and taste profile of a snack, along with design parameters such as shape, pattern, and structural type. The framework recognises input data from the user and optimises AI in 3D food printing for enhancing printability and structural stability to generate snack images. The STL format evaluates files of the Tamil Nadu snacks into different shapes and tastes. Therefore, the framework optimises the 3D food printing through AI and generates images through the STL format through the data fed by the user, through which novel designs could be customised in printing the traditional Tamil Nadu snacks

Keywords: Artificial Intelligence (AI), Stereolithography, 3D food printing

SMART MULTI-SENSOR SYSTEM FOR REAL-TIME EDIBLE OIL QUALITY ANALYSIS (VISCOSITY, OXIDATION AND POLAR COMPOUNDS)

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ABSTRACT

The quality of edible oil deteriorates with repeated heating, leading to the formation of harmful oxidation products and total polar compounds that pose risks to human health. Conventional laboratory methods for oil quality analysis are time-consuming, expensive, and unsuitable for real-time monitoring in practical cooking environments. This study presents a smart multi-sensor system for real-time edible oil quality monitoring. The system integrates a viscosity sensor, oxidation detection sensor, and a chemical sensor for polar compound estimation, all connected to a microcontroller-based data acquisition platform. Sensor data are continuously collected and processed to evaluate oil degradation during heating cycles. Signal preprocessing and feature extraction techniques are applied, followed by threshold-based classification to categorize oil quality into safe, moderate, and degraded conditions. Validation experiments conducted on different edible oils under controlled heating conditions showed measurable changes in viscosity, oxidation level, and polar compounds. The system successfully detected oil deterioration and provided rapid, reliable results without laboratory testing. The proposed system is cost-effective, portable, and user-friendly, making it suitable for domestic and industrial applications. It contributes to improved food safety, public health, and efficient oil management.

Keywords: Edible Oil Monitoring, Multi-Sensor System, Real-Time Analysis, Oxidation, Polar Compounds, Food Safety.

DEVELOPMENT AND EVALUATION OF A MELINIS REPENS-BASED HYDROGEL FOR TOPICAL TREATMENT OF NON-MELANOMA SKIN CANCER

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ABSTRACT

Skin cancer is one of the most common forms of cancer worldwide, with non-melanoma types such as squamous cell carcinoma and basal cell carcinoma showing increasing incidence due to prolonged exposure to ultraviolet radiation and environmental factors. Conventional treatment methods, including chemotherapy, radiation, and surgery, often result in adverse side effects and limited patient compliance. Therefore, there is a growing need for safer, more effective, and targeted therapeutic approaches. The present study focuses on the development of a hydrogel-based topical drug delivery system incorporating the ethanolic extract of Melinis repens, a plant belonging to the Poaceae family with potential medicinal properties. The extract was evaluated for its phytochemical composition, antioxidant, anti-inflammatory, cytotoxic, and anticancer activities. Phytochemical screening confirmed the presence of bioactive compounds such as phenols, flavonoids, tannins, glycosides, and quinones, which are known for their therapeutic potential. Toxicity analysis using the brine shrimp lethality assay indicated low toxicity and good biocompatibility of the extract. The anticancer potential was assessed using the MTT assay on A431 human skin cancer cell lines, which revealed a dose-dependent decrease in cell viability with a significant IC_{50} value, indicating strong cytotoxic activity. Apoptosis studies further confirmed that the extract induces programmed cell death, as evidenced by nuclear condensation, chromatin fragmentation, and formation of apoptotic bodies. Furthermore, a polyvinyl alcohol (PVA)-based hydrogel was successfully formulated to enhance the stability and controlled release of the plant extract for topical application. The hydrogel system offers advantages such as improved drug penetration, sustained release, and reduced systemic toxicity.

Keywords: *Melinis repens*, Skin Cancer, Topical Drug Delivery, PVA Hydrogel, Phytochemicals, Anticancer Activity, Apoptosis, A431Cell Line

STUDY ON POLYCYSTIC OVARIAN DISEASE AND POLYCYSTIC OVARIAN SYNDROME ACTIVITY USING AQUEOUS EXTRACT OF COMBINATION OF PLANTS EXTRACT

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ABSTRACT

Polycystic ovarian disease (PCOD) and polycystic ovarian syndrome (PCOS) are common endocrine disorders affecting women of reproductive age, often leading to hormonal imbalance, irregular menstrual cycles, and infertility. The present study aims to evaluate the therapeutic potential of aqueous extracts of selected medicinal plants, namely *Cinnamomum verum*, *Vitex negundo*, and *Anacyclus pyrethrum*, in the management of PCOD and PCOS. These plants are traditionally known for their anti-inflammatory, antioxidant, and hormone-regulating properties. The aqueous extracts were prepared and analysed for their combined effect on hormonal balance and ovarian function. The study focuses on assessing their ability to reduce cyst formation, regulate menstrual cycles, and improve metabolic parameters associated with PCOD/PCOS. Preliminary findings suggest that the combination of these plant extracts may exhibit significant beneficial effects due to their synergistic action. This study highlights the potential of herbal formulations as a safer and cost-effective alternative approach for managing PCOD and PCOS.

Keywords: PCOD, PCOS, *Cinnamomum verum*, *Vitex negundo*, *Anacyclus pyrethrum,* Aqueous Extract, Herbal Medicine, Hormonal Imbalance, Ovarian Function.

FORMULATION AND EVALUATION OF TRANSDERMAL PATCHES OF SARGASSUM LONGIOTOM EXTRACTION AGAINST A375 CELL LINE IVITRO STUDY

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ABSTRACT

Skin cancer, particularly malignant melanoma, is one of the most aggressive and rapidly increasing forms of cancer worldwide. Conventional treatments such as chemotherapy and radiotherapy often result in systemic toxicity, drug resistance, and undesirable side effects. The present study focuses on the formulation and evaluation of a marine algae-based transdermal drug delivery system using *Sargassum longiotom* extract for its potential anticancer activity against A375 human melanoma cell lines. *Sargassum longiotom* possess bioactive compounds such as polyphenols, flavonoids, terpenoids, and sulfated polysaccharides. The obtained extract was subjected to qualitative phytochemical screening to confirm the presence of secondary metabolites. A matrix-type transdermal patch was formulated using methyl cellulose and polyvinyl pyrrolidone (PVP) as polymeric matrices along with glycerol and propylene glycol as plasticizers by the solvent casting method. The prepared patches were evaluated for physicochemical parameters including weight uniformity, thickness, folding endurance, and in vitro disintegration time. Instrumental characterization studies such as UV spectroscopy, FT-IR, and SEM analysis were carried out to determine drug content, compatibility, and surface morphology. The *in vitro* anticancer activity of the formulated extract was evaluated against A375 melanoma cell lines using the MTT assay to determine cell viability and IC_{50} value. The results are expected to demonstrate significant dose-dependent cytotoxic activity through induction of apoptosis and inhibition of melanoma cell proliferation. This study aims to establish a marine algae-based transdermal patch as a novel, non-invasive, and effective therapeutic strategy for melanoma treatment, providing a foundation for future *in vivo* and clinical investigations.

Keywords: *Sargassum longiotom*, Marine algae, Transdermal patch, A375 cell line, Melanoma, MTT assay, Anticancer activity, Phytochemicals.

FORMULATION AND PHYSICOCHEMICAL CHARACTERIZATION OF BINARY AND TERNARY SOLID DISPERSIONS USING HYDROPHILIC POLYMERS

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ABSTRACT

Poor aqueous solubility is a major challenge in pharmaceutical formulation development, often leading to limited dissolution and reduced bioavailability of drugs. Solid dispersion is a widely employed strategy to enhance the solubility and dissolution characteristics of poorly water-soluble drugs by dispersing the active pharmaceutical ingredient within hydrophilic polymer matrices. The present study focuses on the preliminary development of solid dispersion formulations using hydrophilic polymers. Initially, formulation work was carried out using Mebendazole as the drug candidate to explore the feasibility of preparing polymer-based solid dispersions. Binary systems consisting of the drug and polymer were developed to understand the interaction and dispersion behaviour of the drug within the carrier matrix. This preliminary study provided a basis for further formulation development using model drug systems. Subsequently, the experimental work was continued using Aspirin as a model drug for the preparation and evaluation of solid dispersion formulations. A series of formulations were developed using hydrophilic polymers such as Polyvinylpyrrolidone (PVP) and Hydroxypropyl Methylcellulose (HPMC). Binary formulations containing ASA and PVP were prepared and designated as F1, F2, and F3. In addition, ternary formulations containing ASA, PVP, and HPMC were prepared and designated as F4 and F5. The developed formulations were subjected to physicochemical characterization in order to evaluate their structural and surface properties using Powder X-ray Diffraction (PXRD) and Field Emission Scanning Electron Microscopy (FE-SEM). The results highlight the importance of polymer composition in influencing the physical characteristics of the formulations and demonstrate the potential of solid dispersion approaches for modifying the physicochemical properties of pharmaceutical compounds.

Keywords: Mebendazole, Polyvinylpyrrolidone (PVP), Hydroxypropyl Methylcellulose (HPMC), Aspirin, Bioavailability, Hydrophilic polymers

CALENDULA OFFICINALIS -BASED GREEN SYNTHESIS OF CARBON QUANTUM DOTS INFUSED HYDROGEL FOR DIABETIC FOOT ULCER TREATMENT

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ABSTRACT

Diabetic foot ulcer (DFU), a severe complication of diabetes mellitus, arises from impaired wound healing, poor vascularization, neuropathy, and microbial infection, often resulting in chronic inflammation, delayed tissue regeneration, and increased risk of amputation. Conventional therapies frequently fail due to limited drug penetration and rising antimicrobial resistance, emphasizing the need for an effective and environmentally safe alternative. This study presents the green synthesis of Carbon Quantum Dots (CQDs) using Calendula officinalis flower extract and their incorporation into a poly(vinyl alcohol)–sodium tripolyphosphate (PVA–STPP) hydrogel for DFU treatment. The carbon quantum dots (CQDs) were created using thermal carbonization. Their properties were then studied using Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), X-ray diffraction (XRD), and dynamic light scattering (DLS). The investigations verified the fluorescence characteristics, nanoscale size, and presence of functional groups associated with the antibacterial activity of the nanoparticles. Subsequently, membrane stability testing, protein leakage assay, hydrophobicity analysis, and fluorescence microscopy all demonstrated significant inhibitory effects and validated their potent antibiofilm properties. Because of its superior moisture retention, structural integrity, and sustained release properties, the resulting hydrogel injected with CQDs is appropriate for situations involving chronic wounds. The brine shrimp fatality assay was used in the toxicity analysis to confirm its compatibility and safety. As a conclusion, the calendula-derived CQD hydrogel demonstrates notable antibacterial, antibiofilm, and wound-healing properties, offering a biodegradable, cost-effective, and nanotechnology-based therapeutic approach for the management of diabetic foot ulcers.

Keywords: Carbon Quantum Dots (CQDs), *Calendula officinalis*, Green synthesis, Hydrogel, Diabetic Foot Ulcer (DFU), Antibacterial activity, Biofilm inhibition, PVA–STPP Nanotechnology, Biocompatibility.

FORMULATION OF SYNERGISTIC POLYHERBAL ANTIDEPRESSANT CAPSULE USING EXTRACT OF *OCIMUM SANCTUM, CENTELLA ASIATICA, WEDELIA CALENDULACEA*

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ABSTRACT

Depression is a prevalent global health challenge, often requiring long-term pharmacological intervention. While synthetic antidepressants are effective, they frequently present adverse side effects, driving the search for safer, plant-based alternatives. This study investigates the development and evaluation of a novel polyherbal capsule formulation aimed at providing synergistic antidepressant and neuroprotective effects. The formulation integrates extracts from *Ocimum sanctum* (Tulsi), *Centella asiatica* (Vallarai), and *Wedelia calendulacea* (Yellow False Daisy) botanicals recognized for their adaptogenic and restorative properties. The methodology encompasses the systematic extraction of these plant materials, followed by comprehensive *in vitro* phytochemical, antioxidant, and anti-inflammatory profiling to establish their baseline therapeutic potential. Gas Chromatography-Mass Spectrometry (GC-MS) analysis is employed to identify and characterize the key bioactive phytoconstituents within the extracts. Furthermore, computational molecular docking studies are utilized to predict the binding affinities and interactions of these isolated compounds with relevant neurological target receptors associated with depressive disorders. Following the computational and *in vitro* evaluations, the optimized polyherbal extract blend is formulated into capsules to ensure accurate dosing, structural stability, and patient compliance. Ultimately, this research aims to provide a scientifically validated, safe, and effective polyherbal alternative for the management of depression.

Keywords: Depressive Disorder, Polyherbal Formulation, Capsule Formulation, *Ocimum sanctum*, *Centella asiatica*, *Wedelia calendulacea*, Molecular Docking.

INVITRO ANTI-DIABETIC AND ANTI-INFLAMMATORY ACTIVITY OF AGNPS USING AVOCADO, DRAGON, PASSION FRUITS PEEL EXTRACTION

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ABSTRACT

The increasing prevalence of type 2 diabetes and inflammatory disorders has created a demand for effective and eco-friendly therapeutic approaches. In this study, silver nanoparticles (AgNPs) were synthesized using peel extracts of avocado, dragon fruit, and passion fruit, which are rich in natural bioactive compounds such as polyphenols, flavonoids, and antioxidants. These fruit peels, often considered waste materials, were utilized as reducing and stabilizing agents for green synthesis of nanoparticles. The formation of AgNPs was confirmed by visual color change and further characterized using standard analytical techniques. The synthesized nanoparticles were evaluated for their in vitro anti-diabetic activity through α-amylase and α-glucosidase enzyme inhibition assays, which play a key role in carbohydrate metabolism and glucose absorption. Additionally, the anti-inflammatory activity was assessed using protein denaturation and membrane stabilization assays. The results demonstrated that the AgNPs exhibited significant inhibitory activity against both enzymes, indicating improved control over glucose levels. Furthermore, the nanoparticles showed effective anti-inflammatory properties by preventing protein denaturation. Among the different peel extracts, the combined formulation showed enhanced activity due to the synergistic effect of phytochemicals. This study highlights that fruit peel-mediated silver nanoparticles offer a cost-effective, sustainable, and eco-friendly alternative for the development of therapeutic agents. The findings suggest that these nanoparticles have strong potential in the management of type 2 diabetes and inflammatory conditions, and they can be further explored for advanced biomedical applications.

Keywords: Silver nanoparticles (AgNPs), Green synthesis, *In vitro* study, Anti-diabetic activity, Anti-inflammatory activity, Nanotechnology.

IN VITRO ANTIOXIDANT, ANTIDIABETIC, ANTICANCER AND ANTICARIOGENIC ACTIVITY OF BIOSYNTHESIZED COPPER OXIDE NANOPARTICLES USING *DRYNARIA QUERCIFOLIA* ROOT EXTRACT

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ABSTRACT

The biosynthesis of Copper oxide nanoparticles used in an expanding research for its potential application for the eco-friendly development of novel technologies. Generally, nanoparticles are prepared by a variety of chemical methods which are not environmentally friendly. A green synthesis of Copper oxide nanoparticles was carried out using roots of *Drynaria quercifolia*. On treatment of ethanolic solution of 2mM Copper sulphate (CuSo4) with leaves extract, copper oxide nanoparticles could be rapidly synthesized within one hour. These nanoparticles were characterized with UV-visible spectroscopy, Fourier Transform Infrared spectroscopy (FTIR), and X-ray Diffraction (XRD).X- ray diffraction (XRD) results confirmed that these nanostructures exhibit a face centred cubic crystal structure. The antioxidant activity of synthesized copper oxide nanoparticles showed better inhibition (71.92%) at a concentration of 100 µg/ml. The anti diabetic analysis showed better percentage inhibition for the synthesized copper oxide nanoparticles. The anti diabetic activity showed the maximum inhibition for alpha amylase (71.17%) for roots of *Drynaria quercifolia* and for alpha glucosidase (71.02%) for roots of *Drynaria quercifolia* . The anticancer analysis showed better percentage inhibition for the synthesized copper oxide nanoparticles. The results showed that the synthesized copper oxide nanoparticle using *Drynaria quercifolia* has IC50 value 7.34 µg/ml. The anticariogenic activity showed a better percentage inhibitin against pathogen which includes *Streptococcus mutants* (12 mm), *Streptococcus salivaryus* (10 mm), *Streptococcus sobrinus* (8 mm) and *Staphylococcus aureus* (9 mm).

Keywords: *Drynaria quercifolia*, Copper oxide nanoparticles, Antidiabetic, alpha amylase, Alpha glucosidase, Antioxidant, Anticancer.

INVITRO EVALUATION OF MAGNESIUM OXIDE, MANGANESE OXIDE AND MANGANESE DOPED MAGNESIUM OXIDE NANOPARTICLES AS POTENTIAL NANOTHERAPEUTICS FOR LUNG CANCER

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ABSTRACT

Nanotechnology has emerged as a promising approach in cancer therapeutics due to its ability to enhance drug delivery, reduce systemic toxicity, and improve therapeutic efficiency. Lung cancer remains one of the leading causes of cancer-related mortality worldwide, necessitating the development of novel and effective treatment strategies. In this context, metal oxide nanoparticles such as magnesium oxide nanoparticles (MgONPs), manganese oxide nanoparticles (MnONPs), and manganese-doped magnesium oxide nanoparticles (Mn-doped MgONPs) have gained significant attention because of their unique physicochemical and biomedical properties. The present study focuses on the green synthesis of MgONPs, MnONPs, and Mn-doped MgONPs using *Chrysopogon zizanioides* (vetiver) root extract. Green synthesis offers an eco-friendly, cost-effective, and sustainable alternative to conventional chemical methods by utilizing plant phytochemicals as reducing and stabilizing agents. *Chrysopogon zizanioides* is rich in bioactive compounds such as phenolics, flavonoids, terpenoids, and essential oils, which facilitate nanoparticle formation and enhance biological activity. The synthesized nanoparticles were characterized by using analytical techniques including X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR) and transmission electron microscopy (TEM). These analyses confirmed the formation of crystalline, nanoscale particles with controlled morphology and size distribution. Mn doping into MgO lattice was observed to modify structural and surface properties, potentially enhancing biological reactivity. The *in-vitro* anticancer activity was evaluated against human lung cancer cell lines such as A549. The enhanced anticancer activity of Mn-doped MgO nanoparticles can be attributed to increased reactive oxygen species (ROS) generation, mitochondrial membrane disruption, and induction of apoptosis in cancer cells.

Keywords: *Chrysopogon zizanioides,* Human Lung Cancer, Nanotechnology, Magnesium Oxide, Manganese, Apoptosis

FORMULATION AND EVALUATION OF IMATINIB AND LENALIDOMIDE LOADED CHITOSAN NANOPARTICLE FOR CONTROLED RELEASE IN HEPG2 CELL LINE IN ANTICANCER ACTIVITY

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ABSTRACT

Liver cancer, particularly hepatocellular carcinoma (HCC), remains one of the leading causes of cancer-related mortality worldwide. Conventional treatment strategies such as chemotherapy and targeted therapy are often associated with systemic toxicity, poor tumor selectivity, and the development of drug resistance. The present study focuses on the formulation and evaluation of dual-drug loaded chitosan nanoparticles containing Imatinib and Lenalidomide for enhanced anticancer activity against HepG2 liver cancer cell lines.Chitosan, a biodegradable and biocompatible natural polymer, was selected as the drug carrier due to its mucoadhesive properties, controlled release behavior, and ability to enhance cellular uptake. Nanoparticles were prepared using the ionic gelation method with sodium tripolyphosphate (TPP) as a cross-linking agent. The developed formulation was characterized using UV–Visible spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), Dynamic Light Scattering (DLS), and morphological analysis to evaluate particle size, drug loading efficiency, compatibility, and structural properties. *In vitro* anticancer activity was assessed using the MTT assay on HepG2 liver cancer cell lines to determine cell viability, dose-dependent cytotoxicity, and IC_{50} values. The dual-drug nanoparticle formulation is expected to exhibit enhanced cytotoxic activity compared to free drug solutions due to improved cellular internalization and synergistic therapeutic effects. The findings of this study aim to establish chitosan-based dual-drug nanoparticles as a promising and effective nanotherapeutic approach for targeted hepatocellular carcinoma treatment, providing a strong foundation for future in vivo and clinical investigations.

Keywords: Imatinib, Lenalidomide, Chitosan nanoparticles, HepG2 cell line, Hepatocellular carcinoma (HCC), Dual drug delivery, Cytotoxicity, MTT assay

FORMULATION AND EVALUATION OF ANTI-CANCER PROPERTY OF HERBAL EXTRACT *CAMELLIA SINENSIS, VITIS VINIFERA, CURUCUMA LONGA* AGAINST HEP-G2 CELL LINES

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ABSTRACT

Liver cancer, particularly hepatocellular carcinoma (HCC), remains one of the leading causes of cancer-related mortality worldwide. While conventional treatments such as chemotherapy and radiation are standard, they are frequently associated with severe systemic toxicity and the development of drug resistance. This study investigates the formulation and evaluation of a polyherbal extract comprising *Camellia sinensis* (Green tea), *Vitis vinifera* (Grape), and *Curcuma longa* (Turmeric) for its synergistic anti-cancer properties against HepG2 liver cancer cell lines. The selected plants are rich in potent bioactive compounds—namely epigallocatechin gallate (EGCG), resveratrol, and curcumin—which are well-documented for their strong antioxidant, anti-inflammatory, and apoptotic activities. The herbal extracts were prepared, phytochemically screened, and formulated to maximize their therapeutic efficacy. *In vitro* anti-cancer activity was evaluated using the MTT assay on HepG2 cells to determine cell viability, dose-dependent cytotoxicity, and the specific IC_{50} value. The polyherbal formulation is anticipated to demonstrate superior targeted cytotoxicity and radical scavenging activity compared to individual extracts due to the synergistic interaction of its phytoconstituents. The findings of this study aim to establish this herbal formulation as a safe, effective, and biocompatible alternative or adjunct therapy for the management of liver cancer, providing a foundation for future *in vivo* and clinical studies.

Keywords: *Camellia sinensis, Vitis vinifera, Curcuma longa*, HepG2 cell line, Hepatocellular Carcinoma (HCC), Polyherbal Formulation, Cytotoxicity, MTT assay, Apoptosis

DRUG REPURPOSING AGAINST MULTI DRUG RESISTANT (MDR) *CANDIDA ALBICANS* AND *CANDIDA PARAPSILOSIS* USING COMPUTATIONAL AND IN-VITRO METHODOLOGIES FOLLOWED BY FORMULATION INTO HYDROGEL FOR TOPICAL DRUG DELIVERY

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ABSTRACT

The emergence of multidrug-resistant (MDR) Candida species, particularly *Candida albicans* and *Candida parapsilosis*, presents a severe global health challenge. Due to the declining efficacy of conventional antifungal therapies, this study explores computational drug repurposing to identify novel, effective treatments. *In silico* screening of FDA-approved drugs from the ZINC15 database identified Bosentan as a highly promising candidate targeting the fungal Sterol 14-alpha demethylase (CYP51) receptor, demonstrating a strong binding affinity of -9.2 kcal/mol. Molecular dynamics, ADMET, and toxicity profiling successfully validated the compound's stability and safety. Subsequent in vitro evaluations revealed that combining Bosentan with the conventional antifungal fluconazole produces a potent synergistic effect, lowering the minimum inhibitory concentration (MIC) to 25 µg/ml. This synergistic combination significantly inhibited biofilm formation—achieving 87.59% inhibition against *C. albicans* and 80.24% against *C. parapsilosis* and drastically reduced cell surface hydrophobicity. Finally, to overcome the limitations of standard topical treatments, this combination was formulated into a polyvinyl alcohol (PVA) hydrogel for localized delivery. Physicochemical characterization confirmed excellent drug-polymer compatibility and optimal hydrophilic properties, resulting in a localized delivery system with enhanced antifungal efficacy against resistant strains.

Keywords: Computational drug repurposing, Bosentan, Fluconazole, *Candida albicans, Candida parapsilosis*, Multidrug Resistance (MDR), Biofilm Inhibition, Polyvinyl Alcohol (PVA) Hydrogel.

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Dr. Chandran Masi, M.Tech., Ph.D., serves as Professor and Head of the Department of Food Technology, bringing over 24 years of expertise as an esteemed academic and researcher in Microbial Food Technology. He earned his Ph.D. in Food Microbial Technology from Anna University, Chennai, complemented by advanced degrees in Biochemistry and Biotechnology. His international contributions include a distinguished tenure at Addis Ababa Science and Technology University, Ethiopia. Dr.Chandran Masi's research encompasses bioprocess engineering, enzyme technology, fermentation, and biowaste valorization, with over 65 publications, including 48 Scopus-indexed articles. He has secured substantial research funding in India and globally, mentored numerous doctoral scholars, and actively contributes to curriculum development, faculty training, and the guidance of emerging scientists.

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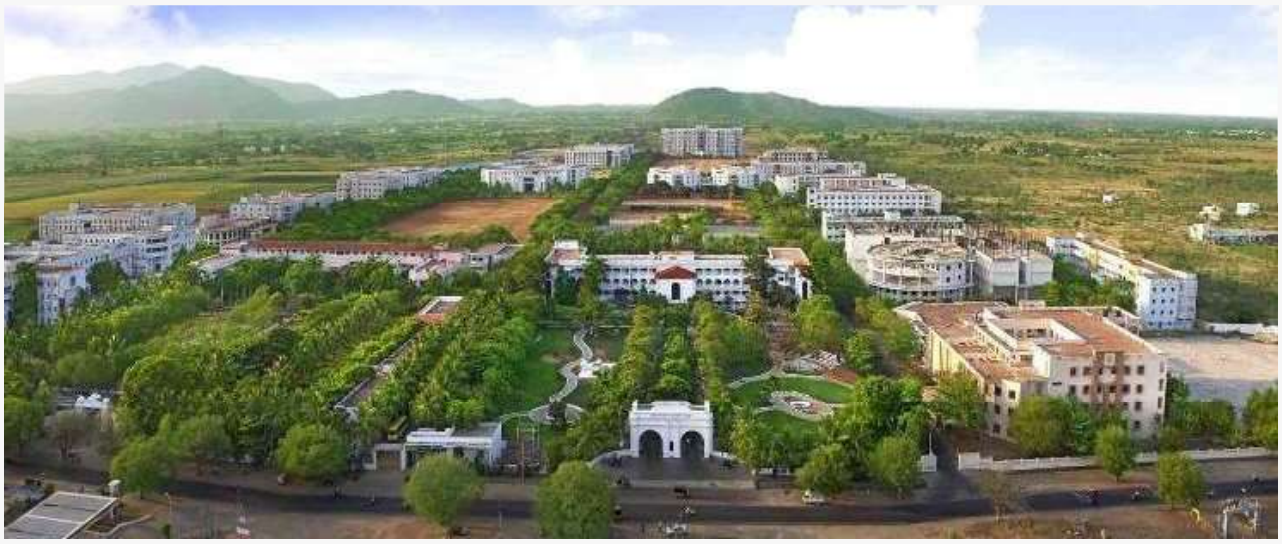

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