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48th INTERNATIONAL CONGRESS ON SCIENCE TECHNOLOGY AND TECHNOLOGY-BASED INNOVATION

"SCIENCE AND TECHNOLOGY FOR ADVANCING TOWARDS SDGs"

~ABSTRACT BOOK~

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Oral Session

Session A: PHYSICS / APPLIED PHYSICS

THE EFFECTS OF SOLAR ACTIVITY ON FOOD AVAILABILITY IN NIGERIA

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Abstract:

The sun is an extremely powerful source of energy, and sunlight is the largest source of energy received by the earth [1]. It varies over a broad span of timescales, from its brightening to the fluctuations commonly associated with magnetic activity giving rise to the solar activity cycle [2,3,4]. The last activity affects the terrestrial environment in different ways [1]. Hence the effects of solar activity on food availability in Nigeria cannot be overemphasized. Consequently, the impact of solar activity on food availability in Nigeria was investigated using yearly mean total sunspot number for a period of 22 years (1996-2017) [5], alongside annual crop yield data [6] for six major crops in Nigeria (cassava, yam, maize, rice, sorghum and millet). To begin with, descriptive statistics were used to determine the coefficient of variability, while correlation and polynomial regression analyses were subsequently employed to model the actual solar activity crop yield relationship as well as impact of solar activity on food availability. The model results were further validated using observed yield data for the corresponding years. The overall result from this study suggests an adverse effect of solar activity on food availability in Nigeria.

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MODIFICATION OF HADRON MULTIPLICITY RATIOS AT THE CHIRAL PHASE TRANSITION

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Abstract:
We investigate the impact of a first-order chiral phase transition and critical point on hadron multiplicity ratios. We model the dynamical expansion of the hot and dense matter created in a heavy ion collision with a Bjorken hydrodynamics expansion coupled to the explicit evolution of the chiral order parameter at center-of-mass energies from 2 to 7 GeV. Hereby, the chiral dynamics is implemented using a Langevin equation including dissipation and noise. We find a strong enhancement of the entropy-per-baryon S/A at lowest energies which is created at the non-equilibrium first-order phase transition. By mapping the initial and final S/A to a hadron resonance gas, we are able to quantify the shift of hadron multiplicity ratios.

DNA-BASED FLUORESCENT SENSORS AND PORTABLE DEVICES FOR FLUORESCENCE DETECTION

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Abstract:

Deoxyribonucleic acid (DNA) is much more than being the genetic code storage. Key examples are DNA aptamers that can fold and bind very specifically to non-oligonucleotide targets or DNA with specific oligonucleotide sequences that can bind with high affinity to toxic chemicals such as mercury ions. In the first part of this presentation, we present some modest examples of fluorescent DNA-based sensors developed in our laboratory for the detection of non-oligonucleotide targets, such as thrombin (linear dynamic range (LDR) in early nM), adenosine (LDR in early μM), mercury (II) ion (limit of quantification (LOQ) at 23.4 nM and LDR of 10.0 – 200.0 nM), cisplatin (limit of quantification (LOQ) at 10.0 nM and LDR of 10.0 – 500.0 nM), potassium ion (LOQ at 72.9 nM and LDR of 25.0 – 500.0 nM), and cysteine (LOQ at 159.3 nM and LDR of 100.0 – 1,200.0 nM). In the second part, we present an effort of mobilizing the sensors outside the laboratory for on-site and point of care detection via the developments of portable fluorescence detection devices.

INVESTIGATED THE ENERGY GAP OF NiCu COATINGS PREPARED BY ELECTROPLATING

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Abstract:
The objective of the research investigated energy gap of NiCu coatings prepared by electroplating with various $CuSO_4$ contents. The coating thickness increased with additive $CuSO_4$ into the electrolytic solution. The X-ray diffraction result presented the Ni (JCPDF 87-0712) and $Cu_{0.81}Ni_{0.19}$ (JCPDF 47-1406) chemical compositions in NiCu coating. The $Cu_{0.81}Ni_{0.19}$ phase percentages calculated by semi-quantitative from XRD that presented a rapid value with additive $CuSO_4$ over 0.1 g. The $CuSO_4$ addition in electrolytic, it supported the Cu ion amount for interaction with Ni and formed to mix-phase the $Cu_{0.81}Ni_{0.19}$. The microstructure of cross-section coatings was appeared the Stranski-Krastanov type. The UV-Vis spectrum of NiCu coatings waere calculated band gap between wavelength 450-700 nm, cut-off at 610.0 nm with band gap 2.04 eV. It could be explained that the Cu addition to the NiCu coating by electroplating technique affected the growth of the $Cu_{0.81}Ni_{0.19}$ alloy phase, which develop the band gap in the coatings.

ANALYSIS OF CHARMED LAMBDA PRODUCTION IN pp COLLISIONS AT $\sqrt{s} = 13$ TeV IN ALICE AT LHC

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Abstract:

Charmed lambda baryon Λ_c^+ is the lightest charmed baryon. A study of the production of Λ_c^+ in colliding heavy ions can lead to an investigation of the properties of the very early universe shortly after the Big Bang which is the Quark-Gluon Plasma (QGP) state. We investigated the datasets collected from pp collisions in 2016 - 2018 at $\sqrt{s} = 13$ TeV in ALICE at LHC using GRID computing with the analysis framework, AliRoot and AliPhysics. To measure the production of Λ_c^+, the hadronic decay mode $\Lambda_c^+ \rightarrow pK^-\pi^+$ was used. Due to its short lifetime and low production rate, the circular and squared topological cut were applied for particle identification separately. Those cut procedures are standard approaches to purifying particle information while retaining as many related particles as feasible, where it can be used as reference for machine learning approaches. The decay particles were implemented with invariant mass reconstruction technique to obtain the invariant mass spectra of Λ_c^+. The invariant mass spectra were implemented with event-mixing background subtraction strategy for eliminating the dominant background. After that, the fitted results are presented in several integrated transverse momentum intervals. The invariant masses of Λ_c^+ have been compared with the data from the Particle Data Group (PDG) database. The results differ from the PDG less than 0.24% and give high significance for both cut strategies.

GAMMA-RAY SHIELDING PROPERTIES OF NATURAL RUBBER/BASO$_4$ COMPOSITES AND RUBBER COMPOUND/BASO$_4$ COMPOSITES

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Abstract:
This study aims to compare the gamma-ray shielding properties of Natural Rubber (NR) and Rubber compound (RC) filled with barium sulphate ($BaSO_4$). The NR/$BaSO_4$ composites were prepared by the Dunlop method. A two-roll mixing mill was used for fabricating the RC/$BaSO_4$ composites. The different concentrations of $BaSO_4$ filler ranging between 0 - 100 phr and 0 – 150 phr was used for NR/$BaSO_4$ composites and RC/$BaSO_4$ composites preparation, respectively. The gamma-ray shielding properties were measured with ^{60}Co sources. The results indicated that the RC/$BaSO_4$ composites showed a higher linear attenuation coefficient (μ_l) than the NR/$BaSO_4$ composites. The linear attenuation coefficient (μ_l) was increased with the increase of fillers concentrations. The highest μ_l was 0.40 and 0.23 m^{-1} for the RC/$BaSO_4$ composites and the NR/$BaSO_4$ composites, respectively. The highest mass attenuation coefficient (μm) was found at 50 phr of $BaSO_4$ filler. They were 0.25 and 0.38 cm^2/g for the RC/$BaSO_4$ composites and the NR/$BaSO_4$ composites, respectively. For the half value layer (HVL), it was decreased with the increase of $BaSO_4$ in the composites. The lowest HVL of the RC/$BaSO_4$ and the NR/$BaSO_4$ composites were 1.74 and 3.00 cm, respectively.

STUDY ON CORROSION RESISTANCE OF DLC FILM COATED ON THE TENSIONED TITANIUM SUBSTRATE

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Abstract:
The objective of this research is to study on corrosion resistance of DLC film coated on the tensioned titanium substrate. DLC, Si-DLC and Si-N-DLC films were prepared from a gaseous mixture of C_2H_2, C_2H_2:TMS, and C_2H_2:TMS:N_2 by Plasma Based Ion Implantation (PBII) technique. All of the films were deposited with a film thickness of 500 nm on a titanium Ti-6Al-4V substrate. The adhesion strength of the films to sample substrates were measured by the scratch tester. All coated samples were tensioned with 3%, 5% and 7% elongation. The surface morphologies of the film after tensioned were measured by Scanning Electron Microscope (SEM). The corrosion resistance of films after tensioned was conducted by potentiodynamic polarization experiments in Ringer's solution. The results indicate that Si-N-DLC film had highest adhesion strength of the films to sample substrates of 30.47 N. Moreover, Si-N-DLC film with 3% elongation had a corrosion potential (E_{corr}) value of -0.221 V.

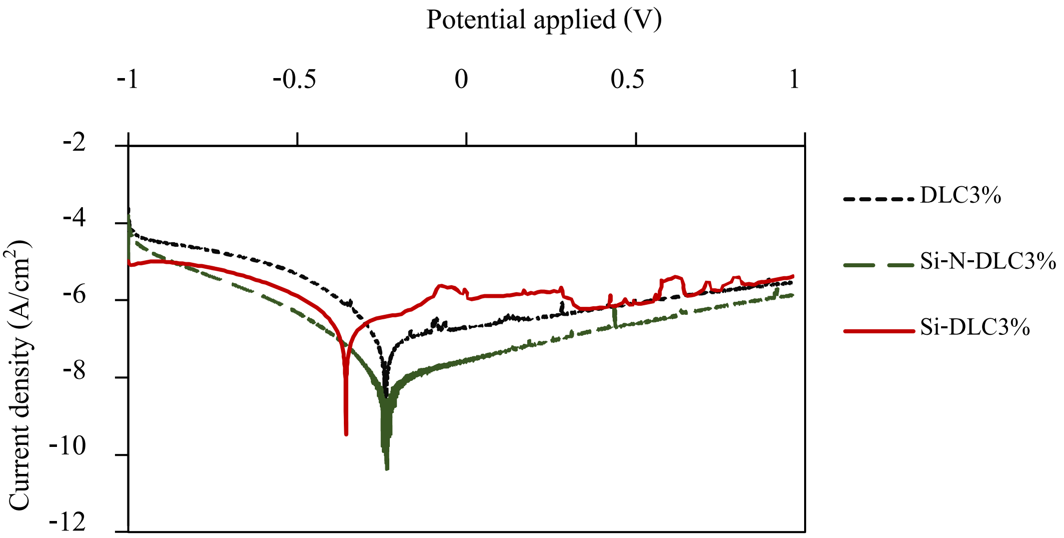

Figure 1.
Potentiodynamic polarization curve of DLC, Si-DLC and Si-N-DLC films at 3% elongation.

THEORECTICAL STUDY OF SPIN CROSSOVER MATERIALS ON 2D MATERIALS

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Abstract:
Aiming for investigation of a suitable substrate for a spin crossover (SCO) molecule, namely, [Fe(salEen-I)$_2$]anion, we probe several nitrogen ratios on Cu substrate: Cu(001), Cu_3N/Cu(001), Cu_2N/Cu(001), and CuN/Cu(001). To explore the SCO-substrate interaction, first-principles density functional theory calculations within Perdew-Burke-Ernzerhof (PBE) functional and DFT-D3 method are carried out to treat the exchange-correlation interaction and vdW interaction, respectively. From the analysis of electronic structures of the SCO on the substrates with respect to that of the SCO free molecule, we propose that Cu_2N/Cu(001) is a suitable substrate for [Fe(salEen-I)$_2$]anion for spin-related applications. By introducing nitrogen on the Cu surface as Cu_2N, the electronic structure of SCO-Cu_2N/Cu(001) compound is minimally deviated from that of the SCO free molecule, implying weak interaction between the SCO and Cu_2N/Cu(001) substrate as well as the preservation of the SCO bistability functionality. Based on the total-energy calculations of various adsorption geometries and binding sites, the iodine atoms of the SCO are likely to be diagonally deposited on copper atoms of the Cu_2N/Cu(001) substrate in a low-spin state. The energy difference between the high- and low-spin states of this adsorption geometry is 2.509 kJ/mol.

AN ATTENUATION OF SOLAR RADIATION BY DIFFERENT CLOUD TYPES AT NAKHON PATHOM

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Abstract:
Clouds can attenuate the solar radiation by scattering, reflecting, and absorbing processes. During a direct obstacle of the sun by clouds, an amount of the solar radiation intensity changes in both direct and indirect ways. Clouds normally change in types, heights, or shapes, which are complicated to measure, especially in a tropical area. Therefore, in this study, an attenuation of broadband solar radiation or global solar radiation by clouds, which are divided into three levels: low clouds, middle clouds, and high clouds was investigated. All measured data were conducted in Nakhon Pathom Province using a ceilometer, pyranometer and sky view. Then, these data were used to determine a cloud modification factor (CMF) with in one minute of interval during the year of 2019 - 2020. From the analyzed results, the most amounts of clouds occupied in the sky were mid – level clouds and the highest value of CMF was found to be 0 – 25%. For this case study, the stratus clouds delivered the highest CMF compared to other clouds found on the selected date. The results obtained in this work can be used to estimate solar radiation for generating an electricity from solar cells.

THE INVESTIGATION OF UNSATURATED POLYESTER RESIN CONTAINING BORON CARBIDE FOR USE AS NEUTRON SHIELDING

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Abstract:

Neutrons were electrically neutral that can penetrate through materials and interact with the nuclei of atoms. They can emit different ranges of energy, which can be harmful to humans and the environment. This research presents the study on thermal neutron (0.025 eV) shielding properties of unsaturated polyester resin containing boron carbide content in the range of 0 – 20 wt% for use as neutron shielding materials. The interactions between thermal neutron and materials with 5 cm thickness were simulated by FLUKA program. The total cross-section, mean free path, and half-value thickness were also calculated. The results showed that total cross-section increased while mean free path and half value thickness decreased trend when the boron carbide content increased. Furthermore, the polyester resin containing boron carbide at 20%wt has the best properties for shielding thermal neutrons.

THE ELECTRIC POTENTIAL AND ELECTRIC FIELD ON CONDUCTING MATERIALS

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Abstract:
This research work is a part of the space technology startup project. The company is interested in many material removals by the new company's invention. The main idea of this alternative method is the attractive force from an electric induction. Assuming that the conducting materials which are supposed to be space debris are lying between the positive and negative circular electrodes. These circular electrodes are connected to the electrical generators. The electric charges in the conducting materials are induced by an external electric field generated from these electrodes. The electric potential and electric field on a conducting surface are calculated by an image charge method. The value and the position of an image charge are specified by the Dirichlet condition. For simplicity, the image charge position is lying on a line between the center of a circular electrode and the center of a conducting sphere. However, this approximation method can be used well when the conducting sphere is moving near the central axis of an electrode or far away from an electrode due to the symmetry of the circular electrode. The result of the electric potential for near-field and far-field approximation up to the second order is shown in this article. Referring to the result, the electric field and electric potential will gradually be stronger if the conducting sphere is moving away from the central axis for near-field approximation while the far-field approximation gives the result in the opposite direction.

OBSERVED CONVERSION OF ELECTROMAGNETIC ENERGY TO PLASMA PARTICLE ENERGY AS A FUNCTION OF FREQUENCY IN KELVIN-HELMHOLTZ WAVES AT EARTH'S MAGNETOPAUSE

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Abstract:
Energy conversion between electromagnetic fields and plasma is a key issue in understanding the nature of high energetic particles around the Earth. We investigated the energy conversion in the event featuring Kelvin-Helmholtz waves at the dusk flank magnetopause on 8 September 2015. We analyzed the in situ data from NASA's Magnetospheric Multiscale (MMS) mission with four spacecraft in a close tetrahedral formation. We reported the electromagnetic energy conversion via $\boldsymbol{J} \cdot \boldsymbol{E}$ from the components of the electric field parallel and perpendicular to the local magnetic field. We also investigated the total energy conversion in the frequency domain. We found that most electromagnetic energy is converted into plasma kinetic energy via the perpendicular electric field. A significant amount of energy conversion is from the near-zero frequency electric field. For a parallel electric field, the contribution is significantly lower than the perpendicular field. However, the main parallel contribution comes from the frequency of around 1 Hz and may provide a physical mechanism for energy conversion.

THE SIMULATION OF THE BAND STOP 2.45 GHz FREQUENCY SELECTIVE SURFACE FOR A MICROWAVE OVEN APPLICATION

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Abstract:
Without proper caution, microwave leakage from a microwave oven door can be harmful to users' health. In practice, the leaked radiation has to be blocked while the visible light is allowed to pass for a visual inspection inside the oven by the metal grid at the front door. The metallic mesh is commonly known as the frequency selective surface (FSS). A typical microwave oven front door with a circular perforated metal sheet provides low shielding effectiveness (<27 dB) and poor visibility (<50 %). On top of that the level of microwave leakage should not exceed 5mW/cm^2 at 5 cm away from the oven's door while in operation to comply with a safety regulation. In this study, an alternative design of FSS as the gridded square loop configuration was proposed and studied. The simulation study was conducted by COMSOL software in terms of two important characteristics, i.e., shielding effectiveness (SE) and optical transparency (OT). The SE and OT of the proposed structure were found to be 67.8 dB and 64.7%, respectively at normal incidence. For the shielding ability, 3.62 mW/cm^2 of leaked microwave, not exceed the safety condition, was determined from the simulation. The studies on the proposed FSS characteristics due to oblique incident angle were also explored and found to be stable up to 60° incident angle with dual polarization states (TM and TE). In all, the simulation results show a potential of the alternative design for a microwave shielding. This design may be implemented for any microwave shielding applications such as microwave oven door in which a low level of microwave exposure is a major safety concern for a microwave user.

QUANTUM DIAMOND SPECTROMETER FOR MAGNETIC FIELD SENSING

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Abstract: We build a quantum diamond spectrometer (QDS), outlined by Bucher et. al, to study the fluorescence of the nitrogen-vacancy (NV) center in diamond, a quantum defect that can be used as a qubit or quantum sensor. The QDS has several advantages to a traditional confocal microscopy, particularly in terms of measurement speed. The setup consists of a green laser excitation onto the diamond that is placed on an optical light guide for fluorescence detection. A microwave loop is then placed onto the diamond to deliver oscillating magnetic field to probe the NV center transition. Finally, permanent magnets are attached to a kinematic stage for tuning the transition energy of the NV center. With this setup, we can adjust the magnet distance, azimuth angle, and polar angle with reference to the NV center axis for optimizing NV center fluorescence. We demonstrate measurements of NV center fluorescence as a function of microwave frequency and show the intensity drop at 2.87 GHz, showing the interaction at zero-field splitting, and measurements of the Zeeman splitting of NV center electronic spin from an external magnetic field in different orientations. The results can be used to perform vector magnetometry, which has potential applications in quantum sensing.

SYSTEMATIC INVESTIGATION AND CORRECTION OF THE MAGNETIC HYSTERESIS OBTAINED BY VIBRATING SAMPLE MAGNETOMETRY

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Abstract: Vibrating sample magnetometry (VSM) is a powerful technique to investigate the magnetic properties of matters. One important drawback of this technique is the ‘open-loop’ setup which can significantly distort the exact magnetic properties. Thus, appropriate corrections, especially in the strong ferromagnet such as permanent magnets, are required. In this work, we design the systematic experiments by varying the length/radii ratio between 1-5 and provide the step-by-step corrections of two commercial NdFeB powder magnets with reported energy product ($(BH)_{max}$) of 5.5-6.5 and 12.2-13.2 MGOe. It is seen that the raw VSM hysteresis loops contain the paramagnetic-like slope and unsaturated curve which directly pervert their magnetic properties. These effects could be experienced from the equipment calibrations, characteristic of powder sample, and ‘open-loop’ setup. These hysteresis loops give the calculated $(BH)_{max}$ of 47.3–62.6% compared to their reported values with improper values of saturation magnetization (M_s), remnant magnetization (M_r) and M_r/M_s ratio. In order to correct the measured VSM hysteresis loop, firstly, the paramagnetic-like slope of 0.0500-0.0735 G/Oe was subtracted until the flat at high fields was obtained. Then, up to 6% of magnetization value and demagnetizing factor (N) of 0.30-0.53 was applied to achieve the similar hysteresis loops for all samples. The corrected $(BH)_{max}$ after all processes is around 86-95% of the reported values. Moreover, the samples with different packing densities were also examined. The results show that the loose-packed samples exhibit hysteresis distortion which could be caused by an unwanted magnetostatic interaction and degree of particle rotation of the powder. This work demonstrates the importance in preparing and interpreting the VSM results and might be a facile way to get credible magnetic performance without performing the magnetic alignment of such permanent magnets.

DESIGNING OF ONE-DIMENSIONAL MICROPHONE ARRAYS FOR AN ACOUSTIC CAMERA BY USING MACHINE LEARNING

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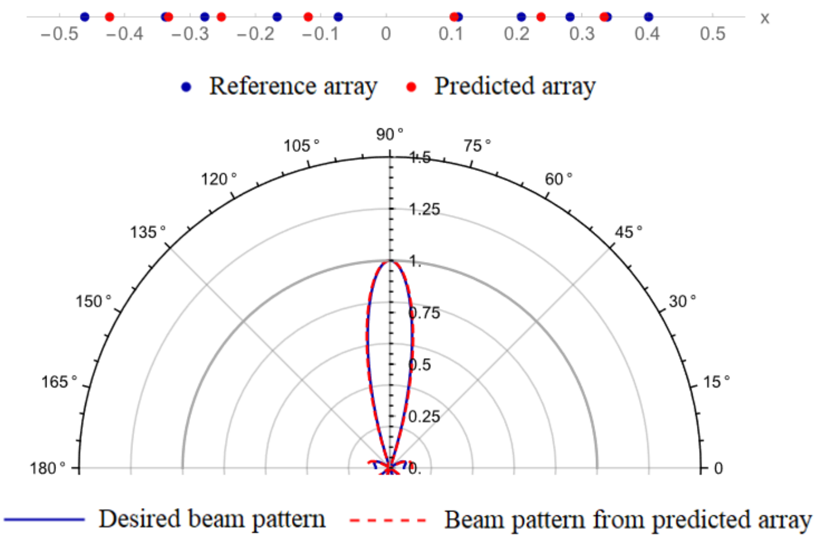
Abstract:

The performance of an acoustic camera is described by directivity pattern, i.e., main lobe size, side lobe size, and the number of side lobes. Designing a microphone array for an acoustic camera to a specific performance requirement can be tedious. It requires numerical optimization among array aperture width, microphone positions, and the number of microphones. This work aims to predict the arrangement of microphone array from the desired beam pattern using machine learning, Deep Neural Network (DNN). The DNN model was trained from 66,680 designs of microphone arrays and beam patterns of 1,000-Hz sound. Three different DNN models were created based on activation functions of hidden layers: ReLU, linear, and sigmoid. The results showed that the median percentage errors of predicted beam patterns for the desired beam patterns were 11.22%, 19.66%, and 9.55%, respectively. The median percentage changes of the array aperture widths were 8.17%, 7.92, and 3.72% smaller than those of the reference widths. The median percentage change of the microphone number showed no difference for the predicted and reference microphone counts from all models. In conclusion, the sigmoid DNN model can predict the arrays that provide the best performance compared to the ReLU and linear DNN models.



Comparison of reference array and predicted array (top)
and their beam patterns (bottom)

Session B:
BIOLOGICAL SCIENCES

DEVELOPMENT AND PRODUCTION OF *Penaeus stylirostris* DENSOVIRUS-LIKE PARTICLE LINKED DOUBLE STRANDED RNA SPECIFIC TO *RR2* GENE OF WHITE SPOT SYNDROME VIRUS

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Abstract:
White spot disease caused by a white spot syndrome virus (WSSV) has threatened shrimp aquaculture industry worldwide. It is well known that double-stranded RNA (dsRNA)-mediated RNA interference can be employed to suppress viral replication in shrimp. The previous study showed that dsRNA specific to the *rr2* (ribonucleotide reductase small subunit) gene of WSSV (dsWSSV-*rr2*) could give a promising protective degree against WSSV. However, the development of dsRNA cargo is needed to promote the uptake and protect dsRNA from the nucleolytic enzyme in shrimp hemolymph. Therefore, this study aimed to simultaneously produce dsRNA joined its cargo, known as the virus-like particle (VLPs), in a prokaryotic expression system. DsWSSV-*rr2* was first cloned into a plasmid harboring capsid gene of *Penaeus stylirostris* densovirus (pET28a-cp*Pst*DNV) and transformed into a competent *E. coli* cell. The recombinant clone was then cultured in a selective LB medium, and the expression of recombinant counterparts (Linked cp*Pst*DNV-ds*rr2*) was induced by the addition of IPTG. The result showed approximately 37 kDa recombinant protein associated with roughly 400 bp dsRNA in the novel construct. Moreover, the *Pst*DNV VLPs could be observed under the transmission electron microscope following purification by affinity chromatography. The efficiency of Linked *Pst*DNV VLPs-ds*rr2* to reduce and delay shrimp mortality caused by WSSV needs further investigation.

PROTECTIVE ANTI-INFLAMMATORY EFFECT OF OXOCREBANINE FROM *Stephania pierrei* TUBER AGAINST ACUTE LUNG INJURY

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Abstract:

Acute lung injury (ALI) and its more severe form, acute respiratory distress syndrome (ARDS), are acute pulmonary inflammatory conditions that are associated with high morbidity and mortality rates, but specific treatment options are limited. Plant-derived bioactive natural compounds have been shown in animal models to be effective in the treatment of ALI by suppressing lung inflammation. Oxocrebanine, an aporphine alkaloid from *Stephania pierrei* tubers, has been shown to possess an anti-inflammatory effect in lipopolysaccharide (LPS)-activated murine macrophages. This study aimed to access oxocrebanine's anti-inflammatory effect in mouse alveolar epithelial (MLE-12) cells and ALI in C57BL/6 mice induced by LPS. The results revealed that oxocrebanine exerted considerable anti-inflammatory effects in activated MLE-12 cells by suppressing pro-inflammatory mediators including inducible nitric oxide synthase (iNOS), interleukin (IL)-1β, and IL-6 via the inactivation of nuclear factor κB (NF-κB), p-stress-activated protein kinase (SAPK)/c-Jun N-terminal kinase (JNK), p38, and Akt/p-glycogen synthase kinase3β inflammatory signaling pathways. Furthermore, intraperitoneal administration of oxocrebanine suppressed lung pathological alterations, lung edema, and inflammatory cell infiltration in lung tissues induced by intranasal LPS injection. Oxocrebanine lowered the levels of tumor necrosis factor-α and IL-6 in bronchoalveolar lavage fluid and serum, as well as iNOS protein expression in lung tissues, in ALI mice. The mechanism of action of oxocrebanine on the attenuation of ALI was due to the suppression of NF-κB, SAPK/JNK, p38, and Akt signaling proteins. Our findings highlight oxocrebanine's potential anti-inflammatory properties as a therapeutic agent in the treatment of ALI.

INSULAR HERPETOFAUNA DIVERSITY OF KO TAO, KO PHA-NGAN, KO SAMUI AND MAINLAND AREA OF SURAT THANI PROVINCE, THAILAND

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Abstract:
Insular herpetofauna are wildly underassessed and especially vulnerable due to encroachment by humans. We have compiled a comprehensive list of the herpetofauna in Surat Thani Province focusing on Ko Pha-ngan and surrounding islands and mainland area. Transect surveys by foot, road cruising, drift line and pitfall traps and community notification were all utilized from January 2020 to July 2022. The number of species detected by survey and trapping is greatest on Ko Pha-ngan (45) as that is the island we are stationed. When including notifications via Facebook or personal correspondence requesting identification of a species, the main land area of Surat Thani Province has the most species with 81 counted thus far. As the distance from the mainland increases the number of species on each island decreases. Ko Tao has the least number of species detected with a total of 16 and it is the furthest away (121 km). Ko Tao is absent of the iconic King Cobra (*Ophiophagus hannah*) and true cobra *Naja kaouthia*; however, the island has the endemic Ko Tao caecilian. According to Thai law, thirteen snake species with Ko Samui having nine and Ko Pha-ngan and Ko Tao having only five and four, respectively, are protected. Two species of amphibian, one turtle, and seven lizard species found in the surveyed area are also under protection. According to Thailand Red List, Water Dragon (*Physignathus cocincinus*) is endangered. Black Marsh Turtle (*Siebenrockiella crassicollis*) is also listed as vulnerable but IUCN lists it as globally endangered. During this study, White Spotted Slug Snake (*Pareas margaritaphorus*), was discovered on Ko Pha-ngan when never previously recorded, seen or known as present. This species is potentially important as it is a specialized terrestrial snail and slug eating snake. In addition, another venomous species, Small Spotted Coral Snake (*Calliophis maculiceps*), was detected after thought to be locally extinct as it had not been detected for over 6 years. Puddle Frog (*Occidozyga martensii*) was the most abundant amphibian, Common Forest Lizard (*Calotes versicolor*) was the most common lizard and Vine Snake (*Ahaetulla prasina*) was the most common snake species. Additional monitoring is required to better understand the endemic species and their relationship to the other fauna on the islands in addition to the impact tourist driven development and habitat destruction has on a species with a insularly finite habitat.

DEVELOPMENT OF MICROSATELLITE MARKERS AND SCREENING IN TWO-SPOTTED CRICKETS (*Gryllus bimaculatus* De Geer, 1773)

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Abstract:
Molecular markers are utilized to study the genetic variation of any population. Specially, simple sequence repeats (SSRs), also known as microsatellites. However, traditional SSR marker development approaches are laborious and time consuming. Therefore, the current study proposes using the Basic Sequence Alignment Tool (BLAST) to find polymorphic SSRs in *Gryllus bimaculatus* genomes. 25 polymorphic SSRs were found from 400 randomly selected sequences from the whole genome using an *in silico* method. The *in silico* method is also validated using DNA amplification, in which, 6 out of 12 primer pairs were able to amplify DNA fragments with expected size. The developed polymorphic SSR markers can be used to study the genetic variation of *G. Bimaculatus* and other related species. The alternative approach proposed in this study will be valuable for developing SSR markers from genomic and transcriptomic sequence data in other species.

INHIBITORY EFFECT OF *Carissa carandas* Linn. EXTRACT ON ADIPOGENESIS AND LIPID ACCUMULATION OF 3T3-L1 ADIPOCYTE

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Abstract:
In this study, we aimed to investigate the anti-obesity activity of *Carissa carandas* Linn. (CC) extract and its possible mechanism on 3T3-L1 adipocytes. CCA and CCE were obtained from ripe fruit by aqueous and ethanol extraction, respectively. CCE contained higher amounts of phenolic, flavonoid, and anthocyanin compounds than CCA. CC extracts treatment up to a concentration of 400 μg/mL had no cytotoxicity in 3T3-L1 cells. CCE (200-400 μg/mL) treatment during 12 days of adipocytes differentiation exhibited a dose-dependent reduction of lipid accumulation compared to the control ($p<0.05$) whereas CCA at 400 μg/mL significantly possessed this inhibitory activity. Interestingly, CCE treatment (100-400 μg/mL) of 3T3-L1 cells for 72 hours during initiation of adipocytes differentiation significantly suppressed lipid accumulation in a dose dependent manner. Thus, CCE was selected to further analyze expression of adipogenic genes. Notably, CCE treatment of 3T3-L1 cells at 400 μg/mL significantly suppressed the expression of major adipogenic transcription factors, including CCAT/enhancer-binding proteinα (C/EBPα) and peroxisome proliferator-activated receptorγ (PPARγ). Therefore, the inhibition of adipogenesis by regulating the expression of C/EBPα and PPARγ by CCE occurred primarily in the early stages of differentiation. Overall, *C. carandas* extract demonstrated anti-adipogenic activity, which has a potential effect in anti-obesity in 3T3-L1 adipocytes.

THE EXISTENCE OF *Platerodrilus* BEETLES IN NAKHON SI THAMMARAT PROVINCE, SOUTHERN THAILAND

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Abstract:
This study reports the existence of neotenic net-winged beetles (*Platerodrilus sinuatus* group) for the first time from Nakhon Si Thammarat province, southern Thailand. These insects are terrestrial and mostly found in rainforest habitats. They prefer to live on dead wood, forest litter, and soil with a higher organic matter content. In these beetles, the males and females are morphologically different. Though the males undergo complete metamorphosis and become fully winged adults, the females do not pupate and stay in larval morphology even when they are sexually matured. Females are longer than males. Due to the winglessness of the females they are not able to disperse so far. Whereas, the males look like other typical lycid beetles and they can fly for a short distance. In this study, three females were observed in 'Khao Mahachai' mountain located in Nakhon Si Thammarat Rajabhat University area, Nakhon Si Thammarat province, and their photographs were taken. This mountain has tropical moist evergreen forest. The first female was observed in July 2020 which was 3.84 cm long, the 2nd one was observed in November 2020 which was 2.92 cm long, and the 3rd female was observed in May 2021 which was 4.78 cm long. Unfortunately, no male was obtained through using light traps since *Platerodrilus* males do not respond to light traps. To our knowledge, this is the first photographic record and published report on the existence of *P. sinuatus* group beetles in southern Thailand. Reporting these *P. sinuatus* group beetles is important for their conservation in Thailand. For doing this, protection and preservation of mountainous rainforests in Thailand are necessary.
Keywords: Animal conservation, mountainous rainforest, Nakhon Si Thammarat Rajabhat University, *Platerodrilus* beetles

DEVELOPMENT OF DNA VACCINE AGAINST TUBERCULOSIS

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Abstract:
Worldwide tuberculosis (TB) is the 13th leading cause of death. TB along with HIV and malaria, remains one of the "big three" infectious diseases globally. Currently, BCG is the only licensed vaccine against TB used in children. Therefore, the development of DNA vaccine is pursued which may prove more efficacious and cost effective for providing protection against TB.

M. tb-specific immunogenic genes were used as potential candidates for the DNA vaccine approach. Each gene was cloned, constructs were sequenced and sub-cloned in mammalian expression vector for optimal expression *in vitro* and *in vivo* conditions. All of the constructs gave significantly high expression levels in the 293T cell line. For *in vivo* studies, eight-week-old female Balb/c mice were divided into five groups including positive and negative control groups, inoculated intradermally with endotoxin-free DNA constructs and were bled as per schedule. The antibodies were confirmed by Western blot (WB) analysis and their plasma level was monitored by the multiplex micro-bead immunoassay. The study concludes that DNA vaccines produced significant immunologic responses in the mouse model. However, further study is needed with the use of more immunogenic genes before starting clinical trials.

CHARACTERIZATION OF RUBBER DEGRADATION BY ACTINOMYCETES ISOLATED FROM RUBBER PLANTATION SOIL

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Abstract:
Recently, the quantity of rubber wastes, especially medical latex gloves, has been increasing dramatically due to the COVID-19 pandemic. The processes of rubber waste management are highly toxic, causing long-term health and environmental problems. This research objectives focused on isolation and characterization of actinomycetes in the soil collected from the rubber (*Hevea brasiliensis*) plantation in Wangchan District, Rayong Province, Thailand, which could degrade natural rubber, processed natural rubbers, and synthetic rubbers. The rubber-degrading actinomycetes were isolated and screened from soil samples by observing the formation of clear zones on latex overlay agar (Figure 1). The results revealed ten isolates of bacteria (RD01-10) capable of degrading natural rubber, exhibiting colony/clearing zone ratios in the range between 1.36 and 2.46. The efficiency of all bacterial isolates in rubber degradation was further investigated on different types of rubbers in liquid medium. Bacteria-treated rubber gloves were then analyzed with FT-IR spectroscopy, which confirmed the presence of aldehyde and ester groups, suggesting that polyisoprene was broken down into isoprenoid aldehydes by the rubber-degrading enzymes. When the treated rubber gloves were examined under a scanning electron microscope (SEM), it was found that the surface was densely colonized with bacterial colonies and displayed increased roughness (Figure 2). The findings of competent rubber-degrading actinomycetes would bring alternative methods for the sustainable and environmental-friendly rubber waste management.

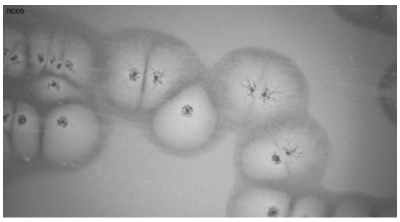

Figure 1. Clear zones around colonies of RD09 on latex overlay agar.

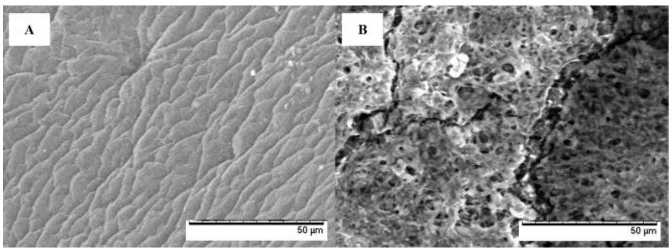

Figure 2. SEM micrographs of latex gloves: (A) control latex glove and (B) latex glove after incubated with RD03 for 15 days.

RECOMBINANT HUMAN SECRETORY LEUKOCYTE PROTEASE INHIBITOR COATED TITANIUM MATERIAL ENHANCED OSTEOBLAST ADHESION

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Abstract:
A decline in bone healing potential is observed in the elderly, and this may result in increased rates of morbidity. Therefore, any strategies that can enhance osteogenic activity could benefit to fracture healing. Titanium (Ti) and its alloys are widely used for medical and dental implant devices, especially bone fixators. It is challenging for scientist to coat on Ti surface with several substances for enhancing bone healing process. Several studies showed pre-treatment of osteoblast with secretory leucocyte protease inhibitor (SLPI) seem to benefit for enhancing osteoblastic activity. However, pre-treatment of SLPI on osteoblast prior to adherence on materials 'surface seem unpractical in real clinical settings. Therefore, this study aims to elucidate the effect of rhSLPI coated on Ti surface to enhance human fetal osteoblastic cells (hFOB 1.19) adhesion. Cell adhesion was evaluated by seeding hFOB1.19 at density 5×10^4 cells/well on the bottom of a 24-well polystyrene culture plate or Ti surface for 20 min. Then, culture medium was aspirated from the wells and non-adherence cells were washed out twice with phosphate buffer saline (PBS). The adherence cells were cultured further for 2 h before subjected to cell viability by MTT assay. The results showed that optimum timing for osteoblast adhesion was 20 min, which was used throughout the experiments. In addition, 1 μg/ml of rhSLPI coated on 24-well polystyrene culture plate or Ti surface could significantly enhance osteoblast adhesion (Figure 1A, 1B). In conclusion, this study showed for the first time that recombinant human SLPI coated on culture plate surface and Ti surface potentially induce osteoblast adhesion. Further study on osteoblastic activity, differentiation, and mineralization should be investigated.

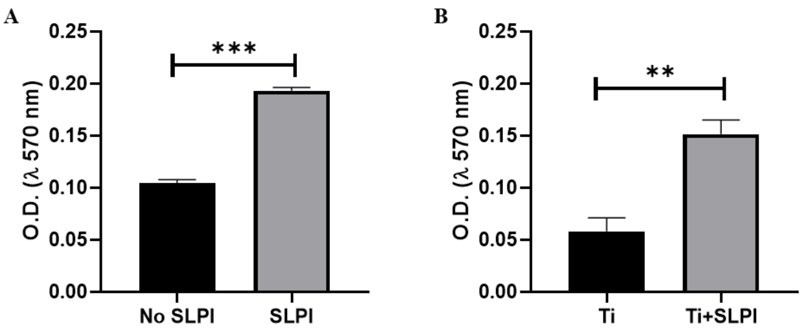

Figure 1. The effect of rhSLPI coated on 24-well polystyrene culture plate (A) or Titanium surface (B) on osteoblast adhesion

NOVEL ANIMAL LIKE-RAW STARCH DEGRADING α-AMYLASE FROM *Roseateles terrae* HL11 AS POTENTIAL BIOCATALYST FOR APPLICATION IN CASSAVA PULP SACCHARIFICATION

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Abstract:
In-depth understanding the biochemical characteristics of starch-hydrolyzing enzymes are the way to advocate the starch-based biorefinery development. In this work, a novel raw starch-degrading α-amylase isolated from *Roseateles terrae* HL11 (HL11Amy) was firstly expressed as a recombinant enzyme in *Escherichia coli* BL21(DE3) and functional characterized. In-depth evolutionary analysis revealed that HL11Amy was classified into glycoside hydrolase family 13 subfamily 32 (GH13_32). Interestingly, HL11Amy shared many amino acid motifs with true animal α-amylases and animal-like α-amylases. It contains four protein domains consisting of domain A, domain B, domain C and starch binding domain classified as carbohydrate-binding module 20 (CMB20) facilitating raw starch granule binding. HL11Amy greatly performed under a broad range of moderate temperatures (30–55 °C) and a wide range of pH (4.0–6.0) with a specific activity of 6,270 U/mg protein and 1,030 raw starch-degrading (RSD) U/mg protein toward soluble starch at optimal condition. Remarkably, HL11Amy capable hydrolyzed both raw and gelatinized forms of various substrates with the highest catalytic efficiency (k_{cat}/K_m) on starch from rice, followed by potato and cassava, respectively. In addition, HL11Amy exhibited effective hydrolysis of cassava pulp (CP) by releasing maltooligosaccharides as products. The reducing sugar yields were 736 and 183 mg/g starch from gelatinized and raw CP that equivalent to 72% and 18% conversion based on starch content in the substrate, respectively. These demonstrated that HL11Amy represents a promising raw starch-degrading enzyme with potential applications in environment friendly biorefinery system with non-thermal process development.

SUSTAINABLE MANGROVE ENVIRONMENT AND BIODIVERSITY OF GASTROPODS AND CRABS: A CASE STUDY ON THE EFFECT OF MANGROVE REPLANTATION UNDER ECOTOURISM AND RESTORATION IN KO LIBONG, TRANG, THAILAND

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Abstract:
The relative abundance and diversities of gastropods and crabs were assessed for mangrove areas of Ko Libong, Kantang district. Trang, Thailand in June 2022. Two sample sites (I and II) were studied. The site I was replanted under ecotourism, whereas site II represented the protected natural restored mangroves. This study is aimed to assess faunal diversity could become re-established and resemble to natural restored mangroves. There was one sample plot at each study site with the dimension (10m x 25m) in study site I and (20m x 30m) in site II. The sample was randomly taken from each plot by using a quadrate measuring at 1 m x 1 m (1 m^2) in site I and 3m x3m (3m^2) in site II; there were four quadrates in total of each site. The species richness (S), Shannon Index (H') and Evenness Index (J'), vegetative measurements and physico-chemical parameters were calculated for each site. Seventeen gastropod species belonged to 11 families and six crab species under two families were collected in both study sites. Overall, in gastropod species, the highest relative abundance of *Nerita planospira* exhibited (53.45%, category C) with lower population density (1.61 individuals/m^2) was observed in study site II and for crab species, *Parasesarma plicatum* (83.33%, category C) with lower population density (0.33 individuals/m^2). The diversity indices of gastropod species at the study site I was calculated in higher indicating by (S= 12, H'= 2.27, J' and SDI=0.91) compared to study site II (S= 7, H'= 1.22, J' and SDI=0.63, 0.62). For the crabs, (S= 4, H'=1.33, J' and SDI=0.96, 0.9) in study site I and (S= 2, H'=0.64, J' and SDI=0.92, 0.67) in site II. Overall, the higher species diversity indices of study site I can be categorized in a "very equally" with a very good category according to evenness criteria (>0.81). This can be gained by increasing restoration sites through an ecotourism replanting program for achieving the goals of sustainable development for mangrove conservation and long-term studies are required to confirm this hypothesis.
Keywords: biodiversity, replantation, ecotourism, restoration, population

BIODEGRADATION OF PLASTIC WASTE BY YELLOW MEALWORMS (*Tenebrio molitor* LARVAE)

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Abstract:
Plastics are ubiquitous across the world, lacking degradability properties making plastic one of the most global environmental concerns. Plastic usage is exponentially growing than it did in the past, especially during the COVID-19 outbreak, reaching overall plastic production of 360 million tons in 2021. Biodegradation of plastic is an emerging field in microbiology. In this study, the mealworm larvae were fed with different types of plastic as their sole diet. Over the course of a month, mealworm larvae consumed more polyvinyl chloride (0.1921 g/ 30 days) content than other types of plastics, which was evident from their survival rate (94.8727 ± 0.0264%) and normal life cycle. A possible PVC-degrading bacterial strains were isolated from guts of the mealworms. Based on 16S rRNA gene and phylogenetic analysis, they were identified as *Enterobacter xiangfangensis*. The strains were able to survive over 60 days in carbon free basal medium with PVC film as sole carbon source. To the best of our knowledge, as *E. xiangfangensis* has been recently discovered in the past decade, little information has been provided regarding the plastic degradation of this organism. This study is the first to suggest that this species may be involved in the disintegration of PVC. However, biodegradability of plastic by microorganisms is a relatively slow process; using mealworms and microorganisms in combination could be a viable strategy for minimizing plastic waste in the environment.

Keywords: Plastic biodegradation, *Enterobacter xiangfangensis*, *Tenebrio militor*

CORDYCEPS EXTRACT-LOADED NANOPARTICLES PROMOTES COLLAGEN SYNTHESIS AND ENHANCES WOUND HEALING

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Abstract:

The most common cause of slow-healing wounds is a loss of fibroblast function and a decreased response to tissue injury. Cordycepin, a bioactive compound of *Cordyceps militaris*, is the potential herbal bioactive compound, which has various activities, including antioxidant, anti-inflammatory, and tissue remodeling process. The aim of the present study was to improve the effective of cordycepin, and evaluate the synthesis of collagen and elastin by dermal fibroblasts to support wound healing activity. Human dermal fibroblasts were cultured and treated with cordycepin, cordycepin medium (CM), and CM-loaded cassava starch nanoparticles (CMP). The treated cells were evaluated, including cell proliferation, gene expression of collagen and elastin, protein expression of type 1 collagen (Col1A1), and wound healing activity. The result showed that CMP could significantly increase cell proliferation up to 10-fold, gene expression of Col1A1, KRT18, and Elastin up to 2.44 to 5.53-folds, when compared with the untreated control cells. In addition, CMP could promote Col1A1 up to 27-, 21- and 3-folds, comparing to the untreated control, cordycepin, and CM, respectively. Noteworthy, CMP improved the potential of wound healing activity 12-, 4.46- and 3.12-folds, when compared to the untreated group, cordycepin and CM, respectively. Thus, this evidence supported that the encapsulated nanoparticle of CMP could enhance the efficiency of wound healing process in human dermal fibroblasts and might be applicable for cosmetic product development.

CHARACTERIZATION OF BACTERIAL CYTOLOGICAL PROFILE OF ANTIBIOTIC RESISTANT *Acinetobacter baumannii*

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Abstract:

The rapid increase of antimicrobial resistance caused by drug misuse and overuse is currently a serious global public health. One of the causes arises from prescribing broad-spectrum antibiotics prior to diagnosing the pathogen, mainly because the current antibiotic susceptibility testing methods are time consuming. To reduce the turnaround time, this study aims to develop and apply a bacterial cytological profiling (BCP) method that can differentiate antibiotic-sensitive and resistant strains of *Acinetobacter baumannii*, based on the degree of morphological changes after antibiotic treatment. The results showed that the minimal inhibitory concentration (MIC) of ciprofloxacin in *A. baumannii* was 0.5 µg/mL. Five strains of ciprofloxacin-resistant *A. baumannii* with various degree of resistance were isolated by serial passage method and these were used as the test models. Next, fluorescent microscopy was employed to observe the morphological changes of both ciprofloxacin-sensitive and resistant strains of *A. baumannii* following exposure to 1x MIC of ciprofloxacin. From the BCP analysis based on 34 morphological parameters of the bacteria, the result showed that all resistant strains exhibit less morphological changes when compared to their sensitive counterparts upon antibiotic treatment as indicated by the degree of cluster separation via Uniform Manifold Approximation and Projection. Collectively, these results suggest that degree of morphological changes of the bacteria upon antibiotic treatment could be useful for the development of a single-cell and rapid antibiotic susceptibility test in the future.

LEPTIN ENHANCES INFLAMMATORY EFFECT OF INTERLEUKIN-1-BETA IN HUMAN SYNOVIOCYTES VIA NF-KB AND STAT SIGNALING

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Abstract:
Osteoarthritis (OA) is the inflammation of a whole joint, which is commonly found in elderly and obese patients. While OA is mostly found in load-bearing joints like knee joint, non-load bearing joints such as hand and wrist joints were also affected, especially in obese population. Thus, some factors other than the weight-bearing might be accounting for OA in these joints. Leptin, a cytokine secreted from the adipose tissue and found to be increased in the synovial fluid of obese patients, was reported to link with OA. However, the combined effect of leptin and other inflammatory cytokines on fibroblast-like synoviocytes (FLSs) has not yet studied. The objective of this study is to investigate the effect of leptin alone and combined leptin and the pro-inflammatory cytokine, IL-1β, on inflammation of FLSs. Our study found that leptin induced the expressions of pro-inflammatory cytokines IL-6 and IL-8, both gene and secretory protein levels, in FLSs significantly. Moreover, leptin enhanced the inductive effect of IL-1β on expressions of these cytokines via NF-κB and STAT signaling pathways. From these results, leptin, via enhancing the inflammatory effect of IL-1β, might be participated in the progression of OA in non-loading joints of obese patients.

A SYNTROPHIC METABOLISM OF THE DESIRED BACTERIAL CONSORTIUM ENHANCES PETROLEUM OIL REMOVAL FROM THE SIMULATED FRESHWATER ENVIRONMENT

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Abstract:
Bioaugmentation of petroleum hydrocarbons contaminated real environments has been considered with use of bacteria which can survive under various extreme conditions, in the presence of toxic compounds, and under environmental changes, including pH, salinity, temperature and nutrient availabilities. In this study, nonpathogenic bacterial hydrocarbon degraders, *Mycolicibacterium parafortuitum* J101, *Rhodococcus ruber* S103 and *Mycolicibacterium austroafricanum* Y502, were isolated from mixed polycyclic aromatic hydrocarbons (PAHs)-enriched river sediments which were collected from tropical country. These strains exhibited no antagonistic interactions and thus they were constructed as a defined consortium for enhanced removal of petroleum oils. The defined consortium showed more effective syntrophic degradation of diesel and fuel oil than individual strains. The consortium immobilized on plastic balls could degraded more than 46% of total fuel oil adsorbed on plastic balls in liquid medium and contaminated freshwater without nutrient supplementation. Thus, the results indicated that the immobilized consortium has the potential use for bioremediation of fuel oil-contaminated environments. Additionally, genomic sequences of J101 and S103 contained genes encoding hydrocarbon-degrading enzymes, dioxygenase and alkane monooxygenase, indicating the assimilation of broad substrate specificities toward various PAHs and aliphatic compounds as sole carbon sources. Moreover, both strains carried stress response genes (*dps* and *ectABC* operon etc.), supporting the phenotypic ability to grow under a broad range of pH values (5-11) and salinities (0-5%). Therefore, a motivation in understanding effects of environmental changes on bacterial hydrocarbon degraders and in particular microbial interactions should further be evaluated for successful bioremediation of petroleum pollution in realistic contaminated sites.

BACTERIAL IMMOBILIZATION ON RUBBER WASTE BIOCHAR FOR DIESEL REMOVAL

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Abstract: Abstract: Petroleum hydrocarbons are persistent in the environment and cause living organisms to lose their good qualities of foods, habitats and health conditions. A bioremediation using hydrocarbon-degrading bacteria is considered as a budget-, effective- and environmentally- friendly method for environmental cleanup. Encapsulated bacteria inside a capsule such as sodium alginate increase the pollutant removal efficiency. However, it sometimes has the problem of capsule thickness that prevents bacteria to contact hydrocarbons. Addition of an oil adsorption material to the capsule can reduce this problem. The objectives of this study were to isolate and select efficient diesel-degraders and to verify rubber waste biochar as a new bacterial supporting material for diesel removal. Mangrove sediment from the petrol gas station for boat in Bangkhunthien, Bangkok, Thailand was collected to be used as a source of the bacteria. The isolations were performed using hexadecane and phenanthrene as a sole carbon source. The two hydrocarbons represented different parts of diesel. As a result, 14 hydrocarbon-degrading bacteria were isolated. After isolation, diesel-degradation efficiency test of all isolates was conducted using 300 mg l^{-1} of diesel. Only 3 out of 14 isolates could maintain diesel-degradation activity after long-term storage. The results showed that *Nocardioides zeae* IH3, *Micrococcus luteus* PS3 and *Priestia aryabhattai* PS4 degraded 87%, 75% and 74% of the added diesel, respectively within 7 days. To compare diesel-degrading efficiency among single strain and defined consortia, the consortia consisted of two and three diesel-degrading strains were constructed. The consortium consisted of IH3 and PS3 provided the highest degradation efficiency (80% degradation of the added diesel within 7 days). To verify rubber waste biochar as a supporting material, different commercial adsorption materials and two types of rubber waste biochar were tested for their diesel adsorption capacity and toxicity to the isolated bacteria. Rubber waste biochar and activated rubber waste biochar showed high diesel adsorption capacities (1.94 g g^{-1} and 1.95 g g^{-1}, respectively), compared to other materials (i.e., graphene, bamboo biochar and activated coconut shell biochar). However, the activated rubber waste biochar was less toxic to the bacteria than the non-activated one. The immobilization efficiency of IH3 single strain and IH3 and PS3 consortium was verified. Both treatments showed comparable immobilization efficiencies. Due to the diesel-degradation efficiency and immobilization efficiency, IH3 and activated rubber waste biochar will be used to develop the novel diesel removal bio-based product which can be sustainably produced and used for bioremediation.

EXTRACTION AND CHARACTERIZATION OF HYDROPHOBINS CLASS I AND CLASS II FROM MUSHROOMS AND MACROFUNGI IN THAILAND

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Abstract:
Hydrophobins are small amphipathic proteins found only in mushrooms and filamentous fungi. They are classified into 2 groups: class I and class II based on their hydropathy patterns and solubility. Hydrophobins can reduce water surface tension and reverse the wettability of the coated surface. They play important biological roles throughout fungal life cycle, such as aerial hyphae, fruiting body formation and distribution of hydrophobic spores. Hydrophobins can be applied in current biotechnology such as food innovation and medical technology. The objectives of this study are to extract hydrophobins from *Cookeina sulcipes*, *Xylaria cf. polymorpha*, *Ganoderma lucidum* and *Schizophllum commune* in Thailand and study their emulsifying property. The highest concentration of extracted hydrophobin (class I) was up to 1 mg/ml from mycelia of *S. commune*. Their yields were in the range of 1-9 mg protein/g dried mycelia which were higher than basidiomycete fungi. Putative hydrophobins (class I and class II) were approximately ranging from 10-40 kDa. Extracted hydrophobins acted as potential emulsifiers in 60% ethanol solvent.

Keyword: Hydrophobins, Fungi, Protein extraction

COMPARATIVE GENOMIC ANALYSIS OF ACUTE HEPATOPANCREATIC NECROSIS DISEASE-CAUSING *Vibrio parahaemolyticus* ISOLATES

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Abstract:
Vibrio parahaemolyticus is a halophilic bacterium that causes global shrimp disease known as acute hepatopancreatic necrosis disease (AHPND) by possessing deadly toxin genes, pirAB-like genes ($pirAB^{vp}$). It has been reported that different AHPND-causing *V. parahaemolyticus* (VP_{APHND}) strains exhibit different virulence levels. However, the genomic factors that contribute to different levels of virulence in VP_{APHND} are poorly understood. Therefore, comparative genomic analysis of different VP_{APHND} isolates was our focus. Seven VP_{APHND} isolates were used to infect white shrimp. The result showed that they caused different mortality rate to experimental shrimp. The DNA of VP_{APHND} isolates was analyzed by Illumina sequencing platform, and approximately 5 Mb of draft genomes were obtained. Simultaneously, VP_{APHND} was characterized based on antimicrobial susceptibility (AMR) test, bacterial growth rate and motility assay. The result showed 100% of *V. parahaemolyticus* isolates was resistant to ampicillin, while susceptible to chloramphenicol. Besides, 6 of 7 isolates had similar growth rate. On the other hand, there was a huge difference in motility, namely, three isolates exhibited significantly better swimming and swarming ability, at approximately 2-3 times, compared to the others. Comparative genomic analysis revealed several variants among seven isolates including absent and present genes and single nucleotide polymorphisms. These variants were found in virulence-associated factors such as bacterial secretory systems, biofilm formation and motility. This suggested a better attachment ability and secretory system might contribute to the increasing level of virulence of VP_{APHND}. These findings improve understanding about virulence factors of VP_{APHND}, hence, facilitate future study on pathogenicity of AHPND-causing *V. parahaemolyticus.*

POSTNATAL EXERCISE INDUCES THE DISTINCTIVE ROLES OF INFLAMMATORY CYTOKINE TO AMELIORATE THE EFFECTS OF MATERNAL RESTRAINT STRESS-INDUCED SPATIAL MEMORY IMPAIRMENT IN THE RAT OFFSPRING

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Abstract:
Any perturbation to the neurohormonal-immune system during the fetal developmental period carries over effects to later in life. Prenatal stress (PS) induces hippocampus changes in structure and functions that may cause cognitive impairment and psychiatric disorders. Increasing exercise showed that physical exercise could ameliorate cognitive impairment in young and old rats. We aimed to investigate the therapeutic effect of postnatal voluntary wheel running (VWR) exercise. The restraint stress was carried on during gestation day (GD)14-21 in the pregnant Sprague-Dawley (S.D.) rats. VWR was performed in the rat pups at postnatal day (P)25-P40. Thereafter, spatial memory performance was tested by Morris water maze (MWM) during P36-40. The effect of prenatal stress and the potential effects of VWR on the levels of hippocampal NR2A, NR2B, PSD-95, BDNF, and IL-6 in the rat offspring was ascertained by western blot analysis. Stress during gestation induced the decreases in NR2A, NR2B, PSD-95and BDNF, but an increase in IL-6. Postnatal exercise could ameliorate the adverse effects of PS. MWM test confirmed the ameliorative effect of VWR on spatial memory performance of the pups. Our findings suggest that postnatal exercise has a high potential to ameliorate the adverse effects of maternal stress on neuroendocrine-immune system and spatial memory in the rat offspring.

Keywords: Postnatal exercise, Prenatal stress, Spatial memory, NMDA receptor, Hippocampus, Proinflammatory cytokine

EXPRESSION, PURIFICATION AND CHARACTERIZATION OF QUINONE REDUCTASE FROM *Leishmania orientalis*

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Abstract:
Leishmaniasis disease is caused by the infection of *Leishmania* parasites that are transmitted through the bites of infected sandflies, especially in tropical and subtropical landscapes. Quinone reductase which is an oxidoreductase that functions as free radicals scavenger in the cell via quinone substrate reduction is one attractive target for Leishmaniasis treatment. In the research project, the overexpression, purification and characterization of quinone reductase from *Leishmania orientalis* (QR) were investigated. QR was overexpressed from QR-pET-28a plasmid that was co-transformed pG-KJE8 chaperone plasmid into *E. coli* BL21 (DE3) under auto-induction approach at 16ºC. QR was purified by DEAE-Sepharose anion-exchange column chromatography yields pure QR with subunit molecular weight 34.72 kDa in size. The kinetic experiment of QR was monitored by measuring the reduction of NAD(P)H at a wavelength of 340 nm over time. The experimental results showed the QR is flavin-dependent enzyme which can use both flavin mononucleotide (FMN) and flavin adenine dinucleotide (FAD) as cofactors where FMN give the higher enzyme activity. Consider to the kinetic variables such as K_m, k_{cat} and k_{cat}/K_m, NADH is better electron donor than NADPH, while menadione is the best electron acceptor comparing to nitrofurazone and 1,4-benzoquinone. The information obtained from this research, could be further studied in-depth to develop the QR as a drug target for the treatment of Leishmaniasis in the future.

PHYLOGENETIC ANALYSIS AND ORTHOLOG PREDICTION OF THE LEGUME NAC TRANSCRIPTION FACTORS

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Abstract:

The NAC (NAM, ATAF, and CUC) transcription factor is one of the most prominent plant-specific transcription factor families. Members of this family play an essential role in regulating plant growth and development as well as abiotic and biotic stress responses. Among the legume family, most studies have focused on the genome-wide identification and evolution of NAC transcription factors in a given plant. However, little is known about the overview of *NAC* gene evolution and specific functions in the legume family. We obtained NAC transcription factor sequence data of the ten legumes and *Arabidopsis thaliana* from the PlantTFDB database. The phylogeny of NAC proteins in ten legumes demonstrated that they could be classified into 16 subgroups. Most legume *NAC* genes belong to the *ATAF* subgroup, which plays a role in photosynthesis and stress signaling. We also analyzed the orthologous relationship and found that legume NAC might have some specific response functions. These results will be helpful for insight into understanding the evolution and functional characteristics of legume *NAC* genes in the future.

ROLE OF DNA METHYLTRANSFERASES ON TSHR EXPRESSION AND ORBITAL FIBROBLASTS ACTIVATION

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Abstract:

Graves' ophthalmopathy (GO) is the extra-thyroidal complication of Graves' disease (GD), an autoimmune disease induced by TSHR autoantibody. The characteristics of GO are erythema of periorbital tissue, upper eyelid retraction, conjunctivitis, proptosis, and fibrosis. Severe symptoms of GO could lead to sight-threatening symptoms from keratitis and optic nerve compression. Current treatments of GO including glucocorticoid treatment and decompression surgery are not effective and could induce side effects. Therefore, a new therapy for GO requires further investigation. Previous studies demonstrated that platelet-derived growth factor (PDGF)-BB plays an important role in GO pathogenesis by inducing orbital fibroblast activities such as proliferation, cytokine and hyaluronan production, adipogenesis, and *TSHR* expression. Novel GO pathogenesis during orbital fibroblast activation induced by Epigenetics modification has recently been reported which play important roles in regulating gene expression level by several mechanisms. One of the mechanisms is DNA methylation which could reduce gene expression level. The previous studies suggested that global DNA methylation level in GO orbital fibroblasts is significantly higher than in healthy control orbital fibroblasts. However, the role of DNA methyltransferases (DNMT) in orbital fibroblasts activation is unknown. Consequently, this study aims to investigate the role of DNA methylation by using decitabine, a DNMT inhibitor, on PDGF-BB-induced *TSHR* mRNA expression and orbital fibroblasts activation. Inhibition of DNMT significantly decreases PDGF-BB-induced orbital fibroblasts proliferation ($p<0.01$) and *TSHR* mRNA expression ($p<0.05$). On the other hand, decitabine did not affect PDGF-BB-induced IL-6 and hyaluronan production by orbital fibroblasts. These results support the important role of DNA methylation on *TSHR* mRNA regulation. However, the effects of decitabine in orbital tissue required further investigation which might lead to the development of a new approach for GO therapy.

Keywords: Graves' ophthalmopathy, orbital fibroblasts, PDGF-BB, DNA methylation, TSHR

ANTIBACTERIAL ACTIVITY OF ALLICIN AGAINST PATHOGENS CAUSING BACTERIAL MENINGITIS

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Abstract:
Bacterial meningitis is a life-threatening disease that occurs when the pathogens can penetrate the blood-brain barrier (BBB) and cause inflammation of the meninges. Allicin, a major active compound derived from garlic (*Allium sativum*), exhibits antibacterial activity against a wide range of bacteria, including some of the meningitis pathogens. There are studies suggesting that allicin may be able to pass the BBB. The objective of this study is to investigate the antibacterial activity against pathogens causing bacterial meningitis. The broth microdilution method was used to investigate the antibacterial activity of allicin against tested bacterial pathogens. The results revealed that the minimum inhibitory concentration (MIC) values of allicin against *Neisseria meningitidis* ATCC13090 DMST7950, *Listeria monocytogenes* DMST20093, *Escherichia coli* TISTR780, *E. coli* O157:H7 DMST12743, and methicillin-resistant *Staphylococcus aureus* (MRSA) DMST20654 were 3, 30, 25, 25, and 15 µg/ml, respectively. According to the range of tested allicin concentrations, the results demonstrated that the minimum bactericidal concentration (MBC) value of allicin against *N. meningitidis* was 4 µg/ml. Our findings demonstrated for the first time that allicin exhibited antibacterial activity against the most common meningitis bacterium, *N. meningitidis,* with low MIC and MBC values, suggesting that allicin could be beneficial for the treatment of meningitis caused by *N. meningitidis*.

APPLICATIONS OF BACTERIOPHAGE PHI-SY AGAINST INTRACELLULAR *Acinetobacter baumannii*

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Abstract:
The increasing number of multidrug-resistant (MDR) *Acinetobacter baumannii* associated with high morbidity and mortality rates has been emphasized as a global therapeutic problem. Despite a large portion of scientific research concerning antimicrobial agent discovery, there is currently no effective treatment for MDR *A. baumannii* infection. However, there has been reported more frequently in publications regarding the use of bacteriophage, suggesting that bacteriophage therapy has the potential to be an alternative antibacterial approach.
This study aimed to study the efficiency of bacteriophage Phi-SY treatment against intracellular MDR *A. baumannii*. Bacteriophage Phi-SY with broad activity against MDR *A. baumannii* was isolated from a water sample after activated sludge treatment. The bacteriophage showed a high ability to reduce established biofilms and inhibit biofilm formation. Scanning electron microscopic studies demonstrated membrane damage of bacterial cells treated with the bacteriophage Phi-SY, leading to cell lysis. Additionally, the efficiency of bacteriophage Phi-SY treatment against intracellular MDR *A. baumannii* was evaluated. Bacteriophage Phi-SY could reduce MDR *A. baumannii* adhesion and invasion. The results indicate that bacteriophage Phi-SY was a novel therapeutic treatment considered a promising tool to be used against emerging MDR *A. baumannii*.

EFFECT OF BIOACTIVE COMPOUNDS FROM *Eurycoma longifolia* Jack. ON ANTI-INVASIVE ACTIVITY IN HUMAN NON-SMALL CELL LUNG CANCER CELLS

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Abstract:
Non-small cell lung cancer (NSCLC) is the predominant form of lung cancer. About 40% of diagnosed NSCLC cases are metastatic cancers. Migration and invasion are essential steps for cancer progression. Inhibition of these processes effectively attenuates the metastasis of cancer. Eurycomalactone (ECL) and Eurycomanone (ECN) are major compounds found in the root extract of *Eurycoma longifolia* Jack. Both have potent cytotoxic activity against various carcinoma cell lines including human NSCLC cells and they can inactivate the NF κB signaling pathway. Yet, whether ECL and ECN inhibit cancer cell migration and/or invasion in NSCLC cells remains unknown. Therefore, this study aims to investigate the anti-invasive effect of ECL and ECN. In this study, TGF-β1 was used to promote cell migration and invasion of human NSCLC cells, Calu-1. ECL showed higher cytotoxicity to Calu-1 than ECN. Using the wound-healing assay, TGF-β1 enhanced cancer cell migration, but only ECN could significantly reduce this effect. In addition, the non-toxic doses of ECN could suppress TGF-β1-induced cell invasion through Matrigel by significantly decreasing the secretion of matrix metalloproteases-2 (MMP-2). Therefore, this study has provided evidence on the application of ECN as an alternative therapy for metastatic NSCLC.

Session C:
CHEMISTRY (Analytical Chemistry)

NON-ENZYMATIC ELECTROCHEMICAL SENSOR FOR CREATININE DETECTION BASED ON POROUS COPPER FOAM AND GRAPHENE OXIDE MODIFIED ELECTRODE

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Abstract:

A glassy carbon electrode (GCE) was modified with graphene oxide (GO) to support the electrodeposition of porous copper (Cu) foam. The modified electrode was used to create a non-enzymatic electrochemical sensor to detect creatinine (Cr), which is a byproduct of phosphocreatine metabolism in muscles. Cr is eliminated by the kidneys via urine, therefore certain levels of Cr in urine can indicate chronic renal disease. The detection of Cr by the proposed sensor is enabled by the formation of a soluble Cu-Cr complex. The porosity of Cu foam enhanced the accessibility of active sites and the passage of ions, and the large surface area of GO allowed a large amount of Cu foam to be electrodeposited. The surface morphology of the modified electrode was studied with scanning electron microscopy (SEM). Cyclic voltammetry (CV) and linear sweep voltammetry (LSV) were used to study the electrocatalytic activity of Cr on the sensor and analytical performances. Under optimum conditions, the developed sensor showed a linear range of 5.0–600 µM with a detection limit of 3.12 µM. The method exhibited good reproducibility (RSD < 6%) and was devoid of interferences from uric acid, glucose, ascorbic acid, and dopamine. The developed sensor determined Cr in real human serum and urine samples with good recoveries.

THE DEVELOPMENT OF AN ELECTROCHEMICAL SENSOR FOR SILVER IONS AND SILVER NANOPARTICLES DETECTION

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Abstract: Silver ions (Ag^+) and silver nanoparticles (AgNPs) are used in various industries because of their antibacterial properties. However, excessive concentrations of Ag^+ and AgNPs cause serious harm to the environment and human health. This work thus develops a fast and facile electrochemical sensor for Ag^+ and AgNP detection. First, we used scanning electron microscopy (SEM), UV-vis spectroscopy, and dynamic light scattering (DLS) to characterize the AgNPs shape and size distribution. The SEM image of silver nanoparticles showed spherical AgNPs with a relatively uniform size distribution having the average diameter of 40.0 ± 2.3 nm. The DLS spectra revealed that the AgNPs had the average hydrodynamic diameter of 54.33 ± 0.23 nm. The zeta potential of AgNPs was determined to be -69.87 ± 22.13 mV due to the negatively charged citrate capping agents. The extinction coefficient of AgNPs was determined by Beer-Lambert law to be 0.1616 ± 0.053 $ppm^{-1}cm^{-1}$. To study the electrochemical properties of AgNPs, Ag^+ ions, and their mixtures, linear sweep voltammetry (LSV) and chronoamperometry techniques have been used. The developed method allowed the detection of Ag^+ and AgNPs with the sensitivities of 0.056 ± 0.0018 μC ppm^{-1} and 0.26 ± 0.024 μC ppm^{-1}, respectively. The limits of detection were 0.11 ppm and 0.30 ppm for Ag^+ and AgNPs, respectively.

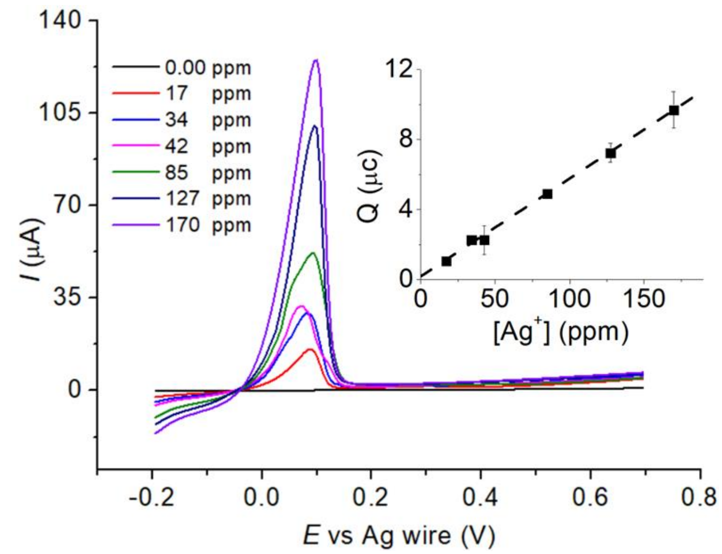

Figure 1: Linear sweep voltammograms of varied concentrations of Ag^+ ions at the scan rate of 50 mV s^{-1} using a glassy carbon working electrode, platinum plate counter electrode, and silver wire reference electrode in 0.10 M KNO_3. The inlay shows a calibration curve of charge (Q) vs. Ag^+ concentrations.

ELECTROCHEMICAL DETECTION OF PARABEN BASED ON PENCIL GRAPHITE ELECTRODE MODIFIED WITH GOLD-ACTIVATED CARBON NANOMATERIAL COMPOSITES

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Abstract:

Parabens is one of the most frequently used as preservatives in cosmetics due to their antimicrobial properties with low toxicity. However, high concentration of parabens can be harmful to consumers health. Therefore, the determination of parabens in cosmetics are necessary. Conventional method such as chromatographic techniques were used to detect parabens. These techniques provided high accuracy but also have some limitations such as cost-effective, take long analysis time, and require complicated sample preparation steps. The alternative method to overcome the limitations is electrochemical method, which has high accuracy comparable to standard methods.

In this study, the electrochemical sensor for parabens will be developed based on the gold-activated carbon nanomaterial composites modified pencil graphite electrode (Au@AC/PGE). From the morphology study, developed electrode provided higher surface area compare with bare electrode due to the exist of porous activated carbon material. The dispersed gold nanoparticles were suggested over supporting layer via SEM-EDS. The couple properties of composited material can be used to enhance the electrode sensitivity, selectivity, and stability due to high conductivity and electroactive property.

In addition, the optimization of electrochemical method was studied based on square wave voltammetry (SWV) to provide the highest response. The modified electrode provides 6 times higher current response compare with unmodified electrode (Figure 1 left). The developed sensor showed good sensitivity with 0.03 mM limit of detection and provided the linear range of 0.05 - 0.75 mM (Figure 1 right). High repeatability and reproducibility were obtained with %RSD lower than 3.51 %. The modified electrode has high stability up to 40 detections. Real sample analysis showed good agreement with the conventional high performance liquid chromatography- with diode- array detector (HPLC-DAD).

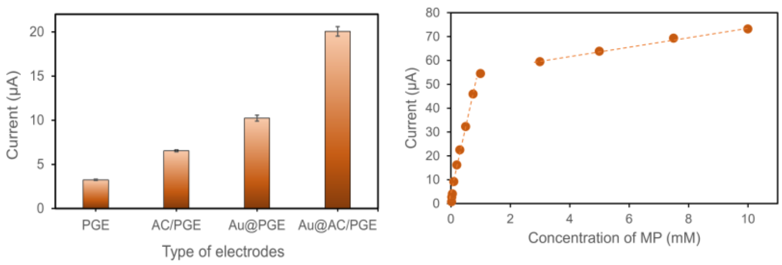

Figure 1.
Comparison of current response of parabens oxidation at different electrodes (left) and calibration plot of current vs. various concentrations of standard paraben at Au@AC/PGE purposed electrode (right).

METHANOL DETECTION BY DIGITAL-IMAGE COLORIMETRY USING OPTICAL NANOPARTICLES WITH N-METHYLPOLYPYRROLE

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Abstract:
Almost of nanoparticles such as metal nanoparticles and quantum dots (QDs) has optical properties like a specific color or fluorescence. In this work, gold nanoparticles (AuNPs) and manganese-doped zinc sulfide quantum dots (Mn/ZnS-QDs) were synthesized and studied their optical properties by spectroscopy and digital-image colorimetry (DIC). AuNPs were studied their color intensity by DIC under a white light, while Mn/ZnS-QDs were studied their fluorescence intensity by DIC under a black light. The minimum concentration limits of AuNPs and Mn/ZnS-QDs which can be detected by DIC were found to be 25 and 50 mg L^{-1}, respectively. N-methypolypyrrole (NMPPy) with sodium dodecyl benzene sulfonate was added into the optical nanoparticles. It was found that NMPPy did not significantly affect the optical response of AuNPs, but Mn/ZnS-QDs with NMPPy has a lower fluorescent response under the black light than a without one. Finally, an addition of methanol into Mn/ZnS-QDs with NMPPy can slightly increase the fluorescent response. This result shows a potential of Mn/ZnS-QDs with NMPPy that can be used as an optical nanoparticle for the methanol detection by DIC, besides a naked eye.

SKIN CARE TEST KIT FOR RETINOIC ACID BY NAKED EYE DETECTION

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[2] Flow Innovation Research for Science and Technology Laboratories (FIRST Labs, Bangkok, 10400, Thailand)
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Abstract:
Retinoic has been used in pharmaceutical products which can irritate our skin. The level of retinoic acid in pharmaceutical product including skin cream should not be over than 0.1 % (w/w). In this work, colorimetric analysis was developed using the formation of a red colored compound of retinoic acid and trifluoroacetic acid (TFA) in dichloromethane medium. Concentration of TFA and reaction time were optimized. We found that used of 20% TFA and reaction time of 4 minutes showed the best result. After reaction time of 4 minutes, color intensity was measured from the captured images by ImageJ software. Red intensity was used to construct a calibration curve. There was no interference effect from common preservative which was used as additive in the pharmaceutical product. Percent recovery was between 99.8 and 109, concluded that there was no interference of the sample matrix. In order to fabricate a prototype of retinoic acid test kit for semi-quantitative analysis, the colored of product solution was compared with a standard color chart and the concentration was read by naked eye with satisfactorily precision. The test kit showed working range between 0.010 to 1.00 % by weight. The limit of detection (LOD) was 0.005 % which is enough to apply to the sample. Considering that the relative error was in the range of -2.50-0.0051 %, Our result indicated that proposed method could be applied for determination of retinoic acid in pharmaceutical products and friendly to unskilled end users.

LIGANDLESS SOLIDIFIED FLOATING ORGANIC DROP MICROEXTRACTION (SFODME) FOR LEAD DETERMINATION IN WATER SAMPLES BY ELECTROTHERMAL ATOMIC ABSORPTION SPECTROMETRY (ETAAS)

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Abstract:

In the present work, a method for the determination of lead in water samples was developed by solidified floating organic drop microextraction (SFODME) without chelating agent. The method was based on ion pair formation between anion compound of lead in form of $[PbI_4]^{2-}$ complexes and cation compound of surfactant of *N*-Cetyl-*N*, *N*, *N*-trimethyl ammonium bromide (CTAB) forming hydrophobic complexes and detected by electrothermal atomic absorption spectrometry (ETAAS). The optimization of important parameters for extraction procedure *i.e.* pH, concentration of potassium iodide, concentration of CTAB, extraction temperature, extraction time, type and volume of organic solvent were investigated. Under the optimized condition, the calibration graph of the proposed method was linear in the range of 4.12 – 20.0 μg/L with the limit of detection (LOD) corresponding to three times of standard deviation (3 x SD, n = 5) of 1.24 μg/L. The percentage recoveries for lead in tap water samples were found in the ranges of 98.6 – 111.2. The precision defined as percentage relative standard deviation (%RSD) for lead determination was in the range of 1.41 – 3.35 at the concentration of 5.0 – 20.0 μg/L. The method was applied to tap water samples. The accuracy of the method by spiked recovery gave satisfactorily results. The results showed that lead concentration in tap water samples did not exceed the guideline level.

ELECTRODEPOSITION SYNTHESIS OF COBALT SELENIDE AS ELECTROCATALYST FOR OVERALL WATER SPLITTING

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Abstract:

One of the alternatives and renewable sources of energy that has been considered as ideal clean energy is hydrogen energy. Hydrogen gas can be produced from various methods, such as plasma arc decomposition, water thermolysis or electrolysis, photoelectrochemical method. By the way, this work focused on water splitting *via* electrolysis because of its environmentally friendly. However, the development of highly active, stable, and cost-effective electrocatalysts is the most challenging part of this field. Herein, the shaggy porous cobalt-selenide (Co-Se) was directly grown on the synthesized carbon-based porous membrane as a bifunctional electrocatalyst *via* chronoamperometry electrodeposition for water splitting. The optimum electrodeposition method and parameters, including potential and duration time, were optimized. Then, the performances of HER and OER were performed in acidic (0.5 M H_2SO_4) and alkaline (1.0 M KOH) aqueous electrolytes, respectively. Under the optimum conditions, Co-Se exhibit stable and excellent activity for HER and OER catalysis which has 119 mV and 301 mV for overpotential and Tafel slope of 80.1 and 117 mV/dec, respectively. The overall water splitting reaction requires the potential of only 2.12 V. In addition, this work also develops a facile fabrication method for growing catalysts on in-house developed support materials.

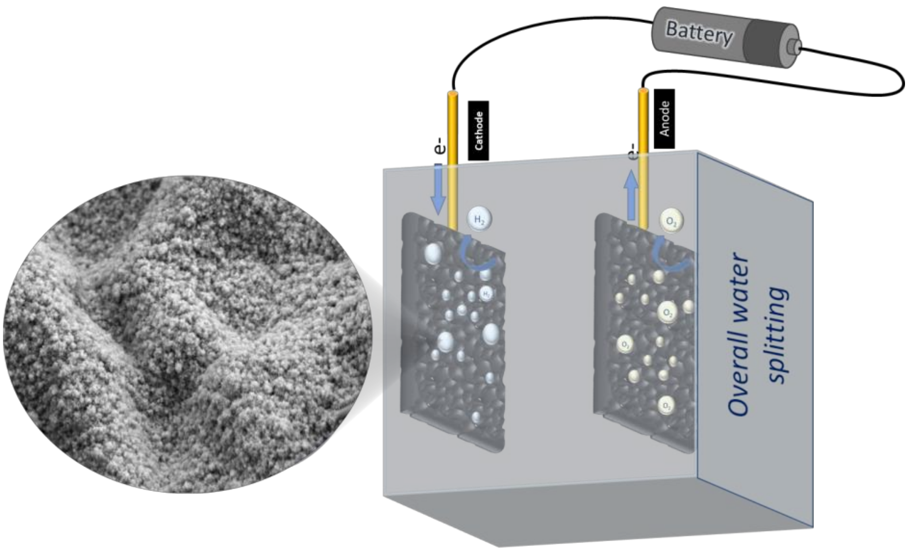

Figure 1. Electrolysis cell set up of water splitting in 1.0 M KOH and SEM image of synthesized electrocatalyst surface.

SCREEN-PRINTED GRAPHENE ELECTRODE DECORATED WITH POLY(L-HISTIDINE) AS AN EFFECTIVE ELECTROCHEMICAL SENSING FOR TYRAMINE DETECTION

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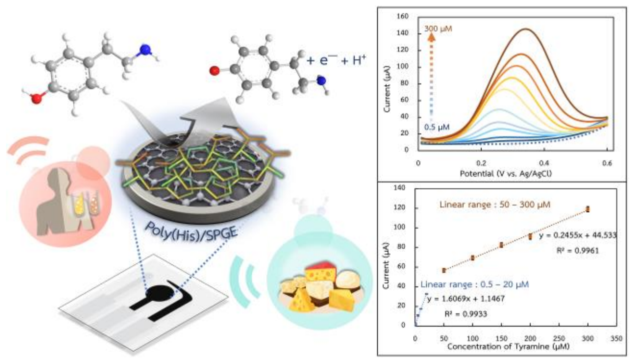
Abstract: Tyramine (Tyr), an electroactive biogenic amine, is indirectly associated with the neurological and cardiovascular systems. It is mainly found in fermented foods, beverages, dairy products, and cheeses. Excessive consumption of tyramine-containing foods can induce adverse health risks such as headaches, respiratory disorders, hypertension, brain hemorrhaging, cardiac failure, and is considered responsible for migraine attacks. Considering the undesirable toxicological effects of Tyr, the development of analytical methods for monitoring Tyr is highly desired. In this work, we presented a simple and highly sensitive electrochemical sensing-based poly(L-histidine) modified screen-printed graphene electrode (Poly(His)/SPGE). The proposed sensing was fabricated via an electropolymerization process for generating the polymeric film of L-histidine directly onto the electrode surface. A single modification step was performed by applying potential from –0.6 to +2.0 V for 20 cycles at a scan rate of 200 mV/s using cyclic voltammetry (CV). Despite only using a poly (L-Histidine) modified electrode, it offered good electrocatalytic activity and significantly amplified the Tyr response signals three times. Subsequently, the amount of Tyr was successfully quantified by differential pulse voltammetry (DPV) using PBS (0.1 M, pH 7.4) as a supporting electrolyte. All parameters concerning the DPV technique were systematically optimized to obtain the optimal conditions. The current response provided two good linear relationship with Tyr concentrations in the ranges of 0.5-20 µM (R^2 = 0.9933) and 50-300 µM (R^2 = 0.9961) with a limit of detection and limit of quantification of 0.065 µM (3SD/slope) and 0.22 µM (10SD/slope), respectively. Many important features, including decent anti-interference, reproducibility, and long-term stability were also observed. Furthermore, this proposed sensor was investigated by detecting Tyr in both biological fluids and cheese samples, with satisfactory recovery ranges (82.58%–109.75%) and relative standard deviations (0.28%–8.03%). Therefore, the developed Tyr sensing could potentially be an alternative tool for quantitative Tyr analysis in food and biological samples. The benefits of this developed sensing include its ease of fabrication, portability, cost-effectiveness, rapid detection time, and suitability for on-site analysis.



A NEW POLYMERIC L-GLUTAMIC ACID-BASED ELECTROCHEMICAL SENSOR FOR 1-HYDROXYPYRENE DETECTION

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Abstract:
1-Hydroxypyrene (1-OHP) is a well-studied target for polycyclic aromatic hydrocarbon (PAH) metabolites and is used as a powerful biomarker for evaluating human PAH exposure in environmental and occupational health. In this work, the fabrication of an electrochemical sensor based on poly(L-glutamic acid)-modified a screen-printed graphene electrode (poly(L-GA)/SPGE) for 1-OHP detection was proposed. Surface morphology and composition studies of the electrodes were investigated by scanning electron microscopy and x-ray photoelectron spectroscopy. In addition, the electrochemical characterization of the electrodes was studied by electrochemical impedance spectroscopy to ensure the fabrication. To assess the capability of the developed sensor, the electrochemical behavior of 1-OHP on the unmodified and modified SPGE was investigated by square wave voltammetry (SWV). The results obtained suggested that the current signal of 1-OHP on poly(L-GA)/SPGE was three times larger than that of the unmodified SPGE. Under optimal conditions, the linearity for 1-OHP detection was achieved in the range of 1–1000 nM with the limits of detection and quantification of 0.95 and 3.16 nM, respectively. Moreover, this developed sensor was successfully applied for the determination of 1-OHP in human urine samples.

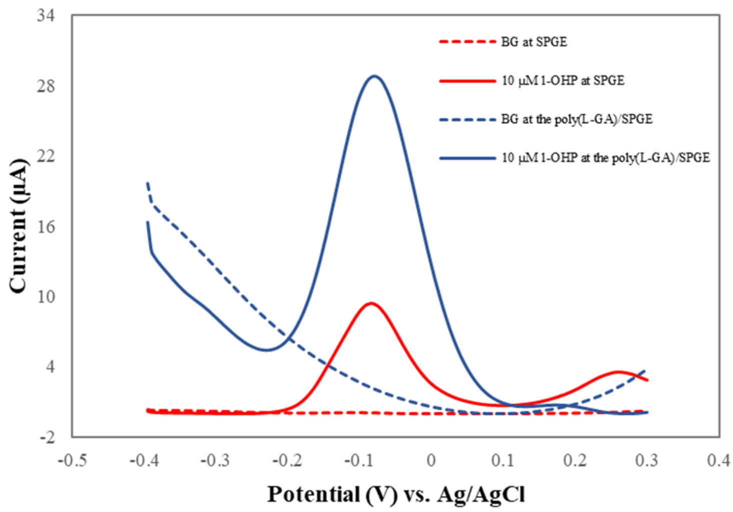

Figure 1. Square wave voltammograms for 1-OHP detection at the unmodified and modified SPGE.

DETERMINATION OF MAGNESIUM USING PAPER-BASED ANALYTICAL DEVICE

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Abstract:
This research aimed to develop a paper-based analytical device coupled with colorimetric detection for determination of magnesium in urine samples because magnesium is one of components in urine that can inhibit calcium oxalate stones formation. Normally, the magnesium concentration in urine samples should not be lower than 50 mg L^{-1} because the low magnesium concentration in urine sample has a potential to cause calcium oxalate stones. In this work, the determination of magnesium was performed using the reaction between magnesium and xylidyl blue in an alkaline condition to form a red complex. The change of color intensity is related to the amount of magnesium in sample solutions. The optimized conditions for the analysis of magnesium were 1 mol L^{-1} NaOH, 2 mmol L^{-1} xylidyl blue, and 10 minutes for the reaction time. The intensity of red color was measured from the picture of the reaction using ImageJ program. The linearity was in the magnesium concentration range of 5–50 mg L^{-1}. The limits of detection and quantitation were found to be 1.6 mg L^{-1} and 5.2 mg L^{-1}, respectively. The developed method was successfully used to determine urinary magnesium with high accuracy and precision. The recovery percentage of standard magnesium spiked in artificial and real urine samples, which was in the range of 87.8 – 1 0 7.0%. The intra-day and inter-day precisions of the analysis were determined from percentage of relative standard deviation (%RSD) of the color intensity obtained from artificial urine spiked with known amounts of magnesium, which were found to be lower than 7%. Accordingly, the paper-based analytical device coupled with colorimetric detection was successfully developed to be a reliable method for determination of magnesium in urine samples. The developed method will hold a great promise to be a simple, rapid, portable, and convenient tool for determination of magnesium, especially in for on-site measurement.

QUANTITY AND QUALITY ELECTROANALYTICAL DETECTION OF SALICYLIC ACID

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Abstract:
Salicylic acid (SA) is used as a preservative in food and as a biocide in some consumer products. However, SA is prohibited in some countries due to negative effects, including gastric irritation, diarrhea, and death. In this work, we employed electroanalytical method to analyze the amount of SA. A screen- printed carbon electrode (SPCE) was used as an working electrode. The behavior of SA on working electrode was investigated. Britton–Robinson buffer pH 2.37 was used as an electrolyte solution. A linear plot of anodic current and square root of scan rate was obtained, with SPCE, diffusion-controlled quasi-reversible process of SA is proven by the scan rate study. We then use differential pulse voltammetry (DPV) and square wave voltammetry(SWV) to investigate the signal response. The result shows linear plots were obtained from 20 to 80 ppm. In conclusion, differential pulse voltammetry (DPV) with addition of 50 mM NaCl in Britton–Robinson buffer is an appropriate method for SA detection.

Session C:
CHEMISTRY (Inorganic Chemistry)

MORPHOLOGY STUDY OF FLUORAPATITE BY HYDROTHERMAL AND PRECIPITATION METHODS

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Abstract:
Fluorapatite was successfully synthesized from duck eggshells using hydrothermal and precipitation methods with calcium carbonate. The goal of the research was to investigate morphologies of fluorapatite by varying synthetic conditions. Different types of phosphate, including ammonium hydrogen phosphate and phosphoric acid, were used. The fluoride types, including ammonium fluoride and sodium fluoride, were selected as fluoride sources. All synthesized fluorapatite were characterized by X-ray powder diffraction (XRD), Fourier transforms infrared spectroscopy (FTIR). XRD showed the primary phase of fluorapatite. These corresponded with FTIR results. The morphology of products was investigated using Scanning Electron Microscopy (SEM). The hydrothermal gave high crystallite than precipitation method. The case of hydrothermal gave results of aggregation of particles and flower-like bundles shapes. The precipitation system showed bundles of round edge rods and hexagonal prisms. Moreover, other parameters such as fluoride concentrations and reaction times were studied to improve understanding of the formation. A higher fluoride concentration induced the formation and caused a larger in the size of the particles. Increasing reaction temperatures allowed the synthesized fluorapatite particles to grow, but a significant change in morphology was not observed. These results provide a strategy for the tunable synthesis of fluorapatite and other apatite materials by varying these parameters.

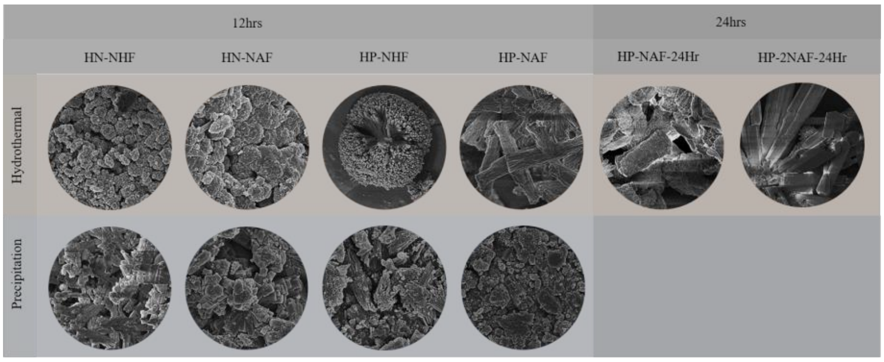

Figure 1.
Summary shape of synthesized fluorapatite products.

IMPROVEMENT OF C-H OXIDATION REACTIVITY THROUGH SUBSTRATE RECOGNITION BY IRON PINCER COMPLEX

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Abstract:

C-H oxidation is a prominent topic in research nowadays due to its various utilization in organic synthesis and functionalization. However, the inertness of the unactivated C-H bonds usually decreases the selectivity and activity of the reaction. In nature, enzymes recognize the specific substrate into the active site via weak interactions. This concept has already improved that can apply to the chemical catalyst. The Costas group, for instance, has already shown the application of their catalyst, a manganese-based catalyst with crown–ether receptors, in the alkyl C-H oxidation reaction with highly substrate selective. In this work, we have applied this concept to study our reported catalyst, the iron complex supported by a pyridine diamine ligand appended with crown-ether receptors (Teptarakulkarn, 2022). With the structure below, crown-ether moiety can bind to the protonated amine functional group of the organic substrate and places a specific C-H bond near the active site of the complex. This strategy could reduce the reaction's energy barrier, leading to higher activity and selectivity of the oxidation reaction, especially hydroxylation reaction.

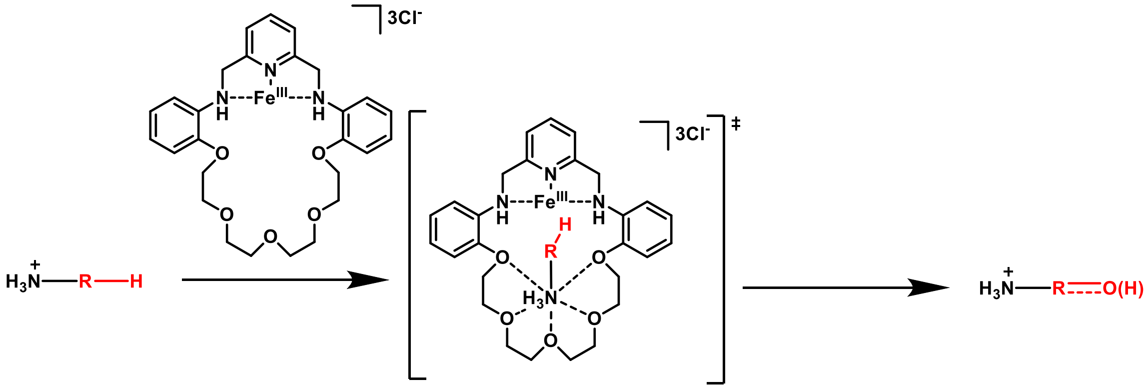

Figure 1. Oxidation of ammonium-substrate products by the target Fe complex.

SYNTHESIS, CHARACTERIZATION AND DNA BINDING STUDY OF NICKEL(II) AND ZINC(II) COMPLEXES USING BENZOTHIAZOLE SCHIFF BASE LIGANDS

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Abstract:

Ni(II) and Zn(II) complexes were synthesized using benzothiazole Schiff base ligands obtained by the condensation reaction between 2-aminobenzothiazole and R-salicylaldehyde (R = 3,5-Cl (**HL^1**), 5-Cl (**HL^2**), 3,5-Br (**HL^3**), 5-Br (**HL^4**)). The ligands and complexes were characterized by spectroscopic techniques. Study of the metal to ligand ratio and the stability constants of the complexes were determined and calculated by Job's method. The formation of Ni(II) complexes (**cpx 1-cpx 4**) show 1:2 metal to ligand ratio and the stability constants of complexes suggest the strong interaction between the metal(II) ion and ligands. The binding interactions of the complex with calf thymus DNA (CT-DNA) were determined by UV-Visible and fluorescence spectroscopic techniques. The binding constants and Gibb's free energy values of complexes confirm the binding ability of the complex with CT-DNA.

MAGNETIC AND STRUCTURAL STUDIES OF $[Fe(salRen\text{-}4\text{-}OMe)_2]Y$ COMPLEXES

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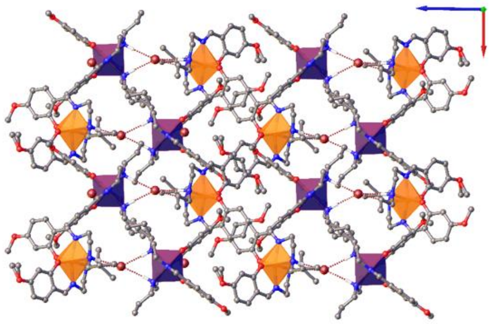
*e-mail: hdavid@mail.wu.ac.th, +66-75672100

Abstract:

Spin crossover (SCO) compounds are a unique class of molecularly switchable materials. In this research we have designed a series of Fe (III), $[Fe(salRen\text{-}4\text{-}OMe)_2]Y$, complexes where we vary both the substituent and counter ion (R = propyl, Y = Cl^- **1**, Br^- **2**, I^- **3**, NO_3^- **4**, ClO_4^- **5**; R = benzyl, Y = Cl^- **6**, Br^- **7**, I^- **8**, NO_3^- **9**, ClO_4^- **10**) have been synthesized. All complexes have been characterized by elemental analysis, IR and UV-Vis spectroscopy. The UV-Vis spectra show two LMCT bands which are assigned to the LS and HS states based on theoretical studies on related complexes. SCXRD studies on **2**, **3**, and **6-8** indicates that they crystallize in triclinic $P\bar{1}$ (**2**, **3** and **8**), and monoclinic $P2_1/n$ (**7**) or $P2_1/c$ (**6**). The structure of **2** reveals spin crossover between 150 and 290 K from a [HS-LS] state to a [HS-HS] state. During the spin transition, a change in symmetry from monoclinic to triclinic is observed. In contrast, in **3** at 150 K a [HS-MS] spin state is observed (MS = mixed spin, a mixture of LS and HS). The crystal structures of **6-8** reveal HS Fe (III) centers in all cases. Further, π-π, CH···π and CH···O interactions have linked 1D chains to create a highly cooperative with P4AE contacts. Solution state studies of SCO in $CDCl_3$ for **2**, **3**, **6**, and **7** show complete SCO with $T_{1/2}$ from 220-260 K depending on the anion. These studies reveal that the substituent and counter ions influence magnetic properties in solution of these series.

a.



b.

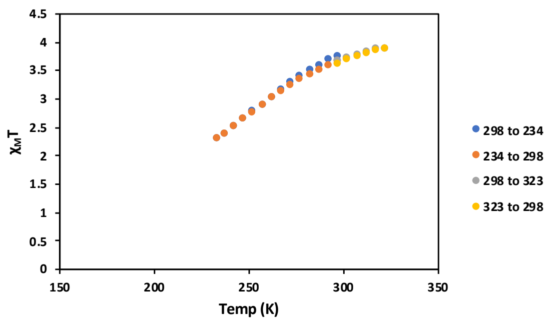


Figure 1. a.) Crystal packing of $[Fe(salPren\text{-}4\text{-}OMe)_2]Br$ **2** at 150 K, in which the purple and orange octahedral polyhedra represent LS and HS Fe(III) centers, respectively. b.) Solution state magnetic susceptibility in $CDCl_3$ of **2**.

DRUG DELIVERY SYSTEM USING POROUS SILICA-MANNAN NANOCOMPOSITES

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Abstract:

Developing a drug delivery system is crucial for ensuring that the drug molecules are transported to the correct target in the body efficiently. In this work, a drug delivery system consisting of nanocomposites of porous silica and mannan is developed with the purpose of transporting the drugs to one interesting target: dendritic cells. Firstly, the porous silica nanoparticles were successfully synthesized via a mechanism involving a microemulsion system. Morphology and size of the particles were characterized using SEM, TEM, and XRD, and it was found that the particles had a spherical shape with the size of 356 ± 15 nm. A study about effects of calcination on methylene blue adsorption was performed, and it was found that calcination at 550°C for 6 hours helped in getting rid of the template and letting the nanoparticles adsorb more molecules into their pores. Amino functionalization followed by the EDC/NHS coupling reaction was performed to synthesize the mannan polysaccharide-coated porous silica nanoparticles. A test for sugar using phenol-sulfuric acid method confirmed the presence of mannan and success of attachment of mannan on the surface of the porous silica nanoparticles. The nanocomposites based on porous silica and mannan show a great potential as a drug delivery system for targeted-drug delivery to dendritic cells.

DEVELOPMENT OF ENZYME RESPONSIVE TRIS-CYCLOMETALATED IRIDIUM COMPLEXES

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Abstract:
Two tris-cyclometalated iridium complexes derived from the archetypal structure [Ir(ppy)$_3$] (ppy = 2-phenyl pyridine), each containing a substituent on a single ppy ligand, have been synthesized. The first complex [Ir(ppy)$_2$ppy-OH] (**1**) contains a hydroxy methyl group while the second complex [I(ppy)$_2$ppy-Oct] (**2**) is an octanoate ester derivative of the first one. The complexes have been synthesized with the aim of developing a method for ratiometric method for the determination of activity of ester hydrolyzing enzymes. The investigation of the photophysical properties of the two complexes in aqueous solution has shown that they posses emission spectra with emission maxima at 520 nm and 580 nm for complex **1** and complex **2**, respectively. The ester containing complex **2** has been incubated with several ester hydrolyzing enzymes. Incubation with porcine liver esterase led to changes in the emission spectra consistent with the hydrolysis of the ester group. The results indicate the possibility to further develop these complexes as responsive probes for enzymatic activity.

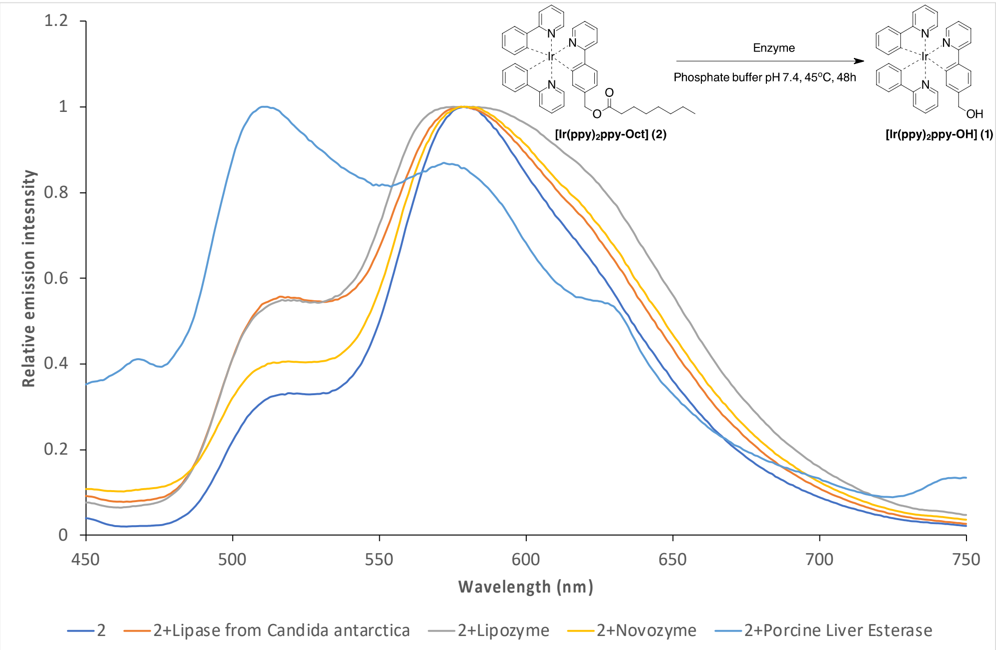

Figure 1. Emission spectra of complex **2** after incubation with various enzymes for 48 h

WATER-SOLUBLE POLYMER DOTS FOR POTENTIAL AEROBIC OXIDATION IN AQUEOUS MEDIA

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Abstract:
A series of conjugated polymers containing a varying ratio of tetraphenylporphyrin cobalt(II) (CoTPP) were synthesized by the Suzuki-cross coupling reaction. By co-precipitating with amphiphilic species, poly(styrene-*co*-maleic anhydride), the water-soluble polymeric nanoparticles (Pdots) were obtained, with average sizes of less than 50 nm to larger than 100 nm in diameters depending on the amount of the incorporated metalloporphyrin units. The optical properties of both conjugated polymers and Pdots were studied and compared using UV-visible and fluorescence spectroscopy. Incorporating more CoTPP resulted in a larger blueshift of the absorption wavelengths and a considerable decline in luminescence intensity, both of which can be explained by the interruption of π-conjugation chain length by CoTPP units. The fluorescence intensity of conjugated polymers was completely quenched in Pdots, implying the efficient energy transfer caused by the compact polymer chains in the nanoparticles. The representative of Pdots has demonstrated its potential as a catalyst for sulfide-to-sulfoxide conversion in water, reaching up to 43% yield under 5-h-blue light irradiation and 31% yield in the dark, in which the reaction was assumed to proceed *via* different mechanisms under both conditions. Given the initial results, Pdots could potentially be candidates for efficient catalysis in a green solvent – water.

Session C:
CHEMISTRY
(Organic & Medicinal Chemistry)

SYNTHESIS OF BISCOUMARIN DERIVATIVES AS α-GLUCOSIDASE INHIBITIORS

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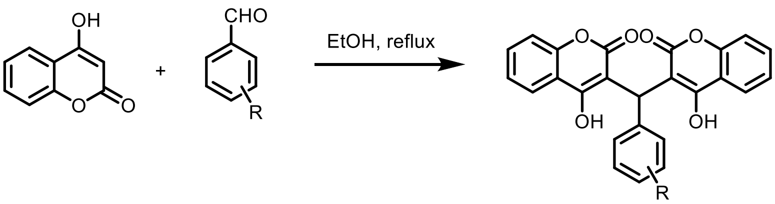
Abstract:
Twelve biscoumarins were synthesized, well-characterized and evaluated against α-glucosidase *in vitro*. Among them, eight compounds have not been synthesized and reported in chemical literatures. Most of the synthesized derivatives illustrated prominent inhibitory activity. Interestingly, the new compound **11** exhibited the strongest inhibition with the IC_{50} value of 0.33 μM (the positive control, acarbose, IC_{50} 93.63 μM). Enzyme kinetic study of **11** revealed that the compound is competitive inhibitor with K_i value of 0.44 μM. When introducing longer alkoxy chain, the better activity was observed possibly due to higher hydrophobicity. In addition, bromo substituent could improve the inhibitory activity of alkoxy biscoumarin derivatives.



1, R=4-OH, IC_{50} (μM) 14.71 ± 2.67
2, R=4-OCH_3, IC_{50} (μM) > 10
3, R=4-OC_2H_5, IC_{50} (μM) 3.29 ± 0.36
4, R=4-OC_4H_9, IC_{50} (μM) 1.56 ± 0.09
5, R=4-OC_8H_{17}, IC_{50} (μM) 0.48 ± 0.03
6, R=4-$OC_{12}H_{25}$, IC_{50} (μM) 1.16 ± 0.10
7, R=3-Br-4-OH, IC_{50} (μM) 4.15 ± 0.06
8, R=3-Br-4-OCH_3, IC_{50} (μM) 3.80 ± 0.05
9, R=3-Br-4-OC_2H_5, IC_{50} (μM) 1.74 ± 0.10
10, R=3-Br-4-OC_4H_9, IC_{50} (μM) 0.58 ± 0.03
11, R=3-Br-4-OC_8H_{17}, IC_{50} (μM) 0.33 ± 0.02
12, R=3-Br-4-$OC_{12}H_{25}$, IC_{50} (μM) 0.96 ± 0.04

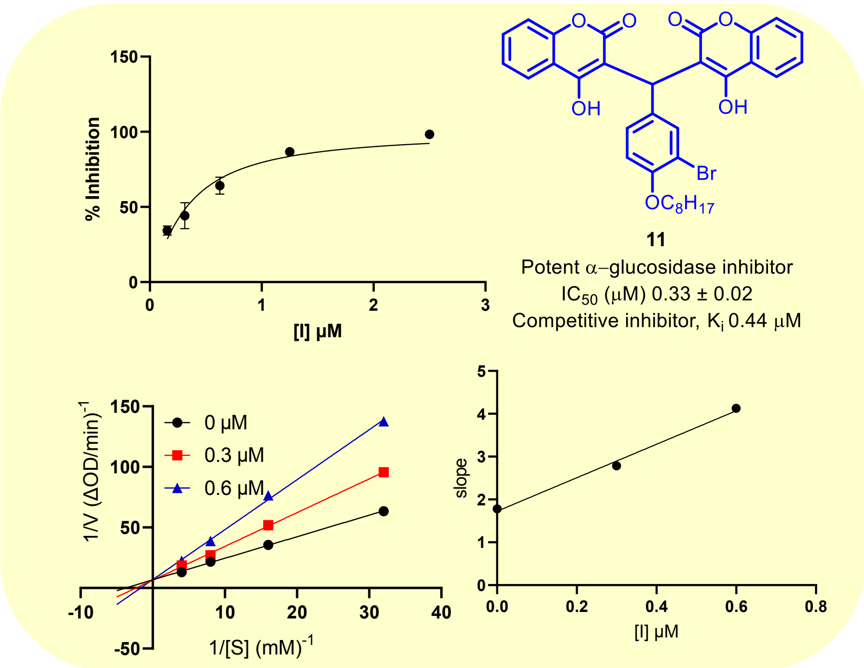


Figure 1. Kinetic study of compound **11**.

CYCLOARTANE-TYPE TRITERPENOIDS FROM THE LEAVES OF *Sandoricum koetjape* AND THE EFFICACY ON α-GLUCOSIDASE INHIBITION ACTIVITY

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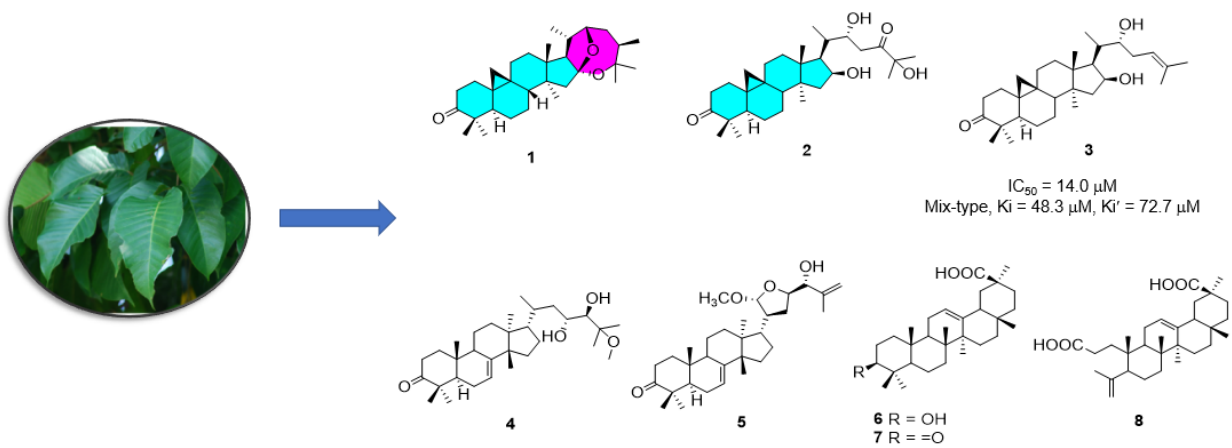
Abstract:
Two new cycloartane-type triterpenoids (**1** and **2**) along with six known compounds (**3**-**8**) were isolated from the methanol extract of the leaves of *Sandoricum koetjape* Merr. that showed the high percent of inhibition (86.02%) to α-glucosidase. Their chemical structures were unambiguously established by interpretation of HRESIMS and NMR (1D and 2D) data. The NMR data revealed six known compounds are 16*R*,22*R*-Dihydroxycycloartenone (**3**), phellochin (**4**), [21α-methylmelianol (21*R*,23*R*) epoxy-24-hydroxy-21α-methoxyl]triucalla-7,25-dien-3-one (**5**), katonic acid (**6**), katononic acid (**7**), and koetjapic acid (**8**). Furthermore, the configuration of two new compounds were determined by using NOESY spectrum as well as comparing their NMR data to the reference. These compounds were evaluated against α-glucosidase. All tested compounds revealed excellent activity with IC_{50} values in the range of 14.0-49.2 μM compared to that of acarbose (IC_{50} 100.6 μM). Due to the strongest activity of compound **3** (IC_{50} 14.0 μM), kinetic analysis was further studied to know what type of inhibitor mechanism it is. The result indicated that compound **3** is a mix-type inhibitor that showed the Ki and Ki′ values of 48.3 and, 72.7 μM, respectively.



REVELATION OF PARAMETERS INFLUENCING THE SYNTHESIS OF THE 7-AZAINDOLES VIA THE LAROCK HETEROANNULATION REACTION

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Abstract:

A synthetic methodology for 2,3-diphenyl-7-azaindole via the Larock heteroannulation is described. Our model reaction utilizes diphenyl acetylene and 2-amino-3-bromopyridine as reactants. Different additives and bases were screened to achieve the desired product. The optimized reaction conditions require 140 °C with $Pd(OAc)_2/PPh_3$ as a catalyst, Na_2CO_3 as a base, and *n*-Bu_4NCl as an additive, providing 2,3-diphenyl-7-azaindole in 56% yield. The presence of an acetyl or trifluoroacetyl substituent on the amino group of 2-amino-3-bromopyridine reactant does not enhance the reaction efficiency. The DFT calculations were employed to investigate the reaction energetics in the oxidative addition step, the rate-determining step in the Larock reaction. The results indicated similar energy barriers in the presence or absence of the electron-withdrawing substituent on the 2-amino-3-bromopyridine, agreeing with the experimental observations.

CYANINE/METHOTREXATE NANOPARTICLES FOR SYNERGISTIC PDT/CHEMOTHERAPY OF BREAST CANCER

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Abstract:
Throughout the development of nanomedicine, drugs are typically loaded into nanostructures using biocompatible carriers, such as polymers or lipids, albeit loading efficiency may not always be consistent. In this study, we present straightforward self-assembly of dye and a hydrophobic drug to create nanostructures without any carriers. The near-infrared (NIR) iodinated cyanine dye (I_2-IR783) was used to make nanoparticles (NPs) with methotrexate (MTX), a chemotherapeutic drug, by an assembly, which can be utilized for imaging and photodynamic/chemo combination therapy. The resulting nanoparticles (I_2-IR783/MTX@NPs) exhibited a monodisperse spherical morphology with hydrodynamic average sizes of 240.6 ± 2.5 nm. The results revealed that I_2-IR783/MTX@NPs substantial internalization in 4T1 murine breast cancer cells and showed a synergistic anticancer effect after NIR light irradiation. Additionally, it was observed that phototoxicity functions just as well in a 3D tumor model as it does in a 2D cell culture. The PDT efficiency of the nanosystem in the physiological environment was confirmed by the detection of intracellular reactive oxygen species, as well as the live/dead viability/cytotoxicity assay following NIR light exposure. In addition, optical coherence tomography (OCT), a non-invasive imaging technology, was used as an alternative tool to monitor the response after treatment. Therefore, I_2-IR783/MTX@NPs show great potential use in a theranostic application for breast cancer PDT-chemotherapy.

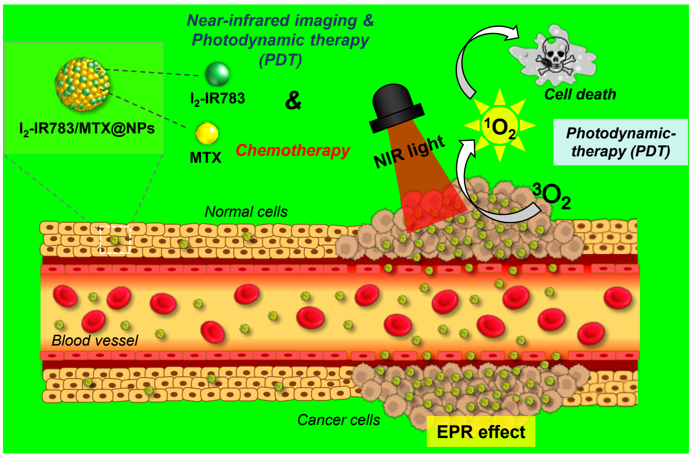

Figure 1. I_2-IR783 and MTX were self-assembled to form nanoparticles, without any carrier, that can be used for NIR fluorescent imaging and chemo-PDT combination therapy.

DEVELOPMENT OF ALCOHOL OXIDATION BY VANADIUM CHLOROPEROXIDASE

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Abstract:

Lignin is a biopolymer found in plants that contain high amounts of aromatics, making it an promising raw material for valuable chemical production in industry. According to the literature, a lignin model molecule can be chemically degraded using NaOCl and TEMPO. In this study, the enzyme of *Curvularia inaequalis* vanadium chloroperoxidase (*Ci*VPO) was reported being capable of producing $^{-}$OBr or $^{-}$OCl from bromide or chloride respectively in the presence of hydrogen peroxide. Therefore, *Ci*VPO reaction was coupled with TEMPO to investigate lignin degradation. Furthermore, *Saccharomyces cerevisiae* old yellow enzyme (*Sc*OYE3) and *Pseudomonas aeruginosa* flavin reductase (*Pa*VanB) were investigated to use NADPH to generate hydrogen peroxide, which could be detected by horseradish peroxidase (HRP) assay. The studies showed that both enzymes produced a stoichiometric amount of hydrogen peroxide from NADPH. According to NADPH consumption, *Sc*OYE3 had a higher k_{cat}/K_m value of 0.171 $\mu M^{-1}s^{-1}$ than *Pa*VanB (0.0017 $\mu M^{-1}s^{-1}$), this indicate that *Sc*OYE3 has more efficiency to consume NADPH over *Pa*VanB.

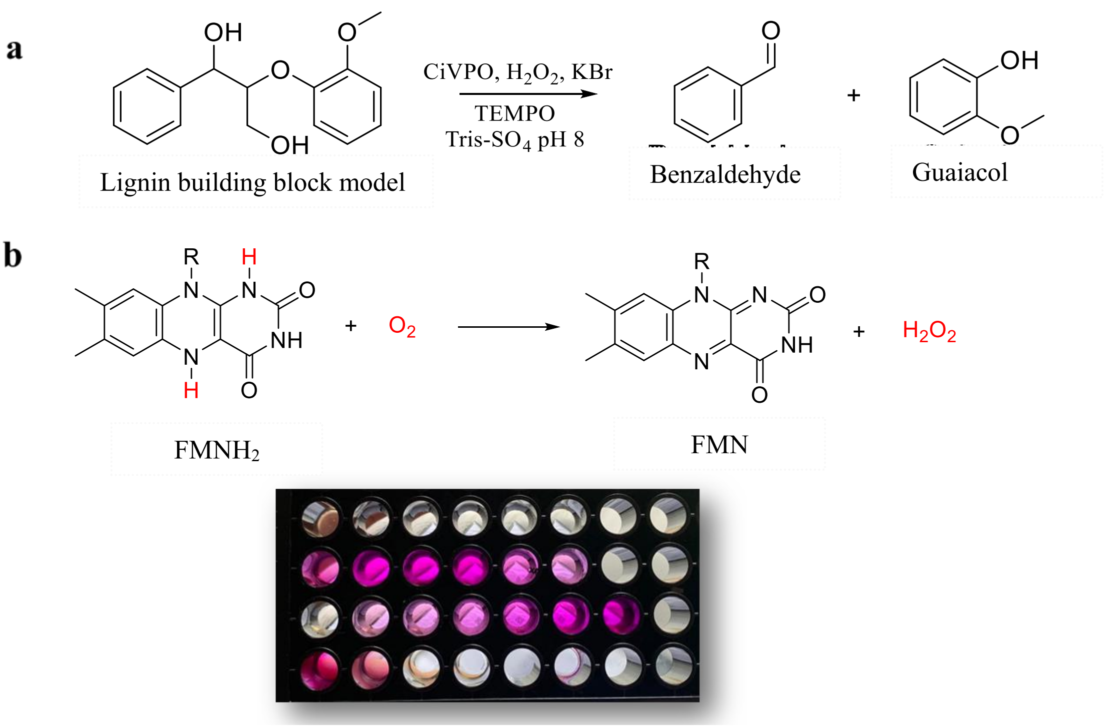

Figure 1. (a) Degradation of lignin model molecule catalyzed by *Curvularia inaequalis* vanadium chloroperoxidase (*Ci*VPO) using halide and hydrogen peroxide in the presence of TEMPO and (b) Enzymatic H_2O_2 generation detected by horseradish peroxidase (HRP) assay.

SYNTHESIS OF COUMARIN DERIVATIVES AND THEIR ANTI-INFLUENZA ACTIVITY

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Abstract:
Coumarin derivatives are an important class of bioactive natural products with useful applications in various fields. Although many coumarin derivatives have been tested for different bioactivity, investigation of their anti-influenza activity has been limited. This work reported a synthesis of coumarin derivatives using Brønsted acid catalysis, giving the products in moderate to good yields. Investigation of the anti-influenza activity of the synthesized derivatives was also reported.

MOLECULAR DOCKING AND MOLECULAR DYNAMICS SIMULATION STUDY OF THE INTERACTIONS OF *Holothuria scabra* TRITERPENE GLYCOSIDES AND THEIR METABOLITES ON ANDROGEN RECEPTOR ALLOSTERIC SITES

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Abstract:
Prostate cancer is the second most common male malignancy and is the fourth most common cancer overall. However, prostate cancer can undergo an adaptive mechanism to eventually become castration-resistant, being able to proliferate even with castrate-level of androgen and posing a limitation for current treatment. This study focuses on the interactions of the sea cucumber's triterpene glycosides, especially holothurin A, holothurin A2, and metabolites from the deglycosylation reaction pathway, on AR by using molecular docking and molecular dynamics (MD) simulations. The docking results showed that HAM2, which is the metabolite of holothurin A comprising only D-xylose and D-quinovose, exhibited the best binding affinity of -17.50 kcal/mol with the Binding Function 3 (BF3) surface groove of AR. The MD simulation data confirmed and demonstrated that HAM2 can form a stable complex with BF3 via hydrophobic and hydrogen bond acceptor interactions. All computational studies indicated that HAM2 can act as an allosteric inhibitor at the BF3 site and might be a promising candidate for further prostate cancer treatment.

SYNTHESIS TOWARDS KUSUNOKININ DERIVATIVES: MODIFICATION OF SUBSTITUENT ON PHENYL RING

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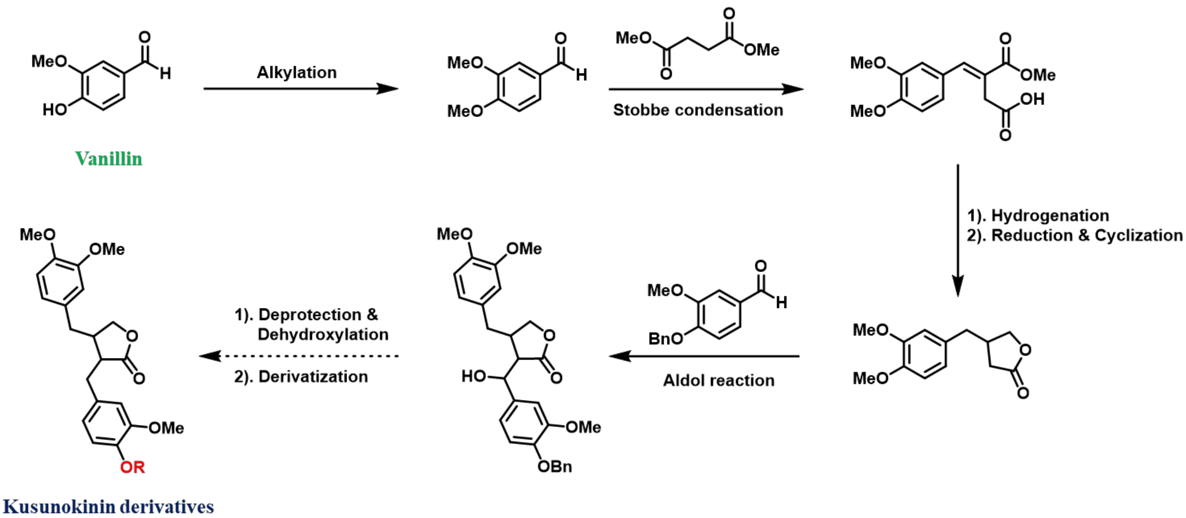
Abstract:

Breast cancer is one of the most common types of cancer worldwide. In general, chemotherapy is a standard and powerful treatment; however, this therapy often provides various severe side effects due to destruction of both cancer and normal cells. Therefore, targeted therapy, which affects directly to cancer cells, is considered as an alternative treatment of breast cancer to reduce serious side effects.

Kusunokinin was reported as a potent lignan that could inhibit the cancer cell which is MCF-7 cells with IC_{50} value around 3.20 μM. From the structure-activity relationship (SAR) study by computational modeling, kusunokinin could potentially bind to many possible target proteins. Thus, to verify the accurate pathway of inhibition and to find the promising anti-cancer agent for breast cancer treatment, in this work, synthesis of kusunokinin derivatives was conducted. Firstly, the synthetic kusunokinin intermediate was synthesized by using low-cost and commercially available starting material, vanillin. So, the reaction between vanillin and dimethyl succinate could provide the monoacid product that was hydrogenated, reduced, and cyclized to give the lactone. Then, aldol reaction and hydrogenation could provide the synthetic kusunokinin intermediate. Finally, the synthetic kusunokinin intermediate will be derivatized to provide various kusunokinin derivatives. Further work, biological activity of all synthetic kusunokinin derivatives will be later investigated.



Scheme 1. Synthesis of kusunokinin derivatives

DEUTERATION OF ORGANIC COMPOUNDS BY HYDROTHERMAL PROCESS

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[2]Organic Synthesis Research Unit, Department of Chemistry, Faculty of Science,
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Abstract:

Deuterium-labelled compounds are widely used in many applications including standard in various analytical techniques, improving drug metabolism, and as NMR solvents. Herein, the objective of this study is to develop a method for the deuteration of organic compounds with deuterium oxide (D_2O) as the deuterium source under hydrothermal conditions. The deuteration experiments performed with various substrates showed that the hydrogen-deuterium exchange (HDx) at the *ortho*-, *para-* positions of phenols and α-position of amino acids occurred efficiently under hydrothermal reaction without the need for any catalyst or additive. The HDx of amino acids occurred with complete racemization at the α-position. The HDx reaction also occurs at the α-position of esters and on the indole ring. Accordingly, the developed hydrothermal HDx provides a green approach for synthesizing deuterated organic compounds that are useful in pharmaceutical, analytical, and many other fields.

Session C:
CHEMISTRY
(Physical & Theoretical Chemistry)

STUDYING THE INTERFACIAL EFFECT OF NANOSCALE TiO_2-Cu_2O HETEROJUNCTION ON THE PHOTOACTIVITY OF METHYLENE BLUE DEGRADATION USING CATALYTIC MODEL SYSTEMS OF Cu_2O NANOPARTICLE ON TiO_2 PLANAR SUPPORT

Passapan Sanguanchua[1], Arjaree Ratanasangsathien[1], Mathus Jirapunyawong[1], Witthawat Wongpisan[2], Thassanant Atithep[3], Yutichai Mueanngern Pradepasena[1], Sakol Warintaraporn[1]

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[2] Thailand National Metal and Materials Technology Center
[3] Vidyasirimedhi Institute of Science and Technology
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Abstract:
Due to its high photoactivity and high photostability, TiO_2 is commonly used in photocatalysis reactions, such as the production of hydrogen through photodehydrogenation of ethanol or organic dye pollutant degradation. However, this material suffers from a high bandgap value of 3.2 eV which limits the excitation energy to UV irradiation. Cu_2O can be used to bridge the energy used by promoting charge carriers due to its low bandgap energy which lies in the visible light region. To investigate the interfacial mechanism of the TiO_2-Cu_2O heterojunction in methylene blue degradation, we designed a systematic photocatalytic system composed of Cu_2O nanocubes which forms a uniform layer on TiO_2 thin film using Langmuir-Blodgett deposition method. The surface coverage of the nanoparticles was varied to study the effect of the interface between TiO_2 and Cu_2O. The kinetic results showed a monotonic increase in reaction rate at first, then the rate reaches a maximum at an intrinsic coverage. The rate, however, drops at higher coverage densities. This can be explained by the suppression of available TiO_2-Cu_2O interface sites at upper and lower coverage limits of Cu_2O on TiO_2. This work represents a method of assembling a novel system of Cu_2O nanoparticles on planar TiO_2 support films using the Langmuir-Blodgett Method, allowing for the direct nanoscale correlation of the photocatalyst's morphology with the observed photocatalytic activity.

A MULTISCALE MOLECULAR SIMULATION OF AMORPHOUS POLY(VINYL ALCOHOL)

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Abstract:

A method to efficiently construct the amorphous structure of polymers was applied for polyvinyl alcohol (PVA). PVA chains were grouped as one bead per monomer and mapped onto the second nearest neighbor diamond (*2nnd*) lattice with intra- and inter-molecular interactions based on the rotational isomeric state (RIS) model and Lennard-Jones potential energy, respectively. Amorphous the fully atomistic models of amorphous PVA bulks can be obtained by the reverse-mapping procedure followed by energy minimization. To validate PVA models, some molecular and material properties were determined and compared with experimental data including conformational statistics, solubility parameter and x-ray scattering structure factor. This work has already been published recently [Mater. Today Commun. 2022; 30: 103029].

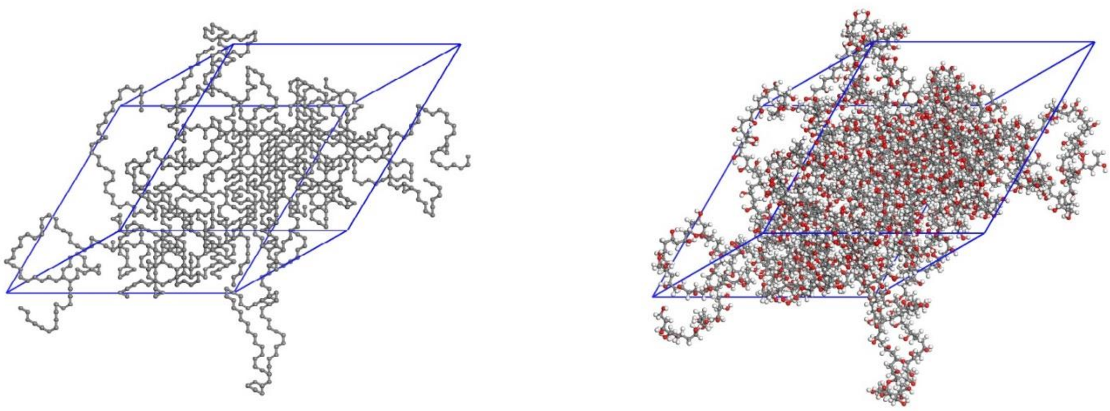

Figure 1.
Example of the snapshot of coarse-grained (left) and fully atomistic PVA model figure (right).

MOLECULAR DOCKING STUDIES OF THE 2,5-DIKETOPIPERAZINE DERIVATIVES AS POTENTIAL ANTI-SARS-CoV2 ACTIVITY

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*e-mail: sirirak_j@silpakorn.edu, +66-34255797

Abstract:

Drugs for the treatment of COVID-19 are continuously developed by scientists and physicians worldwide due to the severe acute respiratory syndrome caused by COVID-19. 2,5-Diketopiperazine derivatives consisting of benzylidene and alkylidene substituents at 3 and 6 positions have been known as the core structure for their antiviral activities. Our group previously reported the novel 2,5-Diketopiperazine derivatives as anti-influenza virus (H5N2). Herein, the potential of our natural 2,5-Diketopiperazine derivatives: Lansai C (LS-C) and synthetic 2,5-Diketopiperazine derivatives (**13a-d**) as COVID-19 inhibitors were investigated with molecular docking approach, using SARS-CoV-2 3CL main protease and SARS-CoV-2 spike receptor-binding domain bound with ACE2 as the receptors, and the results were compared with that of Favipiravir. It was found that LS-C and compound **13d** bound in the active sites of both protein targets and their binding energies were also either similar or lower than those of Favipiravir. Moreover, the piperazine and carbonyl groups on 2,5-DKP scaffold of LS-C and **13d** effectively interacted with amino acids in the active site of both receptors. This indicated that the 2,5-DKP scaffold of our compounds could be the key to bind and inhibit the enzyme involved in anti-SARS-CoV-2 activities leading to the potential COVID-19 drugs

Session D:
MATHEMATICS / STATISTICS / COMPUTER SCIENCE / DATA SCIENCE / AI

AFFINE RATIONAL TRANSFORMATIONS OF COPULAS AND QUASI-COPULAS

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Abstract:
The transformation-based methods are indeed the convenient ways for constructing a new copula using known copulas. In this research, we characterize linear rational transformations for multivariate copulas and multivariate quasi-copulas. This is an extension to the already known results in the bivariate case. We found that this type of transformations extended naturally for the multivariate quasi-copulas. Yet, the only linear rational transformation of multivariate copulas is the identity function which is different from the bivariate case. This means that the set of linear rational functions that transform a multivariate copula varies depending on the copula itself. As an example, we also characterize such sets in the case of the trivariate product copula.

APPLICATION OF THE CORRELATIVE EQUATIONS TO "FILL UP" A MONITORING WATER QUALITY DATA TO SUPPORT THE ASSESSMENT OF WATER QUALITY AND SELF-CLEANING CAPACITY.

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Abstract:
The monitoring of water quality is one of the annual important tasks of environmental management of administrative agencies. However, due to various reasons, the monitoring work does not take place continuously, causing discontinuity/lack of data sets. The lack of data and the discontinuity of the monitoring data set causes the heterogeneity or weak representativeness of the analysis/assessment results about the level quality or self-cleaning capacity of water. The Highest order polynomial fitting Cure Equation (HopCEq) and Multivariable Regression Correlative Equation (MrCEq) are the commonly methods used interpolation/simulation and gives suitable results. In the study, the assessment of water quality and self-cleaning capacity of Nhieu Loc Thi Nghe canal (NLTN) in Ho Chi Minh City (HCMC), the HopCEq and MrCEq are applied to "fill up"/"make continuous" the monitoring data sets by the space and time. This helps to increase efficiency in the analysis/assessment and increases the representativeness of research results with an appropriate correlation coefficient (R) and the corresponding degree of close correlation.

APPLICATION OF IMAGE PROCESSING AND MACHINE LEARNING FOR ABNORMAL VERTEBRAE CLASSIFICATION

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Abstract:
This research aims to optimize an application of artificial intelligence to classify abnormal spines through image processing combined with the use of a machine learning system by convolutional neural network methods. The image processing operation had two part , namely, Sobel edge detection and Adaptive threshold detection. The result of this technique was to compare the processing as mention above. Image processing helped in visualizing important aspects of spine alignment from computed tomography images (CT-image). The processed images were used to create a model by the convolutional neural network method. It was found that the recognition accuracy of the images obtained by Sobel edge detection was 0.5635, whereas the recognition accuracy of the images obtained by Adaptive threshold detection was higher than that of the other method, 0.9429.

SOME RESULTS IN BIPOLAR QUANTUM LINEAR ALGEBRA

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Abstract:
We study calculus for derivatives under the space of Bipolar Quantum Linear Algebra (BQLA). The study is aimed to use another method to solve the derivative of the power function by giving the $\epsilon - \delta$ definition. Then, we also investigate the quotient function $f(-x,y) = \frac{(0,1)}{(-x,0)}$ for any $x \neq 0$ and $f(-x,y) = \frac{(0,1)}{(0,y)}$ for any $y \neq 0$. Moreover, we obtain some results of the limit in bipolar sense. Additionally, via three active learning activities, the authors provide recommendations for learning activities for undergraduate students to develop mathematical thinking abilities.

CREPANT RESOLUTION OF QUOTIENT SINGULARITIES AND THE McKAY CORRESPONDENCE

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Abstract:
The original McKay correspondence was considered for 2-dimensional rational double points which were given as quotient singularities of finite groups. The representations of the finite group appear in the geometry of the minimal resolution of the singularity and this correspondence was called the McKay correspondence.
We will introduce this correspondence and would like to show higher dimensional generalization and recent results.

THE EQUITABLE CHROMATIC NUMBERS OF CARTESIAN PRODUCTS OF SOME GRAPHS

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Abstract:

A graph G is *equitably k-colorable* if its vertex set can be partitioned into independent sets $V_1, V_2, \ldots, V_k$ such that for any $i \neq j$, $||V_i| - |V_j|| \leq 1$. The *equitable chromatic number* of G, denoted by $\chi_=(G)$, is the smallest positive integer k such that G is equitably k-colorable. The *Cartesian product* of graphs $G_1(V_1, E_1)$ and $G_2(V_2, E_2)$ denoted by $G_1 \square G_2$, has the vertex set $\{(u,v) \mid u \in V_1 \text{ and } v \in V_2\}$ and $\{(u,x),(v,y)\}$ is an edge if and only if $u = v$ and $xy \in E_2$ or $x = y$ and $uv \in E_1$. In this paper, we obtain the equitable chromatic numbers of Cartesian products of the graphs as follows:

$\chi_=(K_{1,1,1,1} \square K_{1,3}) = 4$, $\chi_=(K_{\underbrace{1,1,\ldots,1}_{m}} \square K_{1,n}) = m$, $\chi_=(K_{m,m,m} \square K_{1,n}) = 3$,

$\chi_=(K_{\underbrace{m,m,\ldots,m}_{r}} \square K_{1,n}) = r$, $\chi_=(K_{\underbrace{1,1,\ldots,1}_{m}} \square K_{s,t}) = m$, $\chi_=(K_{\underbrace{m,m,\ldots,m}_{r}} \square K_{s,t}) = r$,

$\chi_=(K_{\underbrace{m,m,\ldots,m}_{n}} \square K_{r,s,t}) = n$ and $\chi_=(K_{\underbrace{m,m,\ldots,m}_{r}} \square K_{n_1,n_2,\ldots,n_k}) = r$.

ON THE DIOPHANTINE EQUATION $a^x + b^y + c^z = w^2$

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Abstract:
The exponential Diophantine equations $a^x + b^y = z^n$ have been investigate for over ten years. Especially, there are numerous articles related to the case $n = 2$ or 4 and $2 \leq a, b \leq 200$ but it is merely to see if the left-hand side of the exponential Diophantine equation has to be more than two base numbers. So, in this article, we study the exponential Diophantine equation $a^x + b^y + c^z = w^2$, where x, y, z and w are nonnegative integers with some properties of a, b and c. For any $a, b, c \in \{2,3, \dots ,20\}$, if $a \leq b \leq c$, then our results lead to assure that there are 135 equations which have been considered from all 1,330 equations.

STUDYING THE SHORTEST HAMILTON PATH FOR SIGHTSEEING IN CHAIYAPHUM PROVINCE

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Abstract:
This research aims to find a walking path for traveling in Chaiyaphum Province to achieve the shortest distance and all places. By choosing tourist attractions from website in Chaiyaphum 8 places, then make a graph showing the distance and travel route. The results showed that when using shortest distance data between two points via Dijkstra's algorithms and selecting the route by choosing the next nearest point, it appears that the resulting route has the opportunity to repeat some point. This makes it to not a Hamiltonian path, and the resulting route may not be the shortest walking distance. Later on when programming C++ using by reverse procedures and using the shortest distance data between the two points from the Dijkstra method to perform calculations, the shortest routes could be found, since the program has compares the distance of all possible walking routes. Moreover, the shortest walk found is also a Hamiltonian path.

THE MAXWELL – BURR III DISTRIBUTION: ITS PROPERTIES AND APPLICATION TO THE NEW COPD PATIENT RATE IN KHON KAEN, THAILAND

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Abstract:

This research aimed to propose the newly developed Burr III distribution named The Maxwell–Burr III distribution. We applied the Maxwell generalized family of distributions to construct the proposed distribution by adding the scale parameter. This new expansion has enhanced the flexibility of the basic distribution with the potential to model various types of lifetime data since the hazard curve of the proposed distribution can be increasing and decreasing. The standard statistical functions of Maxwell–Burr III distribution were defined including cumulative distribution function, probability density function, survival function, hazard function, and quantile function. The parameter estimation was constructed by using maximum likelihood method. A simulation study was conducted to access the performance of maximum likelihood estimators. Maxwell–Burr III distribution was also applied to model real lifetime data set relating to the new COPD patient rates in Khon Kaen, Thailand to demonstrate the ability of the distribution against other competing distributions. The results showed that it performed the best among others in terms of information criteria, AIC, CAIC.

HULLS OF CODES FROM COMPLETE MULTIPARTITE GRAPHS

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Abstract: Codes over a finite field of prime order obtained from the row spaces of adjacency matrices of complete multipartite graphs are discussed. The hulls, that are the intersection of the codes and their duals, are examined to obtain the main parameters and bases of minimum-weight vectors. Necessary and sufficient conditions for the codes to be self-orthogonal and self-dual are also established.

A MODIFICATION TO LOGISTIC REGRESSION WITH IMBALANCED DATA: F-MEASURE-ORIENTED LASSO-LOGISTIC REGRESSION

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Abstract:
Logistic regression (LR) is one of the most popular classifiers. However, Logistic regression is not able to perform effectively on imbalanced data (ID). There are two approaches to ID for LR. They are resampling techniques and modifications to the log-likelihood function. Although these approaches can improve performance measures of LR in some cases, their effectiveness is not robust in general. In this paper, we propose a new classifier called *F-measure-oriented Lasso-Logistic regression* (F-LLR). The base learner of F-LLR is Lasso-Logistic regression (LLR) which imposes the prior on the magnitude of parameters by a hyper-parameter λ. The optimal λ is determined by an adjustment of the cross-validation procedure (CV) which aims for the highest F-measure instead of the highest Accuracy as CV. Besides, F-LLR also deals with ID by applying under-sampling (US) and SMOTE selectively based on the scores of the training data. An empirical study on three credit scoring data sets was conducted to test the effectiveness of F-LLR. The obtained results show that F-LLR classifier could increase F-measure and KS as compared with LLR and the traditional solved ID methods, such as RUS-LLR, ROS-LLR, SMOTE-LLR, Ridge, and Weighted likelihood estimation.

TIME REDUCTION METHOD FOR HEURISTIC ALGORITHMS USING LOCAL TEMPORAL MEMORY

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Abstract:

Vehicle routing problem in an urban area is challenging mainly because travel times vary by traffic during the day. Therefore, using a single time frame to create the whole routing plan would deviate from the result and result in fewer efficiency plans. In addition, the Bangkok travel time approximation is currently available as road traffic data are constantly collected by the intelligent traffic information center foundation using traffic CCTV cameras, traffic probes on public transport, and probe applications on mobile phones. The real-time traffic data can be acquired through a traffic data provider, where the data package can be requested online by the map application interface. However, acquiring ad-hoc traffic data is time-consuming, especially when using heuristic algorithms for the vehicle routing problem. Therefore, this project implements a temporal cache of traffic data on-premise to reduce the communication time used by the map application interface. The result showed that applying the cache allowed the heuristic algorithm to search for more solutions and get better solutions.

DISTRIBUTED REPRESENTATIONS OF WIFI FINGERPRINTS FROM WORD-EMBEDDING TECHNIQUES WITH APPLICATIONS IN CROWDSOURCE-BASED ZONE-LEVEL LOCALIZATION

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Abstract:
Over the past decade, indoor positioning system (IPS) has gain increasing attention and found widespread applications in commercial and research environments. Specifically, WiFi-fingerprint-based IPS (WFB-IPS) offers a low-cost solution over its counterparts such as Bluetooth, ultra-wideband (UWB), and radio frequency identification (RFID) technologies due to the ubiquity of WiFi access points (WAPs) in most buildings. However, the main disadvantage of the WFB-IPS system is intensive survey effort required during system initialization and maintenance. This work explores a solution to alleviate this limitation by considering a crowdsource-based approach for zone-level localization. Instead of relying only on the labelled WiFi fingerpint data from trained surveyors, this approach uses the more-attainable unlabeled fingerprint data collected by participating volunteers. This unlabeled data is then used to augment the surveyed data, forming a more comprehensive training dataset for subsequent localization tasks; this semi-supervised approach allows for minimal survey effort during system initialization and maintenance. To enable such solution, this work introduces a novel approach of employing word embedding techniques to construct distributed representation of fingerprint data to overcome three challenges: (a) poor data augmentation and localization performances due to poor data separability in a feature space, (b) potentially reduced localization accuracy due to inhomogeneous data from non-calibrated devices and untrained personnel and (c) high computational and memory requirements due to sparse data representation from a typical "one-hot" feature extraction. We employed word embedding techniques commonly used in natural language processing (NLP) such as *Word2Vec*, *GloVe*, and *Doc2Vec*, and compared their performances with those from well-recognized dimensionality reduction techniques such as PCA and UMAP. The results show that *Word2Vec* and *GloVe* outperform other techniques in terms of data separability, data augmentation performance, localization accuracy and robustness again potential data inhomogeneity. Together with the resulting distributed and compact data representation, *Word2Vec* and *GloVe* are the recommended data-representation techniques for WiFi fingerprints. Finally, we validated the feasibility of the semi-supervised approach for the WFB-IPS system by demonstrating that with very minimal amount of labelled data, the semi-supervised method can still exhibit similar localization accuracy to that from the fully-supervised approach.

WEIBULL–EXPONENTIAL DISTRIBUTION AND ITS PROPERTIES

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Abstract:

This project proposes a new distribution resulting from a finite mixture of weibull distribution and exponential distribution and discuss theoretical properties such as survival functions, hazard rate, kth moment, the generating function, order statistics and parameter estimation.

SOCIAL DISTANCING DETECTOR IN LECTURE CLASSROOM FROM REAL TIME VIDEO

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Abstract:
The development of a social distancing detection in the classroom from real time video, which can be displayed the result of video detection via web application, is originated from the problem of the current situation of the epidemic of the COVID-19 virus. The goal of this project is to made social distancing detector in the lecturer classroom by incorporating machine learning technologies and the policy of university about the decreasing of spreading of COVID-19 virus. This project was created and developed real-time classroom social distance detection technology. The system can be detected the distance between each person in classroom. There are three status that can indicate the distance between individual in lecturer classroom: red indicates a status with a distance of less than one meter, yellow indicates a status that is within range, and blue indicates a status with a distance greater than one kilometer. The experimental results indicate that adopting a convolutional neural network for training to detect a person in realtime video can be successfully used to detect the distancing between people. The proposed algorithms can be utilized to classify the type of activity of people with an accuracy rate of 88.24 percent.

SEMI-ANALYTICAL SOLUTION AND NUMERICAL SOLUTION OF SEIR MODEL

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Abstract:
The Susceptible-Exposed-Infected-Recovered (SEIR) model is the focus of this study. The study begins with solving a semi-analytical solution of the SEIR model, followed by a numerical solution. The results show that by reducing the order of the differential equation and approximating some integrand terms, the semi-analytical solution can be obtained. To achieve the numerical solution, we use the well-known numerical method known as the fourth-order Runge-Kutta method. Furthermore, when the semi-analytical and numerical solutions are compared, the graph patterns of solutions are similar.

ON FIXED POINT THEOREMS FOR KANNAN AND CHATTERJEA TYPE MAPPINGS

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Abstract :
In this paper, we prove some fixed point theorems for generalized Kannan and Chatterjea type mappings in compact metric spaces or complete metric spaces. Moreover, we characterize the completeness of the underlying space in terms of a unique fixed point of such mapping.

ARTIFICIAL INTELLIGENCE FOR INTERNATIONAL CLASSIFICATION OF DISEASES

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Abstract:

Abstract:

The International Classification of Diseases 10th revision (ICD10) is an essential global standard for diagnostic health information. This project aims to predict the ICD10 key from an ambiguous English word for a medical condition using a machine learning (ML) method. The ML algorithms include Logistic Regression, Decision Tree, Nearest Neighbors, Neural Network, Random Forest, Naive Bayes, and Markov. The ICD10 code data is divided into 1,975 for the training process and 395 for the testing procedure. Association rule is a programming technique for ML recognizing between keys and English words. The "TextWords" functional programming is a control to separate words by punctuation and whitespace used for transforming data for the association rule in the ML training process. As a result, the best method for precisely predicting was a Logistic Regression with an accuracy of 99.3±0.6%. This method was an AI algorithm for predicting the categorical dependent variable using a given set of independent variables. In the comparison of accuracies, Logistic regression was more efficient than Naive Bayes 99.01±0.31%, Nearest Neighbors 99.0±0.7%, Markov 93.8±1.7%, Random Forest 87.2±2.3%, Decision Tree 5.3±1.5%, and Neural Network 0.01±0.07%, respectively. The Decision Tree and Neural Network methods were not suitable for this study. Therefore, each task is specific to a particular AL method. The ML can contribute to the solution of medical outcomes. Additionally, this initiative will be advantageous for future medical resources and practical for doctors at some point.

THE INFLUENCED DESTINATION CULTURAL ATTRACTION USING DECISION TREE METHOD

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Abstract:

The objective of this research is to search the influenced destination cultural attraction places by collecting the attraction place along the green line train, Bangkok, Thailand with total instance of 400, number of cultural attractions is 30, considered from the distance around all 16 green line train stations and classify 3 classes forms of tourism, comprising with Buddhism, Museum and Natural. This research method uses decision trees to establish rules for introducing influenced destination cultural attractions, the results reveal the accuracy is 62.36%, Buddhism class precision value is 57.69%, Museum class precision value is 64.29%, Natural class precision value is 68.97%, Buddhism class recall value is 63.83%, Museum class recall value is 51.43%, Natural class recall value is 74.07%, and the Influencer Destination places are MOCA Bangkok, St. Michael's Church, Songyae and Jib Sing Sang Tung respectively.

AN APPLICATION OF SOLUTIONS OF LINEAR DIFFERENCE EQUATIONS FOR OBTAINING THE CONDITIONAL MOMENTS OF THE TRENDING ORNSTEIN-UHLENBECK PROCESSES

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Abstract:
This paper presents an application of solutions of linear difference equations for obtaining a closed-form formula for the γ^{th} conditional moment of the Ornstein-Uhlenbeck (O-U) process, for any positive real number γ. The partial differential equation associated with the O-U process is reduced to a system of ordinary differential equations (ODEs), which can be solved analytically in Laplace-transformed space using solutions of linear difference equations. Our success in performing Laplace inverse transform leads to a simple closedform formula for the conditional moment. Interestingly, several asymptotic properties of the conditional moment can easily be deduced using our closed-form formula. Secondly, the n^{th} conditional moment of the trending O-U process is derived in closed form, for any positive integer n. Finally, we derive the n^{th} unconditional moment of the O-U process and explore some asymptotic properties.

A DATA-DRIVEN APPROACH FOR MANAGING INVESTMENT RISK IN STOCK MARKETS AND ITS APPLICATION IN THE STOCK EXCHANGE OF THAILAND

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Abstract:
In this study, we developed a data-driven approach for obtaining an objective function used for managing investment risk based on historical closing stock prices. We applied our approach to the stocks in SET50 traded in the Stock Exchange of Thailand for several cases of portfolios by optimizing the objective function subject to a suitable constraint derived from an expected return that yields an optimum portfolio. Our results show that an increase in expected return produces a higher risk, while an increase in the number of stocks in the portfolio reduces the risk of investment. Finally, we demonstrated the efficiency of our approach as well as analyzed efficient frontiers for investors in SET50.

LEVITIN-POLYAK WELL-POSEDNESS FOR GENERALIZED (η, g, φ)-MIXED VECTOR VARIATIONAL-TYPE INEQUALITY PROBLEM

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Abstract: We introduce and analyze the notion of Levitin-Polyak (LP) well-posedness for generalized (η, g, φ)-mixed vector variational-type inequality problem. We establish some sufficient conditions for verifying these LP well-posedness and generalized LP well-posedness properties. Moreover, we give examples to explain the determined assumptions.

AN ALTERNATIVE METHOD TO DETECT OUTLIERS IN MULTIVARIATE DATA

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Abstract:

This study proposes techniques for finding outliers in multivariate data. It is based on the Mahalanobis distance and multiple linear regression. The Mahalanobis distance is used to filter the data across all variables to break the data set into two groups, i.e., normal data and data that might be outliers. After that, a multiple linear regression model is built using the normal data to provide a reliable estimate for the cut-off point. For figuring out how well the proposed method works, a simulation study is done with multivariate normal data with and without contaminated data at different levels: 0, 0.01, 0.05, and 0.10. The performance of the proposed method is compared with the earlier methods; Mahalanobis distance and Mahalanobis distance with the robust estimators using the minimum volume ellipsoid method, the minimum covariance determinant method, and the minimum vector variance method. The findings demonstrated that the proposed method effectively identifies the highest accuracy of outliers detected at all levels of contamination regardless of sample size or the number of variables. When the proposed method is used on real data, it also shows that it can find outlier values that are consistent with the real data.

A METHOD FOR OUTLIER DETECTION IN UNIVARIATE CIRCULAR DATA USING PARTITIONING DATA

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Abstract:

Circular data is the value of the direction data and is recorded in the form of an angle. Many fields, such as geology, biology, meteorology, physics, psychology, image analysis, and medicine, correspond to this data. Circular data in the data analysis is still concerned about the outliers because the dataset can be obtained the outliers. The outliers can indicate some properties or anomalies of the sample unit. This research aims to propose a method for detecting outliers for univariate circular data that can detect outliers appropriately and should be easy to implement. The concept of the proposed method is based on the summation of the distance between any point and any other point, and then the partitioning of the data. The performance of the proposed method is evaluated in the simulation study. The results show that the proposed method has a preference over the other methods. Also, the outliers using this method for one real dataset are illustrated.

HAMILTONIAN CYCLES IN CAYLEY GRAPHS OF GYROGROUPS

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[2] Research Group in Mathematics and Applied Mathematics, Department of Mathematics, Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand
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Abstract: The gyrogroup structure is a non-associative algebraic structure discovered by A.A. Ungar during his study of Einstein's relativistic velocity addition law. It can be considered as a generalization of the structure of groups where the associative property is substituted by the left gyroassociative property and the left loop property. In this talk, we will discuss Hamiltonian cycles in the right-Cayley graphs of gyrogroups. In particular, we will present a gyrogroup version of the factor group lemma together with some examples. We will also show that some right-Cayley graphs of a certain class of gyrogroups are Hamiltonian.

COMPARISION OF PERFORMANCE OF DATA CLASSIFICATION USING DECISION TREE AND RANDOM FOREST TECHNIQUES

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Abstract:
The objective of this research is to determine the efficiency of two popular models of data classification, Decision Tree model and Random Forest model. Nowadays, a problem of classification is a concern for researchers to optimize the efficiency of classification accurately. Researcher therefore conducted experiments with four different data sets from UCI data set test, including with: a) Breast Cancer Wisconsin (Diagnostic) data set, which was divided into two classes, Malignant and Benign. b) Heart Disease data set c) Lymphography data set and d) Statlog (Heart) data set.

Results from the Decision Tree method reveal that when considering accuracy, the Heart Disease data set has the highest value at 82.49% , followed by the Lymphography Data set is 81.19% , Statlog (Heart) data set is 79.26% and Breast Cancer Wisconsin (Diagnostic) data set is 73.54%.

Considering Recall values, they reveal that the Breast Cancer Wisconsin (Diagnostic) data set is 65.78% for True Malignant and 79.40% for True Benign. The Heart Disease data set is 75.57% for True Positive and 87.79% for True Negative, the Lymphography data set is 80.33% for True Malign lymph, 85.91% for True Metastases and 50.00% for True Fibrosis. The Statlog (Heart) data set is 80.00% for True Presence and 78.67% for True Absence.

Considering Precision values, they reveal that the Breast Cancer Wisconsin (Diagnostic) data set is 70.71% of Malignant and 75.42% for Benign. The Heart Disease data set is 82.50% for Positive and 82.51% for Negative, the Lymphography data set is 77.78% for Malign lymph, 85.91% for Metastases and 66.67% for Fibrosis. The Statlog (Heart) data set is 75.00% for Presence and 83.10% for Absence.

Results from the Random forest method reveal that when considering accuracy, the Lymphography data set has the highest value at 87.19% followed by, Statlog (Heart) data set is 85.19% , the Heart Disease data set is 80.22% and Breast Cancer Wisconsin (Diagnostic) data set is 74.96%.

The recall values of the random forest experiments, the Breast Cancer Wisconsin (Diagnostic) data set is 63.46% for True Malignant and 83.67% for True Benign. The Heart Disease data set is 63.46% for True Positive and 83.67% for True Negative, the Lymphography data set is 86.89% for True Malign lymph, 91.36% for True Metastases and 50.99% for True Fibrosis. The Statlog (Heart) data set is 77.50% for True Presence and 91.33% for True Absence.

Considering Precision values, they reveal that the Breast Cancer Wisconsin (Diagnostic) data set is 74.61% of Malignant and 75.17% for Benign. The Heart Disease data set is 74.61% for Positive and 75.17% for Negative, the Lymphography data set is 84.13% for Malign lymph, 89.16% for Metastases and 100.00% for Fibrosis. The Statlog (Heart) data set is 87.74% for Presence and 83.54% for Absence.

If we compare accuracy values of 4 data sets, the Random forest model gives higher value in 3 of 4 data sets which are Breast Cancer Wisconsin (Diagnostic) data set, Lymphography data set and Statlog (Heart) data set. For Heart Disease data set, accuracy value of Random forest method is 2.27% less than Decision Tree method. The precision values of Random forest method are performed better than Decision Tree method with all of fours data sets.

SUM OF PRODUCTS OF TWO CONSECUTIVE PRIMES

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Abstract:
Consecutive prime numbers are two prime numbers that there is no other prime number in-between. In particular, the number $2021 = 43 \cdot 47$ is a product of two consecutive prime numbers. Moreover, 2021 is between $1814 = 23 \cdot 29 + 31 \cdot 37$ and $2137 = 17 \cdot 19 + 23 \cdot 29 + 31 \cdot 37$ which are the sums of the products of pairwise distinct consecutive prime numbers. In this work, we investigate the precise bounds for the number of sum of products of two consecutive primes which is less than or equal to real number x.

GEOMETRICAL PROPERTIES OF LEAF APEX AND ITS EFFECT ON WATER DRAINAGE ABILITY

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Pimsiri Danphitsanuparn[2], Pat Vatiwutipong[3,*]
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Abstract:
Water drainage is a vital mechanism for plants. Plants adapt their leaves to survive. The drip tip, the elongated leaf tip, is an example of plant adaptation to high rainfall areas. Water is removed at the drip tip to avoid rotten leaves. This character helps plants drain the water from the leaf surface and protect against leaf damage. This study focuses on the relationship between leaf apex shape and water drainage ability. *Lagerstroemia sp.* was selected in our research. Leaves were collected and flattened by using a plant press and heat. The water was dropped on the leaf. The drained water was weighed, and then calculated the leftover water on the leaf surface. The drip tip pictures were analyzed. A new angle measurement method and mathematical model for drip tip curves were created to find an equation describing the shape of the leaf apex. The different leaf apex shapes affected water drainage ability. Following the previous study, the narrower angle had a higher water drainage ability. The results showed a strong correlation between the water drainage ability and our proposed angle measurement method and the model parameters.

QUANTITATIVE STUDY OF THE EFFECT OF LEAF HARVESTING TIME ON ITS EDGE CURVATURE

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Abstract:
Once a leaf is harvested from a plant, its source of water is eliminated and thus the process of leaf dehydration begins. The reduction in water availability induces stress-coping mechanism in the plant which lowers leaf water potential, thereby instigating leaf contraction. It is observed that the curvature of leaf edge directly correlates with the time passed since harvested. Curvature is geometrically defined as the instantaneous rate of change of direction of a moving point on the curve. In this research, we attempted to quantify such increases by determining the numerical curvature of each point on leaf edges. Experiments are performed on harvested *Magnolia alba* leaves and data on pointwise curvatures are collected. As expected, the average curvature for each leaf constantly increases as a function of time. Furthermore, the distribution of leaf edge curvatures is well-approximated by Poisson distribution, where the rate λ is calibrated using average curvature. This suggests that the increment of leaf edge curvature is a Poisson process, which is applicable to computer graphics, leaf hydraulic system simulation, and leaf age detection.

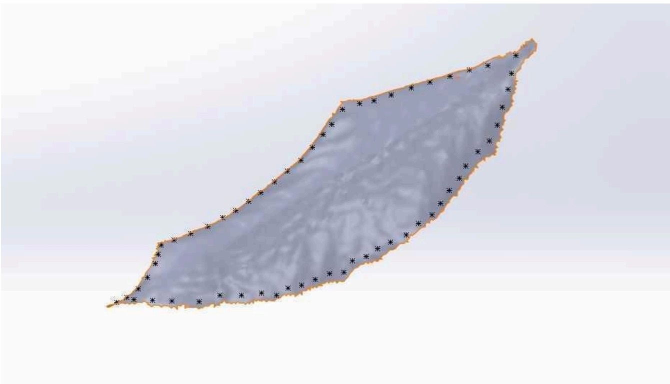

Figure 1. Points on the edge of the *Magnolia alba* leaf that are used to determine its edge curvature.

TIME SERIES CLUSTERING USING FREQUENCY DISTRIBUTIONS OF FIRST-ORDER DIFFERENCES

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Abstract:
Time series clustering is an important process in time series analysis, especially for big time series data. Generally, time series clustering is done by comparing each pair of time series using a distance function, which is fast but is relatively inaccurate. A more sophisticated scheme, dynamic time warping (DTW), provides the accuracy that the former method lacks at the expense of time complexity which leads to impracticality in large-scale implementation. In recent years, a fast DTW algorithm was developed to lower the time complexity although not as accurate as the normal DTW algorithm. To provide a faster but relatively more accurate method, we re-implemented the technique of comparison using statistical distance function, but on the frequencies of first-order differences of the time series instead of the time series themselves. In this work, different statistical distances, including the Euclidean distance, Bhattacharyya distance, and Jensen-Shannon divergence, were used to compare the distribution of the first order difference of the time series. We conducted numerical experiments and discovered that Jensen-Shannon divergence yields the maximum accuracy (79.98±3.66%), followed by Bhattacharyya distance (75.26±2.35%) and Euclidean distance (73.76±3.26%). Furthermore, we evaluated methods of clustering using real data of the number of pedestrians who traveled through each sensor location in Melbourne, Australia. The result shows that, when compared to both fast DTW techniques (58.53±5.47% and 64.12±4.47%), the usage of Jensen's divergence offers the maximum accuracy (72.61±5.09%). However, compared to the control methods, the accuracy of the Euclidean distance (50.57±4.03%) and Bhattacharyya distance (48.29±4.24%) methods is lower. So, we draw the conclusion that Jensen-Shannon divergence performed better than the others. This outcome can be improved upon and used in larger time series data, which is crucial in the current time.

EXPLOITATION OF ONTOLOGY IN SEMANTIC WEB: A CASE STUDY FOR TRANSFERRING THAILAND LICHENS DATA INTO DOMAIN ONTOLOGIES

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Abstract:
Over 100 lichens have been found and identified in Thailand more than a hundred years. Lichens perform useful functions to our environment. Normally, Lichens grow on the trees, rocks, and soils in various forms and colors. They provide shelter and food for animals and plants. We can also use Lichens as the air pollution indicator and some Lichens are researched for drugs, dyeing colors, deodorant, and extracts. This paper presents the ontology knowledge based for Lichens in Thailand by using Lichens data from Khao Pluang, Chai Badan, Lopburi. The major contributions of the system consist of the stored knowledge of Lichens, the latitude and longitude of Lichens at Khao Pluang, and Lichens images. The system was implemented via web and mobile applications. The ontology knowledge consists of 6 main classes: 1) the scientific name, 2) Lichens types, 3) date found, 4) Lichens usage, 5) air pollution indicators, and 6) the specific features of Lichens. The evaluation of the system includes the users' assessment, precision, recall, and overall performance. Figure 1 shows the location of Lichens at Khao Pluang and Hozo class hierarchy diagram.

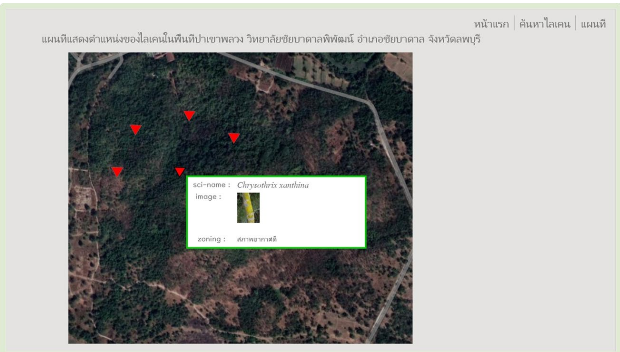
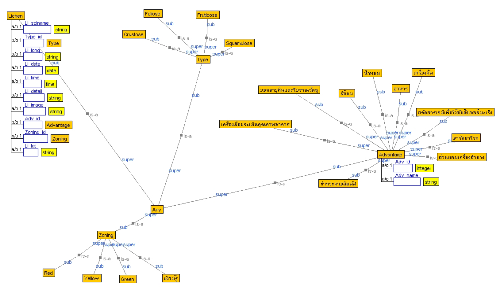

Figure 1. The latitude and longitude of Lichens at Khao Pluang and Hozo editor.

STABILITY ANALYSIS OF UNEMPLOYMENT MODEL IN THAILAND AFTER THE COVID-19 OUTBREAK

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Abstract:
In this paper, a nonlinear mathematical model is formulated to study the unemployment problem in Thailand after the COVID-19 outbreak by considering the number of unemployed, the number of employed people, and the number of new migrants to find work. Moreover, the stability of this system is analyzed. It is found that this system has two equilibriums: the employment-free equilibrium and the positive equilibrium. Additionally, two equilibrium points are stable under certain conditions. The corresponding parameters in the models are derived from data from the National Statistical Office, the Ministry of Digital Economy and Society, and the Foreign Workers Administration Office during the COVID-19 situation in 2020. Finally, the numerical experiments are demonstrated to validate the theoretical results and model.

INDIFFERENCE PRICING OF EXOTIC OPTIONS UNDER MEAN-VARIANCE UTILITY WITH FINITE LIQUIDITY

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Abstract:
We empirically study the portfolio selection problem where tradable assets are a bank account, and standard put and call options written on S&P 500 index. The problem is mathematically formulated as an optimization problem where the variance of the portfolio is perceived as risk. The task is to find the portfolio which has a satisfactory return but has the minimum variance. The underlying is modeled by a variance gamma process which can explain the extreme price movement of the asset. We also study how the optimized portfolio changes subject to a user's view on the future asset price. Moreover, the optimization model is extended for asset pricing. To illustrate the pricing technique, we compute indifference prices for buying and selling six options namely a European call option, a quadratic option, a sine option, a butterfly spread option, a digital option, and a log option and propose the hedging portfolios, which are the portfolios one needs to hold to minimize risk from selling or buying such options, for all the options. The sensitivity of the price from modeling parameters is also investigated. Our hedging strategies are decent. The payouts of the hedging portfolios are very close to those of the bought or sold options. The results shown in this study are just the illustrations of the techniques. The approach can also be used for other assets such as stocks, bonds, or derivatives in any financial markets with just some small adjustments.

Session E:
ENERGY /
ENVIRONMENTAL &
EARTH SCIENCE /
MATERIALS SCIENCE /
SPIN CROSSOVER

EXPRESSION OF MHETase ENZYME BY RECOMBINANT BACTERIA FOR POLYETHYLENE TEREPHTHALATE (PET) PLASTIC DEGRADATION

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Abstract:

Since the beginning of the age of plastics in 1907 numerous different synthetic polymers have been created, and they are now widespread and essential in human life and, sadly, the environment. One of the most widely used plastics today is polyethylene terephthalate (PET), a synthetic polymer generated from crude oil. The features that have made plastic a desirable resource, however, are also to blame for the harm that is done once it becomes garbage since PET is a very stable polymer and resistant to hydrolytic or enzymatic destruction. Two-enzyme system is the main key to depolymerize PET into TPA and EG. BHET is broken down by PETase into MHET and EG, and MHETase then hydrolyzes the soluble MHET product to create TPA and EG. The main focus of this study will be the second enzyme (MHETase). By producing recombinant plasmid containing the gene encoding for MHETase and transforming this plasmid into *E. coli* strain Rosetta-gami 2(DE3) pLysS for the protein expression, our recombinant protein that was designed to be released in the culture media was successfully expressed. Beside optimizing the expression conditions by varying the IPTG concentration at which MHETase gives the highest expression which was found to be at concentration 0.3 mM. These technologies are likely to play a role in the near future in bio recycling of used PET, bioconversion of the monomer TPA to PCA, PET surface treatment, and techniques for the degradation of PEF as well as microplastics and plastic microbeads.

THE EFFECTS OF PLASTICIZER AGENT IN CHITOSAN MEMBRANE MODIFIED MESOPOROUS PHOSPHOTUNGSTIC ACID AND ITS PERFORMANCES FOR DIRECT METHANOL FUEL CELL APPLICATION

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Abstract:

Chitosan (Cs) is an attractive material with outstanding properties, such as excellent film-forming material, biodegradable, and simplicity to modify chemically. Cs can be obtained from crustacean that abundant in nature and categorized as a low-cost biopolymer. However, the low thermal degradation and hydrophilicity of Cs have restricted the usage for energy application especially in fuel cell area. The Cs membrane is usually applied as part of proton exchange membrane (PEM) material in fuel cell application. The drawbacks of Cs membrane can be surmounted by applying the hydrophilic/plasticizer agent and combining the modified heteropoly acid filler. In this research, the Cs membrane was successfully fabricated using solvent evaporation method with incorporation of mesoporous phosphotungstic acid (m-PTA) and glycerol (gly). The composite membranes were varied for its plasticizer's composition from 0, 0.25, 0.50, 0.75, and 1.00 wt.% (w/v). The outstanding performances were obtained by Cs/gly-1/m-PTA membrane having the thermal stability up to 450 °C, chemical stability with the lowest weight loss at 18.33 ± 0.762%, and the highest proton conductivity at 5.13 $mS.cm^{-1}$. The other performances were also investigated including its methanol permeability at 1.982×10^{-6} $cm^2.s^{-1}$, ion exchange capacity (IEC) at 2.949 ± 0.022 $mmol.g^{-1}$, water and methanol uptake at 89.05 ± 0.092% and 1.26 ± 0.031%, respectively. In comparison to the pristine Cs membrane, which exhibits lower proton conductivity and higher methanol permeability at 2.40 $mS.cm^{-1}$ and 1.003×10^{-5} $cm^2.s^{-1}$, respectively. The morphology of the Cs/gly-1/m-PTA membrane indicated the dense structure membrane with the incorporation of PTA compound presenting of O, P, W elements obtained from EDX spectra. The addition of m-PTA filler and gly as plasticizer agent increase the performances of chitosan properties used in direct methanol fuel cell membrane.

HYDRAZINE AND HYDRAZONE FUNCTIONALIZED HYPER-CROSSLINKED COPOLYMERS FOR REMOVAL OF IODINE FROM NUCLEAR WASTE

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Abstract:

Synthesis and characterizations of novel hydrazine and hydrazone functionalized hyper-crosslinked polymers (HCPs) for iodine capture are reported. An $FeCl_3$ catalyzed cross-linking reaction of a bis-tosylated arene monomer (**M-OTs**) and benzene in different stoichiometric ratio gave a tosylate substituted hyper-crosslinked co-polymers (**P-OTs**). The presence of reactive tosylate functional group in the polymer backbone allowed for facile chemical modifications via S_N2 and hydrazone-bond formation reactions, affording a series of HCPs containing hydrazine (**P-Hzine**), and hydrazone (**P-Hzone**) functional groups. FTIR spectra of **P-Hzine** and **P-Hzone** confirm successful functionalization of P-OTs with hydrazine and hydrazone functional groups. **P-Hzine** show characteristic peaks of C-N stretching at 1613 cm^{-1} and **P-Hzone** show characteristic peaks of C=O stretching and 1714 cm^{-1}, respectively. Further characterized by a suite of techniques including elemental analysis, TGA, and BET, the nitrogen-containing HCP series were investigated as iodine extractant materials. Iodine adsorption in gas phase was observed by gravimetric measurement, and hydrazone polymer performed highest adsorption capacity at 1663 mg/g.

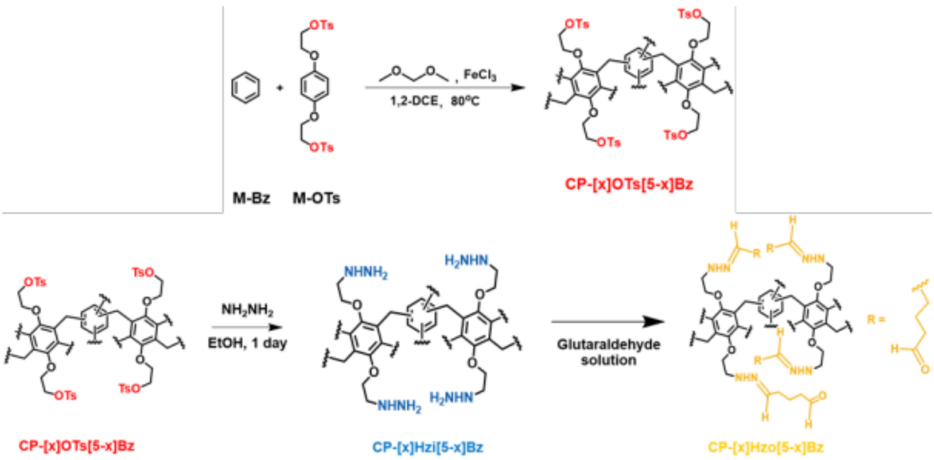

Figure 1.
Synthetic scheme of hydrazine and hydrazone functionalized hyper-crosslinked polymers (HCPs)

REMOVAL OF NITROGEN AND PHOSPHORUS FROM SYNTHETIC URINE WASTEWATER BY BIOCHAR AND ZEOLITE ADSORPTION

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Abstract:
Nowadays, nutrient recovery from urine is being studied for solving resource and environmental crises. Although only 1% of urine was in the total municipal wastewater, the found elements contain nutrients, both nitrogen and phosphorus in large quantities. In this research, 8 types of biochar and 5 types of zeolites were used to find the most efficient adsorbent for nitrogen and phosphorus removal from synthetic urine wastewater to develop alternative adsorbents for nutrients removal and recovery. The BC5 and ZL4 showed the highest adsorption capacity for biochar and zeolite. The maximum ammonium adsorption capacity reached 10.17 ± 0.79 and 12.45 ± 0.91 mg_N/g, respectively. However, both biochar and zeolite showed poor sorption capacity for phosphorus. Pseudo-second-order kinetics were proposed to fit the experimental data well for BC5 and ZL4, suggesting that the adsorption was controlled by chemical processes, which are driven by electrostatic attraction, ion exchange, and surface ligand exchange. For isotherm, BC5 data showed to fit with Langmuir isotherm though ZL4 data showed to fit with Freundlich isotherm. The morphology and elements of K, Mg, N, P and Ca were explored. BC5 was found to be morphos material. Conversely, ZL4 was found to be amorphous. Furthermore, the surface charge of BC5 was found to be positive at pH 9, which means that electrostatic was not the main force for ammonium adsorption in BC5. This is different from ZL4 that electrostatic was the main force according to the negative surface. Our findings showed that the original biochar and zeolite can be used as alternative adsorbents for ammonium adsorption in energy-saving treatment systems, but there are limitations in the absorption of phosphorus that may require surface improvement to suit its application beforehand.

THE RELATIONSHIP BETWEEN LAND SURFACE TEMPERATURE AND VEGETATION ACROSS UNIVERSITY OF TOLEDO CAMPUS AND SURROUNDING NEIGHBORHOODS

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Abstract:
The urban heat island (UHI) effect is a phenomenon that urban areas have significantly higher temperatures than rural areas. The UHI has endangered public health and led to higher energy consumption. The objective of this study is to validate land surface temperature (LST) that is estimated from satellite images and examine relationships between LST and vegetation which would provide information that can be developed to UHI intensity mitigation. This study focused on the University of Toledo campus, Ohio, USA and surrounding neighborhoods. The study site was divided into nine quadrants with the campus in the center. Data from Landsat 8 on June 28, 2022 were acquired to calculate LST and Normalized Difference Vegetation Index (NDVI) which indicates the amount of vegetation in an area. Also, the actual temperatures in nine locations on both grass and asphalt surfaces were in-situ measured using a handheld infrared thermometer (Figure 1). To validate the surface temperatures estimated from remotely sensed data, Pearson correlation analysis was used to test the relationship between in-situ measured and calculated temperatures. Our results showed that the strong correlation between in-situ and calculated temperature ($r = 0.71$) was found on asphalt surfaces. On the other hand, weak correlation ($r = 0.35$) was found on grass surfaces. This indicated that the satellite data can be used to calculate LST and reflect the real value on asphalt surfaces. Moreover, the thermal map of the study site showed that the University of Toledo campus is falling under the strong UHI. The campus has higher LST than the surrounding areas (Figure 1), with the largest difference of 2.2 °C. To investigate the relationship between LST and vegetation, the mean values of LST and NDVI of each quadrant were plotted and analyzed using simple linear regression. The negative regression was observed. NDVI strongly affected LST (R2 = 0.96). The result of this study provides preliminary evidence that more green areas could help reduce UHI intensity.

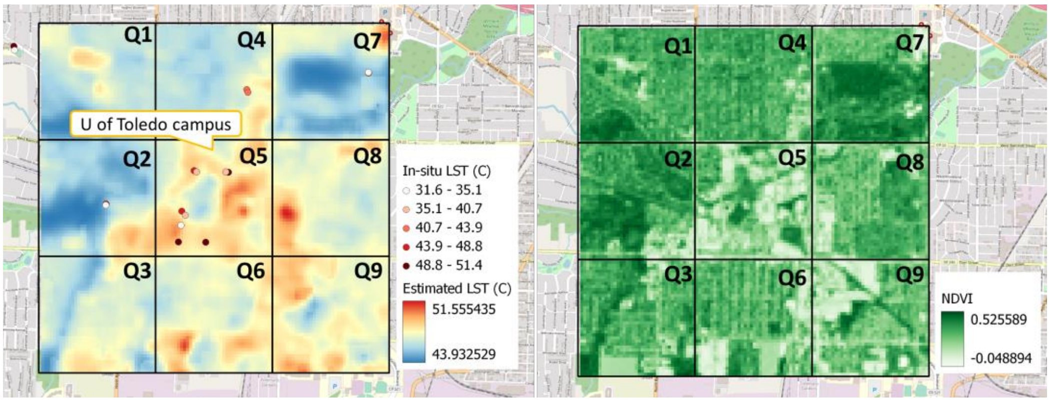

Figure 1. Calculated LST of the study site map, with in-situ measured LST (showed as dots on the map) revealing the urban heat island effect on campus (left) and NDVI map (right)

ESTIMATION OF ABOVEGROUND BIOMASS AND CARBON STOCK USING REMOTE SENSING DATA IN SAKAERAT ENVIRONMENTAL RESEARCH STATION, NAKHON RATCHASIMA, THAILAND

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Abstract:

Carbon credit trading is one of the solutions created from Kyoto Protocols to reduce greenhouse gas emissions (GHGs). Based on this concept there are markets opened for earning carbon credit and trading between various companies and governments. Tropical forests provide a range of ecosystem services, particularly a large carbon sink in terms of global warming. Therefore, the study and the accurate estimation of the carbon stock in the forest should be a great beneficial to carbon credit market. This study aims to develop the tools for estimating carbon stock using remote sensing data. Our methodology is about generating regression models using data from both 1) field measurements in the years 2006 and 2009 in Sakaerat Environmental Research Station (SERS) and 2) satellite indices (EXG, SAVI, GNDVI, NDVI) to estimate aboveground biomass and carbon stock. We examined the satellite indices obtained from Landsat data corresponding to aboveground biomass (AGB) and estimated both AGB and carbon stock of the forests in SERS territory then compared with the allometric model-based method. Our findings indicate that NDVI performs the highest regression coefficient with R-squared of 0.046 to AGB among the four tested indices. The estimated AGB was 7.70 tons/ha with a carbon stock of 3.62 tons/ha. Employing the RS technique provides lower results for both AGB and carbon stocks than the allometric model-based method in SERS. It can be concluded that the amount of AGB is proportional to the amount of carbon stock, which is varied by forest type. Satellite imagery with higher resolution would increase the accuracy of carbon stock estimation, such as Sentinel-2 will be applied in future studies.

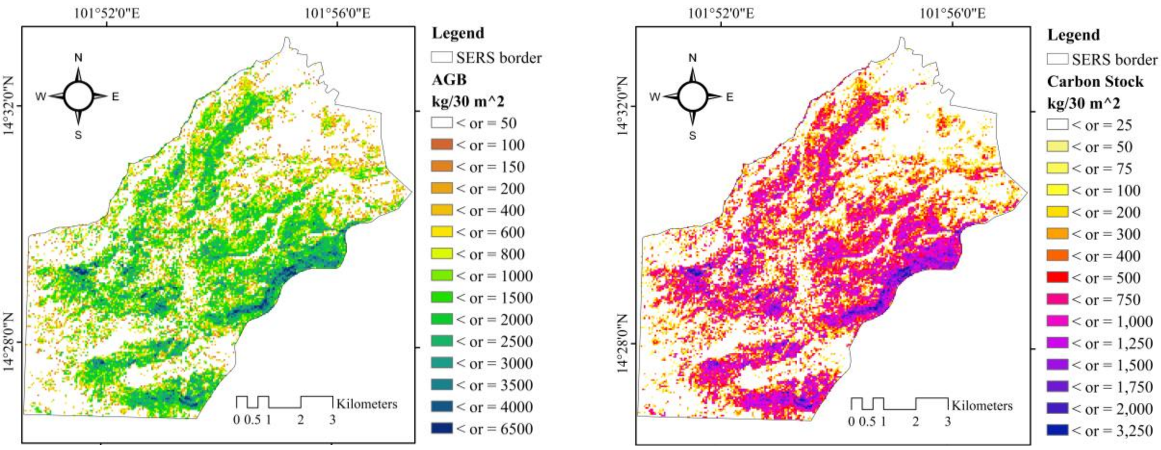

Figure 1.
Aboveground biomass (left) and carbon stock (right) in Sakaerat Environmental Research Station

LOW-COST SUSTAINABLE ELECTROCATALYSTS OF ALLOY/CARBON BASED NANOMATERIALS AND THEIR APPLICATION FOR Li-ION BATTERIES

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Abstract:

Iron (Fe)-germanium (Ge)-based anode material has recently aroused great attention In lithium-ion batteries (LIBs), because of its high theoretical capacity and suitable lithium inserting potential. Nevertheless, because of large volumetric expansion and severe pulverization during lithiation/delithiation, the performance of Fe-Ge-based anode material is poor in LIBs. Herein, a composite with Fe-Ge alloy nanoparticles embedded in a multiwalled carbon nanotube matrix (Fe-Ge/MWCNT) is fabricated by a milling-assisted covalent-bonding method. The introduction of MWCNTs and Fe effectively suppresses the stress/strain originated from the volume change during charge/discharge processes. Excellent electrochemical performance is achieved as a LIB anode, which delivers a high reversible capacity of 502.0 mA h g^{-1} at 100 mA g^{-1}. Our findings not only propose a reasonable design of high-performance alloy-based anodes in LIBs but also promote the practical use of LIBs in large-scale energy storage.

ASSESSMENT AND ZONING OF SELF-CLEANING ABILITY OF NHIEU LOC-THI NGHE CANAL'S WATER IN HO CHI MINH CITY

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Abstract:
Assessment of self-cleaning capacity of water is interested in the environmental protection and management. Because this is the basis for the successful solutions to control and prevent a pollution and declination of water resources, when understanding the capacity of water to degrade the internal pollutants. This self-cleaning capacity is a ratio of the oxygen added (permeable) and losed (declining) for the redox reaction of pollutants in water. The processes of oxygen declining and permeable are expressed through the coefficients. The study has chosen the oxygen declining and dissolved coefficients according to the characteristics of water canal in Ho Chi Minh City to define the self-cleaning capacity the principle research of Nhieu Loc Thi Nghe canal (NLTN). Based on the assessment of water quality by index (WQI), the self-cleaning capacity classification of NLTN water, the study zoned the quality and self-cleaning capacity of water by maps. It also showed that the water quality of NLTN canal being variant, declined and demonstrate the shock phenomenon of the water environment in the canal when the weather conditions change suddenly such as so hot or rainy on the season change.

Keywords: Oxygen declining coefficient, oxygen permeable coefficient, oxygen biological process, self-cleaning capacity, water quality index.

ENANTIOSELECTIVE CRYSTALLIZATION OF $CsCuCl_3$ AND FABRICATION OF CHIRAL GAS SENSORS

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Abstract:

The olfaction perceives ppt- to ppm-level gases and distinguishes the charity of odor molecules because its receptor is composed of a protein. Semiconductor gas sensors detect low concentration gases like olfaction and quantify their gas concentrations. Therefore, the semiconductor gas sensor-based artificial olfaction has been studied to quantify odor. However, materials used for gas sensors are generally centrosymmetric crystals and have mirror planes. Thus, they do not distinguish enantiomers. $CsCuCl_3$ is known as an inorganic chiral crystal that has no inversion center and mirror plane and it composes right-handed and left-handed crystal structures. In this work, we enantioselectivly crystalize $CsCuCl_3$ and fabricate chiral gas sensors using $CsCuCl_3$ as a chiral adsorbent.

$CsCuCl_3$ was crystalized by evaporation of an aqueous solution of $CuCl_2{\cdot}2H_2O$ and CsCl in the presence of L- or D-tartaric acid. The crystals were analyzed by the single crystal XRD measurement (**Figure 1a**). Right-handed $CsCuCl_3$ (space group: $P6_122$) was obtained when L-tartaric acid was used as a chiral auxiliary. On the other hand, left-handed $CsCuCl_3$ (space group: $P6_522$) was crystallized in the presence of D-tartaric acid. The Flack parameters were close to zero, indicating that homochiral crystals were obtained. The bond lengths of Cu-Cl were 2.249 Å (short bonds) and 2.640 Å (long bonds), suggesting that the helical structures were composed of octahedral $CuCl_6$ units distorted by the Jahn-Teller effect.

Chiral gas sensors were fabricated using $CsCuCl_3$ and 10 wt% Pt-SnO_2 as an adsorption layer and a sensing layer ($CsCuCl_3$/Pt-SnO_2). We checked sensor responses (R_{air}/R_{gas}) to optical active gases by the change in the resistance of sensor devices (100°C). The sensor response of (S)-$CsCuCl_3$/Pt-SnO_2 to (+)-α-pinene (R_{air}/R_{gas} = 8.1) were 2.4 times larger than that of (R)-$CsCuCl_3$/Pt-SnO_2 (R_{air}/R_{gas} = 3.4, **Figure 1b**). Opposite responses were confirmed when (-)-α-pinene was fed into the sensors.

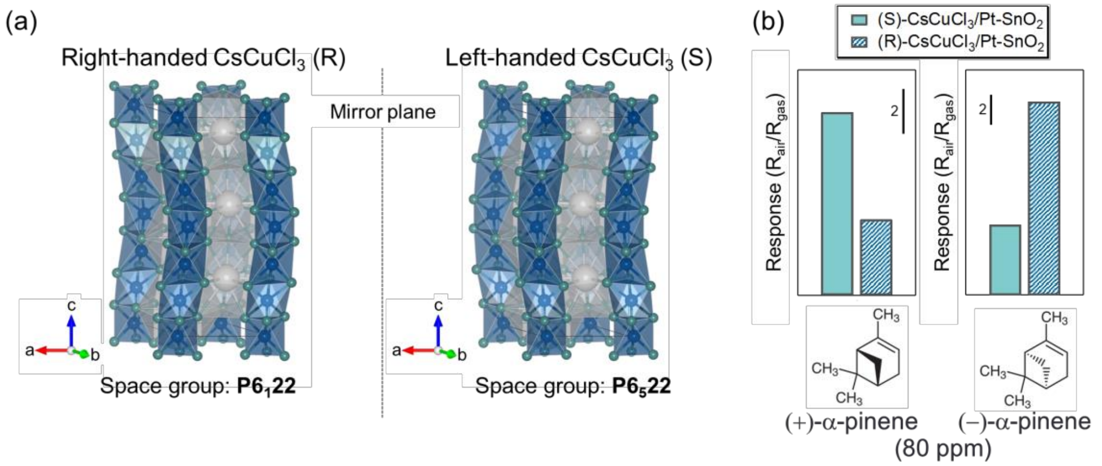

Figure 1. (a) Crystal structures of right-handed and left-handed $CsCuCl_3$ obtained from single crystal XRD measurements. (b) Sensor responses of (S)- and (R)-$CsCuCl_3$/Pt-SnO_2 to (+)- and (-)-α-pinene (80 ppm) in air (100°C).

APPLICATION OF SEASONAL AUTOREGRESSIVE INTEGRATED MOVING AVERAGE MODEL IN FORECASTING THE SALINITY OF BANG PAKONG RIVER, THAILAND

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Abstract:
The Bang Pakong River (BPK) has annual salinity problem. The river is an important source of freshwater supply in the Eastern Economic Corridor (EEC) of Thailand, which has agricultural and industrial activities. Salinity is an essential parameter in the freshwater quality for irrigation purposes. Although there have been many applications of the Time Series Model in several research areas, the research approach to the salinity problem by using the Time Series Analysis—Seasonal Auto-regressive Integrated Moving Average (SARIMA) Model—in the BPK area is scarce. This research aimed to forecast the future concentration of salinity along the BPK river by using the SARIMA method for a better understanding of the salinity issue. The forecasted results show that the lower part of the BPK river has higher salinity values in both February-May and August-November periods, compared to the upper part. Moreover, it is forecasted that the salinity of the BPK river will have a seasonal pattern during the predicted time frame. This research also points out the future research opportunity on salinity forecasting using the combination of SARIMA and Machine Learning algorithms with other management approaches. Interlinkages between hydro-meteorological factors and anthropogenic factors affecting salinity distribution in different seasons should be further investigated.

Keywords: Time Series Analysis, SARIMA, Salinity, Bang Pakong River

EPOXIDATION OF PALM OIL WITH H_2O_2 ON SULFONATED CARBON CATALYST, AND AMBERLITE IR120

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Abstract

Vegetable oils are one of the most attractive renewable compounds compared to other materials used in making building blocks for different applications. The use of modified vegetable oils, such as epoxidized vegetable oils, can produce new value-added compounds. In this work, two types of solid heterogeneous catalysts were used for palm oil epoxidation, including commercial Amberlite IR-120 and sulfonated carbon. The sulfonated carbon having surface area of 468.3 m2 g-1 and acidity of 4.3 mmol/g was successfully prepared by sulfonation of activated coconut shell via hydrothermal. The results showed that the acidity of catalyst can be improved by considering different parameters such as temperature, time, and sonication waves. Moreover, the conversion percentage and epoxidation yield achieved from synthesized catalyst were 80% and 70%, respectively, which is compatible with Amberlite IR-120 catalyst.

Keywords: Epoxidation, Sulfonated carbon, Amberlite IR-120, Palm oil

MODIFICATION OF CHARCOAL KILN VERTICAL TYPE FOR CHARCOAL PRODUCTION FROM BAMBOO WASTE

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Abstract:

The objective of the research aims to study the temperature profile of the vertical single wall kiln (V.S.K.) and double wall kiln (V.D.K.) covered with fiberglass as an insulator. Additionally, the research purposes to evaluate the bamboo waste as a raw material and to investigate the charcoal characteristic and charcoal yield with different design of kiln. The temperature profile for the kiln were collected by using thermocouples type K. The raw material and charcoal were determined by proximate analysis, higher heating value (HHV) and heat utilization efficiency (HU). The results revealed that the maximum temperature of the V.S.K. and V.D.K. were occurred at the reactor (511.33°C) and inner reactor (550.00°C), respectively. It indicated that the vertical kiln covered with fiberglass as an insulator can be prevented heat loss. Furthermore, the charcoal from V.D.K. was highest fixed carbon content (68.63%), HHV (27.57 MJ/kg), charcoal yield (42.73%) and HU (18.08%), indicating that the carbonized kiln design and carbonization temperature affected proximate results, higher heating value, charcoal yield and heat utilization efficiency.

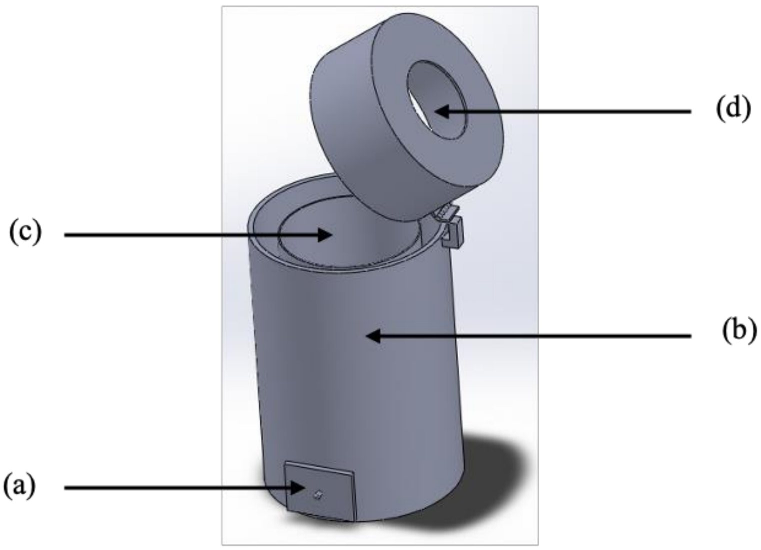

Figure 1. Schematic diagram of the vertical double wall kiln (V.D.K.); (a) combustion chamber, (b) outer reactor, (c) inner reactor and (d) flue.

SYNTHESIS AND CHARACTERIZATION OF ELECTRON BEAM IRRADIATED GLUTINOUS RICE HUSK-DERIVED BIOCHAR AND ACTIVATED CARBON

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Abstract:

Glutinous rice husk, an abundant agricultural biowaste in Thailand, was pretreated with high energy electron beam irradiation (EBI) at doses of 500 kGy, 1000 kGy, and 1500 kGy prior to fabrication into biochar by carbonization at 500 ºC under a nitrogen atmosphere. The biochar was then treated with KOH, and subsequently heated at 800 ºC to afford activated carbon (GAC). The physical, chemical, and electrochemical properties of the as-received biochar (GB) and activated carbon (GAC) were compared. The EBI influences the degree of structural disorder in GB, with the I_D/I_G ratio (as indicated by Raman spectroscopy) rising from 0.622 to 0.637 with increased dose. SEM images confirmed that biochar irradiated with 1500 kGy (GB-1500) has the highest porosity compared to other samples. The electrochemical properties of GB and GAC, as measured in 3M H_2SO_4 using a three-electrode system, indicated that EBI affects the electrochemical performance of the material. The specific capacitance of GB-1500 (6.15 F g^{-1} at 0.05 A g^{-1}) is higher than that of biochar without EBI pretreatment, and the improved performance of the former is potentially due to the formation of structural defects on irradiation which enhance the electronic conductivity of the material. Specific capacitance values of GAC were much higher than those of GB, with capacitance values of GAC decreasing as the EBI dose was increased.

WEAR BEHAVIOUR OF ARC THERMAL SPRAY COATINGS ON BASE-CUTTER BLADES IN SUGARCANE HARVESTERS

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Abstract:
A sugarcane harvester is an agricultural machine, promising to reduce the sugarcane leaf burning in the conventional harvest process. Base-cutter Blades are the parts of the machine that work close to the soil causing high wear rate to the blades. This study applied two types of cored wires, i.e., Chome nickel amorphous (AM) and Titanium tungsten carbide (WC) to arc thermal spray for the purpose of improving the wear resistance of the blades. The abrasive wear test was performed using a modified dry sand rubber wheel. Then, the microstructure and the wear performance were studied by x-ray diffraction (XRD) and scanning electron microscope (SEM). The results show that AM coating includes Ni-Cr-Fe as the main phase, high Al phase and some of high Nb phase. The microstructure is more homogenous than that of WC coating which contains titanium and tungsten carbide dispersion. Base on statistical tests, however, there is not significant difference in the hardness values between both coatings, i.e., 709.40 and 828.67 Hv for AM and WC coatings, respectively. This supports the similar mass loss values of the coatings, 0.0097 g for AM coating and 0.009 g for WC coating. These values reduce about 4 times less than that of the original base-cutter blade (0.0361 g).

SYNTHESIS OF METAL LOADING/ TITANIUM SILICATE CATALYSTS FOR HIGHLY SELECTIVE PALM OIL EPOXIDATION

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Abstract:
The epoxidation reaction of vegetable oil using hydrogen peroxide is being intensively studied with a significant number of studies using homogeneous catalyst, however, there are some drawbacks might observe along the homogeneous catalytic process such as low epoxide rings selectivity, difficult to separate and recover the homogeneous catalyst, and extremely corrosive in the system, etc. Therefore, the heterogeneous catalyst has been used in this study. The titanium silicate catalysts (TS-1) were successfully synthesized by hydrothermal treatment followed by the wet impregnation method with transition metals such as Co, Fe, and Ni which named as Co/TS-1, Fe/TS-1, and Ni/TS-1, respectively. All prepared catalysts were characterized by X-ray powder diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), N_2 adsorption-desorption. The structural properties of the TS-1 zeolites, Co/TS-1, Fe/TS-1, and Ni/TS-1 materials exhibited highly ordered porous structures with mordenite framework inverted (MFI) framework with surface area in the range of 401.8 to 481.4 m^2/g. The catalytic activity was investigated in the epoxidation of palm oil with hydrogen peroxide. The optimum condition to achieve 85.6% conversion of palm oil and 57.4% selectivity of epoxide ring was the ratio of palm oil to hydrogen peroxide of 1:8, 0.2 g of Ni/TS-1 and carried out at 80°C for 3h. The separation of catalyst was simply removed by filtration which environmentally benign compared to the convention homogeneous catalytic process for palm oil epoxidation.

ANALYSIS OF THE 2019 EARTHQUAKE SEQUENCE, XAYABOURY, LAO PDR.

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Abstract:
The magnitude 6.2 earthquake on November 20, 2019 in the Xayaboury, Lao PDR, only 19 kilometers away from the border of Nan Province, Thailand damaged buildings and houses in both Lao PDR and Thailand. The seismic data from the seismic monitoring stations of the Thai Meteorological Department and Kasetsart University were used to analyze the hypocenters, depth, magnitudes and focal mechanisms of this earthquake sequence. The results show that the hypocenters of the mainshock and the aftershocks correspond to the location of the Ban Sa La Fault Zone in Lao PDR which strikes in the NNW-SSE. The analysis of the mainshock suggests that it is a shallow earthquake with a depth of fewer than 5 kilometers. The focal mechanism of the mainshock shows an oblique-strike slip movement with a right lateral-strike slip and normal slip movement. The affected areas of the mainshock were moderately damaged and most of the building's damage was confined to the areas near the epicenter. The results of the study provide important information about this earthquake and can be integrated for planning a mitigation plan for the affected area and can be used as important data for earthquake hazard analysis in Thailand.

COMBINED EFFECTS OF CORN COBS MIXED WITH WASTE GLASS REDUCE FIRING TEMPERATURE IN THERMAL INSULATION CLAY BRICK.

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Abstract:
The research investigates the effects of corn cob (CC) combined with waste glass (WG) to reduce firing temperature in thermal insulation clay brick manufacturing. The raw clay and the CC used in this experiment are from Maha Sarakham province, Thailand. Also, the WG is recycled glass windows (soda-lime glass) from industrial building materials. Clay brick samples were fabricated by clay with constant CC added to 10 wt.%, then added WG at 5, 10, 15, and 20 wt.%. Green clay bricks were fired at 900, 1000, and 1100 ˚C. After that, the fired clay brick tested physical, mechanical, and thermal properties. The XRD, XRF, and SEM analyzed the raw clay and additives. The results found that the WG could reduce firing, but WG must add a high percentage to pass the standard requirements. The high percentage of WG added led to lower porosity and bulk density higher when firing at high temperatures. Thus, they led the thermal conductivity values higher. However, they led to the increase of compressive strength by creating the albite.

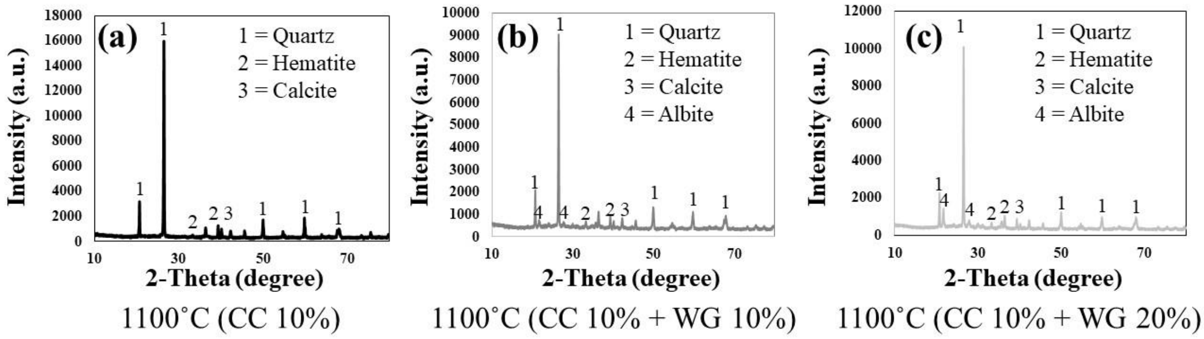

Figure 1.
Mineralogical compositions of the fried brick samples with added WG in various amounts.

ALGAL-BACTERIAL SYNERGY IN TREATMENT OF SYNTHETIC BREWERY WASTEWATER

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Abstract:

The current global environmental issue of wastewater raises an unavoidable challenge to resolve. Numerous organic and inorganic compounds in brewery wastewater are one of the main causes of generating pollution in the environment. This study developed an efficient bioremediation wastewater treatment to investigate the removal efficiency using a microalgae-bacterial system. In addition, to investigate the value-added from algal biomass production from brewery wastewater treatment. In the present work, co-cultivation of *Parachlorella* sp. and *Bacillus subtilis* was cultured in the full strengths and half strengths of brewery wastewater. After 14 days of cultivation, brewery wastewater removal efficiency was analyzed by using parameters of chemical oxygen demand (COD), NH_3–N, total nitrogen (TN), and total phosphorus (TP). Moreover, microalgae biomass after cultivation can be used for carbohydrate production and lipid production. The maximum removal efficiencies of COD, NH_3–N, TN, and TP were 95.46%, 78.38%, 63.40%, and 65.48% in full strength conditions, respectively. The experimental data showed that the microalgae-bacterial system has high potential efficiency of NH_3–N, TN, and TP removal, which are contributing to eutrophication and the deterioration of water resources, compared to a traditional system. Furthermore, microalgae cultivated in the microalgae-bacterial system has the potential value-added productivity of carbohydrates and lipids that could reach 1.23 $mg{\cdot}L^{-1}$ and 3.23 $mg{\cdot}L^{-1}$, respectively. It could be illustrated that the full strengths of brewery wastewater with a microalgae-bacterial system are appropriate to use for the reasons of cost-effectiveness, removal efficiency, and potential value-added.

LIQUID PHASE OXIDATION OF 5-HYDROXYMETHYLFURFURAL WITH BIMETALLIC Co-Cu SUPPORTED ON ACTIVATED CARBON CATALYST

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Abstract:

Polyethylene furanoate (PEF) is a high potential biomass derived polymer for PET replacement. FDCA is a monomer of PER which produces from sugar based biorefinery pathway through oxidation of 5-Hydroxymythylfuran (HMF). To improve the efficiency and cost-effective in FDCA production, this research focuses on the liquid phase 5-HMF oxidation with non-noble metallic catalyst. The cobalt and copper bimetallic catalyst supported on commercial activated carbon (Co-Cu/AC) was prepared with different ratios of Co:Cu (1:1 to 4:1). The reaction is carried out with hydrogen peroxide (H_2O_2) as liquid oxidizing agent and autogenous pressure. Besides, the effect of reaction conditions including reaction temperature (°C), reaction time (h), catalyst loading (wt.%) on catalyst performance were investigated. The conventional oxidation process takes place under an atmospheric oxygen pressure, with the participation of the reaction intermediates such as 5-hydroxymethyl-2- furancarboxylic acid (HMFCA), 2,5-diformylfuran (DFF), and 5-formyl-2-furoic acid (FFCA). Moreover, instead of reducing catalyst under a flowing H_2, the catalyst was reduced by hydrazine hydrate 99 % (N_2H_4OH) at 95 °C for 1 h in this work. The 4Co-Cu/AC catalyst yielded FDCA up to 80 % at the condition of HMF/catalyst = 10, reaction temperature (170 °C) and t = 9 h which was closely yield obtaining from noble metal catalyst and conventional air-oxidation process.

SYNTHESIS OF ISOAMYL ACETATE FROM FUSEL OIL: PERFORMANCE COMPARISON AMONG SEVERAL TYPES OF ZEOLITES CATALYSTS

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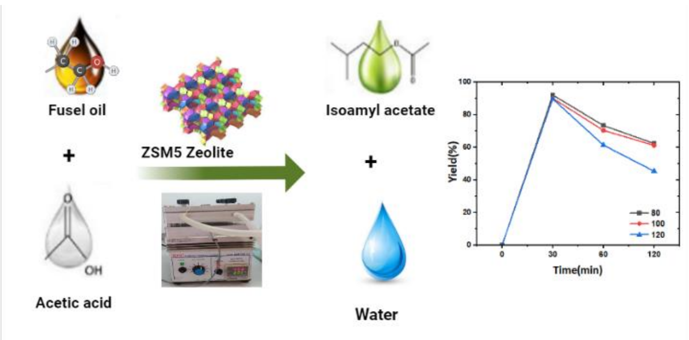
Abstract
Due to increased demand in a number of industries, including energy, polymers, fine chemicals, products with scarce resources, and many more, fossil resources are being depleted. When it comes to environmental preservation, using fossil fuels has a detrimental effect on the ecosystem. Therefore, researchers have been attempting to create clean and sustainable energy sources. Agro-industrial waste is currently a viable resource in the search for renewable energy sources and may be utilized to create a wide range of chemical compounds. Their waste products might be transformed into valuable molecules and even take the place of fossil fuels. Additionally, the capacity to employ the by-products of the processing of agro-industrial waste has created several options for waste reduction and direct money generation.
In this study, the transesterification of acetic acid in the presence of fusel oil and the different type of zeolite catalyst (940 HOA -Beta(40)- 980 HOA -Beta(500)- and H-ZSM-5) were extensively examined in order to synthesize isoamyl acetate. Different catalyst (1.5- 5%) concentrations, reaction times (30 -120 min), temperatures (80-120° C), and molar ratios (0.5:1- 3:1) were used. The experiment examined with 2^k factorial design and for the RSM the Box-Behnken design can be used.



Keywords: *esterification, zeolite, isoamyl acetate, acetic acid*

LIGNIN FRACTIONATION TOWARDS VALUE-ADDED PRODUCTS

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Abstract:

Lignocellulosic biomass mostly comprises of cellulose, hemicellulose, and lignin. The second most prevalent natural energy source in biomass is lignin after cellulose. It could well be converted into a range of petrochemicals, such as phenol, vanillin, and BTX, and even some useful gaseous or liquid fuels. In order to achieve desirable outcomes, high molecular-weighted lignin must be changed into lighter molecular-weighted lignin due to its complex, and strongly cross-linked polymer. While certain methods, including thermo-chemical and bio-chemical conversion, are now in use, others are still in the early stages of development. One of the potential thermochemical methods for converting lignin into a variety of compounds with added value is oxidative fractionation. Palm kernel shell biomass (0.425 nm-0.610 nm) was carried out for the research, employed with organic liquid solvent isopropanol, and the oxidants (30% Hydrogen peroxide). Catalytic fractionation was performed with HY Zeolite and 10% Ni/HY Zeolite. The product that received the most attention was butylated hydroxytoluene (a phenol derivative), and some other fractionation products (vanillin, methylparaben, isopropyl paraben, syringaldehyde, etc.) are also detected in the GCMS test.

WASTEWATER SURVEILLANCE OF SARS-CoV-2 FROM THE AIRCRAFT AND WASTEWATER TREATMENT PLANTS AT DOMESTIC AND INTERNATIONAL AIRPORTS, THAILAND

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Abstract:
Airports play a crucial role as the main entrance for each country. Since a variety of passengers come from different countries, it's more likely to have a higher chance of carrying infectious diseases and spreading them throughout the country. Wastewater-based epidemiology of SARS-CoV-2 is one of the reliable and cost-effective methods for virological surveillance. The aim of this study is to examine the applicability of wastewater surveillance of SARS-CoV-2 from aircraft and airport wastewater. The wastewater samples were collected from domestic and international airports in Thailand (A1 and A2) from March to June 2022. The adsorption-extraction by the electronegative membrane was used for viral concentration and continued RNA extraction and quantified by RT-qPCR assay with primers targeting nucleocapsid gene, N1. All wastewater samples from the aircraft and the airports' wastewater treatment plants were detected for N1 gene. High viral copies of SARS-CoV-2 RNA (267.84 to 6,874.79 copies/ml) were detected in aircraft wastewater from A2 airport, the airport for international travel, which was positively correlated with the number of infected cases from abroad at seven days lag (Pearson correlation = 0.984, $p>0.002$) during 21st March to 5th May 2022. The viral concentration from the aircraft's wastewater of A1 airport, the airport for domestic travel, varied from 164.57 to 10,986.71 copies/ml. No correlation was found between viral concentration and daily new cases in the city as well as from abroad. There was no significant difference in mean viral gene copies of SARS-CoV-2 RNA in aircraft wastewater at both airports from April to June. Moreover, since a high viral concentration of SARS-CoV-2 was detected from the aircraft compared to that from airport wastewater treatment plants, our results suggest that wastewater surveillance from the aircraft can also provide a cost-effective and alternative way to monitor the carriers of the SARS-CoV-2 virus at airports supporting public health decisions and responsive actions related to SARS-CoV-2 at the airports in the future.

PRELIMINARY STUDY ON PETROCHEMISTRY OF BANG THA CHAM GRANITOID, CHONBURI PROVINCE, CENTRAL GRANITE BELT, THAILAND

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Abstract:
Triassic granitoid at the Bang Tha Cham area in Chonburi Province, the eastern of Thailand was exposed along the NW-SE direction along the Klaeng fault zone which occurs between the Central Belt and Eastern Belt Granites. Geology in the Bang Tha Cham area is comprised of Carboniferous sandstone and Triassic granite. Twenty representative samples were collected to classify into three groups such as granite of Group I, quartz syenite of Group II and quartz monzonite of Group III based on mineral compositions, petrography and geochemistry. The modal analysis of Group I is granite consisting of quartz (25-55%), alkali feldspar (30-60%), plagioclase (10-30%) with a small amount of biotite, muscovite, apatite and zircon (3-5%), Group II of quartz syenite containing quartz (10-20%), alkali feldspar (60-85%), plagioclase (10-30%) with a small amount of biotite, apatite, monazite and zircon (3-5%), and Group III of quartz monzonite consisting of alkali feldspar (40-55%), quartz (10-15%), plagioclase (35-50%) with a small amount of biotite and muscovite (2-5%). Whole-rock geochemistry of the granitoid from Groups I to III are plotted in the granite composition (Groups I) and plotted from granite to granodiorite compositions (Groups II and III) in the diagram of SiO_2 against Na_2O+K_2O of S-type granite based the diagram of Al/(Ca+Na+K) versus Al/(Na+K). These granites are originated from high-K calc-alkaline to shoshonitic which are derived from an upper crustal source. Tectonic discrimination diagrams suggest these granites significantly in the within-plate event during Triassic age. Crystallization Pressure-Temperature (P-T) conditions of the granitoid at the Bang Tha Cham area are 2.9-3.5 kbar and 657-732 ^{o}C corresponding to 11-13 km at the intrusive depth. On the other hand, the granitoid is moderated metamorphose and recrystallize from Klaeng tectonic, the crystallization Pressure-Temperature (P-T) conditions estimated to 10.4-10.9 kbar and 310-410 ^{o}C. These granitoid at the Bang Tha Cham, Chonburi Province are S-type granite of the Central Belt Granite which intruded from the results of syn-collisional and post-collision after the closure of the Paleothethyan in Triassic.

ELECTRUM RELATED TO PYRITE, ARSENOPYRITE AND GALENA AT THE HUAI YUAK GOLD DEPOSIT, SUKHOTHAI PROVINCE, THAILAND

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Abstract:
Gold deposits occur in several styles of ore deposits such as Epithermal gold, Porphyry copper-gold, Skarn copper-gold and Orogenic gold deposits. These golds were common formed with quartz, calcite, chlorite, pyrite, chalcopyrite, galena, and sphalerite as veins. The study area is Orogenic gold deposit in the Sukhothai mineral belt which the area is located at the Huai Yuak area, Si Satchanalai District, Sukhothai Province, Thailand. Geology of the Huai Yuak area consists of siltstone, sandstone, shale of Permian granite, phyllite, metashale and metasandstone of Triassic age. Structure of study area NE-SW trending displays by quartz veins hosted in shale, sandstone, metashale and metasandstone. Quartz vein is characterized by veins and veinlets that are NE trending and steep dipping in west direction with sizes ranging from 1 to 4.5 m. Based on the cross-cutting relationship and mineral assemblages of the quartz veins can be divided into three stages. The quartz veins of stage I are containing of major of microcrystalline quartz, minor of calcite, pyrite, arsenopyrite, chalcopyrite and galena. The quartz veins of stage II consist of mainly quartz, while the quartz veins of stage III contain major of quartz and minor of pyrite, arsenopyrite and dolomite. The sulfide minerals such as pyrite, arsenopyrite, galena and electrum in the quartz veins from three stages can be separated into three types from P1 to P3. The P1 occurs in hosted rocks and quartz veins of stages I and III which consists of pyrite and arsenopyrite as shown single grain, cubic, and sizes ranging from 0.1 to 0.5 mm. The P2 occurs in hosted rocks and quartz veins of stages I and III which is composed of pyrite, arsenopyrite and galena, displays accumulate texture and size less than 0.1 mm. The P3 occurs in quartz veins of stages I and III contains pyrite, galena, chalcopyrite, sphalerite, and electrum which is formed in irregular to anhedral crystals with sizes ranging from 0.02 to 0.5 mm. The electrum at Huai Yuak area formed as inclusions in the pyrite, arsenopyrite and galena from the P1 to P3 of the quartz vein of stages I and III, however, native gold displayed in the P3. The electrum and native gold content related to lead and arsenic content in pyrite, arsenopyrite and galena from P1 to P3.

GEOCHEMISTRY OF GRANITOIDS AT NONG BUA DISTRICT, NAKHON SAWAN PROVINCE, THAILAND.

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Abstract:
Triassic granitoid at Nong Bua District, Nakhon Sawan Province belongs to the Eastern Belts Granite of Thailand. The structure of granitoid in the study area is the NW-SE and the NE-SW trends. Twelve samples of the granitoid were collected for modal analysis, petrography, and whole-rock geochemistry. The granitoid samples can be classified into alkali feldspar quartz syenite and monzodiorite. The alkali feldspar quartz syenite is composed of alkali feldspar (~82%), quartz (~13%), plagioclase (~4%) biotite and hornblende (~1%), while the monzodiorite consists of alkali feldspar (~12%), quartz (~2%), plagioclase (~84%), biotite and hornblende (~2%). The NW-SE trend of alkali feldspar quartz syenite intruded to the monzodiorite of the NE-SW trend. The whole-rock geochemistry of the granitoid is plotted in the alkaline granite in the diagram of Na_2O+K_2O versus SiO_2 and plotted in the I-type granite area of $Al_2O_3/(Na_2O+K_2O)$ versus $Al_2O_3/(CaO+Na_2O+K_2O)$ diagram. The alkali feldspar quartz syenite is plotted in the high-K calc-alkaline series, while monzodiorite is plotted in calc-alkaline to high-K calc-alkaline areas as shown in the diagram of K_2O versus SiO_2. Zr, Sr, and Y contents in the monzodiorite are higher than the alkali feldspar quartz syenite, however, TiO_2, MgO, and SiO_2 are similar contents. Tectonic discrimination diagram of the granitoid plotted between Rb and Nb+Y suggests that the granitoid occurs during the within-plate granite. Based on the geology and whole-rock geochemistry, it suggests the monzodiorite and alkali feldspar quartz syenite formed during syn-collision in the Cenozoic age.

OCCURRENCE OF RARE EARTH ELEMENTS IN GREISENIZATION AND SKARN TIN DEPOSITS AT BAN KHAO AREA, KANCHANABURI PROVINCE, THAILAND

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Abstract:
Rare earth minerals deposits in Thailand occur with tin deposits such as Kanchanaburi, Ranong, Phang Nga, and Phuket Provinces which these deposits are related to hydrothermal alterations such as greisenization and skarn deposits. Kanchanaburi Province is a one of large tin deposit (Jarin tin mine) at Ban Khao area. Geology of the Ban Khao area consists of limestone, sandstone, mudstone, and granite from Ordovician to Cretaceous age. Cretaceous granites intruded to limestone, sandstone, and mudstone that formed the greisenization and skarn tin deposits. The aims of this study are to study the characteristics of rare earth minerals that precipitated in the greisenization and skarn tin deposits at Ban Khao area. The geology at the Huai Heang area consists of tourmaline-biotite granite, pegmatite, aplite, and greisen veins which formed the hydrothermal tin deposit as greisenization. The mineral compositions of strongly altered tourmaline-biotite granite and greisen veins are composed of quartz, biotite, muscovite, tourmaline, apatite, columbite, cassiterite, zircon, ilmenite, monazite, and secondary REEs. The monazite is characterized by a subhedral shape with size ranging from 10-50 µm and contains of LREE such as La_2O_3, Ce_2O_3, and Nd_2O_3. However, the secondary REEs contains of LREE (La_2O_3, Ce_2O_3, and Nd_2O_3) and HREE (Y_2O_3, Gd_2O_3, and Dy_2O_3) which precipitated in the fracture of apatite, columbite, zircon, and ilmenite. The geology at the Khao Phu I Kang area is composed of porphyritic biotite granite, pegmatite, aplite, limestone, and marble which formed skarn tin deposit. The mineral compositions of garnet-pyroxene skarn consist of vesuvianite, clinopyroxene, garnet, and secondary REEs. The secondary REEs formed in the fracture of garnet and vesuvianite. According to the occurrence of the secondary REEs in altered granite, greisen veins, and garnet-pyroxene skarn, it was formed by hydrothermal alteration.

EFFECTS OF ADDITIVES ON PROPERTIES OF PVA FILM FOR AGRICULTURAL APPLICATION

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Abstract:
This research was to study the effects of additives i.e., glycerol (20, 30 and 40 wt%), ZnO (0 and 1 phr), and coffee extract (0, 5, 7.5 and 10 phr) on properties of polyvinyl alcohol (PVA) film. Samples of composites were blended by a twin screw extruder and shaped by compression molding. The increase in glycerol content tended to give high water solubility, whereas high glycerol content led to a lower water absorption. Additionally, the glass transition temperature (T_g), melting temperature (T_m) and crystallinity (X_c) decreased, resulting in lower tensile strength but an increase in % elongation at break. Interestingly, the correlation between glycerol content and film crystallinity was found to show linear relationship. The presence of ZnO led to a lower water solubility and water absorption than that of film without ZnO, but the addition of ZnO significantly increased the tensile strength and % elongation at break due to the improvement in X_c and stress-concentrated transfer. Additionally, the presence of coffee extract led to an increase in water solubility and water absorption, whereas the strength and toughness of the film were drastically reduced due to a decrease in X_c and collapsed microstructure. As a result of the film properties tested, PVA composite film could be used for planting seedlings.

THE EFFECT OF ENSO ON VARIABILITY OF RAINFALL AT NAKHON SI THAMMARAT MOUNTAINS, NAKHON SI THAMMARAT PROVINCE

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Abstract:

The El Niño Southern Oscillation (ENSO) is a meteorological phenomenon occurring as a result of the wind circulation system and the surface pressure over the ocean along the ocean in the equatorial zone. ENSO affects the rainfall variability in southern Thailand where is a peninsula with the Indian Ocean to the west and the Gulf of Thailand to the east. Nakhon Sri Thammarat Province is in southern Thailand, and the topography is plain with Nakhon Sri Thammarat Mountains aligned in the north-south direction and dividing Nakhon Sri Thammarat Province into two sides: the east side and the west side of the Nakhon Sri Thammarat Mountains. This research examined the relationship between the Oceanic Niño Index (ONI) and rainfall by using simple linear regression analysis. Data used in this research were monthly rainfall data from 4 stations in Nakhon Sri Thammarat and Oceanic Niño Index from the area of Niño 3.4 during 1991-2020. The period used to find the relationship is divided into 3 seasons: winter (Dec-Feb), summer (Mar-May), and rainy season (Jun-Nov). The results show that during La Niña, rainfall trends to increase and has a medium relationship with ONI index. The coefficient of determination (r2) ranges from 0.035 to 0.359 with a lag time of 4-5 months in winter, 1 month in summer, and 0-2 months in rainy season. However, during El Niño, the relationship between rainfall and ONI index is unclear.

EFFECT OF ANNEALING AND DESTABILIZATION HEAT TREATMENT ON MICROSTRUCTURE AND HARDNESS OF HIGH CHROMIUM CAST IRON

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Abstract:
The aim of this work is to investigate the effect of annealing and destabilization heat treatments on the microstructure and hardness of 28wt.%Cr (R) and 28wt.%Cr-1wt%Mo (Mo1) irons. The as-cast specimens were annealed at a temperature of 800 ºC, followed by furnace cooling. Destabilization was performed at 1000 ºC for 4 h, followed by air-cooling to room temperature. The microstructures were characterized using XRD, OM, SEM and TEM. Vickers macro-hardness was measured. It was found that the as-cast microstructure of the reference iron (R) consisted of primary austenite dendrite with eutectic M_7C_3 and martensite. Multiple eutectic carbides of M_7C_3, $M_{23}C_6$ and M_6C were observed in the Mo1 iron. The microstructures after annealing heat treatment of both irons consisted of eutectic M_7C_3 carbide and precipitated coarse secondary carbides in areas close to eutectic carbides and fine secondary carbides in the centers of the ferrite matrix with a small area of pearlite. After the annealing plus destabilization, the microstructures consisted of secondary carbides in the martensite (α') matrix (in Fig. 1(a)). The inset selected area diffraction patterns (SADP) in Fig. 1(b) confirmed that the secondary carbides formed during annealing plus destabilization heat treatments were $M_{23}C_6$. The macro-hardness after annealing of the reference (R) and the Mo1 irons was 390 and 463 HV30, respectively. This is due to the transformation of the austenite matrix to ferrite. Destabilization increased the macro-hardness up to about 825 and 870 HV30, most likely as a result of secondary $M_{23}C_6$ carbide precipitation within the martensite matrix. This study suggests that annealing can be used to soften iron before machining and that destabilization can be used to increase iron's hardness before service.

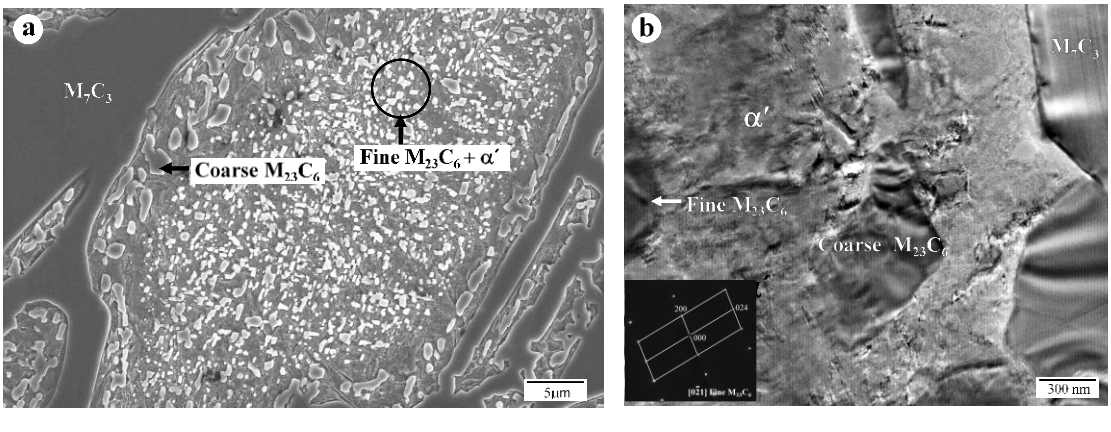

Figure 1. The microstructure after annealing plus destabilization of the Mo1 iron (a) SEM image (b) BF-TEM image and inset corresponding SADP from fine secondary $M_{23}C_6$ carbide.

FACILE PREPARATION OF g-C_3N_4/$MgAl_2O_4$ NANOCOMPOSITE PHOTOCATALYST AND ENHANCED PHOTOCATALYTIC DEGRADATION

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Abstract:

The pure $MgAl_2O_4$ spinel powder was synthesized by a co-precipitation method and the pure g-C_3N_4 was synthesized by a thermal decomposition method. The g-C_3N_4/$MgAl_2O_4$ nanocomposites were prepared by a grinding method for using as a photocatalyst in a photocatalysis process. The crystal structure and phase formation of the samples were characterized by X-ray diffractometry (XRD). The morphology of all samples was performed with scanning electron microscopy (SEM). The optical property of all samples was investigated by UV-Vis diffuse reflectance spectroscopy (DRS). The crystal structure of $MgAl_2O_4$ spinel powder unchanged when $MgAl_2O_4$ spinel powder was coupled with g-C_3N_4 powder. The g-C_3N_4/$MgAl_2O_4$ nanocomposite exhibited a cluster of agglomerated g-C_3N_4 and $MgAl_2O_4$ powders. The optical band gap energy of g-C_3N_4/$MgAl_2O_4$ nanocomposites decreased from 3.84 to 2.80 eV when the g-C_3N_4 increased from 0 to 25%. The photocatalytic degradation of MB solution increased when the g-C_3N_4 content increased. The highest photocatalytic degradation of about 83% over 25%g-C_3N_4/$MgAl_2O_4$ photocatalyst under UV irradiation was obtained in this study.

DETERIORATION OF PALM-BASED BIOTRANSFORMER UNDER THERMAL AGING

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Abstract:
Mineral oil, one of necessary components in an electrical transformer, is used as an insulating liquid and cooling medium. However, it is non-biodegradable, which can the adverse impact on the environment when it is spilled. Currently, there are many attempts to develop vegetable oils having biodegradability and non-toxicity to replace the use of the material oil. Palm-based oil is a good alternative insulating liquid for using as the transformer oil. However, the deterioration of palm oil for long-period aging during operation of the electrical transformer is the aim of this research. The characteristic deterioration of palm-based oil was monitored and compared to the mineral oil and a commercial natural ester (FR3) under thermal aging at 130˚C for 30 and 84 days. Before testing, palm oil was treated by removing moisture, reducing acidity, filling the additives, and it was called as ENPAT. It was observed that the moisture content, acidity, and dissolved decay content of aged ENPAT tended to be increased, which were similar to those of FR3, but the magnitude of these properties were less. Although the dielectric dissipation factor and resistivity of ENPAT were lower than those of mineral oil, the dielectric breakdown voltage of ENPAT was higher than that of the mineral oil and FR3.

Session F:
FOOD SCIENCE AND TECHNOLOGY/ AGRICULTURAL SCIENCE/ (SEA) FOOD INNOVATION/ FOOD SAFETY AND PACKAGING

PROTEIN CONCENTRATED AND THEIR FUNCTIONAL PROPERTIES OBTAINED FROM *Pleurotus pulmonarius* AND *Schizophyllum commune* MUSHROOM

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Abstract:

Mushroom is well-known as a source of high-quality protein with complete essential amino acids composition. This work aimed to investigate an effect of alkaline extraction on protein concentrated from *Pleurotus pulmonarius* and *Schizophyllium commune* mushroom and its functional properties. The alkaline condition for protein concentrated was optimized at pH 12.0. The yield of mushroom protein extract with pH 12.0 had around 5.75-7.00% which higher than that of pH 9.0 was ranged from 1.97-3.61%. The protein yield for both mushroom extracts was increased for 3.9 fold which compared to initial protein in dried mushroom. These dried mushrooms comprised of high total non-essential and essential amino acids, especially, high in hydrophobic amino acid residues. Electrophoresis profile of those mushroom proteins concentrated revealed molecular weight bands of 10-50 kDa. A functional property of mushroom protein extracted was analyzed. Results showed that the solubility in protein extracts was decreased, while it could be able to adsorp oil from 1.55-2.74 g oil/g protein. In addition, the emulsion activity and stability of the protein concentrated had strong ability in emulsion system. The further extraction of the protein concentrated could be used as the alternative plant-based protein in term of functional ingredient.

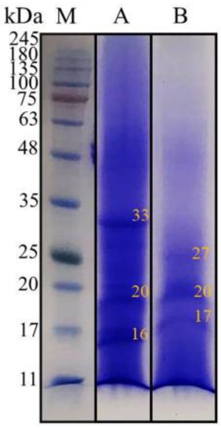

Figure 1. SDS-PAGE pattern of the protein concentrated sample from *Schizophyllium commune* (A) and *Pleurotus pulmonarius* (B) using alkaline protein extraction (pH 12.0) and acid precipitated (pH 4.5) methods. Molecular weight (M_w) standard marker was ranged from 11-245 kDa (M).

STUDIES OF TIME PERIODS OF POLLEN TUBE GROWTH IN STYLE EFFECTED ON FRUIT SET IN DURIAN (*Durio zibethinus* Murr.) cv. 'MONTHONG'

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Abstract:
Flowering behaviors, anatomy, and morphology of durian provide low efficiency with natural pollination. Hand pollination is one of pollination methods pollinated by human helping is necessary for increasing the efficiency of pollination and fruit set. The objective of the experiment was to compare hand pollination and natural pollination method on periods of pollen tube growth from stigma to ovary and fruit set, and to study the pollen tube growth under different environment conditions. Stigma receptivity, pollen viability, pollen tube growth at different hours after pollination and initial fruit set on 7 days after pollination were collected to referenced and analyzed percentage of pollen tube growth between different conditions. The results showed that hand pollination gave higher pollen tube growths than in natural pollination. Moreover, hand pollination caused 100 % fruit set. In different environments, higher in both relative humidity and day temperature caused higher pollen tube growths. Therefore, hand pollination is necessary for better fruit set in Durian cv. Monthong.

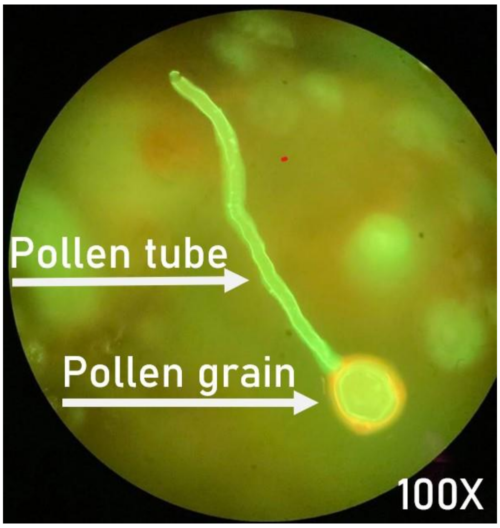

Figure 1. Pollen tube growth on stigma

EFFECTS OF ALFP*m*3 ADMINISTRATION ON INTESTINAL MICROBIOTA AND DISEASE RESISTANCE AGAINST INFECTION OF *Vibrio parahaemolyticus* CAUSING EARLY MORTALITY SYNDROME IN SHRIMP

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Abstract:
The spread of acute hepatopancreatic necrosis disease (AHPND) or early mortality syndrome (EMS) that is caused by *Vibrio parahaemolyticus* AHPND (VP_{AHPND}), severely affected the shrimp farming industry in Thailand. There is a strong demand for feed additives, particularly antibiotics, to prevent mortality. The use of antibiotics as feed additives has, however, allowed for the development of antimicrobial resistance (AMR), which can increase mortality from diseases that were previously curable with antibiotics. Antimicrobial peptides (AMP) have been proven to be a promising candidate to replace conventional antibiotics because they have a broad spectrum of activities. Previous studies showed that an antimicrobial peptide ALF*Pm*3 from *Penaeus monodon* can be recombinantly produced (rALF*Pm*3) in yeast and exhibit antibacterial activity against VP_{AHPND}. In this study, we successfully produced the rALF*Pm*3 wildtype in the 5L-bioreactor. The rALF*Pm*3-supplemented diet was prepared using the crude peptide at (5 and 10 % V/W). The survival of the VP_{AHPND}-infected shrimp pre-fed with a 10% V/W rALF*Pm*3-supplemented diet for 28 days was significantly higher than other treatment and control groups. Analysis of the shrimp intestinal microbiome showed that after 14 days of rALF*Pm*3-supplemented diet feeding, the microbiota composition was altered. At the phylum level, the relative abundance of Proteobacteria and Bacterodes was highest, and the decline of Actinobacteria was observed in the shrimp fed with a rALF*Pm*3-supplemented diet. At the family level, the abundance of Flavobacteriaceae was increased, whereas Rhodococcus was reduced. However, there was a tendency for the Vibrio bacteria to be less abundant in the rALF*Pm*3-fed shrimp. Furthermore, shrimp fed a rALF*Pm*3-supplemented diet survived VP_{AHPND} infection substantially better and had a significantly lower bacterial load than controls. Our results suggest that rALF*Pm*3 may be an effective alternative to conventional antibiotics as a feed additive for the prevention of EMS in shrimp aquaculture.

EFFECT OF ESSENTIAL OILS ON QUALITY AND VOLATILE COMPOSITION OF STERILIZED SMOKED MEAT (SE'I SAPI)

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Abstract:

Indonesian smoked meat (se'i sapi) is one of traditional meat products that is normally degraded by both microorganisms and lipid oxidation. The aim of this study was to determine the effect of essential oils on quality and volatile compounds composition of sterilized se'i sapi. The se'i sapi was produced with the addition of 1000 ppm of cinnamon or nutmeg essential oil. The pH, color, water holding capacity (WHC), textural properties and volatile composition of essential oil treated samples were evaluated. From the study, it was found that addition of cinnamon or nutmeg oil did not affect pH, water holding capacity (WHC), moisture content, color, and texture of the se'i sapi samples. In addition, the volatile profiles of the samples evaluated by SPME/GC-MS were different among samples. It was found that pentadecanal, terpinen-4-ol, α-terpineol, 2,3-butanediol, and safrole were major compounds found in nutmeg oil treated sample. While, benzaldehyde, pentadecanal, eugenol, 1-methylindole, and caryophyllene were major compounds in cinnamon essential oil treated sample. It can be implied that the application of cinnamon or nutmeg oil help in providing the character aroma in each essential oil treated se'i sapi. Among more than twenty volatile compounds identified in nutmeg or cinnamon oil treated sample, methyl euganol and benzaldehyde were considered as the most impact odor-active compounds, which odor activity values (OAVs) of each sample were 97.85 and 69.65, respectively. In conclusion, the selected essential oils affected volatile aroma of se'i sapi samples.

Keyword: smoked meat, essential oil, cinnamon, nutmeg, volatile compounds

EFFECT OF PECTIN AS WALL MATERIAL ON THE PROBIOTIC SURVIVAL OF MICROENCAPSULATED *Lactobacillus plantarum*

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Abstract:
The microencapsulation, a promising technology, can offer maintain the viability of probiotics during processing, storage, and delivery to gastrointestinal tract. However, the loss of probiotic occurs with insufficient covering up through the heat at the atomizer of the spray dryer. Therefore, this study aimed to evaluate the impact of high and low methoxyl pectin as wall material with maltodextrin DE 10-12 on the survival of *Lactobacillus plantarum* and its physicochemical properties. The *L. plantarum* cells were added into maltodextrin 10%, maltodextrin 9% + low methoxyl pectin 1%, maltodextrin 8% + low methoxyl pectin 2%, maltodextrin 9% + high methoxyl pectin 1%, and maltodextrin 8% + high methoxyl pectin 2% solutions, followed by spray drying at an air inlet temperature of 120 ± 4 °C. The cell viability, spray drying yield, moisture, color, and bulk density of microencapsulated *L. plantarum* were evaluated. The results showed that the powders produced with a combination of low methoxyl pectin 1% and maltodextrin 9% had the highest bacterial survival (9.94 ± 0.14 log CFU/g) due to its gelation property. The microencapsulated powders with high and low methoxyl pectin were more yellow than with maltodextrin only. The bulk density of spray-dried probiotics with the addition of low methoxyl pectin was higher than high methoxyl pectin and maltodextrin only. This study presented that low methoxyl pectin can be used to produce spray-dried probiotic products with higher survivability.

Keywords: encapsulation, spray drying, pectin, maltodextrin, probiotic

TOTAL PHENOLIC AND ANTHOCYANIN CONTENTS OF BLACK RICE WINE FERMENTED WITH *Saccharomyces cerevisiae* SC90 AND M30

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Abstract:

Black rice (*Oryza sativa L.indica*) is known for its unique flavor and color, high in protein, fiber, minerals and vitamins. It also contains the abundant presence of phenolics related to its color and antioxidant activity. These compounds are mostly from the complex in the bran layer of rice grains which could be liberated by fermentation. The study, thus, aimed to determine the total phenolic and anthocyanin contents of black rice wine fermented with 2 strains of *Saccharomyces cerevisiae* (SC90 and M30) in the course of 10-day fermentation. Black rice powder was fermented in a liquid state of 5w/v%, adjusted pH to 4.5±0.2 and incubated at 20°C and 40°C, and 6 LogCFU/ml inoculation. The CFU count, pH, Brix, color, total phenolic, total monomeric anthocyanin content and antioxidant activity were evaluated. The results showed that the 20°C incubation was more suitable for both strains of *S.cerevisiae* SC90 and M30 at pH 4.5±0.2 compared to the fermentation at 40°C. The total phenolic contents during the fermentation period were not altered by both yeast strains, 578.18±2.75 GAE mg/L. However, total monomeric anthocyanin contents were significantly decreased by the yeasts over the course of fermentation which in turns negatively affect the overall anti-oxidant activity and significantly decrease the color values especially the redness of the wine.

Keywords: Black rice wine, Fermentation, Phenolic, Anthocyanin

MICRONEEDLES FOR BORAX TESTING IN FOOD

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Abstract:
Borax is a dangerous carcinogenic substance that, if taken in a large dosage, can risk human health. Borax is used as a food additive to create a crisp, chewy texture, and extend the shelf life of the product. This study aims to test borax in food by using microneedles. The microneedles (MNs) prepared from 11.1 % w/w of poly(methyl vinyl ether-alt-maleic acid)(PMVE/MA) and 5.6 % w/w of poly(ethylene glycol)(PEG) with varying 10 mg, 30 mg, and 50 mg of curcumin was to investigate an appropriate method of borax detection. The MNs could absorb liquid containing borax and react with the curcumin embedded in the upper layer of the MNs. Agar gel was prepared with varying concentrations of borax 0, 5, 20, 50, 100, 200, and 500 ppm to be used as test samples. The MNs applied time in the sample was varied with the best time of 60 mins at 60°C. The MNs drying time was also determined for best color observation. The MNs were dried at 60°C for 24 hours. The color change of the MNs can be observed with the naked eye. The detection limit of this MNs-based technique is 5 ppm. The advantages of the MNs-based technique are one-step sample preparation and not having to use strong acids, like, hydrochloric acid.

Session SP2:
SCIENCE EDUCATION: CHALLENGES TOWARDS VUCA ERA

LIFT AND DRAG FORCES LESSONS ON SMARTPHONE APPLICATION AND STUDENTS' LEARNING OUTCOMES

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Abstract:
The aerodynamics lessons on lift and drag forces were developed as a supplement learning resource on Android smartphone application for students. Objectives of the lessons were to provide students with the concepts and applications of lift and drag forces, and to motivate them to learn physics (science) from interesting topics. Content of the lessons were extended from high school physics curriculum of Thailand. In application, the lessons were placed in order of pre-test, lift-and-drag-forces concepts, video labs, exercises, and post-test for learning in 2 hours. After completion of the tests, students instantly received responses and scores. The application was firstly served for school students during online learning of schools due to COVID-19 pandemic. In this study, learning outcomes and application satisfaction were evaluated from 50 students. The findings showed that the lessons suited senior high school students. The students gained knowledge and could applied it to predict phenomena related to lift and drag forces. However, a number of students struggled to calculate the lift force from a given problem. For effectively use of the application, the students had suggested that a video or live introductory of the lessons should be given at the beginning. Most of them interested in learning from demonstration about streamlines and preferred to deal with multiple-choice questions. Overall score of satisfaction given by the users was 4 out of 5.

ELECTROCHEMICAL AND STRUCTURAL INVESTIGATIONS OF COPPER HEXACYANOFERRATE FOR APPLICATION IN HYDROGEN PEROXIDE DETECTION

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Abstract:

Copper hexacyanoferrate (CuHCF) has an open framework structure which consists of repeating coordination of copper, iron, and cyanide. [1] The porous structure of CuHCF is one of the important properties that leads to it being widely used in many applications including battery,[2] fuel cell,[3] and chemical sensors.[4] In this work, the synthesis conditions of CuHCF that affect the structures and electrochemical responses were investigated. CuHCF samples were synthesized by chemical co-precipitation of $CuSO_4$ and ferricyanide or ferrocyanide at varied ratios of $Cu^{2+}/Fe^{2+/3+}$. The chemical composition of the synthesized CuHCF samples was determined by inductively coupled plasma - optical emission spectrometry. The decompose temperature of CuHCF was determined by thermogravimetric analysis. The morphology of the samples was examined by scanning electron microscope. The crystallinity of CuHCF was characterized by X-ray diffraction spectroscopy. In addition, XANES and EXAFS at the Fe K-edge and Cu K-edge were applied to study the oxidation states and chemical coordination environment of elements in the samples. Cyclic voltammetry was used to study the electrochemical behaviors of CuHCF-modified electrodes in 0.10 M KCl and 0.10 M K_2SO_4 aqueous solutions. The material undergoes electrochemical oxidation and reduction in a diffusion-controlled process which involves the diffusion of K^+ ion in and out of the structure, respectively. The excellent performance of CuHCF-modified electrode makes it attractive for sensing applications such as H_2O_2 detection. [4]

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STRUCTURAL INTERPRETATION OF SOUTHERN THAILAND AREA BY USING GOCE

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Abstract:
The Gravity Field and Steady-State Ocean Circulation Explorer (GOCE) is the European Space Agency's (ESA) satellite gravity mission and is a revolutionary tool to reveal geologic information from the Earth. Geothermal energy is heat energy within the earth's interior that can be developed for low-carbon energy in the future. We use the GOCE satellite integrated with other data to extract geophysical information that is related to geothermal, such as boundaries of subsurface structures and plutonic rocks. The study area is in southern Thailand, where large plutonic rocks are associated with major faults in the area, playing an important role in the geothermal system. The residual Bouguer anomalies derived from the model GGMplus 2013 were divided into 3 facies: high anomalies, moderate anomalies, and low anomalies. Low anomalies were mainly dominated in high elevation areas, including the Phuket Mountain range, Nakhon SI Thammarat Mountain range, and San Kala Khiri Mountain range. Although these areas present different lithologies, the anomaly characteristics are similar. Hence, the main factor that affects the anomaly is elevation, as it results in the thickening of the crust. Various features are analyzed from moderate anomalies depending on the local geological setting, including igneous body intrusion and basins. Limestone, which is known as high-density rock, causes high anomalies in the middle part of southern Thailand. However, high anomalies in eastern coastal areas are still ambiguous and other methods are necessary to clarify the causes of high anomalies. The THD filter was applied to the residual Bouguer anomaly to emphasize the lineament structures. The result showed a good correlation with the fault in the upper peninsula. However, in the lower peninsula, the THD anomalies showed lineament structures that corresponded to changes in density, but no fault was reported. Therefore, THD values not only correspond with structural lineaments but also with lithology boundaries.

SINGLE-PHOTON SOURCE FROM SPONTANEOUS PARAMETRIC DOWN-CONVERSION

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Abstract:
Single-photon sources are an essential for quantum technology. One technique for producing single photons is the spontaneous parametric down-conversion (SPDC). This method uses a non-linear crystal to convert a higher-energy photon into two lower-energy photons. This approach is quite practical because it can operate at ambient temperature and incur low costs compared to other methods. However, single photons generated by SPDC are in the infrared range, which is difficult to set a laser alignment for a subsequent experiment. In this work, we used a beta barium borate (β-Ba $(BO_2)_2$) or BBO as a non-linear crystal. By sending a light of a 405 nm wavelength, through the BBO it will generate 810 nm-wavelength pairs of single photons. Then, we propose a convenient schematic for setting up SPDC by using the geometry of the SPDC and a visible laser as a guide for the light path. From our setup, a coincident count for pairs of photons is around 3000 counts per second.

DETECTION OF ELECTROMAGNETIC WAVES BY A HOMEMADE HERTZ EXPERIMENT KIT

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Abstract:

It is well-known that electromagnetic waves were first experimentally generated and detected by Heinrich Rudolf Hertz in 1887 in order to clarify Maxwell's equations. He built an apparatus which consists of a transmitter, involving an induction coil and a capacitor to create electromagnetic waves, and a receiver in form of wire loop containing a gap between two brass spheres to detect the waves. To study this topic by imitating the original Hertz experimental setup is still difficult and dangerous due to high voltage generator. Therefore, this work aims at demonstrating the detection of electromagnetic waves using a simple homemade apparatus. We use a gas lighter gun which cannot produce fire as transmitter to generate electromagnetic wave signal. The receiver is made by a fluted polypropylene sheet covered with aluminum foil which is kept distant from the ground. To detect the existence of electromagnetic waves from the transmitter and their propagation through free space, a light-emitting diode (LED) is used. One LED pin (anode) is connected to the foil via electric alligator clips, while the other one (cathode) is held by hand in order to be connected to the ground. Each time the lighter gun is pressed, the LED glows within the signal period of 0.1 s. This can be explained by the electric field created in the foil by the radiation of electromagnetic waves from the transmitter. This makes higher potential difference between the foil and the ground, yielding enough amount of current to light the LED. No matter the size of LED, our study gives the best observation during daylight when both 3 mm and 5 mm clear green LEDs are used. Our homemade Hertz experiment kit costs less than 100 Thai baht. This work could be improved and designed to be an experimental setup for studying other aspects of electromagnetic waves. In conclusion, our work presents a simple and low-cost way to set up Hertz experiment in high schools, universities, and even at home.

OPTICALLY DETECTED ELECTRON SPIN RESONANCE IN DIAMOND FOR VECTOR MAGNETOMETRY

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Abstract:

Nitrogen Vacancy (NV) center is a defect in a diamond with unique optical transitions in the visible wavelength that is spin-dependent, allowing it to be utilized as an optical qubit or as a magnetometer. Our work primarily focus on magnetic field sensing with NV centers, as they offer high sensitivity and high spatial resolution at the nanoscale level, along with ability to simultaneously measure magnetic field magnitude and direction. To exploit the NV center as a vector magnetometer, the photoluminescence (PL) emitted by the NV center is typically measured, in combination with Optically Detected Electron Spin Resonance (OD-ESR) technique that probes the microwave frequencies corresponding to the NV electronic transition. In OD-ESR, microwave fields are applied at varying frequencies to change the spin population in the NV ground state triplet. If the applied microwave frequency is on resonance with the transition frequency between $m_s = 0$ and $m_s = \pm1$, the measured PL will decrease. A magnetic field can be applied to split the $m_s = \pm1$ states, and the splitting depends on the magnitude and direction of magnetic field. As a result, two resonant transition frequencies can be used to determine the magnetic field experienced by the NV center, and four different orientations of the NV center in the diamond lattice can provide a complete 3-dimensional components of the magnetic field vector. In this work, we demonstrate a method for determining the magnitude and direction of the magnetic field using simulated OD-ESR spectra. The results can be used to understand the experimental OD-ESR data in order to determine the magnetic field vector in nanoscale magnetometry, which can be used for quantum sensing.

ELECTROSPUN CARBON NANOFIBERS DECORATED BY TiO_2 HOLLOW NANOSPHERES FOR HIGH PERFORMANCE FLEXIBLE SUPERCAPACITOR ELECTRODE

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Abstract:

Clean and sustainable energy with flexible energy storage devices has gained more attention. Among various energy storage systems, flexible supercapacitors (SCs) are standing out due to their high capacity, high power density, flexibility, and long cyclic lifetime. In this work, the electrochemical performances of carbon nanofibers decorated by TiO_2 hollow nanospheres (hCNF-TiO_2) supercapacitor electrodes are studied. Various amounts of titanium dioxide hollow spherical nanoparticles are applied to the polymer precursor to study whether the amount of hollow spherical nanoparticles of titanium dioxide had an effect on the electrode enhancement. The hCNF-TiO_2 were synthesized using an electrospinning method followed by heat treatment. The inner structure, morphology, crystal structures and distribution of elements were characterized by TEM, FE-SEM, XRD and EDS, respectively. In addition, the electrochemical properties were studied by using CV and GCD. It was found that the specific capacitance of the bare-CNF electrode (170.03 F g^{-1} (0.5 A g^{-1})) was improved after being embedded with 5 wt% TiO_2 hollow nanospheres (191.39 F g^{-1}). Furthermore, the hCNF-TiO_2 exhibits high cycling stability, retaining 92 % after 2000 cycles. This shows that TiO_2 hollow nanospheres can help enhance the efficiency of the CNF electrode. This might pave a way for high-performance flexible supercapacitors.

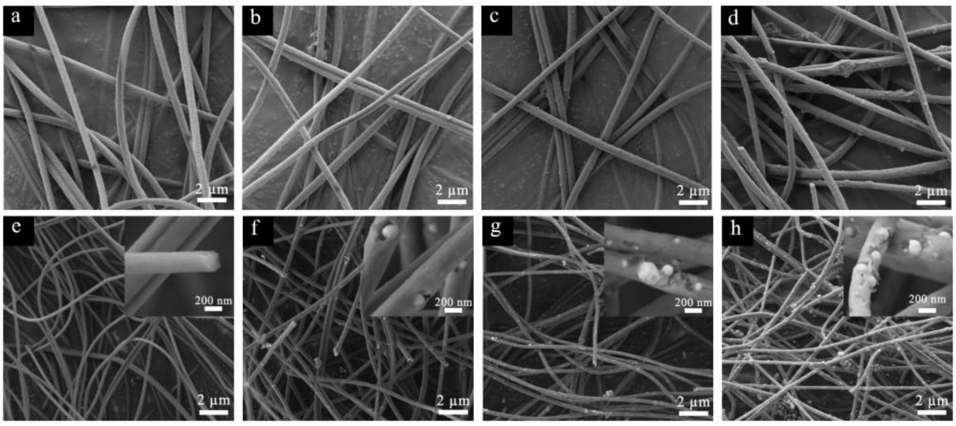

Figure 1.

FESEM images of as-spun PAN-TiO_2 nanofiber with TiO_2 (a) 0, (b) 5, (c) 10 and (d) 15 wt% at 500x magnification. FESEM images of carbon nanofibers (e) bare-CNF, (f) hCNF5-TiO_2, (g) hCNF10-TiO_2 and (h) hCNF15-TiO_2 at 500x magnification. The insets of (e)-(h) represent FE-SEM images of carbon nanofibers bare-CNF, hCNF5-TiO_2, hCNF10-TiO_2 and hCNF15-TiO_2, respectively at 3000x magnification.

Session SP3: X-RAY CRYSTALLOGRAPHY

HALOGEN SUBSTITUED BIS-BIDENTATE SCHIFF BASE LIGANDS EFFECTED STRUCTURAL FORMATION OF {[Ag(TP-bXA)(NO_3)]}$_n$ (X =F, Cl, Br, I) COMPLEXES

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Abstract: Four new coordination complexes, [Ag_2(TP-bFA)$_2$(NO_3)$_2$] (**1**) and {[Ag(TP-bXA)(NO_3)]}$_n$ (where X is Cl (**2**), Br (**3**), I (**4**)) were successfully synthesized by assembly reactions of $AgNO_3$ with halogen substituted bis-bidentate Schiff based ligands (1,4-terephthalylidene-*bis*(*N*-4′-haloaniline)) and characterized. The single crystal X-ray diffraction analysis of compound **1** reveals the discrete dinuclear structure formation, which is further linked by F···F, hydrogen bond, and π-π interactions to produce a 3D framework. The structural analyses of compounds **2** and **3** show that both compounds have infinite 1D chain iso-structures along *a* axis, in which the Cl and Br substituted ligands and nitrate ion as a bridging ligand. The iso-structure of **2** and **3** was crystallized into a framework via halogen···halogen interactions. Furthermore, the crystal determination of **4** reveals a 3D framework structure with the silver ions lying in distorted tetrahedra formed by nitrate ion and TP-bIA ligand as bridging compounds. The results revealed that these halogens substituted Schiff base ligands have an effectively impact to the structural formation of the supramolecular architectures. The fundamental characterizations of the complexes were investigated in detail.

A NOVEL METAL-ORGANIC FRAMEWORK BASED ON 1,3,5-TRIS(4-CARBOXYPHENYL)BENZENE ACID (H_3BTB) WITH TWO TYPES OF SBUS.

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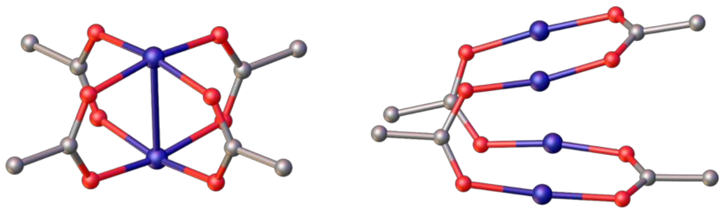
Abstract:
In this work, we present a new Metal-Organic Framework based on copper (II) and BTB organic linker: $[Cu_6(H_3BTB)_2(H_2O)_6(DMF)_2]{\cdot}4DMF{\cdot}2H_2O$ (**1**) obtained under solvothermal conditions. **1** crystallizes in the orthorhombic system with the space group *Pbcm* and its asymmetric unit includes two deprotonated BTB^{3-} ligands and six Cu(II) atoms. Two different coordination modes for Cu(II) atoms are observed. Cu3 to Cu6 adopt the four-coordination mode with a distorted square planar geometry (*ca.* $\tau = 0.21$), while Cu1 and Cu2 display the two coordination mode with linear geometry (*ca.* $\tau = 0.24$) when the solvent is removed. **1** exhibits a 3D dimensional framework with two types of secondary building blocks units (SBUs). A dinuclear $[Cu_2(CO_2)_4]$ unit (Cu3-Cu4 and Cu5-Cu6), and a tetranuclear $[Cu_4(CO_2)_4]$ unit (Cu1, Cu1, Cu2, Cu2). Both SBUs contain four *syn-syn* bridging bidentate carboxylate groups but different arrangements are observed. For the dinuclear $[Cu_2(CO_2)_4]$, the carboxylate groups are connected parallel to each other (paddle-wheel), whereas a perpendicular arrangement is observed for the tetranuclear $[Cu_4(CO_2)_4]$. The two SBUs are alternately connected along the ac plane through two BTB^{3-} ligands to contribute to the formation of the 2D sheets displaying two types of honeycomb of open channels (diameter of *ca.* 0.8 and 1.4 nm). The final 3D structure is obtained through π–π interactions (*ca.* 3.45 Å) between the aromatic groups along the b axis. Although the framework is interpenetrating, the total unrestrained volume according to PLATON is 62 % when the solvent molecules are neglected.



CRYSTAL ENGINEERING OF ULTAMICROPOROUS LANTHANIDE OXALATE FRAMEWORKS WITH DIAMOND-LIKE TOPOLOGY

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Abstract:
The design and synthesis of novel ultramicroporous lanthanide oxalate frameworks with the general formula [Ln(ox)(H_2O)](DMA)·3H_2O (Ln = Ce (**1Ce**), Pr (**2Pr**), Nd (**3Nd**), Sm (**4Sm**), Eu (**5Eu**), Gd (**6Gd**), Tb (**7Tb**), Dy (**8Dy**), and Er (**9Er**)) (ox = oxalate and DMA = dimethylammonium) is presented. Single crystal X-ray diffraction analysis reveals that the compounds **1-9Ln** are isostructural and crystallize in the monoclinic space group $P2_1/n$. Each Ln(III) atom is nine coordinated by eight O atoms from four oxalate ligands and one O atom from a water molecule. All exhibit capped square antiprism coordination geometry, where the distortion increases as the size of the metal. Each oxalate ligand adopts acts as a bidentate oxalato ligand connected with Ln(III) ions act as 4-conneted node, forming a 3D framework with diamond-like (**dia**) topology, having pore channels of about ~5.5 Å. These MOF materials possess high phase purity and exhibit high thermal and chemical stabilities. The solid state photoluminescent properties of **5Eu** and **7Tb** were investigated at room temperature. Notably, CO_2 sorption isotherms at high pressures (up to 50 bar) for the activated **9Er** are described in detail.

THREE NOVEL THREE-DIMENSIONAL BIMETALLIC CADMIUM(II)/CALCIUM(II) -BASED ANIONIC METAL-ORGANIC FRAMEWORKS ENCAPSULATING DIFFERENT CATIONIC GUEST MOLECULES

Kunlanit Chinchan[1,2], Chatphorn Thppitak[1], Suwadee Jiajaroen[1], Bunyarat Rungtaweevoranit[2], Sakchai Laksee[3] and Kittipong Chainok[1,2*].
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Abstract:
Three novel 3D bimetallic metal-organic frameworks (MOFs), $[CaCd_2(BTC)(HBTC)_2](ImH)\cdot 2H_2O$ (**1**), $[Ca_2Cd_4(BTC)_2(HBTC)_4][(Me_2NH_2)(Me_4N)]\cdot 8H_2O$ (**2**) and $[CaCd_2(BTC)(HBTC)_2](Me_2NH_2)\cdot 4H_2O$ (**3**) (BTC = benzene-1,3,5-tricarboxylate, ImH = imidazolium, Me_2NH_2 = dimethylammonium, Me_4N = tetramethylammonium) were synthesized by hydro/solvothermal conditions. All of them crystallize in the monoclinic system with space group $P2_1/c$, except for **2**, that crystallizes in $P2$. The asymmetric unit of **1** and **3** consist of one Cd^{2+} ion, half Ca^{2+} ion, half deprotonated BTC^{3-} ligand, one $HBTC^{2-}$ ligand, lattice water molecules, and a highly disordered ImH and Me_2NH_2 cations for **1** and **3**, respectively. Compound **2** consists of two Cd^{2+} ions, one Ca^{2+} ion, one BTC^{3-} ligand, two $HBTC^{2-}$ ligands, eight lattice water molecules, and a highly disordered Me_2NH_2 and Me_4N cations in the lattice. The Cd^{2+} centers are coordinated by seven oxygens from bidentate BTC ligands showing a pentagonal bipyramid geometry. Instead, the Ca^{2+} centers are coordinated by six oxygens from monodentate BTC ligands displaying a octahedral geometry. All systems exhibit similar crystal packings, where the 3D anionic frameworks $\{CdCd_2(HBTC)_3\}_n$ are stabilized by the different cationic molecules ImH, Me_4NH, and Me_2NH_2 through N-H···O, C-H···O hydrogen bond interactions. In addition $\pi\cdots\pi$ stacking interactions between the aromatic groups of the BTC ligand are observed. Moreover, the luminescent properties of compounds **1-3** were investigated in the solid state at room temperature.

CRYSTAL STRUCTURES OF TWO 3D COPPER(II) BASED METAL ORGANIC FRAMEWORKS BEARING MIXED DICRABOXYLATE LINKERS

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Abstract:
The synthesis, structural characterization, and multifunctional properties of two new copper(II)-based metal-organic frameworks, $[Cu_6(Br_2bdc)_2(adipate)_2(\mu_3\text{-}OH)_4]\cdot 4H_2O$ (**1**), and $[Cu_6(Br_4bdc)_2(adipate)_2(\mu_3\text{-}OH)_4]\cdot DMF\cdot H_2O$ (**2**), (Br_2bdc = 2,5-dibromobenzenedicarboxylate, Br_4bdc = 2,3,5,6-tetrabromobenzenedicarboxylate), are reported. Compounds **1** and **2** crystallize in the monoclinic space group $P2_1/c$ and the triclinic space group P-1, respectively. Both compounds present a three-dimensional framework constructed by the connection of Cu^{2+} cations and the linkers through their carboxylate groups. The magnetic properties of **1** and **2** were studied. Moreover, the CO_2 adsorption at high pressures (≤ 50 bar) of these compounds were also investigated at temperatures of 0, 25, 35 and 45 °C.

X-RAY CRYSTALLOGRAPHIC STRUCTURE OF A DURIAN TRYPSIN INHIBITOR

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Abstract:
Kunitz-type trypsin inhibitors are abundantly expressed in various plant seeds. There are high variation in the protein sequences. The inhibition mechanism of a Kunitz-type trypsin inhibitor from durian (*Durio zibethinus*) seed towards trypsin was investigated in this study. The structure of the durian seed trypsin inhibitor was determined using X-ray crystallography. The inhibitor was crystallized using the hanging drop vapor diffusion method. The crystal belongs to the space group $P2_12_12_1$ (cell dimension 99 x 99 x 116 A^o). The structure was solved by molecular replacement at 1.95 Å resolution, revealing 4 molecules in the asymmetric unit. The refined structure has the R-free value of 0.191. The structure contains a putative inhibition loop that contains an asparagine residue instead of the typical lysine residue found in other Kunitz-type trypsin inhibitor that imitates the peptide substrate.

Session SP7:

RADIOECOLOGY AND ENVIRONMENTAL RADIOACTIVITY

MODELLING ^{210}Pb FOR DATING OF FOREST SOIL PROFILES

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Abstract:
Objective of this modelling is to predict the distribution behavior of radiocaesium in forest soil profile with high accumulation of organic matter and low decomposition ie. in area of temperate or boreal forest. Model concept assumes annual rates of litterfall, 210Pb deposition and organic matter decomposition are constant. Decomposition of litter gradually reduces the mass and volume of annually added litter/organic matter of forest soil layer. Data of unsupported 210Pb is used to date each soil layer which already proved that it is strongly adsorbed with particle of organic matter therefore, naturally occurring 210Pb has been widely used for dating of lake sediment or peat bog. Result of model calculation of data analysed from soil profiles collected at Sherwood Forest in UK found that calculated soil layer of 137Cs originated from nuclear-test-fallout in 1962 dominates at 8 cm which is same as observed data analysed in laboratory. Model was additionally tested for data of soil profile, with low organic matter, collected at pine forest of Wat Chan (Chiang Mai) and teak forest of Khao Krayang (Phitsanulok) which 1 cm error were found. It was concluded that this modelling is likely to work accurately with data of high accumulated organic matter of soil and acceptable inaccurately found with data of soil profile with low accumulated organic matter.

THE STUDY OF NATURAL RADIONUCLIDE AND STABLE CAESIUM CYCLING IN RICE PADDY ECOSYSTEM OF THAI FRAGRANT RICE (*Oryza sativa* L. ssp. indica cv. Pathum Thani 1)

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Abstract:
This study focused on investigation the feasibility of using stable isotopes of Cs for useful analogue on study its radioisotopes in long-term cycling for Thai Fragrant Rice (Oryza sativa L. ssp. indica cv. Pathum Thani 1) in three periods of cultivation. Systematic studies were made of stable Cs and possible competitive elements in soil, rice grain and stalk. Measurements of total concentrations were complemented with determinations of exchangeable fractions of stable Cs. Transfer and translocation factors of pathway within rice paddy ecosystems were calculated. Natural radionuclides were measured and assess for annual committed effective dose of ^{40}K ingestion for various group ages of Thai population. It concludes that stable Cs is useful indicators for study on radiocaesium in rice paddy for long-term cycling following the initial deposition of nuclear fallout in Thailand. Moreover, the results show the annual effective dose for ingestion of ^{40}K in rice grain was minimised at about 0.080 mSv for 3-5.9 years children and maximum at about 0.672 mSv for 18-34.9 years adult which very small amounts compare to average annual exposure dose from natural source (2.0 mSv).

CHARACTERISTICS OF GEOTHERMAL RESERVOIR AND RADON LEVEL IN GEOTHERMAL SPRING GROUNDWATER, SOUTHERN THAILAND

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Abstract:
Geothermal springs in southern Thailand are unknown for their heat sources; all of them are related to non-volcanic geological settings. A suitable geothermal source is emphasized generated by a decay of long-lived radioactive isotopes (e.g., U-238, U-235, Th-232, and K-40) concentrated mainly in the upper third part of the crust, which includes the most differentiated rocks. Radon levels in geothermal spring groundwater are controlled by hydrogeological features, heat flows, reservoir temperatures, and rock properties. In this study, we have investigated the hydrochemical characteristics, estimated geothermometers, and evaluated radon activity concentration in geothermal spring groundwaters. Moreover, the relationships between radon concentrations and reservoir temperatures of geothermal spring systems are considered. Whereas the Na-K-Ca-Mg geothermometer can reasonably estimate the reservoir temperatures for geothermal springs in southern Thailand to be in the range of 86 to 169 °C, both hot springs located in the Surat Thani geothermal system. In comparison, radon concentrations in the geothermal groundwaters vary between 0.12 kBq/m^3 at Krabi geothermal spring and 8507.48 kBq/m^3 at Surat Thani geothermal spring. However, radon is the gaseous state with higher geothermal groundwater solubility under high ambient temperatures. A primary conclusion, no significant correlations were found between the reservoir temperatures and radon activity concentration.

ASSESSMENT OF TERRESTRIAL GAMMA RADIATION DOSE IN GEOLOGICAL TOURIST ATTRACTIONS IN RATCHABURI PROVINCE, THAILAND

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Abstract:

Terrestrial gamma radiations are emitted from radionuclides found in rocks and soils in a natural. A gamma radiation dose depends on the geological features of the region. In regions where a geologic structure is composed of granites, exposures due to external radiation can be comparatively high. The present investigation aims to evaluate the natural background gamma dose rates and corresponding annual effective doses for geological tourist attractions comprising Granitic mountains (Som Maew Rapids and Boa Kleung Hotspring) and Permian limestones (Ratchaburi Grand Canyon, Khao Ngu Stone Park, Pong Krathing Hot Spring, Chompol Cave, and Khao Bin Cave) in Ratchaburi province, central Thailand. Outdoor gamma dose rates were measured 100 cm above the ground level using a Radiation Alert Ranger® Survey Meter. Two measurements at 60 minutes intervals were done at each location in August 2022. Results showed that the average gamma dose rate in Granitic mountains (0.46 ± 0.07 mSv/h) is higher than in the Permian limestones (0.19 ± 0.03 mSv/h). In addition, the annual effective dose would be considered in the study areas. The highest and lowest annual doses were 0.80 ± 0.12 mSv/y (Som Maew Rapids) and 0.23 ± 0.03 mSv/y (Ratchaburi Grand Canyon), respectively, which was lower than the dose from the public exposure limit recommended by the International Commission on Radiological Protection (1 mSv/y). The excess lifetime cancer risks (ELCR) were calculated to assess the radiological hazard, and it was found in the range of 0.95×10^{-3} to 3.34×10^{-3}. Suggest that the radiation level measured at these locations may not pose a health hazard.

Session SP8: Food System Transformation and SDGs

EMPOWERING WOMEN IN INTRA-HOUSEHOLD DECISION-MAKING TO IMPROVE CROP DIVERSITY AND HOUSEHOLD DIETARY DIVERSITY: EVIDENCE FROM FIVE DEVELOPING COUNTRIES IN ASIA

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Abstract:
Realizing the win-win of agrobiodiversity conservation and food security is a vital and urgent part to achieve Sustainable Development Goals. The goal of this study is to identify the associations between intra-household decision-making, a key dimension of women empowerment, on crop choice and food purchase on household dietary diversity and its mechanism through crop diversity. With the field survey data among 1282 rural households in 55 villages or communities of China, Nepal, Cambodia, Thailand, and Myanmar in 2019, linear regression, Poisson regression, Inverse Probability-Weighted Regression-Adjustment method, and mediating effect model were adopted. The results show that the households with women's independent making decision on purchasing food and crop choice have 0.209 and 0.244 more household dietary diversity score (HDDS) than those with men's independent decision-making, respectively. Crop diversity, especially the diversity of vegetable species, plays an important mediating role (8.94%) in the association between intra-household decision-making and HDDS. The benefits of women's empowerment in decision-making for low income and low educated households and those from low- and lower middle countries were not found. The findings implies that women's empowerment on intra-household decision-making can enhance both agrobiodiversity conservation and food security. However, the households with low income, low human capital, and from low- and lower middle countries should be paid high attention when achieving agrobiodiversity conservation and food security through women's empowerment on intra-household decision-making.

FOOD-ENERGY-WATER NEXUS AND CLIMATE CHANGE: RISKS AND SOCIAL VULNERABILITY

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Abstract:
The effects of climate change are global. Although climate change is recognized by many scientists, the influencing factors and consequences of climate change are still unclear. In addition, the growing food imbalance between countries inevitably increases water pressure. Currently, only a few studies are devoted to the international balance of water and food resources. The aim of the current project is to measure the extent of the impact of climate change on water and food resources and the relationship between them on a regional and international scale. Food, water and energy have always been important research topics. In recent years, in order to offer a comprehensive solution, the international community has tried to use the relationship between food, energy and water (FEW Nexus) for a common understanding. Regional resources and the global supply chain should be taken into account when developing interconnection policies, which gets an increasing importance especially in the context of the SDG8. At the initial stage, a preliminary assessment of the existing methods of performing WEF Nexus is carried out; the methods that most adequately assess the state of the system in the studied region are selected and used to assess the relationship and risk analysis in the system in the era of global climate change.

One of the priorities of the Sendai Framework Program for Disaster Risk Reduction for 2015-2030 is understanding risk that is, addressing issues of monitoring and forecasting. It is necessary to assess risk trends using integrated scenarios that take into account not only the hazard forecast, but also changes in socio-economic impact, vulnerability and adaptive capacity, in particular for FEW relationships (Sendai Framework, 2015). Since the structural analysis of climate-related risks includes an assessment of five components: risk hazard, vulnerability, exposure, interaction of risks and adaptation to them, we propose the following risk assessment scheme for FEW Nexus relationships. First, a forecast of temperature and precipitation is given and the probability of extreme fluctuations in (a) temperature and (b) precipitation is estimated. Secondly, dangerous hydrometeorological phenomena associated with a lack of moisture, such as (c) droughts leading to (d) forest fires on agricultural land, cause significant damage to plant ecosystems. On the other hand, excess moisture can cause (e) floods and (f) landslides, which worsen the condition of agricultural land and damage soil fertility and crop yields. Assessment (g) of the water balance of small and medium-sized rivers makes it possible to clarify the quantity and quality of surface and underground waters that feed agricultural land. This affects the commodity structure of agriculture in the region.

CURRENT ENVIRONMENTAL CALAMITY IN PAKISTAN TOTALLY SHAKEN THE FOOD SYSTEMS TRANSFORMATION AND SDGs

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Abstract:
Pakistan is one of the first countries to endorse 2030 Agenda for Sustainable Development globally in 2015 which includes a set of 17 Sustainable Development Goals (SDGs) to end poverty, fight inequality and injustice and tackle climate change by 2030. Pakistan ranked 129^{th} out of 165 countries, with an overall score of 57.7 percent, mainly for its progress on one of the 17 goals-climate action per SDG Index ranking 2021. Pakistan developed a strategic national pathway for food system transformation. Initially COVID-19 pandemic has effected efforts in making headway to achieve most of the goals especially food security. Now massive flooding because of record breaking rain and heat wave in March, 2022 put the country in unpersuaded and highly volatile situation with its contribution less than 1% of the global greenhouse gases emissions. More than 1300 people have so far died, with 81 out of 160 districts in the country directly affected by the floods, leaving ~33 million people homeless. The communication infrastructure, an incalculable number of houses and millions of hectares of crops and livestock are washed away. After rescue efforts, relief process is on way while daunting tasks of rehabilitation and reconstruction are waiting ahead. The "2022 Pakistan Floods Response Plan" was jointly launched by Government of Pakistan and the United Nations but question remained how to achieve SDGs in this dismay situation?

Poster Session

Session A: PHYSICS / APPLIED PHYSICS

EFFECTS OF CONVECTION AND SEGREGATION GENERATED BY GRANULAR MATERIALS IN A PSEUDO-2D RECTANGULAR CONTAINER UNDER VERTICAL VIBRATION

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Abstract:
This research examines the effect of convection and segregation generated by granular materials in a pseudo-2D rectangular container under vertical vibration. Experimental used different wall angles with vibration frequency affect the convection speed of granular materials. The angles of the container wall were 90, 85, 80, and 75 degrees, and the frequencies in the vibration were 28, 29, and 30 Hz. The convection of the bed materials and the intruder material resulted in a flow cycle along the left side of the container wall and surrounded the bed materials. In continuous vibration experiments, the top surface of the bed materials will tilt. Then, the intruder material moved along the top surface of the granular material. Subsequently, the invasive granular material traveled up the right wall of the container and descended to the bottom along the left wall, completing an entire cycle to the starting point. When the angle of the container wall and the frequency were increased, the intruder material was convection cells significantly faster, forming a smaller, asymmetrical loop. By contrast, the intruder material will slowly develop a more extensive, asymmetrical loop when the angle of the container wall and frequency decrease. The segregation effect was generated by the container wall with vertical vibration of granular materials.

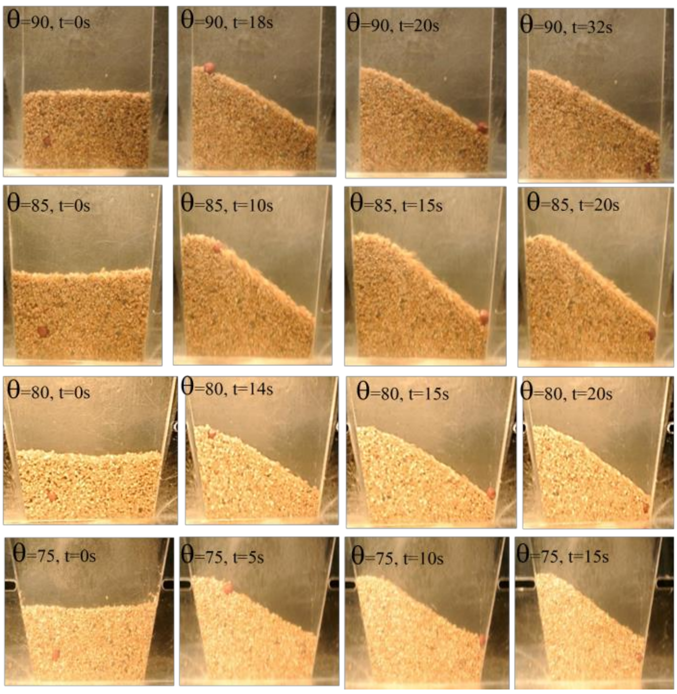

Figure 1. The convection forming and segregation generated by the angle of container wall and frequency at 90 85 80 75 degrees

NUMERICAL ANALYSIS OF COVID-19 SILVA DISPERSION IN AN AIR-CONDITIONED ROOM

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Abstract:
This study numerically explores the dispersion and fall distance of saliva droplets released from the mouth of a COVID-19 infected person sneezing in an air-conditioned restaurant through two-dimensional numerical simulations of air stream and saliva droplets. Parameters studied are the positions of cold-air outlet (E_{supply} = 1.4 and 6.4 m), velocity of supply air (0.125, 0.25 and 0.5 m/s), and angle of supply air leaving from the outlet (45, 60, and 90 degree). The saliva droplets are assumed as spherical particles and exit continuously from the mouth of the infected person at a speed of 8.5 m/s during the first 0 – 0.5 s. It is found from numerical results that when the outlet is placed near the infected person at E_{supply} = 1.4 m, the particles drift and drop farther than when the outlet is at E_{supply} = 6.4 m. In addition, in case of the air outlet at E_{supply} = 1.4 m, the less angle is less than 90 degree, the more particles can drop further away from the infected person. However, when the outlet is at E_{supply} = 6.4 m, the angle does not much affect the fall distance of particles. Moreover, at the angle of 90 degree in both cases of the outlet at E_{supply} = 1.4 and 6.4 m, particles drop near the infected person. It is because the supply cold-air streams, which are injected vertically downwards, block the particle movement. By considering the outlet at E_{supply} = 1.4 m and the angle of 90 degree, it is found that varying the supply-air velocities do not significantly affect the fall distance of particles away from the infected person.

PERSISTENCE EXPONENTS OF A PARTICULAR HEIGHT FLUCTUATION IN MOLECULAR BEAM EPITAXY MODEL

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Abstract:

In this work, we investigate height fluctuations, $h(t)$, in thin film growth of the molecular-beam epitaxy model [1,2] via the study of steady-state persistence probability, $P^S(t)$, and interface width, w. $P^S(t)$ is the chance that $h(t)$ of each site does not cross to its value at the initial time, denoted h_0, throughout a specific time interval [3]. When averaged over all values of h_0, $P^S(t)$ decreases with time as a power-law. The decay rate is the persistence exponent, θ^S. However, results from earlier studies [4,5] suggest that when only a specific value of h_0 is considered, $P^S(h_0,t)$ does not always exhibit a power law behavior. We identify conditions on the value of h_0 that lead to the power-law decay of $P^S(h_0,t)$. The dependence of θ^S on h_0 is studied. We also found that long diffusion length arising from growth with high substrate temperature results in an increase in θ^S. Finally, our investigation of how the persistence probability scales with h_0, the system size, and the discrete sampling time is included.

EXTERNAL CAVITY DIODE LASER IN A CATEYE CONFIGURATION WITHOUT AN INTERFERENCE FILTER

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Abstract:
An external cavity diode laser (ECDL) with 780.24 nm in a cateye reflector mirror type without using an interference filter for the wavelength selection is provided. Here, we prove that the mode selection can be made by its own cavity of the ECDL with a piezo element inside. The reduction of laser intensity due to the interference filter can be avoided inside the external cavity and also the cavity length can be made smaller. Our ECDL was checked by a rubidium saturated absorption spectroscopy with the D2 hyperfine transitions. This tunable laser is commonly used in atomic physics as well as laser spectroscopy.

VEHICLE SPEED ESTIMATION FROM TRACKER VIDEO ANALYSIS

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Abstract:

This study aims to determine the vehicle speed based on the Tracker video analysis. Physics parameters of the moving motorcycles, e.g., distortions, distances between cameras, a moving line, and vehicle speed, were obtained. Smartphones were used to record the motion of the motorcycles and their speeds were also measured by the GPS-speed application. The results showed that the lens distortion of different smartphones can be ignored if a distance between a camera and an object is larger than 1.5 m. The speed of the moving motorcycles was measured at different distances of the moving lines from the camera. We found that the measured speeds of the moving motorcycles from the Tracker video analysis varied within the ranges of ±4 miles per hour compared with those measured by the GPS application. Moreover, the speed of the moving motorcycle when having a perspective distortion was determined in this study.

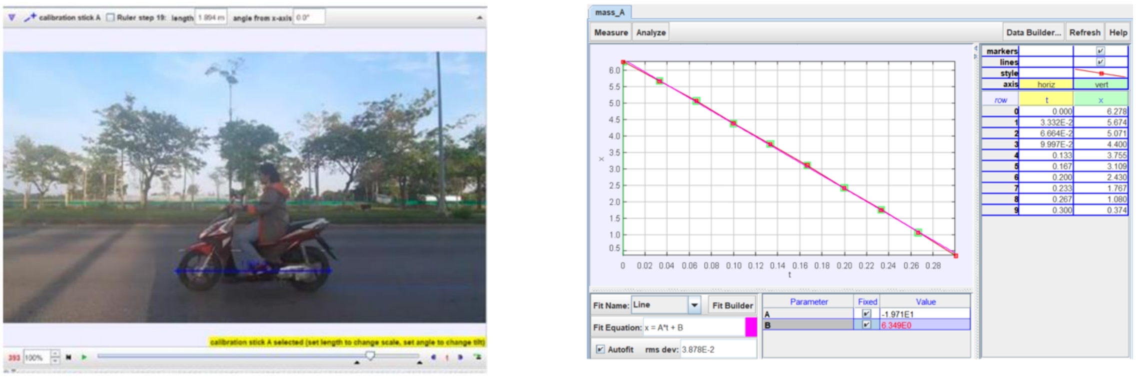

Figure 1.
A moving motorcycle to estimate its speed (left) and its linear distance (right).

DIJKSTRA'S ALGORITHM AND SNELL'S LAW

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Abstract:
We apply the Dijkstra's algorithm to find an optimum path between two arbitrary nodes on a Moser-like lattice. The weight of each edge is defined to be proportional to the Euclidean distance between the corresponding connected nodes. The values of proportional constants are depended on the position of the connected nodes. We find that the optimized path resembles the light ray refracted through the mediums with different refraction indices. This is interesting since it is well known that the Snell's law of refraction can be derived from the Fermat's principle of least time. If we interpret the proportional constant for the edge's weight as the reciprocal of wave velocity, the optimized path will be the path with smallest time of flight, which follow the Fermat's principle. This is an example of the application of path finding algorithm to the variational problem. The advantage of the algorithm is on its simplicity and straightforward. The study of applying the algorithm to the more complicated variational problems is in progress.

EFFECTS OF LIGHTING AND DISTANCE ON COLORIMETRIC MEASUREMENT BY SMARTPHONE

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Abstract:
Digital image colorimetry with built-in smartphone cameras is increasingly implemented in engineering, environmental, and chemical analysis. Such on-site measurements are rapid and cost-effective but need constant calibrations to ensure their accuracy. In addition to the types of smartphone and colorimetric applications, the influential factors are the light source and measurement distance which are the focus of this investigation. The adjustment of the camera distance from 12 colored objects in the 10-30 inches range revealed the variation in colorimetric parameters in the RGB and HSV color spaces. The H (hue), S (saturation), and V (value of brightness) parameters were less sensitive to the measurement distance, giving rise to a fairly constant color quantization in the case of red, pink, purple, and light blue objects. Changing a light source from a fluorescent lamp in ambience to a smartphone flashlight in a closed box had insignificant effect on the blue and brown objects. By contrast, all R (red), G (green), B (Blue) values, and hence the V of other colored objects were drastically decreased in the box illuminated only by a smartphone flashlight.

COMPUTATIONAL SIMULATION OF THE DIFFERENCE IN THE REFRACTIVE INDEX OF THE VACUITY-SILICON OXIDE AND AIR-SILICON OXIDE PERIOD'S PHOTONIC CRYSTAL

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Abstract:
There is little difference in the refractive index between vacuity and air. This paper proposes the idea of measuring little difference between the medium vacuity layer and the medium air layer with the model of the one-dimensional photonic crystal (1DPC), which consists of silver materials, silicon oxide, and air or vacuity. This structure of 1DPC is imitated from organic light-emitting diodes (OLED) to apply maybe as a vacuum sensor and the 1DPC is designed to measure the little difference in a red frequency band. The experimental result of the 1DPC can calculate the little difference clearly for the refractive index with the narrow wave range.

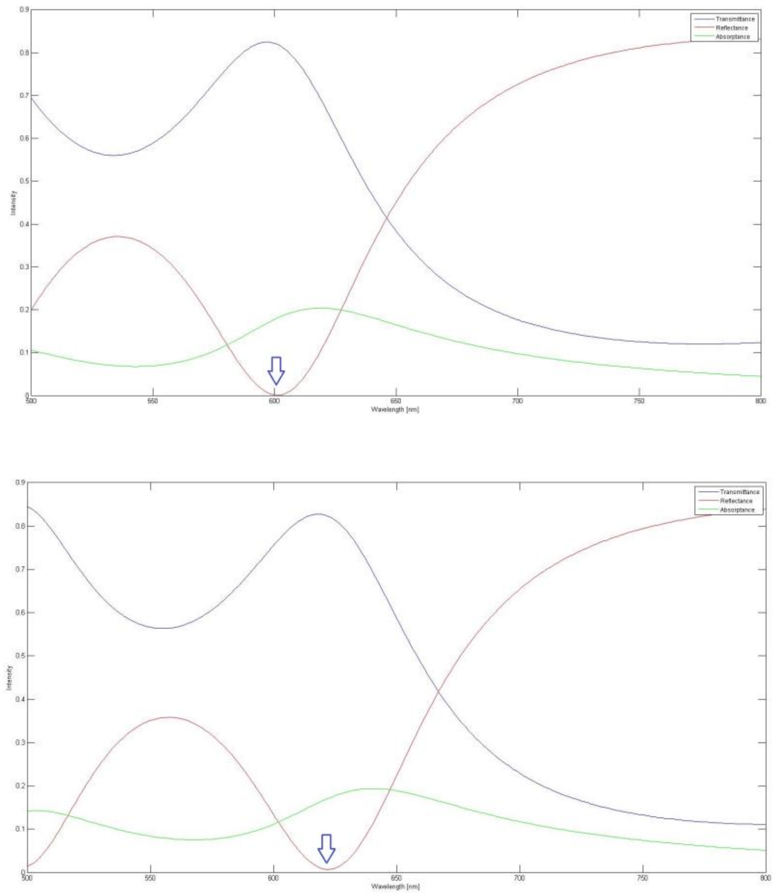

Figure 1.
For examples in the medium vacuity layer (Top) and the medium air layer (Bottom), the blue arrow are the differential result

CONVERSION OF CO_2 AND CH_4 BY DIELECTRIC BARRIER DISCHARGE PLASMA UNDER CATALYSTS

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[2]Department of Material Science and Technology, Faculty of Science, Prince of Songkla University, Songkhla 90110, Thailand

[3]Division of Physics, Faculty of Science and Technology, Phetchabun Rajabhat University, Phetchabun 67000, Thailand

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Abstract:

This research aims to study the conversion of CO_2 and CH_4 to fuel gas and chemicals in hydrocarbon groups by plasma technique under catalytic reaction. The plasma technique used in this research is a Dielectric Barrier Discharge (DBD). In the research, the maximum total gas flow rate was controlled at 100 ml/min. Whilst the effects of CH_4:CO_2 ratio and the concentration of helium (He) gas in the gas mixture on the conversion of reactant gases were investigated. Experimental results showed that after the plasma system was operated and the discharge state reached a stable state, which takes a time for 40 minutes, the electric power and reactor temperature were about 135.57 W and 125.47 °C, respectively. The results showed that when the CH_4:CO_2 ratio was adjusted at 5:1, 4:2, 3:3, 2:4, and 1:5, and the flow rate of He was fixed at 40 ml/min, CH_4 conversion increased, whereas CO_2 conversion slightly decrease. However, CO and H_2 selectivities are clearly increased. In contrast, ethane (C_2H_6) and propane (C_3H_8) selectivities are decreased. The higher selectivity of C_2H_6 and C_3H_8 was obtained at the 5:1 of CH_4:CO_2 ratio, while the selectivity of H_2 and CO is obtained at 1:5 of that ratio. In the case of CH_4:CO_2 constant and concentration of He is varied for 0, 10, 20, 30, 40, and 50 mol%, the conversion of CH_4 and CO_2 slightly increased. However, the trend of C_2H_6 and C_3H_8 selectivities is mostly constant. Furthermore the CH_4:CO_2 ratio of 1:5, CH_4 conversion raised to 75 %, while H_2 and CO selectivities were 60 % and 92 %, respectively. In this work, the chemicals are not created directly from the reaction without the catalyst. In the case of the conversion of CO_2 and CH_4 by plasma under catalytic substance. Whilst the conversion of reactant gases are not further increased, but H_2 selectivity significantly increases.

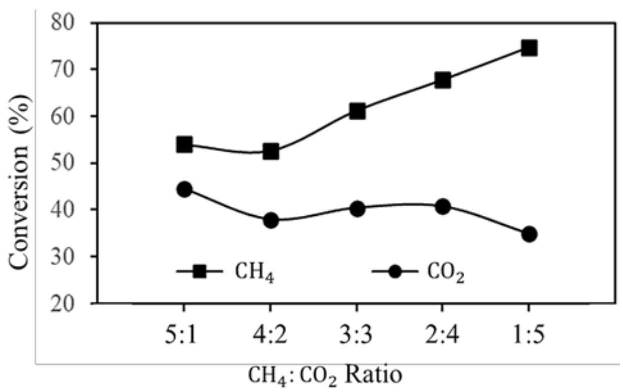

Figure 1. Conversion (%) of CH_4 and CO_2 at different CH_4:CO_2 feeding ratio.

Session B:
BIOLOGICAL SCIENCES

THE STUDY OF PROTEASES/PEPTIDASES FROM *Opisthorchris viverrini* BY USING TRANSCRIPTOMIC ANALYSIS

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Abstract:
Liver fluke infection caused by *Opisthorchis viverrini* have a major impact on the health of tens of millions of people in many parts of Asia. The parasite is long-lived and cause chronic infections which lead to the bile duct cancer. Proteases/peptidases are the crucial enzymes that the parasite used in the process of infection, including migration, food digestion and immune invasion. In this study, we employed a platform based on RNAseq technology and in silico analyses to provide the detailed insight into the transcriptomes of the liver fluke at the adult stage, focusing on all the protease/peptidases enzymes. The result revealed that the family of cysteine proteases are the major excreted/secreted protease. However, the parasite has to encounter a various type of tissues and the host's immune effector cells, which mean it might not only use the cysteine protease but other types of proteases/peptidases such as metallo-, serine and threonine peptidase as displayed in our data. This study shed light on all the protease or peptidase that involved the parasite used for living and it also represents potential drug and/or vaccine targets in the future.

THE EFFECT OF THE TWO FOOD ADDITIVES SODIUM TETRABORATE AND POTASSIUM NITRATE ON VIABILITY OF HUMAN LUNG CARCINOMA EPITHELIAL CELL

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Abstract:
Sodium tetraborate and potassium nitrate are well-known food additives, which have been widely used in food preservatives and food processes. The toxicity of sodium tetraborate has been reported for nephrotoxicity, neurotoxicity, reproductive and development toxicity. It might be lethal in case of high dose consumption. Potassium nitrate has been tested for potential carcinogenicity, alone or in combination with nitrosatable compounds. The purpose of this study is to investigate the effect of those two food additives on viability of lung cancer cell lines. In this study, the human lung carcinoma epithelial cells A549 were treated with sodium tetraborate, potassium nitrate, or the combinations at various concentrations for 24, 48 and 72 hours. The cell cytotoxicity was determined by MTT assay. The results showed that sodium tetraborate, potassium nitrate, or the combinations could significantly reduce cell viability in dose dependent manner. Both food additives did not promote lung cancer cell proliferation, event at high concentration. The mechanisms of cytotoxicity of sodium tetraborate and potassium nitrate in other cancer cell lines such as HepG2 has been proposed to involve several processes such as inhibiting enzyme production, cell division, cell proliferation, cell cycle arrest, and induction cell apoptosis. In conclusion, both tested food additives could reduce the human lung carcinoma epithelial cell viability in dose dependent manner.

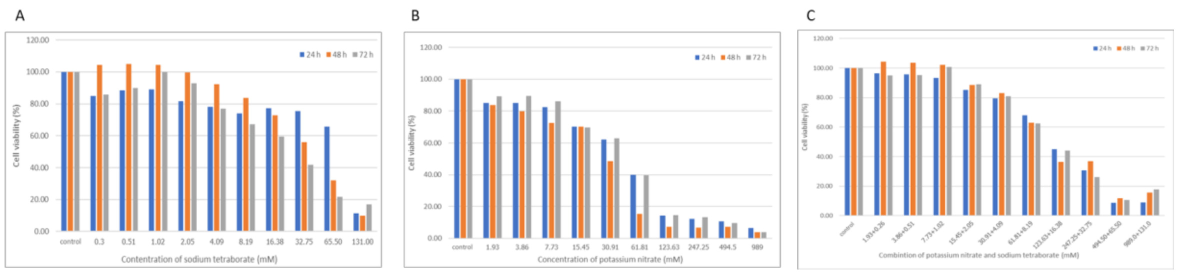

Figure 1.
A549 cells were treated with sodium tetraborate (A), potassium nitrate (B) and combination of two food additives (C) for 24, 48 and 72 hours.

OPTIMIZATION OF THE EXTRACELLULARLY EXPRESSED PETASE PRODUCED FROM *Escherichia coli* FOR PET PLASTIC BIODEGRADATION

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Abstract: Polyethylene terephthalate (PET) is one of the plastic types that can be found in daily life and become a huge accumulation in the environment. A biodegradation breaking the chemical molecule of PET polymer to monomer can decrease the period of PET degradation. Even secreted enzyme, namely PETase, was found from *Ideonella sakaiensis* 201-F6, its secretion mechanism is still unclear, and it is difficult to directly apply in the environment. In this study, *I. sakaiensis*' PETase gene linked with a signal peptide in the expression plasmid was synthetically constructed and the expression of its counterpart was conducted and optimized in *E. coli* strain Rosetta-gami DE3(pLysS) by using various isopropyl β-d-1-thiogalactopyranoside (IPTG) concentration. SDS-PAGE and Western blot analysis showed the recombinant PETase, roughly 30 kDa in size, was present in the culture medium with the highest expression level when inducing the recombinant bacteria at 0.5 mM IPTG final concentration. Anyhow the function in PET degradation of this recombinant enzyme needs further investigation.

CHARACTERIZATION OF A NOVEL MIRNA IN DENGUE VIRUS SEROTYPE 2 INFECTED HEK293T CELLS

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Abstract:
Dengue virus (DENV), a common mosquito-borne viral species that belongs to the Flaviviridae family, is responsible for causing dengue fever (DF) and dengue hemorrhagic fever/dengue shock syndrome (DHF/DSS) in people in tropical and subtropical areas. The single-stranded RNA virus has four different serotypes: DENV 1, DENV 2, DENV 3, and DENV 4. The host's innate and adaptive immune responses are essential for determining the viral infection's history. Even though most illnesses are subclinical, they can nevertheless cause a variety of symptoms. Although a DENV vaccination has already been developed, its effectiveness against the four DENV serotypes varies greatly. We evaluated a few potential miRNAs for changes in expression levels after DENV 2 infection of HEK293T (embryonic kidney) cells to better understand the role that miRNAs play in DENV 2 replication. At every time studied, it was confirmed that one miRNA, miR-MS, showed bands at all time points tested. Moreover, our research is ongoing, and the outcome is not yet achieved. However, from our results so far, we can assume that miR-MS can have the capability in inhibiting dengue virus serotype 2 replication. This study will aid in our ongoing investigation into the function of miRNA in the replication of DENV 2 and fathom the function of microRNA as a therapeutic component in DENV 2 replication.

SULFATED GALACTANS PROMOTE MIGRATION OF KERATINOCYTE CELLS

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Abstract:

Currently, the ineffective treatment of wounds and the delay wound healing in the elderly people with comorbidities illness is an increasing health-economic burden on healthcare systems, thus, there is a growing interest in effective treatment of wound repair. Keratinocytes and fibroblasts are critical players for skin repair after injury. During the wound healing process, proliferation, migration, and differentiation of these cells are the major mechanisms leading to tissue repair. Previously, sulfated galactans (SG) isolated from red seaweed *Gracilaria fisheri* has been shown to stimulate fibroblast migration and proliferation. In this study, we therefore, aimed to explore whether SG displays effects on the migration of a human keratinocyte cell line (HaCaT) using scratch wound healing assay. SG was tested for cytotoxicity and proliferation effects on keratinocyte cells. Expressions of migration associated proteins including E-cadherin, p-FAK and p-NF-κB were investigated by Western blot analyses. The results demonstrated that SG at the tested concentrations showed no toxicity and proliferation effects on keratinocyte cells. SG significantly accelerated HaCaT cell migration in a concentration-dependent manner at 24 h exposure. Furthermore, SG was found to significantly downregulate the expression E-cadherin and upregulate the expression of p-FAK and p-NF-κB. The present findings demonstrate that SG may be a promising compound to promote the migration of keratinocytes for skin wound treatment. Further studies are still required to confirm the underlined wound healing property of SG.

APPLICATION OF THERMAL INSULATOR FOR HEAT STORAGE IN CATFISH PONDS

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Abstract:

Water temperature was an important factor influencing the livelihood of aquatic animals including fishes. The low water temperature resulted in reduced feed intake and growth and lead to a shortage of fish production during the winter, as well as in the highlands region such the northern of Thailand, which the air temperature probably dropped below 15 degrees Celsius. For this reason, many researches had been done into finding methods for increasing the water temperature in aquaculture ponds, such using fish pond heaters, or using greenhouses to prevent heat loss from ponds. In this study, the using of pond insulation together with pond covering in order to store solar heat inside hybrid catfish (*Clarias macrocephalus* x *C. gariepinus*) ponds were conducted and evaluated the performance in increasing water temperatures. The results showed that using insulation together with pond covering not only increased the average water temperatures up to 6.3 degrees Celsius higher than the control, but also reduced the daily water temperature fluctuation. In addition, the catfish raised in the insulated ponds had better growth performances. The growth rates and survival rates were higher than the control up to 34 and 91 percent, respectively, while the feed conversion ratio was lower about 30 percent.

SELECTION AND CHARACTERIZATION OF HIGH L-LACTIC ACID BACTERIA, *Lactobacillus farciminis* KUJ 25-S FROM FERMENTED FISH FOR BIO-POLYLACTIC ACID PRODUCTION

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Abstract:
Production of bio-polylactic acid (PLA) from agricultural biomass and its use as packaging in the fishery industry was focused. Production began by breaking down lignocellulose material into sugars and then fermenting the sugar into lactic acid. Before creating PLA polymers, this work was initiated. The objective of this work was to produce lactic acid through selecting natural microorganisms that produced high L-lactic acid from various fermented fishery products and characterized the strain. From 142 isolated lactic bacteria, a lactic acid bacterium from fermented fish (Pla-Chou) was screened. According to biochemical and biomolecule classification (16S ribosomal RNA gene identification), it was *Lactobacillus farciminis* KUJ 25-S with the following properties: the preliminary biochemical properties as *Lactobacillus*. L-lactic acid production in De Man Rogosa and Sharpe broth (static condition at 37 ^{o}C for 120 h) was 42.0 g/L. The L-lactic acid ratio per sum of DL lactic acid was 93%. The characteristics of lactic acid and its stereoisomers were confirmed by thin layer chromatography (Figure 1), Chiral-HPLC, and enzymatic techniques. This culture could be used as a culture resource for the next step of L-lactic acid production.

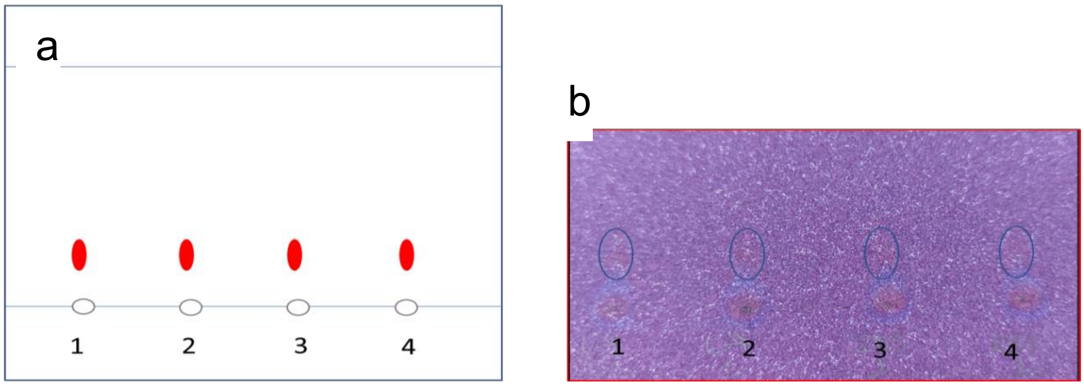

Figure 1.
Lactic acid identification of *Lactobacillus farciminis* KUJ 25-S using thin layer chromatography (TLC) (3 and 4) with the same Rf of standard (0.14; (1 and 2)) from the model plate (a) and red spots (positive lactic acid) on TLC Plate (b).

CHARACTERIZATION OF BIOACTIVE COMPOUNDS ISOLATED BY A CORN SILK FERMENTATION

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Abstract:
Corn silk contains an abundance of bioactive compounds which possess various health benefits and help to avoid numerous chronic diseases. This research aims to assess the bioactivity of the compounds that were isolated from corn silk strains by using a biological extraction, which used hydrolytic enzymes from the microorganisms of the fermentation. The sweet corn and feed corn were fermented with a mixture of microorganisms, Saccharomyces cerevisiae, Bacillus sp., and Lactobacillus sp. The solid-state fermentation and the immersion fermentation were compared in this study, and were tested acidity, inhibition of xanthine oxidase, inhibition of antioxidant using the ABTS assay method, and the amount of total phenolic content and flavonoids content. The results showed that the fermented sweet corn silk had the highest percentage of xanthin oxidase inhibition (76.51± 6.46%), phenolic content (6.05 ± 0.69 µg GAE/g dry wt.) and flavonoids content (59.55± 1.64mg QE/g dry wt.), equally important, process also produced antioxidant inhibition at 61.63± 4.79%. after two months incubation. The results indicated that the fermentation could be used to isolate the bioactive compounds. The sweet corn silk was used to amalgamate the appropriate conditions used for the immersion fermentation process of 2 month. Therefore, due to the potential bioactivity and fermentation suitability, corn silk can be scaled up for industrial production levels.

Keywords: (antioxidant, biological extraction, corn silk, fermentation, xanthine oxidase inhibition)

ANTI-OBESITY ACTIVITY OF PARKIA SPECIOSA POD EXTRACT BY INHIBIT ADIPOGENESIS IN 3T3-L1

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Abstract:
Obesity is a metabolic syndrome that is excessive lipid accumulation in adipose cells and leads to diabetes, dyslipidemia, and nonalcoholic fatty liver. The pharmacological intervention for obesity has side effects and limits the duration. In this study, we determined the anti-obesity effect of Parkia speciosa pod (PS) extracts on the mouse embryonic fibroblast 3T3-L1 cell. The pre-adipose cells were induced to adipose cells by differential medium (0.5 mM 3-Isobutyl-1-methylxanthine, 1 µM dexamethasone, and 10 µg insulin) for 2 days, maintain medium (10 µg insulin) for 2 days, and complete medium for 2 days. The cell viability of pre-adipose and adipose cells under treatment of PS extract were examined by measuring the cell viability using MTT assay relative to the control group. The PS extract did not have cytotoxicity. Furthermore, the lipid accumulation in the differentiated adipose cells was determined by Oil Red O staining and analyzed by comparing with a control group using one-way ANOVA. We found that treatment with a PS extract suppressed lipid accumulation at 50-200 µg/ml. In summary, The PS extract showed anti-obesity effects in adipose cells that can be developed to prevent obesity.

CYTOTOXIC AND ANTI-MIGRATION EFFECTS OF *Artemisia lactiflora* EXTRACT AGAINST COLON CANCER CELLS USING IN VITRO STUDY

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Abstract:
Currently, chemotherapy remains the primary cancer treatment, but its adverse effects and multidrug resistance impede its therapeutic efficiency. Natural polyphenols derived from plants display higher anticancer efficiency and lower toxicity. *Artemisia* has numerous anticancer ingredients, including polyphenols that can promote tumor cell apoptosis, cell cycle arrest and inhibit tumor angiogenesis. The anti-colon cancer properties of *Artemisia lactiflora* (*A. lactiflora*) ethanol extract have yet to be investigated thus far. Therefore, this study investigated the anticancer effects of the ethanolic extract from the *A. lactiflora* (ALET) against HCT-116 and HT-29 colon cancer cells. ALET was obtained by maceration with ethanol. The effect of ALET on cell viability was assessed by MTT assay. A scratch assay was performed to determine the anti-migration effect. Overall analyses revealed that treatment with ALET for 24 h can inhibit the viability of HCT-116 and HT-29 cells. In addition, ALET also significantly inhibited the migration of HCT-116 and HT-29 cells. Consequently, our study provides ALET as a putative therapeutic agent that could be applicable against colon cancer progression.

ANTIDIABETIC AND ANTIOXIDANT ACTIVITY OF *Parkia speciosa* Hassk EXTRACT

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Abstract:
Diabetes mellitus type II is caused by abnormalities of the pancreas that result in abnormally insulin secretion or insulin resistance. Controlling blood glucose levels has become an important factor in treatment. Currently, alternative treatments using herbal medicines draw the attention of many diabetic patients. The plant *Parkia speciosa Hassk* is native to Southeast Asia. In Thailand, it is known as sator or sataw. In folk medicine, it has been used to treat diabetes, hypertension, and kidney disorders. The aim of this study is to determine antidiabetic effect of *Parkia speciosa Hassk* extract. The polyphenol and flavonoid content of the extract was determined. According to the 2,2'-azino-bis 3-ethylbenzthiazoline-6-sulphonic acid (ABTS) assay, the antioxidant activity of the extract is comparable to that of ascorbic acid, with the IC_{50} values of 11.46 g/ml and 7.35 g/ml, respectively. In an antioxidant assay employing 2,2-diphenyl-1-picrylhydrazyl (DPPH), the IC_{50} of the extract and ascorbic acid were determined to be 11.46 g/ml and 7.35 g/ml, respectively. The inhibiting alpha-glucosidase and alpha-glucosidase effects of the extract were significantly greater than those of the standard medication acarbose ($P < 0.001$), with IC50 values 182 and 21 times more than those of acarbose, respectively. Therefore, the extract could be an interesting alternative for further development as a substitute or combination treatment with current diabetes drugs, such as acarbose, which could decrease post-meal hyperglycemia.

ANTIOXIDATIVE ACTIVITY AND INHIBITION OF INTESTINAL GLUCOSE ABSORPTION BY *Sesbania javanica* MIQ EXTRACT

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Abstract:
The flower of *Sesbania javanica* Miq., also called "Sano" or "Phak hong hang" in Thai (northern Thai). The bloom of *Sesbania javanica* Miq. is a native of Southeast Asia, specifically Thailand. In ancient Thai traditional medicine, it was used as an anti-inflammatory for insect bites, detoxication, the treatment of testicular abscesses, stomach pain, and the alleviation of internal fever and thirst. It has a high level of total phenolic compounds and anti-lipid peroxidase. Here, the inhibitory effect of diabetes mellitus (DM)-related glucose absorption and antioxidative activity of *Sesbania javanica* Miq extract were studied. The IC50 values for *Sesbania javanica* Miq. extract using the 2,2'-azino-bis 3-ethylbenzthiazoline-6-sulphonic acid (ABTS) and 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assays were 109.8 ppm and 354.20 ppm, respectively. In this study, the ability of *Sesbania javanica* Miq. extract to modulate intestinal glucose transporters was investigated using Caco-2 cells as a model of an intestinal barrier. *Sesbania javanica* Miq. Extract has no cytotoxicity in concentration ranging from 0 – 500 ppm. Rt-qPCR analysis reveals that incubation of Caco-2 cells with 10 ppm of *Sesbania javanica* Miq. extract significantly decreased glucose uptake by suppressing the SGLUT1 and GLUT2 glucose transporter levels in a manner similar to acarbose. These data suggest that *Sesbania javanica* Miq extract may attenuate glucose absorption and may have potentially beneficial antioxidant effects in the body; however, the mechanisms underlying the effects of CBE must be elucidated through further investigation.

GENERATION OF A CRISPR-Cas9 MUTAGENESIS SYSTEM FOR GENERATING LYTIC PHAGE VARIANTS FROM *Clostridioides difficile* PROPHAGE

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Abstract:

The clustered regularly interspaced short palindromic repeats (CRISPR) and CRISPR-associated protein (Cas) is known to be an adaptive immunity in prokaryotes. Due to its accuracy and efficacy, the CRISPR-Cas system has been widely used to edit the genome of several organisms as well as viruses. In this study, the CRISPR-Cas9 system for the disruption of integrase gene (*int*) in the *C. difficile* prophage genome was created. PAM sequences in the *int* gene of phage ΦHN10 were located to retrieve the potential guide RNA (gRNA) sequences. The protocols used the CRISPR-Cas9 gRNA expression plasmid pJK02 and *in vivo* assembly for cloning and expressing the *int* sequence. The repair fragment was subsequently subcloned to replace the upstream and downstream regions of the pJK02 for homology-directed repair after Cas9 cut the target. The gRNA and upstream/downstream homology arms in the constructed plasmid were verified by restriction digestion and sequencing to ensure the joining and preservation of the local sequence context. The system reported here is an applicable, efficient, and simpler procedure to construct expression clones for CRISPR/Cas9-mediated phage genome editing.

INHIBITION OF PIG BLOOD ALPHA-GLUCOSIDASE WITH ALPHA-GLUCOSYL TRIAZOLES AND RELATED COMPOUNDS

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Abstract: Alpha-glucosidase from pig blood is a potential model for a digestive α-glucosidase, which can be inhibited as a treatment for diabetes. The inhibition of α-glucosidase to reduce postprandial glucose levels can be achieved with commercial inhibitors, such as acarbose. However, these inhibitors have side effects in human, so new inhibitors with less side effects are in demand. In an effort to develop such α-glucosidase inhibitors, we tested α-glucosyl triazoles developed in our laboratory (AGT2-14) and chrysin, which is a component of one of the most effective inhibitors (AGT14). The inhibition of α-glucosidase from pig blood by AGT2-14 and chrysin were obtained from a *p*-nitrophenyl α-D-glucosylpyranoside (pNPαGlc) hydrolysis assay. The best inhibitor of the enzyme was AGT14. The potent inhibitors enzyme selected for finding their IC_{50} values were AGT5, AGT10, AGT14, and chrysin, which had IC_{50} values of 45.7± 2.9, 42.3± 3.3, 19.4± 1.6, and 29.8± 0.2, respectively. AGT14 has the best IC_{50}, so we estimated its competitive inhibition constants at 0.098 mM and 0.11 mM, because pig blood enzymes have two active sites and the type of inhibition is competitive. To synthesize new α-glucosyl triazoles to test as inhibitors, amide alkynes were synthesized by the mechanism of BOP-mediated coupling reagent. These compounds are being coupled to α-azidoglucose to synthesize the new α-glucosyl triazoles compounds, as potential inhibitors, under click chemistry reaction conditions.

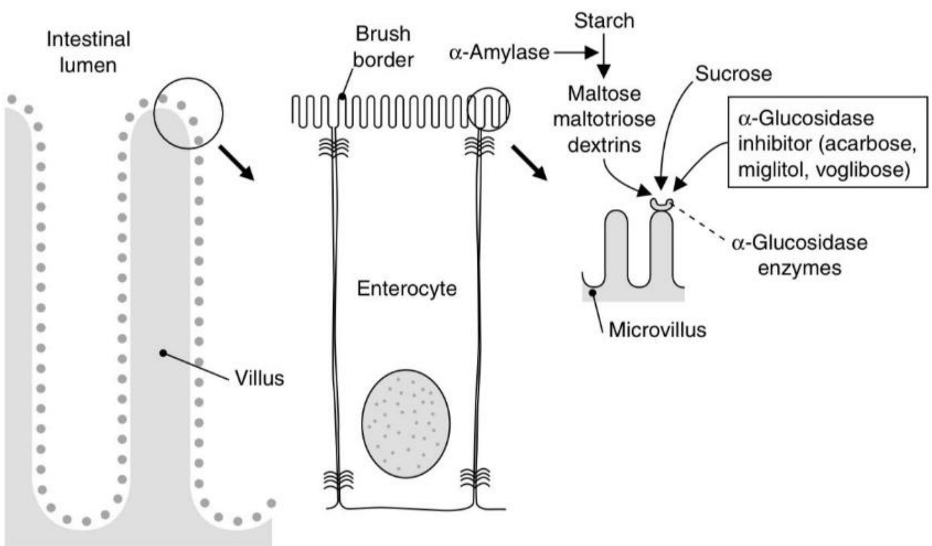

Figure 1. α-Glucosidase inhibitors competitively inhibit the activity of α-glucosidase

A STUDY OF DYS612 MUTATION IN THAI FATHER-SON PAIRS

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Abstract:
The Y-chromosomal short tandem repeat (Y-STR) is a common DNA marker for investigating paternal lineage and identifying male contributors in sexual assault cases in forensic fields. DYS612 marker was one of the rapidly mutating Y-STRs (RM Y-STRs) with higher discrimination power. The mutation rate of DYS612 was reported in each ethnic population except for the Thai population. This study aimed to determine the mutation rate of DYS612 in 150 Thai father-son pairs. The result presented four mutations, with a mutation rate of 2.67×10^{-2}.

POPULATION DENSITY AND MOUND DISTRIBUTION OF MUD LOBSTERS, *Thalassina* spp. IN KAMPUAN MANGROVE FOREST, RANONG PROVINCE

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Abstract:
This study aims to investigate the population density and mound distribution of mud lobsters, *Thalassina* spp. in Kampuan Mangrove forest, Ranong province, Southern Thailand. Mud lobster plays an important role in the mangrove forest for its excavation activity which providing habitat and refuge to other animals. This study was carried out by establishing three 5 x 350 m^2-line transects located in the Kampuan mangrove forest. Each line transect was started at 100 m from the edge of the river towards inland ward composing of six subplots with 50 m intervals (i.e. 100, 150, 200, 250, 300 and 350 m subplots). We counted the number of mounds and measured mound height, diameter, basal area in each subplot. The results showed that as the distance from the river increased, the mound density and mound height also increased (i.e. 267 mounds per hectare at 100 m increased to 1734 mounds per hectare at 350 m. from the river edge). This indicated that mud lobster preferred to build their mounds and also higher mounds further away from river edge where there was less effect by tide and drier soil.

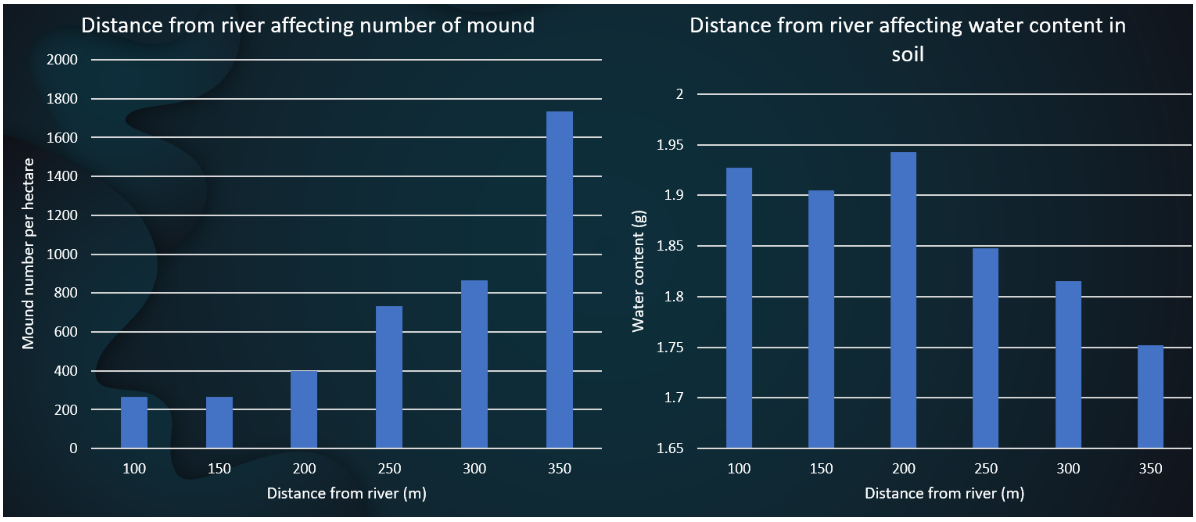

Figure 1. Distance from river edge and the number of mounds per hectare (left) and the amount of water content (g) (right)

ELUCIDATING THE CROSSTALK BETWEEN BLOOD AND LYMPHATIC ENDOTHELIAL CELLS

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Abstract:
Cancer-associated lymphedema is a complex disease presented with swelling of the limb and chronic inflammatory responses occur after cancer treatment. Vascularized lymph node transfer (VLT), one of the treatment strategies, involves autologous implantation of lymph nodes into the edematous site and acts as lymph pumps from tissue to the venous system, proves to be effective in reducing tissue swelling. Our study aims to understand the crosstalk between the two processes, angiogenesis and lymphangiogenesis. Using human umbilical vein endothelial cells (HUVECs) and human dermal lymphatic endothelial cells (HdLECs) as models, our results showed that HUVEC-conditioned media significantly reduced the proliferation of LEC with no impact on cell adhesion or migration abilities. Interestingly, HUVECs appeared to induce cell morphogenesis and promote tube formation in HdLECs. HUVEC-conditioned media increased lymphatic identity in HdLECs. Overall, our preliminary results indicated that there is a crosstalk between HUVECs and HdLECs and possibly promote the functions of HdLECs, implicating the role of blood endothelial cells in the effective treatment of cancer-associated lymphedema.

EXPLORATORY AND DISCRIMINANT ANALYSIS OF UV-VIS SPECTRAL PROFILES OF *Oroxylum indicum* EXTRACTS AND SKIN IRRITATION EVALUATION OF THEIR EMULSION BEAD FORMULATION

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Abstract:
Seeds and barks of *Oroxylum indicum* were extracted via the maceration method using ethanol, ethyl acetate, and butylene glycol as solvents. The UV profiles of all the extracts were collected and classified by partial least squares discriminant analysis (PLS-DA) and hierarchical cluster analysis (HCA). The extracts from seed with ethanol (SET) and ethyl acetate (SEA) were classified into the same groups. The antioxidant activities of the extracts were determined by 1,1-diphenyl-2-picrylhydrazyl (DPPH) assay, and the SET provided the most excellent activity with IC_{50} of 45.84±0.90 µg/mL. The cell viability test of the SET was measured by methyl thiazole tetrazolium (MTT) assay, and all concentrations of the SET showed a great capacity to reduce MTT. The emulsion beads containing SET were prepared, and the physical characteristics, such as symmetry and unwanted color coverage, were also investigated. The patch test was designed to evaluate skin irritation of the SET-loaded emulsion beads in comparison to SET, de-ionized water, emulsion bead base, and sodium lauryl sulfate in 21 healthy female volunteers. The visual clinical skin reaction was evaluated by a physician. The transepidermal water loss (TEWL) value and erythema index were determined using instrumental assessment.

AN ALTERNATIVE APPROACH FOR SCREENING MICROSATELLITE MARKERS FROM TRANSCRIPTOME OF *Acheta domesticus* Linnaeus, 1758

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Abstract:
Simple sequence repeats (SSRs), also known as microsatellites, are highly polymorphic genetic markers found in both genomic and transcriptomic sequences. The conventional methods for developing SSR markers can be laborious, time consuming and less efficient. Therefore, the transcriptome sequences were employed in this study to find polymorphic SSRs, construct microsatellite markers, and assess their transferability using the Basic Sequence Alignment Tool (BLAST). The transcriptomic sequences of *Acheta domesticus* were used to search polymorphic SSR against raw sequences from transcriptomes. The focus of the study was on perfect trinucleotide SSRs, and their variation was observed based on stepwise mutation model. Total 26 polymorphic SSRs out of 200 sequences from transcriptome were identified by *in silico* method. Additionally, five (42%) out of 12 designed primers pairs from 26 polymorphic SSRs were successfully amplified by PCR. Moreover, their transferability was also checked using transcriptome datasets from different species. Two microsatellite markers (50%) out of four primer pairs showed successful amplification with expected size from *Gryllus bimaculatus* DNA samples. *In silico* analysis using BLAST (megablast) and raw sequence databases can be used to screen for polymorphic microsatellite makers and their transferability using the alternative methods proposed in this study. Furthermore, the *in silico* approach provided detailed data of each SSR-containing sequence in the form of alignment, which can be extremely useful for SSR scouring error correction, primer design, and a better knowledge of SSR-containing sequences in general.

EXPLORING ANTIMICROBIAL ACTIVITIES OF NUCLEOSIDE ANALOGS AGAINST FOODBORNE PATHOGENS

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Abstract:
Foodborne illness is a major health concern of human diseases across the world. Treatment of foodborne illness is limited as the emergence of antibiotic resistance is increasing. To tackle antibiotic resistance, novel antimicrobial compounds must be identified. Drug library screening is an approach for discovering novel drugs with a simple, rapid, efficient, and reliable strategy. Therefore, this study aims to explore the antimicrobial activity of compounds against 7 common foodborne pathogens using in vitro screening of the nucleoside analog compounds library. A total of 290 nucleoside analogs was screened for the inhibitory effect against foodborne pathogens using single concentration screening of compounds with a cutting point of 20 µM. From the total of 290 compounds, floxuridine and zidovudine were found to inhibit *Staphylococcus aureus* (MRSA), *Salmonella* Typhimurium, *Listeria monocytogenes*, and *Shigella sonnei*. MIC values of floxuridine were 0.019 µg/ml and 0.308 µg/ml for MRSA and *L. monocytogenes*, respectively. Whereas zidovudine was found to inhibit *S.* Typhimurium and *S. sonnei* with MIC values of 0.01µg/ml and 0.042 µg/ml, respectively. To extend an understanding of the candidate drugs, a further experiment is required to elucidate the mechanism of action.

Keyword: foodborne pathogens, nucleoside analogs, antimicrobial activity.

A PROTEOMIC APPROACH FOR IDENTIFYING POTENTIAL DRUG'S MECHANISM OF ACTION IN *Clostridioides difficile*

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Abstract:

The gram-positive anaerobic bacterium *Clostridioides difficile* is the major cause of diarrhea and enteritis in human. Vancomycin, metronidazole, and fidaxomicin are the mainstay for the treatment of *C. difficile* infection (CDI). However, the incidence of treatment failure and high recurrent rate caused by antibiotics resistance in *C. difficile* have been continuously reported. Several researches have been seeking novel anticlostridial agents, but less is studied on how these compounds are working. Under an antibiotic exposure, alteration of protein expression in the bacteria is unique corresponding to each type of cellular damages. The change in the protein pattern is useful for exploring the mode and/or mechanism of action of antibiotics. Therefore, a mass spectrometry-based proteomic approach was used to analyze changes in the *C. difficile* proteome when challenging with antibiotics. Our study revealed that metronidazole, vancomycin, and fidaxomicin modified number of marker proteins involved in biosynthesis of protein, nucleic acid, as well as in cell wall. This established pipeline can be used to further predict mode and/or mechanism of action of unknown drugs in *C. difficile*.

THE EFFICIENCY OF FLOWER FROM *Sesbania javanica* EXTRACT AGAINST FAT ACCUMULATION USING IN-VITRO STUDY

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Abstract:
Obesity is a metabolic syndrome that high-fat accumulation in the body and is one of the risk factors associated with cardiovascular disease, diabetes, hypertension, and cancers. Currently, it has been found that the natural extracts are increasingly being used in the treatment of obesity. Hence, we aim to investigate the fat accumulation using 3T3-L1 preadipocytes from *Sesbania javanica* (SJ) flower extract. The cell viability of 3T3-L1 preadipocytes treated with SJ extract using MTT assay showed non-toxicity. The adipogenesis was analyzed via intracellular lipid accumulation in differentiated 3T3-L1 adipocytes using Oil Red O staining. We found that treatment adipogenesis cocktail with SJ extract significantly suppressed lipid accumulation in differentiated 3T3-L1 adipocytes at 50-200 µg/ml compared with the control ($P<0.001$). In summary, the SJ extract can decrease fat accumulation in adipocytes and it can be developed to supplementary food against obesity.

IDENTIFICATION OF POTENTIAL DRUG CANDIDATES FOR CHOLANGIOCARCINOMA FROM A META-ANALYSIS OF TRANSCRIPTOMIC PROFILES

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Abstract:
Cholangiocarcinoma (CCA) is an epithelial carcinoma of the bile duct that can be distinguished into distinct subtypes based on anatomical sites. These CCA subtypes have genetic variability but lack a stereotyped genetic profile, resulting in the challenges of diagnosis and treatment. The obstacles in the diagnosis process result in a low survival rate for the patients with late stages of malignancies since CCA are unresponsive to conventional treatment. Therefore, finding the genetic profile of CCA is crucial for developing effective therapy. Several studies have used meta-analysis to extract novel insights into cancers from the data on available databases. In this study, we performed a meta-analysis of gene expression in CCA to identify candidate genes as a target for the treatment. The RNA-sequencing (RNA-seq) and array-based gene expression data of CCA and bile duct were retrieved from public databases, Gene Expression Omnibus (GEO) and European Bioinformatics Institute (EBI). The differentially-expressed genes (DEGs) presented in both platforms were used for downstream analysis. A total of 250 significant DEGs were identified that distinguished between CCA and adjacent normal tissues. Potential drug candidates based on DEGs were retrieved through Enrichr. We hope that our pipeline will lead us to identify novel therapeutic candidates for CCA.

Keywords: Meta-analysis, cholangiocarcinoma, transcriptomics, microarray, RNA-sequencing

RAPID ONE-STEP SYNTHESIS OF SILVER NANOPARTICLES FROM TEA AND COFFEE WASTE

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Abstract:

High jumping growth of the globally caffeine-café business results in increasing tea and coffee waste each year. Using these tea and coffee waste, therefore, is not only the approach to helping a zero-waste society but also to value-adding of these biomass wastes. Thus, this research project aims to use tea and coffee waste as alternative chemicals to synthesize silver nanoparticles (AgNPs) which have an application in a broad range of industries, mainly food and medicine, due to their antibacterial properties. Seven tea wastes (A-G) and two coffee wastes (H-I) were collected from local cafes and extracted in 100 °C water for 10 min. The extracts were tested for their reducing activities using the potassium ferricyanide reducing power (PFRAP) assay. The results showed that both extracts exhibited similar reducing activities, therefore one of each tea and coffee waste extract was chosen for further study based on their reducing activities and waste abundance. AgNPs were successfully synthesized in the reaction containing only silver ion substrate and the tea and coffee waste extracts, suggesting the sufficient reducing and capping capability of these extracts. The formation of AgNPs was determined by the characteristic localized surface plasmon resonance (LSPR) peaks of AgNPs in a range of 411-413 nm. Silver concentration, reaction time, and pH showed the effects on the quantity and size distribution. The results of this work demonstrated that tea and coffee waste extracts effectively promoted the green syntheses of AgNPs.

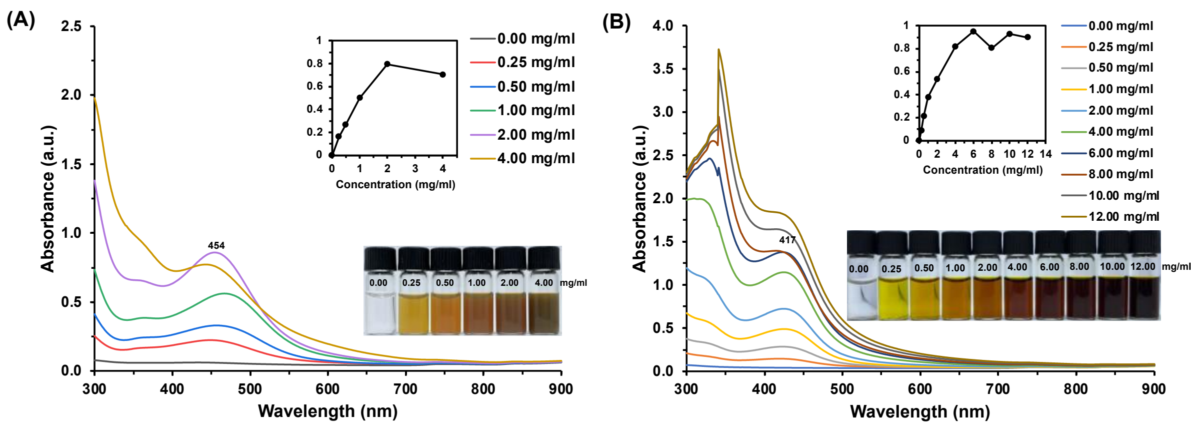

Figure 1.
UV-Vis spectra of the synthesized AgNPs using different concentrations of (A) tea extract and (B) coffee extract.

THE DESIGN OF A PLATELET-DERIVED GROWTH FACTOR DECOY

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Abstract:

The platelet-derived growth factor (PDGF) family plays an essential role in controlling cell-to-cell communication and mediating complex biological processes including cell growth, differentiation, and motility of connective tissue cells. It consists of five ligand isoforms namely PDGF-AA, PDGF-AB, PDGF-BB, PDGF-CC, PDGF-DD and three receptor tyrosine kinase isoforms which are PDGFR-αα, PDGFR-αβ, and PDGFR-ββ. Previous evidence showed that PDGF signaling irregularity was involved in several types of cancer. Thus, inhibition of the PDGF-PDGFR interaction might serve as a potential therapeutic target for cancer therapy. In this study, we designed and developed a biologic PDGF inhibitor based on the structure of PDGFR-alpha (PDGFR-α) and fused with a heavy chain of immunoglobulin (Fc) or "PDGF decoy" to use it as a trap for PDGF ligands and block the PDGF-PDGFR signaling.

LEISHMANIASIS IN SRI LANKA: THEN AND NOW

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Abstract:
Leishmaniasis used to be an exotic disease in Sri Lanka prior to 1990 with a few cases reported from travellers who returned from endemic countries, particularly the middle ease. The first locally-acquired case of cutaneous leishmaniasis (CL) in Sri Lanka was reported in 1992, with only sporadic case reports thereafter. This picture however, changed in 2001 with an outbreak of CL reported from the north-central part of the country. The case numbers steadily increased thereafter, with widening of spatial spread, and cases recorded eventually from all districts of the island. The majority of cases remains as cutaneious leishmaniasis and is due to a dermotropic variant of *L.donovani* with only a few cases of mucosal and visceral disease recorded.
We analysed CL patient data from cases reported since 2001 that enabled the study of patient demographic, temporal and geographic trends and identification and monitoring of disease hotspots. A mixed spatio-temporal regression-autoregression model was used to study the influence of variables viz. environmental temperature, precipitation, neighbouring-district dispersal and infection carryover on disease dynamics and spatial distribution. Similar methods were also used to predict future distribution and trends of leishmaniasis cases.
A total of 19,361 clinically confirmed leishmaniasis cases have been reported in Sri Lanka from 2001–2019. The disease affected all ages, from 1 to 81yrs, regardless of sex. However, there was a significant male preponderance (65%) and involvement of cases between 21 and 40 years (46%). In addition, we noted regional and temporal incidence differences for age and sex.
Majority of lesions were on exposed areas of the body (90%), single and were small in size of <2 cm (65.0%). Both ulcerative and nonulcerative stages of CL lesion were observed in nearly equal proportions (ulcerative: nonulcerative = 50.1: 49.9%); however, the proportions varied over time. Majority of the lesions presented within the first 6 months of onset (74%), less than 10% presented after 12 months, and the pattern varied during the study period. Mean duration of a skin lesion was approximately 6 months.
There were three phases of transmission based on burden of disease: low-transmission phase (2001–2010), steady increasing phase (2011–2017), and outbreak phase (2018–2019). Based on case incidence dynamics the districts could be divided into three groups. The majority of districts were with low incidence (<2.5 cases per 1000 population), 4 districts with intermediate incidence (2.5 to 5 per 1000) and 7 districts with highest average annual incidence rates (>5 per 1000). We noted a progression in case rates, including a sharp rise in 2018, showing temporal expansion of disease-prevalent areas and 2 persistent hotspots. The northern hotspot, shifted and shrank over time unlike the southern hotspot that persistently expanded and remained spatially static. Risk analyses of the 7 districts with the highest incidence rates demonstrated that precipitation, neighbouring district effect and infection carryover effect were the factors that demonstrated the highest correlation with district-level incidence dynamics. The model predicted further intensification of disease transmission in future years with expansion of high transmission areas.
Leishmaniasis case burden in Sri Lanka is steadily progressing and spatially expanding with distinct geographic patterns and disease hotspots. The situation calls for urgent attention of health authorities and policy makers to enable effective disease control through carefully planned interventions.

ECOLOGICAL AND POPULATION DENSITY OF WATER MONITORS (*Varanus salvator*) IN NAKHON PATHOM TOWN MUNICIPALITY, NAKHON PATHOM

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Abstract:

The water monitor *Varanus salvator* is the largest monitor in Thailand. In the present study, we conducted a 4-month survey within 10 km radius around Nakhon Pathom town municipality to estimate population density and study habitat use and behaviour of *V. savaltor*. During the survey, 210 sightings of *V. savaltor* were recorded, consisting of 29 (13.8%) adults, 137 (65.2%) subadults and 44 (21.0%) juveniles. The estimate of population density was 24.8 individuals km^{-2}. The greatest of *V. savaltor* sightings was made in terrestrial habitats, followed by aquatic and arboreal habitats. However, we found no age-specific habitat preference. Although, *V. savaltor* is strong swimmer and is often found near water, we found the temporal shifts in motion behaviour and habitat use. *V. savaltor* used arboreal habitats for resting in the morning and moved into aquatic and terrestrial habitats for swimming and roaming in the afternoon. The results of this study provide useful knowledge for the species conservation and management in Nakhon Pathom town municipality.

PALM OIL MILL EFFLUENT (POME) TREATMENT BY PHENOL-ADAPTED MICROBES: REMOVAL OF CHEMICAL OXYGEN DEMAND (COD) AND PHENOLIC COMPOUNDS

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Abstract:
Palm Oil Mill Effluent (POME) is a high organic load colloidal wastewater from palm oil milling processes, mainly consisting of residual oil, suspended solids, and lignin-derived phenolic compounds. As an easy, low-cost, and environmental-friendly alternative, the biological process has been widely adopted for POME treatment. However, one challenge for biological POME treatment is the presence of phenolic compounds. These compounds, particularly phenol, can be toxic to microbial cells, consequently affecting microbial activities and survival, and thus POME treatment efficiency. Certain microorganisms can adapt themselves to the compounds to overcome toxicity. However, such adaptation may also affect the functionality of the microorganisms. In this study, together with the consortium obtained from POME, two lignin-degrading *Bacillus* strains namely *Bacillus* sp. W1 and *Bacillus* sp. CU2-1 from laboratory culture collection were allowed to be adapted to 100 mg/L phenol for seven days, three cycles. Before adaptation to phenol, the Chemical Oxygen Demand (COD) removal in POME by the strain W1, CU2-1 and the consortium were 45.4%, 51.5%, and 50.4%, respectively. After phenol adaptation, the COD removal by strain W1 and CU2-1 decreased to 21.7% and 28.8%, whereas the COD removal by the consortium increased to 76.6%. The consortium was then exposed to the increasing concentration of phenol from 100 to 500 mg/L. The COD removal by the consortium adapted to 500 mg/L phenol was approximately 77% which is comparable to the COD removal by the non-adapted consortium (75%). However, the removal of the phenolic compound by the phenol-adapted consortium was 47%, which is substantially higher than that of the non-adapted consortium (24.9%). Even though the phenolic compound removal was increased, no notable decoloration of POME was detected. Further study, for example, investigation of metabolites and the activities of involved enzymes, will be useful for better understanding and development of more efficient biological POME treatment.

Keywords: Palm Oil Mill Effluent (POME), phenol, microbial adaptation, biological treatment

PREDICTING SPECIES DISTRIBUTION USING MAXENT – CASE OF THE SIMPLE THALLOID LIVERWORT GENUS *Aneura* Dumort. IN THAILAND

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Abstract

Aneuraceae is the largest family of the simple thalloid liverworts. Member of Aneuraceae is well-known for its unique ecological habitat, cryptic diversity, and species-rich lineages. Many of its members, such as the genus *Aneura*, have cosmopolitan distributions. However, the environmental factors associated with such distributions are poorly studied. In this study, we used the maximum entropy (MaxEnt) species distribution modeling (SDM) to predict potential locations and relevant ecological factors of *Aneura in an* area of Thailand. The results showed that the important variables were the maximum temperature of warmest month, annual precipitation, and precipitation of the warmest quarter. Thus, the possible locations for future exploration would be the north-to-southwestern and peninsular regions of Thailand, together with some major mountain ranges. The MaxEnt SDM performed equally well with only the three most important variables. Our results demonstrated the possibility of using SDMs in further explorations of bryophytes in Thailand.

IN VITRO ANTI-CANCER OF *Piper longum* EXTRACT ON COLON CANCER CELLS

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Abstract:
Colon cancer is one of the most common cancers, and efforts toward its treatment have not been completely successful. Therefore, therapeutic strategies of plant extraction are a better choice as dietary plant products against the development and progression of cancer. This study aimed to investigate the cytotoxicity and anti-migration effects of colon cancer cell lines treated with the crude aqueous and ethanolic extract of *Piper longum*. The extracts were evaluated for cytotoxicity by MTT assays on three cell lines; normal colon (CCD-18co) and colon cancer (HCT-116 and HT29). In addition, the wound scratch assay was used to measure the anti-migration effect. Finally, obtained results were analyzed using ANOVA. Results obtained from the MTT assay revealed that the extract against normal colon and colon cancer (HCT-116 and HT29) cells showed nontoxicity. Migration assay also confirmed the anticancer potential of the extract against HCT-116 and HT29 cells. In conclusion, our results demonstrated that *Piper longum* extract inhibits colon cancer cell migration. These results reveal that *Piper longum* contains potent therapeutic compounds that could be applied to develop a novel antitumor dietary supplement candidate against colon cancer.

IN-DEPTH CHARACTERIZATION OF A NOVEL COLD-ACTIVE AMYLASE FROM *Priestia koreensis* FOR MALTOOLIGOSACCHARIDE PRODUCTION

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Abstract:
Maltooligosaccharide-forming amylases (MFAses) are specific and interesting because of their capacity to hydrolyze starch into functional maltooligosaccharides. In this study, a maltooligosaccharide-forming amylase (PkAmy) isolated from *Priestia koreensis* was first recombinantly expressed in *Pichia pastoris* KM71 and in-depth characterized. By combining phylogenetic analyses and alignment results, interestingly, PkAmy was separated outside of 5 clades of new subfamilies (*a1*, *a2*, *a3*, *a4* and xy) of glycoside hydrolase family 13 (GH13). Based on three-dimensional structure prediction, PkAmy contains 3 domains: catalytic domain A containing the active site within its TIM barrel fold, domain B and domain C with an all-β fold. Compared with most maltooligosaccharide-producing amylases, PkAmy exhibited a relatively low optimal temperature compared to previous reported MFAses isolated from *Bacillus* species. PkAmy exhibited specific activity of 42.2 ± 1.31 U/mg protein toward 1% (w/v) gelatinized soluble starch at 40 °C, pH 7.0. Furthermore, the enzyme exhibited high hydrolytic activity toward various types of starch with higher activity toward an α-1,4 linear D-glucose chain of amylose than amylopectin. The enzyme is highly efficient to produce specific chain length (G2–G4) of maltooligosaccharides from cassava starch. This finding demonstrated that PkAmy is a promising enzyme for the development of maltooligosaccharides production process under low temperature to create value-added products.

EFFECTS OF CANNABINOID RECEPTOR AGONISTS ON BREAST CANCER AND OSTEOBLAST INTERACTION

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Abstract:

Breast cancer is one of the biggest global health concerns. Bone has been reported as a frequent site of breast cancer metastasis resulting in bone pain, bone fracture and hypercalcemia. Cannabinoid receptor (CB) agonists are synthetic cannabinoids that exhibit cannabimimetic effect and have shown the anticancer activity against multiple types of malignant tumors. However, the effect of CB agonists on breast cancer and bone interaction is still unclear. The purpose of this research is to determine the effect of CB agonists on breast cancer-induced osteoblastic cell death. The IC_{50} values of CB agonists, ACEA and GW405833 in breast cancer cell lines were obtained by performing MTT assay. At 48 h after the treatment, the IC_{50} values of ACEA were 41.23 µM and 225.9 µM in MDA-MB-231 and MCF-7, respectively. The IC_{50} values of GW405833 were 24.23 µM and 88.39 µM for MDA-MB-231 and MCF-7, respectively. Moreover, osteoblast (UMR-106) cell viability was decreased significantly upon the exposure of breast cancer conditioned media. Interestingly, negative effect of conditioned medium derived from MDA-MB-231 cells was also recovered by the pretreatment of GW405833 on MDA-MB-231. To explore the potential breast cancer-derived factor(s) affected from GW405833 treatment, qRT-PCR was used. Our results revealed that GW405833 did not suppress IL6 expression, but upregulated the expression of Wnt signaling inhibitor, sclerostin (SOST). Taken together, our results suggested that CB agonists induced breast cancer cell death and GW405833 improved viability of osteoblastic cell in breast cancer and bone interaction.

INHIBITORY EFFECTS OF BREAST CANCER-DERIVED FACTOR(S) ON OSTEOBLAST SURVIVAL AND FUNCTION AND THE DEVELOPMENT OF GELATIN-BASED 3D SCAFFOLD FOR 3D BONE CELL CULTURE SYSTEM

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Abstract:

The most common secondary site for breast cancer metastasis is bone. After the metastatic tumor has colonized the bone, the tumor produces factors that stimulate bone degradation that eventually leads to bone osteolytic lesion. Our study showed that conditioned media (CM) from MDA-MB-231 (MDA-MB-231 CM) also suppressed a bone forming cell (osteoblast; UMR-106) survival. The objectives of this study are to elucidate the effects of breast cancer-derived conditioned media in osteoblast cell survival and function and to develop gelatin-based 3D bone cell culture model for further study. Our results from the mineralization assay revealed that MDA-MB-231 CM significantly decreased the mineralization activity of UMR-106. To access the potential mechanisms involved, genes related to differentiation and mineralization in osteoblasts were analyzed by qRT-PCR. The results indicated a decrease in alkaline phosphatase (ALP), Collagen type I (Col 1) & Osteocalcin (OCN), which imply a reduction in osteoblast activity. Furthermore, to better mimic bone environment in the future study, 3D culture GelMA-based model was also developed.

GENE ISOLATION FROM MANGO RELATED *Colletotrichum gloeosporioides* INFECTION

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Abstract:
Mango is an important export fruit of Thailand, so the high quality and safety of mangoes are required. The major plant disease of mango is anthracnose that gardeners should monitor carefully after post harvesting. The objectives of this research were to isolate *Colletotrichum gloeosporioides* causing anthracnose in mango, to clone genes related defense mechanism and to investigate gene expression in mango fruit after *C. gloeosporioides* infection. The results showed that four genera of pathogenic fungi, namely *Colletotrichum, Neoscytalidium, Lasiodiplodia* and *Pseudofusicoccum*, were identified using morphological and molecular data. From all of 7 genes related fungal infection, only 4 genes were successful to amplify by PCR method and only 3 genes (actin, chitinase and PR-1) were detected in right clones. After that, RNA samples from mango fruit after anthracnose fungi infection for 0, 24, 48, 72, 96 , 120 and 144 hours were extracted and examined quantity and purity. All RNA solutions presented high concentration but low purity; hence, the gene expression could not be detected. Therefore, specific primer design and purity of RNA are important criteria for development of anthracnose detection system in mango further to control mango quality before export.

SYNTHESIS AND CHARACTERIZATION OF NANOSILICA FROM SUGARCANE BAGASSE

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Abstract
The green synthesis of silica has been extensively explored over the last few decades, as silica compounds found in commercial products can cause negative effects on human health [1,2]. This calls for alternative ways to produce silica that are safer, cheaper and more environmentally friendly [1]. The silica obtained from agricultural waste is considered a value added product because of it numerous applications such as removal of contaminants from water, in rubber industry as a reinforcing agent and in tooth paste as cleansing agents [3]. The conversion of this silica to nanosilica makes it suitable for more application due to its small particle size, large specific surface area, strong surface adsorption, high chemical purity and good dispersion [4]. This research describes the synthesis and characterisation of nanosilica obtained from sugarcane bagasse. Sugarcane bagasse is a renewable energy source waste material generated from the sugar and bioethanol industries [5]. The silica was synthesized from sugarcane bagasse using sol-gel method. Silica nanoparticles were then made from the synthesized silica by refluxing it with concentrated hydrochloric acid. The nanosilica was characterised using different analytical methods and the result showed fine powdered nano-sized silica with interesting properties such large surface area and small pore volume as shown in Table 1. The XRD spectrum showed a semi crystalline particles which matches with reference of 01-076-0941 on the JCPDS card. This nanosilica has potential of been an effective adsorbent for water treatment and antimicrobial agent in food industry.

Table1 BET of the synthesised nanosilica

Sample	BET surface area (m^2/g)	Average pore diameter (A)	BET pore volume (cm^3/g)
Silica nanoparticles	92.52±01	30.52±02	0.55±01

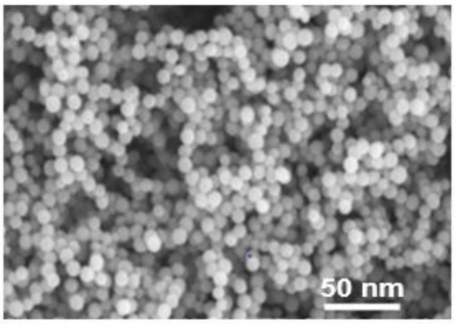

Figure 1 Scanning Electron Microscopy of the synthesised nanosilica

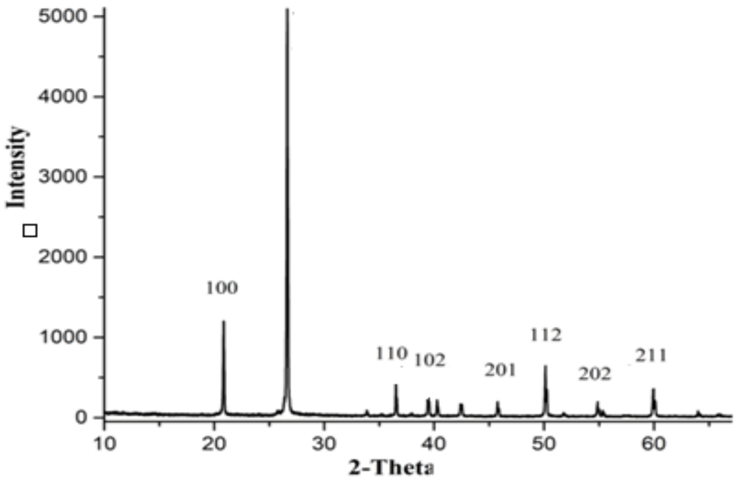

Figure 2 XRD pattern of the synthesised nanosilica

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EFFECT OF MONOCLONAL ANTIBODY AGAINST HUMAN LDL CLONE HLDL-D4 ON FOAM CELL FORMATION AND MMP-9 EXPRESSION

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Abstract:
Macrophage foam cells play an important role in progression of atherosclerosis. Several evidences suggested that a promising way to suppress the atherosclerosis lesion progression is inhibiting of foam cell formation. In our laboratory, monoclonal antibody (mAb) to human LDL clone hLDL-D4 was produced and found specifically bind to an apoB-100 particle. Thus, this study aims to observe the effect of mAb hLDL-D4 on macrophage foam cell formation and MMP-9 expression induced by either LDL or oxidized-LDL. Macrophages were prepared by activation of U937 cell lines with phorbol12-myristate13-acetate (PMA) and used as the study model. Foam cell formation was determined in term of intracellular cholesterol concentration and lipid droplet of oil Red O staining. MMP-9 was examined by gelatin zymographic technique.
The results showed that mAb hLDL-D4 reduced intracellular cholesterol concentration and lipid oil droplets of macrophages incubated with ox-LDL but not with LDL. Furthermore, the mAb hLDL-D4 prevented production of MMP-9 active form of the macrophage, which incubated with ox-LDL, but have no effect upon incubation with LDL. In conclusion the mAb hLDL-D4 displayed an inhibitory effect on macrophage foam cell formation and MMP-9 expression induced by ox-LDL but not with LDL.

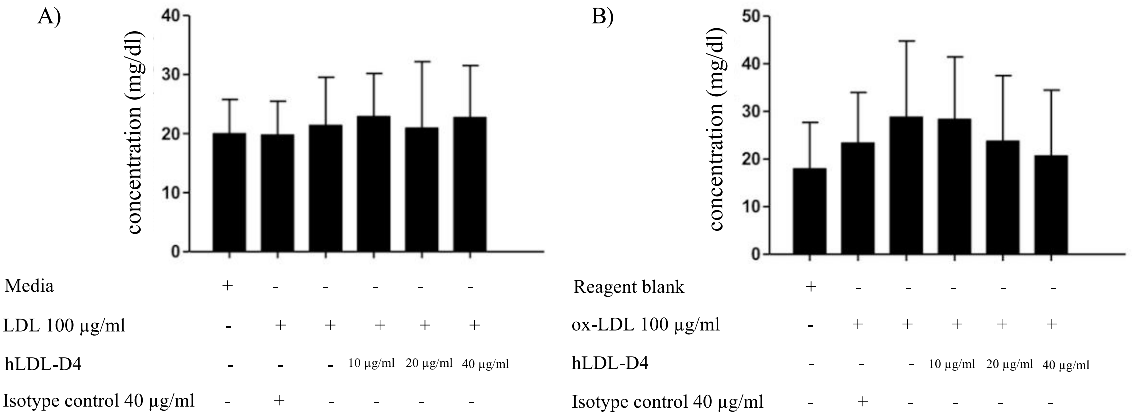

Figure 1 Effect of mAb hLDL-D4 on intracellular cholesterol concentration of macrophages after co-cultivation with either LDL or ox-LDL

THE COMPARISON OF BIOMASS AND LUTEIN PRODUCTION BY NEWLY ISOLATE INDIGENOUS MICROALGAE *Desmodesmus* spp. IN THE AUTO-, HETERO- AND MIXOTROPHIC CULTIVATION

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Abstract:

Lutein, one of the main photosynthetic pigments, is a promising natural product with both nutritional and pharmaceutical applications. *Desmodesmus* is a green microalgal genus and classified in the class Chlorophyceae. It is reported as cosmopolitan genus with high worldwide distribution inhabit. Moreover, *Desmodesmus* also provided high productivity of lutein. In this study, *Desmodesmus* spp. were isolated from some water bodies in Thailand. The isolated microalgae were identified by using morphological evidence and DNA sequence analysis. Then, various carbon sources (glucose, glycerol and acetate) were added to culture medium under hetero- and mixotrophic cultivation of *Desmodesmus* spp. (*D. denticulatus*, *D. tropicus*, *D. maximus*, *D. brasiliensis*, *D. armatus*, *D. opoliensis* and *D. communis*) to investigate biomass production, lutein production and compare with autotrophic cultivation. The results of this study indicate that *D. armatus* under mixotrophic cultivation supplied with glucose showed the highest biomass production at the value of 4.67 ± 0.12 g L^{-1}. The maximum carotenoids content was obtained from *D. opoliensis* (8.41 ± 1.14 mg g^{-1}) under mixotrophic cultivation with glycerol as carbon source. In addition, under this cultivation condition *D. opoliensis* gave the highest lutein production at 3.42 ± 0.77 mg L^{-1}.

THE EFFECT OF AIR TEMPERATURE RISES INSIDE OPEN TOP CHAMBERS (OTCs) ON THE PHOTOSYNTHETIC ACTIVITY OF LICHEN *Heterodermia flabellata* AT DOI INTHANON, THAILAND.

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Abstract:
Climate change is threatening lichen around the world, especially species growing at high elevations and in cool areas. This study aims to investigate the efficiency of photosynthetic activity of *Heterodermia flabellata* impacted by increased air temperature inside Open Top Chambers (OTCs). Five OTCs were installed for lichen experiments under field conditions at Doi Inthanon, Thailand. Our results found that the mean air temperature in the photosynthesis active and maximum air temperature inside OTCs has higher than 1.1 and 4.5^{o}C, and relative humidity is lower than 4% compared with the references site (outside OTCs). The response of photosynthetic activity (Φ_{PSII} and ETR value) of *H. flabellata* related to thallus water content. Lichens growing inside OTCs had photosynthetic efficiency lower than lichens growing outside OTCs. Moreover, after three months of long-term monitoring, the Fv/Fm value of *H. flabellata* shows Fv/Fm value inside OTCs recorded at 0.535 lower than that outside OTCs recorded at 0.560. Therefore, the mean air temperature increases to 1.1^{o}C could be affected to reduce photosynthetic efficiency and growth rate of lichens. In addition, the projection of increasing temperature results that endemic lichens having a high risk of extinction and deterioration of the lichen community under global warming.

ANTIBIOTICS RESISTANCE IN *Clostridioides difficile* MEDIATED BY SECONDARY ACTIVE TRANSPORTERS

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Abstract:

One of the most concerning drug-resistant organisms affecting global public health is *Clostridioides difficile,* which causes antibiotic-associated diarrhea. Since antibiotics are extruded from *C. difficile* cells via efflux pumps, particularly secondary active transporters, most current drugs are ineffective for the treatment of *C. difficile* infections. Increased incidence of treatment failure and recurrence also threatens the future of *C. difficile* treatment. Hence, secondary efflux transporters may serve as a potential therapeutic target for *C. difficile*. The goal of this study is to explore the role of secondary active transporters in antibiotic resistance in *C. difficile*. Using Pfam annotation, 147 candidate genes encoding secondary active transporters were identified in the *C. difficile* genome. Besides which, 43 genes were classified into four clans of well-known secondary multidrug efflux pumps, namely drug/metabolite transporter superfamily (DMT), major facilitator superfamily (MFS), toxic compound extrusion family (MATE), and resistance-nodulation-division family (RND), indicating that these transporters may play important roles in antimicrobial resistance of *C. difficile*. Accordingly, using RT-qPCR, most antibiotic-mediated secondary active transporter genes were observed to upregulate at least twofold upon exposures to ciprofloxacin, erythromycin, levofloxacin, and metronidazole at an MIC. Surprisingly, when exposed to an MIC of fidaxomicin, these genes increased the expression at least fourfold. These upregulated genes will be further characterized to gain insight into the role in the multidrug-resistant phenotype of *C. difficile*. Secondary efflux pumps can be a promising therapeutic target for drug development against *C. difficile*.

EVALUATION OF THE INFLUENCE OF CELL CULTURE DENSITY ON THE CYTOTOXICITY OF HUMAN KERATINOCYTES INDUCED BY COLD ARGON PLASMA

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Abstract:
In the past decade, cold atmospheric pressure plasmas (CAPs) or, in short, cold plasmas, have been a new promising technology for many biomedical applications, such as cancer treatment and wound healing. Previous studies have provided evidence that cold plasma can activate cell proliferation and induce wound closure. However, considerable differences were noted that cold plasma could be cytotoxic to the normal cells. In this study, the effect of cell density (number of cells per unit area of a monolayer culture) on the *in vitro* cytotoxicity of cold argon plasma was investigated. The effect of cells density 1) may explain previous discrepancies in *in vitro* tests, 2) may be important in wound healing where cell density changes over time and 3) may help clarify the mechanisms of cytotoxicity of cold plasma. In this study, human keratinocytes (HaCat) were seeding at cell densities ranging from 15,000-240,000 cells/cm^2 and were exposed to different duration times (15 – 60 sec) of cold argon plasma treatment. The cytotoxic effects of cold plasma were then characterized for cell viability using MTT assay and change in cell morphology. Results showed that a marked decrease in the viability of HaCat was noted at low cell seeding density. Longer duration time exposed to cold plasma significantly reduced the viability. Additionally, the cell morphology corresponding to a typical apoptotic feature such as membrane blebbing and apoptotic bodies was markedly observed. However, higher cell densities significantly reduced the cytotoxicity of HaCat to cold argon plasma suggesting that cytotoxicity could be reverted with high seeding density. Our data suggest that the relative level of cell density is an important determinant for cold plasma cytotoxicity and cell density should be carefully selected in *in vitro* cytotoxicity test.

REDUCTION OF CISPLATIN RESISTANCE OF HUMAN ORAL SQUAMOUS CELL CARCINOMA CELL SPHEROIDS USING COLD ATMOSPHERIC PLASMA

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Abstract:
Cold atmospheric plasma (CAP) has gained increasing attention in the treatment of cancer due to its controllable production of reactive oxygen and nitrogen species. In this study, we examined the effect of combined CAP-activated phosphate buffered saline (cPBS) and cisplatin-mediated chemotherapy *in vitro* on oral squamous cell carcinoma (OSCC) cells by using two-dimensional (2D) and three-dimensional (3D) culture models. The cPBS was generated by irradiation of PBS with plasma jet under room temperature. The 2D monolayers and 3D spheroids of OSCC cell line CLS-354 were then treated with gradient dilutions of cPBS, gradient concentrations of cisplatin or cPBS + cisplatin. The resulting cytotoxicity was monitored using MTT assay to obtain the half-maximal inhibitory concentration (IC_{50}) of cPBS and cisplatin. Our results demonstrated that the viability of CLS-354 monolayers and spheroids was inhibited by cPBS and cisplatin with a dose-dependent manner. However, CLS-354 spheroids exhibited lower IC_{50} to cPBS with higher IC_{50} to cisplatin than 2D cells, suggesting that spheroids were more sensitive to cPBS but resistant to cisplatin. IC_{50} values of cisplatin in CLS-354 spheroids were decreased in cPBS pretreated sequential combined treatments, indicating that chemosensitivity of CLS-354 spheroids to cisplatin was improved. Collectively, our data reinforced the importance of combination therapy to increase the effectiveness of chemotherapeutic drugs and suggested that resistance of CLS-354 spheroids to cisplatin could be reduced when used in combination with cPBS.

ASSESSMENT OF LOW-DENSITY POLYETHYLENE BIODEGRADATION POTENTIAL OF THE PLASTISPHERE CONSORTIA FROM WASTE DISPOSAL SITE

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Abstract:
Environmental pollution by plastic waste has become a serious international problem. Low-density polyethylene (LDPE) is one of the most popular plastic materials. The widespread use of LDPE has led to accumulation of plastic waste in environments. Biological approach has received increasing interest for remediate the environmental pollutants due to its low cost and environmentally friendly. Therefore, this study aims to investigate the potential of indigenous LDPE-degrading bacterial consortia for biodegradation of LDPE and to analyze the enriched culture composition stability during successive subcultures by high-throughput sequencing. Waste plastic bags collected from landfill site in Phitsanulok Province, Thailand were used to enrich the LDPE-degrading bacteria. Five successive subculturing were prepared by transferring 10% (v/v) of the culture to a subsequent subculture in 30-day intervals. LDPE catabolic genes were investigated using conventional polymerase chain reaction. Laccase, esterase, and alkane hydroxylase genes were observed. These genes have been known to be involved in enzymatic biodegradation of LDPE. These results imply that bacteria from plastic waste have the potential ability to degrade LDPE. In terms of the bacterial community structure during successive subcultures, Alphaproteobacteria and Actinobacteria were shown to be dominant class in enriched cultures. It is feasible to expect that these bacterial groups might play a key role in the degradation of LDPE. Moreover, two enriched consortia showed the ability to degrade LDPE film in liquid culture, and the weight loss ranged from 2 to 5% within 30 days of incubation. Our results suggest that indigenous bacterial consortia will be useful for plastic remediation.

ANTI-INFLAMMATORY EFFECT OF SECRETOME DERIVED FROM UCMSCS ON THP-1 MONOCYTES

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Abstract:

The inflammatory diseases are popular in global and predicts a number of patients will rise up in the future, but current treatments still lack and also have many limitations. Currently, there found secretome derived from Mesenchymal Stem cells (MSCs) has considerable potential for modulating immunity and contains various essential cytokines, especially immunomodulatory cytokines that play a role in inhibiting further inflammations. Although the secretome derived from MSCs has high usefulness with various immunomodulation but there is still not reveal to a limitation involve optimal passages for collecting the secretome from MSCs. To gained high effective restoration, so in this study interested to evaluate anti-inflammatory effects between early and late passages – UCMSCs through cell viability, ROS-reduction and expression of inflammatory genes on THP-1 monocytes. The THP-1 cells were cultured and induced inflammatory condition by hydrogen peroxide (H_2O_2) and then treated with early and late passages of MSCs – derived secretome in each condition, before they were evaluated in subsequence experiments. The results showed at 12.5 μg/ml concentration of early passages of MSCs – derived secretome could significantly increase cell viability, reduce ROS levels and considerably decrease genes expression on inflammatory group when compared to H_2O_2 condition. Meanwhile, at the same concentration of late passages of MSCs – derived secretome rather negatively affected in cell viability and expression of inflammatory genes but this condition could contribute to ROS reduction. In conclusion, this study suggested early passages of MSCs – derived secretome could inhibit inflammation via regulating on genes expression within NF-KB pathway and stimulate anti-inflammatory mediators on THP-1 cells after inflammation. This study might be great option for using as a model of anti - inflammatory research and optional drugs to restore the inflammatory issues in the future.

SCREENING AND GROWTH CHARACTERIZATION OF YEAST *Candida tropicalis* ISOLATED FROM SUGAR FACTORY WASTEWATER THAILAND

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Abstract:
The characteristic of stress tolerance is a key factor when using yeast for biotechnology processing such as ethanol production, biomass, or beverage fermentation. However, the majority of yeast species, *Saccharomyces cerevisiae*, had led the limited stress resistance during industrial processes, leading to high risk of microbial contamination and production lost. Various stress factors such as hydrogen peroxide, furfural, and osmotic pressure, act as selective pressure in industrial processes, allowing resistant yeast strains to survive. Therefore, non-*Saccharomyces* spp., such as *Kluyveromyces* spp., *Pichia* spp., and *Candida* spp., that can tolerate and grow under various stressors during industrial fermentation are emphasized and urgently required. Thus, this study aims to characterize thermotolerant yeasts collected from wastewater samples where unavoidable multiple environment hazards. A phylogenetic analysis based on the D1/D2 from the large subunit rDNA region were used to identify of eight yeast isolates to *Candida tropicalis*. Their growth under high temperature and chemical treatments were determined. The results showed that all eight *C. tropicalis* isolates were capable of growing at temperature up to 40°C. In addition, some *C. tropicalis* isolates were found to be tolerant up to 40 mM hydrogen peroxide, 15 mM furfural and 1.5 M sodium chloride. Their specific growth rate under stresses was higher than the reference *S. cerevisiae* TISTR5606. The results suggesting that our newly isolated *C. tropicalis* was multi-stress tolerant yeast. Future studies are required to elucidate gene expression or signal transduction pathways of stress tolerance to develop the use of candidate yeasts in the future.

EFFECT OF MAGNETIC FIELD STIMULATION COMPARED WITH SALICYLIC ACID ELICITATION ON BACOSIDE A ACCUMULATION IN *Bacopa monnieri* (L.) Wettst.

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Abstract:
The bioactive compound which is recognized as a memory enhancer found in *Bacopa monnieri* is called Bacoside A. This study aims to find a way to induce this compound by using 1 mM salicylic acid treating after 4 weeks of culture and using 2 mT magnetic field elicitations (static magnetic field and pulsed electromagnetic field) treating 10 minutes every day for 4 weeks. These two elicitors can cause stress by increasing ROS production in plant cells and leading to an increase in some antioxidant enzymes and secondary metabolites. After detecting ROS production and DPPH antioxidant activity using a spectrophotometer, and detecting Bacoside A using HPLC, we found that magnetic field elicitation can increase ROS production, and both elicitors can increase the antioxidant enzyme activity. However, the Bacoside A production tends to decrease in all treatments. This result suggests that the plant synthesizes other antioxidant enzymes or secondary metabolites instead of Bacoside A in response to the stress, because Bacoside A is not involved in plant defense mechanisms.

MECHANISM OF NON-PREFERENCE RESISTANCE IN CASSAVA VARIETIES AGAINST WHITEFLY *Bemisia tabaci*

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Abstract:

Thailand has increased exports of cassava products but still experiencing problems from the spread of disease and insects. Especially cassava mosaic disease is caused by the Sri Lankan cassava mosaic virus (SLCMV) transmitted by the insect vector whitefly *Bemisia tabaci* Gennadius. This aimed to determine the mechanism of antixenosis resistance in different 6 cassava varieties. The study was conducted on feeding behavior by DC electropenetrography (DC-EPG) and the leaf surface trichome was observed by Scanning electron microscope (SEM). The results found that Kasetsart 50 was significantly different low preferred by whitefly than those of the other varieties was 36.81%. In comparison, Huai Bong 80 and CMR-89 had significantly different highest whitefly preferred of 44.93% and 54.19%, respectively. The study of the whitefly feeding behavior by EPG technique found that Rayong 72 had a short total phloem ingestion duration and a low number of ingestion events. Moreover, the Rayong 72 and Kasetsart 50 had a low number of insects sucking sap. The densities of non-glandular trichomes had a negative relationship with the whitefly's ability to feed and walk. To the best of this knowledge, the present study is the first to demonstrate the trichome is a physiological defense of cassava against the whitefly. The obtained results would provide useful information that the Rayong 72 and Kasetsart 50 had potential resistance to whitefly infestation. This result suggests that, should be avoided planting of Huai Bong 80 and CMR-89 cassava varieties were susceptible to cassava mosaic disease.

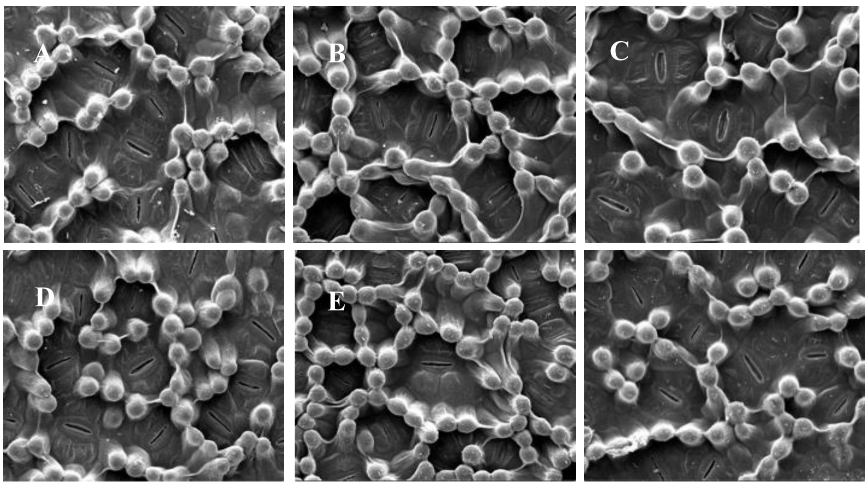

Figure 1. Trichome of cassava. Scanning electron micrograph (SEM) of cassava leaf with 2000x magnification. (A) Rayong 5, (A) Rayong 9, (C) CMR-89, (D) Rayong 72, (E) Kasetsart 50, and (F) Huai Bong 80.

Keywords: EPG, whitefly, cassava mosaic virus, trichome, antixenosis

PHASE STABILITY AND STRUCTURES OF β-TRICALCIUM PHOSPHATE BIOMATERIAL SYNTHESIZED BY A SOLID-STATE REACTION TECHNIQUE

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Abstract: β-tricalcium phosphate (β-TCP, β-$Ca_3(PO_4)_2$) is one of the most attractive biomaterials for bone repair due to its interesting biological properties. In the present work, the structural and phase stability of β-tricalcium phosphate, which is a biomaterial, were fabricated. The β-tricalcium phosphate powder was synthesized from a reaction between calcium carbonate ($CaCO_3$) and diammonium hydrogen phosphate ($(NH_4)_2HPO_4$) by a solid-state reaction technique and calcined at various temperatures of 900, 1000, and 1100 °C for 12 h dwell time. The properties of β-tricalcium phosphate powders were characterized by various techniques, such as X-ray diffraction (XRD), fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), and raman spectroscopy. XRD pattern showed that the stable phase of β-tricalcium phosphate was formed at lower temperatures (900-1000 °C), while α phase (α-tricalcium phosphate, α-TCP) was formed at a higher temperature of 1100 °C. Particle size and crystallite size increased with increasing the temperature. The Ca/P ratio also increased with increasing the temperature. Our results indicated that the characteristics of the β-tricalcium phosphate depended on the temperature parameter. The optimum calcination temperature for prepared the stable of β-tricalcium phosphate phase was found to be 1000 °C for 12 h.

THE EFFECT OF ACTINOMYCETE AND SELENIUM NANOPATICLE ON RICE AGAINST SALT STRESS.

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Abstract:

This study aims to use an endophytic *Streptomyces* sp. GKU 895 together with selenium nanoparticle (SeNP) as plant biostimulant. *Oryza sativa* L. cv. KDML105 was used to study the effect of biostimulant on plant physiologies and gene expression. The effects of SeNP and *Streptomyces* sp. GKU 895 on growth were evaluated in rice under salt stress condition by immersion of 7-days germinated seed with 10 mg L^{-1} SeNP solution and 10^8 spores mL^{-1} of *Streptomyces* sp. GKU 895 for 4 h. The results indicated that the biostimulant significantly increased plant growth of shoot, root, and chlorophyll, but decreased ethylene when compared to the control group. At 5 days post-induction of salt stress, the growth of the treatment group was normal when compared to the control group. Gene related to ethylene production *EREBP1* was down-regulated, whereas genes encoding antioxidant enzymes, *CuZn-SOD1* and *CATb*, were up-regulated. Therefore, SeNP and *Streptomyces* sp. GKU 895 are verified to be the biostimulant for rice under salt stress condition.

Keywords: biostimulant, endophyte, actinomycete, rice, selenium nanoparticle.

IDENTIFICATION AND FUNCTIONAL STUDY OF LONG NON-CODING RNA INVOLVED IN WHITE SPOT SYNDROME VIRUS INFECTION IN WHITE SHRIMP, *Litopenaeus vannamei*

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Abstract:
Long non-coding RNA (lncRNA) is RNA that lacks of the capability for protein coding, usually over 200 nucleotides in length. It is reported to play significant roles in various physiological processes, including immune regulation, reproduction and development. Although several transcriptome have been studies in response to viral infections in many organisms, the role of lncRNAs in viral responses have not been elucidated in shrimp. Therefore, this study aimed to identify putative lncRNAs and study a role in white spot syndrome virus (WSSV) infection in shrimp. The hepatopancreas transcriptome data from WSSV infection was used to identify lncRNAs. Among 221,347 unigenes in the transcriptome, 109,836 putative lncRNAs were identified and 32 of them were differentially expressed between WSSV-infected and control shrimp. Five candidate lncRNAs were validated for their expressions in shrimp tissues and in response to WSSV infection. The *lncDN164* and *lncDN6913* were mainly expressed in hepatopancreas, while other lncRNAs were widely expressed in the tested tissues. The *lncDN164* expression was significantly decreased at 24 and 48 hour after injection with WSSV compared with the control group. RNA interference was used to investigate *lncDN164* function in response to WSSV infection. The result showed that a delay of shrimp mortality was found in *lncDN164* knockdown shrimp infected with WSSV. This suggested that *lncDN164* may play a negative role in immune response, especially in WSSV infection. Our findings revealed information about *L. vannamei* lncRNAs associated with WSSV infection.

POTENTIAL DNA MARKERS ASSOCIATED WITH ACUTE HEPATOPANCREATIC NECROSIS DISEASE TOLERANT WHITE SHRIMP

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Abstract:

Acute hepatopancreatic necrosis disease (AHPND) is one of the most serious diseases in shrimp aquaculture. This is caused by *Vibrio parahaemolyticus* (Vp_{AHPND}) infection resulting in a massive mortality with 3-7 days after infection in either postlarva and juvenile shrimp. To overcome the severe problem, an improvement of shrimp genetic tolerant to Vp_{AHPND} infection is one of promising approaches. Although AHPND tolerant shrimp has been improved by conventional breeding, DNA markers associated with AHPND tolerant phenotype have not been clearly identified and developed so far. Therefore, we aimed to analyze and develop potential DNA markers linking to AHPND tolerant phenotype. In this study, three populations of *Litopenaeus vannaemi* postlarva were challenged with Vp_{AHPND} for 14 days. The DNA samples from moribund or dead shrimp in each day (susceptible group; n = 45) and survived shrimp (survived group; n = 47) were extracted and used for genotyping by DArTseq. The DArTSNP and insilico DArT data showed genetic diversion among these 3 population. We found 34,074 single nucleotide polymorphism (SNP) from all examined samples with call rate > 80% and polymorphic information content > 25%. Furthermore, the 3 candidate SNPs (snp1214, snp14863, and snp15067) associated with AHPND tolerance (p-value $< 10^{-5}$) were obtained by genome wide association analysis. The snp1214 and snp14863 were at intergenic regions, while snp15067 was at the first intron of zwei Ig domain protein zig-8-like gene. Our finding provides SNPs data and potential markers which will be further validated for use for AHPND-tolerant selection of broodstock shrimp for sustainable aquaculture.

AQUEOUS EXTRACTED SPENT COFFEE GROUNDS AS MUSHROOM STIMULATOR AND ANITIMICROBIAL AGENT

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Abstract:
The amount of spent coffee grounds (SCGs), organic industrial waste or organic trash from regular coffee shops is increasing yearly. The objective of this research is to use coffee grounds aqueous extract as mushroom simulator and antimicrobial agent. The aqueous SCGs extract was employed instead of water to estimate the effects on mushroom mycelia growth. The SCG extract to water volumetric ratios were varied at 5 % (v/v), 15 % (v/v), 25 % (v/v), 50 %(v/v), and 100 % (v/v). The 5 % (v/v) SCGs extract showed average growth rate of 12.52 mm/day which is higher than that of PDA solid medium. When SCGs extracted was intensified to 50 % (v/v), the mycelia growth of *Pleurotus sajor-caju (Fr.)* Sing. decreases because the excess amount of caffeine inhibits the growth rate. It was clear that the aqueous SCGs extract at higher concentrations works as an antifungal agent. Additionally, this study was demonstrating the effectiveness of the drop plate and colony plate count procedures. The aqueous SCGs extract prevented the growth of the gram-positive bacterium, *Bacillus subtilis* ATCC 6633 as well. The results of this work revealed that SCGs is an appropriate resource for using as mushroom stimulator and an antibacterial agent.

Keywords: Spent Coffee Ground (SCG), Mushrooms, Antibacterial, Antifungal

THE EFFECT OF NICOTINE ON IMMUNE SUPPRESION

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Abstract:

The immune system is essential in both health and illness. Immunological suppression, which has been linked to various illnesses, can be defined as a loss of immune activity. In the United States and all over the world, Tobacco and cigarette smoking are the primary causes of many ailments. Additionally, while smoking has been shown to have a role in immunosuppression, the effect of nicotine on immunological function is mainly unclear. Macrophages (MΦ) are an essential component of the innate immune system which can be pro- or anti-inflammatory based on their polarization state. M1 polarized macrophages are pro-inflammatory, whereas M2 polarized macrophages are involved in tissue healing and inflammatory response resolution. Nicotine is an addictive constituent of tobacco and various substitutes. Its role in macrophages, however, has yet to be studied. The goal of our research was to investigate the effect of nicotine on macrophages growth, motility, and polarization. We treated macrophage cells (RAW264.7 and THP-1-derived-MΦ) with nicotine in a different dose (0, 100, 250, and 500 nM), and observed MΦ growth, migration and invasion. The growth of RAW264.7 and THP-1-derived-MΦ increased by 99% and 95% upon nicotine treatment (500 nM) respectively. We also found that nicotine treatment significantly augmented macrophages migration and invasion. Furthermore, nicotine exposure to macrophages enhanced M2a/d polarization (Arginase-1 and TGF-β1). Mechanistic studies show that nicotine-induced polarization of macrophages is mediated by Src-driven phosphorylation of STAT3. Further, we will investigate effect of nicotine on other immune cells which are crucial for protecting our body from infection and disease. Overall, our research shows that nicotine plays a unique function in the alternate polarization of macrophages via the Src-STAT3 signaling axis and the future discovery might provide useful information for disease prevention and should be taken seriously by the public.

BACTERIOSPERMIA IN MEN AMONG INFERTILE COUPLES IN NEPALESE POPULATION

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Abstract:

The problem of infertility in married couples where males contribute to about half of infertility cases, which may be due to age, hormone, testicular temperature, an exposure to chemicals, presence of predisposing disease and infection of genitourinary tract and male accessory gland infections. Male genitourinary tract infection is considered as the important cause and may result in the presence of bacteria in semen. Research aims to find the rate of bacteriospermia in semen and to determine the association of bacteriospermia with semen parameters in Nepalese infertile men. A collaborative cross-sectional study was carried out between infertility center of Nepal and university microbiology laboratory during June 2021-July 2022. Semen samples were collected from the male partners consulting for fertility problems. Bacteriological analysis of the samples was performed for the isolation and identification of bacteria by conventional microbiological methods. A total of 213 semen samples were analyzed. Bacteriological analysis of semen samples showed 25.8% had bacteriospermia. *Staphylococcus aureus* and *Corynebacterium* spp. were predominant. The density of sperms, percentage of total sperm motility, sperms with normal forms and vitality were not significantly different in semen with bacteria in comparison to samples without bacteria. Thus, the study provides a baseline data on bacteriospermia in semen of infertile men in Nepal.

PAPAIN INHIBITORY ACTIVITIES APPLIED TO THE ON-FIELD DETERMINATION OF CYANTRANILIPROLE

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Abstract:
An analytical method based on the inhibition of papain activity has been developed for cyantraniliprole determination. The papain activity assay was determined by hydrolysis of *N*-benzoyl-L-arginine-*p*-nitroanilide (BAPNA), giving the yellow product *p*-nitroaniline in a 96-well plate platform. The detector was set to monitor at 430 nm. Various parameters affecting enzyme activity have been evaluated, such as enzyme concentration (0.05 - 0.40 g/mL), substrate concentration (0.1000 - 8.0000 mM), and the organic effect. The K_m and V_{max} were calculated to be 0.82 mM and 0.0055 µmol/min respectively. By using the concentration of dimethylsulfoxide (DMSO) and acetonitrile below 10.0 and 3.0 % (v/v) respectively, the enzyme activity retained almost 100%. Under the optimum conditions, the degree of inhibition was increased in the concentration dependence. The longer incubation time between cyantraniliprole and the enzyme showed a better-inhibited degree. Moreover, the initial experiment on papain activity with different BAPNA concentrations was carried out by smartphone detection. Preliminary results showed a good agreement with the detection by conventional spectroscopic detection. With simple, rapid, and cost-effective characteristics, the developed papain-inhibited system demonstrates that it could be applied for the on-field determination of insecticides.

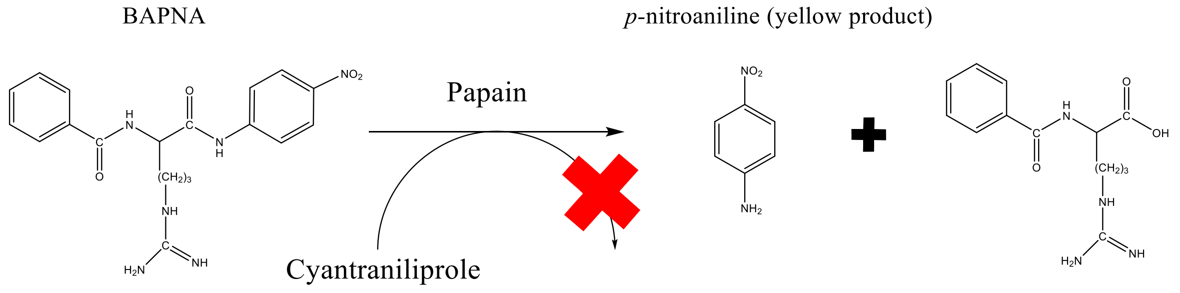

Figure 1. Principle of cyantraniliprole determination based on papain inhibition system

INTEGRATIVE ANALYSIS OF THE MIRNA–MRNA REGULATION NETWORK IN HEMOCYTES OF *Litopenaeus vannamei* FOLLOWING WHITE SPOT SYNDROME VIRUS INFECTION

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Abstract:

MiRNAs play a crucial role in RNA interference that controls gene expression during the white spot syndrome virus (WSSV) infection in the Pacific white shrimp (*Litopenaeus vannamei*). However, the knowledge about shrimp miRNAs in regulating host and WSSV genes is still restricted. Here, small RNA and RNA sequencing data of 24h 0.85% NaCl- and 24h WSSV-challenged *L. vannamei* hemocyte have been analyzed. The 891,181 unique small RNAs were searched for homologous of mature miRNA and hairpin in miRBase, and viral miRNA in VIRMIR database. The result showed that 1,168 miRNA families, 220 hairpin miRNAs, and 48 viral miRNA homologs were found. Hence, the only mature miRNA homologs were further analyzed for differentially expressed miRNAs (DEMs). The result revealed 25 up- and 35 down-regulated miRNAs in WSSV-infected shrimp hemocytes. Additionally, the RNA sequencing data revealed a total of 32,920 genes which were annotated from 123,506 unique RNA sequences. A total amount of 918 differentially expressed genes (DEGs) composed of 284 up- and 634 down-regulated genes. Next, the DEM/target gene interactions were predicted by bioinformatics tools. The expression of up-regulated and top 10 down-regulated miRNAs as well as their selected target were verified. The quantitative real-time RT-PCR showed a negative expression correlation between pva-miR-79b and *Lv*Cytochrome C including pva-miR-166 and *LvProsaposin.* This pointed out that these 2 shrimp genes might be the target of the pva-miR-79b and -166. However, the twenty percent reduction of luciferase intensity from luciferase reporter assays showed the possible inhibitory role of pva-miR-166 on *LvProsaposin.* Furthermore, the regulatory roles of the selected miRNA on *LvProsaposin* in cell proliferation and antiviral immunity need to be more investigated.

MICRO-FRAGMENTATION AND CORAL COLONY FUSION TECHNIQUES FOR *Favites abdita* IN THE INNER GULF OF THAILAND

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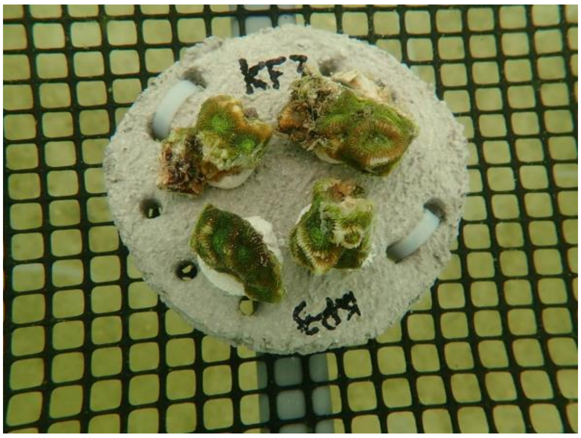
Abstract:
Coral reefs are an important ecosystem because they have high biodiversity and benefit humankind. They are essential to food sources, tourism, coastal protection, and pharmaceutical and cosmetic products. However, coral reefs have degraded in the past decades. Active coral restoration, any human activities to restore the coral reef ecosystem, is significant and needs the development of new techniques. This study aimed to develop new techniques for micro-fragmentation and coral colony fusion in coral *Favites abdita* at Mu Ko Sichang, Chonburi Province, the Inner Gulf of Thailand. The parent coral colonies of *F. abdita* were selected from survival colonies in stressful environments to obtain the coral fragments with high stress-tolerant characteristics. The techniques were developed for producing micro-fragments with a diameter of 1 - 3 centimeters. Several micro-fragments of *F. abdita* were fixed on a cement base with a short distance between micro-fragments. They were nursed in the land-based and field nurseries. The growth rate of micro-fragments was relatively high and there were fused within two months. The fused coral colonies of *F. abdita* were transferred to the restoration sites. This research provides a pilot study for coral reef restoration projects using new technologies and it can be applied to new marine eco-tourism sites.



Micro-fragments in *Favites abdita*

Colony fusion in *F. abdita*

RESPONSE SURFACE OPTIMIZATION OF BIOMASS AND PHYCOERYTHRIN PRODUCTIONS FROM *Nostoc* sp. NUACC02

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Abstract:

A filamentous cyanobacterium *Nostoc* has gained much interest as a natural source of highly valuable compounds utilized in several industries. One among them is phycoerythrin valued for its natural color and antioxidant properties. In this study, the modified CT medium containing five major nutrients including sodium nitrate ($NaNO_3$), disodium hydrogen phosphate (Na_2HPO_4), calcium chloride ($CaCl_2$), potassium chloride (KCl), and magnesium sulphate ($MgSO_4$) was optimized to increase the biomass production and phycoerythrin yield of *Nostoc* sp. NUACC02. The significant nutrient variables were screened and selected using Plackett-Burman Design (PBD). The Pareto chart for PBD showed that $CaCl_2$, KCl, and $MgSO_4$ significantly influenced biomass production and phycoerythrin yield. Optimization of influencing nutrient variables obtained from PBD was performed using the Response Surface Methodology (RSM) based on a Central Composite Design (CCD). Further optimization study by CCD revealed that the 0.18 g/L of $CaCl_2$, 0.19 g/L of KCl and 0.07 g/L of $MgSO_4$ enhanced the biomass production and phycoerythrin yield of *Nostoc* sp. NUACC02 up to 1.43 g/L and 149.86 mg/gDW, respectively. Furthermore, the results obtained were more analogous to the predicted values, indicating that the models are effective for enhancing biomass (R^2=94.64%) production and phycoerythrin (R^2=93.63%) yield in *Nostoc* sp. NUACC02.

TRANSCRIPTOME PROFILES OF *Streptomyces* sp. GKU 223 IN DIFFERENT GROWTH PHASE

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Abstract:

Streptomyces have the ability to produce a multitude of varied and complex secondary metabolites through a shift from primary to secondary metabolism, which is regulated by activated complex networks after growth termination. This work is aimed to understand the regulatory elements of gene expression related to primary and secondary metabolism in a marine actinomycete, *Streptomyces* sp. GKU 223. Transcriptome profiles were performed from *Streptomyces* sp. GKU 223 growing at three different growth phases to analyze the differentially expressed genes (DEGs) during cell growth. In the lag vs exponential phases (L/E), cellular growth functions, including carbon source consumption and energy production, were up-regulated, while in the lag vs stationary phases (L/S), a general decreasing trend in cell growth and energy production; and an increasing trend of precursors expected leading in the production of secondary metabolism were observed. These transcriptome analyses of *Streptomyces* sp. GKU 223 provided a valuable genetic resource for understanding metabolism during the growth phases and may contribute to facilitating the rational engineering of secondary metabolite production.

Keywords: RNA-seq, *Streptomyces* sp. GKU 223, Gene expression, Growth phase

CHARACTERIZATION OF DISSOLVABLE MICROARRAY PATCHES BASED CARBOXYMETHYLCELLULOSE, POLYVINYLPYRROLIDONE AND CHITOSAN CROSS-LINKED WITH HYALURONIC ACID

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Abstract:
Due to the excellent barrier properties of the upper most layer of the skin, the stratum corneum (SC), microneedle (MN) arrays/microarray patches has been proposed as a method to overcome the SC barrier and to enhance the transdermal transport of bioactive substances/molecules therapeutics. In the present study, three biocompatible and biodegradable materials, carboxymethylcellulose (CMC), polyvinylpyrrolidone (PVP), and chitosan (CS), cross-linked with hyaluronic acid (HA) were characterized for dissolvable microarray patch (DMP) fabrication. The comparative studies were examined by the following parameters: integrity of DMP fabrication, viscosity, and dissolution rate. The analysis showed that the percentage integrity of DMP fabrication for CMC-HA is relatively higher (90 %) than that for PVP-HA, which is as well higher than that for CS-HA. In addition, the dissolution duration of PVP-HA is shorter compared to that of CMC-HA; however, compared to CMC-HA (7 h), PVP-HA formulation requires a longer time for microneedle formation (12 h). Therefore, the DMPs based CMC cross-linked with HA were selected for further experiment (3% CMC + HA). Based on this fabrication, the formulation of CMC-HA was also carried out via chemical structure analysis, and solution viscosity was considered for specific quality control that are suitable for production processes. Additionally, the cell cytotoxicity test was examined to assess the safety and biocompatibility of the CMC-HA combination used for DMP preparation, including 3 % CMC+HA (microneedle layer) and 6 % CMC+HA (backing layer). From these findings, it can be inferred that the fabrication of DMPs is biocompatible and efficacious/safe as potential transdermal drug delivery strategy/system.

Keywords: Drug Delivery System; Dissolvable Microneedle Patch; Microneedle; Hyaluronic Acid; Carboxymethylcellulose

PREVALENCE AND RISK FACTORS OF TICK INFESTATION IN CATTLE FROM UPPER- NORTHEASTERN THAILAND

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Abstract:

Ticks (Acari: Ixodidae) are one of the most significant ectoparasites in economic livestock, especially in cattle. They are generally distributed worldwide in tropical and sub-tropical countries. The aims of this study were to investigate the prevalence of ticks at different body parts of beef cattle and their risk factors in upper-northeastern, Thailand. Ticks were surveyed during July 2021-June 2022 on the body parts of the beef cattle (dewlap, fore udder, leg, abdomen, genital/anal, and ear). Tick infestation was recorded on young age (1-3 years old) and older age (4-5 years old) of 12 female cattles. The results revealed that tick infestation has a significant effect on the cattle body parts, and cattle age. The most infested body part of the cattle was dewlap (35.34%), whereas, the ear was the least infested body part (5.39%). Tick infestation was recorded higher in the old-age cattle than in young ($P<0.03$). Infestation by a female tick was found to be significantly higher than male. In this study, the infestation rate was not significantly different between wet and dry reasons. The observation of the tick infestation on cattle of this study is important for improved management of tick in cattle from upper-northeastern Thailand.

Keywords: Hard tick, Cattle, Risk factors.

DEVELOPMENT OF DNAZYME-BASED BIOSENSOR FOR CIRCULATING TUMOR DNA

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Abstract:

Liquid biopsy is one of the promising techniques that can be used in cancer diagnosis. This technique detects circulating tumor DNA (ctDNA), circulating tumor cells (CTCs), exosomes and miRNA. ctDNA and CTCs are released from tumor cells and exist in the bloodstream. However, ctDNA concentration is higher than the other components, thus ctDNA is mostly used for cancer diagnosis in liquid biopsy. Our research team aimed to develop a colorimetric DNAzyme-based biosensor that can detect ctDNA containing gene mutation. Our biosensor was designed by using G-quadruplex/hemin DNAzyme mimicking horseradish peroxidase (HRP) enzyme which catalyzes H_2O_2 and $ABTS^{2-}$ and changed the color from light green to visible green. In this study, we investigated and optimized the catalytic activity of G-quadruplex/hemin DNAzyme in various conditions. To immobilize onto nanoparticles for signal amplification, DNAzyme has to be modified with NH_2. Thus, the catalytic activity of G-quadruplex/hemin 5'NH_2- and 3'NH_2-modified DNAzymes were compared. Our results showed that the highest catalytic activity was obtained when using the ratio of DNAzyme:hemin at 1:20. Furthermore, the higher DNAzyme concentration exhibited the stronger color change signal. In addition, DNAzyme with NH_2 modification at 5' end showed higher catalytic activity. These results should be appropriate for further development of the ctDNA biosensor.

ISOLATION AND CHARACTERIZATION OF A NOVEL BACTERIOPHAGE SPECIFIC MULTI-DRUG RESISTANT *Acinetobacter baumannii*

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Abstract:

The severe increase in the number of multi-drug resistant (MDR) *Acinetobacter baumannii* related to more patients, and the high death rate has been emphasized as a worldwide public health concern. Although a large number of scientific research studying antimicrobial agents has been discovered, it is an ineffective medical treatment for MDR *A.baumannii* infections. However, many recent studies on the use of bacteriophage presented that bacteriophage can be an alternative antimicrobial approach, suggesting that bacteriophage therapy is effective in further developing as a therapeutic application.

This study aimed to isolate and investigate the biological characterization of bacteriophage. This bacteriophage against MDR *A.baumannii* was isolated from a hospital wastewater sample after activated sludge treatment. The biological assessment, the bacterial lawn appeared to be bacteriophage plaque which had a medium size (0.2 cm average diameter) with a halo. The phage lysed 72% of MDR *A. baumannii*, indicating that the *phage might be a broad host range* virus. The bacteriophage exhibited rapid adsorption (>60% adsorbed in 8 min), a short latent period (40 min), and a burst size of 39 PFU/infected cell. Bacteriophage was sensitive to high temperature (70^{o}C) and stable at 4^{o}C to 60^{o}C. Bacteriophage showed high stability in pH range between 2 to 13. Twenty percent viability under 40 minutes of UV radiation. In conclusion, the results indicated that the bacteriophage exhibited the ability to control *A.baumannii* infections and able to be a potential candidate for bacterial controller.

ISOLATION AND CHARACTERIZATION OF A LYTIC BACTERIOPHAGE INFECTING *Escherichia coli*

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Abstract:

Antibiotic-resistant microorganisms are becoming more widespread. To solve this problem, bacteriophage is an alternative innovative biocontrol agent for suppressing and eliminating pathogenic bacteria. However, bacteriophage has limitations such as sensitivity to temperatures, pH, and ultraviolet irradiation. Therefore, this research aims to isolate and optimize the condition of bacteriophage infecting *Escherichia coli*, which is one of the bacterial pathogens causing foodborne disease and diarrheal disease. The bacteriophage was isolated from hospital water samples after activated sludge treatment. Bacteriophage had the ability to form plaque on the *E. coli* lawn. *Escherichia coli* strain was provided by faculty of science, Songkla University, Songkhla Province, Thailand. The morphology of the plaque had a small size with a halo. The bacteriophage showed high stability under diverse temperatures and pH. The bacteriophage was stable under a range of temperature from 4 to 50 ºC and strong acid. The activity of bacteriophage was decreased after ultraviolet irradiation exposure for 40 minutes. For lytic activity, the lytic phage can inhibit *E. coli* at 1 hour after infection. The results support that the bacteriophage infecting *E. coli* may be a potential candidate for biological control.

ASSESSING CORAL COMMUNITY STRUCTURE ON HIN ANG WANG, SURAT THANI PROVINCE, A DECADE AFTER THE 2010 CORAL BLEACHING EVENT

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Abstract:
Degradation of coral reefs has been documented in Thai waters and other parts of the world. The severe coral bleaching events occurred in the Gulf of Thailand in the years 1998 and 2010. This study aimed to investigate the coral community structure on Hin Ang Wang, Surat Thani Province, ten years following the 2010 coral bleaching event. The SCUBA divers examined coral communities in belt-transects, 1 x 30 m^2 for each. Our results revealed that live coral cover at Hin Ang Wang was less than 20%. The dominant corals on shallow reefs were *Porites* spp., *Pavona* spp. and *Montipora* spp. There were several coral species on sandy substrates, particularly *Pavona frondifera*, *Fungia* spp. and *Montipora* spp. The deeper reef areas were occupied mainly by large colonies of *Diploastrea heliopora* and *Porites lutea*. Assessing coral recruitment showed that the dominant coral recruits were *Montipora* spp, *Acropora* spp., *Pocillopora* spp. *Pseudosiderastrea tayami*, *Pavona* spp., *Fungia* spp., *Ctenactis* spp., *Lithophyllon* spp., *Hydnophora* spp, *Favites* spp., *Goniastrea* spp., *Platygyra* spp, *Diploastrea heliopora*, *Echinopora* spp. and *Porites* spp. The highest recruit density was observed in *Fungia* spp. The abundance microbenthic invertebrate were *Spirobranchus giganteus*, *Bequina semiorbiculata* and *Arca* sp. The dominant reef fish species included *Sphyraena obtusata* and *Abudefduf sexfasciatus, Neopomacentrus anabatoides*. Coral communities on Hin Ang Wang should be effectively managed for recreational fishing.

Figure 1. Coral communities on Hin Ang Wang, Surat Thani Province

COMPARATIVE STUDY OF THE MORPHOLOGICAL AND METAPHASE CHROMOSOME NUMBER OF *Centella asiatica* (L.) URBAN FROM UTTARADIT, PHITSANULOK AND SOME PROVINCES IN THE NORTHEAST OF THAILAND

Thararat Yimcharoen and Somjit Homchan*

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Abstract:
Centella asiatica (L.) Urban or Asiatic pennywort belongs to the family Apiaceae. It has been widely used in medicine and cosmetic productions. In Thailand, pennywort have been found in every part of the country with highly diverse in morphology, particularly size of leaves. Some samples show very big leaves while some of them show very small leaves. The sample with a big size of leaf may hypothesized that is a polyploidy plant. However, there was no report or evidence to confirm that the different size of leaves were effected by ploidy level or environment. Therefore, the purpose of this study was to compare the metaphase chromosome number of *C. asiatica* in different areas in Thailand with morphology of leaves. In this study, chromosomes were studied using cell maceration enzymes and aceto-orcein staining. It was found that all samples from different locations are diploid (2n=2x=18) but different in size and shape of metaphase chromosomes. From this study, the correlation between karyotype of each sample and leaf morphology was not found. However, the type or shape of chromosomes have to be confirmed with centromere staining for clearly conclusion that the variation of metaphase chromosome types are found in pennyworth or not.

Session C:
CHEMISTRY (Analytical Chemistry)

IDENTIFICATION OF VOLATILE COMPOUNDS IN GREEN CURRY USING COMPREHENSIVE HEARTCUT TWO-DIMENTIONAL GAS CHROMATOGRAPHY-MASS SPECTROMETRY

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Abstract:
In this study, comprehensive heart cut two-dimensional gas chromatography hyphenated with mass spectrometry (CH/C 2DGC-MS) was used for identification of volatile compounds in a Green curry sample. The system utilized the first and second dimensional (^{1}D and ^{2}D) columns of 5MS (30 m × 0.25 mm × 0.25 µm) and DB-WAX (60 m × 0.25 mm × 0.25 µm), respectively, connected via a Deans switch. The compound identification approach was based on matches with MS and ^{1}D retention index (^1I) data obtained from the NIST17 library. The analysis offered the approximated total peak capacity of 5840. The Green curry sample was found to contain 93 volatile compounds with the major components of tumerone (14.9%peakarea), β-cubebene (8.7%), cyclopropylbenzene (8.4%) α-ocimene (8.0%) and terpinen-4-ol (5.3%).

UTILIZATION OF ORCHID FLOWER EXTRACT AS SPECIFIC REAGENT FOR DETERMINATION OF COPPER USING A RAPID SEQUENTIAL INJECTION SYSTEM EQUIPPED WITH IN-HOUSE PEDD DETECTOR

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Abstract:
In recent years, green analytical chemistry has become more important. One alternative strategy to achieve environmentally friendly method is to use natural products instead of toxic synthetic chemical compounds in chemical analysis. Anthocyanins is one of the well-known natural compounds which can be extracted from plants with red, blue, and purple pigments. In this study, anthocyanin, pigment in orchid flowers, has been utilized as a natural reagent in flow-based technique in order to potentially determine copper ion. This method has been investigated by the color of anthocyanin-copper complex that could be measured from both general UV-Vis spectrophotometer and a paired emitter detector diode (PEDD), a laboratory-made optical detection unit. After applying with MS-Visual C# - fully automated sequential injection analysis (SIA-PEDD) for on-line measurement, effect of LED color and physical parameters including zone sequence, volume of reagent, and flow rate to detector, were investigated. The result was founded that blue LEDs light gave the best response which were selected to be a light source and light detector. Additionally, the optimal zone sequence should be 'sandwich pattern'. Volume reagent, sample volume, and flow rate to detector were selected at 0.50 mL, 0.50 mL and 3.33 mL/min, respectively. Under the optimal condition, the SIA-PEDD is acceptable for copper content analysis with rapid sample throughput 42 samples/h, limit of detection (LOD) 87.0 µM, %RSD 1.31 within linear range of 100 – 3000 µM. The numbers show how quick and repeatability this system can provide with gratification. Moreover, orchid reagent is cheap, easy-finding, and safe to be counted as green reagent. Finally, the amount of copper in dietary supplement and surface water was determined using the developed methods and the results were compared with standard flame atomic absorption spectroscopy (flame-AAS).

STUDY ON THE ELECTROCHEMICAL EFFICIENCY OF POLYVINYL ALCOHOL, GELATIN, AND AGAR-BASED GEL-ELECTROLYTES FOR PORTABLE ELECTROCHEMICAL SENSOR

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Abstract:
Gel electrolyte is one of the interesting materials in the electrochemical field as a part of electrochemical energy storage. With the benefits of gel electrolytes, it would be attractive to introduce gel electrolytes to other electrochemical applications. Nowadays, many electrochemical portable sensors have been developed with the advantages of low cost and portable instruments. However, the use of liquid electrolytes often brought risks associated with the leakage of unsafe chemicals to the environment and human tissue. Hence, the application of gel electrolyte to portable electrochemical sensors become potential candidates to replace liquid electrolyte system. Herein, the study of the preparation of gel electrolytes on the screen-printed carbon electrode (SPCE) using agar, gelatin, and polyvinyl alcohol (PVA) was firstly discussed in the application of the portable electrochemical sensor. The electrochemical efficiency of prepared gel electrolytes was studied in Ferri/ferrocyanide $[Fe(CN)_6]^{3-/4-}$ solution as the redox probe onto the SPCE as the electrochemical transducer. The cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) were performed to study and compare electrochemical behaviors including sensitivity, reversibility, and charge transfer resistance, which are the important factor for the application of electrochemical sensing. The results of the electrochemical response of each gel electrolyte material under optimal conditions showed in table 1. The results showed that PVA-based gel electrolyte presented the best electrochemical performance with the high sensitivity corresponded to the highest anodic and cathodic peak currents, good reversibility corresponded to the lowest peak potential separation (ΔE_p), and good conductivity corresponded to the lowest charge transfer resistance. Moreover, the prepared PVA gel electrolyte offers better safety to take over liquid electrolytes. The information obtained from this work will greatly enhance the ability to approach the full on-site analysis and could be adapted to apply to various analytes in many applications such as agriculture, clinic, and food quality and safety control.

Table 1. The electrochemical response of the prepared gel electrolyte under the optimal condition

	PVA gel	**Gelatin gel**	**Agar gel**
Anodic peak current (µA)	75.8	71.5	50.2
Cathodic peak current (µA)	53.1	39.0	60.8
Charge transfer resistance (Ω)	109.23	303.23	653.49
Anodic peak potential (V)	0.198	0.210	0.342
Cathodic peak potential (V)	-0.124	-0.144	-0.112
peak potential separation, ΔE_p (V)	0.322	0.354	0.454

BACTERIAL CELLULOSE NANOPAPER: PREPARATION, CHARACTERIZATION, AND ITS APPLICATIONS AS SENSING PLATFORMS

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Abstract:
In this work, a simple method for preparation of bacterial cellulose (BC) nanopaper, characterization and its application were presented. The bare BC nanopaper was prepared by culturing of *Acetobacter xylinum* in Hestrin-Schramm (culture medium). It was purified by soaking in 5 % w/w NaOH and was then bleached with the mixture of 1 % w/w NaOH and 0.2 % w/v H_2O_2 at 80 °C. Finally, the transparent nanopaper was obtained. The nanopaper was characterized using scanning electron microscope (SEM). The SEM images revealed that bundles of cellulose nanofibrils were observed. Two applications of the nanopaper for using as both the sensing platforms and the two-dimensional (2D) microcuvettes were studied. For the first application, the gold nanoparticles (AuNPs)-BC nanopaper was synthesized for the spectrophotometric determination of hydrogen peroxide (H_2O_2). After the embedding process, color of the nanopaper was changed from milky-white to wine-red. Dropping of H_2O_2 onto the AuNPs-BC nanopaper resulted in decreasing in the absorbance of the nanopaper at 525 nm. Detection limit ($y_B + 3S_B$) of 0.79 % (v/v) was observed and this value was enough sensitive for the determination of H_2O_2 in wound cleaner and hair dye samples. For the second application, the bare BC nanopaper was soaked in the solution of fluorescein derivative that was synthesized by our laboratory. This nanopaper was then employed as 2D-microcuvtte for the fluorometric detection of trivalent chromium ion (Cr(III)) instead of using an expensive quartz fluorescent cell. In the presence of Cr(III), fluorescence intensity of the derivative, immobilized on the nanopaper, was decreased accordingly to the quenching effect (λ_{ex} 490 nm, λ_{em} 525 nm). Optimization and evaluation of the analytical performances for the second application will be presented.

GREEN EXTRACTION OF ARABICA COFFEE CHERRY HUSK USING A DEEP EUTECTIC SOLVENT (DES)

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Abstract:
A major agricultural waste product is coffee cherry husk, which is obtained from the processing of Arabica coffee in Northern Thailand. The husk of coffee cherries is known to contain many valuable phytochemical substances using in various products. Therefore, the extraction of phytochemical compounds from the coffee cherry husk is advantageous for the reduction of waste produced by agriculture. The organic solvent commonly used for the extraction of that compounds. However, the concept of "green chemistry" was considered to minimize environmental contamination and reduce chemical-related effects on human health. Therefore, deep eutectic solvents (DESs) prepared by combining two or three inexpensive and safe chemicals, were designed for the extraction of bioactive phytochemical compounds in Arabica coffee cherry husk. The DESs produced from choline chloride and citric acid (1:2 M) were used in the extraction study, along with an ultrasound-assisted extraction at room temperature for 60 min. The ratio of water used to combine with the DESs, which ranged from 20 to 50% w/w, was investigated. Some properties of DESs such as functional groups and viscosity were studied by using a FTIR and Viscosity analysis. Total phenolic content (TPC), total flavonoid content (TFC), and antioxidant activity (AA) of the crude extracts of Arabica coffee cherry husk obtained from using the DESs extraction, were studied. The use of 40% water by weight was found to produce higher levels of TPC, TFC, and AA than other conditions at 27 mg GAE/g, 16.74 mg CE/g and 11.2 mg AAE/g, respectively. Therefore, the crude extracted utilizing the designed DESs has the potential to be used in many applications as a part of safe and environmentally friendly agents.

QUALITY CONTROL OF PROXIMATE ANALYSIS AND HEAT COMBUSTION IN PALM KERNEL SHELLS

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Abstract:

Proximate analysis and calorific value are the common method that is used to observe the quality of coal and biomass as renewable energy source. This study aims to develop the control chart of coal used as quality control for determining the proximate analysis in palm kernel shells (PKS) and studying the heat combustion by a bomb calorimeter. Proximate analysis determines moisture, ash, volatile matter, and fixed carbon content. The percent of volatile dried coal is between 47.61 and 50.02 used for quality control in this study. This control chart is suitable for monitoring processes, identifying causes of variability, and confirming the results of PKS samples in this study. Sixteen palm kernel shell samples were studied proximate analysis by Macro-TGA instrument based on ASTM D7582-15. The data for proximate analysis in PKS showed moisture content in dried was around 6.87±0.06%. The volatile fraction, fixed carbon, and ash content were found at 69.43±0.33%, 20.98±0.27%, and 2.72±0.19%, respectively. Its higher heating values determined by the bomb calorimetric method show 4482.56±73.69 Kcal/kg in the drying process. These results provided useful information about PKS as a raw material for the renewable energy industry and to compare the further studies of properties such as torrefaction and fast pyrolysis in the future.

THE DEVELOPMENT OF FRUIT AND MICROGREENS SMOOTHIES FOR ELDERS BASED ON ANTIOXIDANT CAPACITY AND SENSORY EVALUATION

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Abstract:

Antioxidants are essential due to the ability to scavenge free radicals, which cause many diseases. Natural antioxidants are either synthesized in human bodies or obtained from food. However, the antioxidant production decreases with age, plus elderly usually have trouble chewing leading to inadequate consumption of antioxidants. In this work, high antioxidant capacity and tasty smoothie recipes were developed. Ten smoothies of microgreens and fruits including kale, broccoli, green oak, water spinach, red amaranth, banana, mango, pomelo, mulberry, and guava were individually assessed for sensory evaluation. Total antioxidant capacity (TAC) and total phenolic content (TPC) were estimated using 2,2-diphenyl-1-picryl-hydrazyl-hydrate (DPPH) assay and Folin-Ciocalteu assay. The results showed that mulberry smoothie had the highest TAC and TPC followed by broccoli smoothie; meanwhile, both mango smoothie and banana smoothie received high overall satisfactory scores. Two smoothie recipes were then developed from the microgreens and fruits with highest antioxidant capacity and sensory profiles. The first recipe consisting of banana, mango, and broccoli had TAC and TPC values of 0.49 ± 0.61 mg Ascorbic Acid Equivalent (AAE)/mL and 5.04 ± 0.04 mg Gallic Acid Equivalent (GAE)/mL, respectively. The second recipe consisting of mulberry, mango, and broccoli had TAC and TPC values of 12.63 ± 1.13 mg AAE/mL and 20.41 ± 0.14 mg GAE/mL, respectively. Both smoothie recipes had high sensory perception with no statistically significant difference ($p > 0.05$). Thus, the second recipe having higher TAC than that of the first one and high sensory perception was chosen as a promising beverage to increase antioxidant capacity for elderly.

METHOD VALIDATION OF THE DETERMINING PROTEIN IN LATEX GLOVES BY USING UV-Vis SPECTROPHOTOMETER

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Abstract:

Protein is a contaminant substance in latex gloves. In the manufacturing process of latex gloves, where protein is not completely removed and a large amount of protein residue remains, it can cause an allergic reaction to the user, which can be life threatening. Therefore, the FDA organization has established the optimal protein content in such gloves. The determination of protein residues in latex gloves was performed using the Modified Lowry Method, based on ASTM D5712 testing with an UV-Vis spectrophotometer. This research aims to study the method validation of the ASTM D5712-standard protein quantitation test method to improve the protein content test results. According to AOAC guideline, the linearity (R^2-value) was found to be 0.9980. The accuracy was reported as the recovery being 98.88%, which is in the acceptable range of 80%-110%. Moreover, it showed good precision with the RSD at 4.74%. The limits of detection (LOD) and the limits of quantitation (LOQ) were 2.49 µg/mL and 7.54 µg/mL, respectively.

ELECTROCHEMICAL DETERMINATION OF DEXAMETHASONE IN COSMETICS BY USING COMPOSITE METAL ORGANIC FLAMEWORK-CARBON ELECTRODE

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Abstract:
The development of nanomaterials modified electrode for rapid screening of illegally used dexamethasone (DEX) in cosmetic products is the goal of this work. MIL-100(Fe) or MIL-101(Cr) nanomaterials were composited with graphene oxide (GO) or carbonized cigarette filters and modified on the screen-printed electrode. The carbonized cigarette filter (CF) was prepared by embedding the GO into the cigarette filters (CF@GO) to enhance porosity. The ferric/ferro-cyanide redox couple was selected to study electrochemical behavior by cyclic voltammetry. For the DEX detection, 0.5 and 1.0 mM of DEX were prepared in Britton-Robinson buffer solution (pH 2). The results showed that the modified electrodes were able to detect DEX, except for CF@GO. However, the electrochemical behavior of the CF@GO demonstrated high surface area and high current, which were suitable properties for capacitor application. Furthermore, the results showed that using composite materials increased the sensitivity of DEX detection. Besides, the results indicated that the GO with MIL-100(Fe) nanocomposite provided the highest current, and the oxidation peaks appeared at 0.3 and 0.6 V.

DIFFERENTIATION OF ORIGINS OF THAI COFFEES BY CHEMOMETRIC ANALYSIS OF AROMA PROFILES FROM GAS CHROMATOGRAPHY – MASS SPECTROMETRY

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Abstract:

Coffee is one of the most important agricultural commodities, and the demand for specialty coffee and single-origin coffees is also increasing significantly. Methods that can effectively differentiate the origins of coffee is tremendously beneficial. In this work, headspace solid-phase microextraction (HS-SPME) in combination with gas chromatography-mass spectrometry (GC-MS) was used as a tool for differentiating coffee origins. The acquired data was then processed by principal component analysis (PCA) and linear discriminant analysis (LDA), resulting in successful identification of the origins of coffee with prediction accuracies of 65-100%. Studies with the aforementioned performance include the discrimination of Arabica vs Robusta, Arabica coffees from different geographical origins, Robusta coffees from different geographical origins, and geographical origins of Arabica coffees within each province in Thailand. In brief, the overall workflow is simple, free of sample pre-treatment, but yet effective for distinguishing origins of coffee.

DEVELOPMENT OF SAMPLE PREPARATION AND ANALYTICAL METHOD FOR THE DETERMINATION OF ANDROGRAPHOLIDE IN *Andrographis paniculata* EXTRACT

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Abstract:
The objective of this work was developed sample preparation and analytical method using HPLC-DAD system for the quantification of andrographolide in *Andrographis paniculata* extract. The chromatographic HPLC-DAD system for the separation of andrographolide was carried out using a reverse phase LiChrospher 100 RP-18 (4.0 x 250 mm, 5µm particle size) column at 40 degrees Celsius using isocratic elution of mobile phase consisted of Methanol:Deionized water in the ratio of 80:20, v/v at a flow rate of 0.80 mL/min, and the absorption wavelength was monitored at 220 nm with a run time of 10 minutes. Under the optimum conditions, the linearity was obtained in the concentration range of 0.4-40 mg/g. The limit of detection (LOD) was 0.02 mg/g, limit of quantification (LOQ) was 0.04 mg/g, the accuracy and precision were (100.1±4.2) %recovery and 1.1 %RSD (n=10), respectively with acceptable criteria. This method was simplicities of extraction procedure, good accuracy and precision. Moreover, the developed method for the andrographolide detection in *Andrographis paniculata* extract was successfully and can be applied to the new service at the Office of Scientific Instrument and Testing, Prince of Songkla University, Songkhla, Thailand.

COLORIMETRIC DETERMINATION OF ANDROGRAPHOLIDE FACILITATED BY MOLECULARLY IMPRINTED POLYMER

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Abstract:

Andrographolide is bioactive compound found in Thai herb named Fa-Ta-Lai-Jone. This compound can react with 3,5-dinitrobenzoic acid in basic solution to produce purplish red complex. Absorbance of the complex was measured at 546 nm with the linear working range up to 800 ppm. Nevertheless, Fa-Ta-Lai-Jone consists of many compounds beside andrographolide. In order to colorimetrically determine andrographolide amounts in Fa-Ta-Lai-Jone herbal medicine, sample preparation is necessary to improve detection selectivity for andrographolide. For this purpose, molecularly imprinted polymer or MIP was synthesized. Photo polymerization of monomers and cross-linkers, using 2-hydroxyethyl methacrylate and ethylene glycol dimethacrylate, respectively, initiated by 2,2-dimethoxy-2-phenylacetophenone in the presence of the andrographolide template was performed under UV radiation. Template removal using ethanol afforded MIP which was used to absorb andrographolide in real samples for further determination by colorimetry.

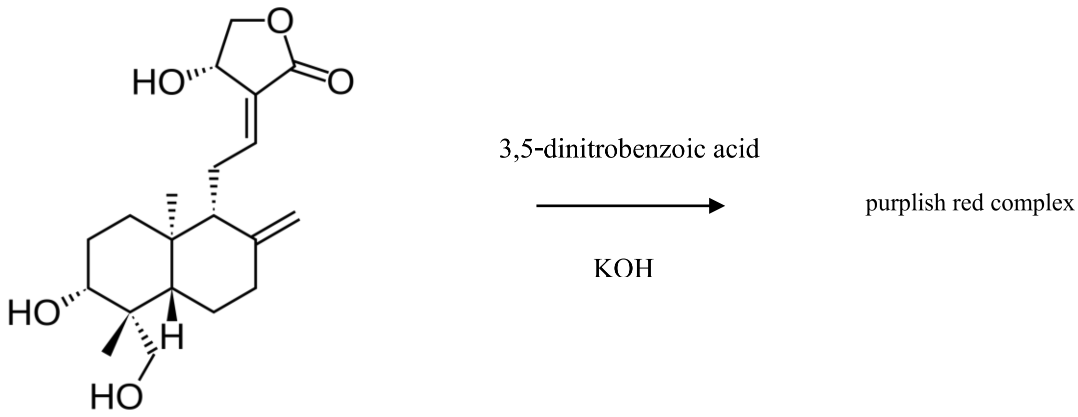

Figure 1. Reaction of andrographolide with 3,5-dinitrobenzoic acid in basic solution

GRAPHENE-BASED ELECTRODE APPLICATIONS IN THE JEWELRY INDUSTRY FOR GOLD SENSING

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Abstract:
Precious metals are rare, naturally existing metallic elements with high economic value. They are significantly employed in the manufacture of numerous products, such as jewelry, electronics, and automotive industries. Gold is one of the most electrically conductive metals that is widely used in jewelry manufacture. For metal plating processes, precious metal compounds of special quality and purity need to be quantified to ensure the proper number of precious metals in both the plating and waste baths. Therefore, we developed a new electrochemical sensor using a paper-based screen-printed graphene electrode (SPGE) for the determination of gold (III) ions by the square wave voltammetry technique. All parameters affecting the performance of the SWV technique, such as pulse amplitude, square wave frequency, and step potential, were investigated to obtain the optimal operating conditions. Under optimal conditions, the determination of Au (III) ion showed linearity from 1 mgL^{-1} to 50 mgL^{-1} with a correlation coefficient of 0.9956. The detection limit (S/N = 3) was found to be 0.240 mgL^{-1} and the relative standard deviations (n = 7) were found between 0.52 and 3.65%. In addition, this developed sensor provided high selectivity toward the reduction of gold ions without suffering from interferences. Furthermore, the proposed method was successfully applied for the determination of Au (III) in plating and post-plate drag-out solution samples obtained from the plating processes. According to a paired *t*-test, the results were in good agreement with results from the standard ICP-OES method. These results demonstrate that the proposed sensing can be used as an alternative way for the low cost-effective, rapid, selective, and sensitive determination of Au (III) in precious metal plating processes.

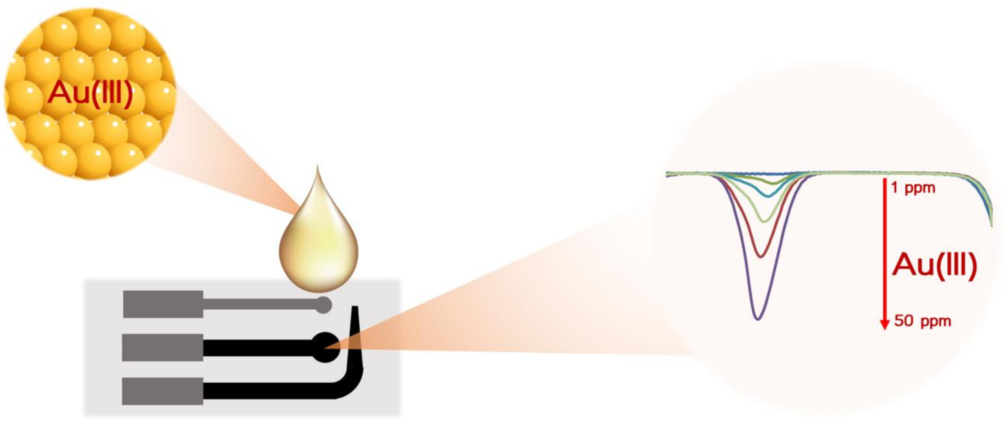

Figure 1. Graphical Abstract

FAST SYNTHESIZED PRUSSIAN BLUE NANOPARTICLES AS A RAPID COLORIMETRIC SENSING FOR DETERMINATION OF RIBOFLAVIN

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Abstract: Riboflavin (vitamin B_2) is one of the water-soluble vitamin families. This vitamin cannot be formed in the human body and thus must be obtained through food, supplements, and pharmaceutical products. The deficiency of riboflavin leads to several problems, like irritation of the eyes, sore tongue, itching, and peeling skin. Therefore, the quantitative analysis of this vitamin is essential. Herein, we aim to develop a simple colorimetric sensor-based transparency sheet platform for the determination of riboflavin via the redox reaction of Prussian blue nanoparticles. Prussian blue nanoparticles were synthesized in mild conditions by using the reaction between potassium ferricyanide, ferric chloride, and colloidal silver nanoparticles within 1 min. The colorimetric assay was performed by the blue color of the system and changed to yellow after incubation with vitamin B_2, which can be used to achieve visualization detection. The riboflavin concentration can be quantified by image J processing. Moreover, all parameters affecting analytical performance, such as reagent concentration for Prussian blue synthesis, reaction time for detection, and RGB values for quantitative analysis, were investigated and optimized. Under the optimal condition, the linearity range was found to be 10 to 600 μg/mL (R^2= 0.9936) with the detection limit (S/N = 3) of 1.36 μg/mL. This device exhibited high sensitivity, excellent reproducibility (%RSD = 1.71), and good selectivity for riboflavin detection. Furthermore, the recovery percentage were also investigated in the range of 83.41 % to 118.03 %. Finally, this proposed assay has successfully been used to detect riboflavin in supplement samples with satisfactory results. Considering the advantages of rapid detection time, easy procedure, high sensitivity, and selectivity, the proposed method possesses an alternative way for vitamin B_2 detection.

DEVELOPMENT OF AN ENZYME-FREE HYDROGEN PEROXIDE SENSOR USING DUAL-SHAPED SILVER NANOPARTICLES

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Abstract:
In the past decade, silver nanoparticles (AgNP) facilitate the enzyme-free measurement of hydrogen peroxide owing to its unique optical properties. Decomposition-based colorimetric sensing with silver nanoparticles have been reported previously for various analytes including hydrogen peroxide. However, this technique continues to suffer disadvantages such as low selectivity and sensitivity. Thus, an alternative method is necessary to address these concerns. Herein, we report the development of a silver nanospheres (AgNS) and citrate-capped silver nanoprisms (AgNPr) mixture as a highly selective and sensitive sensor for hydrogen peroxide. Etching of the silver nanospheres by hydrogen peroxide releases Ag^+ which is sequentially reduced by excess H_2O_2 to silver metal that deposits anisotropically at the edges of the citrate-capped nanoprisms. A reduction of plasmon band intensity at around 400 nm, a red shift, and an increase in intensity of the in-plane dipole plasmon resonance peak were observed corresponding to a multi-color change with varying H_2O_2 concentrations. Quantitative analysis has been accomplished by tracking the changes in peak intensities of the nanospheres and nanoprisms. Using the AgNS/NPr sensor, a sub-micromolar limit of detection was achieved. Growth-based sensing using dual-shaped silver nanoparticles is a potential alternative for hydrogen peroxide determination as it enables a highly selective and sensitive colorimetric and naked-eyes approach with high accuracy and precision.

DISPERSIVE LIQUID-LIQUID MICROEXTRACTION FOR DETERMINATION OF ACRYLAMIDE USING GAS CHROMATOGRAPHY MASS SPECTROMETRY

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A new efficient and sensitive method has been developed and validated for determination of neurotoxic compound as acrylamide which is a byproduct from Maillard reaction at high temperature processing in carbohydrate-rich foods. This method was based on derivatization with bromination reaction coupled with sample preconcentration technique; dispersive liquid-liquid microextraction (DLLME) followed by detection with gas chromatography-mass spectrometry (GC-MS). Acrylamide was derivatized to form 2,3-dibromopropionamide (2,3-DBPA). 1.5 g of sodium sulfate was added and mixed in the solution. The mixture of ethyl acetate and triethylamine was then added and vortexed for 1 minute. The phases were separated by centrifugation at 5,000 rpm for 5 minutes. The organic phase was collected and injected into GC-MS. The developed method was successfully validated and shown good linearity from 0.30 – 20.0 ppm, R^2 = 0.9999, limit of detection and quantitation of 0.10 and 0.30 ppm, respectively and a high repeatability (%RSD = 0.55, n = 10). Finally, the developed method has a possibility to apply for determination of acrylamide in potato chips.

APPLICATION OF TWO-DIMENSIONAL THIN-LAYER CHROMATOGRAPHY FOR IMPROVED ANALYSIS OF AGARWOOD OIL

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Abstract: Agarwood oils are considerably one of the most valuable essential oils which requires efficient essential oil analysis to investigate the adulterants and qualities of genuine agarwood oil. TLC has been recognized as a simple and effective approach to perform this task. This study developed comprehensive two dimensional thin-layer chromatography (TLC×TLC) technique for an agarwood sample. The system employed a single stationary phase of silica gel 60 and two different mobile phase systems. Gas Chromatography-Mass Spectrometry (GC-MS) analysis was applied to investigate the agarwood sample. The best mobile phase system is dichloromethane for the first dimensional and 9:1 (v:v) hexane/ethyl acetate in second dimensional separations. This showed the greater separation with the orthogonality *(A_0)* of 0.6636 based on the asterisk approach separating 14 spots of the agarwood sample compared with 9 spots separated by the conventional one dimensional TLC analysis using 1:1 (v:v) hexane/dichloromethane. The developed TLC×TLC is expected to be applicable as an effective method providing a fingerprint of essential oils in the future.

Session C:
CHEMISTRY
(Organic & Medicinal Chemistry)

SECONDARY METABOLITES FROM INVERTEBRATE-PATHOGENIC FUNGUS *Gibellula scorpioides* MY05583 AND ANTI-INFLAMMATORY ACTIVITY

Ubon Rerk-am,[1,2] Praphakorn Kaemchantuek,[2] Pattarawadee Kengkwasingh,[2] Wilawan Kuephadungphan[3], Janet Jennifer Luangsa-ard,[3] and Jiraporn Arunpanichlert[1,*]
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Abstract:
Gibellula scorpioides is fungal species of the specialized spider-parasitic genus found in Thailand. The secondary metabolites isolated from *G. scorpioides* MY05583 were identified, evaluated, and developed, respectively. Chemical investigation of the ethyl acetate crude extract led to the isolation of three compounds, which were 2-hydroxycinnamic acid methyl ester, oleic acid and 1-methoxyoctane. Their structures were elucidated based on the spectroscopic data and confirmed by comparison of the ^{1}H, and ^{13}C NMR data with those previously reported. The isolated compounds were evaluated for anti-inflammatory effect by LPS stimulated-murine macrophage cell line (RAW 264.7) as well as cytotoxic activity. The measurements of NO, TNF-α and IL-6 concentration assay were determined using the Elisa kit by comparison of the activity between the treated and the non-treated cells. The concentration of NO, TNF-α and IL-6 are correlated to the anti-inflammatory properties of the active compounds derived from *G. scorpioides* MY05583. Moreover, the *in vivo* study will further be carried out to prove the efficacy.

SYNTHESIS OF ENAMINE DERIVATIVES OF USNIC ACID AS *α*-GLUCOSIDASE INHIBITORS

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Abstract:

Usnic acid, a secondary metabolite of lichens with a unique dibenzofuran scaffold distributed in various lichen species, was structurally modified to enamine derivatives **1**–**14**. All derivatives were evaluated for their *α*-glucosidase inhibitory activity. Most of the derivatives displayed potent inhibition with the IC_{50} values ranging from 16.56 to 43.29 μM in comparison with acarbose as the standard inhibitor (IC_{50} = 100.00 μM). Compound **5** was revealed as the strongest derivative with IC_{50} = 16.56 ± 1.05 μM.

α-GLUCOSIDASE AND α-AMYLASE INHIBITORS FROM THE STEMS OF *Knema globularia*

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Abstract:
Knema globularia (Lam.) Warb., known as “Lueat Raet” in Thailand, has been used popularly as a folk medicine. As part of our efforts in the search for bioactive metabolites of native Thai plants, a bioactivity-guided investigation from the stems of *Knema globularia* led to the isolation of twelve compounds (**1**−**12**) (Figure 1). The chemical structures were elucidated by an analysis of their NMR, as well as by comparison with literature values. The known compounds were characterized as 2,3-dihydrocalodenin B (**1**),[1] lophirone H (**2**),[2, 3] campylospermone A (**3**),[4] biflavanone (**4**),[5] lophirone A (**5**),[6] lophirone B (**6**),[7] 4-hydroxybenzaldehyde (**7**),[8] 7-hydroxy-4′,5,6,- trimethoxyisoflavone (**8**),[9] erontoisoflavone A (**9**),[10] 3,3′-bis(3,4-dihydro-4-hydroxy-6,8-dimethoxy-2H-1-benzopyran) (**10**),[11] bis(2-ethylhexyl) terephthalate (**11**),[12] yangambin (**12**).[13] All isolated compounds were tested for their α-glucosidase and α-amylase inhibitory activities (Table 1). Most biflavanoids (**1**−**6**) showed quite potent activity. Of these, lophirone F (**1**) was the most active compound, and powerfully inhibited both enzymes. The IC_{50} values of **1** against α-glucosidase and α-amylase were 1.07 and 3.99 µM, respectively (the positive control, acarbose, IC_{50} 93.63 and 6.24 µM, respectively). A kinetic study revealed that **1** was identified as a non-competitive inhibitor against α-glucosidase and a competitive inhibitor against α-amylase.

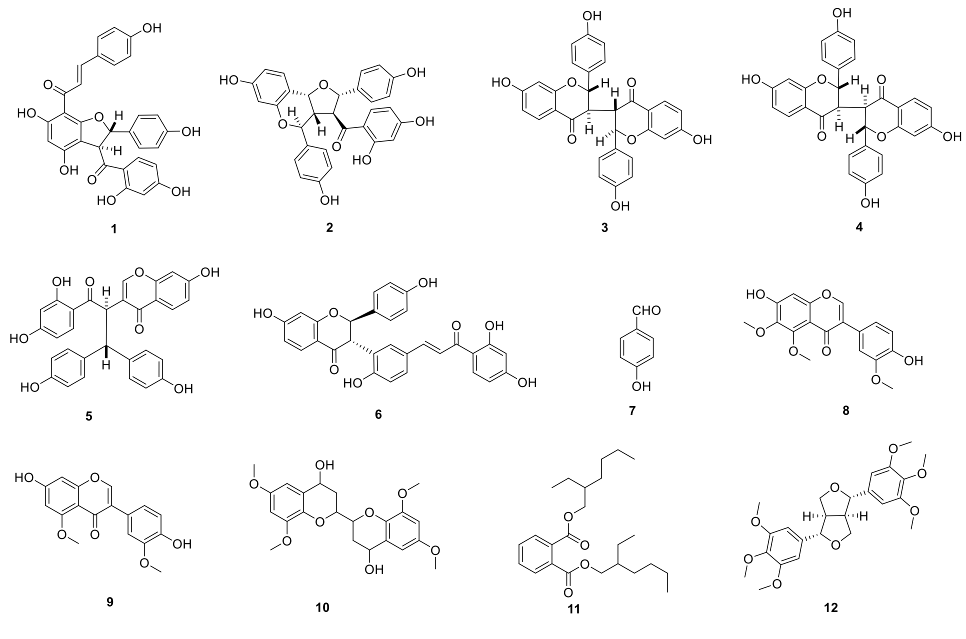
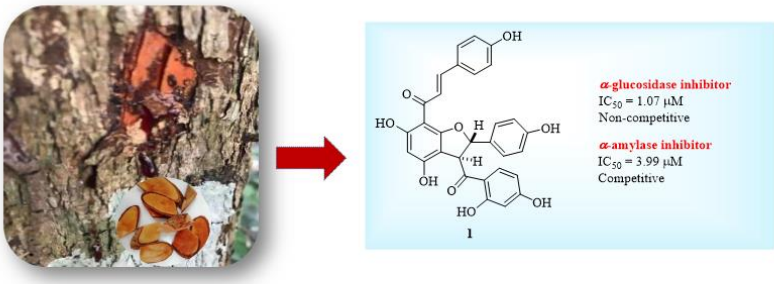


Figure 1. Structures of compounds **1**−**12**.

Table 1. α-Glucosidase and α-Amylase Inhibitory Activities of Compounds 1−12

α-glucosidase		α-amylase	
Compound	IC_{50} (μM)	Compound	IC_{50} (μM)
1	1.07±0.04	**1**	3.99±0.25
2	9.69±0.21	**2**	10.57±0.64
3	6.09±0.26	**3**	10.15±0.55
4	5.56±0.18	**4**	12.82±0.64
5	2.28±0.17	**5**	7.60±0.37
6	4.13±0.23	**6**	21.62±0.99
7	>200	**7**	>50
8	>200	**8**	>50
9	>200	**9**	>50
10	>200	**10**	>50
11	>200	**11**	>50
12	>200	**12**	>50
acarbose	93.63±0.49	acarbose	6.24±0.37



Stems of
Knema globularia

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DESIGN AND SYNTHESIS OF 9-*O*-BERBERINE BENZOATES AS α-GLUCOSIDASE INHIBITORS

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Abstract:
The rising number of diabetic patients around the world is an urgent problem that is required to find effective treatment. A promising treatment for diabetes mellitus is to reduce postprandial hyperglycemia by using α-glucosidase inhibitors to prevent carbohydrate digestion. α-Glucosidase is an crucial hydrolytic enzyme functioning in the carbohydrates digestion process to transform unabsorbed dietary sugars and starches into glucose. Berberine (**BBR**), a quaternary ammonium salt of benzylisoquinoline plant alkaloid, displayed various biological activities such as antimicrobial, anticancer and antidiabetic. In this study, eight berberine derivatives were synthesized by esterification reaction between berberubine and acid chloride and subjected to α-glucosidase inhibitory activity testing (**Figure 1**). All compounds demonstrated better activity than the parent compounds **BBR** and **BBRB** with the IC_{50} values in the range of 25.32 - 6.44 μM. Compounds **5** and **7** exhibited potent α-glucosidase inhibitory activity with the IC_{50} values of 7.51 and 6.44 μM, respectively. The structure-activity relationship study indicated that the hydroxy group on the aromatic ring of benzoates is more important for the activity than the methoxy group. In addition, the 3,4-methylenedioxy group enhances the activity better than the 3,4-dimethoxy and the 3,4,5-trimethoxy groups. Compounds **5** and **7** will be chosen for further study as the anti-diabetic candidates.

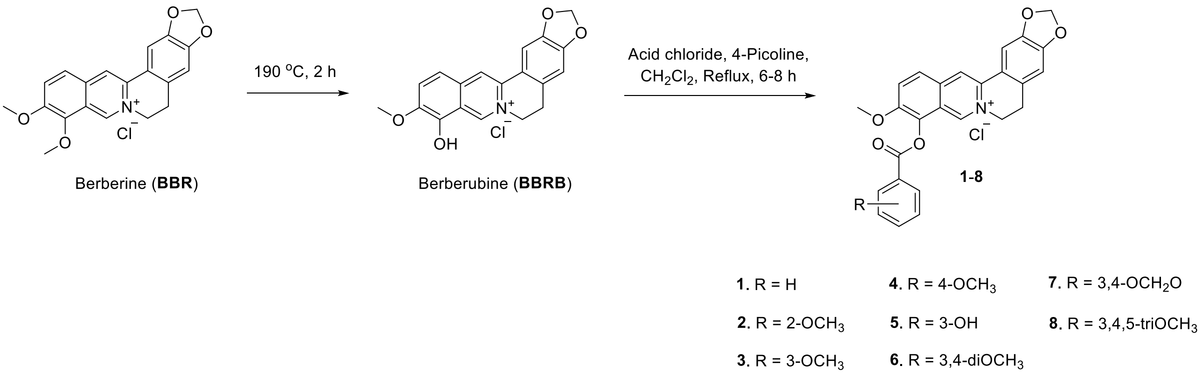

Figure 1. Synthetic route of **BBRB** and compound **1-8**

SYNTHESIS OF CHRYSIN ALKYL ETHER DERIVATIVES FOR SUPPRESSING YEAST α-GLUCOSIDASE ACTIVITY

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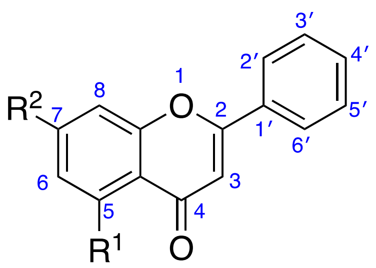
Abstract:
With the intention of discovering potent agents for suppressing α-glucosidase activity, eleven chrysin alkyl ether derivatives (**FL1–FL11**) were synthesized *via* alkylation of chrysin (**FL**), a naturally occurring flavonoid present in a variety of flowers and fruits. The chemical structures of chrysin derivatives were elucidated by the spectroscopic method and their bioactivities were screened toward yeast α-glucosidase in which acarbose was used as a standard drug. The results indicated that the 7-*O*-alkyl chrysin derivatives displayed better suppression than **FL**. Among ether derivatives, **FL5** displayed very strong suppression yeast α-glucosidase activity in a competitive manner with an IC_{50} value of 0.08 μM. This preliminary finding indicates the potency of semisynthetic chrysin derivative which should hold great potential as a leading compound for the treatment of type 2 diabetes mellitus. However, further studies are required to determine and validate the potency.



Chrysin (**FL**): $R^1 = R^2 = OH$
FL1: $R^1 = OH$, $R^2 = OCH_3$
FL2: $R^1 = OH$, $R^2 = OC_2H_5$
FL3: $R^1 = OH$, $R^2 = OC_4H_9$
FL4: $R^1 = OH$, $R^2 = OC_6H_{13}$
FL5: $R^1 = OH$, $R^2 = OC_8H_{17}$
FL6: $R^1 = OH$, $R^2 = OC_{10}H_{21}$
FL7: $R^1 = OH$, $R^2 = OC_{12}H_{25}$
FL8: $R^1 = OH$, R^2 = O-allyl
FL9: $R^1 = OH$, R^2 = O-prenyl
FL10: $R^1 = R^2 = OCH_3$
FL11: $R^1 = R^2 = OC_2H_5$

Figure 1. Structures of chrysin and 7-*O*-alkyl chrysin derivatives.

BROMINATION OF 2-AMINOPYRAZINE: THE EXPERIMENTAL AND COMPUTATIONAL STUDIES

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Abstract:

Bromination of 2-aminopyrazine was conducted using *N*-bromosuccinamide (NBS). Two brominated products, 2-amino-5-bromopyrazine (**1**) and 2-amino-3,5-dibromopyrazine (**2**), were obtained in 79% and 9% yields, respectively. Density functional theory calculations provided insight into the selectivity of the bromination process. A comparison of intermediate energies indicates a more favored pathway leading to the major monobrominated product. Moreover, natural bond orbital (NBO) charge analysis revealed that the site of bromination was determined by the intrinsic electronic influence of the reactant. This work highlights our effort to theoretically describe the selectivity of the bromination reaction using the computational method.

THE DEVELOPMENT OF NOVEL COLORIMETRIC TEST KIT FOR DETECTION OF DNA AND RNA VIRUSES

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Abstract:

An accurate and portable diagnostic technique can effectively limit the spread of infectious diseases caused by viruses. Our novel test kit integrates loop mediated isothermal amplification (LAMP) with the pH-sensitive dye to deliver a blue-to-green color that is visible to the naked eye within 3 simple steps: 1) Genetic materials extraction. Insert a sample of interest into a tube containing extraction enzymes. 2) LAMP reaction with portable test box. Put a drop of extracted genetic materials into a tube containing LAMP solution and run the reactions for 45 minutes. 3) Visible read-out. LAMP solutions containing targeted genetic materials will have their color changed. Blind testing with 75 unknown samples was done with the test kit in order to calculate statistical accuracy compared with the testing results from the standard polymerase chain reaction (PCR). Moreover, molecular sensitivity tests were done to find the limit of detection (LOD) of the test kit. To demonstrate the versatile detection capability of our platform, the test kit's testing solution was slightly modified by changing pathogen-specific primers, then challenged with various types of pathogens: SARS-CoV-2 (Covid-19) representing RNA virus infecting human, Mycobacterium (TB) representing bacteria infecting humans, Scale Drop Disease (SDDV) representing DNA virus infecting animals, *Staphylococcus iniae* representing DNA bacteria infecting animals, and Phytoplasmas representing parasite infecting plants. The whole diagnosis process of the developed test kit takes less than 1 hour from sampling to visible readout. This will be running on 96% accuracy compared to the PCR and being 10 times more sensitive than the PCR, with the detection limit approaching 10 copies of the initial targeted genetic materials. Our portable, 5-dollar test box provides approximate efficiency to a thousand-dollar PCR machine, and a 5-min, equipment-free, genetic materials extraction procedure was also established. These have made the whole diagnosis process take less than 1 hour from sampling to visible readout within a cost of 2 dollars, 4-6 times faster, and 10-fold cheaper than conventional PCR methods. Finally, for the versatility test, all of the samples were diagnosed correctly. All of these factors are highlighting that its potential would be a future model for emerging point-of-care disease diagnoses in the future.

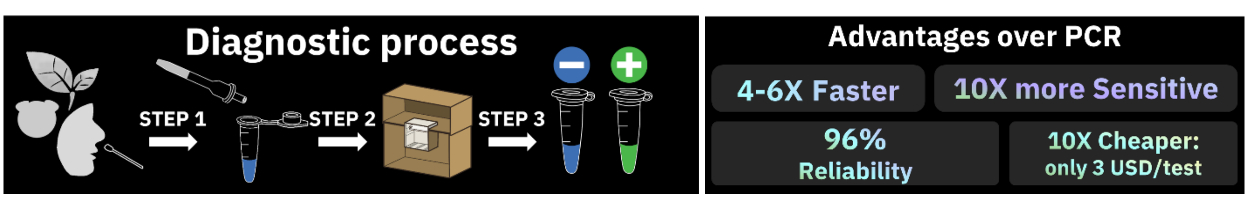

Figure 1. Diagnostic process (left) and advantages of test kit over PCR (right)

THE EFFECT OF HEAVY ATOM ON INTERSYSTEM CROSSING IN BORON DIFLUORIDE FORMAZANATE COMPLEX-BASED PHOTOSENSITIZERS

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Abstract:

Photodynamic therapy (PDT) is a photochemical-based cancer treatment approach that involves reactive oxygen species (ROS) generation associated with intersystem crossing (ISC) that is enhanced by the heavy atom effect on a photosensitizer (PS) upon light activation. Until now, there are still fewer studies on BF_2-formazanate complexes used as PDT agents. In this study, we systematically studied the synthesized compound's ability to generate the excited triplet state (T_1) using photoexcitation designed via the Jablonski diagram guide. We determined the capability of the BF_2-formazanate complexes to be efficient in generating T_1 using two methods: (1) measuring $^1O_2$ generation using the UV-Vis absorption method and (2) computing the potential energy curves for photophysical mechanisms of BF_2-formazanate complexes using the Density functional theory (DFT) combined with the Nudged Elastic Band (NEB) method. The heavy halogen atom effect increases in the $^1O_2$ generation when the benzene hydrogen atoms in BNH and BCH are replaced by iodine atoms (I-). By Singlet oxygen quantum yield (Φ_Δ) of BNI, BCI, BNH and BCH are 0.056, 0.074, 0.0060, and 0.0020, respectively. Photophysical properties and quantum chemical calculations were performed to understand the mechanism of the electronic transition. The outcomes verified that the synthesized BF_2-formazanate complexes adhered to the theory.

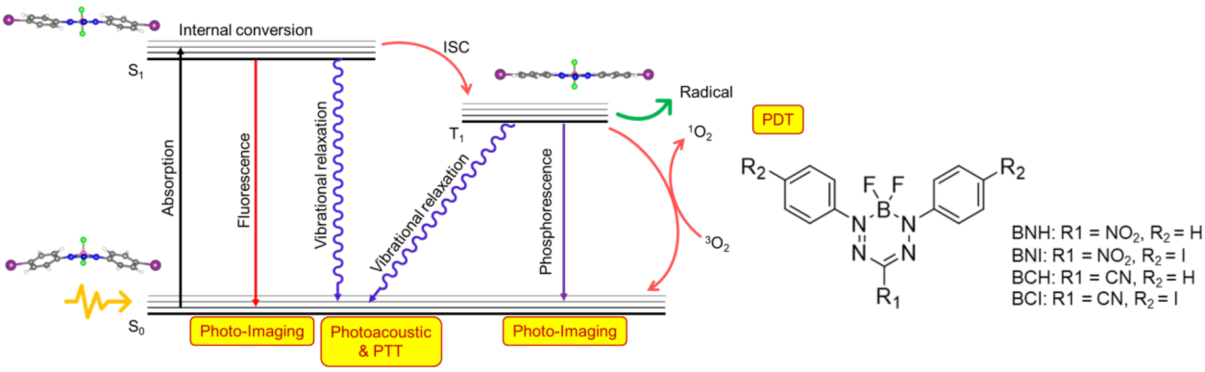

Figure 1. Pathway of PDT calculated for our BF_2-formazanate complexes.

SYNTHESIS OF 5-ARYLBENZO[*a*]PHENAZINE DERIVATIVES AND THEIR PHOTOPHYSICAL PROPERTIES

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Abstract:
An efficient, simple, and low-cost synthesis of 5-arylbenzo[*a*]phenazine derivatives was reported. A condensation reaction between 4-aryl-1,2-naphthoquinone derivatives and 1,2-phenylenediamine under mild reaction conditions afforded the corresponding products in good to excellent yields. Absorption and fluorescence emission spectra of 5-(2,4,6-trimethoxyphenyl)benzo[*a*]phenazine were also reported. The result suggested that the compound exhibited solvatochromic behavior.

BIOASSAY-GUIDED ISOLATION AND IDENTIFICATION OF BIOACTIVE COMPOUNDS FROM *Leonurus japonicus* HOUTT. EXTRACT

Trirath Sukthawee,[1,2,3] Wuttichai Jaidee,[3] Narawadee Rujanapun,[3] Surat Laphookhieo,[1,2,3] Rawiwan Charoensup,[3,4] and Tharakorn Maneerat[1,2,3,*]
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Abstract:

Leonurus japonicus (*L. japonicus*) is widely used in folk medicine to treat diabetes, menstrual irregularities, and bronchitis. This study evaluated the *α*-glucosidase inhibitory and anti-inflammatory activity of the crude extract, semi-purified fractions, and isolated compounds from the aerial of *L. japonicus* through bioassay-guided isolation. The crude ethanolic extract was partitioned with ethyl acetate. Bioassay-guided fractionation of an EtOAc-soluble extract led to the isolation of six known compounds (**1-6**). Their structures were elucidated based on data analysis, including ^{1}H NMR data, LC-QTOF-MS, ECD, UV, and FT-IR. Compounds **1-6** exhibited *α*-glucosidase inhibitory and anti-inflammatory activities in range IC_{50} values at 143.9 - 598.4 µM and 66.9 – 285.8 µM, respectively, when compared with the positive control.

α-GLUCOSIDASE INHIBITORY ACTIVITY OF CHEMICAL CONSTITUENTS FROM *Premna herbarcea* Roxb. ROOT EXTRACT

Angkana Doungsanit[1-4], Passakorn Teerapongpisan[1,2], Wutthichai Jaidee[3,4], Virayu Suthiphasilp[3,4], Surat Laphookhieo[1-4], Rawiwan Charoensup[3,4], Tharakorn Maneerat[1-3,*]

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Abstract:

Premna herbacea Roxb. or Khao Yen Tai in Thailand, is used in the Ayurvedic traditional Thai medicine system as an ingredient formula for treating several ailments, especially diabetes. Nevertheless, the antidiabetic against α-glucosidase enzyme of chemical components from this plant remains unknown. In this study, four diterpenoid quininemethides were isolated and identified as known compounds: bharangin (**1**), bharangi-δ-lactone (**2**), salvilenone (**3**), and sapriolactone (**4**) from the EtOAc extract of *P. herbacea* roots. Their chemical structures were determined by analysis of spectroscopic methods and by comparison with literature data. Crude extracts and all isolated compounds were screened at a concentration of 200 μg/mL and evaluated the IC_{50} values in a series of concentrations for α-glucosidase inhibitory activity. Compounds **1**, **3,** and **4** showed significant inhibitory activity against α-glucosidase with IC_{50} values of 67.9, 30.9, and 44.4 μM, respectively, while compound **2** showed the weakest activity with an IC_{50} value of 282.5 μM.

STUDIES TOWARD THE TOTAL SYNTHESIS OF WALTHERIONE C

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Abstract:

Waltherione C is a member of the quinolone family. This compound is more active against the HIV virus than azidothymidine, which is a current anti-HIV drug. This project aimed to synthesize waltherione C from 2-amino-6-bromobenzoic acid, which is commercially available. Three steps were successfully performed, and they were 1) protection of the amino group, 2) formation of the Weinreb amide, and 3) the Grignard reaction. The desired products of each step were obtained in 61%, 30%, and 9% yields, respectively. Since most of the yields were low, the optimization of these steps will be required before protecting amine with carbamate in the next step.

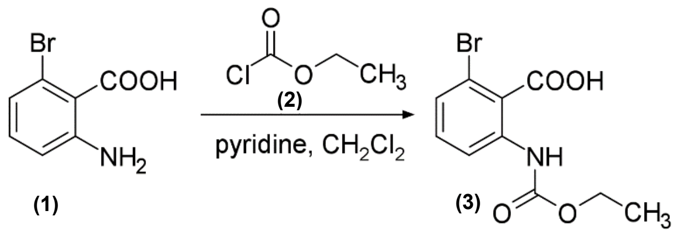

Figure 1. Synthesis of 2-bromo-6-((ethoxycarbonyl)amino)benzoic acid (**3**)

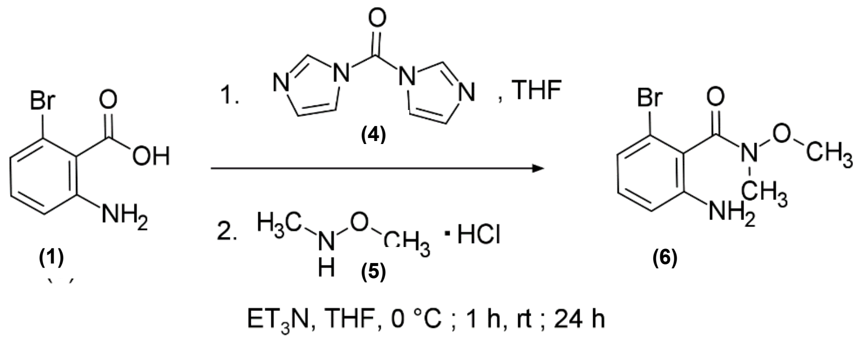

Figure 2. Synthesis of 2-amino-6-bromo-N-methoxy-N-methylbenzamide (**6**)

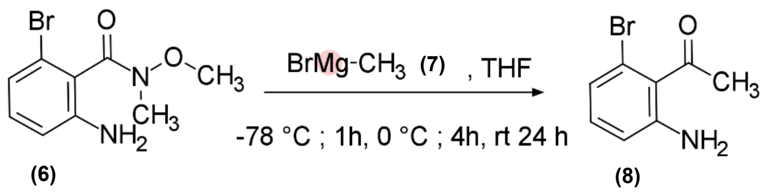

Figure 3. Synthesis of 1-(2-amino-6-bromophenyl)ethenone (**8**)

IN VITRO FREE RADICAL SCAVENGING AND α-GLUCOSIDASE INHIBITORY ACTIVITIES OF *Ludwigia adscendens* EXTRACTS

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Abstract:

The objective of this research was to study the *in vitro* free radical scavenging and α-glucosidase inhibitory activities of *Ludwigia adscendens* (phaeng phuai nam) extract. In the study, fresh shoots of *L. adscendens* were extracted with 95% ethanol. The crude ethanolic extract was then partitioned with ethyl acetate and water to provide ethyl acetate and aqueous extracts. The abilities of both extracts to scavenge DPPH radical and inhibit α-glucosidase were investigated. The preliminary isolation of active compounds based on bioassay-guided fractionation was performed. The determination of total flavonoids of crude extracts and their fractions was also studied. Sub-fractions of ethyl acetate extract and aqueous extract exhibited DPPH radical scavenging activity with IC_{50} values of 4.43-5.11 μg/mL and 10.38 μg/mL, respectively. At the concentration of 80.70 μg/mL, ethyl acetate and aqueous extracts inhibited α-glucosidase activity to a comparable level (98.16 and 97.75 %, respectively). A phenolic compound, ethyl gallate, was identified through preliminary study on the isolation of chemical constituents. Moreover, total flavonoid content in other active fractions was detected. Our findings provide basic information about active fractions; however, further research is required to identify bioactive compounds.

SYNTHESIS TOWARDS PANDURATINS H, PANDURATIN A AND THEIR DERIVATIVES

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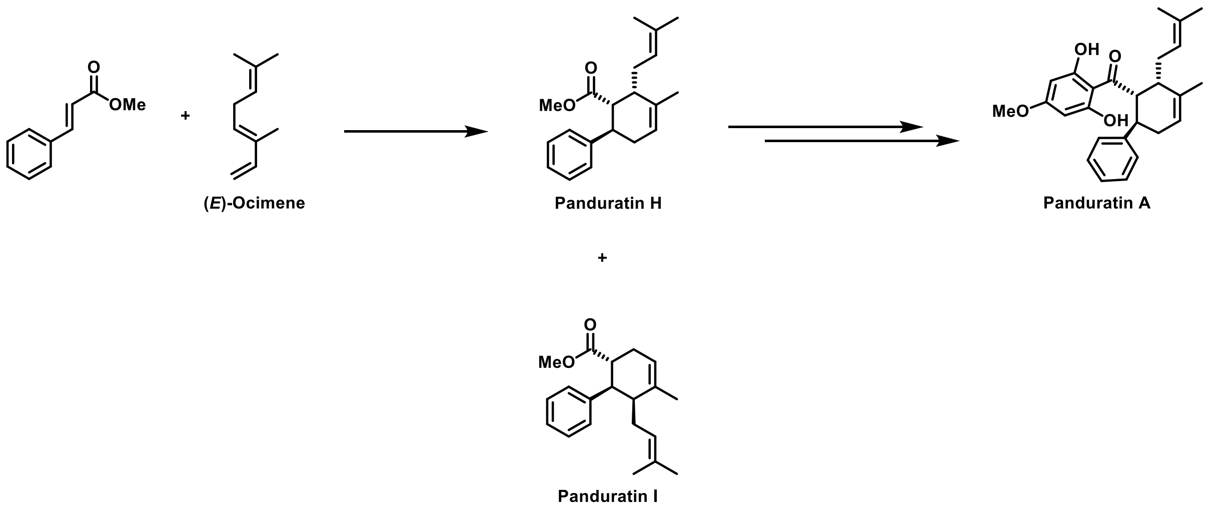
Natural products panduratin A and its derivatives such as panduratins H and I were reported to show a variety of biological activities, *e.g.* inhibition of dengue virus NS2B-NS3 protease, anti-HIV-1-protease, and cytotoxicity against androgen-independent human prostate cancer cells PC3 and DU, and human pancreatic PANC-1 cancer cells. Recently, biological activity of panduratin A as anti-SARS-CoV-2 agent was reported. Herein, synthesis of panduratins H and I *via* the Diels-Alder reaction between methyl cinnamate and (*E*)-ocimene was investigated. Transformation of panduratin H to panduratin A will then be studied. Antibacterial activity of the synthetic panduratins H, I and A will later be investigated.



Scheme 1. The synthesis of panduratins H, I and A.

ULTRASOUND-ASSISTED EXTRACTION OF PHENOLIC COMPOUNDS AND BETALAINS FROM *Beta vulgaris*

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Abstract:
Beetroot (*Beta vulgaris*) contains high amounts of polyphenols and red pigments, betalains. This study aimed to evaluate bioactive compounds including total phenolic compounds and betalains from beetroot extracted by distilled water with different amplitudes using ultrasound-assisted (UAE) technique. Total phenolic compounds and betalains were measured using spectrophotometrically at 765, 538 and 480 nm, while the antioxidant activities were determined using DPPH, ABTS and FRAP assays. The results showed that the 75%-amplitude UAE extraction in distilled water of 1:20 w/v ratio for 30 minutes provided the highest amounts of phenolic compounds. However, the amplitude of UAE did not affect betalain content. In addition, the content of phenolic compounds depended on the amplitude of the pulse condition of the ultrasonic wave. The phenolic compounds obtained under the condition of 75% amplitude with 1-minute pulse for 30 minutes was 991±88 mg GAE/100 g dried beetroot of total phenolic content, while the absence of pulse condition delivered 689±95 mg GAE/100 g dried beetroot. The IC_{50} values of radical scavenging activities of beetroot extract using this optimal condition of UAE were 1.50±0.03 and 10.64±0.42 mg/mL measured by DPPH and ABTP assays, respectively. Furthermore, the value of ferric reducing antioxidant power of beetroot extract was 34.6±1.80 μM TE/ g extract. In conclusion, UAE might improve the extraction of antioxidant compounds of beetroot.

SYNTHESIS OF OXIME-FUNCTIONALIZED CARBAZOLE FOR CHLORPYRIFOS DETERMINATION

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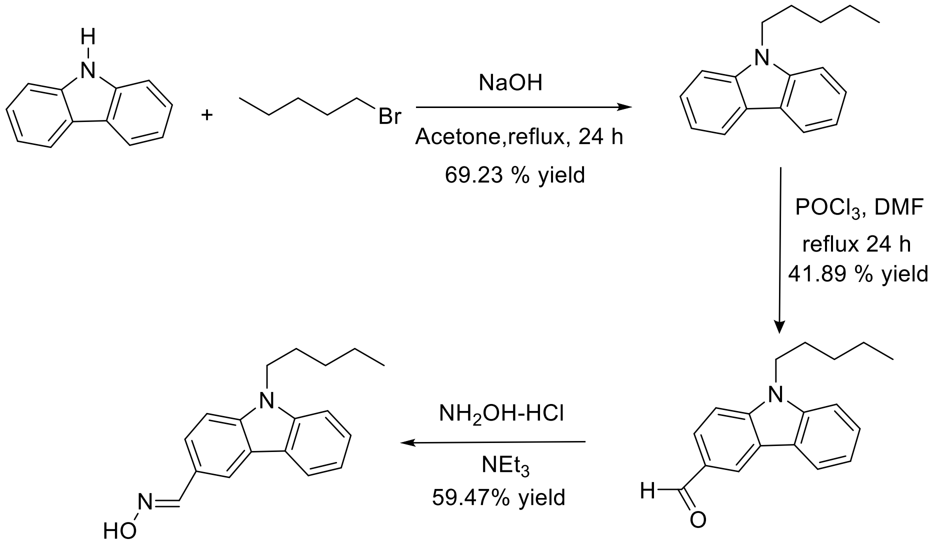
Abstract:
Due to the high demand for the crop productivity, agricultural chemicals have been used widely. One of those chemicals is organophosphates which exist in many derivatives. Chlorpyrifos, a member of organophosphorus compounds, was recently banned in Thailand due to the toxicity on humans, living animals and the ecosystem. The excessive use of chlorpyrifos can contaminate the ecosystem and affect the nervous system of humans when consuming agricultural products. Therefore, the synthesis of a fluorescent sensor containing an oxime group was conducted to determine chlorpyrifos. The sensor was synthesized in three steps, and the structure was confirmed by NMR and infrared spectroscopy. To study the sensitivity and selectivity of a new sensor, some organophosphates were chosen, such as cholrpyrifos, diazinon, dimethoate, chlorfenvinphos and malathion. The results showed the on-off fluorescence system of a new sensor during the detection of chlorpyrifos in basic buffer and the highly selective detection of chlorpyrifos over other organophosphates. The detection limit for chlorpyrifos was 1.38 μM or 485.2 ppb. The new sensor presented a promising utility for making a new test-kit.



Scheme 1 Three steps synthesis of carbazole oxime

Session C:
CHEMISTRY
(Physical & Theoretical Chemistry)

THEORETICAL STUDY OF THE FORMATION OF HYDROXYL GROUPS ON Pt-DOPED ZnO(10-10) FROM THE HETEROLYSIS OF WATER

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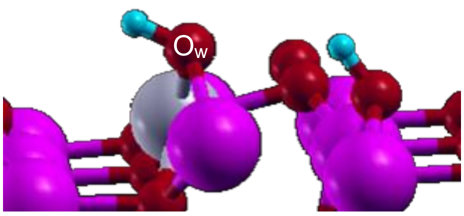
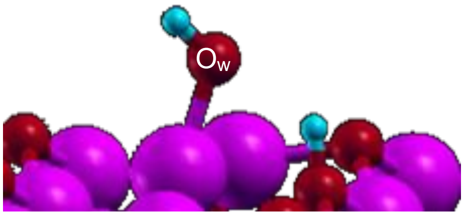
Abstract:

Gas sensors based on semiconductor metal oxides (SMOx) register changes in their electrical conductivity as a result of the interaction of certain species with the SMOx component. The interactions of these target analytes involve not only the bare SMOx, but also other gases that adsorb on its surface. Because gas sensors are typically exposed to the atmosphere, water is among these pre-adsorbed species. Upon adsorption on the SMOx surface, water may remain intact as H_2O or split into –OH and –H.

Our previous results suggest that hydroxyl groups on the surface of Pt-modified ZnO play an active role in its gas sensing mechanism. Herein, we report the results of our theoretical study of the formation of –OH from the heterolysis of water on Pt-doped ZnO(10-10) (Pt-ZnO). First, our band gap calculations revealed that doping with Pt at 9.37 wt% results in the occupation of the band gap of the pristine ZnO (p-ZnO) by the *d*-states of platinum. Second, using the nudge elastic band method, the heterolysis of water over Pt-doped ZnO was shown to be more favorable than over p-ZnO. Not only was the activation energy lower by 1.21 eV, but the ratio of the energies for the forward and reverse reactions $E_{a,f}/E_{a,r}$ was also lower: 0.74 for Pt-ZnO against 0.98 for p-ZnO. The lower $E_{a,f}/E_{a,r}$ for Pt-ZnO can be attributed to the bonding of the oxygen from water (O_W) with Pt and an adjacent Zn after splitting with one of its hydrogen (Figure 1a). In the case of p-ZnO, O_W bonded with only a single Zn (Figure 1b). These results indicate that platinum doped on the ZnO(10-10) surface can stabilize the adsorbed hydroxyl formed from the heterolysis of water.



(a)



(b)

• Zn • O • Pt • H O_W: oxygen from water

Figure 1. Optimized structures of (a) pristine ZnO and (b) Pt-doped ZnO with an adsorbed hydroxyl group following the heterolysis of water.

EFFECT OF RICE HUSH BIOCHAR ON THE REMOVAL OF Pb^{2+} FROM AQUEOUS SOLUTION

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Abstract:

Nowadays, lead contamination in water has become an environmental problem of worldwide concern due to its poisoning in humans cause severe damage to many organs or death. The use of organic amendments, especially biochar, can decrease the decrease of Pb^{2+} in aqueous solution. The aims of this work were to investigate the adsorption capacity and isotherm of Pb^{2+} by biochar prepared from rice husk (RH). The RH was combusted at 500 °C for 4 h. The maximum adsorption capacity at equilibrium (q_e) of Pb^{2+} equal 45.64 mg•g^{-1} was achieved when using RHBC adsorbent, Pb^{2+} concentration of 30 mg•L^{-1}, pH of 5, adsorbent dose of 0.25 g and contact time of 60 min. The isotherm adsorption was found to fit well with the Freundlich isotherm, indicating that the adsorption of Pb^{2+} onto RHBC adsorbent has a high degree of heterogeneity on the surface. The B_1 of Temkin isotherm indicated that the adsorption reaction was an exothermic process. The value of E obtained from D-R isotherm plot was 1.138 kJ•mol^{-1}, indicating that the adsorption process was a physical adsorption.

MOLECULAR DYNAMICS SIMULATION STUDY OF NEWLY DESIGNED GELDANAMYCIN ANALOGUES FOR TARGETED CANCER-CAUSING Hsp90 INHIBITOR

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Abstract:

Heat shock protein 90 (Hsp90) is one of the attractive molecular targets for the development of anticancer drugs because it contributes to cancer incidence or maintains cancer persistence based on the GDM derivatives such as alvespimycin (17-DMAG). Herein, using in-silico approaches, molecular docking was performed to gain insights into the binding between Hsp90 and our newly designed geldanamycin derivative, **F1**, compared with 17-DMAG. Moreover, to observe its physical movements and molecular interactions, molecular dynamics simulation was conducted for 200 ns using Amber20. The results show that **F1** is located in the active site of Hsp90 throughout 200 ns of simulations. Amine and amide groups of indole derivative substitution group at the C17 position of **F1** can interact with amino acid side chains outside the cavity of Hsp90 including Asp47, Asp50, and Ser46, leading to lower binding energy than 17-DMAG. This indicates that these substitution groups could play a significant role in the Hsp90 binding site and **F1** could be the potential anticancer drug.

Session D:
MATHEMATICS / STATISTICS / COMPUTER SCIENCE / DATA SCIENCE / AI

THE ENHANCEMENT OF TOURISM STAFF IN KHANOM FOR GOOGLE TRANSLATE APPPLICATION TO PROMOTE LOCAL TOURISM: NAKHON SI THAMMARAT

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Abstract:
This research aims to study the difficulties in the translation of tourism personnel in Khanom District. Learn about attitudes and acceptance of google translation technology. Learn about the basic readiness of using google translation applications. Study and analyze the feasibility of using the application. Google Translate of travel personnel in Khanom District and to provide guidance on how to elevate tourism personnel in Khanom district to use the application. Translate from Google to support secondary city tourism The sample is a tourism worker in Khanom District. 140 persons

The findings It found that the percentage of problem-solving conditions in translation of the most people was ignorance of vocabulary, 86.43% of english grammar, 72.86% and the least percentage of problems: embarrassment, fear and nervousness in Speaking English, 16.43%. Google's application attitude ($\bar{X}$ = 4.21), application usage feasibility ($\bar{X}$ = 3.85) and the elevated approach that people need to use the application ($\bar{X}$ = 4.12) are very high. Application Acceptance Section ($\bar{X}$ = 3.36) and application availability ($\bar{X}$ = 3.42) moderate

SOME CONTINUED FRACTIONS WITH PARTIAL QUOTIENTS 1 OR 2, AND RECURRENCE

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Abstract:

Guy [3] mentions that not every number n can be expressed as the sum of two positive integers $n = a + b$ where $\frac{a}{b}$ is written as a continued fraction with partial quotients 1 or 2 only; for example, $5 = 3 + 2$ and $\frac{3}{2} = [1;\ 2]$ and $7 = 5 + 2$ and $\frac{5}{2} = [2;\ 2]$. However, he does mention that 23 cannot be so expressed. We consider only bump sequences that are close to Fibonacci sequence in their continued fraction expansion. We can use basic recurrence techniques.

First, we show that $[1;1,1,\ldots,1] = \frac{F_{n+1}}{F_n}$, where F_n is the nth Fibonacci Number. Then, we consider $[2;1,1,1,1,\ldots]$, a *1*- Bump Sequence of continued fraction $[2;1,1,1,1,\ldots] = \frac{p_n}{q_n} = \frac{F_{n+2}}{F_n}$ is true for all positive integers. Next, we will consider $[1;2,1,1,1,\ldots]$, a *2*- Bump Sequence: $[1;2,1,1,1,\ldots] = \frac{p_n}{q_n} = \frac{(\frac{1+\sqrt{5}}{2})^n + \left(\frac{1-\sqrt{5}}{2}\right)^n}{F_n}$. Moreover, we consider $[1;1,2,1,1,\ldots]$ *3*- Bump Bumped Sequence. $[1;1,2,1,1,\ldots] = \frac{p_n}{q_n} = \frac{(\frac{7}{2\sqrt{5}}-\frac{1}{2})(\frac{1+\sqrt{5}}{2})^n - (\frac{7}{2\sqrt{5}}+\frac{1}{2})\left(\frac{1-\sqrt{5}}{2}\right)^n}{(\frac{\sqrt{5}}{2}-\frac{1}{2})(\frac{1+\sqrt{5}}{2})^n - (\frac{\sqrt{5}}{2}+\frac{1}{2})\left(\frac{1-\sqrt{5}}{2}\right)^n}\ ;n \geq 2$.

Finally, we consider $[2], [2;2], [2;2,2], \ldots$ obtaining the pattern
$\frac{p_n}{q_n} = \frac{\frac{\sqrt{2}}{4}(1+\sqrt{2})^n - \frac{\sqrt{2}}{4}(1-\sqrt{2})^n}{(\frac{1}{2}-\frac{\sqrt{2}}{4})(1+\sqrt{2})^n + \frac{1}{4-2\sqrt{2}}(1-\sqrt{2})^n}$.

Session E:
ENERGY / ENVIRONMENTAL & EARTH SCIENCE / MATERIALS SCIENCE / SPIN CROSSOVER

3D PRINTABLE HYDROGEL ELECTROLYTE FOR ZINC-ION BATTERY

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Abstract:
The increasing use of electronic wearable devices for diverse applications leads to demand for new energy storage, especially flexibility and wearable design. Zinc-ion batteries (ZIBs) are significant potential energy storage for such applications. However, the lack of stable and durable electrolytes for flexible ZIBs significantly limits their applications. Hydrogel electrolytes can challenge these limitations; however, it offers low ionic conductivity compared to conventional liquid electrolytes. Increasing porosity is one proposed approach to improve the ion mobility interconnect pathway. The 3D printing process is a versatile technology that can be applied to hydrogels. This research aims to develop 3D-printable flexible hydrogel from polyacrylamide and further use it as hydrogel electrolytes for ZIBs. The porosity pattern was designed and fabricated using digital light processing (DLP) 3D printing. The electrochemical properties showed that the highest area of CV curve and the lowest charge transfer resistance were accomplished by increasing the hydrogel porosity. The specific capacity of ZIBs was 161.4 mAh/g at 0.1 A/g with 40% porosity. The designed structure of hydrogel electrolyte fabricated from 3D printing technique effectively improves the electrochemical properties.

PETROGRAPHY OF XENOLITHS IN BASALT FROM THE CHANTHABURI-TRAT GEM FIELDS, THAILAND

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Abstract:
In the Chanthaburi-Trat basalts, xenoliths are composed of essentially ultramafic xenoliths (particularly spinel lherzolite) with a few of an aggregate of feldspar. Modal compositions of the ultramafic nodules vary with olivine (60-75%), clinopyroxene (20-30%), orthopyroxene (0-15%), minor spinel (1-3%) and plagioclase (<1%). The essential minerals form an equigranular, medium- to coarse-grained, granoblastic texture, and all are in mutual contact indicating attainment of equilibrium. Reaction rims are common along the nodule margins and in some are also present along grain boundaries. Zoning occurs in clinopyroxene, and to a lesser extent in orthopyroxene. The equilibration temperatures of these xenoliths are estimated to be in the range 973 to 1063°C. The general mineral assemblage of the lherzolite xenoliths and the absence of garnet indicate a pressure range of approximately 12–19kbar, which is equivalent to depths approximately of 38 to 60km.

GREEN SYNTHESIS AND CHARACTERIZATION FROM STEM BARK OF *Oroxylum indicum* MEDIATED AgNPs and AuNPs FOR ANTIOXIDANT AND ANTIMICROBIAL ACTIVITIES

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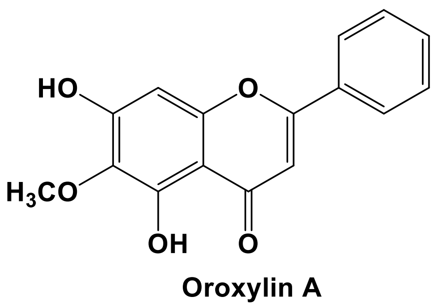
Abstract:
Nowadays, green-mediated synthesis of metal nanoparticles has been aimed to be useful for reducing waste by avoiding or minimizing the production of hazardous by-products. In terms of biosynthesis of metal nanoparticles, several phytochemicals including hydroxyl-rich phenolic compounds in plant extracts play a role as reducing agents for metal ions. *Oroxylum indicum*, also known as Pheka, is a traditional plant in Thailand. Considering the chemical constituents of stem bark extract, the TLC result was effective to prove the mainly components of *Oroxylum indicum*, namely Oroxylin A. Since the structure of oroxylin A was characterized by FTIR, ^{1}H NMR, ^{13}C NMR, HMQC, mass spectrometry and herein, we designed to synthesize silver and gold nanoparticles by using stem bark extracts of *Oroxylum indicum*. Among the phytochemicals exist in the stem bark extracts of *Oroxylum indicum*, phenolic compounds and flavonoids are shown to be involved in the reduction of Ag^{+} and Au^{3+} to Ag and Au, respectively. The plant-mediated silver (Oi-AgNPs) and gold nanoparticles (Oi-AuNPs) were characterized by UV-VIS spectrophotometer, Fourier Transform Infrared Spectroscopic (FTIR), Transmission Electron Microscope (TEM), and X-ray powder diffraction (XRD). Regarding the TEM showed the size of Oi-AgNPs and Oi-AuNPs at 15±3 nm and 5±1 nm, respectively. Moreover, the antioxidant activity of Oi-AgNPs and Oi-AuNPs were examined by DPPH assay. However, Oi-AgNPs showed higher antioxidant properties than Oi-AuNPs corresponded with the IC_{50} values of Oi-AgNPs and Oi-AuNPs at 11.8 and 137.9 ppm, respectively. For the antimicrobial activity, Oi-AgNPs were higher disinfectant activity than Oi-AuNPs against *S. aureus* and *E. coli*. Finally, the *Oroxylum indicum* synthesized silver (Oi-AgNPs) and gold nanoparticles (Oi-AuNPs) were further utilized as antioxidant and antimicrobial agents, indicating that Oi-AgNPs were more potentially effective.



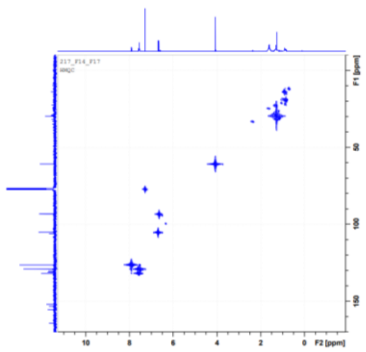


Figure 1. Structure of Oroxylin A (left) and HMQC spectrum of Oroxylin A (right)

A FACILE ONE-POT HYDROTHERMAL PROCESS OF ACTIVE AND DURABLE GOLD, SILVER AND CERIUM NANOPARTICLES-LOADED MESOPOROUS SILICA SBA-15 FOR THEIR CATALYTIC PERFORMANCES

Panod Lukkanavaraporn[1], Suchanun Phuangnak[1], Nattapat Kaewthong[1], Tin Vejruk[2], Thussanee Mananunsap,[2] Supakorn Boonyuen[2,*]
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*e-mail: chemistrytu@gmail.com

Abstract:
The preparation of gold, silver and cerium nanoparticle-embedded mesoporous silica SBA-15 containing Pluronic P123 as a triblock copolymer surfactant and tetraethyl orthosilicate (TEOS) as a silica precursor were conducted by a facile one-step hydrothermal preparation. For gold and silver nanoparticles, we designed to synthesize by using stem bark extracts of *Oroxylum indicum*, while cerium (III) nitrate hexahydrate [$Ce(NO_3)_3$ $6H_2O$] was used for cerium nanoparticles. A series of SBA-15-supported metal catalysts were prepared by a hydrothermal heating technique at 100ºC for 24 hours, followed by calcination at 500ºC for 12 hours. The bare SBA-15 and SBA-15-supported metal nanoparticles were characterized by Fourier Transform Infrared Spectroscopic (FTIR), Transmission Electron Microscope (TEM) and X-ray powder diffraction (XRD). Moreover, the effect of total metal loading and calcination in metal nanoparticles-encapsulated mesoporous silica were investigated active metal particles range from 0.1% to 2.0%wt by X-ray powder diffraction (XRD). For face-centred cubic (FCC) structure, the diffraction patterns and d-spacing values were related to the (111), (200), (220), and (311) of lattice planes which is the polycrystalline structure and proves the synthesis of gold and silver nanoparticles. In this research, we further planned to study the actively catalytic performances of catalysts toward the reduction of 4-nitroaniline and 4-nitrophenols that are highly harmful in pharmaceutical industrial wastewater at room temperature.

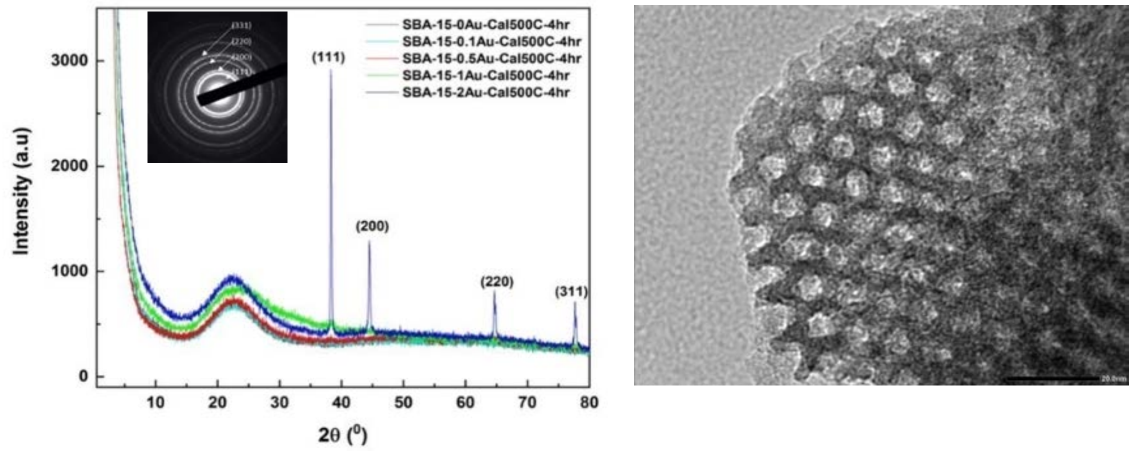

Figure 1. XRD of calcined SBA-Au samples (left) and TEM of calcined SBA-15-0.5Au samples (right)

IN-SITU DEVELOPMENT OF BORON DOPED g-C_3N_4 SUPPORTED SBA-15 NANOCOMPOSITES FOR PHOTODEGRADATION OF TETRACYCLINE

Lanlana Phumipatyothin[1], Chanapa Manakan[1], Itthiphat Phinphatphro[1], Paramasivam Shanmugam, [2] Supakorn Boonyuen, [2,*]
[1]SCIUS TU, Faculty of Science and Technology, Thammasat University, Pathum Thani 12120, Thailand
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Abstract
In this study, versatile boron doped graphitic carbon nitride (g-C_3N_4) incorporated mesoporous SBA-15 (B-g- g-C_3N_4/SBA-15) composite materials were prepared by a simple thermal polymerization method using boric acid, melamine as a precursor and SBA-15 as mesoporous support. The prepared B-g- g-C_3N_4/SBA-15 composites are utilized in a sustainable process using solar light as the energy source for the continuous flow of photodegradation of tetracycline (TC) antibiotics. This work highlights that the photocatalysts preparation was carried out with an eco-friendly strategy, solvent-free and without additional reagents. To alter the amount of boron quantity (0.12 g, 0.24 g, and 0.49 g) have to prepare three different composites using a similar procedure. The Physico-chemical property of the prepared composites was characterized by X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), Raman, diffraction reflectance spectra (UV-DRS), Photoluminescence (PL), thermos-gravimetric analysis (TGA), BET, scanning electron microscope (SEM), energy dispersive spectroscopy (EDS), and transmission electron microscopy (TEM). The obtained results indicate that B-g-C_3N_4/SBA-15 (0.24 g) composites degrade TC up to 95%, which is much higher than the rest of the catalyst. The mesoporous SBA-15 enhanced the surface area and the boron atom reduce the band gap, thus enhancing the photodegrading efficiency. Additionally, the stability and recycling efficiency of the representative photocatalysts viz., B-g-C_3N_4/SBA-15 (0.24 g) was observed to be good even at the fifth cycle. The photocatalysts can be continuously used to conduct the photodegradation of various organic dyes, pesticides antibiotics in a continuous mode of industrial-scale operation.

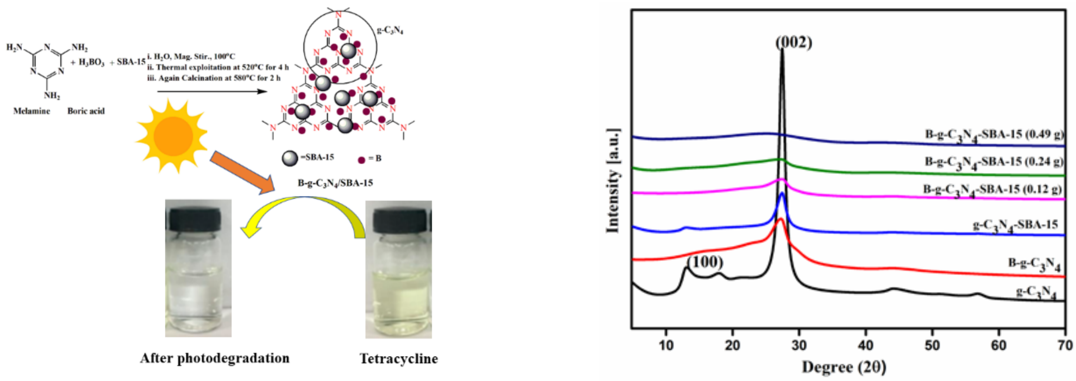

Figure 1. (a). Schematic representation of the preparation of B-g-C_3N_4/SBA-15 composites, (b). X-ray diffraction pattern of g-C_3N_4 and its B-g-C_3N_4/SBA-15 composites

DEVELOPMENT OF A CAPACITIVE DEIONIZATION STACK FOR BRACKISH WATER DESALINATION

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Abstract:
Capacitive deionization (CDI) as a promising desalination technology has attracted wide attention with a cost-effectiveness in brackish water treatment. In this study, we aimed to develop a scale-up CDI stack with a coconut shell-based carbon electrode to desalinate brackish water. The optimal operational parameters such as flow rate and concentration of NaCl solution were symmetrically investigated in terms of the CDI performances: salt removal efficiency (R) and salt adsorption capacity (SAC). The results demonstrated that a low flow rate caused an enhancement of the overall CDI performance due to a sufficient contact time for ions on the electrode surface. The initial feed concentration had a direct effect on EDL formation in terms of a high ion concentration gradient resulting in an increase in salt adsorption capacity. However, a reduction in salt removal efficiency was obtained with increasing of salt concentration. It was because of the fixed mass loading and surface area of the CDI electrode with 10 stacks. Finally, the data in this study can be used as guidance for further improvement of CDI system for practical applications in brackish groundwater desalination.

GEOLOGICAL CARBON STORAGE IN THE KHORAT PLATEAU, THAILAND

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Abstract:
The main carbon dioxide (CO_2) emission in Thailand comes from the energy sector. Gas-based power plants including natural gas and biogas are considered as CO_2 point sources and are mostly located in the Khorat Plateau. Geological CO_2 storage is an important key element to reduce CO_2 emissions from the CO_2 point sources. The study evaluates a geological CO_2 storage potential in the Khorat Plateau. A potential geological formation is screened and ranked in terms of its suitability for a CO_2 storage site. The results of the screening and ranking indicate that the Khorat Permian carbonate is the most suitable for a geological CO_2 storage, followed by the Khorat Group sandstone and Khorat evaporite. The Khorat Cenozoic basalts are not suitable for a geological CO_2 storage in the Khorat Plateau. The results from this study should help to understand carbon capture and storage technology in Thailand.

METAL-REDOX SYNTHESIS OF MnBi-BASED NANOPARTICLES

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Abstract:
MnBi alloy is a prominent candidate for rare-earth-free permanent magnet. However, chemical synthesis of the MnBi nanoparticles has been unsuccessful. This work prepares the particles using a metal-redox reaction with an alternative solvent. The as-prepared particles were characterized by many techniques including X-ray diffraction, energy dispersive X-ray spectroscopy, scanning electron microscopy, and X-ray absorption near edge spectroscopy. The obtained particles were quite uniform in size and shape, and their average sizes could be reduced by increase of a precursor molar ratio. The X-ray analyses suggested that the particles were composed of manganese oxides and bismuth which might incorporate in a core-shell structure.

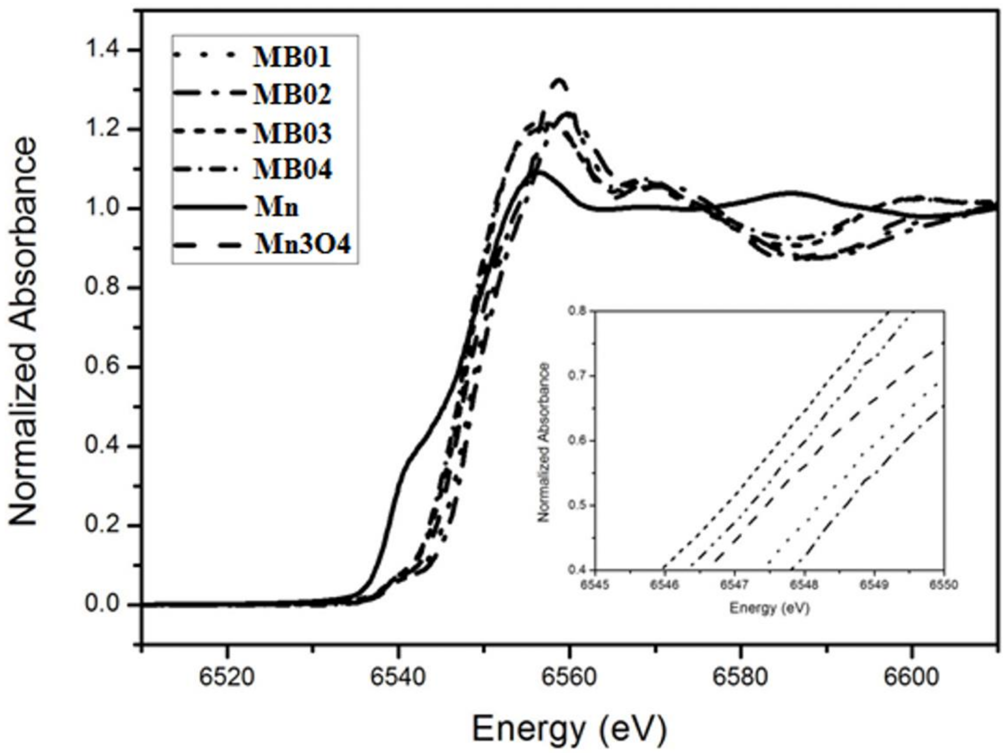

Figure 1.
Mn-K edge X-ray absorption of the samples compared with the standard Mn and Mn_3O_4. Inset shows contrast of the sample spectra compared to the Mn_3O_4.

FABRICATION AND CHARACTERIZATION OF 3D PRINTABLE LIGNIN-BASED HYDROGEL

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Abstract:
This research aimed to develop a UV-curable lignin-based hydrogel for UV-Assisted three-dimensional (3D) printing techniques. Recently, lignin-based composites have been developed, expecting their anti-microbial properties, particularly for wound dressing applications. However, with conventional fabrication methods such as solvent casting electrospinning, the products cannot be customized or personalized design. Thus, the 3D printing process became more attractive according to its advantages, particularly the customized and freedom design ability. Besides, 3D printing is an effective technique to fabricate high-shape-complexity products without molds. Herein, Lignin/acrylamide/bis-acrylamide hydrogel composites were prepared and 3D printed via Digital Light Processing (DLP) 3D printing technique. The properties of the obtained 3D printed hydrogel composites were then characterized, including the chemical structure, thermal properties and thermal stability, using the Fourier transform infrared (FTIR) spectroscopy, Differential scanning calorimetry (DSC), and Thermal gravimetric analysis (TGA), respectively. Moreover, the tensile properties of the hydrogel composites were also investigated. The lignin/acrylamide/bis-acrylamide showed excellent thermal and mechanical properties, suggesting the good potential for developing and using as modern wound dressings with custom shapes and functional properties.

GEOMORPHOLOGY AND LITHOLOGY OF THE PHU PHRA ANGKHAN CENOZOIC VOLCANO, BURIRAM PROVINCE, THAILAND

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Abstract:
The Phu Phra Angkhan volcano is located in Nang Rong and Chaloem Phra Kiat Districts, Buriram Province, northern east Thailand which is covered by Late Cenozoic basalts. The 3D analysis used ArcScene 10.6.1 and ArcMap 10.6.1 programs for analyses based on data from Google Earth satellite images, and a topographic map for defining the size, slop, and location of the crater, and volcanic cone height. Although the volcano is clearly an eruption crater that is relatively round, and the crater's location is almost at the center of the volcanic cone, the breakdown of the crater in the latest eruption can make the horseshoes shape crater. The drainage pattern is outward radial and annual drainage patterns. In addition, the volcano slope is asymmetrical, steep in the east side and gentle in the northwest side. The calculated overall top crater slope angle is 29° while the basal volcanic slope angle is 11.39° (Fig. 1). Field investigation this mountain was cover largely lava flow rock and minor of pyroclastic pumice and scoria. Petrographically, the lava flow rock samples show fine-grained porphyritic textures that the microphenocrysts consist of olivine, plagioclase laths, clinopyroxene, and opaque minerals and sit in trachytic plagioclase laths, clinopyroxene, opaque minerals, and minor amount volcanic glass groundmass. Geochemistry, Major oxides and some certain trace elements of lava flow rock samples are chemically classified as tholeiitic basaltic andesite and alkali basalt. The tectonic setting was interpreted based on the tectonic discrimination diagram as the within-plate basalt. The volcano is categorized according to its geomorphology as a dome volcano with a caldera that is assumed to be a fissure eruption from a mantle plume. This scientific data on the Phu Phra Angkhan Cenozoic Volcano is helpful for sustainable geotourism.

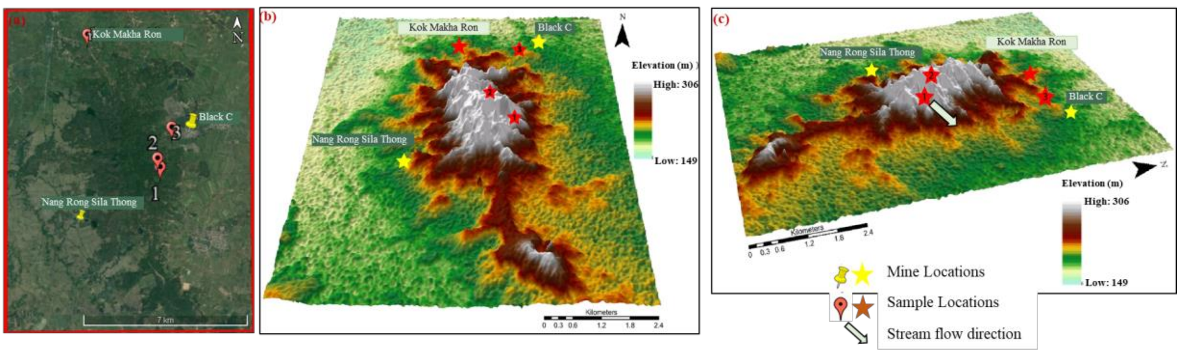

Figure 1.
(a) Satellite image of the Phu Phra Angkhan volcano and the 3-D model show field investigation location (b) N view and (c) E view

3D PRINTING OF PLASTICIZED POLYHYDROXYBUTYRATE/POLYLACTIC ACID/HYDROXYAPATITE

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Abstract:

In this work, we focus on the bio-composite filament fabricated from polymer blends between polyhydroxybutyrate (PHB) and polylactic acid (PLA) reinforced by hydroxyapatite (HA) and plasticizing with polypropylene glycol (PPG), targeting to be an alternative material utilized in a 3D printer for commercial PLA substitution. PHB/PLA blends containing various amounts of HA (10, 20, and 30 phr), with 10, 20, and 30 phr of PPG were interblended using a melt-extrusion process via a twin-screw extruder. Except for the blends with 10 phr of PPG, the blends with 20 and 30 phr of PPG are unable to be extruded. The thermal properties and flowability were first investigated to optimize the 3D printing conditions. The results showed that PPG could improve the processability during the filament extrusion and 3D printing process. The bio-composite with 10 phr HA and 10 phr PPG (HA-PPG 11) showed a flowing consistency, however, the flowability decreased with an increase in HA loading. Furthermore, the morphological and mechanical properties of the 3D printed specimens were investigated. HA-PPG 11 showed the greatest mechanical properties among the other bio-composite, which included impact strength (1.85 kJ/m^2), flexural modulus (3.20 GPa), and flexural stress at 2% strain (42.5 MPa); especially, elongation at break which is higher than commercial PLA.

EFFECTIVENESS ON THE STRATUM CORNEUM LAYER AFTER USING NANOEMULSIONS FROM HONEYSUCKLE FLOWERS ESSENTIAL OILS

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Abstract:

The objective of this research was to study the efficacy of a nanoemulsion containing honeysuckle essential oil on Tween 80 at a ratio (1:2) in 10 volunteers for 8 weeks. Stratum corneum measurements revealed that After using the nanoemulsion, wrinkles were reduced and the indentation index was at 9.621 ± 0.11, the deepest groove was reduced at 0.098 ± 0.19 mm, elevations were reduced at 8.54 ± 0.41 mm^3, roughness was reduced at 9.676 ± 0.24. It also resulted in increased hydration at 3.79 ± 0.85 uS, Transepidermal water loss (TEWL) was reduced at 2.1 ± 0.62 $g/m^2/h$, and the elasticity could be increased. The total value between skin tightening and recovery was at 11.4 ± 0.42 MPa. Young's elasticity modulus increased to 5.9 ± 0.05 MPa. Therefore, this nanoemulsion is effective in reducing wrinkles, roughness, and TEWL as well as stimulating the skin to be more hydrated and elastic. It is an alternative product for people who focus on skin care.

PREPARATION AND GAS SENSING PROPERTY OF MULTI-METAL OXIDE NANOCRYSTALS

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Abstract:

Semiconductor gas sensors detect low-concentration gases, but their characteristics are notable for high-temperature operations. In this study, we synthesize nanocrystals of ternary oxides containing Sn, In, and Zn (SIZ oxides) that improve gas sensing characteristics. We also synthesize SIZ oxides with Pt (Pt-SIZ) to increase their sensitivities at lower temperature.

The SIZ oxides were synthesized by hot soap method. Sn, In, and Zn acetylacetonate complexes (each 1mmol), 1,2-hexadecanediol (3mmol), oleylamine (1.5mL), and dibenzyl ether (15mL) were prepared. When we synthesized Pt-SIZ, 1mol% of Pt-oleylamine complex was added. Then, the mixture was heated at 220°C, and washed by centrifugation. After O_3 treatment, SIZ and Pt-SIZ sensors were fabricated by coating ink with α-terpineol. We calculated sensor response from the ratio of device resistance in the air and resistance in the target gas.

XRD patterns of SIZ and Pt-SIZ are shown in Figure 1(a). These peaks don't match theoretical peaks. Comparing the sensor response to several gases, SIZ oxides showed the largest response to acetone gas (Rair/Rgas=51,250°C). Figure 1(b). shows the result of the sensor response to acetone gas. We will elucidate the sensing mechanism and the effect of each metal species.

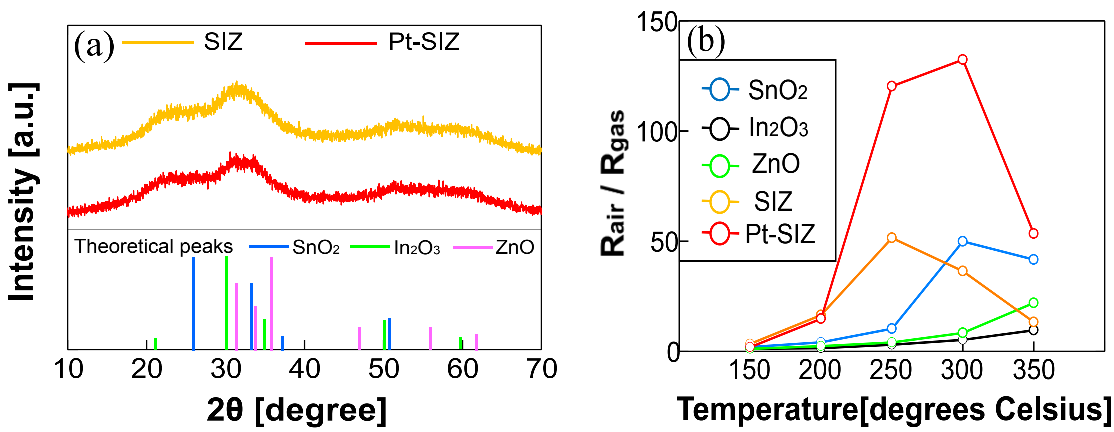

Figure 1. (a) XRD patterns of SIZ oxides and Pt-SIZ. (b) Sensor response of SIZ oxides, Pt-SIZ and single metal oxides (SnO_2, In_2O_3 and ZnO).

IN-SITU DRIFTS ANALYSIS OF ACETONE DETECTION MECHANISM OF Pt-DOPED SnO_2

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Abstract:

Acetone is considered to be a biomarker for diabetes and breath analysis is a common method as a non-invasive and rapid method. However, acetone is often in the ppm-level even for people with diabetes. Therefore, the use of semiconductor metal oxides are known to their high sensitivity to gases at low concentrations as a gas sensing material to detect acetone is proposed in this work.However, they operate at temperatures as high as 350°C. In this study, sensor devices are fabricated using tin oxide doped with 10 wt% platinum (10 wt% Pt-SnO_2) as a gas sensing material that works at low temperature.

The 10 wt% Pt-SnO_2 was prepared by the hot soap method, and the material was applied to an alumina substrate by screen printing. The sensor responses to acetone were investigated from room temperature to 350°C.

Sensor measurements were conducted for SnO_2 and 10 wt% Pt-SnO_2. The 10 wt% Pt-SnO_2 showed 2.5 times higher sensitivity than that of SnO_2 at 100°C. To elucidate the mechanism of acetone detection, we performed diffuse reflectance infrared Fourier transform spectroscopy (DRIFTS) coupled with electrical resistance measurements at 100°C. We found the IR peaks assigned to chemisorbed acetone (2967 cm^{-1}, 2934 cm^{-1} and 2900 cm^{-1}), acetate (1540 cm^{-1}, 1521 cm^{-1} and 1427 cm^{-1}) and methoxide (1170 cm^{-1} and 1065 cm^{-1}) on the surface of 10 wt% Pt-SnO_2. The results suggest that the mechanism involves the chemisorption of acetone on the surface of 10 wt% Pt-SnO_2 followed by the oxidation of chemisorbed acetone to acetic acid with a C-C bond cleavage. On the other hand, we found the IR peaks assigned to only chemisorbed acetone for SnO_2, indicating that oxidized surface species are responsible for sensor response and thus 10 wt% Pt-SnO_2 showed higher response.

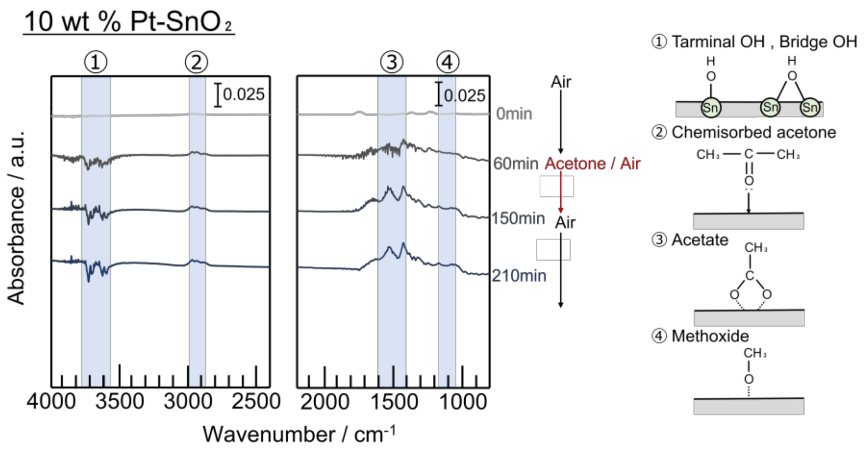

Figure 1. *In situ* DRIFT spectra of 10 wt% Pt-doped SnO_2 upon exposure to acetone (25 ppm) at 100 °C and surface species that are estimated from the IR peaks.

MILD TEMPERATURE OPERATION OF SnO_2-BASED VOC SENSORS UNDER LIGHT IRRADIATION

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Abstract:

SnO_2 has been widely used as a functional material for gas detection because of its high sensitivity and selectivity to volatile organic compound (VOC) gases. Its basic principle of operation involves the monitoring of changes in electrical conductivity, which are induced by the adsorption of target molecules on its surface. However, the high-temperature requirement (> 573 K) of SnO_2-based gas sensors remains as its major disadvantage.

Irradiation of metal oxides by light promotes the excitation of electrons to the conduction band leaving behind holes in the valence band. Previous studies have shown that VOCs act as scavengers of these photogenerated holes in metal oxides even at room temperature, resulting in a decrease in resistance across the material upon reaction. In this study, we propose the use of light irradiation to reduce the operating temperature of SnO_2 to detect ethanol.

Resistance measurements at room temperature were performed by passing air over SnO_2 for 1 hour, followed by ethanol (50 ppm in dry air) for 3 hours, and finally air for another 3 hours. The same procedure was conducted under white light irradiation and under dark conditions. Based on the response curves, the sensor response of SnO_2 under white light irradiation (Figure 1a) was 52 times higher than that under dark conditions (Figure 1b). Therefore, white light irradiation of SnO_2 promotes its ability to detect ethanol under room temperature.

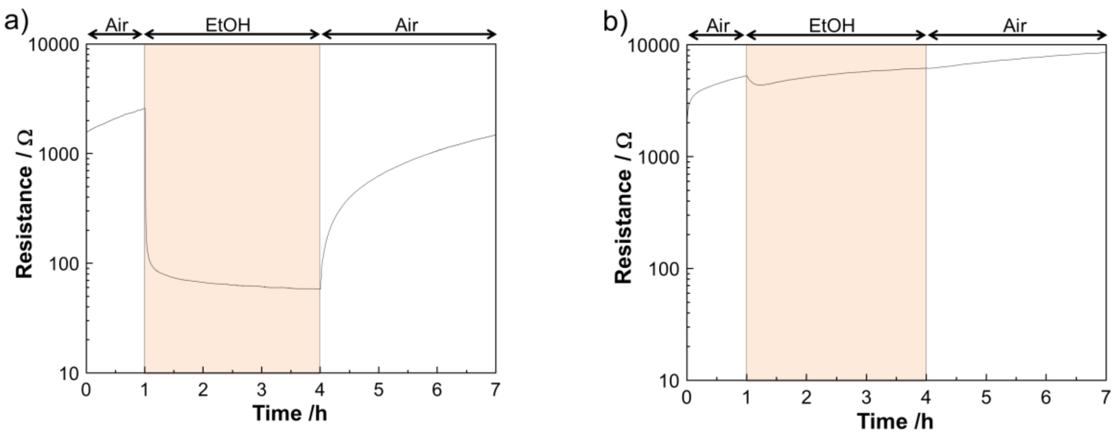

Figure 1. Gas sensing response curves of SnO_2 to ethanol (50 ppm, dry, 100 mL/min) under (a) white light irradiation and (b) dark conditions at room temperature.

AZIDE-ALKYNE CYCLOADDITION AS A COUPLING METHOD IN THE SYNTHESIS OF QUANTUM DOT SUPERLATTICES

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Abstract:
Quantum dots (QDs) are particles of semiconducting materials with diameters of 2–10 nm and compositions of only 10–100 atoms. As a result of quantum size effects, QDs exhibit spectral properties distinct from their bulk counterparts. QDs are considered to be promising fluorescent materials because of this feature, which are used in next-generation optical and electronic devices, such as solar cells and liquid crystal displays. In the current field of QD research, superlattices have gained interest because of the novel functionalities that emerge from the interaction between neighboring QDs in the superlattice. In this study, we propose the click reaction of a surface ligand, the copper-catalyzed azide-alkyne cycloaddition, as a coupling method between two QDs (Figure 1).

As a preliminary step, we synthesized *in-house* 3,5-diazidobenzoic acid (DAB) from 3,5-diaminobenzoic acid as an azide-terminated ligand and checked the click reaction between DAB and ethynylbenzene (model alkyne compounds) without QDs. To reduce polarity, DAB was esterified with methanol.From a nuclear magnetic resonance (NMR) analysis, we confirmed the cycloaddition between DAB and ethynylbenzene in the presence of a copper catalyst and the formation of triazole bonds (Figure 1).

Although we used model alkyne compounds for the click reaction, 3,5-diethynylbenzoic acid (DEB) will be synthesized as a coordinating alkyne on QDs. Furthermore, the coupling of DAB- and DEB-coordinated QDs will be tested.

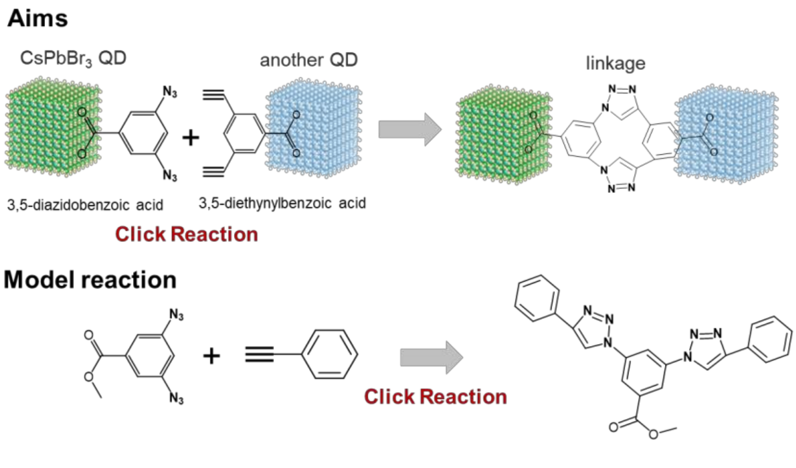

Figure 1. The click reaction between different QDs and and its model reaction.

IMPROVING THE CO SENSING PERFORMANCE OF SnO_2 AT MILD TEMPERATURES BY MODIFICATION WITH PALLADIUM

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Abstract:

Semiconductor metal oxides (SMOxs) are used as sensing materials in gas sensors because of their sensitivity to a number of chemical substances that are harmful to the human body, even at ppm-level concentrations. The response of SMOxs to the adsorption and desorption of certain gas species is easily quantified by measuring the changes in electrical resistance across the device. Among SMOxs for gas sensors, SnO_2 has been widely studied because of its excellent stability and low cost. Its main disadvantage, however, is that its operation requires a high temperature (> 300°C). Previous studies have shown that their working temperature decreases by adding other elements such as noble metals into the structure of SMOx. In this study, SnO_2 surface is modified with palladium (Pd-SnO_2) to enhance sensor response at a low temperature.

Pd-SnO_2 (1 wt %) was prepared by the hot soap method. Pd was atomically dispersed on the surface of SnO2 for scanning transmission electron microscopy (STEM) and XRD measurements. Electrical resistance measurements (100 °C) revealed that the sensitivity *S* of Pd-SnO_2 (S = 43.27) towards CO is higher than that of pristine SnO_2 (S = 4.27). The sensing mechanism of pristine SnO_2 (Figure 1a) and of Pd-SnO_2 (Figure 1b) on the detection of CO were compared at 100°C by *in situ* diffuse reflectance infrared Fourier transform spectroscopy (DRIFTS) observations. The measurements were conducted as follows; pretreatment in air for 60 min (100 °C), exposure to CO for 90 min (100 °C), and air for 60 min. *In situ* DRIFTS spectra of 1 wt % Pd-SnO_2 and SnO_2 are shown in Fig 1. As shown in the Fig 1, peaks assigned to CO adsorption (2050–2200 cm^{-1}) appeared only for Pd-SnO_2. Therefore, Pd plays a major role in improving the adsorption of CO on SnO_2 and thus it shows high sensitivity (100 °C).

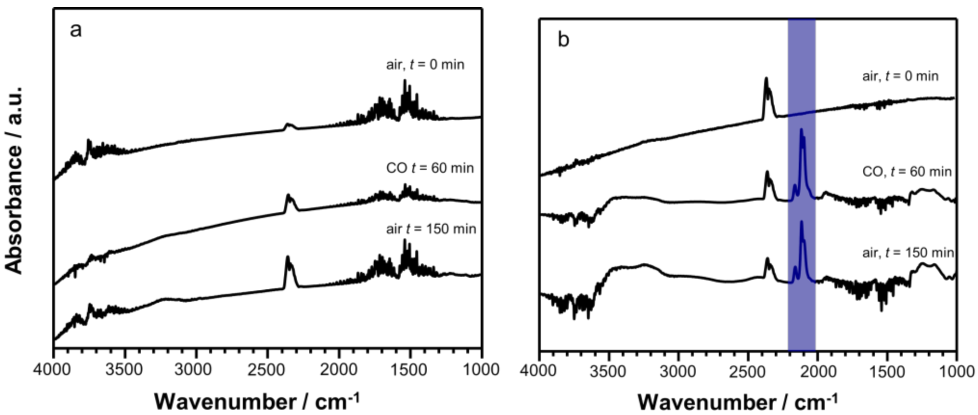

Figure 1. *In situ* DRIFT spectra of (a) pristine SnO_2 and (b) 1 wt% Pd-SnO_2 under CO gas exposure (50 ppm, dry, 100 mL/min) at 100°C K. Blue area indicates the peaks for CO absorption (2050–2200 cm^{-1}).

CARBON MONOXIDE DETECTION USING A PROTON-CONDUCTING GRAPHENE OXIDE MEMBRANE BASED SENSOR

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Abstract:
Gas sensors are an important technology for the quantitative detection of harmful gases. Electrochemical sensors based on solid electrolytes have high sensitivity, low cost, and ease of application compared to other sensing technologies. They are often used to detect combustible gases such as hydrogen, CO, and volatile organic compounds (VOCs). This device generates the sensor signal when cathodic and anodic electrochemical reactions occur simultaneously at the three-phase boundary (TPB) between the sensing electrode and the solid electrolyte. As the concentration of combustible gas changes, a semi-logarithmic relationship between the sensor signal and the gas concentration occurs, and the sensor response changes. In the past decades, mixed-potential gas sensors that respond to various toxic gases have been realized. However, conventional electrochemical gas sensors, such as yttrium-stabilized zirconia, operate at high temperatures and have high power consumption. To overcome these drawbacks, we report an electrochemical sensor based on proton-conducting graphene that can be used at room temperature.
A sensor device was fabricated to evaluate the gas sensor characteristics. In brief, Pt-SnO_2 (10 wt%) was applied to the detection electrode side of a GO membrane synthesized by Tour's method using the drop-cast method. Similarly, conductive carbon was placed on the reference electrode. The sensor response was observed from the change in voltage when the target gas flowed to the detector electrode side. The difference in the voltage (ΔV) increased when CO has flowed at room temperature, and ΔV changed depending on the concentration of CO (Figure 1a). The Pt-SnO_2 sensor responded to 10 ppm EtOH (ΔV = 20 mV), 200 ppm H_2 (ΔV = 90 mV), and 200 ppm CO (ΔV = 125 mV) (Figure 1b). The synthesized materials prove to be good as a selective room temperature sensor for harmful and poisonous carbon monoxide gas.

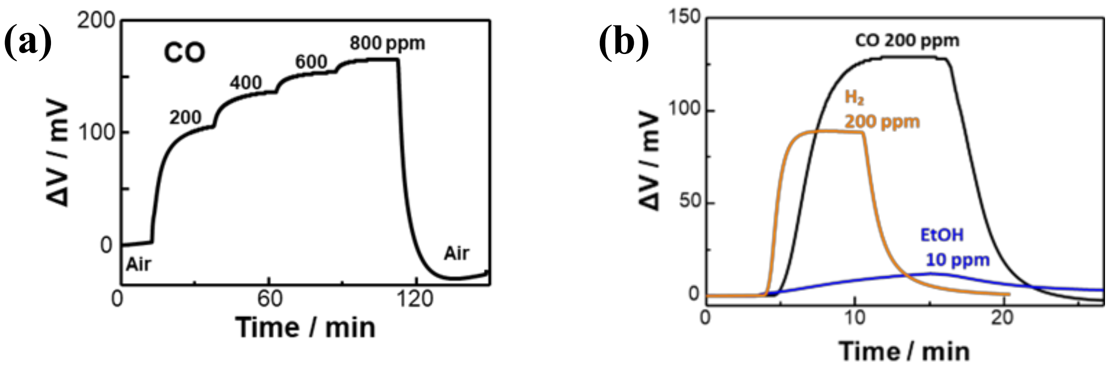

Figure 1. (a) Sensor responses of Pt-SnO_2 to CO at room temperature. (b) Sensor responses of Pt-SnO_2 sensor for CO (200 ppm), H_2 (200 ppm), and EtOH (10 ppm)

ELECTROCHEMICAL CO_2 REDUCTION TO FORMIC ACID OVER TIN DECORATED GRAPHENE OXIDE

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Abstract:
Urgent solutions are needed to efficiently convert the greenhouse gas carbon dioxide (CO_2) into a value-added product such as formic acid. In this work, Sn-loaded graphene oxide was employed as heterogeneous electrocatalysts to enhance the reductive CO_2 conversion. The graphene oxide was prepared by modified Hummer's, and Brodie's methods were used to synthesize graphene oxide (HGO) and epGO, respectively. SnO_2 nanoparticles were prepared by the hot soap method. Sn-loaded epGO (SnO_2/epGO) was prepared by mixing epGO with SnO_2 nanoparticles at 60°C for 12 h, followed by calcination at 700°C under an inert atmosphere. For comparison, SnO_2-supported nitrogen-doped GO (SnO_2/NrHGO) was prepared by the same method, while urea was used as a nitrogen source. The structure of catalysts was then investigated by various technologies such as XRD, TEM, and elemental mapping (EDS). Cyclic voltammetry and chronoamperometry measurements were performed to investigate the electrocatalytic activity and selectivity of the catalyst toward formic acid. In a practical CO_2 reduction test by a flow cell reactor, LSV (Linear Sweep Voltammetry) measurements were conducted. The Sn/repGO shows the highest Faradic efficiency (50.4% at -1.6 V) (Figure 1a). These results suggest that the uniform loading of Sn nanoparticles on epGO contributes to the high CO_2 reduction activity for Sn/repGO (Figure 1b).

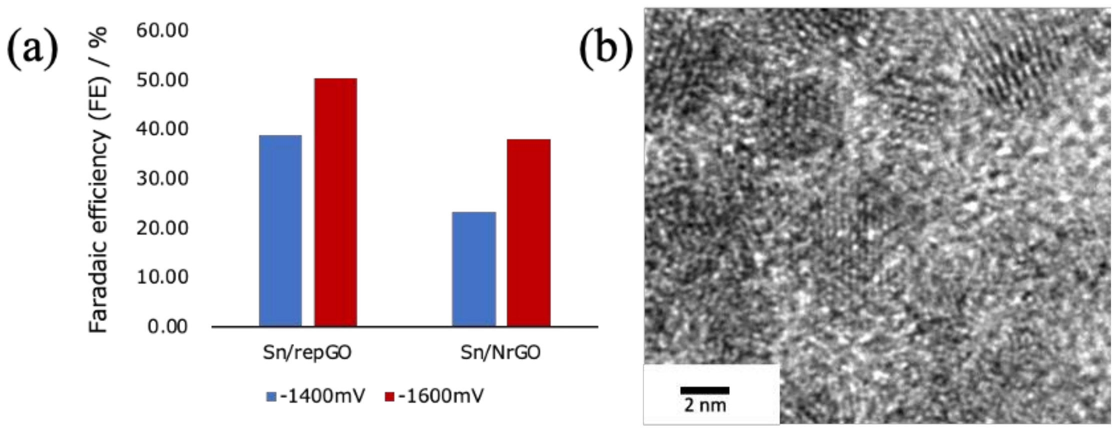

Figure 1. (a) Faradic efficiency of Sn/epNrHGO and Sn/epHGO for formic acid formation. (b) STEM of Sn/epHGO.

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FABRICATION OF TWO-DIMENSIONNAL NANOSHEETS BY SELF-ASSEMBLY OF ALKYNES AND PHOSPHONIC ACIDS

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Abstract:

Two-dimensional nanosheets are highly anisotropic two-dimensional materials with a thickness of less than 10 nm and a lateral size is hundred times larger than that thickness. Nanosheets are generally characterized by their high crystallinity and wide surface area, as well as their excellent electron mobility and unique physicochemical properties. Therefore, they has been investigated for applications to catalysts, electrodes, and electronic materials. In general, nanosheets are synthesized by bottom-up or top-down processes. The latter is possible large-scale synthesis. However, the synthesis process is multi-step, complex, and time-consuming. In this study, we aim to develop a simple and efficient bottom-up method for the synthesis of two-dimensional nanosheets by self-assembly of alkynes and phosphonic acids.

The AP-nanosheets were synthesized by dispersing 10-Undecynoic acid and Decyl phosphonic acid in a toluene solvent, mixing them thoroughly by vortex followed by drying the solution on a substrate.

The sheet structure was formed only when alkyne and phosphonic acid were mixed. From TEM observation, nanosheet structures were confirmed (Figure 1). Hexagonal arrangements were seen from high-resolution TEM image and its FFT patterns. As a future plan, we will check the effects of molecules on geometric structures and bond forming.

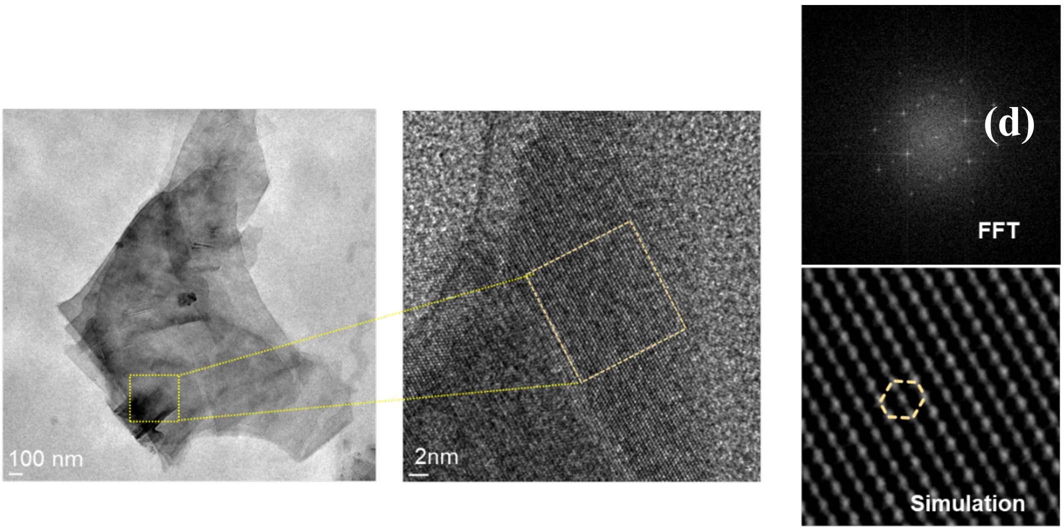

Figure 1. (a) TEM image of the nanosheets synthesized from alkyne and phosphonic acid and (b) its high resolution image. (c) FFT pattens and (d) simulation image of yellow part in figure 1b.

ASSESSMENT OF EARLY-STAGE OF SOIL EROSION: EVIDENCE FROM STABLE CARBON ISOTOPE AND PARTICLE SIZE DISTRIBUTION

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Abstract:
The loss of top soil and soil organic carbon (SOC) in mountainous arable land are a crucial concern on environmental issue worldwide. It was documented that redistribution of SOC in hilly land was strongly associated with soil erosion and deposition. However, researches currently in Thailand concerning the relationship between soil erosion-deposition and SOC using stable carbon isotope signatures have been rarely carried out. The objectives of this present study were (1) to determine stable carbon isotope signatures ($\delta^{13}C$) of SOC and soil particle size distribution (PSD) in the soil cores and (2) to assess the early-stage of soil erosion by using $\delta^{13}C$ signatures of SOC or an eroded materials together with soil PSD as a sediment migration. Soil cores at 30 cm depth were conducted in 2019 at hilly land maize field located in Mae Ramat district, Tak province, Thailand. A total of 100 soil samples were collected using transect-based technique in 4 line transects down the slope of 250 meters distances. Results revealed that $\delta^{13}C$ of eroded SOC together with soil PSD in maize field were unsteady state and found to be positively correlated. The spatial patterns of $\delta^{13}C$ signatures and soil PSD values shown slightly fluctuated up and down in both horizontal and vertical direction in all plots. In one year studied also found the relationship between rainfall events and $\delta^{13}C$ of eroded SOC. A complex interaction factors of early-stage erosion in the study area might be wind and rainfall events which influencing on erosion dynamic in both magnitudes and directions. The overall results indicated that $\delta^{13}C$ signatures of SOC, the eroded sediment, are useful for estimation of the spatial distribution of initial stage of soil erosion and deposition.

EXPERIMENTAL HEAT TREATING OF YELLOW JADEITE JADE FROM MYANMAR

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Abstract:
Jadeite has been one of the popular gemstones in the gems and jewelry market because of its distinct toughness and various colors. In this study, twenty yellow jadeite beads from Myanmar were experimentally heat treated to change their color and characterized gemological properties using gemological standard methods, and some advanced techniques. Specific gravities of the samples were in the range of 3.31 to 3.33. The refractive index tested by spot reading method was in the range of 1.64-1.67. They were inert under short-wave and long-wave UV radiation. The samples were heated at a maximum temperature of 400, 450, 500, and 550°C in oxidizing conditions and soaking time for 1 hour at each temperature. The result of the heating experiments revealed that the optimum temperature to change from yellow to red color without transparency decreasing was between 450°C and 500°C. Chemical composition analysis using WD-XRF showed major elements of Na, Al, and Si while trace elements comprised Fe and Ca. The mineral compositions of the studied samples analyzed by XRD before and after heat treatment consisted mainly of jadeite, hematite, and goethite. The hematite content was likely to increase after heat treatment when the sample's color changed from yellow to red. FTIR absorption spectra showed the characteristic peaks in the range of 3200-3600 cm^{-1} which related to the mineral compositions of natural jadeite. The UV-Visible-NIR absorption spectra exhibited a broad absorption between 400 - 490 nm due to Fe^{3+} ion. After heating, the yellow samples changed to red or reddish brown, and the absorption between 400 - 490 nm was intensified.

OPTIMUM METHOD AND CHARACTERIZATION OF MODIFIED LEONARDITE WITH K_2CO_3-CARBON COMPOSITE FOR POST-COMBUSTION CO_2 CAPTURE

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Abstract:
Global warming is mainly caused by the continuous increase of CO_2 concentration from the large-scale use of fossil fuels into the atmosphere. To circumvent this problem, that is crucial to develop an efficient carbon capture associated with low energy consumption. This research presented the utilization of leonardite as a carbon based-solid material for post-combustion CO_2 capture. In addition, an optimum method of the modified leonardite by K_2CO_3-carbon composite for CO_2 capture via surface adsorption and carbonation reaction was proposed. The control of the calcination temperature was important for obtaining the sorbents with a high CO_2 capture capacity. As a result, the CO_2 capture capacities of the sorbents were decreased as the calcination temperature increased from 500 to 700 ˚C owing to the decomposition of the active material (dipotassium terephthalate) through the formation of the alloy species which were produced through the reaction of dipotassium terephthalate with SiO_2 contained in leonardite. For CO_2 adsorption activity at 25 ˚C and 1 atm, the modified leonardite which was calcined at 500 ˚C (LKC-CC30-500) exhibited CO_2 capture capacity of 10.9 mg CO_2/g sorbent, compared to 7.10 and 5.30 mg CO_2/g sorbent of the LKC-CC30-600 and LKC-CC30-700 sorbents, respectively. Furthermore, Barrett-Joyner-Halenda analysis showed that LKC-CC30-500 sorbent was mesoporous material with an average pose size of 9.54 nm. Consequently, leonardite can be used as a carbon based-solid material in the design of potassium-based sorbents for post-combustion CO_2 capture by controlling the amount of inactive component formed in the calcination process.

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

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Abstract:
Fossil fuels are used in many aspects of everyday life and are necessary for people's lives. Another attractive feature of fossil fuels is that they are not expensive. For their low cost, they can be efficiently converted into energy. 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. (**Fig. 1)** 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.

(a)

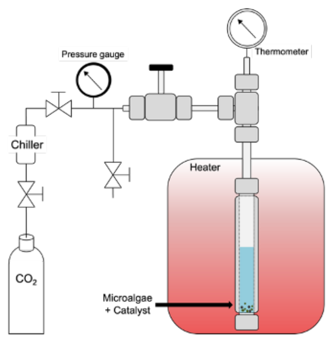

Figure 1. (a) Schematic diagram of HTL apparatus.

STABLE CARBON ISOTOPE TECHNIQUE FOR ESTIMATING SOIL ORGANIC CARBON IN RICE-CORN ROTATION AND CORN MONOCROPPING

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Abstract:
Soil organic carbon **(**SOC**)** is a significant component that plays an important role on soil fertility and crop sustainable production. The aim of this study was to investigate SOC in soil profiles of rice-corn rotation and corn monocropping using stable carbon isotope of SOC ($\delta^{13}C_{SOC}$) technique. The soil samples were collected from two plots of rice-corn rotation and corn monocropping fields. Soil core sampling of 25 soil cores down to a depth of 30 cm for each plot were carried out at Tak province during 2018-2019. Each soil core was cut into 0-5 cm, 5-10 cm, 10-15 cm, 15-20 cm, 20-25 cm, and 25-30 cm depth layers that were air dried, pulverized and sieved through a 200-mesh sieve. The results revealed that the values of $\delta^{13}C_{SOC}$ for each soil profile were gradually increasing with soil depth. The $\delta^{13}C_{SOC}$ in rice-corn rotation ranged from -28.41‰ to -23.72‰ while corn monocropping were -24.59 ‰ to -15.83‰. Since $\delta^{13}C_{SOC}$ levels were negative correlated to SOC. In this investigation, therefore, SOC decreased with increasing soil depth in both the rice-corn and corn fields. However, the higher SOC contents were observed in rice-corn rotation rather than corn monocropping fields. It was found that SOC contents were higher in soil with rice straw retention than without rice residues. Consequently, the rotation of rice-corn practice is a potential to retain organic carbon in soil compared to corn monocropping.

APPLICATIONS OF GLYCEROL IN THE BIODIESEL MARKET

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Abstract:
In recent years, attention has focused on the development of sustainable renewable energy sources in order to achieve the SDGs by 2030 and a carbon-neutral society by 2050. In this context, biodiesel is seen as a promising renewable energy source. However, synthesizing biodiesel produces a large amount of glycerin as a byproduct, which increases the environmental burden. In this study, glycerol tert-butyl ether (GTBE), another useful chemical that can be used as an additive to improve the properties of biodiesel, is synthesized from glycerin.
The positive synergistic effect of microwave irradiation and graphene oxide catalyst is exploited. Graphene oxide (GO) prepared by the Hummer's or Tour's method was used as the catalyst. The prepared GO was characterized using FT-IR, TGA, BET, TPD and XRD analysis. Next, the effects of reaction temperature, reaction time and catalyst loading on GTBE yield, and carbon dioxide addition on yield and selectivity were investigated. The optimal reaction temperature was 110°C, reaction time was 1 hour, and catalyst loading was 11.9 wt%. The addition of carbon dioxide was found to improve the yield and selectivity, and further investigation is required. Tour's GO was found to have higher catalytic performance than Hummer's GO due to its higher surface acidity. However, Hummer's GO was found to exhibit higher catalytic performance under higher temperature conditions, which was attributed to its higher thermal stability than Tour's GO, as observed from TPD-NH3 analysis.

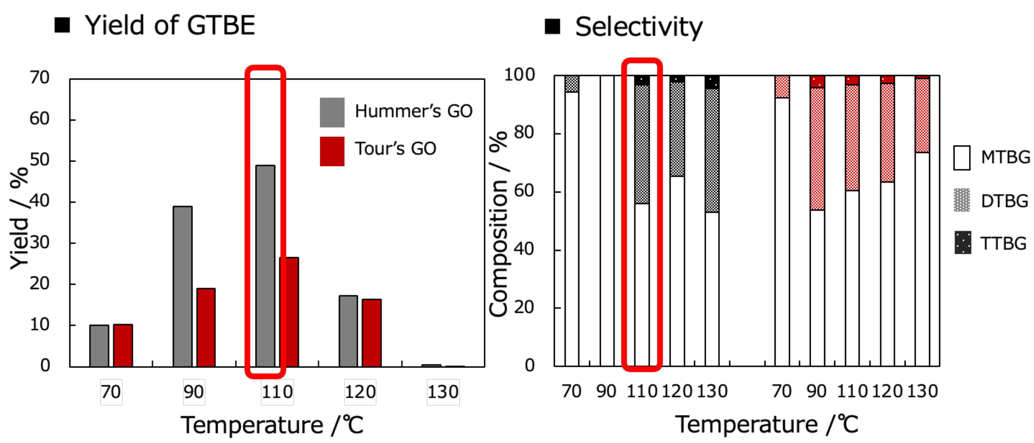

Figure 1.
Yield variation with temperature for different catalysts
(Gly:0.24 mol, TBA:0.04 mol, GO:0.5g, reaction time 60 min, max microwave power 500w)

POLY (ACRYLIC ACID)-BASED NANOCOMPOSITE HYDROGEL AS A UREA SENSING PATCH

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Abstract:
Poly (acrylic acid) (PAA) nanocomposite hydrogel was fabricated by γ-irradiation crosslinking of PAA, graphene oxide (GO), and cellulose nanofiber (CNF) to serve as a sensing patch for non-invasive dual detection of urea in sweat. In this work, CNF helped improve the mechanical properties of the hydrogel whereas GO played a key role in enhancing the detection signal of urea in laser desorption/ionization mass spectroscopy (LDI-MS) and increased the hydrogel functionalities. The hydrogel possessed high water-sorption capacity and transparency suitable to accommodate coloring reagents and enzymes for colorimetric sensor application. The sensor exhibited vivid color change towards the increase of urea concentration in a linear range of 40–80 mM covering a cut-off value (60 mM) for chronic kidney disease (CKD) indication. Furthermore, the hydrogel could be directly applied as a substrate for the direct quantitation of urea by LDI-MS. LDI-MS verified that GO/CNF/PAA hydrogel could act as a direct matrix for promoting urea ionization and these results corresponded well with the colorimetric sensor. Hence, this hydrogel patch might be a potential material to be applied in the non-invasive dual detection of CKD in medical diagnosis.

CHEMICAL PRE-TREATMENT ON CARBONIZATION OF CORN COB AGRICULTURAL WASTE FOR SUPERCACACITOR ELECTRODE

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Abstract:

Agricultural wastes are considered as the extensive sources to produce carbon-based materials using as electrode materials for energy storage due to a high surface area, an enormous microporous structure and a suitable electronic property. Especially in Thailand, corn is one of the major of cultivated area in Asia to produce corn and corn-derived products. An abundant agricultural waste from corn cob is produced. Thus, the increase the value-added product form corn cob agricultural wastes by converting to activated carbon is much attention. In this study, the precursor of ground-up maize cob powder was pre-treated with three different types including of DI water, potassium hydroxide (KOH) and sulfuric acid (H_2SO_4). The precursor was chemically pretreated at 60 °C for 1 h and then impregnated with the solution of $ZnCl_2$ activator. The carbonization process was employed by tubular furnace operating at 700 °C for 2 h. As results, the using of H_2SO_4 pre-treatment exhibited the favorable specific capacitance of 151.0 $F.g^{-1}$ at 1 $A.g^{-1}$, which greater than that of the using KOH and DI water pre-treatment. Additionally, the obtained activated carbon revealed an excellent rate performance of 80% capacitance retention from 1 to 10 $A.g^{-1}$. These results indicated that the utilization with acidic pre-treatment can be applied for the producing of energetic carbon electrode in supercapacitor applications.

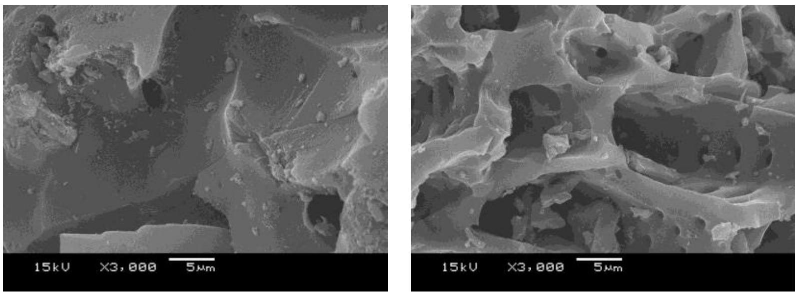

Figure 1. SEM images of bare water-based (left) and H_2SO_4-based activated carbon

SUPERHYDROPHOBIC COATING ON STAINLESS STEEL MESH FOR ANTI-BIOFOULING

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Abstract:
Superhydrophobic stainless steel mesh with diameter of 120 micrometer was fabricated by dip coating method. Prior to the coating, stainless steel mesh was treated with hydrogen peroxide. Metal oxide nanoparticles at various amounts were dispersed thoroughly with 1H,1H,2H,2H-perfluorooctyltriethyl silane (PFOTES). The coatings were characterized using water contact angle measurements and a scanning electron microscope All coatings demonstrated a superhydrophobic surface with water contact angle higher than 150°. The anti-biofouling performance was investigated by dynamic mode with the circulation of culture media containing ***Escherichia coli*** for 35 days. The coating with zinc oxide nanoparticle dispersion showed the lowest adhered bacteria compared to the uncoating and titanium dioxide coating. Analyses of metal leached in solution show that after 35 days of circulation, the amount of zinc released is negligible.

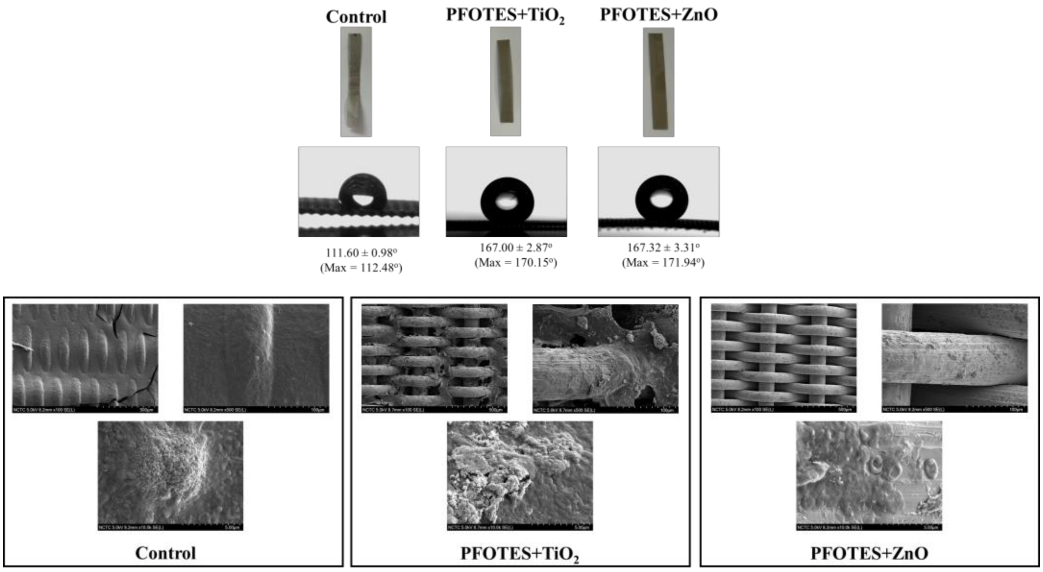

Figure 1.

SYNTHESIZED OF SILICONE URETHANE ACRYLATE POLYMERS AS 3D PRINTING MATERIALS

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Abstract:
The viability of synthetic silicone urethane acrylate as an alternative 3D printing material is examined in this study. The chosen synthetic materials were isocyanates, polydimethylsiloxane (PDMS), and acrylic monomer. Polyethylene glycol diacrylate (PEGDA) and hydroxyethyl methacrylate (HEMA) acrylic monomers were examined in combination ratios at various weights as cross-linkers. The Masked stereolithography (MSLA) 3D printing technology was used to test the printability of synthetic resin. According to results from Fourier transform infrared spectroscopy (FT-IR) and nuclear magnetic resonance spectroscopy (NMR) characterization, the silicone urethane acrylate was effectively produced. The addition of combination cross-linker at 30% were successfully printed using the same printing condition. The resins with a 70:30 ratio of PEGDA and HEMA showed the possibility of usage as printing materials; however, the mechanical performance of materials should be studied in further study.

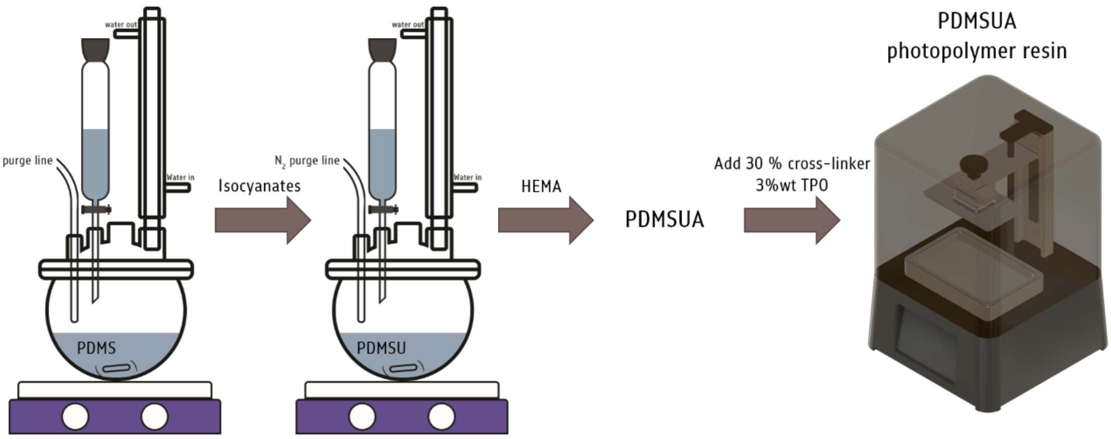

Figure 1.
The synthesis of silicone urethane acrylate resin for using as 3D printing material

POLYURETAHNE ACRYLATE/CARBON NANOTUBE COMPOSITES FOR STRAIN SENSOR APPLICATION VIA 3D PRINTING

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Abstract:
Flexible strain sensors are gaining more attractive interests in wearable electronic devices, particularly for human motion detection and utilization in soft robotic industry. 3D printing is a notable technology to fabricate the strain sensor with customizable and specific functionality desired. This study developed UV-curable electrically conductive composites from flexible polyurethane, carbon nanotube and polypyrrole (FPU/CNT/PPy). The electrically conductive composites were fabricated using Digital Light Processing (DLP) 3D printing process and the strain sensing performance of the obtained 3D printed composites was then examined. It was found that a high gauge factor of 91.9 at 20 percent strain was achieved with high durability in 100 stretching-releasing cycles. The printing ability shows high accuracy of 85%. Moreover, high sensitivity of small deformation was observed during the stretching-releasing process during time dependence testing. A slight motion of the human finger and high complex spring movement were successfully detected with the pattern of relative resistance changing. The electrically conductive composites developed in this study exhibited the ability to reach the field of strain sensing and can be further applied to other fields, such as healthcare and soft robotics.

THE OXIDIZING OF H_2O AND H_2O_2 ON TETRAKIS(DIMETHYLAMINO) TITANIUM ADSORBED SILICON (100) SURFACE OF THE INITIAL SURFACE OF TIO_2 THIN FILM GROWN BY ATOMIC LAYER DEPOSITION PROCESS; A DFT STUDY

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Abstract:
Atomic layer deposition (ALD) is a thin film deposition technique that produces the film by sequential self−limiting surface reaction. To form a monolayer, metal oxide precursor and reactive gas (oxygen source) are introduced to the reactor alternately, called ALD cycle. By repeating ALD cycle, the film is very smooth and uniform, without pinholes on complex shape of substrates. The film thickness and composition were precisely controlled at the atomic level. Nowadays, the semiconductor industry is heavily reliant on ALD technology because of miniaturization, which the size of modern semiconductor chips continues to decline. Enormous reports of both experimentation and simulation have been reported to develop an ALD process. The precursor is considered to be the key of the process development. The understanding of the reaction mechanism of the precursor on the initial surface reaction is very important. In this paper, we simulated the reaction mechanism of ALD grown TiO_2 thin film using tetrakis(dimethylamino) titanium (TDMAT) as titanium source. The molecules of H_2O and H_2O_2 were used as an oxidizing agent (oxygen source) in the reaction step of ALD. The $(SiO)_2$ $=Ti[N(CH_3)_2]_2$ cluster is used to represent the adsorbed specie of TDMAT on silicon (100) surface. The reaction mechanisms of H_2O and H_2O_2 oxidizing on this surface were investigated for comparison. Density functional theory (DFT) with the B3LYP method is used to calculate the reaction characteristics via the Gaussian program. The theoretical results, including geometry characteristics, energy profiles and infrared (IR) vibrational characteristics were compared to the previously experimental reports and discussed.

MINERALOGY AND GEOCHEMISTRY OF CENOZOIC BASALTS ALONG NATIONAL HIGHWAY NO. 225, WICHIAN BURI DISTRICT, PHETCHABUN PROVINCE

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Abstract:
Phetchabun Basin is located in the lower northern part of Thailand and presents many interesting geological features, including Cenozoic columnar basalt, national geopark, petroleum, and other geological resources. Along national highway number 225 area, the outcrop appeared by new road cut. A distinctive point of the outcrop is the large porphyritic texture of basalt. This work aims to identify rock names and magma series as well as classify phenocrysts of basaltic rocks. The methodology comprises petrography, geochemistry analyzed by Handheld ED-XRF, and mineralogy of phenocrysts studied by SEM-EDS. Petrography classifies the rocks as porphyritic olivine tholeiite basalt, consisting of plagioclase (andesine), olivine, and clinopyroxene with a small amount of orthopyroxene opaque minerals. According to the geochemistry of phenocrysts, the plagioclases are classified as andesine-bytownite (An_{33-70}), and olivine is hyalosiderite (Fo_{57}). Major oxides and trace elements classify magma series as sub-alkali, including tholeiite and calc-alkali. So, the results show that these basaltic andesites were generated from transitional tholeiitic magma and erupted in continental rifting process of the Phetchabun Basin.

FACTORS AFFECTING BUDBURST DATE OF ALASKA BIRCH (*Betula neoalaskana*) IN ALASKA

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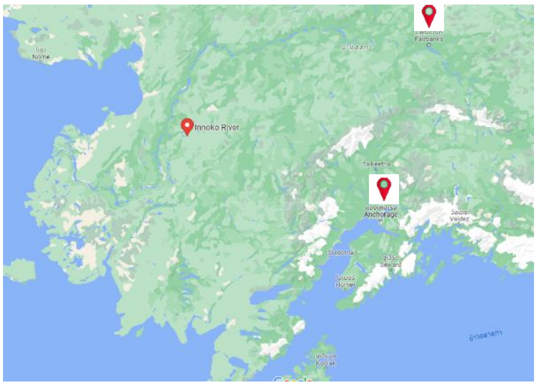
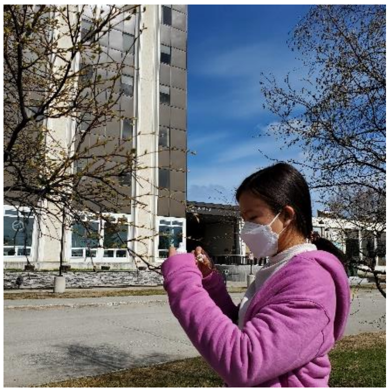
Abstract:
Tree phenology in Alaska is undergoing profound changes as a result of the changing climate. The shifts in the timing of growth onset may be affected by several factors such as temperature, sea level pressure, precipitation, day length, and the interacting effects of these climate variables on phenology. This study's goal is to better understand which factors affect the budburst date of Alaska birch (*Betula neoalaskana*). We obtained temperature, sea level pressure, precipitation, day length from automatic weather station and collected Alaska birch's budburst dates. We used correlation and multiple linear regressions to determine the association between temperature, sea level pressure, precipitation, day length and Alaska birch's budburst date. Our results showed a positive relationship between day length and growing degree summation on Alaska birch's budburst dates. The findings highlight the importance of interacting effects of climate factors in model projections of future budburst dates.

Keywords: Budburst date, Phenology, Environmental factors, Alaska birch, Growing degree summation



(a)



(b)

Figure 1: (a) Data collecting in each area (b) Measuring the Alaska birch leaves length

CHARACTERIZATION OF POLYACRYLONITRILE/POLYURETHANE INCORPORATED MOF/MXENE MEMBRANES

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Abstract:
In the present investigation, polyacrylonitrile/polyurethane (PAN/PU) based electrospun membrane is developed using metal organic framework (MOF) and MXene particles. Three distinct electrospun membranes were developed, i.e. PAN/PU (P1), PAN/PU with 5wt% MOF (P2), and PAN/PU with 5wt% MXene and 5wt% MOF (P3). Fiber diameter, electrolyte uptake, pore size, porosity, and thermal properties of the developed electrospun membranes were characterized. The inclusion of MOF and MXene exhibited a significant change in the morphology of the fibers of the developed membranes. A noticeable reduction in fiber diameters from 463 nm of the P1 composite membrane to 400 nm of the P2 membrane and 339 nm of the P3 composite membrane than the P2 composite membrane was observed. The P3 membrane exhibited higher porosity and absorption of electrolytes than the P1 membrane. The thermal properties of the P3 membrane are higher than P1 and P2. The MOF/MXene incorporated PAN/PU membrane could be a novel membrane that helps to enhance the performance of battery.

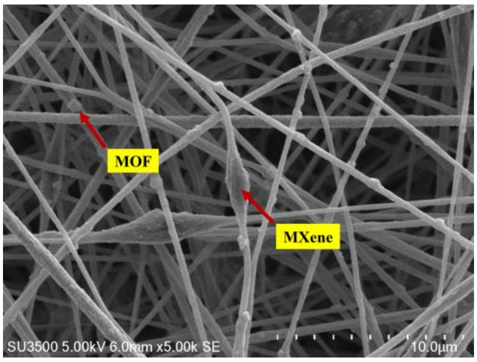

Figure 1.
Morphology of PAN/PU with 5wt% MXene and 5wt% MOF electrospun membrane.

AN ANCIENT PETRIFIED WOOD TRUNG IN BAN NONRUNG, KHON KHEAN PROVINCE, NORTHERN THAILAND

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Abstract:

Petrified wood deposit in Ban Nonrung, Sawatee Subdistrict, Khonkhean Province more than 30 timbers of petrified wood in a gravel pond of private area. Sizes of the petrified woods range from 0.3 to 14.8 meters preserved in a gravel and sand beds. These petrified wood trunks were preserved in the sediment of the Khorate basin. The sSediment beds in the area can be separated into 4 beds. Fossil woods are preserved in sediment beds 2 and 3 consisting of sand and gravel with thicknesses of 1 to 5 m. The sediment bed is composed of sandstone, shale, chert, and quartz. Fossil wood also found in sediment bed 1 and 4 with a sized of fossil wood less than 0.2 meters. Thermoluminescence age dating of sediment beds of 2 and 3 range from 183,000 to 200,000 years ago while fossil woods range from 60,000 to 115,000 years ago.

The anatomy of the petrified wood is characterized by pore, vessel, ray, and parenchyma. The pore is shown as diffusion porous wood of solitary pore and multiple pores. Deposit in rays is observed in some samples. Parenchyma is characterized by aliform paratracheal parenchyma without any linkage to other pores. The mineral compositions in the petrified woods are composed of 90% of quartz, and 5% of calcite, iron oxide and clay minerals. The quartz was precipitated in vessels, ray, and fractures and replaced holes around the vessels for external walls to adhesion the cell such as parenchyma, ray, and fiber. Based on the geology, the chemical composition of silica in fossil woods, suggests the silica solution was formed by weathering of sediment.

VERTEBRATE FOSSIL DIVERSITY FROM PHU WAT FOSSIL SITE, NONG BUA LAMPHU PROVINCE, NORTHEASTERN THAILAND

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Abstract:
Fossil is a geological resource that is useful for geological history in each area. In the Phu Wat locality in Nong Bua Lamphu Province where the theropod dinosaur *Vayuraptor nongbualamphuensis* Samathi et al., 2019, and hybodont shark *Heteroptychodus steinmanni* and *Hybodus* sp. (Cuny et al., 2007) was reported. Moreover, this area contains many vertebrate fossils that we are concerned about. The age of this locality is the Early Cretaceous in Sao Khua Formation of the Khorat Group. This formation consists of red clay, sandstone, and conglomerates, deposited in a floodplain with a meandering river. Here, we add more information on vertebrate fossils from the Phu Wat site meanwhile most of the fossils appear as fragmentary elements but still can be classified as a pedal claw from a paravian theropod dinosaur, tooth, and tibia from an allosauroid-like theropod dinosaur, bones from sauropod dinosaurs, teeth from freshwater sharks, the number of scales, teeth, and a dentary from ray-finned fish, teeth from crocodyliforms, and turtle shells. Of the classified 78 fossil specimens, they are consisting of 34.63 % of dinosaurs (12.82 % of theropod, 6.41% of sauropod, and 15.38 % of unidentified dinosaurs) 34.61% of bony fish, 8.97% of turtles, 7.69 % of sharks, 6.41% of crocodyliform, 6.41 % of unidentified vertebrate bones, and 1.28% of coprolite. The knowledge from this research could fulfil the paleoenvironmental and paleoecology reconstruction during the Early Cretaceous in Thailand and be used for correlation to the vertebrate fossil in Asia.

RADIATION-INDUCED GRAFTING OF TITANIUM DIOXIDE NANOPARTICLES ONTO POLYPROPYLENE NONWOVEN FABRIC AS UV PROTECTION, AND ANTIBACTERIAL FABRIC

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Abstract:
Presently, modification of textile materials using an alternative to the conventional chemical approach has significantly garnered more interest in the scientific society. As a consequence, this work intentionally used gamma irradiation to induce graft polymerization of titanium dioxide (TiO_2) nanoparticles onto polypropylene (PP) nonwoven fabric. The presence of TiO_2 on PP fabric can provide antibacterial and UV-protection properties. Before grafting TiO_2 onto PP fabric, TiO_2 nanoparticles were initially modified with maleic anhydride (MAH) to generate the active site, which can chemically graft on the fabric surfaces. The findings showed that after modification, MAH did not change the crystal structure of TiO_2, and the active sites (C=C groups) were established on the TiO_2, leading to surface interaction between PP fabric and the modified TiO_2 was fairly efficient. The grafted fabrics had a remarkable UV protection factor (UPF) around 124 and an excellent antibacterial test with a visible clear zone. In addition, this grafted fabric demonstrated high durability against chemical, mechanical, and washing tests. The antibacterial and UV-protection properties of grafted fabric still remained after these durability tests. It was notable that the grafted fabric developed in this work seems to have an interesting potential use in medical, outdoor, and technical applications.

THERMOPLASTIC VULCANIZATES BASED ON POLY(3-HYDROXYBUTYRATE-CO-3-HYDROXYVALERATE)/EPOXIDE NATURAL RUBBER (ENR-25, AND ENR-50) BLENDS

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Abstract:

According to our previous study, the incorporation of epoxidized natural rubber (ENR-25 and ENR-50) into poly(3-hydroxybutyrate-co-3-hydroxyvalerate)(PHBV) through melt blending using an internal mixer enhanced PHBV toughness and flexibility, however; sacrificed tensile strength due to low ENR strength and inadequate compatibility between phases. The study showed that adding 5wt% polybutadiene grafted maleic anhydride (PB-g-MA) as a compatibilizer significantly improved the impact property of the blends, while the effect of different epoxide concentrations of ENR was not significantly observed. This study proposed thermoplastic vulcanizate (TPV) prepared by melt blending via dynamic vulcanization (DV) to improve mechanical properties, especially the toughness of the 70/30PHBV/ENR blends, which is the favorable blending ratio delivering the highest toughness according to our previous study. To fabricate the PHBV/ENR vulcanizate, PHBV/ENRv, the ENR was first compounded with Dicumyl peroxide (DCP) 2 phr, followed by blending to PHBV with and without compatibilizer. The toughness values of PHBV/ENRv were 62.99 ± 14.76 and 24.40 ± 2.84 Jm^{-1} for the blends with ENRv-25 and ENRv-50, respectively. The morphology was observed as a small rubber phase dispersed in the PHBV matrix. The thermal stability of the mixtures was enhanced over pristine PHBV, which indicated the processability enhancement. Furthermore, the crosslinking density was investigated by using a Flory-Rehner equation.

DECARBOXYLATION OF FATTY ACID USING METAL/IONIC LIQUID CATALYST

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Abstract:

The decline of petroleum resources and concerns about environmental issues caused by excessive energy consumption have motivated the search for alternative energy sources. A potential solution for this problem is biomass, which can be found in plant and animal remains. Fatty acids are a component of biomass that is an attractive choice of renewable energy sources because they can be converted to long-chain hydrocarbons *via* the decarboxylation reaction. However, the process of fatty acid decarboxylation to alkanes is energy-intensive and suffers efficiency and selectivity issues. In this research, we aimed to develop new catalysts that can improve the fatty acid decarboxylation efficiency by using the combination of metal/ionic liquid as catalysts. The palladium-catalyzed thermal decarboxylation of stearic acid to heptadecane was used as a model reaction for this study. In the presence of a Pd catalyst in various forms, the decarboxylation proceeded poorly at 300 °C. Nuclear Magnetic Resonance (NMR) analysis demonstrated that the use of $Pd(OAc)_2$ catalyst alone at 2.86 mol% Pd loading gave only 8.8% conversion of stearic acid. Importantly, the addition of the ionic liquid $[BMIM]PF_6$ substantially improved the conversion to 95.0%. The improvement of conversion by ionic liquid and the formation of heptadecane was further confirmed by gas chromatographic analysis. Consequently, the Pd-ionic liquid combination is a promising new catalyst system for the decarboxylation of fatty acids with high conversion.

EFFECT OF HEAT TREATMENT ON MICROSTRUCTURE AND PROPERTIES OF PEARLITIC RAIL STEEL

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Abstract:
Pearlitic steel is the most widely used in rail materials. The strength and wear resistance of these steels depend on the spacing between cementite lamellae, pearlite colony size and austenite grain size, which could be changed via different heat treatment processes. The aim of this work, therefore, is to investigate the effect of heat treatment on the microstructure, hardness and wear resistance of R260 pearlitic rail steel. The rail samples were reheated to the austenite temperature range of 800-1000 $^{\circ}$C for 1 h, and then subjected to pearlite transformation at the temperatures of 400, 500 and 600 $^{\circ}$C in the salt bath for 5 min, and then quenched in the water. Microstructures were characterized using an optical microscope (OM) and a field emission scanning electron microscope (SEM). Vickers micro-hardness test with a load of 500 gf (HV0.5) and a pin-on-disc wear test were performed. It was found that with increased austenite temperatures, the austenite grain size was increased from 29 µm to 80 µm and the hardness was decreased from 393 HV0.5 to 318 HV0.5. The decrease in the pearlite formation temperature led to a reduction of the pearlite interlamellar spacing from 117 nm to 89 nm, and increased the hardness from 374 HV0.5 to 418 HV0.5. The wear rate was also decreased from 3.15 x 10^{-4} mm^3/m to 2.08 x 10^{-4} mm^3/m with decreasing pearlite formation temperature. In this work, the maximum hardness and wear resistance in sliding wear tests of the rail samples were obtained after heat treatment at the austenite temperature of 900 $^{\circ}$C and the isothermal temperature of 400 $^{\circ}$C.

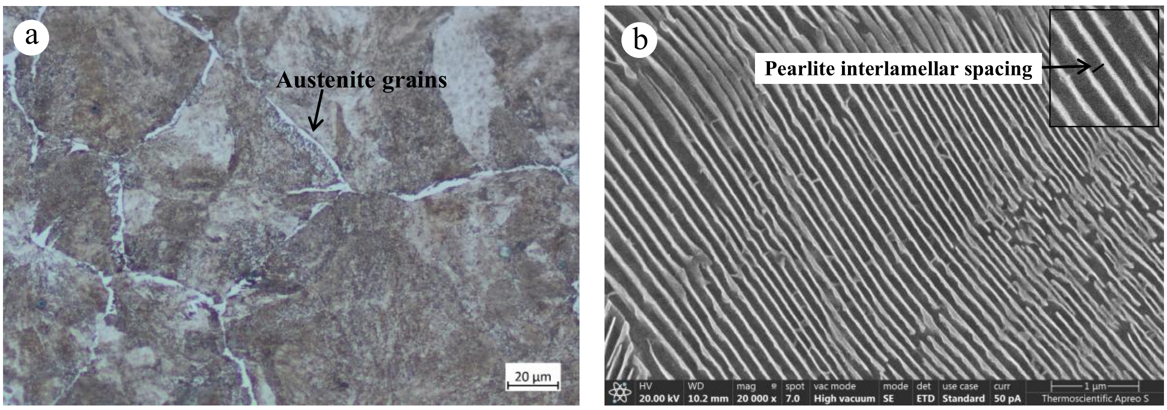

Figure 1. OM and SEM images of typical pearlite microstructure for the R260 rail grades after heat treatment at austenite temperature of 1000°C and isothermal temperature of 500 $^{\circ}$C (a) austenite grain size (b) pearlite interlamellar spacing.

TIME-TEMPERATURE INDICATOR FROM POLYDIACETYLENE AND LONG-CHAIN HYDROCARBONS

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Abstract:
Intelligent packaging can provide information about the quality of perishable products that require transportation in cold chain system such as food, cosmetics, and medicine. One of the recent innovations in packaging technology is the use of time-temperature colorimetric indicator that displays irreversible color change from cumulative effect of thermal exposure and storage time. This study demonstrated a prototype of paper-based time-temperature indicator from polydiacetylene (PDA) and long-chain hydrocarbons (LHC). The LHC part was oleic acid or coconut oil that was refrigerated until it was solidified to wax. The time-temperature indicator was fabricated by sandwiching PDA-coated filter paper and LHC wax in a clear plastic sheet. At the temperature above the melting point, the LHC molecules can penetrate into the PDA structure, disrupt the conjugate system in the polymer backbone, and cause gradual color transition from blue to red. In general, the color transition of the PDA-coconut oil system required higher temperature or longer exposure time than PDA-oleic acid. At room temperature, oleic acid could trigger complete color change of PDA within one hour, while coconut oil took more than 24 hours. At 9 °C in a household refrigerator, PDA with coconut oil showed no color change, while PDA with oleic acid changed to purple color after 45 hours. Thus, the PDA-LHC system is a versatile time-temperature indicator that could be adjusted for different storage requirements of the product by simply choosing the LHC with suitable melting point.

Session F:
FOOD SCIENCE AND TECHNOLOGY/ AGRICULTURAL SCIENCE/ (SEA) FOOD INNOVATION/ FOOD SAFETY AND PACKAGING

EFFECT OF MILK ADDITION ON ANTIOXIDANTS AND QUALITY OF DURIAN DRINK DURING COLD STORAGE

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Abstract:

Durian fruit, one of the most popular fruits in Thailand, is an excellent source of various nutrients such as minerals and vitamins and also rich in phenolic compound. In addition, development the new product from durian fruit is challenging to satisfy consumer's lifestyle. Functional beverage's trend is on the rise since consumer's demand includes improvement of overall health and availability in convenient formats. Therefore, the objectives of this research were to study effect of milk addition on stability of antioxidant properties (total phenolic compound, antioxidant activity by DPPH and FRAP assay), color value (L*, a*, b*) and microbial properties (total plate count and yeast and mold count) of durian drink during cold storage at 4°C for 15 days. Samples were pasteurized (90°C, 5 min) before stability experiment. The results showed that total phenolic compound and antioxidant activity of durian drink decreased with the increased storage time. However, addition of milk in sample provided an increase in antioxidant properties of durian drink compared to no milk addition. Furthermore, L*, and b* values tended to decrease while the increasing trend of a* value was found. According to microbial properties during storage, total plate count and yeast and mold count increased approximately 2 log CFU/mL at the end of storage. This study could be used as a fundamental information for the development of functional drink from durian. However, more studies should develop to increase the bioactivity and the shelf life these products.

DEVELOPMENT OF NAPIER GRASS SILAGE FORMULA FOR CATTLE FEED

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Abstract:

The purpose of this research was to study the Napier grass silage formula, and nutritional value of fermented Napier grass. The fresh Napier grass was fermented in 2 ways, fermented in bags and fermented in tank. In each form there are 3 formulas (Formula 1 100% pure fresh Napier grass ; Formula 2 Fresh Napier Grass 98% Molasses 2% ; Formula 3 Fresh Napier Grass 83% Molasses 2% Acacia 15%). After 21 days of fermentation, the acidity and alkalinity, color, odor, moisture and nutrient value of fermented Napier grass were examined. The results showed that acidity and alkalinity. After 21 days of fermentation, it had a pH in the range of 3.85 – 5.45, the fermentation in a bag was quite acidic with a pH in the range of 3.85-4.31. The physical characteristics of Napier grass fermented in bags have better fermentation conditions than fermented in tank, with yellowish green slightly damp Sour smell like fermented Miang. For recipes that add molasses, it will also have the aroma of sugarcane juice. The amount of Dry matter (DM), Crude fiber (CF), Ether extract (EE), Crude protein (CP), Nitrogen free extract (NFE) and Energy of the three formulas of Napier grass fermented in Bag and tank fermentation after 21 days of fermentation process were significantly different ($P < 0.05$). However, bag fermentation yields higher protein content than fermentation in tanks. By fermenting in bags for 21 days, Formula 3 had the highest crude protein content of 10.7%. The Napier silage formula with the highest dry matter content was Formula 3 fermented in a bag (20.08%). The highest ash content of Napier silage was Formula 2 silage in bags (11.35%). The Napier silage formula with the highest Crude fiber content was Formula 2 silage (33.91%). The highest fat content of the Napier fermented grass recipe is Formula 3 fermented in a bag (3.30%). The most Nitrogen free extract content of Napier grass is Formula 3 fermented in tank (47.7%). And the Napier silage formula with the highest energy content was Formula 3 fermented in a bag (4,078.50 cal/g). It can be seen that the Napier grass Formula 3 Silage in a bag is suitable for further use as a silage formula for raising cattle.

UTILIZATION OF FOOD WASTE AND BIOMASS TO PRODUCE BIO-COMPOST

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Abstract

The aim of this research is to study compost production in a nano-composter machine. By using food waste mixed with 2 types of biomass, corncob and rubber tree roots as raw materials, it took about 24 hours for compost production. The compost was crushed to a size of less than 2 mm using a Hammer mill. The results showed that the corncob compost had a C/N ratio of 17.49, moisture content of 9.38%, and pH of 4.34. where the C/N ratio and moisture content met the criteria for compost, but the pH did not. From the sunflower sprouts' seedling test, they germinated well on the obtained compost. However, it did not grow well in corncob compost mixed with soil. For rubber tree root compost, it has a C/N ratio of 31.49 ± 1.86 and a pH of 4.83, which did not meet the criteria of compost.

PROPERTIES OF SOY PROTEIN ISOLATE FILM INCORPORATED WITH EPIGALLOCATECHIN GALLATE AND GREEN TEA EXTRACT

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Abstract:

Epigallocatechin gallate (EGCG) and green tea extract (GTE) of different oxidation states (oxidized and non-oxidized) were used as safe cross-linking agents to improve the properties of soy protein isolate (SPI) film. It was found that SPI film containing 7.2% oxidized EGCG possessed the highest tensile strength while the highest elongation at break was demonstrated by that added with 1.8% oxidized EGCG. The addition of 3.6 and 7.2% EGCG in oxidized states into SPI film revealed significantly higher tensile strength than in non-oxidized states ($p \leq 0.05$). Different oxidation states of EGCG or GET significantly affected the elongation at break of SPI film ($p \leq 0.05$). Besides, SPI film containing 7.2% oxidized EGCG significantly exhibited the lowest %transmittance in both UV/visible light ($p \leq 0.05$). As compared to the control, SPI films added with EGCG or GTE, either in oxidized or non-oxidized state, exhibited significantly greater thickness, UV and visible light barrier, and water vapor barrier, with a decrease in water solubility, surface hydrophobicity, and hue angle ($p \leq 0.05$). SPI film incorporated with EGCG displayed significantly improved mechanical properties, UV and visible light barrier than that added with GTE ($p \leq 0.05$). In summary, EGCG and GTE could be used to modify properties of SPI film via covalent C-N cross-linking of protein as proven using SDS-PAGE and FTIR spectroscopic techniques.

CONTROL OF POSTHARVEST FUNGAL DECAY IN PAPAYA FRUITS BY CHITOSAN-CARBOXYMETHYL CELLULOSE COATING INCORPORATED WITH ESSENTIAL OILS AND POTASSIUM SORBATE

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Abstract:
The objective of this study is to evaluate the effect of plant essential oils in combination with acid salts including ammonium carbonate and potassium sorbate on controlling postharvest fungal decay in papaya fruits. Antifungal activity of cinnamon (*Cinnamomum verum*), clove (*Syzygium aromaticum*) and colla aromatica Roxb. (*Homalomena aromatica*) oils at 0.0397-0.5%, and acid salts (ammonium carbonate, potassium metabisulfite and potassium sorbate) at 0.25-1.0% was studied. Cinnamon and clove oils at 0.0125-0.2% minimum inhibitory concentration (MIC) were effective to inhibit growth of *Aspergillus flavus* TISTR 3041, *Penicillium citrinum* TISTR 3437 and two mold isolates P8A6 and P2D4 from papaya fruits, while those salts showed antifungal activity at 0.5-8%MIC. These two molds were identified by molecular biological and morphological technique as *Aspergillus* P8A6 and *Talaromyces* P2D4. Then, synergy testing of combined cinnamon or clove oil with potassium sorbate or ammonium carbonate was performed. Only combination of cinnamon or clove oil with potassium sorbate showed synergistic effect against *Talaromyces* P2D4. The poison agar method was used to screen appropriate concentrations of cinnamon or clove oil combined with potassium sorbate. Effect of cinnamon or clove oil combined with potassium sorbate in 0.1%chitosan–0.25%carboxymethyl cellulose (ChiCMC) coating on controlling of postharvest fungal decay in papaya fruits during storage at 30°C for 8 days was then studied. Synergistic combinations of 0.0397% clove oil and 0.25% potassium sorbate, or 0.25% cinnamon oil combined with 1% potassium sorbate in ChiCMC coating were effective to delay fungal decay in papaya fruits. At the end of storage time, these coating significantly affected less decay incidence (53.3-56.7%) as compared to control treatment (100% decay incidence). Therefore, use of cinnamon or clove oil combined with potassium sorbate in ChiCMC coating could potentially be used in postharvest management for decay control in papaya fruits.

EFFECT OF SUCROSE CONCENTRATION ON CHARACTERISTICS OF FERMENTED VINEGAR FROM CORN SILK

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Abstract
This study aims to produce a flavouring agent as a food additive from corn silk. Corn silk has an abundance metabolites, flavonoids, and phenolic compounds that influence antioxidant and xanthine oxidase inhibitors for the treatment of gout. The objective of this study is to divide added sugar between qualitative and quantitative vinegar fermentation. The sweet corn silk (*Zea mays*) was boiled for 20 min, then the fragments were separated. To the corn silk boiled water, 20% sucrose was added to prepare for anaerobic fermentation with *Saccharomyces cerevisiae* who convert the glucose to alcohol. In addition, the alcohol fermentation was co-cultured with *Lactobacillus casei* to obtain lactic acid for enhancing the flavouring agent. In the second step, the alcohol was converted to acetic acid as vinegar by aerobic fermentation with *Acetobacter aceti*. Therefore, the fermented alcohol was divided to add different sucrose concentration (0%, 10%, 12% and 14%) and aerated 0.5 vvm in 100 ml working volume of 250 ml an Erlenmeyer flask at 30°C for 45 days. The vinegar was measured for cell growth and the percentage of acids. Moreover, the activities of substances in the vinegar were determined antioxidant inhibition and xanthine oxidase inhibition including total phenolic and flavonoids. The results showed that the highest initial growth rate of *A. aceti* on 12% sucrose (0.314 h^{-1}) with doubling time of 2.2 h, significantly ($p \leq 0.05$). The culture of 0%, 10%, 12% and 14% sucrose concentration obtained significantly ($p \leq 0.05$) the percentage of acetic acid content which were of 6.95±0.14 %, 11.34±0.0%, 11.66±0.0% and 8.87±0.03%, respectively after 42 days of incubation. The activity of the substance in vinegar showed significant *p*-value at 0.05 of antioxidant inhibition and xanthine oxidase inhibition. The results indicate that corn silk could be value-added vinegar as a functional food additive by aerated fermentation with 10% sucrose addition.

IDENTIFICATION OF *Litopenaeus vannamei* miRNAs REGULATING THE WHITE SPOT SYNDROME VIRUS GENES

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Abstract:

White spot syndrome virus (WSSV) is a major viral pathogen causing massive losses in shrimp production. Numerous studies have revealed a diverse role of microRNAs (miRNAs), a class of small non-coding RNA, in shrimp antiviral immunity. Nevertheless, the information obtained from shrimp miRNAs regulating the viral genes is still limited. Therefore, this study aims to identify shrimp miRNAs targeting the WSSV genes and further test if they have therapeutic potential. Using bioinformatic analysis, differential expressed miRNAs (DEMs) were identified from small RNA libraries of 24h-WSSV-infected and NaCl-challenged shrimp hemocytes. A total of 60 miRNA homologs and 1,239 differentially expressed unannotated small RNAs (DEUs) were identified. Of those, Pva-small RNA-11881, was selected as a WSSV-responsive small RNA based on its function and the number of target WSSV genes predicted. In addition, a region with a precursor-miRNA-like structure of Pva-small RNA-11881 has been identified, confirming the presence of this miRNA in *P.vannamei*. As a result, we will refer to it as a novel miRNA, Pva-miR-11881. Furthermore, we found a negative correlation between Pva-miR-11881 expression and its four relevant target genes. In conclusion, Pva- miR-11881, a novel shrimp miRNA, was found to be a hub miRNA that might play a key role in WSSV gene regulation. However, the role of Pva-miR-11881 in the anti-WSSV response needs to be confirmed.

ENZYMES-ASSISTED EXTRACTION OF BIOACTIVE COMPOUNDS FROM NONI LEAVES (*Morinda citrifolia*)

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Abstract:
Noni leaves provide several health benefits as food and traditional medicines due to their bioactive compounds. This study investigated the preliminary effects of cellulase and hemicellulase assisted extraction on bioactive compounds extraction from noni leaves compared to maceration technique. Cellulase and hemicellulase-assisted extraction formed small holes on the extracts surface and provided rough surface, angular and fragmentation structures indicated some breakdown of noni leaves cell wall after enzyme reaction. There was a significant difference of the extracts particle size between the samples from cellulase assisted extraction and hemicellulase assisted extraction while no significant difference was observed between the samples from maceration technique and cellulase assisted extraction. For antioxidant activity, cellulase assisted extraction provided the highest antioxidant activity (92.83 and 73.05 mg TEAC g of sample^{-1} which was determined by DPPH and FRAP method respectively). However, hemicellulase extraction exhibited the lowest antioxidant activity (36.38 and 33.33 mg TEAC g of sample^{-1} in DPPH and FRAP method respectively). This results can lead to the use of green technology for bioactive compounds extraction from plant sources for use as a medical and functional food ingredients.

SOLID-STATE FERMENTATION OF HEALTHY VINEGAR FROM BLACK GLUTINOUS RICE AND CORN SILK

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Abstract:
Black glutinous rice and corn silk provide a unique formula for producing an innovative healthy vinegar. The objective of this study was to evaluate efficacy from a mixture of koji and loog-pang microorganisms. Black glutinous rice (Oryza sativa var. glutinosa), Leum Pua glutinous rice and fresh corn silk were steamed together. The steamed glutinous rice has been mixed with corn silk strains that were divided to inoculated with koji, loog-pang, and koji plus loog-pang microorganisms. The microbes were then incubated at 30°C for 10 days in anaerobic fermentation to obtain alcohol. Acetobacter aceti TBRC 474 was added, which converted continuously the alcohol to acetic acid for 50 days incubation. The results showed the efficacy of koji plus loog-pang produced a low percentage of alcohol (10.5%), which was less than using sole the koji and loog-pang microorganisms, which produced alcohol level of 17% and 21%, respectively. However, the treatment of koji plus loog-pang converted mostly alcohol to acetic acid (6.67 %) after 50 days incubation, while the treatment of koji and loog-pang produced acetic acid of 4.33% and 2.03%, respectively. There was possibility of the higher concentrated alcohol product from the fermentation inhibited Acetobacter growth. In addition, the functional benefit of vinegar was determined to function well as an antioxidant and xanthine oxidase inhibition, which include total phenolic and flavonoids compounds. These results indicated that there was significantly high activities at p-value, less than 0.05. Therefore, the mixture of koji and loog-pang could be used in a suitable solid-state fermentation needed to achieve a black glutinous rice plus corn silk vinegar product that can be used as a functional flavoring agent.

Session SP3: X-RAY CRYSTALLOGRAPHY

SYNTHESIS, CHARACTERIZATION AND X-RAY STRUCTURAL STUDIES OF NEW TRANSITION METAL COORDINATION POLYMERS CONTAINING 1,4-BIS(IMIDAZOLE-1-METHYL) BENZENE LINKER

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Abstract:

A new one-dimensional Co(II) coordination polymer, $\{Co_2(bix)_3(NO_3)_4\}_n$ (**1**) was synthesized by using solvothermal method (where bix =1,4-bis(imidazole-1-methyl)benzene). Compound **1** was characterized by elemental analyst FT-IR, TGA, solid state diffuse reflectance spectroscopy, powder X-ray diffraction. The crystal structure of this compound has been determined by using single-crystal X-ray diffraction technique. Compound **1** crystallines in triclinic crystal system and space group is *P*-1. The Co(II) ion is surrounded by capped octahedral environment built up from three nitrogen atoms from three bix ligands, four oxygen atoms form nitrate anions. Bix ligand bridges Co(II) ions 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) interactions.

DESIGN AND SYNTHESIS OF METAL-ORGANIC FRAMEWORKS BASED ON ALKALI METALS WITH CHLORANILATE LIGANDS FOR CARBON DIOXIDE CAPTURE

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Abstract:

Three novels MOFs using chloranilate ligand (2,5-Dichloro-3,6-dihydroxy-p-benzoquinone, CA) with three different alkali metals (lithium (Li), sodium (Na), and potassium (K)) were synthesized: $[Li(CA)(H_2O)]$ **1**, $[Na_3(CA)]$ **2**, and $[K_4(CA)_2(H_2O)_2]$ **3** using solvothermal conditions. **1-3** crystallize in tetragonal (*P*4/*mbm*), monoclinic (*C*2/*c*), and triclinic (*P*-1) symmetry, respectively. The asymmetric unit of **1** includes half molecule of CA ligand and one of Li^+ ion. The Li center exhibits square pyramidal geometry coordinated with two terminal bidentate CA^{2-} ligands through four oxygen atoms located in the equatorial plane and one water molecule coordinated in the apical position. The crystal packing is governed by hydrogen bonds between the water molecule and the oxygen atoms from the CA ligands. In addition, halogen-π bonds between Cl groups and the aromatic rings are observed. For **2**, the asymmetric unit shows one molecule of CA^{2-} and three Na^+ ions. Different geometry is observed in each center (Na1 octahedral, Na2 tetrahedral, and Na3 square pyramidal). The CA^{2-} ligands are acting as a bridge between the Na^+ ions, leading to the formation of the 3D structure. For **3** the asymmetric unit includes one molecule of CA^{2-} ligand, one molecule of water, and two K^+ ions. The geometry of the K1 is octahedral, whereas K2 adopts a capped trigonal prism. The coordination mode of the CA^{2-} ligand is bridging (bis)bidentate. In the 1D chain, the metals are connected through the ligand which act as a bridge along the a axis. For the 2D and 3D structure, the K^+ ions are connected through the Cl groups of the CA^{2-} ligands. In addition, hydrogen bonds from the water molecule are observed. The structures of these compounds show a high thermal stability that was analyzed by thermogravimetric analysis and the adsorption isotherm both of compounds were analyzed at high pressure.

CRYSTALLIZATION OF GLYCOGEN DEBRANCHING ENZYME FROM C*orynebacterium glutamicum* (*Cg*GDE)

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Abstract:
Glycogen debranching enzyme (GDE) is a bifunctional enzyme that is different from other debranching enzymes. It catalyzes hydrolysis of α-(1-6) glycosidic bond, and transfer α-(1-4) glucan from donor molecule to acceptor molecule. Debranching enzymes hydrolyzes the remaining α-(1-6) bond in amylopectin, glycogen and pullulan, producing a linear chain of glucose. The mechanism by which the glucosidase cleaves the α-(1-6) linkage is not fully known because the amino acids in the active site have not yet been identified. Thus, this research aims to determine the tertiary structure of GDE from *Corynbacterium glutamicum*. *Cg*GDE by X-ray crystallography. *Cg*GDE was successfully crystallized, then the protein crystals have been prepared and tested at beamline BL13B1. The *Cg*GDE crystal belonged to space group R32 with unit cell parameter a = 192.244, b = 191.244, c= 276.289, α = 90, β = 90, γ = 120. The estimated solvent content was 66% and the number of molecules in the asymmetric unit was 2.

SYNTHESIS, CHARACTERIZATION AND THE CRYSTAL STRUCTURES OF TWO NEW ONE-DIMENSIONAL CADMIUM(II) COORDINATION POLYMERS CONTAINING 4,4′-BIPYRIDINE AND BENZOATE LIGANDS

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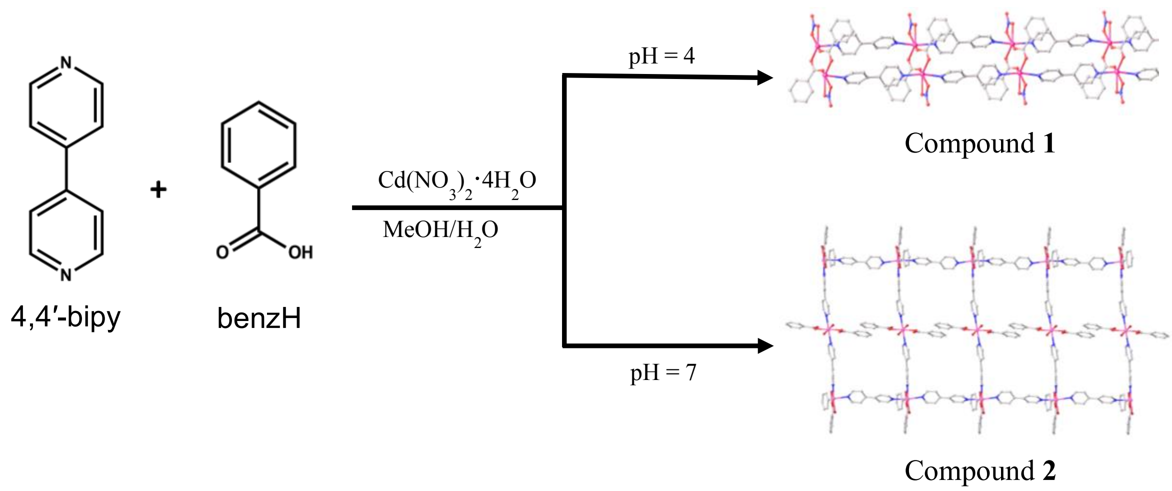
Abstract:

Two new 1D Cd(II) coordination polymers, $[Cd(4,4'\text{-bipy})(benz)(NO_3)]_n$ (**1**) and $[Cd_3(4,4'\text{-bipy})_4(benz)_6(H_2O)_2]_n$ (**2**) (4,4′-bipy = 4,4′-bipyridine and benzH = benzoic acid) have been synthesized by slow evaporation with different pH. Compounds **1** and **2** were characterized by using Fourier transform infrared spectroscopy (FTIR), powder X-ray diffraction (PXRD) and the crystal structure of both compounds has been determined using the single-crystal X-ray diffraction (SCXRD) technique. The structure of compound **1** presents a ladder-like chain with two bridging μ_2-*O*,*O′* carboxylates with a *syn-anti* coordination mode from benzoate ligands to form a binuclear unit, $[Cd\text{-}(benz)_2\text{-}Cd]$ with a Cd···Cd distance of 4.148 Å. These dinuclear units are linked by 4,4′-bipy ligands extended along the crystallographic *a* axis. Compound **2** contains two crystallographically independent Cd(II) ions with different coordination geometries. The Cd(1) center displays a distorted pentagonal bipyramid geometry, while Cd(2) adopts a distorted octahedral geometry. Each Cd(1) center is connected together by 4,4′-bipy bridging ligands, providing a one-dimensional linear chain-like structure along *b* axis. These two adjacent linear chains are linked by $[Cd(2)(4,4'\text{-bipy})_2(benz)_2(H_2O)_2]$ units, leading to a one-dimensional ladder chain-like structure. In addition, both complexes are further stabilized into supramolecular frameworks *via* hydrogen bonding, $\pi\cdots\pi$ stacking, and C-H$\cdots\pi$ interactions. Interestingly, the dye adsorption properties of these coordination polymers are investigated and the results show that both compounds present selective adsorption for congo red dye.



SYNTHESIS, CHARACTERIZATION AND CRYSTRAL STRUCTURE OF A NEW MONONUCLEAR COPPER(II) COMPLEX CONTAINING BENZIMIDAZOLE LIGAND

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Abstract:

This research concerns to the exploration of new Cu(II) complexes with benzimidazole (bzim) ligand. We have successfully synthesized new mononuclear Cu(II) complex, [Cu(bzim)3-(H2O)2]SO4·H2O·DMF by using direct preparation method from the mole ratio. This complex has been characterized by using Fourier transform infrared spectroscopy (FT-IR), electronic diffuse reflectance spectroscopy and powder X-ray diffraction (PXRD). The crystal structure was determined by using the single crystal X-ray diffraction (SCXRD) technique. The results show that the crystal structure of this complex crystallized in monoclinic system with *C*c space group. The asymmetric unit consists of two independent Cu(II) units, two sulfate counter anions, two lattice water and two DMF solvents. Each Cu(II) unit shows the five-coordinated environment around Cu(II) ions, but different degree of distortion of square pyramid geometry for [Cu(1)N_3O_2] and [Cu(2)N_3O_2] chromophores with τ parameter of 0.46 and 0.25, respectively. The supramolecular interactions such as hydrogen bonding, $\pi\cdots\pi$ and C–H$\cdots\pi$ of this complex have been investigeted and analyzed by using Hirshfeld surface analysis.

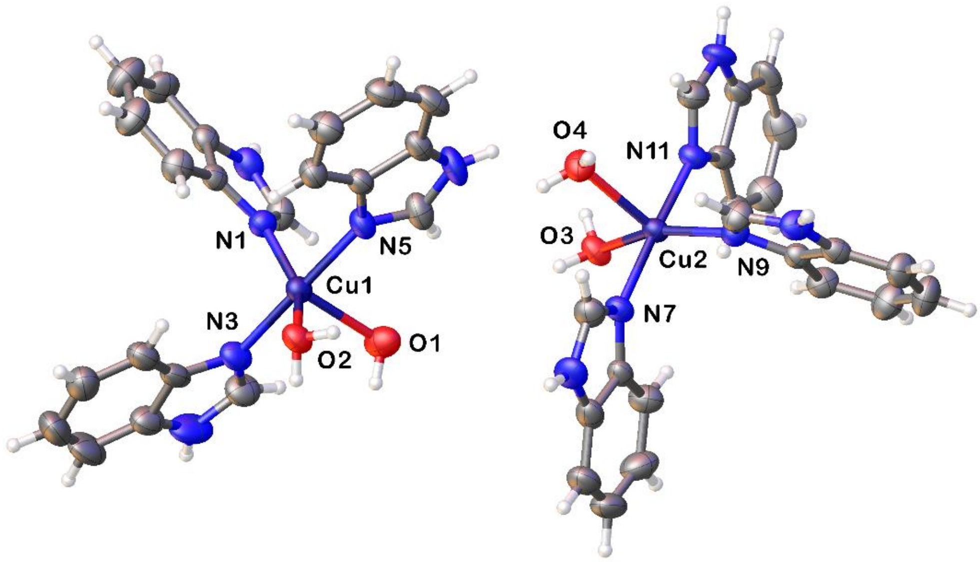

Figure 1. View of two independent Cu(II) units of [Cu(bzim)$_3$(H_2O)$_2$]SO_4·H_2O·DMF

CRYSTAL STRUCTURE STUDY OF A NEW DINUCLEAR DOUBLY-BRIDGED COPPER(II) COMPLEX CONTAINING 1,10-PHENANTHROLINE AND *m*-NITROBENZOATE LIGANDS

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Abstract:
According to the aim of this work focuses on the discovery of new copper(II) complexes and study their biological activities, a new dinuclear doubly-bridge copper(II) complex containing 1,10-phenanthroline (phen) and *m*-nitrobenzoate (*m*-NO_2benz) ligands, [Cu_2(phen)$_2$(*m*-NO_2benz)$_2$(μ-3-NO_2benz)$_2$]·3-NO_2benzH was successfully synthesized and charecterized. The crystal structure of complex has been determined by using single-crystal X-ray diffraction. The results show that this complex crystallizes in triclinic crystal system with *P*-1 space group. The coordination environment of Cu(II) ion surrounded by two *N*-donor atoms of a phen ligand and two *O*-donor atom of two *m*-NO_2benz molecules in the square base and an *O*-donor atom from *m*-NO_2benz bridging ligand, resulting a distorted square pyramidal geometry with [CuN_2O_3] chromophore and relating to the τ structural parameter of 0.30. Two Cu(II) ions are doubly-bridged by two *m*-NO_2benz bridging ligands with *syn-anti* coordination mode. The packing structure of this complex has been stabilized by supramolecular interactions such as hydrogen bonding, π···π and C–H···π interactions. In addition, Hirshfeld surface study of this compound had been performed to investigate these supramolecular interactions.

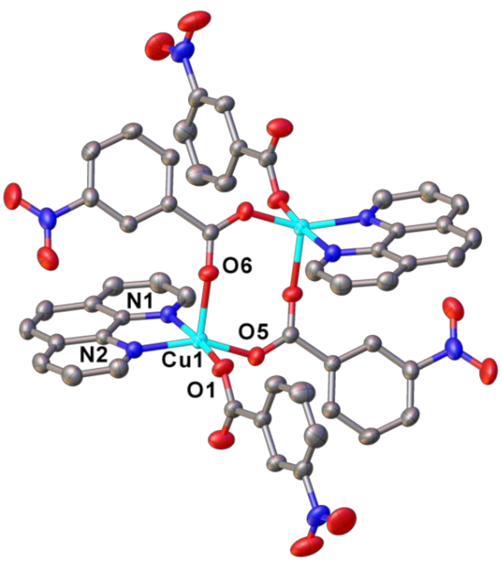

Figure 1. Molecular structure of [Cu_2(phen)$_2$(*m*-NO_2benz)$_2$(μ-3-NO_2benz)$_2$] dinuclear unit. Hydrogen atoms and lattice 3-NO_2benzH molecule are omitted for clarity.

CRYSTAL STRUCTURES AND HIRSHFELD SURFACE ANALYSIS OF TWO NEW COPPER(II) COMPLEXES WITH 2,2´-DIPYRIDYLAMINE AND HYDROXYBENZOATE DERIVATIVES

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Abstract:
Two new mononuclear copper(II) complexes namely [Cu(dpyam)(3-OHbenz)(HCO_2)] (**1**) and [Cu(dpyam)(4-OHbenz)$_2$]·H_2O (**2**) (dpyam = 2,2´-dipyridylamine, 3-OHbenz = 3-hydroxybenzoate and 4-OHbenz = 4-hydroxybenzoate) have been successfully synthesized and characterized in order to study their bioactivity for antimicrobial activity. The X-ray structures of both complexes have been determined by using the single-crystal X-ray diffraction technique. These complexes crystallize in a monoclinic crystal system with $P2_1/c$ and $P2_1/n$ space groups for complexes **1** and **2**, respectively. The Cu(II) ion in complex **1** shows a distorted square pyramidal geometry with a CuN_2O_3 chromophore that formed by one dpyam, one 3-OHbenz, and one formate ligands. The complex **2** Cu(II) ion exhibits a distorted square planar geometry with a CuN_2O_2 chromophore, while **2** consists of one dpyam and two 4-OHbenz ligands. The hydroxybenzoate ligands act as mono- and bidentate mode for 4-OHbenz and 3-OHbenz, respectively. The crystal structures of these complexes have been stabilized by intermolecular interactions such as hydrogen bonds, C–H···π, and π···π stacking. The Hirshfeld surface analysis and the 2D-fingerprint plots of all complexes have been investigated in order to study the intermolecular interactions.

CRYSTAL STRUCTURE OF SILVER (I) BROMIDE COMPLEX CONTAINING 1,3-DIISOPROPYL-2-THIOUREA AND TRIPHENYLPHOSPHINE LIGANDS

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Abstract:
The reaction of silver(I) bromide with triphenylphosphine (PPh_3) and 1,3-Diisopropyl-2-thiourea (DSPTU) gave mononuclear complex of formular [AgBr(DSPTU)(PPh_3)]. The structure of the complex was characterized by infrared (IR) spectra, single crystal X-ray diffraction. The Ag(I) ion exhibits distorted trigonal planar coordination with one P atom from PPh_3 ligand, one terminal S atom from the DSPTU ligand and bromide ion. Intramolecular N—H···Br hydrogen bond is observed (graph set motif S(6)). In the crystal, the amine and bromide group are linked into a zigzag chain along the *b* axis by N—H···Br hydrogen bonds.

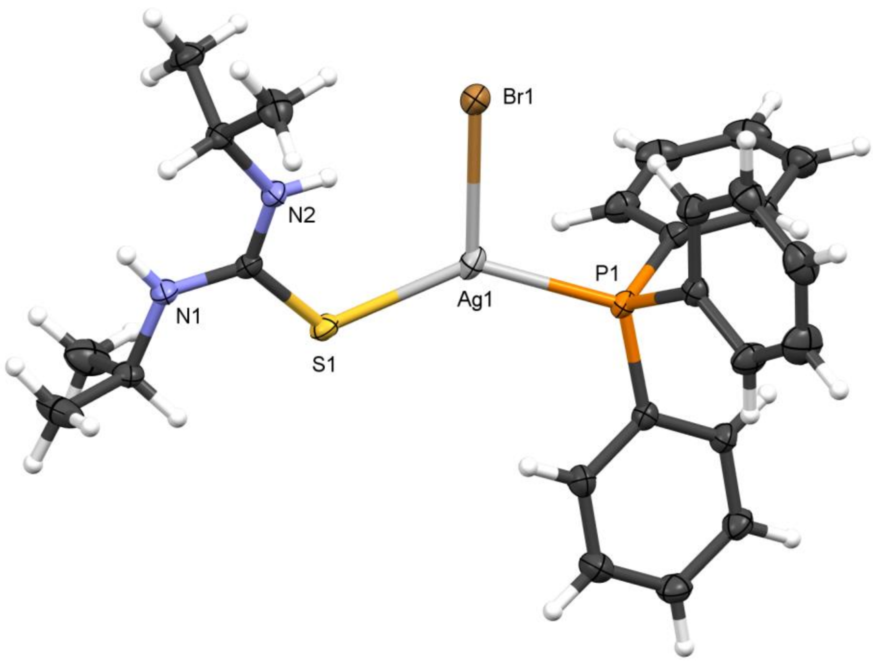

Figure 1. The molecular structure of [AgBr(DSPTU)(PPh_3)], with displacement ellipsoids drawn at the 50% probability level.

Corresponding Author Index

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