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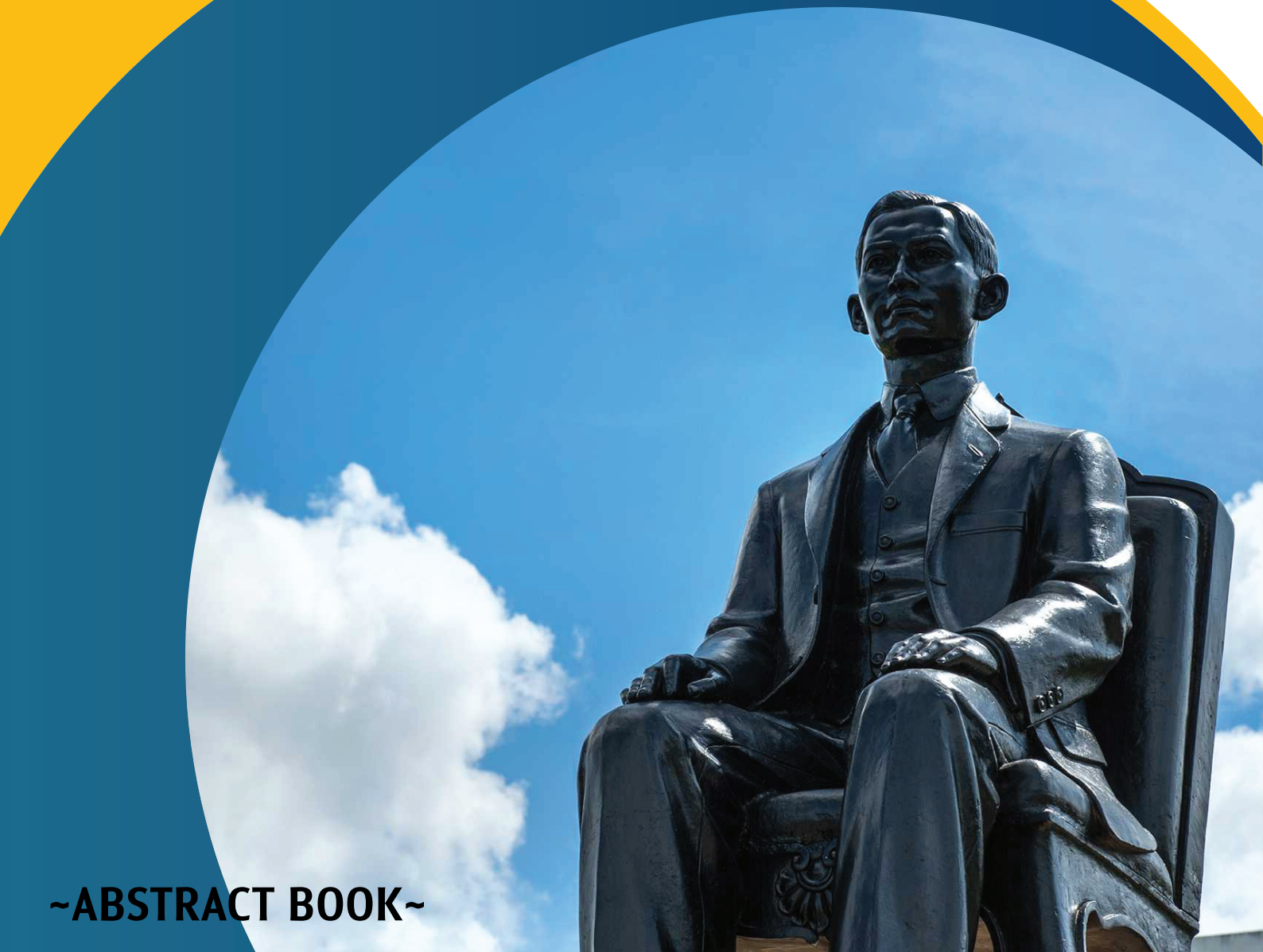

~ABSTRACT BOOK~

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ORAL PRESENTATION

SESSION A-PHYSICS / APPLIED PHYSICS

CHARACTERIZATION OF HYBRID WAVEGUIDE FOR THZ GUIDANCE

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Abstract:
In this study, the characterization of the hybrid waveguide for Terahertz (THz) guidance is investigated. It has been reported that the conventional two-wire waveguide is a good candidate chosen for guiding the THz wave. However, the waveguide may not be suitable for some practical purposes because of the environmental sensitivity and bulky set-up. We proposed the hybrid waveguide as an alternative THz waveguide. The structure of the waveguide is mainly composed of dielectric material, transparent to THz wave, with a central square of air gap flanked by a pair of copper wires along the waveguide axis. The waveguide is robust due to the mechanical support of the metal wires, while the dielectric cover can prevent any disturbance from the environment that could affect the wave propagation properties. The numerical studies of the proposed waveguide were carried out by a commercial software, COMSOL Multiphysics which is based on finite element analysis to determine the propagation properties in this work. The complex effective refractive index of the proposed waveguide calculated by using COMSOL shows that the proposed hybrid waveguide can provide low-loss and low-dispersion due to the guidance mechanism of the surface plasmon wave propagation similarly to the conventional two-wire structure. Using two identical copper wires with the radii and the center-to-center distance given as 150 μm and 300 μm, respectively, results in the effective refractive index of the waveguide about 1.3 at the operating frequency of 0.1 THz and gradually increasing to the consistent values of ~1.45 at the operating frequency of 0.6 THz. The simulation also shows that the confined THz wave is polarized and distributed over the whole square area of central air gap. In addition, high modal energy is confined, and a low absorption loss is achieved. All these studies are expected to provide essential characteristics to design and develop a more reliable hybrid THz waveguide in practice.

EFFECT OF GEOMETRY AND ALIGNMENT OF THE TRIANGULAR-SHARPED VIBRATING STRUCTURE ON ACOUSTIC STREAMING

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Abstract:
Acoustic streaming is a well-known phenomenon that occurs when certain bodies vibrate in fluids, creating specific flow patterns. The study investigated acoustic streaming produced by the vibration of triangular-shaped edge(s). Thermoviscous equations and Navier-Stokes equations were employed for the numerical simulation. The novel alternation of jet's direction and emergence of lateral jet were observed: jet changes its direction from outward to inward as the apex angle becomes bigger, which wasn't predictable in the prior research. Moreover, the lateral jet is observed only in the acoustic streaming from triangle with big apex angle. In addition, the number of vortices as well as the streaming velocity—both magnitude and direction—were affected by the apex angle of the triangle(s). The experiment was conducted to validate the simulation using the same scenario and PIV technique. The jet's direction alternation, pattern, and the number of vortices, as well as the emergence of lateral jets, were observed in the experiment, showing agreement with the simulation. The mechanism for jet's direction alternation and emergence of lateral jet were investigated and were explained using body forces analysis. Furthermore, the relationship between the magnitude and direction of the streaming and the geometry makes great promises in the development of microfluidic devices, where precision is crucial. Moreover, it provides an application in the manipulation of microparticles: circulating, mixing, and trapping.

Investigation of styrofoam ball stability in acoustic field

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Abstract:
Acoustic levitation has been widely used for acoustophoretic contactless transportation, leading to a broad range of applications, such as spectroscopy, biochemistry, and pharmaceuticals. In this paper, we explored the stability of styrofoam ball in acoustic fields generated by a pair of transducers by simulating the potential field in the system. The simulation can be validated by tracking the oscillation of the styrofoam ball with a high-speed camera. We analyzed the stability of the system from the oscillation of the ball under the effects of external force, using forced oscillation. To further explore the stability of acoustic levitation, inspired by silicon oil drop which exhibited quantum-like behavior in a macroscopic scale, we considered cases where the balls' behavior is considered quantum-like when there is no external disturbance. We then calculated the probability of the styrofoam balls escaping through quantum tunneling even though the barrier has higher energy, and the balls should completely be held captive. It is shown that although there is a probability that quantum tunneling might occur, it is significantly low and would take a long time to observe.

Low-Cost Fiber Polarization Controllers by 3D Printer

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Abstract: Fiber Polarization Controllers (FPCs) are essential optical devices used to control and manipulate the polarization state of light propagating through optical fibers. FPCs create mechanical stress-induced birefringence on an optical fiber by two mechanisms: compressing and twisting of the fiber. The stress-induced birefringence in fiber makes the fiber under stress to behave like a conventional polarizer. FPCs are important devices in many applications such as telecommunications, photonics, and optical instrumentation. In this study, FPCs are designed and created by using a 3D printer which not only offers cost-efficiency but also provides greater design flexibility and rapid prototyping capabilities. They can be designed for various wavelength operation and fiber diameters.

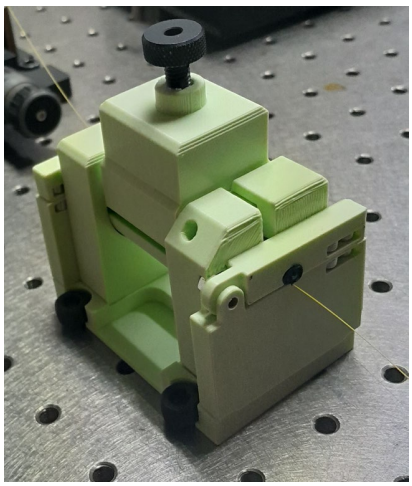

Figure 1.
Fiber Polarization Controllers created by using 3D printer.

Personalized Human Speech Cancellation Using Synthesized Voice

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This project is interested in developing the Active Noise Cancellation (ANC) technology. Previously, this technology could only cancel out sounds with low and constant frequencies. However, it struggled to cancel out human speech due to its complicated frequency components. Therefore, we aimed to advance this technology by eliminating vowel sounds since vowel sounds are essential components of human speech. If the vowel sounds are eliminated from the words, it can render those words incomprehensible. We scope our project by using only the /a/ sound. Our approach involved synthesizing the anti-phase sound waves of the target sound by repeatedly recording the vowel sound /a/. Then, we used the Fast Fourier Transform (FFT) to convert these recordings into the frequency domain, displaying magnitude values. We combined these frequency sets and phased them back to create the desirably synthetic sound waves. In the experiment, we placed two speakers facing each other, one emitting original sound and another emitting synthesized sound. A microphone was set up between them. We recorded the resulting sound and used FFT to analyze whether the specific frequency component had reduced and by how much. We also checked if other frequency components had increased. The preliminary results showed that the particular sound significantly reduced by approximately 17.75 decibels. In addition, we demonstrated the capability to cancel out sounds with multiple frequency components. Detailed research and refinement are progressing for more development and optimization for practical uses. We expect our work will contribute to the audio and entertainment industry and daily life. The existing headphones that are capable of cancelling only noise would potentially be able to cancel human speech as well. The dual benefit is reducing noise pollution. Moreover, in the livestock industry, it may help reduce the fluctuating frequencies that lead to animal stress, resulting in suboptimal productivity.

Keywords: Active Noise Cancellation (ANC), fast Fourier transform (FFT), frequencies, synthesized sound

THE DESIGN OF HOLLOW CORE WITH NESTED ANTI-RESONANCE TUBE FOR CARBON DIOXIDE DETECTION

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Abstract:
Carbon dioxide is a nonflammable, acidic, and odorless gas that is present in the atmosphere. Nowadays, a large amount of carbon dioxide has been added to the atmosphere by various human activities and caused harmful impacts to the environment such as the global temperature rising. This has prompted researchers worldwide to pursue effective methods to detect and monitor the level of carbon dioxide in the atmosphere. Laser absorption spectroscopy is one of the typical detection techniques for gas sensing, which relies on the "fingerprint" absorption line of molecules for identifying and detecting trace chemical. In this study, an effective gas detection is proposed by filling the gas of interest in the hollow core fiber and using a mid-infrared laser as a light source. A hollow core with nested anti-resonance fiber is designed for carbon dioxide at the operating wavelength of 4.3 μm (carbon dioxide absorption wavelength). The proposed fiber material is polyethylene terephthalate glycol (PETG). The structure of the fiber consists of six outer tubes with one inner tube in each. The fiber core diameter is 86 μm and the thickness and the diameter of inner tubes are 1.3 μm and 70 μm, respectively. The simulation result shows that the detectivity of the fiber-based sensor to the carbon dioxide can be achieved.

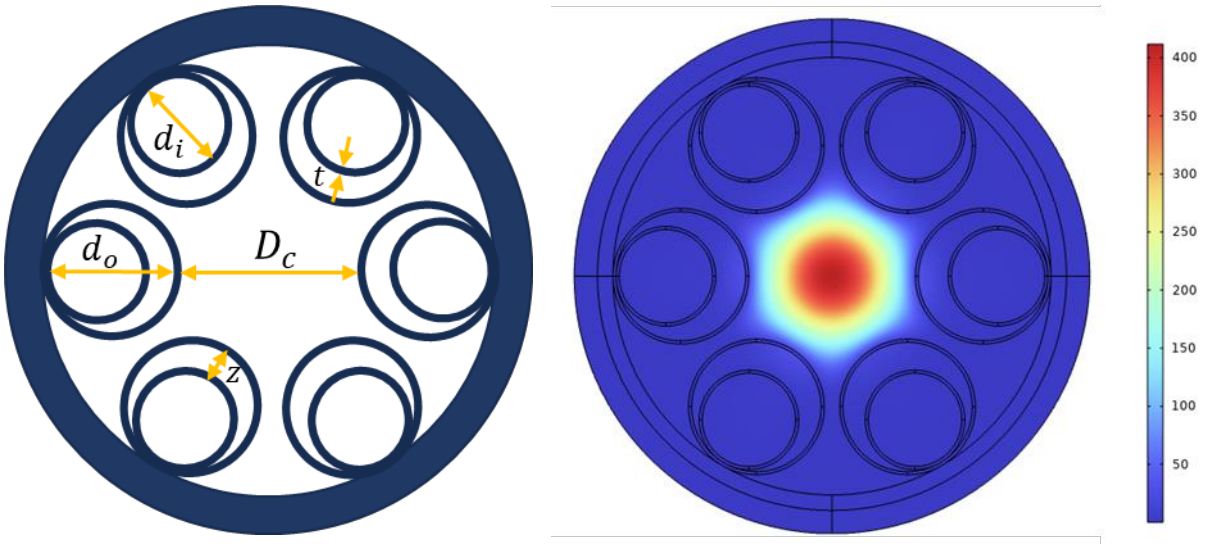

Figure 1.
The design of hollow core with nested anti-resonance tube (left) Electric field distribution of the fundamental mode guided in the fiber core (right)

SESSION B-BIOLOGICAL SCIENCES

ANTIOXIDANT AND ANTI-INFLAMMATORY ACTIVITIES OF ENCAPSULATED ANTHOCYANIN-RICH EXTRACT FROM SILK OF *Zea mays* L. CULTIVAR SIAM RUBY QUEEN CORN

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Abstract:
Many chronic diseases are caused by oxidative stress and low-grade chronic inflammation. Polyphenols, particularly anthocyanins, have anti-inflammatory and antioxidant properties. Several studies have found that anthocyanins can lower inflammatory biomarkers both *in vitro* and *in vivo*. Consequently, research findings regarding anthocyanidin-rich products will effectively contribute to the prevention and alleviation of chronic disease. The objective of this research is to investigate the effect of anthocyanins and microencapsulated anthocyanins derived from Siam Ruby Queen Corn (SRQ) silk on antioxidant and anti-inflammatory properties *in vitro*, with the goal of formulating natural anthocyanins as dietary supplements. Anthocyanins from SRQ silk were extracted in acidified ethanol and subjected to spray drying for encapsulation with maltodextrin DE-10. The antioxidant activity against ABTS, as well as the phenolic and anthocyanin content, were studied. In RAW 264.7 macrophages, the anti-inflammatory effect was evaluated by measuring NO secretion, cell survival, and iNOS protein expression. The results demonstrate that corn silk extract has a high anthocyanin concentration (3,574.42 mg/100 g extract). Following the encapsulation procedure, microencapsulated anthocyanin extract with 5% maltodextrin (EA-MD5) had the maximum anthocyanin content (3,901 mg/100 g extract) and antioxidant activity (4,663 mg TEAC/100 g extract). In LPS-activated RAW264.7 cells, EA-MD5 at 5 mg/ml significantly reduced NO levels by 50%, although corn silk extract alone did not. At 5 mg/ml, EA-MD5 consistently reduced iNOS protein expression by 50% without cytotoxicity. The findings of this study suggest that the microencapsulated anthocyanins derived from the silk of SRQ exhibit antioxidant and anti-inflammatory properties in macrophages via suppressing iNOS expression, making them a potential candidate for the development of dietary supplements aimed at lowering oxidative stress and low-grade chronic inflammation.

Key words: corn silk, antioxidants, LPS-activated RAW264.7, inflammation

CHARACTERIZATION OF NUCLEUS ACCUMBENS' LOCAL FIELD POTENTIAL AND PHASE-AMPLITUDE COUPLINGS OF MICE IN RESPONSE TO HIGH PLATFORM INDUCED ACUTE STRESS

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Abstract:
Acute stress has been found to disrupt brain reward circuits, including the Nucleus Accumbens (NAc). However, the mechanisms underlying acute stress modulation of NAc neural signaling remain unknown. This study aims to characterize NAc signal oscillations in response to acute stress. Intracranial local field potential (LFP) electrodes were implanted in the Nucleus Accumbens (NAc) of three-month-old male ICR mice. The NAc LFP signal was recorded when animals were placed on a 50 cm-high platform for 10 minutes, and the baseline open field recording was used for comparison. Frequency analysis and phase-amplitude coupling (PAC) were utilized to investigate signal processing. The results showed that standing on the high platform specifically increased the alpha (9-12 Hz) and decreased the high gamma (55.5-98.5 Hz) frequency power spectral density compared to the open field baseline. The PAC comodulogram showed that coupling strength changed into the faster frequency of both phase and amplitude in mice on high platform. These results suggest a transient change in NAc reward function during acute stress induced by high platform. Furthermore, studying the NAc signal response to stress will provide insight into better understanding the neurophysiological mechanisms and diseases related to stress and reward circuits.

COMPOSITION OF CULTIVABLE SYMBIOTIC BACTERIAL COMMUNITY ON JAPANESE SPECIES OF FROG *Buergeria buergeri* SKIN DURING DEVELOPMENTAL LIFE-STAGES

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Abstract:

All living things host a myriad of microorganisms, including amphibians, known to have a diversity of symbiotic bacteria associated with their skin. Frog life stages will shape the symbiotic bacteria and these bacteria can protect frog from pathogens and thereby support the conservation of amphibians. Here, we investigate the cultivable bacterial frog skin from the Japanese native frog species, *Buergeria buergeri* during their three life stages: egg, tadpole and adult. This study examined whether cultivable frog skin bacteria differ among host developmental stages. We collected skin swabs of eggs, tadpoles and adults from the Itsukaichi River in Tokyo, Japan. We released them back to nature after swabbing. We isolated the bacteria on R2A media. As a control, bacteria from the river water where the sample frog was taken were also isolated and compared with the isolated bacteria from frog skin. Based on the 16S rDNA sequence analysis, the diversity of bacteria from egg and adult frog was higher than that from the tadpole stage. Collected bacterial classes from all frog life stages and river water did not overlap. It indicated that all collected bacteria from frog skin were indigenous bacteria. Among seven bacterial taxa classes, only two classes, namely *Deinococcus-Thermus* (*Deinococci*) and *Actinobacteria* (*Actinobacteria*), were dominantly found in water rivers. For the tadpole stage, only class Gamma *Proteobacteria* were present. Class *Flavobacteriia* dominated at the adult stage, and other classes such as *Firmicutes* and *Proteobacteria* shared within the other three stages of frog life. Further study is required to determine all collected bacteria for their potential of host resistance to infection against amphibian pathogens and discover antimicrobial peptide production.

DETECTION OF F_1 FISH HYBRIDS USING MITOCHONDIRAL DNA MARKERS: APPROACH FOR GENETIC MANAGEMENT OF AQUACULTURE IN BANGLADESH

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Abstract:
To meet the demand of fish fingerlings in aquaculture, hybrids and/or crossbreeds of several fish species are producing although there are no guidelines for producing such hybrids. Sometimes the productions of such hybrids and/or crossbreeds are not supported by the government of Bangladesh. Among the available hybrid/crossbreed fingerlings resulting from hybridization of the indigenous catfish *Clarias batrachus* and exogenous *C. gariepinus*/*C. macrocephalaus*; and crossbreeding between indigenous and exotic *Anabas testudienus* is mostly produced. The demand for purebred indigenous *C. batrachus* and *A. testudinues* are always more over the hybrids or crossbreeds in Bangladesh. As the production of purebred fingerling is not high, the hatcheries practice the production of hybrids/crossbreeds than the purebred of these fish species. Sometimes, farmers are intended to culture the indigenous species, but getting the seeds of hybrids/crossbreeds which have less demands. Therefore, they do not obtain the production of desired species and expected benefits. Thus, identifying these seeds at early stages is highly necessary. Hence, in this study, attempts were made to detect the hybrid/crossbreed fingerlings of these species in Bangladesh by using analyses of three mitochondrial genes. The COI, Cytb and 16SrRNA genes were amplified by PCR and the DNA sequences were submitted to the NCBI GeneBank database. Along with the sequenced gene, the nucleotide sequences of the same gene were also retrieved from the NCBI genebank database as the reference sequences. Finally, the selected sequences were analyzed by using MEGA software (version 11.0) and detected the hybridization between *C. batrachus* and *C. gairepinus* and crossings between indigenous *A. testudineus* and Vietnamese *A. testudineus*. Phylogenetic trees constructed showed that the *C. batrachus* of Bangladesh did not form a cluster with *C. batrachus* from other countries; instead, *C. batrachus* of Bangladesh formed a sister with exotic *C. gariepinus* of Bangladesh. Similarly the phylogenetic trees showed that the clade formation of native *A. testudienus* with suspected crossbreed and Vietnamese one where Thai *A. testudienus* formed a separate clade. The issue of cross-breeding/hybridization between native and exotic species may resolve using these mitochondrial genes. The study demonstrated the efficient detection of fish species hybrids which would effectively manage the genetic makeup of cultured species.

EFFECT OF HIGH-INTENSITY GREEN LIGHT ON *Streptomyces* spp. PHYSIOLOGY

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Abstract:

The search for novel natural products is continuously ongoing, as many bioactive compounds are believed to have yet to be discovered. Regarding the genome sequences of actinomycetes, particularly the genus *Streptomyces*, contain more secondary metabolite biosynthetic gene clusters than the number of known natural products. Thus, the research on activating cryptic secondary metabolite biosynthesis genes in actinomycetes has continued. Here, we develop a novel approach to induce weakly expressed secondary metabolites in actinomycetes by stimulating them with high-intensity green LED light. Previously, in the model actinomycetes *Streptomyces coelicolor* A3(2), producing blue pigment actinorhodin (ACT) and red pigment undecylprodigiosin (RED), we found the acceleration in cellular differentiation and ACT production caused by high-intensity green light irradiation. New peaks possibly corresponding to metabolites induced by green light irradiation were detected during HPLC analysis. In this study, we found the delay in aerial mycelia formation and sporulation inhibition in our isolated strain, *Streptomyces andamanensis* I-EHB-18, under high-intensity green light irradiation. The HPLC chromatogram profile of methanol extracts illustrated a higher peak at 21.65 min compared to the control. The LC-MS-based non-targeted metabolomic analysis of the methanol extracts suggested that more small molecule compounds were produced under high-intensity green light irradiation than the control. Therefore, we suggest that using high-intensity monochromatic green light to stimulate secondary metabolite production pathways of actinomycetes could potentially lead to the discovery of cryptic antibiotics that are not to be produced under dark culture conditions.

ENHANCED BIODEGRADATION OF LOW-DENSITY POLYETHYLENE USING THERMOPHILIC BACTERIA WITH THE ADDITION OF CO-SUBSTRATE

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Abstract:
The global consumption of low-density polyethylene (LDPE) is growing rapidly, resulting in the accumulation of LDPE in the environment. LDPE is recalcitrant and poses serious risks to humans, animals, and environments. Bioremediation is an alternative approach to manage plastic pollution due to its cost-effectiveness and environmental friendliness. Thermophilic bacteria are potential candidates for the sustainable management of plastic waste because they possess robustness and thermostable enzymes which can be applied in plastic-polluted thermal environment or in high thermal plastic treatment system. Therefore, the objectives of this study are to evaluate the potential of thermophilic bacteria for LDPE biodegradation at high temperatures (55 °C) and to enhance LDPE biodegradation by the addition of co-substrates. The soils from waste dumpsite were collected to isolate of LDPE-degrading bacteria. Two potential bacterial strains identified as *Anoxybacillus rupiensis* KL02 and *Thermocrispum agreste* KL05 were isolated. These strains exhibited good LDPE degradation efficiency (measured by the dry weight of the residual LDPE), enzyme activity, and biofilm formation. Furthermore, the additions of paraffin oil and tributyrin could enhance LDPE biodegradation by these strains. *Anoxybacillus rupiensis* KL02 reduced the weight of LDPE film by 5.88% within 60 days at 55 °C in the presence of paraffin oil, while 3.76% of LDPE weight reduction was obtained in the absence of paraffin oil. *Thermocrispum agreste* KL05 showed a 6.21% reduction in weight for LDPE films in the presence of tributyrin, while a 4.16% reduction in LDPE weight was obtained in the absence of tributyrin. Additionally, the addition of paraffin oil could enhance lipase activity and biofilm formation of both strains. Moreover, the scanning electron microscope (SEM) analysis revealed the attachment of bacterial cells to LDPE films and surface erosion. These results indicate that the combination of thermophilic bacteria with a co-substrate can develop to be a sustainable approach for LDPE waste management.

ENHANCED BIODEGRADATION OF PLA PLASTIC BY PRETREATMENT AND BIOAUGMENTATION

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Abstract:
Polylactic acid (PLA) is the most prevalent biobased plastic with large scale commercialization. It is recommended that PLA waste be treated in an industrial composting facility under controlled elevated temperature, moisture, and aeration. However, this process is not generally practical due to its high energy demand and operational complexity. To enhance PLA biodegradation under ambient temperature, this study explored several PLA pretreatment techniques including UV-C irradiation, NaOH immersion, deep eutectic solvent (DES) coating, and sub-critical water hydrolysis. The aim of these PLA pretreatment processes is to reduce tensile strength, partially hydrolyze PLA, produce desired functional groups for degradation, increase surface hydrophilicity, and promote biofilm formation. This study also investigated the biodegradation of the pretreated PLA by a defined bacterial consortium comprising *Nocardioides zeae* EA12, *Stenotrophomonas pavanii* EA33, *Gordonia desulfuricans* EA63, and *Chitinophaga jiangningensis* EA02, which were previously enriched and isolated from polymeric wastes. The biodegradation of the pretreated PLA was carried out by bioaugmentation with the bacterial consortium in aqueous media, lab-scale traditional composting, pilot-scale composting, and in a household food waste composter. PLA waste was biodegraded along with organic waste and composting materials as evidenced by the reduction in PLA molecular weight, disintegration of PLA pieces, and production of carbon dioxide. Additionally, the results indicated the advantages and disadvantages of each PLA pretreatment technique. It is thus possible to select specific pretreatment techniques based on the type and scale of the biodegradation process. For example, DES comprising of choline chloride and glycerol could be applied as a pretreatment step in large scale traditional composting facilities that receive a mixture of PLA and other plastic wastes along with organic waste. For low concentration of PLA plastic waste, UV-C irradiation using a sterilizing box followed by degradation in a household food waste composter is a better option. In both composting systems, bioaugmentation with the bacterial consortium showed enhanced PLA biodegradation compared to the control, i.e., no bioaugmentation. Nonetheless, PLA waste was not completely removed, and the percent weight loss of PLA ranged between 10-60% after 2 months. Future studies should identify microplastics and degradation by-products generated during the waste treatment processes.

EVALUATING THE ANTIOXIDANT CAPACITY AND ANTICANCER ACTIVITY OF CAROTENOID EXTRACTS FROM THE CYANOBACTERIA *Synechocystis* sp. PCC 6803 OVEREXPRESSING CAROTENOID BIOSYNTHETIC GENES

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Abstract:

Carotenoids are the primary photosynthetic pigments that can be found in various autotrophic organisms, such as bacteria, microalgae, and advanced plants. In addition to their roles in photosynthesis, carotenoids also act as antioxidant agents that are capable of scavenging free radicals and reactive oxygen species (ROS), thereby protecting cells and tissues from oxidative stress and damage. Notably, many previous studies have reported that carotenoids exhibited biological and pharmaceutical activities against various diseases in humans, particularly cancer. Currently, cyanobacteria are considered important alternative sources for carotenoids with high potentials for applications in pharmaceutical and biomedical research. In this study, we employed genetic engineering approaches to enhance carotenoid production and its antioxidant activities in the cyanobacteria *Synechocystis* sp. PCC 6803. We successfully constructed five engineered *Synechocystis* sp. PCC 6803 strains with overexpressing (OX) carotenoid biosynthetic genes, including OX_*CrtB*, OX_*CrtP*, OX_*CrtQ,* OX_*CrtO*, and OX_*CrtR*. Based on our findings, all engineered stains showed significantly greater antioxidant activities, as assessed by the DPPH assay, compared to the wild-type control, especially in OX_*CrtQ* and OX_*CrtR*. Similarly, carotenoid extracts from all engineered strains demonstrated enhanced suppression in cell viability and proliferation in H460 and A549 lung cancer cell lines compared to the extracts from the wild-type control. These results suggest that all engineered strains possess high antioxidant activities, and their carotenoid extracts exhibit significant potentials for use in pharmaceutical and cancer cell biology research, especially for *in vitro* lung cancer treatments.

Genetic Insights for Thai Asian Elephants (*Elephas maximus*): Enhancing Individual Identification for Effective Protection Against Illegal Trade

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Abstract:

Genetic diversity analysis and matching probability establishment with wildlife species are deemed critical to support legal legislation concerning Thai elephants, with over 6000 individuals in the country, although historical numbers have dwindled. To mitigate and conserve the Thai Asian elephant population, genetic monitoring and maintaining individual identification records is deemed necessary. In this study, a genetic parameter platform was developed for reference records and comparisons in identifying individual elephants. A total of 322 elephant individuals from four Asian elephant populations (National Elephant Institute of Thailand, Elephant Kingdom Surin, Maetaeng Elephant Park, and Baag Chang Elephant Park) were assessed for genotyping and determining allelic frequency to establish matching probabilities, along with genetic diversity parameters based on 18 microsatellite loci. The efficiency of 18 microsatellite primer sets were evaluated for the 327 samples (including wild population) and a set of 6 markers were selected employing the Ant Colony Optimization Algorithm. A combination of the 18 microsatellite markers showed a low matching probability at a value of 5.2×10^{-15} whilst using 6 microsatellite loci showed a value of 7.9×10^{-15}. In terms of paternity testing, the probability of exclusion (PE) for one candidate parent when the genotype of the other parent is not known was at a high level in both marker sets, with 99.99% rate for both marker sets. Substantial genetic variation was detected within the populations, characterized by an average allelic number of 14.511±1.235, allelic richness of 17.042±2.220, and heterozygosity of 0.733±0.022. This made the microsatellite primer sets suitable genetic markers that provide valid information on their contribution to genetic variation and differentiation or fingerprinting of the Thai Asian elephants which could be used to infer the original sources of the Thai Asian elephants. The genetic parameters identified in this study can be used for forensic identification in conjunction with legal regulations, providing a fundamental knowledge base for assessing genetic diversity and contributing to the sustainability and conservation of species population.

Keyword: Asian elephant; legal legislation; populations; heterozygosity, genetic diversity

IMPLICATIONS OF REDUCED GENETIC DIVERSITY ON NORTH AFRICAN CATFISH IN THAILAND

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Assessing the extent of genetic diversity is an essential prerequisite for the effective management of natural resources and the successful implementation of genetic improvement programs. In this study, our primary goal was to detect genetically distinct populations of North African catfish (*Clarias gariepinus*) in Thailand. Specimens were collected from three captive population (Sing Buri, SBR; Nakhon Nayok, NYK; and Kalasin, KSN). Microsatellite genotyping sequence analyses were performed to examine the genetic diversity and population structure in 136 North African catfish. Fifteen microsatellite loci were developed as primers for this species. The results revealed significant genetic differentiation among stocks, as indicated by pair-wise F_{IS} values. A highly reduced effective captive population size with trends of outbreeding was observed. These significantly reduced effective captive population sizes and outbreeding trends have diminished reproductive fitness and the effectiveness of breeding efforts, thereby increasing the risk of population decline. The results have unveiled genetically distinct stocks of North African catfish in Thailand, providing a valuable foundation for establishing a base population for a genetic improvement program.

Keyword: North African catfish, *Clarias gariepinus*, genetic diversity, effective population size, breeding

Improving Microsatellite Marker Panels for Genetic Diversity and Population Studies Using an Ant Colony Algorithm and Polymorphic Information Content

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Abstract:
Microsatellites are considered to be invaluable molecular markers in population genetics research due to their cost-effectiveness and inherent genetic variability. However, relying solely on the Polymorphic Information Content (*PIC*) is limited when it comes to select an appropriate panel of markers. To address this limitation, we introduce an innovative approach that overcomes the drawbacks of existing methods for microsatellite marker panel selection. This novel approach leverages the Ant Colony Optimization algorithm, and incorporates individual *PIC* values to refine the process of identifying the most optimal set of markers. We have further improved our algorithm by fine-tuning it using two datasets, one pertaining to chickens (*Gallus gallus*) and the other to Chinese gorals (*Naemorhedus griseus*). The results we have obtained validate the presence of hidden variables impacting the actual effectiveness of a microsatellite marker panel. These variables encompass factors such as the number of alleles (N_a), number of effective alleles (N_{ea}), allele richness (*AR*), Polymorphic Information Content (*PIC*), and observed or expected heterozygosity (H_o/H_e). Implementing this methodology holds considerable potential for significantly reducing laboratory costs. This development is crucial for overcoming substantial challenges in the realms of population genetics research, breeding programs, and conservation initiatives.

Keywords: microsatellite, marker selection, ant colony optimization, population genetics, polymorphism information

INVESTIGATING THE ENVIRONMENTAL PHYSIOLOGY OF THE SESARMID CRAB *Episesarma mederi* (H. Milne Edwards, 1853): WHAT HAVE WE LEARNT? AND FURTHER DIRECTIONS

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Abstract:

Osmoregulation serves as the primary physiological homeostatic mechanism for intertidal crabs, maintaining osmotic and ionic concentrations in their body fluids during salinity changes. In addition to osmotic stress, prolonged emersion during low tides could disrupt their extracellular fluid homeostasis, affecting osmo-ionoregulation, excretion, and pH regulation. Hence, various physiological adaptive strategies are very necessary for them to deal with rapid changes in intertidal environments. The sesarmid crab *Episesarma mederi* (H. Milne Edwards, 1853) is a commercially and ecologically important species that inhabits mid to upper intertidal mangroves. These crabs regularly experience salinity fluctuations and desiccation due to tidal rhythms. Although the crabs can certainly acclimate to tidal-induced stressors, their underlying physiological responses and adaptations are still not well understood. In this study, we examined the physiological responses of *E. mederi* to salinity stress and desiccation using both physiological and molecular approaches. Our findings showed that *E. mederi* rapidly achieved physiological homeostasis to salinity challenges through modifications in enzyme activities and gene expression levels involved in their osmoregulation. Under osmotic stress, the crabs may escape from seawater to aerial environments. However, prolonged air exposure impaired certain homeostatic responses, leading to increased susceptibility to physiological stress and death. Moreover, trade-offs between adaptive resistance and behavioural avoidance of the crabs will also be discussed. Overall, this study contributes to a better understanding of the environmental physiology of *E. mederi*, which may have further implications for explaining its ecology and adaptability to changing conditions in the Anthropocene.

NEUROPROTECTIVE EFFECT OF *Centella asiatica* ETHANOLIC EXTRACT ON TOLUENE-LED NEURODEGENERATION IN *Caenorhabditis elegans*

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Abstract:

Toluene, a persistent organic pollutant (POP), is commonly used as a solvent and often remains in various polymer-based products such as nail polish remover, glue, or paint. Several studies had confirmed toluene's neurotoxicity, particularly in locomotor neurodegeneration through inhalation. Recent research revealed that toluene can also induce degeneration and dysfunction in dopaminergic neurons leading to impaired locomotion behavior. Our study aims to investigate the neuroprotective effect of the local herb *Centella asiatica* (CA) commonly known as Asiatic pennywort which is widely studied in the medical field. The CA's neuroprotective effect on toluene-led neurodegeneration was studied in an invertebrate animal model, *Caenorhabditis elegans* (*C. elegans*) — a soil-dwelling nematode universally used for neuroscience research and drug testing. *C. elegans* were fed with *E. coli* OP50, their primary food, combined with different concentrations of CA ethanolic extract or L-DOPA, a dopamine precursor used for Parkison's disease treatment. Subsequently, they were exposed to airborne toluene at 666 ppm to induce neurodegeneration. Video recordings of the treated *C. elegans* were analyzed by image processing software to extract the average speed. Statistical analysis was performed using one-way ANOVA and Tukey HSD post hoc tests. The results indicated that CA ethanolic extract significantly attenuated toluene-induced locomotion deficits in a dose-dependent manner. Notably, the highest CA concentration (1.00 mg/ml) exhibited no significant difference from the L-DOPA group, a positive control. Furthermore, our analysis of CA ethanolic extract using High-Performance Liquid Chromatography (HPLC) revealed that 1 gram of the extract contains 23.66 - 31.15 mg of asiaticoside, a neuroprotective chemotype. In conclusion, our preliminary findings suggest that CA ethanolic extract exerts a dose-dependent neuroprotective effect against toluene-induced neurodegeneration.

PROTECTIVE EFFECTS OF ASCORBIC ACID AND JAMBLANG (*Syzygium cumini*) LEAF EXTRACT ON BLOOD BIOCHEMICAL PARAMETERS IN LEAD-ACETATE-EXPOSED RATS

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Abstract:
A dangerous metal that causes oxidative stress is lead (Pb). Organs damaged by lead include the kidneys, spleen, liver, heart, and lungs. Antioxidant is required to stop the lead-induced oxidative damage. This study examines the preventive effects of ascorbic acid and jamblang (*Syzygium cumini*) leaf extract on liver and kidney blood biochemical parameters. Thirty-three male rats were used in this research, separated into five groups: a negative control group, a positive control group, and three combinations of ascorbic acid and jamblang leaf extract. The positive control group was induced by lead acetate (40 mg/kg BW), and the treatment group was induced by lead acetate and three doses of combination (35 mg/kg BW and 15 mg/kg BW; 75 mg/kg BW and 35 mg/kg BW; and 150 mg/kg BW and 75 mg/kg BW), for 30 days. At the end of the experiment, blood was collected and centrifuged to measure ALT, AST, urea, and creatinine levels. The result showed that combination therapy significantly decreased AST, ALT, urea, and creatinine serum levels compared to a positive control group. In conclusion, combination therapy of jamblang leaf extract and ascorbic acid protect liver and kidney function.

Keywords: *Syzigium cumini*, vitamin C, AST, ALT, urea, creatinine, rats

Signature of selection analysis provide insight into thermal stress, purine content, and immunity selection in Thai fighting chicken breeds: A consequences from human-made selection

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It is anticipated that selection will create genetic variation in the genomes of chicken. Chickens have undergone extensive natural and artificial selection, resulting in modifications in their genetic and phenotypic variations. The discovery of genetic signatures can speed up breed selection by illuminating the molecular mechanisms of regulating preferred traits. Thai fighting chickens have unique genetic and phenotypic traits as a consequence of intensive artificial selection. Thai fighting chickens are expected to show selection signals for thermal stress, purine content, and immunity due to prolonged human-made selection. To better understand selection signatures in Thai fighting chickens, we investigated polymorphisms and the signature of selection in the functional genes related to thermal stress (Heat Shock Protein: *HSP70* and *HSP90*), purine content (Adenylosuccinate lyase: ADSL), and immunity (Major Histocompatibility Complex (MHC): Transporter associated with antigen processing 1 (*TAP1*),

BG1 and *Blec2*) in 98 individuals of Thai fighting chickens from 7 breeds (Lueng Hang Khao, Keaw Hang Dam, Pradu Hang Dam, Lai Hang Khao, Trat, Prama, and Lao Pa Koi), 11 individuals of fighting chicken (admixture breed), and 14 individuals of Thai indigenous chicken (Black Phuphan and Samae Dam) by metabarcoding approach using Illumina paired-end sequencing and then compare with genotyping data using 28 microsatellite loci. The knowledge from this study will contribute to improving our knowledge about the consequences of selective breeding and to identify resources for genetic improvement in commercial chickens and develop appropriate strategies for chicken bioresource conservation.

Keyword: Adenylosuccinate lyase, fighting chicken, genetic diversity, Heat Shock Protein, Major Histocompatibility Complex, gene pool

SYNTHESIS OF QUANTUM DOTS FOR LEPTOSPIRA LABELING

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Abstract:

Quantum dots (QDs) have unique intrinsic optical properties, displaying high sensitivity and fluorescence quantum yield. Even though QDs have been widely employed as fluorescent imaging probes in various biomedical applications, their utilization in labeling Leptospira remains limited. This study focus on the green synthesis of luminescent CdTe quantum dots in an aqueous phase, employing a less toxic solvent, shorter reaction time, and lower temperature (90 ^{o}C) compared to conventional processes exceeding 200 ^{o}C. The method utilizes mercaptosuccinic acid (MSA) as a stabilizing agent, yielding highly water-soluble quantum dots (MSA-capped QDs) with a carboxylic functional group conducive to the *in situ* decoration of CdTe core particles. In addition, the QDs was further modified with specific protein to enhance labeling efficiency with Leptospira. The resulting QDs exhibit a narrow fluorescent emission spectrum and demonstrate stability in an aqueous solution, indicated by a zeta potential of approximately -30 mV. Toxicity assessment reveals the safe usage of these particles up to a concentration of 900 nM against bacteria. Consequently, these successfully synthesized QDs possess excellent properties for Leptospira labeling, offering a valuable and more straightforward tool than traditional methods for visualizing and tracking Leptospira, thereby enhancing the understanding of infection mechanisms in hosts.

THE EFFECT OF CINNAMON (*Cinnamomum burmannii*) BARK EXTRACT ON HISTOPATHOLOGICAL FEATURES AND KIDNEY Mn-SOD (MANGANESE SUPEROXIDE DISMUTASE) EXPRESSION IN HYPERGLYCEMIA RATS

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Abstract:

Diabetes mellitus (DM) is a chronic disease that involves metabolic disorders characterized by hyperglycemia which occurs due to abnormalities in insulin secretion by the pancreas. Hyperglycemia conditions trigger oxidative stress conditions with increased ROS (Reactive Oxygen Species). The Kidney is one of the organs affected by hyperglycemia and increased ROS. Cinnamon plant (*Cinnamomum burmanii*) is a plant that bark contains anti-diabetic and antioxidant properties. This study aimed to determine the effect of cinnamon bark extract on the histopathological feature and expression of endogenous antioxidants (Mn-SOD) in rat kidney. This research was an experimental study with a Post Test-Only Control Group design using 30 rats divided into five groups, namely K(-) distilled water, K(+) alloxan induction, then continued with administration of cinnamon bark extract P1 (100 mg/kgBB dose), P2 (200 mg/kgBB dose) and P3 (300 mg/kgBB dose) for 30 days. Histopathological examination of the kidneys using Hematoxylin-Eosin (HE) staining and examination of Mn-SOD expression in kidney tissue using immunohistochemical staining. The results of the study showed that cinnamon bark had an effect on the histopathology of the kidneys of hyperglycemic rat by improving kidney structure, both by reducing deganized cells, reducing necrosis, reducing inflammatory cells, and reducing vascular abnormalities ($P<0.05$). Administration of cinnamon bark extract in this study was able to act as an exogenous antioxidant in the kidneys of hyperglycemic rats by showing increased expression of the Mn-SOD gene (exogenous antioxidant) which appeared as a brown color in the cytoplasm of tubular epithelial cells, some stromal cells and glomerular endothelium.

Keywords : Hyperglycemia, Cinnamon Bark Extract, Kidney Histopathology, Mn-SOD Expression.

THE EFFECT OF CINNAMON (*Cinnamomum burmannii*) BARK EXTRACT ON MALONDIALDEHYDE LEVELS, CATHALLASE ACTIVITY AND HISTOPATHOLOGICAL FEATURES OF THE PANCREATIC IN HYPERGLYCEMIA RATS

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Abstract:

Hyperglycemia is a condition where blood glucose levels increase. Hyperglycemia can induce oxidative stress. Oxidative stress is a condition caused by an increase in free radicals or reduced antioxidant defense activity, this condition is often known as ROS. The aim of administering cinnamon bark extract in this study was to act as an exogenous antidiabetic and antioxidant. This research is an experimental research using the Post Test-Only Group design involving experimental animal, namely white Wistar rats as research subject. Rats were divided into 5 group, negative control group (K-), positive control group (k+), group P1, group P2 and group P3. The normality test was carried out using the Shapiro-Wilk test followed by One Way ANOVA and Kruskal Wallis. Administering additional cinnamon bark was proven to have an effect on blood malondialdehyde levels in group P1 yielding a mean result of 2.3067 nmol/ml, P2 at 2.5783 nmol/ml and P3 at 3.1500 nmol/ml lower than K+. The catalase activity of group P1 reached 5.6283 unit/mg P2 at 4.9800 unit/mg and P3 at 4.2583 unit/mg higher than K+. Based on the One Way Anova test, there was a significant difference in malondialdehyde levels, the Kruskall Wallis test revealed significant differences in catalase akctivity. Regarding the histopathology of the pancreas, similar significant differences were found through the Kruskall Wallis test. it can be concluded that there is an effect of cinnamon bark extract (Cinnamomum burmanii) on blood malondialdehyde levels, catalase activity and histopathological features of the pancreas in hyperglycemic rats.

Keywords :Hyperglycemia, Cinnamon Bark Extract, MDA level, catalase activity, Histopathological pancreas.

THE PREBIOTIC PROPERTY OF FLOUR FROM THE GERMINATED RICEBERRY RICE (*Oryza sativa* L.) FERMENTED WITH *Pleurotus ostreatus* MYCELIUM AFTER THE *IN VITRO* DIGESTION

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Abstract:
The trend of using functional ingredients such as prebiotics is increasing in the food industry nowadays. The oligosaccharides are the main sources of prebiotics compound which are used as the food ingredients. One of the oligosaccharides which could be a potential for a prebiotic compound is beta-glucans which contains in plants and mushrooms. In this study, the investigation on the prebiotic property after the *in vitro* digestion on flour obtained from the germinated Riceberry rice fermented with *Pleurotus ostreatus* mycelium has been carried out in comparison with commercial inulin, commercial beta-glucans and Riceberry rice. The prebiotic potential was determined by digests all samples (except inulin); Riceberry rice (R), germinated Riceberry rice (GR), fermented Riceberry rice (FR), and yeast beta-glucans commercial, with pepsin (115 U/g sample) and α-amylase (110 U/g sample) to obtain digested crude. The results showed that, the process of germination and fermentation the Riceberry rice with *Pleurotus ostreatus* mycelium led significantly increasing in the beta-glucan content in R and GR from 21 mg and 27 mg in 100 g rice sample respectively to 1,190 mg in 100 g FR sample. Afte *in vitro* digestion with enzymes pepsin and α-amylase, the digested samples were used as supplement media in the prebiotic test with probiotics bacteria which are *Lactobacillus acidophilus* TISTR 2365 and *Lactobacillus casei* subsp. *Rhamnosus* TISTR 047. Result shown that the prebiotic index for *L.acidophilus* at 8 hours of R, GR and FR are 1.125, 1.153 and 1.244 respectively which is higher than commercial inulin (0.995), and commercial beta-glucan (1.056). Notably, both GR and FR demonstrated significantly higher prebiotic activity ($P < 0.05$) compared to inulin and commercial beta-glucan. The prebiotic index of samples on *L. casei* subsp *Rhamnosus* at 8 hours showed that the prebiotic index of GR and FR samples were not significantly different with those of inulin and beta-glucan commercial ($P < 0.05$) but the R sample did not show the prebiotic potential towards this probiotic bacterium. The results shown the potential of prebiotic activity increase in Riceberry rice after the germination and fermentation with mushroom mycelium, which can further develop into various kind of rice based functional food products.

SESSION C-CHEMISTRY (ANALYTICAL CHEMISTRY)

AN AMPEROMETRIC SENSOR BASED ON NANODENDRITRIC POROUS COPPER DECORATED ON AN ORDERED MESOPOROUS CARBON MODIFIED ELECTRODE FOR SENSITIVE DETECTION OF NO_3^-

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Abstract:
Nitrate (NO_3^-) contamination of drinking water from agricultural and industrial wastes is known to negatively impact environmental water quality and cause severe diseases. Therefore, the development of electrochemical sensors to detect NO_3^- is necessary due to their rapid response, high sensitivity, and ease of use. This work presented an electrochemical sensor for NO_3^- detection by modifying a glassy carbon electrode with a nanodendritric porous copper and an ordered mesoporous carbon. The nanodendritric porous copper exhibited excellent electrocatalytic activity towards NO_3^- reduction, thus increasing the sensitivity. The advantages of OMC, such as a high surface area and high porosity, make it a suitable supporting material for porous copper decoration and an increase in the conductivity and surface area of the electrode. To obtain the best detection performance, relevant parameters were then optimized. The developed sensor exhibited linearity from 0.050 to 2.00 mM and a detection limit of 0.043 µM (3σ/slope). Furthermore, the developed sensor showed good selectivity, high stability, and reproducibility. Finally, the application in real samples was successfully evaluated by spiking standard NO_3^- into the drinking water samples, with a good recovery obtained.

DEVELOPMENT OF MINIATURIZED BIOSENSOR FOR A SWEAT CONTENT MONITORING SYSTEM

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Abstract:

Recently, sweat has been a promising body fluid, which is rich in biomarkers, for real-time health management based on non-invasive wearable systems. However, there are still many challenges to the real-time molecular-level sensing of sweat fluids (e.g. eliminating the influences of sweat rate changes). To overcome the problems, we developed a sweat lactic acid (SLA) monitoring system, which utilizes continuous flow for transporting whole secretions to the LA biosensor. In this study, we developed an LA biosensor that makes the SLA monitoring system capable of minimizing and low-energy operation for the application of wearable devices.

The LA biosensor was a screen-printed carbon electrode containing Prussian blue. The reference electrode was fabricated by screen-printing silver/silver chloride paste onto a carbon electrode. Lactate oxidase (LOD) was immobilized by pressing the LOD solution-soaked screen-printing mesh to the surface of the working electrode with the polydimethylsiloxane stamp. Characteristics of the biosensor were investigated using amperometric techniques. The sensitivity of the LA biosensor was 0.18 nA/µM, and the calibration range was from 0 µM to 500 µM. The biosensor output increased and resulted in a certain level corresponding to each LA concentration. Furthermore, our biosensor exhibited performance for LA detection selectively based on the substrate specificity of LOD. We also conducted the SLA monitoring during bike exercise. The exercise resulted in a significant increase in the output current as well as the sweat rate. The output current peaked at the end of the exercise and gradually decreased over time. The result indicates the LA was secreted in sweat due to the exercise. In conclusion, our biosensor was confirmed to have the potential for in-time monitoring of SLA. The miniaturized LA biosensor enables the miniaturization of other components that compose the system, such as the flow channels and pump. We will further improve by integrating them and multiple sensors into a wearable system. This will contribute to a more detailed real-time assessment of health conditions.

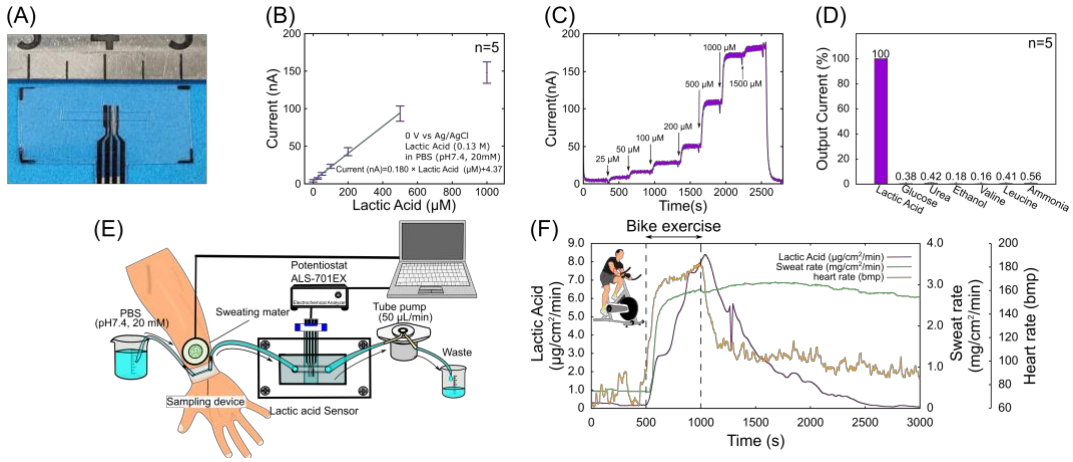

Figure 1. Photograph of Lactic acid (LA) biosensor (A). The sensitivity characteristics (B) , the continuous response (C) , and the selectivity (D) of the LA biosensor. The monitoring setup (E) and results for monitoring LA in sweat (F).

FLOW INJECTION AMPEROMETRIC SENSOR BASED ON REDUCED GRAPHENE OXIDE MODIFIED ON A SCREEN-PRINTED CARBON ELECTRODE FOR CONTINUOUS SALICYLIC ACID DETECTION IN COSMETIC AND PHARMACEUTICAL SAMPLES

Supapich Romportong,[1,2,3] Apon Numnuam,[1,2,3] Natha Nontipichet,[1] Thanawath Tuntiwongmetee,[1,2,3] Panote Thavarungkul,[1,2,3] Proespichaya Kanatharana,[1,2,3] Suntisak Khumngern[1,2]*

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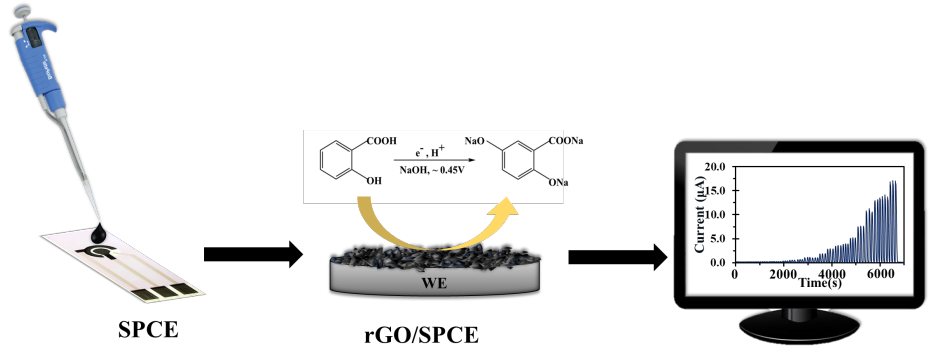
Abstract:

Salicylic acid (SA) is widely used in cosmetics and medicine for its anti-inflammatory, antimicrobial and antifungal properties. Excessive exposure to SA may cause vomiting, irritated skin, headaches and increased blood pressure. In this work, an electrochemical SA sensor was developed by modifying a screen-printed carbon electrode with reduced graphene oxide (rGO/SPCE). The surface morphology of the rGO/SPCE was characterized using scanning electron microscopy (SEM). Electrochemical behaviors of rGO/SPCE toward SA were characterized by cyclic voltammetry. SA was determined at the detection potential of +0.55 V by an amperometric method coupled with a flow injection system. Under optimum conditions, the SA sensor provided a wide linear range (2.0 µmol L^{-1} to 1.0 mmol L^{-1}), a detection limit of 0.69 µmol L^{-1}, and a short analysis time (1 min). Stability, reproducibility, and selectivity of the developed sensor were excellent. The modified electrode could be used for over 91 detections. The developed sensor detected SA in cosmetic and pharmaceutical samples with a recovery range of 95.5–102.9%, indicating that the method was highly accurate. Therefore, the developed sensor offers a reliable electrochemical strategy for the detection of SA.



Scheme 1. Schematics showed the preparation of an rGO/SPCE and detection mechanism of SA with amperometric responses.

FLOW-BASED AMPEROMETRIC SENSOR FOR DEXAMETHASONE DETECTION USING Fe-MOF/GRAPHENE OXIDE COMPOSITES MATERIAL MODIFIED PENCIL GRAPHITE ELECTRODE

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Abstract

A highly stable flow-injection amperometric sensor for dexamethasone (DEX) has been developed using a pencil graphite electrode (PGE) modified with MIL-100(Fe)-graphene oxide (MG) composite material. Scanning electron microscopy and energy-dispersive x-ray spectroscopy (SEM/EDS), transmission electron microscopy (TEM), powder X-ray diffraction (PXRD), and Fourier-transform infrared spectroscopy (FT-IR) were used to characterize the MG composite. The MG modified PGE (MG/PGE) was electrochemically characterized using cyclic voltammetry. The electrocatalytic activity of the MG/PGE electrode toward dexamethasone oxidation was much higher than that of bare PGE, MIL-100(Fe)/GCE, and GO/PGE electrodes. The sensor provided the best performances while a low working potential of –0.10 V (vs. Ag/AgCl) is required. The excellent sensitivity to DEX detection and high operational stability (85 injections/ electrode preparation) were exhibited under optimized conditions. The working linear range was obtained between 0.010–5.0 mM. The limit of detection (LOD) and limit of quantitation (LOQ) were determined based on 3 and 10 signal-to-noise ratios of 4.85 and 10.0 μM, respectively. The sensor demonstrated high repeatability with RSD < 5.1%, reproducibility (RSD < 5.2%), and anti-interference properties when used to detect DEX. The effective determination of dexamethasone in real samples demonstrated the feasibility of the electrochemical sensor, and the results were in good agreement with those obtained from HPLC analysis.

UNMODIFIED SCREEN-PRINTED CARBON ELECTRODE FOR DETECTION OF PROLINE IN HONEY

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Abstract: Honey contains a specific amino acid known as proline, which can serve as an indicator of honey quality, enabling the assessment of its purity and the preservation of its nutritional value. While honey provides natural sweetness, its high cost has driven the production of synthetic honey derived from corn syrup. The consumption of synthetic honey in substantial quantities can lead to adverse effects on our health, including increased fat accumulation. Hence, the authentication of honey is imperative to ensure its quality, providing confidence in consumers, beekeepers, and entrepreneurs. This study aims to develop a nonenzymatic electrochemical platform for the direct detection of proline, with the potential for application in the authentication of honey quality. An unmodified screen-printed carbon electrode was employed as a straightforward sensor to detect proline within an alkaline medium. The results obtained from voltammetric techniques indicated that an alkaline medium is a suitable supporting electrolyte for the detection of proline, as compared to acidic (0.1 M HCl) and neutral (0.1 M NaCl) electrolytes. Furthermore, various types of alkaline media were studied in both strong and weak electrolytic conditions. The results revealed that the detection of proline in a 0.075 M KOH solution provided the highest response at an oxidation potential of +0.87 V (vs. Ag/AgCl). Differential pulse voltammetry (DPV) was employed as the quantitative technique for the determination of proline. Under the optimal DPV conditions (a step potential of 0.03 V, a pulse potential of 0.2 V, a pulse time of 0.05 s, and a scan rate of 0.075 V/s), the developed method demonstrated a broad linear concentration, ranging from 0.075 mM to 10 mM, with a detection limit of 0.047 mM. Additionally, the repeatability in terms of intra-day and inter-day precisions was studied by detecting proline at low, mid, and high concentrations. The results, reported as relative standard deviation, yielded values of less than 9.3%, indicating a moderately good result of repeatability. However, the selectivity and analysis in real honey samples have not been studied yet. These topics will be performed in our future research endeavors. Therefore, this proposed methodology would possibly be a choice for the determination of proline in honey samples and related food products, thereby addressing the growing demand for food quality control.

SESSION C-CHEMISTRY (INORGANIC CHEMISTRY)

FLUOROGENIC SENSING MATERIALS FOR DETECTION OF LONG-CHAIN ALDEHYDES

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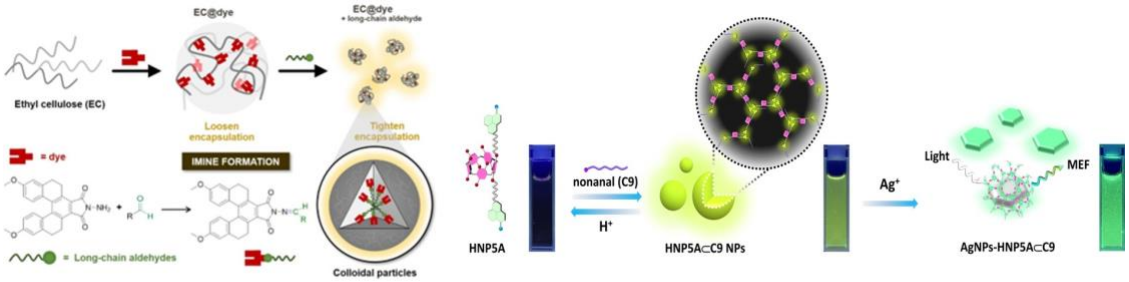
Abstract:
Lung cancer is a major cause of cancer-related deaths worldwide, and there is a need for convenient and effective diagnostic approaches to identify the severity of the disease. The long-chain aldehydes, such as hexanal, heptanal, octanal, and nonanal are the potential biomarkers of lung cancer. The hydrazine-derivatives based on fluorophores of **EC@Naph-NH** and **HNP5A** were used for the sensitive and specific detection of long-chain aldehydes in aqueous media. The hydrazide group of dye-NH, which can react with aldehyde groups via imine formation. For the first work, the EC backbone was used to encapsulate **Naph-NH** to produce **EC@dye** (**EC@Naph-NH**), which offers hydrophobic interactions with alkyl long-chain aldehydes. This results in the self-assembly encapsulation of **EC@dye** and strong fluorescence responses. The quantitative analysis of **EC@dye** towards long-chain aldehyde offered in micromolar level with limit of detection of 10 µM. The sensing platform was developed for quantification of long-chain aldehydes in lung fluid samples with 98-101% recoveries. For the second work, **HNP5A** having **NaphNH** as fluorophore and binding site and pillar[5]arene as a building block has successfully synthesized and selectively bound with nonanal. The hydrazone product of **HNP5A** and nonanal performed self-assembled supramolecular pseudorotaxane polymeric nanoparticles inducing a strong fluorescence enhancement with the limit of detection of 1 x10^{-7} M.



Dye-encapsulation by ethyl cellulose for detection of nonanal

Napthalimide-hydrazine on pillar[5]arene for detection of nonanal

Figure 1. the systematic illustration of the aldehyde sensing platform

OPTIMIZATION OF AMORPHOUS SILICA PRODUCTION FROM PALM KERNEL SHELL USING SOL-GEL METHOD

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Abstract:
The growth of global industries involving rubber, agrochemicals, and adsorbents has driven the demand for amorphous silica (SiO_2) with a rate of more than 8.8% (valued at US$ 7.6 billion) between 2022 and 2032 by the market forecast of precipitated silica. Amorphous silica could be produced from various agricultural residues such as palm kernel shell (PKS), coconut shell, cogon grass, and rice husk. PKS is among these biomass because of its abundance and local availability from palm oil manufacturing in Southern Thailand. In this study, PKS as raw feedstock is clean, ground, and further treated with an acidic solution to remove undesired metal ions. Its morphologies from different parts (see Figure 1) provide that the outer shell has a highest silicon/carbon mass ratio (Si/C). This preliminary result indicates there is feasibility of silica extraction from PSK. The silica from the treated PKS powder is then extracted using the sol-gel method. The extraction conditions of the silica are optimized in terms of refluxing temperature, acid and base concentration, and reaction time. The characterization results of the obtained silica including X-ray diffraction (XRD), scanning electron microscope (SEM) with energy dispersive X-ray (EDX), and Fourier transform infrared (FTIR) techniques will be presented. This will provide insights into the conversion of PKS feedstock to high-valued silica for promising application in future.

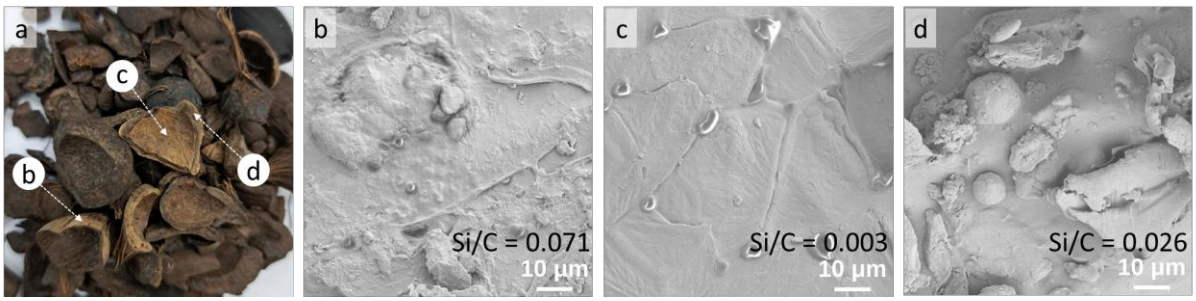

Figure 1.
Photograph of a) raw palm kernel shell (PKS) with indexed parts for SEM images including b) outer shell, c) inner shell, and d) shell edge with silicon/carbon (Si/C) mass ratios analyzed by EDX.

SESSION C-CHEMISTRY (PHYSICAL & THEORETICAL CHEMISTRY)

DENSITY FUNCTIONAL THEORY INVESTIGATION ON DYE ADSORPTIVITY OF MCM-41 MESOPOROUS MATERIALS

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Abstract:

The MCM-41 mesoporous material is well known for its wide applications in the field of adsorption, catalysis, drug delivery and material science which is attributed to its high surface area, eco-friendliness, and low-cost. In this work, Density Functional Theory investigation was conducted to explain experimental adsorption data obtained by one of the author. The MCM-41 was modelled to understand its adsorptivity of three organic dyes: neutral red, methylene blue, and methyl orange at the molecular level. These three dyes were chosen as representative of neutral, cationic, and anionic dyes respectively. Different adsorptivity was expected from their adsorption on MCM-41 or other related materials. Their adsorptivity on MCM-41 should also provide useful information for developing new adsorbents. Due to its amorphous nature, a cluster model of MCM-41 was developed. The structure of dye adsorbed on the MCM-41 surface and the corresponding adsorption energy were calculated at the revPBE-D4 level with def2-TZVP basis sets which is known to yield good adsorption energy. From our results, the adsorption was characterized as physisorption. Moreover, the adsorption energy depend on the orientation of organic dye on the surface. Each dye yielded different degree of adsorptivity as observed in the experiment. Furthermore, the MCM-41 framework was modified by incorporating an aluminium atom into the framework leading to the change in the adsorption energy. This can be explained in terms of the change of electrostatic potential of the surface. The results suggest that aluminium doping affects the dye adsorptivity of MCM-41 differently depending on the type of organic dye.

ELUCIDATION OF THE ETHANOL GAS SENSING MECHANISM OF ZnO USING A COMBINED DRIFTS AND DFT APPROACH

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[1]International Research Organization for Advanced Science and Technology (IROAST), Kumamoto University, Japan
[2]Graduate School of Science and Technology (GSST), Kumamoto University, Japan
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Abstract:
ZnO is a common semiconductor metal oxide (SMOX) that is used in gas sensors because of its low cost, thermal stability, and sensitivity to several flammable and toxic gases. As an *n*-type SMOX, the sensing mechanism of ZnO involves a decrease in its electrical resistivity because of the oxidation of reducing gases (*e.g.*, ethanol) by ionosorbed oxygen (O_{ion}) typically from air. In this study, we propose a mechanism for the ethanol gas sensing of ZnO using *in situ* diffuse reflectance infrared Fourier transform spectroscopy (DRIFTS) and density functional theory (DFT)-based calculations. From *in situ* DRIFTS, we were able to monitor the progress of the conversion of ethanol over the ZnO sensing layer while simultaneously measuring the changes in the electrical resistance of the device and determining the composition of the product gases. Among the adsorbates and product gases that were detected were ethoxide, acetaldehyde, and acetate. The vibrational modes for the O=C–O stretching of acetate are shown in Figure 1. The effects of these adsorbates on the electrical property of ZnO were then investigated using DFT with the (10-10) surface as the test case. In particular, we determined the projected density of states of ZnO(10-10) with the aforementioned adsorbates, as well as O_{ion}. The results showed that O_{ion} and ethoxide introduce energy levels within the bandgap of ZnO, which translate to an increase in the resistivity of ZnO. In the case of acetaldehyde and acetate, an energy level is introduced in the conduction band region, which can effectively decrease the resistivity of ZnO. The shift of the energy levels introduced by O_{ion} away from the Fermi level as this adsorbate is consumed to form acetate also causes a decrease in resistivity (Figure 2). Since the gas sensing measurements showed a decrease in the electrical resistance of ZnO upon exposure to ethanol, the dehydrogenation of ethoxide to acetaldehyde and further oxidation by O_{ion} to acetate are proposed to be key surface reactions in the detection of ethanol by ZnO.

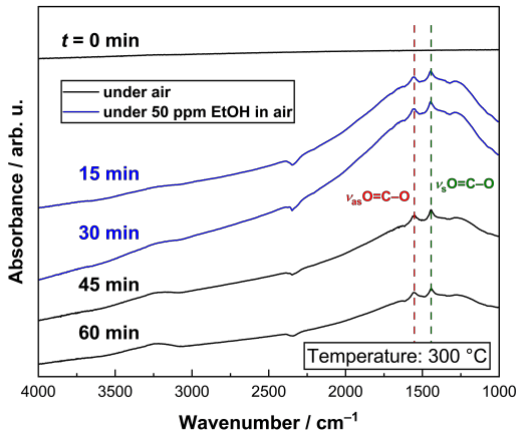

Figure 1. *In situ* DRIFT spectra of ZnO during ethanol gas detection showing the O=C–O vibrational modes of acetate

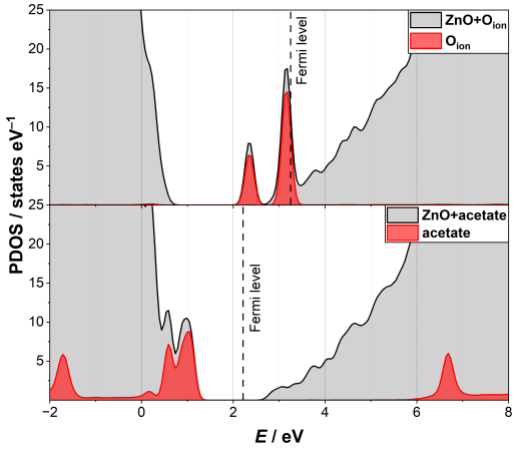

Figure 2. Projected density of states (PDOS) of ZnO with ionosorbed oxygen O_{ion} (top) and acetate (bottom)

SESSION D-MATHEMATICS / STATISTICS / COMPUTER SCIENCE / DATA SCIENCE / AI

A Closeness Centrality-Based Graph Clustering Method and its Application in Urban Tourism Planning

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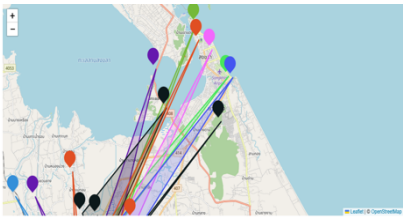
Abstract:

Graph clustering is a fundamental technique used in various fields such as logistics, social analysis, and urban planning to unveil data relationships. Several kinds of graph clustering algorithms rely on the structure of the graph and the data associated with its nodes and edges. One commonly used algorithm is Girvan-Newman algorithm, recognized for its utilization of Edge Centrality statistics. This algorithm employs betweenness centrality concept by iteratively removing edges with highest edge betweenness. However, other centrality metrics can be explored to enhance the algorithm. In this study, our focus is on adapting a modified version of Girvan-Newman clustering for Urban Tourism planning. To achieve this, we substitute the edge centrality algorithm with a closeness centrality algorithm in clustering, prioritizing a compact and densely clustered outcome. This reflects the characteristic preference in urban tourism route planning for routes to be compact and easily transportable. Our newly developed closeness centrality-based clustering algorithms outperform the Girvan-Newman algorithm concerning modularity and conductance metrics in the Hat Yai Tourism dataset and either outperform or closely approximate Girvan-Newman in conductance metrics across several selected benchmarking datasets. We plan to integrate these improved algorithms into our ongoing urban tourism management prototype, currently utilizing data from Songkhla, Thailand, for early-stage development and planning.



Network	Number of clusters				Modularity		Conductance	
	V	*E*	Proposed	GN	Proposed	GN	Proposed	GN
Zachary's Karate Club	34	78	3	5	**0.41**	0.38	**0.32**	0.45
Aves-Weaver Social	42	152	4	11	**0.41**	0.38	**0.35**	0.61
Contiguous_USA	49	107	6	6	0.56	**0.60**	0.26	0.22
American_football	115	613	8	10	0.55	**0.60**	0.31	0.31
Les Misérables	77	254	5	11	0.54	0.54	**0.18**	0.44
Political_Books	105	441	3	5	0.47	0.52	0.33	0.25
Dolphins-Interaction	62	159	4	5	0.49	**0.52**	**0.25**	0.30
Hat Yai Tourism Data	315	2536	4	193	**0.20**	0.07	**0.55**	0.99

Figure 1 (left) Screenshot from our graph clustering based urban tourism planning prototype using data from Hat Yai, Songkhla, Thailand
(right) Experiment result, modularity and conductance measurement between our newly proposed algorithm against Girvan Newman algorithm

A MODIFIED PROJECTIVE BI-INERTIAL FORWARD-BACKWARD SPLITTING ALGORITHM FOR DETECTING BONE MINERAL DENSITY

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Abstract:

In this work, we introduce a projective bi-inertial forward-backward splitting algorithm for solving the sum of two monotone operators in a real Hilbert space, one is maximally monotone and the other is Lipschitz continuous. Under standard assumptions, we prove weak convergence theorems of the proposed algorithm. Furthermore, we provide an application for data classification using an extreme learning machine. To gauge the effectiveness of the algorithm, a reliable dataset for bone mineral density prediction was taken from the Harvard Dataverse. Among the algorithms that have been compared, the best performance was obtained with our algorithm in terms of accuracy, precision, recall, and F1-score. The data classification results show that our algorithm is more efficient in handling classification problems.

MODELING PERTURBED PATTERN FORMATION IN LOGISTIC PROBABILISTIC CELLULAR AUTOMATON (LCPA) FOR VEGETATION

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Abstract:
In nature, vegetation plants self-organize through ecological interaction, resulting in the formation of regular patterns. However, stochastic factors, such as random plant removal or fluctuations in growth rates, can disrupt the uniformity of vegetation. To demonstrate this, we utilize a logistic probabilistic cellular automaton (LCPA), which models the two-dimensional spatial dynamics of plant propagation, competition, and stochastic influences from random removal and growth rate fluctuations. Random removal can be represented by randomly assigning death to a plant with certain probability, while random fluctuation of the growth rate is based on normal distribution. To assess the complexity of the perturbed pattern, we use the upper bound estimated Kolmogorov complexity based on LZ78 compression. Simulation results show that minor stochastic influences can alter the equilibrium state, leading to dynamic pattern formation. Nevertheless, when a certain degree of influence is reached, the pattern breaks, resulting in increased Kolmogorov complexity and chaotic patterns.

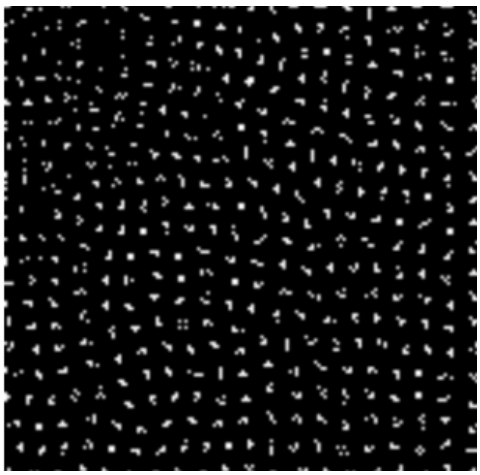

Figure 1.
The regular pattern formation of LCPA without stochastic influences

OPTIMIZATION METHODS FOR SOLVING VEHICLE ROUTING PROBLEMS WITH UNIFORMLY DISTRIBUTED CUSTOMER DEMAND

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Abstract: This research focuses on solving the Stochastic Vehicle Routing Problem (SVRP), where customer demand is uniform distributed. The objective is to find the optimal routes for vehicles while minimizing the total expected distance. To achieve this , we developed an Ant Colony Optimization (ACO) algorithm with the 2-Opt local search, implemented in Python. We tested the algorithm on modified instances of the Capacitated Vehicle Routing Problem (CVRP), taken from previous literature. These instances include small, medium, and large-sized problems with 10, 20, and 50 customers, respectively. In all scenarios, there is only one vehicle and a single depot.The customer demands are uniformly generated in three ranges: [1,5], [6,10], and [11,15], representing low, medium, and high demand levels. The experiments show that the ACO algorithm is more effective than the Large Neighborhood Search (LNS) and the Savings Algorithm (SA), especially when dealing with larger problems and medium to high levels of demand uncertainty.

SCREENING OSTEOPOROSIS IN ELDERLY USING A NEW TWO INERTIAL PROJECTIVE FORWARD-BACKWARD SPLITTING ALGORITHM

Chakarach Mekkrua,[1] Pronpat Peeyada,[2] Wongthawat Liawrungrueang,[3] Watcharaporn Cholamjiak[2,*]
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Abstract:

In this work, we propose a new two inertial projective forward-backward splitting algorithm for approximating the solution of the variational inclusion problem in real Hilbert spaces. We prove weak convergence of the sequence generated by our proposed iterative algorithm. Moreover, we also provide an application to predict osteoporosis using a dataset from the Harvard Dataverse. The comparison of algorithm performance is calculated using accuracy, precision, recall, and F1-score. Our algorithm's performance is higher than other comparable algorithms. As a result, our algorithm is an effective classification technique for identifying osteoporosis.

THE INVESTIGATION OF THE EQUILIBRIUM DISTRIBUTION MASS-POINT WITHIN FRACTAL TRIANGLES

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Abstract:
This research aimed to determine the relationship between the fractal triangle model that had n-level concentric triangles at a two-dimensional equilibrium and the mass point theorem, which explained the relationship in the form of a mathematic equation and mathematic inequality. The research methodology studied the elementary algebra and geometric contents of the science and mathematics textbooks of the Promotion of Academic Olympiad and Development of Science Education (POSN) to examine the mathematic theories of the principles of mathematical induction, pigeonhole principle, intermediate value theorem, arithmetic series, inequality of the arithmetic mean-geometric mean, and theory of physics about the moment from the digital file of the mass point theorem. Then, the basic geometry theory and physics theory about the moment of inertia were applied to construct the relationship or various theories of physics and mathematics. The research results indicated that the relationship of any triangle where the three lines from the vertex intersected at the same point as the mass of the vertex was called the equation of triangle mass equilibrium distribution theory. This theory was then expanded to discover the inequality of triangle mass equilibrium distribution. Moreover, the relationship between the gamma triangle at the n level and the mass of 3n was determined and called the model of mass series of figure mass equilibrium in the gamma triangle n level. This geometric model led to the discovery of five theories, which were only consistent with the 3n vertex painting conditions. In short, this research discovered six relationship theories and one form of inequality between the physic mass equilibrium theory and basic geometric theory, which could be extended or developed toward pure math that was relevant to the mass.

SESSION E-ENERGY / ENVIRONMENTAL & EARTH SCIENCE / MATERIALS SCIENCE / CHEMICAL TECHNOLOGY

A comparison of atmospheric carbon dioxide concentrations between ground - and satellite - based measurements at Lulin Atmospheric Background station (LABs), Taiwan.

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Abstract:

Carbon dioxide (CO_2) is one of the most important greenhouse gases (GHGs) and monitoring of its concentration in the atmosphere must be continuously observed. Understanding the carbon dioxide cycle requires a variety of measuring methods, techniques, and instruments. In this research, surface CO_2 and column - averaged CO_2 (XCO_2) was observed from ground-based measurements at Lulin Atmospheric Background station (LABs), situated on the top of Lulin Mountain in a central part of Taiwan (23.47^{o}N,120.87^{o}E and 2,862 meters above sea level). The Picarro's Cavity Ring-Down Spectroscopy (CRDS) was used for collecting the data during January 2011 to August 2023. These data were then analyzed to obtain a monthly average daily CO_2 for further comparison with the satellite data. The data from three satellites such as Orbiting Carbon Observatory-2 (OCO-2) from July 2017 to August 2023, Greenhouse gases Observing Satellite-2 (GOSAT-2) from March 2019 to August 2023 and Orbiting Carbon Observatory-3 (OCO-3) from February 2020 to August 2023 were also prepared and interpolated covering the desire area. The results demonstrated that the monthly average daily CO_2 concentration from ground-based measurement and that from the satellite was in good agreement with a discrepancy in term of root mean square error (RMSE) of 3.51, 2.90 and 2.99 parts per million (ppm) for OCO-2, GOSAT-2 and OCO-3, respectively. Moreover, Peason's correlation coefficients (r) from the comparison of both dataset for these satellites were found to be 0.91, 0.79 and 0.78, respectively.

ASSESSMENT AND FORECASTING OF MONTHLY AVERAGE SOLAR RADIATION IN SONGKHLA PROVINCE USING ARTIFICIAL NEURAL NETWORK

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Abstract:
The objective of this study was to evaluate the monthly average solar radiation in Songkhla province by determining the monthly average solar radiation pattern with descriptive statistics and cluster analysis and to forecast the monthly average solar radiation in Songkhla province using a neural network model form meteorological data that can be measured in 2009 to 2018. The forecast solar radiation using parameters consist of maximum temperature, minimum temperature, sunshine duration, cloud cover, relative humidity and rainfall with modeling to forecast the average monthly solar radiation. According to the study, the period with only enough solar radiation can be grouped to be used to develop the potential of solar energy into 3 cluster. The principles for experimenting with building a model by using variables in the atmosphere by specifying different input layers and hidden layers but expecting the results to predict only one output and comparing the validation data set, training data and testing data. From test data of prediction by studying artificial neural networks using Multilayer perceptron (MLP) and Radial basis function (RBF). The suitable for neural network model, ML, consisted of 6 input variable, 5 node in a hidden layer and 1 output node (MLP 6-5-1) was the best performance in forecast of monthly average solar radiation in Songkhla province as considering from the provides statistical analysis results are the coefficient of determination (R^2), root mean square error of validation data set (RMSE) and mean absolute percentage error (MAPE) equal to 0.99, 1.09 and 7.46% respectively.

CHARACTERIZATION OF HYDROCHAR OBTAINED BY MICROWAVE-ASSISTED HYDROTHERMAL CARBONIZATION OF SAGO (*Metroxylon spp*)

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Abstract:
Development of environmentally benign process for sustainable management of agricultural residues has gained momentum worldwide. This study focuses on the use of microwave for hydrothermal carbonization (HTC) of sago (*Metroxylon spp*) agriculture residue material for hydrochar production at temperatures between 200 to 250 ^{o}C and treatment time of 1h. The sago *(Metroxylon spp)* samples were characterized, and it was found that their composition had a great influence on the hydrochar yield and properties. Sago biomass yields more hydrochar (29.0 – 59.6%) compared to the conventional heating reactor (14.0–17.8%) at the same hydrothermal temperature. The mass fraction of fixed carbon of hydrochars was observed to be in the range of 22.10–26.42%, which were much higher than the biomass. The mass fraction of carbon in the derived hydrochars were in the range of 48.70–52.94%. The hydrochar with the highest mass fraction of carbon was found at a hydrothermal temperature of 200 $^{\circ}$C. Hydrochars with low aromatic atom of H/C (0.05-0.12) and O/C (0.55-0.96) confirmed their highly carbonized, aromatized and hydrophobic nature. The BET surface area of hydrochar samples were in the range of 30.00 to 70.00 m^2 g^{-1}, hydrochar with the higher surface area was obtained at hydrothermal carbonization temperature and found to be in the range of 7.25-10.20. The acidic and polar functional groups were successively removed and resulted in a more hydrophobic well-organized carbon layered hydrochar at a temperature of 200°C. The scanning electron microscope (SEM) analyses revealed that the structure of the sago biomass and hydrochar was distinct due to the different temperature gradients provided by the thermochemical processes. The results clearly show that the suitable temperature for the HTC of sago biomass was at 200 ^{o}C. Experimental results showed that sago hydrochar is a potential for catalysis application.

Co-hydrothermal carbonization of brewery waste and polystyrene packing waste for high-quality solid biofuel production

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Abstract:
Co-hydrothermal carbonization (Co-HTC) approach thermochemically transforms multiple solid feedstocks into energy-dense hydrochar products. Herein, this study employed packing brewery waste (BW) and waste polystyrene (PS) as the raw biomass feedstocks for the Co-HTC. A comprehensive investigation was conducted to examine the impact of hydrothermal treatment reaction temperatures (220, 240, and 260 °C) and the mixing ratios (10, 20, 30, 40, and 50% by weight of PS) of raw materials on the Co-HTC process, with a fixed reaction period of 8 h. The findings indicated that an increase in the hydrothermal reaction temperature and PS content substantially enhanced the heating value of the co-hydrochar products. Fourier transform infrared spectroscopy (FTIR) analysis explains the altered chemical properties of co-hydrochar on surface functional groups. Furthermore, augmenting the proportion of PS in the PS combination used in the BW might potentially enhance the production yield of co-hydrochar. The Co-HTC process, which involves the treatment of BW and PS, has potential as a viable approach for fuel production and addressing waste disposal challenges.

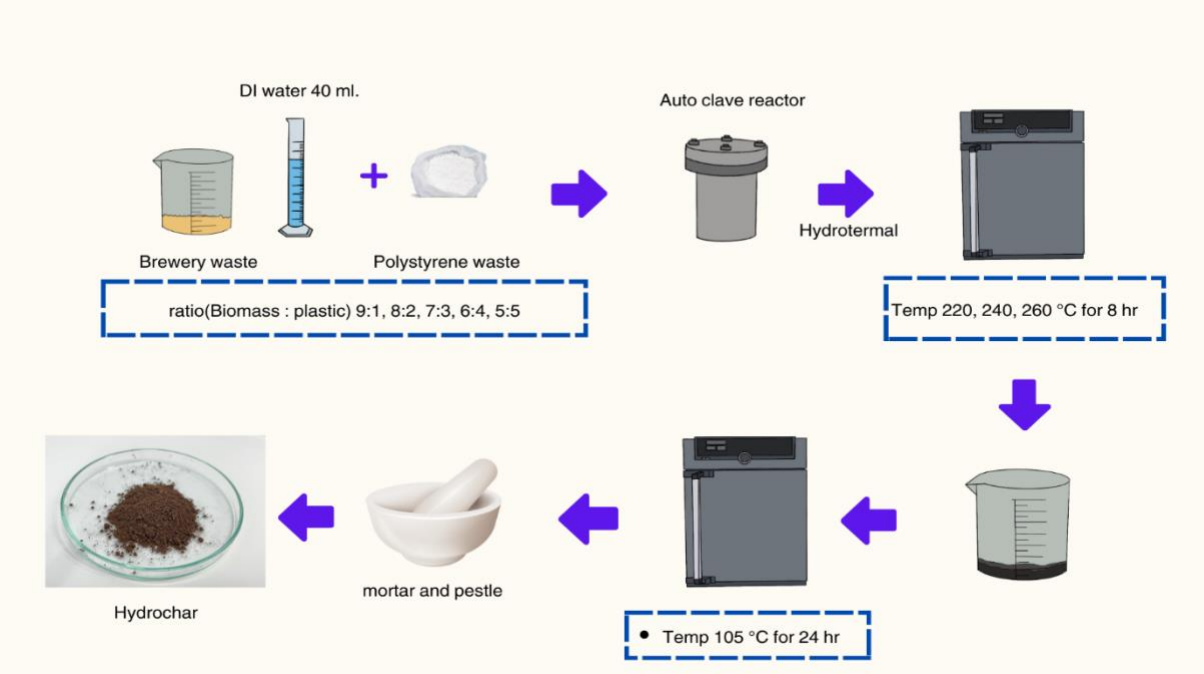

Figure 1.
Production of blended hydrochar produced from brewery waste and polystyrene waste

DEVELOPMENT OF NANOCRYSTALLINE TUNGSTEN FOR THAILAND TOKOMAK X (TT-X): GRAIN BOUNDARY ENERGIES AND POPULATIONS

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Abstract:
In a wide range of solid materials, microstructural engineering is a common process to enhance the properties of polycrystalline. It was well demonstrated that a relative area of grain boundary determines various properties of the polycrystalline materials (i.e. strength, hardness, and wear resistance). Interestingly, these properties can be significantly enhanced by reducing the grain size of the polycrystalline to the nanoscale range (< 100 nm), leading to the development of grain boundary engineering (GBE) for nanocrystalline materials. Nonetheless, it should be pointed out that our understanding of microstructure-property-processing relationships for the nanocrystalline is limited due to the lack of comprehensive analysis between the grain boundary (GB) energies and populations. Because the nanocrystalline tungsten (W) can be used under extreme conditions of high temperature and pressure, the first wall material for an advanced fusion experimental device in Southeast Asia (Thailand Tokamak X, TT-X) should be developed with the nanocrystalline W thin film. Building up on our grain boundary function for W or the other body-centered cubic (BCC) metals, recently published in ***Scripta Materialia***, we carried out large-scale comparisons between the interpolated energies and measured GB populations in W, Fe, or ferritic steel. Based on these comprehensive studies for various misorientations having distinctive grain boundary structures (i.e. Σ3, Σ5, Σ7, Σ9, Σ11, and Σ33), we clearly demonstrated that the GBE could also be achieved in the nanocrystalline W thin film, indicating a major step forward for the development of the superior first fall material for our TT-X.

Fabrication of a BCN/$ZnFe_2O_4$ composite: An improved photocatalyst for indigo carmine degradation under direct sunlight

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Abstract

The nanocomposites material consisting of boron carbon nitride (BCN) and zinc ferrite ($ZnFe_2O_4$) was synthesized through a direct pyrolysis process. BCN was synthesized process involving boric acid, citron peel, and melamine, while BCN/$ZnFe_2O_4$ was fabricated using a simple co-precipitation technique. High performance material exhibits unusual property combinations and unique design possibilities. The as-synthesized material underwent comprehensive characterization and validation through various techniques, including X-ray diffraction analysis, Fourier-transform infrared spectroscopy, field-emission scanning electron microscopy, high-resolution transmission electron microscopy, UV-visible diffuse reflectance spectroscopy, Photoluminescence spectroscopy, N_2 adsorption-desorption isotherm analyser, and X-ray photoelectron spectroscopy. The physic-chemical properties were confirmed. The photocatalytic activity of BCN/ $ZnFe_2O_4$ nanocomposite was evaluated towards the degradation of indigo carmine in the presence of visible light irradiation exposure as direct sunlight. The acquired findings validated that the BCN/$ZnFe_2O_4$ composite exhibits superior degradation performance (95%) under particular optimized operating parameters such as pH, photocatalyst dosage, and dye concentration.

Keywords: Pyrolysis, Co-precipitation, BCN/$ZnFe_2O_4$, Visible light photocatalyst, Indigo carmine.

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HYDROGEN SEPARATION USING ASYMMETRIC MIXED PROTON-ELECTRON CONDUCTING GRAPHENE OXIDE MEMBRANE

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Abstract:
Hydrogen (H_2) separation is crucial for advancing the hydrogen energy economy. Membrane separation technology emerges as a promising alternative offering environmental-friendly, easy operation, and cost-effectiveness compared to conventional technology. However, promoting selectivity and permeability simultaneously through the membrane remains a challenge. Ceramic oxide-based membranes, while possessing excellent H_2 purity, face limitations in large-scale commercial applications due to the high-temperature operation. Graphene oxide (GO) has recently gained attention due to its mass production and high solubility, making it a cost-effective solution for various applications. Moreover, by tuning the physical and chemical properties of GO, mixed proton-electron conductivity (MPEC) properties can be achieved. In this study, we developed an asymmetric MPEC membrane with the permeation mechanism as shown in Fig. 1, based on GO by forming a thin permeation layer with carbon paper as a substrate for highly selective H_2 separation at room temperature. The GO suspension was synthesized using Tour`s improved method and mixed with intercalated molecules, cerium sulphate tetrahydrate ($Ce(SO_4)_2{\cdot}4H_2O$) and 2-hydroxyethane sulfonic acid ($C_2H_6O_4S$). Further, the asymmetric membrane was fabricated via vacuum filtration using acid-treated carbon paper (A-CP) as a porous substrate. The catalyst was cast on both sides of the membrane, followed by thermal reduction. The hydrogen separation experiment was performed by introducing H_2/He as the feed gas in an equal ratio, and the permeate gas was detected by gas chromatography (GC). The SGO-Ce membranes exhibited a high mixed conductivity with σ_{proton} and $\sigma_{electron}$ of 1.13 $mS.cm^{-1}$ and 1.19 $mS.cm^{-1}$, respectively. This increase in conductivity can be attributed to the incorporation of sulfonic acid groups and cerium ions, which provide additional pathways for proton transport between the material and water molecules inside the membrane. Constructing an asymmetric structure effectively reduces the diffusion resistance inside the membrane by reducing its thickness. These modifications showed a promising result of the As- PrSGO-Ce membrane achieved a high hydrogen permeation flux of 0.15 $mL.min^{-1}$ cm^{-2} while maintaining 99.99% selectivity against helium gas. Further enhancement, up to 0.267 $mL.min^{-1}.cm^{-2}$, was observed when facilitating the surface exchange reactions with 5wt%Pd/C. The utilization of MPEC carbon-based membrane at room temperature underpins efficient and cost-effective hydrogen separation under the visualization of a green and sustainable society.

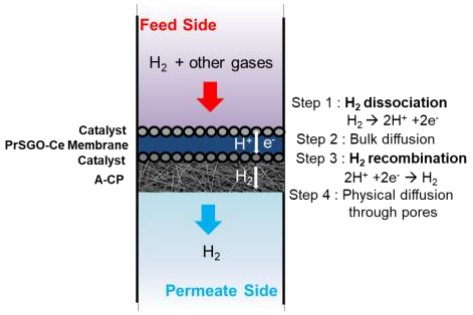

Figure 1. H_2 permeation mechanism on asymmetric PrSGO-Ce membrane

LIGNOCELLULOSIC WASTE BIOREFINERY TO BIOSURFACTANT-BASED MICROEMULSIONS FOR AGRICULTURAL ENHANCEMENT AND ENVIRONMENTAL REMEDIATION

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Abstract:
Improper handling of lignocellulosic wastes may produce excessive amounts of greenhouse gases and pollute the environment. Alternatively, lignocellulose from the agricultural and agro-industrial sectors could encourage the bioeconomy by serving as a valuable resource in biorefineries for biosurfactant production by bacteria. Lignocellulosic wastes were pretreated using a combination of hydrothermal and alkaline methods during the sterilization process. Lignin was a major by-product derived from this pretreatment process. *Brevibacterium casei* NK8 is a biosurfactant-producing alkaliphilic bacteria, therefore bacterial inoculum could be transferred into the sterile medium without pH neutralization. Sacha inchi shell, corn husk, durian shell, rice husk, defatted rice bran, coconut kernel cake, and coconut oil cake could be utilized as substrates in this study. The produced biosurfactants were identified as zwitterionic phospholipids and lipopeptides. The combination of phospholipids, lipopeptides, and lignin facilitated a synergistic effect on microemulsion formation. This mixture showed no toxicity to plant seed, biocontrol, and marine bacteria compared to chemical surfactants. According to the combination of phase behavior study and statistical modeling, the biosurfactants and lignin based microemulsions were developed and exhibited their potential as bio-adjuvants for biocontrol delivery, bio-herbicides for weed control, bio-dispersants for oil spill remediation, and bio-washing agents for industrial sludge treatment. This research demonstrates the critical techniques used for the biorefinery of lignocellulosic wastes for value-added and sustainable applications within the Bio-Circular-Green Economy concept.

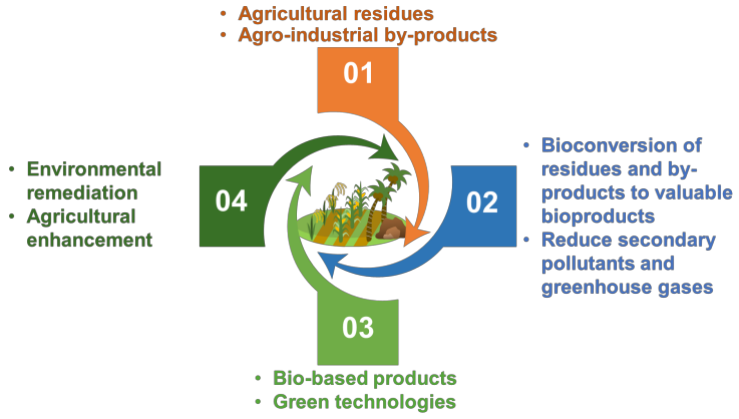

Figure 1.
A conceptual framework of the biorefinery of lignocellulosic wastes into biosurfactant-based microemulsions and their potential applications for sustainable development.

MODIFIED TRASATTI'S AND DUNN'S METHODS ON CHARACTERIZING CHARGE STORAGE MECHANISM USING SINUSOIDAL POTENTIAL SCANS

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Abstract:
The surging demand for high-power energy storage devices, especially those requiring rapid charging capabilities, underscores the critical need for advancements in supercapacitor development. Supercapacitors exhibit exceptional power capabilities and boast an impressive cycle life, making them a vital focus of energy storage research. Two primary charge storage mechanisms govern supercapacitors: one is surface-controlled, involving an electric double layer process, and the other is diffusion-controlled, relying on charge storage through redox reactions. Characterizing these charge storage mechanisms is essential for understanding how modifications to the electrode impact the supercapacitor's performance. Cyclic voltammetry (CV), a well-established electroanalytical technique often employed with Dunn's and Trasatti's methods developed several decades ago, has been the traditional approach for this characterization. However, several challenges have emerged when using CV for charge storage mechanism analysis. One issue is the significant discrepancy in the charge storage mechanism contributions obtained from these two distinct approaches, which has led to difficulties in result comparison and communication, ultimately impeding the advancement of supercapacitor technology. Recently, our research revealed that the disparity between these approaches is largely due to the applied potential signal. To address this, we adopted the concept of applying sinusoidal potential scans in this study. We subsequently modified Dunn's and Trasatti's methods to accommodate these sinusoidal potential scans, as well as the growing consensus that the electric double layer should be modeled using a constant phase element rather than a pure capacitor. This modeling approach allowed us to simulate voltammetric responses, which we then analyzed using the modified Dunn's and Trasatti's methods. The results from this study unveiled that the modified methods yield consistent and acceptable outcomes with minimal discrepancy. These findings provide valuable insights into characterizing charge storage mechanisms and have significant implications for assessing electrode modifications, ultimately contributing to the advancement of clean energy technologies and a more sustainable future.

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MoS_2-Impregnated FeO–Biochar Composite as a novel anode catalyst in Microbial Electrolysis Cell for H_2 production

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Abstract:
In an era marked by the growing concern for environmental sustainability and the need for transition towards clean energy sources, Microbial Electrolysis Cells (MECs) have emerged as a promising green technology for energy production from wastewater. As the world seeks cleaner and more sustainable energy solutions, MECs with biochar (BC) catalysts offer a promising avenue for environmental protection and clean, renewable hydrogen fuel production. One of the pivotal factors influencing MEC performance is the selection of anode catalyst materials. This study explores the development of a novel anode catalyst, a MoS_2-impregnated FeO-biochar composite, and investigates its efficacy in enhancing H_2 production in MECs. The proposed anode catalyst aims to boost the catalytic activity and electrochemical performance of MECs by combining the distinctive characteristics of MoS_2, FeO, and biochar. The impregnation process is done to create MoS2-impregnated FeO BC, while the pyrolysis method is used to create biochar from biomass, cheap and sustainable waste products. Electrochemical studies have to be carried out to characterize the composite catalyst. FeO Modified Biochar Composite with and without MoS_2 Impregnation will be employed as an anode catalyst and evaluated for H_2 generation. This catalyst is expected to perform synergistically with biochar and effectively increase the Hydrogen production rate. Further, this anode composite can be researched and developed into a photoanode, which will eliminate the amount of external voltage used in MECs.

NANOPOROUS CARBON DERIVED FROM DURIAN HUSK WASTE VIA HYDROTHERMAL CARBONIZATION

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Abstract:
Nanoporous carbon is one of the carbon materials with a characteristic highly porous structure and large specific surface area. Recently, the plant-biomass-derived nanoporous carbon (DNC) was widely applied as a bio-adsorbent for adsorption. In this study, we investigated the synthesis of nanoporous carbon from a relevant agricultural waste, durian husk, which has a high lignocellulose content and makes it suitable for synthesis into carbon materials. The DNC was completely produced by the hydrothermal carbonization (HTC) process coupled with physical activation using CO_2. The HTC process was investigated at different temperatures of 180, 200, 220, and 240 °C for 4, 8, and 12 h. Meanwhile, the second step of physical activation was investigated at different activation temperatures of 700, 800, and 900 °C for 1 h. The effects of activation temperatures were examined on the physicochemical properties of DNC. The resulting DNC was characterized by N_2 adsorption-desorption, Fourier Transform Infrared (FTIR), X-ray diffractometer (XRD), Raman spectroscopy, and Scanning Electron Microscopy (SEM). The results showed that with the increasing HTC temperatures and times, the yield of hydro chars decreased, and the surface functional groups of hydro chars from FTIR spectra could be removed from the hydrothermal carbonization (HTC) process. Regarding these findings, it can imply that durian hush has become a potential alternative feedstock for producing nanoporous carbon.

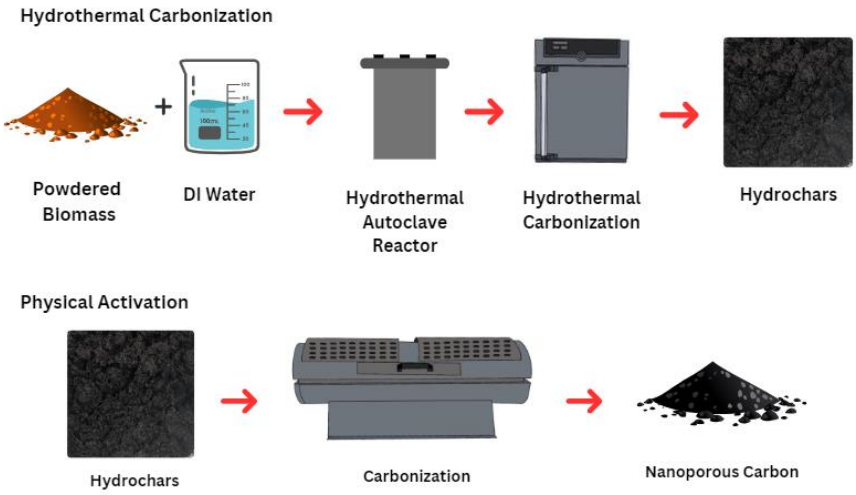

Figure 1.
Preparation of durian husk-nanoporous carbon

NANOPOROUS CORE SHELL ACTIVATED CARBON PRODUCED FROM PALMYRA PALM FIBER WASTE AS SORBENT FOR CAPTURING CARBON DIOXIDE

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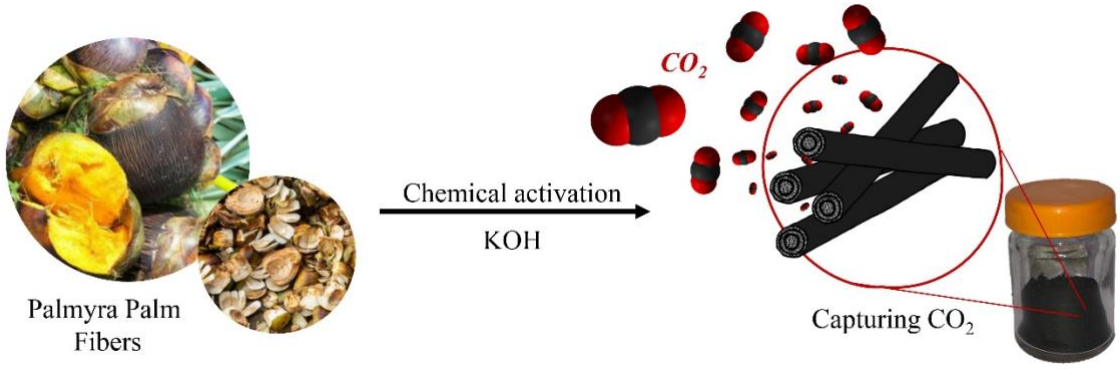
Abstract:
To enhance carbon dioxide (CO_2) capture capacity and selectivity in carbonaceous porous materials, tailored narrow pore (< 2 nm) in porous carbon materials have received great attention because narrow pore size in carbon materials is a crucial aspect for high capturing of CO_2 gas. The nanoporous core-shell activated carbon was successfully prepared from palmyra palm fiber waste. The palm fiber waste was first carbonized to biochar at 400 °C for 4 hours before being activated by different ratios of KOH to the biochar (1:1, 1:2, 1:4) at 700 °C for 2 h with a heating rate of 10 °C/min under a nitrogen atmosphere. To determine the surface morphology and properties of the nanoporous core shell activated carbon, the samples were analyzed by scanning electron microscopy (SEM), thermogravimetric analysis (TGA), Fourier transform infrared spectroscopy (FTIR), N_2 ads-/desorption analyzer, and CO_2 ads-/desorption measurement at 0, 25, and 40 °C. The surface morphology shows that the samples in the 1:2 and 1:4 ratios have nanoporous core shell structures along their webs, whereas the sample in the 1:1 ratio gives non-porous carbon material since the porous structure was decomposed by a high concentration of KOH during activation process. The 1:4 ratio not only promotes nanopore structure formation but also provides the highest surface area (SAA_{BET} 748.04 m^2 g^{-1}). As expected, the 1:4 ratio sample gives the highest capturing capacity of CO_2 gas at 0 °C of 95.86 cm^3 g^{-1} (4.28 mmol g^{-1}) while the 1:1 ratio sample provides the lowest CO_2 uptake capacity of 70.89 cm^3 g^{-1} (3.16 mmol g^{-1}). Moreover, the adsorption kinetics of CO_2 in the nanoporous core shell activated carbons are in good accordance with the intraparticle diffusion model, in which intraparticle diffusion is the rate-limiting step.



Petroleum Source Rock Assessment of the Wang Saphung Formation, Loei Province, Northeastern Thailand

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Abstract:

The Wang Saphung Formation encompassing the three locations of the study areas included Phu Pha Ruak Hill (PPR), Ban Nam Suai Tha Sawan (NST), and Phu Bo Bit Hill (PBB). Lithology in the study areas consists of intraformational limestone conglomerate, dolomitic limestone, micritic limestone, fossiliferous limestone, fine to very fine-grained sandstone, mudstone, and calcareous shale. A total of eight samples were carried out to study kerogen types, geochemical analysis, and HAWK pyrolysis. Kerogen type III (gas-prone) was identified from a modified Van-Krevelen diagram because the hydrogen index (HI) value is lower than the oxygen index (OI). The determination of the maximum temperature (Tmax) ranges from 434°C to 574°C, while the production index (PI) ranges from 0.07% to 0.29%. The total organic carbon (TOC) ranges from 0.21–0.83% wt, which is considered poor to fair in shale and fair to good in carbonate rocks. The findings of this study contribute valuable insights into the petroleum potential of the Wang Saphung Formation, indicating favorable conditions for the generation of dry gas within the examined geological units.

POSSIBILITY STUDY OF DRIED *SAMANEA* (BENTH.) MERR. AS ALTERNATIVE SOLID BIOFUEL TO REDUCE WASTE DISPOSAL

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Abstract:

Samanea (Benth.) Merr. is a huge tree native to tropical Southeast Asia that has expanded throughout the humid and sub-humid tropics. In this study, the possibility of leaf trees was studied using ASTM standards. Moisture content, volatile matter, fixed carbon and ash contents of the study material are well analyzed. The results of an approximate analysis of dried ornamental plant Samanea (Benth.) Merr. as a source of alternative solid biofuel were given in this study. From the approximate analysis volatile organic compound value was at 10.00%. The ash content of Samanea (Benth.) Merr. was 1.02%, while the moisture content of Samanea (Benth.) Merr. was 3.50%. Low values of moisture and ash content of the Samanea (Benth.) Merr. increase the calorific value of a material. The fixed-carbon was 22.17%.

Moreover, the results revealed that Samanea (Benth.) Merr. was a possible alternative solid biofuel for local community as their approximate parameters presented in this work. This finding means Samanea (Benth.) Merr. can help to manage the leave waste and environment, and generate income for the study area. The results of the approximate analysis however indicated that all the samples were significantly different ($p<0.05$). The study indicated that the Samanea (Benth.) Merr. samples have low ash contents, low fix carbon. Although the Samanea (Benth.) Merr. generated are not of greater quality than those produced by wood, they are a feasible alternative to costly fuels and a beneficial waste management tool.

Preparation and characterization of *Pennisetum Purpureum Schumach* and *Chrysopogon zizanioides (L.) Roberty* biobriquettes with tapioca as adhesive

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Abstract:
Pennisetum purpureum Schumach (Napier grass) and *Chrysopogon zizanioides (L.) Roberty* (vetiver) are two grass species that produce abundant leaves useful for animal feed, reforestation, and environmental sustainability. Burning grass leaves, previously commonplace in some towns, is now widely prohibited as a pollutant detrimental to health and the environment and a cause of wildfires. In addition, ash particles are eye and throat irritants, reducing visibility. Nonetheless, powder from dried leaves is a viable raw material for briquettes as an alternative source of energy if the carbonation process is followed correctly. This research describes the synthesis and characterization of briquettes made from powdered grass dry leaves with tapioca as an adhesive.The proximate study revealed that carbonization of *Pennisetum* purpureum Schumach (Napier grass) briquettes resulted in the lowest water content of 4.13% and lowest ash content of 4.06%. The lowest volatile matter for carbonization briquettes was 25.00% for *Chrysopogon zizanioides (L.) Roberty*, whereas the highest fixed carbon was 36.32%. *Pennisetum purpureum Schumach* (Napier grass) briquettes provided the maximum calorific value of 25.32 megajoules per kilo (MJ/Kg). These findings indicate that using tapioca as an adhesive could increase the calorific value of as-prepared briquettes.

Keywords: Napier grass, Vetiver, Grass species, Animal feed, Reforestation, Environmental sustainability, Burning grass leaves

STRUCTURAL EVOLUTION OF STRIKE-SLIP FAULTS IN A TRIASSIC FOLD-THRUST BELT IN THE BOWEN BASIN, EASTERN QUEENSLAND, AUSTRALIA

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Abstract:
Contractional structures in the Bowen Basin are either offset or dragged by strike-slip faults, which develop obliquely or perpendicularly to the N-S to NW-SE structural trend of the Triassic foreland fold-thrust belt. This study provides insight into the formation of strike-slip faults that laterally deform a hanging-wall anticline (9 km long and 2.5 km wide) above the Mile Fault based on 3D seismic data. The results show that the NW-SE trending anticline is affected by three sets of E-W to ENE-WSW trending strike-slip faults. A right-stepping en echelon fault pattern indicates sinistral deformation at the northern plunge of the anticline. In the middle part of the anticline, drag is formed by a sinistral sense of displacement with a horizontal offset of approximately 1.7 km. Near the southern plunge of the anticline, a sharply defined E-W strike-slip fault has accommodated abrupt lateral changes in horizontal shortening and can be traced for more than 7 km. Their formations indicate variations in abrupt lateral changes during an approximately E-W horizontal shortening. The implications of this research extend to discussions on reservoir properties for geological CO_2 storage and fluid circulation across the strike-slip fault zones in the burial foreland fold-thrust belt.

SYNTHESIS OF BIO-BASED TRANSFORMER OIL FROM POLYHYDRIC ALCOHOLS AND VEGETABLE OIL METHYL ESTERS

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Abstract:

Bio-based lubricant is crucial to be developed according to the environmental concerns and sustainability aspect. In a previous study, di-trimethylolpropane tetra esters (Di-TMPTTE) synthesized from palm oil methyl ester (POME) have potential as bio lubricant. Although the bio lubricant produced from POME and di-trimethylolpropane (Di-TMP) in the presence of sodium methoxide ($NaOCH_3$) used as a catalyst has high oxidation stability (49.6 h) and dielectric breakdown voltage (100 kV), the physical properties of this lubricant including kinematic viscosity at 40 °C (96.7 mm^2/s) and pour point (17 °C) are susceptible due to the high molecular weight structure and containing high saturated content. To investigate the most suitable bio transformer oil (BTO), the lubricant was synthesized from neopentyl glycol (NPG) to form diester, trimethylolpropane (TMP) to form triester, and Di-TMP to form tetraester with five different fatty acid sources including refined palm oil: RFP, high olein palm oil: HOP, palm kernel oil: PK, sunflower oil: SF, and soybean oil: SB via transesterification adapting from Di-TMPTTE condition. It found that all BTO in form of NPG diester have lower flash point than the specification (≥ 250 °C). While the BTO in Di-TMPTTE forms have over kinematic viscosity specification value (≤ 50 mm^2/s) from their complicated and high molecular weight structure. Conversely, the BTO in TMP triester form matched the required physical properties. The TMP triester produced from palm oil sources has unqualified pour point (RFP-TE 19°C and HOP-TE 6 °C) but having high oxidation stability (≥ 30 h), while TMP triester produced from SF and SB have great pour point (-14 °C and -10 °C) but having low oxidation stability (4.7 h and 4.0 h). However, the oxidation stability of BTO could be enhanced via partial hydrogenation. Therefore, SF-TE was the most suitable BTO to be partially hydrogenated for further investigation of the saturation degree to its pour point and oxidation stability to obtain qualified BTO.

WASTE-DERIVED CATALYSTS FOR BIODIESEL PRODUCTION

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Abstract:
Eggshells, animal bones, and biomass can be used as raw materials to prepare catalysts with various acid-base properties that are then active for specific chemical transformations. The talk will cover an overview of past and ongoing research projects focusing on the value creation of local waste resources through the development of waste-derived catalysts. We report the comprehensive performance and recyclability of waste-derived catalysts for the conversion of free fatty acids or plant oil feedstocks to fatty acid methyl esters (FAME), which have a similar composition to biodiesel. Effective conversions, transesterification and esterification, require appropriate matching between the acidity of oil feedstocks and suitable catalysts with specific acid-base characters. These waste-derived catalysts not only contribute to the production of biofuels but also have the potential to reduce waste accumulation and promote sustainable resource utilization. The benefits and use of waste materials may form the basis for the future development of even higher-activity catalytic materials for sustainable fuel production. Challenges and opportunity of waste-derived catalysts for biodiesel production are summarized.

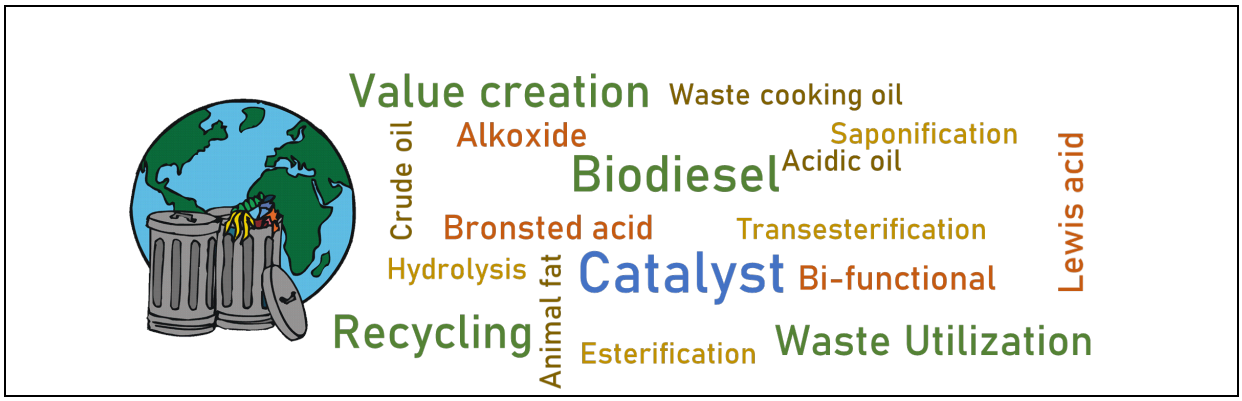

Figure 1.

SESSION F-FOOD SCIENCE AND TECHNOLOGY/AGRICULTURAL SCIENCE

Development of Innovative Mango-based Functional Products

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Abstract:
Mangoes are seasonal produce, highly perishable and susceptible to poor storage and post-harvest handling by which large quantities are wasted during its peak season. Development of commercialize products from mango are produced like puree (fruit pulp), flour (peel and pulp) and powder products that able to use as functional ingredients and can preserve its nutritional properties and sensory characteristics. Given the abundant availability of mangoes in CLSU, this research aimed to utilize these mangoes in developing products such as spray-dried mango powder, extrudates and instant mango powdered juice. Ripe mango is processed into puree and subjected to spray-drying with 200°C inlet temperature, and 30 ml/min feeding speed flow. Treatments were based on the carrier (Maltodextrin) and sugar content (5%) of the produced powder and were analyzed for its yield and sensory characteristics. Through ranking test, sample treatment with 40% Maltodextrin with 20% sugar obtained highest yield and frequency of most acceptable in terms of overall quality. Moisture content and water activity of the mango powder (MP) were also analyzed and results showed spray-dried mango powder have 1.72-2.71% and 0.20-0.24%, respectively. MP had a moisture content of 0.59%; ash of 0.88%; protein of 0.86%; fat of 0.08%, total dietary fiber of <1.0%, and total carbohydrates of 97.59%. Mango powder is an excellent source of Vitamin C of 6966.43 mg/100g with phytochemicals and exhibited antioxidant activities (DPPH-Radical Scavenging, ABTS-Radical Cation Scavenging, and Ferric Reducing Antioxidant Power). Functional products were produced with the spray-dried mango powder such as extrudates through extrusion processing and instant mango powdered juice. Characterization of the products for its nutrient composition, and Vitamin C content was conducted. Findings showed that physico-chemical characteristics and nutrient content of the curls and instant mango powdered juice were comparable to the commercially available products. Sensory evaluation of 0%, 50%, 70%, and 90% MP added to extrudates was conducted in terms of its appearance, color, aroma, texture, flavor, and overall acceptability using a 9-point hedonic scale. Curls with 90% MP scored highest in the sensory evaluation and can retain its quality up to 2-3 weeks reported in the shelf- life study. In conclusion, spray-dried mango powder may be considered as a potential functional food ingredient in the development of food products e.g., extrudates and instant powdered juice.

Keywords: *spray-dried, mango powder, extrudates*

Effect of Coconut Protein Powder Addition on Soymilk Yogurt Using *Lactobacillus plantarum* TISTR 2084 : Evaluation of Quality Aspects

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Abstract:
The dairy probiotic sector, particularly yogurt, has taken over the functional food market. Due to allergies to milk protein and lactose intolerance, there is a need to develop plant-based yogurt. This was the first study to evaluate some quality criteria of plant-based yoghurt (pH, titratable acidity, lactic acid bacteria, viscosity, syneresis, and water holding capacity). Herein, coconut protein powder (CPP) was fortified in soymilk yogurts before being incubated with *Lactobacillus plantarum* TISTR 2084 at 35°C for 24 h. This product is in high demand for increasing the protein level of regular yogurts, which offers numerous health benefits. Yoghurt made from soy milk and supplemented with 3, 5, and 7% CPP was compared to soy milk yoghurt. The results revealed that soymilk yoghurt had average bio-physico-chemical properties such as acidity and viable cell number with 0.9%, 9.8 log cfu/mL. Furthermore, raising the CPP content to 5% or greater would boost viscosity relative to other samples and decrease syneresis, making it possible for use in quality yogurt. Protein fortification had a significant influence on yoghurt water holding capacity ($p < 0.05$) in the following order: 7% CPP > 5% CPP > 3% CPP. However, product with 7% CPP resulted in lower lactic viability (9 log cfu/mL), while 5% CPP resulted in higher cell viability (10 log cfu/mL). Thus, CPP at 5% is an effective ingredient in the production of fermented soymilk. This result could provide the fundamental information for developing novel plant-based yogurt as a reference in the future.

EFFECTS OF ANTIBIOTICS ON MICROBIAL DIVERSITY AND GENE EXPRESSION OF THE BLACK TIGER SHRIMP (*Penaeus monodon*)

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Abstract:

Antibiotics have played a critical role in animal healthcare and aquaculture for more than five decades. Oxytetracycline, sulphadiazine, and enrofloxacin are the most commonly used antibiotics in shrimp production. However, there are many reasons for the overuse and misuse of antibiotics in shrimp farming, including the difficulty of accurately diagnosing diseases in low-income countries and poor farm management practices, such as bad farming practices, intensive aquaculture, and poor hygiene. Consequently, the prophylactic use of antibiotics can lead to the development of antimicrobial resistance (AMR) in animals and humans. To investigate the effects of antibiotics on shrimp production, the intestinal microbiota was investigated via 16S rRNA gene amplicon sequencing and gene expression was evaluated using whole transcriptome sequencing (RNA-Seq) on hemocyte samples from the black tiger shrimp, *Penaeus monodon* treated with antibiotics (enrofloxacin and oxytetracycline) and control diets to determine differentially expressed (DE) host genes. The shrimp were supplemented with each antibiotic at a dosage of 3 g/kg of commercial pellets for 7 consecutive days. Tissue samples were collected on days 0 and 7. The result showed that microbial diversity profiles in the intestines were affected by antibiotic treatment on day 7 compared to day 0. Additionally, gene enrichment analysis revealed that transcripts associated with the immune system, growth and development, and metabolism were also influenced by the treatments.

EVALUATION OF LACTIC AND FORMIC ACIDS IN SILAGE PRODUCTION FROM VISCERA OF ATLANTIC REDFISH (Sebastes norvegicus; Ascanius, 1772)

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Abstract:
Organic acids either single or in combination have been studied worldwide for producing silage from fish processing wastes. Although, formic acid is popularly used as ensiling agent, there is lack of information on the effectiveness of weak organic acids such as lactic acid. From this perspective, formic acid (85%) and lactic acid (85%) were added at the rate of 3.5% (w/v) to the minced viscera of Atlantic redfish (*Sebastes norvegicus*, Ascanius, 1772) for producing silage under two temperature conditions, i.e., ambient (±25^{0}C) and elevated (±45^{0}C) temperature. Temperature 45^{0}C was used in this experiment to accelerate the rate of hydrolysis of the produced silages and heat treatment (±80^{0}C for 1 minute) was performed to inactivate the digestive enzymes at storage. Changes in sensory properties, chemical parameters and nutritional quality of the produced silages were assessed. Lactic acid silages were stabilized at pH 4.09 (25^{0}C) and 4.12 (45^{0}C) while formic acid silages were found to be stable at pH 3.38 (25^{0}C) and 3.26 (45^{0}C) respectively. There was no sign of putrefaction in the silages during the entire 35 days storage. Aqueous phase was found to increase over time due to hydrolysis in both lactic and formic acid silages, while the proportion was comparatively more in 45^{0}C silages. An increase of protein in soluble phase was observed in all the silages compared to initial stage. However, protein in lactic acid silages was proportionately higher than their formic acid counterparts. Major amino acids i.e., tryptophan, (cysteine + cystine), methionine, alanine, aspartic acid, and arginine were obtained in both lactic and formic acid silages (25^{0}C) in higher concentration contrasted to untreated raw material. It was remarkable that heat-labile tryptophan sustained until the end of storage. Initially, free fatty acid content in the silages rose gradually then slowed down. Higher proportion of free fatty acids in 45^{0}C silages was possibly due to influence of elevated temperature. Overall, the results suggest that lactic acid could be used as effectively as formic acid to produce silage from Atlantic redfish viscera at optimum temperature of 25^{0}C.

INVESTIGATION OF METABOLOMICS AND ANTIOXIDANT PROPERTIES OF MODIFIED TEMPE

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Abstract:

Tempe, a traditional Indonesian fermented soy product, has garnered global acclaim for its health benefits and nutritional value. This study focuses on enhancing the bioactivity of tempe by utilizing organic soybeans and fermenting it with *Rhizopus oligosporus* and *Saccharomyces cerevisiae*. Despite the popularity of these modifications, there has been a lack of research into the profiling of isoflavones and their derivatives in these modified tempe. The objective of this research is to annotate the metabolites in modified tempe through library matching and in silico fragmentation using MS/MS data. Additionally, LCMS-based metabolomics was employed to analyze the isoflavone profiles in various modified tempe. The study also includes antioxidant assessments such as DPPH, FRAP, and ABTS in all modified tempe. The results reveal variations in isoflavones, amino acids, fatty acids, and other related metabolites. The LCMS-based metabolomics approach effectively generated PCA, PLS-DA, PLS, variable importance in projection (VIP) scores, and heatmap analyses, systematically identifying the metabolite alterations in these modified tempe. Furthermore, the antioxidant activities in the modified tempe were found to be higher than in conventional tempe. These findings suggest that modified tempe holds promising potential for the future development of fermented soybean food products.

TISSUE CULTURE OF CANNABIS 'MANGO HYBRID' VARIETY

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Abstract:
Cannabis is an economic plant. Micropropagation is a valuable method for mass propagating and producing disease-free plantlets. The seed germination of 'Mango hybrid' variety was compared between peeled and unpeeled methods using MS culture medium. After a 10-day period, peeling method is more effective in increasing the germination rate of 98%, higher than the unpeeled seeds (66%). The effects of different plant growth regulators on inducing both shoot and callus formation from nodal segments of plantlets were evaluated using MS culture medium supplemented with PGRs. The MS culture medium supplemented with the growth regulator TDZ at a concentration of 3.0 mg/L showed the best shoot induction, with the highest average of 3.7±1.3 shoots, which was significantly different from BA (3.0 mg/L=2.5±0.5 shoots), 2iP (1.0 mg/L=2.1±0.5 shoots), and the MS control (2.1±0.7shoots). Furthermore, callus induction was observed to have a larger size in TDZ 3.0 mg/L compared to 2iP and BA. In addition, roots were observed only in the MS control without PGRs. The findings from this research can be applied to enhance large-scale mass propagation of elite cannabis varieties.

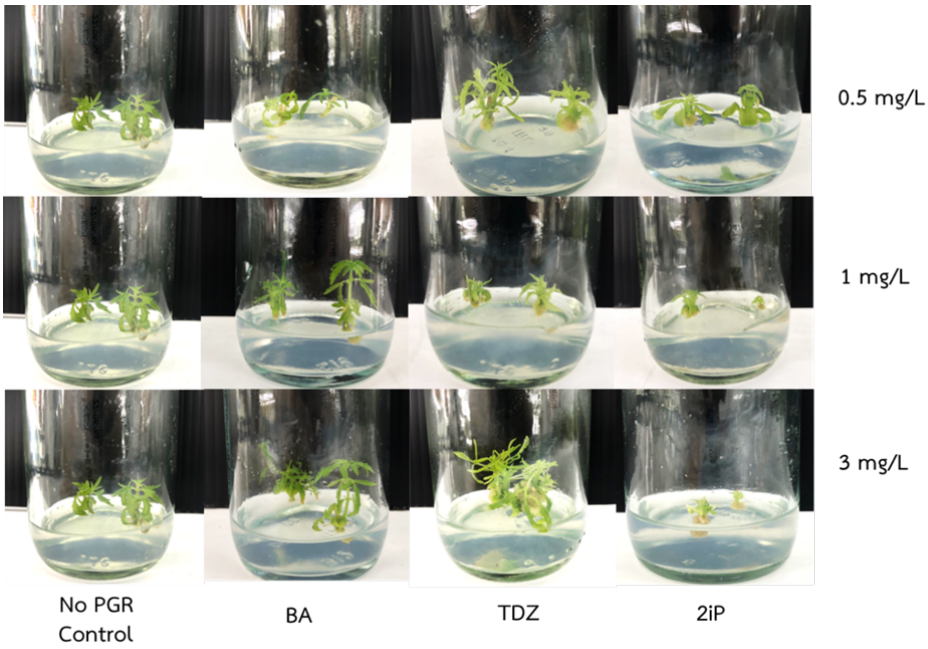

Figure 1.
The effects of different concentrations of PGRs on the shoot induction of cannabis node explants after 30 days in culture media. Abbrev; PGRs = plant growth regulator, BA=6-benzyladenine, TDZ=thidiazuron, and 2iP= 6-(γ,γ-dimethylallylamino) purine

TROPICAL THAI TULIP BREEDING

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Abstract:
Despite numerous tulip varieties cultivated in Thailand, In the past, they had never yielded bulbs. After the Thai tulip breeding program started in 2018, it resulted in successful bulb products at the Chiang Rai station. Four varieties 'Strong gold', 'Negrita', 'Ile de France', and 'Golden Parade' were used as parents of the Thai tulip which could produce the first Thai bulb products with percentages of 34.13, 20.17, 10.30, and 15.83 respectively. In the 2019 season, five tulip varieties ‘Strong Gold’, ‘Negrita’, ‘Ile de France’, ‘Golden Parade’, and ‘Strong Love’ were planted in Chiang Rai, all varieties in Chiang Rai station produced tulip bulbs in the percentages of 35.00, 22.50, 10.25, 13.50 and 9.85 respectively. In the later year 2020-2022 with a mutation breeding, 20 Gy gamma irradiated tulip of ‘Ile de France’ and ‘Strong gold’ mutants were discovered. ‘Ile de France’ mutant had a tiny dark stripe on its red petals and ‘Strong Gold’ had red stripes on its yellow petals. In addition to irradiated mutants, the white tulip ‘Royal virgin’ and another ‘Strong gold’ spontaneous mutants were found. The white tulip ‘Royal virgin’ mutant had a red stripe petal while ‘Strong Gold’ had green stripes on its yellow petals.

Figure 1. Tulip flowers, bulb products, and their mutants in Thailand

Using of *Lactobacillus plantarum* TISTR 2084 Starter powder to Making Curd Milk with Prebiotic

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Abstract:
Curd is prepared by fermentation of milk with lactic acid bacteria (LAB). Beneficial of curd has led to the widespread consumption of healthy food with probiotic. One of LAB is *Lactobacillus plantarum* which has been using in fermentation technology and for the development of different probiotic formulations. The aim of this study was to determine the curd properties change during storage. The curd was prepared in the presence of *L. plantarum* TISTR2084 starter powder 5% (w/v), saba banana flour 5% (w/v), milk powder 3% (w/v), sugar 5% (w/v) in fermenting milk at 35°C for 24 h. This curd product also contains saba banana flour as the prebiotic source was stored in 4°C and evaluate chemical properties of curd sample (pH, titratable acidity and lactic acid bacteria) in every day of shelf life for 1 week. The effects on chemical properties were indicated by the growth of *L. plantarum* TISTR2084. The pH and acidity were 4.87-5.13 and 0.81-0.92%, respectively. MRS media used was specific for growth of *Lactobacillus* spp. The colonies was found decreasing in the curd from $3.1x10^8$CFU/g to $4.9x10^6$CFU/g but the number of colonies was contain at least 10^6CFU viable bacteria to classify as probiotics. Further, this curd had the potential to application in ingredient of cream or health food.

SESSION SP3: TRANSFORMING SCIENCE EDUCATION IN THE PANDEMIC ERA

POST-PANDEMIC IMPACT ON A PRIVATE UNIVERSITY IN MALAYSIA: ADAPTING STRATEGIES FOR SUSTAINABLE EDUCATION IN CHEMISTRY

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Abstract:
The emergence of the COVID-19 pandemic marked an unprecedented disruption in global education systems, affecting a vast population of approximately 1.6 billion learners across over 200 countries. Specifically, within Malaysia, where private universities hold a significant role in shaping the educational sphere, the pandemic brought about notable shifts in higher education. This research focuses on the post-pandemic impact on a private university situated in the Malaysian capital, focusing on transformations in teaching and learning approaches, student engagement, and technological integration in chemistry education. Through an in-depth analysis of diverse data sources, including literature review, institutional reports, and expert opinions, this study aims to shed light on the challenges faced by the teaching and learning process in chemistry and the strategies employed to mitigate the adverse effects. In addition, the study also discusses the potential long-term transformations in higher education that may persist beyond the pandemic and offers recommendations to ensure the resilience and adaptability of private universities in Malaysia. Understanding the post-pandemic impact on private universities is crucial for formulating effective policies and strategies to enhance the quality and accessibility of higher education in the evolving educational landscape.

SESSION SP4: ENERGY FOR THAILAND - FOR TOMORROW AND BEYOND

EFFECTS OF NEOCLASSICAL AND ANOMALOUS TRANSPORTS ON ELMS DYNAMICS BASED ON THREE-FIELD BIFURCATION MODEL

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Abstract:
The edge localized modes (ELMs), a repetitive MHD instability occurring in the edge pedestal region of H-mode plasmas, is a significant challenge faced in tokamak devices used for magnetic confinement fusion experiments. Therefore, the understanding of suitable plasma conditions is important for tokamak devices to avoid dangerous ELMs. This research studies ELM instabilities that occur after the high confinement (H-mode) mode based on the three-field transport bifurcation concept. Three field transport equations of thermal, particle, and toroidal momentum transport equations are numerically solved simultaneously. Both neoclassical and anomalous transports are included. The anomalous transport is suppressed by the velocity shear based on the calculation of force balance between gradient pressure force and Lorentz's force. The intrinsic rotation in plasma is included in this research. Moreover, the driven plasma current is modified as a quadratics function and the intrinsic bootstrap current driven by the pressure gradient is also included. A peeling-ballooning model of ELMs is included in the form of thermal and particle loss once the critical pressure gradient or plasma current density at the top pedestal has been reached. The results demonstrate ELMs phenomenon in the form of a periodical drop of plasma profiles, hence a loss of energy can be observed in a pattern of plasma fluctuation. The ELM repetition frequency is calculated by fast Fourier transform (FFT). The plasma pressure, density and toroidal momentum profiles are discussed in different ELM violation regimes. ELMs affected by varying neoclassical and anomalous transport coefficients are discussed in order to understand the suitable plasma conditions for avoiding dangerous ELMs. This research is supported by TSRI Fundamental Fund project number 181077.

ETB FORMATION AND L-H TRANSITION IN TURBULENT MAGNETO-CONFINED PLASMA

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Abstract:
In the present work, an L-H transition of magnetically confined plasma is investigated using a three-field bifurcation model consisting of thermal, density and turbulent intensity equations. These parameters are normalized by their respective reference values. The pressure and density equations are modelled with both neoclassical and anomalous effects, whereas the nonlocal turbulent intensity equation is modelled with local growth, local nonlinear damping, and nonlinear diffusion terms, leading to propagating fluctuating fronts. The fluctuation of turbulence intensity evolves as power law, with power equal to one denoting weak turbulence and less than one denoting strong. The edge turbulent effects, both in weak as well as in strong turbulent regime have been suppressed by flow shear mechanism. Hence, an edge transport barrier (ETB) appears, thus reducing the heat and particle transport at the edge. The pressure maintains stability at the core and its gradient decreases sharply in the ETB which does not show any variation with nonlinearity power index. Intensity at the plasma core is maintained at a value slightly higher than 1 which decreases to zero at the edge. The turbulence profile remains a constant value from the core toward the edge till 84% of normalized radius approximately where it starts a sharp fall due to the sheared radial electric field which suppresses the turbulence in the pedestal region.

Exploring the Impact of Magnetic Polywell Configurations on Electron Confinement

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Abstract:
Polywell fusion is an opened magnetic field confinement device, where plasma is confined using magnetic mirror effect. Traditionally, Polywell consists of 6 current coils arranging in the opposite direction of the cubic configuration. Consequently, the produced magnetic field is canceled out at the center, called magnetic null point. In this work, we study the effects of different polywell configurations using numerical simulation. There are total of 4 configurations such as the cube configuration (6 coils), dodecahedron configuration (12 coils), double-layer configuration (14 coils) and disco configuration (26 coils). It is found that magnitude of magnetic flux density is not influenced by the magnitude of current loop. However, the increasing of coil numbers results in an extension of the opposite distance of coils and the width of magnetic null region. In order to calculate the efficiency of confinement capability, numerical electrons are injected into the center of each configuration and the decay of electron number in magnetic null region is investigated. It can be demonstrated that the direction of magnetic mirror forces directed towards the middle to null point. Therefore, the increasing number of coils affect electron reflection and confinement time.

Keyword: polywell fusion, magnetic null, confinement time

HCN Interferometer: Advanced Technique for Plasma Density Measurement in TT-1 and Early Results

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Abstract:

Hydrogen cyanide (HCN) laser, which is generated by a DC plasma glow discharge in a low vacuum chamber, emits a high sensitivity 337 μm infrared laser. The 337 μm wavelength radiation of the HCN laser is very useful for Thailand Tokamak-1 (TT-1) diagnostics because lower degree of diffraction by plasma electron density gradients than the longer wavelength microwave radiation. An HCN laser is set as follow. a) A low vacuum chamber with a well-proportionated gas mixture of CH_4, N_2, and H_2 and undergoes a DC plasma glow discharge. b) An Interferometer mirror set directs infrared laser towards the tokamak to enable precise measurements of plasma density. The interferometer operates at a rapid 10 kHz frequency. c) The HCN laser beam is split into two separate beams: one as a reference and the other a plasma probing. These two beams are then directed to the tokamak. d) The probing laser beam is further divided into three distinct beams, each aimed at measuring plasma density at different plasma positions in the tokamak simultaneously. e) The phase difference between the reference and the measurement beams is then detected by the interferometer, providing precise and rapid measurements of plasma density. This advanced setup provides real-time data on plasma density at multiple positions within the tokamak chamber, all without significantly perturbing the plasma conditions. An analysis from shot#1785 is provided as an example, plasma densities varied from $8.5\text{x}10^{18}$, $1.05\text{x}10^{19}$, to $9.8\text{x}10^{18}$ m^{-3}, indicating high plasma density in the middle, lower outwards to the edge. For comparison, shot#1798, which operated at different working parameters, has plasma densities varied from $1.08\text{x}10^{19}$, $1.2\text{x}10^{19}$, to $1.0\text{x}10^{19}$ m^{-3}.

NORTHEASTERN THAILAND AS THE NEW AND FUTURE POWER HOUSE

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Abstract:
The continuous and ongoing release of CO_2 into the atmosphere from fossil fuel burning and other human-made activities is resulting in an increase in the global land and ocean temperatures, thus threatening the long established band of tolerance for ecosystems and humans. Renewable energy sources, like solar, wind, water, geothermal, and others offer a way for a CO_2 free/less energy system, affordable and available for all. As many research-based publication have shown this is energy transition is possible, technical feasible, and will even create jobs. Solar energy systems are one of the backbones of the energy transition, with the widely known roof top solar systems and the solar farms, where solar panels are installed in great numbers on a plot of land or even water bodies. Less know, but since a few years gaining more attention, are agrivoltaic systems, where solar panels and systems are installed on agricultural land while agricultural work is continuing under. Systems are designed for various crop types across the globe, including rice fields, one of the major food sources in Asia and SE Asia. In Thailand, the northeastern part, or *Ihsan*, is one of the major agricultural areas, especially for rice farming. This region is historically and until these days often considered poor, with farmers looking for additional job opportunities in Bangkok region or abroad. Additionally, certain areas cannot be farmed anymore as they are contaminated by salt from a shallow geological layer. In addition, industrial development in the area is limited. Agrivoltaic provides an opportunity for the farmers in Northeastern Thailand to do agriculture and to have a stable income from renewable energy production. Current research has shown that solar infrastructure on agricultural land does not necessary has to have negative effects on crop yields. Additional shade, for example, can minimize water loss in rice fields, comparable to evaporation minimization from solar floating on water. The business model asks investors to build the solar energy infrastructure on farmers' land without purchasing or owning the land, and both parties then will get a share from the marketing of the produced electricity. Such systems are not limited to rice fields, as other crops are also suitable. Solutions here can be rather individual. For example, vertical solar between crops and farm or grassland is also possible and feasible. However, legal issues have to be resolved allowing other activities than agriculture on agricultural land. Further, legal documents have to be framed to clarify and stipulate ownership of land and solar infrastructure and income share. With such a clear regulatory environment and framework of policies, the northeastern region of Thailand could be the powerhouse of the country providing renewable energy to Bangkok and greater area.

SIMULATION STUDY OF STREAMER MODEL OF AN ATMOSPHERIC PRESSURE NITROGEN DIELECTRIC BARRIER DISCHARGE (DBD) AT BODY TEMPERATURE TO GENERATE AMINE GROUPS ON POLYSTYRENE

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Abstract:
A two-dimensional computational model representing a dielectric barrier discharge with electrode gap of 1.2 mm is used in this study. The model of polystyrene, a rectangular box with base dimension of 3 mm by 1.5 mm, is constructed as a substrate for plasma treatment and deposition (dielectric material). The simulation is generated at 1 atm and at body temperature. In this study, electrons gain energy from electric field. The mean electron energy is calculated from local field approximation. Maxwellian distribution function is applied as electron energy distribution function (EEDF). A non-homogeneous electric field due to a residual non-uniform charging of the dielectric barrier is involved to the discharge formation by the Townsend mechanism. The model shows that the discharge develops in two phases: ionization process and streamer propagation. The density and velocity of plasma species are explained.

Thailand Tokamak-1 Operation and Results from the first Commission period

Nopporn Poolyarat, Somsak Dangtip, Thawatchai Onjun, Jiraporn Promping, Kamtorn Saidarasamoot, Arlee Tamman, Suebsak Suksaengpanomrung, Pasit Wonghabut, Kewalee Nilgamhang, Wasin Nupangtha, EGAT team, and ASIPP team.

Thailand Institute of Nuclear Technology, Nakorn Nayok, THAILAND

Abstract:

Thailand Tokamak-1 or TT-1 is a small size, 0.65 m major radius and 0.20 minor radius, limiter-type tokamak. The installation of TT-1 tokamak at Thailand Institute of Nuclear Technology, Nakorn Nayok, was completed in April 2023, making TT-1 the first tokamak in Thailand and Southeast Asia region.

This work presents the results of the TT-1 operation during the first commissioning period during April-July, 2023. Operation parameters include, Toroidal Field power supply voltage (V_{TF}), Vertical Field power supply voltage (V_{VF}), Ohmic heating field power supply voltage (V_{OH}), … etc. Typical setting values are for example V_{TF} = 3,500 V , V_{VF} = 2,000-3,500 V, and V_{OH} = 2,500-3,500 V . When all subsystems are ready, a chief operation officer initiates the plasma discharge process. 128 signals are measured and recorded for each shot. As of Oct 11, 2023, we have already operated TT-1 on hydrogen plasma for more than xxx shots. We have successfully operated with plasma currents of greater than 50 kA , and plasma duration of 118 ms, which is longer than the nominal value of 100 ms. The electron temperature ranges up to 30 eV, while electron density was able to achieve 9×10^{18} particles/m^3.

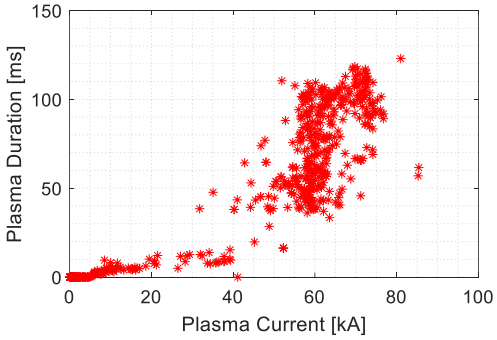

Figure 1. TT-1 Plasma current and plasma duration distribution.

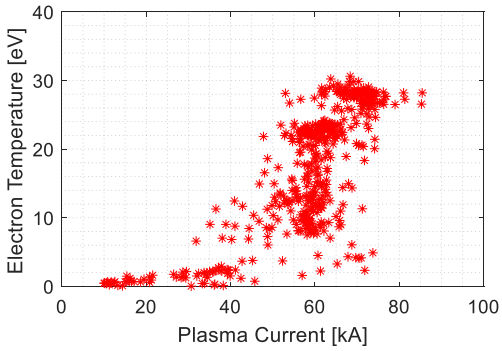

Figure 2. TT-1 Plasma current and electron temperature distribution.

THE EFFECTS OF ZONAL FLOW DAMPING ON LIMIT-CYCLE OSCILLATIONS DURING L-I-H TRANSITION

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Abstract:
In this work, we utilize the simple zero-dimensional self-consistency time evolution of turbulence amplitude, zonal flow shear, and pressure gradient to investigate the effect of zonal flow damping on limit-cycle oscillation (LCO) during L-I-H transition. The other parameter regimes are the same as in the primitive model to stay in the L-I-H transition dynamics. Changing some parameter coefficients may result in a different dynamic due to the stability of the fixed point. The main physics of the primitive model can be described as follows: first, the turbulence equation is based on the two predator-one prey concept where zonal flow shear acts as the first predator, used to trigger the transition, while mean flow shear, which is proportional to the pressure gradient, used to lock in the transition, and turbulence, which is driven by pressure gradient as a linear instability, acts as a prey. Second, zonal flow is generated by turbulence via the Reynold stress and inhibited by mean flow shear. Zonal flow is linearly damped by the collisional process between zonal flow and trapped particles in the banana orbit. Last, the pressure gradient evolution consists of turbulence diffusion, neoclassical transport, and time-dependent heating source. It was found that the increasing zonal flow damping rate (γ_{damp}), proportional to the ion-ion collision frequency, results in a higher turbulence amplitude due to the decreased zonal flow shear population, as expected from the predator-prey concept. In addition, it also prolongs the oscillation duration (I-phase) with a decreasing LCO period and delays the transition. It implies that an increased γ_{damp} can upshift the power threshold. Therefore, the mechanism that can enhance ion-ion collisions, such as neutral charge exchange due to the presence of the impurities or neutral particle beam injection, should be considered to avoid the power threshold upshift.

SESSION SP5: ENVIRONMENTALLY FRIENDLY RUBBER AND ITS FUTURE

NATURAL RUBBER-MODIFIED POLY(ETHYLENE GLYCOL) METHYL ETHER METHACRYLATE ELASTOMERIC SEMI-IPN FOR METHYLENE BLUE DYE ADSORPTION

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Abstract:

This study presents the synthesis and characterization of a semi-interpenetrating network (semi-IPN) elastomeric hydrogel comprising natural rubber (NR) and polyethylene glycol methacrylate (PEGMA) for the removal of Methylene Blue (MB) dye from aqueous solutions. The influence of the PEGMA/NR ratio, ranging from 100/0 to 50/50, was systematically investigated. Scanning electron microscopy (SEM) images revealed a porous and uniformly structured hydrogel with interconnected pores of various sizes. Fourier-transform infrared (FTIR) analysis confirmed the successful formation of a semi-IPN structure, highlighting the presence of distinctive functional groups in both NR and PEGMA. Adsorption studies demonstrated the exceptional efficacy of the hydrogel in removing MB dye, achieving a maximum adsorption capacity of 6536 mg/g at a NR/PEGMA ratio of 10/90. UV-vis spectroscopy further validated the reduction in MB concentration following exposure to the hydrogel. These findings underscore the substantial potential of the NR/PEGMA semi-IPN elastomeric hydrogel as a highly efficient adsorbent for MB dye removal in wastewater treatment applications. Its notable adsorption capacity and cationic ionic nature position it as a promising candidate for industrial wastewater treatment.

Keywords: Elastomer, Hydrogel, Natural rubber, Poly(ethylene Glycol) Methyl Ether Methacrylate, Methylene blue

SESSION SP6: IMPACTS OF CLIMATE CHANGE ON BIODIVERSITY AND ENVIRONMENT INCLUDING THE STRATEGIES TO TACKLE SUCH ISSUES

Development of the Sustainable Use of Marine Natural Resources in the Gulf of Thailand: Case Studies of Coral Reef Fishes in Samaesarn Islands, Chonburi Province, Thailand

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Abstract:
This study was aimed to investigate the relationship of big data among satellite data for quantifying chlorophyll-A, water depth data from navigation charts, general bathymetric chart of the oceans, water quality data and ecological data of coral reef fishes in Samaesarn Islands, Chonburi Province, Thailand. These areas are under responsibility of the Royal Thai Navy and are the conserved area for research of biological resources under Plant Genetic Conservation Project Under the Royal Initiative of Her Royal Highness Princess Maha Chakri Sirindhorn (RSPG). The research was conducted between June 2022 and September 2023: research planning, data review and collecting the previous data and field survey. Finally, the above data were analyzed to investigate their relationship. It was found that there was low disturbance to marine ecosystem in Samaesarn Islands from the mainland and nutrient pollution when comparing other coastal areas in the Eastern Economic Corridor (EEC). Therefore, this research could be used to develop a study model to investigate the relationship between biodiversity and environmental factors in order to use as marine pollution indicators in the future. Also, it could be used as a study guide to expand the finding of this study to other areas in the Eastern region in order that marine natural resources in the Gulf of Thailand can be used sustainably.

SESSION SP8: X-RAY CRYSTALLOGRAPHY

REVERSIBLE STRUCTURAL TRASNFORMATION BETWEEN SUPRAMOLECULAR ISOMER AND RESPECTIVE [2+2] CYCLOADDITION

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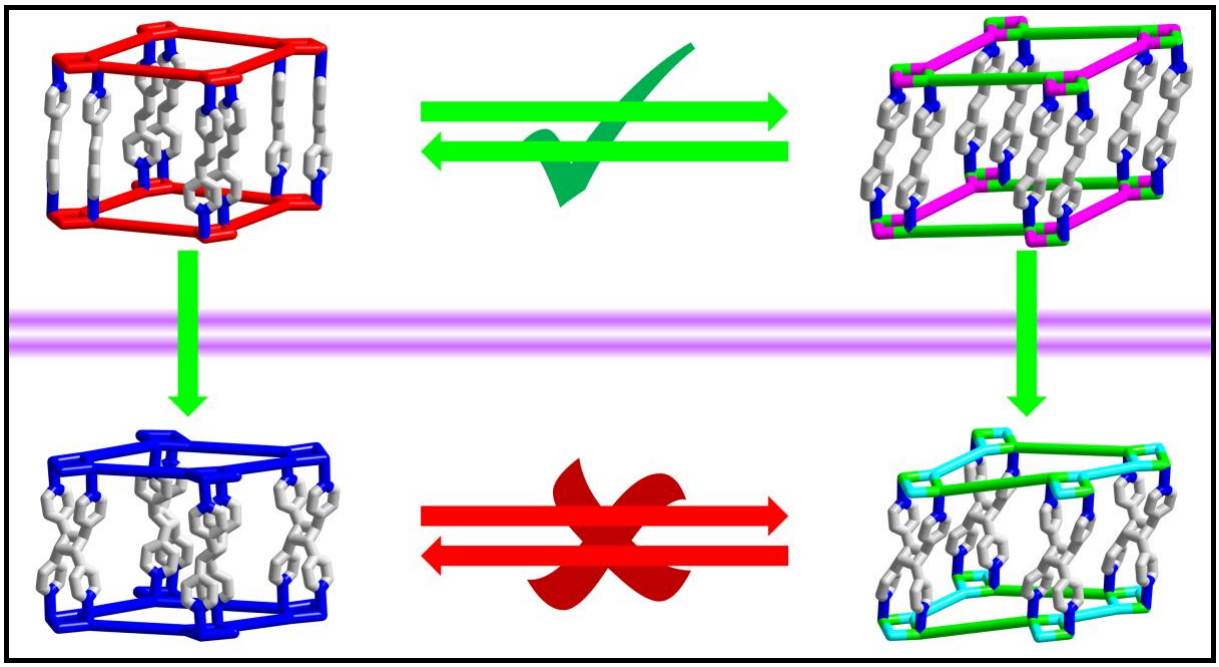
Abstract:

Two distinct supramolecular isomers, **α** and **β**, characterized as a doubly pillared layer structure, were successfully synthesized using specific methods. Significantly, these isomers exhibited reversible structural transformations when their powders were suspended in a suitable solvent. Moreover, the olefin moieties of the pillar ligands in both isomers were meticulously aligned, satisfying Schmidt's criteria. Upon exposure to 350nm UV light for hours, crystals of both isomers underwent a complete [2+2] cycloaddition reaction, resulting in the formation of photo-dimerized supramolecular isomers, **α'** and **β'**. Interestingly, while **α** and **β** displayed reversible transformations, **α'** and **β'** did not exhibit similar structural changes. These unique phenomena not only shed light on the intricate chemistry of these compounds but also significantly impacted the porosity of metal-organic frameworks and their ability to uptake CO2. This study unveils novel insights into the interplay between structural transformations, photoreactions, and the properties of MOFs, offering promising avenues for the development of flexible and post-synthetic modifications of functional materials.



SYNTHESIS, CHARACTERIZATION, CRYSTAL STRUCTURES AND PHOTOCATALYSIS OF NEW CADMIUM(II) COORDINATION POLYMERS CONSTRUCTED FROM IMIDAZOLE-CONTAING BASE AND PSEUDOHALIDE LIGANDS

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Abstract:

This work reveals a series of four new cadmium(II) coordination polymers containing mixed imidazole-based and pseudohalide ligands, $\{Cd(bzi)_2[Ag(CN)_2]_2\}_n$ (**1**), $\{[Cd(bix)_2[Ag(CN)_2]_2]\cdot(H_2O)_{0.3}\}_n$ (**2**), $\{Cd(bix)_2[Ag(CN)_2]_{1.8}(CH_3O)_{0.2}\}_n$ (**3**) and $\{[Cd(bix)_2(N(CN)_2)](N(CN)_2)\cdot(H_2O)_{0.75}\}_n$ (**4**) (bzi = 1-benzylimidazole and bix = 1,4-bis(imidazol-1-ylmethyl)benzene) have been successfully synthesized. All these Cd(II) compounds have been characterized by means of FT-IR, EA, TGA and PXRD. The crystal structures of all compounds have been determined by using the single crystal X-ray diffraction. The coordination frameworks of all these compounds present various types of topologies namely 2D 2-fold interpenetrating network for compound **1**, 2D square grid-like and 2D undulated network for compounds **2** and **3**, respectively and the 3D 2-fold interpenetrating framework for compound **4**. The crystal structures of all compounds are further stabilized by weak interactions such as hydrogen bonding, π···π stacking and C–H···π and also the argentophilic interactions ($Ag^I\cdots Ag^I$) from $[Ag(CN)_2]^-$ ligand in case of compounds **1**-**3**. For the solid-state photoluminescence properties, compound **1** presents the red-shift and slightly enhanced intensities comparing to free a bzi ligand, while that of compounds **2**-**4** present the quenched intensities comparing to a free bix ligand. Moreover, the photocatalytic activities of the degradation of MB under UV irradiation have been investigated with the photocatalytic efficiency of 64.39% and 56.21% for compounds **3** and **4**, respectively. In addition, the energy gaps of these Cd(II) CPs has been evaluated by density functional theory (DFT) calculations.

UNVEILING HALOGEN BOND IN THE PLAY: CO-CRYSTALS OF 1,4-DIIODOTETRAFLUOROBENZENE

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Abstract:
This study delves into the investigation of I...N halogen bonding within co-crystals constructed from 1,4-diiodotetrafluorobenzene and isomeric n-pyridinealdazines (n = 2, 3, and 4). The primary focus lies in delineating the nature and strength of these non-covalent I...N interactions, which play a central role in dictating molecular packing within the co-crystals. Single-crystal X-ray diffraction analysis reveals distinct structural arrangements, emphasizing the unique geometric characteristics and binding energies characterizing the halogen bonds in each co-crystal. Additionally, solid-state photoluminescence investigations underscore a direct correlation between molecular assembly and the resulting emission properties, effectively demonstrating the profound influence exerted by I...N halogen bonding on the electronic characteristics of these materials. This research advances the understanding of co-crystal formation via halogen bonding and its implications for luminescent properties, opening promising avenues for tailoring photoluminescent properties through co-crystallization.

X-RAY CRYSTALLOGRAPHIC STRUCTURE OF COPPER(II)-SQUARATE FRAMEWORK

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Abstract:
The reaction between squaric acid (H_2sa) and copper(II) nitrate under solvothermal conditions produced a new metal-organic framework (MOF) with the formula $[Cu_3(sa)_2(OH)_2]\cdot 2.5H_2O$ (**1**). MOF-1 crystallizes in the monoclinic $P2_1/c$ space group. The structure consists of cage-like cavities and a neutral three-dimensional framework. MOF-1 has excellent thermochemical stability and good CO_2 absorption.

SESSION SP9: RADIOECOLOGY AND ENVIRONMENTAL RADIOACTIVITY

DEPOSITION OF Cs-137 IN FOREST SOIL OF THAILAND

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Abstract:

Incident of Cs-137 radioactive source missing from a stream power plant in Prachin Buri and later found contaminated in steel melting plant on March 2023 frighten people on danger of Cs-137 dispersion. Cs-137 is a radionuclide produced by fission and activation reactions which occurring in nuclear reactor and nuclear explosion. Following the peak of atmospheric nuclear test in 1960s and Chernobyl accident in 1986, large amount of Cs-137 fallout dispersed throughout the globe. Forests are important receptors of atmospheric fallout, the deposition of fallout Cs-137 in forest soil has been found in area of temperate forest zone particularly in Europe after Chernobyl accident. However, examination of Cs-137 deposition in forest soil of Thailand has not been investigated, therefore only few evidences were published. This study aimed to collect the data of Cs-137 deposition in area of forest soil in Thailand. Those depositions are expected to be generated by nuclear-test during 1960s. Initial depositions were calculated for comparison between forest sites. It is concluded that Cs-137 fallout generated from nuclear-test delivered into area of Thailand and could be found in surface forest soil. Establishment of database of Cs-137 deposition is recommended to avoid misinterpretation of Cs-137 source particularly after incident of industrial factory or hospital in the future.

Measurement of external gamma dose rates and assessment of seasonal variation and annual effective dose around the radiation monitoring stations in Thailand

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Abstract:

Office of Atoms for Peace (OAP), Thailand's national nuclear and radiation regulatory body, has established and operated the National Radiation Monitoring Network in 17 provinces covering all regions in Thailand to monitor the gamma radiation levels from nuclear activities both in the country and in the region and to assess radiation doses in the public and the environment. A total of 18 radiation monitoring stations consist of 17 NaI(TI) scintillation detectors, ø3×3 inch, and 5 Geiger-Muller (GM) detectors. In this work, the real-time environmental monitoring data were measured and averaged monthly and yearly for each station from January 2020 to September 2023. The gamma radiation levels at all the stations were found to be in a range of 0.010-0.300 μSv/h with averages of 0.052±0.021, 0.052±0.021, 0.052±0.023, and 0.053±0.020 μSv/h for NaI detector-equipped stations in 2020, 2021, 2022, and 2023, respectively. While the average values reported at the GM detector-equipped stations were 0.098±0.028 μSv/h in 2022 and 0.099±0.028 μSv/h in 2023. The seasonal variations can be observed from these measurements, indicating that the higher gamma radiation dose rates were detected in the winter season when compared to other seasons. Additionally, the average Annual Effective Doses (AEDs) received by the populations living nearby each station from external exposures (indoors and outdoors) ranged between 0.084 and 1.420 mSv with the means of 0.368±0.151 mSv/y in 2020, 0.371±0.148 mSv/y in 2021, 0.449±0.221 mSv/y in 2022, and 0.456±0.212 mSv/y in 2023. All the AED values were lower than the average global external terrestrial radiation level of 0.48 mSv/y and well below the average worldwide background radiation level of 2.4 mSv/y or even the level recommended by ICRP at 1 mSv/y. This implies such low radiation levels would not pose observed radiation effects in the exposed population both at the local and national levels. Furthermore, the obtained results would be used as the national reference radiation levels or the baseline data for the public and environmental radiation protection in the future, especially in case of nuclear and radiation emergencies.

Radioactivity Measurement in Japan-imported Seafood before and after the Release of the ALPS-treated Water

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Abstract:

Twelve years after the Fukushima-Daiichi Nuclear Power Plant (FDNPP) accident in Japan in 2011, Tokyo Electric Power Company (TEPCO) and the Government of Japan released 1.4 million tons of Advanced Liquid Processing System (ALPS) treated water into the ocean starting in August 2023. The release will continue over the next 30 years causing concerns in several countries over food safety both imported seafood from Japan and local seafood, and possible radioactive contamination in the marine ecosystem. To address such concerns in Thailand, relevant national competent authorities consisting of Department of Fisheries (DOF), Food and Drug Administration (FDA), Thailand Institute of Nuclear Technology (TINT), and Office of Atoms for Peace (OAP), have carried out a comprehensive monitoring program. Prior to the planned release, four different types of Japan-imported seafood including halibut, salmon, oyster, and wakame seaweed collected from areas nearby the Fukushima-Daiichi NPP were bought from the seafood market in Bangkok in 2021 and 2022 for Cs-137 and Co-60 measurements using HPGe Gamma Spectrometry. Ranges of <0.002-0.53 Bq/kg and <0.02-<0.32 Bq/kg were found for Cs-137 and Co-60 in the analysed seafoods. Immediately after the 1st discharge, 81 imported seafood (pelagic and benthic fish, crustacean, and mollusca) from Japan were randomly collected at the ports of arrival. The results showed that the Cs-137 and Co-60 concentrations in all seafood of interest were lower than the Minimum Detectable Activities (MDAs) ranging from <0.53 to <1.38 Bq/kg and from <0.40 to <1.51 Bq/kg, respectively. There are no elevated Cs-137 and Co-60 values observed in the Japan-imported seafood analysed in this present work after the release of the ALPS-treated water when compared to the measured values obtained before the release. And the value is lower than the standard criteria of CODEX STAN 193-1995, in which the concentration in food must not exceed 1,000 Becquerel per kilogram. It can be concluded at this point in time that consuming the imported seafood from Japan will not cause any radiological health risks to Thai seafood consumers.

RADIOLOGICAL RISK ASSESSMENT OF ABANDONED TIN MINES IN PHUKET AND SONGKHLA PROVINCES

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Abstract:

Naturally occurring radioactive materials (NORMs) is well understood that could be contaminated in abandoned mines. However, in southern part of Thailand abandoned mines are used as reservoirs for tap water production, tourist attractions and recreational areas which possibly risk on public health of long-term exposure of radiation. This research aims to study the naturally occurring radioactive materials (NORMs) possibly accumulated in abandoned tin mines in Phuket and Songkhla provinces. Environmental samples (surface soil and water) of 7 and 1 abandoned tin mines in Phuket and Songkhla respectively have been collected. All samples were packed in sealed plastic containers then left for 3 weeks until reaching a secular equilibrium**.** Samples were counted for 80,000 seconds and analyzed for radioactivity of natural radionuclides using gamma spectrometry (HP-Ge detector). Finally, radiation dose of public has been assessed. The results suggest that activity concentration of natural radionuclides in studied abandoned tin mines are very low. Activity concentration of Ra-226, Ra-228 and K-40 in surface soil of those abandoned mines are range of 33±2-313±14, 67±6-398±20 and 108±11-1295±70 Bq/kg respectively, while in water samples are lower than Minimum Detectable Concentration (MDC of Ra-226, Ra-228 K-40 are approximately 0.1-0.2, 0.2-0.4 and 0.3-0.9 Bq/kg respectively). They are also suggested that people living in those areas 24 hours received radiation dose of those natural radionuclides less than approximately 0.1-0.5 mSv/y which concluded that no possible risk of radiation on public health for living in area of those abandoned tin mines.

THE COMPUTATIONAL FLUID DYNAMICS (CFD) MODELING FOR NUMERICAL STUDY ON RADON CONCENTRATION AND VENTILATION EFFECTS IN LIVING AREAS WITHIN A SINGLE-STORY HOUSE

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Abstract:

Radon is a natural radioactive noble gas in the uranium decay series and is formed directly from the alpha decay of radium. Radon is the leading environmental cause of lung cancer. The health implications of human exposure to radon in the environment are a primary public concern worldwide. Therefore, evaluating indoor radon concentration is a matter of public interest. The radon gas emanation within a room contributes to poor indoor air quality when the place is not adequately ventilated. Understanding how this gas is distributed within a room helps predict spatial and temporal variations in radon levels. This study focuses on computational fluid dynamics (CFD) modeling of radon concentration and ventilation effects in living areas within a single-story house. The ANSYS code based on the finite volume method was used to estimate indoor radon concentrations in a detached house. The influence of several parameters on indoor radon levels, such as indoor temperature, humidity conditions, and ventilation rates, was simulated to determine their effects on indoor radon distribution and concentration. The numerical simulation results show that ventilation rates significantly impact radon content and distribution.

POSTER PRESENTATION

SESSION A-PHYSICS / APPLIED PHYSICS

'RADIOACTIVE DICE' EXPERIMENT: A NEW APPROACH TO MORE ACCURATELY APPROXIMATING RADIOACTIVE DECAY

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Abstract:
The investigation of the decay process of radioactive elements is frequently conducted through the utilization of an analogous experiment involving the rolling of dice. Previous studies have indicated that the half-life derived from dice-rolling experiments is shorter in comparison to the half-life observed in the natural decay of radioactive elements. The continuous decay of radioactive elements in nature is the underlying cause of this phenomenon. However, it is important to note that the decay of dice rolls takes place subsequent to each individual roll. In the present study, a novel experimental design was formulated. In this experimental study, a total of 1000 six-sided dice were rolled repeatedly over the course of one hour, with each die being subjected to 10 decay events within this time frame. Each decay event was set to occur at intervals of 0.1 hours. The experimental half-life of rolling the dice was determined to be 4.125 hours, while the theoretical half-life was calculated to be 4.158 hours, resulting in a discrepancy of 0.78 percent. The values exhibit a higher degree of similarity.

CONVERSION OF SUGARCANE LEAVE INTO CLEAN SOLID BIOFUEL VIA CATALYTIC HYDROTHERMAL CARBONIZATION

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Abstract:
High ash constituents in agricultural waste have been shown to restrict the efficiency of downstream conversion processes. Hydrothermal carbonization (HTC) is an excellent thermochemical conversion approach to enhance the fuel characteristics of biomass feedstocks. The present work utilized sugarcane leaves (SL) as a raw feedstock to produce a solid biofuel with a high heating value and low ash content. The HTC experiment was investigated at different temperatures of 200, 240, and 280 °C for 1, 4, and 8 h with existing sodium citrate, sodium bicarbonate, citric acid, and biomass combustion ash (pH=10.7) as a catalyst for effectiveness in ash reduction. The ash content of SS-derived biofuel significantly decreased by approximately 43.49–74.52% compared to raw feedstock. Existing catalysts enhanced effectiveness in removing ash. The alkali catalyst exhibited a selective capacity for the removal of SiO_2 as well as other metal oxides contained in the biomass ash. Furthermore, a reduction in ash content is directly proportional to an increase in the higher heating value of the product. Based on those findings, the catalytic hydrothermal carbonization (HTC) process could be considered a practical integrated approach for converting various biowastes into a higher-quality solid biofuel with lower ash content, making it acceptable for bioenergy applications.

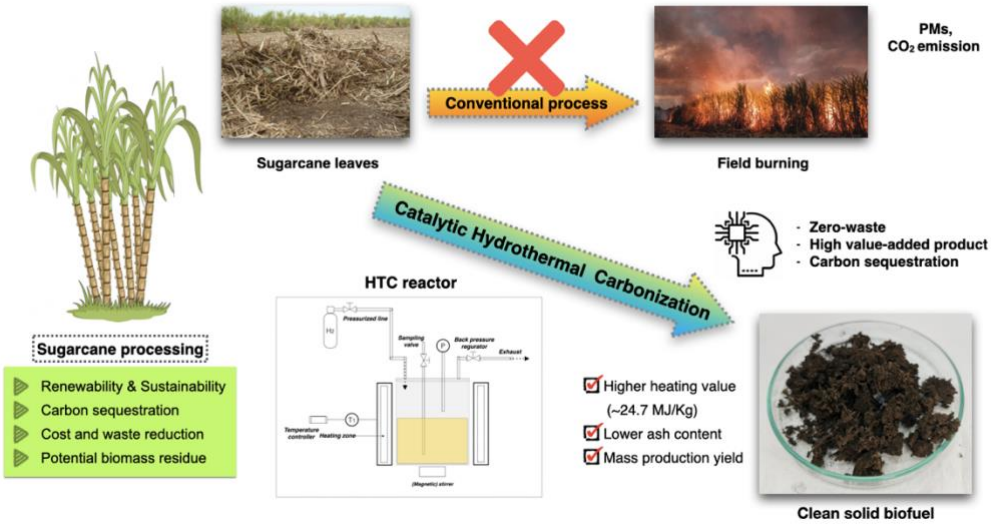

Figure 1.
Scheme diagram of the research experiment

Development of Control Software and Data Acquisition for Neutron imaging Facility at Thai Research Reactor (TRR-1/M1)

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Abstract:
The Thai Research Reactor (TRR-1/M1) is a vital resource for the scientific community in Thailand and neighboring countries, providing unique opportunities for training and neutron experiments. One of its active laboratories, the Neutron Imaging Facility (NIF), is undergoing continuous improvements. To enhance performance and efficiency, two new control software and data acquisition programs were developed using LabView. The first program controls the sample holder system, synchronized with the neutron camera for precise experimentation. The second program serves as an all-in-one solution for controlling both the camera and the sample stage, automating snapshot capturing for neutron tomography experiments. Additionally, a new 3-directional servo motor was upgraded from the small step motor previously used for rotation control, significantly improving rotation control for neutron tomography. The results of this project indicate a significant enhancement in the capabilities of the Neutron Imaging Facility at TRR-1/M1. These advancements not only resolve previous software limitations but also unlock new possibilities for research and collaboration across various scientific fields.

FABRICATION OF THE HOLLOW CORE ANTI-RESONANT FIBER BY A MODIFIED OFF-THE SHELF 3D PRINTER

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Abstract:
The goal of this project is to modify printer settings of an off-the-shelf 3D printer. to fabricate a specific type of hollow core anti-resonant fiber for THz waveguide. The 3D printing method used in this research work is extrusion, also called. Fused Deposition Modelling (FDM). In this study, PETG was chosen as the fiber filament, because of their unique properties suitable for guide terahertz waveguides such as high impact resistance. The transparency, flexibility, good thermal stability, easily extruded, low water absorption and low cost. The operating frequency for this fiber is below 0.62 THz. Due to the unique structure of this fiber, the standard nozzle of the 3D printer was replaced by a specifically designed nozzle. A set of PETG waveguides were 3D printed by systematically varying some printing parameters, including the filament feeding speed and the nozzle temperature. These two parameters are crucial and found to affect the quality of the printed structures. The printed fibers samples were preliminarily examined in terms of their structures against the designed waveguides. The printer settings were optimized so as to minimize the discrepancy between the printer and the corresponding designed waveguides.

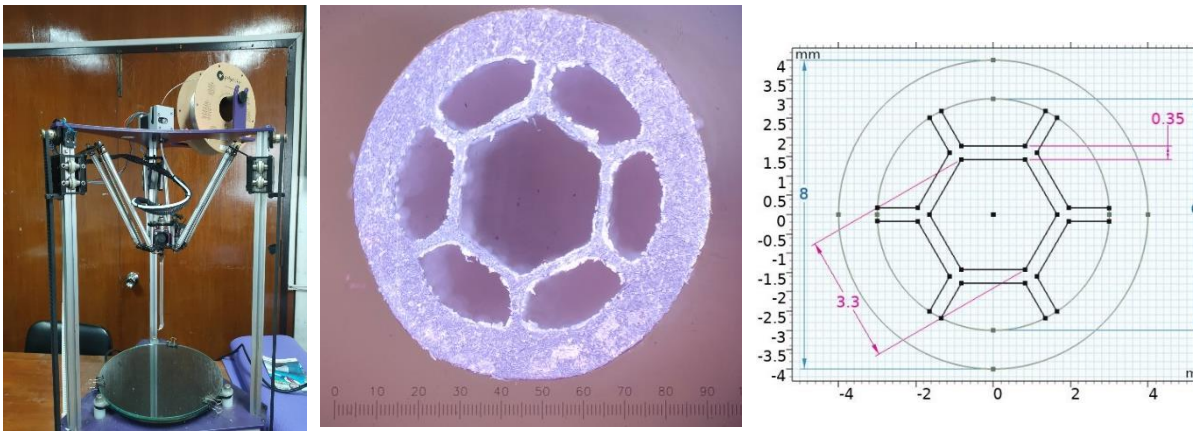

Figure 1.
An off-the Sheff 3D printer is modified to fabricate the hollow core anti-resonant fiber(left), cross section of the hollow core anti-resonant fiber(middle) and the design of hollow core anti-resonant structure(right)

LARTENT HEAT OF VAPORIZATION OF KRATOM LEAVES

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Abstract:
The study latent heat of vaporization using the principle of Kratom leaves using the Othmer model (1940) is feasible. The model takes into account the relative humidity of the air within the range of 10-90% and temperatures between 50-70 degrees celsius. This relationship can be expressed as $h_{fg} = (2502 - 2.386T)(1 + 21.986\, e^{-2.782M})$ where T represents the temperature in degrees celsius and M is the moisture content of Kratom leaves in decimal units. When humidity and temperature decrease the latent heat of transpiration increases. This is because the water inside the Kratom leaves exists in the form of free water and the cohesive forces of free water decrease. As a result the latent heat of transpiration decreases. Furthermore as the temperature rises the latent heat of transpiration decreases due to the increased kinetic energy of water molecules leading to a reduction in cohesive forces between water and the leaf structure. Therefore the latent heat of transpiration decreases.

Neutronics Effects Study for Tritium Breeding Blanket of Fusion Reactor

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Abstract

Nuclear fusion is one of the most promising options that can provide sustainable clean energy to meet growing demand while having a relatively low impact on the environment [1]. After several decades of research and development (R&D) on magnetic confinement fusion, many of the scientific and technological obstacles to fusion have now been overcome. At present, the International Thermonuclear Experimental Reactor (ITER) is under construction in France [2]. The ITER is an international collaboration of China, India, Japan, Korea, Russia, United States of America, and Europe which will be the first burning plasma machine to demonstrate the feasibility of fusion energy [3]. To overcome the primary missions of internal fusion heating, fusion energy production with long pulses and tritium breeding testing; a tritium breeding blanket (TBB) is an essential component for the tritium breeding fusion reactors. The TBB has functions of tritium breeding, energy generation and neutron shielding. Moreover, tritium breeding ratio (TBR) is a key parameter for a fusion reactor to evaluate whether the TBB could produce enough tritium to achieve tritium self-sufficiency (TBR > 1). However, the TBR of the fusion reactor can be impacted by a number of factors, including the geometries (the opening ports to install the corresponding heating and diagnostic equipment [4], and a heterogeneous model of the blanket [5]), materials (type, density, enrichment), nuclear libraries (uncertainty) and neutron transport codes (uncertainty). Meanwhile, the tritium losses occur during the fuel cycle because of tritium decay, leakage, extraction, and retention, which is a considerable challenge to tritium sustaining. Therefore, a higher TBR is needed. According to the mentioned constraints, the study of neutronics effects for first wall region as shown in Fig.1 tritium breeding blankets would be scientific significance for fusion reactor efficiency improvement in the future.

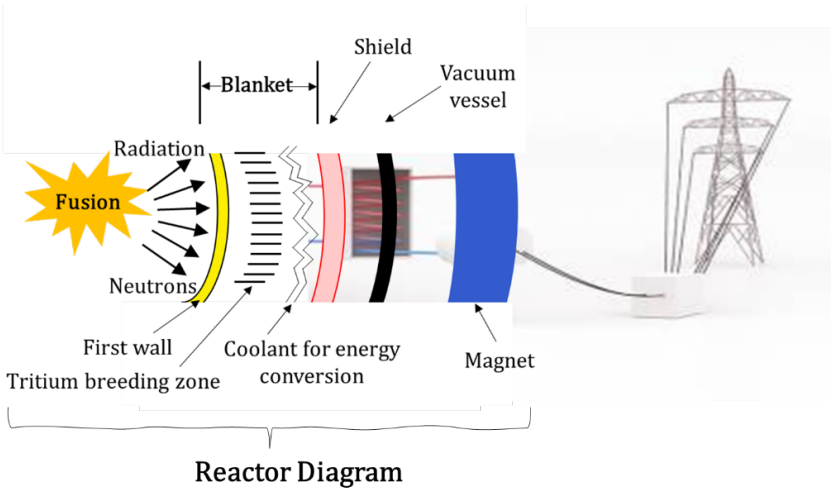

Fig. 1 Internal components and energy generation from nuclear fusion reactor walls diagram [6,7]

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[7] https://en.wikipedia.org/wiki/DEMOnstration_Power_Plant

SORPTION ISOTHERM OF KRATOM LEAVES

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Abstract:
The sorption isotherm of Kratom leaves were determined at temperatures of 50 60 and 70 degrees celsius using a static method by saturated salt solution was used experimentally to determine the equilibrium moisture content. The effect of the initial moisture content of Kratom leaves on equilibrium moisture content was also studied. Four different models is Oswin (1946), Halsey (1948), Henderson (1952) and Chung & Pfost (1967) were used to represent the experimental data. The mathematical model of equilibrium moisture content of Halsey (1948) was able to best predict the equilibrium moisture content of Kratom leaves at temperatures of 50 60 and 70 degrees celsius. The equation Halsey (1948) got it from $M_{eq} = [(-RT/A)\ln RH]^{(1/B)}$. The results found that equilibrium moisture content were decreased when temperature was increased at constant relative humidity in contrast at the same temperature the equilibrium moisture content was increased when increased relative humidity. The provides statistical analysis results are the coefficient of determination (R^2), standard error of estimate (SEE) and root mean square error (RMSE) equal to 0.998, 0.157 and 0.109 respectively.

Study the End of Near Field Interference By Gaussian Function Series for Vibration Detector Development

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Abstract:

Nowadays, physics has been used more in technological or academic development. The most important thing is physics theory must be applied to solve the problems that we are facing. One of those problems is vibration, small vibrations can sometimes be difficult to detect because they have such small amplitudes that conventional vibration detectors cannot distinguish them. For this reason, the researcher used electromagnetic wave theory, the basic knowledge used to develop the wave diffraction. The researcher will develop to increase the clarity of the images by using graph analysis techniques. We also avoid estimation based on the diffraction of light through the grating combined with wave phenomena using a simple model to find the theoretically most accurate endpoint of near-field interference. And use changes in light intensity as points that indicate vibrations have entered the system.

According to our study, The researcher found that the general form or near-field end equation corresponds to the theory and can cover the entire near-field, So this is the most suitable place to place a light sensor. The general equations also correspond to the Fresnel Number, an approximation in the near-field region. The result location will be a location with high light intensity fluctuations. This will make the response of the light sensor also sensitive when vibrations enter the system, causing the position of the light sensor to change. It causes the system to send signals and interpret signals as vibrations entering the system. Both the concept and the model can be used to further sensor development or accumulate knowledge in the field of Optics.

TEACHING DEVICE UTILIZING VIRTUAL PHYSICS LABORATORY V 8.0 EXPERIMENTS ON ENERGY IN ELEMENTARY PHYSICS

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Abstract:
The primary aim of this study is to employ instructional media in fundamental Physics, specifically focusing on the topic of energy. To facilitate the learning of fundamental principles in Physics on energy, students are provided with the opportunity to engage in virtual experimentation through the utilization of Virtual Physics Laboratory V 8.0 software. This software serves as a substitute for physical equipment traditionally employed in conducting experiments. Lastly, the third objective of this study is to assess the suitability of virtual science learning media as a format and to develop problem-solving abilities using scientific process skills. The utilization of Program Virtual Physics Laboratory V 8.0 has been found effective in facilitating the instruction of fundamental Physics experiments. The study examined the levels of students' engagement and involvement in the learning process. This program enables users to engage in Physics experiments in the absence of physical tools. Students can carry out experiments in the absence of internet connectivity. This study investigated the degree of student satisfaction and the suitability of employing the Program Virtual Physics Laboratory V 8.0 to conduct experimental activities. The results of the study revealed that the students exhibited a considerable degree of competence in their ability to solve problems.

SESSION B-BIOLOGICAL SCIENCES

A Comparison of Aquatic Arthropod Diversity in Organic and Conventional Rice Paddy Fields

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Abstract:
This study was aimed to investigate diversity of aquatic arthropods and predatory arthropods in organic and conventional rice paddy fields during July 2018 and May 2019 in Nong Seang Sub-district, Pakphli District, Nakhon Nayok Province, Thailand. For field sampling, aquatic arthropods were collected by using a sweep net and they were randomly sampled 6 points/field. There were 3 organic rice fields and 3 conventional rice fields for collecting the arthropods. It was found that there were a total of 158 individuals of all arthropods were collected and identified, comprising 21 families, 24 species and there were a total of 123 individuals from 15 families and 16 species of predatory arthropods.The most abundant aquatic arthropods were Order Hemiptera (11 families, 12 species). However, when analyzing the diversity indices (Shannon-Weiner's index and Simpson's index) of arthropods, there was no statistically significant difference in the diversity of aquatic arthropods between organic and conventional rice fields.

ALGAL-BASED PROTEIN: TEMPEH PRODUCED FROM *Chara corallina* (SARAI-KHAM-KUNG)

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Abstract:
Edible freshwater algae *Chara corallina*, commonly found in the southern part of Thailand, has high protein content. The aim of this study was to introduce an algae-based protein as a supplement for protein-rich tempeh production. The nutrition content of the algae extract was identified to be 17.3 ± 0.31%, 0.78 ± 0.77%, 11.83 ± 0.31%, and 18.6 ± 1.63% for protein, fat, moisture, and ash, respectively. The optimum ratio of sterile algae in tempeh production was 50% in cooked soybean with 0.2% of *Rhizopus oligosporus* as a starter inoculum. The fungal mycelium showed a complete penetration into the algae tempeh with a mixture of soybean and slightly algal odor. The total protein content of the algal-based tempeh was 17.28 ± 0.60% with a soluble protein content of 342 ± 0.10 μg/100 g tempeh, and a pH of 6.41 ± 0.03. For the incubation duration, the algae tempeh incubated for 48 h exhibited the acceptable odors similar to soybean tempeh (control), with the highest total protein content of 21.81 ± 0.97%. The essential amino acids composition was estimated to be in the range of 1.57–7.47% in the algae tempeh. Among the total of 18 amino acids composing the product, the algae tempeh comprises of umami amino acid (glutamate and asparagine) in the range of 11.7–18.3%, and sweet amino acids (alanine, glycine, serine, threonine, and proline) in the range of 3.7–6.1%. In conclusion, our study demonstrates that *C. corallina* can be effectively utilized to create tempeh products that serve as plant-based protein sources, possessing nutritional and flavor characteristics identical to soybean-based tempeh. Additionally, we produced a freeze-dried algal protein powder from these tempeh products, opening up further possibilities for innovative food applications.

Figure 1.
Tempeh and its powder (right) produced from *Chara corallina* (Sarai-Kham-Kung; สาหร่ายก้ามกุ้ง) (left)

AN INTEGRATED COMPUTATIONAL APPROACH: MACHINE LEARNING AND MOLECULAR DYNAMICS SIMULATION FOR REPURPOSING G-QUADRUPLEX LIGANDS AGAINST SARS-COV-2 MAIN PROTEASE

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Abstract:

The emergence of highly infectious and drug-resistant SARS-CoV-2 variants necessitates urgent therapeutic options. Targeting the main protease protein (Mpro) of the virus has been recognized as an attractive strategy. This study introduces a screening pipeline employing a machine learning (ML)-based quantitative structure–activity relationship (QSAR) model integrated with molecular docking and molecular dynamics (MD) simulation. Our aim is to identify potential inhibitors against the Mpro of SARS-CoV-2. A dataset comprising 10,691 compounds with SARS-CoV-2 Mpro inhibitory (pIC50) values from the ChEMBL database was curated for building and testing the model. 546 PubChem fingerprint descriptors described the inhibitors, and multiple ML algorithms were used to train the model. The light gradient boosting machine (LGBM) algorithm demonstrated high predictive performance and robustness with R^2_{Tr} = 0.897, Q^2_{CV} = 0.657, and Q^2_{Ext} = 0.668 for the training set, 10-fold cross-validation set, and testing set, respectively. Utilizing the LGBM model, we screened 4,669 compounds from the G-quadruplex ligand database, identifying a candidate inhibitor against SARS-CoV-2 Mpro. This compound and nirmatrelvir (PF-07321332) were docked into the active site of SARS-CoV-2 Mpro via Autodock-GPU. Subsequently, all-atom 100 ns MD simulations were performed using GROMACS version 2023.3 to analyze the stability and interactions of the protein-ligand complexes. Post-MD simulation analysis, encompassing protein-ligand complex properties (RMSD, Rg, SASA, RMSF, number of H-bonds, and MM/PBSA binding free energy calculations), revealed the stability and superior binding affinity of the top lead compound compared to nirmatrelvir (PF-07321332), an orally active inhibitor of SARS-CoV-2 Mpro. Finally, the promising candidate compound as a potent SARS-CoV-2 inhibitor was highlighted to be further developed. In conclusion, integrating ML-based QSAR modeling and molecular dynamics simulation approaches may also be beneficial for identifying a novel inhibitor of a G-quadruplex stabilizing agent with repurposing potential for COVID-19 prevention and treatment, leading to the enhancement of the design and discovery of new bioactive molecules.

ANTIFUNGAL ACTIVITY OF ENDOPHYTIC FUNGI ISOLATED FROM HERBS IN SOUTHERN THAILAND AGAINST CANDIDIASIS AND MUCORMYCOSIS

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Abstract:
The occurrence of mucormycosis is a severe epidemic in India during the COVID-19 crisis because it is a fungus that can rapidly invade tissues invasively, posing a relatively high risk of death. Therefore, the purpose of this study is to investigate the antifungal activity of endophytic fungi against mucormycosis. Endophytic fungi were isolated from medicinal plants in the botanical park of Walailak University between March and September 2022. In this investigation, selected endophytic fungi, such as *Purpureocillium lilacinum*, *Fusarium verticillioides*, *Acremonium pinkertoniae*, *Rigidoporus vinctus*, *Fusarium proliferatum*, and *Aspergillus aculeatinus* were incubated in Sabouraud dextrose broth at 25°C for 2 weeks. Antifungal properties were tested using agar well diffusion, broth microdilution, and germination test. Cell-free supernatants (CFS) and hyphae-break cultures (HBC) extracts were used against five *Candida* species, including *C. albicans*, *C. krusei*, *C. parasilopsis*, *C. tropicalis*, and *C. glabata*. The results revealed that the CFS and HBC demonstrated reduction of yeast cell germination ranging from 75% to 80%, compared to 95% for the untreated control of *C. albicans*. In dual culture assay, the results showed that *F. proliferatum*, *A. aculeatinus*, and *P. lilacinum* inhibited the mycelial growth of *Rhizopus* species at 70.69% , 57.90% and 83.74%, respectively.

CAFFEINE RESPONSE OF *Cordyceps militaris* ON GROWTH AND METABOLITE PRODUCTION

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Abstract: This study aims to investigate the caffeine response of entomopathogenic fungi, *Cordyceps militaris*, involved in growth, development, metabolite production, and caffeine degradation. Our results demonstrated that caffeine showed a dosage effect on the growth, development, and adenosine production of *C. militaris*. Caffeine concentrations (1 and 10 mM) inhibited the mycelial growth of C. militaris, reducing the mycelial growth rates at 1 mM (0.37±0.01 cm/day) and 10 mM (0.27±0.01 cm/day) compared to the control without caffeine (0.42±0.02 cm/day) and the number of conidia was also reduced by 23% (1 mM) and 77% (10 mM) compared to the control. Caffeine also affected the fungal metabolite production by increasing the extracellular adenosine productivity 5-fold (from 4.34±0.60 µg/g/day to 24.28±0.65 µg/g/day) but there was no change in cordycepin (p<0.05). Interestingly, this fungus could metabolize caffeine, resulting in the accumulation of methylated caffeine derivatives, including theophylline (55.23±2.18 µg/mL), theobromine (16.95±0.97 µg/mL), and paraxanthine (12.88±1.22 µg/mL). These findings provide information on the effect of caffeine on growth and development of *C. militaris*. In particular, the increased extracellular adenosine and caffeine biotransformation by this fungus could be used for cosmetic and medical applications.

CARBON STORES FROM A CORAL - SEAGRASS COMMUNITY AT AO NAMMAO, KRABI PROVINCE, THE ANDAMAN SEA

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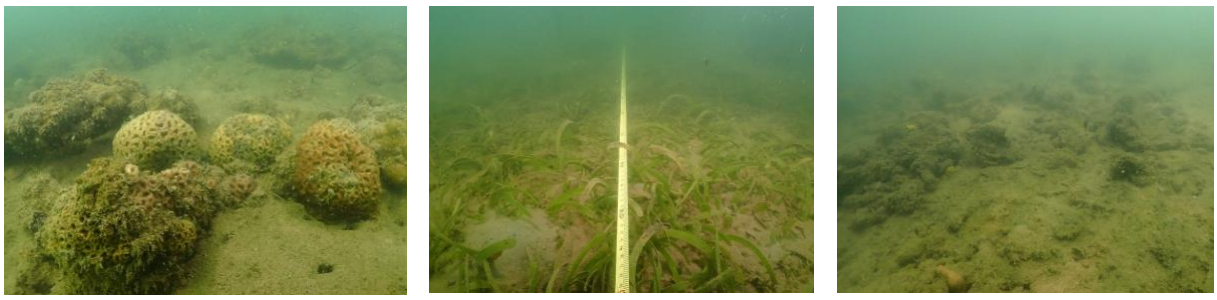
Abstract:

Blue carbon ecosystems (sandy beaches, coral reefs and, seagrasses) are important ecosystems that provide essential ecosystem services such as biodiversity support, ecosystem resilience, and human well-being. They are recognized as one of the nature-based solutions for climate mitigation through anthropogenic CO_2 sequestration and storage. Nevertheless, blue carbon ecosystems are sensitive to climate change, leading to uncertainties about the future integrity and the quality of the ecosystem services provided by these ecosystems. Little is known about the climate mitigation potential of a coral - seagrass community. This study aimed to evaluate the carbon stores in the coral -seagrass community at Ao Nammao, Krabi Province. The results revealed that the coral-seagrass community may provide a potential blue carbon opportunity. The carbon stocks in seagrass, algal biomass, and sediment sampled in the coral-seagrass community were 50.89, 31.68, and 119.74 $MgC.h^{-1}$, respectively. Comparing the carbon storage between zones, the seagrass beds exhibited the highest value of carbon storage (108.99 $MgC.h^{-1}$), while the lowest was found within the sandy zone, which is located between the live coral zone and the seagrass beds zone (10.66 $MgC.h^{-1}$). The estimated total carbon storage of 3,636.72 MgC was found in the coral-seagrass community. This study provides baseline information that supports Thailand's nationally determined contribution and highlights the carbon dynamics in the coral reef and associated ecosystems in carbon storage that should not be overlooked.



Underwater photos of a coral-seagrass community at Ao Nammao, Krabi Province, Andaman Sea

Characterization of melanin from *Streptomyces* spp. isolated from rubber plantation soil

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Abstract:
Nanoparticles have been increasingly used for delivering drugs due to their specific targeting, reduced side effects, prolonged drug release, and improved drug solubility. Melanin is a natural dark pigment produced by various organisms including plants, animals, and microorganisms. Thanks to its biocompatibility, non-toxicity, and high antioxidant activity, melanin nanoparticles have recently been investigated for targeted drug delivery in cancer therapy. Here, we demonstrated that melanin derived from *Streptomyces* bacteria showed chemical and physical properties most identical with synthetic melanin. First, melanin was extracted by liquid-liquid extraction method from a 10-day culture medium of *Streptomyces* spp. (RD01, RD02, RD04, RD06, RD07, RD08, and RD09) collected from rubber plantation soil. After purification, multiple physicochemical properties of *Streptomyces* melanin were confirmed and characterized using UV-vis spectrophotometry, FT-IR spectroscopy, DPPH scavenging assay, SEM-EDX, and NMR spectroscopy. FT-IR and NMR analyses suggested the presence of carboxylic, phenolic and/or amide groups functionalized aliphatic alkyl and aromatic indole and/or pyrrole moieties. Based on elemental analysis, *Streptomyces* melanin consisted of carbon, oxygen, nitrogen, and sulfur. From DPPH assays, *Streptomyces* melanin showed an approximately equivalent free radical scavenging activity to BHT and synthetic melanin. Remarkably, melanin from RD07 displayed the highest activity of free radical scavenging assay at 95.32% compared to the activity of synthetic melanin at concentration of 1 mg/ml. Our studies confirmed the similar characteristics of *Streptomyces* melanin and synthetic melanin in terms of the chemical constituents and antioxidant activity. These results allow the promising application of *Streptomyces* melanin as nano-drug carriers in our further studies.

CLONING AND PREDICTION OF ANTIFUNGAL PEPTIDES IN SILICO APPROACH OF THAUMATIN-LIKE PROTEIN FROM CHUMPHON 1 CACAO

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Abstract:

Thaumatin-like proteins (TLPs), a class of pathogenesis–related (PR) proteins, have the potential to enhance plant resistance against fungal pathogens. When plants are attacked by pathogens it may induce the expression of TLPs as part of their defense response. The TLP gene from the Chumphon 1 cacao (*Theobroma cacao*) leaf was cloned via RT-PCR amplification, resulting in a full-length transcript measuring 675 bp and encoding 162 amino acid residues. The BLASTN and multiple alignment sequence analyses showed a 100% similarity to the database of Thaumatin-like proteins from *Theobroma cacao* and conducted in silico investigations to predict potential antifungal peptides. Additionally, the results of the in silico research using Alphafold2.ipynb to predict the protein 3D structure and Phobius to predict the peptide showed that TLPs contain a region named 'MKFKTVSIFSFSFIALYFTVATAA' that exhibits significant antifungal activity, with a signal peptide (SP) score of approximately 0.8155. The result can help us to recognize potential binding sites and expand the library of Antifungal Peptides. This investigation conducted through computer simulations enhances our understanding of how plants defend themselves against fungal infections. Moreover, it explores the antifungal properties of TLPs, and develops new antifungal agents and therapies for plant fungal diseases, reducing global agricultural losses. The findings provide a solid groundwork for future studies in the plant fungal disease field.

DIVERSITY AND ABUNDANCE OF CORAL REEF FISH IN TRAT PROVINCE, THE EASTERN GULF OF THAILAND

Ploypailin Rangseethampanya,[1] Makamas Sutthacheep,[1] Jirasin Limpichat,[1] Nuttawat Limsuntorn,[2] Thamasak Yeemin[1,*]
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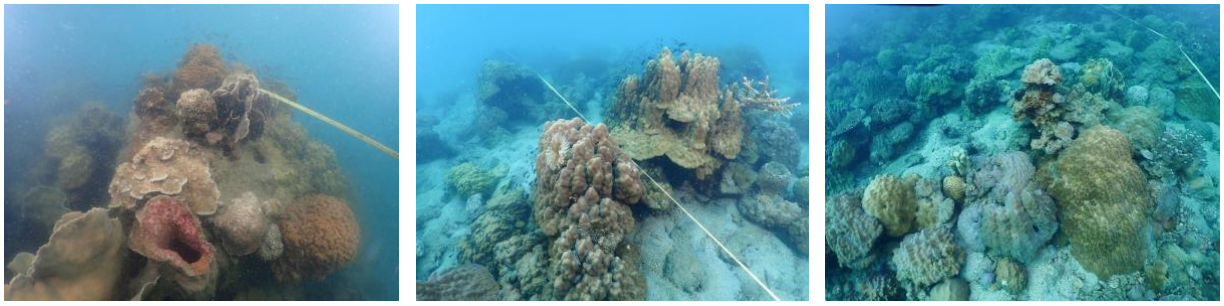
Abstract:
Coral reefs are among the most diverse ecosystems on earth, playing crucial roles in maintaining marine biodiversity and ecosystem functions as well as supporting the livelihoods of coastal communities. Understanding the dynamics of coral reef fish communities is important for effective conservation and sustainable management; however, a large gap of this knowledge in Thailand still exists. In this study, we aim to assess the diversity and abundance of coral reef fish communities in Trat Province, the Eastern Gulf of Thailand. The study was conducted in April 2023 at three reef sites, including Ko Bai Dang (located within Mu Ko Chang National Park), Ko Mai Si, and Ao Pak-wang, located in Trat Province. The abundance and biomass of coral reef fish were assessed using the underwater visual census technique. Coral reef fish were visually identified and counted. The total lengths (TL) of eight families: Mullidae, Carangidae, Siganidae, Kyphosidae, Lutjanidae, Nemipteridae, Scaridae, and Serranidae, were estimated for biomass determination. The results revealed a significant difference in the biomass of target fish among the study sites. Ko Bai Dang exhibited a significantly higher biomass of target fish compared to both Ko Mai Si and Ao Pak-wang ($p<0.05$), while no significant difference was found between Ko Mai Si and Ao Pak-wang ($p>0.05$). Moreover, Ao Pak-wang demonstrated the highest diversity with 56 species from 13 families, followed by Ko Mai Si with 48 species from 18 families and Ko Bai Dang with 44 species from 17 families. Reef sites with higher percentages of live coral cover, such as Ko Bai Dang (83.20%) and Ao Pak-wang (77.70%), exhibited higher diversity and abundance of coral reef fish. This study emphasizes the critical role of coral reef conservation in sustaining the diversity and abundance of coral reef fish communities.



Coral reef at the study sites; Ko Bai Dang, Ko Mai Si, and Ao Pak-wang, respectively

EFFECT OF SODIUM CHLORIDE ON GROWTH AND PETASE EXPRESSION OF *Escherichia coli* STRAIN ROSETTA-GAMI AND PET DEGRADATION

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Abstract:
Polyethylene Terephthalate (PET) is a common component in bottles and containers, contributing significantly to plastic usage. Despite recycling efforts, a substantial amount of PET still enters the environment. The discovery of *Ideonella sakaiensis*, a bacterium containing a PETase enzyme capable of degrading PET, has sparked interest in biodegradation solutions. Our recent study successfully produced recombinant PETase from *I. sakaiensis* within the *E. coli* strain Rosetta-gami, facilitating its release into the culture medium by adding a signal peptide. This enzyme exhibited efficacy when incubated with PET sheets under controlled conditions. However, practical field applications require optimizing the NaCl content in the LB medium. In this research, we cultured recombinant *E. coli* in varying NaCl concentrations, observed growth patterns, and determined the expression, release, and activity of PETase following IPTG induction. The results demonstrated a relationship dependent on NaCl concentration between bacterial growth, PETase release, and PET degradation, with 1% NaCl being the most effective condition. However, the cellular PETase levels did not show significant differences. Furthermore, 0.5% NaCl showed a similar extent of PET release compared to 1% NaCl, suggesting it is a cost-effective alternative for scaling up production for field applications.

EFFECTIVE MELANIN DECOLORIZATION AND TYROSINASE INHIBITORY BY *Pleurotus cystidosus* PROTEINS

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Abstract:
Hyperpigmentation or overproduction of melanin condition is a major cause of freckles or dark spots. Skin treatment with kojic acid and ascorbic acid results in skin irritation and side effects. Natural products with anti-tyrosinase and melanin decolorization have been focused on skin safety. In this study, *Pleurotus cystidosus* was cultured by Kirk's medium, and laccase in the medium was detected. The enzyme extract showed high efficiency in direct melanin decolorization. The fruiting body of *P. cystidosus* was also hydrolyzed with gastric protease and demonstrated excellent tyrosinase inhibition as similar to kojic acid with IC50 values of 0.07 µg/µl and 0.05 µg/µl, respectively. The protein hydrolysate showed no toxicity to HaCaT keratinocytes. The tyrosinase inhibitory peptide from Pleurotus protein hydrolysate was identified with the highest score as a laccase sequence. The synthetic peptide represented mixed inhibition and showed hydrophobic and metal interaction with tyrosinase. The *P. cystidosus* protein should be the alternative natural compound in cosmetics for skin treatment.

EFFECTS OF TEMPERATURE ON BIOLOGICAL ACTIVITIES OF BEE VENOM FROM 3 DIFFERENT SPECIES OF HONEYBEE IN THAILAND

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[2]Microbial Products and Innovation Research Group, Mae Fah Luang University, Chiang Rai 57100, Thailand
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Abstract:

Bee venom (BV) is one of well-known honeybee products, used as traditional alternative medicine. Due to its protein components such as melittin, phospholipase A_2 and hyaluronidase, BV has been reported to possess pharmaceutical properties including anticancer and antimicrobial activities. The activities of BV would be varied due to different species and temperature. In this study, BV from 3 species of honeybee (*Apis mellifera*, *A. dorsata* and *A. florea*) were investigated for its anticancer activity against B16F10 melanoma cell and antimicrobial activities against skin pathogen and gram-negative bacteria. All BV samples were prepared using 10 kDa protein concentrator to separate complex components according to molecular weight and tested for inhibitory concentration causing 20% of death cell (IC_{20}) against melanoma cells. Prior to determining the effect of temperature on the cell viability and Minimum Inhibitory Concentration (MIC), BV samples at IC_{20} were assigned to different cohorts for incubation at 40°C, 60°C, 80°C and unincubated BV as a control. The result indicated that BV from all species exhibited activity to decrease cell viability of melanoma compared to the control after being incubated at temperatures of 40 to 80°C. BV incubated at 60°C from *A. mellifera*, at 40 to 60°C from *A. dorsata* and 40°C and 80°C from *A. florea* showed the lowest cell viability. The MIC results showed that *A. mellifera* BV had the lowest MIC (6.25-12.5 µg/ml) at 40-60°C against *Streptococcus pyogenes* and under control condition against *Staphylococcus aureus* while *A. dorsata* BV showed the lowest MIC (6.25-12.5 µg/ml) at 40°C against *S. aureus*. Meanwhile, BV from *A. florea* indicated MIC values over 100 µg/ml among temperature levels against all bacteria species. In conclusion, each species demonstrated differing activities on melanoma cells and gram-positive bacterial pathogens at different temperatures. Temperature affects the structure of BV protein components. Therefore, BV have shown a potential to inhibit melanoma cells and bacterial skin pathogen which is interesting to use as alternative treatment for anti-skin cancer and antimicrobial which are related to skin diseases.

EFFICIENCY OF BIOMASS ROTTEN BANANA MUSA "KLUAI NAMWA" AS FEEDSTOCK FOR ETHANOL PRODUCTION AND SINGLE CELL PROTEIN BY YEAST *Pichia kudriavzevii*

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Abstract:
A wide variety of microorganisms and agro–industrial wastes are utilized for ethanol production and single cell protein. Banana (Kluai Namwa) waste is discarded due to the imperfection during grading process. However, these banana wastes are suitable substrate for bioethanol and single cell protein due to their high carbohydrate contents. In this study, locally banana (*Musa sapientum* L.) wastes were investigated for their suitability to produce ethanol concentration using yeast fermentation. Single cell protein was also produced using ripen banana without pretreatment processing as the carbon and nitrogen sources through fermentation. Yeast *Pichia kudriavzevii* was able to utilize the ripen banana for production of ethanol concentration, 61.14±7.79 g/L, under temperature fermentation of 30°C. In the other hand, the reference yeast *Saccharomyces cerevisiae* TISTR5606 could slightly produce ethanol, 49.17±0.12 g/L, under temperature of 30°C. Fermentation between yeast *P. kudriavzevii* and rotten banana gave a biomass yield above 38.55±0.21 g/L (dry weight) and the crude protein content was 8.07±0.05% dried weight. *S. cerevisiae* produced 27.12±0.14 g/L of dry weight and 7.53±0.03% of crude protein. The optimum condition for protein production ability of *P. kudriavzevii* was 48 h of cultivation and 37°C. The study demonstrated that banana wastes may be successfully used as a carbon source in the production of ethanol and single cell protein by fermentation of *P. kudriavzevii*.

GROWTH RATE OF CORAL MICRO-FRAGMENTS IN CHONBURI PROVINCE, THE UPPER GULF OF THAILAND

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Wanlaya Klinthong, Arirush Wongnutpranont, Thamasak Yeemin*
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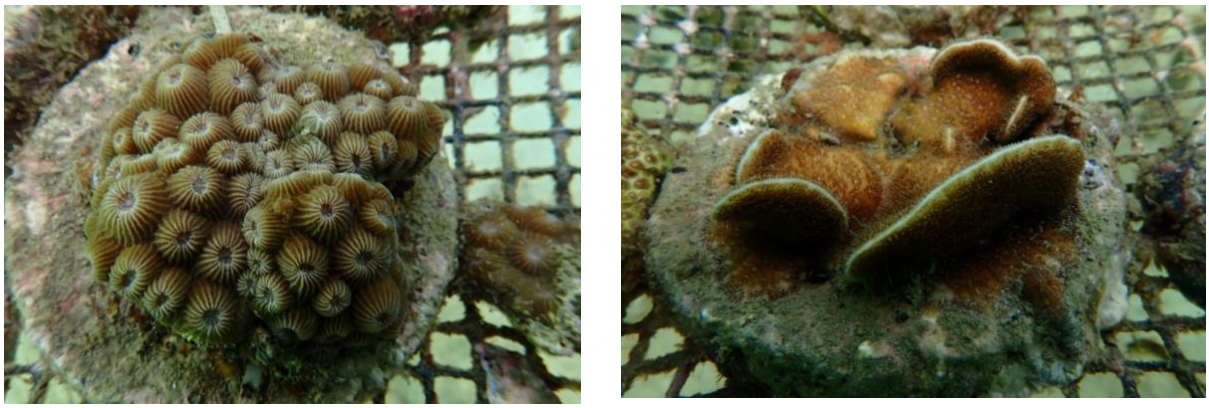
Abstract:
Coral reef restoration is crucial for reversing degraded coral reefs to enhance ecological functions and ecosystem services as well as their climate adaptation. Active coral restoration refers to human efforts aimed at revitalizing the coral ecosystem, including activities like direct coral transplantation and coral gardening, etc. Some active coral reef restoration projects have encountered significant challenges, notably due to limitations in technical knowledge, making success difficult to achieve. Coral micro-fragmentation and coral colony fusion are innovative techniques promoting a high growth rate of coral fragments, thus contributing to coral restoration. This study aimed to apply and develop new techniques for coral reef restoration with several corals, such as *Diploastrea heliopora* and *Pavona decussata* through *ex-* and *in-situ* experiments in Chonburi Province, the Inner Gulf of Thailand. The study found that the survival rates of coral micro-fragments observed in land-based and field nurseries on coral reefs exceeded 80%. Coral micro-fragments with a 1 cm initial diameter exhibited the highest growth rates. This study provides crucial scientific evidence, demonstrating the potential for applying new techniques effectively in current and future large-scale coral restoration projects in Thailand.



Coral colony fusion in a nursery plot at Ao Nuan, Ko Larn, Chonburi Province
Diploastrea heliopora (left) *Pavona decussata* (right)

IDENTIFICATION OF CIRCULAR RNA IN WHITE SHRIMP AFTER WHITE SPOT SYNDROME VIRUS INFECTION

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Abstract:

White spot syndrome is one of the most serious diseases in shrimp and affects shrimp aquaculture. It is caused by white spot syndrome virus (WSSV) which kills shrimp within 7 days. Hence, study and research to prevent and protect shrimp from the disease are necessary. Study in physiological changes and molecular biology will explore a response of shrimp after getting infection, resulting in finding a key factor involved in a control of immune regulation, Circular RNA (circRNA) is one of biomolecules involved in regulations of several physiological processes. It has been discovered for years, and only model organisms have been well studied. Recently, circRNAs were identified in hemocyte of white shrimp upon WSSV infection. Here, we aimed to identify and study the function of circRNA in gills of shrimp infected with WSSV. Circular RNA sequencing was performed to identify circRNA in gills using CIRIQuant package. The 7,184 circRNA transcripts were identified and only 55 differentially expressed circRNA were obtained. In addition, a network of circRNA-miRNA-mRNA interaction was constructed. In this study, four candidate circRNAs were chosen to determine their expressions in gills after WSSV infection. The results revealed that expressions of *circAGO3* and *AGO3* mRNA were significantly increased in shrimp infected with WSSV at 24-48 hr after infection. The *circMAST3*, *circADAP1*, and their mRNAs were significantly higher expressed in WSSV-infected shrimp at 48 hr after infection. However, *circFP1* and *FP1* mRNA expressions tended to decrease in shrimp infected with WSSV at 24-48 hr. These suggested the involvement of circRNA in a response of WSSV infection. The circAGO3 and AGO3 were further selected to study for their functions in WSSV infection. In this progress, the siRNA and dsRNA specific to circAGO3 and AGO3 were successfully generated, respectively. These dsRNAs will be determined for their gene silencing activity before determination of effect of *circAGO3* suppression on shrimp mortality after WSSV infection.

INHIBITORY EFFICACY OF FRUIT PEEL EXTRACTS AGAINST ORAL PATHOGENIC BACTERIA

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Abstract:

Natural extracts from plants have been used to treat diseases for a long time. There are some beneficial substances from plant extracts that provide many biological properties. Nowadays, antibiotic resistant strains of bacteria have been found. Thus, plant extracts can be used as an alternative treatment to inhibit bacterial infection. In this study, fruit peel extracts, namely, *Citrus hystrix* (Kiffer lime), *Citrus maxima* (Pomelo), *Citrus aurantifolia* (Lime) and *Garcinia mangostana* (Mangosteen) were extracted by distilled water and evaporated to obtain the aqueous extracts. The inhibitory efficacy of fruit peel extracts was further tested on pathogenic bacteria causing oral diseases including *Porphyromonas gingivalis, Prevotella intermedia, Streptococcus mutans* and *Streptococcus pyogenes* by agar well diffusion method. The results revealed that aqueous extracts of *C. maxima, C. hystrix, C. aurantifolia* and *G. mangostana* at 500 mg/ml showed inhibitory activity against tested bacteria with the diameter of the inhibition zone ranging between 9.67 ± 0.58 - 28.50 ± 0.71 mm. Moreover, minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) of the aqueous extracts were from 15.63 ± 0.0 - 250.00 ± 0.0 mg/ml. The highest inhibitory activity was observed from aqueous extract of *G. mangostana* with MBC value of 31.25 ± 0.0 mg/ml against *P. intermedia* and *S. pyogenes*. In addition, antioxidant activity of fruit peel extracts was determined by DPPH radical scavenging assay. It was found that the aqueous extract of *G. mangostana* showed the highest antioxidant activity of 17.06 ± 0.52 mg gallic acid/g extract. In this study, the aqueous extract of *G. mangostana* showed the highest antioxidant and antibacterial activity against *P. intermedia* and *S. pyogenes*. Therefore, this new finding provided valuable information on *G. mangostana* fruit peel extract that demonstrated the efficacy to inhibit oral pathogenic bacteria and antioxidant activity and it can be considered as a natural extract for treatment of pathogenic bacterial infections in the oral cavity and antioxidant agent.

INVESTIGATION INTO PET PLASTIC DEGRADATION VIA EXTRACELLULAR PETASE PRODUCED FROM *Escherichia* coli, EMPLOYING FOURIER TRANSFORM-INFRARED SPECTROSCOPY (FT-IR) FOR ANALYSIS

Phatpimol Kitchanakan,[1] Sucharat Suksai,[2] Kitipong Angsujinda[3] and Wanchai Assavalapsakul[1,4*]

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[2]Program in Biotechnology, Faculty of Science, Chulalongkorn University
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[4]Center of Excellence in Microbial Technology for Marine Pollution Treatment (MiTMaPT), Department of Microbiology, Faculty of Science, Chulalongkorn University, Bangkok, Thailand
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Abstract:

Due to its persistence, polyethylene terephthalate (PET), a ubiquitous material in product packaging, represents a considerable environmental challenge. Biodegradation offers a promising approach for mitigation this issue, especially by decomposing PET polymers into their monomeric constituents. The bacterium *Ideonella sakaiensis* 201-F6, known for its ability in degrading PET, employs an enzyme termed PETase, which has garnered significant attention for plastic degradation. Despite its potential, the direct application of PETase in environmental contexts poses complexity. Earlier studies have shown that the PETase, incorporating a signal peptide, can be effectively produced in *Escherichia coli* strain Rosetta-gami. This recombinant PETase exhibits superior PET degradation efficiency in comparison to the control. This study aims to explore PET plastic degradation using extracellular PETase. Advanced analytical methodology, particularly Fourier Transform-Infrared Spectroscopy (FT-IR), is used to conduct a comprehensive examination of the degradation process and its mechanisms.

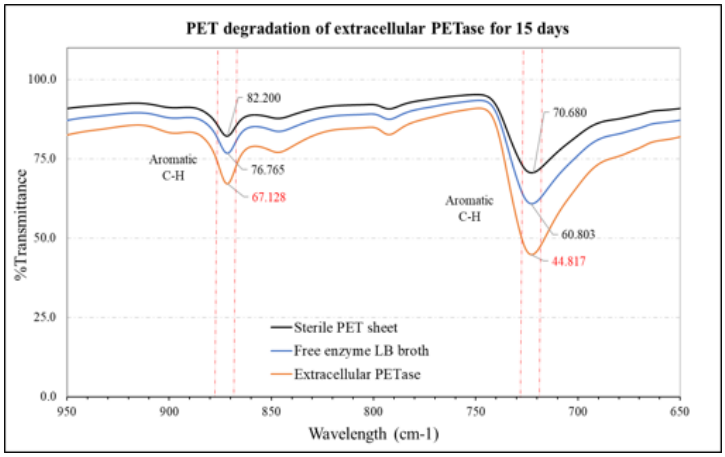

Figure 1. Comparative FT-IR spectra showing PET plastic degradation at day 15 with extracellular PETase, in comparison to a control consisting of free-enzyme LB broth and a sterile PET sheet. Spectra are observed at wavelength numbers 870 and 730 cm-1, corresponding to the aromatic (C-H) carbon.

INVESTIGATION OF STRESS TOLERANCE OF *Pichia kudriavzevii* FOR IMPROVING BIOETHANOL PRODUCTION

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Abstract:
New industrial microorganisms are required to improve biofuel production. Multiple stresses are critical factors, hampering cell survival and ethanol production of yeast cell in bioethanol industry. The common stresses that yeast cells encounter during fermentation is an elevated temperature and fermentation inhibitor including 2–furaldehyde (furfural). These stresses inhibit yeast growth and ethanol productivity. In this study, twenty yeast isolates from wastewater were established and classified into two major yeast species, *Pichia kudriavzevii* and *Candida tropicalis*. All isolates were characterized for growth performance under stress conditions (high temperature and furfural concentration) and for fermentation activity. The thermotolerant yeast *P. kudriavzevii* NUCG–S3 displayed higher specific growth rate under each stress condition of heat and furfural, and multi–stress (45°C with 15 mM furfural) than the reference *S. cerevisiae* TISTR5606 and other isolated yeasts. The specific growth rate of NUCG–S3 under stress of high temperature (45°C), 15 mM furfural and multi–stresses were 0.27 ± 0.02, 0.26 ± 0.01 and 0.14 ± 0.02 h^{-1}, respectively. Morphological features of yeast NUCG–S3 changed distinctly with the production of granules and vacuoles when exposed to heat and furfural. The isolate NUCG–S3 exhibited the high ethanol concentration of 99.46 ± 0.82 g/L at temperature of 30°C. Therefore, the thermotolerant yeast *P. kudriavzevii* NUCG–S3 was resistant to multiple stresses and presented high ethanol production. This study suggests that yeast *P. kudriavzevii* NUCG–S3 is a potential candidate and present a significant advantage in physiological behavior for industrial–scale fermentation.

LEGUMINOUS PLANTS (FABACEAE) IN LIMESTONE AREA OF NAKHON SI THAMMARAT PROVINCE, SOUTHERN THAILAND

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Abstract:
Limestone in southern Thailand is one of the lowland forests, which are the most dominant vegetation in peninsular regions. It is characterized by a unique plant community, but it is continuously threatened by land-use changes. A study on leguminous plants (Fabaceae) in the limestone area of Nakhon Si Thammarat province, southern Thailand, aims to report on the species diversity of legumes found in the limestone area. This study was carried out between October 2022 and April 2023. Three duplicates of each specimen were collected during fieldwork, and then they were pressed and dried as herbarium specimens. Plant identification was based on the flora of Thailand and other research articles. The result showed that 23 genera and 31 species were found. The most diverse genus was *Senegalia* with 3 species, including *Senegalia megaladina*, *S. rugata*, and *S. torta*. One taxon can not be identified due to the lack of flower or fruit collections. The study found two vulnerable plants, viz., *Mucuna stenoplax* and *Phanera tubicalyx;* one species was a rare plant, *Flemingia strobilifera,* due to their limited geographic range, which followed the lists of Threatened Plants in Thailand, and eight species that had been introduced to Thailand.

Mahachai bettas: Genetic Diversity, Population Structure, and Their Crucial Role in Conservation Management

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Abstract

Mahachai bettas, scientifically designated *Betta mahachaiensis*, inhabit exclusively the brackish waters of Samut Sakhon and nearby areas in Thailand. Recognized for their vibrant colors and distinct patterns, they are celebrated among ornamental fish enthusiasts. However, the Mahachai betta population is declining and nearing threatened status due to urbanization and expanding industries. To better understand Mahachai bettas' current population genetics and their conservation area planning drawbacks, genetic diversity and population structure analyses were conducted. Eighty-one individuals were collected from ten sampling locations in Bangkok, Samut Prakan, and Samut Sakhon to assess heterozygosity and genetic structure. Results indicated significantly lower observed heterozygosity (H_o) than expected heterozygosity (H_e), suggesting potential inbreeding, consistent with a positive inbreeding

value (F_{IS}=0.569±0.112). Consequently, the population exhibited positive F values of 0.381±0.196, showing that the ten populations of this fish have a common origin. The pairwise F_{ST} value among ten populations showed is 0.237, indicating no significant positive genetic differentiation between populations (p = 0.157). These findings emphasize the need for precise genetic monitoring and habitat suitability in long-term Mahachai betta conservation, boosting future conservation success.

Keywords: conservation, genetic diversity, Mahachai bettas, inbreeding

MICROBIAL COMMUNITY STRUCTURE OF MUNICIPAL SOLID WASTE LANDFILL SOIL AND ITS POTENTIAL BIODEGRADATION OF BIOPLASTIC FILM

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Abstract:
Bioplastics are rapidly becoming a feasible alternative to petroleum-based plastics. However, bioplastics frequently end up in landfills, thus the investigation of landfill soil microbiome and its bioplastic degradation capacity is necessary. This study collected soil samples from a domestic waste landfill to use as a model bioplastic contaminated landfill soil. The microbial diversity and its functional profiling of landfill soil were carried out to evaluate their influence on the biodegradation of a bioplastic film, which was based on blends of polylactic acid (PLA), polybutylene adipate terephthalate (PBAT), and starch. A landfill soil microcosm study was conducted with 640 mL hexagonal glass jar containing 100 g of the landfill soil and 0.3% (w/w) of bioplastic film (2x2 cm^2; thickness 40 μm) under aerobic and dark conditions at room temperature. The moisture content was set at approximately 40 % with deionized water. Physio-chemical properties of the landfill soil were measured. The results showed that microorganisms in the landfill soil effectively utilized the bioplastic film, resulting in significant weight reduction (29.26%) within 35 days. Biofilm on the plastic surface was observed along with the physical changes. SEM analysis revealed notable alterations in the micrometric surface features. After 21 days, FTIR analysis suggested functional group modification related to C–H (2,800 cm^{-1}), O–H (3,400 cm^{-1}), and C–O (1,018 cm^{-1}), indicating biodegradation of polymer. From the 16S rRNA gene analysis, *Corynebacterium* (10.69%), *Pseudomonas* (9.25%) *Aquabacterium* (8.45%), *Truepera* (5.44%), *and Comamonadaceae* (3.02%) were found as major genera in the soil. Functional profiling revealed key pathways for surface attachment, motility, and xenobiotic-degrading enzymes. The findings provide insights into the landfill soil community and initial degradation profiles, which can be used to implement more efficient bioplastic remediation techniques. In addition, it can support a circular economy by designing bioplastics for effective end-of-life solutions, thereby substantially reducing the environmental footprint.

Microstructure-Property Relations of Thermally Sprayed Hydroxyapatite Coatings

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Abstract:

This research explores the relationship between microstructural characteristics and material properties in thermally sprayed hydroxyapatite (HA) coatings on 316 stainless steel substrates using a flame spray technique, employing commercially hydroxyapatite powders. These powders were classified into three size ranges: small (<38 μm), medium (between 38-75 μm), and large (>75 μm). Subsequently, a medium-sized powder coating was chosen, falling within the size range between small and large particles. An analysis of the crystal structure of hydroxyapatite coatings using X-ray diffraction analysis (XRD), revealed the primary phase is HA (Hydroxyapatite), with a secondary phase of α-TCP (Alpha-Tricalcium Phosphate). When examining the microstructural characteristics, it became evident that the coating surface exhibited a notably rough texture, appearing grey to the naked eye, showcasing. A scanning electron microscope (SEM) examination revealed a porous surface with some unmelted and melted particles distributed throughout the coating surface. The coating had an average thickness of 117 micrometers and an average hardness of 2.08±0.01 GPa, with a Ca/P ratio of 1.60. After immersing the coated surface in a solution simulating human plasma (SBF) for 7 and 14 days, an increase in the germination and growth of apatite crystals was observed, indicating its potential applications in the biomedical field.

Mitochondrial and Microsatellite Data Reveal the Genetic Diversity and Landscape Factors of Fish (*Tor spp*) in Mae Hong Son Thailand

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Mahseer Tor (*Neolissochilus stacheyi*) hold considerable religious and cultural importance. Unfortunately, their status is increasingly threatened due to human activities, particularly the construction of hydropower dams and overexploitation, which have a significant impact on their riverine habitats. This research delves into the genetic variety, population arrangement, and preservation implications concerning Mahseer Tor at Mae Hong Son in Thailand. Specimens were collected from five river locations. Microsatellite genotyping analyses were performed to examine the genetic diversity and population structure in 93 Mahseer Tor. Thirteen microsatellite markers were developed as primers for Mahseer Tor species. The results revealed all populations of this species across the five sites conform to the Hardy-Weinberg equilibrium, as demonstrated by the nearly equal heterozygosity ($H_o = H_e$). This thorough genetic examination provides critical insights into the dynamics of Mahseer Tor populations and their genetic richness. This information forms the basis for well-informed conservation strategies aimed at safeguarding this ecologically pivotal species..

Keyword: Mahseer tor, mitochondrial DNA, microsatellite, structure, genetic diversity.

PREBIOTIC PROPERTIES OF MEDICINAL PLANT EXTRACTS FOR PROMOTING THE GROWTH OF PROBIOTIC MICROORGANISMS

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Abstract:

Prebiotics are commonly found in various natural sources, with medicinal plants being particularly rich in prebiotic compounds that play a significant role in maintaining and enhancing gut microflora. This study was to investigate four medicinal plants including *Terminalia catappa* (leaves), *Psidium guajava* (leaves), *Sandoricum koetjape* (fruit) and *Aegle marmelos* (fruit), which are extracted by hot water. The HPLC assay quantified sugar fibers such as fructooligosaccharides (FOS) and inulin in these plant extracts. Inulin was detected in *P. guajava, S. koetjape*, and *A. marmelos*, with the highest content found in *S. koetjape* (3.452 ± 0.143 mg/g extract), followed by *A. marmelos* and *P. guajava*, which revealed inulin contents of 0.800 ± 0.009 and 0.446 ± 0.012 mg/g extract, respectively. Moreover, *T. catappa* and *S. koetjape* extracts exhibited efficient resistance against α-amylase and artificial gastric juice hydrolysis. Additionally, the impact of these plants extracts on the growth of probiotic strains, including *Lactiplantibacillus plantarum* TISTR 2070, *Lacticaseibacillus casei* TISTR 1340, and *Bifidobacterium bifidum* TBRC 7153, was determined using total plate count technique. *S. koetjape* and *A. marmelos* extracts were found to promote the growth of probiotic strains, as measured by spectrophotometry. In particular, *S. koetjape* extract (7.81 mg/ml) significantly increased the growth of *L. plantarum* by up to 1.28 log CFU/ml ($p \leq 0.001$) at 24 hrs compared to the control without the extract. At a concentration of 15.63 mg/ml, *S. koetjape* and *A. marmelos* extracts increased the growth of *B. bifidum* to 1.45 log CFU/ml ($p \leq 0.002$) and 2.20 log CFU/ml ($p \leq 0.002$) at 24 hrs, respectively. For the growth of *L. casei*, *S. koetjape* extract (15.63 mg/ml) enhanced the growth of *L. casei* by 0.46 log CFU/ml at 12 hrs ($p \leq 0.014$). In this study, *S. koetjape* and *A. marmelos* extracts demonstrated the presence of inulin and significantly promoted the growth of probiotics. These findings suggest that they could be considered as potential functional food ingredients.

PREPARATION, CHARACTERIZATION AND *IN VITRO* STUDY OF GALLIC ACID (GA) ENCAPSULATED POLY(LACTIC-CO-GLYCOLIC ACID) (PLGA) NANOPARTICLES IN BREAST CANCER CELLS

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Abstract:
Breast cancer is one of the most common cancers among women. Although traditional cancer treatments have proven effective, they often result in enduring side effects in patients. Therefore, natural products derived from plants, fruits, and food sources have emerged as promising alternatives for cancer therapies. Gallic acid (GA) is a phytochemical renowned for its various biological activities including anticancer, antibacterial, antiviral, and anti-inflammatory. This study focuses on enhancing the therapeutic potential of GA for breast cancer cells by encapsulating it within chitosan (CS) and chitosan-riboflavin (CSRf)-coated poly(lactic-co-glycolic acid) nanoparticles (PLGA NPs) to generate PLGA/CS-(GA) and PLGA/CSRf-(GA) NPs, respectively. Both NPs exhibited spherical shapes with sizes in a range of 165-420 nanometers. The encapsulation efficiency (EE) and loading efficiency (LE) were within the range of 0.6-1.6% and 0.26-0.56%, respectively. Cellular uptake studies in breast cancer (MDA-MB-231) cells using fluorescent microscopy demonstrated that both NPs (0.5 and 1.0 mg/mL) were internalized into cells in a dose-dependent manner, however, the PLGA/CSRf exhibited higher uptake compared to the PLGA/CS NPs. This result suggested that the PLGA/CSRf is a better nanocarrier for breast cancer cells. Furthermore, to evaluate the anti-breast cancer efficiency, both types of nanoparticles were incubated with breast cancer cells (MCF-7) for 48 hours before analysis using the MTT assay and were compared with cells treated with free GA. The results showed that the PLGA/CS-(GA), PLGA/CSRf-(GA) NPs, and free GA demonstrated notable cytotoxicity against MCF-7 cells, with IC_{50} of 4.51, 3.25, and 2.82 μg/mL, respectively. These results indicated that the PLGA/CSRf-(GA) has better anti-breast cancer than the PLGA/CS-(GA) which could be due to the higher uptake in breast cancer cells. In summary, we have developed two types of nanocarriers capable of successful delivery into breast cancer cells, showing promising implications for breast cancer treatment.

PRIMARY SCREENING AND RAPID IDENTIFICATION BY MALDI-TOF MS OF DOMINANT MICROBIAL ISOLATES FROM THAI KOMBUCHA SAMPLES

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Abstract:
The global demand for Kombucha, a fermented tea drink made through a symbiotic culture of acetic acid bacteria (AAB) and yeast, also known as SCOBY, is on the rise due to its refreshing and beneficial effects. Understanding both the microbial population type and their survival is crucial as they directly influence the beneficial and sensory properties of the product. This research aimed to characterize the predominant acetic acid bacteria (AAB), lactic acid bacteria (LAB), and yeast strains. A total of 64 isolates were obtained from five commercially traditional Thai Kombucha samples. The AAB, LAB, and yeast were screened using Hestrin and Schramm (HS), de Man, Rogasa, and Sharpe (MRS), and yeast malt (YM) media, respectively. Identification of microbial isolates was achieved through phenotypic and rapid methods involving morphological and biochemical characterization, followed by MALDI-TOF MS analysis. Viable AAB and yeast were exclusively observed in the samples, while LAB were absent. The prevalent AAB species identified were *Acetobacter aceti*, *Gluconobacter sacchari*, and *Komagataeibacter xylinus*. The yeast isolates were identified as *Brettanomyces bruxellensis*, *Candida parapsilosis*, *Pichia kudriavzevii*, *Saccharomyces cerevisiae*, and *Schizosaccharomyces pombe*. The yeast communities exhibited a greater complexity and variability compared to the AAB communities in the Kombucha samples.

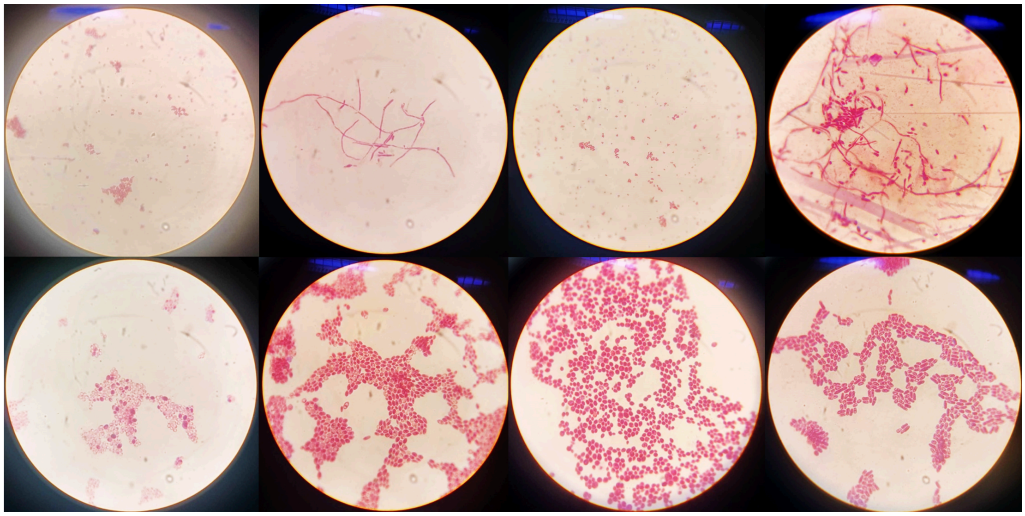

Figure 1. Microscopic appearances of microbial isolates were isolated from the traditional Thai Kombucha samples.

PURIFICATION OF GERM CELLS USING SUCROSE AND PERCOLL GRADIENT CENTRIFIGATION IN THREE SPECIES OF SHRIMP (*Fenneropenaeus merguiensis*, *Litopenaeus vannamei* AND *Penaeus monodon*)

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Abstract:
Sucrose and Percoll gradients were the methods used to purify spermatogonial germ cells from there shrimp's species, *Fenneropenaeus merguiensis*, *Litopenaeus vannamei* and *Penaeus monodon*. These techniques were developed to obtain a high yield of purified spermatogonia cells for use in transplantation method. Four different concentration gradients of each with various amounts were investigated, and the optimum condition for highly purified was using a sucrose gradient at a concentration between 20% for 2 mL and 35% for 3 mL. After purification, the spermatogonia cells were stained with trypan blue to ensure that they were alive.

SCREENING OF ANTI-MIGRATION ACTIVITY OF LUNG CANCER CELLS OF ENDOPHYTIC FUNGI EXTRACTS ISOLATED FROM *Terminalia bellirica* AND *Capsicum annuum* L.

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Abstract:
Endophytic fungi are microorganisms that internally infect living plant tissues without causing any visible symptoms and live in a symbiotic relationship with plants for at least a part of their life cycle. Nowadays, endophytic fungi are used as alternative sources for novel bioactive compounds with high efficiency. The purpose of this study was to investigate the antimigration potential of fermented crude extracts isolated from *Terminalia bellirica* and *Capsicum annuum* L. on the lung cancer A549 cells. MTT and wound healing assay were used to observe the effects of the crude extracts on the cell viability and migration potential in A549 cells. The results showed that the fermented crude extracts of endophytic fungi *Terminalia bellirica* and *Capsicum annuum* L. exhibited no toxicity to A549 cells. At non-cytotoxic concentrations of fermented broths dramatically reduced A549 cell migration as compared with the untreated control. The findings suggested that endophytic fungi crude extracts derived from *Terminalia bellirica* and *Capsicum annuum* L. could inhibit migration of A549 cells. This might provide a fundamental knowledge of endophytic fungi extracts to facilitate the development of anti-metastatic therapy. However, further study on biologically active compounds from endophytic fungi extracts on lung cancer cells is required.

TEMPORAL CHANGES OF MEIOFAUNA ASSEMBLAGE ON HIN PHOENG UNDERWATER PINNACLE, RAYONG PROVINCE, THE EASTERN GULF OF THAILAND

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Abstract:
Meiofauna in sediments are important components of the seafloor, coral reefs, and associated ecosystems, playing vital roles in the marine benthic food web and biogeochemical cycles. Understanding the dynamics of meiofauna in marine ecosystems in Thailand is still limited, particularly in underwater pinnacle ecosystems. This study aims to examine the temporal changes of meiofauna on Hin Phoeng, an underwater pinnacle located in Rayong Province, the Eastern Gulf of Thailand. The meiofauna samples were taken in both dry and rainy seasons using a PVC core of 3.5 cm diameter. Eighteen groups of meiofauna were found with the dominant groups of Foraminifera, Nematoda, Harpacticoida, Ostracoda, and Bivalvia. The abundance of most meiofauna (eg. forams, nematodes, ostracods, bivalves, and gastropods) varied seasonally ($p<0.05$). The diversity of meiofauna in rainy season ($H' = 0.43$) was significantly higher than that in dry season ($H' = 0.08$) ($p<0.05$). This study provides crucial information on the meiofaunal assemblage in the samples taken from the underwater pinnacle sediments, suggesting that underwater pinnacles with diverse meiofauna may have ecological functions and processes similar to those of coral reefs.

Dominant meiofauna found at the study site,
Foraminifera (left) and Nematoda (right)

The induction of Cancer Stem Cell-Like Properties in HCT-116 Human Colon Cancer Cells by Butyrate

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Abstract

Colon cancer is the third most common cancer in Thailand. Previous reports have indicated that colon cancer can recur in some patients after treatment. Cancer stem cells (CSCs) are hypothesized to be a primary factor contributing to cancer recurrence because these cells can resist chemotherapy drugs and possess tumorigenic properties. The anti-cancer agent used in this study is sodium butyrate, an intrinsic short-chain fatty acid produced by gut microbiota, known for its minimal side effects on colonocytes. Recent reports suggest that butyrate may induce resistance in colon cancer cells. The purpose of this study is to induce butyrate-resistant cells (HCT116-BR) from HCT116 colon cancer cells and characterize their cancer stem cell (CSC)-like properties. The researchers studied three groups of cells that are resistant to different concentrations of sodium butyrate. This research focused on three cell lines: HCT116, HCT116-BR 1.0mM, and HCT116-BR 2.5mM, which were induced for 1 month. The expression levels of various CSC markers were investigated using both RT-PCR (ABCG2, ALDH1, LGR5, SOX2, OCT4) and Western blot techniques (CD44, and CD133). Cell-cycle profiles were assessed through flow cytometry. Notably, HCT116-BR 2.5 mM cells exhibited greater CSC-like properties compared to HCT116-BR 1.0 mM cells. These cells could serve as a valuable model for studying chemo-resistant cancer cells in the context of cancer prevention and recurrence.

SESSION C-CHEMISTRY (ANALYTICAL CHEMISTRY)

AN ECO-FRIENDLY OF DEEP EUTECTIC SOLVENTS IMMOBILIZED IN A MICROCRYSTAL CELLULOSE-POLYVUNYL ALCOHOL SPONGE FOR THE DETERMINATION OF PARABENS IN FOOD SAMPLES

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Abstract:

An eco-friendly, easy, and reusable deep eutectic solvents (DESs)–microcrystal cellulose (MCC)–polyvinyl alcohol (PVA) sponge was prepared using DESs adsorbed on MCC (DESs–MCC), which was subsequently entrapped in a PVA sponge. Under optimal conditions, good linearities were achieved in the concentration range from 0.8 ng mL^{-1} to 1.6 µg mL^{-1} for methylparaben (MP) and from 1.6 ng mL^{-1} to 1.6 µg mL^{-1} for ethylparaben (EP), propylparaben (PP), and butylparaben (BP). The limits of detection (LODs) were 0.5602±0.0021, 0.6424±0.0042, 0.6111±0.0037, and 0.7468±0.0056 ng mL^{-1} for MP, EP, PP, and BP, respectively. Good sorbent-to-sorbent reproducibility (n = 6, %RSD ≤ 4.0) and precision (n = 6, %RSD < 6.0) were also obtained. Interestingly, the DESs–MCC/PVA sponge can be reused up to five times retaining > 80% of its extraction efficiency. The developed DESs–MCC/PVA sponge was applied for the extraction of four parabens in milk, beverages, and tea samples which MP and EP were detected in two beverages and tea samples in the range of 29.0±1.1–38.4±1.3 ng mL^{-1} and 8.01±0.95–10.6±1.2 ng mL^{-1}, respectively. Good recoveries were obtained in the range of 87.6±3.5%–100.8±4.7%.

DENDRITIC COPPER NANOSTRUCTURE FUNCTIONALIZED DIAZONIUM SALT ON INTERLEUKIN-6 IMMUNOSENSOR FOR HIGHLY SENSITIVE SEPSIS SCREENING

Whitchuta Jesadabundit,[1] Sakda Jampasa,[1] Robert D. Crapnell[2], Nina C. Dempsey[2], Craig E. Banks[2], Weena Siangproh[3], Orawon Chailapakul[1,*]
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Abstract: Sepsis is a primary cause of global fatalities due to the quick development from initial blood infection to septic shock. Hence, we developed an electrochemical immunosensing device for interleukin-6 detection to enable rapid screening of sepsis. To achieve high sensitivity, the copper nanostructures (CuNSs) were modified on screen-printed graphene electrode to increase capacity of antibody immobilization by enlarging the effective surface area. Subsequently, the diazonium salt, 4-aminobenzoic acid (4-AB), was functionalized on surface as coupling reagent for antibody attachment. Electrodeposition techniques were utilized in the modification step, offering simplicity and environmental friendliness. The morphology of CuNSs/4-AB was analyzed using SEM and EDX. During the detection process, the presence of IL-6 reduced the current response of the ruthenium (III) redox species measured by differential pulse voltammetry, attributed to the hindering of the antigen-antibody complex. The subtraction of the signal (ΔI) was interpreted as concentration of IL-6. As a result, this sensor demonstrated a linear range from 0.05 to 500 pg mL^{-1}, with a low detection limit of 0.02 pg mL^{-1}. Furthermore, the developed immunosensor successfully quantified IL-6 in human serum samples, and the results were in good agreement with those obtained using the standard method, emphasizing practical applicability in clinical diagnosis.

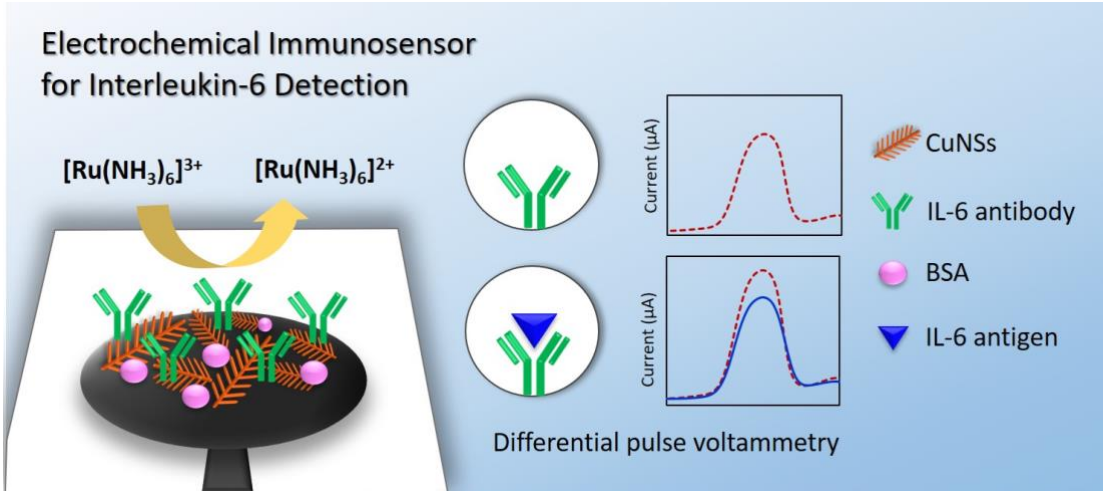

Figure 1.
The schematic illustration of electrode components and principle of immunoassay for IL-6 detection.

DETERMINATION OF ACRYLAMIDE FROM POTATO CHIPS USING SEA SAND DISRUPTION METHOD COUPLED WITH HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY

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Abstract:
Fried and baked foods, mainly french fries, biscuits, potato chips and other bakery products, are widely consumed all over the world. During the high-temperature frying and baking process acrylamide (AA) is produced. AA is listed as potentially carcinogenic for human beings by the International Agency for Cancer Research (IACR). It is a toxin that can be both mutagenic and carcinogenic in humans and livestock and can damage the nervous system. Therefore, the determination of AA in food items is necessary. This work demonstrates the use of sea sand disruption method (SSDM) coupled with high-performance liquid chromatography for the determination of acrylamide in potato chips. Preliminary results indicated the potential of this method to extract acrylamide in a very simple manner. Matrix interference is very challenging in sample preparation. In potato chip samples, the matrixes are very soluble in the extraction solvent and interfere with the analyte recovery. The preliminary results of this proposed method provide over 50% of the analyte recovery from a very complex sample matrix. It would be improved after optimizing extraction parameters. A good linear range of acrylamide standard solutions between 0.0090 and 30 mg L^{-1} was achieved. The limit of detection (LOD) and limit of quantitation (LOQ) of acrylamide standard solutions were 9.0 and 30 µg L^{-1}, respectively. The final results of this work will be presented in the poster presentation section.

DUAL COLORIMETRIC/ELECTROCHEMICAL DETECTION OF ANTIOXIDANTS USING A SCREEN-PRINTED GRAPHENE ELECTRODE INTEGRATED INTO A MICROFLUIDIC

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Abstract:

Mulberries are rich in various antioxidant compounds, including anthocyanins and gallic acid. Anthocyanins and gallic acid belong to the broader category of polyphenols, naturally occurring compounds found in plants. Polyphenols are organic molecules with the presence of multiple phenolic (aromatic rings) and hydroxyl groups. These compounds often possess antioxidant properties and can contribute to various health benefits. In this research, we developed a dual-detection approach, combining electrochemical and colorimetric methods for the detection of antioxidants in mulberry fruit. The electrochemical method involved oxygen plasma treatment of electrode to improve the sensitivity, enabling precise quantitative analysis. Additionally, a colorimetric method was applied and sequentially visualized on microfluidic device for the rapid screening of total phenolic acid using The Folin-Ciocalteu (F-C) Assay. The overall dual-mode process can be automatically operated after sample dropping due to the sequential flow of microfluidic design and completed within a 15-minute timeframe, emphasizing the feasibility as tools for on-site screening in agricultural product.

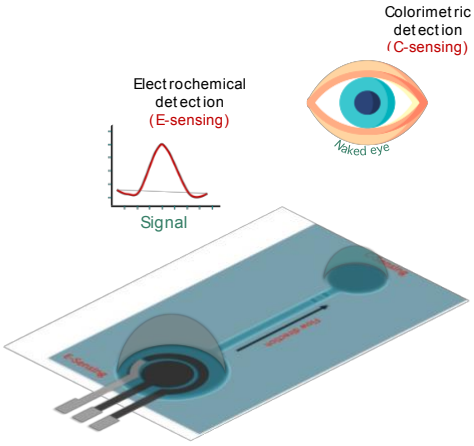

Figure 1. The schematic illustration of the dual colorimetric/electrochemical detection using a screen-printed graphene electrode integrated into a microfluidic

ELECTROCHEMICAL SENSOR FOR CAFFEINE DETECTION USING CARBON NANOTUBES AND METAL-ORGANIC FRAMEWORK COMPOSITE

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Abstract:
This study introduces an electrochemical sensor for caffeine (CAF) detection based on carbon nanotubes (CNTs) and metal-organic framework (MOF) composite-modified electrode. The electrode modified with high conductivity and surface area of CNTs demonstrated excellent electrocatalytic activity towards CAF oxidation. In addition, the combination of MOF and CNTs enhances the oxidation current response of CAF due to an increase in the number of active sites for CAF oxidation. The optimal conditions were also evaluated to obtain the best performance for CAF detection. Under optimal conditions, the fabricated sensor was applied to detect CAF using differential pulse voltammetry which exhibited a linear range from 0.050 to 1.50 mM with a detection limit of 0.042 mM. Moreover, the selectivity was successfully evaluated against possible interference. Finally, the proposed CAF sensor was applied to detect CAF in a black coffee sample with acceptable recoveries. Therefore, the developed sensor demonstrates favorable potential for practical integration in a broad range of real-world applications.

FLUOROMETRIC ANALYSIS OF BENZOIC ACID USING Ni-MnFe-LAYERED DOUBLE HYDROXIDES PEROXIDASE-LIKE MIMICKING

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Abstract:

This study aimed to develop a fast, affordable, simple, and efficient approach to analyzing preservatives in skincare samples by using nanomaterials as key substances in the analysis reactions, followed by fluorometric detection. The proposed method was based on using Ni-MnFe-layered double hydroxides (Ni-MnFe-LDHs) as peroxidase-like mimicking. Benzoic acid was studied as a preservative model target. In the presence of benzoic acid, Ni-MnFe-LDHs can catalyze the oxidation of H_2O_2. The generated hydroxy radical (•OH) was then consumed by benzoic acid to form phenoxy radical, leading to less of •OH to catalyze o-phenylenediamine (OPD) into the yellow-fluorescent product of 2, 3- diamino phenazine (DAP). The yellow fluorescence signal of DAP significantly decreased, corresponding to the concentration of benzoic acid in skincare products. A smartphone captured the color of the solution under a UV-controlled lightbox within 20 minutes. Under the optimum conditions, this developed method showed a linear range of 0.008-1.0 mM benzoic acid, with a limit of detection of 0.0042 mM benzoic acid. Our proposed method was validated with the HPLC-DAD and showed an acceptable percentage recovery. It is important to note that this recent method contributes to the promotion of sustainable consumption by using low chemical reagent volumes, minimizing toxicity and waste, and aligning with production patterns outlined in the SDGs.

IN VITRO MODEL OF A TRIPLET-REPEAT RNA DISEASE IN MYOTONIC DYSTROPHY TYPE 1 UTILIZING DNA NANOSTRUCTURES

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Abstract: Myotonic dystrophy type 1 (DM1), a neuromuscular disorder, arises from an expanded CTG repeat and results in RNA-protein (RNP) aggregates. Muscleblind-like 1 (MBNL1) protein is a crucial protein in forming these RNP aggregates. However, the structure, chemical, and physical properties of aggregates formed by MBNL1 and mRNA inside the cell, which are key to understanding this disease, are still unclear. Intriguingly, MBNL1 protein binds to shorter CUG repeat mRNAs with less than 30 repeats without forming RNP aggregates. However, longer mRNAs containing between 100 to several 1000 repeats result in RNP aggregates. To better comprehend this phenomenon, we utilize DNA nanostructures to investigate in vivo formation and analysis of RNP aggregates as a novel in vitro model. The binding site of the accumulated CUG repeat RNA using the rectangle DNA origami will be constructed outside the cell. The number of RNA repeats, and the position of RNA molecules will be precisely controlled to achieve the over 1000 extracellularly CUG repeats and to reproduce the higher order structure or aggregates of RNA. Hence, protein binding behavior to arrayed RNA will be analyzed using high-speed atomic force microscopy (AFM) measurements to elucidate the aggregation mechanism.

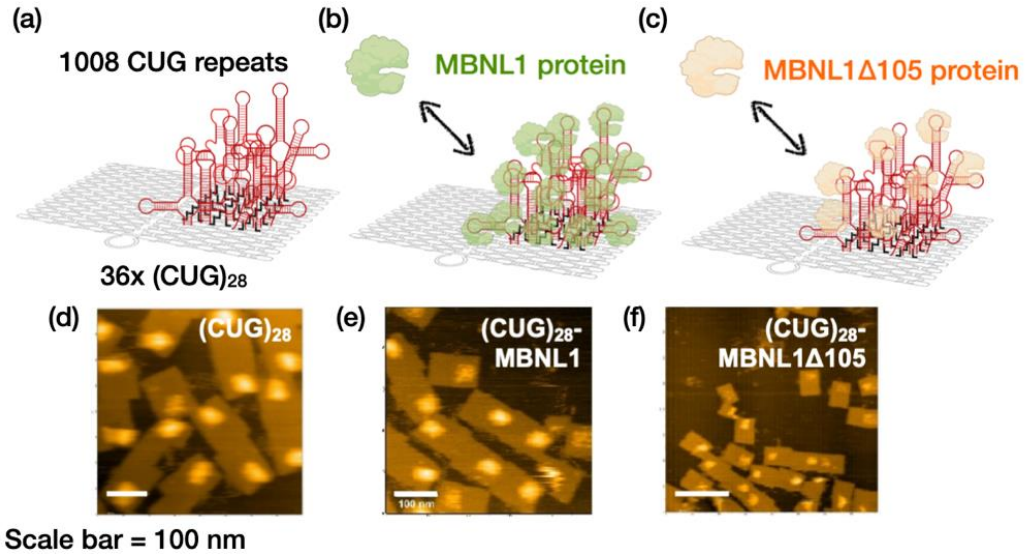

Figure 1. DNA nanostructure designs (a-c) and AFM images (d-f) of $(CUG)_{28}$ RNA, $(CUG)_{28}$ RNA-MBNL1 complex, and $(CUG)_{28}$ RNA-MBNL1Δ105 complex.

PORTABLE ELECTROCHEMICAL MICROFLUIDIC DEVICE FOR USER-FRIENDLY DETECTION OF Cd AND Pb

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Abstract:
We developed a novel microfluidic device that integrates with a screen-printed electrode (SPE) for simultaneous detection of Cd(II) and Pb(II) in field conditions. The platform was created by assembling a SPE with a layer-stacking of transparent and double-sided adhesive films. The microfluidic device was specially designed to facilitate sample collection through a simple dipping and automate the mixing of sample with the electrolyte, eliminating the need for external pumps and complex operations. To achieve a fully portable device, the electrochemical measurements were conducted using smartphone connectivity through a near-field communication (NFC) potentiostat. The electrochemical signals of Cd(II) and Pb(II) were subsequently measured using anodic stripping differential pulse voltammetry. The signal peaks were presented −900 mV for Cd(II), and −680 mV vs. Ag/AgCl for Pb(II). The linear ranges for the determination of Cd(II) and Pb(II) were found to be 400–5500 ng mL^{-1} and 400–5500 ng mL^{-1} with detection limits of 186 and 183 ng mL^{-1}, respectively. This innovative electrochemical microfluidic platform present advantages, including user-friendliness, cost-effectiveness, and on-site analysis capabilities, which conclusively makes it as a highly promising analytical device for the Cd(II) and Pb(II).

SESSION C-CHEMISTRY (INORGANIC CHEMISTRY)

EFFECTIVE DECOLORIZATION OF CONGO RED DYE USING Mg- OR Ba-DOPED COPPER HYDROXY NITRATE

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Abstract:

The intricate molecular structure of Congo red, an anionic dye, incorporates various diazo aromatic groups. These structural features render Congo red remarkably resistant to environmental factors, establishing it as a versatile candidate for numerous applications, particularly in clothing production within the textile industry. However, the extensive use of Congo red in these processes has posed a substantial environmental challenge, specifically in terms of water pollution. Consequently, there is an urgent need for dedicated research to develop effective wastewater treatment methods.

A promising solution involves the utilization of Layered Hydroxide Salts (LHS), which can be easily synthesized in a laboratory. LHS not only boasts low toxicity but also provides flexibility in the selection of different anions and metals, whether inorganic or organic species. Coupled with their large surface area and chemical stability, these attributes make LHS highly advantageous.

In this study, Copper Hydroxy Nitrate, a member of the LHS group, has been doped with Mg and Ba in various molar ratios. The as-synthesized samples undergo various characterization techniques, including PXRD, IR, and ICP-OES, to elucidate their structures and properties. PXRD conclusively confirms the identity of the synthesized sample as Copper Hydroxy Nitrate. Additionally, these samples were employed in the decolorization of Congo red to assess their catalytic performance without the need for additional chemicals or light. Remarkably, within 240 minutes, the most effective sample demonstrates a decolorization efficiency of 90% or more for 200 ppm 100 mL Congo red. The possible mechanism for this remarkable decolorization efficiency is its ability to generate reactive oxygen species (ROS), a crucial component in the decolorization of organic dyes such as Brilliant green or Methyl orange, as proposed in the literature.

LUMINESCENCE QUENCHING BEHAVIOR OF Fe(III) SENSOR BASED ON IRIDIUM(III) COMPLEX WITH BIS(DIPHENYLPHOSPHINO)METHANE ANCILLARY LIGAND

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Abstract:

Luminescence quenching behavior of $Ir(3m\text{-}ppy)_2(dppm)Cl$ [1] complex (3m-ppy = 3-methyl-2-phenylpyridine and dppm = bis(diphenylphosphino)methane) was investigated toward metal ions (Zn^{2+}, Cr^{2+}, Co^{2+}, Fe^{3+}, Hg^{2+}, Pb^{2+}, Cu^{2+}, Ni^{2+}, Mn^{2+}, Cd^{2+}, Na^{+}, K^{+}, Mg^{2+} and Ca^{2+}). Significant luminescence quenching was observed with the presence of Fe^{3+}, Hg^{2+} and Cu^{2+} in dimethylsulfoxide. The driving force of the Ir(III) luminophore and these metal ions tends to be available. Studied concentration range of metal ions were carried out from 10 μM to 0.2 mM. Emission intensity of $Ir(3m\text{-}ppy)_2(dppm)Cl$ complex was 70 % reduced by Fe^{3+}, 10 % by Hg^{2+} and around 50 % by Cu^{2+}ions The Stern Volmer equation; $I_0/I = K_{sv}.[Q]$ was investigated, where I_0 is the intensity without quencher, I is the intensity with quencher at its certain concentration, [Q] refers to the concentration of quencher and K_{SV} is the Stern-Volmer constant giving a number of luminescence quenching process due to a short-range interaction of species. The Stern-Volmer (SV) plot of Fe^{3+} in the studied concentration range is non-linear while the other two show linear relations. For Fe^{3+} system, inner filter effect played an important role because the total absorbance of the solution was high (greater than 0.1 au). This led to a reduction of the intensity of the excitation radiation over the path length. Therefore, Inner filter effect had been corrected. The stoichiometric analysis of the binding between the complex and Fe^{3+} was found to be 1:1 through the Benesi-Hildebrand method.

Synthesis of Highly Luminescent and Thermally Stable Pb-free Perovskite Nanocrystals with Nonlinear Optical Response

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Abstract:
Research has made significant strides in lead (Pb) metal halide semiconductors for optoelectronics in the past decade. However, their high toxicity and chemical instability pose practical limitations. Alternative metal halide perovskites like Sn, Ge, Bi, and Sb have been proposed, but they need more luminous efficiency compared to Pb-based counterparts. This research introduces Cu(I)-based metal halide compounds as a viable replacement for Pb and Sn perovskites. These materials are known for their low toxicity and excellent stability and exhibit unique luminescence governed by self-trapped excitons (STEs). We have developed a colloidal process to synthesize $Cs_5Cu_3Cl_6I_2$ nanocrystals (NCs) with high luminescence efficiency (QY ≈ 100%) and thermal stability. We also explore the impact of varying reaction parameters on the anisotropic growth of these NCs. $Cs_5Cu_3Cl_6I_2$, exemplified here, notably emits blue light, making it a leading candidate for future blue light applications.

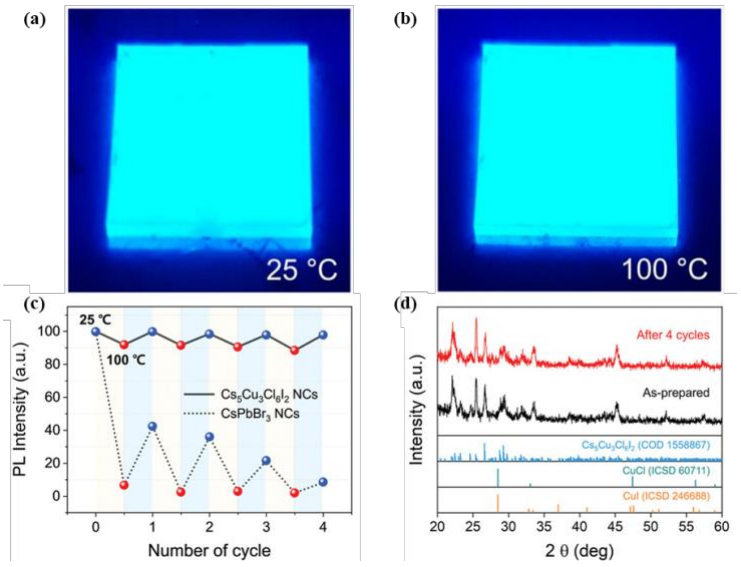

Figure 1.
Temperature-dependent properties of $Cs_5Cu_3Cl_6I_2$ films. Temperature-dependent film photographs (a), (b). Temperature-dependent PL spectra (c) and XRD measurements.

SESSION C-CHEMISTRY (ORGANIC & MEDICINAL CHEMISTRY)

ANTI-INFLAMMATORY CHARACTERISTICS OF SPIRO[INDOLIZIDINE-1,3′-OXINDOLE] AND ITS INDOLIZIDINE DERIVATIVES

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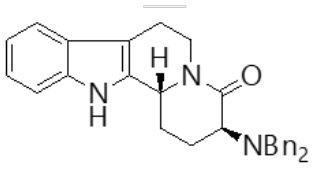
Abstract:
Spiroindolizidine oxindole alkaloids stand as prominent constituents amidst various active compounds presenting in both natural products and pharmaceutical research. The realm of total synthesis chemistry and medicinal investigation revolves around the manipulation of this fundamental molecular core. Due to the core chemical structure of this alkaloid was found in Kratom (*Mytragyna speciosa*). Its pharmaceutical and therapeutic attributes have piqued interest due to their potential applicability in combatting tumors and inflammatory conditions. Thus, the present study aims to delve into the potential medicinal capabilities inherent in spiro[indolizidine-1,3′-oxindole] and its indolizidine derivatives from total synthesis as potent anti-inflammatory agents, utilizing a murine macrophage cell line (Raw264.7) as a representative model. Cytotoxicity assessments were performed for all seven oxindole alkaloids to establish appropriate concentrations for investigating their impact on inflammatory pathways. We focused on the secretion of pro-inflammatory cytokines and extended to the transcriptional and translational expression of key factors and enzymes associated with inflammation, including inducible nitric oxide synthase. Notably, Chem 3 displayed compelling potential as an anti-inflammatory agent by reducing the expression of TNF-alpha, IL-6 and enzyme-related inflammation both transcriptional and translational level. Molecular docking investigations were carried out involving Chem 3 and Peroxisome Proliferator-Activated Receptor Gamma (PPARɣ), an established transcription factor associated with the inflammatory process, aiming to illustrate the potential target. The result shown that Chem 3 also gives best score compared with other seven oxindole alkaloid. Our exploration will pave the way for the identification of a novel molecule which can fight against the inflammation which will useful for therapeutic purposes.



Chem 3

CYTOTOXIC POTENTIAL OF BIOACTIVE COMPOUNDS ISOLATED FROM *Kaempferia elegans* RHIZOMES AGAINST BREAST CANCER CELLS

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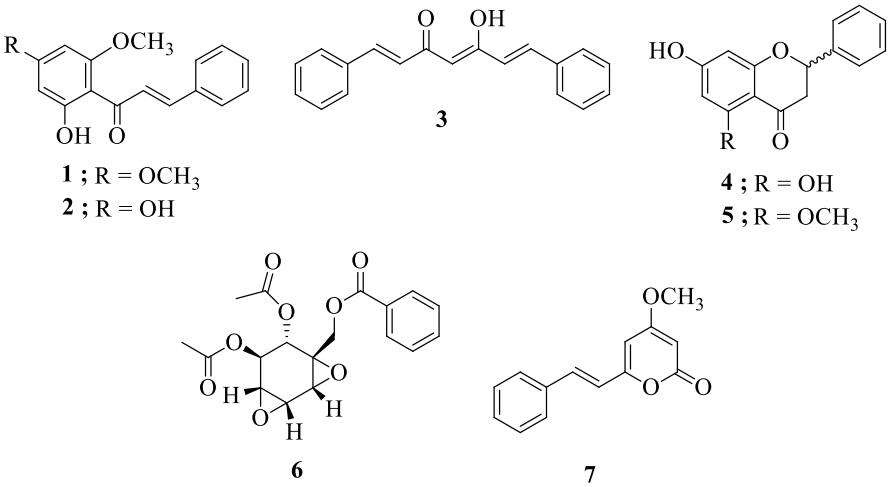
Abstract:

Breast cancer is one of the most common cancers with morbidity statistics among Thai women and tends to increase continuously every year. Traditional cancer treatments, including surgery, radiotherapy, and chemotherapy, often show their side effects to patients. Hence, this study aims to extract and isolate bioactive constituents from *Kaempferia elegans* rhizomes using various solvents, resulting in evaluation of their cytotoxic effects against human breast cancer cell lines. The air-dried powders of *K. elegans* rhizomes were consecutively extracted with hexane, ethyl acetate and methanol to yield the corresponding extracts with 0.56%, 4.60% and 5.19% dry weight, respectively. Flavokawain B (**1**) as a known compound was isolated from the crude hexane extract. Furthermore, cardamonin (**2**), (1*E*,4*Z*,6*E*)-5-hydroxy-1,7-diphenylhepta-1,4,6-trien-3-one (**3**), pinocembrin (**4**), alpinetin (**5**) and crotepoxide (**6**) were isolated from the crude ethyl acetate extract, while 5,6-dehydrokawain (**7**) was isolated from the crude methanol extract. Compounds **3** and **5** were first isolated from this plant species. According to the *in vitro* cytotoxicity, compounds **1**, **2** and **3** showed IC_{50} values of 23.07 ± 4.96, 20.84 ± 4.81 and 80.88 ± 8.47 μM, respectively, against MCF-7 cell line, and compounds **1** and **2** were actively cytotoxic against MDA-MB-231 cell line with IC_{50} values of 21.77 ± 4.82 and 26.64 ± 5.48 μM, respectively. While doxorubicin as a positive control showed the cytotoxicity against MCF-7 and MDA-MB-231 cell lines with IC_{50} values of 0.159 ± 1.38 and 0.099 ± 1.73 μM, respectively. These findings suggest that some bioactive compounds isolated from *K. elegans* this showed their moderate anticancer activity, leading to further development of Thai medicinal plants in cancer research.



DEGRADATION OF HESPERIDIN INTO HIGH-VALUE CHEMICALS BY CO_2-H_2O SYNERGY UNDER MICROWAVE IRRADIATION

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Abstract:
Hydrolysis of naturally available compounds into more bioactive and bioavailable materials is gaining popularity in food and pharmaceutical industries. Among these compounds is hesperidin (HPD), which can be hydrolyzed into its aglycone hesperetin (HPT) to make it more easily metabolized in the human body. However, this conversion typically requires either (1) an enzyme, which requires very stringent reaction conditions and costly recovery of the target compound, or (2) strong acids like sulfuric, which are harmful to the environment. To overcome these problems in the production of HPT, this research aims to develop, optimize and evaluate by experimental approaches the combined reaction and separation process employing the CO_2-H_2O synergy under microwave irradiation. The carbonic acid that forms in the CO_2-H_2O system can serve as a catalyst in breaking the glycosidic bond in HPD to produce HPT and its corresponding saccharide rutinose (Figure 1). To compensate for the lower acidity of carbonic acid, the CO_2 phase acts as an extraction solvent for the less polar HPT, thus promoting the forward reaction in the conversion of HPD. Using a batch reactor, we were successful in hydrolyzing HPD into HPT under hydrothermal conditions with supercritical CO_2. The highest yield of HPT of about 40.0% was obtained at T = 160 °C, P = 15 MPa and t = 4 h. Based on the results, a semi-batch reactor system was developed to study the reaction and separation process employing the mixture of supercritical CO_2 and subcritical H_2O. After the reaction, extraction of HPT was carried out by passing supercritical CO_2 through the reaction products. These results have confirmed the possibility of separating HPT from the mixture, and a higher yield can be obtained by simply manipulating the pressure and temperature of CO_2. This work was extended by applying microwave irradiation obtaining promising results.

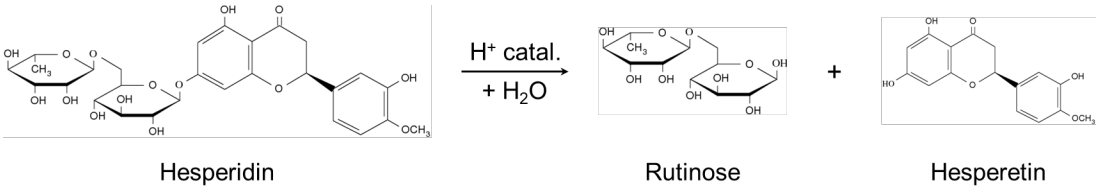

Figure 1. Acid-catalyzed hydrolysis of hesperidin into rutinose and hesperetin

EXPLORING THE *α*-GLUCOSIDASE INHIBITORY COMPOUNDS FROM *Garcinia schomburgkiana* FRUITS USING BIO-GUIDED ISOLATION: *IN VITRO* AND *IN SILICO* INVESTIGATIONS

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Abstract:
Garcinia schomburgkiana Pierre (Clusiaceae), known as Madan in Thai, is an edible tree widely distributed in the southern region. There has been little investigation into its *α*-glucosidase inhibitory activity. This study aimed to investigate the potential anti-diabetic effects of *G. schomburgkiana* fruits. Various fractions of *G. schomburgkiana* were examined for their ability to inhibit *α*-glucosidase, leading to the isolation of a new benzoylphloroglucinol, *epi*-guttiferone Q (**1**), together with ten known compounds, guttiferones I and K (**2** and **3**), hypersampsone I (**4**), sampsonione D (**5**), sampsonione H (**6**), *β*-mangostin (**7**), *α*-mangostin (**8**), 9-hydroxycalabaxanthone (**9**), fuscaxanthone (**10**), and 11-hydroxy-1-isomangostin (**11**). The chemical structure of compound **1** was determined by NMR spectroscopy and MS analysis. Notably, all isolated compounds, except compound **3**, have never been previously reported from this plant. The *α*-glucosidase inhibitory activity of all isolated compounds was assessed, and compounds **1-6** exhibited good activity with IC_{50} values ranging from 16.2 to 130.6 µM. Compound **2** was selected for the enzyme inhibitory kinetic analysis based on the greater amount that occurred in the bio-source, showing a competitive inhibition mechanism. In addition, *in silico* docking was employed to predict the binding mechanisms of compounds **1-2** and **4-6** (molecular docking of compound **3** was reported previously) in the active site of *α*-glucosidase, suggesting their potential as promising anti-diabetic agents. Molecular dynamic simulation was also applied to the previously undescribed compound (**1**) to enhance understanding of its inhibitory mechanism.

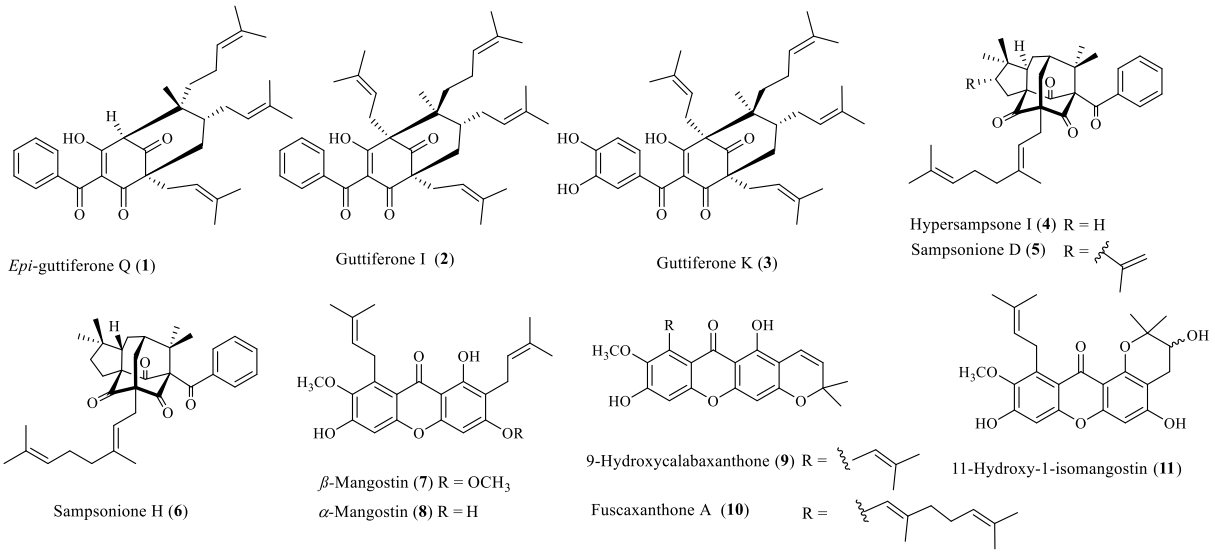

Figure 1. Chemical structures of **1–11**.

POTENTIAL OF THE EXTRACTS FROM SOME MEDICINAL PLANTS TO INHIBIT *Vibrio harveyi* INFECTING THE WHITE SHRIMP (*Litopenaeus vannamei*)

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Abstract:

Vibrio harveyi is a common pathogenic bacterium that infects cultured shrimp in Thailand. Many antibiotics have been used to manage the vibriosis pandemic, which has led to an antibiotic- resistance phenomena. The extracts from medicinal plants are used as an alternative method to prevent antibiotic- drug resistance in cultured shrimp. The main objectives of this research were (i) to examine the potential of the extracts from the leaves of four Thai medicinal plants, including *Psidium guajava*, *Citrus hystrix*, *Ocimum tenuiflorum*, and *Cymbopogon citratus* to inhibit *V. harveyi* isolated from the Pacific white shrimp, (ii) to investigate the chemical composition of active components. The results revealed that the methanolic extracts from *P. guajava* and *C. hystrix* showed the inhibition zones of 15.48±0.03 and 10.60±0.03 mm against *V. harveyi*, respectively, whereas those of *O. tenuiflorum*, and *C. citratus* were inactive. Tetracycline and 30% DMSO were used as positive and negative controls. Based on screening results, the extract of *P. guajava* plant was selected to study the potential of anti–*V. harveyi* and was also analyzed for their active constituents. This extract showed minimum inhibitory concentration (MIC)and the minimum bactericidal concentration (MBC)of 3.75±0.075 and 7.5±0.075 mg/mL, respectively. The chemical composition of the extract was analyzed using the thin layer chromatography (TLC). The developed TLC sheets were sprayed with various reagents including anisaldehyde, ninhydrin, vanillin, dragentdroff, and sulfuric acid. The directed TLC- bioautography technique was also performed to observe the position of active compounds. The results revealed that three active components are terpenoid compounds, which were further purified by preparative TLC. The pure metabolites were primarily analyzed by liquid chromatography quadrupole time of flight mass spectrometry (LC-Q-TOF-MS) to identify the type of compounds by searching their molecular weight and mass fragment patterns with those in the natural products database. The isolated compounds were identified as psiketide ($C_{16}H_{17}O$, MW 289.10726), psidial A ($C_{30}H_{34}O_5$, MW 473.0650), and guadial A ($C_{25}H_{26}O_5Na$, MW 429.1109) with the similarity values of 99.23%, 99.89%, and 99.90%, respectively. Based on the results, it is suggested that the extract of *P. guajava* should be further studied for its using to treat vibiosis pathogen (*Vibrio harveyi*) infecting cultured white shrimp.

WATER SENSORS IN ORGANIC SOLVENTS FROM ETHYLNYL NAPHTHALIMIDE DERIVATIVES

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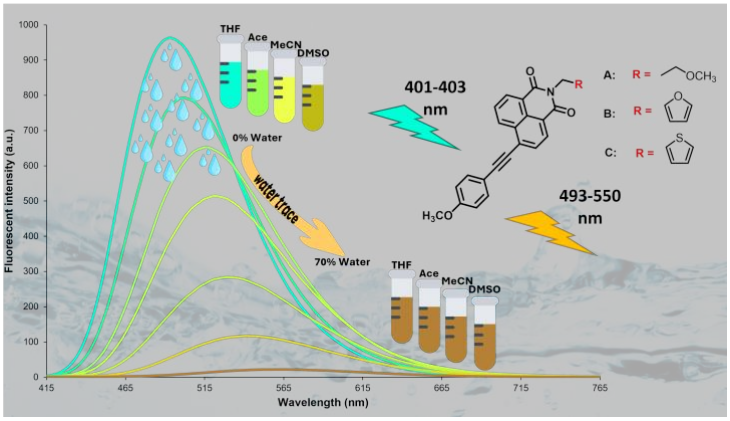
Abstract:
Three new derivatives of (4-methoxyphenyl)ethynylnaphthalimide (A-C) have been designed by means of *N*-substituted reaction and Sonogashira coupling reaction. The introduction of the (4-methoxyphenyl)ethynyl moiety into the naphthalimide framework results in a remarkable and robust fluorescence signal, transitioning from blue to orange as the solvent systems are changed from nonpolar to polar organic, respectively. Importantly, the fluorescence emission of probe A in organic solvents is sensitive to the presence of water in the range of 0-30% (v/v) in THF, 0-15% (v/v) in DMSO, 0-15% (v/v) in MeCN, 0-15% (v/v) in acetone, and 0-40% (v/v) in EtOH with good limits of detection. As a result, it serves as an instrumental water fluorescence probe and potentially a useful sensor for the wide-range detection of alcohol content in beverages.



SESSION C-CHEMISTRY (PHYSICAL & THEORETICAL CHEMISTRY)

COMPUTATIONAL DESIGN FOR ENHANCING THERMOSTABILITY OF *N,N*-8-DEMETHYL-8-AMINORIBOFLAVIN DIMETHYLTRANSFERASE (RosA)

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Abstract:
Roseoflavin, or RoF, is a natural analog of riboflavin, also named as 8-demethyl-8-dimethylaminoriboflavin. It is naturally found in *Streptomyces davaonensis* and *Streptomyces cinnabarinus*. RoF demonstrates potent antibiotic properties by impacting FMN riboswitches and flavoproteins within cellular targets. *N,N*-8-Demethyl-8-aminoriboflavin dimethyltransferase, known as RosA, plays a crucial role in catalyzing the final step of RoF biosynthesis. This process involves in the consecutive dimethylation of 8-demethyl-8-aminoriboflavin (AF) to generate the antibiotic compound, RoF. Consequently, enhancing the thermostability of RosA is crucial for improving RoF synthesis. In this research, molecular dynamics (MD) simulations were employed to identify the hotspots of RosA. Then, the PoPMuSiC server was utilized to screen for thermostable variants. Analysis of root mean square fluctuation (RMSF) values at different temperatures revealed that residues 95-104, 124-152 and 263-272 are highly sensitive to temperature changes. Subsequently, mutations in this region were explored using the PoPMuSiC server. The results indicated that V151F, R152A, D153A, and E154I mutations in RosA exhibit lower predicted ΔΔG, suggesting increased stability. To validate these findings, molecular dynamics simulations of the variants of RosA were conducted, revealing an overall lower RMSF value for V151F, R152A, D153A, and E154I variants compared to that of the wild type. The results could be implied that the variants enhanced thermostability of RosA.

CURVATURE AND EXTERNAL ELECTRIC FIELD EFFECTS ON GRAPHENE QUANTUM DOTS

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Abstract:
In this study, we investigated the effects of external electric fields (EEFs) on three different sizes of graphene quantum dots (GQDs): coronene ($C_{24}H_{12}$), circumcoronene ($C_{54}H_{18}$), and circumcircumcoronene ($C_{96}H_{24}$), as illustrated in **Figure 1**. We employed density functional theory (DFT) calculations using M06-2x functionals and 6-31g (d) basis sets to analyze the geometries of these GQDs under the influence of EEFs. Our findings indicate that when subjected to strong EEFs, the structures of GQDs exhibit curvature or bending. Consequently, we proposed a method to induce curvature in GQDs using external electric fields. Furthermore, our results demonstrate a direct correlation between the electric field strength, GQDs size, and curvature, with the order of curvature effects being as follows: $C_{96}H_{24}$ > $C_{54}H_{18}$ > $C_{24}H_{12}$. Additionally, we observed that as the curvature of GQDs increases, the HOMO-LUMO gap decreases. This suggests that external electric fields can be used to modify the electronic properties of graphene.

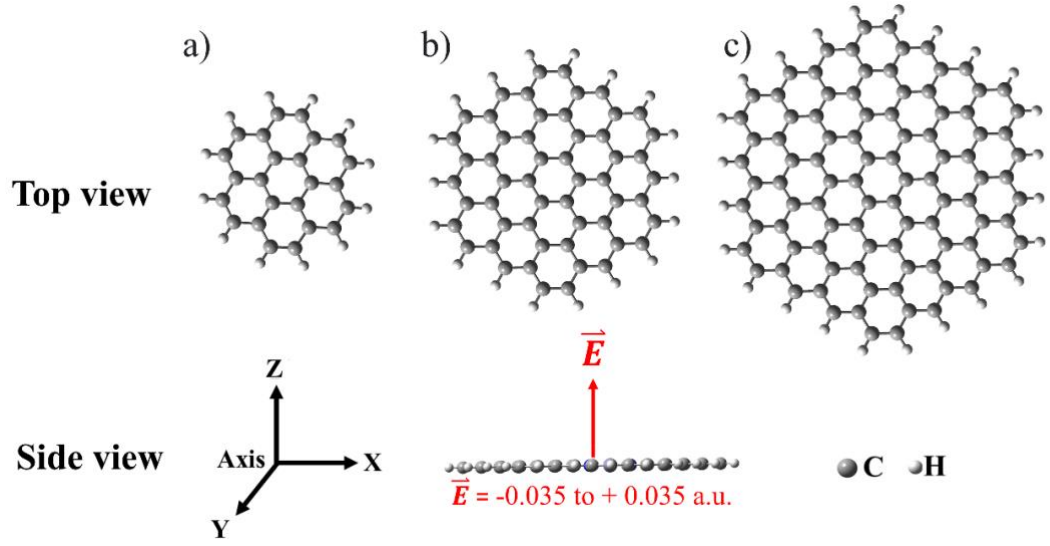

Figure 1. Geometry of (a) $C_{24}H_{12}$, (b) $C_{54}H_{18}$, and (c) $C_{96}H_{24}$ and the direction of the applied electric field.

NUCLEOPHILIC SUSTITUTION OF SQUARIC ACID TO SQUARAMIDES INVESTIGATED BY DENSITY FUNCTIONAL THEORY

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Abstract:

Squaric acid is a diprotic acid with four carbon atoms forming an almost square structure. Squaramide, its amide derivative, has gained some interest in many applications such as bioconjugation, material science, medicinal chemistry, molecular recognition, organometallics, and molecular transport. This is partly due to its molecular structure that can act as both H-bond donors and acceptors which in turn increased squaramide aromaticity and stability.

Despite its extensive applications and synthesis advancements across various fields, an understanding towards the reaction mechanism of nucleophilic substitution of squaric acid to squaramide is scarce. This work attempts to employ the density functional theory (DFT) to elucidate the nucleophilic substitution reaction mechanism of squaric acid and to understand the effect of different nucleophiles on the reaction kinetics and the product yield. The reaction mechanism was proposed. All species along the reaction profile were computed using the M06-2X/cc-pVTZ method under the implicit solvation model. The results suggest a two-step mechanism involving the formation of tetrahedral intermediates through a nucleophilic attack followed by the solvent-assisted proton transfer to an OH leaving group. For example, the reaction of squaric acid with N-butylamine has two transition states with activation energies of 18.31 kcal/mol and 19.60 kcal/mol respectively. The activation energies of other amines as nucleophiles were in similar magnitudes., Different product yield from aliphatic and aromatic amines as nucleophiles can be explained by using both the activation energy and the deprotonation energy of the product.

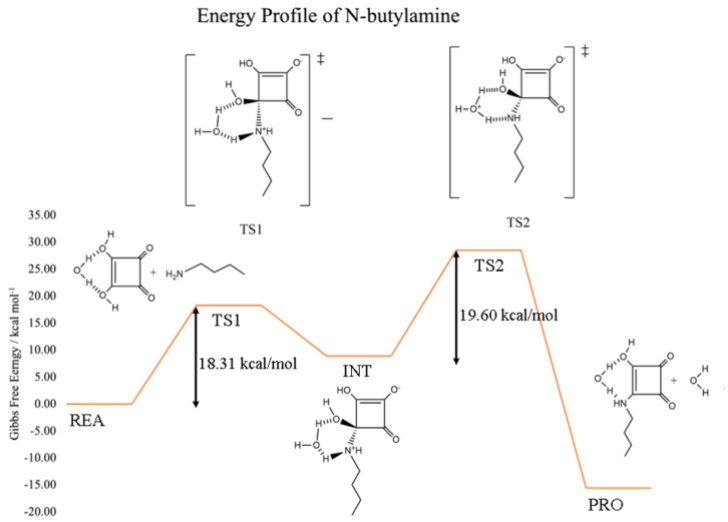

Figure 1. M06-2X/cc-pVTZ Reaction Energy Profile of Squaric Acid with N-butylamine

SESSION D-MATHEMATICS / STATISTICS / COMPUTER SCIENCE / DATA SCIENCE / AI

A Novel Intelligent Electronic Personalized Health Record (iEPHR) Model for Infectious Diseases in Malaysia

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Abstract:
Malaysia, like many other countries, has been significantly impacted by infectious diseases throughout its history, with notable recent attention focused on the COVID-19 pandemic. The nation's response to infectious diseases involves a complex interplay of factors, including its healthcare system, public health measures, socio-economic conditions, and international collaborations. Malaysia has faced challenges in managing outbreaks, with infectious diseases affecting public health, the economy, and societal well-being. The country has implemented various strategies to control the spread of diseases, such as robust testing and contact tracing, movement restrictions, vaccination campaigns, and public health education initiatives. Personalized Health Record (PHR) refers to an individual lifelong health records and combine medical information provided by various medical institutions. Electronic Personalized Health Record (EPHR) have the potential to advance personal engagement in healthcare. EPHR refer to accessible, layperson comprehensible, lifelong tool for managing relevant health information, promoting health maintenance and assisting with chronic disease management via an interactive, common data set of electronic health information and e-health tools. Infectious diseases are disorders caused by pathogenic microorganisms, such as bacteria, viruses, fungi, or parasites. These microorganisms can enter the body, multiply, and cause illness by disrupting the normal functioning of tissues and organs. Infectious diseases can be spread from person to person, through the bites of insects or animals, or through the contamination of food and water. Infectious diseases represent an ongoing challenge with far-reaching implications for public health. Infectious diseases have a significant impact on public health globally. Viral infection refer to Communicable Disease (CDs) as one of infectious diseases type such as influenza, SARS-CoV-2 (responsible for COVID-19), Human Immunodeficiency Virus (HIV) /AIDS, dengue and tuberculosis can have widespread consequences, affecting communities, economies, and healthcare systems. Common symptoms include fever, fatigue, muscle aches, cough, and gastrointestinal issues. Thus, addressing these challenges requires interdisciplinary collaboration, innovation, and a comprehensive understanding of the dynamic nature of viruses agents and their interactions with human and environmental factors. Therefore, understanding the viruses agent is crucial for effective diagnosis, treatment, and prevention strategies. Agent-based modelling (ABM) is intelligent method that simulates the behavior and interactions of entities called agents to observe their emergent behavior over time. These agents interact with each other and their environment, leading to complex and dynamic emergent patterns at the macroscopic level. ABM is particularly valuable for represent intelligent model where individual and viruses entities play a crucial role, and their interactions give rise to model-level outcomes. In the Malaysian population's health, with a focus on the intricacies of viral infections, the research emphasizes the integration of EPHR and ABM which implements the AI approach. This approach incorporates attributes such demographic, medical histories, real-

time information, and behavior rules, thereby offering an understanding of the dynamics of viral infections by defining what are the attributes of EPHR and ABM to support the iEPHR. This integration gains a deeper dimension, allowing the simulation of diverse components related to individual behaviors, movement patterns, and demographicattributes that contribute to the spread of viral infections, iEPHR provides a sophisticated model to simulate and analyze the spread of viral infections, optimize healthcare resource, utilization of viral contexts by determine what are the components of the proposed iEPHR model. As Malaysia continues to navigate the complexities of infectious diseases, the integration of EPHR and ABM, with defined the suitable model to represent iEPHR for viral infection in Malaysia related to behavior rules, emerges as a transformative strategy with the potential to enhance early detection, optimize resource allocation, and shape evidence-based public health measures tailored to the unique needs of the Malaysian population, especially in the viral infections. This innovative synergy, grounded fundamentals, provides significant potential for advancing the efficiency and effectiveness of infectious disease strategies in Malaysian healthcare, in the context of viral outbreaks. This collaboration reflects the commitment of the Faculty of Information Science and Technology (FTSM) and the Faculty of Medicine (FPER) at National University of Malaysia (UKM) to address complex challenges in infectious disease, offering a unique opportunity to synergize IT and health sciences for the benefit of public health in Malaysia. This research aims to produce an iEPHR model for infectious disease from Malaysian perspective. The novelty of this research lies in its pioneering approach to infectious disease management within the Malaysian context, particularly focusing on viral infections.

DEVELOPMENT OF AUTOMATED PULMONARY VOLUME MONITORING SYSTEM WITH INCENTIVE SPIROMETER BASED ON DEEP LEARNING DETECTION

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Abstract:

Individuals with compromised lung capacity, such as post-surgery patients, the elderly, and those with chronic respiratory conditions, require continuous care during pulmonary rehabilitation. This vital process aims to restore lung volume and enhance respiratory efficiency, significantly impacting overall well-being. While the widely used the flow-oriented incentive spirometer (Triflow) relies on patient-generated airflow to move three balls, aiding in lung volume increase, the need for expert assistance in training, and progress monitoring remains. Given the considerable caregiver workload, especially with a large patient population over extended training periods, an alternative solution is imperative. This study proposes an automated pulmonary volume monitoring system based on a YOLOv8 model. Experimental data from healthy volunteer with Triflow device usage, capturing instances with stationary and moving balls, are guided by an aruco marker for the model training process. The proposed method is subjected to a comparative analysis with the traditional object detection method, utilizing precision and recall metrics for evaluation. Results indicate that the YOLOv8 model achieves high precision and recall. In conclusion, the proposed model successfully detects the Triflow in pulmonary rehabilitation videos, even in a variety of scenarios. This capability could be an effective system for monitoring lung volume recovery in the future.

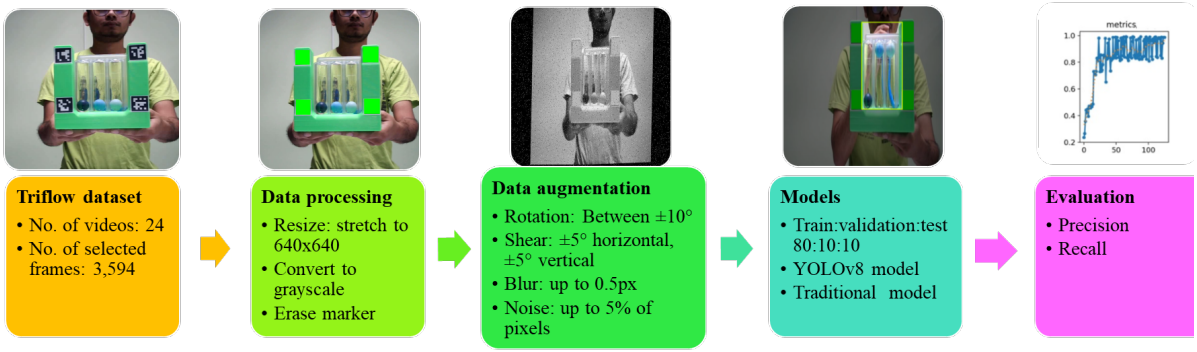

Figure 1. The diagram of proposed method.

MULTIFLARENET: LIGHT-WEIGHT CONVOLUTIONAL NEURAL NETWORKS FOR SOLAR FLARE FORECASTING USING MULTISPECTRAL FLARING REGION IMAGES

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Abstract:
Solar flares could trigger solar storms, which pose substantial risks and incur high costs for ground-based and near-space systems, particularly satellites. The ability to forecast these events is pivotal in reducing associated damages. Traditional forecasting based on statistical analysis of active region images has been effective but is time-consuming and intricate. Consequently, recent studies have explored the application of convolutional neural networks (CNNs) in analyzing active region magnetograms. However, there is a lack of studies investigating the model performance when employing multispectral images of flaring regions beyond magnetograms. In this study, we introduce MultiFlareNet, a light-weight CNN with transfer learning to predict solar flares within 24 hours using multispectral images of flaring regions. Our findings indicate that using the images captured at 94 and 131 angstroms, depicting flaring regions, for model training yields comparable performances to the model trained with magnetograms, suggesting that these images can serve as alternative tools for prediction. Furthermore, our models demonstrate generalization capabilities, as evidenced by their performance on an unseen dataset. Our approach holds the potential to enhance the forecasting accuracy of solar flares and pave the way for future research aimed at elucidating the underlying mechanisms within flaring regions.

VOICE-BASED COVID-19 CLASSIFICATION USING MACHINE LEARNING TECHNIQUES

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Abstract:

The COVID-19 pandemic has caused problems for healthcare systems around the world, necessitating innovative strategies for early detection. Voice-based diagnostics has emerged as a promising non-invasive method. However, COVID-19 symptoms are similar to other respiratory diseases as cold, flu, and heavy cough. This research studies voice features with severe cough to classify COVID-19 patients based on machine learning. The Coswara dataset for heavy cough (N = 2273) is selected and extracted 45 features based on both time and frequency domain methods. Then, these are cleaned by removing zero values (1.98%) and selected in the top-10 ranking features using the random forest feature important method. Then, these selected features are min-max normalized and applied to the SMOTE (synthetic minority over-sampling technique) method for dealing with imbalanced datasets. The 5-folds cross validation with 10 traditional classifiers are trained the models and evaluated in accuracy, precision, recall, F1, and AUC (Area Under the Curve). The result shows that an extra trees classifier outperformed among classifiers with an accuracy, precision, recall, F1, and AUC: 0.86, 0.85, 0.87, 0.86, and 0.94, respectively. Finally, although patients have severe coughs, the extra trees classifier with selected features can be classified the COVID-19 patients based on voice signal.

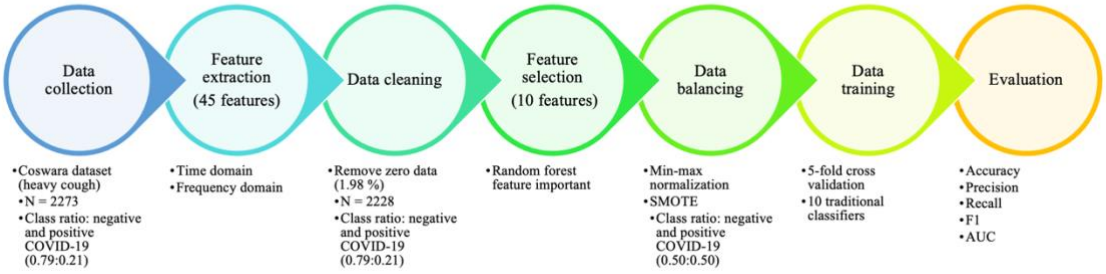

Figure 1. The diagram of the proposed method.

SESSION E-ENERGY / ENVIRONMENTAL & EARTH SCIENCE / MATERIALS SCIENCE / CHEMICAL TECHNOLOGY

$CaCu_{2.95}Ni_{0.05}Ti_{4-x}Ga_xO_{12}$ CERAMICS: ENHANCED DIELECTRIC PERMITTIVITY AND REDUCED DIELECTRIC LOSS TANGENT

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Abstract:
In this investigation, the structure and dielectric properties of $CaCu_3Ti_4O_{12}$ and $CaCu_{2.95}Ni_{0.05}Ti_{4-x}Ga_xO_{12}$ (x = 0.05, and 0.1) ceramics were investigated in detail. The presence of a $CaCu_3Ti_4O_{12}$ phase (JCPDS No. 75 – 2188) has been conclusively verified in all the sintered ceramics through X-ray diffraction analysis. The insertion of Ni^{2+}/Ga^{3+} dopants into the $CaCu_3Ti_4O_{12}$ lattice results in obvious microstructural variations. Furthermore, the substitution of Ni^{2+}/Ga^{3+} doping into the $CaCu_3Ti_4O_{12}$ lattice demonstrates a remarkable capability to preserve a high dielectric permittivity while simultaneously lowering the loss tangent. At room temperature, the $CaCu_{2.95}Ni_{0.05}Ti_{3.90}Ga_{0.10}O_{12}$ ceramic material demonstrates a remarkable dielectric permittivity of approximately 7.94×10^4, indicating its ability to store electrical energy efficiently. Additionally, it exhibits a remarkably low loss tangent of approximately 0.023, signifying minimal dissipation of energy during electrical processes. The impedance spectroscopy result reveals the presence of two distinct electrical states within the $CaCu_3Ti_4O_{12}$ and $CaCu_{2.95}Ni_{0.05}Ti_{4-x}Ga_xO_{12}$ system. The initial portion corresponds to the semiconducting characteristics exhibited by the grain, while the subsequent portion pertains to the insulating properties observed at the grain boundary. The colossal dielectric permittivity observed in $CaCu_3Ti_4O_{12}$ and $CaCu_{2.95}Ni_{0.05}Ti_{4-x}Ga_xO_{12}$ ceramics can be attributed to the presence of a heterogeneous microstructure consisting of semiconducting grain and insulating grain boundary.

DEAMINATION OF BIO-OIL USING HYDROTHERMAL LIQUEFACTION INTENSIFIED WITH SUPERCRITICAL CARBON DIOXIDE

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[2] Center for International Education, Kumamoto University, Kumamoto, 860-8555, Japan
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*e-mail: 237d8824@st.kumamoto-u.ac.jp

Abstract:
Fossil fuels are used in many aspects of everyday life and are necessary for people's lives. However, fossil fuels are finite substances and will eventually be depleted. In addition, the use of fossil fuels emits large amounts of carbon dioxide, which is a greenhouse gas. Recently, biomass-based fuels have attracted attention as an alternative to fossil fuels. One of the advantages of biomass-derived fuels is that they are more sustainable than other renewable energies in terms of supply. Another advantage is that they are not affected by weather conditions, as is the case with solar and wind power. In addition, the combustion of biomass-based fuels does not significantly increase carbon dioxide emissions by virtue of the carbon cycle, thus making them an environment-friendly energy source. However, the existing refining processes for this type of fuels are costly. In this study, we propose the use of hydrothermal liquefaction (HTL) in the deamination of bio-oil as an alternative to the conventional expensive process of hydrogenation. Deamination is an essential step in the refining process because it reduces the amount of the pollutant NOx released after the combustion of fuels. As an intensification strategy to HTL, supercritical carbon dioxide was introduced into the system to generate an acidic environment necessary to remove the amino-groups in the various compounds that are present in bio-oil. The main products in the bio-oil produced by HTL treatment with aspartic acid were found to be long-chain alkenes and nitrogen-containing heterocyclic compounds, and GC-MS results showed that the use of supercritical CO_2 suppressed the formation of nitrogen-containing heterocyclic compounds.

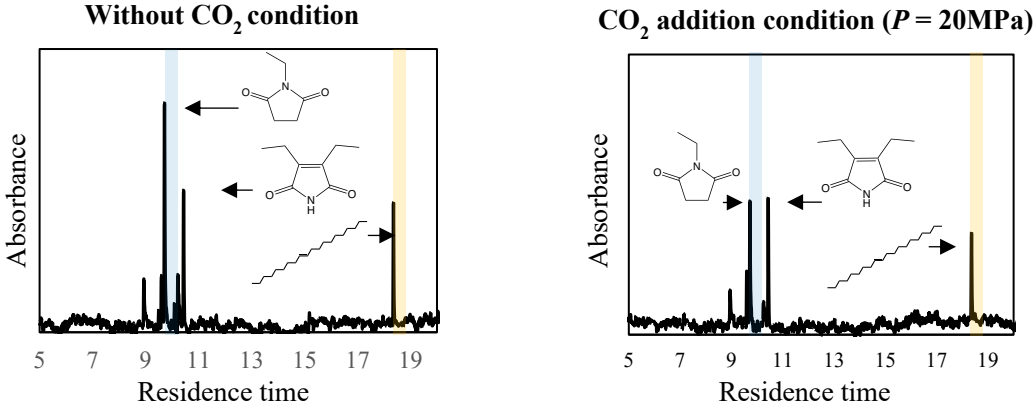

Figure 1. Elucidation of the effects of $scCO_2$ add. GC-MS analysis of bio-oil

DIELS ALDER REACTION OF BIO-BASED DERIVATIVES

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Abstract:

Biorefinery is an important branch in the landscape of green chemistry that caters to both current and future energy demands. Firstly, it utilizes natural products for production. On the other hand, it is virtually free of cost, waste products, and environmentally friendly as opposed to the current hazardous traditional methods. Currently, amidst of world's atmospheric menace where natural calamities such as wildfire and floods are becoming more frequent than ever, bio-based derivatives offer a sustainable alternative to the conventional ways, for instance, petrochemical commodities. Bio-based products, obtained from agricultural waste include 5-(hydroxymethyl)furfural (HMF), 2,5-Bis(hydroxymethyl)furan (BHMF), and 2,5-Furandicarboxylic acid (FDCA)**.** These products were referred to as "Sleeping Giants" due to their untapped potential which is yet to be explored. Their stability is also compatible with most of the chemical reactions. Recent works have unveiled that they can be converted into various useful products such as plastics, fibres, bulk chemicals, and solvents. Diels-Alder reaction is one such reaction. It is a [4+2] cycloaddition reaction involving diene and dienophile, acting as nucleophile and electrophile respectively based on molecular orbital theory. In this work, we tried the Diels-Alder reaction of BHMF with 3 different types of N-substituted maleimide derivatives to determine varying yields followed by optimization. The main idea behind it is that electron-rich dienophiles tend to show lower reactivity than electron-poor dienophiles. Since e-rich dienophiles tend to have higher energy Lowest Unoccupied Molecular Orbital (LUMO) than e-poor electrophiles. So, the higher will be the difference between the Highest Occupied Molecular Orbital (HOMO) of diene and the LUMO of the dienophile, the more difficult will be its reaction and vice-versa. Therefore, by this understanding, we can also modify dienophile for better reactivity. The product obtained, have been characterized using 1H, 13C NMR, mass spectroscopy, single crystal-XRD, and CHN elemental analysis. In conclusion, the Diels-Alder reaction offers a more sunrise opportunity for the generation of more useful products out of bio-based derivatives, which can be used in various domains in the future.

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EFFECT OF PARTICLE SIZE ON DIELECTRIC PROPERTIES OF ZnO-DOPED $Ba_{0.85}Ca_{0.15}Ti_{0.90}Zr_{0.10}O_3$ CERAMIC

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Abstract:
This study investigates the effect of particle size on the dielectric properties of $Ba_{0.85}Ca_{0.15}Ti_{0.90}Zr_{0.10}O_3$-x wt% ZnO (x = 0, 0.06, 0.08, and 0.1) ceramics, varying the high-energy ball-milling speed to enhance dielectric performance. Lead-free ceramics were prepared through a conventional solid-state reaction method. The powders were subjected to high-energy ball-milling at speeds ranging from 500 to 1,500 revolutions per minute at room temperature. Dense BCZT ceramics were then calcined and sintered at 1,300°C. Dielectric properties were measured in air at temperatures ranging from ~34°C to 150°C and a frequency of 1 kHz. The results show that BCZT-0.06Zn, ball-milled at 500 rpm, exhibited the highest dielectric constant (ε_r ~9,182) at a measured temperature of ~76°C, with a relative density (ρ_0 ~99.96%) playing a crucial role in determining the dielectric property. Furthermore, reducing particle size through this technique not only helps decrease the synthesis temperature but also enhances its applicability in the industrial sector.

EFFECTS OF Fe^{3+} DOPING ON STRUCTURE AND DIELECTRIC PROPERTIES OF $CaCu_3Ti_4O_{12}$ CERAMICS

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Abstract:
The structure, dielectric properties, and electrical response of $CaCu_{3-x}Fe_xTi_4O_{12}$ (x=0, 0.05, 0.10, and 0.15) were all thoroughly investigated in this study. All of the sintered ceramics contain a $CaCu_3Ti_4O_{12}$ phase, according to the XRD analysis. Microstructural changes can be discerned after the addition of Fe^{3+} doping. Importantly, the doped samples exhibit a significant decrease in dielectric permittivity in comparison to the undoped sample. At 1 kHz, the dielectric permittivity of $CaCu_{3-x}Fe_xTi_4O_{12}$ decreases from $2.15 \cdot 10^4$ to $2.47 \cdot 10^2$ with increasing x from 0 to 0.15. In the dielectric results, it was found that the doped ceramics exhibited low-frequency dielectric relaxation. In $CaCu_{3-x}Fe_xTi_4O_{12}$ ceramics, an extrinsic factor, such as an internal barrier layer capacitor structure, can be the primary cause of the dielectric response. However, intrinsic factors such as charge compensation and oxygen vacancy, among others, also play a significant role in explaining the significant decrease in dielectric permittivity and low-frequency dielectric relaxation in the doped samples.

EXPLORING SUSTAINABLE BIOPOLYMER COMPOSITES FOAM FOR ENHANCED FOOD PACKAGING: A STUDY ON POLY(LACTIC ACID) AND POLYBUTYLENE SUCCINATE BLENDS INCORPORATED WITH ZINC OXIDE

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Abstract:

This study focuses on the development of Poly(lactic acid) (PLA) and Polybutylene succinate (PBS) foams for consumable food packaging. The foams were prepared by blending PLA and PBS with Azodicarbonamide (ADC), Zinc Oxide (ZnO), and Poly(ethylene glycol) (PEG) as blowing agents, composites, and plasticizers, respectively, with PEG and ADC content of 20 wt% and 1 phr. Previous research demonstrated that PLA/PBS foam (80/20 w/w) exhibited the highest flexural modulus (325 MPa) and the smallest cell size. Thus, the investigation delved into the impact of varying ZnO content (1, 3, 5, and 7 phr) on the properties of PLA/PBS (80:20) foam. The addition of ZnO significantly reduced flexural stress and modulus by 38% and 65%, respectively, regardless of increasing flexural strain, and influenced the crystallinity of the composite foam. Higher ZnO content resulted in a minor decrease in flexural properties and water absorption. Furthermore, ZnO increased cell size by 28% while decreasing cell density by 11% compared to ZnO-free blend foam. ZnO demonstrated antibacterial properties by inhibiting the growth of *E. Coli* and *S. Aureus*. Higher ZnO content could higher antibacterial against *E. Coli* and *S. Aureus* of PLA/PBS composite foam. Future research should focus on enhancing long-term stability with co-antibacterial agents, exploring the synergy between PLA/PBS/ZnO and other bio-based materials to create multifunctional, eco-friendly packaging materials.

Fe SKARN DEPOSIT IN KHAO MAE LEK AND KHAO LEK AREAS, NAKHON SAWAN PROVINCE, CENTRAL THAILAND

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Abstract:

Distributions of precious metals deposits are mainly in the Loei mineral belt such as Phu Lon Fe-Cu-Au skarn (Nong Khai province), Phu Thep Fe-Cu-Au Skarn (Loei province), Chatree epithermal Au-Ag and porphyry Cu-Au (Phichit province), and French mine Fe-Cu-Au skarn (Prachinburi province) in Thailand. The aim of this research is to study mineral assemblages related to Fe veins at Khao Mae Lek and Khao Lek in Nakhon Sawan province, and Khao Um Khlum deposit in Kanchanaburi province. Khao Mae Lek and Khao Lek deposits are located in the Loei mineral belt which are composed of Permian limestone intruded by Triassic diorite which the deposits form hydrothermal alteration and veins. The veins consist of a large amount of magnetite and hematite with a small amount of andradite, quartz, calcite, actinolite, chlorite, pyrite, chalcopyrite, sphalerite, and galena. In addition, the Khao Um Khlum deposit is composed of Triassic granite and granodiorite intruded into Palaeozoic sediment and limestone and formed a large amount of hematite, goethite, quartz, and manganese dioxides with a small amount of magnetite.

The Fe veins from Khao Mae Lek deposit contain a total of Fe_2O_3 ranging from 61.25-77.18 wt.% and 67.68-77.76 wt.% of Khao Lek deposit. However, Khao Um Khlum deposit consists of a total of Fe_2O_3 ranging from 55.67-56.04 wt.%. The high percentages of total Fe_2O_3 from the Khao Mae Lek and Khao Lek deposits are related to a large amount of magnetite and hematite. On the other hand, the low percentage of total Fe_2O_3 from the Khao Um Khlum deposit is associated with hematite and goethite including manganese dioxides. The hydrothermal alteration and mineral assemblages such as garnet, pyroxene, epidote, and chlorite were precipitated with magnetite and hematite suggesting that Khao Mae Lek and Khao Lek areas are Fe skarn deposits in the central part of the Loei mineral belt.

GEMOLOGICAL CHARACTERISTICS, CHEMICAL COMPOSITIONS AND CAUSE OF COLOR OF CHALCANTHITE CLAIMED TO BE FROM AFRICA

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Abstract:
Chalcanthite is one of the rarest minerals in the world. The crystal system of chalcanthite is Triclinic and a richly colored blue-green water-soluble sulfate mineral CuSO4.5H2O. The specific gravity ranged from 2.120-2.302. Refractive indices of $\alpha = 1.514$ $\beta = 1.537$ $\gamma = 1.543$ and has low hardness about 2.5 in Moh's hardness scale. Chalcanthite can dissolve in water and recrystallize. Color of Chalcanthite is caused principally by cupper (Cu). Chalcanthite samples claimed to be from Africa were studied for gemological characteristic, chemical composition and cause of color. The studied samples were 15 single crystals ranging weight from 0.215-0.573 carat. Single crystal has specific gravity ranged from 2.105-2.280. The examples show perfect cleavage in 3 directions. They were inert to both long-wave and short-wave UV radiation. From studying the inclusions of Chalcanthite crystals found as negative crystals, 2 phases inclusions and fractures. UV-Vis-NIR absorption spectra showed absorption bands at 750 and 820 nm, due to Cu^{2+}. 6 samples were chosen for chemical analysis by using Scanning Electron Microscope (SEM) with energy dispersive X-ray spectrometer and found major elements of copper (Cu), Sulphur (S) and oxygen (O). X-Ray Diffraction (XRD) analyses indicate that the samples contain only chalcanthite mineral. From the study of chalcanthite samples claimed to be from Africa showed that the data were consistent with other naturally occurring chalcanthite deposits.

GIANT DIELECTRIC PROPERTIES, ELECTRICAL RESPONSE, AND MICROSTRUCTURE OF $CaCu_3Ti_{4-x}Ga_xO_{12}$ CERAMICS

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Abstract:
The present study involved a comprehensive examination of the structure, dielectric properties, and electrical response of $CaCu_3Ti_{4-x}Ga_xO_{12}$ (x = 0, 0.05, and 0.10) ceramics. Based on the X-ray diffraction analysis, it has been determined that all of the sintered ceramics exhibit the presence of a $CaCu_3Ti_4O_{12}$ phase. The substitution of Ga^{3+} dopant into the $CaCu_3Ti_4O_{12}$ lattice leads to observable microstructural changes. Also, the doping of Ga^{3+} in the $CaCu_3Ti_4O_{12}$ lattice exhibits a remarkable ability to maintain high dielectric permittivity while simultaneously reducing the loss tangent. The $CaCu_3Ti_{3.95}Ga_{0.05}O_{12}$ ceramic exhibits a high dielectric permittivity of approximately $5.28 \cdot 10^4$ and a low loss tangent of approximately 0.07. Impedance spectroscopy analysis indicates that the $CaCu_3Ti_{4-x}Ga_xO_{12}$ ceramics display a heterogeneous microstructure characterized by the presence of semiconducting grains and insulating grain boundaries. Thus, the observed high dielectric permittivity of $CaCu_3Ti_{4-x}Ga_xO_{12}$ ceramics could be attributed to their heterogeneous microstructure.

INFLUENCE OF OPERATIONAL PARAMETERS ON ELECTROSTATIC PRECIPITATOR EFFICIENCY THROUGH PROCESS SIMULATION

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Abstract:

Currently, global air pollution has become a pressing concern. Not only are greenhouse gases on the rise, but the exposure to particulate matter, mainly originating from combustion processes, is also increasing significantly. Consequently, post-combustion processes have become a new trend of study aimed at mitigating pollution and its harmful effects on human life. The Electrostatic Precipitator (ESP) is one such post-combustion process designed to capture unburnt solid particles after combustion by utilizing an electrostatic field. This study focuses on investigating the ESP of a real industry company, modeling it in a process simulation to identify the primary factors influencing its efficiency. The model is validated using operational data with a minimal number of errors. Subsequently, the impact of operating conditions is explored using a 2^k factorial design of experiments to evaluate results. Four factors are investigated in this work: gas flow rate, solid flowrate, gas temperature, and applied voltages. The factors found to significantly influence the separation efficiency of the ESP are gas flow rate and applied voltages. An increase in gas flow rate leads to a decrease in separation efficiency due to the higher velocity of gases, resulting in a shorter residence time for particles in the ESP. Conversely, enhancing the applied voltage to the collecting plate in the ESP results in an improved separation efficiency due to the raised electrostatic force responsible for capturing solid particles. In summary, the optimal conditions for ESP operation, maximizing separation efficiency, are identified as 90.37 kV of applied voltage and 115.83 kg/s of gas flow rate.

MICROWAVE REGENERATION OF MODIFIED SOLID SORBENTS WITH EXHAUSTION INDICATOR FOR DIRECT AIR CO_2 CAPTURE

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Abstract:

Currently up to 66% of extreme climate change is attributable to CO_2, leading people to focus on reducing and capturing CO_2 outdoors. On the other hand, humans spend most of their time doing indoor activities, up to 90% of each day. This increases the chance of indoor CO_2 inhalation. Therefore, more attention should be paid to indoor CO_2 capture because CO_2 affects health. Long-term exposure to CO_2 can cause headaches, dizziness, drowsiness, stress, and increased blood pressure and respiratory rate. Therefore, the aim of this study was to develop the $K_2CO_3/\gamma\text{-}Al_2O_3$ solid sorbent that can capture CO_2 efficiently. The sorbent must have the capability to indicate when the adsorbent is fully desiccated by using phenolphthalein indicator. It can allow the user to notice the saturation of the adsorbent by observing the color change of the indicator in the sorbent after the CO_2 capture process. This makes the user to aware when the adsorbent should be replaced. Moreover, the regeneration of modified sorbent was investigated by using a conventional microwave oven to reduce time and energy consumption. The study factor was varying the microwave power, regeneration time and percent of closing time of microwave on the regeneration efficiency.

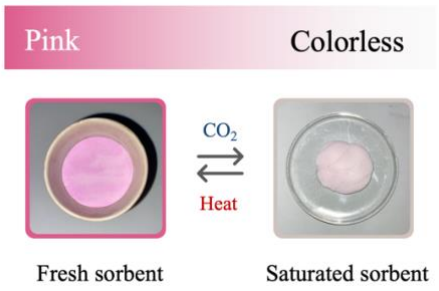

Figure 1.
Color change of modified K_2CO_3/Al_2O_3 after capture CO_2

MODEL FOR ESTIMATE SOLAR RADIATION FROM CLOUD COVER IN SONGKHLA PROVINCE

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Abstract:
The primary aim of this study is to find a model for estimating solar radiation from cloud cover in Songkhla province. The development of the model started with the collection of global solar radiation and cloud cover data from Songkhla province meteorological station between 2019-2018. Then taken to find the Angstrom-Prescott model was $\overline{H}/\overline{H}_{\circ} = 0.9088 - 0.1096\,\overline{C}$. The model was validated by using cloud cover data from 2019-2021 to predict solar radiation and then compared with data from the Songkhla province meteorological station. The provides statistical analysis results are the coefficient of determination (R^2), relative error (%Ɛ), root mean square difference (RMSD) and mean bias error (MBE) equal to 0.9425, 2.24%, 0.23 and 0.36 respectively.

REVEALING THE PHYSICOCHEMICAL PROPERTIES AND CELLULAR INTERACTIONS OF COMMERCIAL TITANIUM DIOXIDE NANOPARTICLES

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Abstract:

Nowadays many nanoparticles-based products have been launched in the market such as paints, detergents, and sunscreens. Among nanoparticles (NPs), titanium dioxide NPs (TiO_2 NPs) are widely used especially in sunscreen products. TiO_2 NPs are known for their ability to reflect UV rays, providing broad-spectrum UV protection. However, their safety issues for skin contact or inhalation are still in an argument. It is quite difficult to avoid contact with NPs. If the NPs cannot penetrate to the skin, they will not be able to circulate to blood stream, accumulate in the body and cause side effects, ensuring them safety-to use. Therefore, this work aimed to investigate TiO_2 NPs which are commercially available in the market from chemical and cosmetic grades in terms of physicochemical properties and cellular interactions to skin cells in order to evaluate their benefit and potential to penetrate to the skin cells.

Nine commercially available TiO_2 NPs with different advertised sizes were randomly bought from the market. Then, the TiO_2 NPs were analyzed for their physicochemical properties. Transmission electron microscopy (TEM) micrographs revealed various sizes ranging from approximately 25 nm to 690 nm with needle-like, spherical-, and irregular shapes. Broad spectrum-UV absorption of the TiO_2 NPs indicated wide range protection against UVA and UVB. There were no differences in sun protection factor (SPF) values of all samples except for 15 nm Liquid (Gloss)-TiO_2 NPs. All TiO_2 NPs exhibited high biocompatibility towards HaCaT skin cells with IC_{50} more than 1,000 µg/mL. Titanium(IV) oxide nanopowder, 21 nm (P25), well-known widely used TiO_2 NPs was chosen to further study their cellular uptake. The P25-TiO_2 NPs showed internalization in HaCaT cells under TEM and co-localization with lysosome under confocal laser scanning microscopy (CLSM). Quantitative cellular uptake was studied by inductively coupled plasma mass spectrometry (ICP-MS). Transdermal diffusion testing using Franz diffusion cells demonstrated an increase of Ti after passing through Strat-M membrane, a synthetic, non-animal-based model for prediction of diffusion in human skin, with increasing incubation times. Moreover, the amount of cumulative Ti was found at 4.434 ± 0.462 µg after 24 h of incubation in HaCaT cells. The findings emphasize that safety is important as well as efficacy and raise a critical question 'how can nanoparticles-based products be made safer for both human and environmental health?'

SELECTIVE PRODUCTION OF RUTINOSE FROM THE HYDROLYSIS OF HESPERIDIN IN THE SUBCRITICAL H_2O-CO_2 SYSTEM UNDER MICROWAVE IRRADIATION

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Abstract:
Rutinose is a disaccharide that is used in pharmaceutical research, specifically in the study of the composition and function of flavonoid glycosides. Because it is not naturally occurring, it is typically derived from glycosides like hesperidin or rutin using enzymes, which are difficult to obtain and require very stringent reaction conditions. As a more practical alternative, we propose the use of the subcritical H_2O-CO_2 reaction solvent to produce rutinose from hesperidin. The carbonic acid that is produced in this system can effectively serve as a catalyst to hydrolyze hesperidin into rutinose and its aglycone hesperetin, as shown in Figure 1. Furthermore, in this biphasic system, rutinose remains dissolved in the aqueous phase while the less polar hesperetin is extracted to the CO_2 phase; thus, increasing the purity of the product. As a heating method, microwave was employed; and as a secondary catalyst, microwave-absorbent silicon carbide was added to provide a locally heated surface where the reaction can take place. In one set of experiments, we dissolved 115 mg of hesperidin in 4 mL H_2O and performed the reaction at 130 °C and 1.5 MPa. A sugar analysis of the product using HPLC revealed that the yield of rutinose was 18.4% with a corresponding selectivity of 72.0%. Glucose and rhamnose, the constituent units of rutinose, were also detected. Future studies will focus on the optimization of the reaction conditions such as temperature, pressure, and silicon carbide loading to improve the yield and selectivity of rutinose.

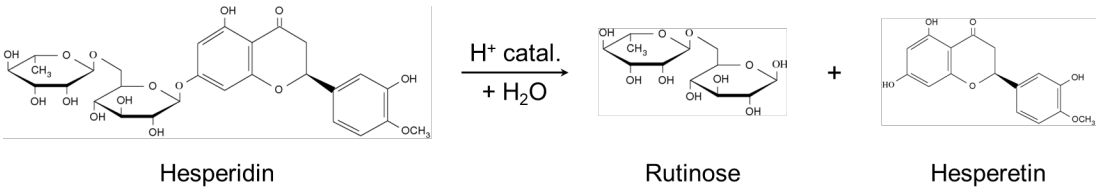

Figure 1. Acid-catalyzed hydrolysis of hesperidin into rutinose and hesperetin

SUSTAINABLE UTILIZATION OF FLUE GAS DESULFURIZATION WASTE FOR CONSTRUCTION AND CASTING APPLICATIONS THROUGH OPTIMIZED CALCINATION CONDITIONS

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Abstract:
Due to growing environmental concerns, Flue Gas Desulfurization (FGD) waste is being considered as a substitute for natural calcium sulfate sub-hydrate in a variety of applications. This study focused on the calcination of FGD waste from Mae Moh Power Plant in Thailand under four atmospheric conditions - dry, wet, pressure of 160 kPa, and pressure of 190 kPa using the same temperature (150°C). The calcination time was varied from 0 to 40 minutes. The optimum condition was 23 minutes with a crystallization water content of 6.2%. The chemical composition was examined using XRF, and the XRD patterns showed a phase change from calcium sulfate dihydrate to calcium sulfate hemihydrate. The contents of alpha- and beta-phases in calcium sulfate hemihydrate were examined using the Rietveld refinement. SEM imaging showed that the particles had a semi-rod-like shape. The particle size distribution ranged from 50 to 90 microns. The dry atmospheric sample demonstrated high flexural strength (4.31 MPa) and compressive strength (6.69 MPa), indicating its potential use as raw material for construction and casting applications.

SYNTHESIS OF GTBE BY CARBON-BASED CATALYTIC METHOD USING MICROWAVE IRRADIATION

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Abstract:
Biodiesel is a sustainable and renewable energy source that can address the global problem of diminishing reserves of fossil fuels and the negative environmental impact that comes with their continued use. However, one of the byproducts in the synthesis of biodiesel is glycerol, which is a hazardous waste. Therefore, several researches have focused on the transformation of glycerol to useful products. In this study, we utilized glycerol as the raw material in the synthesis of glycerol *tert*-butyl ether (GTBE), which can be used as an additive to enhance the properties of biodiesel. The etherification of glycerol with *tert*-butyl alcohol (TBA) typically requires an acid catalyst and may result in a mixture of mono- (MTBG), di- (DTBG), and tri-*tert*-butyl glycerol (TTBG) with TTBG as the most desired product. To achieve the etherification, we utilized the heterogeneous catalyst graphene oxide (GO) as the source of acidity. Moreover, we used microwave irradiation as the heating method to take advantage of the microwave absorptivity of GO. Lastly, we investigated the effect of adding silicon carbide (SiC) to further enhance the microwave heating over our reaction mixture. As shown in Figure 1, the addition of SiC had a negative impact on the conversion of glycerol and the yield of MTBG. However, it had a positive effect on the yield of DTBG and TTBG. Further studies will focus on improving the synergy between the two carbon-based catalysts by wrapping SiC with GO instead of simple mixing. Moreover, parameters such as temperature, catalyst loading, and glycerol-to-TBA ratio will be optimized.

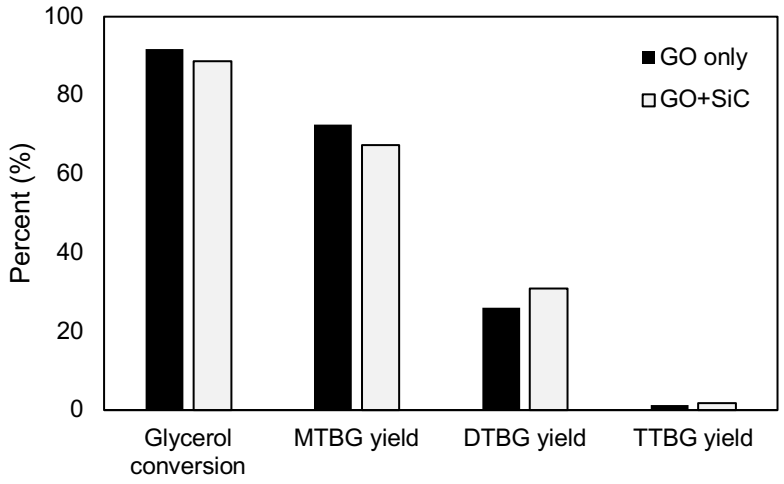

Figure 1. Glycerol conversion and product yield of mono- (MTBG), di- (DTBG), and tri-tert-butyl glycerol (TTBG) using graphene oxide (GO) only and GO with silicon carbide (SiC) as the catalysts. Reaction conditions: T = 110 °C, t = 1 h, glycerol:*tert*-butyl alcohol = 1:8, m_{GO} = 0.2 g, m_{SiC} = 1 g

THE POWER SYSTEM: THE SEMI-AUTOMATIC PIPING SYSTEM OF FUEL OIL INTO POWER GENERATOR

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Abstract:

Infrastructure for power systems is required for industrial and scientific institution purposes. The unstable and drop-off of electricity during the raining season in Thailand, causing several severe problems. As an engineer of IFRPD research institute, the stability of power system is the main responsibility. The current power generator platform is incomplete and disconnected. The fuel petroleum storage and the fuel tank for supplying the generator are placed in a difference area of 60 meters. The current refill fuel method is inappropriate, causing a high risk of accidents occurring. The forklift truck, temporary fuel tank and at least 3 manpower are used for all processes. Dust and raindrops might contaminate fuel during batch refill process, and the petroleum might expose toxic to environment. Thus, in order to improve the working welfare, decrease risk and energy of the refilling processes, the semi-automatic piping system of fuel oil into power generator have been conducted. The piping system would be placed underground. The risk and energy loss during transportation by forklift truck is decreased to zero percent. Manpower could be reduced to only one person for this work. This work was designed following the ESG metrics and SDGs-7, 11, 13 and 17.

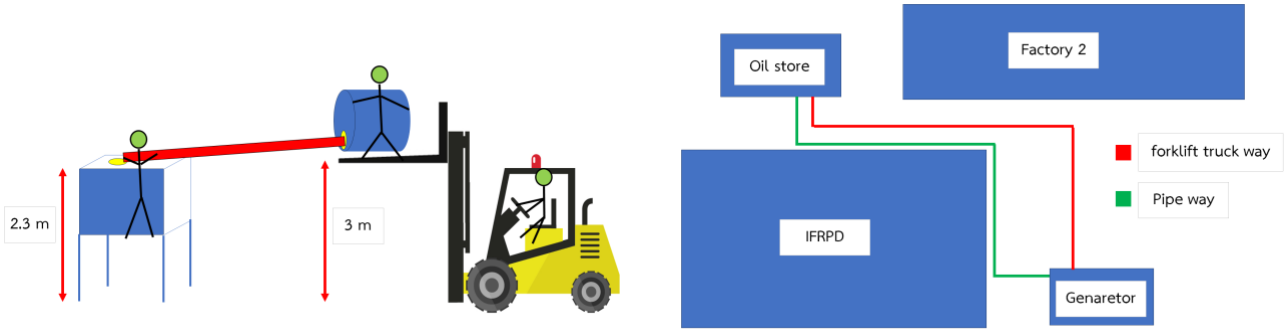

Figure 1. Graphic diagram illustrating (left) the current refill fuel method, which is inappropriate, causing a high risk of accidents occurring. (right) the top view of the semi-automatic piping system of fuel oil into power generator (green line) comparing the old system with forklift truck way (red line)

TUNABLE ORGANOSULFONIC ACID–FUNCTIONALIZED NATURAL RUBBER/ WORMHOLE-LIKE MESOSTRUCTURED SILICA NANOCOMPOSITES FOR ENHANCING THE ESTERIFICATION

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Abstract:
Organosulfonic acid–functionalized natural rubber/wormhole-like mesostructured silica (NR/WMS–SO_3H) nanocomposites are hybrid/composite-type solid acid catalysts used in esterification owing to their large surface area, shape-selective properties, highly acidic sites, and hydrophobicity. Herein, NR/WMS–SO_3H catalysts with different mesoporosity and acidity values were prepared via an in-situ sol–gel process, in which tetraethylorthosilicate mixed with different primary amines ($C_nH_{2n+1}NH_2$, n = 12, 14, and 16) as structural templating agents were simultaneously condensed with 3-mercaptopropyltrimethoxysilane in an NR solution, followed by oxidation with hydrogen peroxide. The X-ray diffraction analysis and transmission electron microscopy revealed a wormhole-like framework of the NR/WMS–SO_3H composites. The use of amine templates with longer alkyl chains provided the NR/WMS–SO_3H catalysts with a larger pore diameter, acidity, and enhanced hydrophobic properties. In addition, the NR/WMS–SO_3H catalysts exhibited superior catalytic performance compared to that of conventional organosulfonic acid–functionalized wormhole-like mesostructured silica in the esterification of acetic and octanoic acids with methanol. Furthermore, the NR/WMS–C_{16}–SO_3H catalyst yielded the highest conversion of acetic (84.1%) and octanoic acids (80.2%) at 3 h.

SESSION F-FOOD SCIENCE AND TECHNOLOGY/AGRICULTURAL SCIENCE

ANTIOXIDANT (INDOLE-3-CARBINOL) IN VEGETABLES FROM LOCAL MARKET, SOUTHERN THAILAND

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Abstract: Antioxidant (Indole-3-Carbinal; I3C), a secondary plant metabolite has been found in Brassica genus and it showed interesting in various biological activities. The antioxidant activity exhibited a crucial role in anti-cancer properties and has been shown to inhibit carcinogenesis at the initiation stage of human, such as lung cancer, colon cancer, prostate cancer, and breast cancer. In this study, the researchers aimed to study the quantity of I3C in 20 species of vegetable collected from local market in Songkhla province, southern Thailand. A microplate spectrophotometric method using a chromogenic reagent was used to analyze the concentration of I3C in the samples. The concentration of I3C in vegetable among species were statistically tested by the Games-Howell method. The results found that the highest concentration of I3C was found in *Piper sarmentosum* and *Ocimum tenufiorum*, but the lowest concentration of I3C was found in Brassica genus (*B. oleracea* (*var. italica*), *B. oleracea* (*var. capitata*) and *B. pekinensis*) and *Acacia pennata*. The concentration of I3C in 7 species of Brassica genus (*B. oleracea* (*var. italica*), *B. oleracea* (*var. capitata*), *B. pekinensis*, *B. chinensis*, *B. rapa*, *B. oleracea* (*var. botrytis*) and *Brassica alboglabra* were significantly lower than 9 species of vegetable plants (*Piper sarmentosum*, *Ocimum tenufiorum*, *O. gratissimum*, *Amaranthus viridis*, *Coriandrum sativum*, *Helianthus annuus*, *Oenanthe javanica*, *Centella asiatica* and *Anethum graveolens*) ($p<0.05$). The I3C concentration was non differed in comparison between *B. alboglabra* and *B. oleracea* (*var. botrytis*) with *Lactuca sativa* and *Gnetumgnemon limm* ($p>0.05$), but significantly higher than vegetable plants (*Ipomoea aquatica* and *Acacia pennata*) ($p<0.05$).

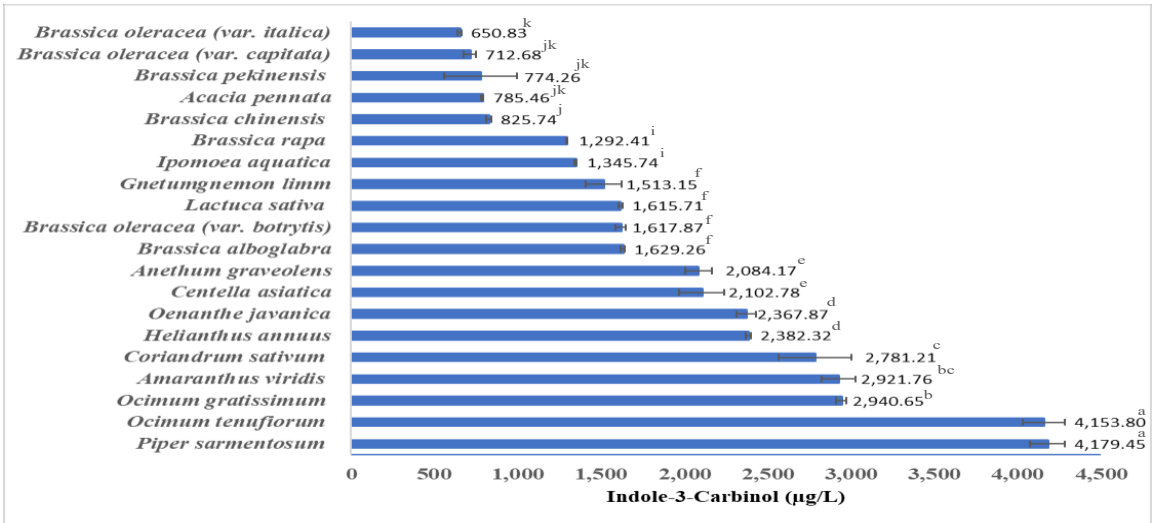

Figure 1.
The concentration of antioxidant (Indole-3-Carbinal) in 20 species of vegetable collected from local market in Songkhla province, southern Thailand

BIOCHEMICAL CHARACTERISATION OF BETA-AMYLASE 1 (DzBAM1) FROM DURIAN PULP (*Durio zibethinus* L.) MONTHONG CULTIVAR DURING RIPENING

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Abstract:
β-amylase (BAM, EC 3.2.1.2) or α-(1,4)-glucan glucohydrolase belongs to glycoside hydrolase family 14 (GH14). It is an exo-enzyme that plays an important role in starch degradation via β-amylolysis in dicotyledons. The enzyme catalyses the hydrolytic cleavage of α-1,4-glucosidic linkage of starch from the non-reducing end, thereby liberating maltose. According to the RNA-Seq of Monthong cultivar, this research mainly focuses on *DzBAM1* whose expression levels were increased during ripening and higher than those of other isoforms. pET21b-*DzBAM1* was constructed and further transformed into *E. coli* TOP10 for plasmid multiplication and isolation. The constructs were successfully transferred to *E. coli* SoluBL21 (DE3) for gene expression. The rDzBAM1 was produced under optimal conditions and purified using a nickel affinity column. A molecular size of rDzBAM1 was ~ 55 kDa according to SDS-PAGE and western blot approaches. The optimal pH and temperature (acetate buffer pH 6.0 and 30 °C, respectively) and Ca^{2+} ion-enhancing activity were found in biochemical characterisation assays. In addition, the enzyme apparently preferred cleavage of starches (potato and cassava starches) and maltodextrins. Moreover, maltose production from different substrates was primarily confirmed by the thin-layer chromatography (TLC) technique. Next, enzyme kinetics will be further investigated and product analysis will be entirely determined by using the High-performance anion-exchange chromatography-pulsed amperometric detection (HPEAC-PAD) technique.

BIODIVERSITY OF ENDOPHYTIC ACTINOBACTERIA ISOLATED FROM JASMINE RICE (*Oryza sativa* KDML 105) AND THEIR PLANT GROWTH PROMOTING IN VITRO AND IDENTIFICATION OF *Quadrisphaera endophytica* SP. NOV.

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Abstract:

This study aimed to study the biodiversity of endophytic actinobacteria from Jasmin rice and evaluated their plant growth-promoting (PGP) properties. Seventy-tree isolates of endophytic actinobacteria were obtained from surface-sterilized Jasmin rice tissue (*Oryza sativa* KDML 105) collected from three rice paddy fields in Mahasarakham province, Thailand. Identification based on their morphology and 16S rRNA gene analysis showed that most isolates belonged to the genus *Streptomyces* (66, 90.4%), with the rest genera belonging to *Microbispora* (4, 5.5%), *Micromonospora* (1, 1.4 %), *Actinoplanes* (1, 1.4%) and rare genus *Quadrisphaera* (1, 1.4%). All endophytic actinobacteria were tested for antimicrobial activity against bacterial and fungal rice pathogens: *Xanthomonas oryzae* PXO71 and *Pyricularia oryzae* 21009. The result showed that 18 and 3 isolates showed good inhibition against these pathogens, respectively. Twenty isolates showing good activity against at least one pathogen were selected to study PGP in vitro. The result showed that 15 isolates (75%) could solubilize phosphate, but none could fix nitrogen. Eleven isolates (55%) could produce cellulase, and six isolates could produce 1-aminocyclopropane (ACC) deaminase. Twenty isolates (100%) could produce indole acetic acid (IAA) in range 9 to 227 ug/mL. Twelve and twenty isolates grew on 10% NaCl (w/v) and 20% Polyethylene glycol. Two strains, RD12 and RD28, were selected to study PGP traits in planta, and the result is pending. The result of polyphasic taxonomy showed that strain KR29 was a novel species of genus *Quadrisphaera* named *Quadrisphaera endophytica* sp. nov., and strain RD6 was a novel subspecies named *Microbispora rosea* subsp. *phytophila*. Genome data mining of these two strains revealed that these strains contained a variety of biosynthesis gene clusters, including genes encoding proteins relating to PGP traits and biodegradation enzymes.

In conclusion, endophytic actinobacteria from this study had the potential to be applied as rice inoculum to increase rice yield in the future.

CULTIVATION OF OYSTER MUSHROOM USING 5 AGRICULTURAL WASTES

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Abstract:

Agroindustry plays an important role for Thailand economy. So that large amounts of agricultural waste are generated as by-products. They are usually discarded or burnt, resulting in environmental pollution and causing health problems for humans. The objective of this research was to screen the use of 5 agricultural wastes including corn husk, rice straw, coconut meal, coconut husk and sugarcane bagasse for mushroom cultivation. To observe the mycelial growth on these 5 potential substrates, the two oyster mushroom candidates were cultured in jars (8-cm diameter, 400 ml in volume). The agricultural wastes were dried in the sun for 12 hours, they were chopped and ground into smaller pieces. Twenty grams of each substrate were added into jars and 1.2 g of potato dextrose broth medium and 50 ml of distilled water were added into every jar. The jars were autoclaved at 121°C for 1 hour. After cooling down to room temperature, the oyster mushroom cultures were inoculated into the jars. The jars were incubated at 25°C for 6 weeks. They were observed weekly, and the photographs of the jars were taken at the final week of incubation. The results show that oyster mushrooms grew best on coconut meal, producing very densely packed mycelia. Corn husk and rice straw were also good sources for oyster mushroom cultivation. This study shows that these three substrates should be selected for further study on a commercial scale. This would offer mushroom growers other alternatives to combine these substrates with existing substrates currently used.

DEVELOPMENT OF COMPOSITE KERATIN/CHITOSAN FILMS FOR SUSTAINABLE FOOD PACKAGING APPLICATIONS

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Abstract:
Chicken meat processing industries generate several by-products, including chicken feathers utilizing for keratin production. Keratin is a protein that possesses a high value, commercial potential and can be utilized as a sustainable biopolymer for manifold applications. This research aimed to construct biodegradable composite films made from keratin (FK) and chitosan (CS) in various ratios by simple solution casting techniques. The physical properties of each formulated film were assessed including tensile, transparency, and solubility. Results revealed that the native film of keratin could not be formed due to their brittleness, while the blended of FK: CS were able to form a film in all ratios of designed experiments following 1:1, 1:2, 2:1, and 0:1 (w/w). The optimal ratios of FK and CS for film-forming was 1:1 (w/v). The film of selected ratio 1:1 was uniform, homogeneous, thin, transparent, and flexible indicating a good compatibility between components. Moreover, they showed strength and high solubility. In conclusion, this film has remarkable potential as a biodegradable film material with promising potential for the food packaging industry, as it has a positive influence on environmental concerns. The finished product of composite film is shown in figure 1, which possess biocompatibility and biodegradability.

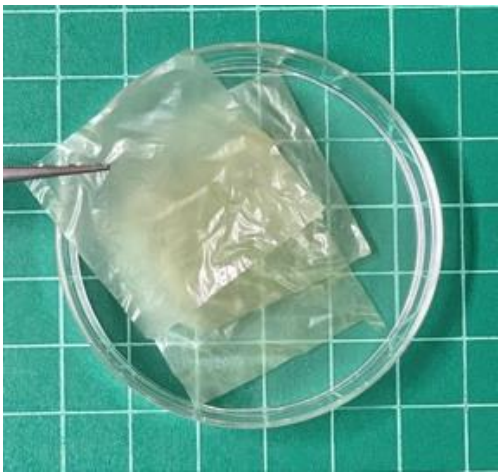

Figure 1 Digital images of composite feather keratin/Chitosan film

EFFECT OF LIGHT STRESS ON GROWTH AND ALLELOPATHIC ACTIVITY OF RICE IN SOUTHERN THAILAND

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Abstract:
Global warming has effect on agriculture such as rising temperature and lack of water. Climate change can also reduce sunlight for several months continuously. This problem brings about this research to study the effect of light on growth and allelopathic activity of rice aiming for rice plants to exude allelochemicals to suppress the growth of weed. Seven rice cultivars, i.e. Khao Dawk Mali 105, Phathum Thani 1, RD55, Chai Nat 1, Sang Yod Muang Phattalung, Leb Nok Pattani and Cho Lung, were grown for three weeks. Two light intensities were used: 300 and 200 µmol photon m^{-2} s^{-1}. Results showed that rice cultivars had effect on growth and allelopathic potential when tested with lettuce. Phathum Thani 1 rice cultivar growth was the lowest when compared with other cultivars but its allelopathic potential was the highest, while rice cultivars that grew well, e.g. Leb Nok Pattani and Chat Nat 1 had low allelopathic potential. Rice plants that received light at 200 µmol E m^{-2} s^{-1} grew better than at 300 µmol E m^{-2} s^{-1} but their allelopathic potential was less when compared with rice plants that received 300 µmol E m^{-2} s^{-1}.

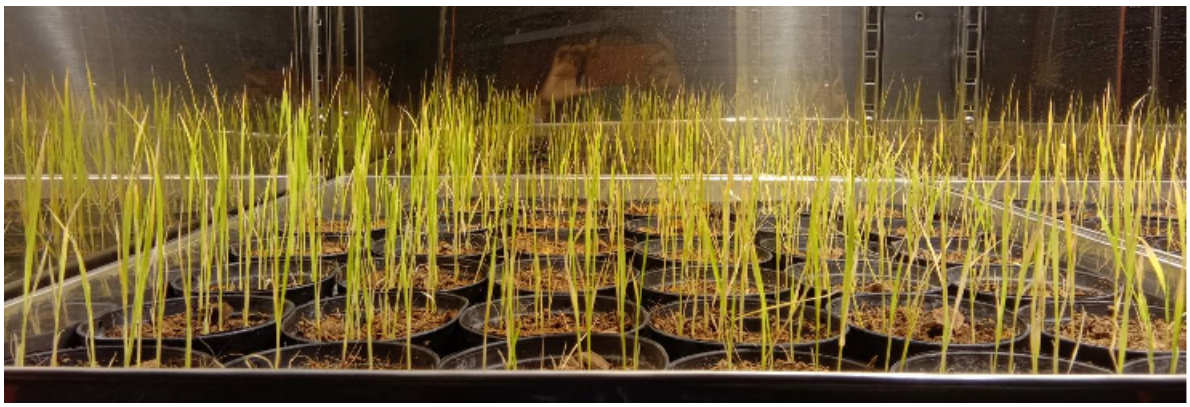

Figure 1.
Rice grown in growth chamber

EFFECTS OF COFFEE PROCESSING METHODS ON CHEMICAL COMPOSITIONS OF GREEN BEAN AND ROASTED BEAN OF ARABICA COFFEE

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Abstract:
Green bean processing and roasting methods could affect the chemical composition and profile of coffee beans. Therefore, the chemical compositions of coffee green bean and medium roasted-coffee beans obtained from Doi Chang (Chiang Rai province, Thailand) with different green bean processing methods, which were dry process, semi-dry process, wet process, and carbonic maceration process, were investigated. Aroma and taste profiles were also studied using an electronic nose and tongue, respectively. The data of the chemical compositions of coffee beans and the flavoring agents produced from the roasted coffee beans could be used to improve the coffee bean processing and roasting guideline for coffee makers in Thailand. It was found that the coffee bean produced from different processing presented different chemical compositions. Coffee beans produced by Carbonic maceration process presented the highest amounts of chlorogenic acid and caffeine at 19.03 and 7.89 mg/g, respectively, while the wet process coffee had the lowest content at 12.63 and 5.10 mg/g, respectively. Protein content was highest in coffee beans obtained from wet process (2.42 mg/g) and lowest in the green bean from dry process (1.58 mg/g). In addition, several volatile compounds were found in the medium roasted-coffee beans. Each roasted bean presents a different number and amount of volatile substances. It is consistent with the results of an electronic nose and electronic tongue analysis that clearly indicate differences in pattern of aroma and flavor of the medium roasted coffee beans produced through different processes. It can be seen that the coffee bean production process is an important factor affecting the chemical composition and volatile content of coffee beans.

PLANT-BASED GRILLED PORK IN BAMBOO STICK: THE IMPROVEMENT OF KASET TEXTURED PROTEIN, ELIMINATING UNWANTED ODORANT AND REDUCING ROUGH TEXTURE

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Abstract:
KASET Textured Protein is a plant-based well-known product. It is made from defatted soybean flour with extrusion processing by a food extruder. The most disadvantage of this product is composed of the rough texture and unwanted odorant from soybean. These odorant compounds are generally dissolved in oil phase. The aims of this study are to reduce the rough texture and remove unwanted odorant in KASET Textured Protein which could improve customer satisfaction toward product. The prototype of the improvement product is plant-based grilled pork in bamboo stick. The outputs of this project are filed 2 types of the intellectual property with DIP Thailand, including petty patent and the trademark of this product prototype. The methodology of eliminating unwanted odorant and reducing rough texture is based on the exchange substance in oil phase and processing approaches. All the details are present in the petty patent KUService no. 1408, date of applied 13 June 2023. The "VeganGoods" is filed and received the DIP Thailand No. 230133630 with date of applied 15 September 2023. This plant-based grilled pork in bamboo stick could mimic the real grilled pork without noticing that it is made from soy KASET Textured Protein. More than 70% of 5-point hedonic scale for sensory evaluation from 30 untrained panelists in the exhibition reflected the satisfication on softness and chewiness texture. 80% of the panelists cannot detect the signature odor of soybeen from the product.

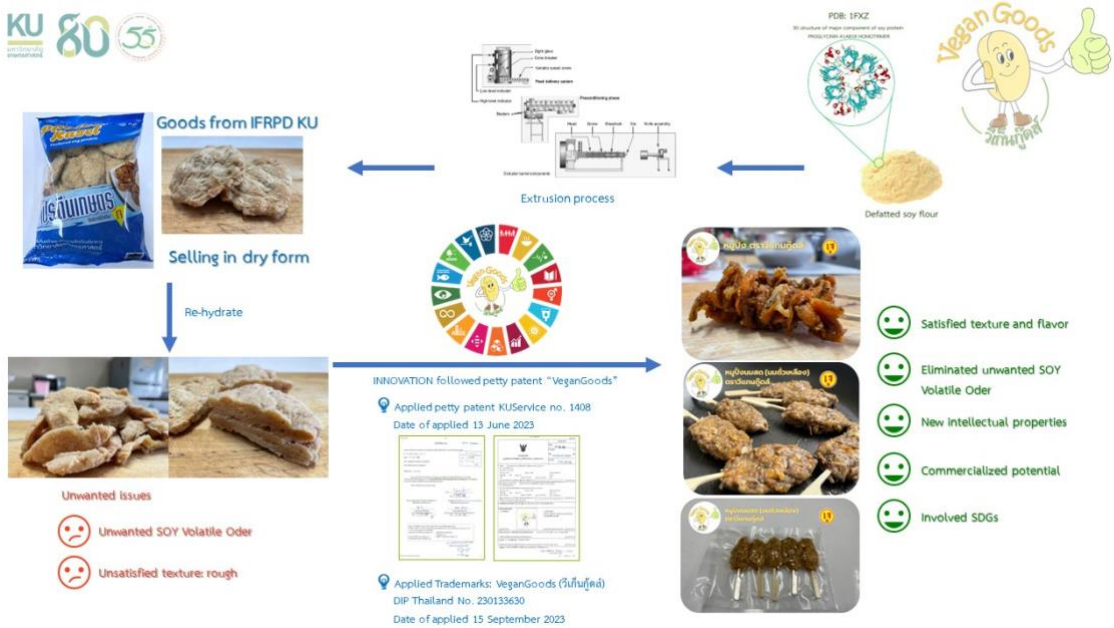

Figure 1. Conceptual workflow of plant based grilled pork with bamboo stick.

PREBIOTIC PROPERTIES OF THAI LOTUS (*Nelumbo nucifera*) SEED FLOUR

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Abstract:
Thai lotus (*Nelumbo nucifera*) seeds are a good source of carbohydrates and have been widely utilized for both food and medication. The aim of this research was to investigate prebiotic properties of Thai lotus seed flour. It was found that 100 g Lotus seed flour (LSF) 100 g consisted 9.15, 21.17, 1.06, 63.12, 2.24, and 3.26 g of moisture, protein, total fat, total carbohydrate, ash, and dietary fiber, respectively. Non-reducing sugar analysis showed that the LSF contained 758.26 mg/g of non-reducing sugar which includes oligosaccharide, a prebiotic. LSF were evaluated on their prebiotic as the resistant ability to the *in vitro* digestion of artificial human saliva α-amylase, acidic, and pancreatic α-amylase. The LSF showed that 76.14 % remained undigested through the colon. Moreover, LSF in MRS broth could enhance the growth rate of both *Lactobacillus acidophilus* ATCC 4356 and *Lactobacillus casei* BCC 13300 rather than the commercial prebiotic standard, inulin. However, the enhanced activity was different in the strains of probiotics tested. The results of this study could provide basic information to promote lotus seed flour utilization in functional food products.

Production of *Bacillus amyloliquefaciens* strain C2-1 In Powder Form For Inhibiting Rice Diseases

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Abstract:
Currently, rice cultivation in Thailand still faces the problem of low yields due to rice diseases. The main rice diseases are bacterial leaf blight disease, bakanae disease caused by *Xanthomonas oryzae* pv. *oryzicola* (*Xoo*) and *Fusarium moniliforme*, respectively. *Bacillus* spp. have been used as bioactive and environmentally ecofriendly agents to control these diseases. In this study, *B. amyloliquefaciens* strain C2-1 was cultured in nutrient broth medium at 24, 48, and 72 h to determine the optimum cultivation time before preparation into dry powder using spray drying and hot air oven techniques. The optimal cultivation time was found to be 24 h, giving the highest concentration of cell at 1.67 ± 0.3 x10^{10} CFU/ml. The survival rate of *B. amyloliquefaciens* strain C2-1 spray-dried powder obtained from spray drying and hot air oven techniques were 3.33 ± 0.8 x10^{10} CFU/g and 1.52 ± 1 x10^{4} CFU/g, respectively. The *B.amyloliquefacien* strain C2-1 spray-dried powder was further tested for their efficacy against rice diseases caused by *Xoo* and *F. moniliforme* using swab method and dual cultures. It was found that *B.amyloliquefacien* strain C2-1 in spay-dried powder (0.25 g/mL) was able to control the growth of *Xoo* with clear zone measuring 5.2 ± 1.0 mm at 24 h.. Regarding inhibiting *F. moniliforme*, it was found that *B.amyloliquefacien* strain C2-1 was able to control the growth of *F. moniliforme* with 1.4 ± 0.3,1.6 ± 0.2 and 2.0 ± 0.2 mm inhibitions, at 3, 5 and 7 days respectively. The results suggest that *B.amyloliquefacien* strain C2-1 obtained from spray drying can be used as a biocontrol agent against bacterial leaf blight disease and bakanae disease.

Keywords: *Bacillus amyloliquefaciens*, *Bacillus spp., Fusarium moniliforom, Spray drying*, *Xanthomonas oryzae* pv. *oryzae* (*Xoo*).

Production of Thailand Reference Materials (TRMs) for Detection of Genetically Modified Rice

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Abstract:

Genetically modified (GM) rice detection is a critical aspect of food safety and regulatory compliance, as it plays an important role in monitoring and managing GM rice presence in the global food supply. However, to ensure the accuracy and consistency of analytical testing in laboratories, the availability of reliable reference materials is essential. This study introduces the "Thailand Reference Materials (TRM)," addressing the pressing need for certified reference materials in GM rice testing. TRMs were produced as the plasmid type containing DNA fragments of GM rice *events Bt63, LLrice62,* and *LLrice601*. A well-developed and validated droplet digital PCR method was employed for characterization, homogeneity assessment, and short- and long-term stability studies. The TRMs exhibited good between-bottle homogeneity and remained stable at 4 ^{o}C for 2 weeks (short term stability) and could be stored at -20 ^{o}C for 1 year (long term stability) as demonstrated in testing. The certified values of TRM S-1007 Bt63-Rice Plasmid, TRM S-1017 LLrice601-Rice Plasmid and TRM S-1011 LLrice62-Rice Plasmid along with expanded uncertainty (k=2, 95%CI) were 1.2 x 10^5 ±1.7 x 10^4 cp/µL, 1.2 x 10^5 ±2.6 x 10^4 cp/µL and 1.2 x 10^5 ±2.7 x 10^4 cp/µL, respectively. These results underline the successful development of TRMs, enhancing the reliability and accuracy of GM rice testing in laboratories, and strengthening food safety measures and regulatory compliance.

Key words: Genetically modified rice, Certified Reference Material, Thailnad Reference Material, droplet digital PCR

PROTEIN BIOINFORMATICS ANALYSIS OF LACCASE ON *Lentinus squarrosulus* AND RELATIVE SPECIES

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Abstract:
Lentinus squarrosulus, Hed-Khon-Khao, is promoted to cultivate as economic mushroom by Department of Agriculture. *L. squarrosulus* is not only utilized as food resource but also possess property as ligninolytic enzymes resource. Ligninolytic enzymes play a crucial role in the global carbon cycle, which is involved in the degradation of various xenobiotic compounds and dyes. Crude extracts of ligninolytic enzymes from *L. squarrosulus* have been conducted. These crude enzymes were tested with decolorizing assays of AZO dyes. The results showed that the main enzyme for decoloring color of synthetic azo dyes was laccase (EC:1.10.3.2). This present research project performed further research based on previous mentioned work about laccase enzyme from white-rot fungi in mushroom. The 3D protein structure of laccase *L. squarrosulus* is unavailable in Protein Data Bank (PDB). Protein bioinformatics approaches: data gathering from protein database, multiple protein sequence alignments, phylogenetic tree, have been applied to understand the protein structure of laccase enzymes from *Lentinus sp.* and relative species. The 22 protein sequences from 3 categories, fungi with (ft) and without (nft) fruiting body and other kingdom were retrieved from GenBank. Laccases share protein sequence identity above 73.8% in ft-group, below 46.1% and 6.8% in nft-group and other, respectively.

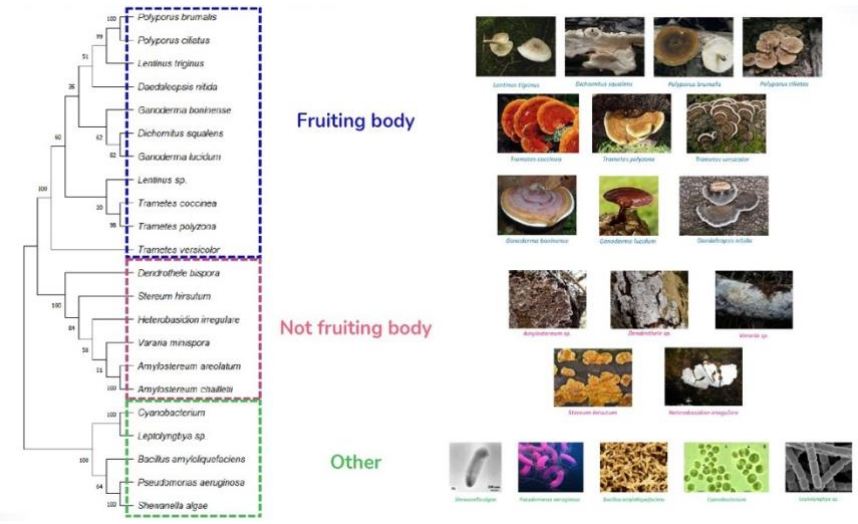

Figure 1. Phylogenetic tree of LACCASE enzyme of *Lentinus squarrosulus* and relative species visualized by program MEGA version 11.0.13

SYNTHESIS OF FISETIN GLUCOSIDES USING ALTERNANSUCRASE FROM *Leuconostoc citreum* ABK-1

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Abstract:

Fisetin, a bioflavonoid, has been widely found as a secondary metabolite in many plants, especially strawberries, apples, grapes, onions, kale, etc. In addition to its remarkable antioxidant activity, fisetin significantly enhances various biological activities such as anti-cancer, anti-aging, antidepressant effects, and anti-inflammatory properties. However, one of the major limitations is that fisetin is poorly soluble in water, approximately 10 µg/mL. We herein aim to improve the solubility of fisetin by derivatizing it into fisetin glucoside forms, using alternansucrase (ALT, EC 2.4.1.140) generating mainly alternating α-1,3- and 1,6-linked glucan and oligosaccharides from sucrose substrate. The fisetin glucosides were successfully synthesized by cosolvent with ethanol in the reaction. The highest yield of fisetin glucosides was obtained, approximately 96%, as analyzed by HPLC, when the reaction was incubated with 250 mM sucrose and 1 mg/mL fisetin in 25 mM phosphate buffer at pH 6.0 with the presence of 30% (v/v) ethanol, using 0.1 U/mL ALT at 20 °C for 24 hr. Interestingly, the degree of polymerization (DP) of fisetin glucosides was obviously increased at lower incubated temperature, with the maximum DP detected by MALDI-TOF MS being DP = 9 when the reaction was incubated at 20 °C. Five major products of the fisetin glucosides were successfully purified by HPLC fractionation and then analyzed by MALDI-TOF MS. The main products consisted of fisetin mono- to pentaglucosides. Additionally, the ratio of fisetin mono- to pentaglucosides could be changed depending on ALT's concentration. The structure and properties of these fisetin glucosides will be further elucidated in the future.

SESSION SP8: X-RAY CRYSTALLOGRAPHY

CRYSTAL STRUCTURE OF A NEW 3D INTERPRENATRATING CADMIUM(II) COORDINATION POLYMER CONTAINING 1,4-BIS(IMIDAZOL-1-YLMETHYL) BENZENE AND DICYANAMIDE

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Abstract:
A new crystal structure of cadmium(II) coordination polymer containing 1,4-bis(imidazol-1-ylmethyl)benzene (bix) and dicyanamide ($N(CN)_2^-$), $\{[Cd(bix)_2(N(CN)_2)]_n \cdot N(CN)_2 \cdot H_2O\}$, has been successfully synthesized. The molecular structure of this compound has been determined by single-crystal X-ray diffraction. The asymmetrical unit of this compound comprises a one Cd(II) ion, one $N(CN)_2^-$ ligand, two bix ligands, lattice $N(CN)_2^-$, and water molecules. The Cd(II) ion adopts a distorted octahedral geometry with a $[CdN_6]$ chromophore formed by six nitrogen atoms derived from four disparate bix bridging ligands and two disparate μ-1,5-$N(CN)_2$ ligands. In terms of structural arrangement, all bix ligands in this compound exhibits a *trans* conformation, forming a (4,4)-connected net. These 2D nets interconnect through the auxiliary μ-1,5-$N(CN)_2^-$ bridging ligands, resulting in the formation of a 3D framework. The presence of substantial void spaces leads to the emergence of an interpenetration phenomenon, leading to a two-fold interpenetrating framework. The stability of this 3D framework is facilitated by C-H···π interactions occurring between the phenyl rings of the bix ligand.

CRYSTAL STRUCTURE OF NEW TWO-DIMENTIONAL CADMIUM(II) COORDINATION POLYMER CONTAINING 1,3-BENZENEDICARBOXYLATE LINKER

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Abstract:

A new two-dimensional cadmium(II) coordination polymer, $\{[Cd_2(1,3\text{-bdc})_2(DMF)]\cdot DMF\cdot 2H_2O\}_n$ (1,3-bdc = 1,3-benzenedicarboxylate) was synthesized and characterized. This complex crystallizes in the triclinic crystal system with *P*-1 space group. The asymmetric unit of this complex contains two independent Cd(II) atoms centers, two 1,3-bdc, one coordinated DMF molecule, one DMF and two water lattice solvent molecules. The structure of this complex consists of trinuclear Cd(II) SBUs that formed by linking of Cd(1) and Cd(2) ions by μ-κ^2O,O' and μ-1κO:1$\kappa O'$:2$\kappa O'$ coordination modes of carboxylate group in two difference 1,3-bdc bridges. Cd(1) ion is coordinated by five oxygen atoms from four 1,3-bdc ligands with the bond distances of Cd-O are in the range of 2.194(3) to 2.499(3) Å and one oxygen atom from a terminally coordinated DMF molecule with the bond distances of Cd-O(DMF) = 2.381(7) Å, forming an octahedral geometry. While that of Cd(2) ion is an octahedral built from six oxygen atoms from six 1,3-bdc ligands with the bond distances of Cd-O are in the range of 2.209(3) to 2.373(3) Å. The Cd···Cd distance in the trinuclear unit is 3.756 Å. Furthermore, each trinuclear SBU is further connected together *via* 1,3-bdc linkers to form 2D frameworks in crystallographic *ac* plane. The crystal structure of this 2D Cd(II) coordination polymer is further stable by CH···π intermolecular interaction between 2D layers, resulting 3D supramolecular framework.

CRYSTAL STRUCTURE OF TERBIUM(III) COORDINATION POLYMERS CONTAINING 4-(HYDRAZINECARBONYL)BENZOATE LIGANDS

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Abstract:
The crystal structures of four new three-dimensional (3D) coordination polymers (CPs) containing terbium and bifunctional 4-(hydrazidecarbonyl)benzoate ligands, $[Tb(HCB)_2]X$ (X = NO_3^-, Cl^-, Br^-, I^-) are reported. These CPs have an isostructural structure and crystallize in the orthorhombic space group *Pccn*. The solid-state structure of these isomorphous CPs exhibits a 3D cationic framework formed through connecting the central Tb^{3+} ions with the HCB ligand via its carboxylate and hydrazide moieties. The 3D frameworks feature 1D channels with charge-balancing anions, where the anions participate in hydrogen bonding with the amine donor of the HCB ligands. Under UV radiation (λ_{ex} = 254 nm), all CPs showed the vibrant green fluorescence of Tb^{3+}.

CRYSTAL STRUCTURES OF COPPER(II)-BENZENEDICARBOXLATE FRAMEWORKS HAVING MIL-53 TOPOLOGY

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Abstract:
The crystal structures of two copper(II)-benzenedicarboxylate frameworks based on MIL-53 topology, namely $[Cu(\mu_2\text{-}OH)(bdc)_{0.5}]\cdot 3H_2O$ (**1**), and $[Cu(\mu\text{-}MeOH)(Br_4bdc)_{0.5}]$ (**2**) (bdc = 1,4-benzenedicarboxylate), were accurately determined for the first time using single crystal X-ray diffraction. Both **1** and **2** crystallize in the orthorhombic system with *Imma* space group. They possess three-dimensional open-frameworks that have large one-dimensional channels.

CRYSTAL STRUCTURES OF MIXED Ca(II)/Cd(II) ANIONIC MOFs

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Abstract:

Three new heterometallic metal-organic frameworks, $[CaCd_2(btc)(Hbtc)_2](ImH)\cdot 2H_2O$ (**1**), $[CaCd_2(btc)(Hbtc)_2](Me_2NH_2)\cdot 4H_2O$ (**2**), and $[Ca_2Cd_4(btc)_2(Hbtc)_4][(Me_2NH_2)(Me_4N)]\cdot 8H_2O$ (**3**), were synthesized and structurally characterized using single crystal X-ray diffraction. Compounds **1** and **2** crystallize in the centrosymmetric monoclinic system with space group *P*2/*c*, while compound 3 crystallizes in *P*2. These compounds have similar three-dimensional anionic frameworks, formed by linking trimeric $\{CdCd_2(Hbtc)_3\}_n$ units with btc^{3-} ligands. These compounds have strong blue luminescent emissions in the solid state at room temperature and are selective multiresponsive luminescent sensors for Cu^{2+}, Fe^{2+}, and Fe^{3+} ions via quenching with good sensitivity.

SYNTHESIS, CHARACTERIZATION AND CRYSTAL STRUCTURES OF NEW MONONUCLEAR COPPER(II) COMPLEXES CONTAINING DIIMMINE DERIVATIVES AND 4-HYDROXYBENZOATE LIGANDS

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Abstract:

Three new mononuclear copper(II) complexes namely [Cu(dpyam)(4-OHbenz)$_2$]·H_2O (**1**), [Cu(phen)(4-OHbenz)$_2$] (**2**) and [Cu(bipy)(4-OHbenz)(H_2O)] (**3**) (where dpyam = 2,2'-dipyridylamine, bipy = 2,2'-dipyridyl, phen = 1,10-phenanthroline and 4-OHbenz = 4-hydroxybenzoate) have been successfully synthesized and characterized in order to investigate their bioactivity. The X-ray structures of these complexes have been determined by using the single-crystal X-ray diffraction techniques. Complex **1** crystallizes in monoclinic crystal system with $P2_1/n$ space group. The Cu(II) ion in complex **1** is coordinated by two nitrogen atoms from dpyam and two oxygen atoms from 4-OHbenz, forming a distorted square planar geometry with a [CuN_2O_2] chromophore. The Cu1–O and Cu1–N bond lengths range from 1.923(11) - 1.933(11) Å and 1.993(13) - 1.983(13) Å, respectively, and bond angles are in the range of 91.67(5)˚ - 152.03(6)˚ with the bite angle of 39.70˚. While the complex **2** crystallizes in orthorhombic crystal system with $C2/c$ space group. In complex **2**, the Cu(II) center is coordinated by two nitrogen atoms from phen and two oxygen atoms from 4-OHbenz, leading a distorted square planar geometry with a [CuN_2O_2] chromophore. The Cu1–O and Cu1–N bond lengths fall in the range from 1.923(11) - 1.933(11) Å and 1.993(13) - 1.983(13) Å, respectively, and bond angles are in the range of 81.79(9)˚ - 173.36(6)˚ with the bite angle of 1.27˚. While complex **3**, it crystallizes in monoclinic crystal system with $Pbcn$ space group. The Cu(II) center is surrounded by two nitrogen atoms from bipy, two oxygen atoms from 4-OHbenz and one oxygen atoms from aqua ligand, resulting in a distorted square pyramidal geometry with a [CuN_2O_3] chromophore. The Cu1–(N, O) bond lengths of the basal atoms originating from the chelating ligands are in the range 1.928(2) - 2.007(3) Å, while the Cu1–O2 bond length to the aqua ligand is 2.264(16) Å and bond angles are in the range of 80.93(11)˚ - 171.38(11)˚ with the structural parameter τ_5 is 0.24. Moreover, the crystal structures of these complexes have been stabilized by intermolecular interactions such as hydrogen bonds, C-H···π and π···π stacking.

SYNTHESIS, CHARACTERIZATION, AND CRYSTAL STRUCTURE OF NEW TERNARY MONONUCLEAR COPPER(II) COMPLEXES CONTAINING 2,2′-DIPYRIDYLAMINE AND HYDROXYBENZOATE DERIVATIVE

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Abstract:

Two new ternary mononuclear copper(II) complexes, [Cu(dpyam)(2-OHbenz)Cl] (**1**) and [Cu(dpyam)(3-OHbenz)Cl] (**2**) (dpyam = 2,2′-dipyridylamine, 2-OHbenz = 2-hydroxy benzoate and 3-OHbenz = 3-hydroxybenzoate) have been designed and successfully synthesized in order to study their catalytic oxidation. Both complexes were characterized by using FT-IR, UV-vis, solid-state diffuse reflectance spectroscopy, EPR, CHN elemental analysis, TGA and PXRD. The molecular structure of both complexes has been determined by using the single-crystal X-ray diffraction technique. Complex **1** crystallizes in monoclinic crystal system with *C*c space group, while complex **2** crystallizes in an orthorhombic crystal system with *P*na2$_1$ space group. Both complexes are isostructural, slightly distorted square pyramidal geometry with a [CuN_2O_2Cl] chromophore and τ_5 of 0.04 and 0.02 for complexes **1** and **2**, respectively. In the structure, the environment Cu(II) ion of both complexes is surrounded by two nitrogen atoms of the pyridine rings from a chelating dpyam ligand, two oxygen atoms of the carboxylate group from a chelating 2-OHbenz for complex **1** and 3-OHbenz ligand for complex **2** and one chloride atom from a monodentate chlorido ligand. The crystal structures of these complexes have been stabilized by various types of intermolecular interactions such as hydrogen bonding and π–π, and these supramolecular interactions have been investigated by Hirshfeld surface analysis (d_{norm}) and two-dimensional fingerprint plots.

SYNTHESIS, CHARACTERIZATION, CRYSTAL STRUCTURE AND SENSING PROPERTY OF TWO NEW ZINC(II) COORDINATION POLYMERS BASED 4,4′-BIPYRIDINE AND BENZOATE LIGANDS

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Abstract:

Two new Zn(II) coordination polymer, $[Zn_3(4,4'\text{-bipy})_2(benz)_4(fum)]_n$ (**1**) and $[Zn_2(4,4'\text{-bipy})_2(benz)_4]_n$ (**2**) (4,4′-bipy = 4,4′-bipyridine, benz = benzoate and fum = fumaraldehyde) have been synthesized and characterized by ATR-FTIR, elemental analysis, PXRD and TGA. The crystal structures of both compounds have been determined by using the single-crystal X-ray diffraction technique. Compound **1** is constructed by the linear trinuclear $[Zn_3N_4O_{10}]$ unit. These adjacent trinuclear units are linked together by 4,4′-bipy and fumaraldehyde ligands providing a three-dimensional framework. Compound **2** presents a one-dimensional zigzag chain-like structure through 4,4′-bipy ligand. The solid-state photoluminescence of both compounds were investigated. The results exhibit emission peaks at λ_{ex} of 375 nm and 370 nm for compounds **1** and **2**, respectively. The PL sensing properties of compounds **1** and **2** for the detection of various organic solvents, metal ions and anions have been studied by investigation of the quenching effect. Interestingly, the results show that both compounds present selective sensing toward acetone in acetonitrile with LOD of 1.89×10^{-3} and 7.61×10^{-3} v/v% for compounds **1** and **2**, respectively. In addition, compound **1** also shows a selective sensing for ferric ion (Fe^{3+}) in aqueous solution with the LOD of 1.28×10^{-6} mol/L.

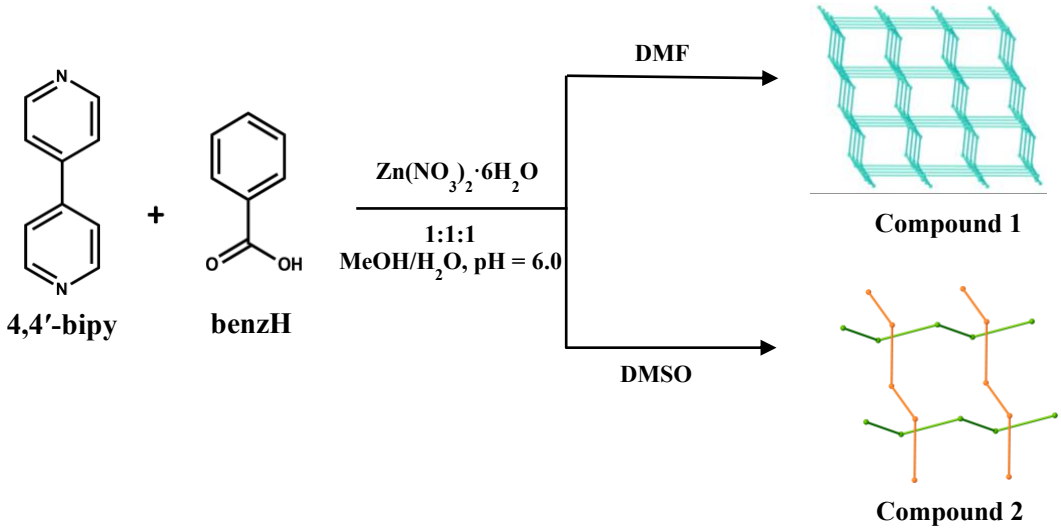

Figure 1. Synthetic route of compounds **1** and **2**

TWO NEW LUMINESCENT 3D STRONTIUM(II) COORDINATION POLYMERS WITH ALIPHATIC DICARBOXYLATE LIGANDS

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Abstract:
Two novel strontium(II) coordination polymers with aliphatic dicarboxylate ligands, [Sr(suc)] (**1**) and [Sr(fum)] (**2**), were synthesized hydrothermally and characterized using single crystal X-ray diffraction. The crystal structures of both CPs exhibit a three-dimensional network in which Sr^{2+} ions are interconnected by suc^{2-} or fum^{2-} ligands in a hexadentate coordination mode. The network structures of **1** and **2** were thermally stable up to 500 °C, according to thermogravimetric analysis. Interestingly, both CPs emits blue light in the solid state at room temperature under UV light.

TWO NEW ZINC(II) COORDINATION COMPOUNDS BASED ON IMIDAZOLE-DERIVATIVES CONTAINING LIGANDS: SYNTHESIS, CHARACTERIZATION AND CRYSTAL STRUCTURES

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Abstract:

Two new Zn(II) coordination compounds, $[Zn(bzi)_2(NCS)_2]_n$ (**1**) and $\{[Zn(bix)_{1.5}(NO_3)]\cdot NO_3\}_n$ (**2**) were synthesized by using solvothermal method (where bzi = 1-benzylimidazole, bix = 1,4-bis(imidazole-1-methylbenzene and NCS^- = thiocyanate). These compounds were characterized by powder X-ray diffraction and FT-IR techniques. The crystal structure of two new compounds have been determined by using single-crystal X-ray diffraction techniques. Compound **1** is crystallines in monoclinic crystal system with a C_2 space group. The coordination environment of Zn(II) ion is surrounded by two nitrogen atoms from bzi ligand and two nitrogen atoms from NCS^- ligand, resulting a distorted tetrahedral geometry. The bond distances between Zn–N are in range of 1.938(3) - 2.000(3) Å Å and the bond angles are in the range of 105.38(16)° - 118.8(3)° with the bite angle of 0.93°. The crystal structure of compound **1** is stabilized by C–H···S and C–H···π interactions providing 2D supramolecular network. Whereas compound **2** crystallines in the triclinic crystal system, with *P*-1 space group. The Zn(II) ion is surrounded by one oxygen atom from the nitrate group and three nitrogen atoms from different bix ligands in the distorted tetrahedral geometry. The bond distances between Zn–N/O in range of 1.993(2) - 2.023(2) Å and the bond angles are in the range of 105.17(8)° - 122.91(8)° with the bite angle of 0.93°and show the distance between Zn···Zn is 14.057 Å. Each Zn(II) ion is connected with a bix bridging ligand with *trans*-conformation, leading to a one-dimensional ladder-like chain structure. The supramolecular framework of this compound is stabilized by the presence of hydrogen bonding (C–H···O) and π–π interactions.

SESSION SP9: RADIOECOLOGY AND ENVIRONMENTAL RADIOACTIVITY

Assessment of gamma-ray dose and natural radioactivity in Satun Geopark, Thailand

Kittisak Chaisan, Thawatchai Itthipoonthanakorn, Yutthana Tumnoi, Saroh Niyomdecha, Rungroj Sakulnaeramit, Jirat Vimorkcharoensuk, Banchert Inkeaw, Saranrat Pithakpathompong, Piyawan Kittiprayok, Chitsanupong Khrautongkieo, Daruwan Chuenbubpar, Rungsak Suwanklang

Office of Atoms for Peace, Thailand
Phachirarat Sola and Ritiron Samran
Thailand Institute of Nuclear Technology (Public Organization), Thailand

Abstract:
Satun Geopark is first UNESCO World Geopark of Thailand. From the sea 500 million years to the great Geopark connecting to people's way of life, there are several Geological Attractions including caves, beaches, hot spring and fossil sites. These tourist attraction areas can be found Naturally Occurring Radioactive Material such as K-40, Ra-226, Th-232 and U-238 lead to human exposure for tourists and particularly local authorities who work in these tourist attractions. Measuring gamma-ray dose in land area of Geopark including 6 major districts by NaI carborne system, the average is 0.0624 µSv/h and the rang is 0.0214-0.2272 µSv/h. While gamma-ray dose measured by NaI backpack device in Lipe Island (including three famous beaches) are 0.065 and 0.024-0.171 µSv/h for average and range respectively. The measurement of radon concentration (highest area) from AlphaGUARD detector in important caves namely Urai Thong and Thalu are 36.39 ± 5.80 and 1,427.16 ± 65.80 Bq/m3 respectively. Moreover, the gamma activities of Back Sand samples (the famous consumer product for skin treatment) are 8.25±0.36, 44.08±9.31, 47.78±8.71 and 120.41±21.27 Bq/kg for Ra-226, Ra-228, Th-228 and K-40 respectively. These measured data and further data (environmental and other consumer product samples) will be used to determine the human dose, and preventive measures and supervision for radiation safety.

Keyword: gamma-ray dose, radon concentration, gamma activity NORM and Sutun Geopark.

Distribution of Cs-137 fallout vertically in the soil at forest plantations in Ban Gangkulasamakkee, Province of Phitsanulok

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Abstract:
Cs-137 radioactive waste from nuclear tests conducted in the 1960s has been discovered in surface soils in Thailand. This study objects to investigate the trace of fallout Cs-137 in undisturbed area of forest plantations Ban Gangkulasamakkee, Phitsanulok province. Specific activity of Cs-137 in a cm depth of soil core was analyzed using High Purity Germanium (HP-Ge) detector and gamma spectrometry analysis system. Result of this study indicates that nuclear fallout generated from nuclear tests in 1960s was deposited and distributed in soil of Ban Gangkulasamakkee, Phitsanulok province. Two of ten soil cores evident Cs-137 deposition. Calculated total deposition in year of fallout released is 9 – 16 Bq/m^2.

Measurement and Analysis of Specific Activities Rn-222 In Thanthip, Phasawan and Khao Tham Phra caves at Nakhonsawan province

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Abstract:
Radon is a radioactive gas that tends to accumulate inside homes, and it is the second lung cancer risk factor after smoking. Inside caves Thanthip Phasawan and Khao Tham Phra Nakhonsawan province locate in a granite layer, there is a higher amount of radon gas in the ground, causing more radon gas to accumulate than in a house. The reason that residents or tourists are exposed to radon through breathing and are at risk of lung cancer. Therefore, this study attempts to measure the amount of radon gas that radiated from the ground and accumulated in the cave. Radon, like many other gases, can be adsorbed onto charcoal. By counting the gamma ray activity of a bed of charcoal that has been exposed to radon gas, the radon concentrations can be measured 3 days. Radon enters through a 3/4 inch diameter hole in the top of the can, and a desiccant is included to eliminate water vapor. After sample collection, a high-purity germanium (HPGe) detection system is used to calculate the 609 keV gamma ray from Bismuth-214. This study found that the amount of radon gas are 7.740 – 31.547 mBq/liter, 11.717 – 35.359 mBq/liter and 11.134 – 21.132 mBq/liter in Thanthip Phasawan and Khao Tham Phra caves respectively. These values lower than the standard criteria of the United States Environmental Protection Agency (USEPA), which is 148 mBq/liter. The study concluded that the accumulation of radon gas in the caves does not pose a risk of lung cancer for tourists and residents who enter the caves.

AUTHOR INDEX

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